MITSUBISHI ELECTRIC

Personal Computer Embedded Type Servo System Controller

Simple Motion Board User's Manual (Application)

-MR-EM340GF

SAFETY PRECAUTIONS

(Read these precautions before using this product.)
Before using this product, please read this manual and the relevant manuals carefully and pay full attention to safety to handle the product correctly.
The precautions given in this manual are concerned with this product only.
In this manual, the safety precautions are classified into two levels: "⚠WARNING" and "⚠CAUTION".

⚠ **WARNING**	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠ **CAUTION**	Indicates that incorrect handling may cause hazardous conditions, resulting in minor or moderate injury or property damage.

Under some circumstances, failure to observe the precautions given under "⚠CAUTION" may lead to serious consequences.
Observe the precautions of both levels because they are important for personal and system safety.
Make sure that the end users read this manual and then keep the manual in a safe place for future reference.

[Design Precautions]

⚠WARNING

- Configure safety circuits externally to ensure that the entire system operates safely even when a fault occurs in the personal computer. Failure to do so may result in an accident due to an incorrect output or malfunction.
  (1) Configure external safety circuits, such as an emergency stop circuit, protection circuit, and protective interlock circuit for forward/reverse operation or upper/lower limit positioning.
  (2) If an incorrect home position return direction is set, motion control may continue without deceleration. To prevent machine damage caused by this, configure an interlock circuit external to the Simple Motion board.
  (3) When the Simple Motion board detects an error, the motion slows down and stops or the motion rapidly stops, depending on the stop group setting in parameter. Set the parameter to meet the specifications of a positioning control system. In addition, set the home position return parameter and positioning data within the specified setting range.
- For the operating status of each station after a communication failure, refer to manuals relevant to the network. Incorrect output or malfunction due to a communication failure may result in an accident.
- When modifying data of a running Simple Motion board, configure an interlock in the program to ensure that the entire system will always operate safely. For other forms of control (such as program modification, parameter change, forced output, or operating status change) of a running Simple Motion board, read the relevant manuals carefully and ensure that the operation is safe before proceeding. Improper operation may damage machines or cause accidents. Determine corrective actions to be taken in case of a communication failure.
- Especially, when a remote Simple Motion board is controlled, immediate action cannot be taken if a problem occurs in the Simple Motion board due to a communication failure. To prevent this, configure an interlock in the program, and determine corrective actions to be taken in case of a communication failure.
- Do not write any data to the "system area" and "write-protect area" of the buffer memory in the Simple Motion board. Doing so may cause malfunction of the Simple Motion board. For the "system area", and "write-protect area", refer to the user's manual for the Simple Motion board.

[Design Precautions]

⚠WARNING

- If a communication cable is disconnected, the network may be unstable, resulting in a communication failure of multiple stations. Configure an interlock in the program to ensure that the entire system will always operate safely even if communications fail. Failure to do so may result in an accident due to an incorrect output or malfunction.
- To maintain the safety of the Simple Motion board against unauthorized access from external devices via the network, take appropriate measures. To maintain the safety against unauthorized access via the Internet, take measures such as installing a firewall.
- If safety standards (ex., robot safety rules, etc.,) apply to the system using the Simple Motion board, servo amplifier and servomotor, make sure that the safety standards are satisfied.
- Construct a safety circuit externally of the Simple Motion board or servo amplifier if the abnormal operation of the Simple Motion board or servo amplifier differs from the safety directive operation in the system.

[Design Precautions]

⚠CAUTION

- Do not install the control lines or communication cables together with the main circuit lines or power cables. Keep a distance of 100 mm or more between them. Failure to do so may result in malfunction due to noise.
- After the personal computer is powered on or rebooted, the time taken for the Simple Motion board to enter the RUN status varies depending on the system configuration, parameter settings, and/or program size. Design circuits so that the entire system will always operate safely, regardless of the time.
- Do not power off or reboot the personal computer during the setting registration. Doing so will make the data in the flash ROM undefined. The data need to be set in the buffer memory and to be written to the flash ROM again. Doing so may cause malfunction or failure of the Simple Motion board.

[Installation Precautions]

⚠WARNING

- Shut off the external power supply (all phases) used in the system before mounting or removing the Simple Motion board to or from the personal computer. Failure to do so may result in electric shock or cause the Simple Motion board to fail or malfunction.
- Do not touch any connectors while power is on. Doing so may cause electric shock or malfunction.

[Installation Precautions]

⚠CAUTION

- Use the Simple Motion board in an environment that meets the general specifications in the Simple Motion Board User's Manual. Failure to do so may result in electric shock, fire, malfunction, or damage to or deterioration of the product.
- Fix the Simple Motion board securely with the board-fixing screw. Tighten the screws within the specified torque range. Undertightening can cause drop of the screw, short circuit, or malfunction. Overtightening can damage the screw and/or Simple Motion board, resulting in drop, short circuit, or malfunction. For the tightening torque of the board-fixing screws, refer to the manual supplied with the personal computer.
- Do not directly touch any conductive parts and electronic components of the Simple Motion board. Hold the front panel or edge of the print board. Not holding by the front panel or edges may cause malfunction or failure of the Simple Motion board.
- Do not disassemble or modify the Simple Motion board. Doing so may cause failure, malfunction, injury, or a fire.
- Before handling the Simple Motion board, touch a conducting object such as a grounded metal to discharge the static electricity from the human body. Failure to do so may cause the Simple Motion board to fail or malfunction.
- Install the Simple Motion board to a personal computer which is compliant with PCI Express® standard. Failure to do so may cause a failure or malfunction.
- Securely insert the Simple Motion board into the slot following the board installation instruction of the personal computer. Incorrect insertion of the Simple Motion board may cause malfunction, failure, or drop of the board.
- When installing the Simple Motion board, take care not to contact with other boards.
- When installing the Simple Motion board, take care not to get injured by an implemented component or a surrounding member.
- Handle the Simple Motion board in a place where static electricity will not be generated. Failure to do so may cause a failure or malfunction.
- The Simple Motion board is included in an antistatic envelope. When storing or transporting it, be sure to put it in the antistatic envelope. Failure to do so may cause a failure or malfunction.
- Do not drop or apply a strong impact to the Simple Motion board. Doing so may cause a failure or malfunction.

[Wiring Precautions]

⚠WARNING

- Shut off the external power supply (all phases) used in the system before installation and wiring. Failure to do so may result in electric shock or damage to the Simple Motion board.
- After installation and wiring, attach the cover of the equipment the Simple Motion board is installed to before turning it on for operation. Failure to do so may result in electric shock.

[Wiring Precautions]

⚠CAUTION

- Ground the controllers, servo amplifiers and servo motors embedded with a Simple Motion board with a ground resistance of 100 ohm or less. Do not use a common grounding with other equipment.
- Check the rated voltage and signal layout before wiring to the Simple Motion board, and connect the cables correctly. Connecting a power supply with a different voltage rating or incorrect wiring may cause fire or failure.
- Connectors must be correctly connected. Incomplete connections may cause short circuit, fire, or malfunction.
- Securely connect the connector to the Simple Motion board. Poor contact may cause malfunction.
- Do not install the control lines or communication cables together with the main circuit lines or power cables. Keep a distance of 100 mm or more between them. Failure to do so may result in malfunction due to noise.
- Place the cables in a duct or clamp them. If not, dangling cable may swing or inadvertently be pulled, resulting in damage to the Simple Motion board or cables or malfunction due to poor contact.
- Check the interface type and correctly connect the cable. Incorrect wiring (connecting the cable to an incorrect interface) may cause failure of the Simple Motion board and external device.
- When disconnecting the cable from the Simple Motion board, do not pull the cable by the cable part. For the cable with connector, hold the connector part of the cable. Pulling the cable connected to the Simple Motion board may result in malfunction or damage to the Simple Motion board or cable.
- Prevent foreign matter such as dust or wire chips from entering the personal computer. Such foreign matter can cause a fire, failure, or malfunction.
- For Ethernet cables to be used in the system, select the ones that meet the specifications in the user's manual of the Simple Motion board. If not, normal data transmission is not guaranteed.

[Startup and Maintenance Precautions]

⚠WARNING

- Shut off the external power supply (all phases) used in the system before cleaning or retightening the board-fixing screws. Failure to do so may result in electric shock or malfunction.
- Turn off the external power supply for the system in all phases before installing the Simple Motion board to or removing it from the personal computer. Failure to do so may result in electric shock or cause the Simple Motion board to fail or malfunction.
- Do not connect or disconnect any communication cable while power is on. Doing so may result in a malfunction.

[Startup and Maintenance Precautions]

⚠CAUTION

- When modifying data of a running Simple Motion board, configure an interlock in the program to ensure that the entire system will always operate safely. For other forms of control (such as program modification, parameter change, forced output, or operating status change) of a running Simple Motion board, read the relevant manuals carefully and ensure that the operation is safe before proceeding. Improper operation may damage machines or cause accidents. Determine corrective actions to be taken in case of a communication failure.
- Especially, when a remote Simple Motion board is controlled, immediate action cannot be taken if a problem occurs in the Simple Motion board due to a communication failure. To prevent this, configure an interlock in the program, and determine corrective actions to be taken in case of a communication failure.
- Do not disassemble or modify the Simple Motion board. Doing so may cause failure, malfunction, injury, or a fire.
- Use any radio communication device such as a cellular phone or PHS (Personal Handyphone System) more than 25 cm away in all directions from the Simple Motion board. Failure to do so may cause malfunction.
- Shut off the external power supply (all phases) used in the system before mounting or removing the Simple Motion board. Failure to do so may cause the Simple Motion board to fail or malfunction.
- Tighten the board-fixing screws within the specified torque range. Undertightening can cause drop of the component or wire, short circuit, or malfunction. Overtightening can damage the screw and/or Simple Motion board, resulting in drop, short circuit, or malfunction. For the tightening torque of the board-fixing screws, refer to the manual supplied with the personal computer.
- After the first use of the product, do not mount/remove the Simple Motion board to/from the personal computer more than 50 times. Exceeding the limit of 50 times may cause malfunction.
- Maintenance must be performed by qualified maintenance personnel with knowledge.
- Before handling the Simple Motion board, touch a conducting object such as a grounded metal to discharge the static electricity from the human body. Failure to do so may cause the Simple Motion board to fail or malfunction.
- The Simple Motion board is included in an antistatic envelope. When storing or transporting it, be sure to put it in the antistatic envelope. Failure to do so may cause a failure or malfunction.
- The microprocessor built in the Simple Motion board will reach a high temperature during operation. Do not touch it directly when replacing the Simple Motion board. Doing so may result in a burn.
- Before testing the operation, set a low speed value for the speed limit parameter so that the operation can be stopped immediately upon occurrence of a hazardous condition.
- Confirm and adjust the program and each parameter before operation. Unpredictable movements may occur depending on the machine.
- When using the absolute position system function, on starting up, and when the Simple Motion board or absolute position motor has been replaced, always perform a home position return.
- Before starting the operation, confirm the brake function.
- Do not perform a megger test (insulation resistance measurement) during inspection.
- After maintenance and inspections are completed, confirm that the position detection of the absolute position detection function is correct.
- Extreme adjustments and changes may lead to unstable operation, so never make them.

[Startup and Maintenance Precautions]

⚠CAUTION

- Do not place the Simple Motion board or servo amplifier on metal that may cause a power leakage or wood, plastic or vinyl that may cause static electricity buildup. Doing so can cause malfunction or failure of the Simple Motion board.

[Operating Precautions]

⚠CAUTION

- When changing data and operating status, and modifying program of the running Simple Motion board, read relevant manuals carefully and ensure the safety before operation. Incorrect change or modification may cause system malfunction, damage to the machines, or accidents.
- Do not power off or reboot the personal computer while the setting values in the buffer memory are being written to the flash ROM in the Simple Motion board. Doing so will make the data in the flash ROM undefined. The values need to be set in the buffer memory and written to the flash ROM again. Doing so also can cause malfunction or failure of the Simple Motion board.
- Note that when the reference axis speed is specified for interpolation operation, the speed of the partner axis (2nd, 3rd, or 4th axis) may exceed the speed limit value.
- Do not go near the machine during test operations or during operations such as teaching. Doing so may lead to injuries.

[Disposal Precautions]

⚠CAUTION

- When disposing of this product, treat it as industrial waste.

[Transportation Precautions]

⚠CAUTION

- The halogens (such as fluorine, chlorine, bromine, and iodine), which are contained in a fumigant used for disinfection and pest control of wood packaging materials, may cause failure of the product. Prevent the entry of fumigant residues into the product or consider other methods (such as heat treatment) instead of fumigation. The disinfection and pest control measures must be applied to unprocessed raw wood.
- The Simple Motion board is a precision machine, so do not drop or apply strong impacts on it.

CONDITIONS OF USE FOR THE PRODUCT

(1) Mitsubishi Simple Motion board ("the PRODUCT") shall be used in conditions;
i) where any problem, fault or failure occurring in the PRODUCT, if any, shall not lead to any major or serious accident; and
ii) where the backup and fail-safe function are systematically or automatically provided outside of the PRODUCT for the case of any problem, fault or failure occurring in the PRODUCT.

(2) The PRODUCT has been designed and manufactured for the purpose of being used in general industries.
MITSUBISHI SHALL HAVE NO RESPONSIBILITY OR LIABILITY (INCLUDING, BUT NOT LIMITED TO ANY AND ALL RESPONSIBILITY OR LIABILITY BASED ON CONTRACT, WARRANTY, TORT, PRODUCT LIABILITY) FOR ANY INJURY OR DEATH TO PERSONS OR LOSS OR DAMAGE TO PROPERTY CAUSED BY the PRODUCT THAT ARE OPERATED OR USED IN APPLICATION NOT INTENDED OR EXCLUDED BY INSTRUCTIONS, PRECAUTIONS, OR WARNING CONTAINED IN MITSUBISHI'S USER, INSTRUCTION AND/OR SAFETY MANUALS, TECHNICAL BULLETINS AND GUIDELINES FOR the PRODUCT.
("Prohibited Application")
Prohibited Applications include, but not limited to, the use of the PRODUCT in;
- Nuclear Power Plants and any other power plants operated by Power companies, and/or any other cases in which the public could be affected if any problem or fault occurs in the PRODUCT.
- Railway companies or Public service purposes, and/or any other cases in which establishment of a special quality assurance system is required by the Purchaser or End User.
- Aircraft or Aerospace, Medical applications, Train equipment, transport equipment such as Elevator and Escalator, Incineration and Fuel devices, Vehicles, Manned transportation, Equipment for Recreation and Amusement, and Safety devices, handling of Nuclear or Hazardous Materials or Chemicals, Mining and Drilling, and/or other applications where there is a significant risk of injury to the public or property.

Notwithstanding the above, restrictions Mitsubishi may in its sole discretion, authorize use of the PRODUCT in one or more of the Prohibited Applications, provided that the usage of the PRODUCT is limited only for the specific applications agreed to by Mitsubishi and provided further that no special quality assurance or fail-safe, redundant or other safety features which exceed the general specifications of the PRODUCTs are required. For details, please contact the Mitsubishi representative in your region.

INTRODUCTION

Thank you for purchasing the personal computer embedded type servo system controllers.
This manual describes the functions and programming of the relevant products listed below.
Before using this product, please read this manual and the relevant manuals carefully and develop familiarity with the functions and performance of the personal computer embedded type servo system controller to handle the product correctly.
When applying the program examples provided in this manual to an actual system, ensure the applicability and confirm that it will not cause system control problems.
Please make sure that the end users read this manual.

Relevant products

MR-EM340GF

Point

Symbols used in this manual are shown below.
A serial No. is inserted in the "**" mark.
- [Pr.**]: Symbols indicating positioning parameter or home position return parameter items
- [Da.**]: Symbols indicating positioning data or block start data items
- [Md.**]: Symbols indicating monitor data items
- [Cd.**]: Symbols indicating control data items

COMPLIANCE WITH EMC AND LOW VOLTAGE DIRECTIVES

Method of ensuring compliance

To ensure that this product maintains EMC and Low Voltage Directives, please refer to the following manual.

📖Simple Motion Board User's Manual (Startup)

CONTENTS

SAFETY PRECAUTIONS 1
CONDITIONS OF USE FOR THE PRODUCT 7
INTRODUCTION 7
COMPLIANCE WITH EMC AND LOW VOLTAGE DIRECTIVES 8
RELEVANT MANUALS 15
TERMS 16

CHAPTER 1 START AND STOP 18

1.1 Start 18
Multiple axes simultaneous start 24
1.2 Stop 27
1.3 Restart 32

CHAPTER 2 HOME POSITION RETURN CONTROL 34

2.1 Outline of Home Position Return Control 34
Two types of home position return control 34
2.2 Machine Home Position Return 36
Outline of the machine home position return operation 36
Machine home position return method 37
Driver home position return method 38
2.3 Fast Home Position Return 41
Outline of the fast home position return operation 41
2.4 Selection of the Home Position Return Setting Condition 43
Outline of the home position return setting condition 43

CHAPTER 3 MAJOR POSITIONING CONTROL 44

3.1 Outline of Major Positioning Controls 44
Data required for major positioning control 46
Operation patterns of major positioning controls 47
Designating the positioning address 55
Confirming the current value 56
Control unit "degree" handling 57
Interpolation control 60
3.2 Setting the Positioning Data 64
Relation between each control and positioning data 64
1-axis linear control 67
2-axis linear interpolation control 69
3-axis linear interpolation control 73
4-axis linear interpolation control 77
Fixed-feed control 79
2-axis circular interpolation control with sub point designation 82
2-axis circular interpolation control with center point designation 86
3-axis helical interpolation control with sub point designation 91
3-axis helical interpolation control with center point designation 97
Speed control 104
Speed-position switching control (INC mode) 108
Speed-position switching control (ABS mode) 116
Position-speed switching control 124

Current value changing 131
NOP instruction 135
JUMP instruction 136
LOOP. 138
LEND 139

CHAPTER 4 HIGH-LEVEL POSITIONING CONTROL 140

4.1 Outline of High-level Positioning Control 140
Data required for high-level positioning control 141
"Block start data" and "condition data" configuration. 142
4.2 High-level Positioning Control Execution Procedure 143
4.3 Setting the Block Start Data 144
Relation between various controls and block start data 144
Block start 145
Condition start 147
Wait start 148
Simultaneous start. 149
Repeated start (FOR loop) 150
Repeated start (FOR condition). 151
Restrictions when using the NEXT start 152
4.4 Setting the Condition Data 153
Relation between various controls and the condition data 153
Condition data setting examples 155
4.5 Start Program for High-level Positioning Control 156
Starting high-level positioning control 156
Example of a start program for high-level positioning control 157

CHAPTER 5 MANUAL CONTROL 160

5.1 Outline of Manual Control. 160
Three manual control methods 160
5.2 JOG Operation. 162
Outline of JOG operation. 162
JOG operation execution procedure 165
Setting the required parameters for JOG operation 166
Creating start programs for JOG operation 167
JOG operation example. 169
5.3 Inching Operation 171
Outline of inching operation. 171
Inching operation execution procedure 174
Setting the required parameters for inching operation 175
Creating a program to enable/disable the inching operation. 176
Inching operation example 178
5.4 Manual Pulse Generator Operation 179
Outline of manual pulse generator operation 179
Manual pulse generator operation execution procedure 184
Setting the required parameters for manual pulse generator operation 185
Creating a program to enable/disable the manual pulse generator operation. 186

CHAPTER 6 INTER-MODULE SYNCHRONIZATION FUNCTION 188

CHAPTER 7 EXPANSION CONTROL 190

7.1 Speed-torque Control 190
Outline of speed-torque control 190
Setting the required parameters for speed-torque control 191
Setting the required data for speed-torque control 192
Operation of speed-torque control 193
7.2 Advanced synchronous control. 201
7.3 Direct Control. 202
Outline of direct control 202
Differences between standard control and direct control 202
Setting the required parameters for direct control 204
Start and stop of direct control. 205
Control method of direct control 211
List of parameters and data. 214
Direct control setting parameter 214
Control data for direct control 215
Direct control monitor data 216

CHAPTER 8 CONTROL SUB FUNCTIONS 218

8.1 Outline of Sub Functions 218
Outline of sub functions. 218
8.2 Functions for Compensating the Control 220
Backlash compensation function 220
Electronic gear function 222
Near pass function. 228
8.3 Functions to Limit the Control 230
Speed limit function 230
Torque limit function. 232
Software stroke limit function. 235
Hardware stroke limit function 241
Forced stop function 247
8.4 Functions to Change the Control Details 250
Speed change function 250
Override function 256
Acceleration/deceleration time change function 258
Torque change function 261
Target position change function. 265
8.5 Functions Related to Start 268
Pre-reading start function 268
8.6 Absolute Position System 270
8.7 Functions Related to Stop 271
Stop command processing for deceleration stop function. 271
Continuous operation interrupt function. 273
Step function 275
8.8 Other Functions. 280
Skip function 280
M code output function 282
Teaching function. 286
Command in-position function. 292
Acceleration/deceleration processing function 294

Deceleration start flag function . . . 296
Speed control 10 x multiplier setting for degree axis function . . . 299
Operation setting for incompletion of home position return function . . . 301
Controller in-position function . . . 303
8.9 Servo ON/OFF . . . 304
Servo ON/OFF . . . 304
Follow up function . . . 306

CHAPTER 9 COMMON FUNCTIONS 307

9.1 Outline of Common Functions . . . 307
9.2 Parameter Initialization Function . . . 308
9.3 Execution Data Backup Function . . . 310
9.4 External Input Signal Select Function . . . 312
9.5 Link Device External Signal Assignment Function . . . 321
9.6 History Monitor Function . . . 328
9.7 Amplifier-less Operation Function . . . 330
9.8 Virtual Servo Amplifier Function . . . 334
9.9 Mark Detection Function . . . 338
9.10 Event History Function . . . 348
9.11 Servo Cyclic Transmission Function . . . 354
9.12 Servo Transient Transmission Function . . . 356
9.13 Test mode . . . 361
9.14 Servo Parameter Change Function . . . 365
9.15 User watchdog function . . . 370
9.16 Remote operation . . . 372
Remote RESET . . . 372
9.17 Time setting . . . 373
9.18 PCI Express connection . . . 374
PCI Express link-down detection function . . . 374
9.19 Interrupt function . . . 375
9.20 DMA transmission function . . . 392
9.21 Ethernet communication connection . . . 395

CHAPTER 10 PARAMETER SETTING 401

10.1 Parameter Setting Procedure . . . 401
10.2 Parameters . . . 402
10.3 Network Parameters . . . 402

CHAPTER 11 SPECIFICATIONS OF I/O SIGNALS WITH USER PROGRAMS 403

11.1 List of Input/Output Signals with User Programs . . . 403
11.2 Details of Input Signals . . . 405
11.3 Details of Output Signals . . . 406

CHAPTER 12 DATA USED FOR POSITIONING CONTROL 407

12.1 Types of Data . . . 407
Parameters and data required for control . . . 407
Setting items for servo network composition parameters . . . 410
Setting items for common parameters . . . 410
Setting items for positioning parameters . . . 411
Setting items for home position return parameters . . . 421

Setting items for positioning data 422
Setting items for block start data 425
Setting items for condition data 425
Types and roles of monitor data 426
Types and roles of control data 429
12.2 List of Buffer Memory Addresses 432
12.3 Basic Setting 453
Servo network composition parameters 453
Common parameters 454
Basic parameters1 456
Basic parameters2 460
Detailed parameters1 461
Detailed parameters2 468
Home position return basic parameters 477
Home position return detailed parameters 480
12.4 Positioning Data 482
12.5 Block Start Data 496
12.6 Condition Data 499
12.7 Monitor Data 507
System monitor data 507
Axis monitor data 518
Servo network composition status 542
12.8 Control Data 543
System control data 543
Axis control data 549
12.9 Memory Configuration and Data Process 578
Configuration and roles 578
Buffer memory area configuration 580
Data transmission timing 582
Data transmission process 583

CHAPTER 13 PROGRAMMING 589

13.1 Precautions for Creating User Program 589
13.2 List of Labels Used 590
13.3 Creating a User Program 592
General configuration of user program 592
13.4 Positioning Program Examples 593

CHAPTER 14 TROUBLESHOOTING 606

14.1 Troubleshooting Procedure 606
Troubleshooting using the LEDs 606
Troubleshooting using the Simple Motion board status 609
14.2 Troubleshooting by Symptom 610
14.3 Error and Warning Details 611
Error type 611
Error code classification 612
Error storage 612
Warning type 613
Warning code classification 613
Warning storage 613

Clearing errors and warnings 614
14.4 **List of Warning Codes** **615**
Simple Motion board detection warning 615
Servo amplifier detection warning 624
14.5 **List of Error Codes** **625**
Simple Motion board detection error 625
Servo amplifier detection error 654

APPENDICES 655

Appendix 1 How to Find Buffer Memory Addresses **655**
Appendix 2 Restrictions by the version **659**

INDEX 661

REVISIONS 664
WARRANTY 665
INFORMATION AND SERVICES 666
TRADEMARKS 666

RELEVANT MANUALS

Manual name [manual number]	Description	Available form
Simple Motion Board User's Manual (Application) [IB-0300324] (This manual)	Functions, input/output signals, buffer memory, parameter settings, programming, and troubleshooting of the Simple Motion board	Print book e-Manual PDF
Simple Motion Board User's Manual (Startup) [IB-0300322]	Specifications, procedures before operation, system configuration, wiring, and operation examples of the Simple Motion board	Print book e-Manual PDF
Simple Motion Board User's Manual (Advanced Synchronous Control) [IB-0300326]	Functions and programming for the synchronous control of the Simple Motion board	Print book e-Manual PDF
Simple Motion Board User's Manual (Network) [IB-0300328]	Functions, parameter settings, troubleshooting, and buffer memory of CC-Link IE Field Network	Print book e-Manual PDF
Simple Motion Board User's Manual (API Library) [IB-0300330]	API library and others that the host personal computer uses to control the Simple Motion board	Print book e-Manual PDF

Point

e-Manual refers to the Mitsubishi FA electronic book manuals that can be browsed using a dedicated tool.
e-Manual has the following features:

- Required information can be cross-searched in multiple manuals.
- Other manuals can be accessed from the links in the manual.
- The hardware specifications of each part can be found from the product figures.
- Pages that users often browse can be bookmarked.

TERMS

Unless otherwise specified, this manual uses the following terms.

Term	Description
API library	A general name for the library that creates the application on the host personal computer controlling the Simple Motion board
Axis	Another term for a servo amplifier
Baton pass	A token to send data over a network
Buffer memory	A memory in the Simple Motion board, where data (such as setting values and monitoring values) are stored
CC-Link IE Field Network	A high-speed and large-capacity open field network that is based on Ethernet (1000BASE-T)
Cyclic transmission	A function by which data are periodically exchanged among stations on the network using link devices
Data link	A generic term for cyclic transmission and transient transmission
Device	A device (X, Y, RX, RY, or others) in the Simple Motion board
Disconnection	A process of stopping data link if a data link error occurs
DMA transmission	Automatic data transfer between a buffer memory of the MR-EM340GF and a memory in the host personal computer
EM Configurator	A product name for start-up and examination tool for Simple Motion board
EM Software Development Kit	A product name for software development kit for Simple Motion board
Host personal computer	A general name for a personal computer which operates user programs
Intelligent device station	A station that exchanges I/O signals (bit data) and I/O data (word data) with another station by cyclic transmission. This station responds to a transient transmission request from another station and also issues a transient transmission request to another station.
Label	A label that represents one of memory areas (I/O signals and buffer memory areas) specific to the Simple Motion board in a given character string
Link device	A device (RX, RY, RWr, or RWw) in a module on CC-Link IE Field Network
Link refresh	Automatic data transfer between a link device of the master station and a device in a CPU module
Link scan (link scan time)	Time required for all the stations on the network to transmit data. The link scan time depends on data volume and the number of transient transmission requests.
Local station	A station that performs cyclic transmission and transient transmission with the master station and other local stations
Master station	A station that controls the entire network. This station can perform cyclic transmission and transient transmission with all stations. Only one master station can be used in a network.
MR-EM340GF	Another term for the Simple Motion board compatible with CC-Link IE Field Network
MR-J4-GF	MR-J4-_GF_(-RJ) Servo amplifier series
MSI	An interrupt name used by PCI Express
Network module	A generic term for the following modules: • Ethernet interface module • CC-Link IE Controller Network module • Module on CC-Link IE Field Network • MELSECNET/H network module • MELSECNET/10 network module • RnENCPU (network part)
Operation cycle	A motion operation cycle that is set in the inter-module synchronization cycle setting of the Simple Motion board
Remote device station	A station that exchanges I/O signals (bit data) and I/O data (word data) with another station by cyclic transmission. This station responds to a transient transmission request from another station.
Remote I/O station	A station that exchanges I/O signals (bit data) with the master station by cyclic transmission
Remote input (RX)	Bit data input from a slave station to the master station (For some areas in a local station, data are output in the opposite direction.)
Remote output (RY)	Bit data output from the master station to a slave station (For some areas in a local station, data are output in the opposite direction.)
Remote register (RWr)	Word data input from a slave station to the master station (For some areas in a local station, data are output in the opposite direction.)
Remote register (RWw)	Word data output from the master station to a slave station (For some areas in a local station, data are output in the opposite direction.)
Return	A process of restarting data link when a station recovers from an error
Routing	A process of selecting paths for communication with other networks. There are two types of routing: dynamic routing that auto-selects the communication routes, and static routing where communication routes are arbitrarily set.
Servo amplifier	A generic term for a drive unit Unless specified in particular, indicates the motor driver unit of the sequential command method which is controlled by the Simple Motion board (belonging to own station).

Term	Description
Simple Motion board	The abbreviation for the personal computer embedded type servo system controller Simple Motion board
Slave station	A generic term for a local station, remote I/O station, remote device station, and intelligent device station
Submaster station	A station that serves as a master station to control the entire network if the master station is disconnected. Only one master station can be used in a network.
Transient transmission	A function of communication with another station, which is used when requested by EM Configurator
User program	A general name for applications using the API library

1 START AND STOP

This chapter describes start and stop methods of the positioning control for the Simple Motion board.

1.1 Start

The Simple Motion board operates the start trigger in each control, and starts the positioning control. The following table shows the start signals for each control. This section describes the start using the positioning start signal [Y10 to Y1F] and the external command signal.

<table>
<tr><th colspan="2">Control details</th><th>Start trigger</th></tr>
<tr><td colspan="2">Major positioning control</td><td rowspan="3">• Turns ON the positioning start signal [Y10 to Y1F].
• Turns ON the external command signal (DI).</td></tr>
<tr><td colspan="2">High-level positioning control</td></tr>
<tr><td colspan="2">Home position return control</td></tr>
<tr><td rowspan="3">Manual control</td><td>JOG operation</td><td rowspan="2">Turns ON the "[Cd.181] Forward run JOG start" or the "[Cd.182] Reverse run JOG start".</td></tr>
<tr><td>Inching operation</td></tr>
<tr><td>Manual pulse generator operation</td><td>Operates the manual pulse generator.</td></tr>
</table>

In the control other than the manual control, the following start methods can be selected.

- Normal start (☞ Page 145 Block start)
- Multiple axes simultaneous start (☞ Page 24 Multiple axes simultaneous start)

The positioning data, block start data, and condition data are used for the position specified at the control. The data that can be used varies by the start method.

Servo ON conditions

Setting of servo parameter

↓

User program READY signal [Y0] ON

↓

All axis servo ON [Y1] ON

Point

[API library]

To turn the user program READY signal ON, use the MMC_Controller::SetUserProgramReady method.

Starting conditions

To start the control, the following conditions must be satisfied.

The necessary start conditions must be incorporated in the user program so that the control is not started when the conditions are not satisfied.

- Operation state

n: Axis No. - 1

Monitor item		Operation state	Buffer memory address
[Md.26]	Axis operation status	"0: Standby" or "1: Stopped"	2409+100n

For labels, refer to the following.

☞ Page 435 Axis monitor data

• Signal state

Signal name		Signal state		Device
I/O signal	User program READY signal	ON	User program preparation completed	Y0
	READY signal	ON	Preparation completed	X0
	All axis servo ON	ON	All axis servo ON	Y1
	Synchronization flag	ON	The buffer memory can be accessed.	X1
	Axis stop signal	OFF	Axis stop signal is OFF	[Cd.180] Axis stop
	M code ON signal	OFF	M code ON signal is OFF	[Md.31] Status: b12
	Error detection signal	OFF	There is no error	[Md.31] Status: b13
	BUSY signal	OFF	BUSY signal is OFF	X10 to X1F
	Start complete signal	OFF	Start complete signal is OFF	[Md.31] Status: b14
External signal	Forced stop input signal	ON	There is no forced stop input	—
	Stop signal	OFF	Stop signal is OFF	—
	Upper limit (FLS)	ON	Within limit range	—
	Lower limit (RLS)	ON	Within limit range	—

Point

[API library]

The synchronization flag is checked within the API library, so that it is not required to be checked by the user program.

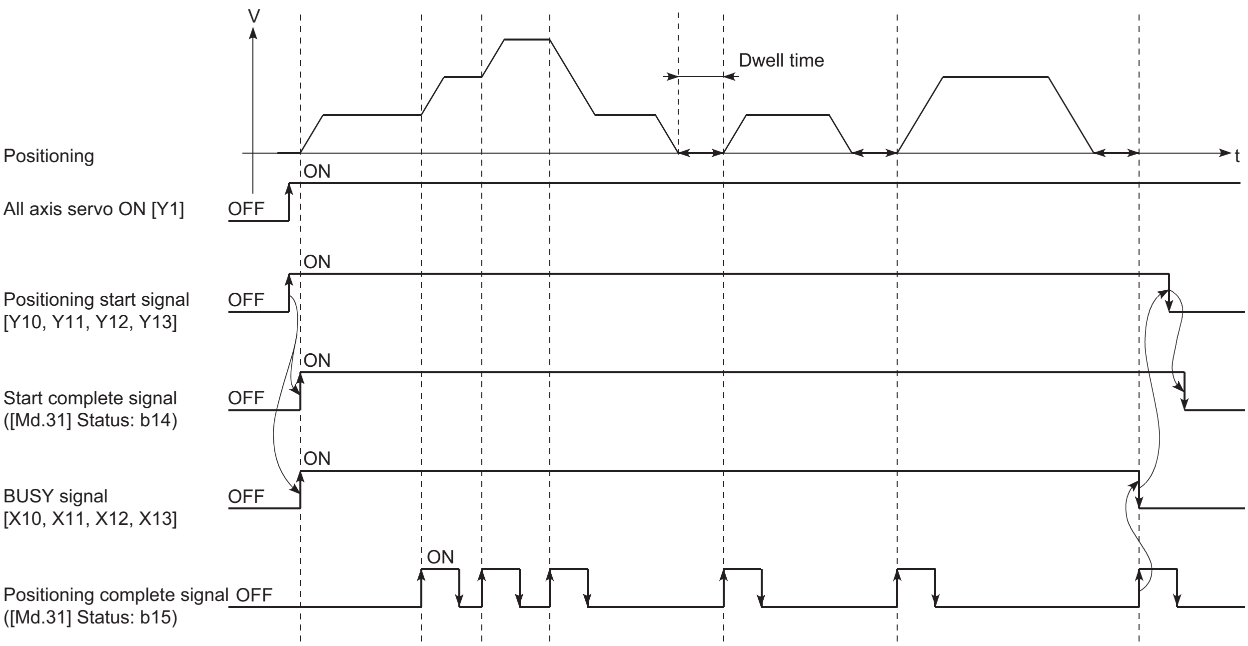
Start by the positioning start signal [Y10 to Y1F]

The operation at starting by the positioning start signal [Y10 to Y1F] is shown below.

- When the positioning start signal [Y10 to Y1F] turns ON, the start complete signal ([Md.31] Status: b14) and BUSY signal [X10 to X1F] turn ON, and the positioning operation starts. It can be seen that the axis is operating when the BUSY signal [X10 to X1F] is ON.
- When the positioning start signal [Y10 to Y1F] turns OFF, the start complete signal ([Md.31] Status: b14) also turns OFF. If the positioning start signal [Y10 to Y1F] is ON even after positioning is completed, the start complete signal ([Md.31] Status: b14) will remain ON.
- If the positioning start signal turns ON again while the BUSY signal [X10 to X1F] is ON, the warning "Start during operation" (warning code: 0900H)" will occur.
- The process executed when the positioning operation is completed will differ by whether the next positioning control is executed.

Whether the next positioning control is executed	Processing details
Do not execute the positioning	• If a dwell time is set, the system will wait for the set time to pass, and then positioning will be completed. • When positioning is completed, the BUSY signal [X10 to X1F] will turn OFF and the positioning complete signal ([Md.31] Status: b15) will turn ON. However, when using speed control or when the positioning complete signal ON time is "0", the signal will not turn ON. • When the time set in "[Pr.40] Positioning complete signal output time" is passed, the positioning complete signal ([Md.31] Status: b15) will turn OFF.
Execute the positioning	• If a dwell time is set, the system will wait for the set time to pass. • When the set dwell time is passed, the next positioning will start.

■Axis 1 to 4 operation example



Point

The BUSY signal [X10 to X1F] turns ON even when position control of movement amount 0 is executed. However, since the ON time is short, the ON status may not be detected in the user program. (The ON status of the start complete signal ([Md.31] Status: b14), positioning complete signal ([Md.31] Status: b15) and M code ON signal ([Md.31] Status: b12) can be detected in the user program.)

Point

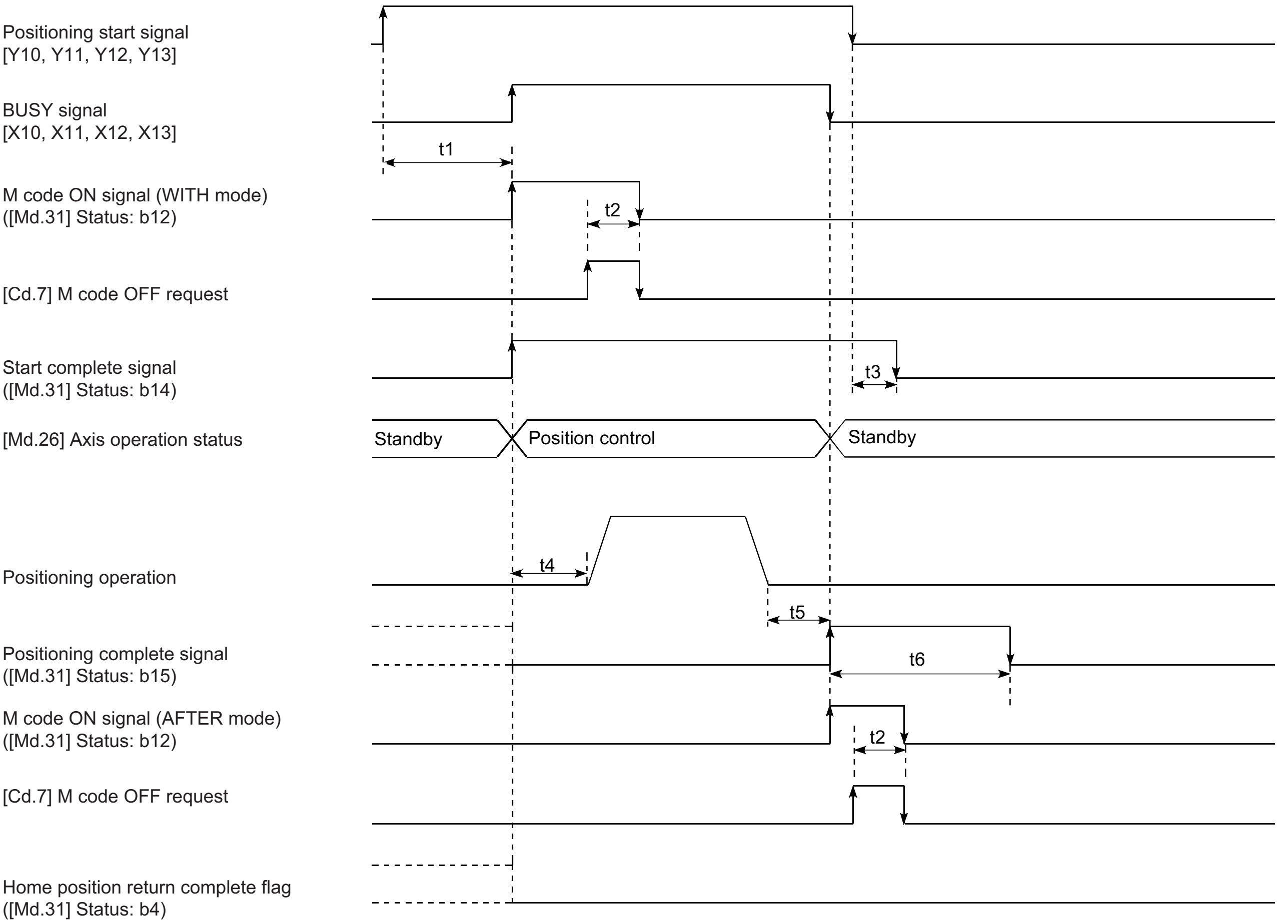
[API library]

- To perform the positioning control start, use the MMC_Axis::StartPositioning method.
- To wait until the positioning control is completed, use the MMC_Axis::WaitPositioningDone method or the MMC_Axis::WaitPositioningDoneIntEvent method.

■Operation timing and processing time

The following shows details about the operation timing and time during position control.

- Axis 1 to 4 operation example



Point

When the positioning start signal turns ON, if the "positioning complete signal" or the "home position return complete flag" are already ON, the "positioning complete signal" or the "home position return complete flag" will turn OFF when the positioning start signal turns ON.

- Normal timing time (Unit: [ms])

Operation cycle	t1*1	t2	t3	t4	t5	t6
0.50	0.227 to 0.704	0.000 to 0.500	0.000 to 0.500	1.288 to 1.440	0.000 to 0.500	Follows parameters
1.00	0.375 to 1.149	0.000 to 1.000	0.000 to 1.000	2.758 to 2.906	0.000 to 1.000	Follows parameters
2.00	0.278 to 2.222	0.000 to 2.000	0.000 to 2.000	5.863 to 5.899	0.000 to 2.000	Follows parameters
4.00	0.399 to 3.120	0.000 to 4.000	0.000 to 4.000	11.858 to 11.896	0.000 to 4.000	Follows parameters

*1 The t1 timing time could be delayed by the operation state of other axes.

Start by the external command signal (DI)

When starting positioning control by inputting the external command signal (DI), the start command via link device can be directly input into the Simple Motion board. By using external command signals (block No.7000 to 7004 start), the block start can be executed without user programs.

■Advance setting

Set the following data in advance. (The setting is carried out using a user program.)

Start signal	Relevant parameter	Positioning No. to be started
External command signal (external positioning start)	[Pr.950] to [Pr.953]	The number set in "[Cd.3] Positioning start No."
External command signal (block No.7000 start)	[Pr.1020] to [Pr.1023]	7000
External command signal (block No.7001 start)	[Pr.1030] to [Pr.1033]	7001
External command signal (block No.7002 start)	[Pr.1040] to [Pr.1043]	7002
External command signal (block No.7003 start)	[Pr.1050] to [Pr.1053]	7003
External command signal (block No.7004 start)	[Pr.1060] to [Pr.1063]	7004

When the start command via link device (block No.7000 to 7004) is executed, the block No. (7000 to 7004) is set in "[Cd.3] Positioning start No." by the Simple Motion board.

Do not overwrite in "[Cd.3] Positioning start No." until the analysis is completed and the operation is started.

Refer to the following for details on the setting method.

☞ Page 321 Link Device External Signal Assignment Function

■Start method

Set "[Cd.3] Positioning start No." and enable "[Cd.8] External command valid" with a user program. Then, turn ON the external command signal (DI).

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.3]	Positioning start No.	1 to 600	Set the positioning data No. to be started.	4300+100n
[Cd.8]	External command valid	1	Set to "1: Validates an external command.".	4305+100n

For labels, refer to the following.

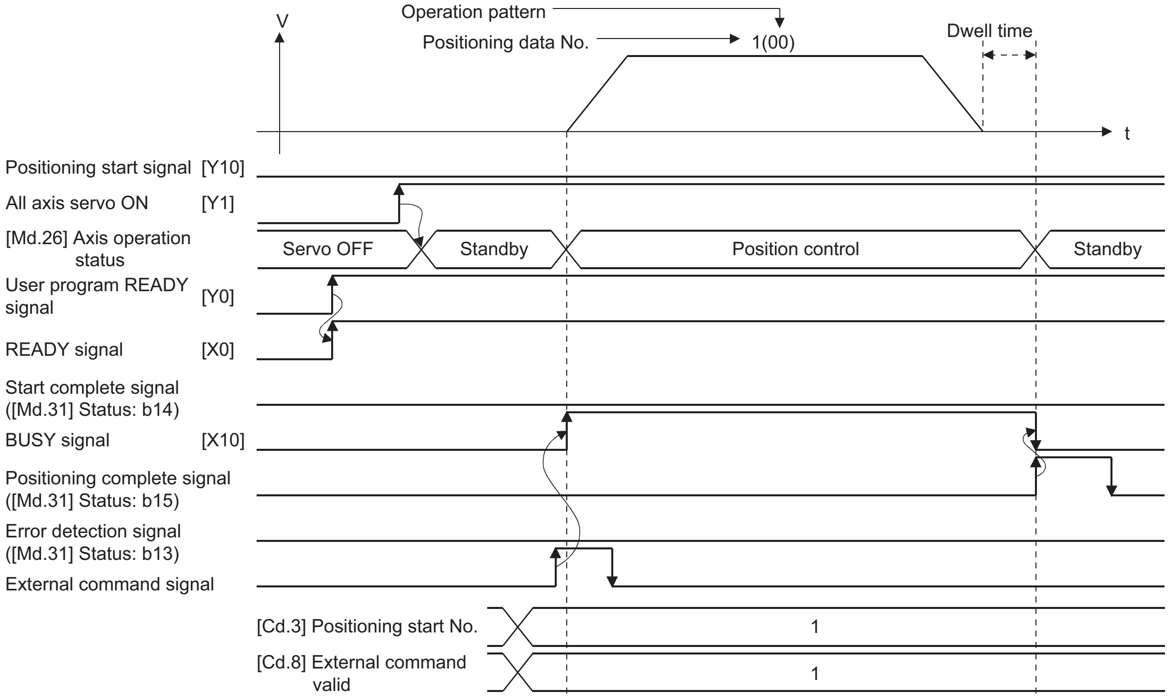
☞ Page 437 Axis control data

■Restriction

When starting by inputting the external command signal (DI), the start complete signal ([Md.31] Status: b14) will not turn ON.

■Starting time chart

- Axis 1 to 4 operation example



Multiple axes simultaneous start

The "multiple axes simultaneous start" starts outputting the command to the specified simultaneous starting axis at the same timing as the started axis. The maximum of four axes can be started simultaneously.

Control details

The multiple axes simultaneous start control is carried out by setting the simultaneous start setting data to the multiple axes simultaneous start control buffer memory of the axis control data, "9004" to "[Cd.3] Positioning start No." of the start axis, and then turning ON the positioning start signal.
Set the number of axes to be started simultaneously and axis No. in "[Cd.43] Simultaneous starting axis", and the start data No. of simultaneous starting axis (positioning data No. to be started simultaneously for each axis) in "[Cd.30] Simultaneous starting own axis start data No." and "[Cd.31] Simultaneous starting axis start data No.1" to "[Cd.33] Simultaneous starting axis start data No.3".

Restrictions

- The error "Error before simultaneous start" (error code: 1990H, 1991H) will occur and all simultaneous starting axes will not start if the simultaneous starting axis start data No. is not set to the axis control data on the start axis or set outside the setting range.
- The error "Error before simultaneous start" (error code: 1990H, 1991H) will occur and all simultaneous starting axes will not start if either of the simultaneously started axes is BUSY.
- The error "Error before simultaneous start" (error code: 1990H, 1991H) will occur and all simultaneous starting axes will not start if an error occurs during the analysis of the positioning data on the simultaneous starting axes.
- No error or warning will occur if only the start axis is the simultaneous starting axis.
- This function cannot be used with the sub function ☞ Page 268 Pre-reading start function.

Procedure

The procedure for multiple axes simultaneous start control is shown below.

1. Set the following axis control data.

- [Cd.43] Simultaneous starting axis
- [Cd.30] Simultaneous starting own axis start data No.
- [Cd.31] Simultaneous starting axis start data No.1
- [Cd.32] Simultaneous starting axis start data No.2
- [Cd.33] Simultaneous starting axis start data No.3

2. Write [9004] in "[Cd.3] Positioning start No.".

3. Turn ON the positioning start signal to be started.

Setting method

The following shows the setting of the data used to execute the multiple axes simultaneous start control with positioning start signals (The axis control data on the start axis is set).

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.3]	Positioning start No.	9004	Set the multiple axes simultaneous start control start No. "9004".	4300+100n
[Cd.43]	Simultaneous starting axis	Set the number of simultaneous starting axes and target axis.		4368+100n 4369+100n
[Cd.30]	Simultaneous starting own axis start data No.	Set the simultaneous starting axis start data No. Set a "0" for the axis other than the simultaneous starting axes.		4340+100n
[Cd.31]	Simultaneous starting axis start data No.1			4341+100n
[Cd.32]	Simultaneous starting axis start data No.2			4342+100n
[Cd.33]	Simultaneous starting axis start data No.3			4343+100n

Refer to the following for the setting details.

☞ Page 543 Control Data

For labels, refer to the following.

☞ Page 437 Axis control data

Setting examples

The following shows the setting examples in which the axis 10 is used as the start axis and the axis 12 and axis 14 are used as the simultaneous starting axes.

Setting item		Setting value	Setting details	Buffer memory address (Axis 10)
[Cd.3]	Positioning start No.	9004	Set the multiple axes simultaneous start control start No. "9004".	5200
[Cd.43]	Simultaneous starting axis	03000D0BH	Set the axis 12 (0BH) to the simultaneous starting axis No.1, and the axis 14 (0DH) to the simultaneous starting axis No.2.	5268, 5269
[Cd.30]	Simultaneous starting own axis start data No.	100	The axis 10 starts the positioning data No.100.	5240
[Cd.31]	Simultaneous starting axis start data No.1	200	Immediately after the start of the axis 10, the axis 12 starts the axis 12 positioning data No.200.	5241
[Cd.32]	Simultaneous starting axis start data No.2	300	Immediately after the start of the axis 10, the axis 14 starts the axis 14 positioning data No.300.	5242
[Cd.33]	Simultaneous starting axis start data No.3	0	Will not start simultaneously.	5243

For labels, refer to the following.

☞ Page 437 Axis control data

Point

The "multiple axes simultaneous start control" carries out an operation equivalent to the "simultaneous start" using the "block start data".

The setting of the "multiple axes simultaneous start control" is easier than that of the "simultaneous start" using the "block start data".

- Setting items for "simultaneous start" using "block start data": Positioning start data, block start data, condition data, and positioning data
- Setting items for "multiple axes simultaneous start control": Positioning data and axis control data

Point

[API library]

- To perform the multiple axes simultaneous start, use the MMC_Axis::StartPositioning(MMC_STNO_MULTIPLE_AXES) method.
- To wait until the multiple axes simultaneous start is completed, use the MMC_Axis::WaitPositioningDone method or the MMC_Axis::WaitPositioningDoneIntEvent method.

1.2 Stop

The axis stop signal or stop signal from external input signal is used to stop the control.
Create a user program to turn ON the axis stop signal [Cd.180] as the stop user program.
Each control is stopped in the following cases.

- When each control is completed normally
- When the Servo READY signal is turned OFF
- When a host personal computer error occurs
- When the user program READY signal is turned OFF
- When an error occurs in Simple Motion board
- When control is intentionally stopped (Stop signal from a host personal computer turned ON, "Stop signal" of external input signal turned ON, etc.)

The stop process for the above cases is shown below.
(Excluding when each control is completed normally.)
Refer to the following for the stop process during speed control mode and torque control mode.
☞ Page 190 Speed-torque Control
Refer to the following for the stop process during test mode operation.
☞ Page 364 Stop operation of the test mode operation axes
Refer to the following for the host personal computer error.
☞ Page 370 User watchdog function
☞ Page 374 PCI Express link-down detection function

Stop process

Stop cause		Stop axis	M code ON signal after stop	Axis operation status after stopping ([Md.26])
Forced stop	• "Forced stop input signal" OFF from an external device	All axes	No change	Servo OFF
	Host personal computer error occurrence • User watchdog detected			
	• PCI Express link-down detected			
	Servo READY OFF • Servo amplifier power supply OFF	Each axis	No change	Servo amplifier has not been connected
	• Servo alarm			Error
	• Forced stop input to servo amplifier			Servo OFF
Fatal stop (Stop group 1)	Hardware stroke limit upper/lower limit error occurrence	Each axis	No change	Error
Emergency stop (Stop group 2)	User program READY signal OFF	All axes	Turns OFF	Error
Relatively safe stop (Stop group 3)	Axis error detection (Error other than stop group 1 or 2)*1	Each axis	No change	Error
Intentional stop (Stop group 3)	"Axis stop signal" ON from a user program	Each axis	No change	Stopped (Standby)
	"Stop signal" of external input signal ON			

*1 If an error occurs in a positioning data due to an invalid setting value, when the continuous positioning control uses multiple positioning data successively, it automatically decelerates at the previous positioning data. It does not stop rapidly even the setting value is rapid stop in stop group 3. If any of the following error occurs, the operation is performed up to the positioning data immediately before the positioning data where an error occurred, and then stops immediately.
No command speed (error code: 1A13H, 1A14H)
Outside linear movement amount range (error code: 1A15H, 1A16H)
Large arc error deviation (error code: 1A17H)
Software stroke limit + (error code: 1A18H, 1A19H)
Software stroke limit - (error code: 1A1AH, 1A1BH)
Sub point setting error (error code: 1A27H, 1A28H, 1A29H, 1A2AH, 1A37H)
End point setting error (error code: 1A2BH, 1A2CH)
Center point setting error (error code: 1A2DH, 1A2EH, 1A2FH)
Outside radius range (error code: 1A32H)
Illegal setting of ABS direction in unit of degree (error code: 19A4H, 19A5H)

Stop cause		Stop process					
		Home position return control		Major positioning control	High-level positioning control	Manual control	
		Machine home position return control*2	Fast home position return control			JOG/ Inching operation	Manual pulse generator operation
Forced stop	• "Forced stop input signal" OFF from an external device	Immediate stop For the stop method of the servo amplifier, refer to each servo amplifier instruction manual.					—
	Host personal computer error occurrence • User watchdog detected						
	• PCI Express link-down detected						
	Servo READY OFF • Servo amplifier power supply OFF						
	• Servo alarm						
	• Forced stop input to servo amplifier						
Fatal stop (Stop group 1)	Hardware stroke limit upper/lower limit error occurrence	Deceleration stop/rapid stop (Select with "[Pr.37] Stop group 1 rapid stop selection".)					Deceleration stop
Emergency stop (Stop group 2)	User program READY signal OFF	Deceleration stop/rapid stop (Select with "[Pr.38] Stop group 2 rapid stop selection".)					Deceleration stop
Relatively safe stop (Stop group 3)	Axis error detection (Error other than stop group 1 or 2)*1	Deceleration stop/rapid stop (Select with "[Pr.39] Stop group 3 rapid stop selection".)					Deceleration stop
Intentional stop (Stop group 3)	"Axis stop signal" ON from a user program						
	"Stop signal" of external input signal ON						

*1 If an error occurs in a positioning data due to an invalid setting value, when the continuous positioning control uses multiple positioning data successively, it automatically decelerates at the previous positioning data. It does not stop rapidly even the setting value is rapid stop in stop group 3. If any of the following error occurs, the operation is performed up to the positioning data immediately before the positioning data where an error occurred, and then stops immediately.
No command speed (error code: 1A13H, 1A14H)
Outside linear movement amount range (error code: 1A15H, 1A16H)
Large arc error deviation (error code: 1A17H)
Software stroke limit + (error code: 1A18H, 1A19H)
Software stroke limit - (error code: 1A1AH, 1A1BH)
Sub point setting error (error code: 1A27H, 1A28H, 1A29H, 1A2AH, 1A37H)
End point setting error (error code: 1A2BH, 1A2CH)
Center point setting error (error code: 1A2DH, 1A2EH, 1A2FH)
Outside radius range (error code: 1A32H)
Illegal setting of ABS direction in unit of degree (error code: 19A4H, 19A5H)

*2 When the driver home position return method is used, the stop process is performed according to the specification of the servo amplifier.

Point

Provide the emergency stop circuits outside the servo system to prevent cases where danger may result from abnormal operation of the overall system in the event of an external power supply fault or servo system failure.

Point

[API library]
To perform the axis stop, use the MMC_Axis::StopPositioning method.

Types of stop processes

The operation can be stopped with deceleration stop, rapid stop or immediate stop.

■Deceleration stop

The operation stops with "deceleration time 0 to 3" ([Pr.10], [Pr.28], [Pr.29], [Pr.30]). Which time from "deceleration time 0 to 3" to use for control is set in positioning data ([Da.4]).

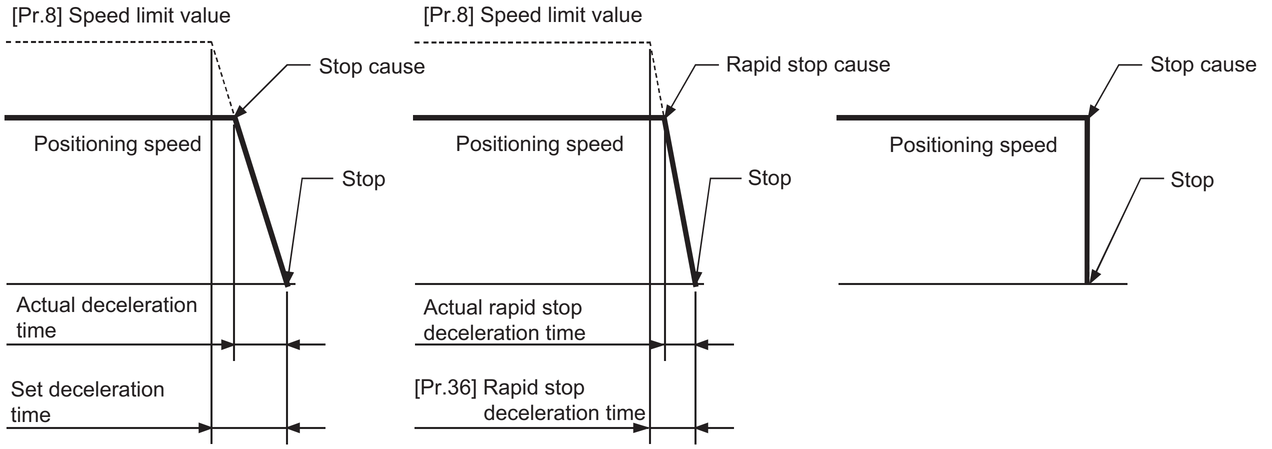
■Rapid stop

The operation stops with "[Pr.36] Rapid stop deceleration time".

■Immediate stop

The operation does not decelerate.

The Simple Motion board immediately stops the command. For the stop method of the servo amplifier, refer to each servo amplifier instruction manual.



Deceleration stop　　Rapid stop　　Immediate stop

Point

"Deceleration stop" and "rapid stop" are selected with the detailed parameter 2 "stop group 1 to 3 rapid stop selection". (The default setting is "deceleration stop".)

Order of priority for stop process

The order of priority for the Simple Motion board stop process is as follows.

(Deceleration stop) < (Rapid stop) < (Immediate stop)

- If the deceleration stop command ON (stop signal ON) or deceleration stop cause occurs during deceleration to speed 0 (including automatic deceleration), operation changes depending on the setting of "[Cd.42] Stop command processing for deceleration stop selection". (☞ Page 271 Stop command processing for deceleration stop function)

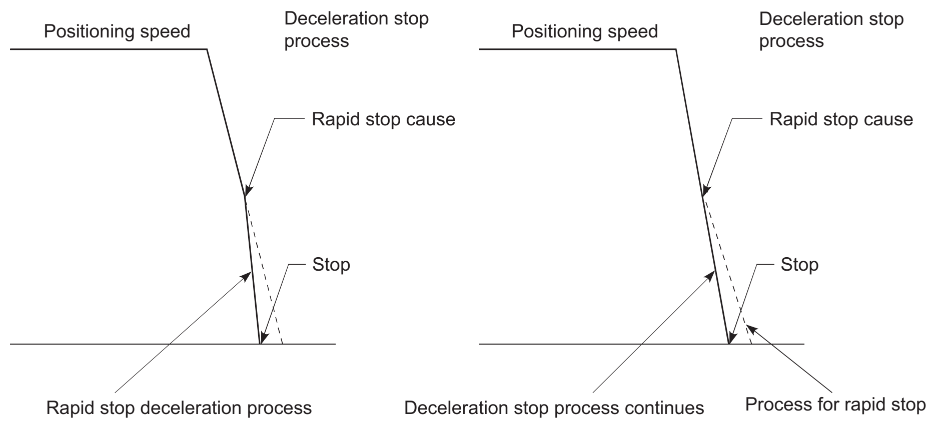
Positioning control during deceleration	Setting value of [Cd.42]	Processing details
Manual control	—	Independently of the [Cd.42] setting, a deceleration curve is re-processed from the speed at stop cause occurrence.
Home position return control*1, positioning control	0: Deceleration curve re-processing	A deceleration curve is re-processed from the speed at stop cause occurrence. (☞ Page 271 Deceleration curve re-processing)
	1: Deceleration curve continuation	The current deceleration curve is continued after stop cause occurrence. (☞ Page 271 Deceleration curve continuation)

*1 When the driver home position return method is used, the stop process is performed according to the specification of the servo amplifier.

- If the stop signal designated for rapid stop turns ON or a stop cause occurs during deceleration, the rapid stop process will start from that point. However, if the rapid stop deceleration time is longer than the deceleration time, the deceleration stop process will be continued even if a rapid stop cause occurs during the deceleration stop process.

Example

The process when a rapid stop cause occurs during deceleration stop is shown below.



(a) When deceleration stop time > rapid stop deceleration time

(b) When deceleration stop time < rapid stop deceleration time

Inputting the stop signal during deceleration

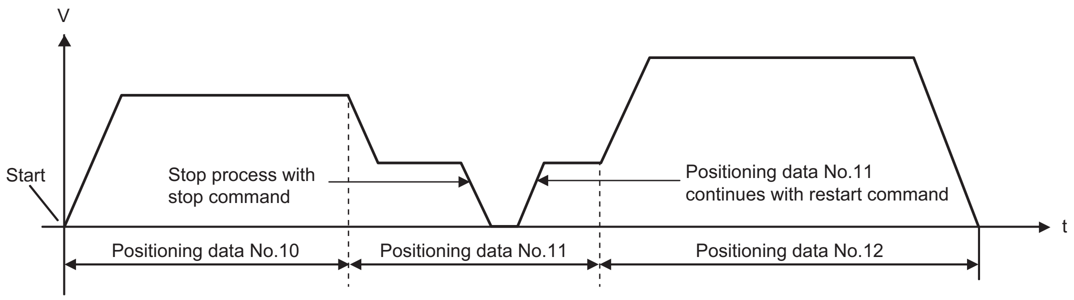
- Even if stop is input during deceleration (including automatic deceleration), the operation will stop at that deceleration speed.
- If stop is input during deceleration for home position return, the operation will stop at that deceleration speed. If input at the creep speed, the operation will stop immediately. When the driver home position return method is used, the stop process is performed according to the specification of the servo amplifier.
- If a stop cause, designated for rapid stop, occurs during deceleration, the rapid stop process will start from that point. The rapid stop process during deceleration is carried out only when the rapid stop time is shorter than the deceleration stop time.

1.3 Restart

When a stop factor occurs during position control and the operation stops, the positioning can be restarted from the stopped position to the position control end point by using the "restart command" ([Cd.6] Restart command). ("Restarting" is not possible when "continuous operation is interrupted.")
This instruction is efficient when performing the remaining positioning from the stopped position in the positioning control of incremental method such as INC linear 1. (Calculation of remaining distance is not required.)

Operation

After a deceleration stop by the stop command is completed, write "1: Restarts" to the "[Cd.6] Restart command" with "[Md.26] Axis operation status" is "stopped" and the positioning restarts.



Restrictions

- Restarting can be executed only when the "[Md.26] Axis operation status" is "stopped (the deceleration stop by stop command is completed)". If the axis operation is not "stopped", restarting is not possible. In this case, the warning "Restart not possible" (warning code: 0902H) will occur, and the process at that time will be continued.
- Do not execute restart while the stop command is ON. If restart is executed while stopped, the error "Stop signal ON at start" (error code: 1908H) will occur, and the "[Md.26] Axis operation status" will change to "Error". Thus, even if the error is reset, the operation cannot be restarted.
- Restarting can be executed even while the positioning start signal is ON. However, make sure that the positioning start signal does not change from OFF to ON while stopped.
- If the positioning start signal is changed from OFF to ON while "[Md.26] Axis operation status" is "stopped", the normal positioning (the positioning data set in "[Cd.3] Positioning start No.") is started.
- If positioning is ended with the continuous operation interrupt request, the operation cannot be restarted. If restart is requested, the warning "Restart not possible" (warning code: 0902H) will occur.
- When stopped with interpolation operation, write "1: Restarts" into "[Cd.6] Restart command" for the reference axis, and then restart.
- If the user program READY signal is changed from OFF to ON while stopped, restarting is not possible. If restart is requested, the warning "Restart not possible" (warning code: 0902H) will occur.
- When the machine home position return and fast home position return is stopped, the error "Home position return restart not possible" (error code: 1946H) will occur and the positioning cannot restarts.
- If any of reference partner axes executes the positioning operation once after interpolation operation stop, the warning "Restart not possible" (warning code: 0902H) will occur, and the positioning cannot restarts.

Setting method

Set the following data to execute restart.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.6]	Restart command	1	Set "1: Restarts".	4303+100n

Refer to the following for the setting details.

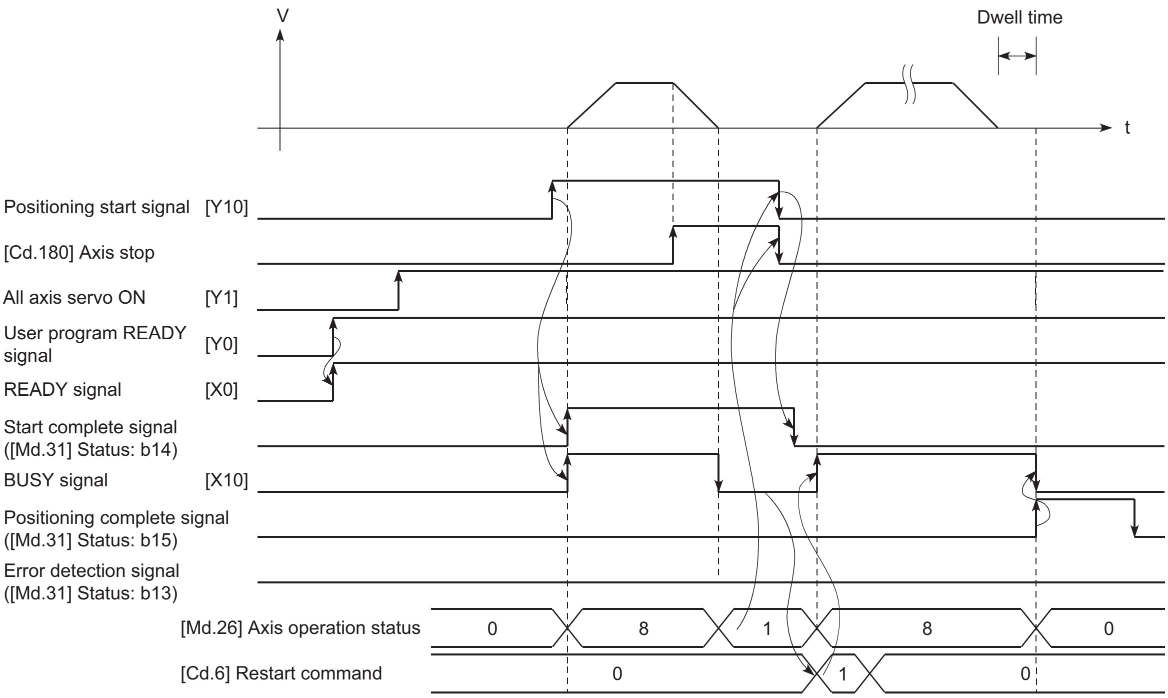
☞ Page 543 Control Data

For labels, refer to the following.

☞ Page 437 Axis control data

Time chart for restarting

■Axis 1 to 4 operation example



Point

[API library]

- To perform the restart of the stopped axis, use the MMC_Controller::RestartPositioning method.
- To wait until the positioning control is completed, use the MMC_Axis::WaitPositioningDone method or the MMC_Axis::WaitPositioningDoneIntEvent method.

Program example

Refer to the following for the user program example of restart.

☞ Page 603 Restart program

2 HOME POSITION RETURN CONTROL

The details and usage of "home position return control" are explained in this chapter.

2.1 Outline of Home Position Return Control

Two types of home position return control

In "home position return control", a position is established as the starting (or "home position") when carrying out positioning control, and positioning is carried out toward that starting point.
It is used to return a machine system at any position other than the home position to the home position when the Simple Motion board issues a "home position return request" with the power turned ON or others, or after a positioning stop.
In the Simple Motion board, the following two control types are defined as "home position return control", following the flow of the home position return work. These two types of home position return control can be executed by setting the "home position return parameters", setting "Positioning start No.9001" and "positioning start No.9002" prepared beforehand in the Simple Motion board to "[Cd.3] Positioning start No.", and turning ON the positioning start signal.

Home position return method	Home position return method operation details
Machine home position return (positioning start No.9001)	Executes the home position return operation to establish a machine home position. The following positioning control is executed based on the home position established by the home position return completion. The machine home position return is required when the machine home position has not been established (the current value monitor of the Simple Motion board and the actual machine position are not matched) due to the power supply ON of the system, etc.
Fast home position return (positioning start No.9002)	Executes the positioning to the home position established by a machine home position return. The fast home position return is operated by specifying the positioning start No.9002, so that the positioning which returns to the home position can be executed without setting the positioning data.

The "machine home position return" above must be carried out in advance to execute the "fast home position return".

CAUTION

- When using an absolute position system, execute a home position return always at the following cases: on starting up and when the controller or absolute position motor has been replaced. Check the home position return request signal using the user program, etc. before performing the positioning control. Failure to observe this could lead to an accident such as a collision.

The address information stored in the Simple Motion board cannot be guaranteed while the "home position return request flag" is ON.
The "home position return request flag" turns OFF and the "home position return complete flag" ([Md.31] Status: b4) turns ON if the machine home position return is executed and is completed normally.
The "home position return request flag" ([Md.31] Status: b3) must be turned ON in the Simple Motion board, and a machine home position return must be executed in the following cases.

Point

The reason of the home position return request flag is ON is recorded in event history.

When not using an absolute position system

- This flag turns on in the following cases:

- System's power supply on or reset
- Servo amplifier power supply on
- Machine home position return start (Unless a machine home position return is completed normally, the home position return request flag does not turn off.)

- This flag turns off by the completion of machine home position return.

When using an absolute position system

- This flag turns on in the following cases:

- When not executing a machine home position return even once after the system starts
- Machine home position return start (Unless a machine home position return is completed normally, the home position return request flag does not turn off.)
- When an absolute position data in the Simple Motion board is erased due to a memory error, etc. (occurrence of the warning "Home position return data incorrect" (warning code: 093CH))
- When the "Rotation direction selection/travel direction selection (PA14)" of servo parameter is changed
- The servo alarm "Absolute position erased" (alarm No.: 25) occurs. ([Md.108] Servo status1: b14 ON) (☞ Page 435 Axis monitor data)
- The servo warning "Absolute position counter warning" (warning No.: E3) occurs. ([Md.108] Servo status1: b14 ON) (☞ Page 435 Axis monitor data)
- When changes of servo amplifiers or motor encoders are detected
- When the MR-J4-GF was not connected at the previous establishment of the home position for virtual servo amplifier connection

- This flag turns off by the completion of the machine home position return.

When a home position return is not required

Control can be carried out ignoring the "home position return request flag" ([Md.31] Status: b3) in systems that do not require a home position return.

In this case, the "home position return parameters ([Pr.43] to [Pr.55])" must all be set to their initial values or a value at which an error does not occur.

Wiring the proximity dog

When using the proximity dog signal, wire the signal terminals corresponding to the proximity dog of the device to be used as follows.

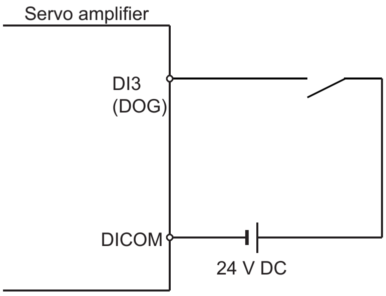
■External input signal of the servo amplifier

Refer to the servo amplifier instruction manual for details on signal input availability and wiring.

Wire the MR-J4-GF as shown in the following drawing. As for the 24 V DC power supply, the direction of current can be switched.

Ex.

When the servo parameter "Function selection T-3 (PT29)" is set to the initial value



■External input signal via host personal computer (buffer memory of the Simple Motion board)

Refer to the manual of the input module to be used for wiring.

■Link device

Refer to the manual of the remote input module to be used for wiring.

The logic setting of the stroke limit signal is configured according to "[Pr.913] Upper limit signal (FLS): Link device logic setting" and "[Pr.933] Proximity dog signal (DOG): Link device logic setting".

Home position return sub functions

Refer to the following for details on "sub functions" that can be combined with home position return control.

Simple Motion Board User's Manual (Startup)

Also refer to the following for details on each sub function.

☞ Page 218 CONTROL SUB FUNCTIONS

2.2 Machine Home Position Return

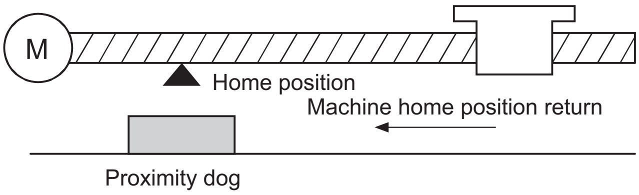
Outline of the machine home position return operation

Machine home position return operation

In a machine home position return, a home position is established.

None of the address information stored in the Simple Motion board or servo amplifier is used at this time.

The position mechanically established after the machine home position return is regarded as the "home position" to be the starting point for positioning control.



The following shows the operation of "Driver home position return method".

1. Set the home position return parameters of the servo amplifier. (Change the setting using the servo transient transmission as required. Refer to the servo amplifier instruction manual for the change method of the setting.)
2. The "machine home position return" is started.
3. The operation starts according to the speed and direction set in the servo amplifier.
4. The "home position" is established and the machine stops.
5. "[Pr.45] Home position address" will be stored as the current position in the "[Md.20] Feed current value" and "[Md.21] Feed machine value" which are monitoring the position.
6. The machine home position return is completed.

Point

The method for establishing a "home position" by a driver home position return method differs according to the setting of the servo amplifier. For details, refer to the servo amplifier instruction manual.

Point

[API library]

- To start the machine home position return, use the MMC_Axis::StartPositioning(MMC_STNO_HOMING) method.
- To wait until the machine home position return is completed, use the MMC_Axis::WaitPositioningDone method or the MMC_Axis::WaitPositioningDoneIntEvent method.

Machine home position return method

The method by which the machine home position is established (method for judging the home position and machine home position return completion) is designated in the machine home position return according to the configuration and application of the positioning method.
The following table shows the methods that can be used for this home position return method. (The home position return method is one of the items set in the home position return parameters. It is set in "[Pr.43] Home position return method" of the basic parameters for home position return.)

[Pr.43] Home position return method	Operation details
Driver home position return method	The servo amplifier is switched to the home position return mode and the home position return set in the servo amplifier starts. After the home position return is completed, the servo amplifier is returned to the previous control mode.

The following shows the signals used for machine home position return.
○: Necessary as required

[Pr.43] Home position return method	Signals required for control		
	Proximity dog	Zero signal	Upper/lower limit
Driver home position return method	○[*1]	○[*1]	○[*1]

*1 Confirm to the home position return specification of the servo amplifier for the signals required for control.

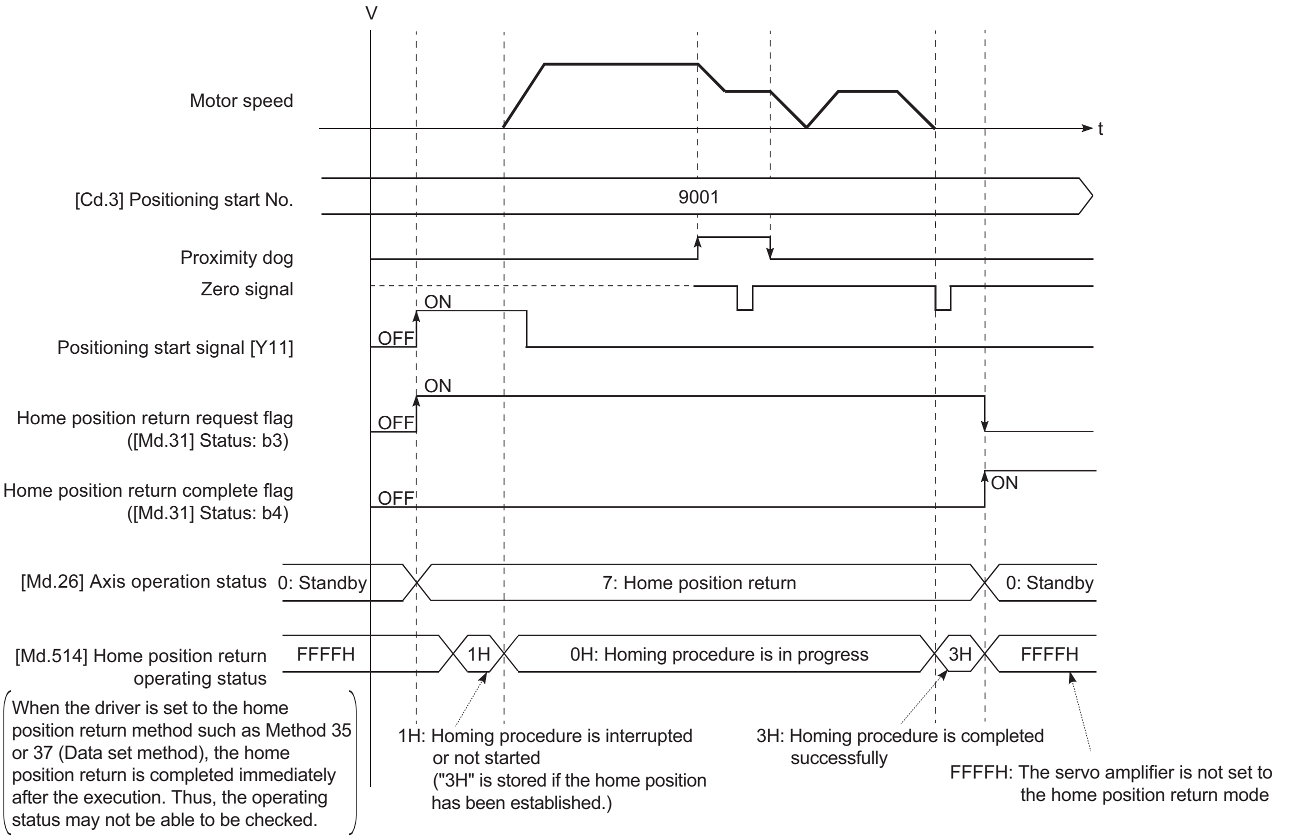
Driver home position return method

The home position return is executed based on the positioning pattern set on the driver (servo amplifier) side (hereafter called the "driver side"). Set the setting values of home position return in the parameters of the driver side. Refer to the manual of the driver because the home position return operation and parameters depend on the specification of the driver.

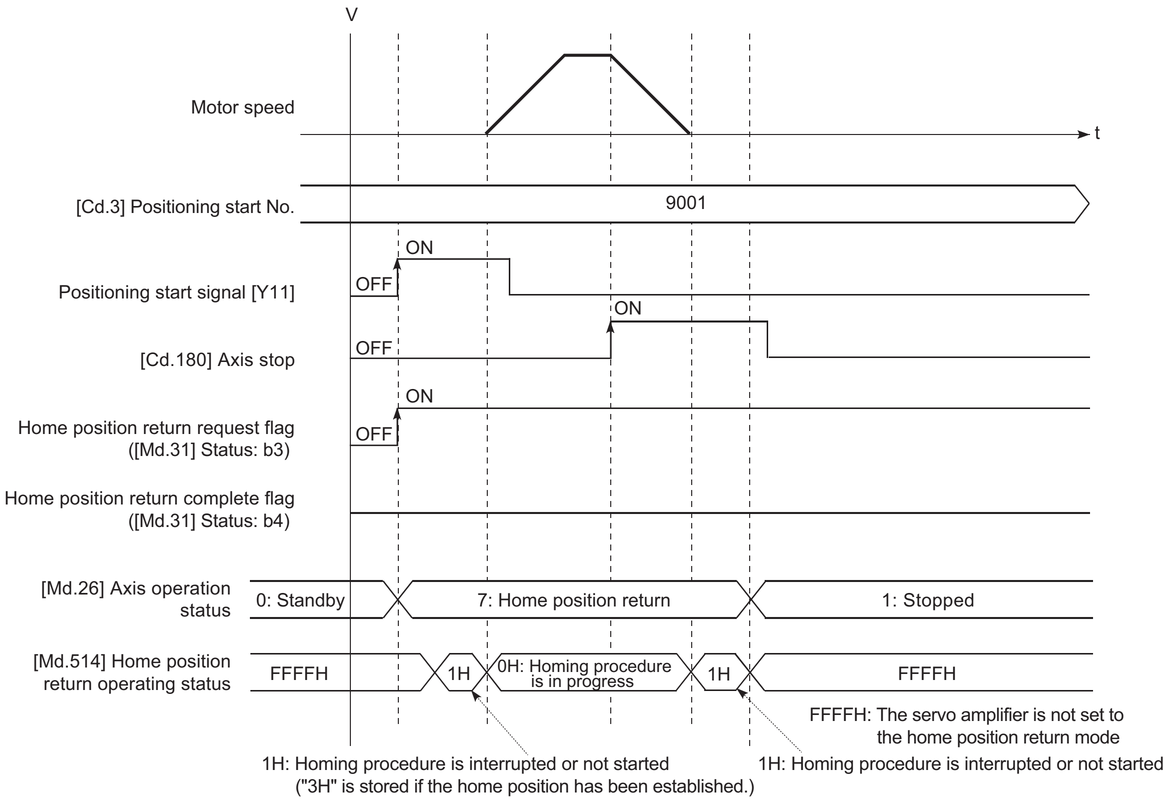
Operation chart

1. The machine home position return is started. (The machine executes the home position return based on the positioning pattern set on the driver side.)
2. The feed current value is continuously updated by follow up processing during the home position return.
3. The home position return complete flag ([Md.31] Status: b4) turns from OFF to ON and the home position return request flag ([Md.31] Status: b3) turns from ON to OFF.

■Operation chart



When the machine home position return is stopped



Parameter setting required after the driver home position return method

Refer to the following.

☞ Page 421 Setting items for home position return parameters

Start of the driver home position return method

Set "9001" in "[Cd.3] Positioning start No.", and start the axis.

The control mode of the servo amplifier is set to "Home mode".

If Zero speed is not ON ([Md.119] Servo status 2: b3 is not ON) at start for the MR-J4-GF, the home position return operation does not start until Zero speed turns ON. Even in this case, "7: Home position return" is set in "[Md.26] Axis operation status".

Axis stop of the driver home position return method

When "[Cd.180] Axis stop" is turned ON during the home position return, the "HALT" signal is sent to the servo amplifier. If the servo amplifier which does not support the "HALT" signal is used, the axis is not stopped by this signal. Use the forced stop signal instead. Refer to the servo amplifier instruction manual for support information on the HALT signal and forced stop signal.

The MR-J4-GF supports the HALT signal.

Backlash compensation after the driver home position return method

When "[Pr.11] Backlash compensation amount" is set in the Simple Motion board, whether the backlash compensation is necessary or not is judged from "[Pr.44] Home position return direction" of the Simple Motion board in the axis operation such as positioning after the driver home position return. When the positioning is executed in the same direction as "[Pr.44] Home position return direction", the backlash compensation is not executed. However, when the positioning is executed in the reverse direction against "[Pr.44] Home position return direction", the backlash compensation is executed.
Note that the home position return is executed based on the home position return direction of the parameter of the driver side during the driver home position return. Therefore, set the same direction to "[Pr.44] Home position return direction" of the Simple Motion board and the last home position return direction of the drive side.

Restrictions

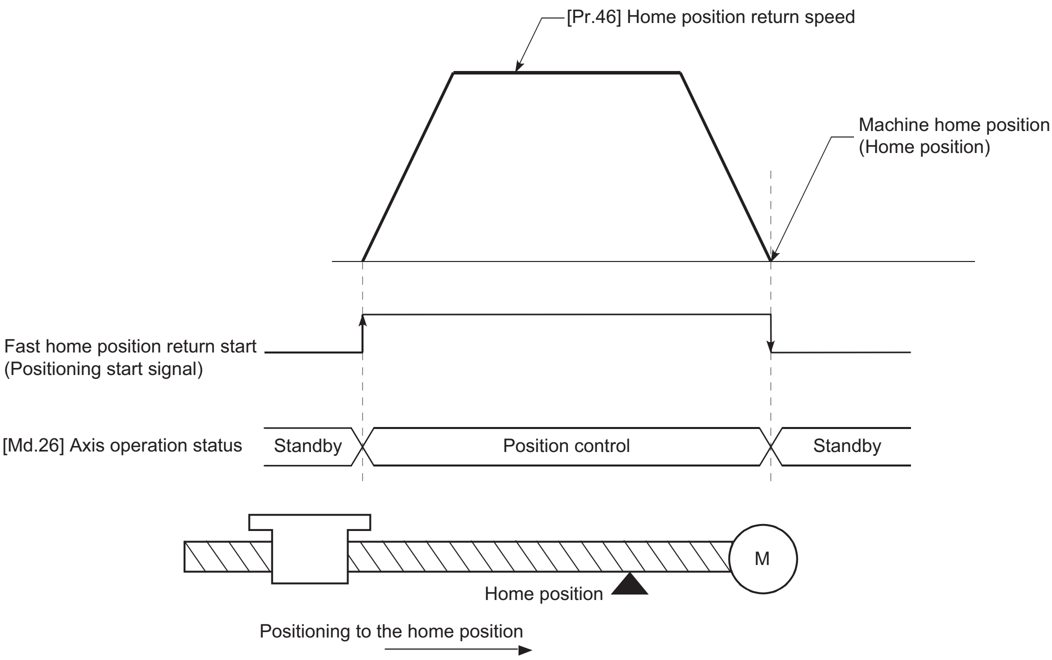
- The home position return cannot be started with the Simple Motion board during servo-off. Thus, the servo amplifier home position return method, Method 35 and 37 (Data set method), cannot be executed during servo-off.
- When the synchronous control is executed with the axis where the MR-J4-GF software version A0 is used as the servo input axis, do not perform the home position return. The alarms (error excessive and command frequency error) might occur in the servo amplifier of the output axis.
- To use the home position return method which uses the proximity dog signal and is not based on the Z-phase, it is recommended to use the servo amplifier built-in DI.

2.3 Fast Home Position Return

Outline of the fast home position return operation

Fast home position return operation

After establishing home position by a machine home position return, positioning control to the home position is executed without using a proximity dog or a zero signal.
The following shows the operation during a basic fast home position return start.



1. The fast home position return is started.
2. Positioning control to the home position established by a machine home position return begins at speed set in "[Pr.46] Home position return speed".
3. The fast home position return is completed.

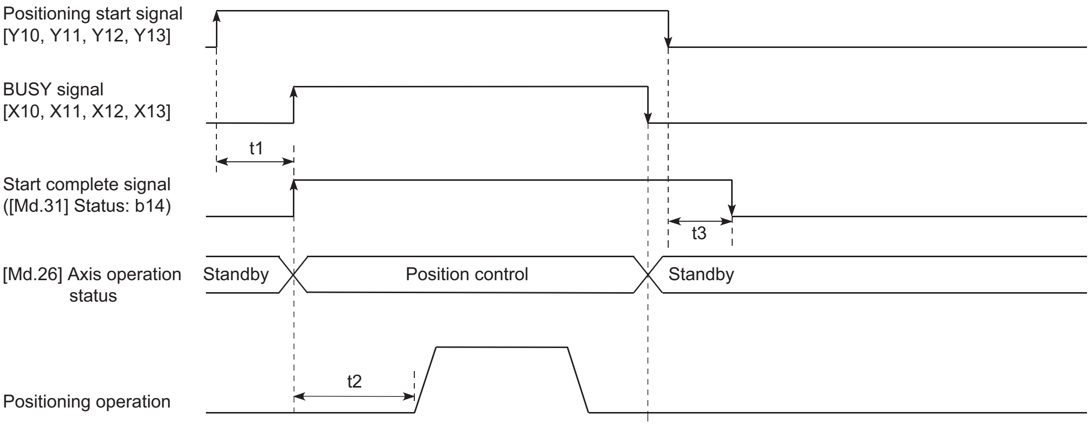
Point

[API library]
- To use the fast home position return, use the MMC_Axis::StartPositioning(MMC_STNO_FAST_HOMING) method.
- To wait until the fast home position return is completed, use the MMC_Axis::WaitPositioningDone method or the MMC_Axis::WaitPositioningDoneIntEvent method.

Operation timing and processing time

The following shows details about the operation timing and time during fast home position return.

[Axis 1 to 4 operation example]



- Normal timing time (Unit: [ms])

Operation cycle	t1*1	t2	t3
0.50	0.250 to 0.660	1.337 to 1.465	0.000 to 0.500
1.00	0.290 to 1.134	2.775 to 3.326	0.000 to 1.000
2.00	0.493 to 2.082	5.878 to 6.795	0.000 to 2.000
4.00	1.485 to 4.184	11.867 to 12.539	0.000 to 4.000

*1 The t1 timing time could be delayed by the operation state of other axes.

Operating restrictions

- The fast home position return can only be executed after the home position is established by executing the machine home position return. If not, the error "Home position return request ON" (error code: 1945H) will occur. (Home position return request flag ([Md.31] Status: b3) must be turned OFF).
- If the fraction pulse is cleared to zero using current value changing or fixed-feed control, execute the fast home position return and an error will occur by a cleared amount.
- When unlimited length feed is executed by speed control and the feed machine value overflows or underflows once, the fast home position return cannot be executed normally.
- The home position return complete flag ([Md.31] Status: b4) is not turned ON.
- The axis operation status during fast home position return is "in position control".

2.4 Selection of the Home Position Return Setting Condition

Outline of the home position return setting condition

To execute the home position return when selecting "0: Need to pass servo motor Z-phase after power on" with the servo parameter of the servo amplifier "Function selection C-4 (PC17)", it is necessary that the servomotor has been rotated more than one revolution and passed the Z phase (Motor reference position signal) and that the zero point pass signal ([Md.119] Servo status2: b0) has turned ON.

When selecting "1: Not need to pass servo motor Z-phase after power on" with "Function selection C-4 (PC17)", it is possible to turn the zero point pass signal ([Md.119] Servo status2: b0) ON without passing the zero point.

n: Axis No. - 1

Monitor item	Buffer memory address
[Md.119] Servo status2: b0	2476+100n

For labels, refer to the following.

☞ Page 435 Axis monitor data

Data setting

To select the "home position return setting condition", set the "servo amplifier" shown in the following table.

Servo parameters are set for each axis.

The "home position return setting condition" is stored into the following buffer memory addresses.

n: Axis No. - 1

Setting item	Setting value	Setting details
Function selection C-4 (PC17)	→	0: Need to pass servo motor Z-phase after power on 1: Not need to pass servo motor Z-phase after power on

Refer to each servo amplifier instruction manual for information on the setting details.

Precautions during operation

- Set "Function selection C-4 (PC17)", and then turn off the power supply of the servo amplifier once and switch it on again to make that parameter setting valid.

3 MAJOR POSITIONING CONTROL

The details and usage of the major positioning controls (control functions using the "positioning data") are explained in this chapter.
The major positioning controls include such controls as "positioning control" in which positioning is carried out to a designated position using the address information, "speed control" in which a rotating object is controlled at a constant speed, "speed-position switching control" in which the operation is shifted from "speed control" to "position control" and "position-speed switching control" in which the operation is shifted from "position control" to "speed control".
Execute the required settings to match each control.

3.1 Outline of Major Positioning Controls

"Major positioning controls" are carried out using the "positioning data" stored in the Simple Motion board.
The basic controls such as position control and speed control are executed by setting the required items in this "positioning data", and then starting that positioning data.
The control method for the "major positioning controls" is set in setting item "[Da.2] Control method" of the positioning data.
Control defined as a "major positioning control" carries out the following types of control according to the "[Da.2] Control method" setting. However, the position loop is included for commanding to servo amplifier in the speed control set in "[Da.2] Control method". Use the "speed-torque control" to execute the speed control not including position loop. (☞ Page 190 Speed-torque Control)

Major positioning control			[Da.2] Control method	Details
Position control	Linear control	1-axis linear control	ABS Linear 1 INC Linear 1	Positioning of the designated 1 axis is carried out from the start address (current stop position) to the designated position.
		2-axis linear interpolation control*1	ABS Linear 2 INC Linear 2	Using the designated 2 axes, linear interpolation control is carried out from the start address (current stop position) to the designated position.
		3-axis linear interpolation control*1	ABS Linear 3 INC Linear 3	Using the designated 3 axes, linear interpolation control is carried out from the start address (current stop position) to the designated position.
		4-axis linear interpolation control*1	ABS Linear 4 INC Linear 4	Using the designated 4 axes, linear interpolation control is carried out from the start address (current stop position) to the designated position.
	Fixed-feed control	1-axis fixed-feed control	Fixed-feed 1	Positioning of the designated 1 axis is carried out for a designated movement amount from the start address (current stop position). (The "[Md.20] Feed current value" is set to "0" at the start.)
		2-axis fixed-feed control*1	Fixed-feed 2	Using the designated 2 axes, linear interpolation control is carried out for a designated movement amount from the start address (current stop position). (The "[Md.20] Feed current value" is set to "0" at the start.)
		3-axis fixed-feed control*1	Fixed-feed 3	Using the designated 3 axes, linear interpolation control is carried out for a designated movement amount from the start address (current stop position). (The "[Md.20] Feed current value" is set to "0" at the start.)
		4-axis fixed-feed control*1	Fixed-feed 4	Using the designated 4 axes, linear interpolation control is carried out for a designated movement amount from the start address (current stop position). (The "[Md.20] Feed current value" is set to "0" at the start.)
	2-axis circular interpolation control*1	Sub point designation	ABS Circular sub INC Circular sub	Using the designated 2 axes, positioning is carried out in an arc path to a position designated from the start point address (current stop position).
		Center point designation	ABS Circular right ABS Circular left INC Circular right INC Circular left	
	3-axis helical interpolation control*1	Sub point designation	ABS helical sub INC helical sub	Using two axes of the three axes, the circular interpolation control is carried out. The remaining axis is used for the positioning of the helical, tangent line, or normal line control to follow the circular interpolation control.
		Center point designation	ABS helical right ABS helical left INC helical right INC helical left	

Major positioning control		[Da.2] Control method	Details
Speed control	1-axis speed control	Forward run speed 1 Reverse run speed 1	The speed control of the designated 1 axis is carried out.
	2-axis speed control*1	Forward run speed 2 Reverse run speed 2	The speed control of the designated 2 axes is carried out.
	3-axis speed control*1	Forward run speed 3 Reverse run speed 3	The speed control of the designated 3 axes is carried out.
	4-axis speed control*1	Forward run speed 4 Reverse run speed 4	The speed control of the designated 4 axes is carried out.
Speed-position switching control		Forward run speed/position Reverse run speed/position	The control is continued as position control (positioning for the designated address or movement amount) by turning ON the "speed-position switching signal" after first carrying out speed control.
Position-speed switching control		Forward run position/speed Reverse run position/speed	The control is continued as speed control by turning ON the "position-speed switching signal" after first carrying out position control.
Other control	NOP instruction	NOP	A nonexecutable control method. When this instruction is set, the operation is transferred to the next data operation, and the instruction is not executed.
	Current value changing	Current value changing	"[Md.20] Feed current value" is changed to an address set in the positioning data. This can be carried out by either of the following 2 methods. ("[Md.21] Feed machine value" cannot be changed.) • Current value changing using the control method • Current value changing using the current value changing start No. (No.9003).
	JUMP instruction	JUMP instruction	An unconditional or conditional JUMP is carried out to a designated positioning data No.
	LOOP	LOOP	A repeat control is carried out by repeat LOOP to LEND.
	LEND	LEND	Control is returned to the top of the repeat control by repeat LOOP to LEND. After the repeat operation is completed specified times, the next positioning data is run.

*1 Control is carried out so that linear and arc paths are drawn using a motor set in two or more axes directions. This kind of control is called "interpolation control". (☞ Page 60 Interpolation control)

Data required for major positioning control

The following table shows an outline of the "positioning data" configuration and setting details required to carry out the "major positioning controls".

Setting item			Setting details
Positioning data No.1	[Da.1]	Operation pattern	Set the method by which the continuous positioning data (Ex: positioning data No.1, No.2, No.3) will be controlled. (☞ Page 47 Operation patterns of major positioning controls)
	[Da.2]	Control method	Set the control method defined as a "major positioning control". (☞ Page 44 Outline of Major Positioning Controls)
	[Da.3]	Acceleration time No.	Select and set the acceleration time at control start. (Select one of the four values set in [Pr.9], [Pr.25], [Pr.26], and [Pr.27] for the acceleration time.)
	[Da.4]	Deceleration time No.	Select and set the deceleration time at control stop. (Select one of the four values set in [Pr.10], [Pr.28], [Pr.29], and [Pr.30] for the deceleration time.)
	[Da.6]	Positioning address/movement amount	Set the target value during position control. (☞ Page 55 Designating the positioning address)
	[Da.7]	Arc address	Set the sub point or center point address during 2-axis circular interpolation control or 3-axis helical interpolation control.
	[Da.8]	Command speed	Set the speed during the control execution.
	[Da.9]	Dwell time/JUMP destination positioning data No.	The time between the command pulse output is completed to the positioning completed signal is turned ON. Set it for absorbing the delay of the mechanical system to the instruction, such as the delay of the servo system (deviation).
	[Da.10]	M code/Condition data No./ Number of LOOP to LEND repetitions/Number of pitches	Set this item when carrying out sub work (clamp and drill stops, tool replacement, etc.) corresponding to the code No. related to the positioning data execution.
	[Da.20]	Axis to be interpolated No.1	Set an axis to be interpolated during the 2- to 4-axis interpolation operation. (☞ Page 60 Interpolation control)
	[Da.21]	Axis to be interpolated No.2	
	[Da.22]	Axis to be interpolated No.3	
	[Da.27]	M code ON signal output timing	Set the M code ON signal output timing to each positioning data.
	[Da.28]	ABS direction in degrees	Set the ABS direction in degrees to each positioning data.
	[Da.29]	Interpolation speed designation method	Set the interpolation speed designation method to each positioning data.

The settings and setting requirement for the setting details of [Da.1] to [Da.10], [Da.20] to [Da.22] and [Da.27] to [Da.29] differ according to the "[Da.2] Control method".
☞ Page 64 Setting the Positioning Data

Major positioning control sub functions

Refer to the following for details on "sub functions" that can be combined with the major positioning control.
📖Simple Motion Board User's Manual (Startup)
Also refer to the following for details on each sub function.
☞ Page 218 CONTROL SUB FUNCTIONS

Point

600 positioning data (positioning data No.1 to 600) items can be set per axis.

Operation patterns of major positioning controls

In "major positioning control" (high-level positioning control), "[Da.1] Operation pattern" can be set to designate whether to continue executing positioning data after the started positioning data. The "operation pattern" includes the following 3 types.

Positioning control	Operation pattern
Positioning complete	Independent positioning control (operation pattern: 00)
Positioning continue	Continuous positioning control (operation pattern: 01)
	Continuous path control (operation pattern: 11)

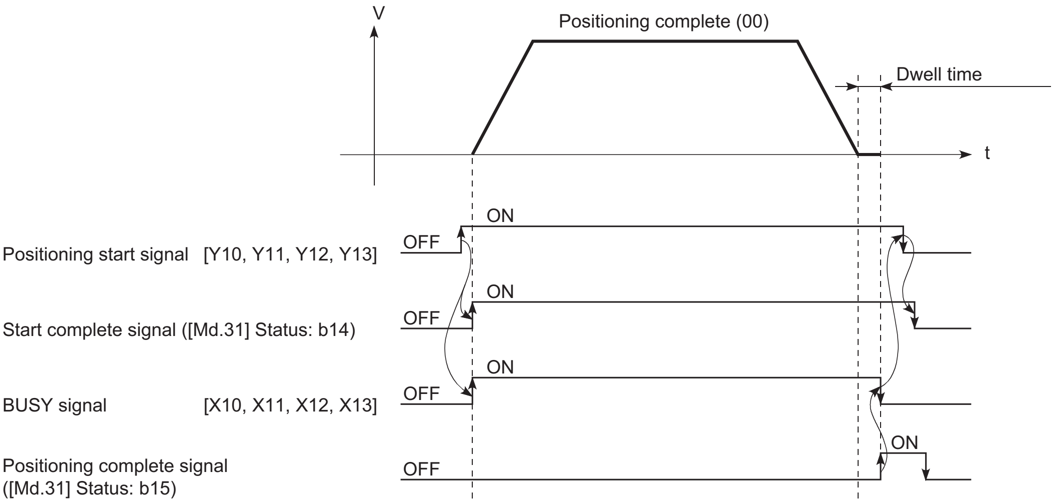
3

Independent positioning control (Positioning complete)

This control is set when executing only one designated data item of positioning. If a dwell time is designated, the positioning completes after the designated time elapses.

This data (operation pattern [00] data) becomes the end of block data when carrying out block positioning. (The positioning stops after this data is executed.)

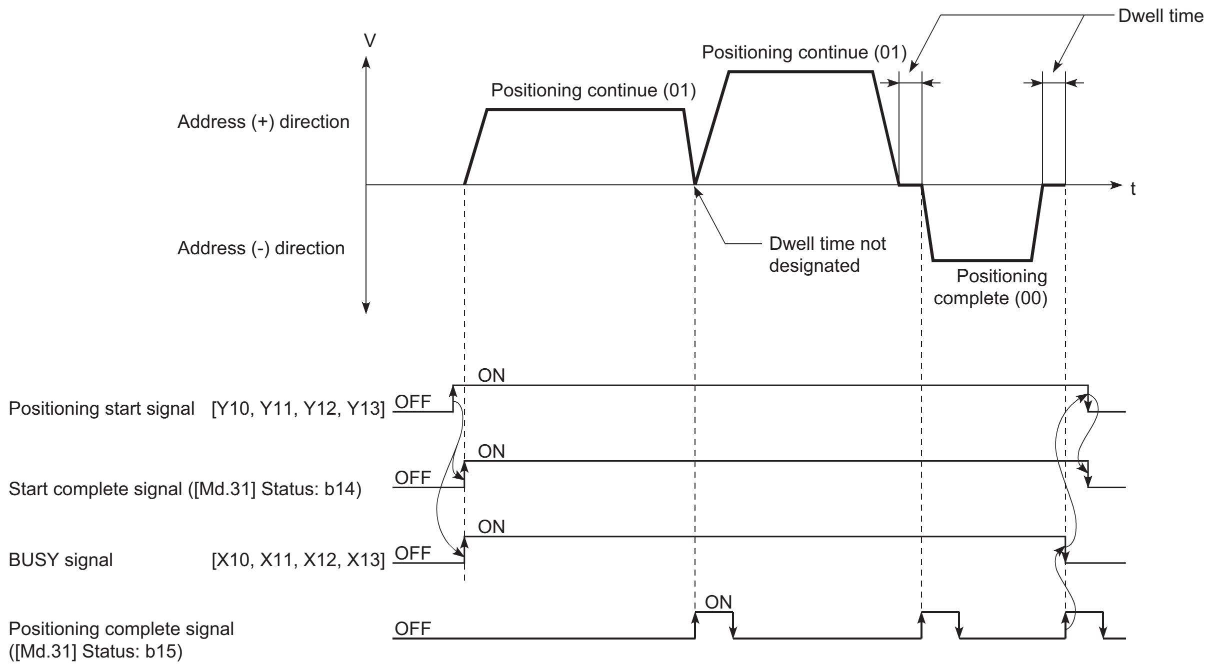
[Axis 1 to 4 operation example]



Continuous positioning control

- The machine always automatically decelerates each time the positioning is completed. Acceleration is then carried out after the Simple Motion board command speed reaches 0 to carry out the next positioning data operation. If a dwell time is designated, the acceleration is carried out after the designated time elapses.
- In operation by continuous positioning control (operation pattern "01"), the next positioning No. is automatically executed. Always set operation pattern "00" in the last positioning data to complete the positioning. If the operation pattern is set to positioning continue ("01" or "11"), the operation will continue until operation pattern "00" is found. If the operation pattern "00" cannot be found, the operation may be carried out until the positioning data No.600. If the operation pattern of the positioning data No.600 is not completed, the operation will be started again from the positioning data No.1.

[Axis 1 to 4 operation example]

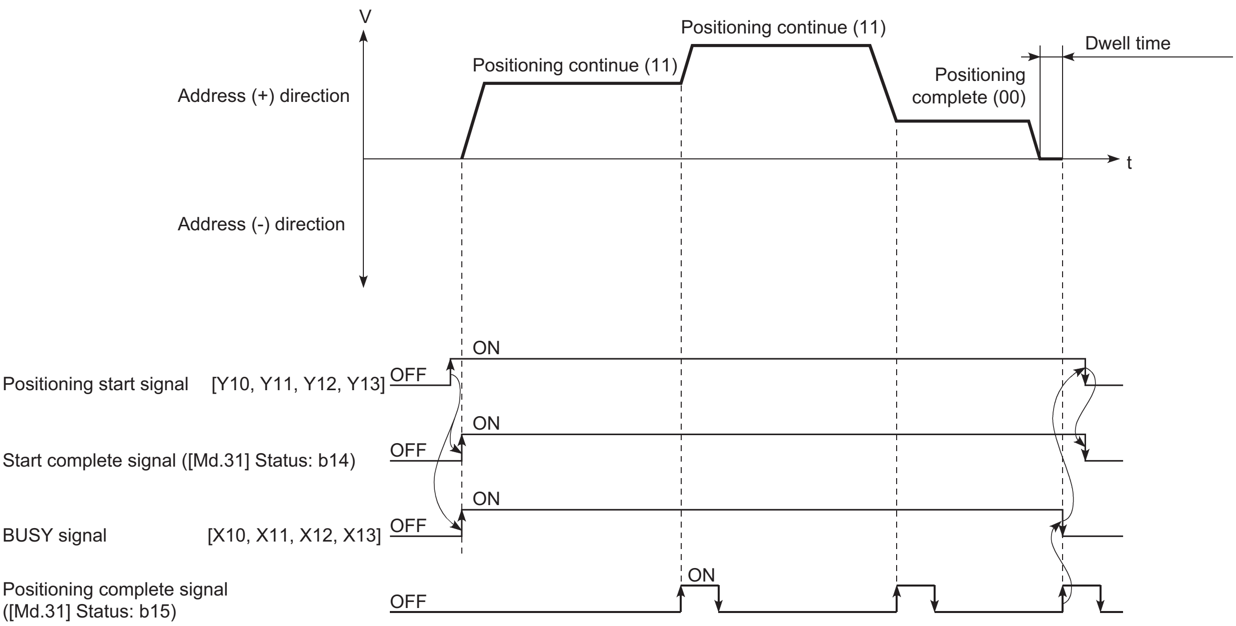


Continuous path control

■Continuous path control

- The speed is changed without deceleration stop between the command speed of the "positioning data No. currently being executed" and the speed of the "positioning data No. to carry out the next operation". The speed is not changed if the current speed and the next speed are equal.
- The speed used in the previous positioning operation is continued when the command speed is set to "-1".
- Dwell time is ignored, even if it is set.
- The next positioning No. is executed automatically in operations by continuous path control (operation pattern "11"). Always complete the positioning by setting operation pattern "00" in the last positioning data. If the operation pattern is set to positioning continue ("01" or "11"), the operation will continue until operation pattern "00" is found. If the operation pattern "00" cannot be found, the operation may be carried out until the positioning data No.600. If the operation pattern of the positioning data No.600 is not complete, the operation will be started again from the positioning data No.1.
- The speed switching includes the "front-loading speed switching mode" in which the speed is changed at the end of the current positioning side, and the "standard speed switching mode" in which the speed is at the start of the next positioning side. (☞ Page 465 [Pr.19] Speed switching mode)
- In the continuous path control, the positioning may be completed before the set address/movement amount and the current data may be switched to the "positioning data that will be run next". This is because a preference is given to the positioning at a command speed. In actuality, the positioning is completed before the set address/movement amount by an amount of remaining distance at speeds less than the command speed. The remaining distance ($\Delta1$) at speeds less than the command speed is $0 \le \Delta1 \le$ (distance moved in operation cycle at a speed at the time of completion of the positioning). The remaining distance ($\Delta1$) is output at the next positioning data No.

■Axis 1 to 4 operation example



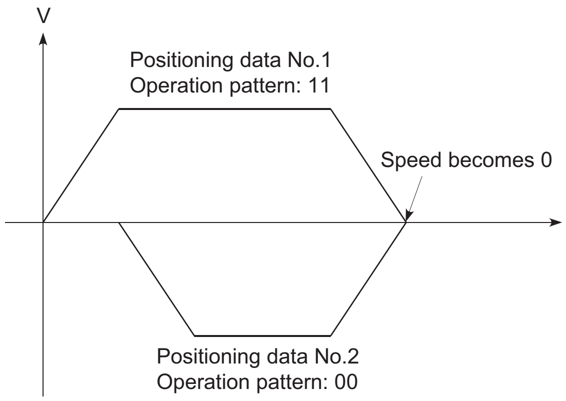
Point

In the continuous path control, a speed variation will not occur using the near-pass function when the positioning data No. is switched.
(☞ Page 228 Near pass function)

■Deceleration stop conditions during continuous path control

Deceleration stops are not carried out in continuous path control, but the machine will carry out a deceleration stop to speed "0" in the following 3 cases.

- When the operation pattern of the positioning data currently being executed is "continuous path control: 11", and the movement direction of the positioning data currently being executed differs from that of the next positioning data. (Only for 1-axis positioning control (Refer to the next point.))

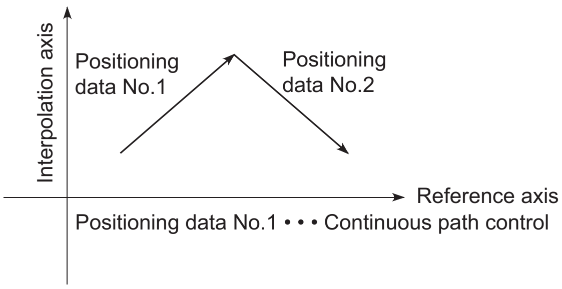


- During operation by step operation. (☞ Page 275 Step function)
- When there is an error in the positioning data to carry out the next operation.

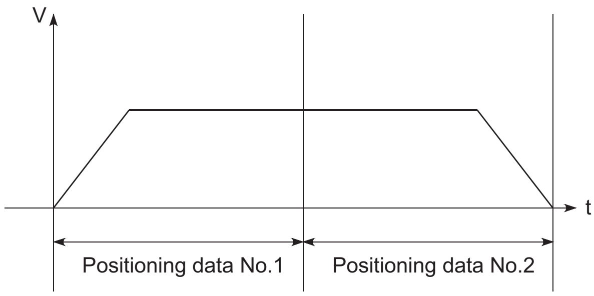
Point

- The movement direction is not checked during interpolation operations. Thus, automatic deceleration to a stop will not be carried out even if the movement direction is changed (See the figures below). Because of this, the interpolation axis may rapidly reverse direction. To avoid this rapid direction reversal in the interpolation axis, set the pass point to continuous positioning control "01" instead of setting it to continuous path control "11".

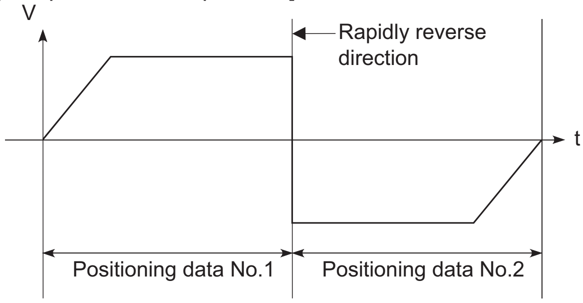
[Positioning by interpolation]



[Reference axis operation]



[Interpolation axis operation]

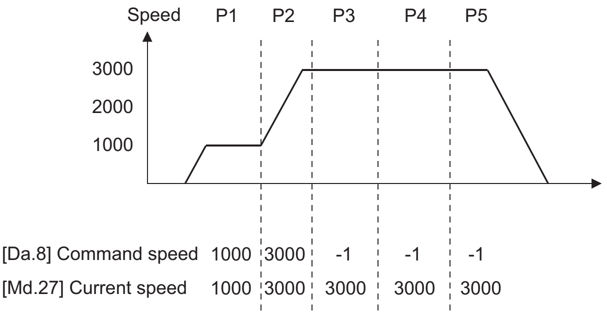


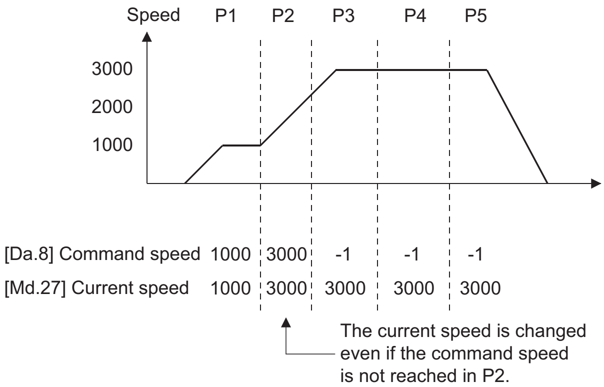
- When a "0" is set in the "[Da.6] Positioning address/movement amount" of the continuous path control positioning data, the command speed is reduced to 0 in an operation cycle. When a "0" is set in the "[Da.6] Positioning address/movement amount" to increase the number of speed change points in the future, change the "[Da.2] Control method" to the "NOP" to make the control nonexecutable. (☞ Page 135 NOP instruction)
- In the continuous path control positioning data, assure a movement distance so that the execution time with that data is 100 ms or longer, or lower the command speed.

■Speed handling

- Continuous path control command speeds are set with each positioning data. The Simple Motion board carries out the positioning at the speed designated with each positioning data.
- The command speed can be set to "-1" in continuous path control. The control will be carried out at the speed used in the previous positioning data No. if the command speed is set to "-1". The "current speed" will be displayed in the command speed when the positioning data is set with EM Configurator. The current speed is the speed of the positioning control being executed currently.
- The speed does not need to be set in each positioning data when carrying out uniform speed control if "-1" is set beforehand in the command speed.
- If the speed is changed or the override function is executed, in the previous positioning data when "-1" is set in the command speed, the operation can be continued at the new speed.
- The error "No command speed" (error code: 1A12H to 1A14H) occurs and positioning cannot be started if "-1" is set in the command speed of the first positioning data at start.

[Relation between the command speed and current speed]





Point

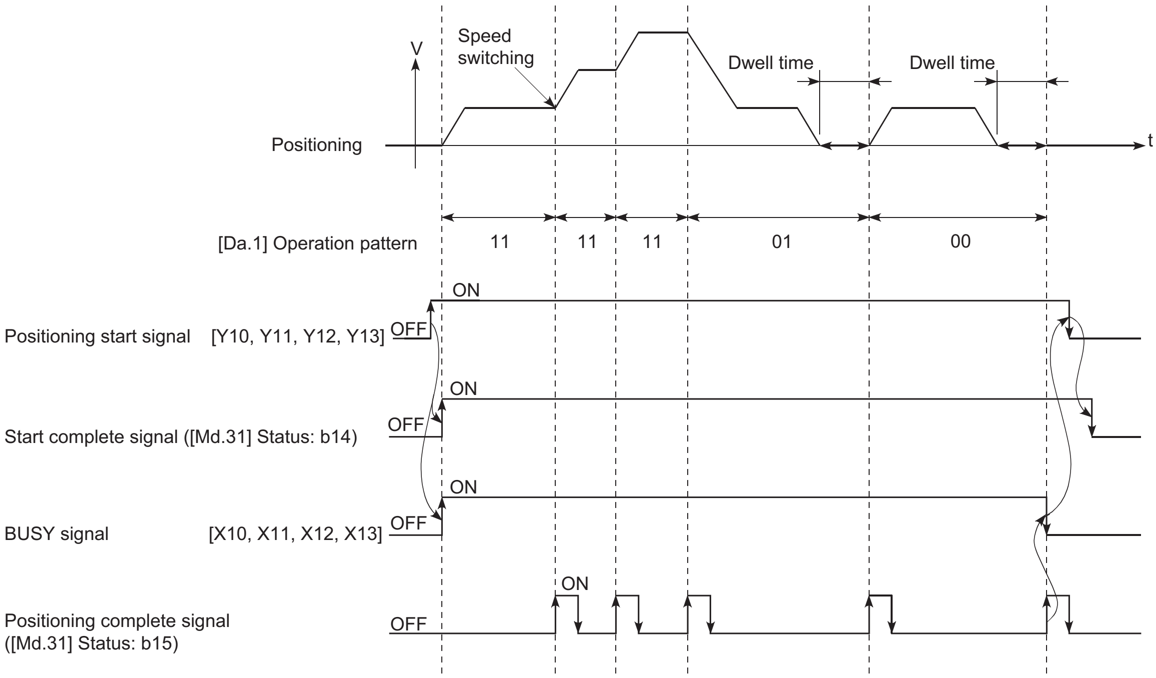
- In the continuous path control, a speed variation will not occur using the near-pass function when the positioning data is switched. (☞ Page 228 Near pass function)
- The Simple Motion board holds the command speed set with the positioning data, and the latest value of the speed set with the speed change request as the "[Md.27] Current speed". It controls the operation at the "current speed" when "-1" is set in the command speed. (Depending on the relation between the movement amount and the speed, the feedrate may not reach the command speed value, but even then the current speed will be updated.)
- When the address for speed change is identified beforehand, generate and execute the positioning data for speed change by the continuous path control to carry out the speed change without requesting the speed change with a user program.

■Speed switching (Standard speed switching mode: Switch the speed when executing the next positioning data.) (☞ Page 465 [Pr.19] Speed switching mode)

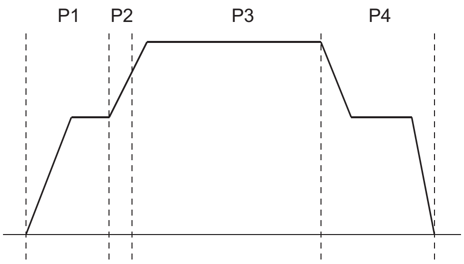
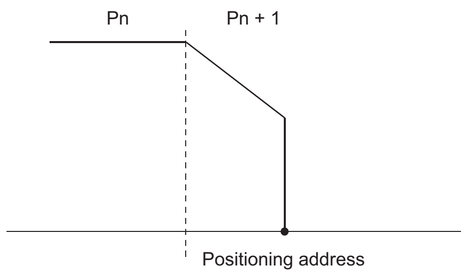
- If the respective command speeds differ in the "positioning data currently being executed" and the "positioning data to carry out the next operation", the machine will accelerate or decelerate after reaching the positioning point set in the "positioning data currently being executed" and the speed will change over to the speed set in the "positioning data to carry out the next operation".
- The parameters used in acceleration/deceleration to the command speed set in the "positioning data to carry out the next operation" are those of the positioning data to carry out acceleration/deceleration. Speed switching will not be carried out if the command speeds are the same.

3

■Axis 1 to 4 operation example



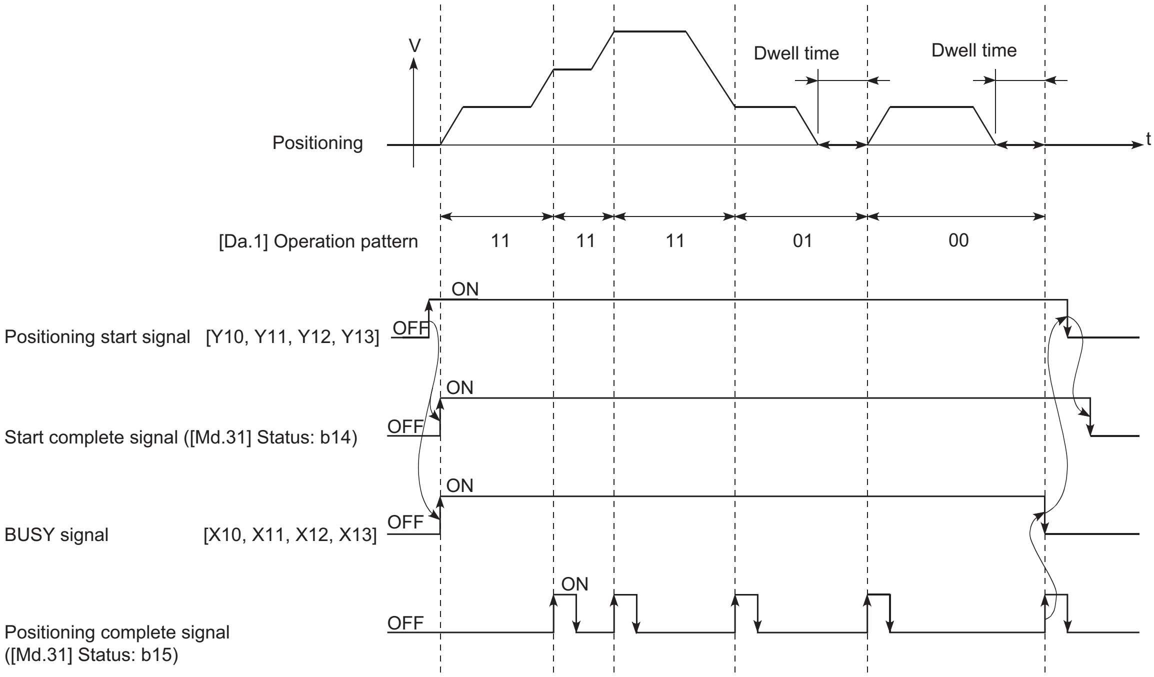
- If the movement amount is small in regard to the target speed, the current speed may not reach the target speed even if acceleration/deceleration is carried out. In this case, the machine is accelerated/decelerated so that it nears the target speed. If the movement amount will be exceeded when automatic deceleration is required (Ex. Operation patterns "00", "01", etc.), the machine will immediately stop at the designated positioning address, and the warning "Insufficient movement amount" (warning code: 0998H) will occur.

[When the speed cannot change over in P2]	[When the movement amount is small during automatic deceleration]
For the following relation of the speed P1 = P4, P2 = P3, P1 < P2 	The movement amount required to carry out the automatic deceleration cannot be secured, so the machine immediately stops in a speed ≠ 0 status. 

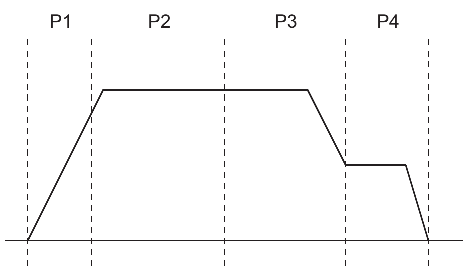
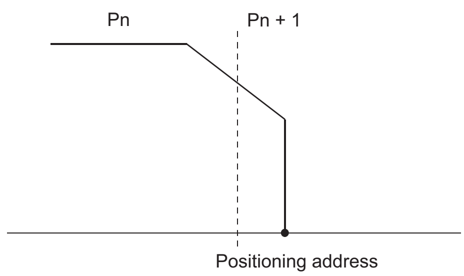
■Speed switching (Front-loading speed switching mode: The speed switches at the end of the positioning data currently being executed.) (☞ Page 465 [Pr.19] Speed switching mode)

- If the respective command speeds differ in the "positioning data currently being executed" and the "positioning data to carry out the next operation", the speed will change over to the speed set in the "positioning data to carry out the next operation" at the end of the "positioning data currently being executed".
- The parameters used in acceleration/deceleration to the command speed set in the "positioning data to carry out the next operation" are those of the positioning data to carry out acceleration/deceleration. Speed switching will not be carried out if the command speeds are the same.

■Axis 1 to 4 operation example



- If the movement amount is small in regard to the target speed, the current speed may not reach the target speed even if acceleration/deceleration is carried out. In this case, the machine is accelerated/decelerated so that it nears the target speed. If the movement amount will be exceeded when automatic deceleration is required (Ex. Operation patterns "00", "01", etc.), the machine will immediately stop at the designated positioning address, and the warning "Insufficient movement amount" (warning code: 0998H) will occur.

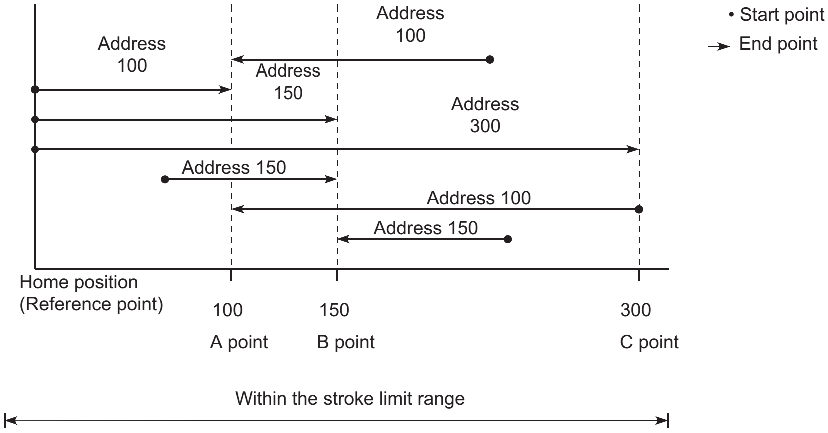
[When the speed cannot change over to the P2 speed in P1]	[When the movement amount is small during automatic deceleration]
For the following relation of the speed P1 = P4, P2 = P3, P1 < P2 	The movement amount required to carry out the automatic deceleration cannot be secured, so the machine immediately stops in a speed ≠ 0 status. 

Designating the positioning address

The following shows the two methods for commanding the position in control using positioning data.

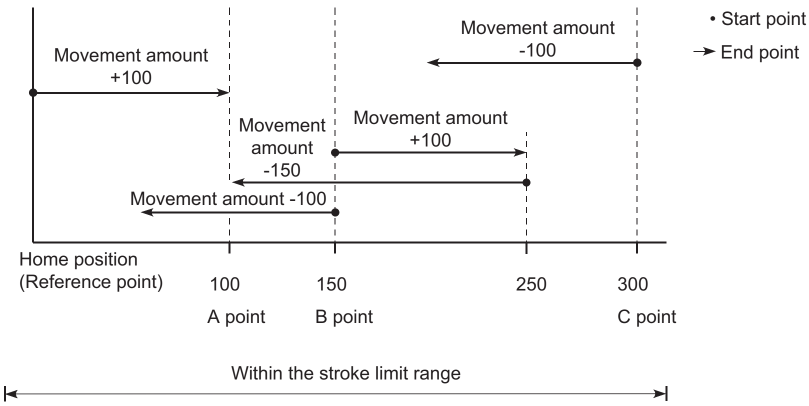
Absolute system

Positioning is carried out to a designated position (absolute address) having the home position as a reference. This address is regarded as the positioning address. (The start point can be anywhere.)



Incremental system

The position where the machine is currently stopped is regarded as the start point, and positioning is carried out for a designated movement amount in a designated movement direction.



Confirming the current value

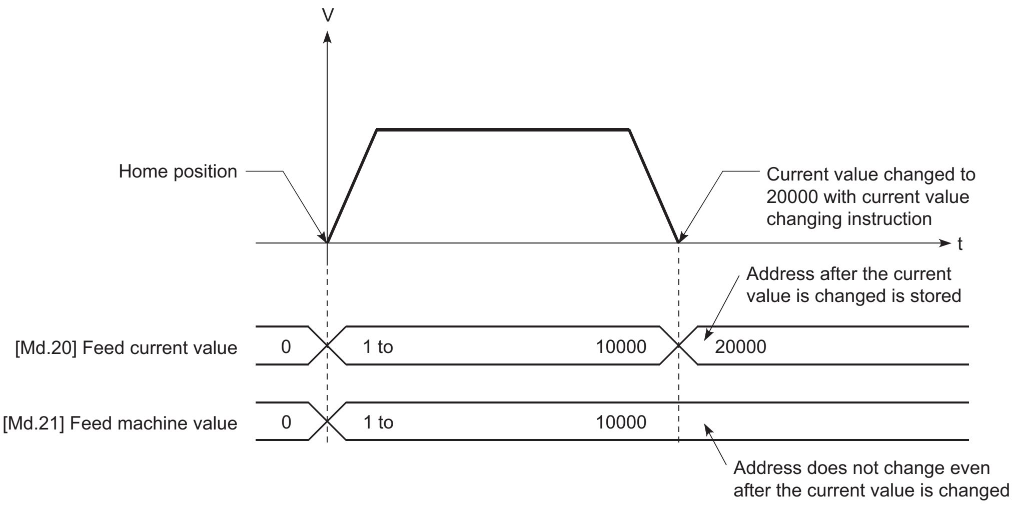
Values showing the current value

The following two types of addresses are used as values to show the position in the Simple Motion board.

These addresses ("feed current value" and "feed machine value") are stored in the monitor data area, and used in monitoring the current value display, etc.

Feed current value	Feed machine value
• This is the value stored in "[Md.20] Feed current value". • This value has an address established with a "machine home position return" as a reference, but the address can be changed by changing the current value to a new value.	• This is the value stored in "[Md.21] Feed machine value". • This value always has an address established with a "machine home position return" as a reference. The address cannot be changed, even if the current value is changed to a new value.

The "feed current value" and "feed machine value" are used in monitoring the current value display, etc.



Restriction

Operation cycle error will occur in the current value refresh cycle when the stored "feed current value" and "feed machine value" are used in the control.

Monitoring the current value

The "feed current value" and "feed machine value" are stored in the following buffer memory addresses, and can be read using labels from the user program.

n: Axis No. - 1

Monitor item		Buffer memory addresses
[Md.20]	Feed current value	2400+100n 2401+100n
[Md.21]	Feed machine value	2402+100n 2403+100n

For labels, refer to the following.

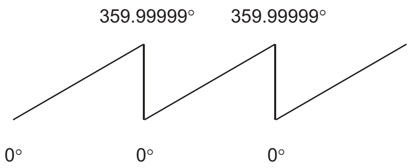
☞ Page 435 Axis monitor data

Control unit "degree" handling

When the control unit is set to "degree", the following items differ from when other control units are set.

Feed current value and feed machine value addresses

The address of "[Md.20] Feed current value" becomes a ring address from 0 to 359.99999°. The address of "[Md.21] Feed machine value" will become a cumulative value. (They will not have a ring structure for values between 0 and 359.99999°.) However, "[Md.21] Feed machine value" is restored with cumulating the machine feed value before the power supply OFF (the rounded value within the range of 0 to 359.99999°) to the movement amount during the power supply OFF at the communication start with servo amplifier after the power supply of the Simple Motion board ON or the remote RESET.

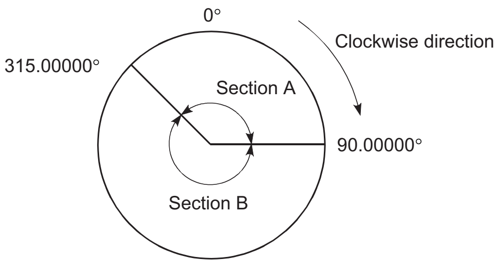


Software stroke limit valid/invalid setting

With the control unit set to "degree", the software stroke limit upper and lower limit values are 0° to 359.99999°.

■Setting to validate software stroke limit

To validate the software stroke limit, set the software stroke limit lower limit value and the upper limit value in a clockwise direction.



- To set the movement range A, set as follows.

Software stroke limit lower limit value	315.00000°
Software stroke limit upper limit value	90.00000°

- To set the movement range B, set as follows.

Software stroke limit lower limit value	90.00000°
Software stroke limit upper limit value	315.00000°

■Setting to invalidate software stroke limit

To invalidate the software stroke limit, set the software stroke limit lower limit value equal to the software stroke limit upper limit value.
The control can be carried out irrespective of the setting of the software stroke limit.

Point

- When the upper/lower limit value of the axis which set the software stroke limit as valid are changed, perform the machine home position return after that.
- When the software stroke limit is set as valid in the incremental data system, perform the machine home position return after power supply on.

Positioning control method when the control unit is set to "degree"

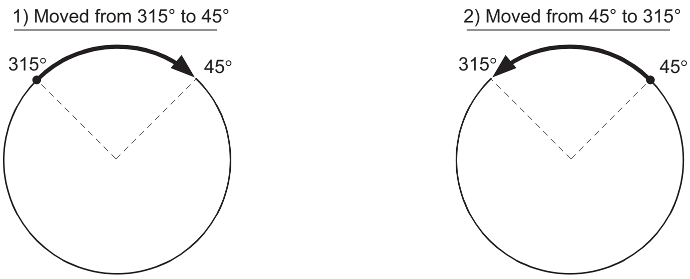
■Absolute system (When the software stroke limit is invalid)

Positioning is carried out in the nearest direction to the designated address, using the current value as a reference. (This is called "shortcut control".)

Ex.

1) Positioning is carried out in a clockwise direction when the current value is moved from 315° to 45°.

2) Positioning is carried out in a counterclockwise direction when the current value is moved from 45° to 315°.



To designate the positioning direction (not carrying out the shortcut control), the shortcut control is invalidated and positioning in a designated direction is carried out by the "[Cd.40] ABS direction in degrees".

This function can perform only when the software stroke limit is invalid. When the software stroke limit is valid, the error "Illegal setting of ABS direction in unit of degree" (error code: 19A5H) occurs and positioning is not started.

To designate the movement direction in the ABS control, a "1" or "2" is written to the "[Cd.40] ABS direction in degrees" of the buffer memory (initial value: 0).

The value written to the "[Cd.40] ABS direction in degrees" becomes valid only when the positioning control is started.

In the continuous positioning control and continuous path control, the operation is continued with the setting set at the time of start even if the setting is changed during the operation.

n: Axis No. - 1

Name	Function	Buffer memory address	Initial value
[Cd.40] ABS direction in degrees	The ABS movement direction in the unit of degree is designated. 0: Shortcut (direction setting invalid) 1: ABS clockwise 2: ABS counterclockwise	4350+100n	0

For labels, refer to the following.

☞ Page 437 Axis control data

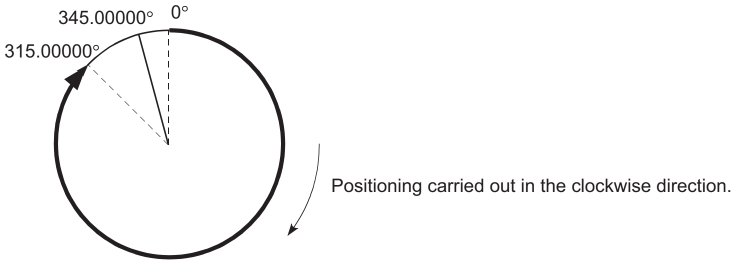
■Absolute system (When the software stroke limit is valid)

The positioning is carried out in a clockwise/counterclockwise direction depending on the software stroke limit range setting method.

Because of this, positioning with "shortcut control" may not be possible.

Ex.

When the current value is moved from 0° to 315°, positioning is carried out in the clockwise direction if the software stroke limit lower limit value is 0° and the upper limit value is 345°.



Point

Positioning addresses are within a range of 0° to 359.99999°.

Use the incremental system to carry out positioning of one rotation or more.

■Incremental system

Positioning is carried out for a designated movement amount in a designated movement direction when in the incremental system of positioning.

The movement direction is determined by the sign (+, -) of the movement amount.

For a positive (+) movement direction	Clockwise
For a negative (-) movement direction	Counterclockwise

Point

Positioning of 360° or more can be carried out with the incremental system.

At this time, set as shown below to invalidate the software stroke limit.

[Software stroke limit upper limit value = Software stroke limit lower limit value]

Set the value within the setting range (0° to 359.99999°).

Interpolation control

Meaning of interpolation control

In "2-axis linear interpolation control", "3-axis linear interpolation control", "4-axis linear interpolation control", "2-axis fixed-feed control", "3-axis fixed-feed control", "4-axis fixed-feed control", "2-axis speed control", "3-axis speed control", "4-axis speed control", "2-axis circular interpolation control", and "3-axis helical interpolation control", each control is performed so that linear and arc paths are drawn using a motor set in two to four axis directions. This kind of control is called "interpolation control".

In interpolation control, the axis in which the control method is set is defined as the "reference axis", and the other axis is defined as the "interpolation axis".

The Simple Motion board controls the "reference axis" following the positioning data set in the "reference axis", and controls the "interpolation axis" corresponding to the reference axis control so that a linear or arc path is drawn.

The following table shows the reference axis and interpolation axis combinations.

Interpolation control set in "[Da.2] Control method"	Reference axis	Interpolation axis
2-axis linear interpolation control 2-axis fixed-feed control 2-axis circular interpolation control 2-axis speed control	Any of axes 1 to 16	"Axis to be interpolated No.1" set in reference axis
3-axis linear interpolation control 3-axis fixed-feed control 3-axis speed control		"Axis to be interpolated No.1" and "Axis to be interpolated No.2" set in reference axis
4-axis linear interpolation control 4-axis fixed-feed control 4-axis speed control		"Axis to be interpolated No.1", "Axis to be interpolated No.2" and "Axis to be interpolated No.3" set in reference axis

The combinations of axes available for the 3-axis helical interpolation control are the same as the ones for the "3-axis linear interpolation control", "3-axis fixed-feed control", and "3-axis speed control". The following table shows the combinations of the reference axis, circular interpolation axis, and linear interpolation axis for the 3-axis helical interpolation control.

Interpolation control set in "[Da.2] Control method"	Reference axis	Circular interpolation axis	Linear interpolation axis
3-axis helical interpolation control	Any of axes 1 to 16	"Axis to be interpolated No.1" set in reference axis	"Axis to be interpolated No.2" set in reference axis

Setting positioning data

When carrying out interpolation control, the same positioning data Nos. are set for the "reference axis" and the "interpolation axis". The following table shows the "positioning data" setting items for the reference axis and interpolation axis.

◎: Setting always required, ○: Set according to requirements (Set to "—" when not used.), △: Setting restrictions exist

—: Setting not required (Use the initial value or a value within the setting range.)

Setting item			Reference axis setting item	Interpolation axis setting item
Same positioning data Nos	[Da.1]	Operation pattern	◎	—
	[Da.2]	Control method	◎ Linear 2, 3, 4 Fixed-feed 2, 3, 4 Circular sub, Circular right, Circular left Helical sub, Helical right, Helical left Forward run speed 2, 3, 4 Reverse run speed 2, 3, 4	—
	[Da.3]	Acceleration time No.	◎	—
	[Da.4]	Deceleration time No.	◎	—
	[Da.6]	Positioning address/movement amount	△ (Forward run speed 2, 3, and 4. Reverse run speed 2, 3, and 4 not required.)	△ (Forward run speed 2, 3, and 4. Reverse run speed 2, 3, and 4 not required.)
	[Da.7]	Arc address	△ (Only during circular sub, circular right, circular left, helical sub, helical right, and helical left.)	△ (Only during circular sub, circular right, circular left, helical sub, helical right, and helical left.)
	[Da.8]	Command speed	◎	△ (Only during forward run speed 2, 3, 4 and reverse run speed 2, 3, 4).
	[Da.9]	Dwell time/JUMP destination positioning data No.	○	—
	[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	○	— Set the number of pitch for the linear interpolation axis only during helical sub, helical right, and helical left.
	[Da.20]	Axis to be interpolated No.1	○*1	—
	[Da.21]	Axis to be interpolated No.2	○*1	—
	[Da.22]	Axis to be interpolated No.3	○*1	—
	[Da.27]	M code ON signal output timing	○	—
	[Da.28]	ABS direction in degrees	○	—
	[Da.29]	Interpolation speed designation method	△	—

*1 The axis No. is set to axis to be interpolated No.1 for 2-axis linear interpolation, to axis to be interpolated No.1 and No.2 for 3-axis linear interpolation, and to axis to be interpolated No.1 to No.3 for 4-axis linear interpolation.
If the self-axis is set, the error "Illegal interpolation description command" (error code: 1A22H) will occur. The axes that are not used are not required.

Refer to the following for information on the setting details.

☞ Page 482 Positioning Data

Starting the interpolation control

The positioning data Nos. of the reference axis (axis in which interpolation control was set in "[Da.2] Control method") are started when starting the interpolation control. (Starting of the interpolation axis is not required.)

The following errors or warnings will occur and the positioning will not start if both reference axis and the interpolation axis are started.

- Reference axis: Interpolation while interpolation axis BUSY (error code: 1998H)
- Interpolation axis: Control method setting error (error code: 1A24H), start during operation (warning code: 0900H).

Interpolation control continuous positioning

When carrying out interpolation control in which "continuous positioning control" and "continuous path control" are designated in the operation pattern, the positioning method for all positioning data from the started positioning data to the positioning data in which "positioning complete" is set must be set to interpolation control.

The number of the interpolation axes and axes to be interpolated cannot be changed from the intermediate positioning data. When the number of the interpolation axes and axes to be interpolated are changed, the error "Control method setting error" (error code: 1A25H) will occur and the positioning will stop.

Speed during interpolation control

Either the "composite speed" or "reference axis speed" can be designated as the speed during interpolation control. ([Pr.20] Interpolation speed designation method)

Only the "Reference axis speed" can be designated in the following interpolation control.

When a "composite speed" is set and positioning is started, the error "Interpolation mode error" (error code: 199AH) occurs, and the system will not start.

- 4-axis linear interpolation
- 2-axis speed control
- 3-axis speed control
- 4-axis speed control

Cautions

- If any axis exceeds "[Pr.8] Speed limit value" during 2- to 4-axis speed control, the axis exceeding the speed limit value is controlled with the speed limit value. The speeds of the other axes being interpolated are suppressed by the command speed ratio.
- If the reference axis exceeds "[Pr.8] Speed limit value" during 2-axis circular interpolation control, the reference axis is controlled with the speed limit value. (The speed limit does not function on the interpolation axis side.)
- If any axis exceeds "[Pr.8] Speed limit value" during 2- to 4-axis linear interpolation control or 2- to 4-axis fixed-feed control, the axis exceeding the speed limit value is controlled with the speed limit value. The speeds of the other axes being interpolated are suppressed by the movement amount ratio.
- In the 3-axis helical interpolation control, the composite speed of the circular interpolation axis or the speed of the linear interpolation axis is controlled not to exceed "[Pr.8] Speed limit value". (However, when the movement amount of the linear interpolation axis is more than the composite movement amount of the circular interpolation axis, such as when the number of pitches ("[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches") set in the linear interpolation axis is less, the speed of the linear interpolation axis cannot be suppressed with "[Pr.8] Speed limit value".)
- In 2- to 4-axis interpolation, you cannot change the combination of interpolated axes midway through operation.

Point

When the "reference axis speed" is set during interpolation control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed the "[Pr.8] Speed limit value".

Limits to interpolation control

There are limits to the interpolation control that can be executed and speed ([Pr.20] Interpolation speed designation method) that can be set, depending on the "[Pr.1] Unit setting" of the reference axis and interpolation axis. (For example, 2-axis circular interpolation control cannot be executed if the reference axis and interpolation axis units differ.)

The following table shows the interpolation control and speed designation limits.

○: Setting possible, ×: Setting not possible

Interpolation control set in "[Da.2] Control method"	[Pr.20] Interpolation speed designation method	[Pr.1] Unit setting*1	
		Reference axis and interpolation axis units are the same, or a combination of "mm" and "inch".*3	Reference axis and interpolation axis units differ*3
Linear 2 (ABS, INC) Fixed-feed 2	Composite speed	○	×
	Reference axis speed	○	○
Circular sub (ABS, INC) Circular right (ABS, INC) Circular left (ABS, INC)	Composite speed	○*2	×
	Reference axis speed	×	×
Linear 3 (ABS, INC) Fixed-feed 3	Composite speed	○	×
	Reference axis speed	○	○
Linear 4 (ABS, INC) Fixed-feed 4	Composite speed	×	×
	Reference axis speed	○	○
Helical sub (ABS, INC) Helical right (ABS, INC) Helical left (ABS, INC)	Composite speed	○*2	○*4
	Reference axis speed	×	×

*1 "mm" and "inch" unit mix possible.
When "mm" and "inch" are mixed, convert as follows for the positioning.
If interpolation control units are "mm", positioning is controlled by calculating position commands from the address, travel value, positioning speed and electronic gear, which have been converted to "mm" using the formula: inch setting value × 25.4 = mm setting value.
If interpolation control units are "inch", positioning is controlled by calculating position commands from the address, travel value, positioning speed and electronic gear, which have been converted to "inch" using the formula: mm setting value/25.4 = inch setting value.

*2 "degree" setting not possible.
The error "Circular interpolation not possible" (error code: 199FH) will occur and the positioning control does not start if 2-axis circular interpolation control and 3-axis helical interpolation control is set when the unit is "degree".
The machine will carry out a deceleration stop if "degree" is set during positioning control.

*3 The unit set in the reference axis will be used for the speed unit during control if the units differ or if "mm" and "inch" are combined.

*4 Only linear interpolation axis can use a unit different from that of the reference axis.

Axis operation status during interpolation control

"Interpolation" will be stored in the "[Md.26] Axis operation status" during interpolation control. "Standby" will be stored when the interpolation operation is terminated. Both the reference axis and interpolation axis will carry out a deceleration stop if an error occurs during control, and "Error" will be stored in the operation status.

3.2 Setting the Positioning Data

Relation between each control and positioning data

The setting requirements and details for the setting items of the positioning data to be set differ according to the "[Da.2] Control method".

The following table shows the positioning data setting items corresponding to the different types of control.

(In this section, it is assumed that the positioning data setting is carried out using EM Configurator.)

◎: Always set

○: Set as required ("—" when not required)

×: Setting not possible (If set, the error "Continuous path control not possible" (error code: 1A1EH to 1A20H) will occur at start.)

△: Setting limited

—: Setting not required (Use the initial value or a value within the setting range.)

Positioning data			Position control				1 to 4 axis speed control
			1-axis linear control 2/3/4-axis linear interpolation control	1/2/3/4-axis fixed-feed control	2-axis circular interpolation control	3-axis helical interpolation control	
[Da.1]	Operation pattern	Independent positioning control (Positioning complete)	◎	◎	◎	◎	◎
		Continuous positioning control	◎	◎	◎	◎	×
		Continuous path control	◎	×	◎	◎	×
[Da.2]	Control method		Linear 1 Linear 2 Linear 3 Linear 4 *1	Fixed-feed 1 Fixed-feed 2 Fixed-feed 3 Fixed-feed 4	Circular sub Circular right Circular left *1	Helical sub Helical right Helical left *1	Forward run speed 1 Reverse run speed 1 Forward run speed 2 Reverse run speed 2 Forward run speed 3 Reverse run speed 3 Forward run speed 4 Reverse run speed 4
[Da.3]	Acceleration time No.		◎	◎	◎	◎	◎
[Da.4]	Deceleration time No.		◎	◎	◎	◎	◎
[Da.6]	Positioning address/movement amount		◎	◎	◎	◎	—
[Da.7]	Arc address		—	—	◎	◎	—
[Da.8]	Command speed		◎	◎	◎	◎	◎
[Da.9]	Dwell time/JUMP destination positioning data No.		○	○	○	○	—
[Da.10]	M code/Condition data No./ Number of LOOP to LEND repetitions/Number of pitches		○	○	○	○*2	○
[Da.20]	Axis to be interpolated No.1		◎: 2 axes, 3 axes, 4 axes, —: 1 axis			◎	◎: 2 axes, 3 axes, 4 axes, —: 1 axis
[Da.21]	Axis to be interpolated No.2		◎: 3 axes, 4 axes, —: 1 axis, 2 axes			◎	◎: 3 axes, 4 axes, —: 1 axis, 2 axes
[Da.22]	Axis to be interpolated No.3		◎: 4 axes, —: 1 axis, 2 axes, 3 axes			—	◎: 4 axes, —: 1 axis, 2 axes, 3 axes
[Da.27]	M code ON signal output timing		○	○	○	○	○
[Da.28]	ABS direction in degrees		○	○	○	○	○
[Da.29]	Interpolation speed designation method		△	△	△	△	△

*1 Two control systems are available: the absolute (ABS) system and incremental (INC) system.

*2 Set an M code for the reference axis and set the number of pitches for the linear interpolation axis.

◎: Always set

○: Set as required ("—" when not required)

×: Setting not possible (If set, the error "Continuous path control not possible" (error code: 1A1EH to 1A20H) will occur at start.)

—: Setting not required (Use the initial value or a value within the setting range.)

Positioning data			Speed-position switching control	Position-speed switching control
[Da.1]	Operation pattern	Independent positioning control (Positioning complete)	◎	◎
		Continuous positioning control	◎	×
		Continuous path control	×	×
[Da.2]	Control method		Forward run speed/position Reverse run speed/position *1	Forward run position/speed Reverse run position/speed
[Da.3]	Acceleration time No.		◎	◎
[Da.4]	Deceleration time No.		◎	◎
[Da.6]	Positioning address/movement amount		◎	◎
[Da.7]	Arc address		—	—
[Da.8]	Command speed		◎	◎
[Da.9]	Dwell time/JUMP destination positioning data No.		○	○
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches		○	○
[Da.20]	Axis to be interpolated No.1		—	—
[Da.21]	Axis to be interpolated No.2		—	—
[Da.22]	Axis to be interpolated No.3		—	—
[Da.27]	M code ON signal output timing		○	○
[Da.28]	ABS direction in degrees		○	○
[Da.29]	Interpolation speed designation method		—	—

*1 Two control systems are available: the absolute (ABS) system and incremental (INC) system.

◎: Always set
○: Set as required ("—" when not required)
×: Setting not possible (If set, the error "Continuous path control not possible" (error code: 1A1EH to 1A20H) will occur at start.)
—: Setting not required (Use the initial value or a value within the setting range.)

Positioning data			Other control				
			NOP instruction	Current value changing	JUMP instruction	LOOP	LEND
[Da.1]	Operation pattern	Independent positioning control (Positioning complete)	—	◎	—	—	—
		Continuous positioning control	—	◎	—	—	—
		Continuous path control	—	×	—	—	—
[Da.2]	Control method		NOP	Current value changing	JUMP instruction	LOOP	LEND
[Da.3]	Acceleration time No.		—	—	—	—	—
[Da.4]	Deceleration time No.		—	—	—	—	—
[Da.6]	Positioning address/movement amount		—	New address	—	—	—
[Da.7]	Arc address		—	—	—	—	—
[Da.8]	Command speed		—	—	—	—	—
[Da.9]	Dwell time/JUMP destination positioning data No.		—	—	JUMP destination positioning data No.	—	—
[Da.10]	M code/Condition data No./ Number of LOOP to LEND repetitions/Number of pitches		—	○	JUMP condition data No.	Number of LOOP to LEND repetitions	—
[Da.20]	Axis to be interpolated No.1		—	—	—	—	—
[Da.21]	Axis to be interpolated No.2		—	—	—	—	—
[Da.22]	Axis to be interpolated No.3		—	—	—	—	—
[Da.27]	M code ON signal output timing		—	○	—	—	—
[Da.28]	ABS direction in degrees		○	○	○	○	○
[Da.29]	Interpolation speed designation method		—	—	—	—	—

Point

[API library]
- Store the positioning data in the positioning data structure MMST_PositioningData.
- To set the positioning data, use the MMC_Axis::SetPositioningData method.
- To check the positioning data, use the MMC_Axis::GetPositioningData method.

1-axis linear control

In "1-axis linear control" ("[Da.2] Control method" = ABS linear 1, INC linear 1), one motor is used to carry out position control in a set axis direction.

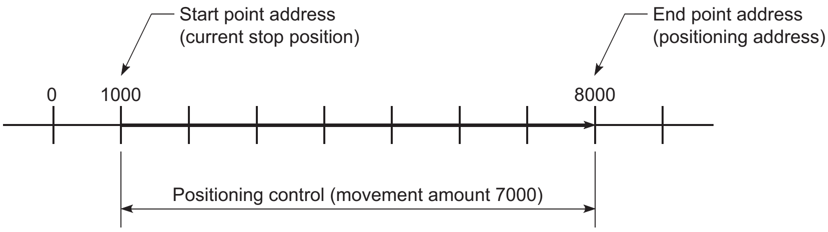
1-axis linear control (ABS linear 1)

■Operation chart

In absolute system 1-axis linear control, positioning is carried out from the current stop position (start point address) to the address (end point address) set in "[Da.6] Positioning address/movement amount".

Ex.

When the start point address (current stop position) is 1000, and the end point address (positioning address) is 8000, positioning is carried out in the positive direction for a movement amount of 7000 (8000 - 1000)



■Setting positioning data

When using 1-axis linear control (ABS linear 1), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting required/not required
[Da.1]	Operation pattern	◎
[Da.2]	Control method	◎ (Set ABS linear 1.)
[Da.3]	Acceleration time No.	○
[Da.4]	Deceleration time No.	○
[Da.6]	Positioning address/movement amount	◎
[Da.7]	Arc address	—
[Da.8]	Command speed	◎
[Da.9]	Dwell time/JUMP destination positioning data No.	○
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	○
[Da.20]	Axis to be interpolated No.1	—
[Da.21]	Axis to be interpolated No.2	—
[Da.22]	Axis to be interpolated No.3	—
[Da.27]	M code ON signal output timing	○
[Da.28]	ABS direction in degrees	○
[Da.29]	Interpolation speed designation method	△

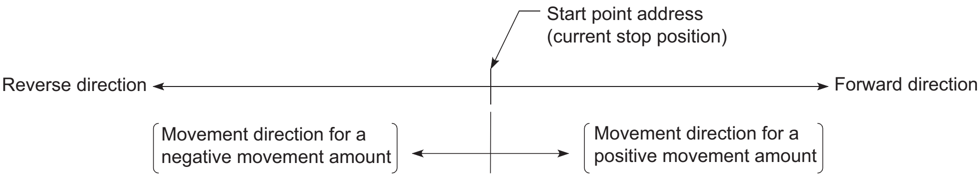
Refer to the following for information on the setting details.

☞ Page 482 Positioning Data

1-axis linear control (INC linear 1)

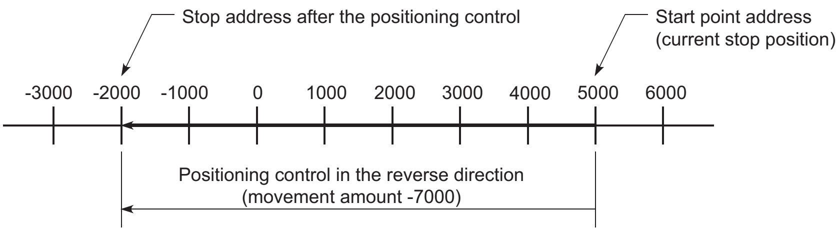
■Operation chart

In incremental system 1-axis linear control, positioning is carried out from the current stop position (start point address) to a position at the end of the movement amount set in "[Da.6] Positioning address/movement amount". The movement direction is determined by the sign of the movement amount.



Ex.

When the start point address is 5000, and the movement amount is -7000, positioning is carried out to the -2000 position.



■Setting positioning data

When using 1-axis linear control (INC linear 1), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting required/not required
[Da.1]	Operation pattern	◎
[Da.2]	Control method	◎ (Set INC linear 1.)
[Da.3]	Acceleration time No.	○
[Da.4]	Deceleration time No.	○
[Da.6]	Positioning address/movement amount	◎
[Da.7]	Arc address	—
[Da.8]	Command speed	◎
[Da.9]	Dwell time/JUMP destination positioning data No.	○
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	○
[Da.20]	Axis to be interpolated No.1	—
[Da.21]	Axis to be interpolated No.2	—
[Da.22]	Axis to be interpolated No.3	—
[Da.27]	M code ON signal output timing	○
[Da.28]	ABS direction in degrees	○
[Da.29]	Interpolation speed designation method	△

Refer to the following for information on the setting details.

☞ Page 482 Positioning Data

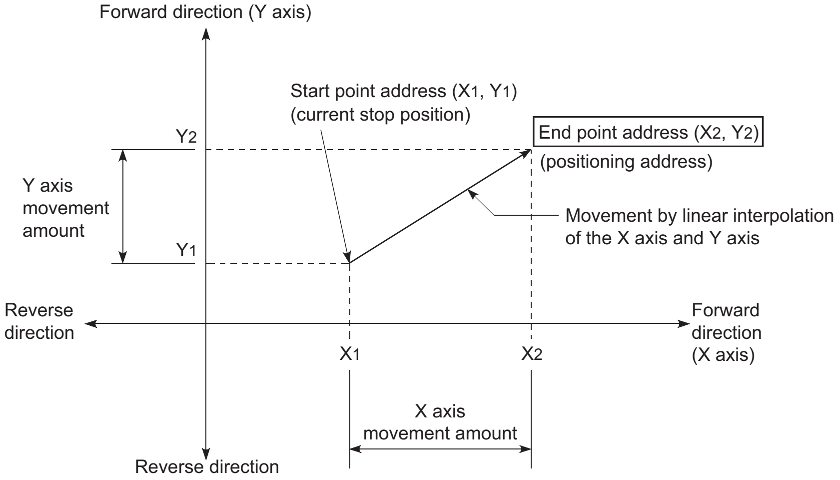
2-axis linear interpolation control

In "2-axis linear interpolation control" ("[Da.2] Control method" = ABS linear 2, INC linear 2), two motors are used to carry out position control in a linear path while carrying out interpolation for the axis directions set in each axis. (Refer to ☞ Page 60 Interpolation control for details on interpolation control.)

2-axis linear interpolation control (ABS linear 2)

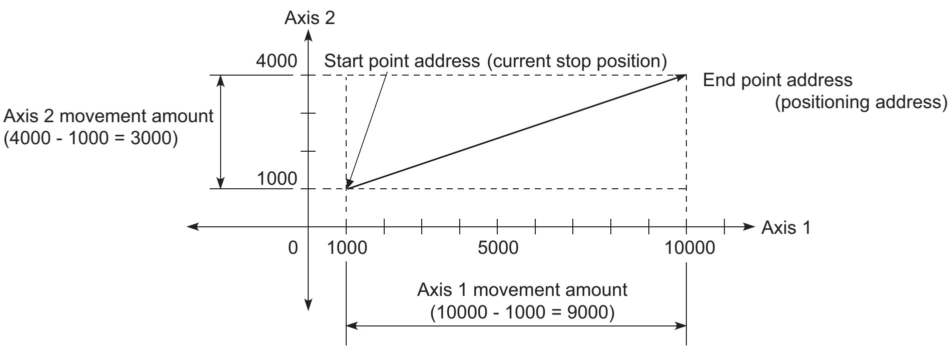
■Operation chart

In absolute system 2-axis linear interpolation control, the designated 2 axes are used. Linear interpolation positioning is carried out from the current stop position (start point address) to the address (end point address) set in "[Da.6] Positioning address/movement amount".



Ex.

When the start point address (current stop position) is (1000, 1000) and the end point address (positioning address) is (10000, 4000), positioning is carried out as follows.



■Restrictions

An error will occur and the positioning will not start in the following cases. The machine will immediately stop if the error is detected during a positioning control.

- If the movement amount of each axis exceeds "1073741824 (= 2^{30})" when "0: Composite speed" is set in "[Pr.20] Interpolation speed designation method", the error "Outside linear movement amount range" (error code: 1A15H, 1A16H) occurs at a positioning start. (The maximum movement amount that can be set in "[Da.6] Positioning address/movement amount" is "1073741824 (= 2^{30})".)

■Setting positioning data

When using 2-axis linear interpolation control (ABS linear 2), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting required/not required for the reference axis	Setting required/not required for the interpolation axis
[Da.1]	Operation pattern	◎	—
[Da.2]	Control method	◎ (Set ABS linear 2.)	—
[Da.3]	Acceleration time No.	○	—
[Da.4]	Deceleration time No.	○	—
[Da.6]	Positioning address/movement amount	◎	◎
[Da.7]	Arc address	—	—
[Da.8]	Command speed	◎	—
[Da.9]	Dwell time/JUMP destination positioning data No.	○	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches	○	—
[Da.20]	Axis to be interpolated No.1	◎	—
[Da.21]	Axis to be interpolated No.2	—	—
[Da.22]	Axis to be interpolated No.3	—	—
[Da.27]	M code ON signal output timing	○	—
[Da.28]	ABS direction in degrees	○	—
[Da.29]	Interpolation speed designation method	△	—

Refer to the following for information on the setting details.

☞ Page 482 Positioning Data

Restriction

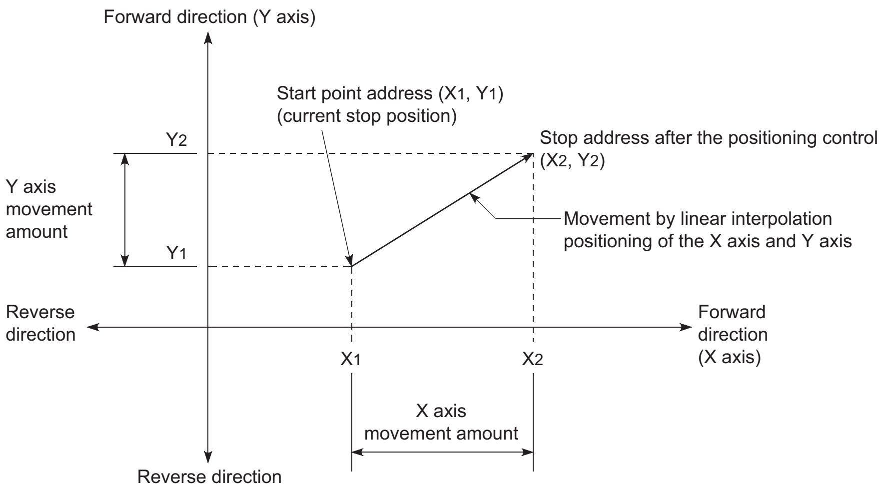
When the "reference axis speed" is set during 2-axis linear interpolation control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed the "[Pr.8] Speed limit value".

2-axis linear interpolation control (INC linear 2)

■Operation chart

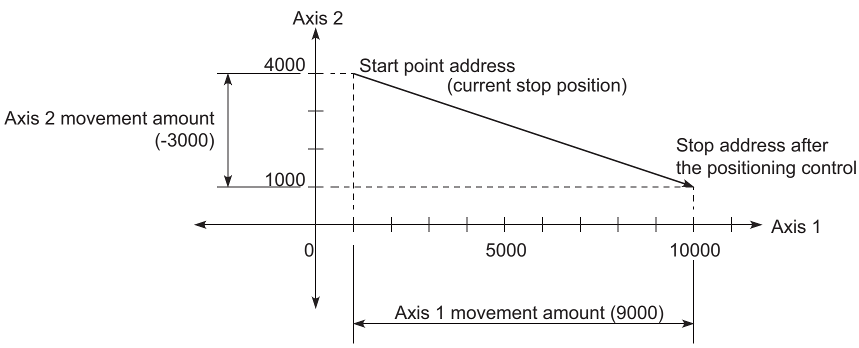
In incremental system 2-axis linear interpolation control, the designated 2 axes are used. Linear interpolation positioning is carried out from the current stop position (start point address) to a position at the end of the movement amount set in "[Da.6] Positioning address/movement amount". The movement direction is determined by the sign of the movement amount.

- Positive movement amount: Positioning control to forward direction (Address increase direction)
- Negative movement amount: Positioning control to reverse direction (Address decrease direction)



Ex.

When the axis 1 movement amount is 9000 and the axis 2 movement amount is -3000, positioning address (10000, 4000) is carried out as follows.



■Restrictions

An error will occur and the positioning will not start in the following cases. The machine will immediately stop if the error is detected during a positioning operation.

- If the movement amount of each axis exceeds "1073741824 (= 2^{30})" when "0: Composite speed" is set in "[Pr.20] Interpolation speed designation method", the error "Outside linear movement amount range" (error code: 1A15H, 1A16H) occurs at a positioning start. (The maximum movement amount that can be set in "[Da.6] Positioning address/movement amount" is "1073741824 (= 2^{30})".)

■Setting positioning data

When using 2-axis linear interpolation control (INC linear 2), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting required/not required for the reference axis	Setting required/not required for the interpolation axis
[Da.1]	Operation pattern	◎	—
[Da.2]	Control method	◎ (Set INC linear 2.)	—
[Da.3]	Acceleration time No.	○	—
[Da.4]	Deceleration time No.	○	—
[Da.6]	Positioning address/movement amount	◎	◎
[Da.7]	Arc address	—	—
[Da.8]	Command speed	◎	—
[Da.9]	Dwell time/JUMP destination positioning data No.	○	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches	○	—
[Da.20]	Axis to be interpolated No.1	◎	—
[Da.21]	Axis to be interpolated No.2	—	—
[Da.22]	Axis to be interpolated No.3	—	—
[Da.27]	M code ON signal output timing	○	—
[Da.28]	ABS direction in degrees	○	—
[Da.29]	Interpolation speed designation method	△	—

Refer to the following for information on the setting details.

☞ Page 482 Positioning Data

Restriction

When the "reference axis speed" is set during 2-axis linear interpolation control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed the "[Pr.8] Speed limit value".

3-axis linear interpolation control

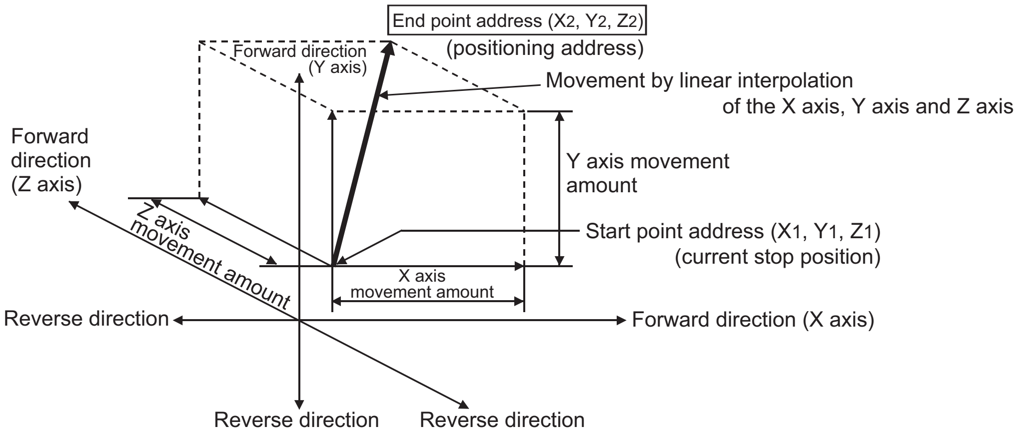
In "3-axis linear interpolation control" ("[Da.2] Control method" = ABS linear 3, INC linear 3), three motors are used to carry out position control in a linear path while carrying out interpolation for the axis directions set in each axis.
(Refer to ☞ Page 60 Interpolation control for details on interpolation control.)

3-axis linear interpolation control (ABS linear 3)

3

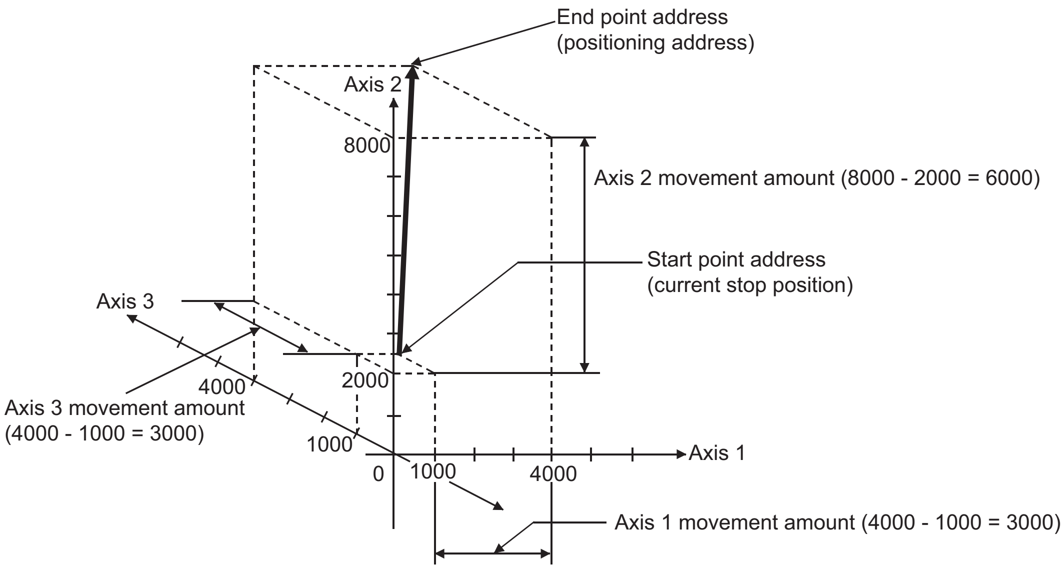
■Operation chart

In the absolute system 3-axis linear interpolation control, the designated 3 axes are used. Linear interpolation positioning is carried out from the current stop position (start point address) to the address (end point address) set in the "[Da.6] Positioning address/movement amount".



Ex.

When the start point address (current stop position) is (1000, 2000, 1000) and the end point address (positioning address) is (4000, 8000, 4000), positioning is carried out as follows.



■Restrictions

An error will occur and the positioning will not start in the following cases. The machine will immediately stop if the error is detected during a positioning control.

- If the movement amount of each axis exceeds "1073741824 (= 2^{30})" when "0: Composite speed" is set in "[Pr.20] Interpolation speed designation method", the error "Outside linear movement amount range" (error code: 1A15H, 1A16H) occurs at a positioning start. (The maximum movement amount that can be set in "[Da.6] Positioning address/movement amount" is "1073741824 (= 2^{30})".)

■Setting positioning data

When using 3-axis linear interpolation control (ABS linear 3), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting required/not required for the reference axis	Setting required/not required for the interpolation axis
[Da.1]	Operation pattern	◎	—
[Da.2]	Control method	◎ (Set ABS linear 3.)	—
[Da.3]	Acceleration time No.	○	—
[Da.4]	Deceleration time No.	○	—
[Da.6]	Positioning address/movement amount	◎	◎
[Da.7]	Arc address	—	—
[Da.8]	Command speed	◎	—
[Da.9]	Dwell time/JUMP destination positioning data No.	○	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches	○	—
[Da.20]	Axis to be interpolated No.1	◎	—
[Da.21]	Axis to be interpolated No.2	◎	—
[Da.22]	Axis to be interpolated No.3	—	—
[Da.27]	M code ON signal output timing	○	—
[Da.28]	ABS direction in degrees	○	—
[Da.29]	Interpolation speed designation method	△	—

Refer to the following for information on the setting details.

☞ Page 482 Positioning Data

Restriction

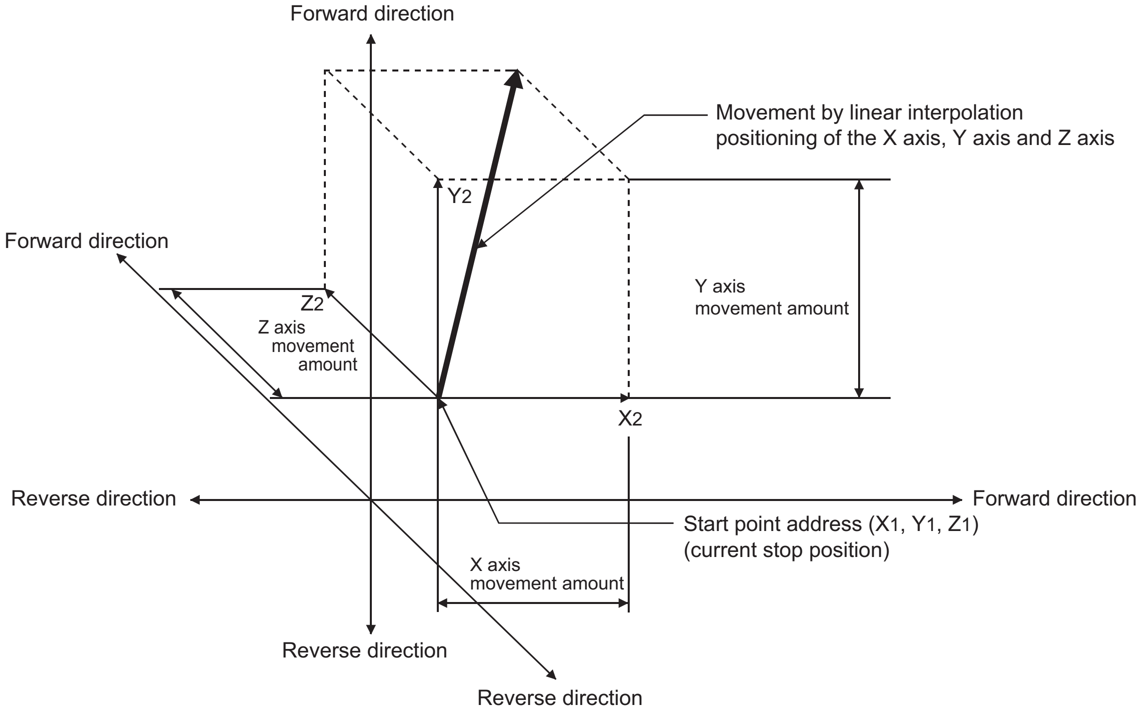
- When the "reference axis speed" is set during 3-axis linear interpolation control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed the "[Pr.8] Speed limit value".
- Refer to ☞ Page 60 Interpolation control for the reference axis and interpolation axis combinations.

3-axis linear interpolation control (INC linear 3)

■Operation chart

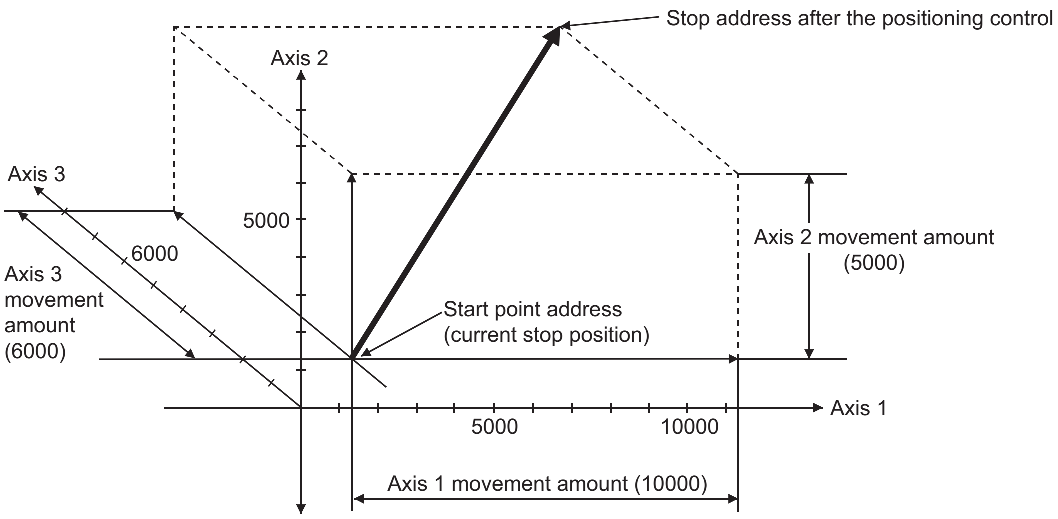
In the incremental system 3-axis linear interpolation control, the designated 3 axes are used. Linear interpolation positioning is carried out from the current stop position (start point address) to a position at the end of the movement amount set in the "[Da.6] Positioning address/movement amount". The movement direction is determined the sign of the movement amount.

- Positive movement amount: Positioning control to forward direction (Address increase direction)
- Negative movement amount: Positioning control to reverse direction (Address decrease direction)



Ex.

When the axis 1 movement amount is 10000, the axis 2 movement amount is 5000 and the axis 3 movement amount is 6000, positioning is carried out as follows.



■Restrictions

An error will occur and the positioning will not start in the following cases. The machine will immediately stop if the error is detected during a positioning operation.

- If the movement amount of each axis exceeds "1073741824 (= 2^{30})" when "0: Composite speed" is set in "[Pr.20] Interpolation speed designation method", the error "Outside linear movement amount range" (error code: 1A15H, 1A16H) occurs at a positioning start. (The maximum movement amount that can be set in "[Da.6] Positioning address/movement amount" is "1073741824 (= 2^{30})".)

■Setting positioning data

When using 3-axis linear interpolation control (INC linear 3), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting required/not required for the reference axis	Setting required/not required for the interpolation axis
[Da.1]	Operation pattern	◎	—
[Da.2]	Control method	◎ (Set INC linear 3.)	—
[Da.3]	Acceleration time No.	○	—
[Da.4]	Deceleration time No.	○	—
[Da.6]	Positioning address/movement amount	◎	◎
[Da.7]	Arc address	—	—
[Da.8]	Command speed	◎	—
[Da.9]	Dwell time/JUMP destination positioning data No.	○	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches	○	—
[Da.20]	Axis to be interpolated No.1	◎	—
[Da.21]	Axis to be interpolated No.2	◎	—
[Da.22]	Axis to be interpolated No.3	—	—
[Da.27]	M code ON signal output timing	○	—
[Da.28]	ABS direction in degrees	○	—
[Da.29]	Interpolation speed designation method	△	—

Refer to the following for information on the setting details.

☞ Page 482 Positioning Data

Restriction

- When the "reference axis speed" is set during 3-axis linear interpolation control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed the "[Pr.8] Speed limit value".
- Refer to ☞ Page 60 Interpolation control for the reference axis and interpolation axis combinations.

4-axis linear interpolation control

In "4-axis linear interpolation control" ("[Da.2] Control method" = ABS linear 4, INC linear 4), four motors are used to carry out position control in a linear path while carrying out interpolation for the axis directions set in each axis. (Refer to ☞ Page 60 Interpolation control for details on interpolation control.)

4-axis linear interpolation control (ABS linear 4)

In the absolute system 4-axis linear interpolation control, the designated 4 axes are used. Linear interpolation positioning is carried out from the current stop position (start point address) to the address (end point address) set in the "[Da.6] Positioning address/movement amount".

3

■Setting positioning data

When using 4-axis linear interpolation control (ABS linear 4), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting required/not required for the reference axis	Setting required/not required for the interpolation axis
[Da.1]	Operation pattern	◎	—
[Da.2]	Control method	◎ (Set ABS linear 4.)	—
[Da.3]	Acceleration time No.	○	—
[Da.4]	Deceleration time No.	○	—
[Da.6]	Positioning address/movement amount	◎	◎
[Da.7]	Arc address	—	—
[Da.8]	Command speed	◎	—
[Da.9]	Dwell time/JUMP destination positioning data No.	○	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches	○	—
[Da.20]	Axis to be interpolated No.1	◎	—
[Da.21]	Axis to be interpolated No.2	◎	—
[Da.22]	Axis to be interpolated No.3	◎	—
[Da.27]	M code ON signal output timing	○	—
[Da.28]	ABS direction in degrees	○	—
[Da.29]	Interpolation speed designation method	△	—

Refer to the following for information on the setting details.

☞ Page 482 Positioning Data

Restriction

- When the "reference axis speed" is set during 4-axis linear interpolation control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed the "[Pr.8] Speed limit value".
- Refer to ☞ Page 60 Interpolation control for the reference axis and interpolation axis combinations.

4-axis linear interpolation control (INC linear 4)

In the incremental system 4-axis linear interpolation control, the designated 4 axes are used. Linear interpolation positioning is carried out from the current stop position (start point address) to a position at the end of the movement amount set in the "[Da.6] Positioning address/movement amount". The movement direction is determined by the sign of the movement amount.

■Restrictions

An error will occur and the positioning will not start in the following cases. The machine will immediately stop if the error is detected during a positioning operation.

- When the movement amount for each axis exceeds "1073741824 (= 2^{30})", the error "Outside linear movement amount range" (error code: 1A15H, 1A16H) will occur at the positioning start. (The maximum movement amount that can be set in "[Da.6] Positioning address/movement amount" is "1073741824 (= 2^{30})".)

■Setting positioning data

When using 4-axis linear interpolation control (INC linear 4), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting required/not required for the reference axis	Setting required/not required for the interpolation axis
[Da.1]	Operation pattern	◎	—
[Da.2]	Control method	◎ (Set INC linear 4.)	—
[Da.3]	Acceleration time No.	○	—
[Da.4]	Deceleration time No.	○	—
[Da.6]	Positioning address/movement amount	◎	◎
[Da.7]	Arc address	—	—
[Da.8]	Command speed	◎	—
[Da.9]	Dwell time/JUMP destination positioning data No.	○	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches	○	—
[Da.20]	Axis to be interpolated No.1	◎	—
[Da.21]	Axis to be interpolated No.2	◎	—
[Da.22]	Axis to be interpolated No.3	◎	—
[Da.27]	M code ON signal output timing	○	—
[Da.28]	ABS direction in degrees	○	—
[Da.29]	Interpolation speed designation method	△	—

Refer to the following for information on the setting details.

☞ Page 482 Positioning Data

Restriction

- When the "reference axis speed" is set during 4-axis linear interpolation control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed the "[Pr.8] Speed limit value".
- Refer to ☞ Page 60 Interpolation control for the reference axis and interpolation axis combinations.

Fixed-feed control

In "fixed-feed control" ("[Da.2] Control method" = fixed-feed 1, fixed-feed 2, fixed-feed 3, fixed-feed 4), the motor of the specified axis is used to carry out fixed-feed control in a set axis direction.
In fixed-feed control, any remainder of below control accuracy is rounded down to convert the movement amount designated in the positioning data into the command value to servo amplifier.

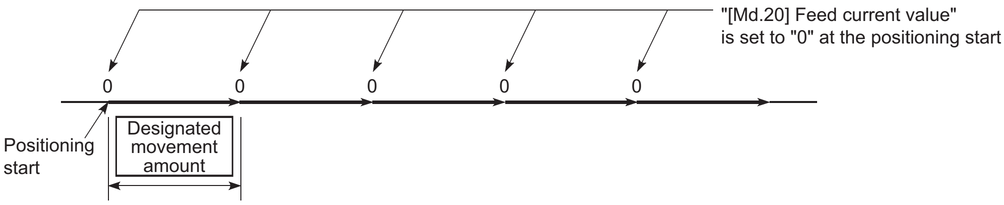
Operation chart

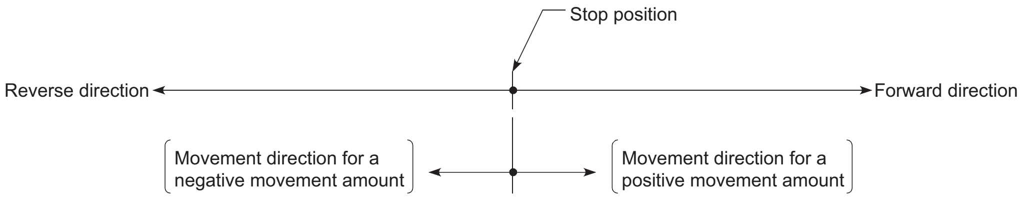
In fixed-feed control, the address ([Md.20] Feed current value) of the current stop position (start point address) is set to "0". Positioning is then carried out to a position at the end of the movement amount set in "[Da.6] Positioning address/movement amount". The movement direction is determined by the movement amount sign.

- Positive movement amount: Positioning control to forward direction (Address increase direction)
- Negative movement amount: Positioning control to reverse direction (Address decrease direction)

Ex.

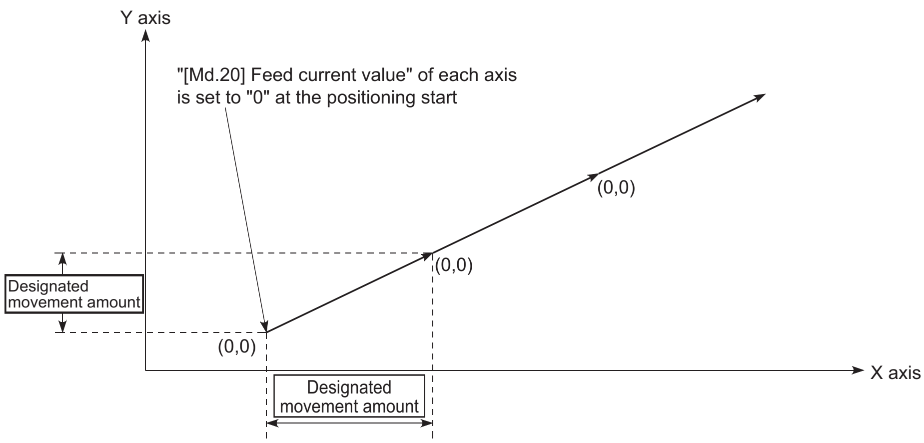
1-axis fixed-feed control





Ex.

2-axis fixed-feed control



3

■Restrictions

- The error "Continuous path control not possible" (error code: 1A1EH to 1A20H) will occur and the operation cannot start if "continuous path control" is set in "[Da.1] Operation pattern". ("Continuous path control" cannot be set in fixed-feed control.)
- "Fixed-feed" cannot be set in "[Da.2] Control method" in the positioning data when "continuous path control" has been set in "[Da.1] Operation pattern" of the immediately prior positioning data. (For example, if the operation pattern of positioning data No.1 is "continuous path control", fixed-feed control cannot be set in positioning data No.2.) The error "Continuous path control not possible" (error code: 1A1EH to 1A20H) will occur and the machine will carry out a deceleration stop if this type of setting is carried out.
- In 2- or 3-axis fixed-feed control, if the movement amount of each axis exceeds "1073741824 (=2^{30})" when "0: Composite speed" is set in "[Pr.20] Interpolation speed designation method", the error "Outside linear movement amount range" (error code: 1A15H, 1A16H) occurs at a positioning start and the positioning cannot be started. (The maximum movement amount that can be set in "[Da.6] Positioning address/movement amount" is "1073741824 (= 2^{30})".
- In 4-axis fixed-feed control, set "1: Reference axis speed" in "[Pr.20] Interpolation speed designation method". If "0: Composite speed" is set, the error "Interpolation mode error" (error code: 199AH) occurs and the positioning cannot be started.

Setting positioning data

When using fixed-feed control (fixed-feed 1), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting required/not required for the reference axis	Setting required/not required for the interpolation axis
[Da.1]	Operation pattern	◎	—
[Da.2]	Control method	◎	—
[Da.3]	Acceleration time No.	○	—
[Da.4]	Deceleration time No.	○	—
[Da.6]	Positioning address/movement amount	◎	◎
[Da.7]	Arc address	—	—
[Da.8]	Command speed	◎	—
[Da.9]	Dwell time/JUMP destination positioning data No.	○	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches	○	—
[Da.20]	Axis to be interpolated No.1	—*1	—
[Da.21]	Axis to be interpolated No.2	—*1	—
[Da.22]	Axis to be interpolated No.3	—*1	—
[Da.27]	M code ON signal output timing	○	—
[Da.28]	ABS direction in degrees	○	—
[Da.29]	Interpolation speed designation method	△	—

*1 To use the 2- to 4-axis fixed-feed control (interpolation), it is required to set the axis used as the interpolation axis.

Refer to the following for information on the setting details.

☞ Page 482 Positioning Data

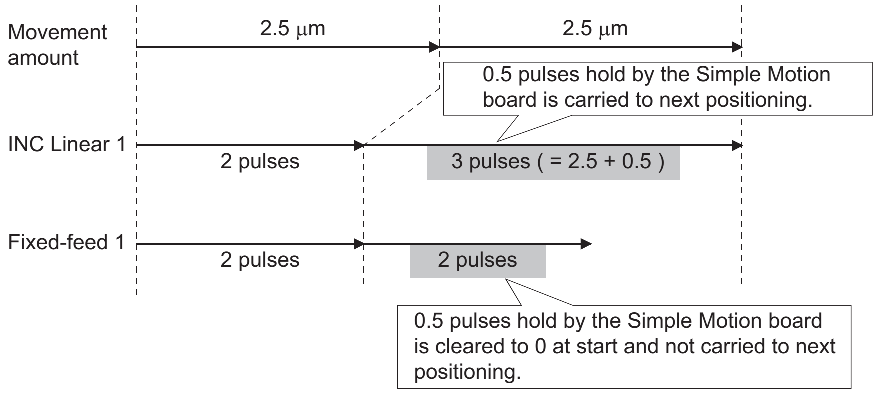
Point

When the movement amount is converted to the actual number of command pulses, a fraction appears after the decimal point, according to the movement amount per pulse. This fraction is normally retained in the Simple Motion board and reflected at the next positioning. For the fixed-feed control, since the movement distance is maintained constant (= the command number of pulses is maintained constant), the control is carried out after the fraction pulse is cleared to zero at start.

[Accumulation/cutoff for fractional pulses]

When movement amount per pulse is 1.0 [µm] and movement for 2.5 [µm] is executed two times.

→ Conversion to command pulses: 2.5 [µm]/1.0 = 2.5 [pulse]



When the "reference axis speed" is set in 2- to 4-axis fixed-feed control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed the "[Pr.8] Speed limit value".

Refer to the following for the combination of the reference axis and the interpolation axis.

☞ Page 60 Interpolation control

2-axis circular interpolation control with sub point designation

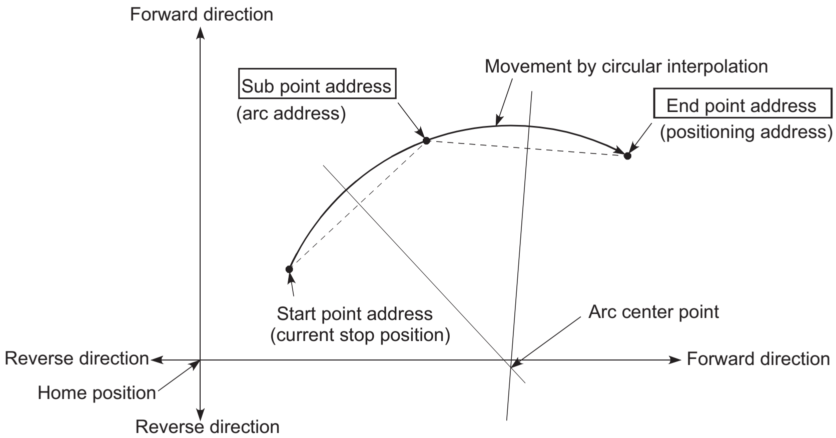
In "2-axis circular interpolation control" ("[Da.2] Control method" = ABS circular sub, INC circular sub), two motors are used to carry out position control in an arc path passing through designated sub points, while carrying out interpolation for the axis directions set in each axis. (Refer to ☞ Page 60 Interpolation control for details on interpolation control.)

2-axis circular interpolation control with sub point designation (ABS circular sub)

■Operation chart

In the absolute system, 2-axis circular interpolation control with sub point designation, positioning is carried out from the current stop position (start point address) to the address (end point address) set in "[Da.6] Positioning address/movement amount", in an arc path that passes through the sub point address set in "[Da.7] Arc address".

The resulting control path is an arc having as its center the intersection point of perpendicular bisectors of a straight line between the start point address (current stop position) and sub point address (arc address), and a straight line between the sub point address (arc address) and end point address (positioning address).



■Restrictions

2-axis circular interpolation control cannot be set in the following cases.

- When "degree" is set in "[Pr.1] Unit setting"
- When the units set in "[Pr.1] Unit setting" are different for the reference axis and interpolation axis. ("mm" and "inch" combinations are possible.)
- When "reference axis speed" is set in "[Pr.20] Interpolation speed designation method"

An error will occur and the positioning start will not be possible in the following cases. The machine will immediately stop if the error is detected during positioning control.

- When the radius exceeds "536870912 (= 2^{29})" (the maximum radius for which 2-axis circular interpolation control is possible is "536870912 (= 2^{29})"): The error "Outside radius range" (error code: 1A32H) will occur at positioning start.
- When the center point address is outside the range of "-2147483648 (-2^{31}) to 2147483647 (2^{31} - 1)": The error "Sub point setting error" (error code: 1A27H to 1A2AH) will occur at positioning start.
- When the start point address is the same as the end point address: The error "End point setting error" (error code: 1A2BH, 1A2CH) will occur.
- When the start point address is the same as the sub point address: The error "Sub point setting error" (error code: 1A27H to 1A2AH) will occur.
- When the end point address is the same as the sub point address: The error "Sub point setting error" (error code: 1A27H to 1A2AH) will occur.
- When the start point address, sub point address, and end point address are in a straight line: The error "Sub point setting error" (error code: 1A27H to 1A2AH) will occur.

■Setting positioning data

When using 2-axis circular interpolation control with sub point designation (ABS circular sub), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting required/not required for the reference axis	Setting required/not required for the interpolation axis
[Da.1]	Operation pattern	◎	—
[Da.2]	Control method	◎ (Set ABS circular sub.)	—
[Da.3]	Acceleration time No.	○	—
[Da.4]	Deceleration time No.	○	—
[Da.6]	Positioning address/movement amount	◎	◎
[Da.7]	Arc address	◎	◎
[Da.8]	Command speed	◎	—
[Da.9]	Dwell time/JUMP destination positioning data No.	○	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches	○	—
[Da.20]	Axis to be interpolated No.1	◎	—
[Da.21]	Axis to be interpolated No.2	—	—
[Da.22]	Axis to be interpolated No.3	—	—
[Da.27]	M code ON signal output timing	○	—
[Da.28]	ABS direction in degrees	○	—
[Da.29]	Interpolation speed designation method	△	—

Refer to the following for information on the setting details.

☞ Page 482 Positioning Data

Restriction

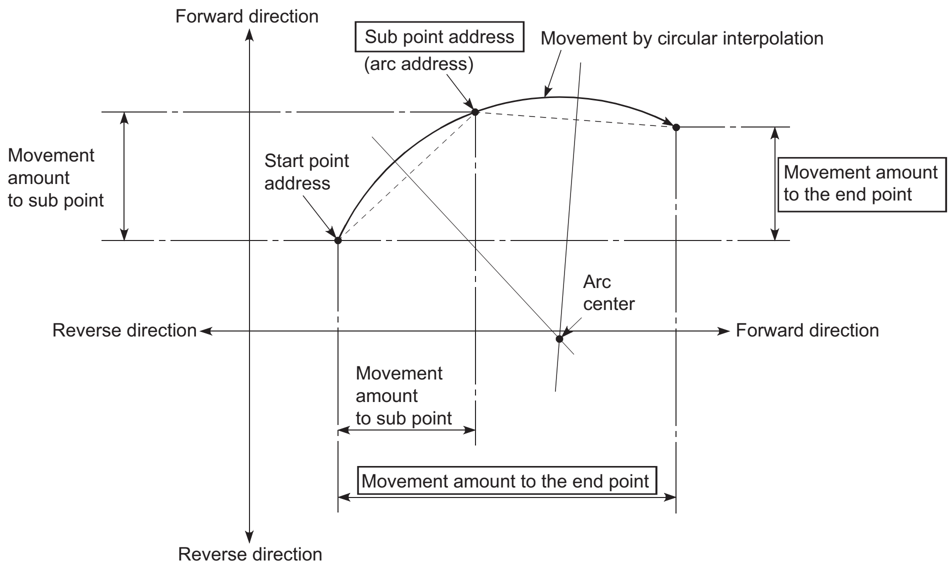
Set a value in "[Da.8] Command speed" so that the speed of each axis does not exceed the "[Pr.8] Speed limit value". (The speed limit does not function for the speed calculated by the Simple Motion board during interpolation control.)

2-axis circular interpolation control with sub point designation (INC circular sub)

■Operation chart

In the incremental system, 2-axis circular interpolation control with sub point designation, positioning is carried out from the current stop position (start point address) to a position at the end of the movement amount set in "[Da.6] Positioning address/ movement amount" in an arc path that passes through the sub point address set in "[Da.7] Arc address". The movement direction depends on the sign (+ or -) of the movement amount.

The resulting control path is an arc having as its center the intersection point of perpendicular bisectors of the straight line between the start point address (current stop position) and sub point address (arc address) calculated from the movement amount to the sub point, and a straight line between the sub point address (arc address) and end point address (positioning address) calculated from the movement amount to the end point.



■Restrictions

2-axis circular interpolation control cannot be set in the following cases.

- When "degree" is set in "[Pr.1] Unit setting"
- When the units set in "[Pr.1] Unit setting" are different for the reference axis and interpolation axis. ("mm" and "inch" combinations are possible.)
- When "reference axis speed" is set in "[Pr.20] Interpolation speed designation method"

An error will occur and the positioning start will not be possible in the following cases. The machine will immediately stop if the error is detected during positioning control.

- When the radius exceeds "536870912 (= 2^{29})" (the maximum radius for which 2-axis circular interpolation control is possible is "536870912 (= 2^{29})"): The error "Outside radius range" (error code: 1A32H) will occur at positioning start.
- When the sub point address is outside the range of "-2147483648 (-2^{31}) to 2147483647 (2^{31} - 1)": The error "Sub point setting error" (error code: 1A27H to 1A2AH) will occur.
- When the end point address is outside the range of "-2147483648 (-2^{31}) to 2147483647 (2^{31} - 1)": The error "End point setting error" (error code: 1A2BH, 1A2CH) will occur.
- When the center point address is outside the range of "-2147483648 (-2^{31}) to 2147483647 (2^{31} - 1)": The error "Sub point setting error" (error code: 1A27H to 1A2AH) will occur at positioning start.
- When the start point address is the same as the end point address: The error "End point setting error" (error code: 1A2BH, 1A2CH) will occur.
- When the start point address is the same as the sub point address: The error "Sub point setting error" (error code: 1A27H to 1A2AH) will occur.
- When the end point address is the same as the sub point address: The error "Sub point setting error" (error code: 1A27H to 1A2AH) will occur.
- When the start point address, sub point address, and end point address are in a straight line: The error "Sub point setting error" (error code: 1A27H to 1A2AH) will occur.

■Setting positioning data

When using 2-axis circular interpolation control with sub point designation (INC circular sub), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting required/not required for the reference axis	Setting required/not required for the interpolation axis
[Da.1]	Operation pattern	◎	—
[Da.2]	Control method	◎ (Set INC circular sub.)	—
[Da.3]	Acceleration time No.	○	—
[Da.4]	Deceleration time No.	○	—
[Da.6]	Positioning address/movement amount	◎	◎
[Da.7]	Arc address	◎	◎
[Da.8]	Command speed	◎	—
[Da.9]	Dwell time/JUMP destination positioning data No.	○	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches	○	—
[Da.20]	Axis to be interpolated No.1	◎	—
[Da.21]	Axis to be interpolated No.2	—	—
[Da.22]	Axis to be interpolated No.3	—	—
[Da.27]	M code ON signal output timing	○	—
[Da.28]	ABS direction in degrees	○	—
[Da.29]	Interpolation speed designation method	△	—

Refer to the following for information on the setting details.

☞ Page 482 Positioning Data

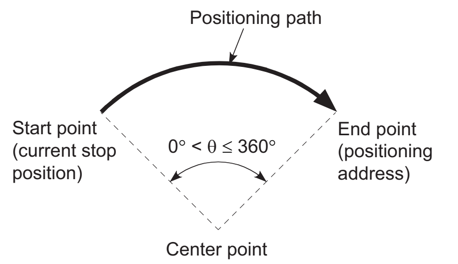
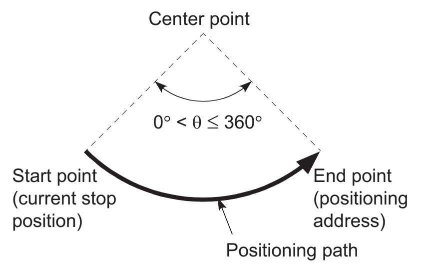
Restriction

Set a value in "[Da.8] Command speed" so that the speed of each axis does not exceed the "[Pr.8] Speed limit value". (The speed limit does not function for the speed calculated by the Simple Motion board during interpolation control.)

2-axis circular interpolation control with center point designation

In "2-axis circular interpolation control" ("[Da.2] Control method" = ABS circular right, INC circular right, ABS circular left, INC circular left), two motors are used to carry out position control in an arc path having an arc address as a center point, while carrying out interpolation for the axis directions set in each axis. (Refer to ☞ Page 60 Interpolation control for details on interpolation control.)

The following table shows the rotation directions, arc center angles that can be controlled, and positioning paths for the different control methods.

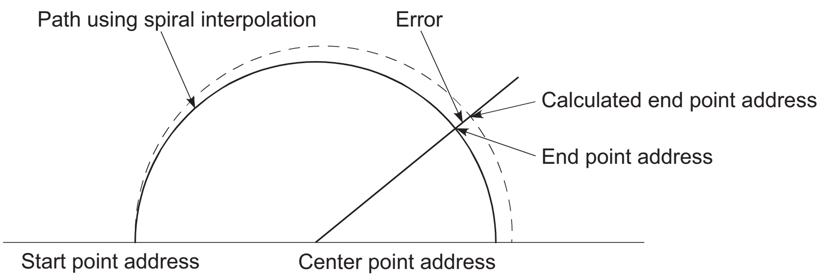
Control method	Rotation direction	Arc center angle that can be controlled	Positioning path
ABS circular right	Clockwise	$0^\circ < \theta \leq 360^\circ$	
INC circular right			
ABS circular left	Counterclockwise		
INC circular left			

Circular interpolation error compensation

In 2-axis circular interpolation control with center point designation, the arc path calculated from the start point address and center point address may deviate from the position of the end point address set in "[Da.6] Positioning address/movement amount". (Refer to ☞ Page 473 [Pr.41] Allowable circular interpolation error width.)

■Calculated error $\leq$ "[Pr.41] Allowable circular interpolation error width"

2-axis circular interpolation control to the set end point address is carried out while the error compensation is carried out. (This is called "spiral interpolation".)



In 2-axis circular interpolation control with center point designation, an angular velocity is calculated on the assumption that operation is carried out at a command speed on the arc using the radius calculated from the start point address and center point address, and the radius is compensated in proportion to the angular velocity deviated from that at the start point.

Thus, when there is a difference (error) between a radius calculated from the start point address and center point address (start point radius) and a radius calculated from the end point address and center point address (end point radius), the composite speed differs from the command speed as follows.

Start point radius > End point radius	As compared with the speed without error, the speed becomes slower as end point address is reached.
Start point radius < End point radius	As compared with the speed without error, the speed becomes faster as end point address is reached.

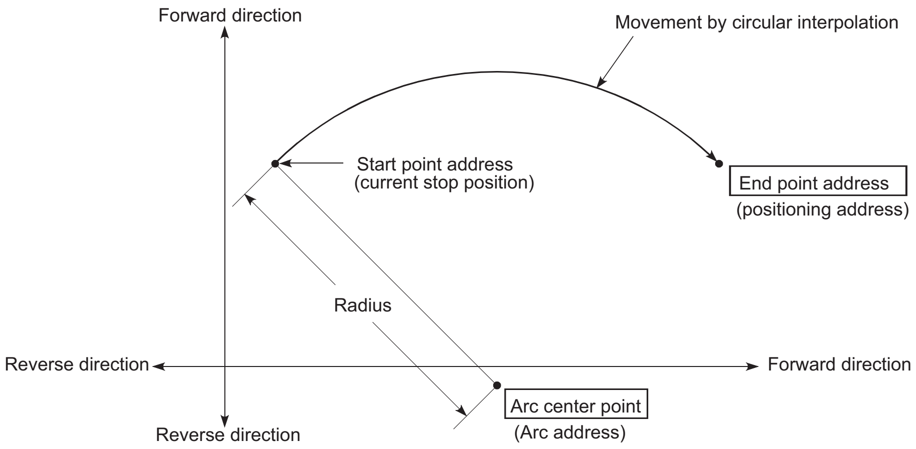
■Calculated error > "[Pr.41] Allowable circular interpolation error width"

At the positioning start, the error "Large arc error deviation" (error code: 1A17H) will occur and the control will not start. The machine will immediately stop if the error is detected during positioning control.

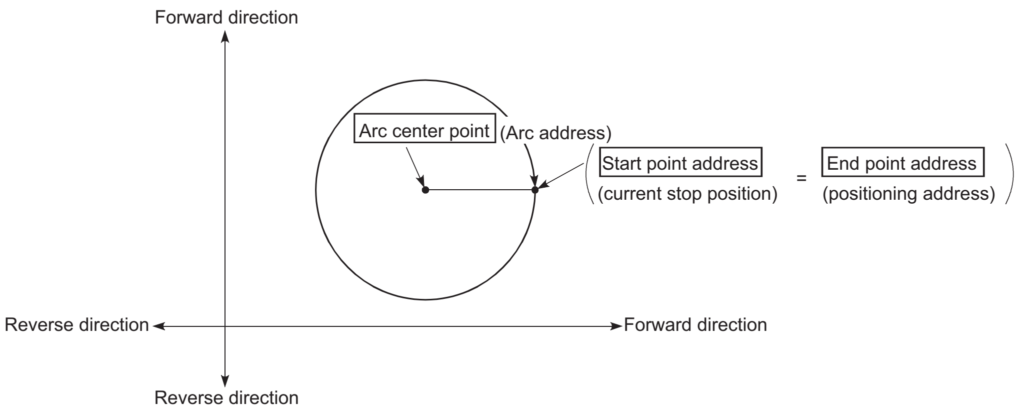
2-axis circular interpolation control with center point designation (ABS circular)

■Operation chart

In the absolute system, 2-axis circular interpolation control with center point designation positioning is carried out from the current stop position (start point address) to the address (end point address) set in "[Da.6] Positioning address/movement amount", in an arc path having as its center the address (arc address) of the center point set in "[Da.7] Arc address".



Positioning of a complete round with a radius from the start point address to the arc center point can be carried out by setting the end point address (positioning address) to the same address as the start point address.



In 2-axis circular interpolation control with center point designation, an angular velocity is calculated on the assumption that operation is carried out at a command speed on the arc using the radius calculated from the start point address and center point address, and the radius is compensated in proportion to the angular velocity deviated from that at the start point.
Thus, when there is a difference (error) between a radius calculated from the start point address and center point address (start point radius) and a radius calculated from the end point address and center point address (end point radius), the composite speed differs from the command speed as follows.

Start point radius > End point radius	As compared with the speed without error, the speed becomes slower as end point address is reached.
Start point radius < End point radius	As compared with the speed without error, the speed becomes faster as end point address is reached.

■Restrictions

2-axis circular interpolation control cannot be set in the following cases.

- When "degree" is set in "[Pr.1] Unit setting"
- When the units set in "[Pr.1] Unit setting" are different for the reference axis and interpolation axis. ("mm" and "inch" combinations are possible.)
- When "reference axis speed" is set in "[Pr.20] Interpolation speed designation method"

An error will occur and the positioning start will not be possible in the following cases. The machine will immediately stop if the error is detected during positioning control.

- When the radius exceeds "536870912 (= 2^{29})" (the maximum radius for which 2-axis circular interpolation control is possible is "536870912 (= 2^{29})"): The error "Outside radius range" (error code: 1A32H) will occur at positioning start.
- When the start point address is the same as the center point address: The error "Center point setting error" (error code: 1A2DH) will occur.
- When the end point address is the same as the center point address: The error "Center point setting error" (error code: 1A2EH) will occur.
- When the center point address is outside the range of -2147483648 (-2^{31}) to 2147483647 (2^{31} - 1): The error "Center point setting error" (error code: 1A2FH) will occur.

■Setting positioning data

When using 2-axis circular interpolation control with center point designation (ABS circular right, ABS circular left), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting required/not required for the reference axis	Setting required/not required for the interpolation axis
[Da.1]	Operation pattern	◎	—
[Da.2]	Control method	◎ (Set ABS circular right or ABS circular left.)	—
[Da.3]	Acceleration time No.	○	—
[Da.4]	Deceleration time No.	○	—
[Da.6]	Positioning address/movement amount	◎	◎
[Da.7]	Arc address	◎	◎
[Da.8]	Command speed	◎	—
[Da.9]	Dwell time/JUMP destination positioning data No.	○	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches	○	—
[Da.20]	Axis to be interpolated No.1	◎	—
[Da.21]	Axis to be interpolated No.2	—	—
[Da.22]	Axis to be interpolated No.3	—	—
[Da.27]	M code ON signal output timing	○	—
[Da.28]	ABS direction in degrees	○	—
[Da.29]	Interpolation speed designation method	△	—

Refer to the following for information on the setting details.

☞ Page 482 Positioning Data

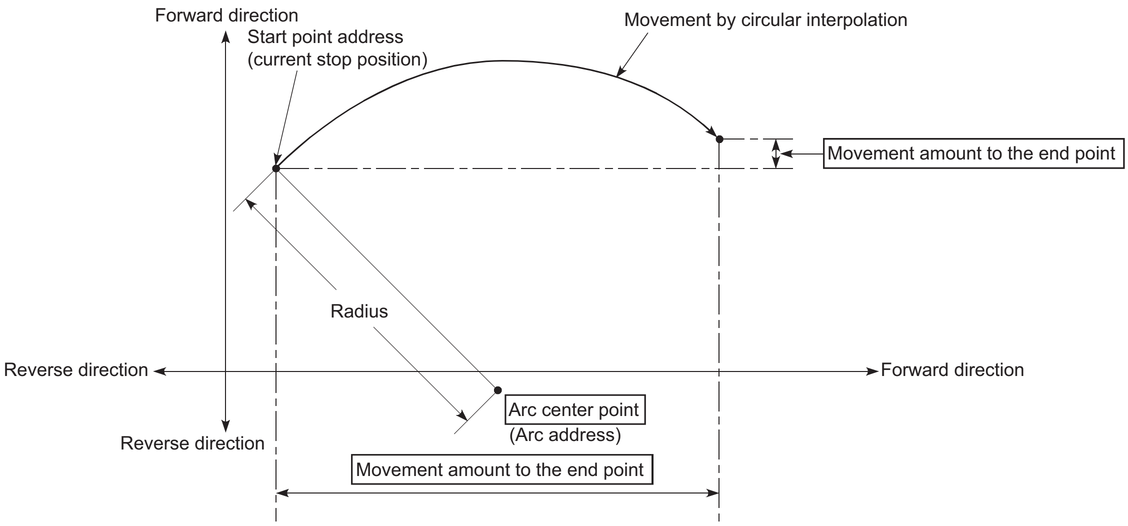
Restriction

Set a value in "[Da.8] Command speed" so that the speed of each axis does not exceed the "[Pr.8] Speed limit value". (The speed limit does not function for the speed calculated by the Simple Motion board during interpolation control.)

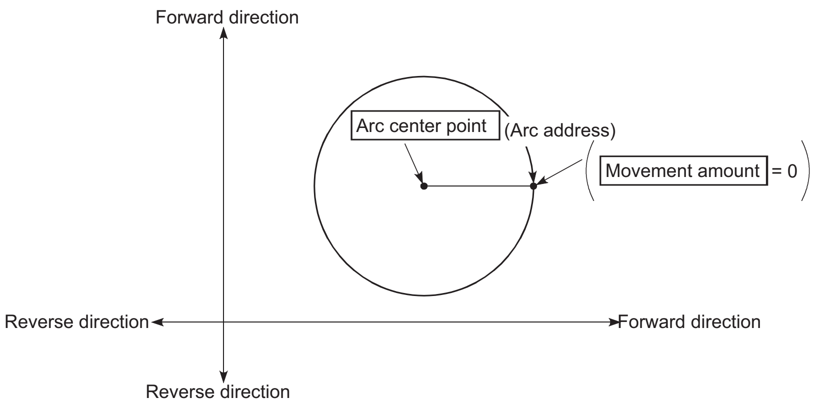
2-axis circular interpolation control with center point designation (INC circular)

■Operation chart

In the incremental system, 2-axis circular interpolation control with center point designation, positioning is carried out from the current stop position (start point address) to a position at the end of the movement amount set in "[Da.6] Positioning address/ movement amount", in an arc path having as its center the address (arc address) of the center point set in "[Da.7] Arc address".



Positioning of a complete round with a radius of the distance from the start point address to the arc center point can be carried out by setting the movement amount to "0".



In 2-axis circular interpolation control with center point designation, an angular velocity is calculated on the assumption that operation is carried out at a command speed on the arc using the radius calculated from the start point address and center point address, and the radius is compensated in proportion to the angular velocity deviated from that at the start point.

Thus, when there is a difference (error) between a radius calculated from the start point address and center point address (start point radius) and a radius calculated from the end point address and center point address (end point radius), the composite speed differs from the command speed as follows.

Start point radius > End point radius	As compared with the speed without error, the speed becomes slower as end point address is reached.
Start point radius < End point radius	As compared with the speed without error, the speed becomes faster as end point address is reached.

■Restrictions

2-axis circular interpolation control cannot be set in the following cases.

- When "degree" is set in "[Pr.1] Unit setting"
- When the units set in "[Pr.1] Unit setting" are different for the reference axis and interpolation axis. ("mm" and "inch" combinations are possible.)
- When "reference axis speed" is set in "[Pr.20] Interpolation speed designation method"

An error will occur and the positioning start will not be possible in the following cases. The machine will immediately stop if the error is detected during positioning control.

- When the radius exceeds "536870912 (= 2^{29})" (the maximum radius for which 2-axis circular interpolation control is possible is "536870912 (= 2^{29})"): The error "Outside radius range" (error code: 1A32H) will occur at positioning start.
- When the end point address is outside the range of -2147483648 (-2^{31}) to 2147483647 (2^{31} - 1): The error "End point setting error" (error code: 1A2BH, 1A2CH) will occur.
- When the start point address is the same as the center point address: The error "Center point setting error" (error code: 1A2DH) will occur.
- When the end point address is the same as the center point address: The error "Center point setting error" (error code: 1A2EH) will occur.
- When the center point address is outside the range of -2147483648 (-2^{31}) to 2147483647 (2^{31} - 1): The error "Center point setting error" (error code: 1A2FH) will occur.

■Setting positioning data

When using 2-axis circular interpolation control with center point designation (INC circular right, INC circular left), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting required/not required for the reference axis	Setting required/not required for the interpolation axis
[Da.1]	Operation pattern	◎	—
[Da.2]	Control method	◎ (Set INC circular right or INC circular left.)	—
[Da.3]	Acceleration time No.	○	—
[Da.4]	Deceleration time No.	○	—
[Da.6]	Positioning address/movement amount	◎	◎
[Da.7]	Arc address	◎	◎
[Da.8]	Command speed	◎	—
[Da.9]	Dwell time/JUMP destination positioning data No.	○	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches	○	—
[Da.20]	Axis to be interpolated No.1	◎	—
[Da.21]	Axis to be interpolated No.2	—	—
[Da.22]	Axis to be interpolated No.3	—	—
[Da.27]	M code ON signal output timing	○	—
[Da.28]	ABS direction in degrees	○	—
[Da.29]	Interpolation speed designation method	△	—

Refer to the following for information on the setting details.

☞ Page 482 Positioning Data

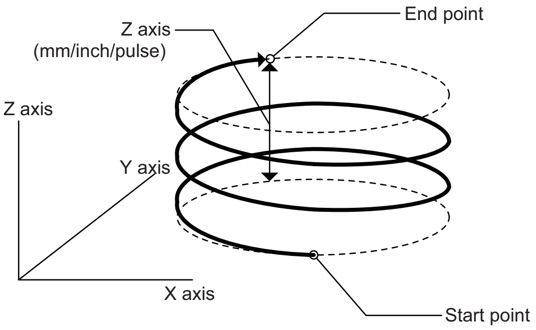
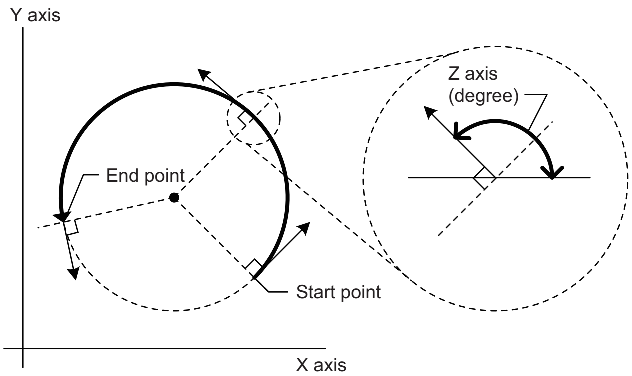
Restriction

Set a value in "[Da.8] Command speed" so that the speed of each axis does not exceed the "[Pr.8] Speed limit value". (The speed limit does not function for the speed calculated by the Simple Motion board during interpolation control.)

3-axis helical interpolation control with sub point designation

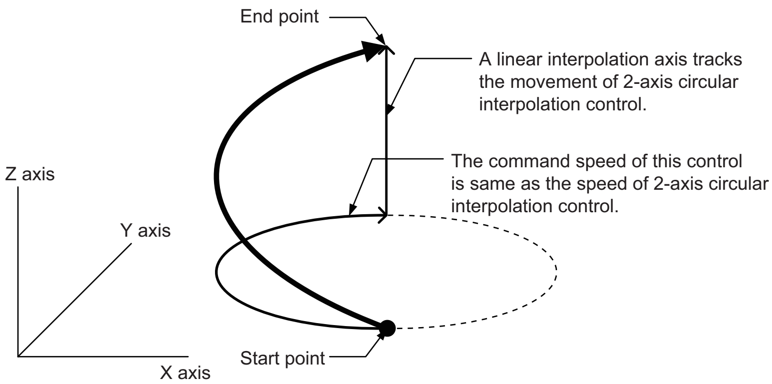
In "3-axis helical interpolation control" ("[Da.2] Control method" = ABS helical sub, INC helical sub), three motors are used to carry out the circular interpolation control of 2 axes. The remaining axis is used for "helical control" or "tangent control and normal line control".

X axis: Reference axis, Y axis: Circular interpolation axis, Z axis: Linear interpolation axis

<table>
<tr><th>Control details</th><th>Control overview</th><th>Positioning path</th></tr>
<tr><td>Helical control</td><td>
</td><td>Draws a helical path by following the linear interpolation axis (linear control) to the 2-axis circular interpolation control.
■Unit setting
• Reference axis: mm/inch, pulse
• Circular interpolation axis: The same as the reference axis
• Linear interpolation axis: mm/inch, pulse</td></tr>
<tr><td>Tangent control/
Normal line control</td><td>
</td><td>Keeps the direction of the workpiece against the center point of the 2-axis circular interpolation control by following the value of the linear interpolation axis (degree) to the 2-axis circular interpolation control. The figure shown on the left is an example in which the direction of the workpiece is kept to the direction of the tangent or normal line.
■Unit setting
• Reference axis: mm/inch, pulse
• Circular interpolation axis: The same as the reference axis
• Linear interpolation axis: degree</td></tr>
</table>

Speed of the 3-axis helical interpolation control

The 2-axis circular interpolation control (Reference axis—Composite speed of the circular interpolation axis) is the target of the command speed of the 3-axis helical interpolation control.

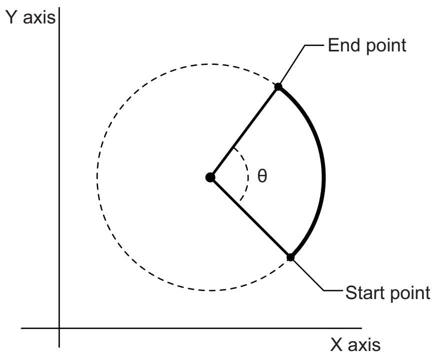


Point

- When the movement amount of the linear interpolation axis is more than the composite movement amount of the circular interpolation axis, the speed of the linear interpolation axis cannot be suppressed with "[Pr.8] Speed limit value".
- When "0: Composite speed" is set in "[Pr.20] Interpolation speed designation method" or "1: Composite speed" is set in "[Da.29] Interpolation speed designation method", the command speed of ABS3/INC3 is the composite speed of the three axes (X axis—Y axis—Z axis). The command speed of the 3-axis helical interpolation control is the composite speed of the two axes (X axis—Y axis). When the continuous path control is performed using ABS3/INC3 and the 3-axis helical interpolation control, the movement speed of the workpiece may change at the positioning data switching; therefore, adjust the command speed not to shake the workpiece.

Rotation angle of circular interpolation axis (X axis—Y axis)

The rotation angle of the circular interpolation axis in the 3-axis helical interpolation control is as follows.



Number of pitch	Control of the circular interpolation axis
0	θ°
1	360° + θ°
2	720° + θ°
⋮	⋮
n	360° × n + θ°
⋮	⋮
999	360° × 999 + θ°

Restriction

When "degree" is set to "[Pr.1] Unit setting", the positioning range of the absolute system is 0 to 359.99999°. If the rotation angle is 360° or larger in the circular interpolation axis (X axis—Y axis), the tangent control and normal line control cannot be performed because 360° or larger angle cannot be set for "[Da.6] Positioning address/movement amount" of the linear interpolation axis (Z axis: degree). To perform the tangent control or normal line control with the rotation of 360° or larger angle, use the incremental system.

Rotation direction when the linear interpolation axis (Z axis) is set in degrees

When "degree" is set to "[Pr.1] Unit setting" for the linear interpolation axis, the rotation direction is determined depending on the axis control data in "[Cd.40] ABS direction in degrees" of the reference axis. To set a rotation direction for each positioning data, set "[Da.28] ABS direction in degrees" of each positioning data.

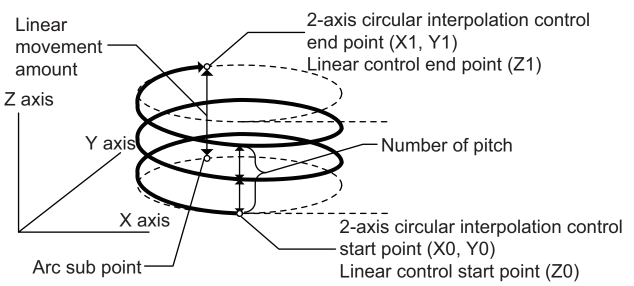
3-axis helical interpolation control with sub point designation (ABS helical sub)

■Operation chart

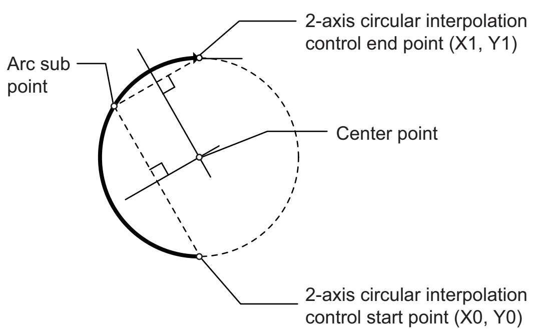
In the absolute system and 3-axis helical interpolation control with sub point designation, the positioning is performed from the current stop position (X0, Y0, Z0) to the position indicated with the arc end point address (X1 and Y1) and the linear interpolation axis end point address (Z1) set in "[Da.6] Positioning address/movement amount". As the positioning to the commanded position, the linear interpolation with the other linear interpolation axes is performed and the positioning target is rotated helically for the number of pitches set in "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches" of the linear interpolation axis while the circular interpolation through the sub point address (sub point address) set in "[Da.7] Arc address" is performed.

The resulting path is an arc whose center is the intersection point of the perpendicular bisectors of a straight line between the start point address (current stop position) and sub point address (arc address) and a straight line between the sub point address (arc address) and end point address (positioning address).

Operation chart



Top view of the circular interpolation



■Restrictions

In the following cases, the 3-axis helical interpolation control cannot be set.

- When "degree" is set in "[Pr.1] Unit setting" of the reference axis and circular interpolation axis
- When the units set in "[Pr.1] Unit setting" are different between the reference axis and circular interpolation axis (The combination of "mm" and "inch" is possible.)
- When "reference axis speed" is set in "[Pr.20] Interpolation speed designation method"
- When the value out of the range of "0 to 999" is set in the number of pitches ("[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches")

In the following case, an error occurs and the positioning will not start. During the positioning control, the operation stops immediately at the detection of the error.

Error cause	Error code
When the radius exceeds 536870912 (= 2^{29}) (The maximum radius for which the 2-axis circular interpolation control is possible is 536870912 (= 2^{29}).)	The error "Outside radius range" (error code: 1A32H) occurs at the start of the positioning.
When the center point address is out of the range of -2147483648 (-2^{31}) to 2147483647 (2^{31}-1)	The error "Sub point setting error" (error code: 1A37H) occurs at the start of the positioning.
Start point address = End point address	The error "End point setting error" (error code: 1A2BH)
Start point address = Sub point address	The error "Sub point setting error" (error code: 1A27H)
End point address = Sub point address	The error "Sub point setting error" (error code: 1A28H)
When the start point address, sub point address, and end point address are on a straight line	The error "Sub point setting error" (error code: 1A29H)

■Positioning data to be set

When using 3-axis helical interpolation control with sub point designation (ABS helical sub), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting requirement of reference axis	Setting requirement of circular interpolation axis[*1]	Setting requirement of linear interpolation axis[*2]
[Da.1]	Operation pattern	◎	—	—
[Da.2]	Control method	◎ (Set ABS helical sub.)	—	—
[Da.3]	Acceleration time No.	◎	—	—
[Da.4]	Deceleration time No.	◎	—	—
[Da.6]	Positioning address/movement amount	◎	◎	◎
[Da.7]	Arc address	◎	◎	—
[Da.8]	Command speed	◎	—	—
[Da.9]	Dwell time/JUMP destination positioning data No.	○	—	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	○	—	◎[*3]
[Da.20]	Axis to be interpolated No.1	◎	—	—
[Da.21]	Axis to be interpolated No.2	◎	—	—
[Da.22]	Axis to be interpolated No.3	—	—	—
[Da.27]	M code ON signal output timing	○	—	—
[Da.28]	ABS direction in degrees	○	—	—
[Da.29]	Interpolation speed designation method	△	—	—

*1 Specified in "[Da.20] Axis to be interpolated No.1" of the reference axis.

*2 Specified in "[Da.21] Axis to be interpolated No.2" of the reference axis.

*3 Set the number of pitches for the linear interpolation axis.

Refer to the following for the setting details.

☞ Page 482 Positioning Data

Restriction

Set a value in "[Da.8] Command speed" so that the speed of each axis does not exceed the value in "[Pr.8] Speed limit value". (The speed limit does not function for the speed calculated by the Simple Motion board.)

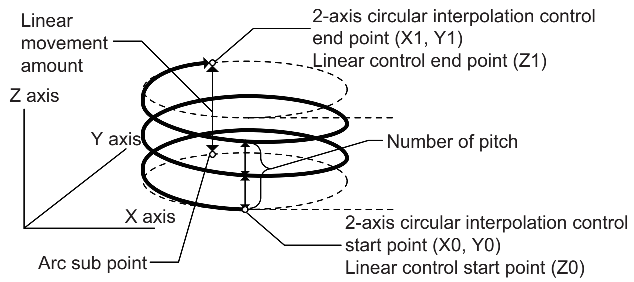
3-axis helical interpolation control with sub point designation (INC helical sub)

■Operation chart

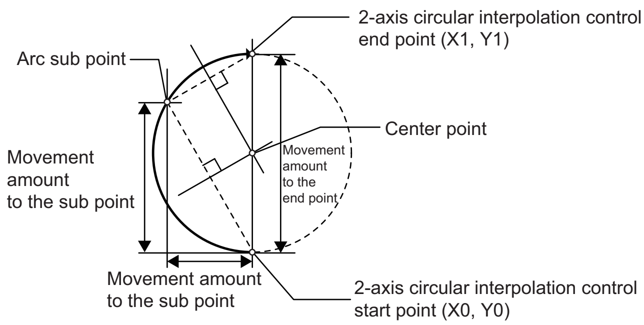
In the incremental system and 3-axis helical interpolation control with sub point designation, the positioning is performed from the current stop position (X0, Y0, Z0) to the position (X1, Y1, Z1) for the movement amount set in "[Da.6] Positioning address/ movement amount". As the positioning to the commanded position, the linear interpolation with the other linear interpolation axes is performed and the positioning target is rotated helically for the number of pitches set in "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" of the linear interpolation axis while the circular interpolation through the sub point address (sub point address) set in "[Da.7] Arc address" is performed. The movement direction is determined by the sign of the movement amount.

The resulting path is an arc whose center is the intersection point of the perpendicular bisectors of a straight line between the start point address (current stop position) and the sub point address (arc address) calculated from the movement amount to the sub point, and a straight line between the sub point address (arc address) and the end point address (positioning address) calculated from the movement amount to the end point.

Operation chart



Top view of the circular interpolation



■Restrictions

In the following cases, the 3-axis helical interpolation control cannot be set.

- When "degree" is set in "[Pr.1] Unit setting" of the reference axis and circular interpolation axis
- When the units set in "[Pr.1] Unit setting" are different between the reference axis and circular interpolation axis (The combination of "mm" and "inch" is possible.)
- When "reference axis speed" is set in "[Pr.20] Interpolation speed designation method"
- When the value out of the range of "0 to 999" is set in the number of pitches ("[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches")

In the following case, an error occurs and the positioning will not start. During the positioning control, the operation stops immediately at the detection of the error.

Error cause	Error code
When the radius exceeds 536870912 (= 2^{29}) (The maximum radius for which the 2-axis circular interpolation control is possible is 536870912 (= 2^{29}).)	The error "Outside radius range" (error code: 1A32H) occurs at the start of the positioning.
When the sub point address is out of the range of -2147483648 (-2^{31}) to 2147483647 (2^{31}-1)	The error "Sub point setting error" (error code: 1A2AH) occurs at the start of the positioning.
When the end point address is out of the range of -2147483648 (-2^{31}) to 2147483647 (2^{31}-1)	The error "End point setting error" (error code: 1A2CH) occurs at the start of the positioning.
When the center point address is out of the range of -2147483648 (-2^{31}) to 2147483647 (2^{31}-1)	The error "Sub point setting error" (error code: 1A37H) occurs at the start of the positioning.
Start point address = End point address	The error "End point setting error" (error code: 1A2BH)
Start point address = Sub point address	The error "Sub point setting error" (error code: 1A27H)
End point address = Sub point address	The error "Sub point setting error" (error code: 1A28H)
When the start point address, sub point address, and end point address are on a straight line	The error "Sub point setting error" (error code: 1A29H)

■Positioning data to be set

When using the 3-axis helical interpolation control with sub point designation (INC helical sub), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting requirement of reference axis	Setting requirement of circular interpolation axis*1	Setting requirement of linear interpolation axis*2
[Da.1]	Operation pattern	◎	—	—
[Da.2]	Control method	◎ (Set INC helical sub.)	—	—
[Da.3]	Acceleration time No.	◎	—	—
[Da.4]	Deceleration time No.	◎	—	—
[Da.6]	Positioning address/movement amount	◎	◎	◎
[Da.7]	Arc address	◎	◎	—
[Da.8]	Command speed	◎	—	—
[Da.9]	Dwell time/JUMP destination positioning data No.	○	—	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	○	—	◎*3
[Da.20]	Axis to be interpolated No.1	◎	—	—
[Da.21]	Axis to be interpolated No.2	◎	—	—
[Da.22]	Axis to be interpolated No.3	—	—	—
[Da.27]	M code ON signal output timing	○	—	—
[Da.28]	ABS direction in degrees	○	—	—
[Da.29]	Interpolation speed designation method	△	—	—

*1 Specified in "[Da.20] Axis to be interpolated No.1" of the reference axis.
*2 Specified in "[Da.21] Axis to be interpolated No.2" of the reference axis.
*3 Set the number of pitches for the linear interpolation axis.

Refer to the following for the setting details.

☞ Page 482 Positioning Data

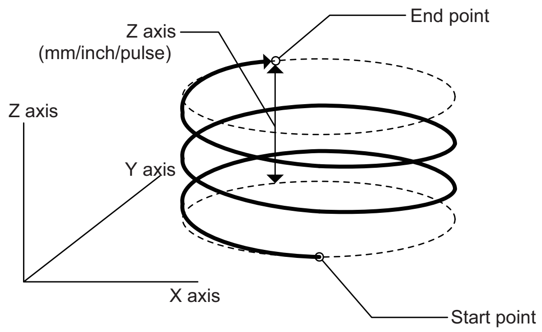
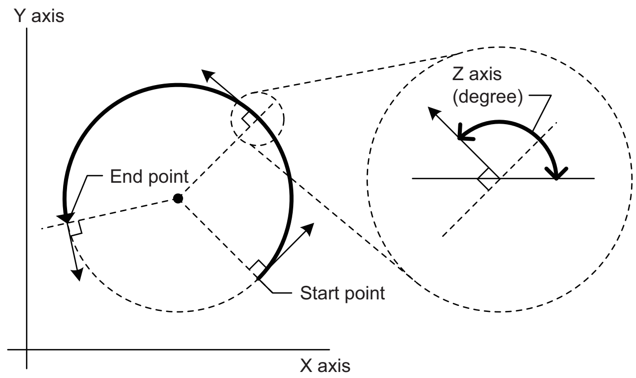
Restriction

Set a value in "[Da.8] Command speed" so that the speed of each axis does not exceed the value in "[Pr.8] Speed limit value". (The speed limit does not function for the speed calculated by the Simple Motion board.)

3-axis helical interpolation control with center point designation

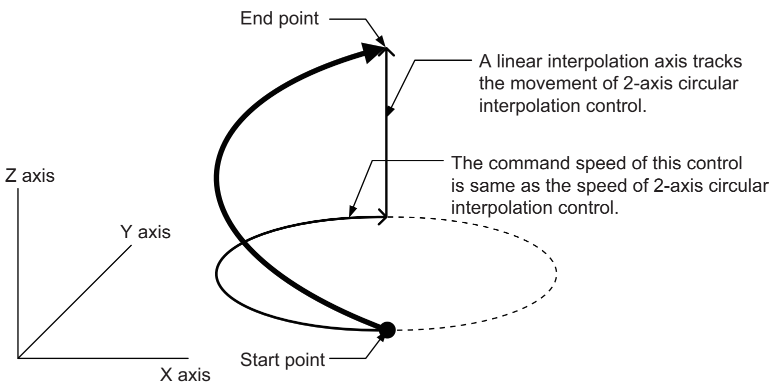
In "3-axis helical interpolation control" ("[Da.2] Control method" = ABS helical right, INC helical right, ABS helical left, INC helical left), three motors are used to carry out the circular interpolation control of 2 axes. The remaining axis is used for "helical control" or "tangent control and normal line control".

X axis: Reference axis, Y axis: Circular interpolation axis, Z axis: Linear interpolation axis

Control details	Control overview	Positioning path
Helical control		Draws a helical path by following the linear interpolation axis (linear control) to the 2-axis circular interpolation control. ■Unit setting • Reference axis: mm/inch, pulse • Circular interpolation axis: The same as the reference axis • Linear interpolation axis: mm/inch, pulse
Tangent control/ Normal line control		Keeps the direction of the workpiece against the center point of the 2-axis circular interpolation control by following the value of the linear interpolation axis (degree) to the 2-axis circular interpolation control. The figure shown on the left is an example in which the direction of the workpiece is kept to the direction of the tangent or normal line. ■Unit setting • Reference axis: mm/inch, pulse • Circular interpolation axis: The same as the reference axis • Linear interpolation axis: degree

Speed of the 3-axis helical interpolation control

The 2-axis circular interpolation control (Reference axis—Composite speed of the circular interpolation axis) is the target of the command speed of the 3-axis helical interpolation control.

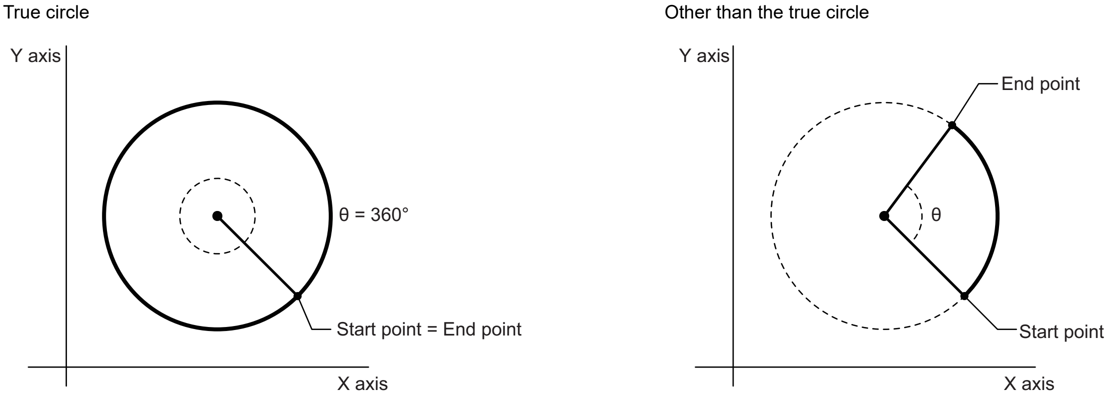


Point

- When the movement amount of the linear interpolation axis is more than the composite movement amount of the circular interpolation axis, the speed of the linear interpolation axis cannot be suppressed with "[Pr.8] Speed limit value".
- When "0: Composite speed" is set in "[Pr.20] Interpolation speed designation method" or "1: Composite speed" is set in "[Da.29] Interpolation speed designation method", the command speed of ABS3/INC3 is the composite speed of the three axes (X axis—Y axis—Z axis). The command speed of the 3-axis helical interpolation control is the composite speed of the two axes (X axis—Y axis). When the continuous path control is performed using ABS3/INC3 and the 3-axis helical interpolation control, the movement speed of the workpiece may change at the positioning data switching; therefore, adjust the command speed not to shake the workpiece.

Rotation angle of circular interpolation axis (X axis—Y axis)

The rotation angle of the circular interpolation axis in the 3-axis helical interpolation control is as follows.



Number of pitch	Control of the circular interpolation axis	
	True circle	Other than the true circle
0	360°	θ°
1		360° + θ°
2	720°	720° + θ°
⋮	⋮	⋮
n	360° × n	360° × n + θ°
⋮	⋮	⋮
999	360° × 999	360° × 999 + θ°

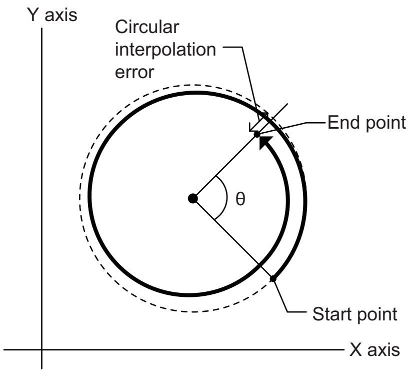
The setting of the true circle is available only when "Start point = End point" is set for the 3-axis helical interpolation (ABS/INC, center point).

Restriction

When "degree" is set to "[Pr.1] Unit setting", the positioning range of the absolute system is 0 to 359.99999°. If the rotation angle is 360° or larger in the circular interpolation axis (X axis—Y axis), the tangent control and normal line control cannot be performed because 360° or larger angle cannot be set for "[Da.6] Positioning address/movement amount" of the linear interpolation axis (Z axis: degree). To perform the tangent control or normal line control with the rotation of 360° or larger angle, use the incremental system.

Error compensation of the circular interpolation axis

In the 3-axis helical interpolation control with center point designation, as well as the 2-axis circular interpolation control, "[Pr.41] Allowable circular interpolation error width" is enabled. When a circular interpolation error occurs, the path of the 2-axis circular interpolation control (X axis—Y axis) becomes spiral as shown below.



Rotation direction when the linear interpolation axis (Z axis) is set in degrees

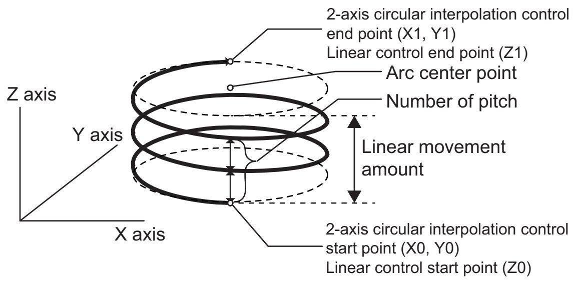
When "degree" is set to "[Pr.1] Unit setting" for the linear interpolation axis, the rotation direction is determined depending on the axis control data in "[Cd.40] ABS direction in degrees" of the reference axis. To set a rotation direction for each positioning data, set "[Da.28] ABS direction in degrees" of each positioning data.

ABS helical right, ABS helical left

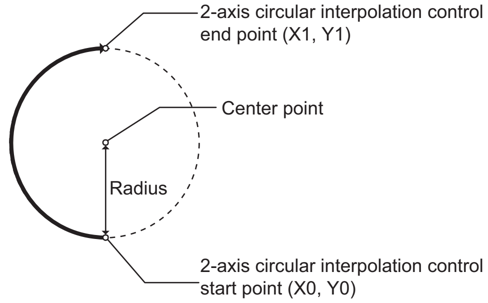
■Operation chart

In the absolute system and 3-axis helical interpolation control with center point designation, the positioning is performed from the current stop position (X0, Y0, Z0) to the position indicated with the arc end point address (X1 and Y1) and the linear interpolation axis end point address (Z1) set in "[Da.6] Positioning address/movement amount". As the positioning to the commanded position, the linear interpolation with the other linear interpolation axes is performed and the positioning target is rotated helically for the number of pitches set in "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" of the linear interpolation axis while the circular interpolation of the circle whose center is the center point address (arc address) set in "[Da.7] Arc address" is performed.

Operation chart

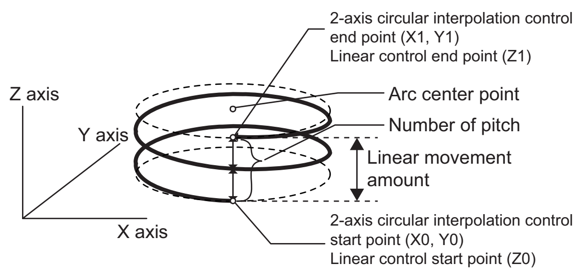


Top view of the circular interpolation

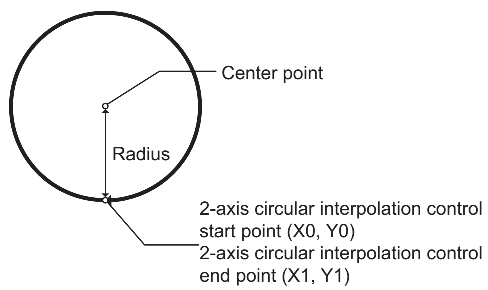


If the end point address (positioning address) of the circular interpolation axis is set to be the same as the start point address, the positioning of a true circle whose radius is from the start point address to the center point of the arc can be performed.

Operation chart



Top view of the circular interpolation



■Restrictions

In the following cases, the 3-axis helical interpolation control cannot be set.

- When "degree" is set in "[Pr.1] Unit setting" of the reference axis and circular interpolation axis
- When the units set in "[Pr.1] Unit setting" are different between the reference axis and circular interpolation axis (The combination of "mm" and "inch" is possible.)
- When "reference axis speed" is set in "[Pr.20] Interpolation speed designation method"
- When the value out of the range of "0 to 999" is set in the number of pitches ("[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches")

In the following case, an error occurs and the positioning will not start. During the positioning control, the operation stops immediately at the detection of the error.

Error cause	Error code
When the radius exceeds 536870912 (= 2^{29}) (The maximum radius for which the 2-axis circular interpolation control is possible is 536870912 (= 2^{29}).)	The error "Outside radius range" (error code: 1A32H) occurs at the start of the positioning.
Start point address = Center point address	The error "Center point setting error" (error code: 1A2DH)
End point address = Center point address	The error "Center point setting error" (error code: 1A2EH)
When the center point address is out of the range of -2147483648 (-2^{31}) to 2147483647 ($2^{31}-1$)	The error "Center point setting error" (error code: 1A2FH)

■Positioning data to be set

When using the 3-axis helical interpolation control with center point designation (ABS helical right, ABS helical left), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting requirement of reference axis	Setting requirement of circular interpolation axis*1	Setting requirement of linear interpolation axis*2
[Da.1]	Operation pattern	◎	—	—
[Da.2]	Control method	◎ (Set ABS helical right or ABS helical left.)	—	—
[Da.3]	Acceleration time No.	◎	—	—
[Da.4]	Deceleration time No.	◎	—	—
[Da.6]	Positioning address/movement amount	◎	◎	◎
[Da.7]	Arc address	◎	◎	—
[Da.8]	Command speed	◎	—	—
[Da.9]	Dwell time/JUMP destination positioning data No.	○	—	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	○	—	◎*3
[Da.20]	Axis to be interpolated No.1	◎	—	—
[Da.21]	Axis to be interpolated No.2	◎	—	—
[Da.22]	Axis to be interpolated No.3	—	—	—
[Da.27]	M code ON signal output timing	○	—	—
[Da.28]	ABS direction in degrees	○	—	—
[Da.29]	Interpolation speed designation method	△	—	—

*1 Specified in "[Da.20] Axis to be interpolated No.1" of the reference axis.
*2 Specified in "[Da.21] Axis to be interpolated No.2" of the reference axis.
*3 Set the number of pitches for the linear interpolation axis.

Refer to the following for the setting details.

☞ Page 482 Positioning Data

Restriction

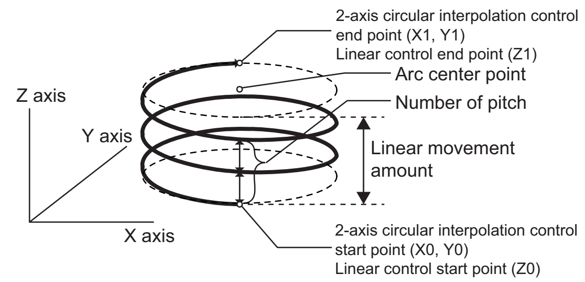
Set a value in "[Da.8] Command speed" so that the speed of each axis does not exceed the value in "[Pr.8] Speed limit value". (The speed limit does not function for the speed calculated by the Simple Motion board.)

INC helical right, INC helical left

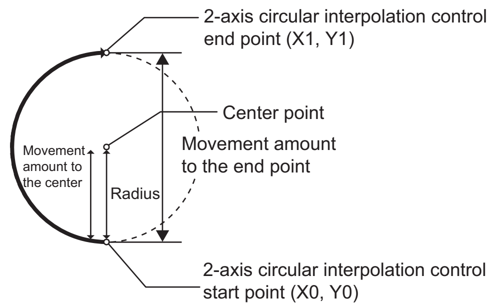
■Operation chart

In the incremental system and 3-axis helical interpolation control with center point designation, the positioning is performed from the current stop position (X0, Y0, Z0) to the position (X1, Y1, Z1) for the movement amount set in "[Da.6] Positioning address/movement amount". As the positioning to the commanded position, the linear interpolation with the other linear interpolation axes is performed and the positioning target is rotated helically for the number of pitches set in "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" of the linear interpolation axis while the circular interpolation of the circle whose center is the center point address (arc address) set in "[Da.7] Arc address" is performed.

Operation chart

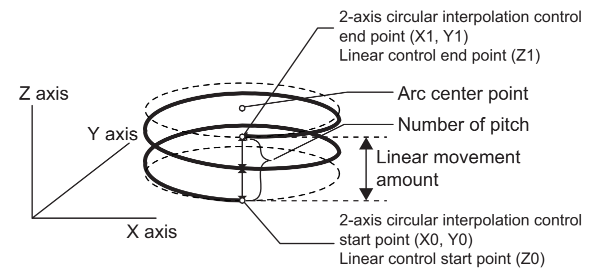


Top view of the circular interpolation

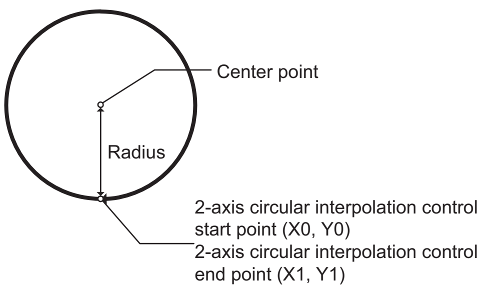


If "0" is set for the movement amount of the circular interpolation axis, the positioning of a true circle whose radius is from the start point address to the center point address of the arc can be performed.

Operation chart



Top view of the circular interpolation



■Restrictions

In the following cases, the 3-axis helical interpolation control cannot be set.

- When "degree" is set in "[Pr.1] Unit setting" of the reference axis and circular interpolation axis
- When the units set in "[Pr.1] Unit setting" are different between the reference axis and circular interpolation axis (The combination of "mm" and "inch" is possible.)
- When "reference axis speed" is set in "[Pr.20] Interpolation speed designation method"
- When the value out of the range of "0 to 999" is set in the number of pitches ("[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches")

In the following case, an error occurs and the positioning will not start. During the positioning control, the operation stops immediately at the detection of the error.

Error cause	Error code
When the radius exceeds 536870912 (= 2^{29}) (The maximum radius for which the 2-axis circular interpolation control is possible is 536870912 (= 2^{29}).)	The error "Outside radius range" (error code: 1A32H) occurs at the start of the positioning.
When the end point address is out of the range of -2147483648 (-2^{31}) to 2147483647 ($2^{31}-1$)	The error "End point setting error" (error code: 1A2CH) occurs at the start of the positioning.
Start point address = Center point address	The error "Center point setting error" (error code: 1A2DH)
End point address = Center point address	The error "Center point setting error" (error code: 1A2EH)
When the center point address is out of the range of -2147483648 (-2^{31}) to 2147483647 ($2^{31}-1$)	The error "Center point setting error" (error code: 1A2FH)

■Positioning data to be set

When using the 3-axis helical interpolation control with center point designation (INC helical right, INC helical left), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting requirement of reference axis	Setting requirement of circular interpolation axis*1	Setting requirement of linear interpolation axis*2
[Da.1]	Operation pattern	◎	—	—
[Da.2]	Control method	◎ (Set INC helical right or INC helical left.)	—	—
[Da.3]	Acceleration time No.	◎	—	—
[Da.4]	Deceleration time No.	◎	—	—
[Da.6]	Positioning address/movement amount	◎	◎	◎
[Da.7]	Arc address	◎	◎	—
[Da.8]	Command speed	◎	—	—
[Da.9]	Dwell time/JUMP destination positioning data No.	○	—	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	○	—	◎*3
[Da.20]	Axis to be interpolated No.1	◎	—	—
[Da.21]	Axis to be interpolated No.2	◎	—	—
[Da.22]	Axis to be interpolated No.3	—	—	—
[Da.27]	M code ON signal output timing	○	—	—
[Da.28]	ABS direction in degrees	○	—	—
[Da.29]	Interpolation speed designation method	△	—	—

*1 Specified in "[Da.20] Axis to be interpolated No.1" of the reference axis.

*2 Specified in "[Da.21] Axis to be interpolated No.2" of the reference axis.

*3 Set the number of pitches for the linear interpolation axis.

Refer to the following for the setting details.

☞ Page 482 Positioning Data

Restriction

Set a value in "[Da.8] Command speed" so that the speed of each axis does not exceed the value in "[Pr.8] Speed limit value". (The speed limit does not function for the speed calculated by the Simple Motion board.)

Speed control

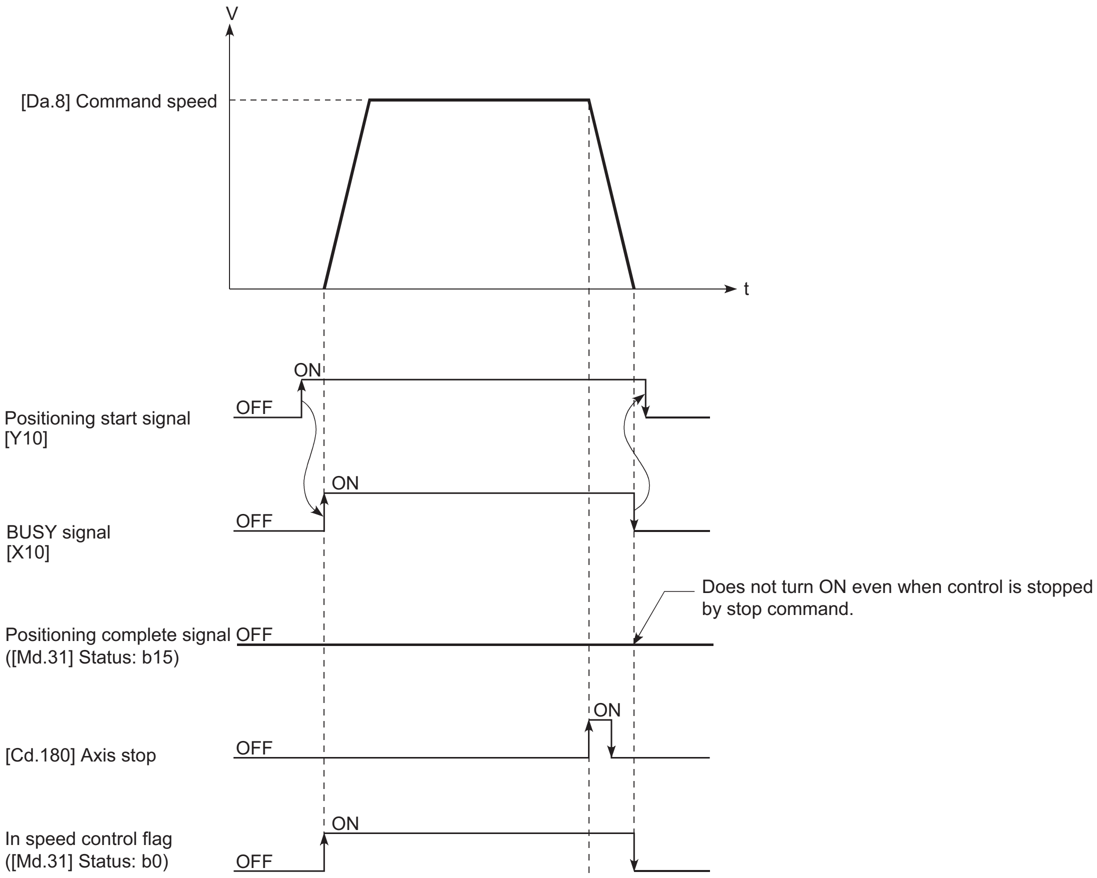
In "speed control" ("[Da.2] Control method" = Forward run: speed 1 to 4, Reverse run: speed 1 to 4), control is carried out in the axis direction in which the positioning data has been set by continuously outputting pulses for the speed set in "[Da.8] Command speed" until the input of a stop command.
The eight types of speed control includes "Forward run: speed 1 to 4" in which the control starts in the forward run direction, and "Reverse run: speed 1 to 4" in which the control starts in the reverse run direction.
Refer to the following for the combination of the reference axis and the interpolation axis.
☞ Page 60 Interpolation control

Operation chart

The following charts show the operation timing for 1-axis speed control with axis 1 and 2-axis speed control with axis 2 when the axis 1 is set as the reference axis.
The "in speed control" flag ([Md.31] Status: b0) is turned ON during speed control.
The "Positioning complete signal" is not turned ON.

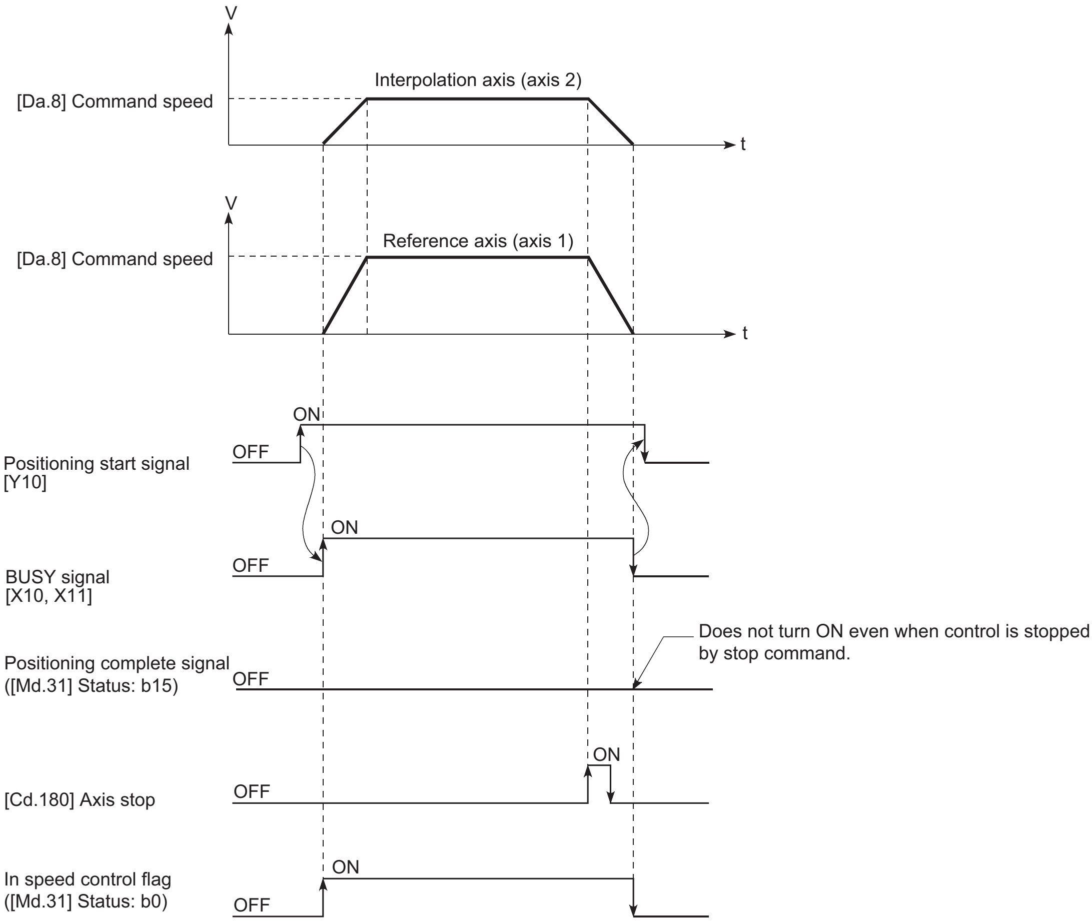
■1-axis speed control

Axis 1 to 4 operation example



■2-axis speed control

Axis 1 to 4 operation example

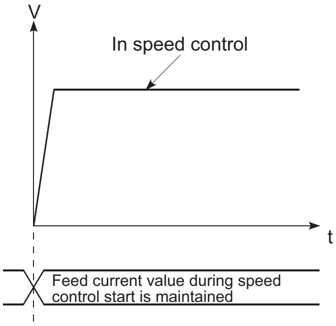


3

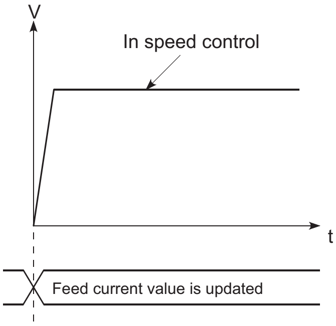
Feed current value

The following table shows the "[Md.20] Feed current value" during speed control corresponding to the "[Pr.21] Feed current value during speed control" settings. (However, the parameters use the set value of the reference axis.)

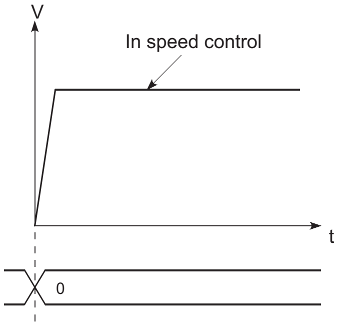
"[Pr.21] Feed current value during speed control" setting	[Md.20] Feed current value
0: Do not update feed current value	The feed current value at speed control start is maintained.
1: Update feed current value	The feed current value is updated.
2: Zero clear feed current value	The feed current value is fixed at 0.



(a) Feed current value not updated



(b) Feed current value updated



(c) Feed current value zero cleared

Restrictions

- Set "Positioning complete" in "[Da.1] Operation pattern". The error "Continuous path control not possible" (error code: 1A1EH to 1A20H) will occur and the operation cannot start if "continuous positioning control" or "continuous path control" is set in "[Da.1] Operation pattern". ("Continuous positioning control" and "continuous path control" cannot be set in speed control.)
- Set the WITH mode in the output timing when using an M code. The M code will not be output, and the M code ON signal will not turn ON if the AFTER mode is set.
- The error "No command speed" (error code: 1A12H to 1A14H) will occur if the current speed (-1) is set in "[Da.8] Command speed".
- Set "1: Reference axis speed" in "[Pr.20] Interpolation speed designation method". If "0: Composite speed" is set, the error "Interpolation mode error" (error code: 199AH) occurs and the positioning will not start.
- The software stroke limit check is not carried out if the control unit is set to "degree".

■Restriction for the speed limit value

When either of control axes (1 to 4 axes) exceeds the speed limit, that axis is controlled with the speed limit value. The speeds of the other axes are limited at the ratios of "[Da.8] Command speed".

Ex.

When the axis 1 and the axis 2 are used

Setting item		Axis 1 setting	Axis 2 setting
[Pr.8]	Speed limit value	4000.00 mm/min	5000.00 mm/min
[Da.8]	Command speed	8000.00 mm/min	6000.00 mm/min

With the settings shown above, the operation speed in speed control is as follows.

- Axis 1: 4000.00 mm/min (Speed is limited by [Pr.8].)
- Axis 2: 3000.00 mm/min (Speed is limited at a ratio of an axis 1 command speed to an axis 2 command speed.)

Operation runs at speed 1 when a reference axis speed is less than 1 as a result of speed limit. In addition, when the bias speed is set, the set value will be the minimum speed.

Setting positioning data

When using speed control (forward run: speed 1 to 4, reverse run: speed 1 to 4), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting required/not required for the reference axis	Setting required/not required for the interpolation axis
[Da.1]	Operation pattern	◎	—
[Da.2]	Control method	◎	—
[Da.3]	Acceleration time No.	○	—
[Da.4]	Deceleration time No.	○	—
[Da.6]	Positioning address/movement amount	—	—
[Da.7]	Arc address	—	—
[Da.8]	Command speed	◎	◎
[Da.9]	Dwell time/JUMP destination positioning data No.	○	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches	○	—
[Da.20]	Axis to be interpolated No.1	—*1	—
[Da.21]	Axis to be interpolated No.2	—*1	—
[Da.22]	Axis to be interpolated No.3	—*1	—
[Da.27]	M code ON signal output timing	○	—
[Da.28]	ABS direction in degrees	○	—
[Da.29]	Interpolation speed designation method	△	—

*1 When using 2- to 4-axis speed control, it is necessary to set the axis to be used as the interpolation axis.

Refer to the following for information on the setting details.

☞ Page 482 Positioning Data

3

Speed-position switching control (INC mode)

In "speed-position switching control (INC mode)" ("[Da.2] Control method" = Forward run: speed/position, Reverse run: speed/position), the pulses of the speed set in "[Da.8] Command speed" are kept output on the axial direction set to the positioning data. When the "speed-position switching signal" is input, position control of the movement amount set in "[Da.6] Positioning address/movement amount" is exercised.
"Speed-position switching control (INC mode)" is available in two different types: "forward run: speed/position" which starts the axis in the forward run direction and "reverse run: speed/position" which starts the axis in the reverse run direction.
Use the detailed parameter 1 "[Pr.81] Speed-position function selection" with regard to the choice for "speed-position switching control (INC mode)".
n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Pr.81]	Speed-position function selection	0	Speed-position switching control (INC mode)	34+150n

If the set value is other than 0 and 2, it is regarded as 0 and operation is performed in the INC mode.
For details of the setting, refer to the following.
☞ Page 453 Basic Setting
For labels, refer to the following.
☞ Page 432 Positioning parameters: Detailed parameters 1

Switching over from speed control to position control

- The control is selected the switching method from speed control to position control by the setting value of "[Cd.45] Speed-position switching device selection".

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.45]	Speed-position switching device selection	→	The device used for speed-position switching is selected. 1: Use the proximity dog signal for switching from speed control to position control 2: Use the "[Cd.46] Speed-position switching command" for switching from speed control to position control 3: Use the link device for switching from speed control to position control*1	4366+100n

*1 For details of the setting, refer to the following.
☞ Page 321 Link Device External Signal Assignment Function

For labels, refer to the following.
☞ Page 437 Axis control data
The switching is performed by using the following device when "2" is set.
n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.46]	Speed-position switching command	1	Switch from speed control to position control	4367+100n

For labels, refer to the following.
☞ Page 437 Axis control data

- "[Cd.24] Speed-position switching enable flag" must be turned ON to switch over from speed control to position control. (If the "[Cd.24] Speed-position switching enable flag" turns ON after the speed-position switching signal turns ON, the control will continue as speed control without switching over to position control. The control will be switched over from position control to speed control when the speed-position switching signal turns from OFF to ON again. Only position control will be carried out when the "[Cd.24] Speed-position switching enable flag" and speed-position switching signal are ON at the operation start.)

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.24]	Speed-position switching enable flag	1	Speed control will be taken over by position control when the external command signal [DI] comes ON.	4328+100n

For labels, refer to the following.

☞ Page 437 Axis control data

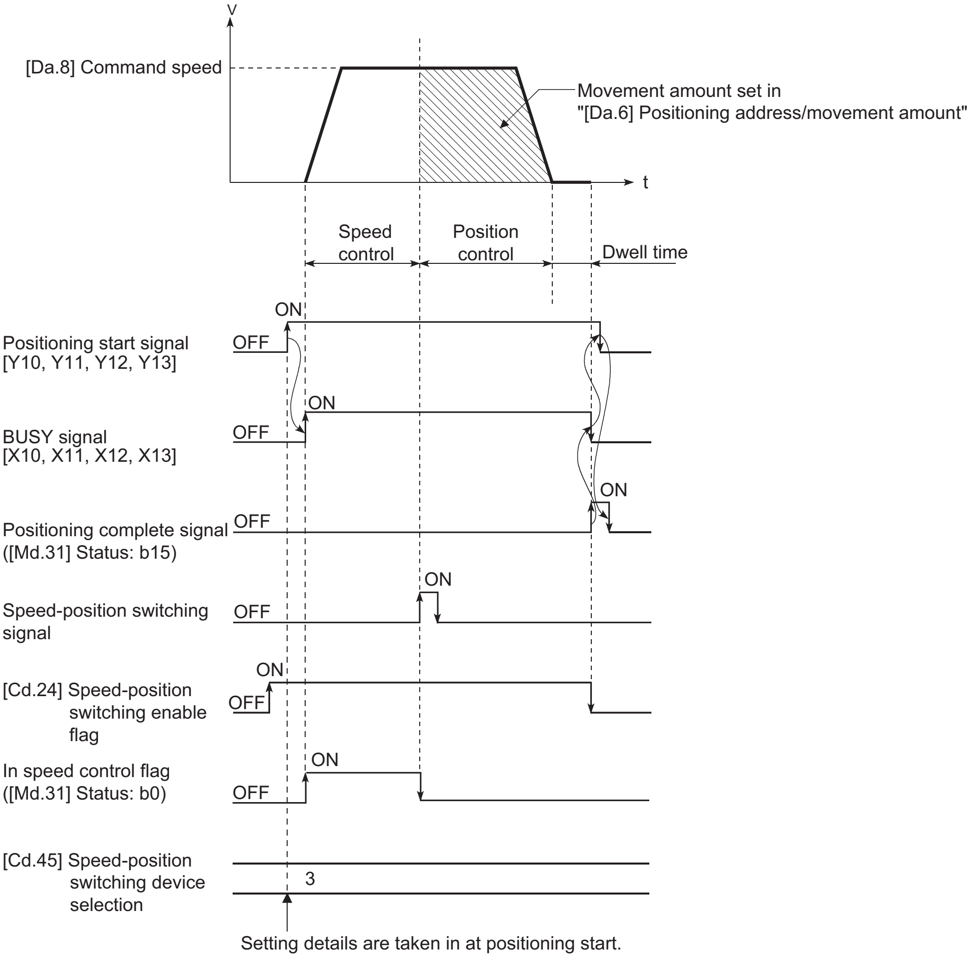
3

Operation chart

The following chart shows the operation timing for speed-position switching control (INC mode).

The "in speed control flag" ([Md.31] Status: b0) is turned ON during speed control of speed-position switching control (INC mode).

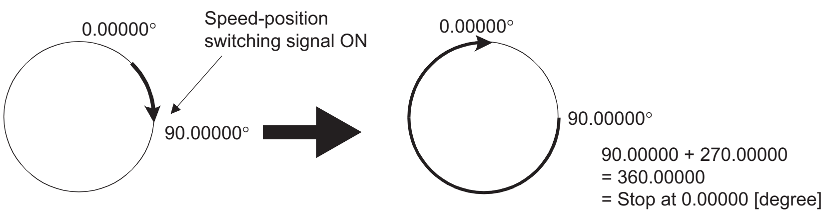
■Axis 1 to 4 operation example



■Operation example

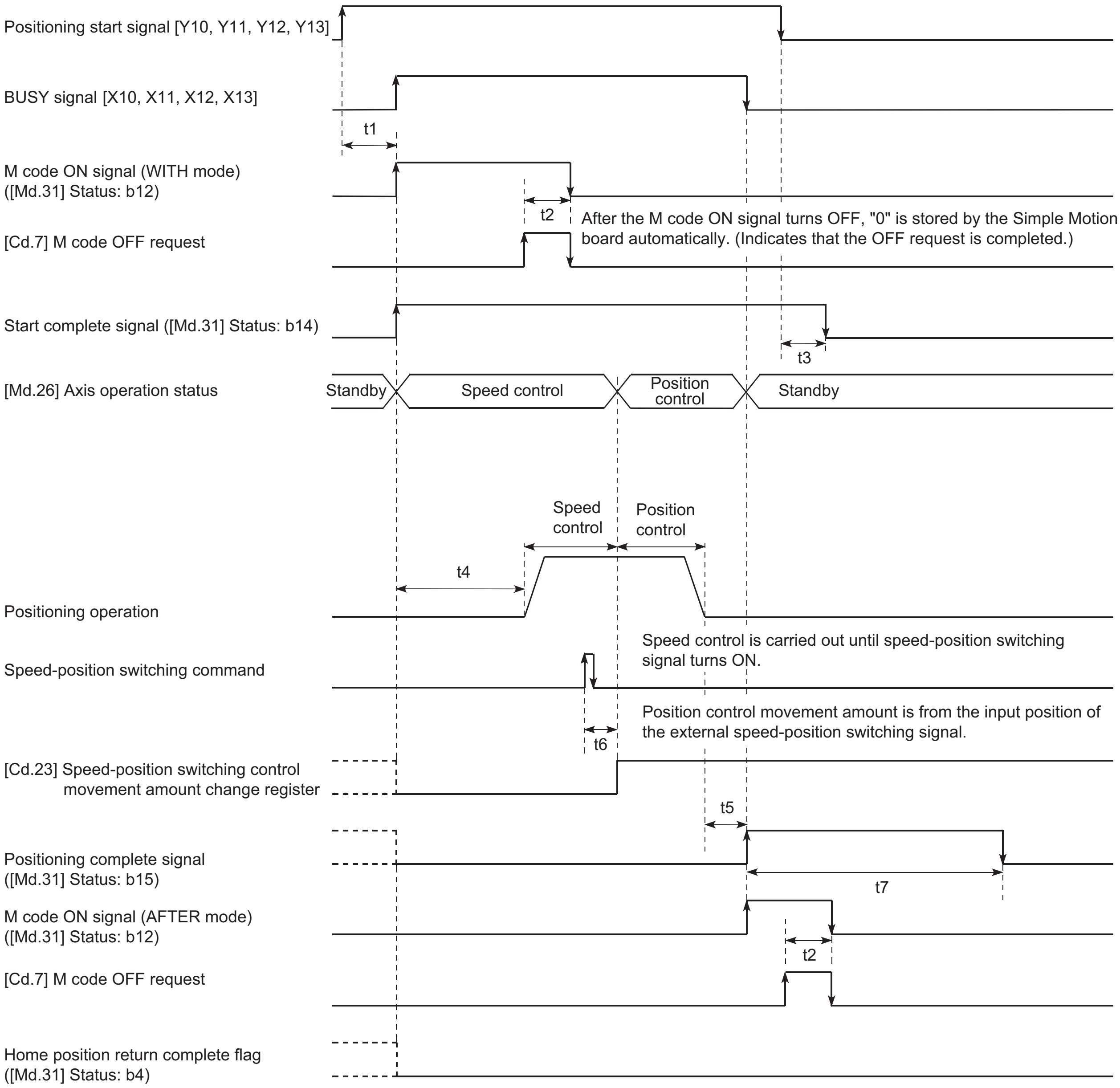
The following operation assumes that the speed-position switching signal is input at the position of the feed current value of 90.00000 [degree] during execution of "[Da.2] Control method" "Forward run: speed/position" at "[Pr.1] Unit setting" of "2: degree" and "[Pr.21] Feed current value during speed control" setting of "1: Update feed current value".

(The value set in "[Da.6] Positioning address/movement amount" is 270.00000 [degree])



Operation timing and processing time

[Axis 1 to 4 operation example]



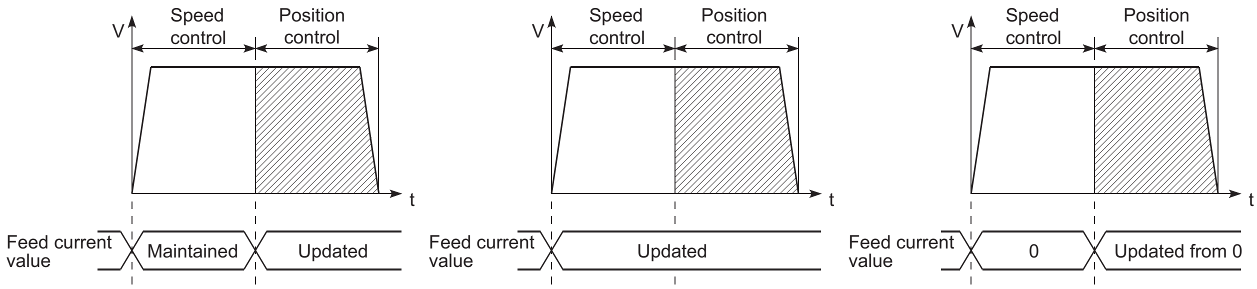
Operation cycle	Normal timing time Unit: [ms]						
	t1	t2	t3	t4	t5	t6	t7
0.50	0.329 to 0.701	0.000 to 0.500	0.000 to 0.500	1.260 to 1.461	0.000 to 0.500	0.272	Follows parameters
1.00	0.258 to 1.202	0.000 to 1.000	0.000 to 1.000	2.742 to 2.903	0.000 to 1.000	0.284	Follows parameters
2.00	0.347 to 2.195	0.000 to 2.000	0.000 to 2.000	5.870 to 5.897	0.000 to 2.000	0.280	Follows parameters
4.00	0.706 to 3.068	0.000 to 4.000	0.000 to 4.000	11.859 to 11.885	0.000 to 4.000	0.279	Follows parameters

- The t1 timing time could be delayed by the operation state of other axes.
- When using the proximity dog signal or "[Cd.46] Speed-position switching command", the t6 timing time could be delayed or vary influenced by the operation cycle of the Simple Motion board or the communication with the slave device.

Feed current value

The following table shows the "[Md.20] Feed current value" during speed-position switching control (INC mode) corresponding to the "[Pr.21] Feed current value during speed control" settings.

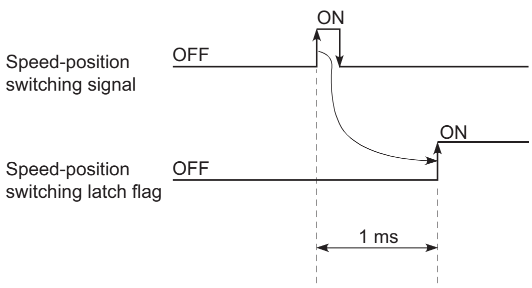
"[Pr.21] Feed current value during speed control" setting	[Md.20] Feed current value
0: Do not update feed current value	The feed current value at control start is maintained during speed control, and updated from the switching to position control.
1: Update feed current value	The feed current value is updated during speed control and position control.
2: Zero clear feed current value	The feed current value is cleared (set to "0") at control start, and updated from the switching to position control.



(a) Feed current value not updated
(b) Feed current value updated
(c) Feed current value zero cleared

Switching time from speed control to position control

It takes 1 ms from the time the speed-position switching signal is turned ON to the time the speed-position switching latch flag ([Md.31] Status: b1) turns ON.



Speed-position switching signal setting

- The following table shows the items that must be set to use the external command signals [DI] as speed-position switching signals.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.8]	External command valid	1	Validates an external command.	4305+100n

For labels, refer to the following.

☞ Page 437 Axis control data

- The following table shows the items that must be set to use the proximity dog signal (DOG) as speed-position switching signals.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.45]	Speed-position switching device selection	1	Use the proximity dog signal for switching from speed control to position control	4366+100n

The setting is not required for "[Cd.8] External command valid". Refer to the following for information on the setting details.

☞ Page 543 Control Data

For labels, refer to the following.

☞ Page 437 Axis control data

- The following table shows the items that must be set to use "[Cd.46] Speed-position switching command" as speed-position switching signals.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.45]	Speed-position switching device selection	2	Use the "[Cd.46] Speed-position switching command" for switching from speed control to position control	4366+100n

The setting is not required for "[Cd.8] External command valid". Refer to the following for information on the setting details.

☞ Page 543 Control Data

For labels, refer to the following.

☞ Page 437 Axis control data

- The following table shows the items that must be set to use link devices as speed-position switching signals.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.45]	Speed-position switching device selection	3	Use the link device for switching from speed control to position control	4366+100n

For details of the setting, refer to the following.

☞ Page 321 Link Device External Signal Assignment Function

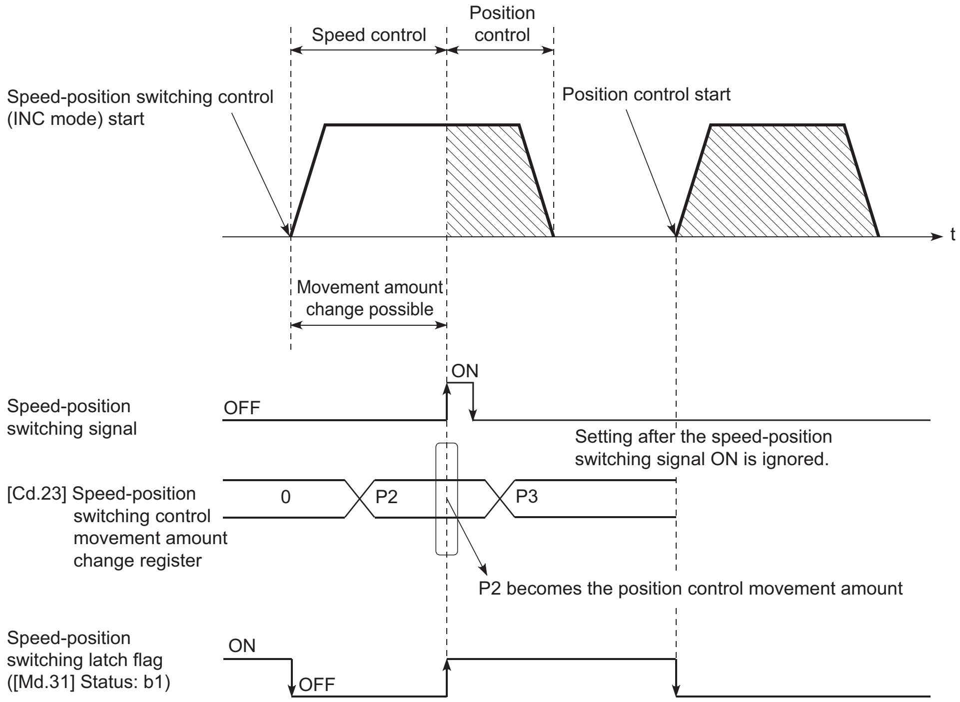
For labels, refer to the following.

☞ Page 437 Axis control data

Changing the position control movement amount

In "speed-position switching control (INC mode)", the position control movement amount can be changed during the speed control section.

- The position control movement amount can be changed during the speed control section of speed-position switching control (INC mode). A movement amount change request will be ignored unless issued during the speed control section of the speed-position switching control (INC mode).
- The "new movement amount" is stored in "[Cd.23] Speed-position switching control movement amount change register" by the user program during speed control. When the speed-position switching signal is turned ON, the movement amount for position control is stored in "[Cd.23] Speed-position switching control movement amount change register".
- The movement amount is stored in the "[Md.29] Speed-position switching control positioning movement amount" of the axis monitor area from the point where the control changes to position control by the input of a speed-position switching signal from an external device.



Point

- The machine recognizes the presence of a movement amount change request when the data is written to "[Cd.23] Speed-position switching control movement amount change register" with the user program.
- The new movement amount is validated after execution of the speed-position switching control (INC mode), before the input of the speed-position switching signal.
- The movement amount change can be enable/disable with the interlock function in position control using the "speed-position switching latch flag" ([Md.31] Status: b1) of the axis monitor area.

Restrictions

- The error "Continuous path control not possible" (error code: 1A1EH to 1A20H) will occur and the operation cannot start if "continuous positioning control" or "continuous path control" is set in "[Da.1] Operation pattern".
- "Speed-position switching control" cannot be set in "[Da.2] Control method" of the positioning data when "continuous path control" has been set in "[Da.1] Operation pattern" of the immediately prior positioning data. (For example, if the operation pattern of positioning data No.1 is "continuous path control", "speed-position switching control" cannot be set in positioning data No.2.) The error "Continuous path control not possible" (error code: 1A1EH to 1A20H) will occur and the machine will carry out a deceleration stop if this type of setting is carried out.
- The error "No command speed" (error code: 1A12H to 1A14H) will occur if "current speed (-1)" is set in "[Da.8] Command speed".
- The software stroke limit range check during speed control is made only when the followings are satisfied:

"[Pr.21] Feed current value during speed control" is "1: Update feed current value".	If the movement amount exceeds the software stroke limit range during speed control in case of the setting of other than "1: Update feed current value", the error "Software stroke limit +" (error code: 1993H) or "Software stroke limit -" (error code: 1995H) will occur as soon as speed control is changed to position control and the axis will decelerate to a stop.
When "[Pr.1] Unit setting" is other than "2: degree"	If the unit is "degree", the software stroke limit range check is not performed.

- If the value set in "[Da.6] Positioning address/movement amount" is negative, the error "Outside address range" (error code: 1A30H, 1A31H) will occur.
- Deceleration processing is carried out from the point where the speed-position switching signal is input if the position control movement amount set in "[Da.6] Positioning address/movement amount" is smaller than the deceleration distance from the "[Da.8] Command speed".
- Turn ON the speed-position switching signal in the speed stabilization region (constant speed status). The warning "Speed-position switching (during acceleration) signal ON" (warning code: 0993H) will occur because of large deviation in the droop pulse amount if the signal is turned ON during acceleration. During use of the servo motor, the movement amount is "[Da.6] Positioning address/movement amount" from the assumed motor position based on "[Md.101] Real current value" at switching of speed control to position control. Therefore, if the signal is turned ON during acceleration/deceleration, the stop position will vary due to large variation of the droop pulse amount. Even though "[Md.29] Speed-position switching control positioning movement amount" is the same, the stop position will change due to a change in droop pulse amount when "[Da.8] Command speed" is different.

Setting positioning data

When using speed-position switching control (INC mode), set the following positioning data.

◎: Always set, ○: Set as required, —: Setting not required

Setting item		Setting required/not required
[Da.1]	Operation pattern	◎
[Da.2]	Control method	◎ (Set "Forward run: speed/position" or "Reverse run: speed/position".)
[Da.3]	Acceleration time No.	○
[Da.4]	Deceleration time No.	○
[Da.6]	Positioning address/movement amount	◎
[Da.7]	Arc address	—
[Da.8]	Command speed	◎
[Da.9]	Dwell time/JUMP destination positioning data No.	○
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches	○
[Da.20]	Axis to be interpolated No.1	—
[Da.21]	Axis to be interpolated No.2	—
[Da.22]	Axis to be interpolated No.3	—
[Da.27]	M code ON signal output timing	○
[Da.28]	ABS direction in degrees	—
[Da.29]	Interpolation speed designation method	—

Refer to the following for information on the setting details.

☞ Page 482 Positioning Data

Speed-position switching control (ABS mode)

In case of "speed-position switching control (ABS mode)" ("[Da.2] Control method" = Forward run: speed/position, Reverse run: speed/position), the pulses of the speed set in "[Da.8] Command speed" are kept output in the axial direction set to the positioning data. When the "speed-position switching signal" is input, position control to the address set in "[Da.6] Positioning address/movement amount" is exercised.

"Speed-position switching control (ABS mode)" is available in two different types: "forward run: speed/position" which starts the axis in the forward run direction and "reverse run: speed/position" which starts the axis in the reverse run direction.

"Speed-position switching control (ABS mode)" is valid only when "[Pr.1] Unit setting" is "2: degree".

○: Setting allowed, ×: Setting disallowed (If setting is made, the error "Speed-position function selection error" (error code: 1AAEH) will occur when the user program READY signal [Y0] turns ON.)

Speed-position function selection	[Pr.1] Unit setting			
	mm	inch	degree	pulse
INC mode	○	○	○	○
ABS mode	×	×	○	×

Use the detailed parameter 1 "[Pr.81] Speed-position function selection" to choose "speed-position switching control (ABS mode)".

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Pr.81]	Speed-position function selection	2	Speed-position switching control (ABS mode)	34+150n

If the set value is other than 0 and 2, it is regarded as 0 and operation is performed in the INC mode. For details of the setting, refer to the following.

☞ Page 453 Basic Setting

For labels, refer to the following.

☞ Page 432 Positioning parameters: Detailed parameters 1

Switching over from speed control to position control

- The control is selected the switching method from speed control to position control by the setting value of "[Cd.45] Speed-position switching device selection".

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.45]	Speed-position switching device selection	→	The device used for speed-position switching is selected. 1: Use the proximity dog signal for switching from position control to speed control 2: Use the "[Cd.46] Speed-position switching command" for switching from position control to speed control 3: Use the link device for switching from speed control to position control*1	4366+100n

*1 For details of the setting, refer to the following.

☞ Page 321 Link Device External Signal Assignment Function

For labels, refer to the following.

☞ Page 437 Axis control data

The switching is performed by using the following device when "2" is set.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.46]	Speed-position switching command	1	Switch from speed control to position control	4367+100n

For labels, refer to the following.

☞ Page 437 Axis control data

- "[Cd.24] Speed-position switching enable flag" must be turned ON to switch over from speed control to position control. (If the "[Cd.24] Speed-position switching enable flag" turns ON after the speed-position switching signal turns ON, the control will continue as speed control without switching over to position control. The control will be switched over from speed control to position control when the speed-position switching signal turns from OFF to ON again. Only position control will be carried out when the "[Cd.24] Speed-position switching enable flag" and speed-position switching signal are ON at the operation start.)

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.24]	Speed-position switching enable flag	1	Speed control will be taken over by position control when the external command signal [DI] comes ON.	4328+100n

For labels, refer to the following.

☞ Page 437 Axis control data

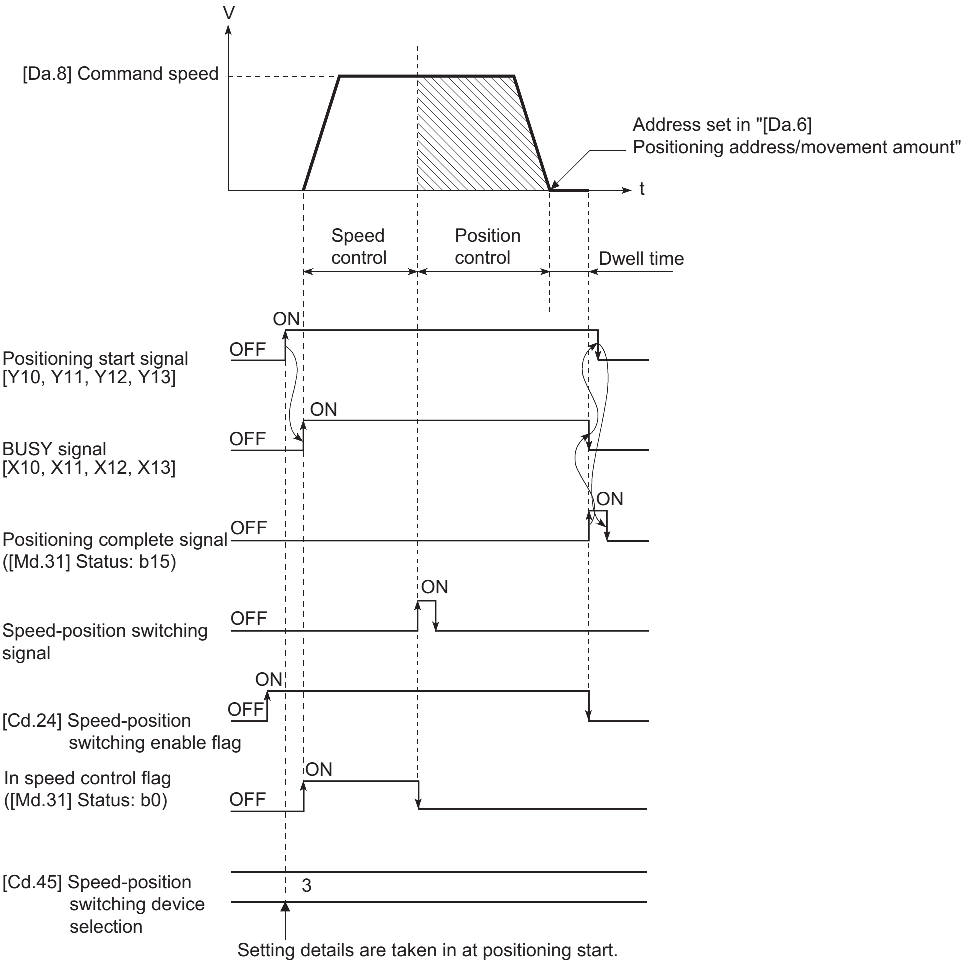
3

Operation chart

The following chart shows the operation timing for speed-position switching control (ABS mode).

The "in speed control flag" ([Md.31] Status: b0) is turned ON during speed control of speed-position switching control (ABS mode).

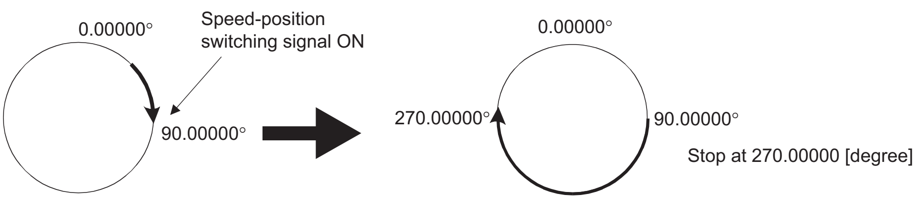
■Axis 1 to 4 operation example



■Operation example

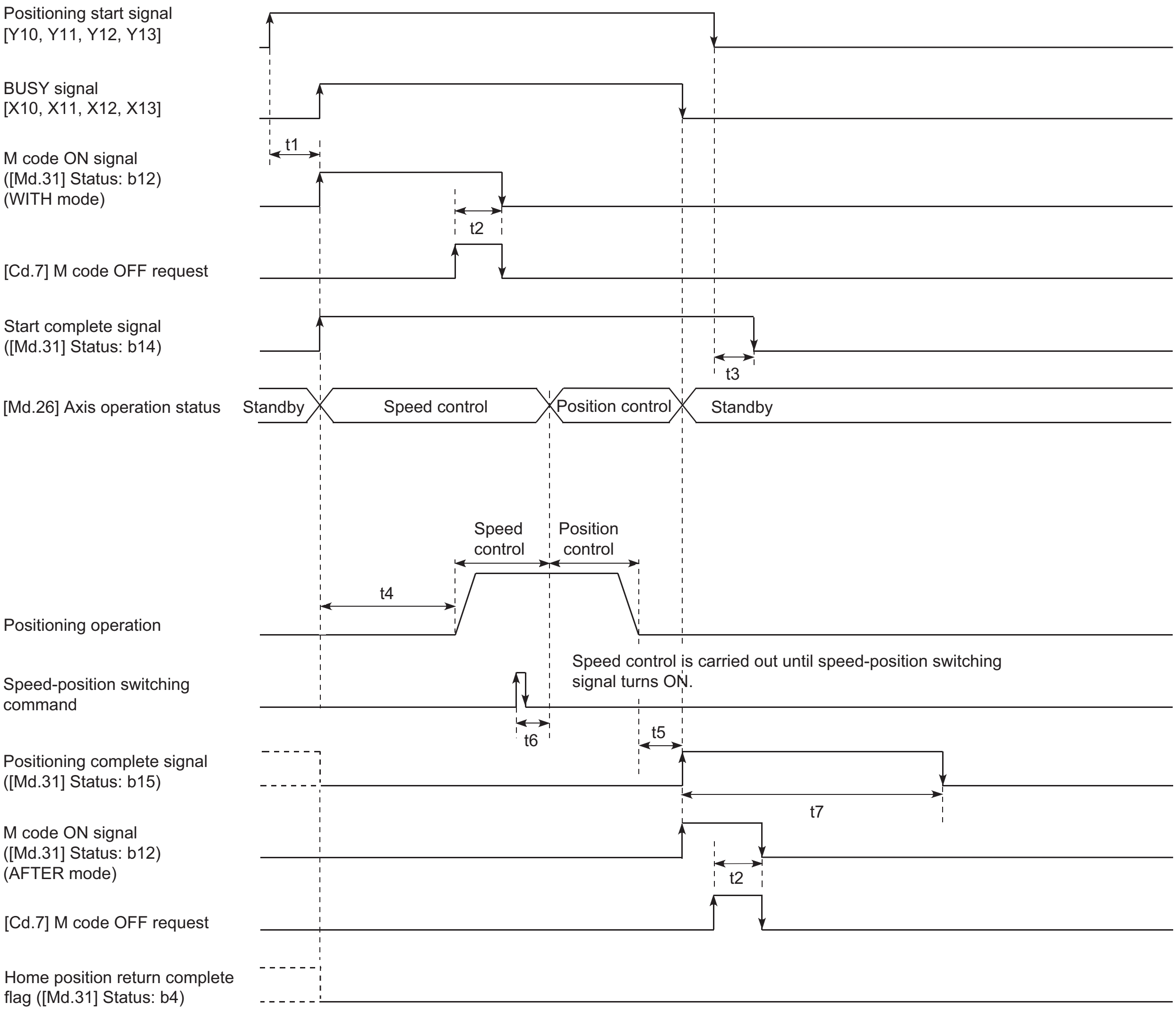
The following operation assumes that the speed-position switching signal is input at the position of the feed current value of 90.00000 [degree] during execution of "[Da.2] Control method" "Forward run: speed/position" at "[Pr.1] Unit setting" of "2: degree" and "[Pr.21] Feed current value during speed control" setting of "1: Update feed current value".

(The value set in "[Da.6] Positioning address/movement amount" is 270.00000 [degree])



Operation timing and processing time

■Axis 1 to 4 operation example



Operation cycle	Normal timing time Unit: [ms]						
	t1	t2	t3	t4	t5	t6	t7
0.50	0.260 to 0.682	0.000 to 0.500	0.000 to 0.500	1.291 to 1.447	0.000 to 0.500	0.275	Follows parameters
1.00	0.442 to 1.004	0.000 to 1.000	0.000 to 1.000	2.755 to 2.895	0.000 to 1.000	0.286	Follows parameters
2.00	0.528 to 2.222	0.000 to 2.000	0.000 to 2.000	5.860 to 5.909	0.000 to 2.000	0.280	Follows parameters
4.00	0.304 to 3.970	0.000 to 4.000	0.000 to 4.000	11.868 to 11.899	0.000 to 4.000	0.278	Follows parameters

- The t1 timing time could be delayed by the operation state of other axes.
- When using the proximity dog signal and "[Cd.46] Speed-position switching command", the t6 timing time could be delayed or vary influenced by the operation cycle of the Simple Motion board or the communication with the slave device.

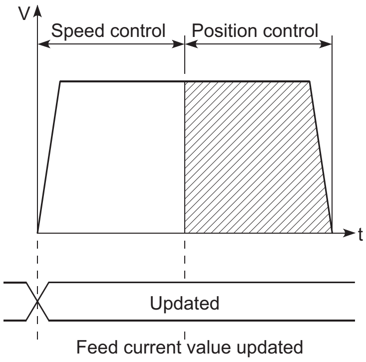
Feed current value

The following table shows the "[Md.20] Feed current value" during speed-position switching control (ABS mode) corresponding to the "[Pr.21] Feed current value during speed control" settings.

"[Pr.21] Feed current value during speed control" setting	[Md.20] Feed current value
1: Update feed current value	The feed current value is updated during speed control and position control.

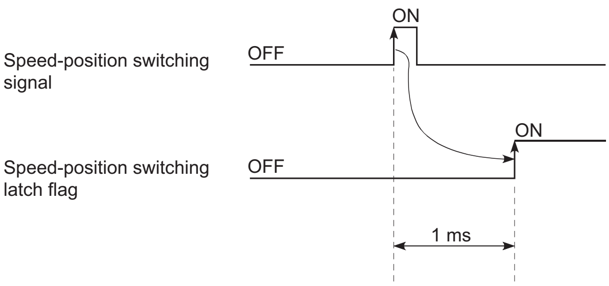
Only "1: Update current value" is valid for the setting of "[Pr.21] Feed current value during speed control" in speed-position switching control (ABS mode).

The error "Speed-position function selection error" (error code: 1AAEH) will occur if the "[Pr.21] Feed current value during speed control" setting is other than 1.



Switching time from speed control to position control

It takes 1 ms from the time the speed-position switching signal is turned ON to the time the speed-position switching latch flag ([Md.31] Status: b1) turns ON.



Speed-position switching signal setting

- The following table shows the items that must be set to use the external command signals [DI] as speed-position switching signals.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.8]	External command valid	1	Validates an external command.	4305+100n

For labels, refer to the following.

☞ Page 437 Axis control data

- The following table shows the items that must be set to use the proximity dog signal (DOG) as speed-position switching signals.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.45]	Speed-position switching device selection	1	Use the proximity dog signal for switching from speed control to position control.	4366+100n

The setting is not required for "[Cd.8] External command valid". Refer to the following for information on the setting details.

☞ Page 543 Control Data

For labels, refer to the following.

☞ Page 437 Axis control data

- The following table shows the items that must be set to use "[Cd.46] Speed-position switching command" as speed-position switching signals.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.45]	Speed-position switching device selection	2	Use the "[Cd.46] Speed-position switching command" for switching from speed control to position control.	4366+100n

The setting is not required for "[Cd.8] External command valid". Refer to the following for information on the setting details.

☞ Page 543 Control Data

For labels, refer to the following.

☞ Page 437 Axis control data

- The following table shows the items that must be set to use link devices as speed-position switching signals.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.45]	Speed-position switching device selection	3	Use the link device for switching from speed control to position control	4366+100n

For details of the setting, refer to the following.

☞ Page 321 Link Device External Signal Assignment Function

For labels, refer to the following.

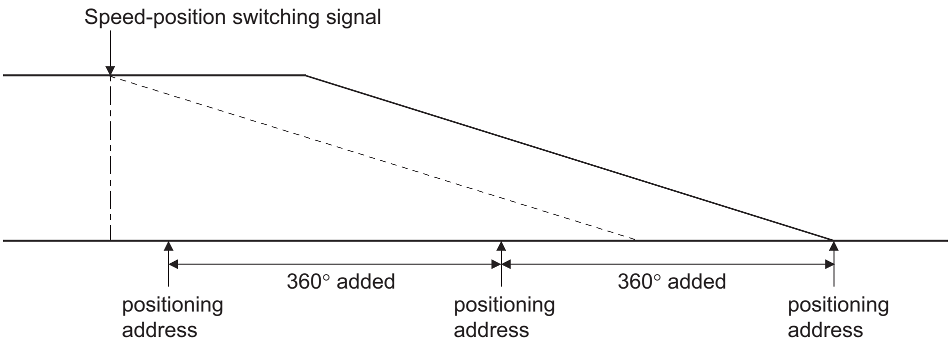
☞ Page 437 Axis control data

Restrictions

- The error "Continuous path control not possible" (error code: 1A1EH to 1A20H) will occur and the operation cannot start if "continuous positioning control" or "continuous path control" is set in "[Da.1] Operation pattern".
- "Speed-position switching control" cannot be set in "[Da.2] Control method" of the positioning data when "continuous path control" has been set in "[Da.1] Operation pattern" of the immediately prior positioning data. (For example, if the operation pattern of positioning data No.1 is "continuous path control", "speed-position switching control" cannot be set in positioning data No.2.) The error "Continuous path control not possible" (error code: 1A1EH to 1A20H) will occur and the machine will carry out a deceleration stop if this type of setting is carried out.
- The error "No command speed" (error code: 1A12H to 1A14H) will occur if "current speed (-1)" is set in "[Da.8] Command speed".
- If the value set in "[Da.6] Positioning address/movement amount" is negative, the error "Outside address range" (error code: 1A30H, 1A31H) will occur.
- Even though the axis control data "[Cd.23] Speed-position switching control movement amount change register" was set in speed-position switching control (ABS mode), it would not function. The set value is ignored.
- To exercise speed-position switching control (ABS mode), the following conditions must be satisfied:

1) "[Pr.1] Unit setting" is "2: degree"
2) The software stroke limit function is invalid (upper limit value = lower limit value)
3) "[Pr.21] Feed current value during speed control" is "1: Update feed current value"
4) The "[Da.6] Positioning address/movement amount" setting range is 0 to 359.99999 (degree). If the value is outside of the range, the error "Outside address range" (error code: 1A30H, 1A31H) will occur at a start.
5) The "[Pr.81] Speed-position function selection" setting is "2: Speed-position switching control (ABS mode)".

- If any of the conditions in 1) to 3) is not satisfied in the case of 5), the error "Speed-position function selection error" (error code: 1AAEH) will occur when the user program READY signal [Y0] turns from OFF to ON.
- If the axis reaches the positioning address midway through deceleration after automatic deceleration started at the input of the speed-position switching signal, the axis will not stop immediately at the positioning address. The axis will stop at the positioning address after N revolutions so that automatic deceleration can always be made. (N: Natural number) In the following example, since making deceleration in the path of dotted line will cause the axis to exceed the positioning addresses twice, the axis will decelerate to a stop at the third positioning address.



Setting positioning data

When using speed-position switching control (ABS mode), set the following positioning data.

◎: Always set, ○: Set as required, —: Setting not required

Setting item		Setting required/not required
[Da.1]	Operation pattern	◎
[Da.2]	Control method	◎ (Set "Forward run: speed/position" or "Reverse run: speed/position".)
[Da.3]	Acceleration time No.	○
[Da.4]	Deceleration time No.	○
[Da.6]	Positioning address/movement amount	◎
[Da.7]	Arc address	—
[Da.8]	Command speed	◎
[Da.9]	Dwell time/JUMP destination positioning data No.	○
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches	○
[Da.20]	Axis to be interpolated No.1	—
[Da.21]	Axis to be interpolated No.2	—
[Da.22]	Axis to be interpolated No.3	—
[Da.27]	M code ON signal output timing	○
[Da.28]	ABS direction in degrees	—
[Da.29]	Interpolation speed designation method	—

Refer to the following for information on the setting details.

☞ Page 482 Positioning Data

3

Position-speed switching control

In "position-speed switching control" ("[Da.2] Control method" = Forward run: position/speed, Reverse run: position/speed), before the position-speed switching signal is input, position control is carried out for the movement amount set in "[Da.6] Positioning address/movement amount" in the axis direction in which the positioning data has been set. When the position-speed switching signal is input, the position control is carried out by continuously outputting the pulses for the speed set in "[Da.8] Command speed" until the input of a stop command.

The two types of position-speed switching control are "Forward run: position/speed" in which the control starts in the forward run direction, and "Reverse run: position/speed" in which control starts in the reverse run direction.

Switching over from position control to speed control

- The control is selected the switching method from position control to speed control by the setting value of "[Cd.45] Speed-position switching device selection".

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.45]	Speed-position switching device selection	→	The device used for speed-position switching is selected. 1: Use the proximity dog signal for switching from position control to speed control 2: Use the "[Cd.46] Speed-position switching command" for switching from position control to speed control 3: Use the link device for switching from position control to speed control*1	4366+100n

*1 For details of the setting, refer to the following.
☞ Page 321 Link Device External Signal Assignment Function

For labels, refer to the following.

☞ Page 437 Axis control data

The switching is performed by using the following device when "2" is set.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.46]	Speed-position switching command	1	Switch from position control to speed control	4367+100n

For labels, refer to the following.

☞ Page 437 Axis control data

- "[Cd.26] Position-speed switching enable flag" must be turned ON to switch over from position control to speed control. (If the "[Cd.26] Position-speed switching enable flag" turns ON after the position-speed switching signal turns ON, the control will continue as position control without switching over to speed control. The control will be switched over from position control to speed control when the position-speed switching signal turns from OFF to ON again. Only speed control will be carried out when the "[Cd.26] Position-speed switching enable flag" and position-speed switching signal are ON at the operation start.)

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.26]	Position-speed switching enable flag	1	Position control will be taken over by speed control when the external command signal [DI] comes ON.	4332+100n

For labels, refer to the following.

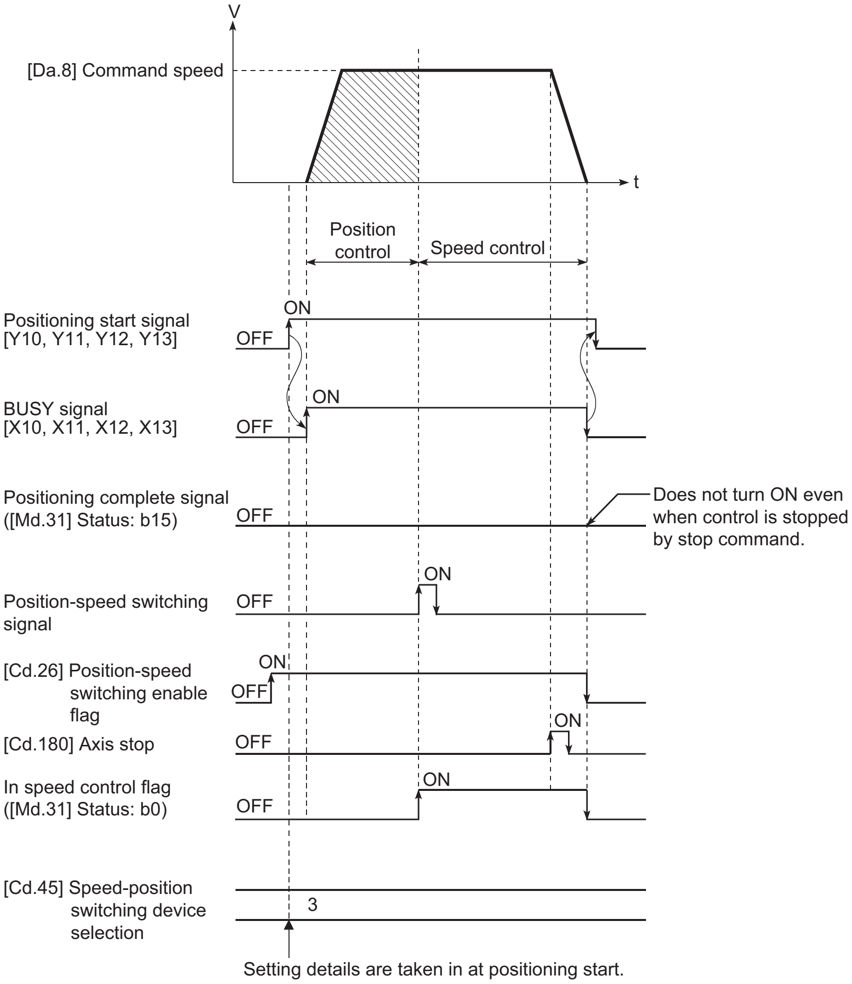
☞ Page 437 Axis control data

Operation chart

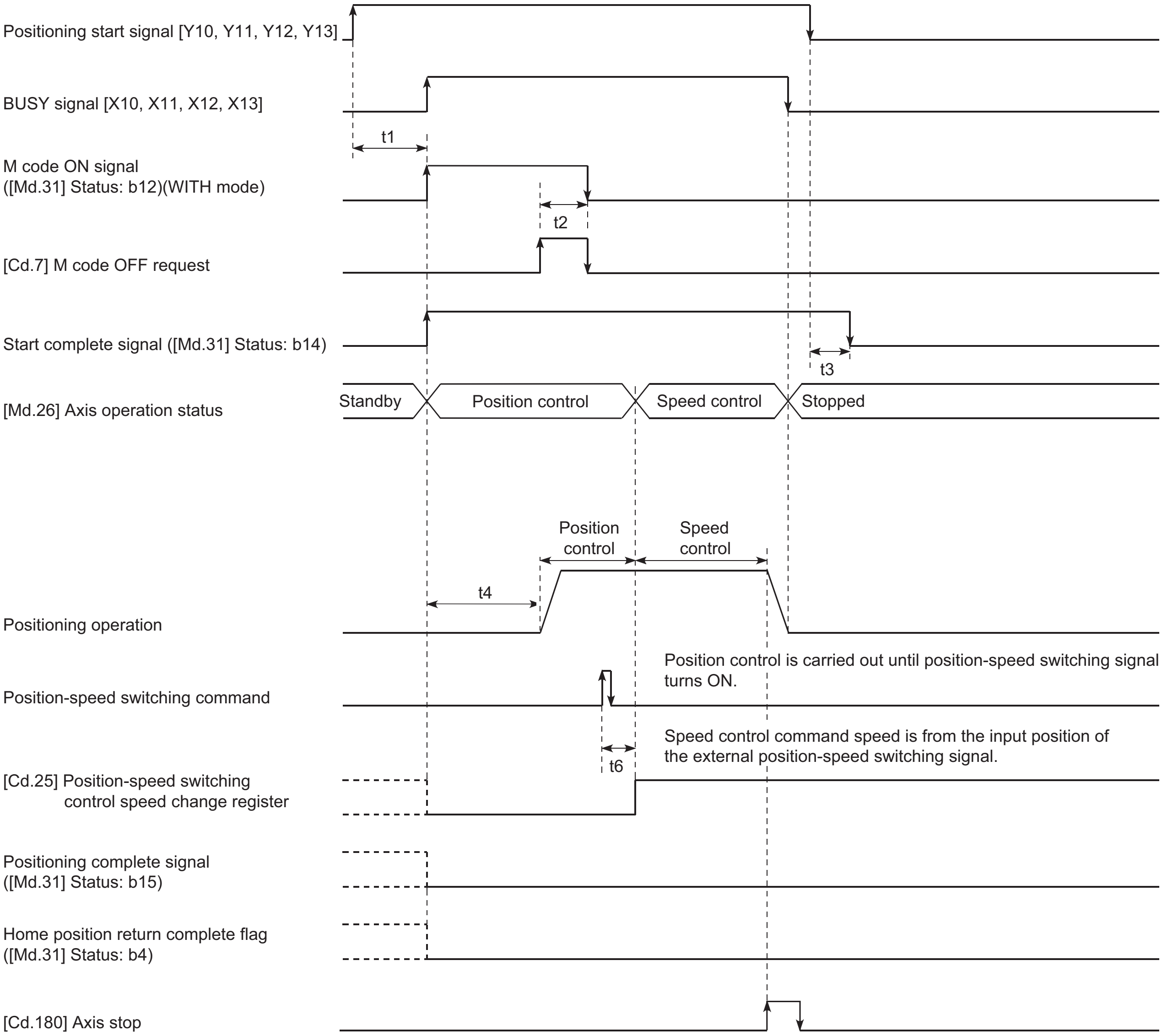
The following chart shows the operation timing for position-speed switching control.

The "in speed control" flag ([Md.31] Status: b0) is turned ON during speed control of position-speed switching control.

■Axis 1 to 4 operation example



Operation timing and processing time



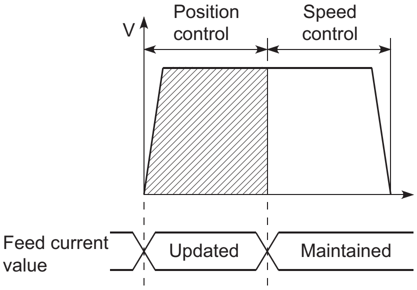
Operation cycle	Normal timing time Unit: [ms]					
	t1	t2	t3	t4	t5	t6
0.50	0.243 to 0.641	0.000 to 0.500	0.000 to 0.500	1.252 to 1.394	—	0.095
1.00	0.233 to 1.065	0.000 to 1.000	0.000 to 1.000	2.740 to 2.899	—	0.034
2.00	0.291 to 1.998	0.000 to 2.000	0.000 to 2.000	5.864 to 5.880	—	0.101
4.00	0.270 to 4.141	0.000 to 4.000	0.000 to 4.000	11.855 to 11.889	—	0.034

- The t1 timing time could be delayed by the operation state of other axes.
- When using the proximity dog signal and "[Cd.46] Speed-position switching command", the t6 timing time could be delayed or vary influenced by the operation cycle of the Simple Motion board or the communication with the slave device.

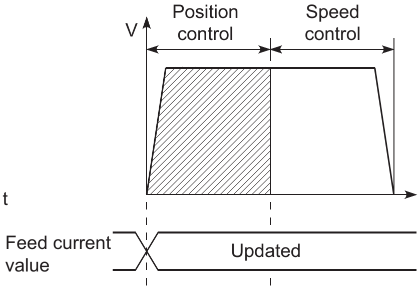
Feed current value

The following table shows the "[Md.20] Feed current value" during position-speed switching control corresponding to the "[Pr.21] Feed current value during speed control" settings.

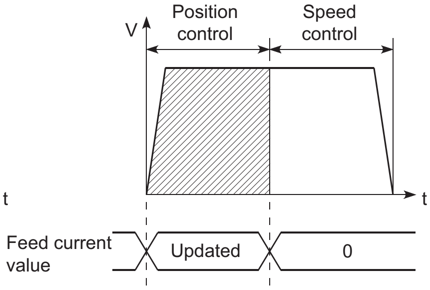
"[Pr.21] Feed current value during speed control" setting	[Md.20] Feed current value
0: Do not update feed current value	The feed current value is updated during position control, and the feed current value at the time of switching is maintained as soon as position control is switched to speed control.
1: Update feed current value	The feed current value is updated during position control and speed control.
2: Zero clear feed current value	The feed current value is updated during position control, and the feed current value is cleared (to "0") as soon as position control is switched to speed control.



(a) Feed current value not updated



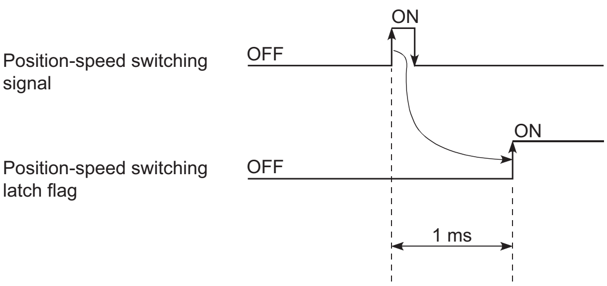
(b) Feed current value updated



(c) Feed current value zero cleared

Switching time from position control to speed control

It takes 1 ms from the time the position-speed switching signal is turned ON to the time the position-speed switching latch flag ([Md.31] Status: b5) turns ON.



Position-speed switching signal setting

- The following table shows the items that must be set to use the external command signals [DI] as position-speed switching signals.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.8]	External command valid	1	Validates an external command.	4305+100n

For labels, refer to the following.

☞ Page 437 Axis control data

- The following table shows the items that must be set to use the proximity dog signal (DOG) as position-speed switching signals.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.45]	Speed-position switching device selection	1	Use the proximity dog signal for switching from position control to speed control.	4366+100n

The setting is not required for "[Cd.8] External command valid". Refer to the following for information on the setting details.

☞ Page 543 Control Data

For labels, refer to the following.

☞ Page 437 Axis control data

- The following table shows the items that must be set to use "[Cd.46] Speed-position switching command" as position-speed switching signals.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.45]	Speed-position switching device selection	2	Use the "[Cd.46] Speed-position switching command" for switching from position control to speed control.	4366+100n

The setting is not required for "[Cd.8] External command valid". Refer to the following for information on the setting details.

☞ Page 543 Control Data

For labels, refer to the following.

☞ Page 437 Axis control data

- The following table shows the items that must be set to use link devices as position-speed switching signals.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.45]	Speed-position switching device selection	3	Use the link device for switching from position control to speed control	4366+100n

For details of the setting, refer to the following.

☞ Page 321 Link Device External Signal Assignment Function

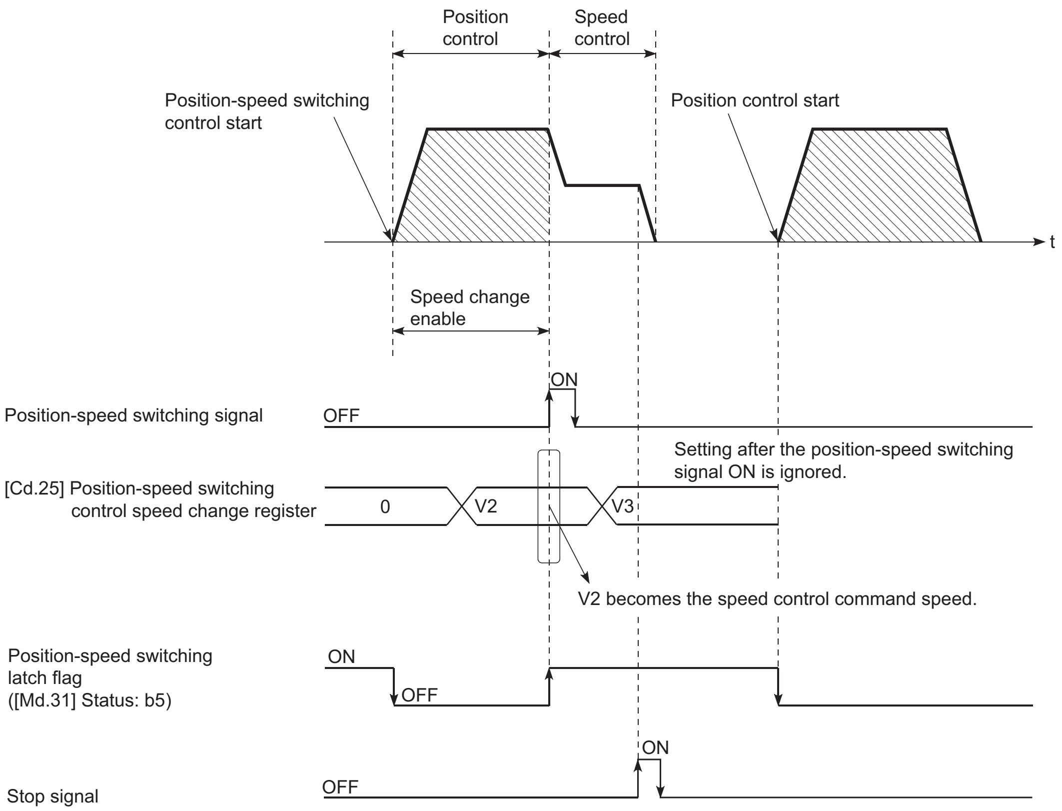
For labels, refer to the following.

☞ Page 437 Axis control data

Changing the speed control command speed

In "position-speed switching control", the speed control command speed can be changed during the position control.

- The speed control command speed can be changed during the position control of position-speed switching control. A command speed change request will be ignored unless issued during the position control of the position-speed switching control.
- The "new command speed" is stored in "[Cd.25] Position-speed switching control speed change register" by the user program during position control. This value then becomes the speed control command speed when the position-speed switching signal turns ON.



Point

- The machine recognizes the presence of a command speed change request when the data is written to "[Cd.25] Position-speed switching control speed change register" with the user program.
- The new command speed is validated after execution of the position-speed switching control before the input of the position-speed switching signal.
- The command speed change can be enabled/disabled with the interlock function in speed control using the "position-speed switching latch flag" ([Md.31] Status: b5) of the axis monitor area.

Restrictions

- The error "Continuous path control not possible" (error code: 1A1EH to 1A20H) will occur and the operation cannot start if "continuous positioning control" or "continuous path control" is set in "[Da.1] Operation pattern".
- "Position-speed switching control" cannot be set in "[Da.2] Control method" of the positioning data when "continuous path control" has been set in "[Da.1] Operation pattern" of the immediately prior positioning data. (For example, if the operation pattern of positioning data No.1 is "continuous path control", "position-speed switching control" cannot be set in positioning data No.2.) The error "Continuous path control not possible" (error code: 1A1EH to 1A20H) will occur and the machine will carry out a deceleration stop if this type of setting is carried out.
- The software stroke limit range is only checked during speed control if the "1: Update feed current value" is set in "[Pr.21] Feed current value during speed control". The software stroke limit range is not checked when the control unit is set to "degree".
- The error "Software stroke limit +" (error code: 1993H) or "Software stroke limit -" (error code: 1995H) will occur and the operation cannot start if the start point address or end point address for position control exceeds the software stroke limit range.
- Deceleration stop will be carried out if the position-speed switching signal is not input before the machine is moved by a specified movement amount. When the position-speed switching signal is input during automatic deceleration by positioning control, acceleration is carried out again to the command speed to continue speed control. When the position-speed switching signal is input during deceleration to a stop with the stop signal, the control is switched to the speed control to stop the machine. Restart is carried out by speed control using the restart command.
- The warning "Speed limit value over" (warning code: 0991H) will occur and control is continued by "[Pr.8] Speed limit value" if a new speed exceeds "[Pr.8] Speed limit value" at the time of change of the command speed.
- If the value set in "[Da.6] Positioning address/movement amount" is negative, the error "Outside address range" (error code: 1A30H, 1A31H) will occur.
- Set WITH mode in the output timing at M code use. The M code will not be output, and the M code ON signal will not turn ON if the AFTER mode is set.

Setting positioning data

When using position-speed switching control, set the following positioning data.

◎: Always set, ○: Set as required, —: Setting not required

Setting item		Setting required/not required
[Da.1]	Operation pattern	◎
[Da.2]	Control method	◎ (Set "Forward run: position/speed" or "Reverse run: position/speed".)
[Da.3]	Acceleration time No.	○
[Da.4]	Deceleration time No.	○
[Da.6]	Positioning address/movement amount	◎
[Da.7]	Arc address	—
[Da.8]	Command speed	◎
[Da.9]	Dwell time/JUMP destination positioning data No.	○
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches	○
[Da.20]	Axis to be interpolated No.1	—
[Da.21]	Axis to be interpolated No.2	—
[Da.22]	Axis to be interpolated No.3	—
[Da.27]	M code ON signal output timing	○
[Da.28]	ABS direction in degrees	—
[Da.29]	Interpolation speed designation method	—

Refer to the following for information on the setting details.

☞ Page 482 Positioning Data

Current value changing

When the current value is changed to a new value, control is carried out in which the "[Md.20] Feed current value" of the stopped axis is changed to a random address set by the user. (The "[Md.21] Feed machine value" is not changed when the current value is changed.)

The two methods for changing the current value are shown below.

- Changing to a new current value using the positioning data
- Changing to a new current value using the start No. (No.9003) for a current value changing

The current value changing using method [1] is used during continuous positioning of multiple blocks, etc.

3

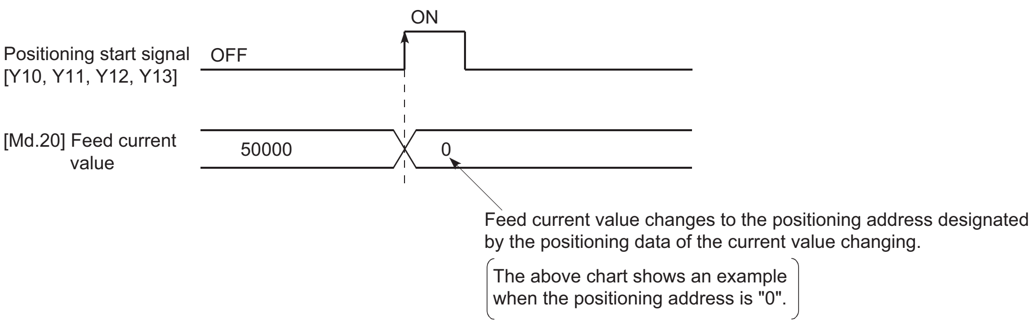
Changing to a new current value using the positioning data

In "current value changing" ("[Da.2] Control method" = current value changing), "[Md.20] Feed current value" is changed to the address set in "[Da.6] Positioning address/movement amount".

■Operation chart

The following chart shows the operation timing for a current value changing. The "[Md.20] Feed current value" is changed to the value set in "[Da.6] Positioning address/movement amount" when the positioning start signal turns ON.

■Axis 1 to 4 operation example



■Restrictions

- The error "New current value not possible" (error code: 1A1CH, 1A1DH) will occur and the operation cannot start if "continuous path control" is set in "[Da.1] Operation pattern". ("Continuous path control" cannot be set in current value changing.)
- "Current value changing" cannot be set in "[Da.2] Control method" of the positioning data when "continuous path control" has been set in "[Da.1] Operation pattern" of the immediately prior positioning data. (For example, if the operation pattern of positioning data No.1 is "continuous path control", "current value changing" cannot be set in positioning data No.2.) The error "New current value not possible" (error code: 1A1CH, 1A1DH) will occur and the machine will carry out a deceleration stop if this type of setting is carried out.
- The error "Outside new current value range" (error code: 1997H) will occur and the operation cannot start if "degree" is set in "[Pr.1] Unit setting" and the value set in "[Da.6] Positioning address/movement amount (0 to 359.99999 [degree])" is outside the setting range.
- If the value set in "[Da.6] Positioning address/movement amount" is outside the software stroke limit ([Pr.12], [Pr.13]) setting range, the error "Software stroke limit +" (error code: 1A18H) or "Software stroke limit -" (error code: 1A1AH) will occur at the positioning start, and the operation will not start.
- The error "Software stroke limit +" (error code: 1994H) or "Software stroke limit -" (error code: 1996H) will occur if the new current value is outside the software stroke limit range.
- The new current value using the positioning data (No.1 to 600) cannot be changed, if "0: Positioning control is not executed" is set in "[Pr.55] Operation setting for incompletion of home position return" and "home position return request flag" ON. The error "Start at home position return incomplete" (error code: 19A6H) will occur.

■Setting positioning data

When using current value changing, set the following positioning data.

◎: Always set, ○: Set as required, —: Setting not required

Setting item		Setting required/not required
[Da.1]	Operation pattern	◎
[Da.2]	Control method	◎ (Set the current value changing.)
[Da.3]	Acceleration time No.	—
[Da.4]	Deceleration time No.	—
[Da.6]	Positioning address/movement amount	◎ (Set the address to be changed.)
[Da.7]	Arc address	—
[Da.8]	Command speed	—
[Da.9]	Dwell time/JUMP destination positioning data No.	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches	○
[Da.20]	Axis to be interpolated No.1	—
[Da.21]	Axis to be interpolated No.2	—
[Da.22]	Axis to be interpolated No.3	—
[Da.27]	M code ON signal output timing	○
[Da.28]	ABS direction in degrees	—
[Da.29]	Interpolation speed designation method	—

Refer to the following for information on the setting details.

☞ Page 482 Positioning Data

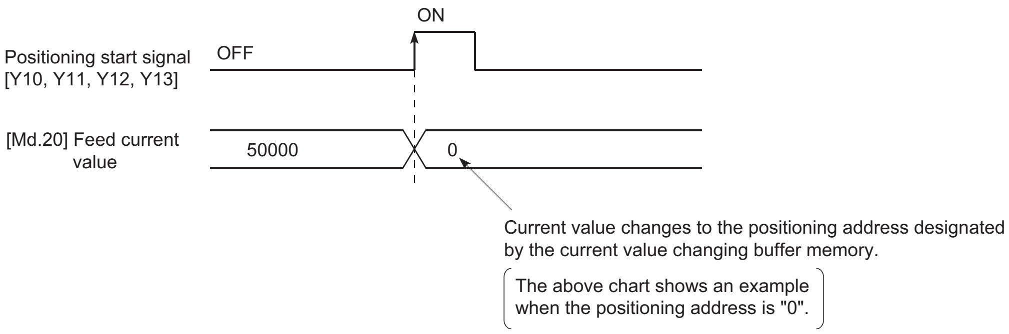
Changing to a new current value using the current value changing start No. (No.9003)

In "current value changing" ("[Cd.3] Positioning start No." = 9003), "[Md.20] Feed current value" is changed to the address set in "[Cd.9] New current value".

■Operation chart

The current value is changed by setting the new current value in the current value changing buffer memory "[Cd.9] New current value", setting "9003" in the "[Cd.3] Positioning start No.", and turning ON the positioning start signal.

■Axis 1 to 4 operation example



■Restrictions

- The error "Outside new current value range" (error code: 1997H) will occur if the designated value is outside the setting range when "degree" is set in "Unit setting".
- The error "Software stroke limit +" (error code: 1994H) or "Software stroke limit -" (error code: 1996H) will occur if the designated value is outside the software stroke limit range.
- The current value cannot be changed during stop commands and while the M code ON signal is ON.
- The M code output function is made invalid.

Point

The new current value can be changed using the current value changing start No. (No.9003) if "0: Positioning control is not executed" is set in "[Pr.55] Operation setting for incompletion of home position return" and home position return request flag is ON.

■Current value changing procedure

The following shows the procedure for changing the current value to a new value.

1. Write the current value to "[Cd. 9] New current value".
2. Write "9003" in "[Cd. 3] Positioning start No.".
3. Turn ON the positioning start signal.

Point

[API library]

- To use the current value change, use the MMC_Axis::StartPositioning(MMC_STNO_CHANGE_VALUE) method.
- To wait until the current value change is completed, use the MMC_Axis::WaitPositioningDone method.

■Setting method for the current value changing function

The following shows an example of a user program and data setting to change the current value to a new value with the positioning start signal. (The "[Md.20] Feed current value" value is changed to "5000.0 µm" in the example shown.)

• Set the following data. (Set using the user program referring to the start time chart.)

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.3]	Positioning start No.	9003	Set the start No. "9003" for the new current value.	4300+100n
[Cd.9]	New current value	50000	Set the new "[Md.20] Feed current value".	4306+100n 4307+100n

Refer to the following for details on the setting details.

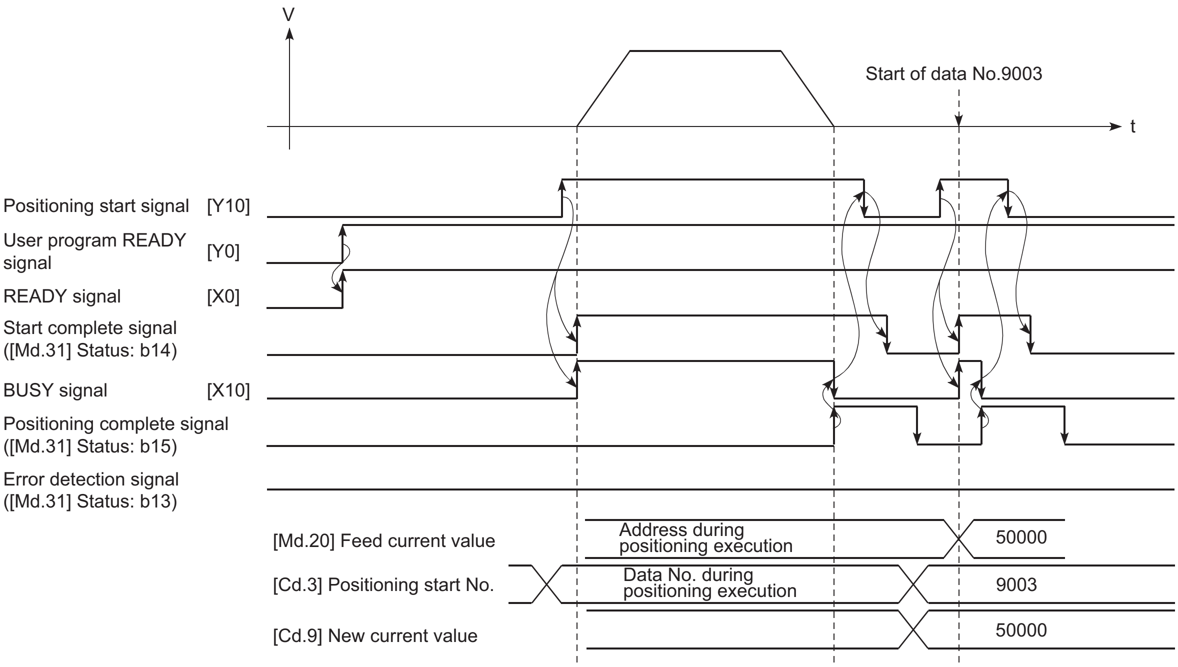
☞ Page 543 Control Data

For labels, refer to the following.

☞ Page 437 Axis control data

• The following shows a start time chart.

■Axis 1 to 4 operation example



Program example

Classification	Method name	Description
Method	MMC_Axis::StartPositioning	Start the positioning control.
	MMC_Axis::WaitPositioningDone	Wait until the positioing control is completed.

C++

```
void ChangeCurrentFeedValueSample( MMC_Axis *axis1, long newPosition )
{
    unsigned long retCode;

    /* Set the current value change value */
    axis1->AxCtrl1.NewPosition = newPosition;

    /* Current value change */
    retCode = axis1->StartPositioning( MMC_STNO_CHANGE_VALUE );
    if( retCode != MMC_OK ) { /* Error process */ }

    /* Wait until the positioning control is completed */
    retCode = axis1->WaitPositioningDone( MMC_POSITIONING_DONE_BUSY, 10000 );
    if( retCode != MMC_OK ) { /* Error process */ }
}
```

NOP instruction

The NOP instruction is used for the nonexecutable control method.

Operation

The positioning data No. to which the NOP instruction is set transfers, without any processing, to the operation for the next positioning data No.

Setting positioning data

When using the NOP instruction, set the following positioning data.

◎: Always set, ○: Set as required, —: Setting not required

Setting item		Setting required/not required
[Da.1]	Operation pattern	—
[Da.2]	Control method	◎ (Set the NOP instruction.)
[Da.3]	Acceleration time No.	—
[Da.4]	Deceleration time No.	—
[Da.6]	Positioning address/movement amount	—
[Da.7]	Arc address	—
[Da.8]	Command speed	—
[Da.9]	Dwell time/JUMP destination positioning data No.	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches	—
[Da.20]	Axis to be interpolated No.1	—
[Da.21]	Axis to be interpolated No.2	—
[Da.22]	Axis to be interpolated No.3	—
[Da.27]	M code ON signal output timing	—
[Da.28]	ABS direction in degrees	—
[Da.29]	Interpolation speed designation method	—

Refer to the following for information on the setting details.

☞ Page 482 Positioning Data

Restrictions

The error "Control method setting error" (error code: 1A26H) will occur if the "NOP instruction" is set for the control method of the positioning data No.600.

Point

Use example of NOP instruction

If there is a possibility of speed switching or temporary stop (automatic deceleration) at a point between two points during positioning, that data can be reserved with the NOP instruction to change the data merely by the replacement of the identifier.

JUMP instruction

The JUMP instruction is used to control the operation so it jumps to a positioning data No. set in the positioning data during "continuous positioning control" or "continuous path control".
JUMP instruction includes the following two types of JUMP.

JUMP instruction	Description
Unconditional JUMP	When execution conditions are not set for the JUMP instruction (When "0" is set to the condition data No.)
Conditional JUMP	When execution conditions are set for the JUMP instruction (The conditions are set to the "condition data" used with "high-level positioning control".)

Using the JUMP instruction enables repeating of the same positioning control, or selection of positioning data by the execution conditions during "continuous positioning control" or "continuous path control".

Operation

■Unconditional JUMP

The JUMP instruction is unconditionally executed. The operation jumps to the positioning data No. set in "[Da.9] Dwell time/ JUMP destination positioning data No.".

■Conditional JUMP

The block start condition data is used as the JUMP instruction execution conditions.

- When block positioning data No.7000 to 7004 is started: Each block condition data is used.
- When positioning data No.1 to 600 is started: Start block 0 condition data is used.
- When the execution conditions set in "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" of the JUMP instruction have been established: the JUMP instruction is executed to jump the operation to the positioning data No. set in "[Da.9] Dwell time/JUMP destination positioning data No.".
- When the execution conditions set in "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" of the JUMP instruction have not been established: the JUMP instruction is ignored, and the next positioning data No. is executed.

Restrictions

- When using a conditional JUMP instruction, establish the JUMP instruction execution conditions by the 4th positioning data No. before the JUMP instruction positioning data No. If the JUMP instruction execution conditions are not established by the time the 4th positioning control is carried out before the JUMP instruction positioning data No., the operation will be processed as an operation without established JUMP instruction execution conditions. (During execution of continuous path control/continuous positioning control, the Simple Motion board calculates the positioning data of the positioning data No. four items ahead of the current positioning data.)
- Set JUMP instruction to positioning data No. that "continuous positioning control" or "continuous path control" is set in operation pattern. It cannot set to positioning data No. that "positioning complete" is set in operation pattern.
- Positioning control such as loops cannot be executed by conditional JUMP instructions alone until the conditions have been established. When loop control is executed using JUMP instruction, an axis operation status is "analyzing" during loop control, and the positioning data analysis (start) for other axes are not executed. As the target of the JUMP instruction, specify a positioning data that is controlled by other than JUMP and NOP instructions.

Setting positioning data

When using the JUMP instruction, set the following positioning data.

◎: Always set, ○: Set as required, —: Setting not required

Setting item		Setting required/not required
[Da.1]	Operation pattern	—
[Da.2]	Control method	◎ (Set the JUMP instruction.)
[Da.3]	Acceleration time No.	—
[Da.4]	Deceleration time No.	—
[Da.6]	Positioning address/movement amount	—
[Da.7]	Arc address	—
[Da.8]	Command speed	—
[Da.9]	Dwell time/JUMP destination positioning data No.	◎ (Set the positioning data No.1 to 600 for the JUMP destination.)
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches	◎ (Set the JUMP instruction execution conditions with the condition data No. 0: Unconditional JUMP 1 to 10: Condition data No. ("Simultaneous start" condition data cannot be set.))
[Da.20]	Axis to be interpolated No.1	—
[Da.21]	Axis to be interpolated No.2	—
[Da.22]	Axis to be interpolated No.3	—
[Da.27]	M code ON signal output timing	—
[Da.28]	ABS direction in degrees	—
[Da.29]	Interpolation speed designation method	—

Refer to the following for information on the setting details.

☞ Page 482 Positioning Data

LOOP

The LOOP is used for loop control by the repetition of LOOP to LEND.

Operation

The LOOP to LEND loop is repeated by set repeat cycles.

Setting positioning data

When using the LOOP, set the following positioning data.

◎: Always set, ○: Set as required, —: Setting not required

Setting item		Setting required/not required
[Da.1]	Operation pattern	—
[Da.2]	Control method	◎ (Set the LOOP.)
[Da.3]	Acceleration time No.	—
[Da.4]	Deceleration time No.	—
[Da.6]	Positioning address/movement amount	—
[Da.7]	Arc address	—
[Da.8]	Command speed	—
[Da.9]	Dwell time/JUMP destination positioning data No.	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches	◎ (Set the repeat cycles.)
[Da.20]	Axis to be interpolated No.1	—
[Da.21]	Axis to be interpolated No.2	—
[Da.22]	Axis to be interpolated No.3	—
[Da.27]	M code ON signal output timing	—
[Da.28]	ABS direction in degrees	—
[Da.29]	Interpolation speed designation method	—

Refer to the following for information on the setting details.

☞ Page 482 Positioning Data

Restrictions

- The error "Control method LOOP setting error" (error code: 1A33H) will occur if a "0" is set for the repeat cycles.
- Even if LEND is absent after LOOP, no error will occur, but repeat processing will not be carried out.
- Nesting is not allowed between LOOP-LEND's. If such setting is made, only the inner LOOP-LEND is processed repeatedly.

Point

The setting by this control method is easier than that by the special start "FOR loop". (☞ Page 150 Repeated start (FOR loop))

- For special start: Positioning start data, special start data, condition data, and positioning data
- For control method: Positioning data

For the special start FOR to NEXT, the positioning data is required for each of FOR and NEXT points. For the control method, loop can be executed even only by one data.

Also, nesting is enabled by using the control method LOOP to LEND in combination with the special start FOR to NEXT. However LOOP to LEND cannot be set across block. Always set LOOP to LEND so that the processing ends within one block.

For details of the "block", refer to the following.

☞ Page 140 HIGH-LEVEL POSITIONING CONTROL

LEND

The LEND is used to return the operation to the top of the repeat (LOOP to LEND) loop.

Operation

When the repeat cycle designated by the LOOP becomes 0, the loop is terminated, and the next positioning data No. processing is started. (The operation pattern, if set to "Positioning complete", will be ignored.)

When the operation is stopped after the repeat operation is executed by designated cycles, the dummy positioning data (for example, incremental positioning without movement amount) is set next to LEND.

The following table shows the operation when the positioning complete (00) is set to LOOP and LEND.

Positioning data No.	Operation pattern	Control method	Conditions	Operation
1	Continuous control	ABS2		Executed in the order of the positioning data No.1 → 2 → 3 → 4 → 5 → 2 → 3 → 4 → 5 → 6. (The operation patterns of the positioning data Nos. 2 and 5 are ignored.)
2	Positioning complete	LOOP	Number of loop cycles: 2	
3	Continuous path control	ABS2		
4	Continuous control	ABS2		
5	Positioning complete	LEND		
6	Positioning complete	ABS2		

Setting positioning data

When using the LEND, set the following positioning data.

◎: Always set, ○: Set as required, —: Setting not required

Setting item		Setting required/not required
[Da.1]	Operation pattern	—
[Da.2]	Control method	◎ (Set the LEND.)
[Da.3]	Acceleration time No.	—
[Da.4]	Deceleration time No.	—
[Da.6]	Positioning address/movement amount	—
[Da.7]	Arc address	—
[Da.8]	Command speed	—
[Da.9]	Dwell time/JUMP destination positioning data No.	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	—
[Da.20]	Axis to be interpolated No.1	—
[Da.21]	Axis to be interpolated No.2	—
[Da.22]	Axis to be interpolated No.3	—
[Da.27]	M code ON signal output timing	—
[Da.28]	ABS direction in degrees	—
[Da.29]	Interpolation speed designation method	—

Refer to the following for information on the setting details.

☞ Page 482 Positioning Data

Restrictions

- Ignore the "LEND" before the "LOOP" is executed.
- When the operation pattern "Positioning complete" has been set between LOOP and LEND, the positioning control is completed after the positioning data is executed, and the LOOP control is not executed.

4 HIGH-LEVEL POSITIONING CONTROL

The details and usage of high-level positioning control (control functions using the "block start data") are explained in this chapter.
High-level positioning control is used to carry out applied control using the "positioning data". Examples of applied control are using conditional judgment to control "positioning data" set with the major positioning control, or simultaneously starting "positioning data" for several different axes.
Read the execution procedures and settings for each control, and set as required.

4.1 Outline of High-level Positioning Control

In "high-level positioning control" the execution order and execution conditions of the "positioning data" are set to carry out more applied positioning. (The execution order and execution conditions are set in the "block start data" and "condition data".)
The following applied positioning controls can be carried out with "high-level positioning control".

High-level positioning control	Details
Block*1 start (Normal start)	With one start, executes the positioning data in a random block with the set order.
Condition start	Carries out condition judgment set in the "condition data" for the designated positioning data, and then executes the "block start data". • When the condition is established, the "block start data" is executed. • When not established, that "block start data" is ignored, and the next point's "block start data" is executed.
Wait start	Carries out condition judgment set in the "condition data" for the designated positioning data, and then executes the "block start data". • When the condition is established, the "block start data" is executed. • When not established, stops the control until the condition is established. (Waits.)
Simultaneous start*2	Simultaneously executes the designated positioning data of the axis designated with the "condition data". (Outputs command at the same timing.)
Repeated start (FOR loop)	Repeats the program from the "block start data" set with the "FOR loop" to the "block start data" set in "NEXT" for the designated number of times.
Repeated start (FOR condition)	Repeats the program from the "block start data" set with the "FOR condition" to the "block start data" set in "NEXT" until the conditions set in the "condition data" are established.

*1 "1 block" is defined as all the data continuing from the positioning data in which "continuous positioning control" or "continuous path control" is set in the "[Da.1] Operation pattern" to the positioning data in which "independent positioning control (Positioning complete)" is set.

*2 Besides the simultaneous start of "block start data" system, the "simultaneous starts" include the "multiple axes simultaneous start control" of control method. Refer to the following for details.
☞ Page 24 Multiple axes simultaneous start

If link devices and external input signals are used in combination, more applied positioning start can be carried out only with a parameter setting.

Ex.

· Repeat the same operation pattern while the switch is ON.
· Start an operation after setting the pattern with a touch panel.
· Start an operation after selecting the positioning No. to be started.

High-level positioning control sub functions

"High-level positioning control" uses the "positioning data" set with the "major positioning control". Refer to the following for details on sub functions that can be combined with the major positioning control.
📖Simple Motion Board User's Manual (Startup)
Note that the pre-reading start function cannot be used together with "high-level positioning control".

Data required for high-level positioning control

"High-level positioning control" is executed by setting the required items in the "block start data" and "condition data", then starting that "block start data". Judgment about whether execution is possible, etc., is carried out at execution using the "condition data" designated in the "block start data".

"Block start data" can be set for each No. from 7000 to 7004 (called "block Nos."), and up to 50 points can be set for each axis. (This data is controlled with Nos. called "points" to distinguish it from the positioning data. For example, the 1st block start data item is called the "1st point block start data" or "point No.1 block start data".)

"Condition data" can be set for each No. from 7000 to 7004 (called "block Nos."), and up to 10 data items can be set for each axis.

The "block start data" and "condition data" are set as 1 set for each block No.

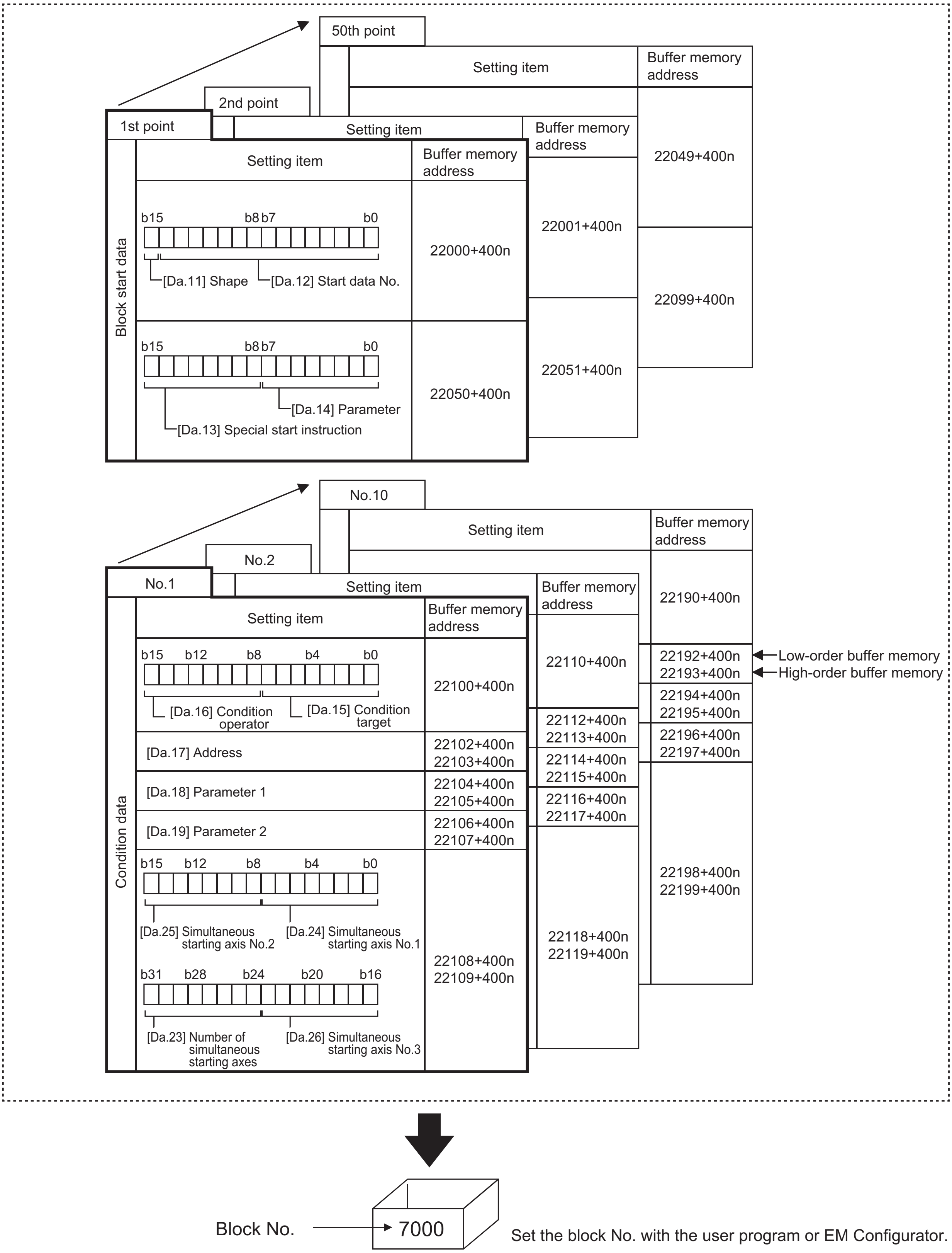
The following table shows an outline of the "block start data" and "condition data" stored in the Simple Motion board.

Setting item			Setting details
Block start data	[Da.11]	Shape	Set whether to end the control after executing only the "block start data" of the shape itself, or continue executing the "block start data" set in the next point.
	[Da.12]	Start data No.	Set the "positioning data No." to be executed.
	[Da.13]	Special start instruction	Set the method by which the positioning data set in [Da.12] will be started.
	[Da.14]	Parameter	Set the conditions by which the start will be executed according to the commands set in [Da.13]. (Designate the "condition data No." and "Number of repetitions".)

Setting item			Setting details
Condition data	[Da.15]	Condition target	Designate the "device", "buffer memory storage details", "positioning data No.", and "link device" elements for which the conditions are set.
	[Da.16]	Condition operator	Set the judgment method carried out for the target set in [Da.15].
	[Da.17]	Address	Set the buffer memory address in which condition judgment is carried out (only when the details set in [Da.15] are "buffer memory storage details").
	[Da.18]	Parameter 1	Set the required conditions according to the details set in [Da.15], [Da.16] and [Da.23].
	[Da.19]	Parameter 2	
	[Da.23]	Number of simultaneous starting axes	Set the number of axes to be started simultaneously in the simultaneously start.
	[Da.24]	Simultaneous starting axis No.1	Set the simultaneous starting axis in the simultaneously start.
	[Da.25]	Simultaneous starting axis No.2	
	[Da.26]	Simultaneous starting axis No.3	

"Block start data" and "condition data" configuration

The "block start data" and "condition data" corresponding to "block No.7000" can be stored in the buffer memory.



Set the "block start data" and "condition data" corresponding to the following "block No. 7001 to 7004" using the user program or EM Configurator to Simple Motion board.

4.2 High-level Positioning Control Execution Procedure

High-level positioning control is carried out using the following procedure.

	Step	Procedure	Description
Preparation	STEP 1	Carry out the "major positioning control" setting.	"High-level positioning control" executes each control ("major positioning control") set in the positioning data with the designated conditions, so first carry out preparations so that "major positioning control" can be executed.
	STEP 2	Set the "block start data" corresponding to each control. ([Da.11] to [Da.14]) × required data amount	The "block start data" from 1 to 50 points can be set.
	STEP 3	Set the "condition data". ([Da.15] to [Da.19] and [Da.23] to [Da.26]) × required data amount	Set the "condition data" for designation with the "block start data". Up to 10 condition data items can be set.
	STEP 4	Create a user program in which block No. is set in the"[Cd.3] Positioning start No." (Control data setting)	The Simple Motion board recognizes that the control is high-level positioning control using "block start data" by the "7000" designation.
		Create a user program in which the "block start data point No. to be started" (1 to 50) is set in the "[Cd. 4] Positioning starting point No."	Use EM Configurator to create a user program to execute the "high-level positioning control".
		Create a user program in which the "positioning start signal" is turned ON by a positioning start command.	
	STEP 5	Execute the following STEPs using user programs created in STEP 4.	
Starting the control	STEP 6	Turn ON the "positioning start command" of the axis to be started.	Same procedure as for the "major positioning control" start.
Monitoring the control	STEP 7	Monitor the high-level positioning control.	Monitor using EM Configurator.
Stopping the control	STEP 8	Stop when control is completed	Same procedure as for the "major positioning control" stop.

Control termination

Point

- Five sets of "block start data (50 points)" and "condition data (10 items)" corresponding to "No.7000 to 7004" are set with a user program.
- Five sets corresponding to "7000" to "7004" can be set with EM Configurator as well. When writing to the Simple Motion board after setting the "block start data" and the "condition data" corresponding to "7000" to "7004" using EM Configurator, "7000" to "7004" can be set in "[Cd.3] Positioning start No." on STEP4.

4.3 Setting the Block Start Data

Relation between various controls and block start data

The "block start data" must be set to carry out "high-level positioning control".
The setting requirements and details of each "block start data" item to be set differ according to the "[Da.13] Special start instruction" setting.
The following shows the "block start data" setting items corresponding to various control methods.
Also refer to the following for details on "condition data" with which control execution is judged.
☞ Page 153 Setting the Condition Data
(The "block start data" settings in this chapter are assumed to be carried out using EM Configurator.)
◎: One of the two setting items must be set.
○: Set as required (Set to "—" when not used.)
×: Setting not possible
—: Setting not required (Set the initial value or a value within the setting range.)

Block start data setting items			Block start (Normal start)	Condition start	Wait start	Simultaneous start	Repeated start (FOR loop)	Repeated start (FOR condition)	NEXT start*1
[Da.11]	Shape	0: End	◎	◎	◎	◎	×	×	◎
		1: Continue	◎	◎	◎	◎	◎	◎	◎
[Da.12]	Start data No.		1 to 600						
[Da.13]	Special start instruction		0	1	2	3	4	5	6
[Da.14]	Parameter		—	Condition data No.			Number of repetitions	Condition data No.	—

*1 The "NEXT start" instruction is used in combination with "repeated start (FOR loop)" and "repeated start (FOR condition)". Control using only the "NEXT start" will not be carried out.

Point

[API library]
- Store the block start data in the block start data structure MMST_BlockStartData. Refer to the following for details.

☞ Page 496 Block Start Data
- To set the block start data, use the MMC_Axis::SetBlockStartData method.
- To check the block start data, use the MMC_Axis::GetBlockStartData method.

Block start

In a "block start (normal start)", the positioning data groups of a block are continuously executed in a set PLC starting from the positioning data set in "[Da.12] Start data No." by one start.
The control examples are shown when the "block start data" and "positioning data" are set as shown in the setting examples.

Setting examples

■Block start data setting example

Axis 1 block start data	[Da.11] Shape	[Da.12] Start data No.	[Da.13] Special start instruction	[Da.14] Parameter
1st point	1: Continue	1	0: Block start	—
2nd point	1: Continue	2	0: Block start	—
3rd point	1: Continue	5	0: Block start	—
4th point	1: Continue	10	0: Block start	—
5th point	0: End	15	0: Block start	—
⋮				

■Positioning data setting example

Axis 1 positioning data No.	[Da.1] Operation pattern	
1	00: Positioning complete	
2	11: Continuous path control	1 block*1
3	01: Continuous positioning control	
4	00: Positioning complete	
5	11: Continuous path control	1 block
6	00: Positioning complete	
⋮		
10	00: Positioning complete	
⋮		
15	00: Positioning complete	
⋮		

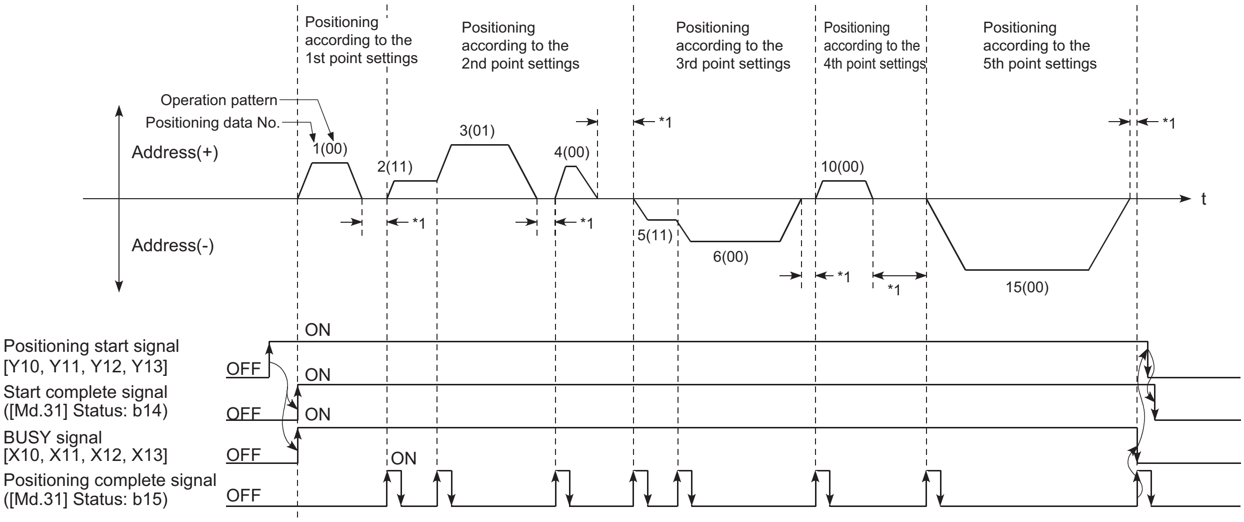
*1 "1 block" is defined as all the data continuing from the positioning data in which "continuous positioning control" or "continuous path control" is set in the "[Da.1] Operation pattern" to the positioning data in which "independent positioning control (Positioning complete)" is set.

Control examples

The following shows the control executed when the "block start data" of the 1st point of axis 1 is set as shown in the setting examples and started.

- The positioning data is executed in the following order before stopping. Axis 1 positioning data No.1 → 2 → 3 → 4 → 5 → 6 → 10 → 15.

■Axis 1 to 4 operation example



*1 Dwell time of corresponding positioning data

Condition start

In a "condition start", the "condition data" conditional judgment designated in "[Da.14] Parameter" is carried out for the positioning data set in "[Da.12] Start data No.". If the conditions have been established, the "block start data" set in "1: condition start" is executed. If the conditions have not been established, that "block start data" will be ignored, and the "block start data" of the next point will be executed.

The control examples are shown when the "block start data" and "positioning data" are set as shown in the setting examples.

Setting examples

■Block start data setting example

Axis 1 block start data	[Da.11] Shape	[Da.12] Start data No.	[Da.13] Special start instruction	[Da.14] Parameter
1st point	1: Continue	1	1: Condition start	1
2nd point	1: Continue	10	1: Condition start	2
3rd point	0: End	50	0: Block start	—
⋮				

The "condition data Nos." have been set in "[Da.14] Parameter".

■Positioning data setting example

Axis 1 positioning data No.	[Da.1] Operation pattern
1	01: Continuous positioning control
2	01: Continuous positioning control
3	00: Positioning complete
⋮	
10	11: Continuous path control
11	11: Continuous path control
12	00: Positioning complete
⋮	
50	00: Positioning complete
⋮	

Control examples

The following shows the control executed when the "block start data" of the 1st point of axis 1 is set as shown in the setting examples and started.

1. The conditional judgment set in "condition data No.1" is carried out before execution of the axis 1 "positioning data No.1".

→ Conditions established → Execute positioning data No.1, 2, and 3 → Go to the next 2.

→ Conditions not established → Go to the next 2.

2. The conditional judgment set in "condition data No.2" is carried out before execution of the axis 1 "positioning data No.10".

→ Conditions established → Execute positioning data No.10, 11, and 12 → Go to the next 3.

→ Conditions not established → Go to the next 3.

3. Execute axis 1 "positioning data No.50" and stop the control.

Wait start

In a "wait start", the "condition data" conditional judgment designated in "[Da.14] Parameter" is carried out for the positioning data set in "[Da.12] Start data No.". If the conditions have been established, the "block start data" is executed. If the conditions have not been established, the control stops (waits) until the conditions are established.

The control examples are shown when the "block start data" and "positioning data" are set as shown in the setting examples.

Setting examples

■Block start data setting example

Axis 1 block start data	[Da.11] Shape	[Da.12] Start data No.	[Da.13] Special start instruction	[Da.14] Parameter
1st point	1: Continue	1	2: Wait start	3
2nd point	1: Continue	10	0: Block start	—
3rd point	0: End	50	0: Block start	—
⋮				

The "condition data Nos." have been set in "[Da.14] Parameter".

■Positioning data setting example

Axis 1 positioning data No.	[Da.1] Operation pattern
1	01: Continuous positioning control
2	01: Continuous positioning control
3	00: Positioning complete
⋮	
10	11: Continuous path control
11	11: Continuous path control
12	00: Positioning complete
⋮	
50	00: Positioning complete
⋮	

Control examples

The following shows the control executed when the "block start data" of the 1st point of axis 1 is set as shown in the setting examples and started.

1. The conditional judgment set in "condition data No.3" is carried out before execution of the axis 1 "positioning data No.1".

→ Conditions established → Execute positioning data No.1, 2, and 3 → Go to the next 2.

→ Conditions not established → Control stops (waits) until conditions are established → Go to the above 1.

2. Execute the axis 1 "positioning data No.10, 11, 12, and 50" and stop the control.

Simultaneous start

In a "simultaneous start", the positioning data set in the "[Da.12] Start data No." and positioning data of other axes set in the "condition data" are simultaneously executed (commands are output with the same timing). (The "condition data" is designated with "[Da.14] Parameter".)
The control examples are shown when the "block start data" and "positioning data" are set as shown in the setting examples.

Setting examples

■Block start data setting example

Axis 1 block start data	[Da.11] Shape	[Da.12] Start data No.	[Da.13] Special start instruction	[Da.14] Parameter
1st point	0: End	1	3: Simultaneous start	4
⋮				

It is assumed that the "axis 2 positioning data" for simultaneous starting is set in the "condition data" designated with "[Da.14] Parameter".

■Positioning data setting example

Axis 1 positioning data No.	[Da.1] Operation pattern
1	01: Continuous positioning control
2	01: Continuous positioning control
3	00: Positioning complete
⋮	

Control examples

The following shows the control executed when the "block start data" of the 1st point of axis 1 is set as shown in the setting examples and started.

1. Check the axis operation status of axis 2 which is regarded as the simultaneously started axis.

→ Axis 2 is standing by → Go to the next 2.

→ Axis 2 is carrying out positioning. → An error occurs and simultaneous start will not be carried out.

2. Simultaneously start the axis 1 "positioning data No.1" and axis 2 positioning data set in "condition data No. 4.

Precautions

Positioning data No. executed by simultaneous starting axes is set to condition data ("[Da.18] Parameter 1", "[Da.19] Parameter 2"), but the setting value of start axis (the axis which carries out positioning start) should be "0". If the setting value is set to other than "0", the positioning data set in "[Da.18] Parameter 1", "[Da.19] Parameter 2" is given priority to be executed rather than "[Da.12] Start data No.".
For details, refer to the following.
☞ Page 499 Condition Data

4

Repeated start (FOR loop)

In a "repeated start (FOR loop)", the data between the "block start data" in which "4: FOR loop" is set in "[Da.13] Special start instruction" and the "block start data" in which "6: NEXT start" is set in "[Da.13] Special start instruction " is repeatedly executed for the number of times set in "[Da.14] Parameter". An endless loop will result if the number of repetitions is set to "0".

(The number of repetitions is set in "[Da.14] Parameter" of the "block start data" in which "4: FOR loop" is set in "[Da.13] Special start instruction".)

The control examples are shown when the "block start data" and "positioning data" are set as shown in the setting examples.

Setting examples

■Block start data setting example

Axis 1 block start data	[Da.11] Shape	[Da.12] Start data No.	[Da.13] Special start instruction	[Da.14] Parameter
1st point	1: Continue	1	4: FOR loop	2
2nd point	1: Continue	10	0: Block start	—
3rd point	0: End	50	6: NEXT start	—
⋮				

The "condition data Nos." have been set in "[Da.14] Parameter".

■Positioning data setting example

Axis 1 positioning data No.	[Da.1] Operation pattern
1	01: Continuous positioning control
2	01: Continuous positioning control
3	00: Positioning complete
⋮	
10	11: Continuous path control
11	00: Positioning complete
⋮	
50	01: Continuous positioning control
51	00: Positioning complete
⋮	

Control examples

The following shows the control executed when the "block start data" of the 1st point of axis 1 is set as shown in the setting examples and started.

1. Execute the axis 1 "positioning data No.1, 2, 3, 10, 11, 50, and 51".
2. Return to the axis 1 "1st point block start data". Again execute the axis 1 "positioning data No.1, 2, 3, 10, 11, 50 and 51", and then stop the control. (Repeat for the number of times (2 times) set in [Da.14].)

Repeated start (FOR condition)

In a "repeated start (FOR condition)", the data between the "block start data" in which "5: FOR condition" is set in "[Da.13] Special start instruction" and the "block start data" in which "6: NEXT start" is set in "[Da.13] Special start instruction" is repeatedly executed until the establishment of the conditions set in the "condition data".
Conditional judgment is carried out as soon as switching to the point of "6: NEXT start" (before positioning of NEXT start point).
(The "condition data" designation is set in "[Da.14] Parameter" of the "block start data" in which "5: FOR condition" is set in "[Da.13] Special start instruction".)
The control examples are shown when the "block start data" and "positioning data" are set as shown in the setting examples.

4

Setting examples

■Block start data setting example

Axis 1 block start data	[Da.11] Shape	[Da.12] Start data No.	[Da.13] Special start instruction	[Da.14] Parameter
1st point	1: Continue	1	5: FOR condition	5
2nd point	1: Continue	10	0: Block start	—
3rd point	0: End	50	6: NEXT start	—
⋮				

The "condition data Nos." have been set in "[Da.14] Parameter".

■Positioning data setting example

Axis 1 positioning data No.	[Da.1] Operation pattern
1	01: Continuous positioning control
2	01: Continuous positioning control
3	00: Positioning complete
⋮	
10	11: Continuous path control
11	00: Positioning complete
⋮	
50	01: Continuous positioning control
51	00: Positioning complete
⋮	

Control examples

The following shows the control executed when the "block start data" of the 1st point of axis 1 is set as shown in the setting examples and started.

1. Execute the axis 1 "positioning data No.1, 2, 3, 10, and 11".

2. Carry out the conditional judgment set in axis 1 "condition data No.5".*1

→ Conditions not established → Execute "Positioning data No.50, 51". Go to the above 1.

→ Conditions established → Execute "Positioning data No.50, 51" and complete the positioning.

*1 Conditional judgment is carried out as soon as switching to NEXT start point (before positioning of NEXT start point).

Restrictions when using the NEXT start

The "NEXT start" is an instruction indicating the end of the repetitions when executing the repeated start (FOR loop) and the repeated start (FOR condition).

(☞ Page 150 Repeated start (FOR loop), Page 151 Repeated start (FOR condition))

The following shows the restrictions when setting "6: NEXT start" in the "block start data".

- The processing when "6: NEXT start" is set before execution of "4: FOR loop" or "5: FOR condition" is the same as that for a "0: block start".
- Repeated processing will not be carried out if there is no "6: NEXT start" instruction after the "4: FOR loop" or "5: FOR condition" instruction. (Note that an "error" will not occur.)
- Nesting is not possible between "4: FOR loop" and "6: NEXT start", or between "5: FOR condition" and "6: NEXT start". The warning "FOR to NEXT nest construction" (warning code: 09F1H) will occur if nesting is attempted.

[Operating examples without nesting structure]

Start block data	[Da.13] Special start instruction
1st point	Normal start
2nd point	FOR
3rd point	Normal start
4th point	NEXT → FOR of the 2nd point
5th point	Normal start
6th point	Normal start
7th point	FOR
8th point	Normal start
9th point	NEXT → FOR of the 7th point
⋮	

[Operating examples with nesting structure]

Start block data	[Da.13] Special start instruction
1st point	Normal start
2nd point	FOR
3rd point	Normal start
4th point	FOR
5th point	Normal start
6th point	Normal start
7th point	NEXT → FOR of the 4th point
8th point	Normal start
9th point	NEXT
⋮	

A warning will occur when starting the 4th point "FOR". The JUMP destination of the 7th point "NEXT" is the 4th point. The 9th point "NEXT" is processed as normal start.

4.4 Setting the Condition Data

Relation between various controls and the condition data

"Condition data" is set in the following cases.

- When setting conditions during execution of JUMP instruction (major positioning control)
- When setting conditions during execution of "high-level positioning control"

The "condition data" to be set includes the setting items from [Da.15] to [Da.19] and [Da.23] to [Da.26], but the setting requirements and details differ according to the control method and setting conditions.

The following shows the "condition data" "[Da.15] Condition target" corresponding to the different types of control.

◎: One of the setting items must be set.

×: Setting not possible

[Da.15] Setting item	High-level positioning control				Major positioning control
	Block start	Wait start	Simultaneous start	Repeated start (For condition)	JUMP instruction
01H: Device X*1	◎	◎	×	◎	◎
02H: Device Y*1	◎	◎	×	◎	◎
03H: Buffer memory (1 word)	◎	◎	×	◎	◎
04H: Buffer memory (2 words)	◎	◎	×	◎	◎
05H: Positioning data No.	×	×	◎	×	×
11H: RX (1 bit)	◎	◎	×	◎	◎
12H: RY (1 bit)	◎	◎	×	◎	◎
13H: RWr (1 bit)	◎	◎	×	◎	◎
14H: RWw (1 bit)	◎	◎	×	◎	◎
21H: RX (1 word)	◎	◎	×	◎	◎
22H: RY (1 word)	◎	◎	×	◎	◎
23H: RWr (1 word)	◎	◎	×	◎	◎
24H: RWw (1 word)	◎	◎	×	◎	◎
31H: RX (2 words)	◎	◎	×	◎	◎
32H: RY (2 words)	◎	◎	×	◎	◎
33H: RWr (2 words)	◎	◎	×	◎	◎
34H: RWw (2 words)	◎	◎	×	◎	◎

*1 Refer to devices X/Y which belongs to Simple Motion board.

Point

[API library]

- Store the condition data in the condition data structure MMST_BlockConditionData. Refer to the following for details.

☞ Page 499 Condition Data

- To set the condition data, use the MMC_Axis::SetBlockConditionData method.
- To check the condition data, use the MMC_Axis::GetBlockConditionData method.

The setting requirements and details of the following "condition data" [Da.16] to [Da.19] and [Da.23] setting items differ according to the "[Da.15] Condition target" setting.

The following shows the [Da.16] to [Da.19] and [Da.23] setting items corresponding to the "[Da.15] Condition target".

—: Setting not required (Set the initial value or a value within the setting range.)

**: Value stored in buffer memory designated in [Da.17]

[Da.15] Condition target	[Da.16] Condition operator	[Da.23] Number of simultaneous starting axes	[Da.17] Address	[Da.18] Parameter 1	[Da.19] Parameter 2
01H: Device X	07H: DEV = ON 08H: DEV = OFF	—	—	X: 0H, 1H, 10H to 1FH, Y: 0H, 1H, 10H to 1FH	—
02H: Device Y					
03H: Buffer memory (1 word)*1	01H: ** = P1 02H: ** ≠ P1 03H: ** ≤ P1 04H: ** ≥ P1 05H: P1 ≤ ** ≤ P2 06H: ** ≤ P1, P2 ≤ **		Buffer memory address	P1 (numeric value)	P2 (numeric value) (Set only when "[Da.16]" is [05H] or [06H].)
04H: Buffer memory (2 words)*1					
05H: Positioning data No.	Setting not possible	2	—	Low-order 16 bits: "[Da.24] Simultaneous starting axis No.1" positioning data No. High-order 16 bits: "[Da.25] Simultaneous starting axis No.2" positioning data No.	—
		3			
		4			Low-order 16 bits: "[Da.26] Simultaneous starting axis No.3" positioning data No. High-order 16 bits: Unusable (Set "0".)
11H: RX (1 bit)	07H: DEV = ON 08H: DEV = OFF	—	Link device No.	—	—
12H: RY (1 bit)					
13H: RWr (1 bit)				0 to 0FH (bit No.)	
14H: RWw (1 bit)					
21H: RX (1 word)	01H: ** = P1 02H: ** ≠ P1 03H: ** ≤ P1 04H: ** ≥ P1 05H: P1 ≤ ** ≤ P2 06H: ** ≤ P1, P2 ≤ **			P1 (numeric value)	P2 (numeric value) (Set only when "[Da.16]" is [05H] or [06H].)
22H: RY (1 word)					
23H: RWr (1 word)					
24H: RWw (1 word)					
31H: RX (2 words)					
32H: RY (2 words)					
33H: RWr (2 words)					
34H: RWw (2 words)					

*1 Comparison of ≤ and ≥ is judged as signed values. (☞ Page 503 [Da.16] Condition operator)

Judgment whether the condition operator is "=" or "≠" at the start of wait.

Judgment on data is carried out for each operation cycle of the Simple Motion board. Thus, in the judgment on the data such as feed current value which varies continuously, the operator "=" may not be detected. If this occurs, use a range operator.

Condition data setting examples

The following shows the setting examples for "condition data".

Setting the device ON/OFF as a condition

[Condition]

Device "X10" (Axis 1 BUSY signal) is OFF

[Da.15] Condition target	[Da.16] Condition operator	[Da.17] Address	[Da.18] Parameter 1	[Da.19] Parameter 2	[Da.23] Number of simultaneous starting axes	[Da.24] Simultaneous starting axis No.1	[Da.25] Simultaneous starting axis No.2	[Da.26] Simultaneous starting axis No.3
01H: Device X	08H: DEV = OFF	—	10H	—	—	—	—	—

Setting the numeric value stored in the "buffer memory" as a condition

[Condition]

The value stored in buffer memory addresses "2400, 2401" ([Md.20] Feed current value) is "1000" or larger.

[Da.15] Condition target	[Da.16] Condition operator	[Da.17] Address	[Da.18] Parameter 1	[Da.19] Parameter 2	[Da.23] Number of simultaneous starting axes	[Da.24] Simultaneous starting axis No.1	[Da.25] Simultaneous starting axis No.2	[Da.26] Simultaneous starting axis No.3
04H: Buffer memory (2 words)	04H: ** ≥ P1	2400	1000	—	—	—	—	—

Designating the axis and positioning data No.*1

*1 The axis and positioning data No. are to be simultaneously started in "simultaneous start".

[Condition]

Simultaneously starting "axis 2 positioning data No.3"

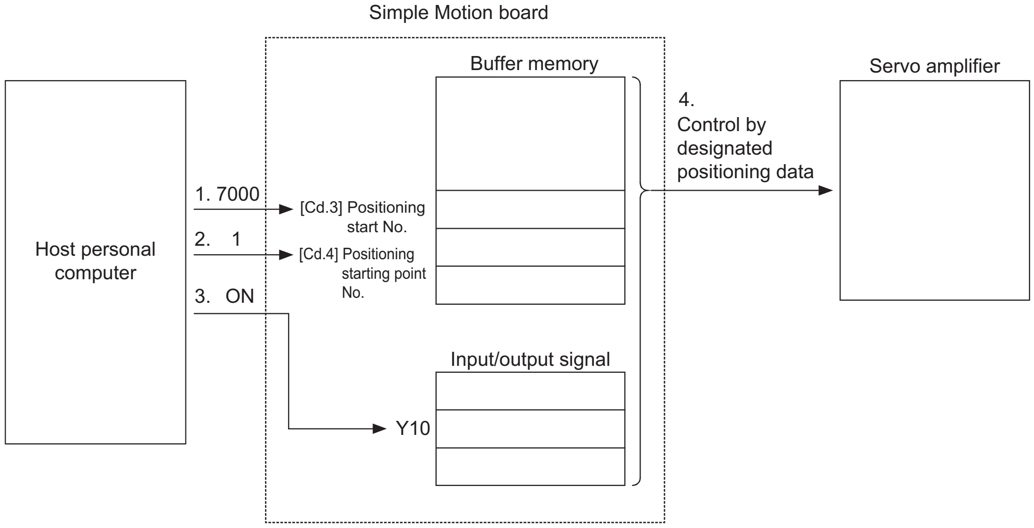
[Da.15] Condition target	[Da.16] Condition operator	[Da.17] Address	[Da.18] Parameter 1	[Da.19] Parameter 2	[Da.23] Number of simultaneous starting axes	[Da.24] Simultaneous starting axis No.1	[Da.25] Simultaneous starting axis No.2	[Da.26] Simultaneous starting axis No.3
05H: Positioning data No.	—	—	Low-order 16 bits "0003H"	—	2H: 2 axes	1H: Axis 2	0H	0H

4.5 Start Program for High-level Positioning Control

Starting high-level positioning control

To execute high-level positioning control, a user program must be created to start the control in the same method as for major positioning control.

The following shows the procedure for starting the "1st point block start data" (regarded as block No.7000) set in axis 1.



1. Set "7000" in "[Cd.3] Positioning start No.".

(This establishes that the control as "high-level positioning control" using block start data.)

2. Set the point No. of the "block start data" to be started. (In this case "1".)

3. Turn ON the start signal.

4. The positioning data set in the "1st point block start data" is started.

Point

[API library]

- To start the positioning control, use the MMC_Axis::StartBlockPositioning method.
- To wait until the positioning control is completed, use the MMC_Axis::WaitPositioningDone method or the MMC_Axis::WaitPositioningDoneIntEvent method.

Example of a start program for high-level positioning control

The following shows an example of a start program for high-level positioning control in which the 1st point "block start data" of axis 1 is started. (The block No. is regarded as "7000".)

Control data that require setting

The following control data must be set to execute high-level positioning control. The setting is carried out using a user program.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.3]	Positioning start No.	7000	Set "7000" to indicate control using "block start data".	4300+100n
[Cd.4]	Positioning starting point No.	1	Set the point No. of the "block start data" to be started.	4301+100n

Refer to the followings for details on the setting details.

☞ Page 543 Control Data

For labels, refer to the following.

☞ Page 437 Axis control data

Start conditions

The following conditions must be fulfilled when starting the control. The required conditions must also be integrated into the user program, and configured so the control does not start unless the conditions are fulfilled.

Signal name		Signal state		Device
Interface signal	User program READY signal	ON	Host personal computer preparation completed	Y0
	READY signal	ON	Preparation completed	X0
	All axis servo ON	ON	All axis servo ON	Y1
	Synchronization flag	ON	The buffer memory can be accessed.	X1
	Axis stop signal	OFF	Axis stop signal is OFF	[Cd.180] Axis stop
	Start complete signal	OFF	Start complete signal is OFF	[Md.31] Status: b14
	BUSY signal	OFF	BUSY signal is OFF	X10 to X1F
	Error detection signal	OFF	There is no error	[Md.31] Status: b13
	M code ON signal	OFF	M code ON signal is OFF	[Md.31] Status: b12
External signal	Forced stop input signal	ON	There is no forced stop input	—
	Stop signal	OFF	Stop signal is OFF	—
	Upper limit (FLS)	ON	Within limit range	—
	Lower limit (RLS)	ON	Within limit range	—

Start time chart

The following chart shows a time chart in which the positioning data No.1, 2, 10, 11, and 12 of the axis 1 are continuously executed as an example.

■Block start data setting example

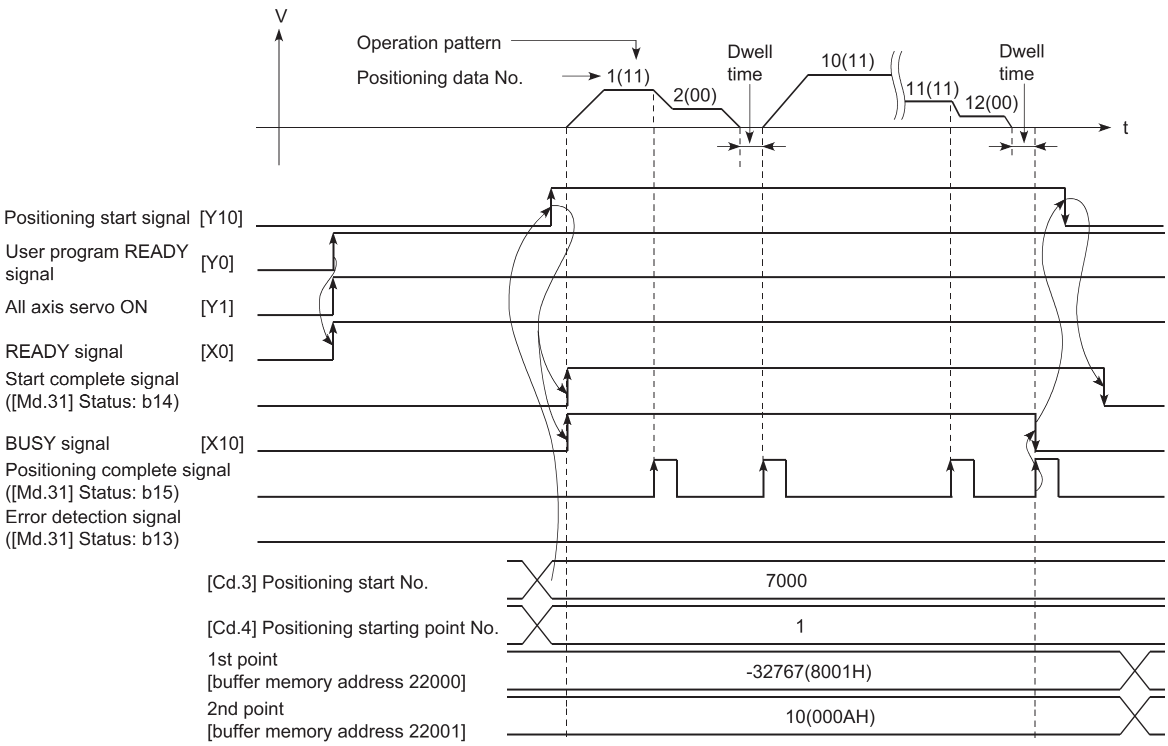
Axis 1 block start data	[Da.11] Shape	[Da.12] Start data No.	[Da.13] Special start instruction	[Da.14] Parameter
1st point	1: Continue	1	0: Block start	—
2nd point	0: End	10	0: Block start	—
⋮				

■Positioning data setting example

Axis 1 positioning data No.	[Da.1] Operation pattern
1	11: Continuous path control
2	00: Positioning complete
⋮	
10	11: Continuous path control
11	11: Continuous path control
12	00: Positioning complete
⋮	

■Start time chart

[Axis 1 to 4 operation example]



Program example

Classification	Method name	Description
Method	MMC_Axis::StartBlockPositioning	Execute the high-level positioning control start.
	MMC_Axis::WaitPositioningDone	Wait until the positioning control is completed.

C++

```
void StartBlockPositioningSample( MMC_Axis *axis1 )
{
    unsigned long retCode;

    /* Start the positioning control */
    retCode = axis1->StartBlockPositioning( 0, 1 );
    if( retCode != MMC_OK ) { /* Error process */ }

    /* Wait until the positioning control is completed */
    retCode = axis1->WaitPositioningDone( MMC_POSITIONING_DONE_INP, 10000 );
    if( retCode != MMC_OK ) { /* Error process */ }
}
```

5 MANUAL CONTROL

The details and usage of manual control are explained in this chapter.
In manual control, commands are issued during a JOG operation and an inching operation executed by the turning ON of the JOG start signal, or from a manual pulse generator connected to the Simple Motion board or the CC-Link IE Field Network device.
Manual control using a user program from the host personal computer is explained in this chapter.

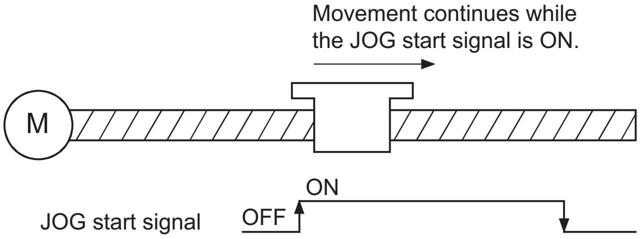
5.1 Outline of Manual Control

Three manual control methods

"Manual control" refers to control in which positioning data is not used, and a positioning operation is carried out in response to signal input from an external device.
The three types of this "manual control" are explained below.

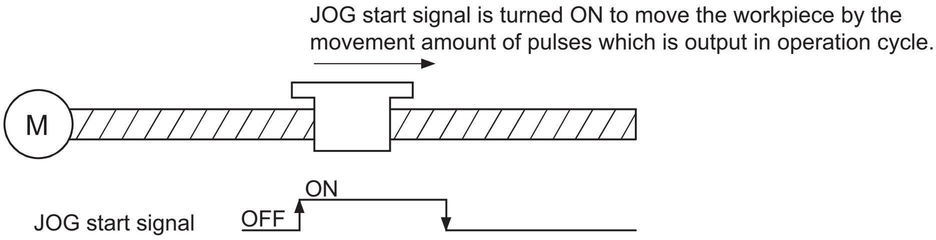
[JOG operation]

"JOG operation" is a control method in which the machine is moved by only a movement amount (commands are continuously output while the JOG start signal is ON). This operation is used to move the workpiece in the direction in which the limit signal is ON, when the operation is stopped by turning the limit signal OFF to confirm the positioning system connection and obtain the positioning data address (☞ Page 286 Teaching function).



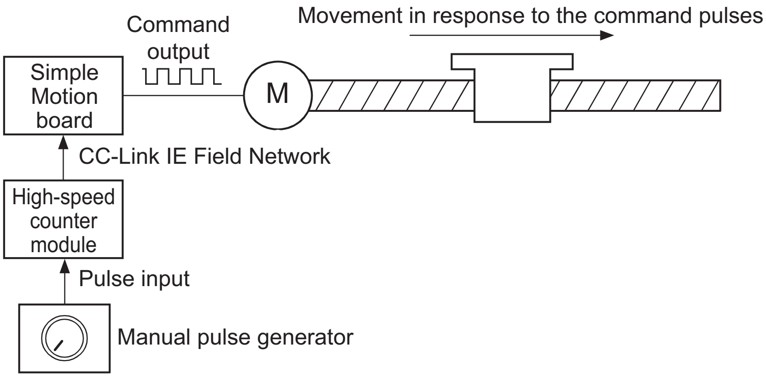
[Inching operation]

"Inching operation" is a control method in which a minute movement amount of command is output manually in operation cycle. When the "inching movement amount" of the axis control data is set by JOG operation, the workpiece is moved by a set movement amount. (When the "inching movement amount" is set to "0", the machine operates as JOG operation.)



[Manual pulse generator operation]

"Manual pulse generator operation" is a control method in which positioning is carried out in response to the number of pulses input from a manual pulse generator (the number of input command is output). This operation is used for manual fine adjustment, etc., when carrying out accurate positioning to obtain the positioning address.



■Manual control sub functions

Refer to the following for details on "sub functions" that can be combined with manual control.

Simple Motion Board User's Manual (Startup)

Also refer to the following for details on each sub function.

☞ Page 218 CONTROL SUB FUNCTIONS

■Monitoring manual control

Refer to the following for directly monitoring the buffer memory using EM Configurator.

☞ Page 507 Monitor Data

Also refer to the "EM Configurator Help" when monitoring with the monitor functions of EM Configurator.

5.2 JOG Operation

Outline of JOG operation

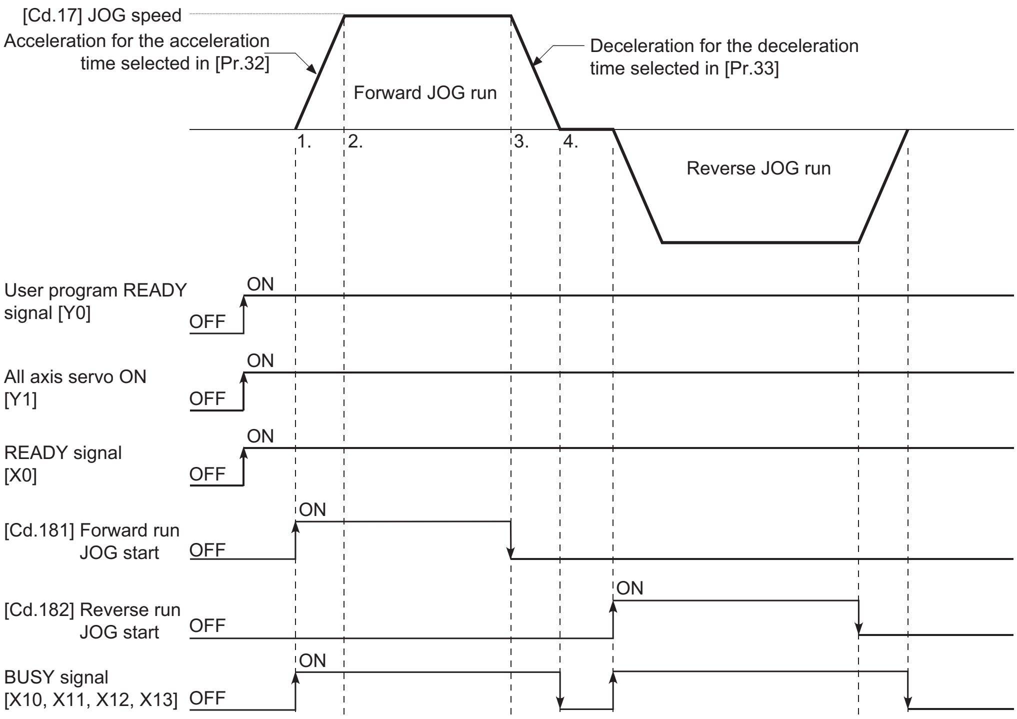
Operation

In JOG operation, the forward run JOG start signal [Cd.181] or reverse run JOG start signal [Cd.182] turns ON, causing pulses to be output to the servo amplifier from the Simple Motion board while the signal is ON. The workpiece is then moved in the designated direction.

The following shows examples of JOG operation.

■Axis 1 to 4 operation example

1. When the start signal turns ON, acceleration begins in the direction designated by the start signal, and continues for the acceleration time designated in "[Pr.32] JOG operation acceleration time selection". At this time, the BUSY signal changes from OFF to ON.
2. When the workpiece being accelerated reaches the speed set in "[Cd.17] JOG speed", the movement continues at this speed. The constant speed movement takes place at 2. and 3.
3. When the start signal is turned OFF, deceleration begins from the speed set in "[Cd.17] JOG speed", and continues for the deceleration time designated in "[Pr.33] JOG operation deceleration time selection".
4. The operation stops when the speed becomes "0". At this time, the BUSY signal changes from ON to OFF.



Restriction

Use the hardware stroke limit function when carrying out JOG operation near the upper or lower limits.
(☞ Page 241 Hardware stroke limit function)
If the hardware stroke limit function is not used, the workpiece may exceed the moving range, causing an accident.

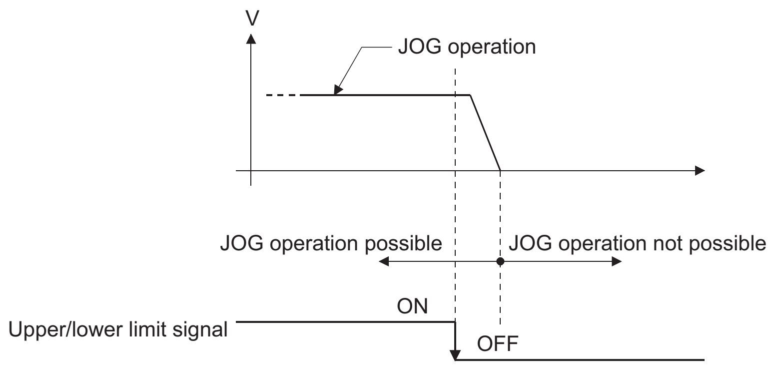
Precautions during operation

The following details must be understood before carrying out JOG operation.

- For safety, set a small value to "[Cd.17] JOG speed" at first and check the movement. Then gradually increase the value.
- The error "Outside JOG speed range" (error code: 1980H) will occur and the operation will not start if the "JOG speed" is outside the setting range at the JOG start.
- The error "JOG speed limit value error" (error code: 1AB7H, 1AB8H) will occur and the operation will not start if "[Pr.31] JOG speed limit value" is set to a value larger than "[Pr.8] Speed limit value".
- If "[Cd.17] JOG speed" exceeds the speed set in "[Pr.31] JOG speed limit value", the workpiece will move at the "[Pr.31] JOG speed limit value" and the warning "JOG speed limit value" (warning code: 0981H, 0982H) will occur in the Simple Motion board.
- The JOG operation can be continued even if an "Axis warning" has occurred.
- Set a "0" in "[Cd.16] Inching movement amount". If a value other than "0" is set, the operation will become an inching operation. (☞ Page 171 Inching Operation)

Operations when stroke limit error occurs

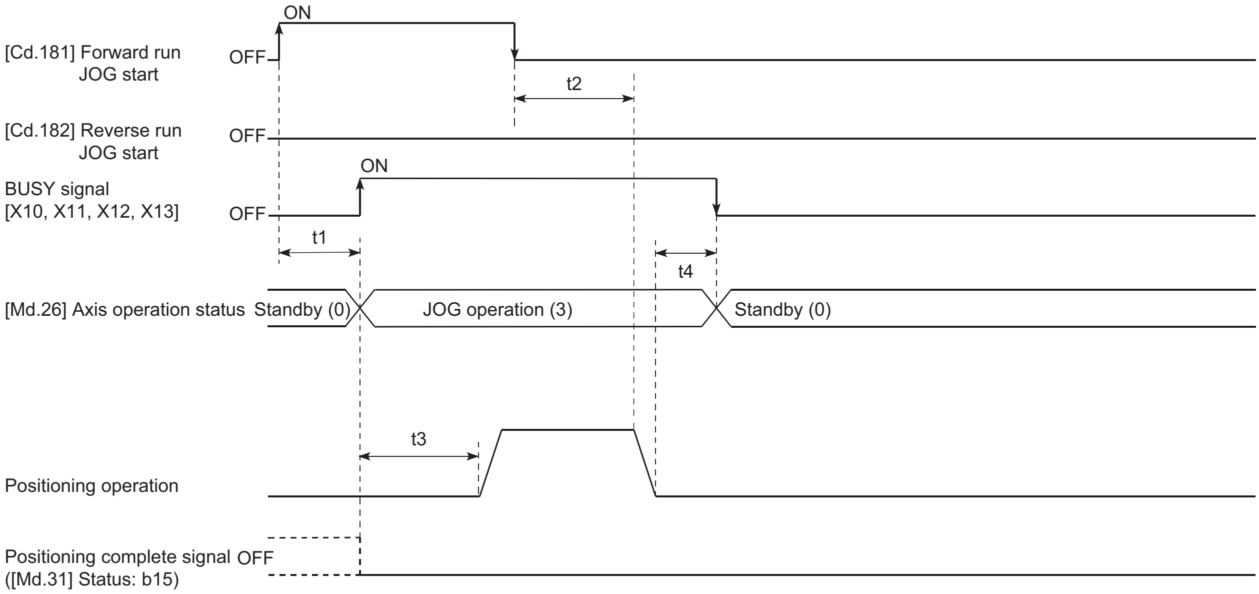
When the operation is stopped by hardware stroke limit error or software stroke limit error, the JOG operation can execute in an opposite way (direction within normal limits) after an error reset. (An error will occur again if JOG start signal is turned ON in a direction to outside the stroke limit.)



Operation timing and processing time

The following drawing shows details of the JOG operation timing and processing time.

■Axis 1 to 4 operation example



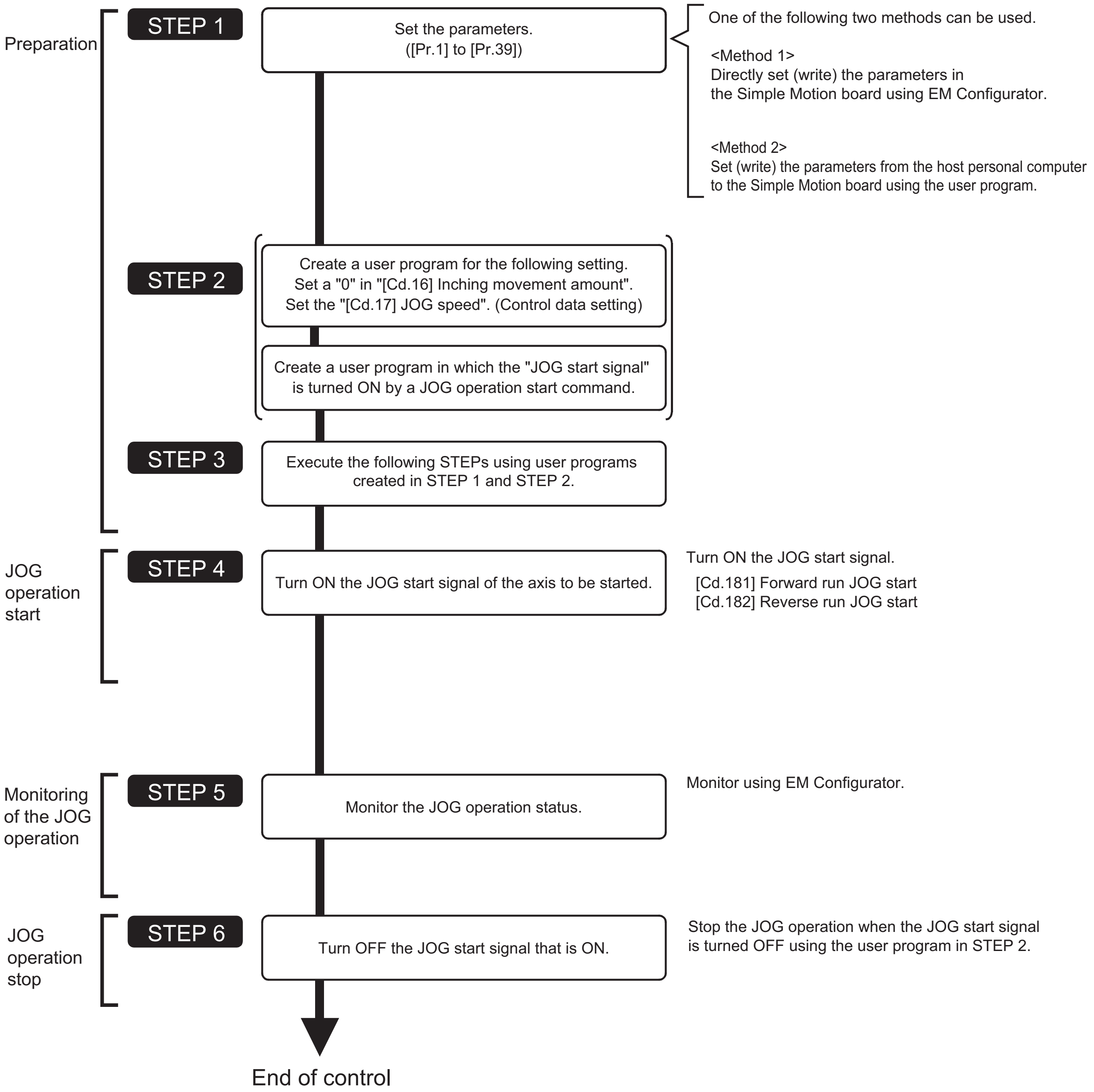
Normal timing time (Unit: [ms])

Operation cycle	t1[*1]	t2	t3	t4
0.50	0.166 to 0.634	0.000 to 0.500	1.313 to 1.491	0.000 to 0.500
1.00	0.299 to 1.083	0.000 to 1.000	2.802 to 2.934	0.000 to 1.000
2.00	0.267 to 2.152	0.000 to 2.000	5.897 to 5.938	0.000 to 2.000
4.00	0.246 to 3.795	0.000 to 4.000	11.905 to 11.936	0.000 to 4.000

*1 Delays may occur in the t1 timing time due to the operation status of other axes.

JOG operation execution procedure

The JOG operation is carried out by the following procedure.



Point

- Mechanical elements such as limit switches are considered as already installed.
- Parameter settings work in common for all control using the Simple Motion board.

Point

[API library]
- To start the JOG operation, use the MMC_Axis::StartJog method.
- To stop the JOG operation, use the MMC_Axis::StopJog method.
- To wait until the axis is stopped, use the MMC_Axis::WaitPositioningDone method or the MMC_Axis::WaitPositioningDoneIntEvent method.

Setting the required parameters for JOG operation

The "Positioning parameters" must be set to carry out JOG operation.

The following table shows the setting items of the required parameters for carrying out JOG operation. Parameters not shown below are not required to be set for carrying out only JOG operation. (Set the initial value or a value within the setting range.)

◎: Setting always required.

○: Set according to requirements (Set the initial value or a value within the setting range when not used.)

Setting item			Setting requirement
Positioning parameters	[Pr.1]	Unit setting	◎
	[Pr.2]	Number of pulses per rotation (AP) (Unit: pulse)	◎
	[Pr.3]	Movement amount per rotation (AL) (Unit: pulse)	◎
	[Pr.4]	Unit magnification (AM)	◎
	[Pr.7]	Bias speed at start (Unit: pulse/s)	○
	[Pr.8]	Speed limit value (Unit: pulse/s)	◎
	[Pr.9]	Acceleration time 0 (Unit: ms)	◎
	[Pr.10]	Deceleration time 0 (Unit: ms)	◎
	[Pr.11]	Backlash compensation amount (Unit: pulse)	○
	[Pr.12]	Software stroke limit upper limit value (Unit: pulse)	○
	[Pr.13]	Software stroke limit lower limit value (Unit: pulse)	○
	[Pr.14]	Software stroke limit selection	○
	[Pr.15]	Software stroke limit valid/invalid setting	○
	[Pr.17]	Torque limit setting value (Unit: 0.1%)	○
	[Pr.25]	Acceleration time 1 (Unit: ms)	○
	[Pr.26]	Acceleration time 2 (Unit: ms)	○
	[Pr.27]	Acceleration time 3 (Unit: ms)	○
	[Pr.28]	Deceleration time 1 (Unit: ms)	○
	[Pr.29]	Deceleration time 2 (Unit: ms)	○
	[Pr.30]	Deceleration time 3 (Unit: ms)	○
	[Pr.31]	JOG speed limit value (Unit: pulse/s)	◎
	[Pr.32]	JOG operation acceleration time selection	◎
	[Pr.33]	JOG operation deceleration time selection	◎
	[Pr.34]	Acceleration/deceleration process selection	○
	[Pr.35]	S-curve ratio (Unit: %)	○
	[Pr.36]	Rapid stop deceleration time (Unit: ms)	○
	[Pr.37]	Stop group 1 rapid stop selection	○
	[Pr.38]	Stop group 2 rapid stop selection	○
	[Pr.39]	Stop group 3 rapid stop selection	○

Refer to the following for the setting details.

☞ Page 453 Basic Setting

Point

- Parameter settings work in common for all controls using the Simple Motion board. When carrying out other controls ("major positioning control", "high-level positioning control", "home position return positioning control"), set the respective setting items as well.
- Parameters are set for each axis.

Creating start programs for JOG operation

A user program must be created to execute a JOG operation. Consider the "required control data setting", "start conditions" and "start time chart" when creating the user program.

The following shows an example when a JOG operation is started for axis 1. ("[Cd.17] JOG speed" is set to "100.00 mm/min" in the example shown.)

Required control data setting

The control data shown below must be set to execute a JOG operation. The setting is carried out with the user program.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.16]	Inching movement amount	0	Set "0".	4317+100n
[Cd.17]	JOG speed	10000	Set a value equal to or below the "[Pr.31] JOG speed limit value".	4318+100n 4319+100n

Refer to the followings for the setting details.

☞ Page 543 Control Data

For labels, refer to the following.

☞ Page 437 Axis control data

Start conditions

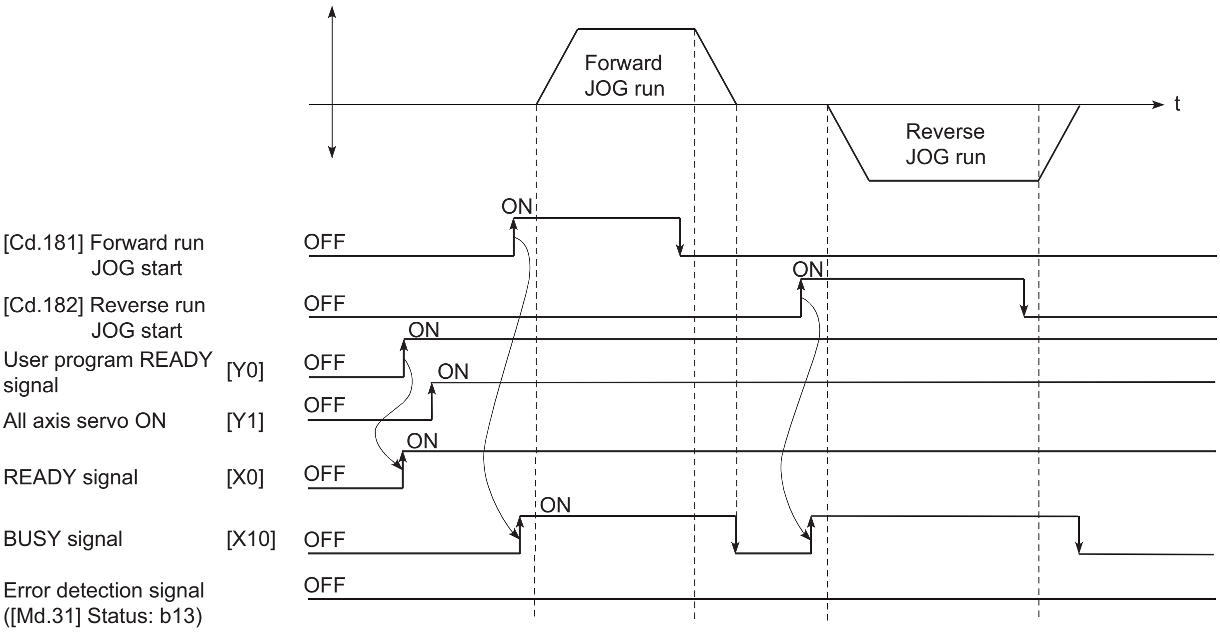
The following conditions must be fulfilled when starting. The required conditions must also be assembled in the user program, and the user program must be configured so the operation will not start if the conditions are not fulfilled.

Signal name		Signal state		Device
Interface signal	User program READY signal	ON	Host personal computer preparation completed	Y0
	READY signal	ON	Preparation completed	X0
	All axis servo ON	ON	All axis servo ON	Y1
	Synchronization flag[*1]	ON	The buffer memory can be accessed.	X1
	Axis stop signal	OFF	Axis stop signal is OFF	[Cd.180] Axis stop
	Start complete signal	OFF	Start complete signal is OFF	[Md.31] Status: b14
	BUSY signal	OFF	Not operating	X10 to X1F
	Error detection signal	OFF	There is no error	[Md.31] Status: b13
	M code ON signal	OFF	M code ON signal is OFF	[Md.31] Status: b12
External signal	Forced stop input signal	ON	There is no forced stop input	—
	Stop signal	OFF	Stop signal is OFF	—
	Upper limit (FLS)	ON	Within limit range	—
	Lower limit (RLS)	ON	Within limit range	—

*1 The interlock must be provided so that the buffer memory is accessed after Synchronization flag [X1] turns on. When no interlock is provided, an unexpected value may be read or written.

Start time chart

■Axis 1 to 4 operation example



Program example

Refer to the followings for the user program example of the JOG operation.

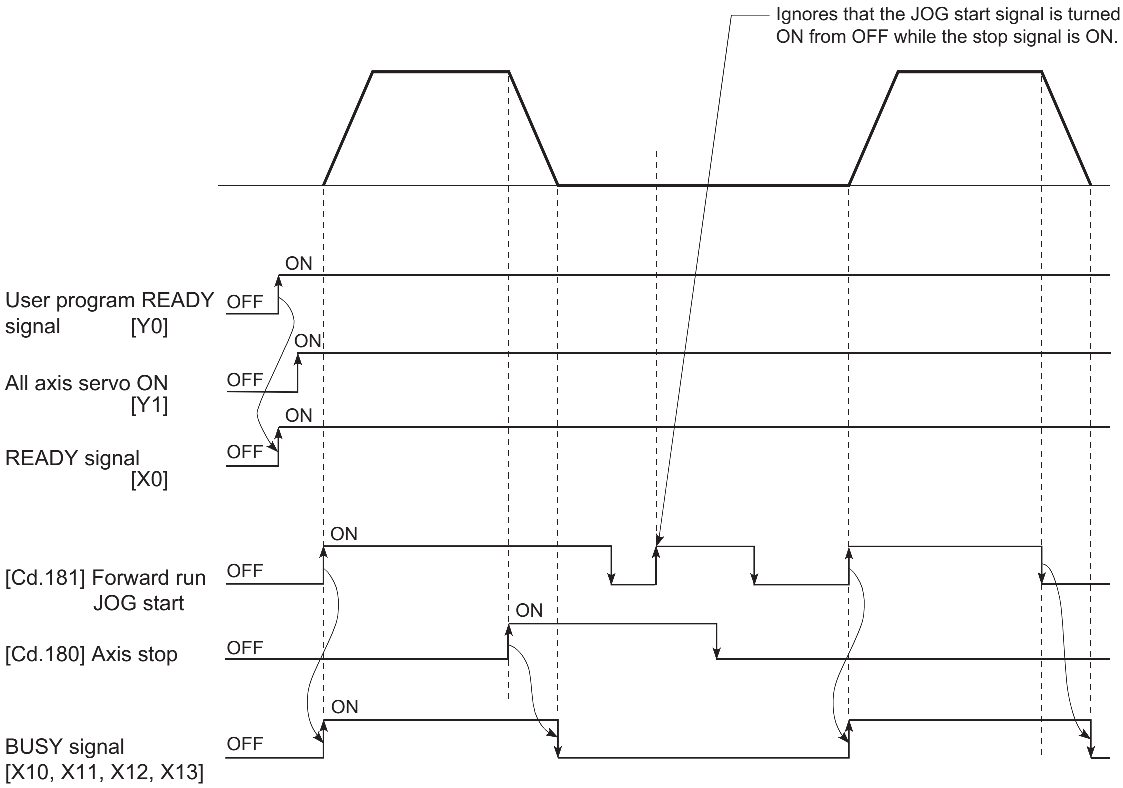
☞ Page 600 JOG operation setting program/JOG operation execution program

JOG operation example

Example 1

When the "stop signal" is turned ON during JOG operation, the JOG operation will stop by the "deceleration stop" method.
If the JOG start signal is turned ON while the stop signal is ON, the error "Stop signal ON at start" (error code: 1908H) will occur.
The inching operation can be re-started when the stop signal is turned OFF and the JOG start signal is turned ON from OFF.

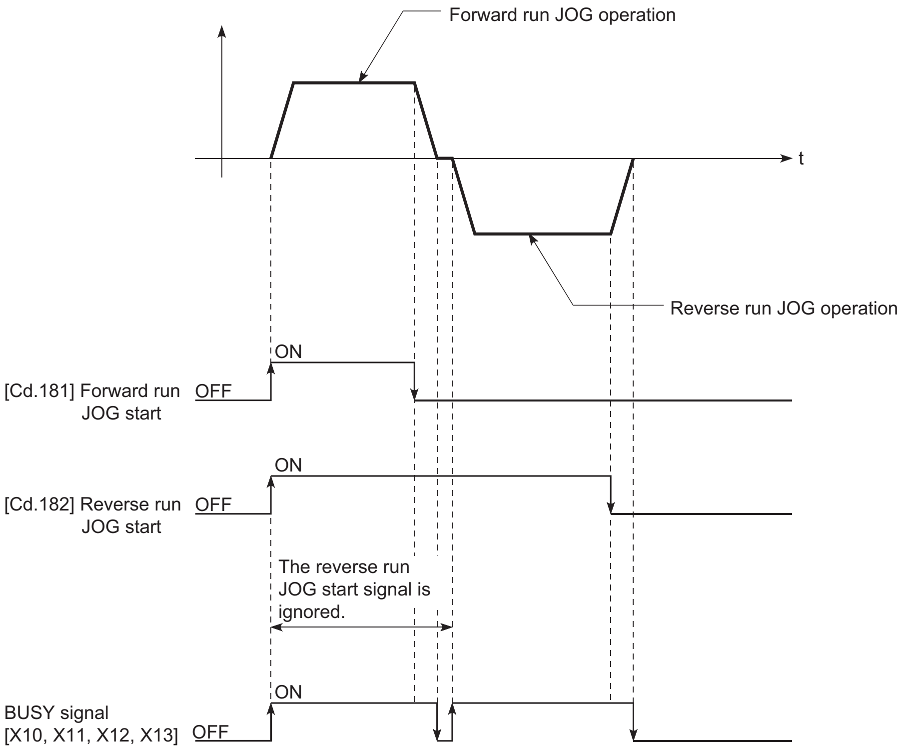
■Axis 1 to 4 operation example



Example 2

When both the "forward run JOG start signal" and "reverse run JOG start signal" are turned ON simultaneously for one axis, the "forward run JOG start signal" is given priority. In this case, the "reverse run JOG start signal" is validated when the BUSY signal of Simple Motion board is turned OFF. If the forward run JOG operation is stopped due to stop by a stop signal or axis error, the reverse run JOG operation will not be executed even if the "reverse run JOG start signal" turns ON.

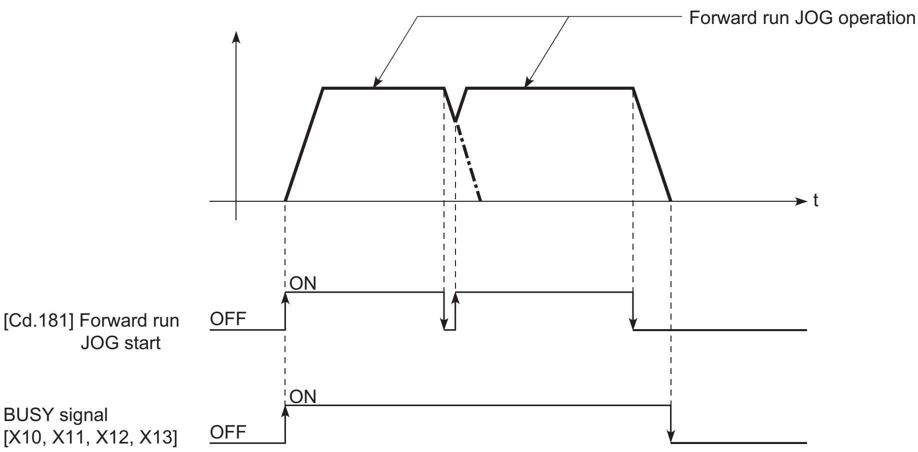
■Axis 1 to 4 operation example



Example 3

When the "JOG start signal" is turned ON again during deceleration caused by the ON → OFF of the "JOG start signal", the JOG operation will be carried out from the time the "JOG start signal" is turned ON.

■Axis 1 to 4 operation example



5.3 Inching Operation

Outline of inching operation

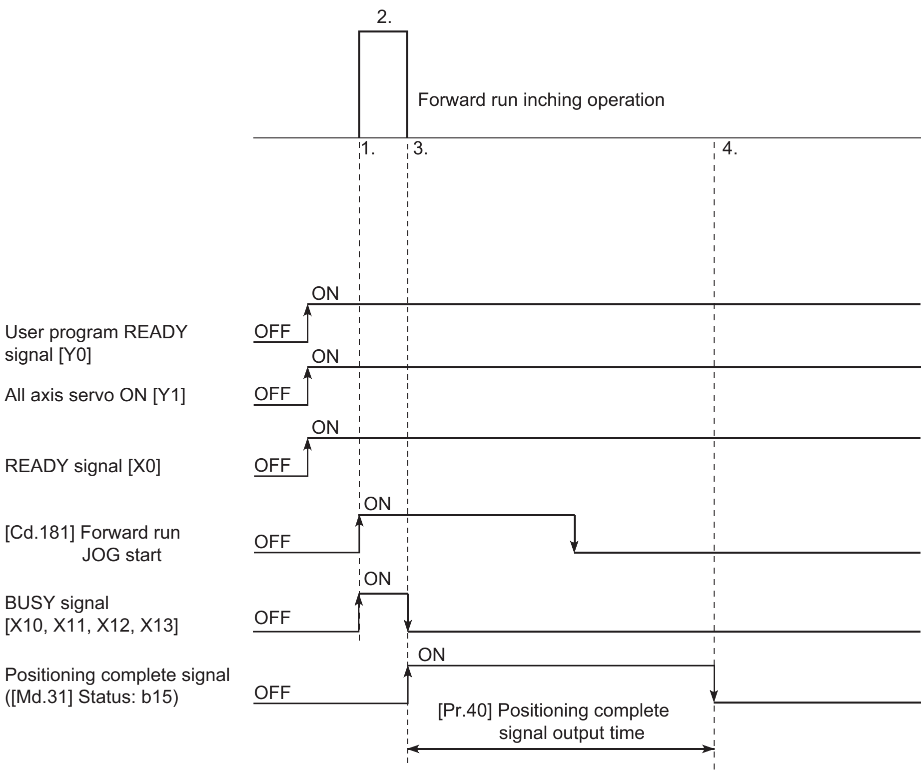
Operation

In inching operation, pulses are output to the servo amplifier at operation cycle to move the workpiece by a designated movement amount after the forward run JOG start signal [Cd.181] or reverse JOG start signal [Cd.182] is turned ON.

The following shows the example of inching operation.

1. When the start signal is turned ON, inching operation is carried out in the direction designated by the start signal. In this case, BUSY signal is turned from OFF to ON.
2. The workpiece is moved by a movement amount set in "[Cd.16] Inching movement amount".
3. The workpiece movement stops when the speed becomes "0". In this case, BUSY signal is turned from ON to OFF. The positioning complete signal is turned from OFF to ON.
4. The positioning complete signal is turned from ON to OFF after a time set in "[Pr.40] Positioning complete signal output time" has been elapsed.

■Axis 1 to 4 operation example



Restriction

When the inching operation is carried out near the upper or lower limit, use the hardware stroke limit function.
(☞ Page 241 Hardware stroke limit function)
If the hardware stroke limit function is not used, the workpiece may exceed the movement range, and an accident may result.

Precautions during operation

The following details must be understood before inching operation is carried out.

- Acceleration/deceleration processing is not carried out during inching operation.

(Commands corresponding to the designated inching movement amount are output at operation cycle. When the movement direction of inching operation is reversed and backlash compensation is carried out, the backlash compensation amount and inching movement amount are output at the same operation cycle.)

The "[Cd.17] JOG speed" is ignored even if it is set. The error "Inching movement amount error" (error code: 1981H) will occur in the following case.

([Cd.16] Inching movement amount) × (A) > ([Pr.31] JOG speed limit value)

However, (A) is as follows.

Unit: [ms]

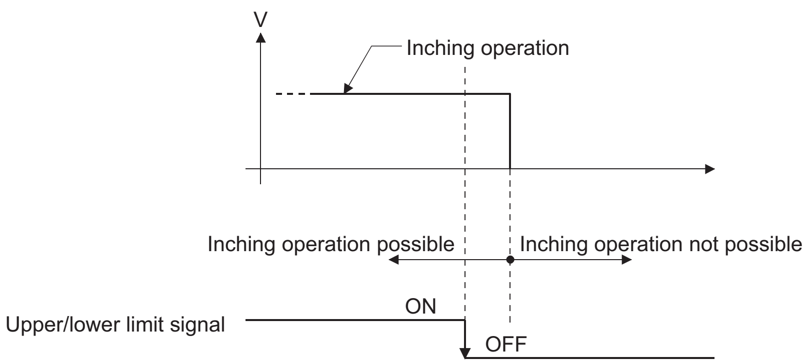
Unit setting	Operation cycle			
	0.50 ms	1.00 ms	2.00 ms	4.00 ms
When the unit setting is pulse	2000	1000	500	250
When the unit setting is degree and the "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid	120	60	30	15
When the unit setting is other than the above	1200	600	300	150

- Set a value other than a "0" in "[Cd.16] Inching movement amount".

If a "0" is set, the operation will become JOG operation. (☞ Page 162 JOG Operation)

Operations when stroke limit error occurs

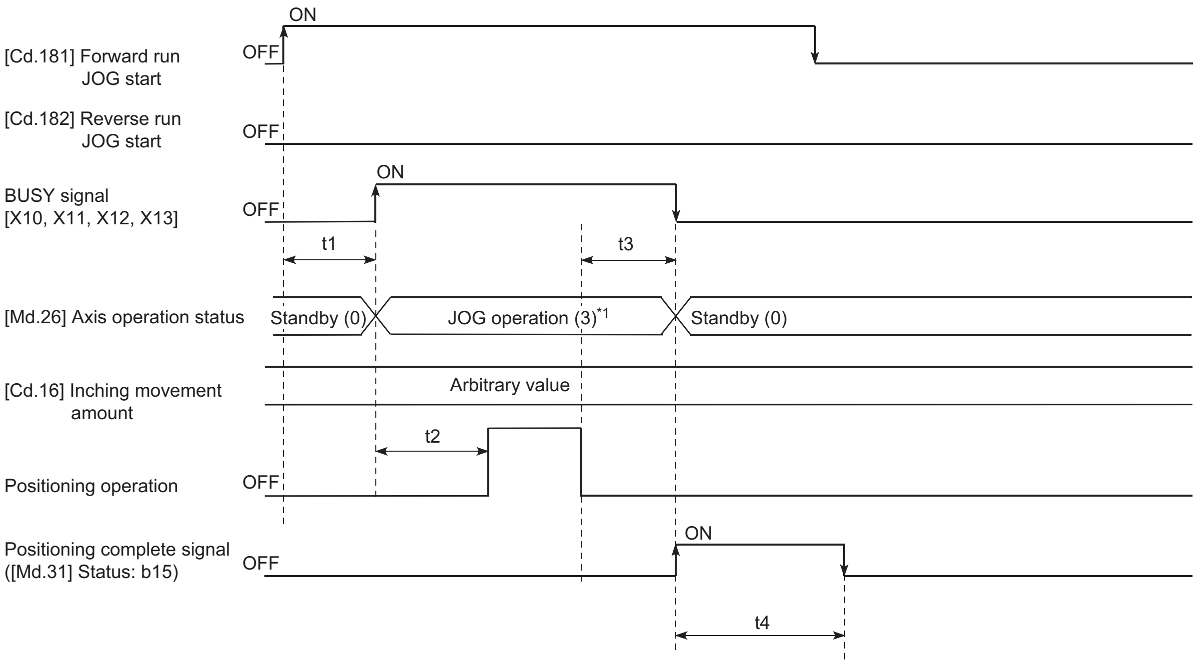
When the operation is stopped by hardware stroke limit error or software stroke limit error, the inching operation can be performed in an opposite way (direction within normal limits) after an error reset. (An error will occur again if JOG start signal is turned ON in a direction to outside the stroke limit.)



Operation timing and processing times

The following drawing shows the details of the inching operation timing and processing time.

■Axis 1 to 4 operation example



*1 "JOG operation" is set in "[Md.26] Axis operation status" even during inching operation.

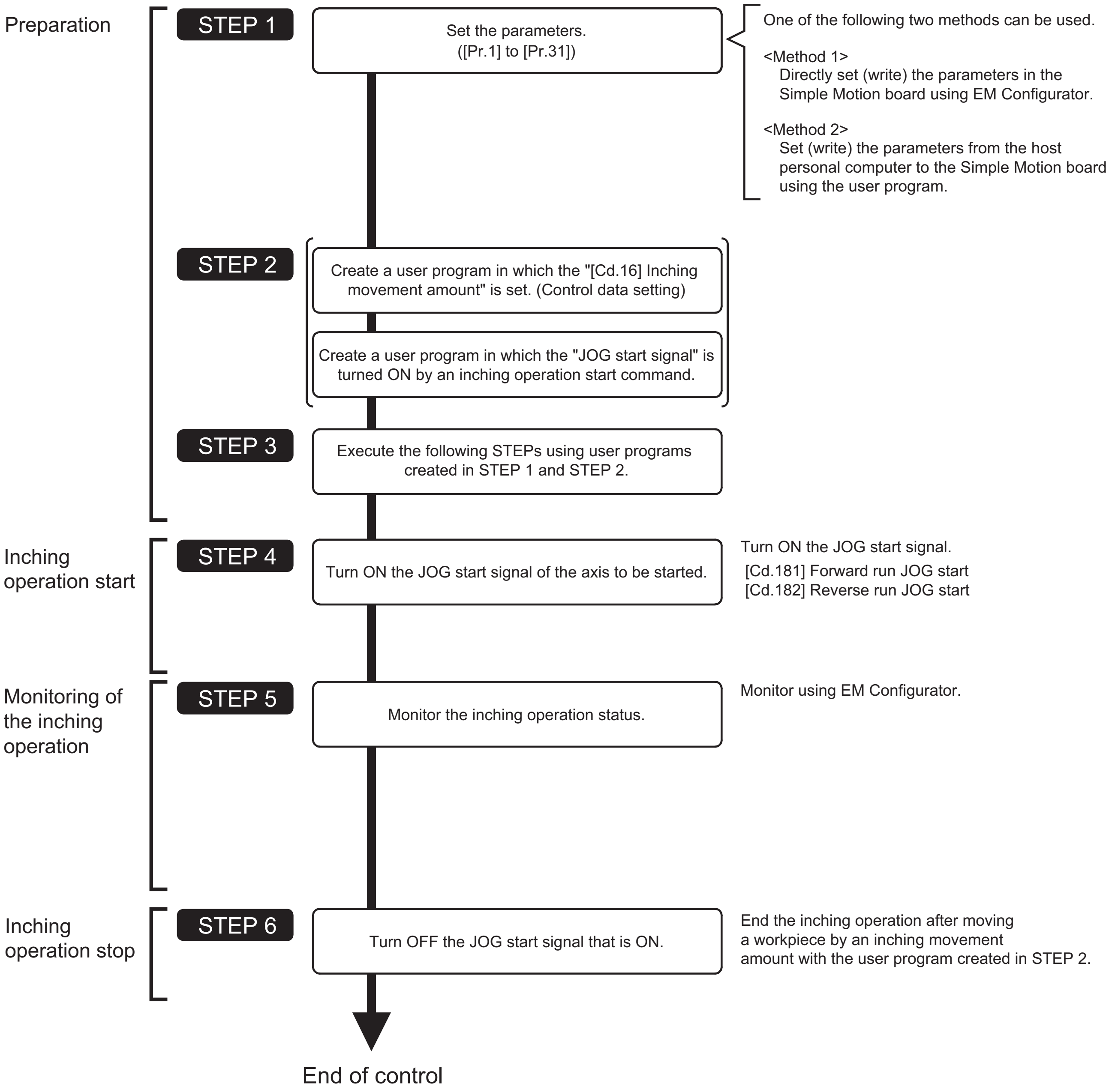
Normal timing time (Unit: [ms])

Operation cycle	t1*1	t2	t3	t4
0.50	0.214 to 0.665	1.320 to 1.493	0.000 to 0.500	Follows parameters
1.00	0.182 to 1.128	2.805 to 2.940	0.000 to 1.000	Follows parameters
2.00	0.648 to 2.112	5.911 to 5.944	0.000 to 2.000	Follows parameters
4.00	0.391 to 4.094	11.908 to 11.943	0.000 to 4.000	Follows parameters

*1 Depending on the operating statuses of the other axes, delay may occur in the t1 timing time.

Inching operation execution procedure

The inching operation is carried out by the following procedure.



Point

- Mechanical elements such as limit switches are considered as already installed.
- Parameter settings work in common for all control using the Simple Motion board.

Point

[API library]
To start the inching operation, use the MMC_Axis::StartInching method. Wait until the axis is stopped in this method.

Setting the required parameters for inching operation

The "Positioning parameters" must be set to carry out inching operation.
The following table shows the setting items of the required parameters for carrying out inching operation. Parameters not shown below are not required to be set for carrying out only inching operation. (Set the initial value or a value within the setting range.)

◎: Setting always required.

○: Set according to requirements (Set the initial value or a value within the setting range when not used.)

Setting item			Setting requirement
Positioning parameters	[Pr.1]	Unit setting	◎
	[Pr.2]	Number of pulses per rotation (AP) (Unit: pulse)	◎
	[Pr.3]	Movement amount per rotation (AL) (Unit: pulse)	◎
	[Pr.4]	Unit magnification (AM)	◎
	[Pr.11]	Backlash compensation amount (Unit: pulse)	○
	[Pr.12]	Software stroke limit upper limit value (Unit: pulse)	○
	[Pr.13]	Software stroke limit lower limit value (Unit: pulse)	○
	[Pr.14]	Software stroke limit selection	○
	[Pr.15]	Software stroke limit valid/invalid setting	○
	[Pr.17]	Torque limit setting value (Unit: 0.1%)	○
	[Pr.31]	JOG speed limit value (Unit: pulse/s)	◎

Refer to the following for the setting details.

☞ Page 453 Basic Setting

Point

- Positioning parameter settings work in common for all controls using the Simple Motion board. When carrying out other controls ("major positioning control", "high-level positioning control", and "home position return control"), set the respective setting items as well.
- Parameters are set for each axis.

Creating a program to enable/disable the inching operation

A user program must be created to execute an inching operation. Consider the "required control data setting", "start conditions", and "start time chart" when creating the user program.

The following shows an example when an inching operation is started for axis 1. (The example shows the inching operation when a "10.0 μm" is set in "[Cd.16] Inching movement amount".)

Required control data setting

The control data shown below must be set to execute an inching operation. The setting is carried out with the user program.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.16]	Inching movement amount	100	Set the setting value so that the JOG speed limit value is not increased larger than the maximum output pulse	4317+100n

Refer to the following for the setting details.

☞ Page 543 Control Data

For labels, refer to the following.

☞ Page 437 Axis control data

Start conditions

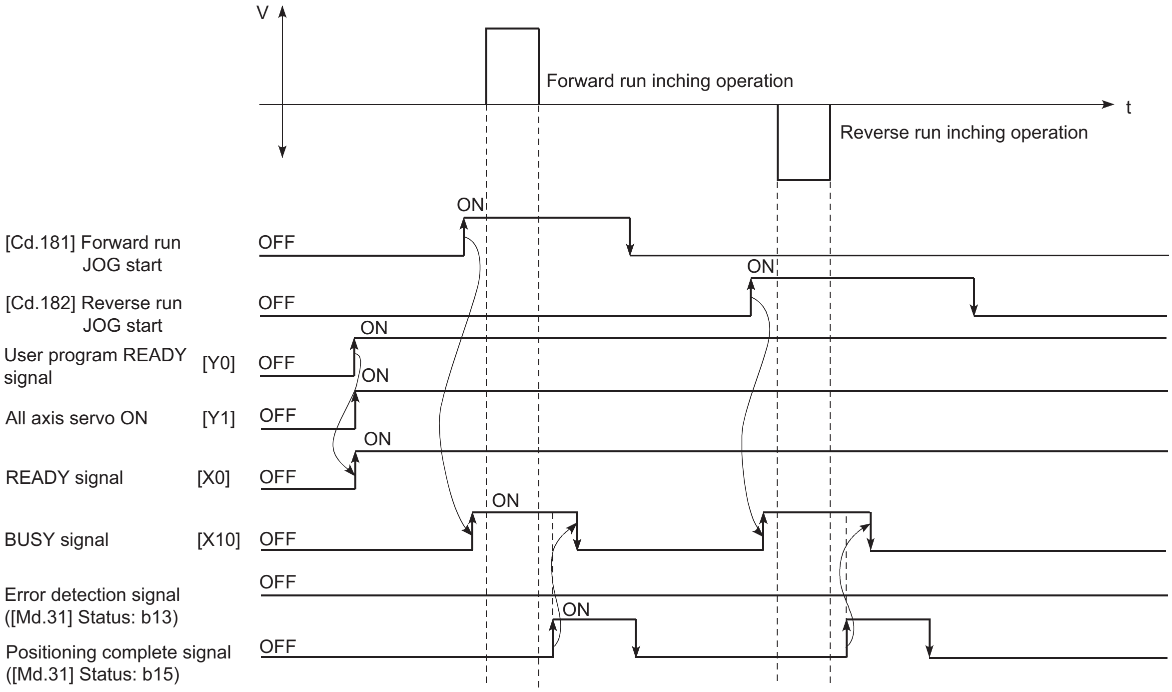
The following conditions must be fulfilled when starting. The required conditions must also be assembled in the user program, and the user program must be configured so the operation will not start if the conditions are not fulfilled.

Signal name		Signal state		Device
Interface signal	User program READY signal	ON	Host personal computer preparation completed	Y0
	READY signal	ON	Preparation completed	X0
	All axis servo ON	ON	All axis servo ON	Y1
	Synchronization flag*1	ON	The buffer memory can be accessed.	X1
	Axis stop signal	OFF	Axis stop signal is OFF	[Cd.180] Axis stop
	Start complete signal	OFF	Start complete signal is OFF	[Md.31] Status: b14
	BUSY signal	OFF	Not operating	X10 to X1F
	Positioning complete signal	OFF	Positioning complete signal is OFF	[Md.31] Status: b15
	Error detection signal	OFF	There is no error	[Md.31] Status: b13
	M code ON signal	OFF	M code ON signal is OFF	[Md.31] Status: b12
External signal	Forced stop input signal	ON	There is no forced stop input	—
	Stop signal	OFF	Stop signal is OFF	—
	Upper limit (FLS)	ON	Within limit range	—
	Lower limit (RLS)	ON	Within limit range	—

*1 The interlock must be provided so that the buffer memory is accessed after Synchronization flag [X1] turns on. When no interlock is provided, an unexpected value may be read or written.

Start time chart

■Axis 1 to 4 operation example



Program example

Refer to the followings for the user program example of the inching operation.

☞ Page 600 Inching operation setting program/Inching operation execution program

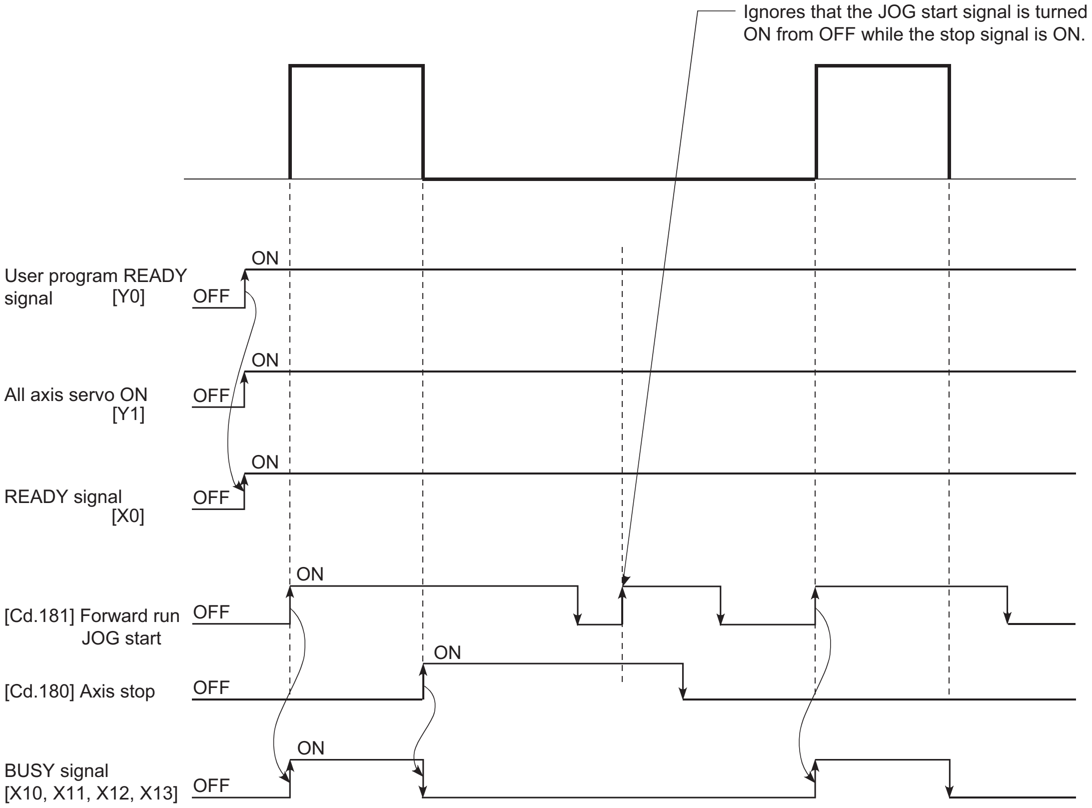
Inching operation example

Example 1

If the JOG start signal is turned ON while the stop signal is ON, the error "Stop signal ON at start" (error code: 1908H) will occur.

The inching operation can be re-started when the stop signal is turned OFF and the JOG start signal is turned ON from OFF.

■Axis 1 to 4 operation example



5.4 Manual Pulse Generator Operation

Outline of manual pulse generator operation

Operation

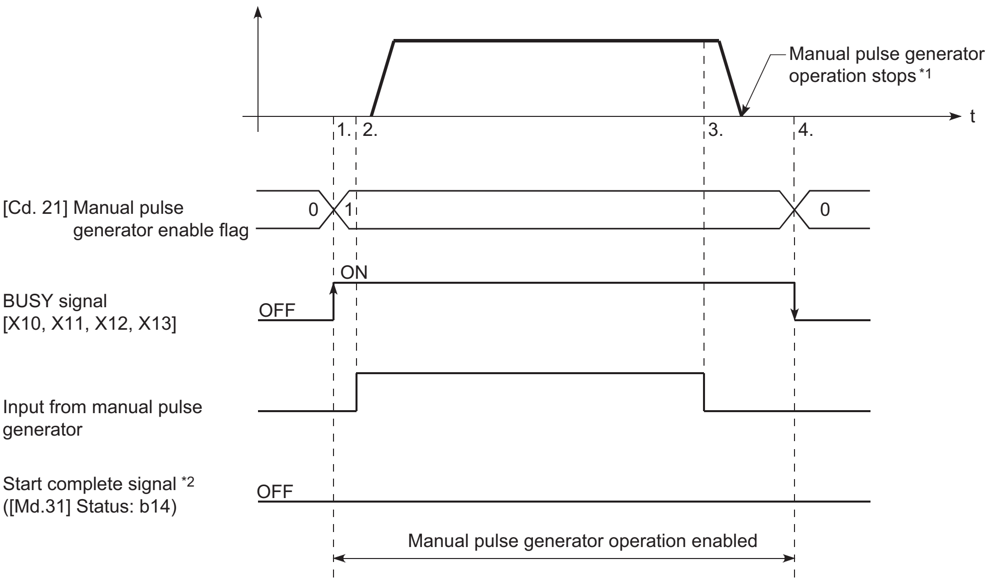
In manual pulse generator operations, pulses are input to the Simple Motion board or the CC-Link IE Field Network device from the manual pulse generator. This causes the same number of input command to be output from the Simple Motion board to the servo amplifier, and the workpiece is moved in the designated direction.

The following shows an example of manual pulse generator operation.

1. When "[Cd.21] Manual pulse generator enable flag" is set to "1", the BUSY signal turns ON and the manual pulse generator operation is enabled.
2. The workpiece is moved corresponding to the number of pulses input from the manual pulse generator.
3. The workpiece movement stops when no more pulses are input from the manual pulse generator.
4. When "[Cd.21] Manual pulse generator enable flag" is set to "0", the BUSY signal turns OFF and the manual pulse generator operation is disabled.

5

■Axis 1 to 4 operation example



*1 If the input from the manual pulse generator stops or "0" is set in "[Cd.21] Manual pulse generator enable flag" during manual pulse generator operation, the machine will decelerate to a stop.

*2 The start complete signal does not turn ON in manual pulse generator operation.

Restriction

- Create the user program so that "[Cd.21] Manual pulse generator enable flag" is always set to "0" (disabled) when a manual pulse generator operation is not carried out. Mistakenly touching the manual pulse generator when the "manual pulse generator enable flag" is set to "1" (enable) can cause accidents or incorrect positioning.
- A pulse generator such as a manual pulse generator is required to carry out manual pulse generator operation.

Precautions during operation

The following details must be understood before carrying out manual pulse generator operation.

- If "[Pr.123] Manual pulse generator speed limit value" is set to a value larger than "[Pr.8] Speed limit value", the error "Manual pulse generator speed limit value error" (error code: 1ABBH) will occur and the operation will not start.
- If "[Cd.21] Manual pulse generator enable flag" is turned ON while the Simple Motion board is BUSY (BUSY signal ON), the warning "Start during operation" (warning code: 0900H) will occur.
- If a stop factor occurs during manual pulse generator operation, the operation will stop, and the BUSY signal will turn OFF. At this time, "[Cd.21] Manual pulse generator enable flag" will remain ON. However, manual pulse generator operation will not be possible. To carry out manual pulse generator operation again, measures must be carried out to eliminate the stop factor. Once eliminated, the operation can be carried out again by turning "[Cd.21] Manual pulse generator enable flag" ON → OFF → ON. (Note that this excludes hardware/software stroke limit error.)
- Command will not be output if an error occurs when the manual pulse generator operation starts.

Restriction

The speed command is issued according to the input from the manual pulse generator irrelevant of the speed limit setting. When the speed command is larger than 62914560 [pulse/s], the servo alarm "Command frequency error" (alarm No.: 35) will occur.

The following calculation formula is used to judge whether or not a servo alarm will occur.

$$(\text{Speed command}) = \begin{array}{l}\text{Number of}\\ \text{input pulses}\\ \text{for one}\\ \text{second}\end{array} \times \begin{array}{l}\text{Manual pulse}\\ \text{generator 1}\\ \text{pulse input}\\ \text{magnification}\end{array} \times \begin{array}{l}\text{Manual pulse}\\ \text{generator 1}\\ \text{pulse movement}\\ \text{amount}\end{array} \times \frac{\text{Number of pulses per rotation}}{\text{Movement amount per rotation}}$$

If a large value is set to the manual pulse generator 1 pulse input magnification, there is a high possibility of the servo alarm "Command frequency error" (alarm No.: 35) occurrence. Note that the servomotor does not work rapidly by rapid pulse input even if the servo alarm does not occur.

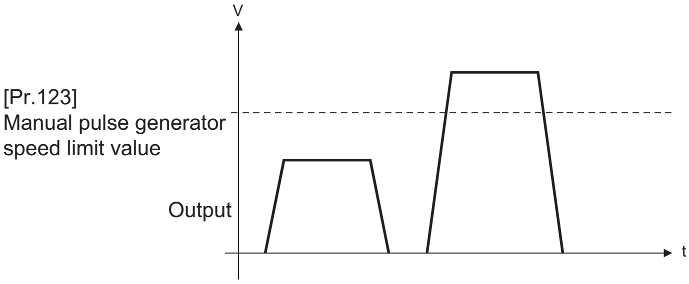
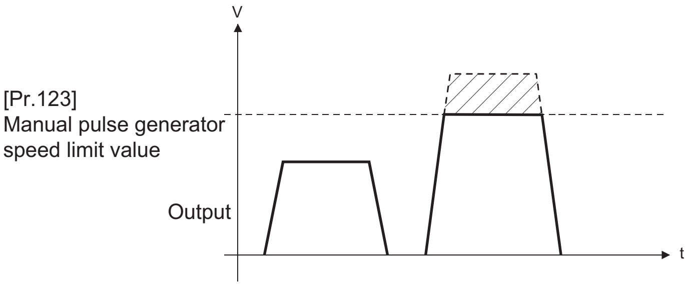
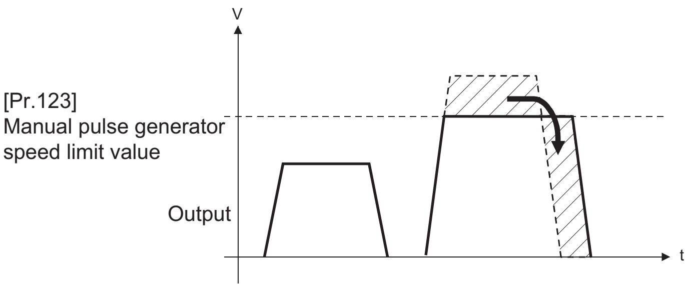
Point

- Connect a manual pulse generator to the CC-Link IE Field Network device set with the link device external signal assignment parameter.
- The Simple Motion board can simultaneously command to multiple servo amplifiers by one manual pulse generator. (Axis 1 to the number of maximum control axes)

Manual pulse generator speed limit mode

In "[Pr.122] Manual pulse generator speed limit mode", the output operation which exceeds "[Pr.123] Manual pulse generator speed limit value" can be set during manual pulse generator operation.

The setting value and operation for "[Pr.122] Manual pulse generator speed limit mode" are shown below.

Setting value	Operation
0	The speed limit by "[Pr.123] Manual pulse generator speed limit value" is not executed. 
1	The pulses which exceed "[Pr.123] Manual pulse generator speed limit value" are not output.*1 
2	The pulses which exceed "[Pr.123] Manual pulse generator speed limit value" are output later. The overcarrying movement amount which exceeds "[Pr.123] Manual pulse generator speed limit value" can be checked in "[Md.62] Amount of the manual pulser driving carrying over movement" (-2147483648 to 2147483647). When the movement amount which exceeds "[Pr.123] Manual pulse generator speed limit value" is generated continuously and "[Md.62] Amount of the manual pulser driving carrying over movement" exceeds tolerance (-2147483648 to 2147483647), the error "Overcarrying movement amount overflow in manual pulse generator" (error code: 1982H) occurs and a deceleration stop is executed.*2 

*1 When exceeding "[Pr.123] Manual pulse generator speed limit value", the input from the manual pulse generator is not the same as the output from the Simple Motion board.

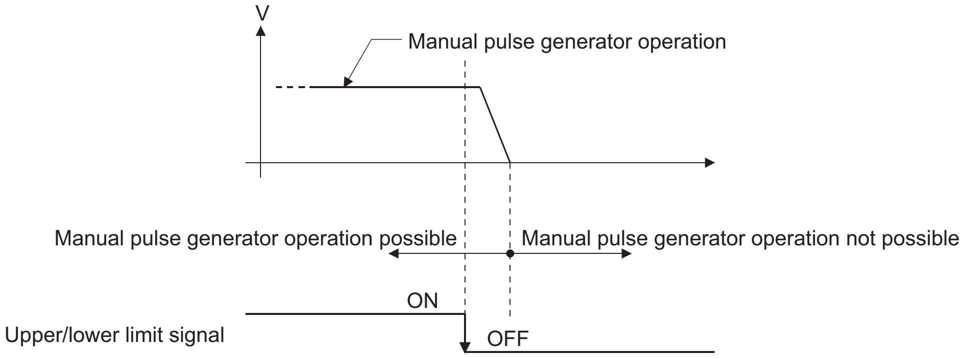
*2 When the pulses which exceed "[Pr.123] Manual pulse generator speed limit value" are large, it takes time between when the input from the manual pulse generator stops and when the output from the Simple Motion board stops.

When "1: Don't output over value of speed limit" or "2: Output over value of speed limit later" is set in "[Pr.122] Manual pulse generator speed limit mode", the warning "Outside manual pulse generator speed limit value" (warning code: 0989H) occurs at exceeding "[Pr.123] Manual pulse generator speed limit value".

Operations when stroke limit error occurs

When the hardware stroke limit error or the software stroke limit error is detected[*1] during operation, the operation will decelerate to a stop. However, in case of "[Md.26] Axis operation status", "Manual pulse generator operation" will continue[*1]. After stopping, input pulses from a manual pulse generator to the outside direction of the limit range are not accepted, but operation can be executed within the range.

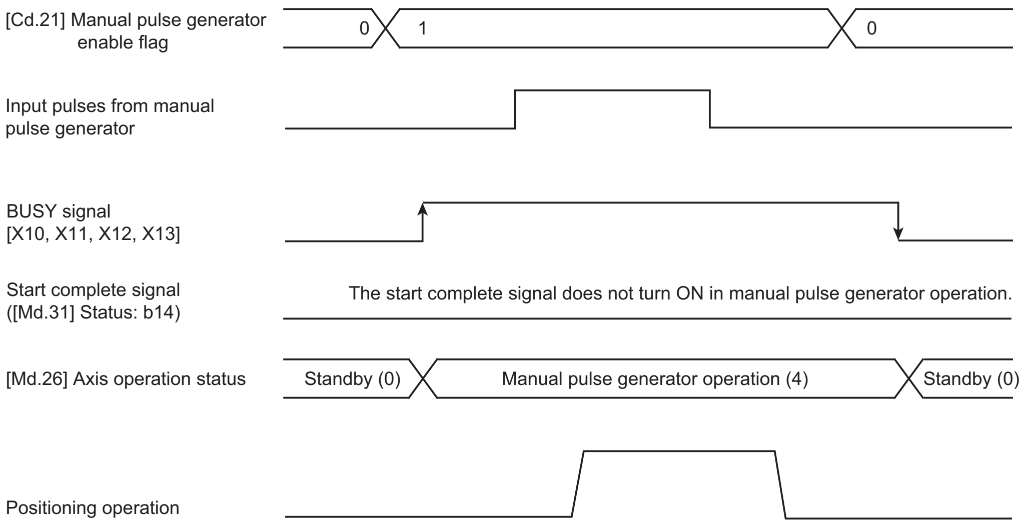
*1 Only when the feed current value or the feed machine value overflows or underflows during deceleration, the manual pulse generator operation will terminate as "error occurring". To carry out manual pulse generator operation again, "[Cd.21] Manual pulse generator enable flag" must be turned OFF once and turn ON.



Operation timing

The following drawing shows details of the manual pulse generator operation timing.

■Axis 1 to 4 operation example



Position control by manual pulse generator operation

In manual pulse generator operation, the position is moved by a "manual pulse generator 1 pulse movement amount" per pulse. The feed current value in the positioning control by manual pulse generator operation can be calculated using the expression shown below.

Feed current value = Number of input pulses × [Cd.20] Manual pulse generator 1 pulse input magnification × Manual pulse generator 1 pulse movement amount

[Pr.1] Unit setting	mm	inch	degree	pulse
Manual pulse generator 1 pulse movement amount	0.1 μm	0.00001 inch	0.00001 degree	1 pulse

For example, when "[Pr.1] Unit setting" is mm and "[Cd.20] Manual pulse generator 1 pulse input magnification" is 2, and 100 pulses are input from the manual pulse generator, the feed current value is as follows.

100 × 2 × 0.1 = 20 [μm] ("[Md.20] Feed current value" = 200)

The number of pulses output actually to the servo amplifier is "Manual pulse generator 1pulse movement amount/movement amount per pulse".

The movement amount per pulse can be calculated using the expression shown below.

$$\text{Movement amount per pulse} = \frac{\text{[Pr.3] Movement amount per rotation(AL)}}{\text{[Pr.2] Number of pulses per rotation(AP)}} \times \text{[Pr.4] Unit magnification(AM)}$$

For example, when "[Pr.1] Unit setting" is mm and the movement amount per pulse is 1 μm, 0.1/1 = 1/10, i.e., the output to the servo amplifier per pulse from the manual pulse generator is 1/10 pulse. Thus, the Simple Motion board outputs 1 pulse to the servo amplifier after receiving 10 pulses from the manual pulse generator.

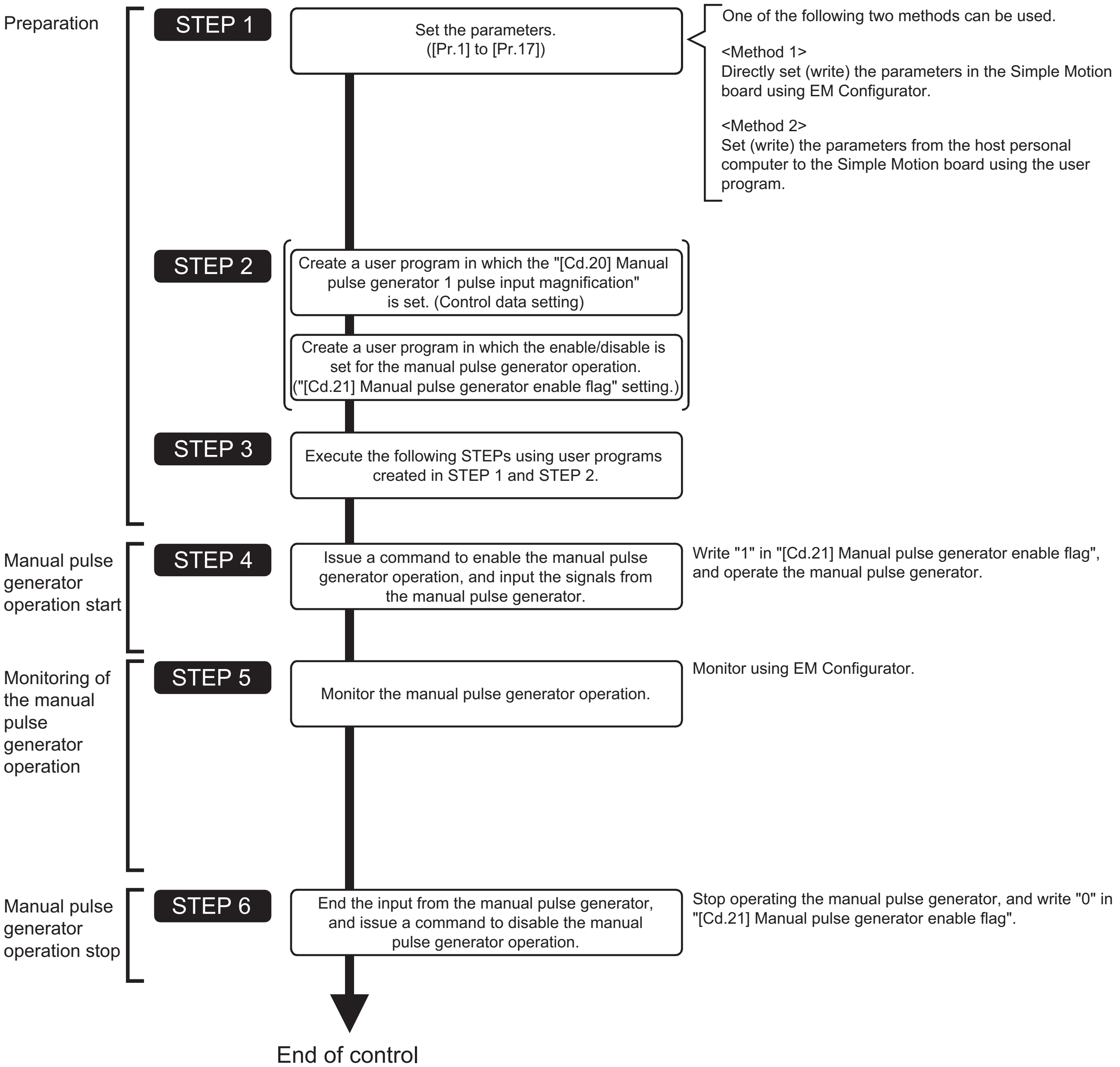
Speed control by manual pulse generation operation

The speed during positioning control by manual pulse generator operation is a speed corresponding to the number of input pulses per unit time, and can be obtained using the following equation.

Output command frequency = Input frequency × [Cd.20] Manual pulse generator 1 pulse input magnification

Manual pulse generator operation execution procedure

The manual pulse generator operation is carried out by the following procedure.



Point

- Mechanical elements such as limit switches are considered as already installed.
- Parameter settings work in common for all control using the Simple Motion board.

Point

[API library]
- To enable the manual pulse generator operation, use the MMC_Axis::EnableMPG method.
- To disable the manual pulse generator operation, use the MMC_Axis::DisableMPG method.
- To wait until the axis is stopped, use the MMC_Axis::WaitPositioningDone method or the MMC_Axis::WaitPositioningDoneIntEvent method.

Setting the required parameters for manual pulse generator operation

The "Positioning parameters" and "Link device external signal assignment parameters" must be set to carry out manual pulse generator operation.

The following table shows the setting items of the required parameters for carrying out manual pulse generator operation. Parameters not shown below are not required to be set for carrying out only manual pulse generator operation. (Set the initial value or a value within the setting range.)

◎: Setting always required.

○: Set according to requirements (Set the initial value or a value within the setting range when not used.)

Setting item			Setting requirement
Positioning parameters	[Pr.1]	Unit setting	◎
	[Pr.2]	Number of pulses per rotation (AP) (Unit: pulse)	◎
	[Pr.3]	Movement amount per rotation (AL) (Unit: pulse)	◎
	[Pr.4]	Unit magnification (AM)	◎
	[Pr.8]	Speed limit value (Unit: pulse/s)	◎
	[Pr.11]	Backlash compensation amount (Unit: pulse)	○
	[Pr.12]	Software stroke limit upper limit value (Unit: pulse)	○
	[Pr.13]	Software stroke limit lower limit value (Unit: pulse)	○
	[Pr.14]	Software stroke limit selection	○
	[Pr.15]	Software stroke limit valid/invalid setting	○
	[Pr.17]	Torque limit setting value (Unit: 0.1%)	○
Link device external signal assignment parameters	[Pr.700]	Manual pulse generator input: Link device type	◎
	[Pr.701]	Manual pulse generator input: Link device start No.	◎
	[Pr.702]	Manual pulse generator input: Link device count direction setting	◎
	[Pr.703]	Manual pulse generator input: Ring counter maximum value	○
	[Pr.704]	Manual pulse generator input: Ring counter minimum value	○

Refer to the following for the setting details.

☞ Page 453 Basic Setting

Point

- Positioning parameter settings and link device external signal assignment parameters settings work in common for all controls using the Simple Motion board. When carrying out other controls ("major positioning control", "high-level positioning control", "home position return control"), set the respective setting items as well.
- "Positioning parameters" are set for each axis.

Creating a program to enable/disable the manual pulse generator operation

A user program must be created to execute a manual pulse generator operation. Consider the "required control data setting", "start conditions" and "start time chart" when creating the user program.
The following shows an example when a manual pulse generator operation is started for axis 1.

Required control data setting

The control data shown below must be set to execute a manual pulse generator operation. The setting is carried out with the user program.
n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.20]	Manual pulse generator 1 pulse input magnification	1	Set the manual pulse generator 1 pulse input magnification. (1 to 10000 times)	4322+100n 4323+100n
[Cd.21]	Manual pulse generator enable flag	1 (0)	Set "1: Enable manual pulse generator operation". (Set "0: Disable manual pulse generator operation" when finished with the manual pulse generator operation.)	4324+100n

Refer to the following for the setting details.
☞ Page 543 Control Data
For labels, refer to the following.
☞ Page 437 Axis control data

Start conditions

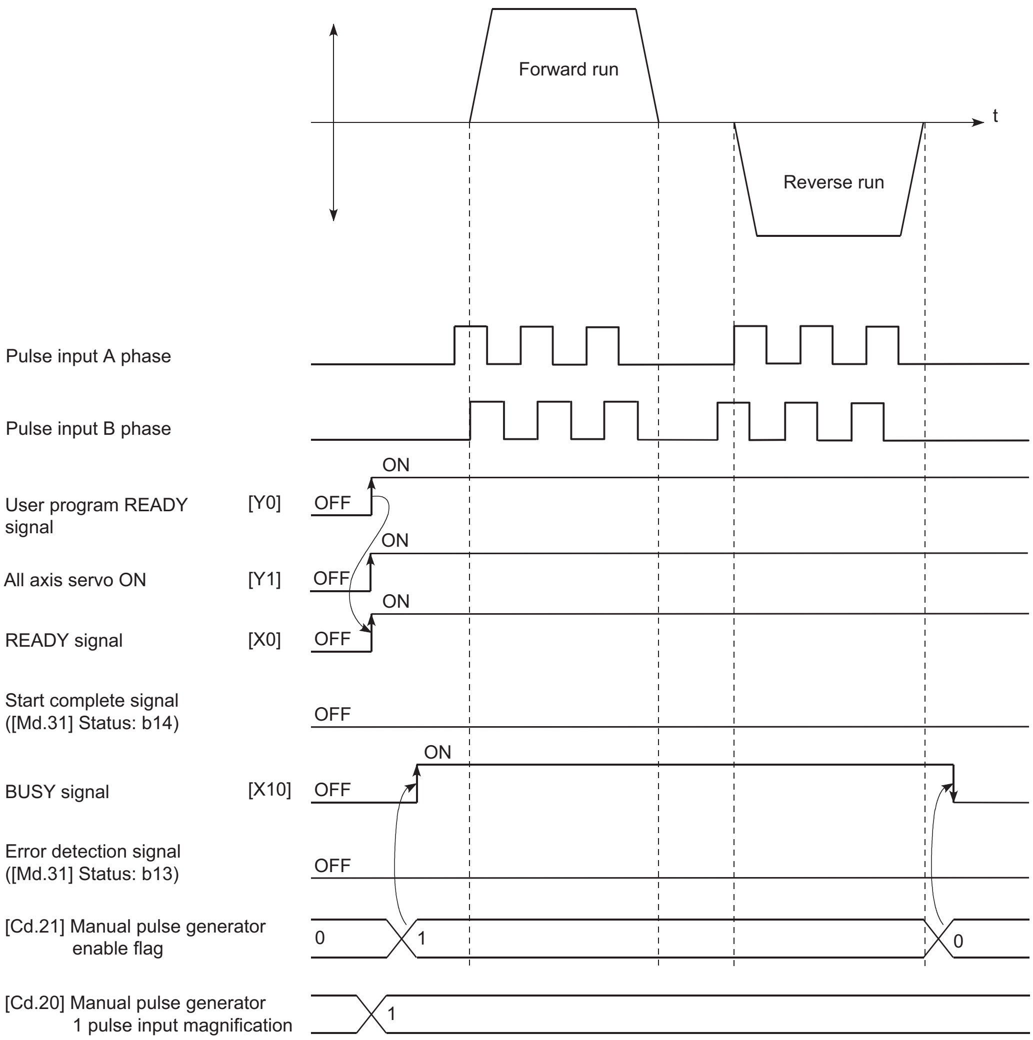
The following conditions must be fulfilled when starting. The required conditions must also be assembled in the user program, and the user program must be configured so the operation will not start if the conditions are not fulfilled.

Signal name		Signal state		Device
Interface signal	User program READY signal	ON	Host personal computer preparation completed	Y0
	READY signal	ON	Preparation completed	X0
	All axis servo ON	ON	All axis servo ON	Y1
	Synchronization flag*1	ON	The buffer memory can be accessed.	X1
	Axis stop signal	OFF	Axis stop signal is OFF	[Cd.180] Axis stop
	Start complete signal	OFF	Start complete signal is OFF	[Md.31] Status: b14
	BUSY signal	OFF	Not operating	X10 to X1F
	Error detection signal	OFF	There is no error	[Md.31] Status: b13
	M code ON signal	OFF	M code ON signal is OFF	[Md.31] Status: b12
External signal	Forced stop input signal	ON	There is no forced stop input	—
	Stop signal	OFF	Stop signal is OFF	—
	Upper limit (FLS)	ON	Within limit range	—
	Lower limit (RLS)	ON	Within limit range	—

*1 The interlock must be provided so that the buffer memory is accessed after Synchronization flag [X1] turns on. When no interlock is provided, an unexpected value may be read or written.

Start time chart

■Axis 1 to 4 operation example



Program example

Refer to the following for the user program example of the manual pulse generator operation.

☞ Page 600 Manual pulse generator operation program

6 INTER-MODULE SYNCHRONIZATION FUNCTION

This function can perform the CC-Link IE Field Network synchronous communication with the Simple Motion board as the inter-module synchronization master.

Control details

This function can synchronize other slave stations connected to the same network according to the inter-module operation cycle using the CC-Link IE Field Network synchronous communication function.

Precautions during control

The following shows the available synchronization cycle to synchronize within the Simple Motion boards.

0.50 ms, 1.00 ms, 2.00 ms, 4.00 ms

When the synchronization cycle except above, the error "Unit synchronization cycle setting unsupported" (error code: 18C0H) will occur.

When the multiple Simple Motion boards are installed to the host personal computer, the inter-module synchronization between the Simple Motion boards cannot be executed. Each Simple Motion board operates as the inter-module synchronization master independently.

Setting method for inter-module synchronization

The operation cycle can be set by the inter-module synchronization setting of the Simple Motion board.

Refer to the following for details.

📖Simple Motion Board User's Manual (Network)

MEMO

7 EXPANSION CONTROL

The details and usage of expansion control are explained in this chapter.
Expansion control includes following controls.

- Speed-torque control to execute the speed control and torque control not including position loop
- Advanced synchronous control to synchronize with input axis using software with "advanced synchronous control parameter" instead of controlling mechanically with gear, shaft, speed change gear or cam, etc.
- Direct control to control the servo amplifier based on the arbitrary position command data written to the buffer memory

Execute the required settings to match each control.

7.1 Speed-torque Control

Outline of speed-torque control

This function is used to execute the speed control or torque control that does not include the position loop for the command to servo amplifier.
Switch the control mode from "position control mode" to "speed control mode" or "torque control mode" to execute the "Speed-torque control".

Control mode	Control	Remark
Position control mode	Positioning control, home position return control, JOG operation, Inching operation and Manual pulse generator operation	Control that include the position loop for the command to servo amplifier
Speed control mode	Speed-torque control	Control that does not include the position loop for the command to servo amplifier
Torque control mode		

Use the servo amplifiers whose software versions are compatible with each control mode to execute the "Speed-torque control".
For the support information, refer to the instruction manual of the servo amplifier to be used.

⚠CAUTION

- If operation that generates torque more than 100% of the rating is performed with an abnormally high frequency in a servomotor stop status (servo lock status) or in a 30 r/min or less low-speed operation status, the servo amplifier may malfunction regardless of the electronic thermal relay protection.

Setting the required parameters for speed-torque control

The "Positioning parameters" must be set to carry out speed-torque control.
The following table shows the setting items of the required parameters for carrying out speed-torque control. Parameters not shown below are not required to be set for carrying out only speed-torque control. (Set the initial value or a value within the setting range.)

◎: Setting always required.

○: Set according to requirements (Set the initial value or a value within the setting range when not used.)

Setting item			Setting requirement
Positioning parameters	[Pr.1]	Unit setting	◎
	[Pr.2]	Number of pulses per rotation (AP)	◎
	[Pr.3]	Movement amount per rotation (AL)	◎
	[Pr.4]	Unit magnification (AM)	◎
	[Pr.8]	Speed limit value	◎
	[Pr.12]	Software stroke limit upper limit value	○
	[Pr.13]	Software stroke limit lower limit value	○
	[Pr.14]	Software stroke limit selection	○
	[Pr.22]	Input signal logic selection	◎
	[Pr.83]	Speed control 10 × multiplier setting for degree axis	○
	[Pr.90]	Operation setting for speed-torque control mode	○
Common parameters	[Pr.82]	Forced stop valid/invalid selection	○

Refer to the following for the setting details.

☞ Page 453 Basic Setting

Point

- Positioning parameter settings and common parameters settings work in common for all controls using the Simple Motion board. When carrying out other controls ("major positioning control", "high-level positioning control", "home position return control"), set the respective setting items as well.
- "Positioning parameters" are set for each axis.

Setting the required data for speed-torque control

Required control data setting for the control mode switching

The control data shown below must be set to execute the control mode switching.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.138]	Control mode switching request	1	Set "1: Switching request" after setting "[Cd.139] Control mode setting".	4374+100n
[Cd.139]	Control mode setting	→	Set the control mode to switch. 0: Position control mode 10: Speed control mode 20: Torque control mode	4375+100n

Refer to the following for the setting details.

☞ Page 543 Control Data

For labels, refer to the following.

☞ Page 437 Axis control data

Required control data setting for the speed control mode

The control data shown below must be set to execute the speed control.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.140]	Command speed at speed control mode	→	Set the command speed at speed control mode.	4376+100n 4377+100n
[Cd.141]	Acceleration time at speed control mode	→	Set the acceleration time at speed control mode.	4378+100n
[Cd.142]	Deceleration time at speed control mode	→	Set the deceleration time at speed control mode.	4379+100n

Refer to the following for the setting details.

☞ Page 543 Control Data

For labels, refer to the following.

☞ Page 437 Axis control data

Required control data setting for the torque control mode

The control data shown below must be set to execute the torque control.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.143]	Command torque at torque control mode	→	Set the command torque at torque control mode.	4380+100n
[Cd.144]	Torque time constant at torque control mode (Forward direction)	→	Set the time constant at driving during torque control mode.	4381+100n
[Cd.145]	Torque time constant at torque control mode (Negative direction)	→	Set the time constant at regeneration during torque control mode.	4382+100n
[Cd.146]	Speed limit value at torque control mode	→	Set the speed limit value at torque control mode.	4384+100n 4385+100n

Refer to the following for the setting details.

☞ Page 543 Control Data

For labels, refer to the following.

☞ Page 437 Axis control data

Operation of speed-torque control

Switching of control mode (Speed control/Torque control)

■Switching method of control mode

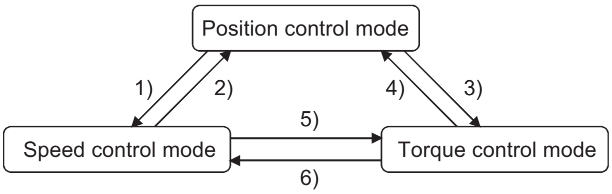
To switch the control mode to the speed control or the torque control, set "1" in "[Cd.138] Control mode switching request" after setting the control mode in "[Cd.139] Control mode setting".

When the mode is switched to the speed control mode or the torque control mode, the control data used in each control mode must be set before setting "1" in "[Cd.138] Control mode switching request".

When the switching condition is satisfied at control mode switching request, "30: Control mode switch" is set in "[Md.26] Axis operation status", and the BUSY signal turns ON. "0" is automatically stored in "[Cd.138] Control mode switching request" by Simple Motion board after completion of switching.

The warning "Control mode switching during BUSY" (warning code: 09E6H) or "Control mode switching during zero speed OFF" (warning code: 09E7H) occurs if the switching condition is not satisfied, and the control mode is not switched.

The following shows the switching condition of each control mode.



Switching operation		Switching condition
1)	Position control mode → Speed control mode	Not during positioning*1 and during motor stop*2*3
2)	Speed control mode → Position control mode	During motor stop*2*3
3)	Position control mode → Torque control mode	Not during positioning*1 and during motor stop*2*3
4)	Torque control mode → Position control mode	During motor stop*2*3
5)	Speed control mode → Torque control mode	None
6)	Torque control mode → Speed control mode	

*1 BUSY signal is OFF.

*2 ZERO speed ([Md.119] Servo status2: b3) is ON.

n: Axis No. - 1

Monitor item	Buffer memory address
[Md.119] Servo status2: b3	2476+100n

For labels, refer to the following.

☞ Page 435 Axis monitor data

*3 Change the setting of "Condition selection at mode switching (b12 to b15)" in "[Pr.90] Operation setting for speed-torque control mode" when switching the control mode without waiting for the servomotor to stop. Note that it may cause vibration or impact at control switching.

The history of control mode switching is stored to the start history at request of control mode switching. (☞ Page 507 System monitor data)

Confirm the control mode with "control mode ([Md.108] Servo status1: b2, b3)" of "[Md.108] Servo status". (☞ Page 518 Axis monitor data)

n: Axis No. - 1

Monitor item	Buffer memory address
[Md.108] Servo status1: b2, b3	2477+100n

For labels, refer to the following.

☞ Page 435 Axis monitor data

Point

[API library]

To switch the control mode, use the MMC_Axis::ChangeControlMode method.

■Precautions at control mode switching

- The start complete signal and the positioning complete signal do not turn ON at control mode switching.
- When "30: Control mode switch", "31: Speed control", or "32: Torque control" is set in "[Md.26] Axis operation status", the BUSY signal turns ON.
- The motor speed might change momentarily at switching from the speed control mode to the torque control mode. Therefore, it is recommended that the control mode is switched from the speed control to the torque control after the servomotors stop.
- "In speed control flag" ([Md.31] Status: b0) does not turn ON during the speed control mode in the speed-torque control.

■Operation for "Position control mode ⇔ Speed control mode switching"

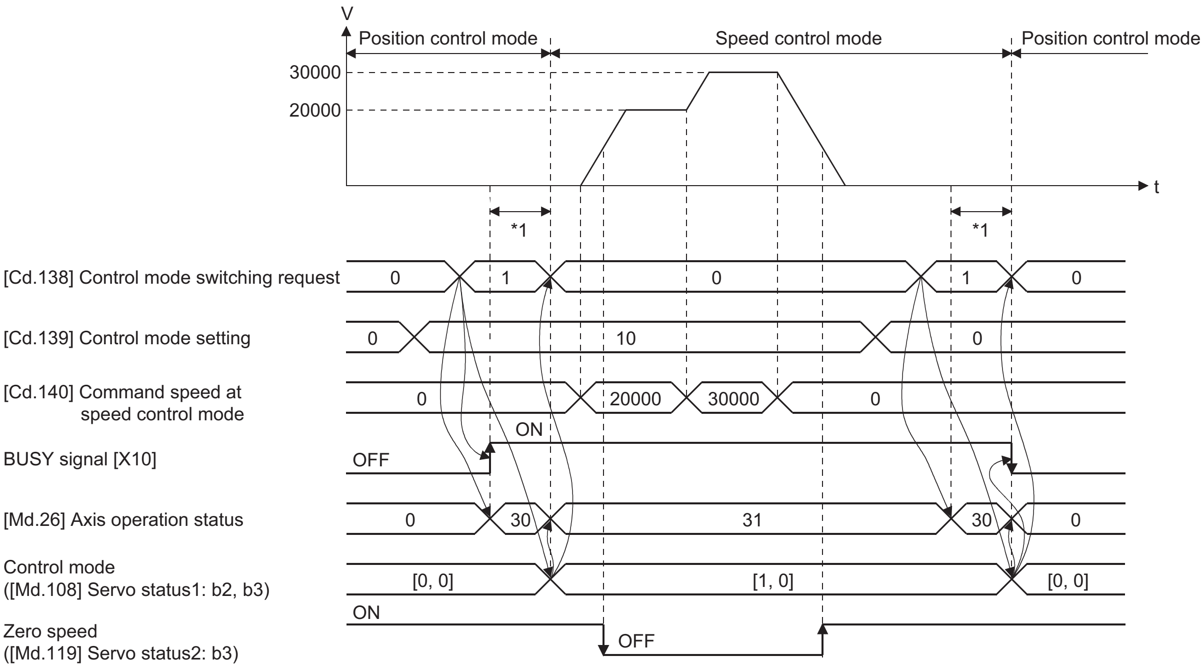
When the position control mode is switched to the speed control mode, the command speed immediately after the switching is the speed set in "speed initial value selection (b8 to b11)" of "[Pr.90] Operation setting for speed-torque control mode".

Speed initial value selection ([Pr.90]: b8 to b11)	Command speed to servo amplifier immediately after switching from position control mode to speed control mode
0: Command speed	The speed to servo amplifier immediately after switching is "0".
1: Feedback speed	Motor speed received from servo amplifier at switching.
2: Automatic selection	At control mode switching, operation is the same as "0: Command speed".

When the speed control mode is switched to the position control mode, the command position immediately after the switching is the feed current value at switching.

The following chart shows the operation timing for axis 1.

■Axis 1 to 4 operation example



*1 The switching time differs by the specification of the servo amplifier. When "ZSP disabled selection at control switching" of the servo parameter "Function selection C-E (PC76)" is set to "0: Enabled" at MR-J4-GF use, the control mode switches after the motor speed becomes zero.

■Operation for "Position control mode ⇔ Torque control mode switching"

When the position control mode is switched to the torque control mode, the command torque immediately after the switching is the torque set in "Torque initial value selection (b4 to b7)" of "[Pr.90] Operation setting for speed-torque control mode".

Torque initial value selection ([Pr.90]: b4 to b7)	Command torque to servo amplifier immediately after switching from position control mode to torque control mode
0: Command torque	The value of "[Cd.143] Command torque at torque control mode" at switching.
1: Feedback torque	Motor torque value at switching.

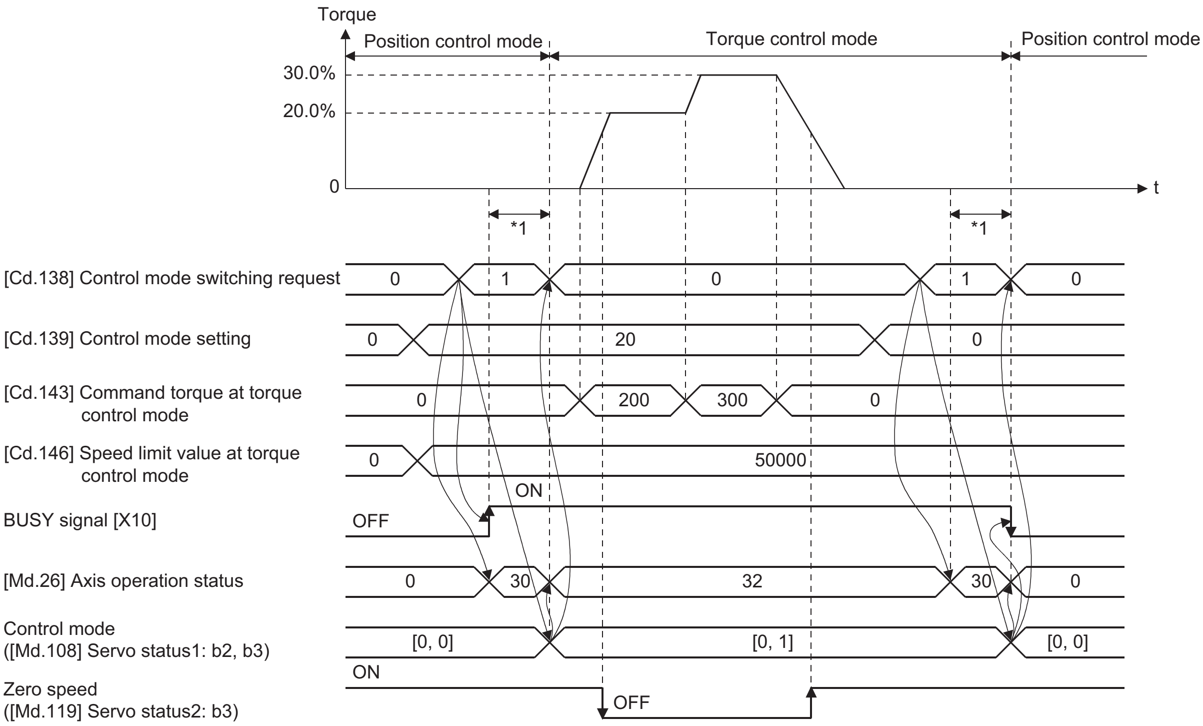
Point

When the servo parameter "Function selection C-B POL reflection selection at torque control (PC29)" is set to "0: Enabled" and "Torque initial value selection" is set to "1: Feedback torque", the warning "Torque initial value selection invalid" (warning code: 09E5H) will occur at control mode switching, and the command value immediately after switching is the same as the case of selecting "0: Command torque". If the feedback torque is selected, set "1: Disabled" in the servo parameter "Function selection C-B POL reflection selection at torque control (PC29)".

When the torque control mode is switched to the position control mode, the command position immediately after the switching is the feed current value at switching.

The following chart shows the operation timing for axis 1.

■Axis 1 to 4 operation example



*1 The switching time differs by the specification of the servo amplifier. When "ZSP disabled selection at control switching" of the servo parameter "Function selection C-E (PC76)" is set to "0: Enabled" at MR-J4-GF use, the control mode switches after the motor speed becomes zero.

■Operation for "Speed control mode ⇔ Torque control mode switching"

When the speed control mode is switched to the torque control mode, the command torque immediately after the switching is the torque set in "Torque initial value selection (b4 to b7)" of "[Pr.90] Operation setting for speed-torque control mode".

Torque initial value selection ([Pr.90]: b4 to b7)	Command torque to servo amplifier immediately after switching from speed control mode to torque control mode
0: Command torque	The value of "[Cd.143] Command torque at torque control mode" at switching.
1: Feedback torque	Motor torque value at switching.

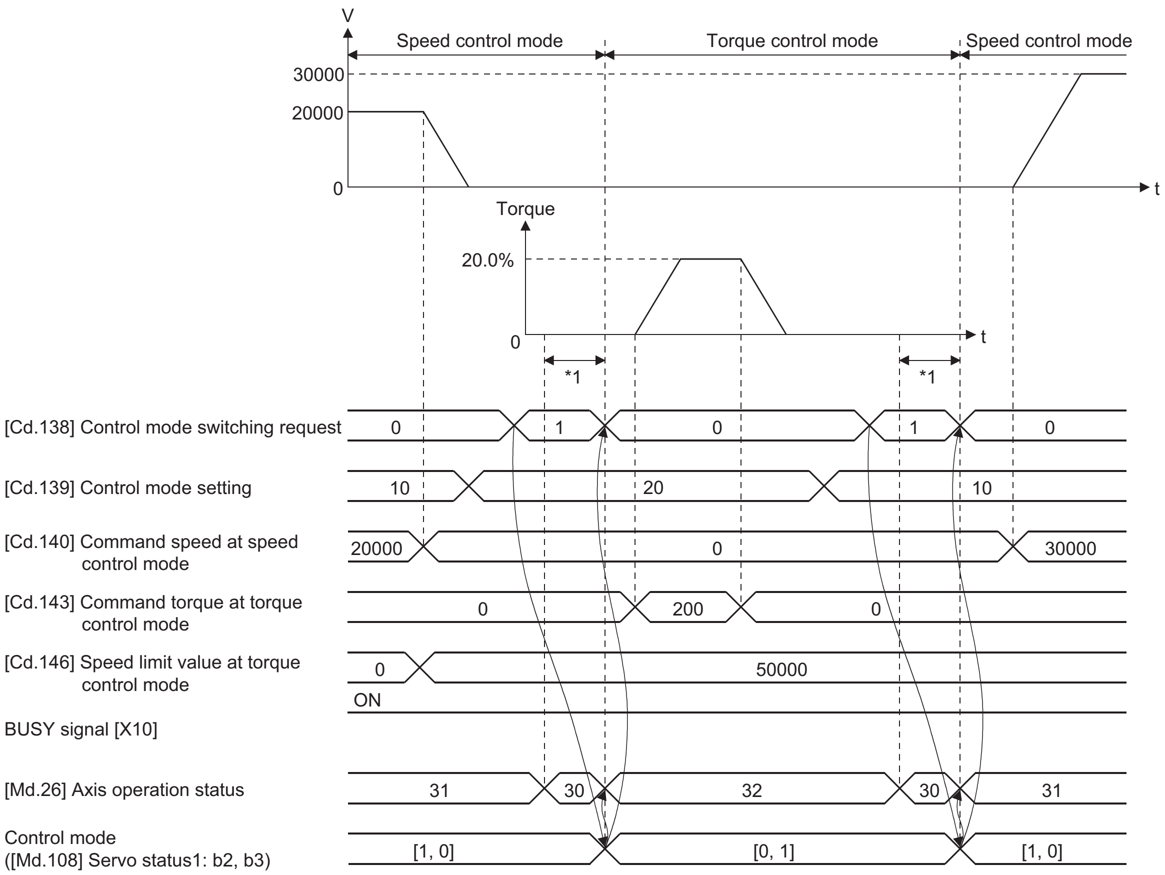
Point

When the servo parameter "Function selection C-B POL reflection selection at torque control (PC29)" is set to "0: Enabled" and "Torque initial value selection" is set to "1: Feedback torque", the warning "Torque initial value selection invalid" (warning code: 09E5H) will occur at control mode switching, and the command value immediately after switching is the same as the case of selecting "0: Command torque". If the feedback torque is selected, set "1: Disabled" in the servo parameter "Function selection C-B POL reflection selection at torque control (PC29)".

When the torque control mode is switched to the speed control mode, the command speed immediately after the switching is the motor speed at switching.

The following chart shows the operation timing for axis 1.

■Axis 1 to 4 operation example



*1 The switching time differs by the specification of the servo amplifier. When "ZSP disabled selection at control switching" of the servo parameter "Function selection C-E (PC76)" is set to "0: Enabled" at MR-J4-GF use, the control mode switches after the motor speed becomes zero.

Speed control mode

■Operation for speed control mode

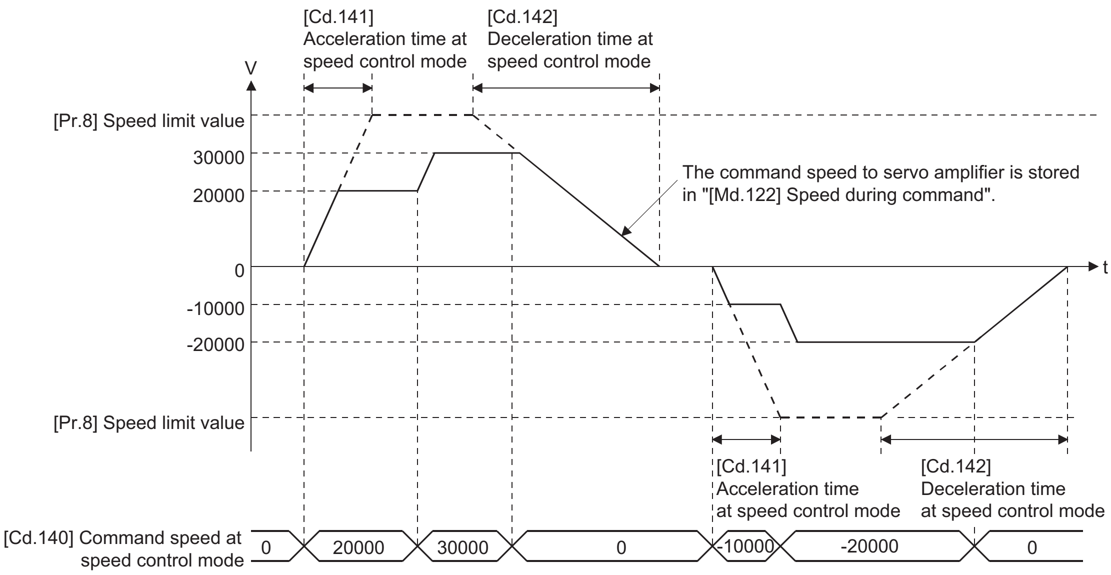
The speed control is executed at the speed set in "[Cd.140] Command speed at speed control mode" in the speed control mode.

Set a positive value for forward rotation and a negative value for reverse rotation. "[Cd.140]" can be changed any time during the speed control mode.

Acceleration/deceleration is performed based on a trapezoidal acceleration/deceleration processing. Set acceleration/ deceleration time toward "[Pr.8] Speed limit value" in "[Cd.141] Acceleration time at speed control mode" and "[Cd.142] Deceleration time at speed control mode". The value at speed control mode switching request is valid for "[Cd.141]" and "[Cd.142]".

The command speed during the speed control mode is limited with "[Pr.8] Speed limit value". If the speed exceeding the speed limit value is set, the warning "Speed limit value over" (warning code: 0991H) occurs, and the operation is controlled with the speed limit value.

Confirm the command speed to servo amplifier with "[Md.122] Speed during command".



■Feed current value during speed control mode

"[Md.20] Feed current value", "[Md.21] Feed machine value" and "[Md.101] Real current value" are updated even in the speed control mode.

If the feed current value exceeds the software stroke limit, the error "Software stroke limit +" (error code: 1993H) or "Software stroke limit -" (error code: 1995H) occurs and the operation switches to the position control mode. Invalidate the software stroke limit to execute one-way feed.

■Stop cause during speed control mode

The operation for stop cause during speed control mode is shown below.

Item	Operation during speed control mode
"[Cd.180] Axis stop" turned ON.	The motor decelerates to speed "0" according to the setting value of "[Cd.142] Deceleration time at speed control mode". The mode switches to the position control mode when "Zero speed" of "[Md.119] Servo status2" turns ON, and the operation stops.
Stop signal of "[Cd.44] External input signal operation device (Axis 1 to 16)" turned ON.	
All axis servo ON [Y1] turned OFF.	The servo OFF is not executed during the speed control mode. The command status when the mode is switched to the position control mode becomes valid.
"[Cd.100] Servo OFF command" turned ON.	
The current value reached the software stroke limit.	An error (error code: 1900H, 1904H to 1907H, 1993H, 1995H) occurs. The mode switches to the position control mode at the current position, and the operation immediately stops. (Deceleration processing is not executed.)
The position of the motor reached the hardware stroke limit.	
User program READY [Y0] turned OFF.	
The forced stop input to Simple Motion board.	The mode switches to the position control mode when the servo OFF (Servo ON of "[Md.108] Servo status1" turns OFF) is executed. (While the servo amplifier is servo OFF, even if the mode is switched to position control mode, the servomotor immediately stops.)
The emergency stop input to servo amplifier.	
The servo alarm occurred.	
The servo amplifier's power supply turned OFF.	The motor immediately stops. (The mode is set to the position control mode at the servo amplifier's power supply ON again.)

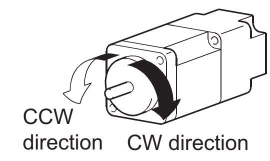
Torque control mode

■Operation for torque control mode

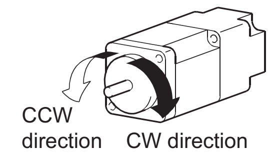
The torque control is executed at the command torque set in "[Cd.143] Command torque at torque control mode" in the torque control mode.

"[Cd.143] Command torque at torque control mode" can be changed any time during torque control mode. The relation between the setting of command torque and the torque generation direction of servomotor varies depending on the setting of servo parameters "Rotation direction selection/travel direction selection (PA14)" and "Function selection C-B POL reflection selection at torque control (PC29)".

- When servo parameter "Function selection C-B POL reflection selection at torque control (PC29)" is set to "0: Enabled"

"Rotation direction selection/ travel direction selection (PA14)"	"[Cd.143] Command torque at torque control mode"	Torque generation direction of servo motor	
0: Forward rotation (CCW) with the increase of the positioning address	Positive value (Forward direction)	CCW direction	
	Negative value (Reverse direction)	CW direction	
1: Reverse rotation (CW) with the increase of the positioning address	Positive value (Forward direction)	CW direction	
	Negative value (Reverse direction)	CCW direction	

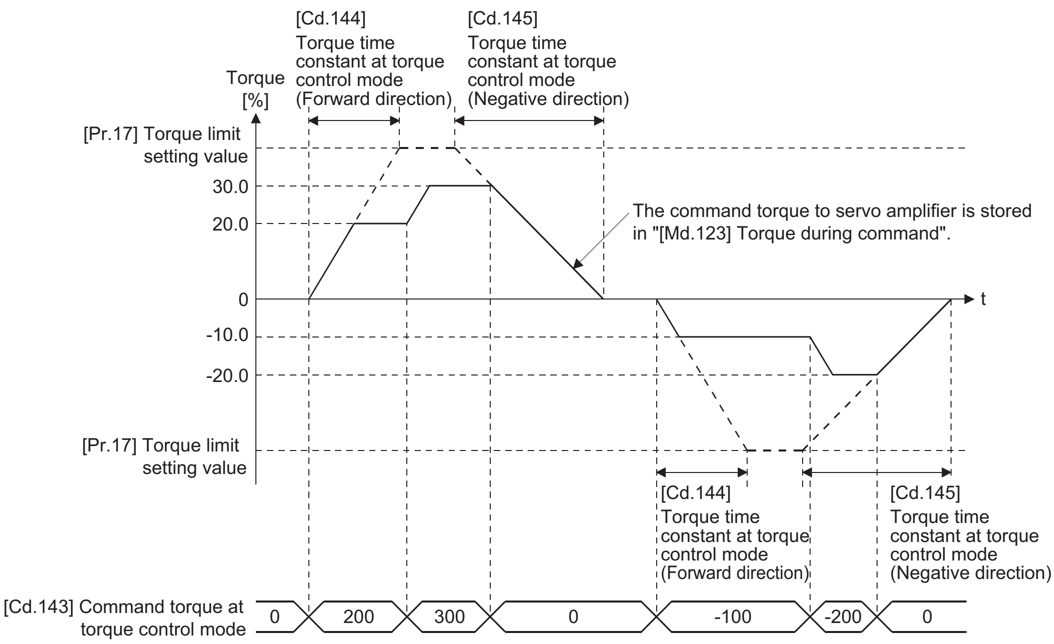
- When servo parameter "Function selection C-B POL reflection selection at torque control (PC29)" is set to "1: Disabled"

"Rotation direction selection/ travel direction selection (PA14)"	"[Cd.143] Command torque at torque control mode"	Torque generation direction of servo motor	
0: Forward rotation (CCW) with the increase of the positioning address	Positive value (Forward direction)	CCW direction	
	Negative value (Reverse direction)	CW direction	
1: Reverse rotation (CW) with the increase of the positioning address	Positive value (Forward direction)	CCW direction	
	Negative value (Reverse direction)	CW direction	

Set time for the command torque to increase from 0% to "[Pr.17] Torque limit setting value" in "[Cd.144] Torque time constant at torque control mode (Forward direction)" and for the command torque to decrease from "[Pr.17] Torque limit setting value" to 0% in "[Cd.145] Torque time constant at torque control mode (Negative direction)". The value at torque control mode switching request is valid for "[Cd.144]" and "[Cd.145]".

The command torque during the torque control mode is limited with "[Pr.17] Torque limit setting value". If the torque exceeding the torque limit setting value is set, the warning "Torque limit value over" (warning code: 09E4H) occurs, and the operation is controlled with the torque limit setting value.

Confirm the command torque to servo amplifier with "[Md.123] Torque during command".



■Speed during torque control mode

The speed during the torque control mode is controlled with "[Cd.146] Speed limit value at torque control mode". At this time, "Speed limit" ("[Md.119] Servo status2": b4) turns ON.

n: Axis No. - 1

Monitor item	Buffer memory address
[Md.119] Servo status2: b4	2476+100n

For labels, refer to the following.

☞ Page 435 Axis monitor data

"[Cd.146] Speed limit value at torque control mode" is set to a positive value regardless of the rotation direction. (Controlled by the same value for forward and reverse directions.)

In addition, "[Cd.146] Speed limit value at torque control mode" is limited with "[Pr.8] Speed limit value". If the speed exceeding the speed limit value is set, the warning "Speed limit value over" (warning code: 0991H) occurs, and the operation is controlled with the speed limit value.

The acceleration/deceleration processing is invalid for "[Cd.146] Speed limit value at torque control mode".

Point

The actual motor speed may not reach the speed limit value depending on the machine load situation during the torque control.

■Feed current value during torque control mode

"[Md.20] Feed current value", "[Md.21] Feed machine value" and "[Md.101] Real current value" are updated even in the torque control mode.

If the feed current value exceeds the software stroke limit, the error "Software stroke limit +" (error code: 1993H) or "Software stroke limit -" (error code: 1995H) occurs and the operation switches to the position control mode. Invalidate the software stroke limit to execute one-way feed.

■Stop cause during torque control mode

The operation for stop cause during torque control mode is shown below.

Item	Operation during torque control mode
"[Cd.180] Axis stop" turned ON.	The speed limit value commanded to servo amplifier is "0" regardless of the setting value of "[Cd.146] Speed limit value at torque control mode". The mode switches to the position control mode when "Zero speed" of "[Md.119] Servo status2" turns ON, and the operation immediately stops. (Deceleration processing is not executed.) The value of command torque is not changed. It might take time to reach the speed "0" depending on the current torque command value.
Stop signal of "[Cd.44] External input signal operation device (Axis 1 to 16)" turned ON.	
All axis servo ON [Y1] turned OFF.	The servo OFF is not executed during the torque control mode. The command status when the mode is switched to the position control mode becomes valid.
"[Cd.100] Servo OFF command" turned ON.	
The current value reached the software stroke limit.	An error (error code: 1900H, 1904H to 1907H, 1993H, 1995H) occurs. The mode switches to the position control mode at the current position, and the operation immediately stops. (Deceleration processing is not executed.)
The position of the motor reached the hardware stroke limit.	
User program READY [Y0] turned OFF.	
The forced stop input to Simple Motion board.	The mode switches to the position control mode when the servo OFF (Servo ON of "[Md.108] Servo status1" turns OFF) is executed. (While the servo amplifier is servo OFF, even if the mode is switched to position control mode, the servomotor immediately stops.)
The emergency stop input to servo amplifier.	
The servo alarm occurred.	
The servo amplifier's power supply turned OFF.	The motor immediately stops. (The mode is set to the position control mode at the servo amplifier's power supply ON again.)

7.2 Advanced synchronous control

"Advanced synchronous control" can be achieved using software instead of controlling mechanically with gear, shaft, speed change gear or cam, etc.

"Advanced synchronous control" synchronizes movement with the input axis (servo input axis or synchronous encoder axis), by setting "advanced synchronous control parameters" and starting synchronous control on each output axis.

Refer to the following for details of advanced synchronous control.

📖Simple Motion Board User's Manual (Advanced Synchronous Control)

7.3 Direct Control

Outline of direct control

"Direct control" controls the servo amplifier based on the arbitrary position command data written to the buffer memory.
In standard control which uses data such as the positioning data, the Simple Motion board executes the motion control operation based on the designated positioning address and the acceleration/deceleration time, and determines the acceleration/deceleration pattern, etc. In direct control, the position command data written by the user program is sent to the servo amplifier, so that the arbitrary acceleration/deceleration pattern can be set.

Differences between standard control and direct control

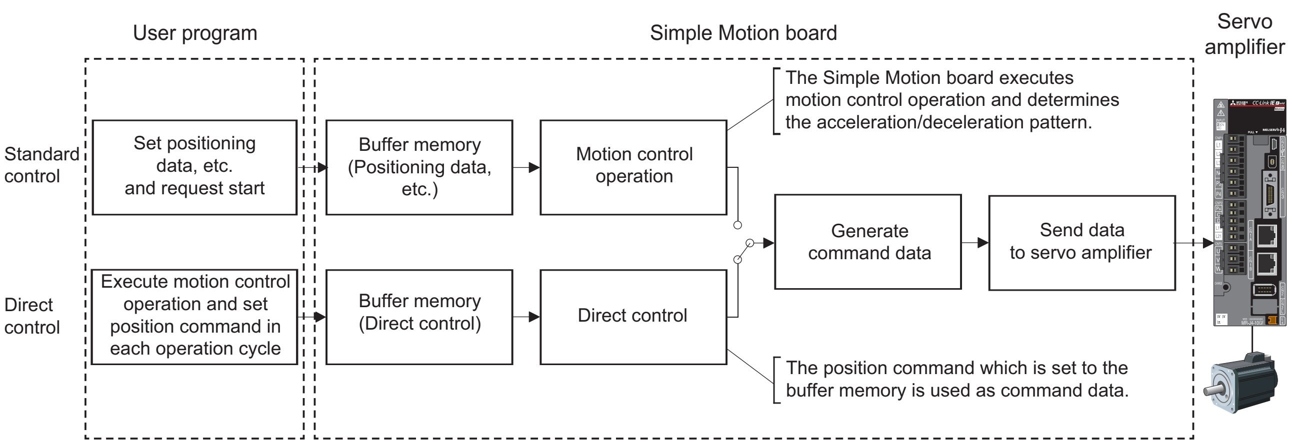
Differences of control method in user program

■Standard control

Controls the servo amplifier by turning the positioning start signal [Y10 to Y1F] ON after setting the positioning data.

■Direct control

Controls the servo amplifier by executing the motion control operation in the user program and writing the position command data to the buffer memory in each operation cycle.



Differences of available functions

The available control functions of the Simple Motion board are different between the standard control and the direct control.

■Differences of available main functions

○: Available, ×: Not available, △: Restricted

Main function		Standard control	Direct control
Home position return control		○	×
Major positioning control		○	×
High-level positioning control		○	×
Manual control		○	×
Expansion control	Position control mode	○	○*1
	Speed control mode	○	×
	Torque control mode	○	×
	Advanced synchronous control	○	△*2

*1 This control method is valid only for direct control.
Refer to the following for details of control method.
☞ Page 211 Control method of direct control

*2 The control is not available as the output axis. When "[Cd.380] Synchronous control start" is turned ON from OFF, the warning "Start during operation" (warning code: 0900H) occurs.

■Differences of available sub functions

○: Available, ×: Not available, △: Restricted, —: Not reflected to axis control

Sub function		Standard control	Direct control
Functions that compensate control	Backlash compensation function	○	○
	Electronic gear function	○	○
	Near pass function	○	×
Functions that limit control	Speed limit function	○	○
	Torque limit function	○	○
	Software stroke limit function	○	△*1
	Hardware stroke limit function	○	△*1
	Forced stop function	○	○
Functions that change control details	Speed change function	○	×
	Override function	○	×
	Acceleration/deceleration time change function	○	×
	Torque change function	○	○
	Target position change function	○	×
Functions related to positioning start	Pre-reading start function	○	×
Absolute position system		○	○
Functions related to positioning stop	Stop command processing for deceleration stop function	○	×
	Continuous operation interrupt function	○	×
	Step function	○	×
Other functions	Skip function	○	×
	M code output function	○	×
	Teaching function	○	×
	Command in-position function	○	×
	Acceleration/deceleration processing function	○	×
	Deceleration start flag function	○	×
	Speed control 10 × multiplier setting for degree axis function	○	×
	Operation setting for incompletion of home position return function	○	×
	Controller in-position function	○	○
Servo ON/OFF	Servo ON/OFF	○	—*2
	Follow up function	○	—*2

*1 Refer to the following for details of restrictions.

☞ Page 210 Precautions during direct control

*2 During direct control, the servo OFF is not executed by the all axis servo ON signal [Y1] or "[Cd.100] Servo OFF command".

7

■Differences of available main functions

○: Available, —: Not reflected to axis control

Common function		Standard control	Direct control
Parameter initialization function		—	—
Execution data backup function		—	—
External input signal select function		○	○
Link device external signal assignment function		○	○
History monitor function		○	○
Amplifier-less operation function		○	○
Virtual servo amplifier function		○	○
Mark detection function		○	○
Event history function		○	○
Servo cyclic transmission function		○	○
Servo transient transmission function		○	○
Test mode		○	×
Servo parameter change function		○	○
User watchdog function		○	○
Remote operation		—	—
Time setting		—	—
PCI Express connection	PCI Express link-down detection function	○	○
Interrupt function		○	○*1
DMA transmission function		○	○
Ethernet communication connection		—	—

*1 It is recommended to use the operation cycle interrupt in order to write the position command every operation cycle.
Refer to the following for details of the interrupt function.
☞ Page 375 Interrupt function

Setting the required parameters for direct control

The following table shows the setting items of the required parameters for carrying out direct control.

Set the positioning parameters and the common parameters other than the direct control parameters as required.

◎: Setting always required.

○: Set according to requirements (Set the initial value or a value within the setting range when not used.)

Setting item			Setting requirement
Direct control setting parameters	[Pr.1210]	Direct control number of used buffers	◎
Positioning parameters	[Pr.1]	Unit setting	◎
	[Pr.2]	Number of pulses per rotation (AP)	◎
	[Pr.3]	Movement amount per rotation (AL)	◎
	[Pr.4]	Unit magnification (AM)	◎
	[Pr.8]	Speed limit value	◎
	[Pr.12]	Software stroke limit upper limit value	○
	[Pr.13]	Software stroke limit lower limit value	○
	[Pr.14]	Software stroke limit selection	○
	[Pr.22]	Input signal logic selection	◎
Common parameters	[Pr.82]	Forced stop valid/invalid selection	○

Refer to the following for the setting details.

☞ Page 214 Direct control setting parameter

☞ Page 453 Basic Setting

Start and stop of direct control

Start of direct control

Start the direct control by setting "[Cd.1210] Direct control start request".

When the direct control is started, the standard control is switched to the direct control and the direct control can be executed.

■Required control data setting for start of direct control

The control data shown below must be set to switch to the direct control.

Setting item		Setting value	Setting details
[Cd.1210]	Direct control start request	1	Set "1: Direct control start".
[Cd.1212]	Direct control writing complete buffer No. (position control)	→	The setting from the user program is not required at the direct control start. The Simple Motion board sets "0: Not write position command data".

Refer to the following for the setting details.

☞ Page 215 Control data for direct control

■Switching conditions of direct control

When the switching conditions shown below are satisfied at direct control start request, "1: Direct control" is set in "[Md.1210] Direct control operation status". Besides, "40: Direct control (position control)" is set in "[Md.26] Axis operation status" and the BUSY signal turns ON.

When the conditions are not satisfied, the error "Direct control start not possible" (error code: 1E06H) occurs and the operation cannot be switched to the direct control.

Monitor item		Monitor value	Storage details
[Md.26]	Axis operation status	—	"40: Direct control (position control)" is stored when the standard control is switched to the direct control.
[Md.1210]	Direct control operation status	—	"1: Direct control" is stored when the standard control is switched to the direct control.

Refer to the following for information on the storage details.

☞ Page 216 Direct control monitor data
☞ Page 518 Axis monitor data

Point

- If the user program READY signal [Y0] has never been turned ON from OFF after the power supply of the Simple Motion board is turned ON from OFF or the remote RESET is executed, an error does not occur.
- If the direct control start is executed during positioning control, the warning "Start during operation" (warning code: 0900H) occurs.

The following shows the switching conditions of direct control.

- The switching conditions of direct control

Switching operation	Switching condition
Standard control → Direct control (direct control start)	• "Direct control parameter" is set. • The READY signal [X0] is turned ON. • Not during test mode. • "[Md.26] Axis operation status" is "0: Standby" or "1: Stopped". • "[Cd.180] Axis stop" is not turned ON. • The stop signal of "[Cd.44] External input signal operation device (Axis 1 to 16)" is not turned ON. • The current value does not reach the software stroke limit. • The position of the motor does not reach the hardware stroke limit.
Direct control → Standard control (direct control stop)	• "[Cd.1212] Direct control writing complete buffer No. (position control)" is not updated. • "[Md.22] Feedrate" is "0".

■Operation after switching from standard control to direct control

After switching from standard control to direct control, direct control controls the servo amplifier using control data and monitor data for direct control.

- Required control data for control

Setting item		Setting value	Setting details
[Cd.1212]	Direct control writing complete buffer No. (position control)	→	Set the buffer No. of "[1220] Direct control command buffer (position control)" in which the latest position command data has been set.
[Cd.1220]	Direct control command buffer (position control)	→	Write the position command data for each operation cycle. The maximum points of command buffer are 16 and the number of points to be used is set in "[Pr.1210] Direct control number of used buffers". The unit of position command data for writing is the same as the unit set in "[Pr.1] Unit setting".

Refer to the following for the setting details.

☞ Page 215 Control data for direct control

Refer to the following for the usage methods.

☞ Page 211 Control method of direct control

- Required monitor data for control.

Monitor item		Monitor value	Storage details
[Md.1211]	Direct control enable flag	→	The status of availability of command buffer control in which the command buffer and writing complete buffer No. have been used is stored.
[Md.1212]	Direct control buffer No. being executed (position control)	→	The buffer No. referred to by the Simple Motion board is stored.

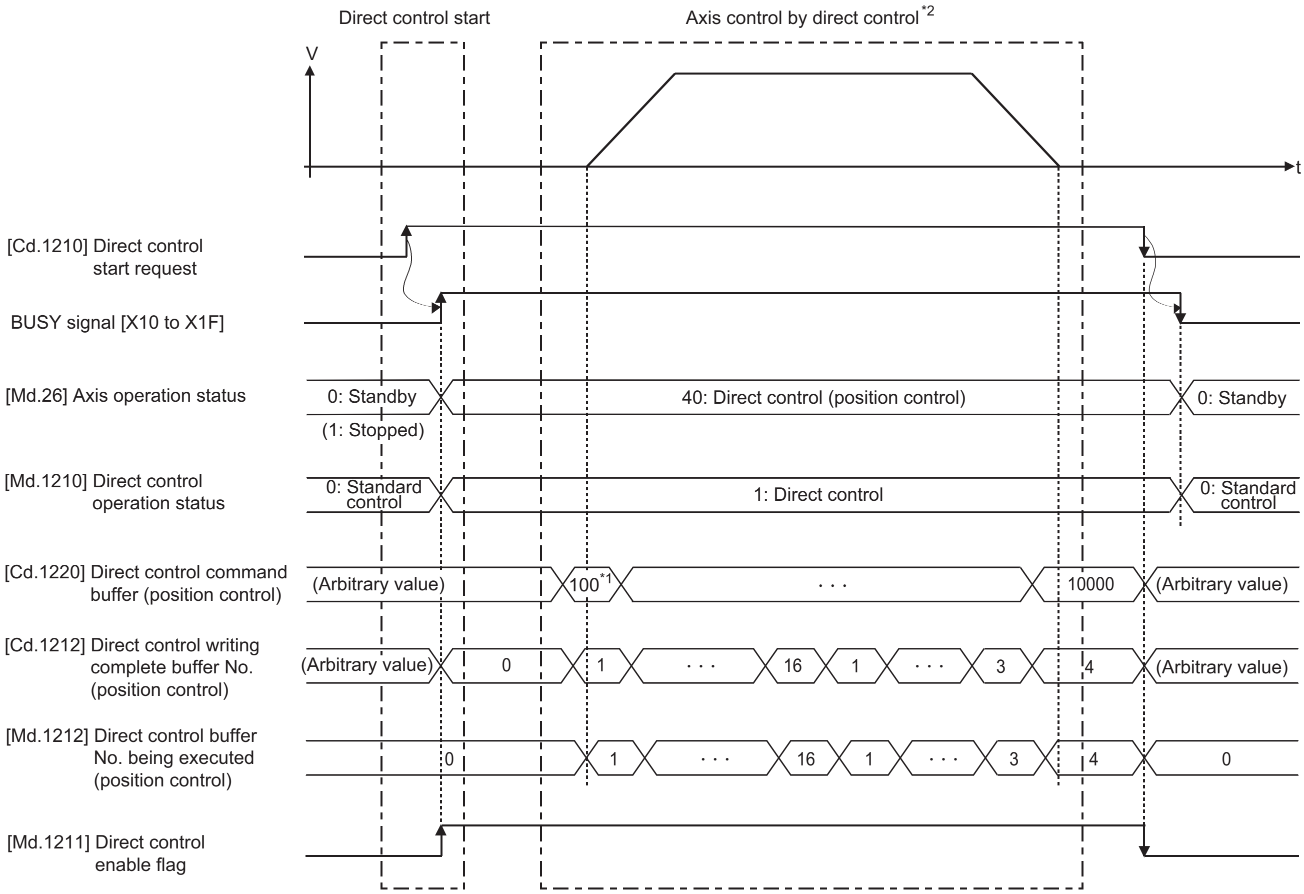
Refer to the following for information on the storage details.

☞ Page 216 Direct control monitor data

Refer to the following for the usage methods.

☞ Page 211 Control method of direct control

- Operation example



*1 After switching to the direct control, the first position command data is set based on "[Md.20] Feed current value".

*2 After writing the position command data to "[Cd.1220] Direct control command buffer (position control)", the axis can be controlled by updating "[Cd.1212] Direct control writing complete buffer No. (position control)".

7

Stop of direct control

To stop the direct control, use the stop signals such as direct control stop and the axis stop signal.

■Stop cause during direct control

The operation for stop cause during direct control is shown below.

Item	Operation during direct control
"0: Direct control stop" is set in "[Cd.1210] Direct control start request".	The operation of the direct control is continued. When the switching conditions are satisfied, the operation is switched to the standard control.[*1]
"[Cd.180] Axis stop" turned ON.	
Stop signal of "[Cd.44] External input signal operation device (Axis 1 to 16)" turned ON.	
"Stop signal" of external input signal turned ON.	
All axis servo ON [Y1] turned OFF.	The servo OFF is not executed during the direct control. The command status when the mode is switched to the standard control becomes valid.
"[Cd.100] Servo OFF command" turned ON.	
The current value reached the software stroke limit.	The operation of direct control continues. Execute the judgment[*2] in the user program and the operation of direct control.
The position of the motor reached the hardware stroke limit.	
The speed exceeds the parameter maxinum value of the speed limit value.	The operation immediately stops and switches to the standard control. The error "Direct control speed limit value over" (error code: 1E07H) occurs.
The No. outside the range is set to the writing complete buffer No.	The operation immediately stops and switches to the standard control. The error "Direct control command buffer over" (error code: 1E08H) occurs.
User program READY signal [Y0] turned OFF.	The operation immediately stops and switches to the standard control.
The forced stop input to Simple Motion board.	
The emergency stop input to servo amplifier.	
The servo alarm occurred.	
The servo amplifier's power supply turned OFF.	

*1 If the switching conditions are not satisfied, the warning "Direct control stop error" (warning code: 0E01H) occurs.
*2 Execute the judgment of the software stroke limit based on "[Pr.12] Software stroke limit upper limit value"/"[Pr.13] Software stroke limit lower limit value". For the judgment of the hardware stroke limit, refer to "[Md.30] External input signal".

Refer to the following for the precautions during direct control.

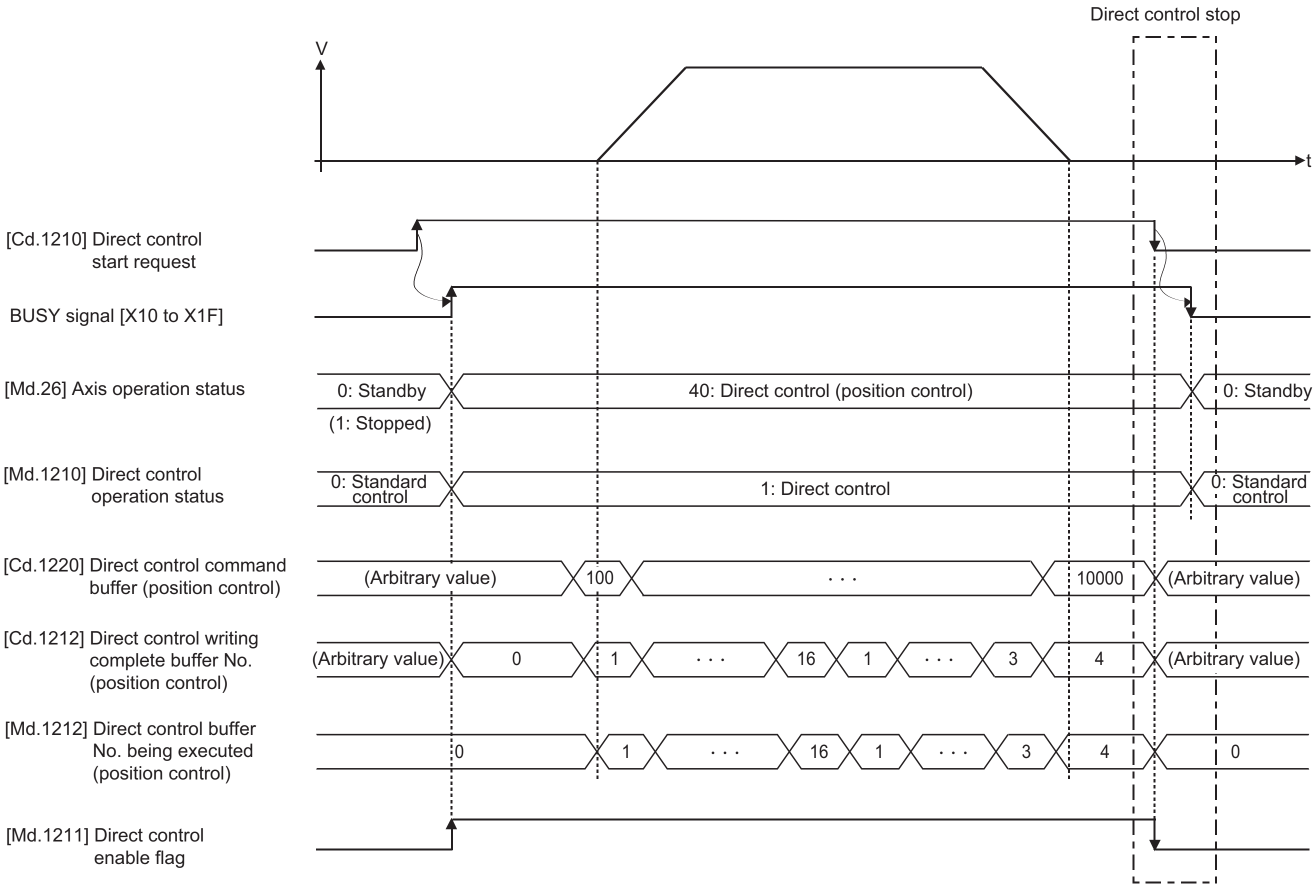
☞ Page 210 Precautions during direct control

Refer to the following for details on switching conditions of direct control.

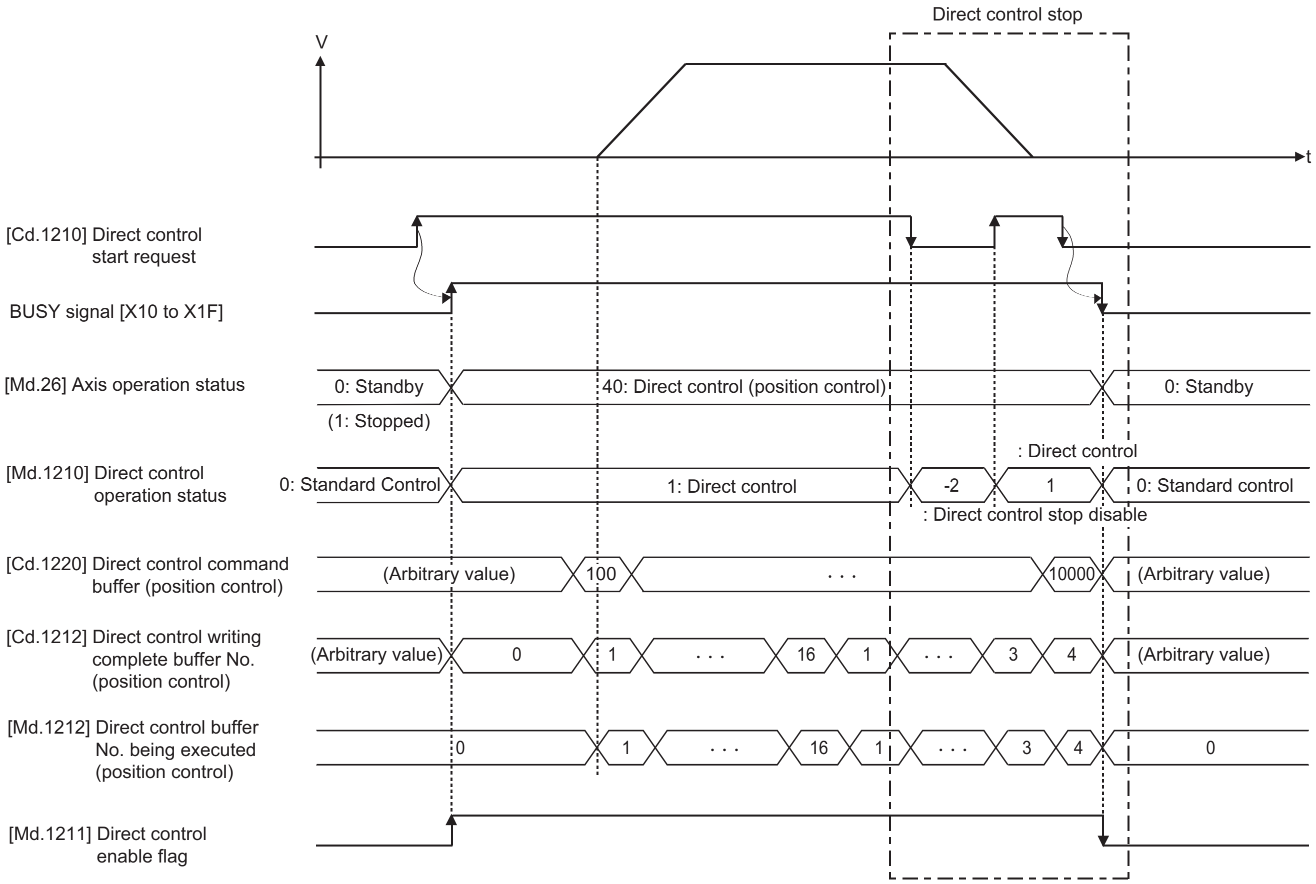
☞ Page 205 Switching conditions of direct control

■Operation example

When "[Cd.1210] Direct control start request" is set to "0: Direct control stop" while the axis stops, the operation is executed as follows.



When "[Cd.1210] Direct control start request" is set to "0: Direct control stop" while the axis operates, the operation is executed as follows.



Precautions during direct control

The functions shown below are invalid.

Function	Operation during direct control
Software stroke limit function	The operation of the direct control is continued even if the upper or lower limit of the software stroke limit is exceeded. Monitor the software stroke limit and execute the stop process by the user program.
Hardware stroke limit function	The operation of the direct control is continued even if the FLS signal and the RLS signal of hardware stroke limit are input. Monitor the hardware stroke limit and execute the stop process by the user program.

The operation of the functions shown below differs from the operation during standard control.

Function	Operation during direct control
"[Cd.180] Axis stop" turned ON.	The operation of the direct control is continued even if the stop is turned ON. Execute the stop process by the user program.
Stop signal of "[Cd.44] External input signal operation device (Axis 1 to 16)" turned ON.	
"Stop signal" of external input signal turned ON.	

Control method of direct control

Outline of command buffer control

Direct control controls the servo amplifier based on the arbitrary position command data written to the buffer memory.

The position command data is set by the command buffer.

The command buffer which sets the position command data is a ring buffer up to 16 buffers. It is controlled by using the writing complete buffer No. and the buffer No. being executed.

Refer to the following for the setting details.

☞ Page 215 Control data for direct control

Refer to the following for information on the storage details.

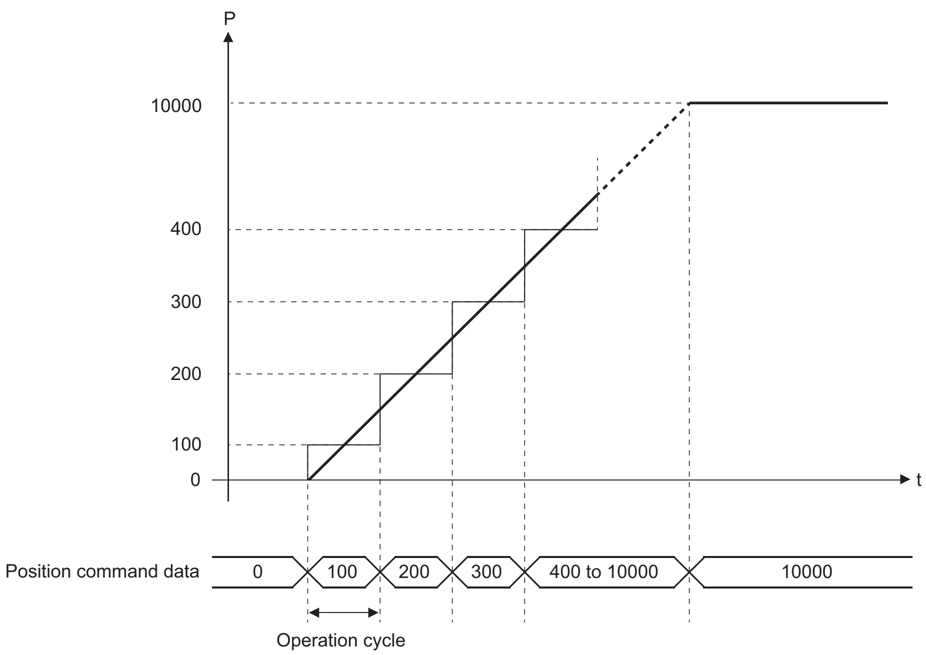
☞ Page 216 Direct control monitor data

■Writing position command data

The Simple Motion board sends the set position command data to the servo amplifier by writing the position command data of each operation cycle to "[Cd.1220] Direct control command buffer (position control)". Doing so may enable the position control of the servo amplifier.

The following shows the operation when the position command data is set.

- Operation example



■Updating command buffer

The Simple Motion board refers to the availability of the command buffer from the writing complete buffer No. and the buffer No. being executed, and writes the position command data. After writing the position command data, the position command data is sent to the servo amplifier in each operation cycle by setting the buffer No. set in "[Cd.1212] Direct control writing complete buffer No. (position control)".

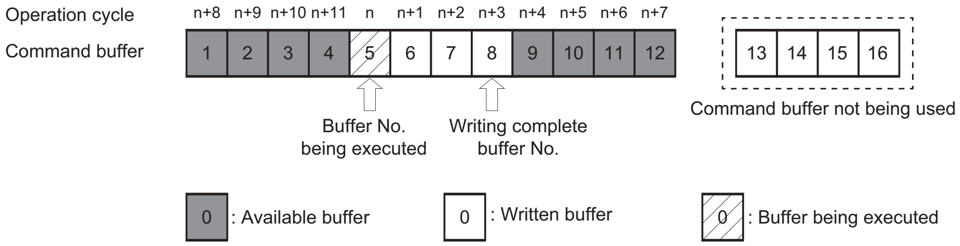
The following shows the operation when 12 command buffers are used.

- Operation example

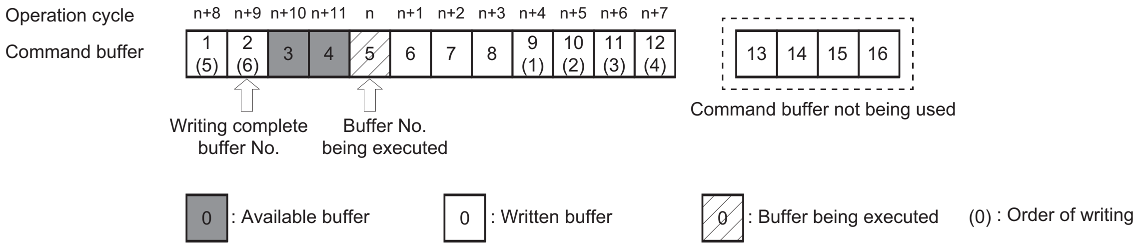
The Simple Motion board updates the buffer No. being executed in each operation cycle and operates direct control using the position command data of the command buffer that is indicated by the buffer No. being executed.

When there is a buffer which has been written, the axis operates because the position command data is sent to the servo amplifier in order.

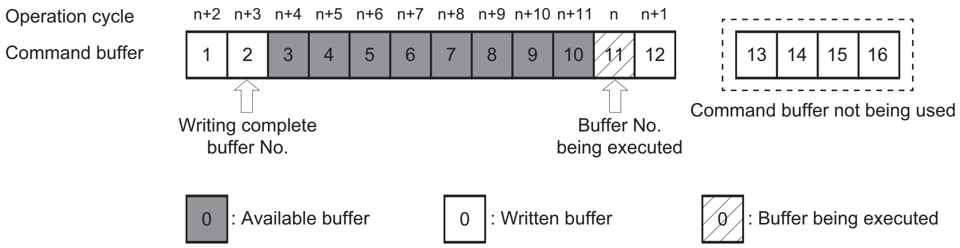
When there is no buffer which has been written (the buffer No. being executed and the writing complete buffer No. are matched), the axis stops because the same position command data is sent to the servo amplifier continuously.



To write the position command data for 6 operation cycles from the above drawing, write as follows.



The available buffers are increased by passing a few operation cycle. Therefore, the axis can be operated continuously by writing the position command data to the available buffer continuously.



■How to remain the servo amplifier stopped at the same position

The methods to remain the servo amplifier stopped at the same position during direct control are shown below.

(1) Not to update the command buffer.

(2) Write the same value of the position command data and update the command buffer continuously.

It is recommended to use the (1) above because the command buffer does not need to be updated by the user program and the load of the user program is reduced.

Precautions of command buffer control

When "[Cd.1212] Direct control writing complete buffer No. (position control)" is set to "0: Not write position command data", the address stored in "[Md.20] Feed current value" is used as the position command data. When "[Pr.1] Unit setting" is set to "2: degree", the operation by the position command data takes a shortcut. When a value larger than 359.99999° is set as the position command data, it is regarded as a rounded address within 359.99999°.

Control method when using operation cycle interrupt

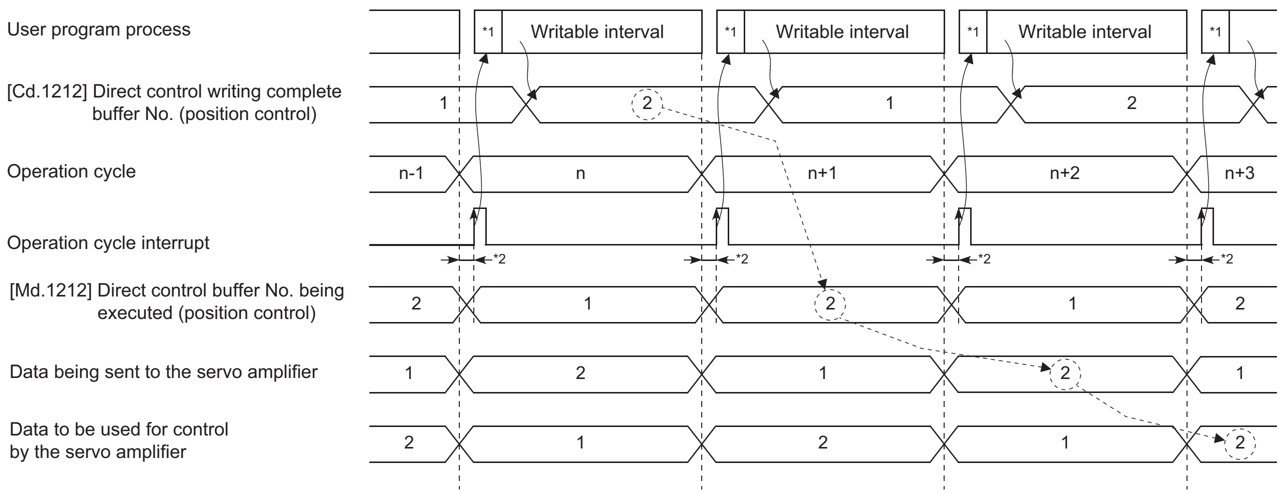
The command buffer can be updated with an interrupt as a trigger by using the operation cycle interrupt of the interrupt function.

The command buffer can be controlled by 2 buffers in a minimum by the operation cycle interrupt, so that the position command data can be sent to the servo amplifier with checking the axis status. Thus, the position control corresponding to the situation can be executed.

When using the operation cycle interrupt, write the position command data within the operation cycle after the interrupt handler processing.

The following shows the timings that the position command data is written and that the written position command data is sent to the servo amplifier.

■Operation example



*1 Handler

*2 The Simple Motion board updates the buffer No. being executed right before the operation cycle interrupt. Thus, it may not be reflected correctly if the position command data is updated right before of the operation cycle switching (right before the next operation cycle interrupt is output).

Control method when not using operation cycle interrupt

The command buffer can be updated at any timing by using up to 16 command buffers.

The command buffer can be updated at any timing, so that the load of the user program can be reduced. Because the multiple command buffers are used, a delay occurs according to the number of command buffers to be used until the position command data is executed.

To keep operating the axis, update the command buffer before the written command buffer is nonexistence.

List of parameters and data

The following shows the configuration of parameters and data for direct control.

Buffer memory area	Item		
Direct control setting parameter	[Pr.1210]	Direct control number of used buffers	1 point
Control data for direct control	[Cd.1210]	Direct control start request	1 point
	[Cd.1212]	Direct control writing complete buffer No. (position control)	1 point
	[Cd.1220]	Direct control command buffer (position control)	16 points
Direct control monitor data	[Md.1134]	Direct control enable flag (all axes)	1 point
	[Md.1210]	Direct control operation status	1 point
	[Md.1211]	Direct control enable flag	1 point
	[Md.1212]	Direct control buffer No. being executed (position control)	1 point
	[Md.1213]	Direct control maximum buffer No. (position control)	1 point

Direct control setting parameter

n: Axis No. - 1

Setting item		Setting details/Setting value	Initial value	Buffer memory address
[Pr.1210]	Direct control number of used buffers	Set the number of command buffers during direct control. 0: Do not use direct control 1: Outside the setting range 2 to 16: The number of command buffers to be used Fetch cycle: User program READY signal [Y0] OFF to ON	0	91000+20n

For labels, refer to the following.

☞ Page 452 Direct control setting parameter

[Pr.1210] Direct control number of used buffers

Set the number of command buffers when using direct control.

Setting the number of command buffers enables update of the command buffers at an arbitrary timing.

However, the execution of the position command data will delay according to the number of command buffers.

Control data for direct control

n: Axis No. - 1

Setting item		Setting details/Setting value	Initial value	Buffer memory address
[Cd.1210]	Direct control start request	Set direct control start/stop. 0: Direct control stop 1: Direct control start Fetch cycle: Operation cycle	0	91640+20n
[Cd.1212]	Direct control writing complete buffer No. (position control)	Set the buffer No. of "[Cd.1220] Direct control command buffer (position control)" in which the latest position command data has been written. 0: Not write position command data 1 to 16: Writing complete buffer No. Fetch cycle: Operation cycle	0	91642+20n
[Cd.1220]	Direct control command buffer (position control)	Write the position command data for each operation cycle. -2147483648 to 2147483647 The unit is the same as "[Pr.1] Unit setting". Fetch cycle: Operation cycle	0	91960+120n

For labels, refer to the following.

☞ Page 452 Control data for direct control

[Cd.1210] Direct control start request

Execute the switching between standard control and direct control by direct control start/stop.
Check the switching conditions of direct control and execute direct control start/stop.
When the conditions are not satisfied, the error "Direct control start not possible" (error code: 1E06H) occurs and the operation cannot be switched to the direct control.
Refer to the following for details on switching conditions of direct control.

☞ Page 205 Switching conditions of direct control

[Cd.1212] Direct control writing complete buffer No. (position control)

After writing the position command data to "[Cd.1220] Direct control command buffer (position control)", set the command buffer No. that has written the position command data. The position command data can be sent to the servo amplifier by updating the writing complete buffer No.
The available writing complete buffer No. is determined according to "[Pr.1210] Direct control number of used buffers". When the command buffer No. outside the range is set, the error "Direct control command buffer over" (error code: 1E08H) occurs and the operation stops immediately.
The Simple Motion board sets "0: Not write position command data" at direct control start. When "0: Not write position command data" is set during direct control, the address stored in "[Md.20] Feed current value" is used as the position command data.

[Cd.1220] Direct control command buffer (position control)

Write the position command data to be sent to the servo amplifier.
The unit of the position command data to be written and the position sending to the servo amplifier are determined according to the parameters shown below.

Setting item		
Positioning parameters	[Pr.1]	Unit setting
	[Pr.2]	Number of pulses per rotation (AP)
	[Pr.3]	Movement amount per rotation (AL)
	[Pr.4]	Unit magnification (AM)

7

Direct control monitor data

n: Axis No. - 1

Storage item		Storage details/Storage value	Initial value	Buffer memory address
[Md.1134]	Direct control enable flag (all axes)	The status of "[Md.1211] Direct control enable flag" of all axes is stored from b0 in order of the axis Nos. OFF: Disable command buffer control ON: Enable command buffer control Refresh cycle: Operation cycle	0	90808
[Md.1210]	Direct control operation status	The operation status of direct control is stored. -2: Direct control stop disable -1: Direct control start disable 0: Standard control 1: Direct control Refresh cycle: At direct control start/stop	0	91320+20n
[Md.1211]	Direct control enable flag	The status of availability of command buffer control in which the command buffer and writing complete buffer No. have been used is stored. 0: Disable command buffer control 1: Enable command buffer control Refresh cycle: At direct control start/stop	0	91321+20n
[Md.1212]	Direct control buffer No. being executed (position control)	The buffer No. of "[Cd.1220] Direct control command buffer (position control)" being executed is stored. 0: Not execute position command data 1 to 16: Buffer No. being executed Refresh cycle: Operation cycle	0	91322+20n
[Md.1213]	Direct control maximum buffer No. (position control)	The maximum buffer No. of "[Cd.1220] Direct control command buffer (position control)" that can be used is stored. 0: Do Not use direct control 2 to 16: Maximum buffer No. Refresh cycle: User program READY signal [Y0] OFF to ON	0	91323+20n

For labels, refer to the following.

☞ Page 452 Direct control monitor data

[Md.1134] Direct control enable flag (all axes)

The status of "[Md.1211] Direct control enable flag" of all axes is stored from b0 in order of the axis Nos.

[Md.1210] Direct control operation status

The operation status of direct control is stored.

When the conditions are not satisfied at direct control start, "-1: Direct control start disable" is set. If stop cause occurs during direct control, "-2: Direct control stop disable" is stored.

Conditions for "-2: Direct control stop disable"	
At stop cause occurrence for direct control	"[Cd.1210] Direct control start request" is set to "0: Direct control stop".
	"[Cd.180] Axis stop" is turned ON.
	The stop signal of "[Cd.44] External input signal operation device (Axis 1 to 16)" is turned ON.

Refer to the following for details of switching conditions of direct control and stop cause.

☞ Page 205 Switching conditions of direct control
☞ Page 208 Stop cause during direct controls

[Md.1211] Direct control enable flag

The status of availability of command buffer control in which the command buffer and writing complete buffer No. have been used is stored.

If stop cause occurs during standard control or direct control, "0: Disable command buffer control" is stored.

Conditions for "0: Disable command buffer control"
During standard control

[Md.1212] Direct control buffer No. being executed (position control)

The buffer No. of "[Cd.1220] Direct control command buffer (position control)" which stores the position command data being executed is stored.
When direct control does not execute the position command data of command buffer at direct control start or stop cause occurrence, "0: Not execute position command data" is stored.

Conditions for "0: Not execute position command data"
During standard control
At direct control start

[Md.1213] Direct control maximum buffer No. (position control)

The maximum buffer No. of "[Cd.1220] Direct control command buffer (position control)" that can be used during direct control is stored. Available number of buffers is set by "[Pr.1210] Direct control number of used buffers".

8 CONTROL SUB FUNCTIONS

The details and usage of the "sub functions" added and used in combination with the main functions are explained in this chapter.
A variety of sub functions are available, including functions specifically for machine home position return and generally related functions such as control compensation, etc. More appropriate, finer control can be carried out by using these sub functions.
Each sub function is used together with a main function by creating matching parameter settings and user programs. Read the execution procedures and settings for each sub function, and set as required.

8.1 Outline of Sub Functions

"Sub functions" are functions that compensate, limit, add functions, etc., to the control when the main functions are executed.
These sub functions are executed by parameter settings, operation from EM Configurator, sub function user programs, etc.

Outline of sub functions

The following table shows the types of sub functions available.

Sub function		Details
Functions that compensate control	Backlash compensation function	This function compensates the mechanical backlash. Feed command equivalent to the set backlash amount are output each time the movement direction changes.
	Electronic gear function	By setting the movement amount per pulse, this function can freely change the machine movement amount per commanded pulse. When the movement amount per pulse is set, a flexible positioning system that matches the machine system can be structured.
	Near pass function [*1]	This function suppresses the machine vibration when the speed is changed during continuous path control in the interpolation control.
Functions that limit control	Speed limit function	If the command speed exceeds "[Pr.8] Speed limit value" during control, this function limits the commanded speed to within the "[Pr.8] Speed limit value" setting range.
	Torque limit function	If the torque generated by the servomotor exceeds "[Pr.17] Torque limit setting value" during control, this function limits the generated torque to within the "[Pr.17] Torque limit setting value" setting range.
	Software stroke limit function	If a command outside of the upper/lower limit stroke limit setting range, set in the parameters, is issued, this function will not execute positioning for that command.
	Hardware stroke limit function	This function carries out deceleration stop with the hardware stroke limit switch.
	Forced stop function	This function stops all axes of the servo amplifier with the forced stop signal.
Functions that change control details	Speed change function	This function changes the speed during positioning. Set the changed speed in the speed change buffer memory ([Cd.14] New speed value), and change the speed with the speed change request ([Cd.15] Speed change request).
	Override function	This function changes the speed within a percentage of 0 to 300% during positioning. This is executed using "[Cd.13] Positioning operation speed override".
	Acceleration/deceleration time change function	This function changes the acceleration/deceleration time during speed change.
	Torque change function	This function changes the "torque limit value" during control.
	Target position change function	This function changes the target position during the execution of positioning. At the same time, this also can change the speed.
Functions related to positioning start	Pre-reading start function	This function shortens the virtual start time.
Absolute position system function		This function restores the absolute position of designated axis.
Functions related to positioning stop	Stop command processing for deceleration stop function	This function selects a deceleration curve when a stop cause occurs during deceleration stop processing to speed 0.
	Continuous operation interrupt function	This function interrupts continuous operation. When this request is accepted, the operation stops when the execution of the current positioning data is completed.
	Step function	This function temporarily stops the operation to confirm the positioning operation during debugging, etc. The operation can be stopped at each "automatic deceleration" or "positioning data".

Sub function		Details
Other functions	Skip function	This function stops the positioning being executed (decelerates to a stop) when the skip signal is input, and carries out the next positioning.
	M code output function	This function issues a command for a sub work (clamp or drill stop, tool change, etc.) according to the code No. (0 to 65535) that can be set for each positioning data. The M code output timing can be set for each positioning data.
	Teaching function	This function stores the address positioned with manual control into the positioning address ([Da.6] Positioning address/movement amount) having the designated positioning data No.
	Command in-position function	This function calculates the remaining distance for the Simple Motion board to reach the positioning stop position, and when the value is less than the set value, sets the "command in-position flag". When using another sub work before ending the control, use this function as a trigger for the sub work.
	Acceleration/deceleration processing function	This function adjusts the control acceleration/deceleration.
	Deceleration start flag function	This function turns ON the flag when the constant speed status or acceleration status switches to the deceleration status during position control, whose operation pattern is "Positioning complete", to make the stop timing known.
	Speed control 10 × multiplier setting for degree axis function	This function executes the positioning control by the 10 × speed of the command speed and the speed limit value when the setting unit is "degree".
	Operation setting for incompletion of home position return function	This function is provided to select whether positioning control is operated or not when the home position return request flag is ON.
	Controller in-position function	This function controls ON/OFF of the controller in-position flag according to the controller in-position range check of the Simple Motion board.
Servo ON/OFF	Servo ON/OFF	This function executes servo ON/OFF of the servo amplifiers connected to the Simple Motion board.
	Follow up function	This function monitors the motor rotation amount with the servo turned OFF, and reflects it on the feed current value.

*1 The near pass function is featured as standard and is valid only for setting continuous path control for position control. It cannot be set to be invalid with parameters.

8.2 Functions for Compensating the Control

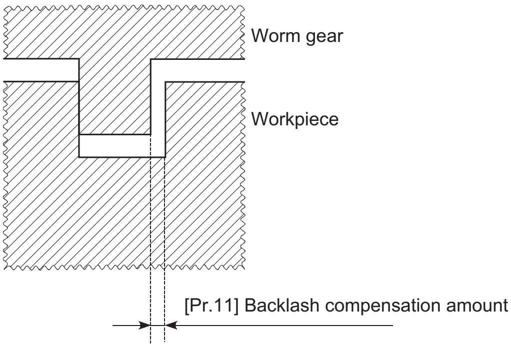
The sub functions for compensating the control include the "backlash compensation function", "electronic gear function", and "near pass function". Each function is executed by parameter setting or user program creation and writing.

Backlash compensation function

The "backlash compensation function" compensates the backlash amount in the mechanical system.

Control details

When the backlash compensation amount is set, an extra amount of command equivalent to the set backlash amount is output every time the movement direction changes.
The following drawing shows the operation of the backlash compensation function.



Precautions during control

- The feed command of the backlash compensation amount are not added to the "[Md.20] Feed current value" or "[Md.21] Feed machine value".
- Always carry out a machine home position return before starting the control when using the backlash compensation function (when "[Pr.11] Backlash compensation amount" is set). The backlash in the mechanical system cannot be correctly compensated if a machine home position return is not carried out.
- Backlash compensation, which includes the movement amount and "[Pr.11] Backlash compensation amount", is output the moment at the moving direction changes.
- Backlash compensation cannot be made when the speed control mode or torque control mode.
- In an axis operation such as positioning after home position return, whether the backlash compensation is necessary or not is judged from "[Pr.44] Home position return direction" of the Simple Motion board. When the positioning is executed in the same direction as "[Pr.44] Home position return direction", the backlash compensation is not executed. However, when the positioning is executed in the reverse direction against "[Pr.44] Home position return direction", the backlash compensation is executed.

Setting method

To use the "backlash compensation function", set the "backlash compensation amount" in the parameter shown in the following table, and write it to the Simple Motion board.

The set details are validated at the rising edge (OFF → ON) of the user program READY signal [Y0].

Setting item		Setting value	Setting details	Factory-set initial value
[Pr.11]	Backlash compensation amount	→	Set the backlash compensation amount.	0
[Pr.44]	Home position return direction	→	Set the same direction as the last home position return direction of the servo amplifier when using the driver home position return method.	0

Refer to the following for the setting details.

☞ Page 453 Basic Setting

Point

Parameters are set for each axis.

Electronic gear function

The "electronic gear function" adjusts the actual machine movement amount and number of pulse output to servo amplifier according to the parameters set in the Simple Motion board.

The "electronic gear function" has the following three functions ([A] to [C]).

[A] During machine movement, the function increments in the Simple Motion board values less than one pulse that could not be output, and outputs the incremented amount when the total incremented value reached one pulse or more.

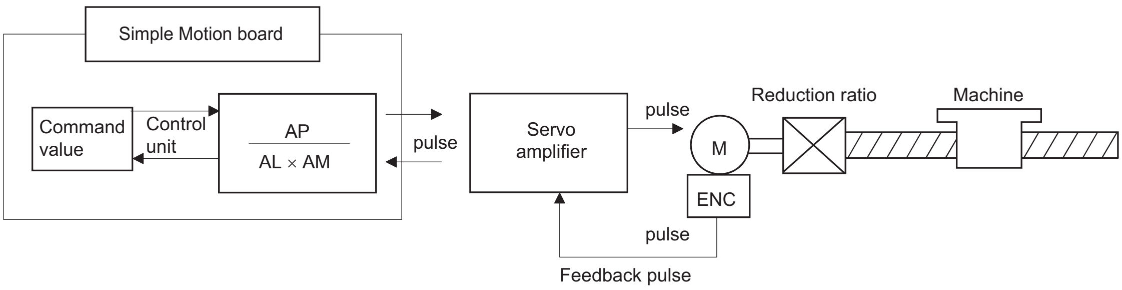
[B] When machine home position return is completed, current value changing is completed, speed control is started (except when feed current value is updated), or fixed-feed control is started, the function clears to "0" the cumulative values of less than one pulse which could not be output. (If the cumulative value is cleared, an error will occur by a cleared amount in the feed machine value. Control can be constantly carried out at the same machine movement amount, even when the fixed-feed control is continued.)

[C] The function compensates the mechanical system error of the command movement amount and actual movement amount by adjusting the "electronic gear". (The "movement amount per pulse" value is defined by "[Pr.2] Number of pulses per rotation (AP)", "[Pr.3] Movement amount per rotation (AL)" and "[Pr.4] Unit magnification (AM)".)

The Simple Motion board automatically carries out the processing for [A] and [B].

Basic concept of the electronic gear

The electronic gear is an item which determines how many rotations (rotations by how many pulses) the motor must make in order to move the machine according to the movement amount specified by the user program.



The basic concept of the electronic gear is represented by the following expression.

[Pr.2] (Number of pulses per rotation) = AP

[Pr.3] (Movement amount per rotation) = AL

[Pr.4] (Unit magnification) = AM

Movement amount of the machine per rotation that considered unit magnification = ΔS

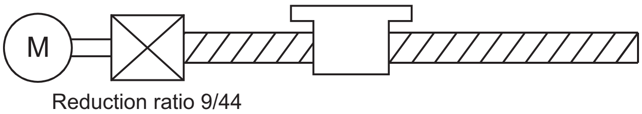
$$\text{Electronic gear} = \frac{AP}{\Delta S} = \frac{AP}{AL \times AM} \quad \cdots (1)$$

Set values for AP, AL and AM so that this related equation is established.

However, because values to be set for AP, AL and AM have the settable range, values calculated (reduced) from the above related equation must be contained in the setting range for AP, AL and AM.

■For "Ball screw" + "Reduction gear"

When the ball screw pitch is 10 mm, the motor is the HG-KR (4194304 pulses/rev) and the reduction ratio of the reduction gear is 9/44.



First, find how many millimeters the load (machine) will travel (ΔS) when the motor turns one revolution (AP).

AP (Number of pulses per rotation) = 4194304 [pulse]

ΔS (Movement amount of the machine per rotation) = Ball screw pitch × Reduction ratio

= 10 [mm] × 9/44

= 10000.0 [μm] × 9/44

When the control unit is "mm", the minimum command unit is 0.1 μm.

Substitute this for the above expression (1).

At this time, make calculation with the reduction ratio 9/44 remaining as a fraction.

$$\frac{AP}{\Delta S} = \frac{4194304\ [\text{pulse}]}{10000.0\ [\mu m] \times 9/44}$$

$$= \frac{4194304 \times 44}{10000.0 \times 9}$$

$$= \frac{184549376}{90000.0}$$

$$= \frac{23068672}{11250.0} = \frac{23068672(AP)}{11250.0(AL) \times 1(AM)}$$

$$= \frac{23068672(AP)}{1125.0(AL) \times 10(AM)}$$

Thus, AP, AL and AM to be set are as follows. These two examples of settings are only examples. There are settings other than these examples.

Setting value	Setting item
AP = 23068672	[Pr.2]
AL = 11250.0	[Pr.3]
AM = 1	[Pr.4]

or

Setting value	Setting item
AP = 23068672	[Pr.2]
AL = 1125.0	[Pr.3]
AM = 10	[Pr.4]

■When "pulse" is set as the control unit

When using pulse as the control unit, set the electronic gear as follows.

AP = "Number of pulses per rotation"

AL = "Movement amount per rotation"

AM = 1

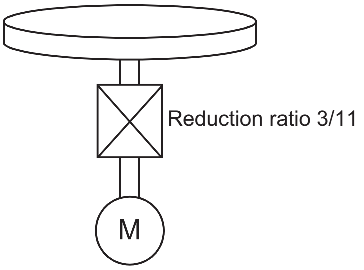
Ex.

When the motor is the HG-KR (4194304 pulses/rev)

Setting value	Setting item
AP = 4194304	[Pr.2]
AL = 4194304	[Pr.3]
AM = 1	[Pr.4]

■When "degree" is set as the control unit for a rotary axis

When the rotary axis is used, the motor is HG-KR (4194304 pulses/rev) and the reduction ratio of the reduction gear is 3/11.



First, find how many degrees the load (machine) will travel (ΔS) when the motor turns one revolution (AP).

AP (Number of pulses per rotation) = 4194304 [pulse]

ΔS (Movement amount of the machine per rotation)

= 360.00000 [degree] × Reduction ratio

= 360.00000 × 3/11

Substitute this for the above expression (1).

At this time, make calculation with the reduction ratio 3/11 remaining as a fraction.

$$\frac{AP}{\Delta S} = \frac{4194304\ [\text{pulse}]}{360.00000\ [\text{degree}] \times 3/11}$$

$$= \frac{4194304\ [\text{pulse}] \times 11}{360.00000\ [\text{degree}] \times 3}$$

$$= \frac{46137344}{1080.00000}$$

$$= \frac{2883584}{67.50000} = \frac{2883584(\text{AP})}{67.50000(\text{AL}) \times 1(\text{AM})}$$

$$= \frac{2883584(\text{AP})}{0.06750(\text{AL}) \times 1000(\text{AM})}$$

Thus, AP, AL and AM to be set are as follows. These two examples of settings are only examples. There are settings other than these examples.

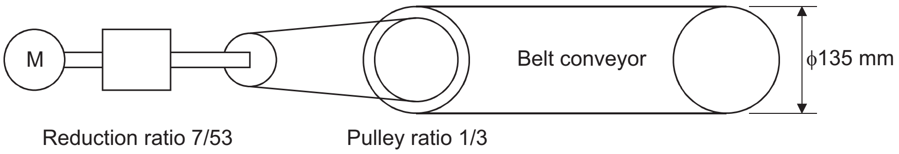
Setting value	Setting item
AP = 2883584	[Pr.2]
AL = 67.50000	[Pr.3]
AM = 1	[Pr.4]

or

Setting value	Setting item
AP = 2883584	[Pr.2]
AL = 0.06750	[Pr.3]
AM = 1000	[Pr.4]

■When "mm" is set as the control unit for conveyor drive (calculation including π)

When the belt conveyor drive is used, the conveyor diameter is 135 mm, the pulley ratio is 1/3, the motor is HG-KR (4194304 pulses/rev) and the reduction ratio of the reduction gear is 7/53.



As the travel value of the conveyor is used to exercise control, set "mm" as the control unit.

First, find how many millimeters the load (machine) will travel (ΔS) when the motor turns one revolution (AP).

AP (Number of pulses per rotation) = 4194304 [pulse]

ΔS (Movement amount of the machine per rotation)

= 135000.0 [μm] × π × Reduction ratio

= 135000.0 [μm] × π × 7/53 × 1/3

Substitute this for the above expression (1).

At this time, make calculation with the reduction ratio 7/53 × 1/3 remaining as a fraction.

$$\frac{AP}{\Delta S} = \frac{AP}{AL \times AM} = \frac{4194304\ [\text{pulse}]}{135000.0\ [\mu m] \times \pi \times 7/53 \times 1/3}$$

$$= \frac{4194304 \times 53 \times 3}{135000.0 \times \pi \times 7}$$

$$= \frac{166723584}{236250 \times \pi}$$

Here, make calculation on the assumption that π is equal to 3.141592654.

$$\frac{AP}{\Delta S} = \frac{AP}{AL \times AM} = \frac{166723584}{742201.2645075}$$

AL has a significant number to first decimal place, round down numbers to two decimal places.

$$\frac{AP}{\Delta S} = \frac{AP}{AL \times AM} = \frac{166723584}{742201.2} = \frac{166723584(AP)}{742201.2(AL) \times 1(AM)}$$

Thus, AP, AL and AM to be set are as follows.

Setting value	Setting item
AP = 166723584	[Pr.2]
AL = 742201.2	[Pr.3]
AM = 1	[Pr.4]

This setting will produce an error for the true machine value, but it cannot be helped.

This error is as follows.

$$\left[\frac{7422012/166723584}{2362500\pi/166723584} - 1 \right] \times 100 = -8.69 \times 10^{-6}\ [\%]$$

AP (Number of pulses per rotation) = 4194304 [pulse]

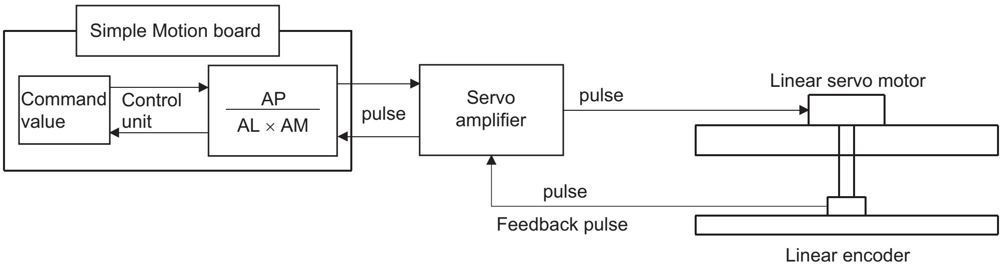
ΔS (Movement amount of the machine per rotation)

= 135000.0 [μm] × π × Reduction ratio

= 135000.0 [μm] × π × 7/53 × 1/3

It is equivalent to an about 86.9 [μm] error in continuous 1 km feed.

■Number of pulses/movement amount at linear servo use



Calculate the number of pulses (AP) and movement amount (AL × AM) for the linear encoder in the following conditions.

$$\text{Linear encoder resolution} = \frac{\text{Number of pulses (AP)}}{\text{Movement amount (AL} \times \text{AM)}}$$

Linear encoder resolution: 0.05 [μm] per pulse

$$\frac{1\ \text{[pulse]}}{0.05\ [\mu\text{m}]} = \frac{\text{Number of pulses (AP) [pulse]}}{\text{Movement amount (AL} \times \text{AM) } [\mu\text{m}]} = \frac{20}{1.0}$$

Set the number of pulses in "[Pr.2] Number of pulses per rotation (AP)", the movement amount in "[Pr.3] Movement amount per rotation (AL)", and the unit magnification in "[Pr.4] Unit magnification (AM)" in the actual setting.
Set the same value in AP, AL, and AM as the value set in the servo parameter "Linear encoder resolution - Numerator (PL02)" and "Linear encoder resolution - Denominator (PL03)". Refer to each servo amplifier instruction manual for details.
When "Linear encoder resolution - Numerator (PL02)" is set to 1 [μm] and "Linear encoder resolution - Denominator (PL03)" is set to 20 [μm], the values of AP, AL and AM are shown below.

Setting value	Setting item
AP = 20	[Pr.2]
AL = 1.0	[Pr.3]
AM = 1	[Pr.4]

The method for compensating the error

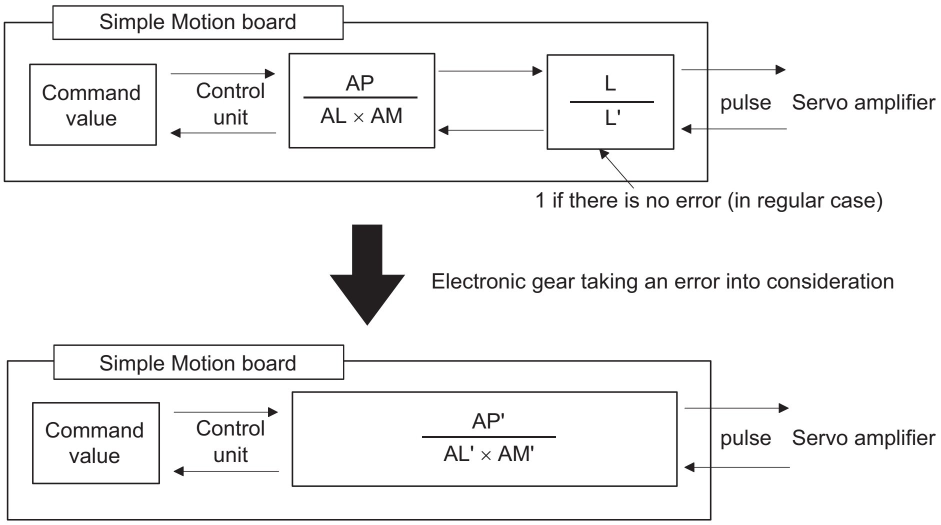
When the position control is carried out using the "Electronic gear" set in a parameter, this may produce an error between the command movement amount (L) and the actual movement amount (L'). With Simple Motion board, this error is compensated by adjusting the electronic gear.

The "Error compensation amount", which is used for error compensation, is defined as follows:

$$\text{Error compensation amount} = \frac{\text{Command movement amount (L)}}{\text{Actual movement amount (L')}}$$

The electronic gear including an error compensation amount is shown below.

$$\frac{AP}{AL \times AM} \times \frac{L}{L'} = \frac{AP'}{AL' \times AM'}$$



■Calculation example

(Conditions)

Number of pulses per rotation (AP) : 4194304 [pulse]
Movement amount per rotation (AL) : 5000.0 [μm]
Unit magnification (AM) : 1

(Positioning results)

Command movement amount (L) : 100 [mm]
Actual movement amount (L') : 101 [mm]

(Compensation value)

$$\frac{AP}{AL \times AM} \times \frac{L}{L'} = \frac{4194304}{5000.0 \times 1} \times \frac{100}{101} = \frac{4194304(AP')}{5050(AL') \times 1(AM')}$$

Number of pulses per rotation (AP') : 4194304 • • • [Pr.2]
Movement amount per rotation (AL') : 5050.0 • • • • [Pr.3]
Unit magnification (AM') : 1 • • • • • • [Pr.4]

Set the post-compensation "[Pr.2] Number of pulses per rotation (AP')", "[Pr.3] Movement amount per rotation (AL')", and "[Pr.4] Unit magnification (AM')" in the parameters, and write them to the Simple Motion board. The set details are validated at the rising edge (OFF → ON) of the user program READY signal [Y0].

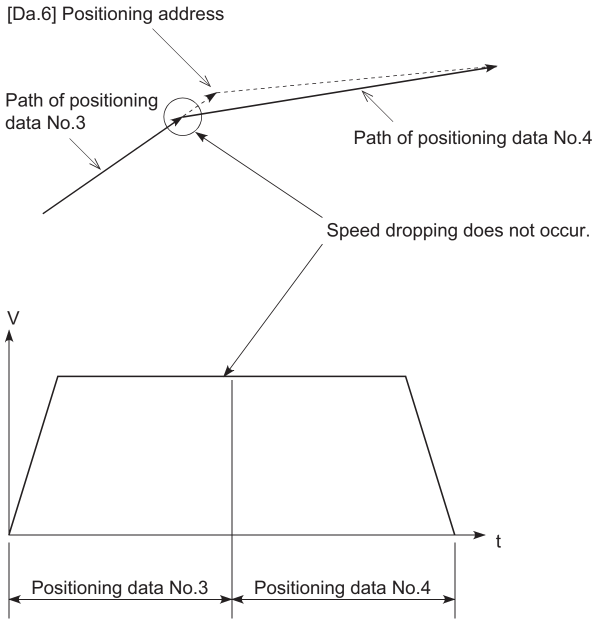
Near pass function

When continuous pass control is carried out using interpolation control, the near pass function is carried out.
The "near pass function" is a function to suppress the mechanical vibration occurring at the time of switching the positioning data when continuous pass control is carried out using interpolation control.
[Near pass function]
The extra movement amount occurring at the end of each positioning data unit being continuously executed is carried over to the next positioning data unit. Alignment is not carried out, and thus the output speed drops are eliminated, and the mechanical vibration occurring during speed changes can be suppressed.
Because alignment is not carried out, the operation is controlled on a path that passes near the position set in "[Da.6] Positioning address/movement amount".

Control details

The following drawing shows the path of the continuous path control by the 2-axis linear interpolation control.

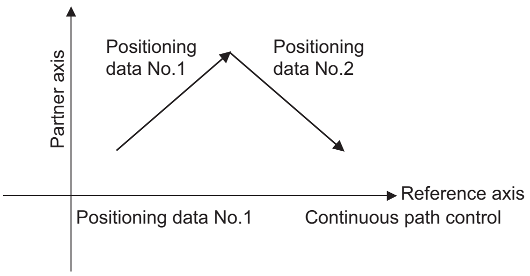
■The path of the near pass



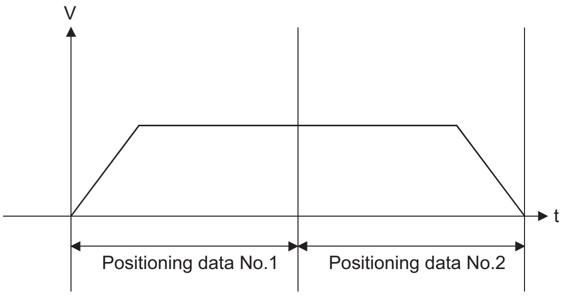
Precautions during control

- If the movement amount designated by the positioning data is small when the continuous path control is executed, the output speed may not reach the designated speed.
- The movement direction is not checked during interpolation operation. Therefore, a deceleration stops are not carried out even if the movement direction changes. (See below) For this reason, the output will rapidly reverse when the reference axis movement direction changes. To prevent the rapid output reversal, assign not the continuous path control "11", but the continuous positioning control "01" to the positioning data of the passing point.

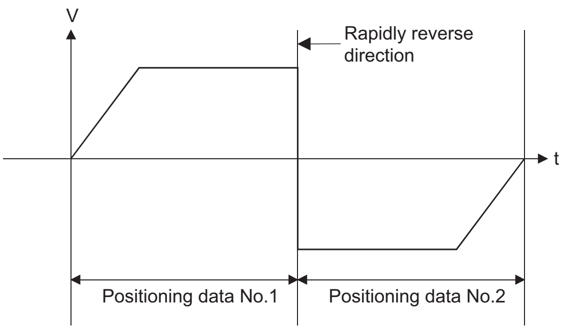
■Positioning by interpolation



■Operation of reference axis



■Operation of partner axis for interpolation



8.3 Functions to Limit the Control

Functions to limit the control include the "speed limit function", "torque limit function", "software stroke limit function", "hardware stroke limit function", and "forced stop function". Each function is executed by parameter setting or user program creation and writing.

Speed limit function

The speed limit function limits the command speed to a value within the "speed limit value" setting range when the command speed during control exceeds the "speed limit value".

Relation between the speed limit function and various controls

The following table shows the relation of the "speed limit function" and various controls.

◎: Always set

—: Setting not required (Use the initial value or a value within the setting range.)

Control type			Speed limit function	Speed limit value
Home position return control	Machine home position return control		◎	[Pr.8] Speed limit value The speed limit value follows the setting of the driver (servo amplifier) when using the driver home position return method.
	Fast home position return control		◎	[Pr.8] Speed limit value
Major positioning control	Position control	1-axis linear control	◎	
		2 to 4-axis linear interpolation control	◎	
		1-axis fixed-feed control	◎	
		2 to 4-axis fixed-feed control (interpolation)	◎	
		2-axis circular interpolation control	◎	
		3-axis helical interpolation control	◎	
	1 to 4-axis speed control		◎	
	Speed-position switching control, Position-speed switching control		◎	
	Other control	Current value changing	—	Setting value invalid
		JUMP instruction, NOP instruction, LOOP to LEND	—	
Manual control	JOG operation, Inching operation		◎	[Pr.31] JOG speed limit value
	Manual pulse generator operation		—	Setting is invalid
Expansion control	Speed-torque control		◎	[Pr.8] Speed limit value

Precautions during control

- If any axis exceeds "[Pr.8] Speed limit value" during 2- to 4-axis speed control, the axis exceeding the speed limit value is controlled with the speed limit value. The speeds of the other axes being interpolated are suppressed by the command speed ratio.
- If the reference axis exceeds "[Pr.8] Speed limit value" during 2-axis circular interpolation control, the reference axis is controlled with the speed limit value (The speed limit does not function on the interpolation axis side.)
- If any axis exceeds "[Pr.8] Speed limit value" during 2- to 4-axis linear interpolation control or 2- to 4-axis fixed-feed control, the axis exceeding the speed limit value is controlled with the speed limit value. The speeds of the other axes being interpolated are suppressed by the movement amount ratio.
- In the 3-axis helical interpolation control, the composite speed of the circular interpolation axis or the speed of the linear interpolation axis is controlled not to exceed "[Pr.8] Speed limit value". (However, when the movement amount of the linear interpolation axis is more than the composite movement amount of the circular interpolation axis, such as when the number of pitches ("[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches") set in the linear interpolation axis is less, the speed of the linear interpolation axis cannot be suppressed with "[Pr.8] Speed limit value".)

Point

When the "reference axis speed" is set during interpolation control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed the "[Pr.8] Speed limit value".

Setting method

To use the "speed limit function", set the "speed limit value" in the parameters shown in the following table, and write them to the Simple Motion board.

The set details are validated at the next start after they are written to the Simple Motion board.

Setting item		Setting value	Setting details	Factory-set initial value
[Pr.8]	Speed limit value	→	Set the speed limit value (max. speed during control).	200000
[Pr.31]	JOG speed limit value	→	Set the speed limit value during JOG operation (max. speed during control). (Note that "[Pr.31] JOG speed limit value" shall be less than or equal to "[Pr.8] Speed limit value".)	20000

Refer to the following for the setting details.

☞ Page 453 Basic Setting

Point

Parameters are set for each axis.

Torque limit function

The "torque limit function" limits the generated torque to a value within the "torque limit value" setting range when the torque generated in the servomotor exceeds the "torque limit value".

The "torque limit function" protects the deceleration function, limits the power of the operation pressing against the stopper, etc. It controls the operation so that unnecessary force is not applied to the load and machine.

Relation between the torque limit function and various controls

The following table shows the relation of the "torque limit function" and various controls.

○: Set when required (Set to " — " when not used.)

—: Setting not required (Use the initial value or a value within the setting range.)

Control type			Torque limit function	Torque limit value *1
Home position return control	Machine home position return control		○	"[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value".*2 The home position return method that can change the torque limit value during the home position return is set in home position return parameters of the servo amplifier.*3
	Fast home position return control		○	"[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value".
Major positioning control	Position control	1-axis linear control	○	
		2 to 4-axis linear interpolation control	○	
		1-axis fixed-feed control	○	
		2 to 4-axis fixed-feed control (interpolation)	○	
		2-axis circular interpolation control	○	
		3-axis helical interpolation control	○	
	1 to 4-axis speed control		○	
	Speed-position switching control, Position-speed switching control		○	
	Other control	Current value changing	—	Setting value is invalid.
		JUMP instruction, NOP instruction, LOOP to LEND	—	
Manual control	JOG operation, Inching operation		○	"[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value".
	Manual pulse generator operation		○	
Expansion control	Speed-torque control		○	Torque limit value is continued after control mode switching.

*1 Shows the torque limit value when "[Cd.22] New torque value/forward new torque value" or "[Cd.113] New reverse torque value" is set to "0".

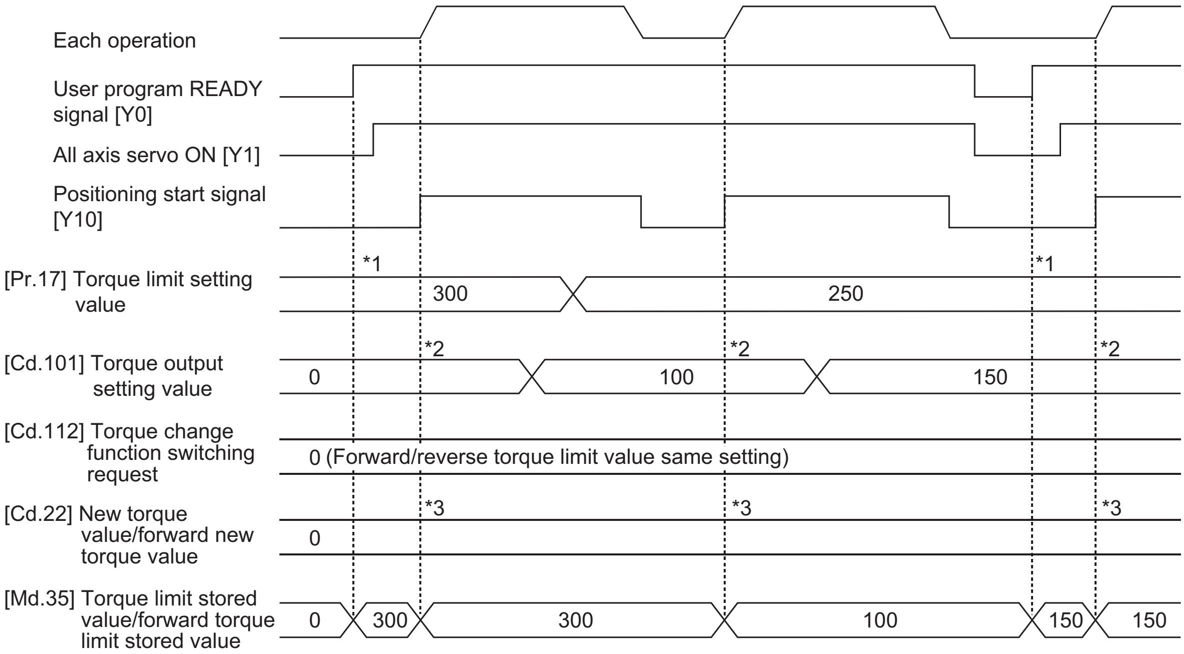
*2 Valid for the value set at start only. It cannot be changed during the home position return.

*3 Refer to the servo amplifier instruction manual for the setting method.

Control details

The following drawing shows the operation of the torque limit function.

■Axis 1 to 4 operation example



*1 The torque limit setting value or torque output setting value becomes effective at the user program READY signal [Y0] rising edge (however, after the servo is turned ON.)
If the torque output setting value is "0" or larger than the torque limit setting value, the torque limit setting value will be its value.

*2 The torque limit setting value or torque output setting value becomes effective at the positioning start signal [Y10] rising edge.
If the torque output setting value is "0" or larger than the torque limit setting value, the torque limit setting value will be its value.

*3 The torque change value is cleared to "0" at the positioning start signal [Y10] rising edge.

Precautions during control

- When limiting the torque at the "[Pr.17] Torque limit setting value", confirm that "[Cd.22] New torque value/forward new torque value" or "[Cd.113] New reverse torque value" is set to "0". If this parameter is set to a value besides "0", the setting value will be validated, and the torque will be limited at that value. (Refer to ☞ Page 261 Torque change function for details about the "new torque value".)
- When the operation is stopped by torque limiting, the droop pulse will remain in the deviation counter. If the load torque is eliminated, operation for the amount of droop pulses will be carried out. Note that the movement might start rapidly as soon as the load torque is eliminated.

8

Setting method

- To use the "torque limit function", set the "torque limit value" in the parameters shown in the following table, and write them to the Simple Motion board.

The set details are validated at the rising edge (OFF → ON) of the user program READY signal [Y0].

Setting item		Setting value	Setting details	Factory-set initial value
[Pr.17]	Torque limit setting value	→	Set the torque limit value*1 in 0.1% unit.	3000

The set details are validated at the rising edge (OFF → ON) of the positioning start signal [Y10].

Setting item		Setting value	Setting details	Factory-set initial value
[Cd.101]	Torque output setting value*2	→	Set the torque output value in 0.1% unit.	0

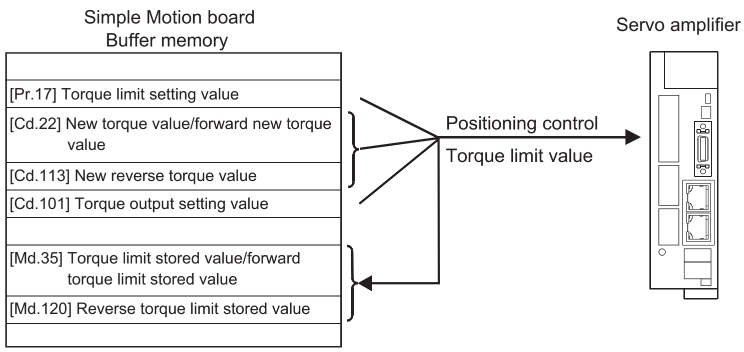
*1 Torque limit value: Will be an upper limit value of the torque change value. If a larger value has been mistakenly input for the torque change value, it is restricted within the torque limit setting values to prevent an erroneous entry. (Even if a value larger than the torque limit setting value has been input to the torque change value, the torque value is not changed.)

*2 Torque output setting value: Taken at the positioning start and used as a torque limit value. If the value is "0" or the torque limit setting value or larger, the parameter "torque limit setting value" is taken at the start.

Refer to the followings for the setting details.

☞ Page 453 Basic Setting, Page 543 Control Data

- The "torque limit value" set in the Simple Motion board is set in the "[Md.35] Torque limit stored value/forward torque limit stored value" or "[Md.120] Reverse torque limit stored value".



- The following table shows the storage details of "[Md.35] Torque limit stored value/forward torque limit stored value" and "[Md.120] Reverse torque limit stored value".

n: Axis No. - 1

Monitor item		Monitor value	Storage details	Buffer memory address
[Md.35]	Torque limit stored value/ forward torque limit stored value	→	The "torque limit value/forward torque limit stored value" valid at that time is stored. ([Pr.17], [Cd.22] or [Cd.101])	2426+100n
[Md.120]	Reverse torque limit stored value	→	The "reverse torque limit stored value" is stored depending on the control status. ([Pr.17], [Cd.22], [Cd.101] or [Cd.113])	2491+100n

Refer to the following for information on the storage details.

☞ Page 507 Monitor Data

For labels, refer to the following.

☞ Page 435 Axis monitor data

Point

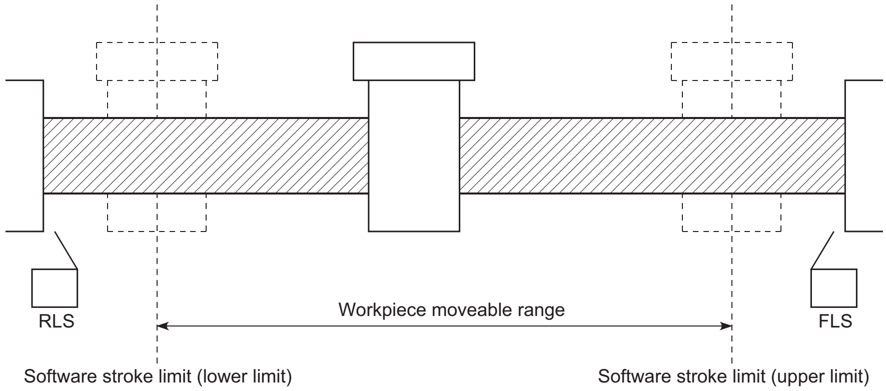
- Parameters are set for each axis.
- Use "[Md.120] Reverse torque limit stored value" and "[Cd.113] New reverse torque value" only when "1: Forward/reverse torque limit value individual setting" is set in "[Cd.112] Torque change function switching request". (☞ Page 261 Torque change function)

Software stroke limit function

In the "software stroke limit function" the address established by a machine home position return is used to set the upper and lower limits of the moveable range of the workpiece. Movement commands issued to addresses outside that setting range will not be executed.
In the Simple Motion board, the "feed current value" and "feed machine value" are used as the addresses indicating the current position. However, in the "software stroke limit function", the address used to carry out the limit check is designated in the "[Pr.14] Software stroke limit selection". Refer to the following for details on the "feed current value" and "feed machine value".
☞ Page 56 Confirming the current value
The upper and lower limits of the moveable range of the workpiece are set in "[Pr.12] Software stroke limit upper limit value"/ "[Pr.13] Software stroke limit lower limit value".

Differences in the moveable range

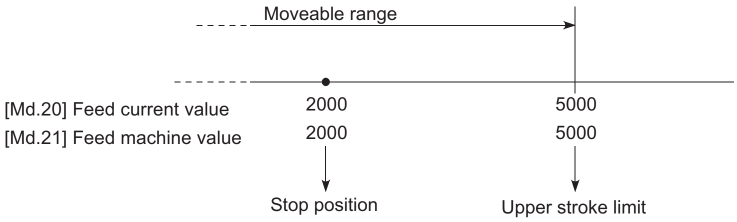
The following drawing shows the moveable range of the workpiece when the software stroke limit function is used.



The following drawing shows the differences in the operation when "[Md.20] Feed current value" and "[Md.21] Feed machine value" are used in the moveable range limit check.

■Conditions

Assume the current stop position is 2000, and the upper stroke limit is set to 5000.

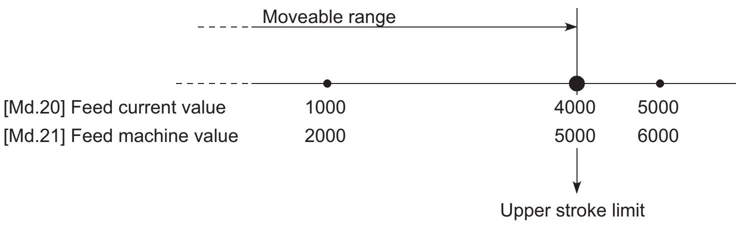


■Current value changing

When the current value is changed by a new current value command from 2000 to 1000, the current value will change to 1000, but the feed machine value will stay the same at 2000.

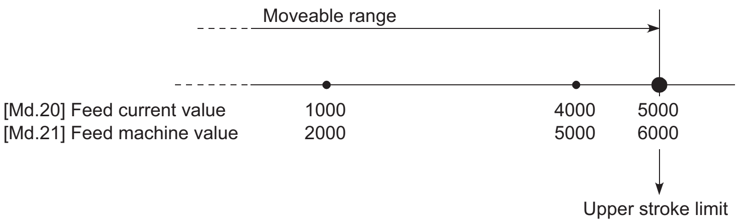
- When the feed machine value is set at the limit

The feed machine value of 5000 (feed current value: 4000) becomes the upper stroke limit.



- When the feed current value is set at the limit

The feed current value of 5000 (feed machine value: 6000) becomes the upper stroke limit.



Point

When "feed machine value" is set in "[Pr.14] Software stroke limit selection", the moveable range becomes an absolute range referenced on the home position. When "feed current value" is set, the moveable range is the relative range from the "feed current value".

Software stroke limit check details

Check details		Processing when an error occurs
1)	An error shall occur if the current value[*1] is outside the software stroke limit range[*2]. (Check "[Md.20] Feed current value" or "[Md.21] Feed machine value".)	An "axis error" will occur (error code: 1993H, 1995H, 1A18H, 1A1AH)
2)	An error shall occur if the command address is outside the software stroke limit range. (Check "[Da.6] Positioning address/ movement amount".)	

*1 Check whether the "[Md.20] Feed current value" or "[Md.21] Feed machine value" is set in "[Pr.14] Software stroke limit selection".

*2 Moveable range from the "[Pr.12] Software stroke limit upper limit value" to the "[Pr.13] Software stroke limit lower limit value".

Relation between the software stroke limit function and various controls

◎: Check valid

○: Check is not made when the feed current value is not updated (☞ Page 466 [Pr.21] Feed current value during speed control) at the setting of "feed current value" in "[Pr.14] Software stroke limit selection" during speed control.

—: Check not carried out (check invalid).

△: Valid only when "0: valid" is set in the "[Pr.15] Software stroke limit valid/invalid setting".

Control type			Limit check	Processing at check
Home position return control	Machine home position return control	Data set method	◎	The current value will not be changed if the home position address is outside the software stroke limit range.
		Other than "Data set method"	—	Check not carried out.
	Fast home position return control		—	
Major positioning control	Position control	1-axis linear control	◎	Checks 1) and 2) in ☞ Page 236 Software stroke limit check details are carried out. For speed control: The axis decelerates to a stop when it exceeds the software stroke limit range. For position control: The axis comes to an immediate stop when it exceeds the software stroke limit range.
		2 to 4-axis axis linear interpolation control	◎	
		1-axis fixed-feed control	◎	
		2 to 4-axis fixed-feed control (interpolation)	◎	
		2-axis circular interpolation control	◎	
		3-axis helical interpolation control	◎	
	1 to 4-axis speed control		○*1*2	
	Speed-position switching control, Position-speed switching control		○*1*2	
	Other control	Current value changing	◎	The current value will not be changed if the new current value is outside the software stroke limit range.
		JUMP instruction, NOP instruction, LOOP to LEND	—	Check not carried out.
Manual control	JOG operation, Inching operation		△*3	Check 1) in ☞ Page 236 Software stroke limit check details is carried out. The machine will carry out a deceleration stop when the software stroke limit range is exceeded. If the address is outside the software stroke limit range, the operation can only be started toward the moveable range.
	Manual pulse generator operation		△*3	
Expansion control	Speed-torque control		◎	Check 1) in ☞ Page 236 Software stroke limit check details is carried out. The mode switches to the position control mode when the software stroke limit range is exceeded, and the operation immediately stops.

*1 The value in "[Md.20] Feed current value" will differ according to the "[Pr.21] Feed current value during speed control" setting.

*2 When the unit is "degree", check is not made during speed control.

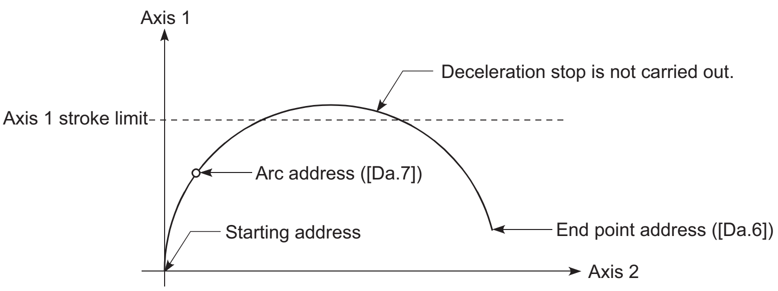
*3 When the unit is "degree", check is not carried out.

8

Precautions during software stroke limit check

- A machine home position return must be executed beforehand for the "software stroke limit function" to function properly.
- During interpolation control, a stroke limit check is carried out for the every current value of both the reference axis and the interpolation axis. Every axis will not start if an error occurs, even if it only occurs in one axis.
- During 2-axis circular interpolation control and 3-axis helical interpolation control (reference axis and interpolation axis), the "[Pr.12] Software stroke limit upper limit value"/"[Pr.13] Software stroke limit lower limit value" may be exceeded. In this case, a deceleration stop will not be carried out even if the stroke limit is exceeded. Always install an external limit switch if there is a possibility the stroke limit will be exceeded.

Ex.



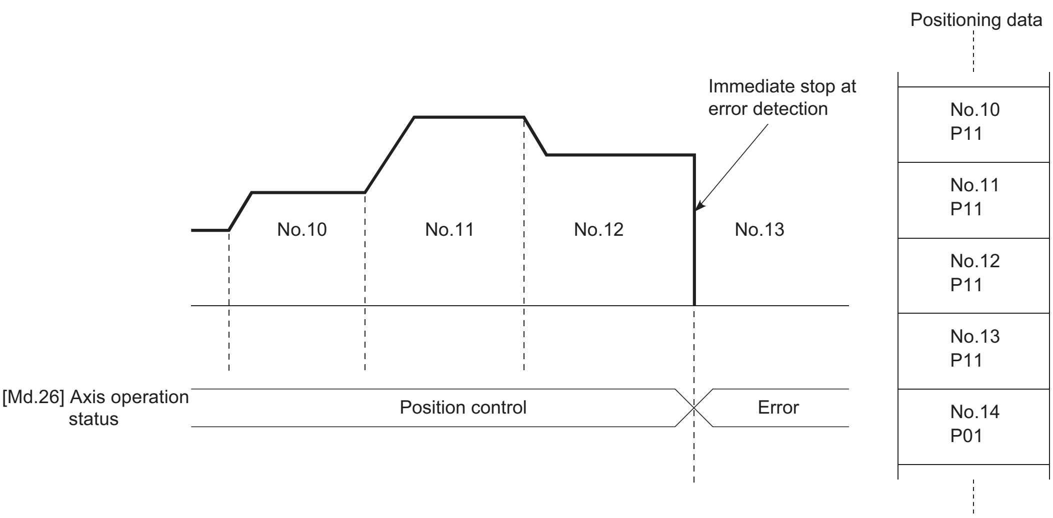
Point

The software stroke limit check is carried out for the following addresses during 2-axis circular interpolation control.
(Note that "[Da.7] Arc address" is carried out only for 2-axis circular interpolation control with sub point designation.)
Current value/end point address ([Da.6])/arc address ([Da.7])

- If an error is detected during continuous path control, the axis stops immediately on completion of execution of the positioning data located right before the positioning data in error.

Ex.

If the positioning address of positioning data No.13 is outside the software stroke limit range, the operation immediately stops after positioning data No.12 has been executed.



- During simultaneous start, a stroke limit check is carried out for the current values of every axis to be started. Every axis will not start if an error occurs, even if it only occurs in one axis.

Setting method

To use the "software stroke limit function", set the required values in the parameters shown in the following table, and write them to the Simple Motion board.

The set details are validated at the rising edge (OFF → ON) of the user program READY signal [Y0].

Setting item		Setting value	Setting details	Factory-set initial value
[Pr.12]	Software stroke limit upper limit value	→	Set the upper limit value of the moveable range.	2147483647
[Pr.13]	Software stroke limit lower limit value	→	Set the lower limit value of the moveable range.	-2147483648
[Pr.14]	Software stroke limit selection	→	Set whether to use the "[Md.20] Feed current value" or "[Md.21] Feed machine value" as the "current value".	0: Feed current value
[Pr.15]	Software stroke limit valid/invalid setting	0: Valid	Set whether the software stroke limit is validated or invalidated during manual control (JOG operation, Inching operation, manual pulse generator operation).	0: valid

Refer to the following for the setting details.

☞ Page 453 Basic Setting

Invalidating the software stroke limit

To invalidate the software stroke limit, set the following parameters as shown, and write them to the Simple Motion board. (Set the value within the setting range.)
(To invalidate only the manual operation, set "1: software stroke limit invalid" in the "[Pr.15] Software stroke limit valid/invalid setting".)
The set details are validated at the rising edge (OFF → ON) of the user program READY signal [Y0].
When the unit is "degree", the software stroke limit check is not performed during speed control (including speed control in speed-position switching control or position-speed switching control) or during manual control, independently of the values set in [Pr.12], [Pr.13] and [Pr.15].

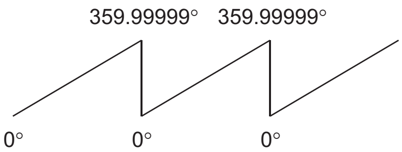
Point

Parameters are set for each axis.

Setting when the control unit is "degree"

■Current value address

The "[Md.20] Feed current value" address is a ring address between 0 and 359.99999°.

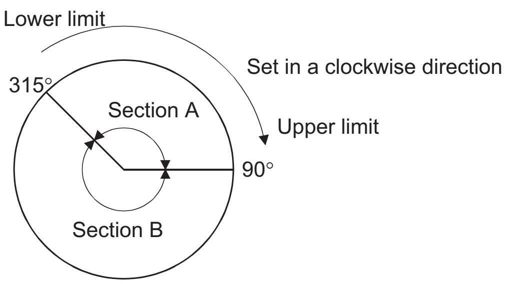


■Setting the software stroke limit

The upper limit value/lower limit value of the software stroke limit is a value between 0 and 359.99999°.

- Setting when the software stroke limit is to be validated.

When the software stroke limit is to be validated, set the upper limit value in a clockwise direction from the lower limit value.



Set as follows to set the movement range of section A or B in the above figure.

Section set as movement range	Software stroke limit lower limit value	Software stroke limit upper limit value
Section A	315.00000°	90.00000°
Section B	90.00000°	315.00000°

Hardware stroke limit function

⚠WARNING

• When the hardware stroke limit is required to be wired, ensure to wire it in the negative logic using b-contact. If it is set in positive logic using a-contact, a serious accident may occur.

In the "hardware stroke limit function", limit switches are set at the upper/lower limit of the physical moveable range, and the control is stopped (by deceleration stop) by the input of a signal from the limit switch.

Damage to the machine can be prevented by stopping the control before the upper/lower limit of the physical moveable range is reached.

The hardware stroke limit is able to use the following signals. (☞ Page 467 [Pr.116] to [Pr.119] FLS/RLS/DOG/STOP signal selection)

- External input signal of servo amplifier
- External input signal via host personal computer (buffer memory of Simple Motion board)
- Input signal on CC-Link IE Field Network (link device)

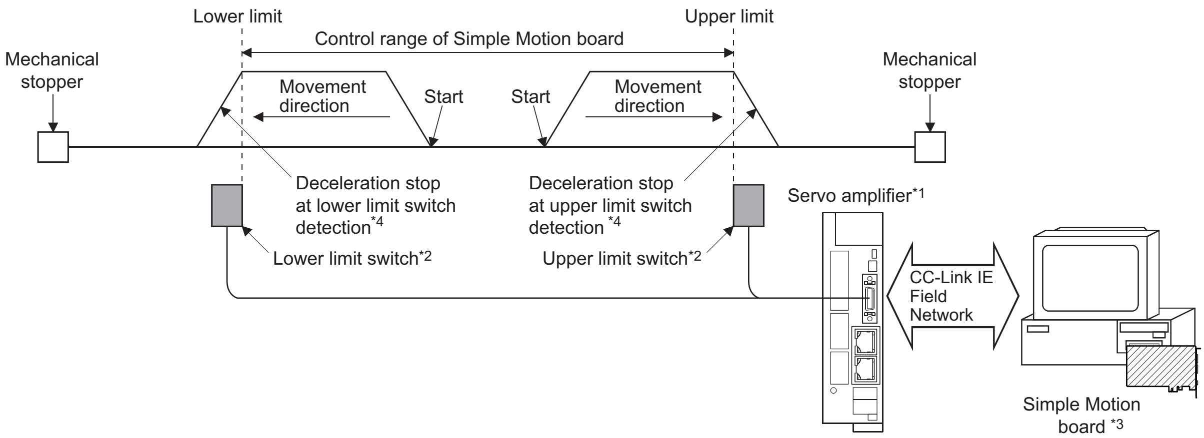
Control details

The following drawing shows the operation of the hardware stroke limit function.

■External input signal of servo amplifier

For the operation when the servo amplifier stroke limit is detected, confirm the specifications of the servo amplifier to be used.

The following shows the case of MR-J4-GF use.



*1 Set the following servo parameters properly.
- Set "0: Input from servo amplifier" to "sensor input method selection" of the servo parameter "Function selection D-4 (PD41)".
- Assign the LSP/LSN signals with the servo parameter "Input device selection 1 to 3 (PD03 to 05)".
For details, refer to the following.
☞ Page 244 Servo parameter setting

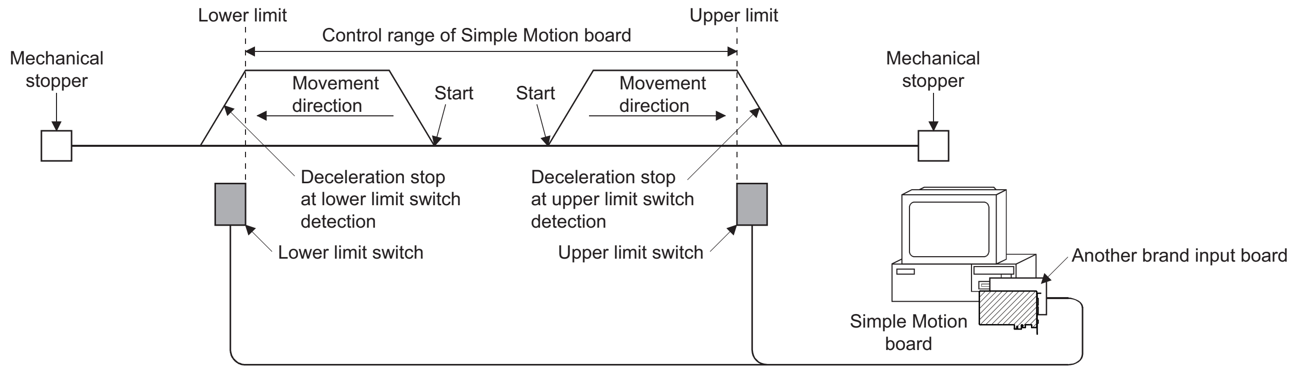
*2 The signal to be wired differs by the servo parameter "Rotation direction selection/travel direction selection (PA14)".

Setting value of "Rotation direction selection/travel direction selection (PA14)"	Signal name of servo amplifier	
	Lower limit	Upper limit
0: Forward rotation (CCW) with the increase of the positioning address	LSN	LSP
1: Reverse rotation (CW) with the increase of the positioning address	LSP	LSN

*3 Set the same value in "[Pr.22] Input signal logic selection" as the value set in the input logic setting of the servo amplifier. For the input logic specification of the servo amplifier, refer to the instruction manual of the servo amplifier to be used.

*4 The stop process differs by the setting of "Stroke limit enabling condition selection" of the servo parameter "Function selection D-4 (PD41)". Refer to the following for details.
☞ Page 232 Torque limit function

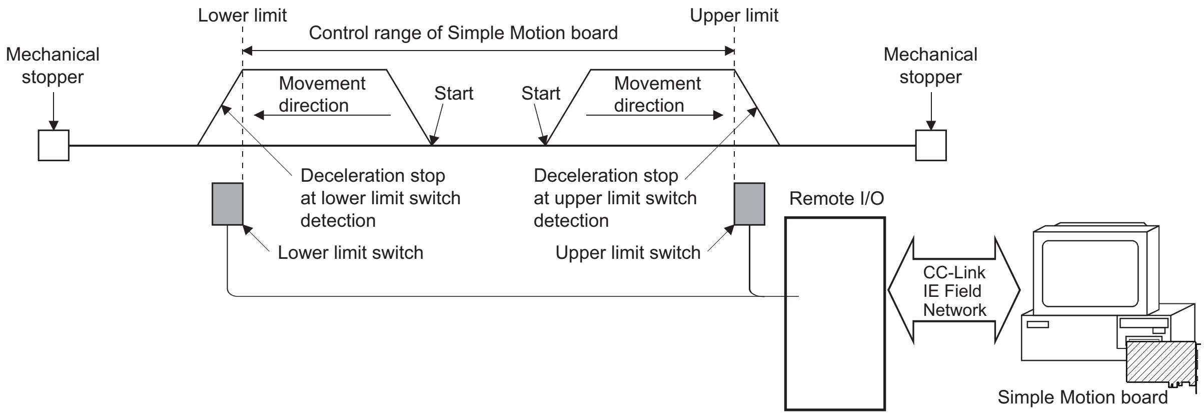
■External input signal via host personal computer (buffer memory of Simple Motion board)



Set the servo parameter properly. For details, refer to the following.

☞ Page 244 Servo parameter setting

■Link device



Set the servo parameter properly. For details, refer to the following.

☞ Page 244 Servo parameter setting

Wiring the hardware stroke limit

When using the hardware stroke limit function, wire the signal terminals corresponding to the upper/lower stroke limit of the device to be used as shown in the following drawing.

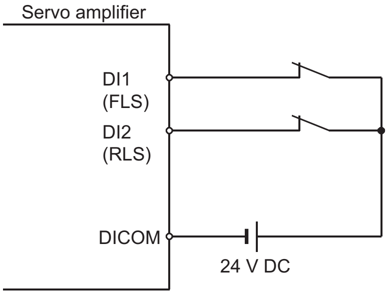
■External input signal of the servo amplifier

Refer to the manual of the servo amplifier to be used for details on input and wiring of the signal.

When using the MR-J4-GF, execute the parameter setting and wiring related to the LSP/LSN signals. (☞ Page 241 Control details)

Ex.

When "[Pr.22] Input signal logic selection" is set to the initial value



■External input signal via host personal computer (buffer memory of the Simple Motion board)

For the wiring, refer to the manual of the input module to be used.

■Link device

For the wiring, refer to the manual of the remote input module to be used.

The logic setting of the stroke limit signal follows "[Pr.913] Upper limit signal (FLS): Link device logic setting" and "[Pr.923] Lower limit signal (RLS): Link device logic setting".

Point

Wire the limit switch installed in the direction to which "Feed current value" increases as upper limit switch and the limit switch installed in the limit switch installed in the direction to which "Feed current value" decreases as lower limit switch.

If inverting the install positions of upper/lower limit switches, hardware stroke limit function cannot be operated properly. In addition, the servomotor does not stop.

The increase/decrease of "Feed current value" and the motor rotation direction/travel direction can be changed by the parameters depending on the servo amplifier. Refer to the servo amplifier instruction manual for details.

When the hardware stroke limit function is not used

Set the logic of FLS and RLS to the "negative logic" (initial value) with "[Pr.22] Input signal logic selection" and input the signal which always turns ON. Otherwise, set the logic of FLS and RLS to the "positive logic" with "[Pr.22] Input signal logic selection" and always turn OFF the input.

Servo parameter setting

Set "Sensor input type selection" of the servo parameter "Function selection D-4 (PD41)" appropriately at MR-J4-GF use. Otherwise, the stroke limit signal cannot be released. The operation at stroke limit detection according to each setting is as follows.

Control details	Controller setting [Pr.116] FLS signal selection [Pr.117] RLS signal selection [Pr.118] DOG signal selection	Servo parameter setting Sensor input type selection of Function selection D-4 (PD41)	Actual signal input	Stop process
Other than home position return	1: Servo amplifier	0: Input from servo amplifier	Servo amplifier	Controller, servo amplifier
				Controller*3
		1: Input from controller	Servo amplifier	—*1
	2: Buffer memory*4	0: Input from servo amplifier	Servo amplifier	—*1
			Controller	—*1
		1: Input from controller	Servo amplifier	—*2
			Controller	Controller
Home position return	1: Servo amplifier	0: Input from servo amplifier	Servo amplifier	Servo amplifier
		1: Input from controller	Servo amplifier	—*1
	2: Buffer memory*4	0: Input from servo amplifier	Servo amplifier	—*1
			Controller	—*1
		1: Input from controller	Servo amplifier	—*2
			Controller	Servo amplifier

*1 The error "Servo amplifier external input signal select error" (error code: 1AD4H) occurs. The stroke limit signal can not be released and the servo ON is not possible.
*2 The stroke limit signal cannot be released.
*3 When "1: Enabled only for home position return mode" is set to "Stroke limit enabling condition selection" of the servo parameter "Function selection D-4 (PD41)"
*4 The consistency is checked even when "15: Invalid" is set.

Point

The consistency between "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection" and "[Pr.118] DOG signal selection" in controller setting and the servo parameter "Function selection D-4 (PD41)" is checked at the start of connection with the servo amplifier.

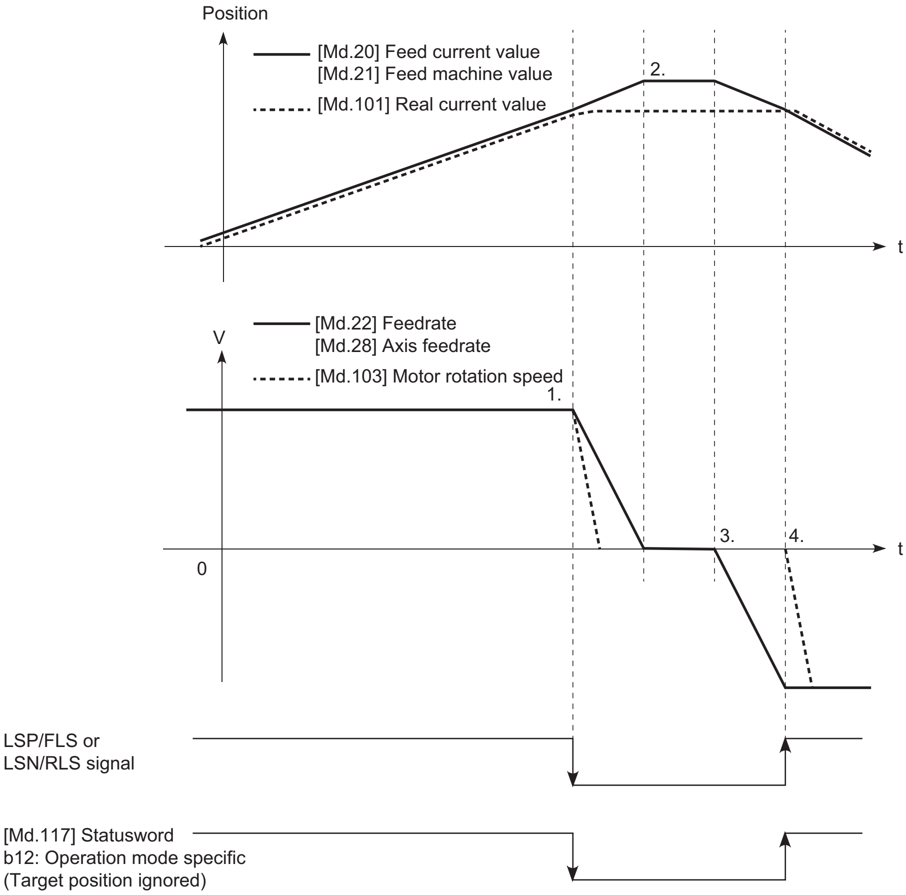
- At the diagnostic error, the error "Servo amplifier external input signal select error" (error code: 1AD4H) occurs and the stroke limit can not be released. (The cyclic transmission with the servo amplifier of the corresponding axis is performed.) In addition, the connected servo amplifier cannot be the servo ON status. Change the setting of the Simple Motion board and the connected servo amplifier, and connect again.
- To specify"1: Servo amplifier" in the controller setting, it is required to set "1: Servo amplifier" in all of the "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection" and "[Pr.118] DOG signal selection". If the setting is incorrect, the error occurs in the consistency diagnostics.
- When "1: Servo amplifier" is set in the controller setting, ON/OFF may be displayed repeatedly in "[Md.30] External input signal" during the consistency diagnostics. When the external signal of the servo amplifier is operated before the current value restoration completion of the corresponding axis (can be checked with "[Md.190] Controller current value restoration completion status"), the consistency error may be detected incorrectly.

Precautions during control

- If the machine is stopped outside the Simple Motion board control range (outside the upper/lower limit switches), or if stopped by hardware stroke limit detection, the starting for the "home position return control", "major positioning control", and "high-level positioning control" and the control mode switching cannot be executed. To carry out these types of control again, return the workpiece to the Simple Motion board control range by a "JOG operation", "inching operation" or "manual pulse generator operation".
- When "[Pr.22] Input signal logic selection" is set to the initial value, the Simple Motion board cannot carry out the positioning control if FLS (limit switch for upper limit) is separated from DICOM or RLS (limit switch for lower limit) is separated from DICOM (including when wiring is not carried out).
- When the MR-J4-GF is connected, the operation at the hardware stroke limit stop differs by the setting of "Stroke limit enabling condition selection" of the servo parameter "Function selection D-4 (PD41)".

Stroke limit enabling condition selection" of the servo parameter "Function selection D-4 (PD41)"	The operation at the hardware stroke limit stop
1: Enabled only for home position return mode	The stop process is executed in the Simple Motion board.
0: Stroke limit always enabled	The stop process is executed in the servo amplifier and the servo amplifier becomes servo-lock status. The Simple Motion board performs the process of deceleration stop and rapid stop depending on the setting of "[Pr.37] Stop group 1 rapid stop selection". However, the command is ignored. (At the time, the motor real current value deviates from the position command. However, it is not reflected in "[Md.102] Deviation counter value".) (Refer to the following drawing.)

When "0: Stroke limit always enabled" is set to the servo parameter "Function selection D-4 (PD41)"



1. When the LSP/FLS or LSN/RLS signal is detected, the sop process is executed in both the Simple Motion board and the servo amplifier.

2. After completion of the stop process of Simple Motion board, it stops with the status where the motor real current value deviates from the position command. (The position command from the Simple Motion board to the outside of the stroke limit is ignored in the servo amplifier.)

3. After stopped and when manual operation is performed to the direction toward the inside of the stroke limit, the position command (feed current value and feed machine value) and speed command of the Simple Motion board are updated. However, the servo motor does not operate.

4. When the position command from the Simple Motion board becomes "the command position where the LSP/FLS or LSN/RLS signal is detected", the servo motor starts operation to the inside of the stroke limit.

Point

- To stop the motor holding the interpolation status and the relation between input axis and output axis at the stroke limit detection of the servo amplifier, set "Stroke limit enabling condition selection" of the servo parameter "Function selection D-4 (PD41)" to "1: Enabled only for home position return mode".
- When the external input signal is turned ON (limit signal OFF) in the status where the real motor current value deviates from the position command with the stop by the hardware stroke limit, the motor makes rapid movement to the position command of the Simple Motion board. Restore the deviation between the motor real current value and the position command by manual operation to the inside of the stroke limit. (Set the servo OFF status in "[Cd.100] Servo OFF command", so that restoring the position command to the motor real current value by follow up is possible. After the restoration, set the servo ON again and move the motor to the inside of the stroke limit with manual operation.)
- When the command position of the Simple Motion board stops at the stroke limit side closer than the motor real current value by the stroke limit detection and the manual operation is performed to the inside of the stroke limit, the operation of the motor real current value follows the command position from the controller.

Forced stop function

⚠ WARNING

- When the forced stop is required to be wired, ensure to wire it in the negative logic using b-contact.
- Provided safety circuit outside the Simple Motion board so that the entire system will operate safety even when the "[Pr.82] Forced stop valid/invalid selection" is set "1: Invalid". Be sure to use the forced stop signal (EMI) of the servo amplifier.

"Forced stop function" stops all axes of the servo amplifier with the forced stop signal (The initial value is set to "0: Valid (External input signal)".)

The forced stop input valid/invalid is selected by "[Pr.82] Forced stop valid/invalid selection".

Control details

When "[Pr.82] Forced stop valid/invalid selection" is set to other than "1: Invalid", the forced stop signal is sent to all axes after the forced stop input is turned on.

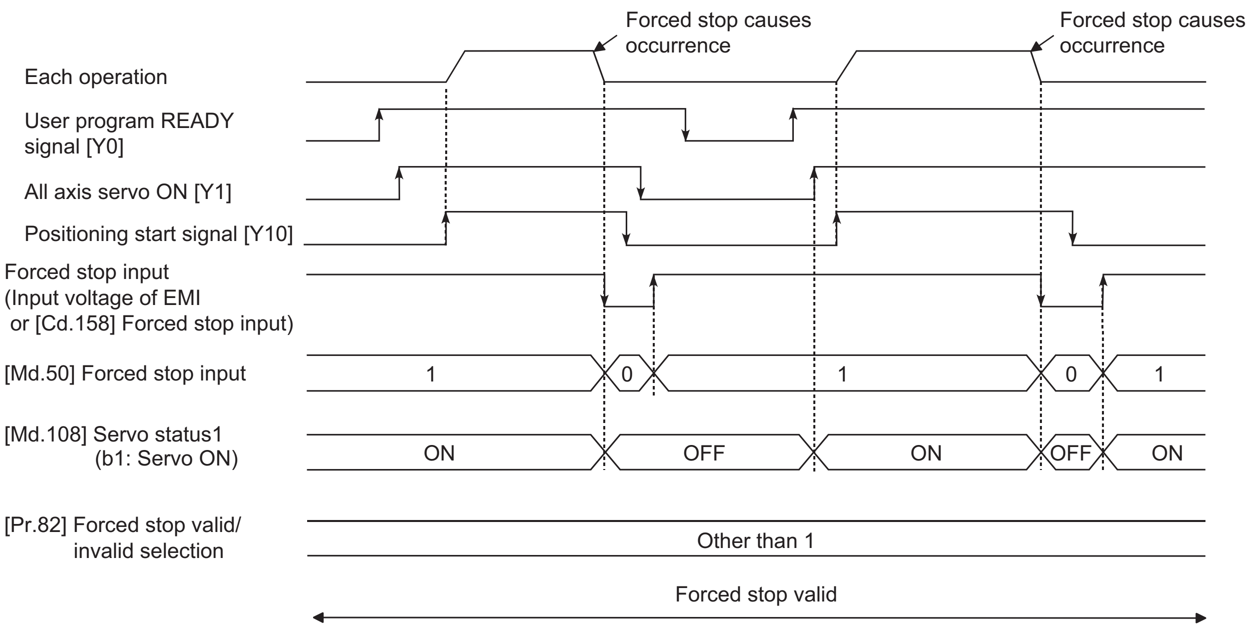
Refer to the servo amplifier instruction manual for the operation of the servo amplifier after the forced stop signal is sent.

The outline of the forced stop process is shown below.

Stop cause		Stop axis	M code ON signal after stop	Axis operation status ([Md.26]) after stopping	Stop process					
					Home position return control		Major positioning control	High-level positioning control	Manual control	
					Machine home position return control	Fast home position return control			JOG/Inching operation	Manual pulse generator operation
Forced stop	"Forced stop input signal" OFF from an external device	All axes	No change	Servo OFF	Immediate stop					—

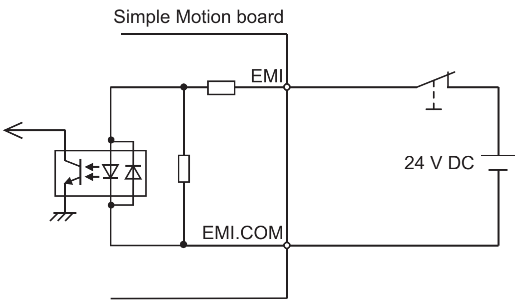
The following drawing shows the operation of the forced stop function.

■Axis 1 to 4 operation example



Wiring the forced stop

When using the forced stop function with the external input signal, wire the terminals of the Simple Motion board forced stop input as shown in the following drawing. As for the 24 V DC power supply, the direction of current can be switched.



For the wiring for using the forced stop function, refer to the manual of the remote input module to be used.

Setting the forced stop

To use the "Forced stop function", set the following data using a user program.
"[Pr.82] Forced stop valid/invalid selection" is validated at the rising edge (OFF → ON) of the user program READY signal [Y0] and "[Cd.158] Forced stop input" checks in the operation cycle.
When "[Pr.82] Forced stop valid/invalid selection" is set to "3: Valid (Link device)", set the link device external signal assignment function.

Setting item		Setting value	Setting details		Buffer memory address
[Pr.82]	Forced stop valid/invalid selection	→	Set the forced stop function.		35
			0: Valid (External input signal)	Forced stop from the external input signal is used	
			1: Invalid	Forced stop is not used	
			2: Valid (Buffer memory)	Forced stop from the buffer memory is used	
			3: Valid (Link device)	Forced stop from the link device is used	
[Cd.158]	Forced stop input	→	Set the forced stop information to the buffer memory.		5945
			0: Forced stop ON (Forced stop)*1	Forced stop	
			1: Forced stop OFF (Forced stop release)	Forced stop release	

*1 A value other than "1" is regarded as "0".

Refer to the following for the setting details.

☞ Page 453 Basic Setting

For labels, refer to the following.

☞ Page 432 Common parameters, ☞ Page 437 System control data

How to check the forced stop

To use the states (ON/OFF) of forced stop input, set the parameters shown in the following table.

Monitor item		Monitor value	Storage details	Buffer memory address
[Md.50]	Forced stop input	→	Stores the states (ON/OFF) of forced stop input. 0: Forced stop input ON (Forced stop) 1: Forced stop input OFF (Forced stop release)	4231

Refer to the following for information on the storage details.

☞ Page 507 Monitor Data

For labels, refer to the following.

☞ Page 434 System monitor data

Precautions during control

- After the "Forced stop input" is released, the servo ON/OFF is valid for the status of all axis servo ON [Y1].
- If the setting value of "[Pr.82] Forced stop valid/invalid selection" is outside the range, the error "Forced stop valid/invalid setting error" (error code: 1B71H) occurs.
- The "[Md.50] Forced stop input" is stored "1" by setting "[Pr.82] Forced stop valid/invalid selection" to "1: invalid".
- When the "Forced stop input" is turned ON during operation, the error "Servo READY signal OFF during operation" (error code: 1902H) does not occur.
- The status of the signal that is not selected in "[Pr.82] Forced stop valid/invalid selection" is ignored.
- The stop could be delayed up to one operation cycle compared to the forced stop by the external input signal, because "[Cd.158] Forced stop input" is checked in operation cycle.
- Errors cannot be cleared by "[Cd.5] Axis error reset" during forced stop. Clear errors after forced stop is released.

8.4 Functions to Change the Control Details

Functions to change the control details include the "speed change function", "override function", "acceleration/deceleration time change function", "torque change function" and "target position change function". Each function is executed by parameter setting or user program creation and writing.

Refer to the following for combination with main function.

Simple Motion Board User's Manual (Startup)

Both the "speed change function" or "override function" change the speed, but the differences between the functions are shown below. Use the function that corresponds to the application.

"Speed change function"

- The speed is changed at any time, only in the control being executed.
- The new speed is directly set.

"Override function"

- The speed is changed for all control to be executed.
- The new speed is set as a percent (%) of the command speed.

Point

"Speed change function" and "Override function" cannot be used in the manual pulse generator operation and speed-torque control.

Speed change function

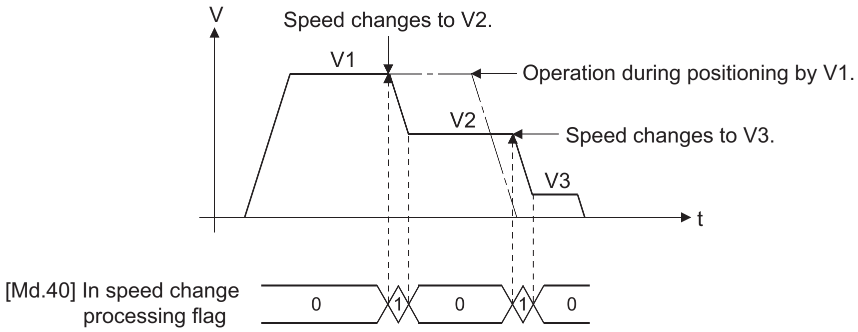
The speed control function is used to change the speed during control to a newly designated speed at any time.

The new speed is directly set in the buffer memory, and the speed is changed by a speed change command ([Cd.15] Speed change request) or external command signal.

During the machine home position return, a speed change to the creep speed cannot be carried out after deceleration start because the proximity dog ON is detected. When the speed change function is enabled and the speed is slower than the creep speed, the speed change is disabled and the speed accelerates to the creep speed after the proximity dog ON is detected.

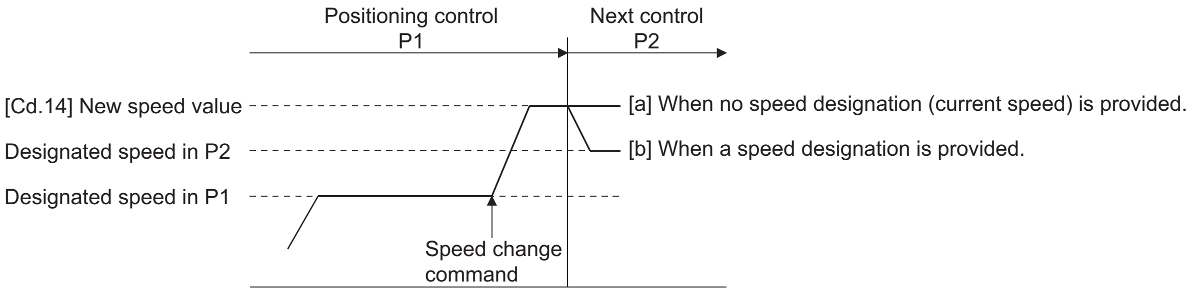
Control details

The following drawing shows the operation during a speed change.

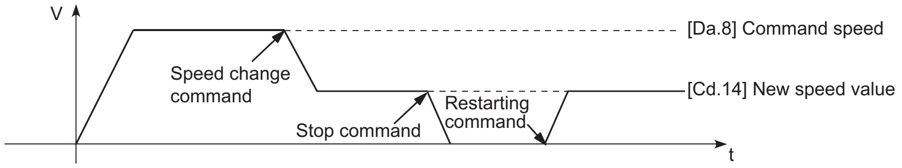


Precautions during control

- At the speed change during continuous path control, when no speed designation (current speed) is provided in the next positioning data, the next positioning data is controlled at the "[Cd.14] New speed value". Also, when a speed designation is provided in the next positioning data, the next positioning data is controlled at its "[Da.8] Command speed".



- When changing the speed during continuous path control, the speed change will be ignored if there is not enough distance remaining to carry out the change.
- When the stop command was given to make a stop after a speed change that had been made during position control, the restarting speed depends on the "[Cd.14] New speed value".

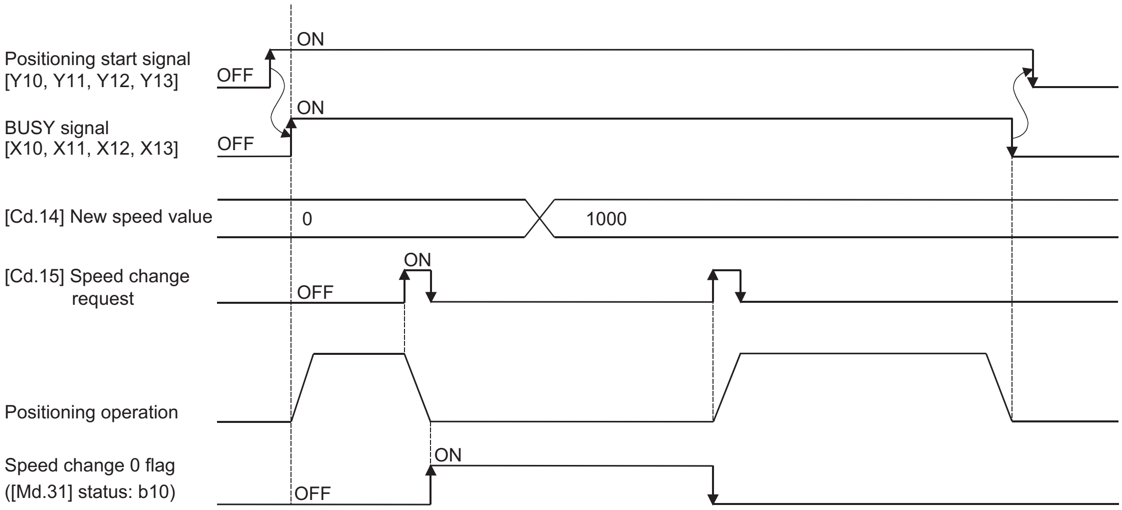


- When the speed is changed by setting "[Cd.14] New speed value" to "0", the operation is carried out as follows.

- When "[Cd.15] Speed change request" is turned ON, the speed change 0 flag ([Md.31] Status: b10) turns ON. (During interpolation control, the speed change 0 flag on the reference axis side turns ON.)
- The axis stops, but "[Md.26] Axis operation status" does not change, and the BUSY signal remains ON. (If a stop signal is input, the BUSY signal will turn OFF, and "[Md.26] Axis operation status" will change to "stopped".) In this case, setting the "[Cd.14] New speed value" to a value besides "0" will turn OFF the speed change 0 flag ([Md.31] Status: b10), and enable continued operation.

8

■Axis 1 to 4 operation example



- The warning "Deceleration/stop speed change" (warning code: 0990H) occurs and the speed cannot be changed in the following cases.

- During deceleration by a stop command
- During automatic deceleration during positioning control

- The warning "Speed limit value over" (warning code: 0991H) occurs and the speed is controlled at the "[Pr.8] Speed limit value" when the value set in "[Cd.14] New speed value" is larger than the "[Pr.8] Speed limit value".
- When the speed is changed during interpolation control, the required speed is set in the reference axis.
- When carrying out consecutive speed changes, be sure there is an interval between the speed changes of 10 ms or more. (If the interval between speed changes is short, the Simple Motion board will not be able to track, and it may become impossible to carry out commands correctly.)
- When a speed change is requested simultaneously for multiple axes, change the speed one by one. Therefore, the start timing of speed change is different for each axis.
- Speed change cannot be carried out during the machine home position return. A request for speed change is ignored.
- When deceleration is started by the speed change function, the deceleration start flag does not turn ON.
- The speed change function cannot be used during speed control mode or torque control mode. Refer to the following for the speed change during speed control mode.

☞ Page 190 Speed-torque Control

Setting method from the user program

The following shows the data settings and user program example for changing the control speed of axis 1 by the command from the user program. (In this example, the control speed is changed to "20.00 mm/min".)

- Set the following data.

(Set using the user program referring to the speed change time chart.)

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.14]	New speed value	2000	Set the new speed.	4314+100n 4315+100n
[Cd.15]	Speed change request	1	Set "1: Change the speed".	4316+100n

Refer to the following for the setting details.

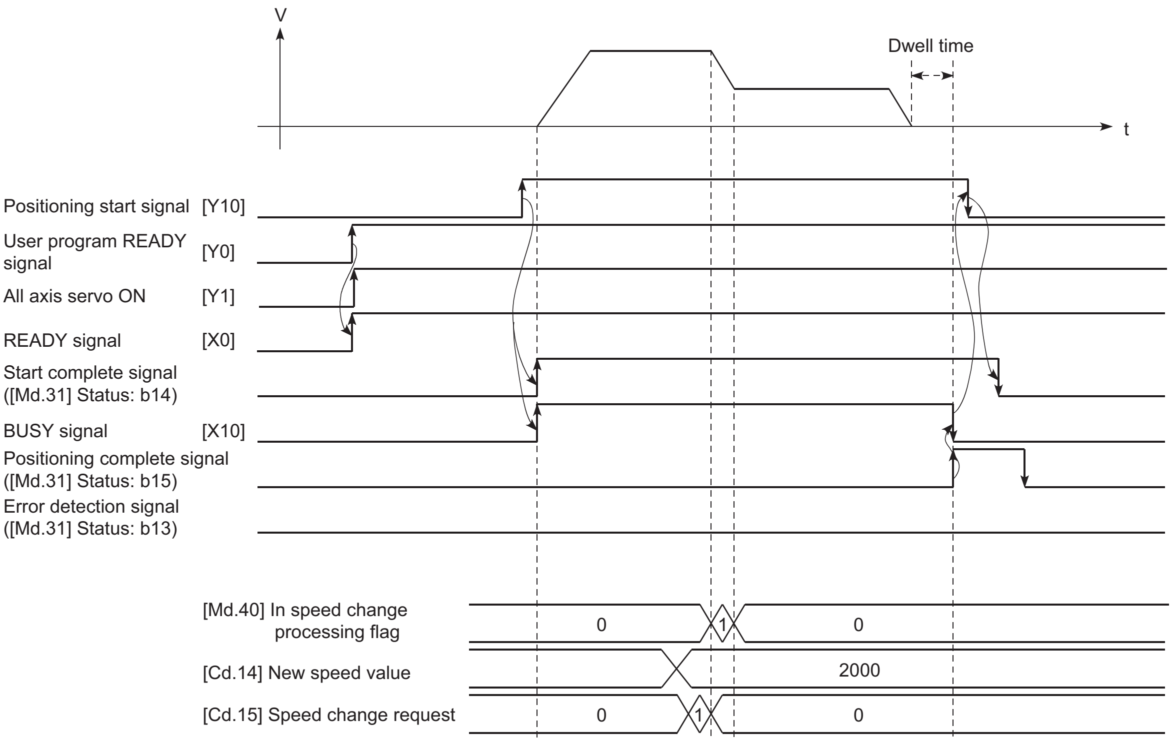
☞ Page 543 Control Data

For labels, refer to the following.

☞ Page 437 Axis control data

- The following shows the speed change time chart.

■Axis 1 to 4 operation example



Point

[API library]

To perform the speed change, use the MMC_Axis::ChangeSpeed method.

Program example

Refer to the following for the user program example of the speed change program.

☞ Page 600 Speed change program

Setting method using an external command signal

The speed can also be changed using an "external command signal".

The following shows the data settings and user program example for changing the control speed of axis 1 using an "external command signal". (In this example, the control speed is changed to "10000.00 mm/min".)

- Set the following data to change the speed using an external command signal. (Set using the user program referring to the speed change time chart.)

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.8]	External command valid	1	Set "1: Validates an external command.".	4305+100n
[Cd.14]	New speed value	1000000	Set the new speed.	4314+100n 4315+100n

For labels, refer to the following.

☞ Page 437 Axis control data

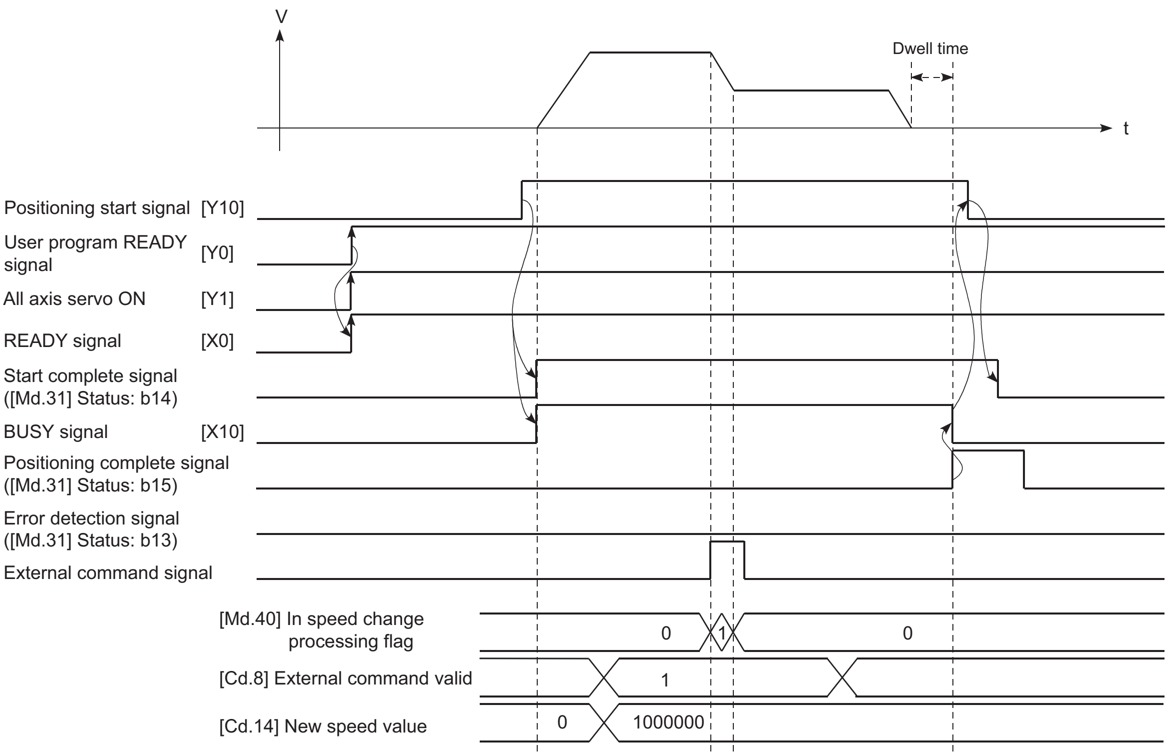
Set the link device to be used in "[Pr.960] External speed change request: Link device type" to "[Pr.963] External speed change request: Link device logic setting".

Refer to the following for the setting details.

☞ Page 321 Link Device External Signal Assignment Function

- The following shows the speed change time chart.

■Axis 1 to 4 operation example



Program example

Classification	Label name	Description
Label	MMC_Axis::AxCtrl1.NewSpeed	RW: [Cd.14] New speed value
	MMC_Axis::AxCtrl1.ExternalCommandValid	RW: [Cd.8] External command valid

C++

```
void ExternalChangeSpeedSample( MMC_Axis *axis1, long newSpeed )
{
    /* Set the new speed value */
    axis1->AxCtrl1.NewSpeed = newSpeed;

    /* External command valid: Validate the external command */
    axis1->AxCtrl1.ExternalCommandValid = 1;
}
```

8

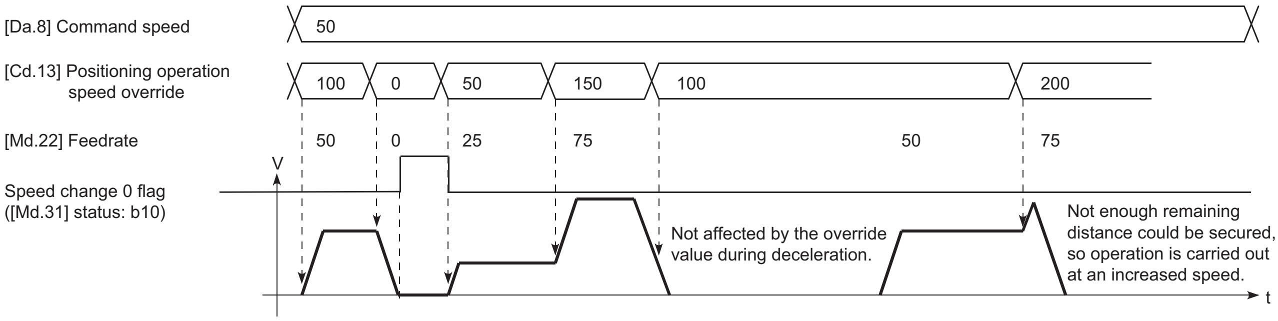
Override function

The override function changes the command speed by a designated percentage (0 to 300%) for all control to be executed. The speed can be changed by setting the percentage (%) by which the speed is changed in "[Cd.13] Positioning operation speed override".

Control details

The following shows that operation of the override function.

- A value changed by the override function is monitored by "[Md.22] Feedrate".
- If "[Cd.13] Positioning operation speed override" is set to 100%, the speed will not change.
- If "[Cd.13] Positioning operation speed override" is set with a value less than "100 (%)" and "[Md.22] Feedrate" is less than "1", the warning "Less than minimum speed" (warning code: 0904H) occurs and "[Md.22] Feedrate" is set with "1" in any speed unit.
- If "[Cd.13] Positioning operation speed override" is set to "0 (%)", the speed is set to "0" and the speed change 0 flag ([Md.31] Status: b10) is set to "1". At the time, the warning "Less than minimum speed" (warning code: 0904H) does not occur.
- If there is not enough remaining distance to change the speed due to the "override function", when the speed is changed during the position control of speed-position switching control or position-speed switching control, the operation will be carried out at the speed that could be changed.
- If the speed changed by the override function is greater than the "[Pr.8] Speed limit value", the warning "Speed limit value over" (warning code: 0991H) will occur and the speed will be controlled at the "[Pr.8] Speed limit value". The "[Md.39] In speed limit flag" will turn ON.



Precaution during control

- When changing the speed by the override function during continuous path control, the speed change will be ignored if there is not enough distance remaining to carry out the change.
- The warning "Deceleration/stop speed change" (warning code: 0990H) occurs and the speed cannot be changed by the override function in the following cases. (The value set in "[Cd.13] Positioning operation speed override" is validated after a deceleration stop.)

- During deceleration by a stop command
- During automatic deceleration during positioning control

- When the speed is changed by the override function during interpolation control, the required speed is set in the reference axis.
- When carrying out consecutive speed changes by the override function, be sure there is an interval between the speed changes of 10 ms or more. (If the interval between speed changes is short, the Simple Motion board will not be able to track, and it may become impossible to carry out commands correctly.)
- When deceleration is started by the override function, the deceleration start flag does not turn ON.
- The override function cannot be used during speed control mode or torque control mode.
- The override function cannot be used during driver home position return.

Setting method

The following shows the data settings and user program example for setting the override value of axis 1 to "200%".

- Set the following data. (Set using the user program referring to the speed change time chart.)

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.13]	Positioning operation speed override	200	Set the new speed as a percentage (%).	4313+100n

Refer to the following for the setting details.

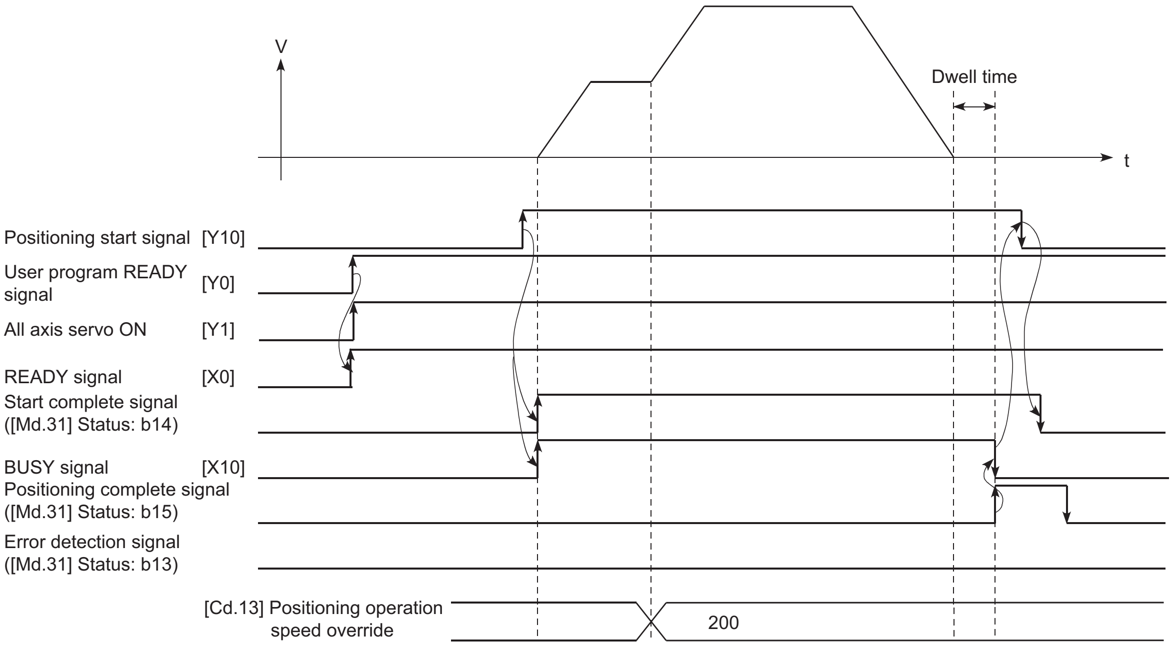
☞ Page 543 Control Data

For labels, refer to the following.

☞ Page 437 Axis control data

- The following shows a time chart for changing the speed using the override function.

■Axis 1 to 4 operation example



Program example

Refer to the following for the user program example.

☞ Page 601 Override program

8

Acceleration/deceleration time change function

The "acceleration/deceleration time change function" is used to change the acceleration/deceleration time during a speed change to a random value when carrying out the speed change by the "speed change function" and "override function".
In a normal speed change (when the acceleration/deceleration time is not changed), the acceleration/deceleration time previously set in the parameters ([Pr.9], [Pr.10], and [Pr.25] to [Pr.30] values) is set in the positioning parameter data items [Da.3] and [Da.4], and control is carried out with that acceleration/deceleration time. However, by setting the new acceleration/deceleration time ([Cd.10], [Cd.11]) in the control data, and issuing an acceleration/deceleration time change enable command ([Cd.12] Acceleration/deceleration time change value during speed change, enable/disable) to change the speed when the acceleration/deceleration time change is enabled, the speed will be changed with the new acceleration/deceleration time ([Cd.10], [Cd.11]).

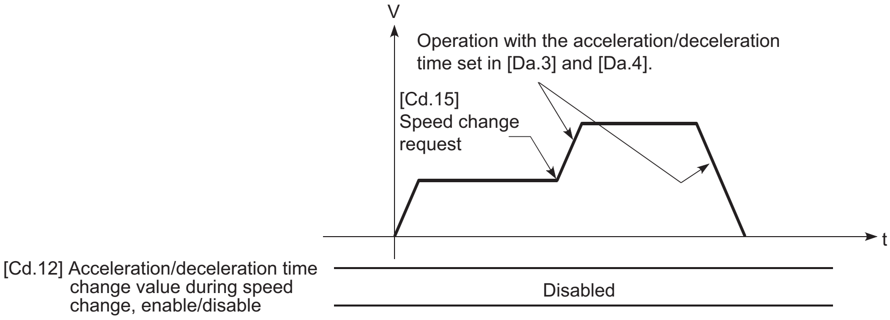
Control details

After setting the following two items, carry out the speed change to change the acceleration/deceleration time during the speed change.

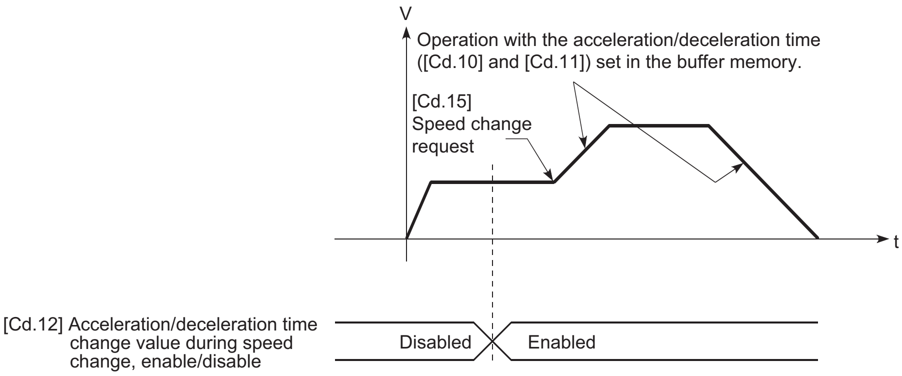
- Set change value of the acceleration/deceleration time ("[Cd.10] New acceleration time value", "[Cd.11] New deceleration time value")
- Setting acceleration/deceleration time change to enable ("[Cd.12] Acceleration/deceleration time change value during speed change, enable/disable")

The following drawing shows the operation during an acceleration/deceleration time change.

[For an acceleration/deceleration time change disable setting]



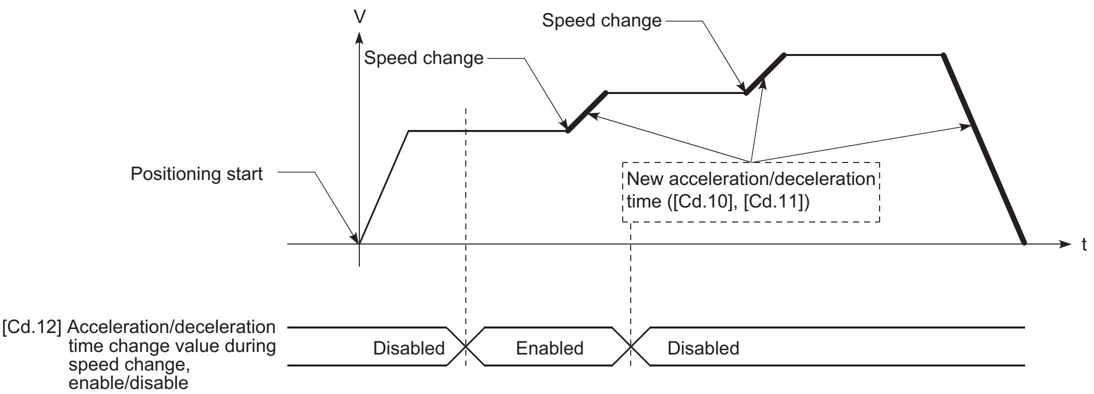
[For an acceleration/deceleration time change enable setting]



Precautions during control

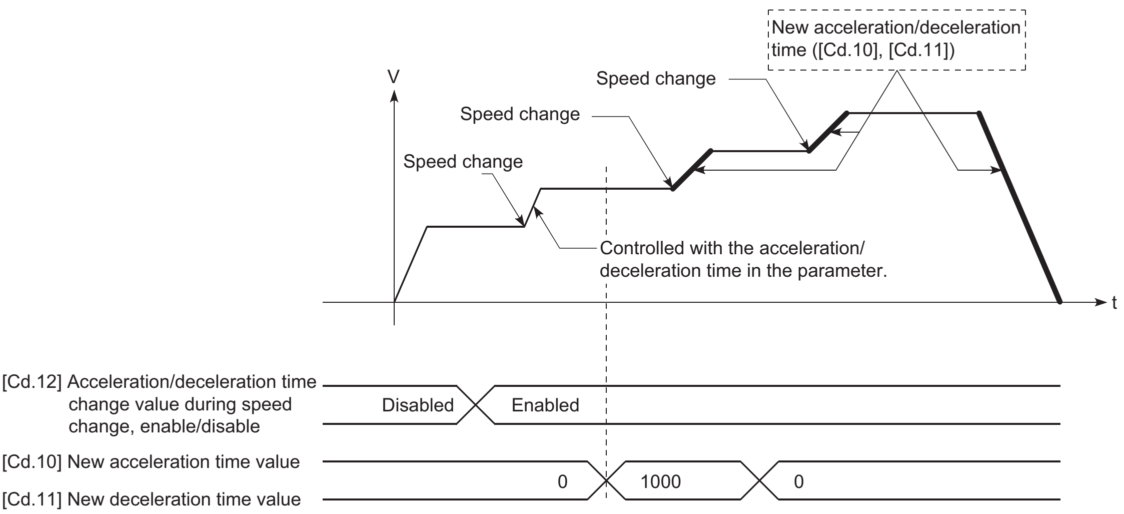
- When "0" is set in "[Cd.10] New acceleration time value" and "[Cd.11] New deceleration time value", the acceleration/deceleration time will not be changed even if the speed is changed. In this case, the operation will be controlled at the acceleration/deceleration time previously set in the parameters.
- The "new acceleration/deceleration time" is valid during execution of the positioning data for which the speed was changed. In continuous positioning control and continuous path control, the speed is changed and control is carried out with the previously set acceleration/deceleration time at the changeover to the next positioning data, even if the acceleration/deceleration time is changed to the "new acceleration/deceleration time ([Cd.10], [Cd.11])".
- Even if the acceleration/deceleration time change is set to disable after the "new acceleration/deceleration time" is validated, the positioning data for which the "new acceleration/deceleration time" was validated will continue to be controlled with that value. (The next positioning data will be controlled with the previously set acceleration/deceleration time.)

Ex.



- If the "new acceleration/deceleration time" is set to "0" and the speed is changed after the "new acceleration/deceleration time" is validated, the operation will be controlled with the previous "new acceleration/deceleration time".

Ex.



- The acceleration/deceleration change function cannot be used during speed control mode or torque control mode. Refer to the following for the acceleration/deceleration processing during speed control mode.

☞ Page 190 Speed-torque Control

Point

If the speed is changed when an acceleration/deceleration change is enabled, the "new acceleration/deceleration time" will become the acceleration/deceleration time of the positioning data being executed. The "new acceleration/deceleration time" remains valid until the changeover to the next positioning data. (The automatic deceleration processing at the completion of the positioning will also be controlled by the "new acceleration/deceleration time".)

Setting method

To use the "acceleration/deceleration time change function", write the data shown in the following table to the Simple Motion board using the user program.

The set details are validated when a speed change is executed after the details are written to the Simple Motion board.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.10]	New acceleration time value	→	Set the new acceleration time.	4308+100n 4309+100n
[Cd.11]	New deceleration time value	→	Set the new deceleration time.	4310+100n 4311+100n
[Cd.12]	Acceleration/deceleration time change value during speed change, enable/disable	1	Set "1: Acceleration/deceleration time change enable".	4312+100n

Refer to the following for the setting details.

☞ Page 543 Control Data

For labels, refer to the following.

☞ Page 437 Axis control data

Point

[API library]

To perform the acceleration/deceleration time change, use the MMC_Axis::ChangeSpeed method.

Program example

Refer to the following for the user program example.

☞ Page 601 Acceleration/deceleration time change program

Torque change function

The "torque change function" is used to change the torque limit value during torque limiting.
The torque limit value at the control start is the value set in the "[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value".
The following two change methods in the torque change function.

Torque change function	Details
Forward/reverse torque limit value same setting	The forward torque limit value*1 and reverse torque limit value*2 are changed to the same value by the new torque value. (Use this method when they need not be separately set.)
Forward/reverse torque limit value individual setting	The forward torque limit value*1 and reverse torque limit value*2 are individually changed respectively by the forward new torque value and new reverse torque value.

*1 Forward torque limit value: The limit value to the generated torque during CW regeneration at the CCW driving of the servo motor.
*2 Reverse torque limit value: The limit value to the generated torque during CCW regeneration at the CW driving of the servo motor.

Set previously "same setting" or "individual setting" of the forward/reverse torque limit value in "[Cd.112] Torque change function switching request". Set the new torque value (forward new torque value/new reverse torque value) in the axis control data ([Cd.22] or [Cd.113]) shown below.

Torque change function	Setting items		
	Torque change function switching request ([Cd.112])	New torque value ([Cd.22], [Cd.113])	
Forward/reverse torque limit value same setting	0: Forward/reverse torque limit value same setting	[Cd.22]	New torque value/forward new torque value
		[Cd.113]	Setting invalid
Forward/reverse torque limit value individual setting	1: Forward/reverse torque limit value individual setting	[Cd.22]	New torque value/forward new torque value
		[Cd.113]	New reverse torque value

8

Control details

The torque value (forward new torque value/new reverse torque value) of the axis control data can be changed at all times. The torque can be limited with a new torque value from the time the new torque value has been written to the Simple Motion board.

Note that the delay time until a torque control is executed is max. operation cycle after torque change value was written.

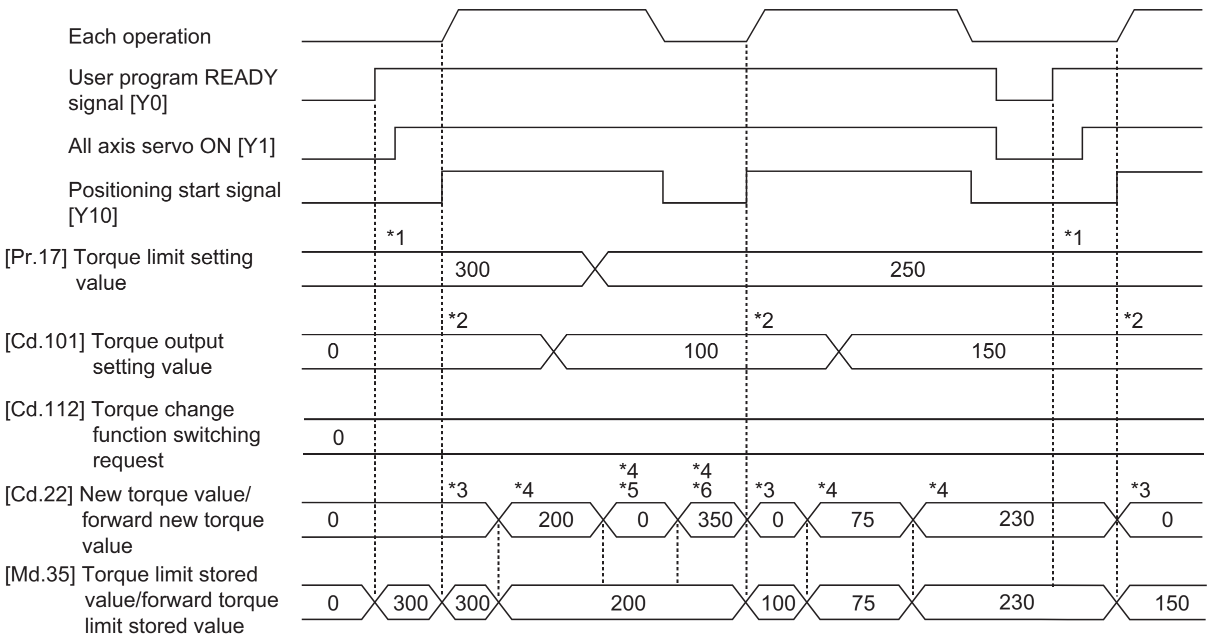
The toque limiting is not carried out from the time the power supply is turned ON to the time the user program READY signal [Y0] is turned ON.

The new torque value ([Cd.22], [Cd.113]) is cleared to zero at the leading edge (OFF to ON) of the positioning start signal [Y10].

The torque setting range is from 0 to "[Pr.17] Torque limit setting value". (When the setting value is 0, a torque change is considered not to be carried out, and it becomes to the value set in "[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value". The torque change range is 1 to "[Pr.17] Torque limit setting value".)

The following drawing shows the operation at the same setting and the operation at the individual setting for the forward new torque value and new reverse torque value.

■Axis 1 to 4 operation example



*1 The torque limit setting value or torque output setting value becomes effective at the user program READY signal [Y0] rising edge (however, after the servo is turned ON.)
If the torque output setting value is "0" or larger than the torque limit setting value, the torque limit setting value will be its value.

*2 The torque limit setting value or torque output setting value becomes effective at the positioning start signal [Y10] rising edge, and the torque limit value is updated.
If the torque output setting value is "0" or larger than the torque limit setting value, the torque limit setting value will be its value.

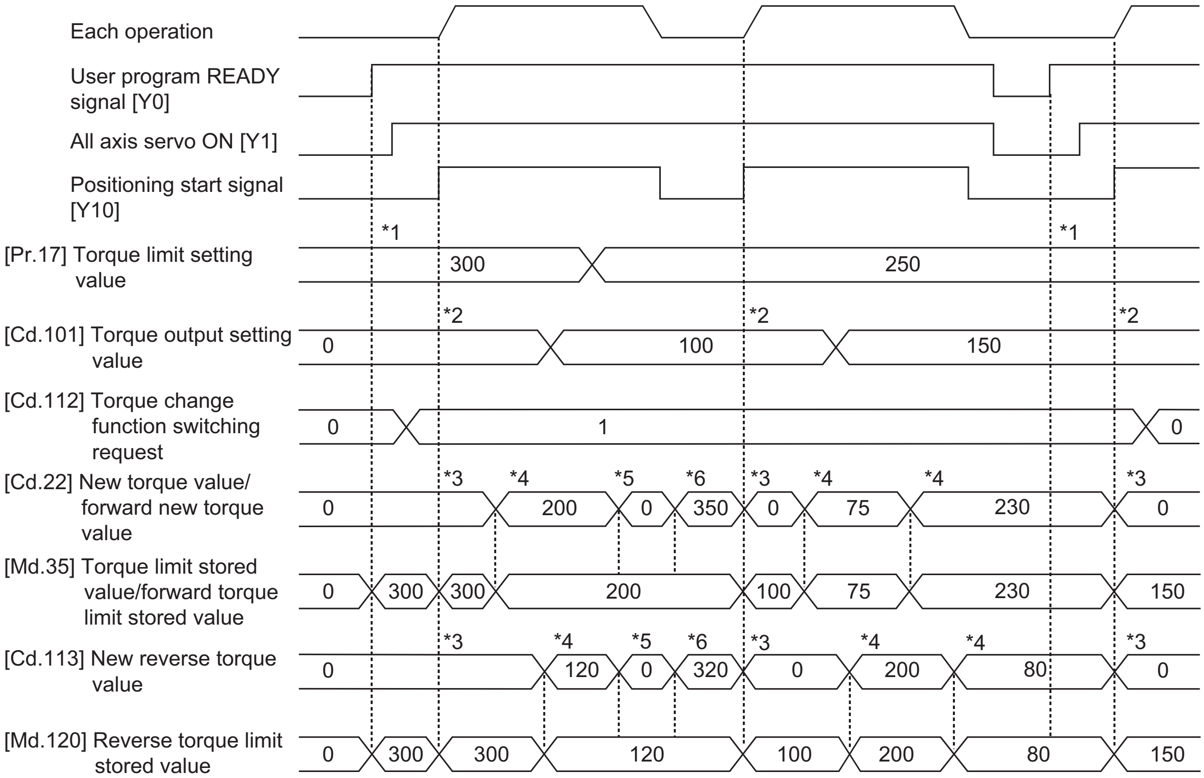
*3 The torque change value is cleared to "0" at the positioning start signal [Y10] rising edge.

*4 The torque limit value is changed by the torque changed value.

*5 When the new torque value is 0, a torque change is considered not to be carried out.

*6 When the change value exceeds the torque limit value, a torque change is considered not to be carried out.

■Axis 1 to 4 operation example



*1 The torque limit setting value or torque output setting value becomes effective at the user program READY signal [Y0] rising edge (however, after the servo is turned ON.)

*2 The torque limit setting value or torque output setting value becomes effective at the positioning start signal [Y10] rising edge, and the torque limit value is updated.

*3 The torque change value is cleared to "0" at the positioning start signal [Y10] rising edge.

*4 The torque limit value is changed by the torque changed value.

*5 When the new torque value is 0, a torque change is considered not to be carried out.

*6 When the change value exceeds the torque limit value, a torque change is considered not to be carried out.

8

Precautions during control

- If a value besides "0" is set in the new torque value, the torque generated by the servomotor will be limited by the setting value. To limit the torque with the value set in "[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value", set "0" to the new torque value.

Setting value of "[Cd.112] Torque change function switching request"	Setting item (New torque value)
0: Forward/reverse torque limit value same setting	[Cd.22] New torque value/forward new torque value
1: Forward/reverse torque limit value individual setting	[Cd.22] New torque value/forward new torque value
	[Cd.113] New reverse torque value

- The "[Cd.22] New torque value/forward new torque value" or "[Cd.113] New reverse torque value" is validated when written to the Simple Motion board. (Note that it is not validated from the time the power supply is turned ON to the time the user program READY signal [Y0] is turned ON.)
- If the setting value of "[Cd.22] New torque value/forward new torque value" is outside the setting range, the warning "Outside new torque value range/outside forward new torque value range" (warning code: 0907H) will occur and the torque will not be changed. If the setting value of "[Cd.113] New reverse torque value" is outside the setting range, the warning "Outside new reverse torque value range" (warning code: 0932H) will occur and the torque will not be changed.
- If the time to hold the new torque value is not more than 10 ms, a torque change may not be executed.
- When changing from "0: Forward/reverse torque limit value same setting" to "1: Forward/reverse torque limit value individual setting" by the torque change function, set "0" or same value set in "[Cd.22] New torque value/forward new torque value" in "[Cd.113] New reverse torque value" before change.

Setting method

To use the "torque change function", write the data shown in the following table to the Simple Motion board using the user program.

The set details are validated when written to the Simple Motion board.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.112]	Torque change function switching request	0: Forward/reverse torque limit value same setting 1: Forward/reverse torque limit value individual setting	Sets "same setting/individual setting" of the forward torque limit value and reverse torque limit value. : Set "0" normally. (When the forward torque limit value and reverse torque limit value are not divided.) : When a value except "1" is set, it operates as "forward/ reverse torque limit value same setting".	4363+100n
[Cd.22]	New torque value/forward new torque value	0 to [Pr.17] Torque limit setting value	When "0" is set to "[Cd.112] Torque change function switching request", a new torque limit value is set. (This value is set to the forward torque limit value and reverse torque limit value.) When "1" is set to "[Cd.112] Torque change function switching request", a new forward torque limit value is set.	4325+100n
[Cd.113]	New reverse torque value	0 to [Pr.17] Torque limit setting value	"1" is set in "[Cd.112] Torque change function switching request", a new reverse torque limit value is set. : When "0" is set in "[Cd.112] Torque change function switching request", the setting value is invalid.	4364+100n

Refer to the following for the setting details.

☞ Page 543 Control Data

For labels, refer to the following.

☞ Page 437 Axis control data

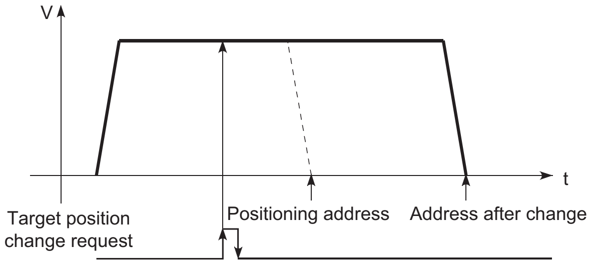
Target position change function

The "target position change function" is a function to change a target position to a newly designated target position at any timing during the position control (1-axis linear control). A command speed can also be changed simultaneously.
The target position and command speed changed are set directly in the buffer memory, and the target position change is executed by "[Cd.29] Target position change request flag".

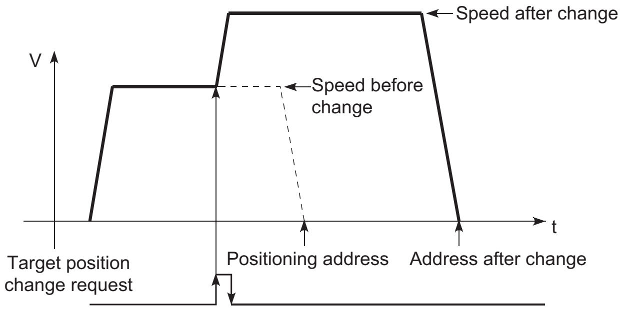
Details of control

The following charts show the details of control of the target position change function.

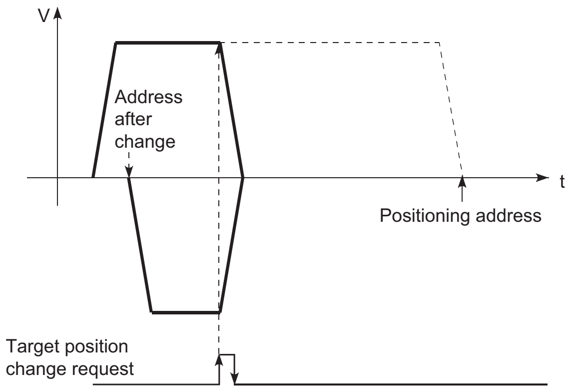
■When the address after change is positioned away from the start point more than the positioning address:



■When the speed is changed simultaneously with changing the address:



■When the direction of the operation is changed:



Precautions during operation

- If the positioning movement direction from the stop position to a new target position is reversed, stop the operation once and then position to the new target position. (☞ Page 265 When the direction of the operation is changed:)
- If a command speed exceeding the speed limit value is set to change the command speed, the warning "Speed limit value over" (warning code: 0991H) will occur and the new command speed will be the speed limit value. Also, if the command speed change disables the remaining distance to the target value from being assured, the warning "Insufficient remaining distance" will occur (warning code: 0994H, 0995H).
- In the following cases, a target position change request given is ignored and the warning "Target position change not possible" (warning code: 099BH to 09A1H) occurs.

- During interpolation control
- While a new target position value (address) is outside the software stroke limit range
- While decelerating to a stop by a stop cause
- While the positioning data whose operation pattern is continuous path control is executed
- While the speed change 0 flag ([Md.31] Status: b10) is turned ON

- When a command speed is changed, the current speed is also changed. When the next positioning speed uses the current speed in the continuous positioning, the next positioning operation is carried out at the new speed value. When the speed is set with the next positioning data, the speed becomes the current speed and the operation is carried out at the current speed.
- When a target position change request is given during automatic deceleration in position control and the movement direction is reversed, the positioning control to a new position is performed after the positioning has stopped once. If the movement direction is not reversed, the speed accelerates to the command speed again and the positioning to the new position is performed.
- If the constant speed status is regained or the output is reversed by a target position change made while "[Md.48] Deceleration start flag" is ON, the deceleration start flag remains ON. (☞ Page 296 Deceleration start flag function)
- Carrying out the target position change to the ABS linear 1 in degrees may carry out the positioning to the new target position after the operation decelerates to stop once, even the movement direction is not reversed.

Restriction

When carrying out the target position change continuously, take an interval of 10 ms or longer between the times of the target position changes. Also, take an interval of 10 ms or longer when the speed change and override is carried out after changing the target position or the target position change is carried out after the speed change and override.

Setting method from the user program

The following shows the data settings and user program example for changing the target position of axis 1 by the command from the user program. (In this example, the target position value is changed to "300.0 μm" and the command speed is changed to "10000.00 mm/min".)

- The following data is set. (Set using the user program referring to the target position change time chart.)

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.27]	Target position change value (New address)	3000	Set the new address.	4334+100n 4335+100n
[Cd.28]	Target position change value (New speed)	1000000	Set the new speed.	4336+100n 4337+100n
[Cd.29]	Target position change request flag	1	Set "1: Requests a change in the target position".	4338+100n

Refer to the following for the setting details.

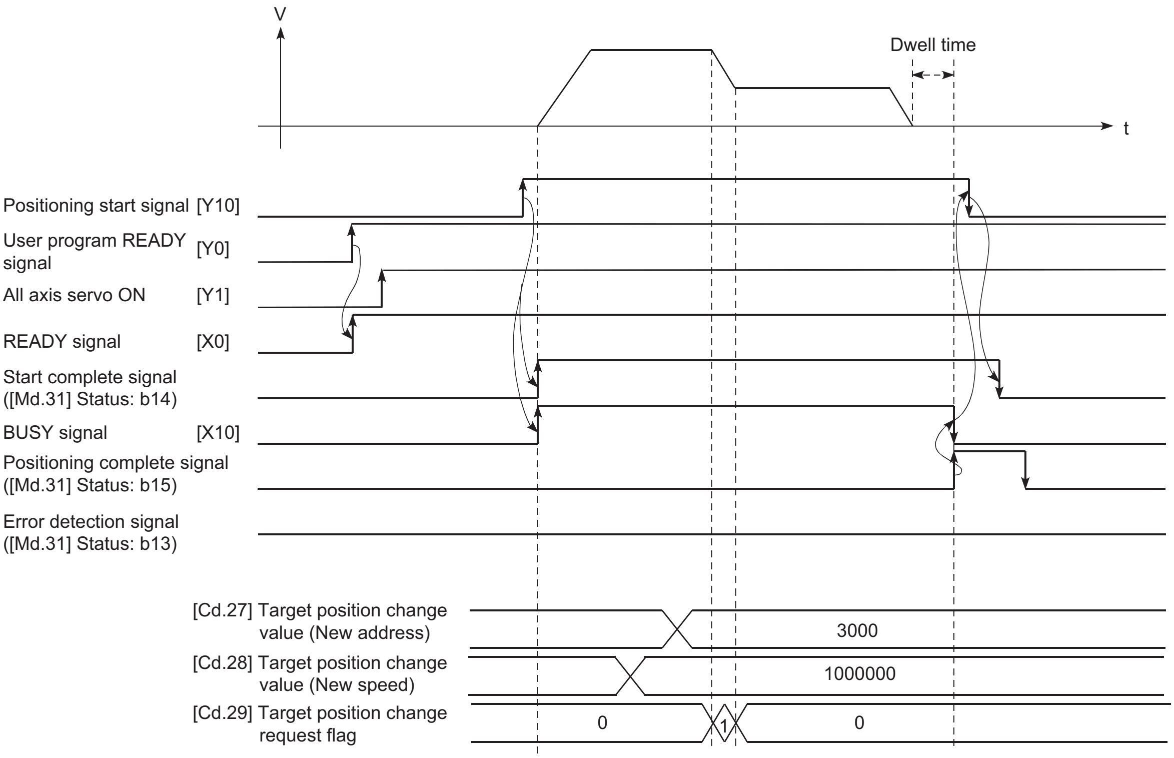
☞ Page 543 Control Data

For labels, refer to the following.

☞ Page 437 Axis control data

- The following shows the time chart for target position change.

■Axis 1 to 4 operation example



Point

[API library]

To perform the target position change, use the MMC_Axis::ChangePosition method.

Program example

Refer to the following for the user program example.

☞ Page 603 Target position change program

8.5 Functions Related to Start

A function related to start includes the "pre-reading start function". This function is executed by parameter setting or user program creation and writing.

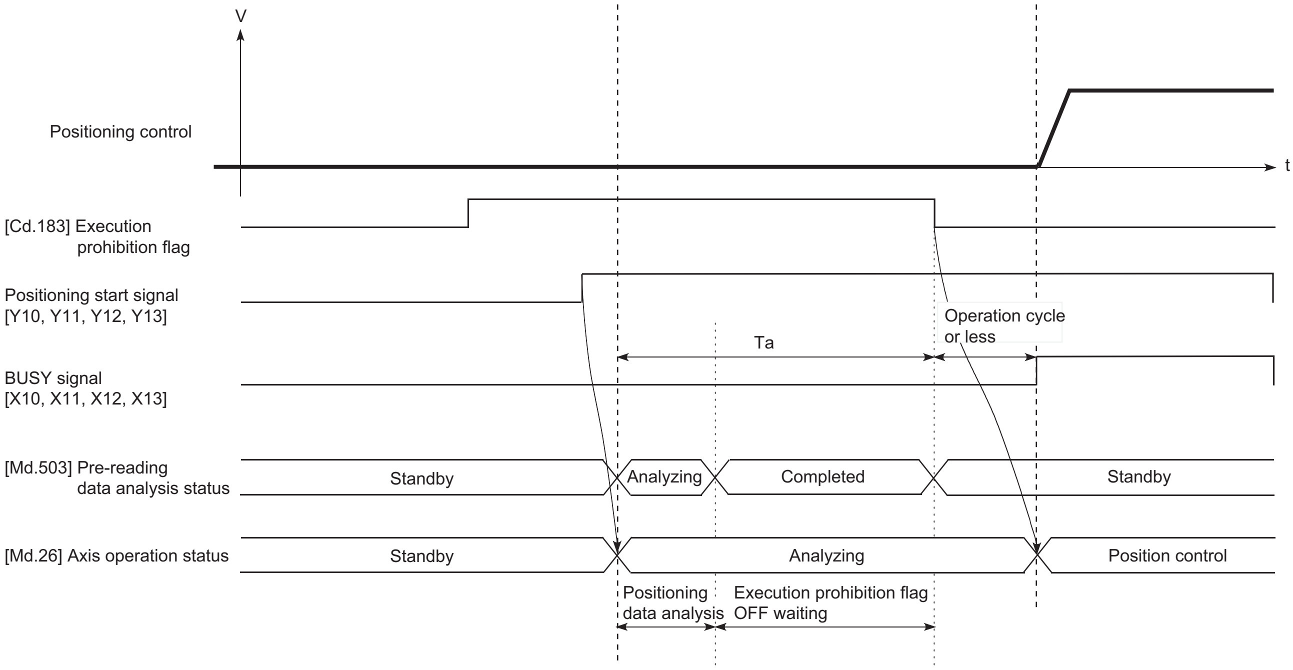
Pre-reading start function

The "pre-reading start function" does not start servo while the execution prohibition flag is ON if a positioning start request is given with the execution prohibition flag ON, and starts servo within operation cycle after OFF of the execution prohibition flag is detected. The positioning start request is given when the axis is in a standby status, and the execution prohibition flag is turned OFF at the axis operating timing.

Controls

The pre-reading start function is performed by turning ON the positioning start signal with the execution prohibition flag ([Cd.183]) ON. However, if positioning is started with the execution prohibition flag ON, the positioning data is analyzed but servo start is not provided. While the execution prohibition flag is ON, "[Md.26] Axis operation status" remains unchanged from "5: Analyzing". The servo starts within operation cycle after the execution prohibition flag has turned OFF, and "[Md.26] Axis operation status" changes to the status (e.g. position control, speed control) that matches the control method. Turn OFF the execution prohibition flag after "2: Completed" is set to "[Md.503] Pre-reading data analysis status". (Refer to the following figure.)

■Axis 1 to 4 operation example



Precautions during control

- After positioning data analysis, the system is put in an execution prohibition flag OFF waiting status. Any change made to the positioning data in the execution prohibition flag OFF waiting status is not reflected on the positioning data. Change the positioning data before turning ON the positioning start signal.
- The pre-reading start function is invalid if the execution prohibition flag is turned OFF between when the positioning start signal has turned ON and when positioning data analysis is completed (Ta < start time, Ta: Reference to the above figure).
- The data No. which can be executed positioning start using "[Cd.3] Positioning start No." with the pre-reading start function are No.1 to 600 only. Performing the pre-reading start function at the setting of No.7000 to 7004 or 9001 to 9004 will result in the error "Outside start No. range" (error code: 19A3H).
- Always turn ON the execution prohibition flag at the same time or before turning ON the positioning start signal. Pre-reading may not be started if the execution prohibition flag is turned ON during Ta after the positioning start signal is turned ON. The pre-reading start function is invalid if the execution prohibition flag is turned ON after positioning start with the execution prohibition flag OFF. (It is made valid at the next positioning start.)

Program example

Refer to the following for the user program example.

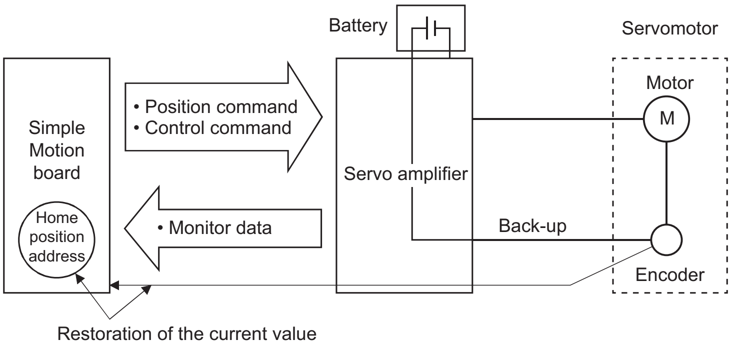
Classification	Label name	Description
Label	MMC_Axis::AxCtrl2.ProhibitPositioning	RW: [Cd.183] Execution prohibition flag
Method	MMC_Axis::StartPositioning	Start the positioning control.
	MMC_Axis::WaitPositioningDone	Wait until the positioning is completed.

C++

```
void StartPreReadingSample( MMC_Axis *axis1 )
{
    unsigned long retCode;

    /* Execution prohibition flag: During execution prohibition */
    axis1->AxCtrl2.ProhibitPositioning = 1;

    /* Start the positioning control */
    retCode = axis1->StartPositioning( 1 );
    if( retCode != MMC_OK ) { /* Error process */ }

    /* Arbitrary process */

    /* Execution prohibition flag: Not during execution prohibition */
    axis1->AxCtrl2.ProhibitPositioning = 0;

    /* Wait until the positioning control is completed */
    retCode = axis1->WaitPositioningDone( MMC_POSITIONING_DONE_INP, 10000 );
    if( retCode != MMC_OK ) { /* Error process */ }
}
```

8.6 Absolute Position System

The Simple Motion board can construct an absolute position system by installing the absolute position system and connecting it through SSCNETⅢ/H.
The following describes precautions when constructing the absolute position system.
The configuration of the absolute position system is shown below.



Setting for absolute positions

For constructing an absolute position system, use a servo amplifier and a servomotor which enable absolute position detection.
It is also necessary to install a battery for retaining the location of the home position return in the servo amplifier.
To use the absolute position system, select "1: Enabled (absolute position detection system)" in "Absolute position detection system (PA03)" in the amplifier setting for the servo parameters (basic setting). In addition, select "0: Invalid" in "Absolute position counter warning (AL.E3) selection (PC18)". Refer to each servo amplifier instruction manual for details of the absolute position system.

Home position return

In the absolute position system, a home position can be determined through home position return.
The stop position at the home position return execution is stored as the home position.

8.7 Functions Related to Stop

Functions related to stop include the "stop command processing for deceleration stop function", "Continuous operation interrupt function" and "step function". Each function is executed by parameter setting or user program creation and writing.

Stop command processing for deceleration stop function

The "stop command processing for deceleration stop function" is provided to set the deceleration curve if a stop cause occurs during deceleration stop processing (including automatic deceleration).

This function is valid for both trapezoidal and S-curve acceleration/deceleration processing methods.

Refer to the following for details of the stop cause.

☞ Page 28 Stop process

The "stop command processing for deceleration stop function" performs the following two operations.

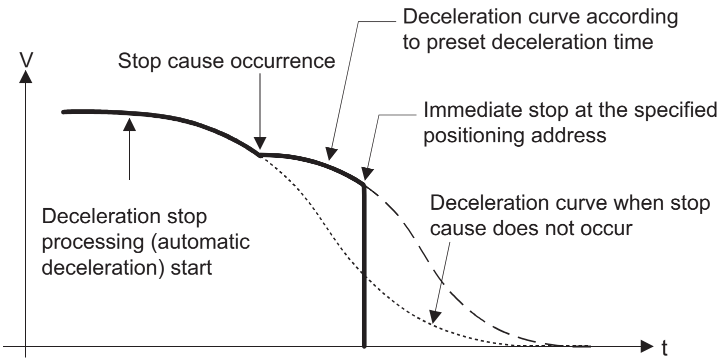
Control

The operation of "stop command processing for deceleration stop function" is explained below.

■Deceleration curve re-processing

A deceleration curve is re-processed starting from the speed at stop cause occurrence until at a stop, according to the preset deceleration time.

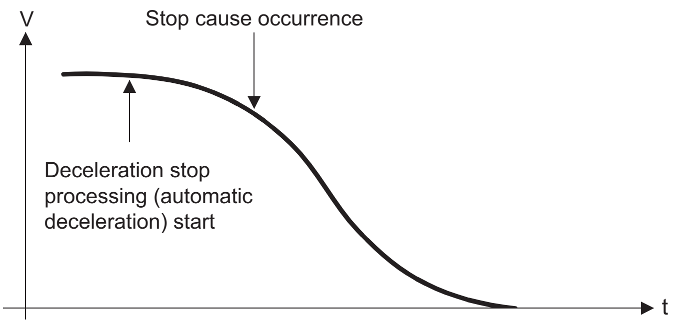
If a stop cause occurs during automatic deceleration of position control, the deceleration stop processing stops as soon as the target has reached the positioning address specified in the positioning data that is currently executed.



■Deceleration curve continuation

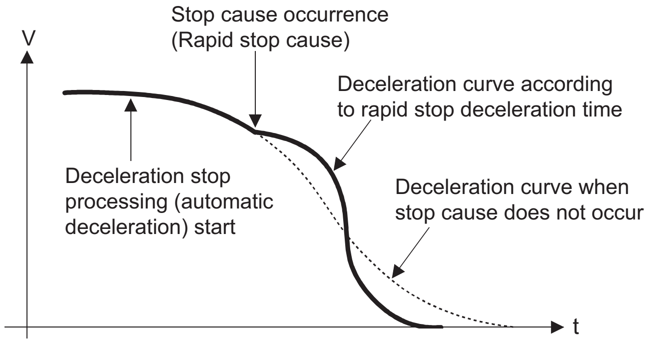
The current deceleration curve is continued after a stop cause has occurred.

If a stop cause occurs during automatic deceleration of position control, the deceleration stop processing may be complete before the target has reached the positioning address specified in the positioning data that is currently executed.

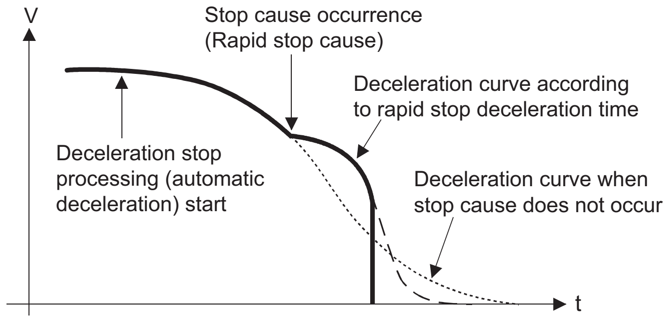


Precautions for control

- In manual control (JOG operation, inching operation, manual pulse generator operation) and speed-torque control, the stop command processing for deceleration stop function is invalid.
- The stop command processing for deceleration stop function is valid when "0: Normal deceleration stop" is set in "[Pr.37] Stop group 1 rapid stop selection" to "[Pr.39] Stop group 3 rapid stop selection" as the stopping method for stop cause occurrence.
- The stop command processing for deceleration stop function is invalid when "1: Rapid stop" is set in "[Pr.37] Stop group 1 rapid stop selection" to "[Pr.39] Stop group 3 rapid stop selection". (A deceleration curve is re-processed starting from the speed at stop cause occurrence until at a stop, according to the "[Pr.36] Rapid stop deceleration time".) In the position control (including position control of speed/position changeover control or position/speed changeover control) mode, positioning may stop immediately depending on the stop cause occurrence timing and "[Pr.36] Rapid stop deceleration time" setting.



(Rapid stop in front of the specified positioning address)



(Immediate stop at the specified positioning address)

Setting method

To use the "stop command processing for deceleration stop function", set the following control data in a user program.
The set data are made valid as soon as they are written to the buffer memory. The user program READY signal [Y0] is irrelevant.

Setting item		Setting value	Setting details	Buffer memory address
[Cd.42]	Stop command processing for deceleration stop selection	→	Set the stop command processing for deceleration stop function. 0: Deceleration curve re-processing 1: Deceleration curve continuation	5907

Refer to the following for the setting details.

☞ Page 543 Control Data

For labels, refer to the following.

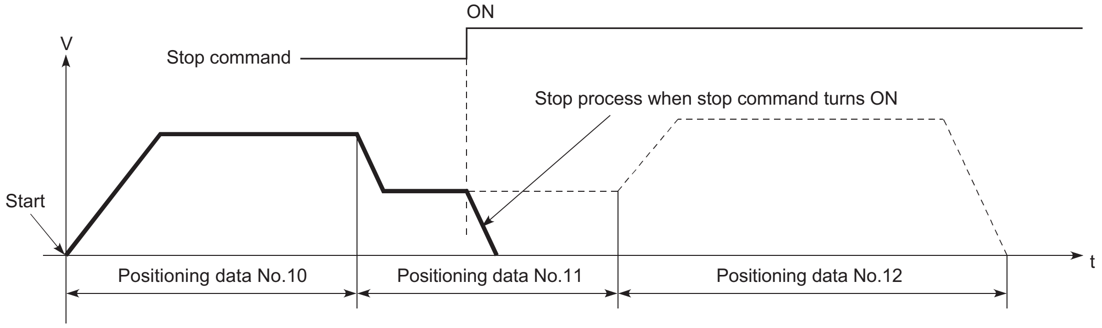
☞ Page 437 System control data

Continuous operation interrupt function

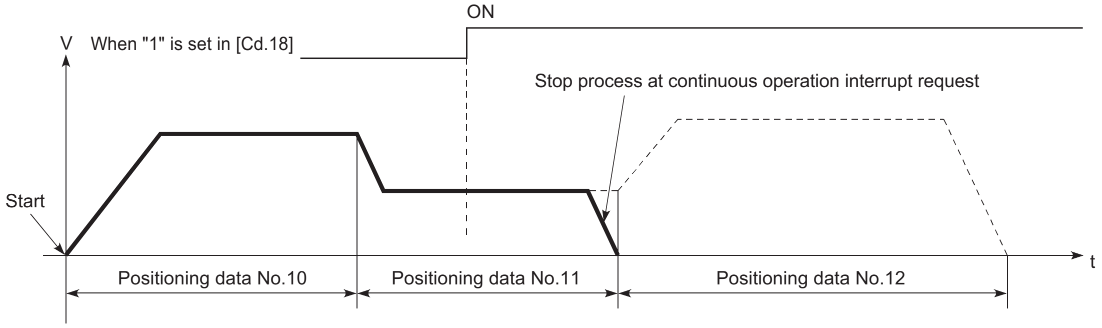
During positioning control, the control can be interrupted during continuous positioning control and continuous path control (continuous operation interrupt function). When "continuous operation interruption" is execution, the control will stop when the operation of the positioning data being executed ends. To execute continuous operation interruption, set "1: Interrupts continuous operation control or continuous path control." for "[Cd.18] Interrupt request during continuous operation".

Operation during continuous operation interruption

When the stop command is ON



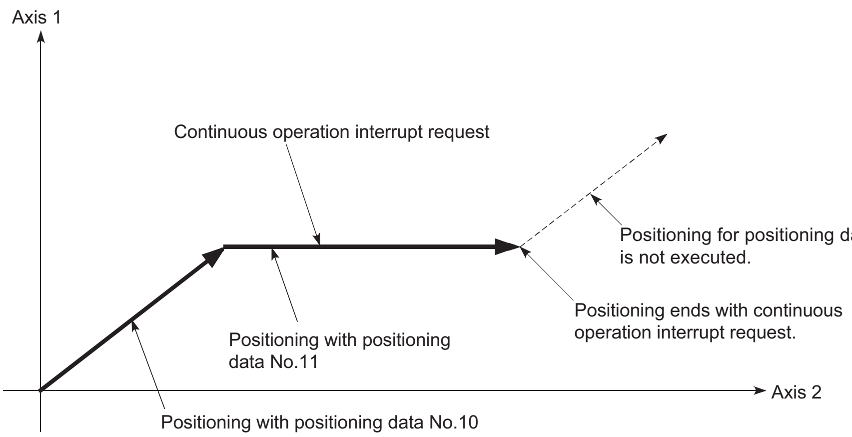
When "1" is set in [Cd.18]



8

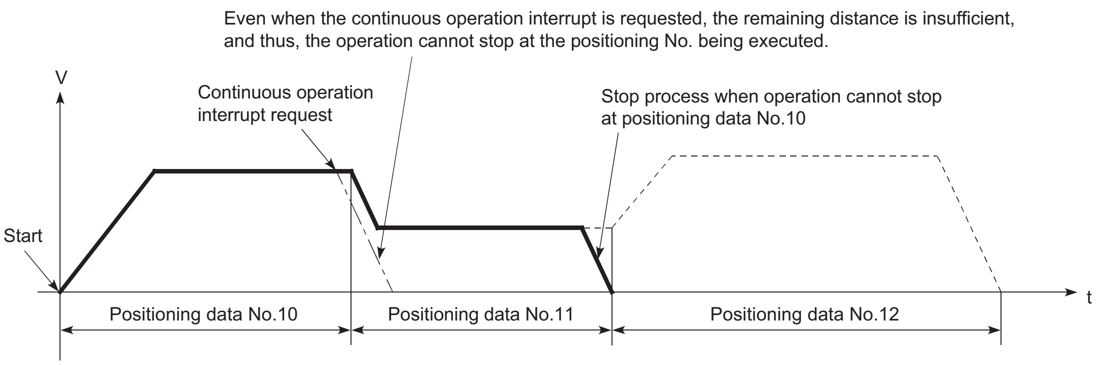
Restrictions

- When the "continuous operation interrupt request" is executed, the positioning will end. Thus, after stopping, the operation cannot be "restarted". When "[Cd.6] Restart command" is issued, the warning "Restart not possible" (warning code: 0902H) will occur.
- Even if the stop command is turned ON after executing the "continuous operation interrupt request", the "continuous operation interrupt request" cannot be canceled. Thus, if "restart" is executed after stopping by turning the stop command ON, the operation will stop when the positioning data No. where "continuous operation interrupt request" was executed is completed.



- If the operation cannot be decelerated to a stop because the remaining distance is insufficient when "continuous operation interrupt request" is executed with continuous path control, the interruption of the continuous operation will be postponed until the positioning data shown below.

- Positioning data No. have sufficient remaining distance
- Positioning data No. for positioning complete (pattern: 00)
- Positioning data No. for continuous positioning control (pattern: 01)



- When operation is not performed (BUSY signal is OFF), the interrupt request during continuous operation is not accepted. It is cleared to 0 at a start or restart.

Control data requiring settings

Set the following data to interrupt continuous operation.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.18]	Interrupt request during continuous operation	1	Set "1: Interrupts continuous operation control or continuous path control.".	4320+100n

Refer to the following for the setting details.

☞ Page 543 Control Data

For labels, refer to the following.

☞ Page 437 Axis control data

Step function

The "step function" is used to confirm each operation of the positioning control one by one.
It is used in debugging work for major positioning control, etc.
A positioning operation in which a "step function" is used is called a "step operation".
In step operations, the timing for stopping the control can be set. (This is called the "step mode".) Control stopped by a step operation can be continued by setting "step continues (to continue the control)" in the "step start information".

Relation between the step function and various controls

The following table shows the relation between the "step function" and various controls.
○: Set when required, ×: Setting not possible

Control type			Step function	Step applicability
Home position return control	Machine home position return control		×	Step operation not possible
	Fast home position return control		×	
Major positioning control	Position control	1-axis linear control	○	Step operation possible
		2 to 4-axis linear interpolation control	○	
		1-axis fixed-feed control	○	
		2 to 4-axis fixed-feed control (interpolation)	○	
		2-axis circular interpolation control	○	
		3-axis helical interpolation control	○	
	1 to 4-axis speed control		×	Step operation not possible
	Speed-position switching control, Position-speed switching control		○	Step operation possible
	Other control	Current value changing	○	
		JUMP instruction, NOP instruction, LOOP to LEND	×	Step operation not possible
Manual control	JOG operation, Inching operation		×	Step operation not possible
	Manual pulse generator operation		×	
Expansion control	Speed-torque control		×	

Step mode

In step operations, the timing for stopping the control can be set. This is called the "step mode". (The "step mode" is set in the control data "[Cd.34] Step mode".)
The following shows the two types of "step mode" functions.

■Deceleration unit step

The operation stops at positioning data requiring automatic deceleration. (A normal operation will be carried out until the positioning data requiring automatic deceleration is found. Once found, that positioning data will be executed, and the operation will then automatically decelerate and stop.)

■Data No. unit step

The operation automatically decelerates and stops for each positioning data. (Even in continuous path control, an automatic deceleration and stop will be forcibly carried out.)

Step start request

Control stopped by a step operation can be continued by setting "step continues" (to continue the control) in the "step start information". (The "step start information" is set in the control data "[Cd.36] Step start information".)

The following table shows the results of starts using the "step start information" during step operation.

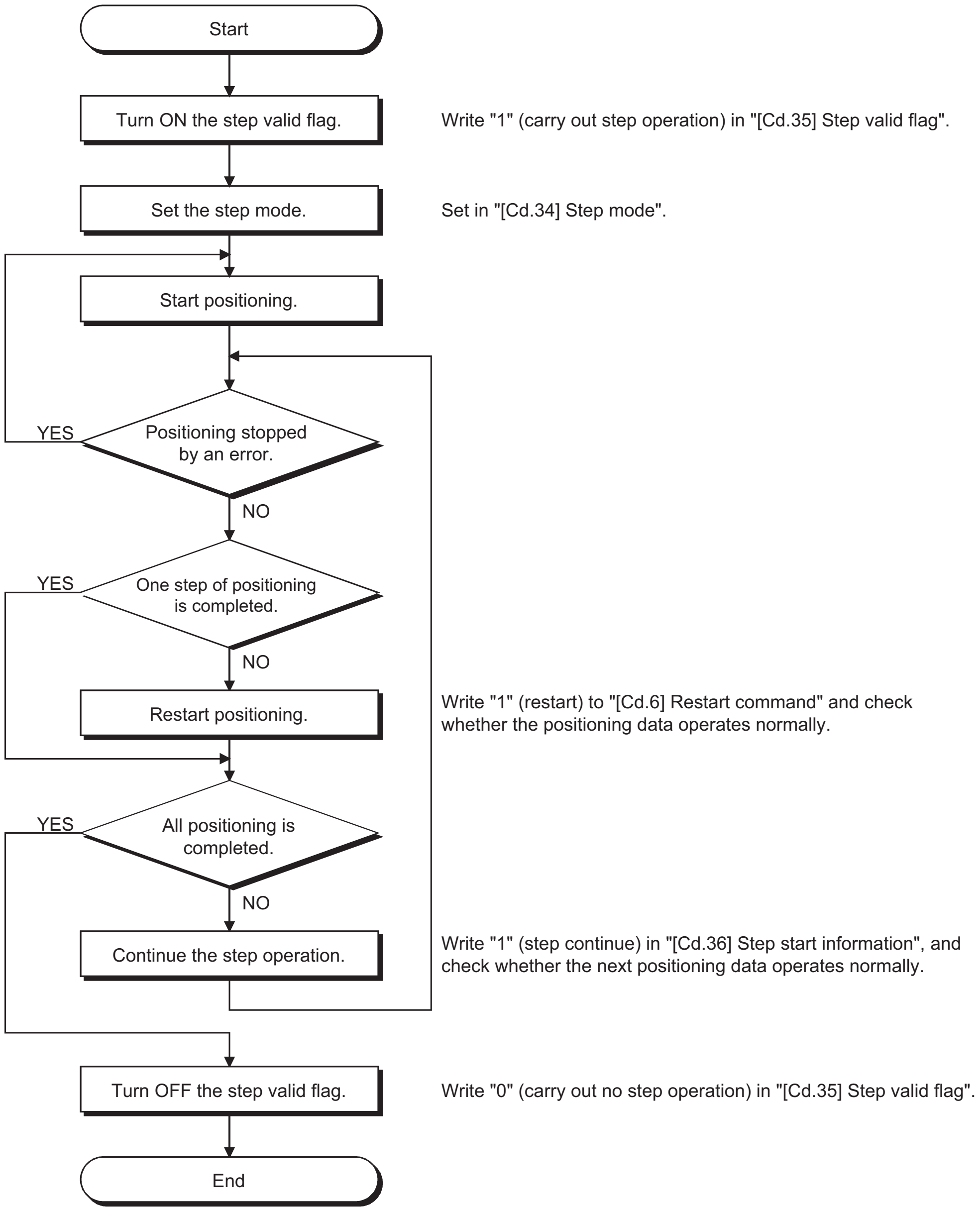
Stop status in the step operation	[Md.26] Axis operation status	[Cd.36] Step start information	Step start results
1 step of positioning stopped normally	Step standby	1: Continues step operation	The next positioning data is executed.

The warning "Step not possible" (warning code: 0996H) will occur if the "[Md.26] Axis operation status" is as shown below or the step valid flag is OFF when step start information is set.

[Md.26] Axis operation status	Step start results
Standby	Step not continued by warning
Stopped	
Interpolation	
JOG operation	
Manual pulse generator operation	
Analyzing	
Special start standby	
Home position return	
Position control	
Speed control	
Speed control in speed-position switching control	
Position control in speed-position switching control	
Speed control in position-speed switching control	
Position control in position-speed switching control	
Synchronous control	
Control mode switch	
Speed control	
Torque control	

Using the step operation

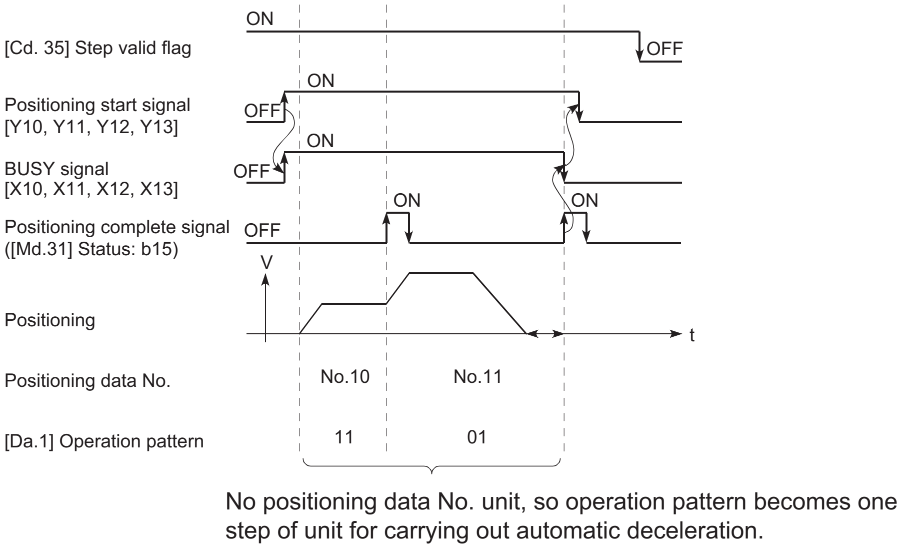
The following shows the procedure for checking positioning data using the step operation.



Control details

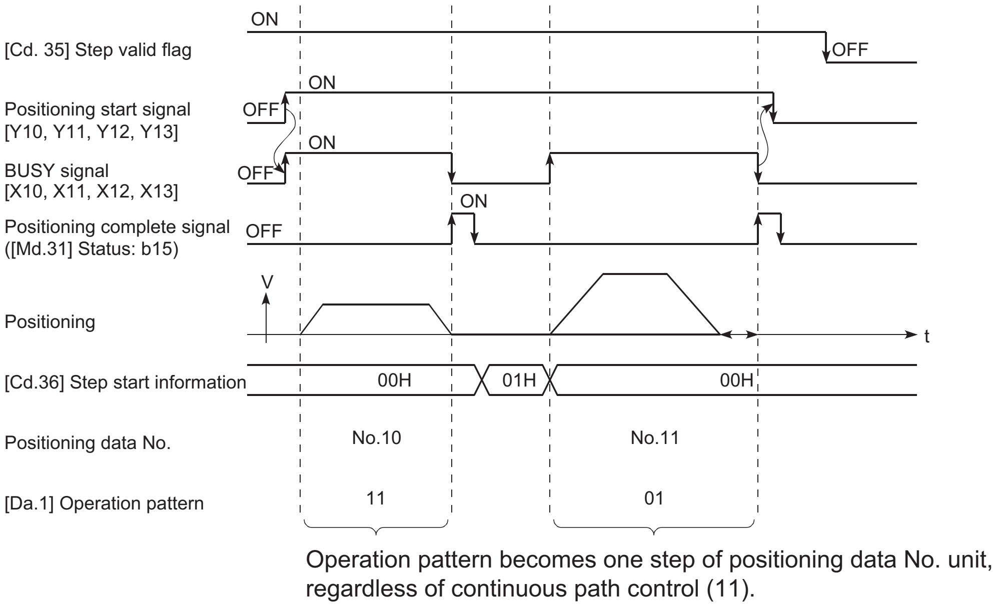
- The following drawing shows a step operation during a "deceleration unit step".

■Axis 1 to 4 operation example



- The following drawing shows a step operation during a "data No. unit step".

■Axis 1 to 4 operation example



Precautions during control

- When step operation is carried out using interpolation control positioning data, the step function settings are carried out for the reference axis.
- When the step valid flag is ON, the step operation will start from the beginning if the positioning start signal is turned ON while "[Md.26] Axis operation status" is "step standby". (The step operation will be carried out from the positioning data set in "[Cd.3] Positioning start No.".)

Step function settings

To use the "step function", write the data shown in the following table to the Simple Motion board using the user program.

Refer to the following for the timing of the settings.

☞ Page 277 Using the step operation

The set details are validated after they are written to the Simple Motion board.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.34]	Step mode	→	Set "0: Stepping by deceleration units" or "1: Stepping by data No. units".	4344+100n
[Cd.35]	Step valid flag	1	Set "1: Validates step operations".	4345+100n
[Cd.36]	Step start information	→	Set "1: Continues step operation", depending on the stop status.	4346+100n

Refer to the following for the setting details.

☞ Page 543 Control Data

For labels, refer to the following.

☞ Page 437 Axis control data

8

8.8 Other Functions

Other functions include the "skip function", "M code output function", "teaching function", "command in-position function", "acceleration/deceleration processing function", "deceleration start flag function", "speed control 10 × multiplier setting for degree axis function", "operation setting for incompletion of home position return function" and "controller in-position function". Each function is executed by parameter setting or user program creation and writing.

Skip function

The "skip function" is used to stop (deceleration stop) the control of the positioning data being executed at the time of the skip signal input, and execute the next positioning data.

A skip is executed by a skip command ([Cd.37] Skip command) or external command signal.

The "skip function" can be used during control in which positioning data is used.

Relation between the skip function and various controls

The following table shows the relation between the "skip function" and various controls.

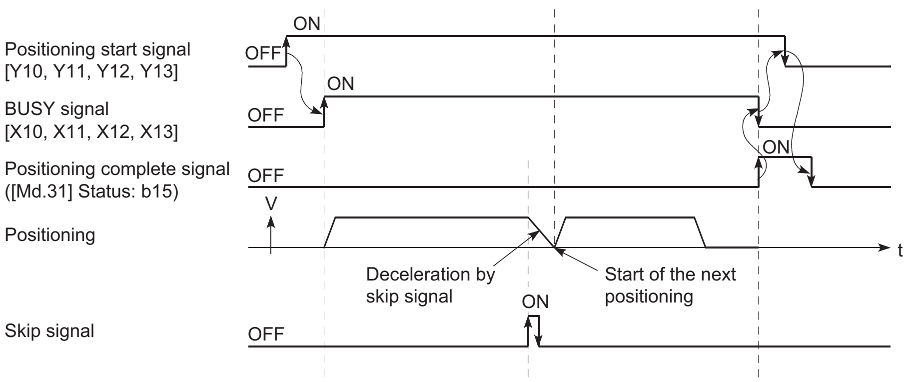
○: Set when required, ×: Setting not possible

Control type			Skip function	Skip applicability
Home position return control	Machine home position return control		×	Skip operation not possible
	Fast home position return control		×	
Major positioning control	Position control	1-axis linear control	○	Skip operation possible
		2 to 4-axis linear interpolation control	○	
		1-axis fixed-feed control	○	
		2 to 4-axis fixed-feed control (interpolation)	○	
		2-axis circular interpolation control	○	
		3-axis helical interpolation control	○	
	1 to 4-axis speed control		×	Skip operation not possible
	Speed-position switching control		○	Skip operation possible
	Position-speed switching control		×	Skip operation not possible
	Other control	Current value changing	○	Skip operation possible
		JUMP instruction, NOP instruction, LOOP to LEND	×	Skip operation not possible
Manual control	JOG operation, Inching operation		×	Skip operation not possible
	Manual pulse generator operation		×	
Expansion control	Speed-torque control		×	

Control details

The following drawing shows the skip function operation.

■Axis 1 to 4 operation example



Precautions during control

- If the skip signal is turned ON at the last of an operation, a deceleration stop will occur and the operation will be terminated.
- When a control is skipped (when the skip signal is turned ON during a control), the positioning complete signals will not turn ON.
- When the skip signal is turned ON during the dwell time, the remaining dwell time will be ignored, and the next positioning data will be executed.
- When a control is skipped during interpolation control, the reference axis skip signal is turned ON. When the reference axis skip signal is turned ON, a deceleration stop will be carried out for every axis, and the next reference axis positioning data will be executed.
- The M code ON signals will not turn ON when the M code output is set to the AFTER mode. (In this case, the M code will not be stored in "[Md.25] Valid M code".)
- The skip cannot be carried out by the speed control and position-speed switching control.
- If the skip signal is turned ON with the M code signal turned ON, the transition to the next data is not carried out until the M code signal is turned OFF.

Setting method from the user program

The following shows the settings and user program example for skipping the control being executed in axis 1 with a command from the user program.

■Setting data

Set the following data.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.37]	Skip command	1	Set "1: Skip request".	4347+100n

Refer to the following for the setting details.

☞ Page 543 Control Data

For labels, refer to the following.

☞ Page 437 Axis control data

When the "skip command" is input, the value "1" (skip request) set in "[Cd.37] Skip command" is written to the buffer memory of the Simple Motion board.

Program example

Refer to the following for the user program example.

☞ Page 602 Skip program

Setting method using an external command signal

The skip function can also be executed using an "external command signal".

The following shows the settings for skipping the control being executed in axis 1 using an "external command signal".

- Set the following data to execute the skip function using an external command signal. (The setting is carried out using the user program.)

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.8]	External command valid	1	Set "1: Validate external command".	4305+100n

For labels, refer to the following.

☞ Page 437 Axis control data

Set the link device to be used in "[Pr.970] Skip request: Link device type" to "[Pr.973] Skip request: Link device logic setting".

Refer to the following for the setting details.

☞ Page 321 Link Device External Signal Assignment Function

M code output function

The "M code output function" is used to command sub work (clamping, drill rotation, tool replacement, etc.) related to the positioning data being executed.
When the M code ON signal ([Md.31] Status: b12) is turned ON during positioning execution, a No. called the M code is stored in "[Md.25] Valid M code".
These "[Md.25] Valid M code" are read from the host personal computer, and used to command auxiliary work. M codes can be set for each positioning data. (Set in setting item "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" of the positioning data.)
The timing for outputting (storing) the M codes can also be set in the "M code output function".

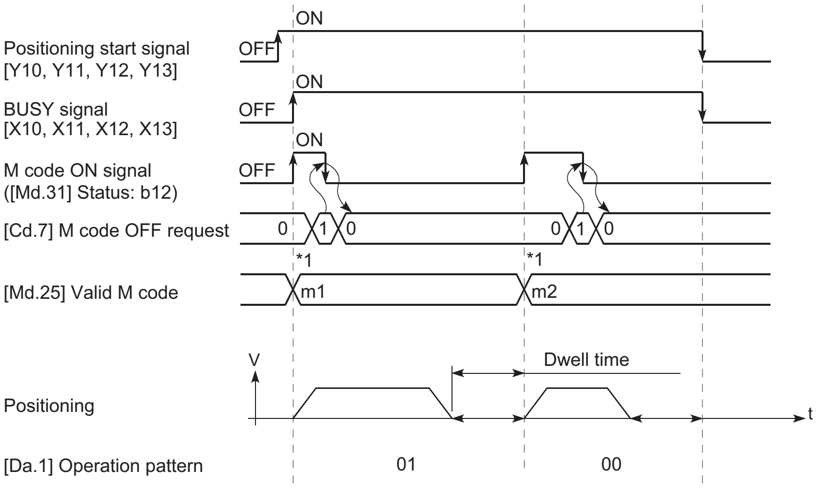
M code ON signal output timing

The timing for outputting (storing) the M codes can be set in the "M code output function". (The M code is stored in "[Md.25] Valid M code" when the M code ON signal is turned ON.)
The following shows the two types of timing for outputting M codes: the "WITH mode" and the "AFTER mode".

■WITH mode

The M code ON signal is turned ON at the positioning start, and the M code is stored in "[Md.25] Valid M code".

■Axis 1 to 4 operation example

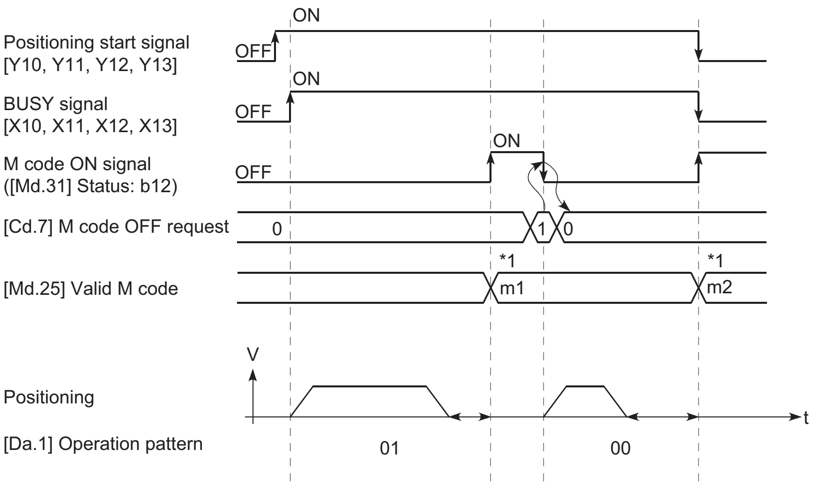


*1 m1 and m2 indicate set M codes.

■AFTER mode

The M code ON signal is turned ON at the positioning completion, and the M code is stored in "[Md.25] Valid M code".

■Axis 1 to 4 operation example



*1 m1 and m2 indicate set M codes.

M code ON signal OFF request

When the M code ON signal is ON, it must be turned OFF by the user program.

To turn OFF the M code ON signal, set "1" (turn OFF the M code signal) in "[Cd.7] M code OFF request".

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.7]	M code OFF request	1	Set "1: Turn OFF the M code ON signal".	4304+100n

Refer to the following for the setting details.

☞ Page 543 Control Data

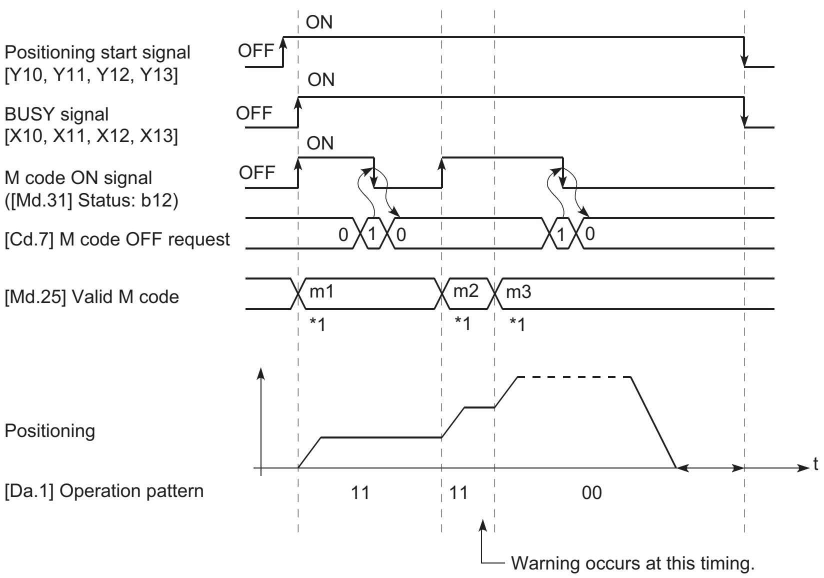
For labels, refer to the following.

☞ Page 437 Axis control data

The next positioning data will be processed as follows if the M code ON signal is not turned OFF. (The processing differs according to the "[Da.1] Operation pattern".)

[Da.1] Operation pattern		Processing
00	Independent positioning control (Positioning control)	The next positioning data will not be executed until the M code ON signal is turned OFF.
01	Continuous positioning control	
11	Continuous path control	The next positioning data will be executed. If the M code is set to the next positioning data, the warning "M code ON signal ON" (warning code: 0992H) will occur.

■Axis 1 to 4 operation example



*1 m1 and m3 indicate set M codes.

Point

If the M code output function is not required, set "0" in the setting item of the positioning data "[Da.10] M code/ Condition data No./Number of LOOP to LEND repetitions/Number of pitches".

Precautions during control

- During interpolation control, the reference axis M code ON signal is turned ON.
- The M code ON signal will not turn ON if "0" is set in "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches". (The M code will not be output, and the previously output value will be held in "[Md.25] Valid M code".)
- If the M code ON signal is ON at the positioning start, the error "M code ON signal start" (error code: 19A0H) will occur, and the positioning will not start.
- If the user program READY signal [Y0] is turned OFF, the M code ON signal will turn OFF and "0" will be stored in "[Md.25] Valid M code".
- If the positioning operation time is short during continuous path control, there will not be enough time to turn OFF the M code ON signal and the warning "M code ON signal ON" (warning code: 0992H) may occur. In this case, set a "0" in the "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" of that section's positioning data to prevent the M code from being output for avoiding the warning occurrence.
- In the AFTER mode during speed control, the M code is not output and the M code ON signal does not turn ON.
- If current value changing where "9003" has been set to "[Cd.3] Positioning start No." is performed, the M code output function is made invalid.

Setting method

The following shows the settings to use the "M code output function".

- Set the M code No. in the positioning data "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches".
- Set the timing to output the M code ON signal. The "WITH mode/AFTER mode" also can be set for each positioning data.

Set the required value in the following parameter, and write it to the Simple Motion board. The set details are validated at the rising edge (OFF → ON) of the user program READY signal [Y0].

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Pr.18]	M code ON signal output timing	→	Set the timing to output the M code ON signal. 0: WITH mode 1: AFTER mode	27+150n

Refer to the following for the setting details.

☞ Page 453 Basic Setting

For labels, refer to the following.

☞ Page 432 Positioning parameters: Detailed parameters 1

Reading M codes

"M codes" are stored in the following buffer memory when the M code ON signal turns ON.

n: Axis No. - 1

Monitor item		Monitor value	Storage details	Buffer memory address
[Md.25]	Valid M code	→	The M code No. ([Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches) set in the positioning data is stored.	2408+100n

Refer to the following for information on the storage details.

☞ Page 507 Monitor Data

For labels, refer to the following.

☞ Page 435 Axis monitor data

The following shows a user program example for reading the "[Md.25] Valid M code". (The read value is used to command the sub work.)

Program example

Refer to the following for the user program example.

Classification	Label name	Description
Label	MMC_Axis::AxMntr.Status_M_Code	R: [Md.31] M code ON
	MMC_Axis::AxMntr.M_Code	R: [Md.25] Valid M code

C++

```
unsigned short GetMcodeSample( MMC_Axis *axis1 )
{
    unsigned short mcode = 0;

    /* When M code is turned ON */
    if( axis1->AxMntr.Status_M_Code != MMC_OFF )
    {
        mcode = axis1->AxMntr.M_Code;
    }

    return( mcode );
}
```

8

Teaching function

The "teaching function" is used to set addresses aligned using the manual control (JOG operation, inching operation manual pulse generator operation) in the positioning data addresses ("[Da.6] Positioning address/movement amount", "[Da.7] Arc address").

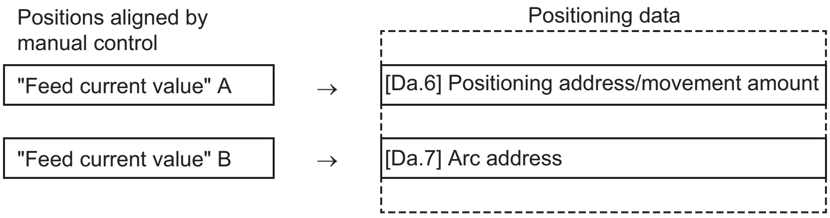
Control details

■Teaching timing

Teaching is executed using the user program when the BUSY signal [X10 to X1F] is OFF. (During manual control, teaching can be carried out as long as the axis is not BUSY, even when an error or warning has occurred.)

■Addresses for which teaching is possible

The addresses for which teaching is possible are "feed current values" ([Md.20] Feed current value) having the home position as a reference. The settings of the "movement amount" used in incremental system positioning cannot be used. In the teaching function, these "feed current values" are set in the "[Da.6] Positioning address/movement amount" or "[Da.7] Arc address".



Precautions during control

- Before teaching, a "machine home position return" must be carried out to establish the home position. (When a current value changing, etc., is carried out, "[Md.20] Feed current value" may not show absolute addresses having the home position as a reference.)
- Teaching cannot be carried out for positions to which movement cannot be executed by manual control (positions to which the workpiece cannot physically move). (During 2-axis circular interpolation control with center point designation, etc., teaching of "[Da.7] Arc address" cannot be carried out if the center point of the arc is not within the moveable range of the workpiece.)
- Writing to the flash ROM can be executed up to 100,000 times. If writing to the flash ROM exceeds 100,000 times, the writing may become impossible (assured value is up to 100,000 times). If the error "Flash ROM write number error" (error code: 1080H) occurs when writing to the flash ROM has been completed, check whether or not the user program is created so as to write continuously to the flash ROM.

Data used in teaching

The following control data is used in teaching.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Cd.1]	Flash ROM write request	1	Write the set details to the flash ROM (backup the changed data).	5900
[Cd.38]	Teaching data selection	→	Sets to which "feed current value" is written. 0: Written to "[Da.6] Positioning address/movement amount". 1: Written to "[Da.7] Arc address".	4348+100n
[Cd.39]	Teaching positioning data No.	→	Designates the data to be taught. (Teaching is carried out when the setting value is 1 to 600.) When teaching has been completed, this data is zero cleared.	4349+100n

Refer to the following for the setting details.

☞ Page 543 Control Data

For labels, refer to the following.

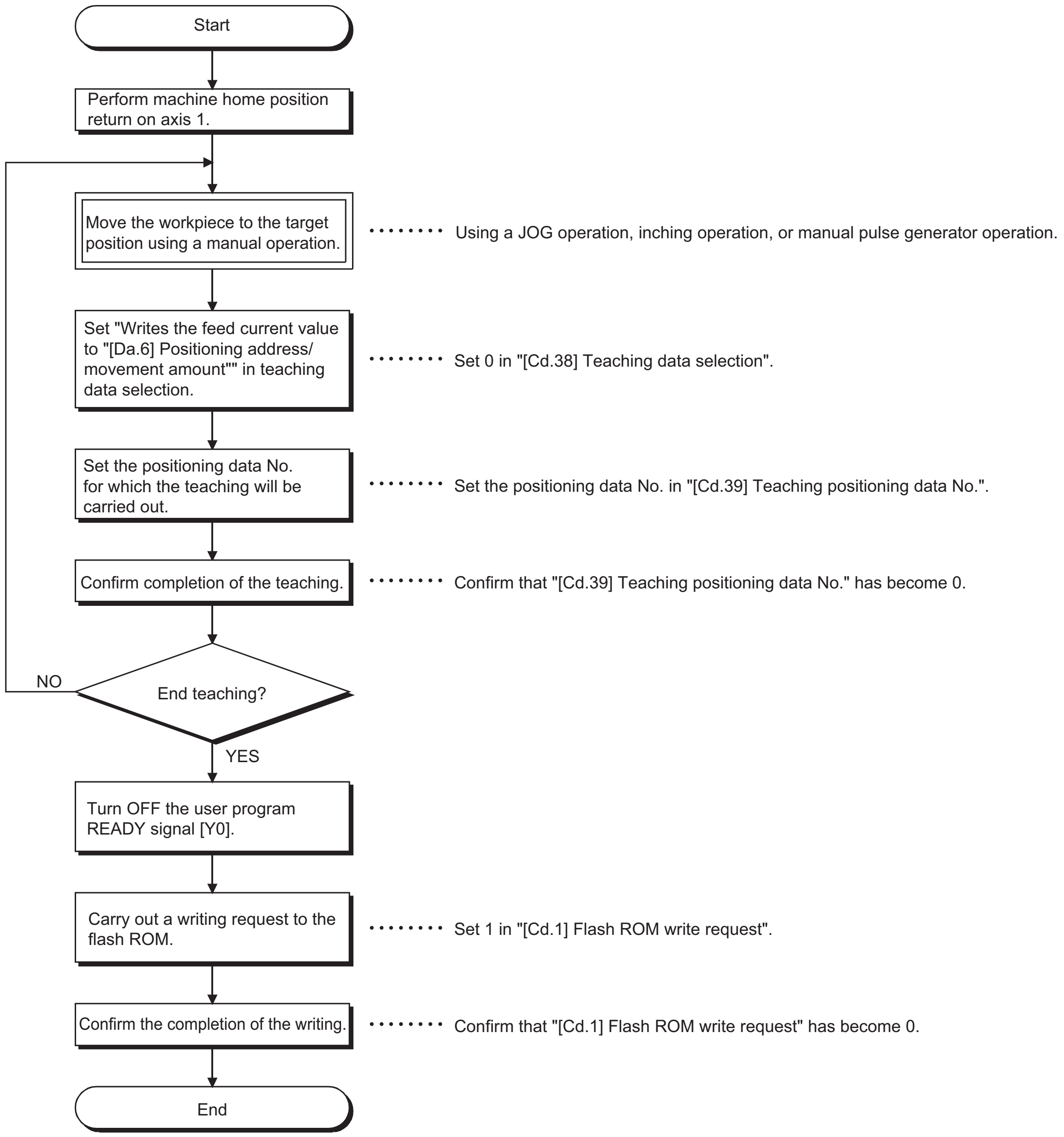
☞ Page 437 System control data, ☞ Page 437 Axis control data

8

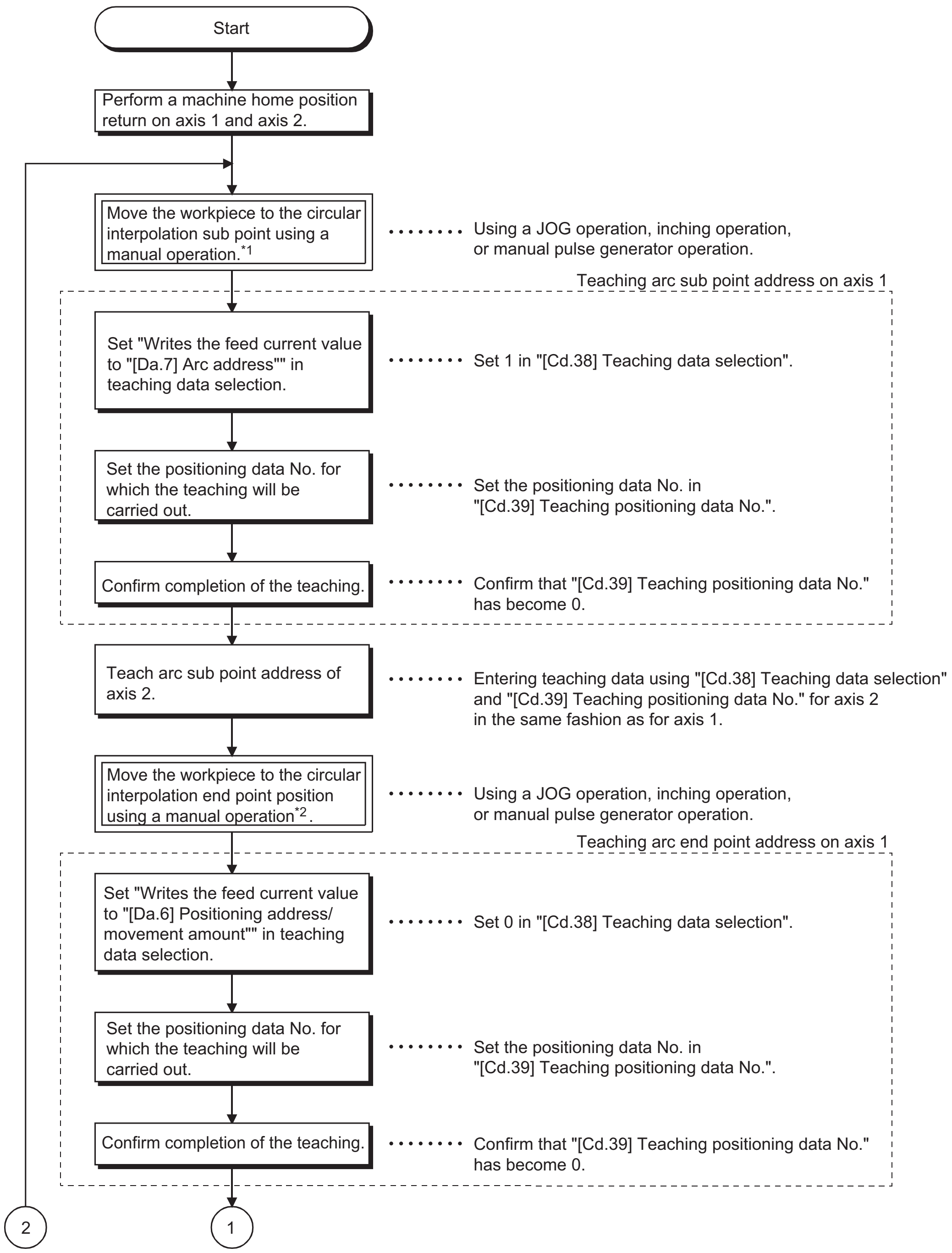
Teaching procedure

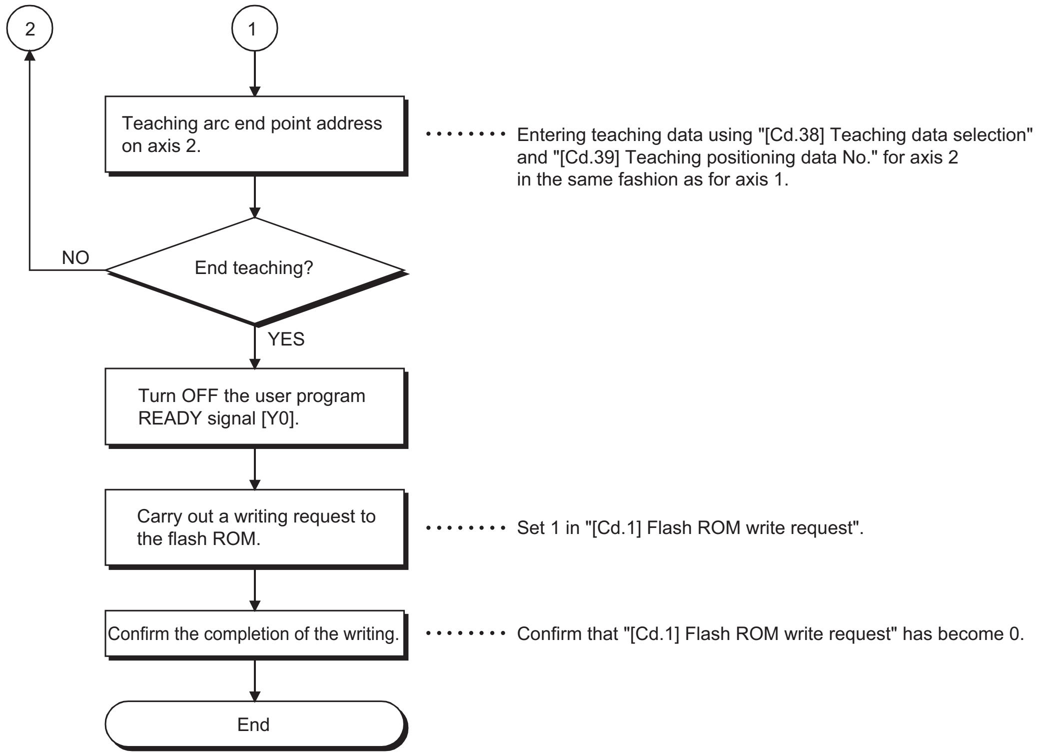
The following shows the procedure for a teaching operation.

- When teaching to the "[Da.6] Positioning address/movement amount" (Teaching example on axis 1)

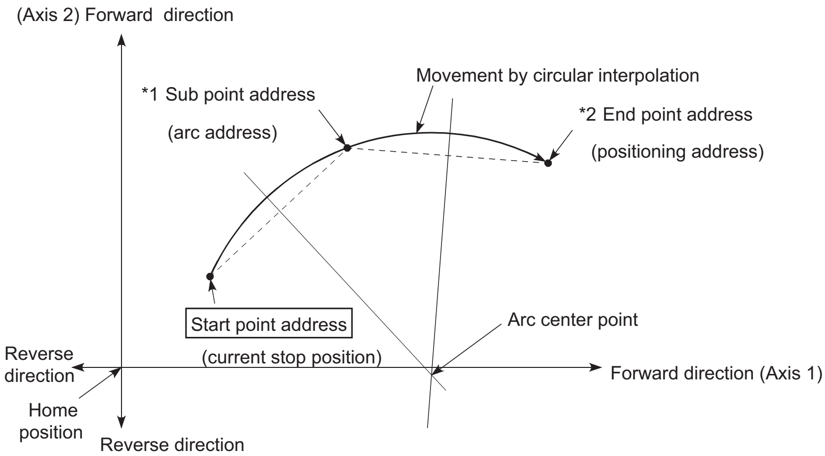


- When teaching to the "[Da.7] Arc address", then teaching to the "[Da.6] Positioning address/movement amount" (Teaching example for 2-axis circular interpolation control with sub point designation on axis 1 and axis 2)





■Motion path



*1 The sub point address is stored in the arc address.
*2 The end point address is stored in the positioning address.

Teaching user program example

The following shows a user program example for setting (writing) the positioning data obtained with the teaching function to the Simple Motion board.

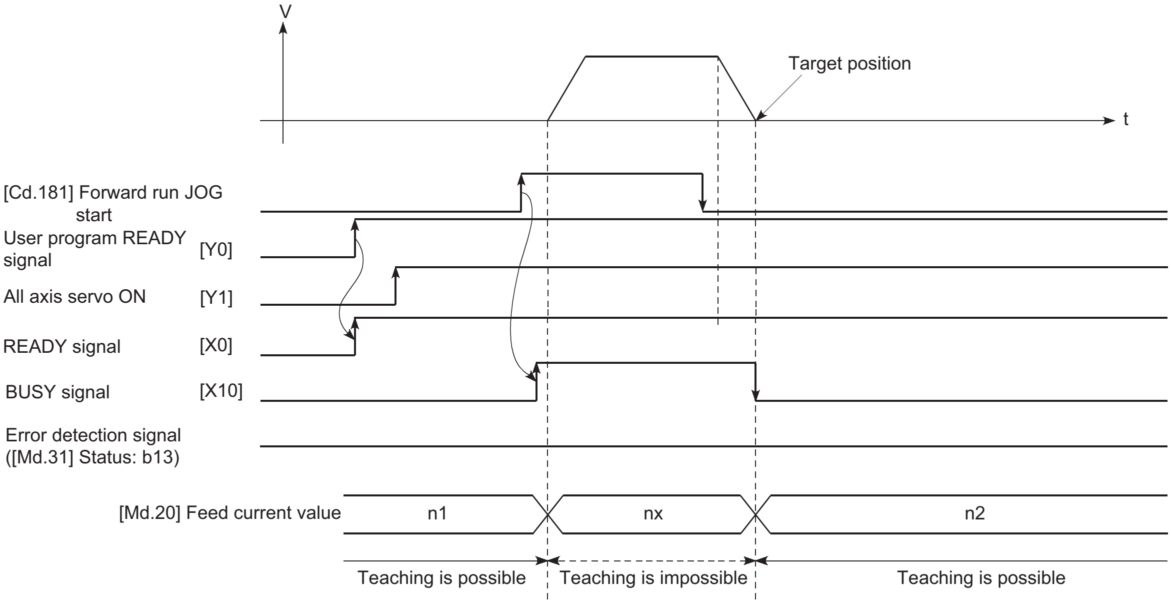
■Setting conditions

When setting the feed current value as the positioning address, write it when the BUSY signal is OFF.

■Axis 1 to 4 operation example

The following example shows a program to carry out the teaching of axis 1.

- Move the workpiece to the target position using a JOG operation (or an inching operation, a manual pulse generator operation).



Point

- Confirm the teaching function and teaching procedure before setting the positioning data.
- The positioning addresses that are written are absolute address (ABS) values.
- The positioning data written by the teaching function overwrites the data of buffer memory only. Therefore, read from buffer memory and write to flash ROM before turning the power OFF as necessary.

Program example

Refer to the following for the user program example.

☞ Page 603 Teaching program

8

Command in-position function

The "command in-position function" checks the remaining distance to the stop position during the automatic deceleration of positioning control, and sets "1". This flag is called the "command in-position flag". The command in-position flag is used as a front-loading signal indicating beforehand the completion of the position control.

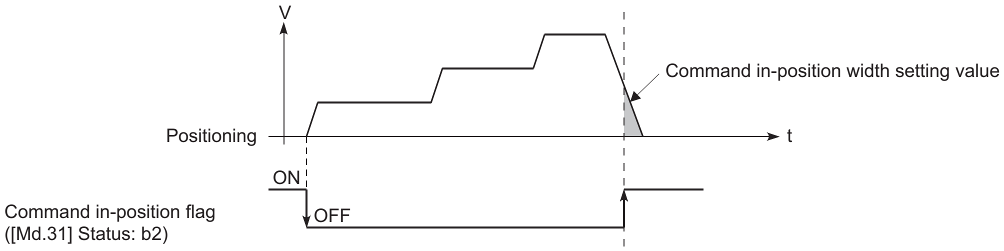
Control details

The following shows control details of the command in-position function.

- When the remaining distance to the stop position during the automatic deceleration of positioning control becomes equal to or less than the value set in "[Pr.16] Command in-position width", "1" is stored in the command in-position flag ([Md.31] Status: b2).

■Command in-position width check

Remaining distance ≤ "[Pr.16] Command in-position width" setting value

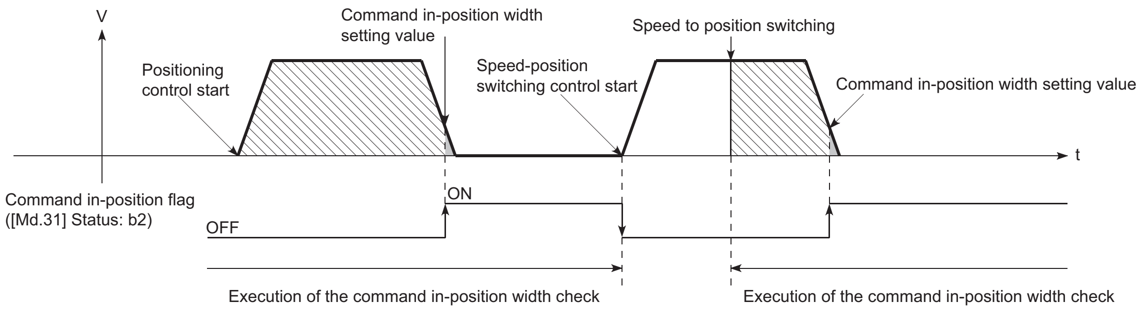


- A command in-position width check is carried out every operation cycle.

Precautions during control

- A command in-position width check will not be carried out in the following cases.

- During speed control
- During speed control in speed-position switching control
- During speed control in position-speed switching control
- During speed control mode
- During torque control mode



- The command in-position flag will be turned OFF in the following cases. ("0" will be stored in "[Md.31] Status: b2".)

- At the positioning control start
- At the speed control start
- At the speed-position switching control, position-speed switching control start
- At the home position return control start
- At the JOG operation start
- At the inching operation start
- When the manual pulse generator operation is enabled

- The "[Pr.16] Command in-position width" and command in-position flag ([Md.31] Status: b2) of the reference axis are used during interpolation control. When the "[Pr.20] Interpolation speed designation method" is "Composite speed", the command in-position width check is carried out in the remaining distance on the composite axis (line/arc connecting the start point address and end point address).

Setting method

To use the "command in-position function", set the required value in the parameter shown in the following table, and write it to the Simple Motion board.

The set details are validated at the rising edge (OFF → ON) of the user program READY signal [Y0].

Setting item		Setting value	Setting details	Factory-set initial value
[Pr.16]	Command in-position width	→	Turn ON the command in-position flag, and set the remaining distance to the stop position of the position control.	100

Refer to the following for the setting details.

☞ Page 453 Basic Setting

For labels, refer to the following.

☞ Page 432 Positioning parameters: Detailed parameters 1

Confirming the command in-position flag

The "command in-position flag" is stored in the following buffer memory.

n: Axis No. - 1

Monitor item		Monitor value	Storage details	Buffer memory address
[Md.31]	Status	→	The command in-position flag is stored in the "b2" position.	2417+100n

Refer to the following for information on the storage details.

☞ Page 507 Monitor Data

For labels, refer to the following.

☞ Page 435 Axis monitor data

Point

Parameters are set for each axis.

Acceleration/deceleration processing function

The "acceleration/deceleration processing function" adjusts the acceleration/deceleration of each control to the acceleration/deceleration curve suitable for device.
Setting the acceleration/deceleration time changes the slope of the acceleration/deceleration curve.
The following two methods can be selected for the acceleration/deceleration curve:
- Trapezoidal acceleration/deceleration
- S-curve acceleration/deceleration

Refer to the following for acceleration/deceleration processing of speed-torque control.
☞ Page 190 Speed-torque Control

"Acceleration/deceleration time 0 to 3" control details and setting

In the Simple Motion board, four types each of acceleration time and deceleration time can be set. By using separate acceleration/deceleration times, control can be carried out with different acceleration/deceleration times for positioning control, JOG operation, home position return, etc.
Set the required values for the acceleration/deceleration time in the parameters shown in the following table, and write them to the Simple Motion board.
The set details are validated when written to the Simple Motion board.

Setting item		Setting value	Setting details	Factory-set initial value
[Pr.9]	Acceleration time 0	→	Set the acceleration time at a value within the range of 1 to 8388608 ms.	1000
[Pr.25]	Acceleration time 1	→		1000
[Pr.26]	Acceleration time 2	→		1000
[Pr.27]	Acceleration time 3	→		1000
[Pr.10]	Deceleration time 0	→	Set the deceleration time at a value within the range of 1 to 8388608 ms.	1000
[Pr.28]	Deceleration time 1	→		1000
[Pr.29]	Deceleration time 2	→		1000
[Pr.30]	Deceleration time 3	→		1000

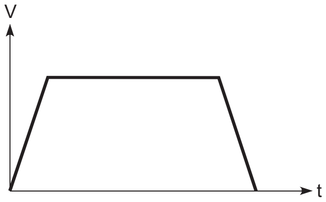
Refer to the following for the setting details.
☞ Page 453 Basic Setting

"Acceleration/deceleration method setting" control details and setting

In the "acceleration/deceleration method setting", the acceleration/deceleration processing method is selected and set. The set acceleration/deceleration processing is applied to all acceleration/deceleration. (except for inching operation, manual pulse generator operation and speed-torque control.)
The two types of "acceleration/deceleration processing method" are shown below.

■Trapezoidal acceleration/deceleration processing method

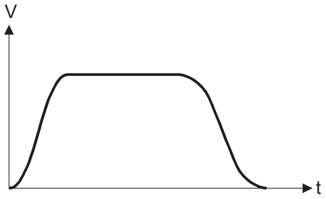
This is a method in which linear acceleration/deceleration is carried out based on the acceleration time, deceleration time, and speed limit value set by the user.



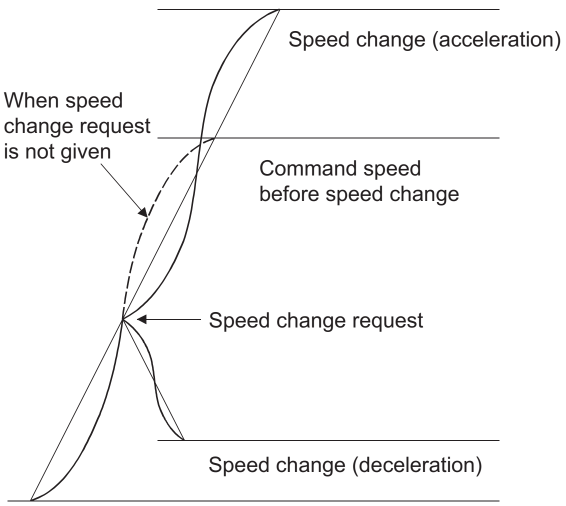
■S-curve acceleration/deceleration processing method

In this method, the motor burden is reduced during starting and stopping.

This is a method in which acceleration/deceleration is carried out gradually, based on the acceleration time, deceleration time, speed limit value, and "[Pr.35] S-curve ratio" (1 to 100%) set by the user.



When a speed change request or override request is given during S-curve acceleration/deceleration processing, S-curve acceleration/deceleration processing begins at a speed change request or override request start.



Set the required values for the "acceleration/deceleration method setting" in the parameters shown in the following table, and write them to the Simple Motion board.

The set details are validated when written to the Simple Motion board.

Setting item		Setting value	Setting details	Factory-set initial value
[Pr.34]	Acceleration/deceleration process selection	→	Set the acceleration/deceleration method. 0: Trapezoidal acceleration/deceleration processing 1: S-curve acceleration/deceleration processing	0
[Pr.35]	S-curve ratio	→	Set the acceleration/deceleration curve when "1" is set in "[Pr.34] Acceleration/deceleration process selection".	100

Refer to the following for the setting details.

☞ Page 453 Basic Setting

Point

Parameters are set for each axis.

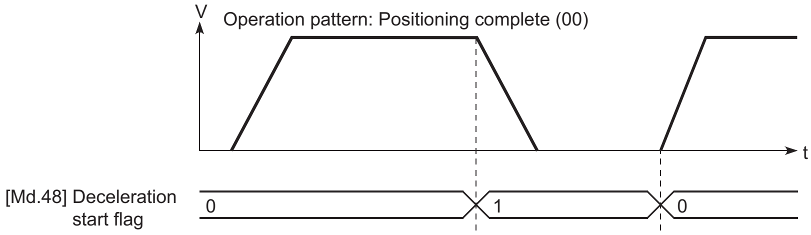
Deceleration start flag function

The "deceleration start flag function" turns ON the flag when the constant speed status or acceleration status switches to the deceleration status during position control whose operation pattern is "Positioning complete". This function can be used as a signal to start the operation to be performed by other equipment at each end of position control or to perform preparatory operation, etc. for the next position control.

Control details

When deceleration for a stop is started in the position control whose operation pattern is "Positioning complete", "1" is stored into "[Md.48] Deceleration start flag". When the next operation start is made or the manual pulse generator operation enable status is gained, "0" is stored. (Reference to the figure below)

■Start made with positioning data No. specified



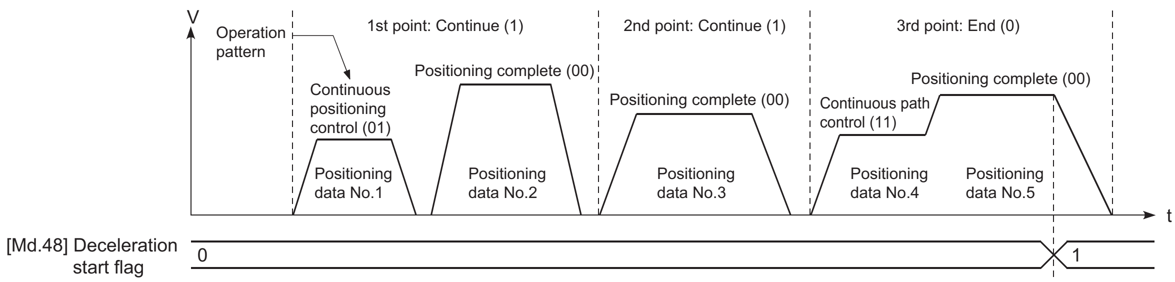
■Block start

At a block start, this function is valid for only the position control whose operation pattern is "Positioning complete" at the point whose shape has been set to "End". (Reference to the figure below)

The following table indicates the operation of the deceleration start flag in the case of the following block start data and positioning data.

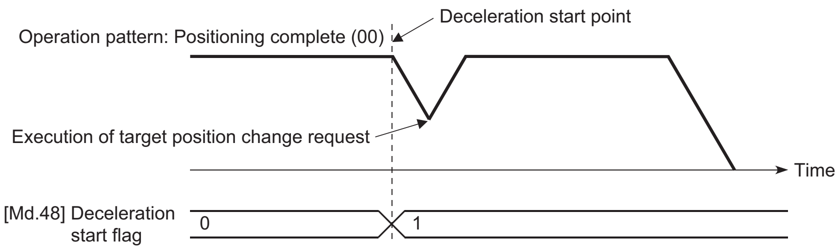
Block start data	[Da.11] Shape	[Da.12] Start data No.	[Da.13] Special start instruction
1st point	1: Continue	1	0: Block start
2nd point	1: Continue	3	0: Block start
3rd point	0: End	4	0: Block start
⋮			

Positioning Data No.	[Da.1] Operation pattern
1	01: Continuous positioning control
2	00: Positioning complete
3	00: Positioning complete
4	11: Continuous path control
5	00: Positioning complete
⋮	

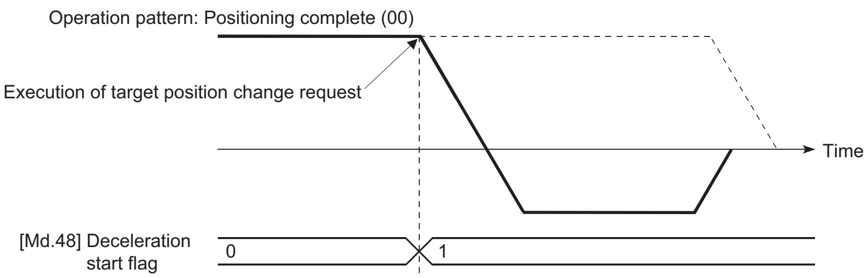


Precautions during control

- The deceleration start flag function is valid for the control method of "1-axis linear control", "2-axis linear interpolation control", "3-axis linear interpolation control", "4-axis linear interpolation control", "speed-position switching control" or "position-speed switching control". In the case of linear interpolation control, the function is valid for only the reference axis. (Simple Motion Board User's Manual (Startup))
- The deceleration start flag does not turn ON when the operation pattern is "continuous positioning control" or "continuous path control".
- The deceleration start flag function is invalid for a home position return, JOG operation, inching operation, manual pulse generator operation, speed-torque control and deceleration made with a stop signal.
- The deceleration start flag does not turn ON when a speed change or override is used to make deceleration.
- If a target position change is made while the deceleration start flag is ON, the deceleration start flag remains ON.



- When the movement direction is reversed by a target position change, the deceleration start flag turns ON.



- During position control of position-speed switching control, the deceleration start flag is turned ON by automatic deceleration. The deceleration start flag remains ON if position control is switched to speed control by the position-speed switching signal after the deceleration start flag has turned ON.
- If the condition start of a block start is not made since the condition is not satisfied, the deceleration start flag turns ON when the shape is "End".
- When an interrupt request during continuous operation is issued, the deceleration start flag turns ON at a start of deceleration in the positioning data being executed.

Setting method

To use the "deceleration start flag function", set "1" to the following control data using a user program.
The set data is made valid on the rising edge (OFF to ON) of the user program READY signal [Y0].

Setting item		Setting value	Setting details	Buffer memory address
[Cd.41]	Deceleration start flag valid	→	Set whether the deceleration start flag function is made valid or invalid. 0: Deceleration start flag invalid 1: Deceleration start flag valid	5905

Refer to the following for the setting details.

☞ Page 543 Control Data

For labels, refer to the following.

☞ Page 437 System control data

8

Checking of deceleration start flag

The "deceleration start flag" is stored into the following buffer memory addresses.

n: Axis No. - 1

Monitor item		Monitor value	Storage details	Buffer memory address
[Md.48]	Deceleration start flag	→	0: Status other than below 1: Status from deceleration start to next operation start or manual pulse generator operation enable	2499+100n

Refer to the following for information on the storage details.

☞ Page 507 Monitor Data

For labels, refer to the following.

☞ Page 435 Axis monitor data

Speed control 10 x multiplier setting for degree axis function

The "Speed control 10 × multiplier setting for degree axis function" is provided to execute the positioning control by 10 × speed of the setting value in the command speed and the speed limit value when the setting unit is "degree".

Control details

When "Speed control 10 multiplier specifying function for degree axis" is valid, this function related to the command speed, monitor data, speed limit value, is shown below.

■Command speed

- Parameters

- "[Pr.7] Bias speed at start"
- "[Pr.46] Home position return speed"
- "[Cd.14] New speed value"
- "[Cd.17] JOG speed"
- "[Cd.25] Position-speed switching control speed change register"
- "[Cd.28] Target position change value (New speed)"
- "[Cd.140] Command speed at speed control mode"
- "[Da.8] Command speed"

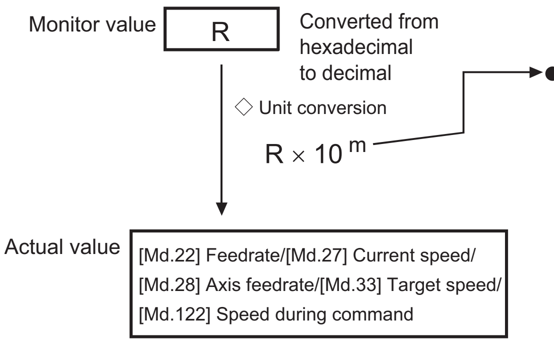
- Major positioning control

- For "2 to 4 axis linear interpolation control" and "2 to 4 axis fixed-feed control", the positioning control is performed at decuple speed of command speed, when "[Pr.83] Speed control 10 × multiplier setting for degree axis" of reference axis is valid.
- For "2 to 4 axis speed control", "[Pr.83] Speed control 10 × multiplier setting for degree axis" is evaluated whether it is valid for each axis. If valid, the positioning control will be performed at decuple speed of command speed.

■Monitor data

- "[Md.22] Feedrate"
- "[Md.27] Current speed"
- "[Md.28] Axis feedrate"
- "[Md.33] Target speed"
- "[Md.122] Speed during command"

For the above monitoring data, "[Pr.83] Speed control 10 × multiplier setting for degree axis" is evaluated whether it is valid for each axis. If valid, unit conversion value is changed ($\times 10^{-3} \rightarrow \times 10^{-2}$). The unit conversion table of monitor value is shown below.



● Unit conversion table ([Md.22], [Md.27], [Md.28], [Md.33], [Md.122])

[Pr.83] setting value	m	Unit
0: Invalid	-3	degree/min
1: Valid	-2	

■Speed limit value

- "[Pr.8] Speed limit value"
- "[Pr.31] JOG speed limit value"
- "[Cd.146] Speed limit value at torque control mode"

For the speed limit value, "[Pr.83] Speed control 10 × multiplier setting for degree axis" is evaluated whether it is valid for each axis. If valid, the positioning control will be performed at decuple speed of setting value (max. speed).

Setting method

Set "Valid/Invalid" by "[Pr.83] Speed control 10 × multiplier setting for degree axis".

Normally, the speed specification range is 0.001 to 2000000.000 [degree/min], but it will be decupled and become 0.01 to 20000000.00 [degree/min] by setting "[Pr.83] Speed control 10 × multiplier setting for degree axis" to valid.

To use the "Speed control 10 × multiplier setting for degree axis function", set the parameters shown in the following table.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Pr.83]	Speed control 10 × multiplier setting for degree axis	→	Set the speed control 10 × multiplier setting for degree axis. 0: Invalid 1: Valid	63+150n

Refer to the following for the setting details.

☞ Page 453 Basic Setting

For labels, refer to the following.

☞ Page 433 Positioning parameters: Detailed parameters 2

Operation setting for incompletion of home position return function

The "Operation setting for incompletion of home position return function" is provided to select whether positioning control is operated or not when the home position return request flag is ON.

Control details

When "[Pr.55] Operation setting for incompletion of home position return" is valid, this function related to the command speed, monitor data, speed limit value, is shown below.

○: Positioning start possible (Execution possible), ×: Positioning start impossible (Execution not possible)

Positioning control	[Pr.55] Operation setting for incompletion of home position return	
	"0: Positioning control is not executed." and "home position return request flag ON"	"1: Positioning control is executed." and "home position return request flag ON"
• Machine home position return • JOG operation • Inching operation • Manual pulse generator operation • Current value changing using current value changing start No. (No.9003).	○*1	○*1
When the following cases at block start, condition start, wait start, repeated start, multiple axes simultaneous start and pre-reading start • 1-axis linear control • 2/3/4-axis linear interpolation control • 1/2/3/4-axis fixed-feed control • 2-axis circular interpolation control (with sub point designation/center point designation) • 3-axis helical interpolation control (with sub point designation/center point designation) • 1/2/3/4-axis speed control • Speed-position switching control (INC mode/ ABS mode) • Position-speed switching control • Current value changing using positioning data No. (No.1 to 600).	×	○*1
Control mode switching	×	○*1

*1 There may be restrictions in the operation for incompletion of home position return depending on the setting or specifications of the servo amplifier. Refer to the servo amplifier instruction manual for details.

Precautions during control

- The error "Start at home position return incomplete" (error code: 19A6H) occurs if the home position return request flag ([Md.31] Status: b3) is executed the positioning control by turning on, when "0: Positioning control is not executed" is selected the operation setting for incompletion of home position return setting, and positioning control will not be performed. At this time, operation with the manual control (JOG operation, inching operation, manual pulse generator operation) is available.
- When the home position return request flag ([Md.31] Status: b3) is ON, starting Fast home position return will result in the error "Home position return request ON" (error code: 1945H) despite the setting value of "[Pr.55] Operation setting for incompletion of home position return", and Fast home position return will not be performed.

Setting method

To use the "Operation setting for incompletion of home position return", set the following parameters using a user program.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
[Pr.55]	Operation setting for incompletion of home position return	→	Set the operation setting for incompletion of home position return. 0: Positioning control is not executed. 1: Positioning control is executed.	87+150n

Refer to the following for the setting details.

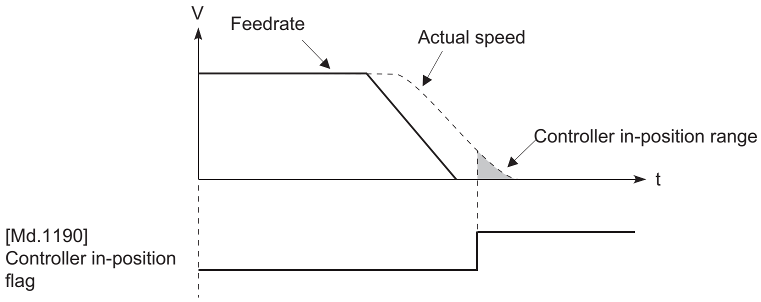
☞ Page 453 Basic Setting

For labels, refer to the following.

☞ Page 434 Home position return parameters: Home position return detailed parameters

Controller in-position function

This function controls ON/OFF of the controller in-position flag according to the controller in-position range check of the Simple Motion board.



Controller in-position range

Setting item		Setting range	Initial value	Buffer memory address
[Pr.1190]	Controller in-position range	0 to 65535 (pulse) Set an in-position range which is judged by a controller. Fetch cycle: User program READY signal [Y0] OFF → ON	1600	900020 ⋮ 900035

For labels, refer to the following.

☞ Page 444 Controller in-position parameters

Controller in-position flag

Monitor item		Storage details	Initial value	Buffer memory address
[Md.1131]	Controller in-position flag (all axes)	■Monitoring is carried out with a hexadecimal display. This area stores the status of "[Md.1190] Controller in-position flag" of all axes from b0 in order of the axis Nos. ON condition: Difference between feed current value and actual current value ≤ Controller in-position range Refresh cycle: Operation cycle	0000H	90802
[Md.1190]	Controller in-position flag	■Monitoring is carried out with a hexadecimal display. Output a controller in-position flag of each axis. ON condition: Difference between feed current value and actual current value ≤ Controller in-position range Refresh cycle: Operation cycle	0000H	900052 ⋮ 900067

For labels, refer to the following.

☞ Page 444 Controller in-position monitor data

Point

Do not refer to the controller in-position flag except during home position return and positioning control.

8.9 Servo ON/OFF

Servo ON/OFF

This function executes servo ON/OFF of the servo amplifiers connected to the Simple Motion board.

By establishing the servo ON status with the servo ON command, servo motor operation is enabled.

The following two signals can be used to execute servo ON/OFF.

- All axis servo ON [Y1]
- [Cd.100] Servo OFF command

n: Axis No. - 1

Setting item	Buffer memory address
[Cd.100] Servo OFF command	4351+100n

For labels, refer to the following.

☞ Page 437 Axis control data

A list of the "All axis servo ON [Y1]" and "[Cd.100] Servo OFF command" is given below.

○: Servo ON (Servo operation enabled)

×: Servo OFF (Servo operation disabled)

Setting item		[Cd.100] Servo OFF command			
		Setting value "0"	Command to servo amplifier	Setting value "1"	Command to servo amplifier
All axis servo ON [Y1]	OFF	×	Servo ON command: OFF Ready ON command: OFF	×	Servo ON command: OFF Ready ON command: OFF
	ON	○	Servo ON command: ON Ready ON command: ON	×	Servo ON command: OFF Ready ON command: ON

Point

When the delay time of "Electromagnetic brake sequence output (PC02)" is used, execute the servo ON to OFF by "[Cd.100] Servo OFF command". (When all axis servo ON [Y1] is turned ON to OFF, set "1" in "[Cd.100] Servo OFF command" and execute the servo OFF. Then, turn off [Y1] after delay time passes.)

Refer to each servo amplifier instruction manual for details of servo ON command OFF and ready ON command OFF from Simple Motion board.

The status of the current value restoration can be checked with the following monitor data.
n: Axis No. - 1

Monitor item		Monitor value	Storage details	Buffer memory address
[Md.190]	Controller current value restoration completion status	→	Store the controller current value restoration completion status of a connected slave device. 0: Incomplete restoration 1: Complete INC restoration 2: Complete ABS restoration If the current value has been restored using the INC restoration method, "1" is set. If the current value has been restored using the ABS restoration method, "2" is set. If the slave device is disconnected, "0" is set. Fetch cycle: 16.0 [ms]	468232+2048n

For labels, refer to the following.
☞ Page 448 Monitor data for slave device operation
After the initial communication with the servo amplifier is completed, the servo ON status is not established if the status is one of the following conditions.

- The error "Servo amplifier external input signal select error" (error code: 1AD4H) occurs at the consistency check of the external input signal.*1
- The current value restoration is not completed.*2

*1 Refer to the following for details.
☞ Page 244 Servo parameter setting
*2 After the initial communication with the servo amplifier is completed, the current value is restored in the Simple Motion board.

Servo ON (Servo operation enabled)

The following shows the procedure for servo ON.

1. Make sure that the servo LED indicates "b_".
(The initial value for "All axis servo ON [Y1]" is "OFF".)

2. Set "0" for "[Cd.100] Servo OFF command".

3. Turn ON "All axis servo ON [Y1]".
Now the servo amplifier turns ON the servo (servo operation enabled state). (The servo LED indicates "d_".)

Servo OFF (Servo operation disabled)

The following shows the procedure for servo OFF.

1. Set "1" for "[Cd.100] Servo OFF command". (The servo LED indicates "c_".)
(If the "[Cd.100] Servo OFF command" set "0" again, after the servo operation enabled.)

2. Turn OFF "All axis servo ON [Y1]".
(The servo LED indicates "b_".)

Point

- If the servomotor is rotated by external force during the servo OFF status, follow up processing is performed.
- Change between servo ON or OFF status while operation is stopped (position control mode). The servo OFF command of during positioning in position control mode, manual pulse control, home position return, speed control mode and torque control mode will be ignored.
- When the servo OFF is given to all axes, "All axis servo ON [Y1]" is applied even if all axis servo ON command is turned ON to OFF with "[Cd.100] Servo OFF command" set "0".

Follow up function

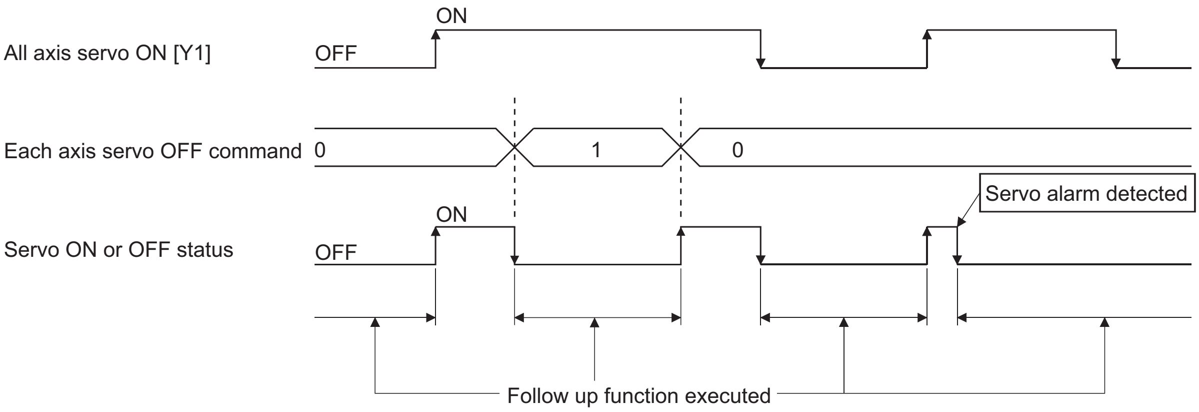
Follow up function

The follow up function monitors the number of motor rotations (actual current value) with the servo OFF and reflects the value in the feed current value.

If the servomotor rotates during the servo OFF, the servomotor will not just rotate for the amount of droop pulses at switching the servo ON next time, so that the positioning can be performed from the stop position.

Execution of follow up

Follow up function is executed continually during the servo OFF status.



Point

The follow up function performs the process if the "Simple Motion board and the servo amplifier is turned ON" and "servo OFF" regardless of the presence of the absolute position system.

9 COMMON FUNCTIONS

The details and usage of the "common functions" executed according to the user's requirements are explained in this chapter.
Common functions include functions required when using the Simple Motion board, such as parameter initialization and execution data backup.
Read the setting and execution procedures for each common function indicated in this chapter thoroughly, and execute the appropriate function where required.

9.1 Outline of Common Functions

"Common functions" are executed according to the user's requirements, regardless of the control method, etc.
These common functions are executed by EM Configurator or user programs.
The following table shows the functions included in the "common functions".

Common function	Details	Means	
		User program	EM Configurator
Parameter initialization function	This function returns the setting data stored in the buffer memory/internal memory and flash ROM/internal memory (nonvolatile) of Simple Motion board to the default values.	○	○
Execution data backup function	This function writes the "execution data", currently being used for control, to the flash ROM/internal memory (nonvolatile).	○	○
External input signal select function	This function sets the input type and signal logic for each external input signal of each axis (upper/lower limit signal (FLS/RLS), proximity dog signal (DOG), and stop signal (STOP)).	○	○
Link device external signal assignment function	This function assigns link devices to external signals of the Simple Motion board.	○	○
History monitor function	This function monitors start history and current value history of all axes.	—	○
Amplifier-less operation function	This function executes the positioning control of Simple Motion board without connecting to the servo amplifiers. It is used to debug the program at the start-up of the device or simulate the positioning operation.	○	—
Virtual servo amplifier function	This function executes the operation as the axis (virtual servo amplifier axis) that operates only command (instruction) virtually without servo amplifiers.	○	○
Mark detection function	This function is used to latch any data at the input timing of the mark detection signal (DI).	○	○
Event history function	This function is used to save errors and event information occurred in the Simple Motion board in the internal memory (nonvolatile). The error history can be checked even after the power cycle or remote RESET by holding the error contents in the Simple Motion board.	—	○
Servo cyclic transmission function	This function reads and writes CiA402 objects of slave devices with cyclic transmission.	○	○
Servo transient transmission function	This function reads and writes CiA402 objects of slave devices with transient transmission.	○	—
Test mode	This mode executes the test operation and adjustment of axes using EM Configurator.	—	○
Servo parameter change function	This function transfers servo parameters. Servo parameters, which are controlled by servo amplifiers, can be changed with a Simple Motion board.	○	—
User watchdog function	This function checks errors of the host personal computer.	○	—
Remote operation	This function restarts the Simple Motion board using EM Configurator or API.	○	○
Time setting	This function notifies the start time to the Simple Motion board.	○	○
PCI Express connection	This function detects link-down of the PCI Express connection between the Simple Motion board and the host personal computer by the PCI Express link-down detection function.	○	○
Interrupt function	This function generates an interrupt to the user program when the interrupt factor is detected.	○	—
DMA transmission function	This function transfers the data of the Simple Motion board to the memory area allocated by the user program.	○	—
Ethernet communication connection	This function connects the Simple Motion board and EM Configurator with the Ethernet cable and performs the communication.	—	○

9.2 Parameter Initialization Function

The "parameter initialization function" is used to return the setting data set in the buffer memory/internal memory and flash ROM/internal memory (nonvolatile) of Simple Motion board to the default values.

Parameter initialization means

- Initialization is executed with a user program.
- Initialization is executed by EM Configurator.

Refer to the "EM Configurator Help" for the execution method by EM Configurator.

Control details

The following table shows the setting data initialized by the "parameter initialization function".
(The data initialized are "buffer memory/internal memory" and "flash ROM/internal memory (nonvolatile)" setting data.)

Target area	
Parameters	Servo network composition parameters
	Common parameters
	Basic parameters
	Detailed parameters
	Home position return basic parameters
	Home position return detailed parameters
	Link device external signal assignment parameters
	Servo object specification parameters
	Interrupt setting parameters
	Controller in-position parameters
	Network parameters
Mark detection	Mark detection setting parameters
Synchronous control parameters	Servo input axis parameters
	Synchronous encoder axis parameters
	Synchronous encoder axis parameters via link device
	Synchronous parameters
Positioning data	Positioning data (No.1 to 600)
Block start data	Block start data (block No.7000 to 7004)
	Condition data (block No.7000 to 7004)
Cam data	

Precautions during control

- Parameter initialization is only executed when the positioning control is not carried out (when the user program READY signal [Y0] is OFF). The warning "In user program READY" (warning code: 0905H) will occur if executed when the user program READY signal [Y0] is ON.
- Writing to the flash ROM is up to 100,000 times. If writing to the flash ROM exceeds 100,000 times, the writing may become impossible, and the error "Flash ROM write error" (error code: 1931H) will occur.
- A "Simple Motion board remote RESET" or "Simple Motion board power restart" must be carried out after the parameters are initialized.
- If an error occurs on the parameter set in the Simple Motion board when the user program READY signal [Y0] is turned ON, the READY signal [X0] will not be turned ON and the control cannot be carried out.

Restriction

The writing time to the flash ROM and the time for parameter initialization are shown below.
- The writing time to the flash ROM: up to 5 seconds
- The time for parameter initialization: approximately 30 seconds

Do not turn the power supply of the Simple Motion board OFF to ON or execute the remote RESET during parameter initialization.
If the power supply of the Simple Motion board is turned OFF to ON or the remote RESET is executed to forcibly end the process, the data backed up in the flash ROM/internal memory (nonvolatile) will be lost.

Parameter initialization method

- Parameter initialization can be carried out by writing the data shown in the table below to the buffer memory of Simple Motion board. The initialization of the parameter is executed at the time point the data is written to the buffer memory of Simple Motion board.

Setting item		Setting value	Setting details	Buffer memory address
[Cd.2]	Parameter initialization request	1	Set "1: Requests parameter initialization.".	5901

Refer to the following for the setting details.
☞ Page 543 Control Data
For labels, refer to the following.
☞ Page 437 System control data
When the initialization is complete, "0" will be set in "[Cd.2] Parameter initialization request" by the Simple Motion board automatically.

Point

[API library]
To initialize the parameter, use the MMC_Controller::InitializeParameter method.

9.3 Execution Data Backup Function

When the buffer memory data of Simple Motion board is rewritten from the host personal computer, "the data backed up in the flash ROM/internal memory (nonvolatile)" of Simple Motion board may differ from "the execution data being used for control (buffer memory data)". In this case, the execution data will be lost when the power supply of the Simple Motion board is turned OFF or the remote RESET is executed.

The "execution data backup function" is used to back up the execution data by writing to the flash ROM/internal memory (nonvolatile). The data backed up will be written to the buffer memory when the power is turned ON next time.

Point

When the Simple Motion board is replaced, all the data in the Simple Motion board including absolute position data can be backed up (read to) in the personal computer and restored to (written to) the Simple Motion board again by using the backup/restore function of EM Configurator. Refer to the "EM Configurator Help" for details.

Execution data backup means

- The backup is executed with a user program.
- The data is written to the flash ROM by EM Configurator.

Refer to the "EM Configurator Help" for the flash ROM write method by EM Configurator.

Control details

- The following shows the data that can be written to the flash ROM/internal memory (nonvolatile) using the "execution data backup function".

Target area	
Parameters	Servo network composition parameters
	Common parameters
	Basic parameters
	Detailed parameters
	Home position return basic parameters
	Home position return detailed parameters
	Link device external signal assignment parameters
	Servo object specification parameters
	Interrupt setting parameters
	Controller in-position parameters
	Network parameters
Mark detection	Mark detection setting parameters
Synchronous control parameters	Servo input axis parameters
	Synchronous encoder axis parameters
	Synchronous encoder axis parameters via link device
	Synchronous parameters
Positioning data	Positioning data (No.1 to 600)
Block start data	Block start data (block No.7000 to 7004)
	Condition data (block No.7000 to 7004)

- The cam data (cam storage area) is separately saved in the flash ROM/internal memory (nonvolatile). Therefore, it is not a target of the backup function.

Precautions during control

- Data can only be written to the flash ROM when the positioning control is not carried out (when the user program READY signal [Y0] is OFF). The warning "In user program READY" (warning code: 0905H) will occur if executed when the user program READY signal [Y0] is ON.
- Writing to the flash ROM can be executed up to 100,000 times. If writing to the flash ROM exceeds 100,000 times, the writing may become impossible, and the error "Flash ROM write error" (error code: 1931H) will occur.
- After the power supply of the Simple Motion board is turned ON or the remote RESET is executed once, writing to the flash ROM using a user program is limited to up to 25 times. If the 26th writing is executed, the error "Flash ROM write number error" (error code: 1080H) will occur. If this error occurs, carry out the error reset or the power supply of the Simple Motion board OFF to ON/remote RESET again.

Restriction

The writing time to the flash ROM is shown below.

- The writing time to the flash ROM: up to 5 seconds

Do not turn the power supply of the Simple Motion board OFF to ON or execute the remote RESET during executing the flash ROM writing.

If the power supply of the Simple Motion board is turned OFF to ON or the remote RESET is executed to forcibly end the process, the data backed up in the flash ROM/internal memory (nonvolatile) will be lost.

Execution data backup method

- Refer to the following for the data transmission processing at the backup of the execution data.

☞ Page 583 Data transmission process

- Execution data backup can be carried out by writing the data shown in the table below to the buffer memory of Simple Motion board. The writing to the flash ROM/internal memory (nonvolatile) is executed at the time point the data is written to the buffer memory of Simple Motion board.

Setting item		Setting value	Setting details	Buffer memory address
[Cd.1]	Flash ROM write request	1	Set "1: Requests write access to flash ROM.".	5900

Refer to the following for the setting details.

☞ Page 543 Control Data

For labels, refer to the following.

☞ Page 437 System control data

When the writing to the flash ROM/internal memory (nonvolatile) is complete, "0" will be set in "[Cd.1] Flash ROM write request" by the Simple Motion board automatically.

Point

[API library]

To backup the execution data, use the MMC_Controller::BackupParameter method.

9.4 External Input Signal Select Function

The "external input signal select function" sets the input type and the signal logic for each external input signal of each axis (upper/lower stroke limit signal (FLS/RLS), proximity dog signal (DOG), and stop signal (STOP)).

Input type setting method

This function sets the input type used for the external input signals used in each axis (upper/lower stroke limit signal (FLS/RLS), proximity dog signal (DOG), and stop signal (STOP)). The setting method is shown below.

Setting item		Initial value	Setting details
[Pr.116]	FLS signal selection	000FH	■Set with a hexadecimal. H _ _ _ _ → Input type Set the input type used as the external input signal. 1 (0001H) : Servo amplifier[*1] 2 (0002H) : Buffer memory 3 (0003H) : Link device[*2] 15 (000FH) : Invalid
[Pr.117]	RLS signal selection	000FH	
[Pr.118]	DOG signal selection	000FH	
[Pr.119]	STOP signal selection	0002H	

*1 The setting is not available in "[Pr.119] STOP signal selection". If it is set, the error "STOP signal selection error" (error code: 1AD3H) occurs and the user program READY signal [Y0] is not turned ON.

*2 For details, refer to the following.

☞ Page 321 Link Device External Signal Assignment Function

Point

- When the connection with the servo amplifier is started, the consistency between "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection", "[Pr.118] DOG signal selection" and the setting of the servo parameter is checked. For detail, refer to the following.
  ☞ Page 241 Hardware stroke limit function
- To specify "1: Servo amplifier" in the controller setting, it is required to set "1: Servo amplifier" in all of the "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection" and "[Pr.118] DOG signal selection". If the setting is incorrect, the error occurs in the consistency diagnostics.
- To change "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection" and "[Pr.118] DOG signal selection" after connecting with the servo amplifier, connect with the corresponding servo amplifier again after changing and execute the consistency diagnostics again. If the axis operates without the consistency diagnostics for the reconnection, the external input signal may not be input correctly.

■When "1: Servo amplifier" is set to the input type

For the external input signals of the servo amplifier to be used, refer to the servo amplifier instruction manual. The stop signal cannot be input from the external input signal of the servo amplifier.

■When "2: Buffer memory" is set to the input type

Uses the control data shown below to operate the external input signals (upper/lower stroke limit signal, proximity dog signal, and stop signal).

Setting item		Setting value	Setting details	Buffer memory address
[Cd.44]	External input signal operation device (Axis 1 to 16)	→	Set the status of the upper/lower limit signal, the proximity dog signal and the stop signal.	5928 to 5931

Refer to the following for the setting details.

☞ Page 543 Control Data

For labels, refer to the following.

☞ Page 437 System control data

■When "3: Link device" is set to the input type

Refer to the following for the setting details.

☞ Page 321 Link Device External Signal Assignment Function

Input logic setting method for external input signals

The signal logic can be switched according to the external input signals (upper/lower stroke limit signal (FLS/RLS), proximity dog signal (DOG), stop signal (STOP), and external command signal/switching signal (DI)) of the servo amplifier.
For the system that does not use the upper/lower limit signal with b-contact, this function enables the control without wiring by setting "Positive logic" to the parameter logic setting.
When using the upper/lower limit signal, be sure to use in the negative logic (b-contact).
For the interface of the logic selection, the setting area varies depending on the input type and signal type of the external signal.
The logic setting method for external input signals (upper/lower limit signal, proximity dog signal and stop signal) is shown below.

Input type of "[Pr.116] FLS signal selection" to "[Pr.119] STOP signal selection"	Signal type	Setting area
1: Servo amplifier	FLS/RLS/DOG	[Pr.22] Input signal logic selection
2: Buffer memory	FLS/RLS/DOG/STOP	
3: Link device	FLS	[Pr.913] Link device logic setting
	RLS	[Pr.923] Link device logic setting
	DOG	[Pr.933] Link device logic setting
	STOP	[Pr.943] Link device logic setting

Precautions

When the MR-J4-GF is connected, set the logic of the upper/lower limit signal (FLS/RLS) and proximity dog signal (DOG) as shown below. If the setting is incorrect, the external input signal may be detected incorrectly during the home position return or positioning operation. For the input logic specification of the servo amplifier, refer to the instruction manual of the servo amplifier to be used.

- When the external input signal of the servo amplifier is used
  Set the same value in "[Pr.22] Input signal logic selection" as the value set in the input logic setting of the servo amplifier to be connected.
- When other than the external input signal of the servo amplifier is used
  Change the servo parameter "Function selection T-3 (PT29)" to "1: Dog detection with on".

■External input signals from the servo amplifier and buffer memory (upper/lower stroke limit signal (FLS/RLS), proximity dog signal (DOG), and stop signal (STOP))

Use the following parameter to switch the logic of the external input signals from the servo amplifier and buffer memory (upper/lower stroke limit signal (FLS/RLS), proximity dog signal (DOG), and stop signal (STOP)).

Setting item		Initial value	Setting details
[Pr.22]	Input signal logic selection	0	Select the logic of the signal which is input to the Simple Motion board from the external device. 0: Negative logic 1: Positive logic (Always "0" is set to the part not used.)

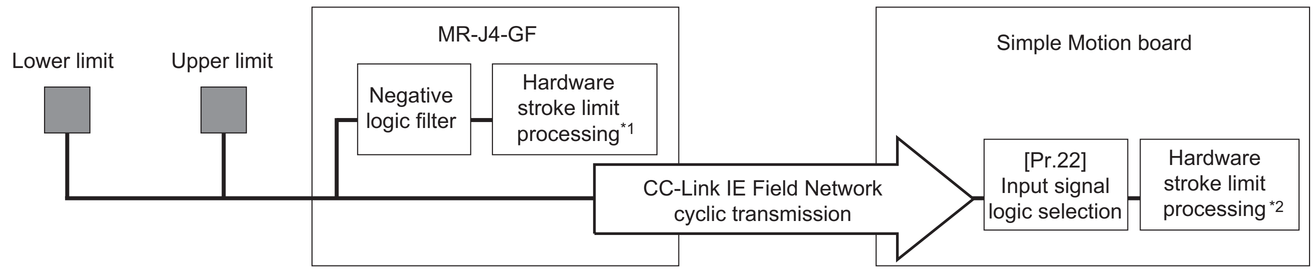
Refer to the following for the setting details.
☞ Page 453 Basic Setting
When the external input signal of the servo amplifier is used, set the same value as the value set in the input logic setting of the servo amplifier. If the value is not same as the value of the input logic setting, the limit signal may be detected during the home position return. For the input logic specification of the servo amplifier, refer to the instruction manual of the servo amplifier to be used.

■External input signals when the MR-J4-GF is connected

The data exchanging of the external input signal when the Simple Motion board is connected with the MR-J4-GF is shown below.

- When the external input signal of the servo amplifier is used

[The process of upper/lower limit switch (FLS/RLS) signal]



Upper/lower limit signal input	MR-J4-GF		→	Data in CC-Link IE Field Network cyclic transmission	→	Simple Motion board	
	External input signal logic	Hardware stroke limit error detection*1				External input signal logic	Hardware stroke limit error detection*2
ON	Negative logic (b-contact)	Detect	→	ON	→	Negative logic (b-contact)	Not detect
OFF		Not detect		OFF			Detect

*1 When the servo parameter "Function selection D-4 (PD41)" is set to "0: Stroke limit always enabled", the error stop is performed in the servo amplifier side not even during home position return.

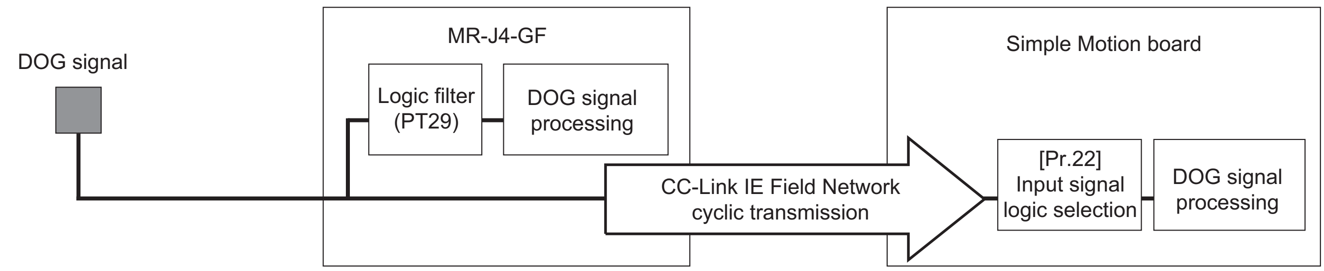
*2 The hardware stroke limit error processing is not performed in the Simple Motion board side during home position return.

Precautions

Do not establish the setting in the following cases because the operation of the servo amplifier differs from the operation of the Simple Motion board.

Upper/lower limit signal input	MR-J4-GF		→	Data in CC-Link IE Field Network cyclic transmission	→	Simple Motion board	
	External input signal logic	Hardware stroke limit error detection				External input signal logic	Hardware stroke limit error detection
ON	Negative logic (b-contact)	Not detect	→	ON	→	Positive logic (a-contact)	Detect
OFF		Detect		OFF			Not detect

[The process of proximity dog (DOG) signal]



Proximity dog signal input	MR-J4-GF		→	Data in CC-Link IE Field Network cyclic transmission	→	Simple Motion board	
	External input signal logic (PT29)	Processing with proximity dog signal detection				External input signal logic	Processing with proximity dog signal detection
ON	0: Dog detection with off	Not proceed	→	ON	→	Positive logic	Not proceed
	1: Dog detection with on	Proceed				Negative logic	Proceed
OFF	0: Dog detection with off	Proceed		OFF		Positive logic	Proceed
	1: Dog detection with on	Not proceed				Negative logic	Not proceed

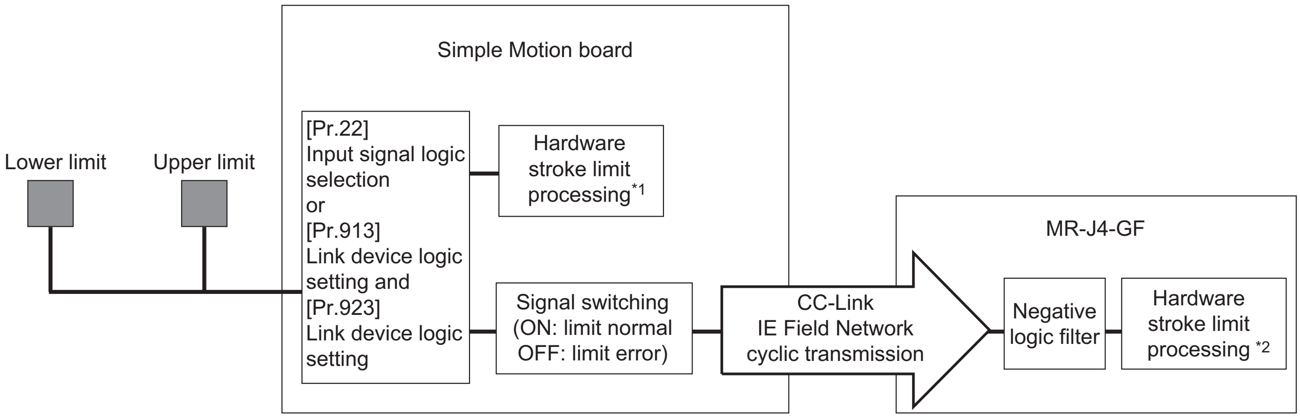
Precautions

Do not establish the setting in the following cases because the operation of the servo amplifier differs from the operation of the Simple Motion board.

Proximity dog signal input	MR-J4-GF		→	Data in CC-Link IE Field Network cyclic transmission	→	Simple Motion board	
	External input signal logic (PT29)	Processing with proximity dog signal detection				External input signal logic	Processing with proximity dog signal detection
ON	0: Dog detection with off	Not proceed	→	ON	→	Negative logic	Proceed
	1: Dog detection with on	Proceed				Positive logic	Not proceed
OFF	0: Dog detection with off	Proceed		OFF		Negative logic	Not proceed
	1: Dog detection with on	Not proceed				Positive logic	Proceed

• When other than the external input signal of the servo amplifier is used

[The process of upper/lower limit switch (FLS/RLS) signal]

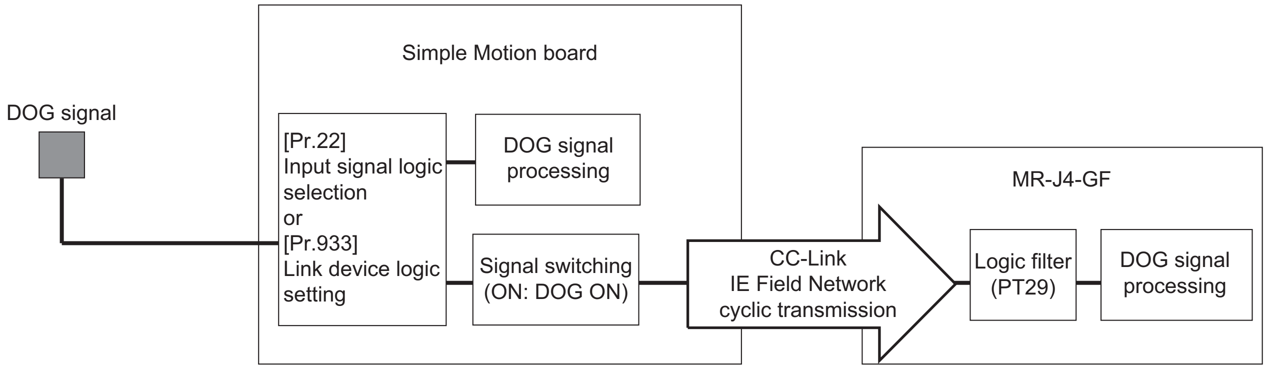


Upper/lower limit signal input	Simple Motion board		→	Data in CC-Link IE Field Network cyclic transmission	→	MR-J4-GF	
	External input signal logic	Hardware stroke limit error detection*1				External input signal logic	Hardware stroke limit error detection*2
ON	Negative logic (b-contact)	Not detect	→	ON	→	Negative logic (b-contact)	Not detect
	Positive logic (a-contact)	Detect		OFF			Detect
OFF	Negative logic (b-contact)	Detect		OFF			Detect
	Positive logic (a-contact)	Not detect		ON			Not detect

*1 The hardware stroke limit error processing is not performed in the Simple Motion board side during home position return.

*2 When the servo parameter "Function selection D-4 (PD41)" is set to "0: Stroke limit always enabled", the error stop is performed in the servo amplifier side not even during home position return.

[The process of proximity dog (DOG) signal]



Proximity dog signal input	**Simple Motion board**		→	**Data in CC-Link IE Field Network cyclic transmission**	→	**MR-J4-GF**	
	External input signal logic	**Processing with proximity dog signal detection**				**External input signal logic (PT29)**	**Processing with proximity dog signal detection**
ON	Negative logic	Proceed	→	ON	→	1: Dog detection with on	Proceed
	Positive logic	Not proceed		OFF			Not proceed
OFF	Negative logic	Not proceed		OFF			Not proceed
	Positive logic	Proceed		ON			Proceed

Precautions

Do not establish the setting in the following cases because the operation of the servo amplifier differs from the operation of the Simple Motion board.

Proximity dog signal input	**Simple Motion board**		→	**Data in CC-Link IE Field Network cyclic transmission**	→	**MR-J4-GF**	
	External input signal logic	**Processing with proximity dog signal detection**				**External input signal logic (PT29)**	**Processing with proximity dog signal detection**
ON	Negative logic	Proceed	→	ON	→	0: Dog detection with off	Not proceed
	Positive logic	Not proceed		OFF			Proceed
OFF	Negative logic	Not proceed		OFF			Proceed
	Positive logic	Proceed		ON			Not proceed

■External input signals and external command signals via link device

Use the following parameters to switch the logic for inputting various external input signals and external command signals from link devices of the CC-Link IE Field Network.

Signal type	Setting item		Initial value	Setting details
External input signals	[Pr.903]	Forced stop signal (EMI): Link device logic setting	0	Select the logic for the input signal from the external device connected with the Simple Motion board. 0: Negative logic 1: Positive logic
	[Pr.913]	Upper limit signal (FLS): Link device logic setting		
	[Pr.923]	Lower limit signal (RLS): Link device logic setting		
	[Pr.933]	Proximity dog signal (DOG): Link device logic setting		
	[Pr.943]	Stop signal (STOP): Link device logic setting		
External command signals	[Pr.953]	External positioning start request: Link device logic setting		
	[Pr.963]	External speed change request: Link device logic setting		
	[Pr.973]	Skip request: Link device logic setting		
	[Pr.983]	Speed-position control switching request: Link device logic setting		
	[Pr.993]	Main shaft clutch control request: Link device logic setting		
	[Pr.1003]	Auxiliary shaft clutch control request: Link device logic setting		
	[Pr.1013]	Synchronous encoder axis start request: Link device logic setting		
	[Pr.1023]	Block No.7000 start request: Link device logic setting		
	[Pr.1033]	Block No.7001 start request: Link device logic setting		
	[Pr.1043]	Block No.7002 start request: Link device logic setting		
	[Pr.1053]	Block No.7003 start request: Link device logic setting		
	[Pr.1063]	Block No.7004 start request: Link device logic setting		
	[Pr.811]	Mark detection signal detection direction setting		Set the signal detection direction. 0: Rising detection 1: Falling detection

Refer to the following for the setting details.

☞ Page 453 Basic Setting

■Precautions on parameter setting

- The logic switching parameters are validated when the user program READY signal [Y0] is turned OFF to ON. (The logic is negative right after power-on.)
- If the logic of each signal is set erroneously, the operation may not be carried out correctly. Before setting, check the specifications of the equipment to be used.

Input filter setting method for external input signals

The input filter is used to suppress chattering when the external input signal is chattering by noise, etc.

The setting area of the input filter varies by the input type of "[Pr.116] FLS signal selection" to "[Pr.119] STOP signal selection".

Input type of "[Pr.116] FLS signal selection" to "[Pr.119] STOP signal selection"	Setting area
1: Servo amplifier	Servo parameter "Input filter setting (PD11)[*1]"
2: Buffer memory	No setting (No input filter when the buffer memory is set.)
3: Link device	Set at the slave station side

*1 Refer to the instruction manual of the servo amplifier to be used.

■External input signals from the servo amplifier (upper/lower stroke limit signal (FLS/RLS) and proximity dog signal (DOG))

Use the following parameter to set the input filter of the external input signals from the servo amplifier (upper/lower stroke limit signal (FLS/RLS) and proximity dog signal (DOG)).

Setting item		Initial value	Setting details
PD11	Input filter setting	4H	■Set with a hexadecimal. Setting value H□□□□ ● Input filter setting 0H: None 1H: 0.888 ms 2H: 1.777 ms 3H: 2.666 ms 4H: 3.555 ms

Refer to the instruction manual of the servo amplifier to be used for details.

Precautions

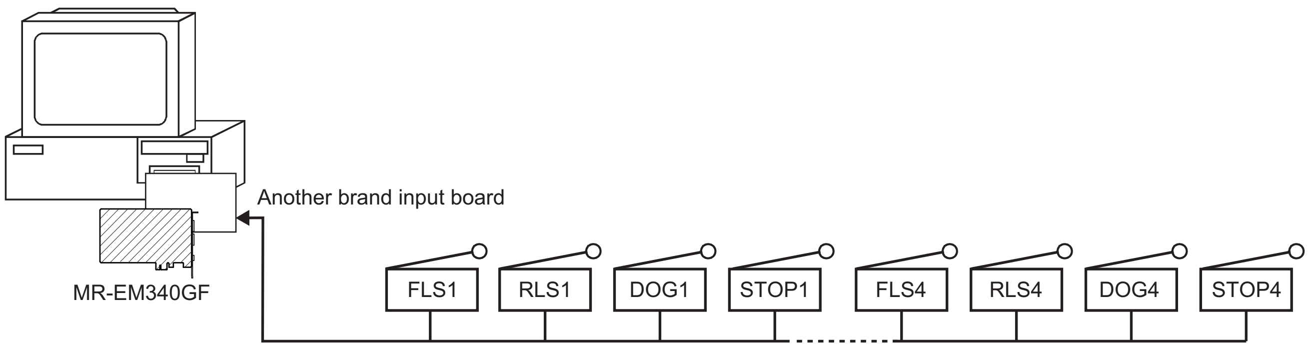
- The servo parameter is transferred from the Simple Motion board to the servo amplifier after the power supply of the Simple Motion board is turned ON or the remote RESET is executed.
- The input filter setting of the servo parameter (PD11) becomes valid when the power supply of the servo amplifier is turned ON from OFF. After executing the above process, turn the power supply of the servo amplifier ON from OFF and turn the power supply of the system or execute the remote RESET again.

User program example

The following shows the program example to operate "[Cd.44] External input signal operation device (Axis 1 to 16)" of axis 1, axis 4, axis 8, and axis 16 using the limit switch connected to another brand input board when "2: Buffer memory" is set in "[Pr.116] FLS signal selection" to "[Pr.119] STOP signal selection".

■System configuration

The following figure shows the system configuration used for the user program examples.



■List of labels to be used

In the user program examples, the labels to be used are assigned as follows.

Classification	Label name	Description
Label	MMC_Controller::SysCtrl.ExternalInputOperationDevice1	RW: [Cd.44] External input signal operation device (Axis 1 to 4)
	MMC_Controller::SysCtrl.Axis1_FLS	RW: Axis 1 Upper limit signal (FLS)
	MMC_Controller::SysCtrl.Axis1_RLS	RW: Axis 1 Lower limit signal (RLS)
	MMC_Controller::SysCtrl.Axis1_DOG	RW: Axis 1 proximity dog signal (DOG)
	MMC_Controller::SysCtrl.Axis1_STOP	RW: Axis 1 Stop signal (STOP)
	MMC_Controller::SysCtrl.Axis4_FLS	RW: Axis 4 Upper limit signal (FLS)
	MMC_Controller::SysCtrl.Axis4_RLS	RW: Axis 4 Lower limit signal (RLS)
	MMC_Controller::SysCtrl.Axis4_DOG	RW: Axis 4 proximity dog signal (DOG)
	MMC_Controller::SysCtrl.Axis4_STOP	RW: Axis 4 Stop signal (STOP)
	MMC_Controller::SysCtrl.ExternalInputOperationDevice2	RW: [Cd.44] External input signal operation device (Axis 5 to 8)
	MMC_Controller::SysCtrl.Axis8_FLS	RW: Axis 8 Upper limit signal (FLS)
	MMC_Controller::SysCtrl.Axis8_RLS	RW: Axis 8 Lower limit signal (RLS)
	MMC_Controller::SysCtrl.Axis8_DOG	RW: Axis 8 proximity dog signal (DOG)
	MMC_Controller::SysCtrl.Axis8_STOP	RW: Axis 8 Stop signal (STOP)
	MMC_Controller::SysCtrl.ExternalInputOperationDevice4	RW: [Cd.44] External input signal operation device (Axis 13 to 16)
	MMC_Controller::SysCtrl.Axis16_FLS	RW: Axis 16 Upper limit signal (FLS)
	MMC_Controller::SysCtrl.Axis16_RLS	RW: Axis 16 Lower limit signal (RLS)
	MMC_Controller::SysCtrl.Axis16_DOG	RW: Axis 16 proximity dog signal (DOG)
	MMC_Controller::SysCtrl.Axis16_STOP	RW: Axis 16 Stop signal (STOP)

Program example

C++

```
void UpdateExternalInputOperationDeviceSample( MMC_Controller *controller, unsigned short input_data )
{
    /* Execute this function periodically */

    /* Update the external input signal via buffer memory */
    controller->SysCtrl.ExternalInputOperationDevice1 = ( controller->SysCtrl.ExternalInputOperationDevice1 & 0x0FF0 )
                                                      | ( input_data & 0x000F )          /* Axis 1 : FLS, RLS, DOG, STOP */
                                                      | ( ( input_data << 8 ) & 0xF000 );  /* Axis 4 : FLS, RLS, DOG, STOP */
    controller->SysCtrl.ExternalInputOperationDevice2 = ( controller->SysCtrl.ExternalInputOperationDevice2 & 0x0FFF )
                                                      | ( ( input_data << 4 ) & 0xF000 );  /* Axis 8 : FLS, RLS, DOG, STOP */
    controller->SysCtrl.ExternalInputOperationDevice4 = ( controller->SysCtrl.ExternalInputOperationDevice4 & 0x0FFF )
                                                      | ( input_data & 0xF000 );          /* Axis 16: FLS, RLS, DOG, STOP */

    /* Use the following labels to update the external input signal in a unit of bit */
    // controller->SysCtrl.ExternalInputOperationDevice1.Axis1_FLS    = ( ( input_data & 0x0001 ) != 0 );
    // controller->SysCtrl.ExternalInputOperationDevice1.Axis1_RLS    = ( ( input_data & 0x0002 ) != 0 );
    // controller->SysCtrl.ExternalInputOperationDevice1.Axis1_DOG    = ( ( input_data & 0x0004 ) != 0 );
    // controller->SysCtrl.ExternalInputOperationDevice1.Axis1_STOP   = ( ( input_data & 0x0008 ) != 0 );

    // controller->SysCtrl.ExternalInputOperationDevice1.Axis4_FLS    = ( ( input_data & 0x0010 ) != 0 );
    // controller->SysCtrl.ExternalInputOperationDevice1.Axis4_RLS    = ( ( input_data & 0x0020 ) != 0 );
    // controller->SysCtrl.ExternalInputOperationDevice1.Axis4_DOG    = ( ( input_data & 0x0040 ) != 0 );
    // controller->SysCtrl.ExternalInputOperationDevice1.Axis4_STOP   = ( ( input_data & 0x0080 ) != 0 );

    // controller->SysCtrl.ExternalInputOperationDevice2.Axis8_FLS    = ( ( input_data & 0x0100 ) != 0 );
    // controller->SysCtrl.ExternalInputOperationDevice2.Axis8_RLS    = ( ( input_data & 0x0200 ) != 0 );
    // controller->SysCtrl.ExternalInputOperationDevice2.Axis8_DOG    = ( ( input_data & 0x0400 ) != 0 );
    // controller->SysCtrl.ExternalInputOperationDevice2.Axis8_STOP   = ( ( input_data & 0x0800 ) != 0 );

    // controller->SysCtrl.ExternalInputOperationDevice4.Axis16_FLS   = ( ( input_data & 0x1000 ) != 0 );
    // controller->SysCtrl.ExternalInputOperationDevice4.Axis16_RLS   = ( ( input_data & 0x2000 ) != 0 );
    // controller->SysCtrl.ExternalInputOperationDevice4.Axis16_DOG   = ( ( input_data & 0x4000 ) != 0 );
    // controller->SysCtrl.ExternalInputOperationDevice4.Axis16_STOP  = ( ( input_data & 0x8000 ) != 0 );

}
```

9.5 Link Device External Signal Assignment Function

This function assigns link devices to the external signals of the Simple Motion board. Signals such as the upper/lower limit signal and proximity dog signal can be assigned to link devices.

Signals that can be assigned

The following signals used in the Simple Motion board can be assigned to the link devices of the CC-Link IE Field Network. Multiple external signals can be assigned to the same link device.

■Bit device

- External input signal

○: Setting possible ×: Setting not possible

External signal	RX			RY			RWr			RWw			Settable points
	1 bit	1 word	2 words	1 bit	1 word	2 words	1 bit	1 word	2 words	1 bit	1 word	2 words	
Forced stop signal (EMI)	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 board*1
Upper limit signal (FLS)	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 axis
Lower limit signal (RLS)	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 axis
Proximity dog signal (DOG)	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 axis
Stop signal (STOP)	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 axis

*1 Only the setting value for the axis 1 is valid.

- External command signal

○: Setting possible ×: Setting not possible

External signal	RX			RY			RWr			RWw			Settable points
	1 bit	1 word	2 words	1 bit	1 word	2 words	1 bit	1 word	2 words	1 bit	1 word	2 words	
External positioning start request	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 axis
External speed change request	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 axis
Skip request	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 axis
Speed-position control switching request*1	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 axis
Main shaft clutch control request*1	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 axis
Auxiliary shaft clutch control request*1	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 axis
Synchronous encoder axis start request*1	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 axis
Block No.7000 start request*2	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 axis
Block No.7001 start request*2	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 axis
Block No.7002 start request*2	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 axis
Block No.7003 start request*2	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 axis
Block No.7004 start request*2	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 axis
Input signal for mark detection*1*3	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 mark detection setting

*1 The high-accuracy processing is executed with these signals using synchronous input timing information only when the following conditions are satisfied. When the following conditions are not satisfied, the processing is performed with the link scan cycle. For the synchronous input timing acquisition function, refer to the following.
CC-Link IE Field Network Remote I/O Module User's Manual
[Conditions for high-accuracy processing]
- RX of the remote input module that supports the "synchronous input timing acquisition function" is assigned.
- The synchronous input timing acquisition function is enabled.
- Link refresh is executed for the synchronous input timing information of the input signal used.

*2 The block start can be executed from any link device directly by using the signals for block No.7000 to 7004 start.
Page 18 Start

*3 The input signal for mark detection is set with mark detection parameters. For details, refer to the following.
Page 338 Mark Detection Function

■Word device

- External input signal

○: Setting possible ×: Setting not possible

External signal	RX			RY			RWr			RWw			Settable points
	1 bit	1 word	2 words	1 bit	1 word	2 words	1 bit	1 word	2 words	1 bit	1 word	2 words	
Manual pulse generator input*1	×	○	○	×	○	○	×	○	○	×	○	○	1 point/1 axis
Synchronous encoder input*1	×	○	○	×	○	○	×	○	○	×	○	○	1 point/1 axis

*1 When RX or RY is assigned, the setting must be configured in increments of 16 points.

Operation when a data link error occurs during communication

■Bit device

Signals turn OFF regardless of the logic setting.

■Word device

Manual pulse generator operation: When manual pulse generator operation start is in operation, the operation stops.

Synchronous encoder axis: When the axis is on counter enabling status, it is changed to counter disabling status.

Setting method

Set this function with link device external signal assignment parameters. The setting becomes valid when the user program READY signal [Y0] is turned ON.

Monitoring method

The input status of each bit device signal can be monitored with the following signals.

- External input signal

n: Axis No. - 1

Monitor item		Storage details	Buffer memory address
[Md.30]	External input signal	Stores the states (ON/OFF) of the external input signal. • Upper limit signal (FLS) • Lower limit signal (RLS) • Proximity dog signal (DOG) • Stop signal (STOP)	2416+100n
[Md.50]	Forced stop input	Stores the states (ON/OFF) of the forced stop input (EMI).	4231

For labels, refer to the following.

☞ Page 435 Axis monitor data, ☞ Page 434 System monitor data

- External command signal

j: Synchronous encoder axis No. - 1, k: Mark detection setting No. - 1, n: Axis No. - 1

Monitor item		Storage details	Buffer memory address
[Md.325]	Synchronous encoder axis status	b6: Start request flag	35210+20j
[Md.802]	Mark detection signal monitor	Monitors the state (ON/OFF) of the mark detection signal.	54961+80k
[Md.900]	External command signal monitor	Monitors the status of the external command signals assigned to link devices. • b0: External positioning start request flag • b1: External speed change request flag • b2: Skip request flag • b3: Speed-position control switching request flag • b4: Main shaft clutch control request flag • b5: Auxiliary shaft clutch control request flag • b7: Block No.7000 start request flag • b8: Block No.7001 start request flag • b9: Block No.7002 start request flag • b10: Block No.7003 start request flag • b11: Block No.7004 start request flag	59328+100n

For labels, refer to the following.

☞ Page 447 Mark detection monitor data, ☞ Page 446 Axis monitor

📖Simple Motion Board User's Manual (Advanced Synchronous Control)

Related buffer memory areas

Each external signal can be assigned by setting the following buffer memory areas. Assigning the forced stop signal (EMI) is valid only for the setting value of the axis 1.

■For bit device setting

- Link device type

n: Axis No. - 1

Setting item		Setting details/setting value	Initial value	Buffer memory address
[Pr.900]	Forced stop signal (EMI): Link device type	Set link device type for use. 11H: RX (1 bit) 12H: RY (1 bit) 13H: RWr (1 bit) 14H: RWw (1 bit) Others: Invalid Fetch cycle: User program READY signal [Y0] OFF to ON	0	440000+320n
[Pr.910]	Upper limit signal (FLS): Link device type		0	440010+320n
[Pr.920]	Lower limit signal (RLS): Link device type		0	440020+320n
[Pr.930]	Proximity dog signal (DOG): Link device type		0	440030+320n
[Pr.940]	Stop signal (STOP): Link device type		0	440040+320n
[Pr.950]	External positioning start request: Link device type		0	440050+320n
[Pr.960]	External speed change request: Link device type		0	440060+320n
[Pr.970]	Skip request: Link device type		0	440070+320n
[Pr.980]	Speed-position control switching request: Link device type		0	440080+320n
[Pr.990]	Main shaft clutch control request: Link device type		0	440090+320n
[Pr.1000]	Auxiliary shaft clutch control request: Link device type		0	440100+320n
[Pr.1020]	Block No.7000 start request: Link device type		0	440120+320n
[Pr.1030]	Block No.7001 start request: Link device type		0	440130+320n
[Pr.1040]	Block No.7002 start request: Link device type		0	440140+320n
[Pr.1050]	Block No.7003 start request: Link device type		0	440150+320n
[Pr.1060]	Block No.7004 start request: Link device type		0	440160+320n

For labels, refer to the following.

☞ Page 444 Link device external signal assignment parameters (bit device)

- Link device start No.

n: Axis No. - 1

Setting item		Setting details/setting value	Initial value	Buffer memory address
[Pr.901]	Forced stop signal (EMI): Link device start No.	Set link device type for use. If the setting value is outside the setting range, the error "Outside link device start No. range" (error code: 1CC0H) occurs and the corresponding external signal becomes invalid. Fetch cycle: User program READY signal [Y0] OFF to ON	0	440001+320n
[Pr.911]	Upper limit signal (FLS): Link device start No.		0	440011+320n
[Pr.921]	Lower limit signal (RLS): Link device start No.		0	440021+320n
[Pr.931]	Proximity dog signal (DOG): Link device start No.		0	440031+320n
[Pr.941]	Stop signal (STOP): Link device start No.		0	440041+320n
[Pr.951]	External positioning start request: Link device start No.		0	440051+320n
[Pr.961]	External speed change request: Link device start No.		0	440061+320n
[Pr.971]	Skip request: Link device start No.		0	440071+320n
[Pr.981]	Speed-position control switching request: Link device start No.		0	440081+320n
[Pr.991]	Main shaft clutch control request: Link device start No.		0	440091+320n
[Pr.1001]	Auxiliary shaft clutch control request: Link device start No.		0	440101+320n
[Pr.1021]	Block No.7000 start request: Link device start No.		0	440121+320n
[Pr.1031]	Block No.7001 start request: Link device start No.		0	440131+320n
[Pr.1041]	Block No.7002 start request: Link device start No.		0	440141+320n
[Pr.1051]	Block No.7003 start request: Link device start No.		0	440151+320n
[Pr.1061]	Block No.7004 start request: Link device start No.		0	440161+320n

For labels, refer to the following.

☞ Page 444 Link device external signal assignment parameters (bit device)

- Link device bit specification

n: Axis No. - 1

Setting item		Setting details/setting value	Initial value	Buffer memory address
[Pr.902]	Forced stop signal (EMI): Link device bit specification	Set the bit No. that used in occasion when "13H: RWr (1 bit)" and "14H: RWw (1 bit)" had been set to link device type. Setting range: 00H to 1FH If the setting value is outside the setting range, the error "Outside the link device bit specification range" (error code: 1CC1H) occurs and the corresponding external signal becomes invalid. Fetch cycle: User program READY signal [Y0] OFF to ON	0	440002+320n
[Pr.912]	Upper limit signal (FLS): Link device bit specification		0	440012+320n
[Pr.922]	Lower limit signal (RLS): Link device bit specification		0	440022+320n
[Pr.932]	Proximity dog signal (DOG): Link device bit specification		0	440032+320n
[Pr.942]	Stop signal (STOP): Link device bit specification		0	440042+320n
[Pr.952]	External positioning start request: Link device bit specification		0	440052+320n
[Pr.962]	External speed change request: Link device bit specification		0	440062+320n
[Pr.972]	Skip request: Link device bit specification		0	440072+320n
[Pr.982]	Speed-position control switching request: Link device bit specification		0	440082+320n
[Pr.992]	Main shaft clutch control request: Link device bit specification		0	440092+320n
[Pr.1002]	Auxiliary shaft clutch control request: Link device bit specification		0	440102+320n
[Pr.1022]	Block No.7000 start request: Link device bit specification		0	440122+320n
[Pr.1032]	Block No.7001 start request: Link device bit specification		0	440132+320n
[Pr.1042]	Block No.7002 start request: Link device bit specification		0	440142+320n
[Pr.1052]	Block No.7003 start request: Link device bit specification		0	440152+320n
[Pr.1062]	Block No.7004 start request: Link device bit specification		0	440162+320n

For labels, refer to the following.

☞ Page 444 Link device external signal assignment parameters (bit device)

- Link device logic setting

n: Axis No. - 1

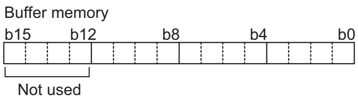
Setting item		Setting details/setting value	Initial value	Buffer memory address
[Pr.903]	Forced stop signal (EMI): Link device logic setting	Set the logic for assignment signal. Only the setting of b0 is effective. 0: Negative logic The link device status and signal status are not inverted. When the link device is set to 0, the corresponding signal is set to 0. When the link device is set to 1, the corresponding signal is set to 1. 1: Positive logic The link device status and signal status are inverted. When the link device is set to 0, the corresponding signal is set to 1. When the link device is set to 1, the corresponding signal is set to 0. Fetch cycle: User program READY signal [Y0] OFF to ON	0	440003+320n
[Pr.913]	Upper limit signal (FLS): Link device logic setting		0	440013+320n
[Pr.923]	Lower limit signal (RLS): Link device logic setting		0	440023+320n
[Pr.933]	Proximity dog signal (DOG): Link device logic setting		0	440033+320n
[Pr.943]	Stop signal (STOP): Link device logic setting		0	440043+320n
[Pr.953]	External positioning start request: Link device logic setting		0	440053+320n
[Pr.963]	External speed change request: Link device logic setting		0	440063+320n
[Pr.973]	Skip request: Link device logic setting		0	440073+320n
[Pr.983]	Speed-position control switching request: Link device logic setting		0	440083+320n
[Pr.993]	Main shaft clutch control request: Link device logic setting		0	440093+320n
[Pr.1003]	Auxiliary shaft clutch control request: Link device logic setting		0	440103+320n
[Pr.1023]	Block No.7000 start request: Link device logic setting		0	440123+320n
[Pr.1033]	Block No.7001 start request: Link device logic setting		0	440133+320n
[Pr.1043]	Block No.7002 start request: Link device logic setting		0	440143+320n
[Pr.1053]	Block No.7003 start request: Link device logic setting		0	440153+320n
[Pr.1063]	Block No.7004 start request: Link device logic setting		0	440163+320n

For labels, refer to the following.

☞ Page 444 Link device external signal assignment parameters (bit device)

■For bit device monitor

n: Axis No. - 1

<table>
<tr><th colspan="2">Storage item</th><th>Storage details/Storage value</th><th>Initial value</th><th>Buffer memory address</th></tr>
<tr><td>[Md.900]</td><td>External command signal monitor</td><td>Monitors the status of the external command signals assigned to link devices.


<table>
<tr><th colspan="2">Storage item</th><th>Meaning</th></tr>
<tr><td>b0</td><td>External positioning start request flag</td><td rowspan="12">0: Signal status OFF/No link device assigned
1: Signal status ON</td></tr>
<tr><td>b1</td><td>External speed change request flag</td></tr>
<tr><td>b2</td><td>Skip request flag</td></tr>
<tr><td>b3</td><td>Speed-position control switching request flag</td></tr>
<tr><td>b4</td><td>Main shaft clutch control request flag</td></tr>
<tr><td>b5</td><td>Auxiliary shaft clutch control request flag</td></tr>
<tr><td>b6</td><td>Not used</td></tr>
<tr><td>b7</td><td>Block No.7000 start request flag</td></tr>
<tr><td>b8</td><td>Block No.7001 start request flag</td></tr>
<tr><td>b9</td><td>Block No.7002 start request flag</td></tr>
<tr><td>b10</td><td>Block No.7003 start request flag</td></tr>
<tr><td>b11</td><td>Block No.7004 start request flag</td></tr>
</table>
The status of the signals to which the link device logic setting is reflected is stored.
Refresh cycle: Operation cycle</td><td>0</td><td>59328+100n</td></tr>
</table>

For labels, refer to the following.

☞ Page 446 Axis monitor

■For word device setting

n: Axis No. - 1

Setting item		Setting details/setting value	Initial value	Buffer memory address
[Pr.700]	Manual pulse generator input: Link device type	Set link device type for use. 21H: RX (1 word) 22H: RY (1 word) 23H: RWr (1 word) 24H: RWw (1 word) 31H: RX (2 words) 32H: RY (2 words) 33H: RWr (2 words) 34H: RWw (2 words) Others: Invalid Fetch cycle: User program READY signal [Y0] OFF to ON	0	450240+100n
[Pr.701]	Manual pulse generator input: Link device start No.	Set link device No. for use. If the setting value is outside the setting range, the error "Outside link device start No. range" (error code: 1CC0H) occurs and the corresponding external signal becomes invalid. Fetch cycle: User program READY signal [Y0] OFF to ON	0	450241+100n
[Pr.702]	Manual pulse generator input: Link device count direction setting	Set the relationship between link device count direction and assignment signal count direction. Only the setting of b0 is effective. 0: Plus count (The signal will also be plus counted while the link device is plus count.) 1: Minus count (The signal will be minus counted while the link device is plus count.) Fetch cycle: User program READY signal [Y0] OFF to ON	0	450246+100n

Setting item		Setting details/setting value	Initial value	Buffer memory address
[Pr.703]	Manual pulse generator input: Ring counter maximum value	Set the maximum and minimum value when the link device value is ring counter. • When the ring counter maximum value is equal to the ring counter minimum value, the setting depends on the link device type setting. 1 word: -32768 to 32767 2 words: -2147483648 to 214748647 • When the link device type is a 1-word device and a value outside the range of 1 word is set, the setting is ignored. • When the ring counter maximum value is smaller than the ring counter minimum value, the error "Outside the link device maximum/minimum value specification range" (error code: 1CC2H) occurs. Fetch cycle: User program READY signal [Y0] OFF to ON	0	450242+100n 450243+100n
[Pr.704]	Manual pulse generator input: Ring counter minimum value		0	450244+100n 450245+100n

For labels, refer to the following.

☞ Page 446 Link device external signal assignment parameters (word device)

Point

For the mark detection assignment parameters, refer to the following.

☞ Page 338 Mark Detection Function

For the parameters related to the synchronous encoder axis, refer to the following.

📖Simple Motion Board User's Manual (Advanced Synchronous Control)

Restrictions

- When using the link device, the fetch timing of the signal disperses in one link scan cycle.
- Set the movement amount per link scan so that the following formula is satisfied. If not, the actual movement amount of the synchronous encoder and the movement amount counted by the Simple Motion board may not be matched.

$$\text{(Movement amount per link scan)} \quad = \quad \left(\frac{|\text{(Ring counter maximum value) - (Ring counter minimum value) + 1}|}{2} \right)$$

9.6 History Monitor Function

This function monitors start history and current value history stored in the buffer memory of the Simple Motion board on the operation monitor of EM Configurator.

Start history

The start history logs of operations such as positioning operation, JOG operation, and manual pulse generator operation can be monitored. The latest 64 logs are stored all the time. This function allows users to check the operation sequence (whether the operations have been started in a predetermined sequence) at system start-up.
For the start history check method, refer to the "EM Configurator Help" of EM Configurator.

Point

Set the clock of the host personal computer.
There may be an error in tens of ms between the clock data of the host personal computer and the time data of the Simple Motion board.

Current value history

The current value history data of each axis can be monitored. The following shows about the current value history data of each axis.

Monitor details	Monitor item
Latest backup data The number of backup: Once	Feed current value
	Servo command value
	Encoder single revolution position
	Encoder multiple revolution counter
	Time 1 (Year: month)*1
	Time 2 (Day: hour)*1
	Time 3 (Minute: second)*1
	Latest backup data pointer
Backup data at the power disconnection The number of backup: 10 times	Feed current value
	Servo command value
	Encoder single revolution position
	Encoder multiple revolution counter
	Time 1 (Year: month)*1
	Time 2 (Day: hour)*1
	Time 3 (Minute: second)*1
	Backup data pointer
Backup data at the power on The number of backup: 10 times	Feed current value
	Servo command value
	Encoder single revolution position
	Encoder multiple revolution counter
	Time 1 (Year: month)*1
	Time 2 (Day: hour)*1
	Time 3 (Minute: second)*1
	Error/warning code at current value restoration
Home position return data The number of backup: Once	Feed current value
	Servo command value
	Encoder single revolution position
	Encoder multiple revolution counter
	Time 1 (Year: month)*1
	Time 2 (Day: hour)*1
	Time 3 (Minute: second)*1

*1 Displays a value set by the clock function of the host personal computer.

■Latest backup data

The latest backup data outputs the following data saved in the fixed cycle to the buffer memory.

- Feed current value
- Servo command value
- Encoder single revolution position
- Encoder multiple revolution counter
- Time 1 (Year: month) data
- Time 2 (Day: hour) data
- Time 3 (Minute: second) data
- Latest backup data pointer

The latest backup data starts outputting the data after the power on.
After the home position is established in the absolute system, the data becomes valid and outputs the current value.
The following servo amplifier and servo motor are connected artificially during amplifier-less operation. Therefore, the encoder single revolution position and encoder multiple revolution counter made virtually by the command value are output.

Servo amplifier type	Motor type
MR-J4-10GF	HG-KR053 (Resolution per servo motor rotation: 4194304 pulses/rev)

■Backup data at the power disconnection

The detail of the latest backup data right before the power disconnection is output to the buffer memory.
The backup data at the power disconnection starts being output after the power on.
The detail of the latest backup data right before the power disconnection used in the absolute system setting is output, regardless of the setting of the absolute system or incremental system.
If the data has never been used in the absolute system in the incremental system setting, "0" is output in all storage items.

■Backup data at the power on

After the power on, the detail of the data which restored the current value is output to the buffer memory.
The backup data at the power on starts being output after the power on.
If the current value cannot be restored in the absolute system, "0" is set to the feed current value and servo command value.
The warning "Home position return data incorrect" (warning code: 093CH) is set in the error/warning code at current value restoration.
When the incremental system is set, the detail of the backup data at the power on used in the absolute system setting is output. If the data has never been used in the absolute system, "0" is output in all storage items.

■Home position return data

The following data saved at home position return completion to the buffer memory.

- Feed current value at home position return completion
- Servo command value at home position return completion
- Encoder single revolution position of absolute position reference point data
- Encoder multiple revolution counter of absolute position reference point data
- Time 1 (Year: month) data
- Time 2 (Day: hour) data
- Time 3 (Minute: second) data

The data becomes valid only when the absolute system is set.
If the data has never been used in the absolute system in the incremental system setting, "0" is output in all storage items.

9.7 Amplifier-less Operation Function

The positioning control of Simple Motion board without servo amplifiers connection can be executed in the amplifier-less function. This function is used to debug of user program or simulate of positioning operation at the start.

Control details

Switch the mode from the normal operation mode (with servo amplifier connection) to the amplifier-less operation mode (without servo amplifier connection) to use the amplifier-less operation function.

Operation for each axis without servo amplifier connection as the normal operation mode can be executed by connecting a virtual servo amplifier during amplifier-less operation mode. The start method of positioning control is also the same procedure of normal operation mode.

■Point for control details

- Switch of the normal operation mode and amplifier-less operation mode is executed by the batch of all axes.
- An axis in the amplifier-less operation mode is connected as a "virtual servo amplifier axis". For operations and restrictions of the virtual servo amplifier axis, refer to the following.

  ☞ Page 334 Virtual Servo Amplifier Function

Restrictions

- Some monitor data differ from the actual servo amplifier during amplifier-less operation mode.

n: Axis No. - 1

Item		Description	Buffer memory address
[Md.102]	Deviation counter value	Always "0".	2452+100n 2453+100n
[Md.105]	Connected device	As the following connected devices artificially. • MR-J4-GF	58660+32n 58661+32n
[Md.108]	Servo status 1	• READY ON (b0), Servo ON (b1): Changed depending on the all axis servo ON signal [Y1] and "[Cd.100] Servo OFF command". • Control mode (b2, b3): Indicates control mode. • Gain switching (b4): Always OFF • Fully closed loop control (b5): Always OFF • Servo alarm (b7): Always OFF • In-position (b12): Always ON • Torque limit (b13): Changed depending on "[Md.104] Motor current value". (Refer to the 2nd and 3rd bullets of restrictions for details.) • Absolute position lost (b14): Turns ON if a connected device is not the MR-J4-GF and a home position is established when a virtual servo amplifier is connected. Turns OFF when a home position return is executed. • Servo warning (b15): Always OFF	2477+100n
[Md.170]	Optional receive PDO data 1	Always "0".	468204+2048n 468205+2048n 468206+2048n 468207+2048n
[Md.171]	Optional receive PDO data 2	Always "0".	468208+2048n 468209+2048n 468210+2048n 468211+2048n
[Md.172]	Optional receive PDO data 3	Always "0".	468212+2048n 468213+2048n 468214+2048n 468215+2048n
[Md.173]	Optional receive PDO data 4	Always "0".	468216+2048n 468217+2048n 468218+2048n 468219+2048n

Item		Description	Buffer memory address
[Md.119]	Servo status 2	• Zero point pass (b0): Always ON • Zero speed (b3): Changed depending on the command speed. • Speed limit (b4): Always ON when the value other than "0" is set to the command torque at torque control mode. Otherwise, always OFF. • PID control (b8): Always OFF	2476+100n

For labels, refer to the following.

☞ Page 435 Axis monitor data, ☞ Page 437 Servo network composition status, ☞ Page 448 Monitor data for slave device operation

- The operation of the following function differs from the normal operation mode during amplifier-less operation mode.

Function	Operation
External signal selection function	When "1: Servo amplifier" is set in "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection", and "[Pr.118] DOG signal selection", the status of external signal at the amplifier-less operation mode start is shown below. • Upper/lower limit signal (FLS, RLS): ON • Proximity dog signal (DOG): OFF Change "[Md.30] External input signal" to change the signal status. (Refer to the 3rd bullet of restrictions for details.) When "2: Buffer memory" is set in "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection", and "[Pr.118] DOG signal selection", the upper/lower limit signal (FLS, RLS) and proximity dog signal (DOG) follow the buffer memory status of Simple Motion board during amplifier-less operation mode.
Torque limit function	Turns ON/OFF torque limit ("[Md.108] Servo status1": b13) depending on "[Md.104] Motor current value". (Refer to the 3rd bullet of restrictions for details.)

- The operation of the following monitor data differs from the normal operation mode during amplifier-less operation mode.

n: Axis No. - 1

Item		Description	Buffer memory address
[Md.30]	External input signal	When "1: Servo amplifier" is set in "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection", and "[Pr.118] DOG signal selection", the external input signal status can be operated by turning ON/OFF the "b0: Lower limit signal", "b1: Upper limit signal" or "b6: Proximity dog signal" during amplifier-less operation mode.	2416+100n
[Md.104]	Motor current value	"0" is set at the amplifier-less operation mode start. The motor current value can be emulated by changing this monitor data in user side during amplifier-less operation mode.	2456+100n

For labels, refer to the following.

☞ Page 435 Axis monitor data

- When the power supply of the Simple Motion board is turned OFF → ON or the remote RESET is executed during amplifier-less operation mode, the mode is switched to the normal operation mode.
- The operation of servo motor or the timing of operation cycle, etc. at the amplifier-less operation is different from the case where the servo amplifiers are connected at the normal operation mode. Confirm the operation finally with a real machine.
- The operation mode cannot be switched to the amplifier-less operation mode in the test mode. Do not request to switch to the amplifier-less operation mode during test mode.
- The amplifier-less operation cannot be used in the fully closed loop system, linear servo or direct drive motor.
- The synchronous encoder via servo amplifier cannot be used during amplifier-less operation mode.
- When the normal operation mode is switched to the amplifier-less operation mode, only the axes which are not connected to the CC-Link IE Field Network are switched to virtual servo amplifier axes. When axes (stations) which are connected to the CC-Link IE Field Network exist, the axes (stations) are not switched to virtual servo amplifier axes. (The value of "[Md.51] Amplifier-less operation mode status" is not changed from "0: Normal operation mode".) When the amplifier-less operation mode is switched to the normal operation mode, virtual servo amplifier axes are disconnected only for the axes (stations) which are not connected to the CC-Link IE Field Network.
- When the amplifier-less operation mode is switched to the normal operation mode, reconnecting the CC-Link IE Field Network is required to connect axes.

Data list

The data used in the amplifier-less operation function is shown below.

- System control data

Setting item		Setting value	Setting details	Buffer memory address
[Cd.137]	Amplifier-less operation mode switching request	→	Switch operation mode. ABCDH: Switch from the normal operation mode to the amplifier-less operation mode. 0000H: Switch from the amplifier-less operation mode to the normal operation mode.	5926

For labels, refer to the following.

☞ Page 437 System control data

Point

- Changing the setting of "[Cd.137] Amplifier-less operation mode switching request" from "0000H" to "ABCDH" is equivalent to setting "FFFFH" in "[Cd.701] Virtual servo amplifier operation station specification" and setting "0001H" in "[Cd.700] Virtual servo amplifier operation command".
- Changing the setting of "[Cd.137] Amplifier-less operation mode switching request" from "ABCDH" to "0000H" is equivalent to setting "FFFFH" in "[Cd.701] Virtual servo amplifier operation station specification" and setting "0011H" in "[Cd.700] Virtual servo amplifier operation command".

- System monitor data

Monitor item		Monitor value	Storage details	Buffer memory address
[Md.51]	Amplifier-less operation mode status	→	Indicate the current operation mode. 0: Normal operation mode 1: Amplifier-less operation mode	4232

For labels, refer to the following.

☞ Page 434 System monitor data

Point

- Only when virtual servo amplifiers are connected to all axes set in the network configuration settings, "1: Amplifier-less operation mode" is set in "[Md.51] Amplifier-less operation mode status".
- When all axes are connected as virtual servo amplifier axes at power ON, "1: Amplifier-less operation mode" is set in "[Md.51] Amplifier-less operation mode status" and the operation mode cannot be switched to the normal operation mode.

Operation mode switching procedure

- Switch from the normal operation mode to the amplifier-less operation mode

1. Confirm that all axes are disconnected from the network.
2. Set "ABCDH" in "[Cd.137] Amplifier-less operation mode switching request".
3. Confirm that "1: Amplifier-less operation mode" was set in "[Md.51] Amplifier-less operation mode status".

- Switch from the amplifier-less operation mode to the normal operation mode

1. Stop all operating axes, and then confirm that the BUSY signal for all axes turned OFF.
2. Confirm that the axes are disconnected from the network.
3. Set "0000H" in "[Cd.137] Amplifier-less operation mode switching request".
4. Confirm that "0: Normal operation mode" was set in "[Md.51] Amplifier-less operation mode status".

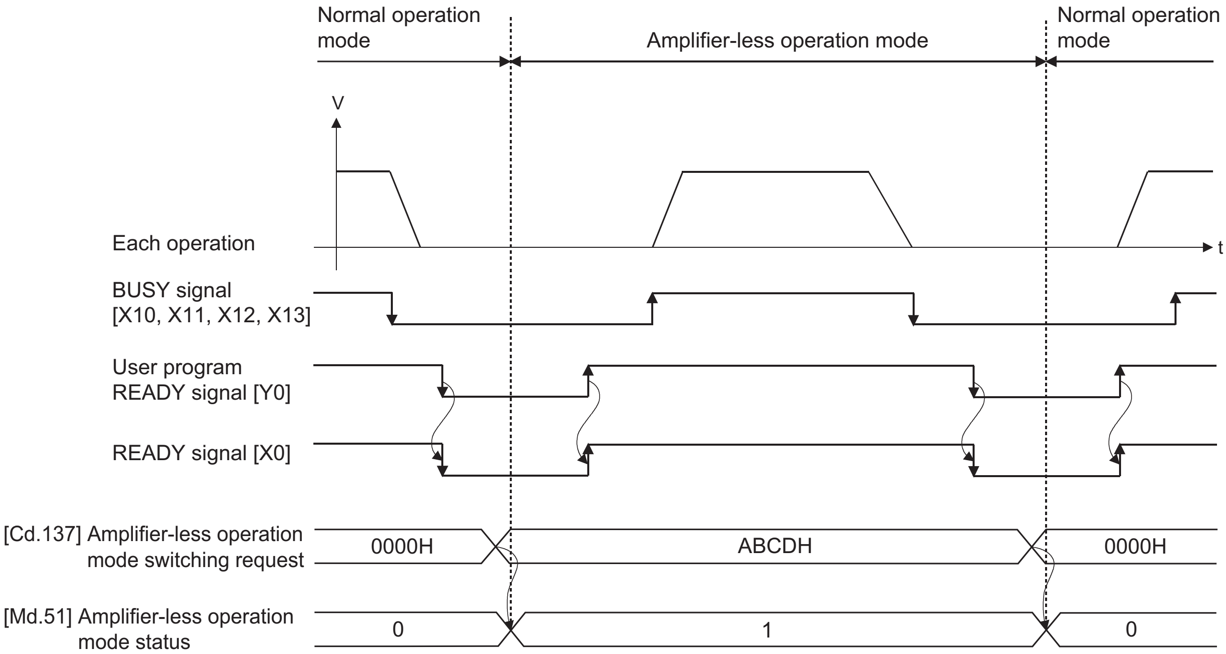
The servo amplifier can be directly switched to a virtual servo amplifier with "[Cd.700] Virtual servo amplifier operation command". Refer to the following for details.

☞ Page 334 Virtual Servo Amplifier Function

■Operation chart

The following drawing shows the operation for the switching of the normal operation mode and amplifier-less operation mode.

[Axis 1 to 4 operation example]



■Point for operation mode switching procedure

- The forced stop is invalid regardless of the setting in "[Pr.82] Forced stop valid/invalid selection" during the amplifier-less operation mode.
- Only "0000H" and "ABCDH" are valid for "[Cd.137] Amplifier-less operation mode switching request". Switching to the amplifier-less operation mode can be accepted only when "[Cd.137] Amplifier-less operation mode switching request" is switched from "0000H" to "ABCDH". Switching to the normal operation mode can be accepted only when "[Cd.137] Amplifier-less operation mode switching request" is switched from "ABCDH" to "0000H".

9.8 Virtual Servo Amplifier Function

This function executes the operation virtually without connecting servo amplifiers (regarded as connected). The synchronous control with virtually input command is possible by using the virtual servo amplifier axis as servo input axis of synchronous control. Also, it can be used as simulation operation for axes without servo amplifiers.

Control details

- The operation that actual servo amplifiers and virtual servo amplifiers are connected is possible following the classification shown in the table below.

Simple Motion board operation mode setting	Switching between actual servo amplifiers and virtual servo amplifiers	Only virtual servo amplifiers
Online mode	Operation possible	Operation possible
Offline mode	Operation not possible	

- In the offline mode, virtual servo amplifiers are connected to all the stations to which "MR-J4-GF" is set in the network configuration settings when the power supply of the Simple Motion board is ON.
- In the online mode, whether virtual servo amplifiers can be connected or not and how to connect virtual servo amplifiers vary according to the network configuration settings. The following shows the connecting/disconnecting methods of virtual servo amplifiers.

Connecting method A	Use the virtual servo amplifier operation command device. Specify an axis No. where a virtual servo amplifier is connected or disconnected for "[Cd.701] Virtual servo amplifier operation station specification" and set "0001H" or "0011H" in "[Cd.700] Virtual servo amplifier operation command". (A virtual servo amplifier axis can be connected or disconnected while the power supply of the Simple Motion board is ON.)
Connecting method B	A virtual servo amplifier is automatically connected at power ON. (A virtual servo amplifier axis cannot be connected or disconnected while the power supply of the Simple Motion board is ON.)
Connecting method C	Use "[Cd.137] Amplifier-less operation mode switching request". (A virtual servo amplifier axis can be connected or disconnected while the power supply of the Simple Motion board is ON.)

The connecting method of virtual servo amplifiers is determined by the parameter combinations at power ON as shown below.

[Pr.100] Connected device	[Pr.101] Virtual servo amplifier setting	Connecting method of virtual servo amplifiers
No setting (0)	—	Connection not possible
Set (Not 0)	0: Use real servo amplifier	Connecting method A/C
	1: Use as virtual servo amplifier	Connecting method B

- The connecting status of virtual servo amplifiers can be monitored using the connecting status monitor device of virtual servo amplifiers.
- Virtual servo amplifiers are connected with the absolute position detection system enabled. The feed current value and feed machine value at connection are as follows.

- The address at the latest power supply of the Simple Motion board OFF is set if the home position has been established.
- Both the feed current value and feed machine value are set to "0" if the home position has not been established.

- Switching to virtual servo amplifiers is also possible in the amplifier-less operation function. When virtual servo amplifiers are connected to all axes, "1: Amplifier-less operation mode" is set in "[Md.51] Amplifier-less operation mode status". For details, refer to the following.

☞ Page 330 Amplifier-less Operation Function

Restrictions

- The following monitor data of virtual servo amplifier differs from the actual servo amplifier.

n: Axis No. - 1

Item		Description	Buffer memory address
[Md.102]	Deviation counter value	Always "0".	2452+100n 2453+100n
[Md.105]	Connected device	As the following connected devices artificially. • MR-J4-GF	58660+32n 58661+32n
[Md.108]	Servo status 1	• READY ON (b0), Servo ON (b1): Changed depending on the all axis servo ON signal [Y1] and "[Cd.100] Servo OFF command". • Control mode (b2, b3): Indicates control mode. • Gain switching (b4): Always OFF • Fully closed loop control (b5): Always OFF • Servo alarm (b7): Always OFF • In-position (b12): Always ON • Torque limit (b13): Changed depending on "[Md.104] Motor current value". (Refer to the 2nd and 3rd bullets of restrictions for details.) • Absolute position lost (b14): Turns ON if a connected device is not the MR-J4-GF and a home position is established when a virtual servo amplifier is connected. Turns OFF when a home position return is executed. • Servo warning (b15): Always OFF	2477+100n
[Md.170]	Optional receive PDO data 1	Always "0".	468204+2048n 468205+2048n 468206+2048n 468207+2048n
[Md.171]	Optional receive PDO data 2	Always "0".	468208+2048n 468209+2048n 468210+2048n 468211+2048n
[Md.172]	Optional receive PDO data 3	Always "0".	468212+2048n 468213+2048n 468214+2048n 468215+2048n
[Md.173]	Optional receive PDO data 4	Always "0".	468216+2048n 468217+2048n 468218+2048n 468219+2048n
[Md.119]	Servo status 2	• Zero point pass (b0): Always ON • Zero speed (b3): Changed depending on the command speed. • Speed limit (b4): Always ON when the value other than "0" is set to the command torque at torque control mode. Otherwise, always OFF. • PID control (b8): Always OFF	2476+100n

For labels, refer to the following.

☞ Page 435 Axis monitor data, ☞ Page 437 Servo network composition status, ☞ Page 448 Monitor data for slave device operation

- The operation of the following function of virtual servo amplifier differs from the actual servo amplifier.

Function	Operation
External signal selection function	When "1: Servo amplifier" is set in "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection", and "[Pr.118] DOG signal selection", the external signal status immediately after the power supply ON is shown below. • Upper/lower limit signal (FLS, RLS): ON • Proximity dog signal (DOG): OFF Change "[Md.30] External input signal" to change the signal status. (Refer to the 3rd bullet of restrictions for details.) When "2: Buffer memory" is set in "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection", and "[Pr.118] DOG signal selection", the upper/lower limit signal (FLS, RLS) and proximity dog signal (DOG) follow the buffer memory status of the Simple Motion board even with a virtual servo amplifier.
Torque limit function	Turns ON/OFF torque limit ("[Md.108] Servo status1": b13) depending on "[Md.104] Motor current value". (Refer to the 3rd bullet of restrictions for details.)

- The following monitor data of virtual servo amplifier differ from the actual servo amplifiers. The writing operation is possible in the virtual servo amplifier.

n: Axis No. - 1

Item		Description	Buffer memory address
[Md.30]	External input signal	When "1: Servo amplifier" is set in "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection", and "[Pr.118] DOG signal selection", the external input signal status can be operated by turning ON/OFF the following signals. • b0: Lower limit signal • b1: Upper limit signal • b6: Proximity dog signal	2416+100n
[Md.104]	Motor current value	"0" is set after immediately power supply ON. The motor current value can be emulated by changing this monitor data in user side.	2456+100n

For labels, refer to the following.

☞ Page 435 Axis monitor data

- When a slave device is connected to the axis (station) operating as a virtual servo amplifier, the slave device is connected to the CC-Link IE Field Network. However, the synchronous communication is not in operation.
- When a virtual servo amplifier is disconnected, reconnecting the CC-Link IE Field Network is required to reconnect the slave stations.
- The axis operating as a virtual servo amplifier are artificially connected to the following types of servo amplifier and servo motor.

Servo amplifier type: MR-J4-10GF
Motor type: HG-KR053 (Resolution per servo motor rotation: 4194304 pulses/rev)

Additionally, the axis operates regarded as the following values of servo parameters are set.

Item		Description
PA03	Absolute position detection system	1: Enabled (absolute position detection system)
PA14	Rotation direction selection/travel direction selection	Holds and uses the value at the latest servo amplifier connection. (0 at initialization)
PC07	Zero speed	50 r/min
PC29	Function selection C-B	1000h ×_ _ _: POL reflection selection at torque control 1: Enabled
PC76	Function selection C-E	0011h _ _ × _: ZSP disabled selection at control switching 1: Disabled (control mode switching regardless of the range of ZSP)
PT07	Home position shift distance	0
PT45	Home position return type	37 (Data set type)

Setting method

Set "[Pr.101] Virtual servo amplifier setting" as follows.

n: Axis No. - 1

Setting item		Setting details/setting value	Buffer memory address
[Pr.101]	Virtual servo amplifier setting	Set if use as virtual servo amplifier axis. It will be read when the power supply is ON. 0: Use real servo amplifier 1: Use as virtual servo amplifier	58022+32n

For labels, refer to the following.

☞ Page 446 Servo network composition parameters

• Virtual servo amplifier operation command

Setting item		Setting details/setting value	Buffer memory address
[Cd.700]	Virtual servo amplifier operation command	Set the following operation requests according to the operation. 0001H: Virtual servo amplifier connection 0011H: Virtual servo amplifier disconnection After the processing is completed, "0" is stored.	5952
[Cd.701]	Virtual servo amplifier operation station specification	Set a station No. where a virtual servo amplifier is connected or disconnected by the virtual servo amplifier operation command. 0: Connection/disconnection not commanded 1: Connection/disconnection commanded	5954

For labels, refer to the following.

☞ Page 437 System control data

• Virtual servo amplifier connection status monitor data

Item		Details	Buffer memory address
[Md.700]	Virtual servo amplifier connected station monitor	Stores the station where a virtual servo amplifier is connected. 0: Virtual servo amplifier not connected 1: Virtual servo amplifier connected	60900

For labels, refer to the following.

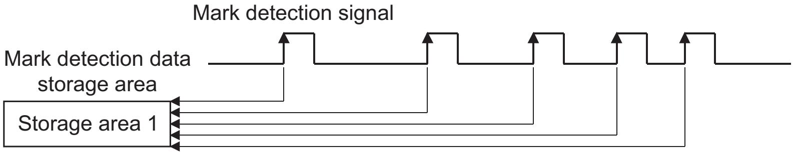
☞ Page 434 System monitor data

9.9 Mark Detection Function

Any data can be latched at the input timing of the mark detection signal (DI).
Also, only data within a specific range can be latched by specifying the data detection range.
The following three modes are available for execution of mark detection.

Continuous detection mode

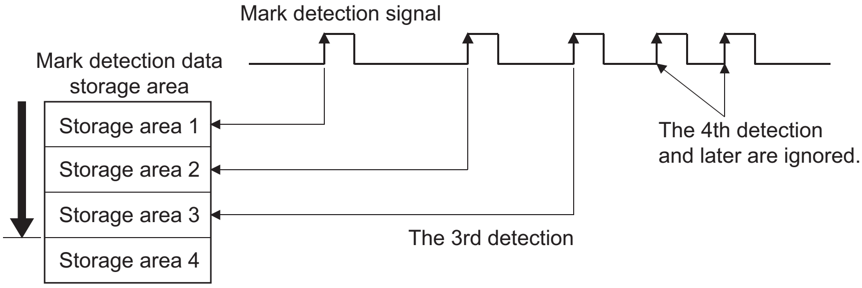
The latched data is always stored to the first of mark detection data storage area at mark detection.



Specified number of detections mode

The latched data from a specified number of detections is stored.
The detected position for a specified number of detections can be collected when the mark detection signal is continuously input at high speed.

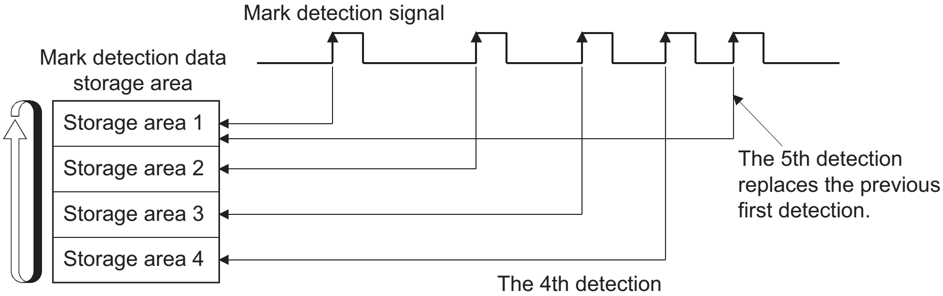
Ex.
Number of detections: 3



Ring buffer mode

The latched data is stored in a ring buffer for a specified number of detections.
The latched data is always stored at mark detection.

Ex.
Number of detections: 4



Performance specifications

Item	Performance specifications
Number of mark detection settings	Up to 16
Input signal	Link device (RX, RY, RWr, RWw)
Input signal detection direction	Selectable for leading edge or trailing edge in "[Pr.811] Mark detection signal detection direction setting".
Input signal compensation time	Correctable within the range of -32768 to 32767 µs
Detection accuracy	High-accuracy (recommended): 0.1µs*1 Normal: Link scan cycle
Latch data	11 types + Optional buffer memory data (2 words) (Feed current value, Feed machine value, Real current value, Servo input axis current value, Synchronous encoder axis current value, Synchronous encoder axis current value per cycle, Current value after composite main shaft gear, Current value per cycle after main shaft gear, Current value per cycle after auxiliary shaft gear, Cam axis current value per cycle, Cam axis current value per cycle (real position))
Number of continuous latch data storage	Up to 32
Latched data range	Settable in the range of -2147483648 to 2147483647

*1 When all the following conditions are satisfied, the high-accuracy detection is possible.
- RX of the remote input module that supports the "synchronous input timing acquisition function" is assigned.
- The "synchronous input timing acquisition function" is enabled.
- Link refresh is executed for the synchronous input timing information of the input signal used.

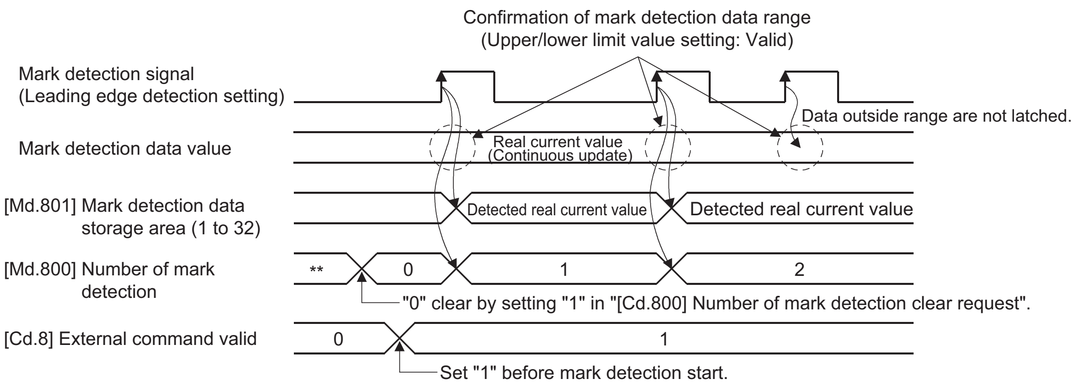
For the "synchronous input timing acquisition function", refer to the following.
CC-Link IE Field Network Remote I/O Module User's Manual

Operation for mark detection function

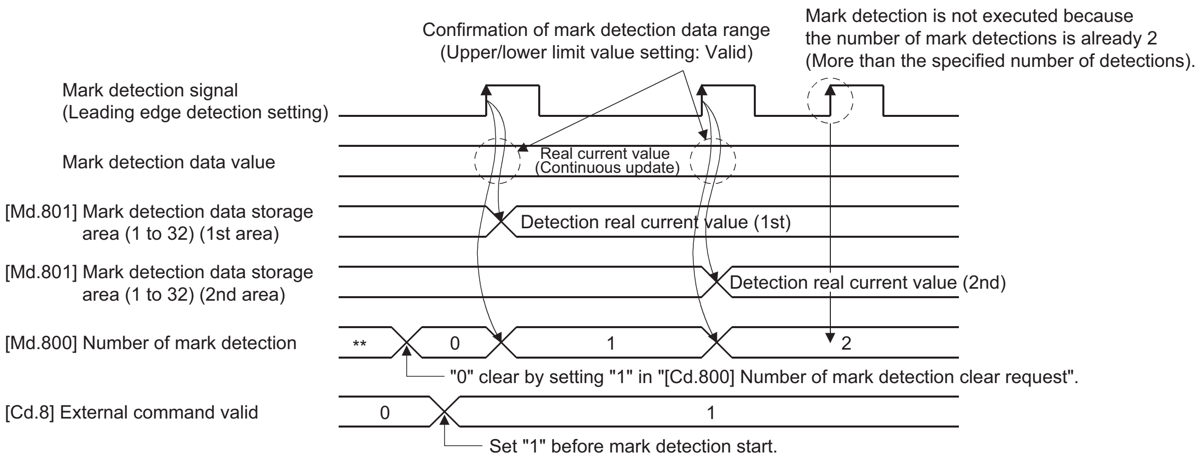
Operations done at mark detection are shown below.

- Calculations for the mark detection data are estimated at leading edge/trailing edge of the mark detection signal. However, when the specified number of detections mode is set, the current number of mark detection is checked, and then it is judged whether to execute the mark detection.
- When a mark detection data range is set, it is first confirmed whether the mark detection data is within the range or not. Data outside the range are not detected.
- The mark detection data is stored in the mark detection data storage area according to the mark detection mode, and then the number of mark detection is updated.

■Continuous detection mode



■Specified number of detection mode (Number of detections: 2)



Point

A delay for one link scan occurs from the mark detection signal input to the update of "[Md.800] Number of mark detection" and "[Md.801] Mark detection data storage area (1 to 32)".

How to use mark detection function

An example for mark detection using the following link device is shown below.

- RX100

The mark detection target is axis 1 real current value, and the all range is detected in continuous detection mode.

- Set the following mark detection setting parameters. The optional mark detection setting No. can be set.

k: Mark detection setting No. - 1

Setting item		Setting value	Setting details/Setting value	Buffer memory address
[Pr.801]	Mark detection signal compensation time	0	Set "0: (No compensation)" to the compensation time such as delay of sensor.	54001+20k
[Pr.802]	Mark detection data type	2	Set "2: Real current value" to the target data for mark detection.	54002+20k
[Pr.803]	Mark detection data axis No.	1	Set "1: Axis 1" to the axis No. of target data for mark detection.	54003+20k
[Pr.805]	Latch data range upper limit value	0	Set "0" to the valid upper limit value for latch data at mark detection. (Mark detection for all range is executed by setting the same value as lower limit value.)	54006+20k 54007+20k
[Pr.806]	Latch data range lower limit value	0	Set "0" to the valid lower limit value for latch data at mark detection. (Mark detection for all range is executed by setting the same value as upper limit value.)	54008+20k 54009+20k
[Pr.807]	Mark detection mode setting	0	Set "0: Continuous detection mode" to the mark detection mode.	54010+20k
[Pr.808]	Mark detection signal link device type	0	Set "11H: RX (1 bit)" for the link device type to be used.	54011+20k
[Pr.809]	Mark detection signal link device No.	0	Set "100H" for the link device No. to be used.	54012+20k
[Pr.810]	Mark detection signal link device bit specification	0	Setting not required	54013+20k
[Pr.811]	Mark detection signal detection direction setting	0	Set "0: Rising detection" for the signal detection direction.	54014+20k

For labels, refer to the following.

☞ Page 447 Mark detection setting parameters

- Turn the power supply of the Simple Motion board OFF or execute the remote RESET to validate the setting parameters.
- The mark detection starts by setting "1: Validates an external command." in "[Cd.8] External command valid" of axis 2 with the user program. Refer to "[Md.800] Number of mark detection" or "[Md.801] Mark detection data storage area (1 to 32)" of the set detection setting No. for the number of mark detections and mark detection data.

List of parameters and data

The following shows the configuration of parameters and data for mark detection function.

Buffer memory address	Item	Mark detection setting No.
54001 to 54019	Mark detection setting parameter [Pr.801] to [Pr.811]	Mark detection setting 1
54021 to 54039		Mark detection setting 2
54041 to 54059		Mark detection setting 3
⋮		⋮
54301 to 54319		Mark detection setting 16
54640 to 54649	Mark detection control data [Cd.800], [Cd.801], [Cd.802]	Mark detection setting 1
54650 to 54659		Mark detection setting 2
54660 to 54669		Mark detection setting 3
⋮		⋮
54790 to 54799		Mark detection setting 16
54960 to 55039	Mark detection monitor data [Md.800], [Md.801], [Md.802]	Mark detection setting 1
55040 to 55119		Mark detection setting 2
55120 to 55199		Mark detection setting 3
⋮		⋮
56160 to 56239		Mark detection setting 16

Refer to the following for the range of mark detection setting No. that can be used for each module.

☞ Page 339 Performance specifications

The following shows the parameters and data used in the mark detection function.

Mark detection setting parameters

k: Mark detection setting No. - 1

Setting item		Setting details/setting value	Default value	Buffer memory address
[Pr.801]	Mark detection signal compensation time	Set the compensation time such as delay of sensor. Set a positive value to compensate for a delay. -32768 to 32767 [µs] Fetch cycle: Power supply ON or user program READY signal [Y0] OFF to ON	0	54001+20k
[Pr.802]	Mark detection data type	Set the target data for mark detection. 0 to 12: Data type -1: Optional 2 word buffer memory Fetch cycle: Power supply ON	0	54002+20k
[Pr.803]	Mark detection data axis No.	Set the axis No. of target data for mark detection. 1 to 16: Axis 1 to axis 16 801 to 816: Synchronous encoder axis 1 to axis 16 Fetch cycle: Power supply ON	0	54003+20k
[Pr.804]	Mark detection data buffer memory No.	Set the optional buffer memory No. Set this parameter as an even number. 0 to 8355838: Optional buffer memory Fetch cycle: Power supply ON	0	54004+20k 54005+20k
[Pr.805]	Latch data range upper limit value	Set the valid upper limit value for latch data at mark detection. -2147483648 to 2147483647 Fetch cycle: Power supply ON, user program READY signal [Y0] OFF to ON, or latch data range change request	0	54006+20k 54007+20k
[Pr.806]	Latch data range lower limit value	Set the valid lower limit value for latch data at mark detection -2147483648 to 2147483647 Fetch cycle: Power supply ON, user program READY signal [Y0] OFF to ON, or latch data range change request	0	54008+20k 54009+20k
[Pr.807]	Mark detection mode setting	Set the continuous detection mode or specified number of detection mode. 0: Continuous detection mode 1 to 32: Specified number of detection mode (Set the number of detections.) -1 to -32: Ring buffer mode (Set the value that made the number of buffers into negative value.) Fetch cycle: Power supply ON or user program READY signal [Y0] OFF to ON	0	54010+20k
[Pr.808]	Mark detection signal link device type	Set link device type for use. Others: Invalid 11H: RX (1 bit) 12H: RY(1 bit) 13H: RWr(1 bit) 14H: RWw(1 bit) Fetch cycle: Power supply ON	0	54011+20k
[Pr.809]	Mark detection signal link device No.	Set link device No. for use. Fetch cycle: Power supply ON	0	54012+20k
[Pr.810]	Mark detection signal link device bit specification	Set the bit No. that used in occasion when "13H: RWr (1 bit)" and "14H: RWw (1 bit)" had been set to "[Pr.808] Mark detection signal link device type". 00H to 0FH Fetch cycle: Power supply ON	0	54013+20k
[Pr.811]	Mark detection signal detection direction setting	Set the signal detection direction. Only the setting of b0 is effective. 0: Rising detection 1: Falling detection Fetch cycle: Power supply ON	0	54014+20k

For labels, refer to the following.

☞ Page 447 Mark detection setting parameters

Point

The above parameters are valid with the value set in the flash ROM of the Simple Motion board when the power supply of the Simple Motion board is turned ON or the remote RESET is executed. Except for a part, the value is not fetched by turning the user program READY signal [Y0] ON from OFF. Therefore, write to the flash ROM after setting the value in the buffer memory to change.

[Pr.801] Mark detection signal compensation time

Compensate the input timing of the mark detection signal.
Set this parameter to compensate such as delay of sensor input. (Set a positive value to compensate for a delay.)

[Pr.802] Mark detection data type

Set the data that latched at mark detection.
The target data is latched by setting "0 to 12". Set the axis No. in "[Pr.803] Mark detection data axis No.".
Optional 2 word buffer memory is latched by setting "-1". Set the buffer memory No. in "[Pr.804] Mark detection data buffer memory No.".

Setting value	Data name
0	Feed current value
1	Feed machine value
2	Real current value
3	Servo input axis current value
6	Synchronous encoder axis current value
7	Synchronous encoder axis current value per cycle
8	Current value after composite main shaft gear
9	Current value per cycle after main shaft gear
10	Current value per cycle after auxiliary shaft gear
11	Cam axis current value per cycle
12	Cam axis current value per cycle (Real position)
-1	Optional 2 words buffer memory

If a value other than the above is set, the warning "Outside mark detection data type setting range" (warning code: 0937H) occurs and the target mark detection is not available.

[Pr.803] Mark detection data axis No.

Set the axis No. of data that latched at mark detection.

[Pr.802] Mark detection data type			[Pr.803] Mark detection data axis No.
Setting value	Data name	Unit	
0	Feed current value	10^{-1} [μm], 10^{-5} [inch], 10^{-5} [degree], [pulse]	1 to 16
1	Feed machine value		
2	Real current value		
3	Servo input axis current value		
6	Synchronous encoder axis current value	Synchronous encoder axis position unit	801 to 816
7	Synchronous encoder axis current value per cycle		
8	Current value after composite main shaft gear	Main input axis position unit	1 to 16
9	Current value per cycle after main shaft gear	Cam axis cycle unit	
10	Current value per cycle after auxiliary shaft gear		
11	Cam axis current value per cycle		
12	Cam axis current value per cycle (Real position)*1		

*1 Cam axis current value per cycle that considered delay of the servo system.

If a value other than the above is set, the warning "Outside mark detection data axis No. setting range" (warning code: 0938H) occurs and the target mark detection is not available.

[Pr.804] Mark detection data buffer memory No.

Set the No. of optional 2 words buffer memory that latched at mark detection.

Set this No. as an even No.

If a value other than the above is set, the warning "Outside mark detection data buffer memory No. setting range" (warning code: 0939H) occurs and the target mark detection is not available.

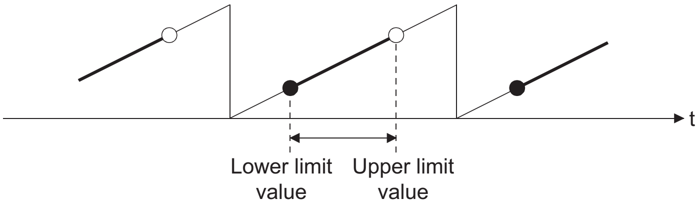
[Pr.805] Latch data range upper limit value, [Pr.806] Latch data range lower limit value

Set the upper limit value and lower limit value of the latch data at mark detection.

When the data at mark detection is within the range, they are stored in "[Md.801] Mark detection data storage area (1 to 32)" and the "[Md.800] Number of mark detection" is incremented by 1. The mark detection processing is not executed.

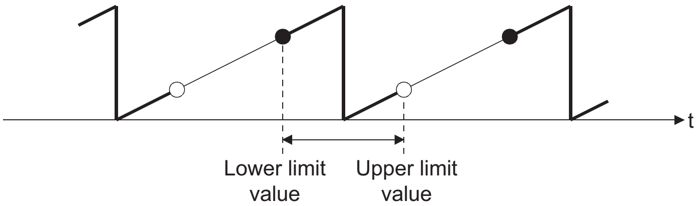
- Upper limit value > Lower limit value

The mark detection is executed when the mark detection data is "greater or equal to the lower limit value and less than the upper limit value".



- Upper limit value < Lower limit value

The mark detection is executed when the mark detection data is "greater or equal to the lower limit value or less than the upper limit value".



- Upper limit value = Lower limit value

The mark detection range is not checked. The mark detection is executed for all range.

[Pr.807] Mark detection mode setting

Set the data storage method of mark detection.

Mode	Setting value	Operation for mark detection	Mark detection data storage method
Continuous detection mode	0	Always	The data is updated in the mark detection data storage area 1.
Specified number of detection mode	1 to 32	Number of detections (If the number of mark detection is the number of detections or more, the mark detection is not executed.)	The data is stored to the mark detection data storage area "n". n = (1 + Number of mark detection)
Ring buffer mode	-1 to -32	Always (The mark detection data storage area 1 to 32 is used as a ring buffer for the number of detections.)	

[Pr.808] Mark detection signal link device type

Set link device type for use.

Setting value	Setting details
11H	RX (1 bit)
12H	RY (1 bit)
13H	RWr (1 bit)
14H	RWw (1 bit)

Values other than the above are invalid.

[Pr.809] Mark detection signal link device No.

Set link device No. for use.

When a link device No. out of the range is set, the warning "Mark detection link device start No. specification" (warning code: 092EH) occurs and mark detection for the specified No. cannot be used.

[Pr.810] Mark detection signal link device bit specification

Set the bit No. that used in occasion when "13H: RWr (1 bit)" and "14H: RWw (1 bit)" had been set to "[Pr.808] Mark detection signal link device type".

When a value out of the range is set, the warning "Mark detection link device bit specification" (warning code: 092FH) occurs and mark detection for the specified No. cannot be used.

[Pr.811] Mark detection signal detection direction setting

Set the signal detection direction. Only the setting of b0 is effective.

0: Rising detection

1: Falling detection

Mark detection control data

k: Mark detection setting No. - 1

Setting item		Setting details/setting value	Default value	Buffer memory address
[Cd.800]	Number of mark detection clear request	Set "1" to execute "0" clear of number of mark detections. "0" is automatically set after completion by "0" clear of number of mark detections. 1: 0 clear of number of mark detections Fetch cycle: Operation cycle	0	54640+10k
[Cd.801]	Mark detection invalid flag	Set this flag to invalidate mark detection temporarily. 1: Mark detection: Invalid Others: Mark detection: Valid Fetch cycle: Operation cycle	0	54641+10k
[Cd.802]	Latch data range change request	Request the processing of latch data range change. Set the following value depending on the timing of updating the change value. 1: Change in the next Operation cycle of the requested 2: Change in the next DI input of the requested "0" is automatically set after the change is completed. Fetch cycle: Operation cycle or DI input	0	54642+10k

For labels, refer to the following.

☞ Page 447 Mark detection control data

[Cd.800] Number of mark detection clear request

Set "1" to execute "0" clear of "[Md.800] Number of mark detection". "0" is automatically set after completion by "0" clear of "[Md.800] Number of mark detection".

[Cd.801] Mark detection invalid flag

Set "1" to invalidate mark detection temporarily. The mark detection signal during invalidity is ignored.

[Cd.802] Latch data range change request

Request the processing of latch data range change. Set the following value depending on the timing of updating the change value.

1: Change in the next Operation cycle of the requested

2: Change in the next DI input of the requested

- "0" is automatically set after receiving the latch data range change request. (It indicates that the latch data range change is completed.)
- "[Pr.805] Latch data range upper limit value" and "[Pr.806] Latch data range lower limit value" at latch data range change request are used as the change value.
- Restrictions according to the type of latch data range change request are shown below.

○: Possible, ×: Not possible

Types of change request	[Cd.801] Mark detection invalid flag	Changing possibility
1: Change in the next Operation cycle of the requested	1: Mark detection: Invalid	○
	Other than 1: Mark detection: Valid	
2: Change in the next DI input of the requested	1: Mark detection: Invalid	×
	Other than 1: Mark detection: Valid	○

Mark detection monitor data

k: Mark detection setting No. - 1

Storage item		Storage details/storage value	Buffer memory address
[Md.800]	Number of mark detection	The number of mark detections is stored. "0" clear is executed at power supply ON. Continuous detection mode: 0 to 65535 (Ring counter) Specified number of detection mode: 0 to 32 Ring buffer mode: 0 to (number of buffers - 1) Refresh cycle: At mark detection	54960+80k
[Md.801]	Mark detection data storage area 1 ⋮ Mark detection data storage area 32	The latch data at mark detection is stored. Data for up to 32 times are stored in the specified number of detection mode. Data are stored as a ring buffer for number of detections in the ring buffer mode. -2147483648 to 2147483647 Refresh cycle: At mark detection	54962+80k 54963+80k ⋮ 55024+80k 55025+80k
[Md.802]	Mark detection signal monitor	The state (ON/OFF) of the mark detection signal is stored. 0: Mark detection signal OFF 1: Mark detection signal ON Refresh cycle: Operation cycle	54961+80k

For labels, refer to the following.

☞ Page 447 Mark detection monitor data

[Md.800] Number of mark detection

The counter value is incremented by 1 at mark detection. Preset "0" clear in "[Cd.800] Number of mark detection clear request" to execute the mark detection in specified number of detections mode or ring buffer mode.

[Md.801] Mark detection data storage area (1 to 32)

The latch data at mark detection is stored. Data for up to 32 times can be stored in the specified number of detection mode or ring buffer mode.

[Md.802] Mark detection signal monitor

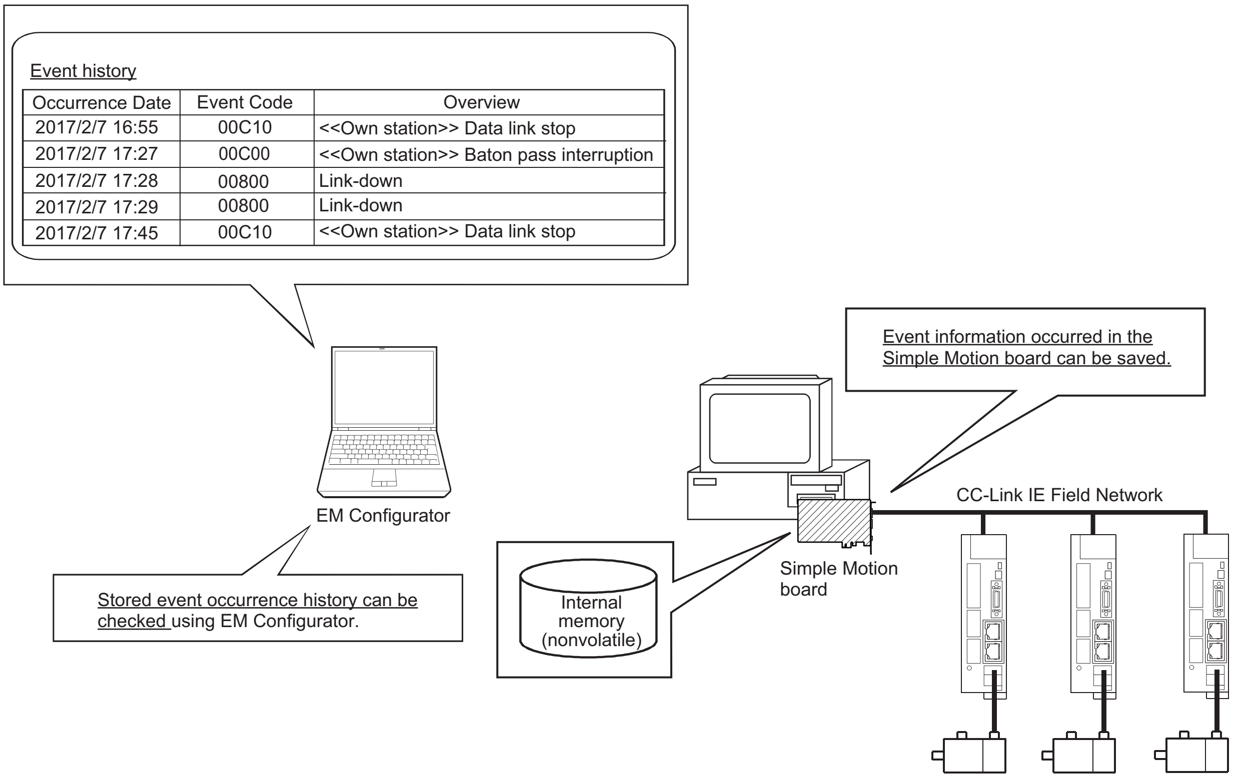
The state (ON/OFF) of the mark detection signal is stored.

Precautions

- When the data of "[Pr.802] Mark detection data type" or "[Pr.803] Mark detection data axis No." is selected incorrectly, the incorrect latch data is stored. For the data of "[Pr.802] Mark detection data type", set the item No. instead of specifying the buffer memory No. directly.
- When "9: Current value per cycle after main shaft gear" or "10: Current value per cycle after auxiliary shaft gear" is set to "[Pr.802] Mark detection data type" and the mark detection is executed right after the cam axis length per cycle is changed during synchronous control, the data before the cam axis length per cycle is changed may be latched. At the time, the latch data is calculated based on the executing cam axis length per cycle. Therefore, the value different from the actual output monitor data may be latched.
- The mark detection function of the Simple Motion board is not linked to the touch probe function of the servo amplifier. To use the touch probe function, access the related object of the touch probe using the servo cyclic transmission function or the servo transient transmission function.

9.10 Event History Function

The "event history function" is used to save the error information and the operation for the board as an event in the internal memory (nonvolatile) of the Simple Motion board. The saved event information can be displayed with EM Configurator and the occurrence history can be checked in chronological order. The detail information of the error also can be checked by referring to "Optional information" in event history.



Event occurred in the Simple Motion board

The items saved in the event history are shown in the table below.

For events related to the CC-Link IE Field Network, refer to the following.

📖Simple Motion Board User's Manual (Network)

Event type	Category	Details	Event item	Event code
System	Error	An error is detected by the Simple Motion board.	Major error	03C00 to 03FFF
			Moderate error	02000 to 03BFF
			Minor error	01000 to 01FFF
	Warning	A warning is detected by the Simple Motion board.	Warning	00800 to 00FFF
	Information	The event shown on the right column is detected by the Simple Motion board.	Home position return request ON	00000 to 007FF
Security	Error	None	None	—
	Warning	None	None	—
	Information	None	None	—
Operation	Error	None	None	—
	Warning	None	None	—
	Information	The operation shown on the right column by an user is detected by the Simple Motion board.	Module initialization (Parameter initialization)	20010
			Module backup (Execution data backup)	20011
			Online module change	20030

Detailed information of error/warning event

The items displayed in the detailed information, which vary depending on each error category, are configured by the items shown in the table below.

Error category	Detailed information 1	Detailed information 2	Detailed information 3
H/W error	—	—	—
Positioning control in common Home position return Absolute position restoration Manual control Positioning operation Block start data Positioning data Speed-torque control Cam data operation Direct control	Axis information • Axis in which an event occurred*3 • Axis operation status • Start No.*6 • Data No. in which an event occurred*6 • Factor axis • Block start Point No. at start*6 • Block start Point No. at occurrence*6 • Data by each error	Current value • Feed current value • Actual current value • Feedrate • Unit	Signal • User program READY [Y0] • All axis servo ON [Y1] • BUSY • External input signal ([Md.30]) • Servo status 1 • Servo status 2 • Servo status 3
Synchronous control (Input axis)	Axis information • Axis in which an event occurred (For a synchronous encoder axis, 800 + Axis No.) • Axis operation status (For a synchronous encoder axis, always 0) • Data by each error	—	—
Synchronous control (Output axis)	Axis information • Axis in which an event occurred • Axis operation status • Cam data No. when an event occurred • Data by each error	Current value • Feed current value • Unit	—
Servo amplifier	Axis information • Axis in which an event occurred • Axis operation status • Start No.*1*6 • Data No. in which an event occurred*1*6 • Block start Point No. at start*6 • Block start Point No. at occurrence*6 • Connected device • Servo alarm • Data by each error	Current value • Feed current value • Actual current value • Unit • Motor speed (0.01 r/min)*4 • Motor current value (0.1%)	Signal • Servo status 1 • Servo status 2 • Servo status 3
I/F • Hold error • Flash ROM error • CPU module error • PCI Express link-down	System information • Number of write accesses to flash ROM • Data by each error	—	—
Parameter setting range error • Common parameter • Basic parameter • Detailed parameter • Home position return parameter • Servo parameter • Interrupt setting parameter • Direct control setting parameter	Axis information • Axis in which an event occurred*2 • Data by each error	Setting value • Parameter 1 • Setting value 1 • Parameter 2 • Setting value 2 Displays the number of parameters in which an error occurred.	Setting value • Parameter 3 • Setting value 3 • Parameter 4 • Setting value 4 Displays the number of parameters in which an error occurred.
Driver home position return	Axis information • Axis in which an event occurred • Operation alarm • Absolute position detection system • Rotation direction selection	Signal • External input signal ([Md.30]) • Servo status 1 • Servo status 2 • Servo status 7 • Home position return status*5	—
SLMP communication	Axis information • Axis in which an event occurred • Request object Index • Request object SubIndex • Abort Code	—	—

Error category	Detailed information 1	Detailed information 2	Detailed information 3
Servo amplifier connection	Axis information • Axis in which an event occurred • Error causes	—	—

*1 Output only at positioning control. Otherwise, "-" is output.
At the time other than the positioning control (during home position return or JOG operation, etc.), judge the timing of when an error occurred by the axis operation status.

*2 For common parameters, an axis in which an event occurred is set to "Axis 1".

*3 For an error code which is independent of an axis, the information for an axis in which an event occurred is not displayed.
(For an error code which is independent of an axis, refer to the following.
☞ Page 606 TROUBLESHOOTING)

*4 The unit is mm/s at a linear servo motor use.

*5 Home position return status (Statusword: b10, b12, b13)
The home position return status is displayed based on the bit values of Statusword.

Statusword bit value	Home position return status
b13 = 0, b12 = 0, b10 = 0	Homing procedure is in progress
b13 = 0, b12 = 0, b10 = 1	Homing procedure is interrupted or not started
b13 = 0, b12 = 1, b10 = 0	Homing is attained, but target is not reached
b13 = 0, b12 = 1, b10 = 1	Homing procedure is completed successfully
b13 = 1, b12 = 0, b10 = 0	Homing error occurred, velocity is not 0
b13 = 1, b12 = 0, b10 = 1	Homing error occurred, velocity is 0

*6 The following table shows the display of the start No., data No. in which an event occurred, block start point No. at start, and block start point No. at occurrence.

Details of start (Positioning start No.)		Start No.	Occurred data No.	Point No. at block start	No. at block start occurrence
Positioning start (1 to 600)	At start (Analyzing)	Started positioning No. (1 to 600)	← (Same as start No.)*1	Not displayed	
	Operating		Data No. in which an error occurred (1 to 600)		
Block start (7000 to 7004)	At start (Analyzing)	Started block start No. (7000 to 7004)	Start data No. of point No. at block start (1 to 600)*1	Started block start point No. (1 to 50)	← (Same as point No. at block start)
	Operating		Data No. in which an error occurred (1 to 600)	Started block start point No. (1 to 50)	Block start point No. in which an error occurred (1 to 50)

Details of start (Positioning start No.)		Start No.	Occurred data No.	Point No. at block start	No. at block start occurrence
Home position return (9001)	At start (Analyzing)	9001	Not displayed	Not displayed	
	Operating				
Fast home position return (9002)	At start (Analyzing)	9002			
	Operating				
Current value changing (9003)	At start (Analyzing)	9003			
	Operating				
Multiple axes simultaneous start (9004)	At start (Analyzing)	9004	Data No. at start (1 to 600)*1		
	Operating		Data No. in which an error occurred (1 to 600)		
JOG operation	At start (Analyzing)	9010	Not displayed		
	Operating				
Manual pulse generator operation	At start (Analyzing)	9011			
	Operating				
Speed-torque control	Mode switching	9030 to 9042			
	Operating				
Positioning start No. outside the setting range		Setting value out of the range			
Test mode JOG operation	At start (Analyzing)	The number of operation axes 1 axis: 1 2 to 4 axes: 9004	1		
	Operating				
Test mode Current value changing		The number of operation axes 1 axis: 1 2 to 4 axes: 9004	1		
Test mode Positioning operation	At start (Analyzing)	The number of operation axes 1 axis: 1 2 to 4 axes: 9004	1		
	Operating				
Direct control	At start	9050	Not displayed		
	Operating				
	At stop	9051			

*1 At start (during analyzing), "0" is displayed when the error processing is executed before fetching the start data No. from the buffer memory.
When a value outside the setting range is set, a setting value outside the range is displayed.

Detailed information of event

The items displayed in the detailed information, which vary depending on each operation, are configured by the items shown in the table below.

System event details	Optional information 1	Optional information 2	Optional information 3
Home position return request ON	■System information • Axis in which an event occurred	■System information • The cause of home position return request ON	—

Operation event details	Optional information 1	Optional information 2	Optional information 3
Parameter initialization	■System information • Flash ROM write count index value*2	—	—
Execution data backup	■System information • Flash ROM write count index value*2	—	—
Writing an object with servo transient transmission*1	■System information • Axis No. which issued servo transient transmission	■System information • Object index • Object subindex • Object size	■System information • SDO abort code

*1 When continuous writing is requested, the event is stored only at the first communication.

*2 The life of the flash ROM is indicated by the flash ROM write count index value and the flash ROM can be written until the flash ROM write count index value reaches 100,000. However, the system performs the process to be longer of the life of the flash ROM, so that the flash ROM write count index value differs from the actual write counts.
The operation of the flash ROM is tested prior to shipping, so that the initial value of the flash ROM write count index value is not set to "0".

Point

If the flash ROM write count index value exceeds 100,000, it is required to exchange the Simple Motion board because the following symptoms may occur.

- Decrease of the writing speed to the flash ROM
- Writing impossible to the flash ROM

If the flash ROM write count index value exceeds 100,000, it is registered to event history.

Saving of event history

The Simple Motion board saves the event history in the internal memory (nonvolatile). Up to 1024 of the event history can be saved. When an event occurs, the event history is overwritten in chronological order. If more than 1024 events occur, the event history is overwritten from the 1st event again.

Event history initialization

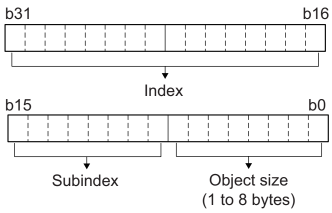
Execute the initialization using the event history" function of EM Configurator.

9.11 Servo Cyclic Transmission Function

The "servo cyclic transmission function" reads and writes CiA402 objects of a slave device with cyclic transmission. The cyclic transmission is appropriate for communication of fixed cycle data.
For the CiA402 objects that can be read and written with the cyclic transmission, refer to the manual of the slave device.
With the servo cyclic transmission, up to four points can be set per axis.

Control details

The following shows the parameters and data used in the "servo cyclic transmission function".
The data to be sent with the settings of "[Pr.500] Optional send PDO 1" to "[Pr.503] Optional send PDO 4" is set with "[Cd.170] Optional send PDO data 1" to "[Cd.173] Optional send PDO data 4". (Up to 16 bytes of data can be sent in total.)
The data received with the settings of "[Pr.506] Optional receive PDO 1" to "[Pr.509] Optional receive PDO 4" can be monitored with "[Md.170] Optional receive PDO data 1" to "[Md.173] Optional receive PDO data 4". (Up to 16 bytes of data can be received in total.)
n: Axis No. - 1

Setting item		Setting details/setting value	Initial value	Buffer memory address
[Pr.500]	Optional send PDO 1	 • Set an object to be sent (written) and received (read). • When the index and subindex are "0", the setting is invalid. • When the object size is out of the range, the setting is regarded as "4". Example) To specify an INTEGER32 object (4 bytes) with object index "2088H" and subindex "00H", specify "20880004H". Fetch cycle: Power supply ON	4H	460000+256n 460001+256n
[Pr.501]	Optional send PDO 2		4H	460002+256n 460003+256n
[Pr.502]	Optional send PDO 3		4H	460004+256n 460005+256n
[Pr.503]	Optional send PDO 4		4H	460006+256n 460007+256n
[Pr.506]	Optional receive PDO 1		4H	460012+256n 460013+256n
[Pr.507]	Optional receive PDO 2		4H	460014+256n 460015+256n
[Pr.508]	Optional receive PDO 3		4H	460016+256n 460017+256n
[Pr.509]	Optional receive PDO 4		4H	460018+256n 460019+256n

For labels, refer to the following.
☞ Page 449 Servo object specification parameters

Point

- Objects read and written with the servo cyclic transmission are registered in the slave devices at communication initialization that is executed after the power supply of the Simple Motion board is turned ON or the remote RESET is executed.
- When the object size exceeds 4 bytes, use any of the following parameters.
  "[Pr.500] Optional send PDO 1" (Set "0" for "[Pr.501] Optional send PDO 2".)
  "[Pr.502] Optional send PDO 3" (Set "0" for "[Pr.503] Optional send PDO 4".)
  "[Pr.506] Optional receive PDO 1" (Set "0 for "[Pr.507] Optional receive PDO 2".)
  "[Pr.508] Optional receive PDO 3" (Set "0 for "[Pr.509] Optional receive PDO 4".)
  When the above setting is not configured, the warning "Servo cyclic transmission setting warning" (warning code: 0933H) occurs after the power supply of the Simple Motion board is turned ON or the remote RESET is executed and the servo cyclic transmission is not executed. ("[Cd.170] Optional receive PDO data 1" to "[Cd.173] Optional send PDO data 4" are not sent. "0" is stored in "[Md.170] Optional receive PDO data 1" to "[Md.173] Optional receive PDO data 4".)
- For the index, subindex, and object size that can be specified, refer to the manual of the slave device. When an object not supported by the slave device is specified, the error "SLMP communication error" (error code: 1CB2H) occurs at cyclic transmission start and the connection to the slave device cannot be executed.

■Axis control data

n: Axis No. - 1

Setting item		Setting details/setting value	Initial value	Buffer memory address
[Cd.170]	Optional send PDO data 1	• Sends the specified data to the objects set in "[Pr.500] Optional send PDO 1" to "[Pr.503] Optional send PDO 4" with each operation cycle. • Stores 0 when not set. Fetch cycle: Cyclic cycle	0	534768+2048n 534769+2048n 534770+2048n 534771+2048n
[Cd.171]	Optional send PDO data 2		0	534772+2048n 534773+2048n 534774+2048n 534775+2048n
[Cd.172]	Optional send PDO data 3		0	534776+2048n 534777+2048n 534778+2048n 534779+2048n
[Cd.173]	Optional send PDO data 4		0	534780+2048n 534781+2048n 534782+2048n 534783+2048n

For labels, refer to the following.

☞ Page 448 Control data for slave device operation

■Axis monitor data

n: Axis No. - 1

Storage item		Storage details/Storage value	Initial value	Buffer memory address
[Md.170]	Optional receive PDO data 1	• Stores the data of the objects set in "[Pr.506] Optional receive PDO 1" to "[Pr.509] Optional receive PDO 4" with each operation cycle. • Stores 0 when not set. Fetch cycle: Cyclic cycle	0	468204+2048n 468205+2048n 468206+2048n 468207+2048n
[Md.171]	Optional receive PDO data 2		0	468208+2048n 468209+2048n 468210+2048n 468211+2048n
[Md.172]	Optional receive PDO data 3		0	468212+2048n 468213+2048n 468214+2048n 468215+2048n
[Md.173]	Optional receive PDO data 4		0	468216+2048n 468217+2048n 468218+2048n 468219+2048n

For labels, refer to the following.

☞ Page 448 Monitor data for slave device operation

Point

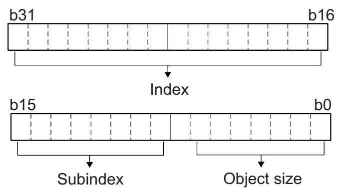
When the communication interrupted due to power supply OFF of the slave device or disconnection of a communication cable, "0" is stored in "[Md.170] Optional receive PDO data 1" to "[Md.173] Optional receive PDO data 4". However, the contents in remote registers (RWr, RWw) are held.

9.12 Servo Transient Transmission Function

The "servo transient transmission function" reads and writes CiA402 objects of a slave device with transient transmission. The transient transmission is appropriate for communication of the data that does not need to be read or written at a fixed cycle and the large data.
For the CiA402 objects that can be read and written with the transient transmission, refer to the manual of the slave device.
With the servo transient transmission, up to four points can be set per axis and the setting can be changed at any time.

Control details

The following shows the parameters and data used in the "servo transient transmission function".
n: Axis No. - 1

Setting item		Setting details/setting value	Initial value	Buffer memory address
[Pr.512]	Optional SDO 1	■Specify an object to which the servo transient transmission is executed.  At reading: Reads an object using SDO Upload of SLMP. "0 to 126" can be specified as the object size. "0" indicates the "default size" and "1 to 126" indicates the number of bytes of the object. When the object size is out of the range, the size is regarded as "0". At writing: Writes an object using the Download command of SLMP. "1 to 126" can be specified as the object size. When the object size is out of the range, the size is regarded as "4". Example) To specify an UNSIGNED32 object with object index "6099H" and subindex "02H", specify the following values. Reading: "60990200H" (default size) Writing: "60990204H" (size of 4 bytes) Fetch cycle: At servo transient request	0	460024+256n 460025+256n
[Pr.513]	Optional SDO 2		0	460026+256n 460027+256n
[Pr.514]	Optional SDO 3		0	460028+256n 460029+256n
[Pr.515]	Optional SDO 4		0	460030+256n 460031+256n

For labels, refer to the following.
☞ Page 449 Servo object specification parameters

Point

- The servo transient processing is a set of operations from a request send to a response reception. This operation is performed in the order of setting Nos.
- For the index, subindex, and object size that can be specified, refer to the manual of the slave device. When an object not supported by the slave device is specified, the processing is completed with an error.

■Axis control data

n: Axis No. - 1

Setting item		Setting details/setting value	Initial value	Buffer memory address
[Cd.160]	Command send request 1	Requests the servo transient transmission. • Changes to values being processed are not accepted. However, if "0: No request" is written while "2: Continuous read request" or "12: Continuous write request" is being processed, the continuous reading/writing operation is stopped after the transient processing being executed is completed. • The setting value is automatically cleared to "0" when the processing is completed. 1: Self read request 2: Continuous read request 11: Self write request 12: Continuous write request Others: No request Fetch cycle: Asynchronous	0	534796+2048n
[Cd.161]	Command send request 2		0	534797+2048n
[Cd.162]	Command send request 3		0	534798+2048n
[Cd.163]	Command send request 4		0	534799+2048n
[Cd.164]	Optional SDO transfer data 1	Stores data of up to 126 bytes (63 words). • When an object is read, a read value is stored when communication is normally completed. When an error occurs, the value is not updated. When the read data exceeds 126 bytes, the data of up to 126 bytes is stored. • To write an object, specify data to be written. Do not change the setting until the processing is completed. Fetch cycle: At command request	0	534800+2048n ⋮ 534862+2048n
[Cd.165]	Optional SDO transfer data 2		0	534864+2048n ⋮ 534926+2048n
[Cd.166]	Optional SDO transfer data 3		0	534928+2048n ⋮ 534990+2048n
[Cd.167]	Optional SDO transfer data 4		0	534992+2048n ⋮ 535054+2048n

For labels, refer to the following.

☞ Page 448 Control data for slave device operation

■Axis monitor data

n: Axis No. - 1

Storage item		Storage details/Storage value	Initial value	Buffer memory address
[Md.160]	Optional SDO transfer result 1	Stores a response code (SDO Abort code) of a slave device for the transient request. (For details of the code, refer to the manual of the slave device.) When a response code cannot be acquired because of a communication error or other causes, "0" is stored. Fetch cycle: At command request	0	468192+2048n 468193+2048n
[Md.161]	Optional SDO transfer result 2		0	468194+2048n 468195+2048n
[Md.162]	Optional SDO transfer result 3		0	468196+2048n 468197+2048n
[Md.163]	Optional SDO transfer result 4		0	468198+2048n 468199+2048n
[Md.164]	Optional SDO transfer status 1	Stores the processing status of the transient request. • b7 to 0: Response object size (byte) Stores the size of objects that the slave device has responded when the processing is completed. When the size of the responded objects exceeds 126 bytes, the value is fixed to 126 bytes. • b8: Communicating Turns ON during the transient transmission. • b9: Communication error detection Turns ON when an error is detected with the transient transmission. It remains ON until the transient transmission is normally completed. Error causes are as follows. - Normal error - Receiving an error response from a slave device (SDO Abort code) - The index, subindex, or size specified with "[Pr.512] Optional SDO 1" to "[Pr.515] Optional SDO 4" is incorrect. • b15: Data valid bit Turns ON when a read request is normally completed. Turns OFF when a read error is detected. Fetch cycle: At command request	0	468200+2048n
[Md.165]	Optional SDO transfer status 2		0	468201+2048n
[Md.166]	Optional SDO transfer status 3		0	468202+2048n
[Md.167]	Optional SDO transfer status 4		0	468203+2048n

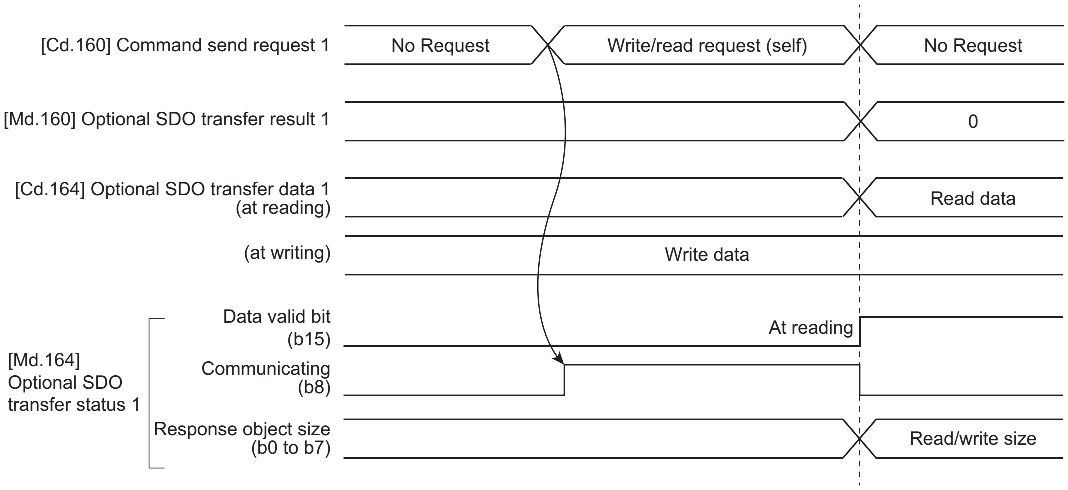
For labels, refer to the following.

☞ Page 448 Monitor data for slave device operation

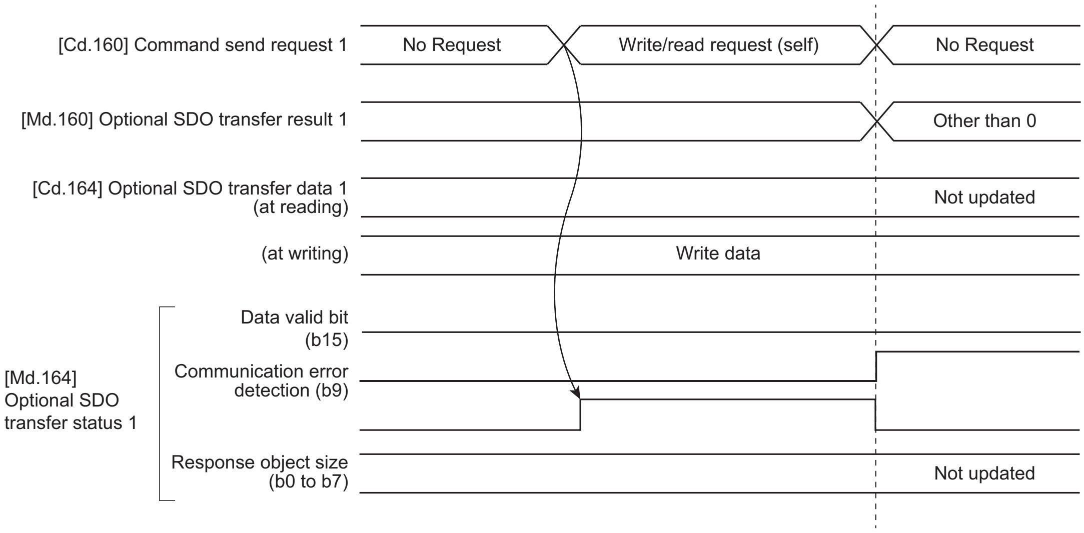
■Sending/receiving timing

The following shows sending/receiving timing of the servo transient transmission.

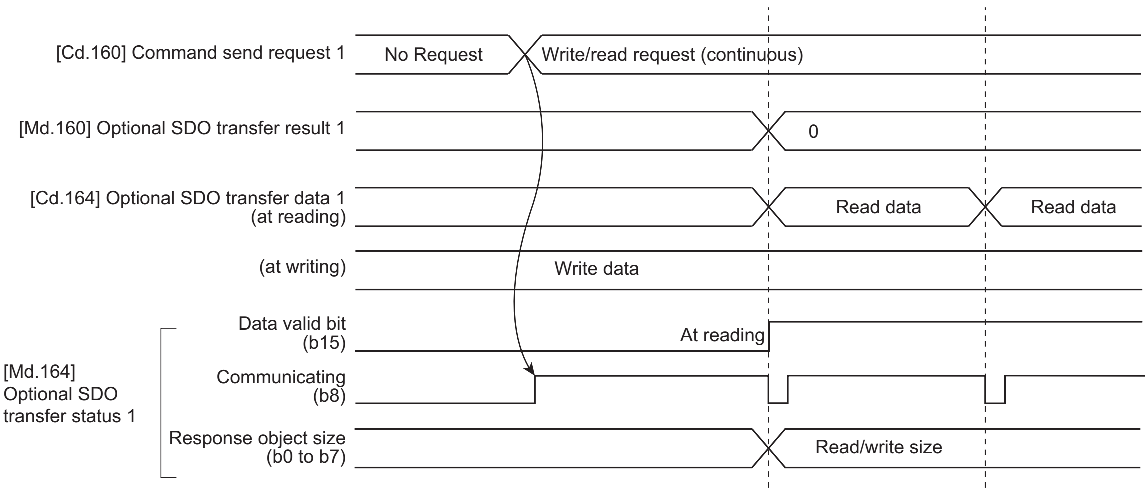
- Sending/receiving timing of self read/write (Normal operation)



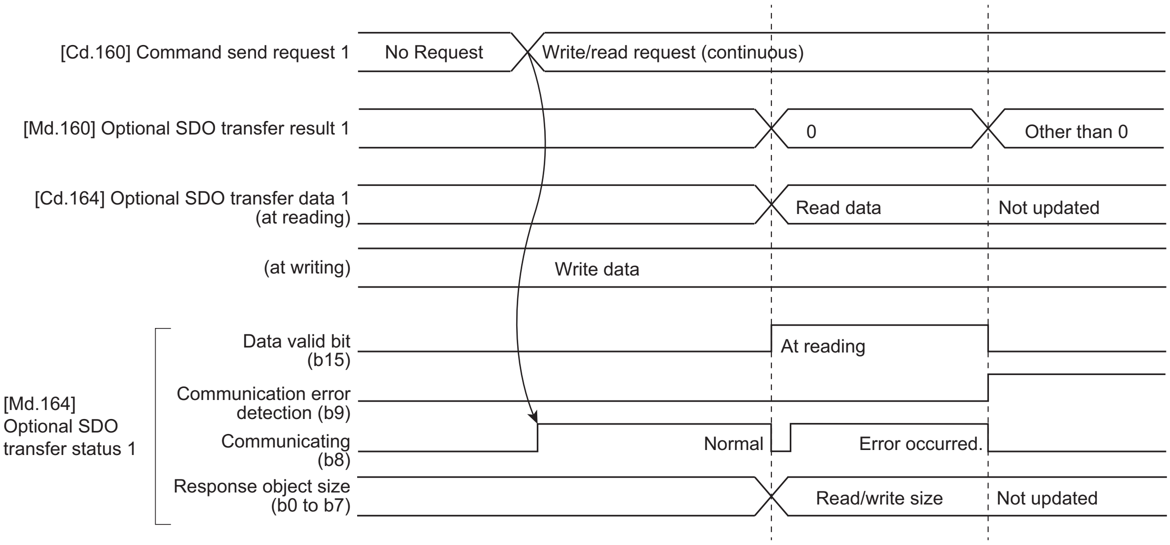
- Sending/receiving timing of self read/write (Operation failure)



- Sending/receiving timing of continuous read/write (Normal operation)



• Sending/receiving timing of continuous read/write (Operation failure)



Data transmission order

With the servo transient transmission, up to four points can be registered per axis and the transient transmission is executed one by one in order.

The processing performance of when transient send requests are executed for multiple axes at the same time depends on the network communication mode as follows.

Communication mode setting	Transmission order ("→" means one link scan.)
High-speed mode	Setting 1 (Axis 1) → ••• → Setting 4 (Axis 1) → Setting 1 (Axis 2) → ••• → Setting 4 (Axis 2) → ⋮ Setting 1 (Axis 16) → ••• → Setting 4 (Axis 16) → Setting 1 (axis 1) → •••

9.13 Test mode

The "test mode" is used to execute the test operation and adjustment of axes using EM Configurator. This mode can execute the test operation and adjustment for multiple axes simultaneously. Therefore, a system such as a tandem configuration can be started up smoothly.
The test mode request for the Simple Motion board is carried out by starting the test operation using EM Configurator.
When the test mode request is accepted correctly, the test display is displayed and each function of the test mode can be selected.
For details of the operation method of the test mode, refer to the "EM Configurator Help" of EM Configurator.

Point

To switch to the test mode, it is required that the user program READY signal [Y0] is turned ON once after the power supply of the Simple Motion board is turned OFF or the remote RESET is executed. Then, turn the user program READY signal [Y0] OFF.

List of specifications

The following shows the list of function specifications of the test mode.

Function	Operation
Operation axis selection	Select the axis to execute the test operation up to 4 axes.
Servo ON	Execute servo ON for the axis to execute the test operation. Execute the magnetic pole detection when the linear servo or direct drive motor is included in the selected operation axis.
Servo OFF	Execute servo OFF for the axis to execute the test operation.
JOG operation	Execute the JOG operation up to 4 axes simultaneously.*1
Home position return	Execute the home position return of the axis No. selected as the start axis.
Current value changing	Execute the current value changing up to 4 axes simultaneously.*1
Positioning operation	Execute the positioning operation up to 4 axes simultaneously.*1
Stop	Execute the stop request for the axis during the test operation.
Rapid stop	Execute the rapid stop request for the axis during the test operation.
Error reset	Execute the error clear request and reset the warning/error/servo alarm.
Software stroke limit check valid/invalid	Stroke limit check valid/invalid is can be selected when the software stroke limit is valid.
Hardware stroke limit check valid/invalid	Stroke limit check valid/invalid is can be selected when FLS or RLS signal setting is valid.*2

*1 If the operation axis selection is set to 2 to 4 axes, the operation starts at multiple axes simultaneous start (9004).
*2 For the MR-J4-GF, when the LSP/LSN signal of the servo amplifier is used for the stroke limit signal and stop process is executed on the servo amplifier side, hardware stroke limit check cannot be invalidated with this function. (Servo parameters need to be changed.)
For details, refer to the following.
☞ Page 241 Hardware stroke limit function

Precautions

When the JOG operation or the positioning operation from the test mode is started, "1" is stored in "[Md.44] Positioning data No. being executed". However, the positioning data No.1 of buffer memory is not used.

Differences from normal operation

The following shows differences between the normal operation and the operation during the test mode.

Item			During test mode	During normal operation
JOG operation	—		JOG operation is executed based on the setting values on the JOG operation display.*1	JOG operation is executed based on the setting values of the positioning parameters.
	Axis monitor data	[Md.44] Positioning data No. being executed	"1" is stored when the JOG operation is executed.	"0" is stored when the JOG operation is executed.
		[Md.46] Last executed positioning data No.		
		[Md.47] Positioning data being executed: Control method	"04h" is stored during forward JOG run and "05h" is stored during reverse JOG run.	"0" is stored duirng JOG operation.
	Event history	Data No. in which an event occurred	"1" is displayed.	Not displayed.
Current value changing			The current value changing is executed based on the setting values on the current value changing display.	[For a new current value using the positioning data] The current value changing is executed based on the setting values of "[Da.6] Positioning address/ movement amount". [For a new current value using the current value changing start No. (No.9003)] The current value changing is executed based on the setting values of "[Cd.9] New current value".
Positioning operation			Positioning operation is executed based on the setting values on the positioning operation display.*1	Positioning operation is executed based on the setting values of the positioning data.

*1 Refer to the following for the parameters used in JOG operation and positioning operation.
☞ Page 362 Parameters to be used during the test mode

Parameters to be used during the test mode

During the test mode, the test operation is executed using the parameters set on each test function display of EM Configurator.

■List of the parameters to be used during JOG operation

Parameter item	During test mode	During normal operation
JOG operation	The setting values on the JOG operation display	The value set in "[Cd.17] JOG speed"
Acceleration time constant		The value set in the positioning parameters
Deceleration time constant		
Rapid stop deceleration time constant		
S-curve ratio*1		The value set in "[Pr.34] Acceleration/deceleration process selection" and "[Pr.35] S-curve ratio"
Torque limit value		The value set in "[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value"
Stop process at error occurrence		The value set in "[Pr.37] Stop group 1 rapid stop selection", "[Pr.38] Stop group 2 rapid stop selection", "[Pr.39] Stop group 3 rapid stop selection"
Stroke limit valid/invalid setting		The software stroke limit upper/lower limit value set with the fixed parameter The FLS/RLS signal set with the external input signal parameters

*1 During the test mode operation, the operation differs depending on the S-curve ratio setting.
0%: Trapezoidal acceleration/deceleration, 1 to 100%: S-curve acceleration/deceleration

■List of the parameters to be used during positioning operation

Parameter item	During test mode	During normal operation
Movement amount	The setting values on the positioning operation display	The value set in the positioning data
Command speed		The value set in the positioning parameters
Acceleration time constant		
Deceleration time constant		
Rapid stop deceleration time constant		
S-curve ratio*1		The value set in "[Pr.34] Acceleration/deceleration process selection" and "[Pr.35] S-curve ratio"
Torque limit value		The value set in "[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value"
Stop process at error occurrence		The value set in "[Pr.37] Stop group 1 rapid stop selection", "[Pr.38] Stop group 2 rapid stop selection", "[Pr.39] Stop group 3 rapid stop selection"
Stroke limit valid/invalid setting		The software stroke limit upper/lower limit value set with the fixed parameter The FLS/RLS signal set with the external input signal parameters
Operation permission for incompletion of home position return		The operation setting for incompletion of home position return set in the home position return data

*1 During the test mode operation, the operation differs depending on the S-curve ratio setting.
0%: Trapezoidal acceleration/deceleration, 1 to 100%: S-curve acceleration/deceleration

Precautions

- Parameters not described above operate with the value set in the buffer memory before the shift to the test mode.
- The torque limit value cannot be changed during JOG/positioning operation that is started from the test mode.

Request of the shift to/cancel of the test mode

The data transmission process of parameters is executed when the shift to the test mode is requested.
Refer to the following for the parameters whose data is transferred.
☞ Page 584 (3) Valid after writing data
The operation cannot be shifted to the test mode in the following cases.

- When the user program READY signal [Y0] is ON
- When any of axes is in operation
- When a parameter error occurs during the shift to the test mode

When canceling the test mode, execute the cancel request after stopping all axes. The test mode cannot be canceled if any of axes is in operation.

Precautions

- When the data transmission process is executed, "b0: READY ON" is turned ON and "b1: Servo ON" is turned OFF in "[Md.108] Servo status1". (The servo amplifier LED indicates "C_".)
- When the cancel request of the test mode is executed, "b0: READY ON" ([Md.108] Servo status1) and "b1: Servo ON" ([Md.108] Servo status1) are turned ON/OFF following to the setting of all axis servo ON [Y1] and "[Cd.100] Servo OFF command".

Stop operation of the test mode operation axes

When the following stop causes occur for the test mode operation axes, the stop process is performed for the all axes in which the test mode is in operation.

When the test operation is executed for multiple axes, the stop process is performed for the test mode operation axes in which a stop command or stop cause does not occur even if a stop command or stop cause occurs for each test mode operation axis.

Stop cause	Stop process	
	Axis in which a stop cause occurs	Axis in which a stop cause does not occur
• "Forced stop input signal" OFF from an external device • User watchdog detected • PCI Express link-down detected	Immediate stop For the stop method of the servo amplifier, refer to each servo amplifier instruction manual.	
Servo READY OFF*1 • Servo amplifier power supply OFF • Servo alarm • Forced stop input to servo amplifier	Immediate stop For the stop method of the servo amplifier, refer to each servo amplifier instruction manual.	Deceleration stop/rapid stop Select with the "Stop process at error occurrence".
"All axes rapid stop request" from the test mode	Rapid stop	
Hardware stroke limit upper/lower limit error occurrence*1*2	Deceleration stop/rapid stop Select with the "Stop process at error occurrence".	
Error in test mode*3*4		
Axis error detection (Error other than stop group 1 or 2)*1		
"Deceleration stop requested" input from the test mode		
"Axis stop signal" ON from a user program*1		

*1 The stop process is not executed for the axes in which a stop cause does not occur during home position return.
*2 When the hardware stroke limit function is not used, the software stroke limit range check is not performed.
*3 If a stop cause occurs, the test mode is canceled.
*4 An error in test mode occurs when the personal computer cannot communicate with the Simple Motion board.

Precautions

When the test mode operation axis is servo OFF by servo OFF from the test display or the servo alarm occurrence, etc, "b0: READY ON" is turned ON and "b1: Servo ON" is turned OFF in "[Md.108] Servo status1". (The servo amplifier LED indicates "C_".)

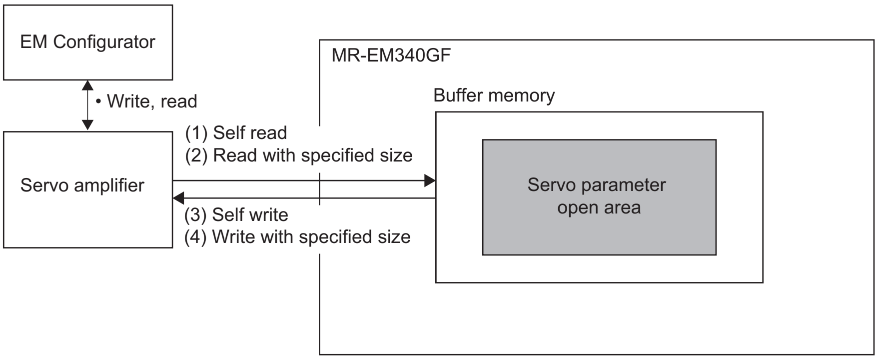
To execute the test operation again, execute servo ON of the test mode operation axis from the test display.

9.14 Servo Parameter Change Function

This function transfers servo parameters. Servo parameters, which are controlled by servo amplifiers, can be changed with a Simple Motion board.

Control details

The following shows the storage destination and the transfer timing of servo parameters.



Point

- When servo amplifier parameters are edited using EM Configurator, write to the servo amplifier using EM Configurator.
- With the Simple Motion board, the parameters in the servo amplifier can be read or written.

■(1) [Servo amplifier → Open area] Self read

1. Specify the object index of a parameter to be read for "[Cd.131] Parameter No.".

2. Set "100" in "[Cd.130] Servo parameter read/write request".

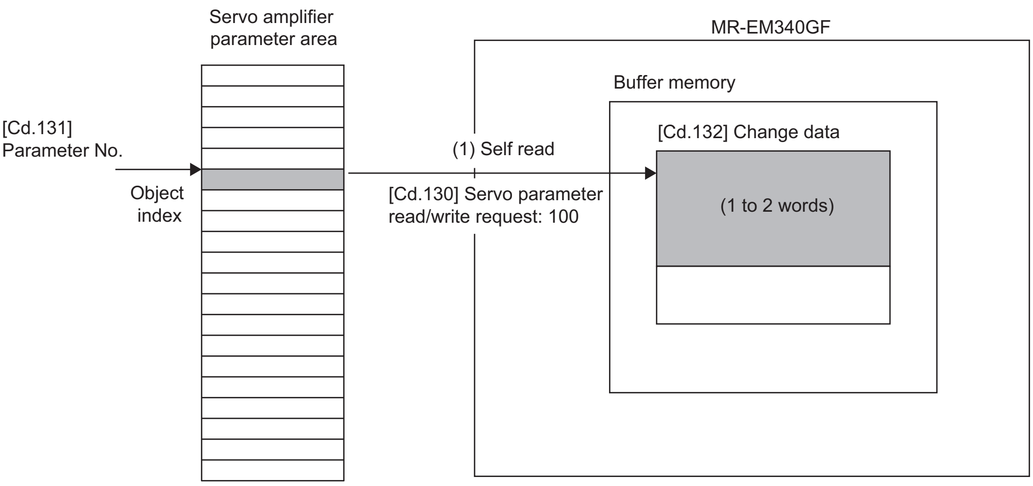
- The Simple Motion board reads the parameter using the SDO Upload command of SLMP.

3. Confirm that "0" is set in "[Cd.130] Servo parameter read/write request".

(Reading is completed.)

4. The read value is set in "[Cd.132] Change data".

- For the size of the data to be stored, refer to the servo amplifier instruction manual.



■(2) [Open area → Servo amplifier] Self write

1. Specify the object index of a parameter to be read for "[Cd.131] Parameter No.".

2. Set the data to be written for "[Cd.132] Change data".

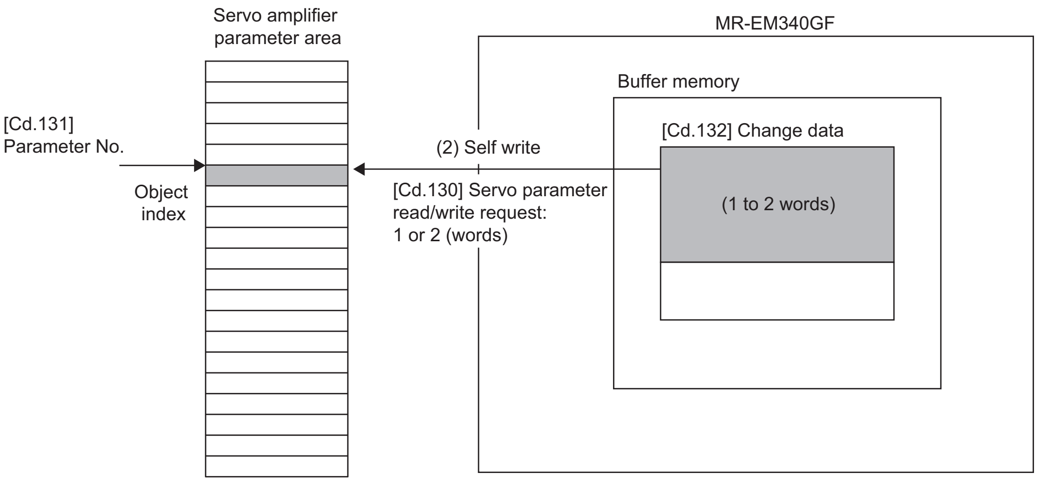
- For the size of the object to be written, refer to the servo amplifier instruction manual.

3. Set "1" or "2" (number of the words of the object) in "[Cd.130] Servo parameter read/write request".

- The Simple Motion board writes the parameter using the SDO Download command of SLMP.

4. Confirm that "0" is set in "[Cd.130] Servo parameter read/write request".

(Writing is completed.)



Point

To save the written parameter to the nonvolatile memory of the servo amplifier, operate the Store parameters (1010H) object using the servo transient transmission function. For details, refer to the servo amplifier instruction manual.

■(3) [Servo amplifier → Open area] Read with specified size

1. Specify the number of parameters to be read for "[Cd.121] Parameter size". Specify the start object of the parameters to be read for "[Cd.122] Parameter offset".

2. Set "1000" in "[Cd.120] Servo parameter operation request".

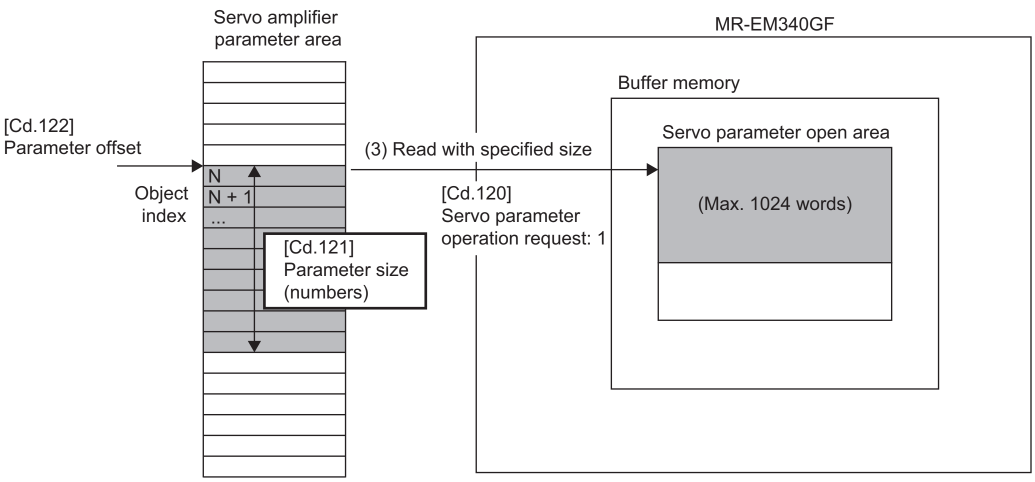
- The Simple Motion board reads the parameters using the SDO Upload command of SLMP.

3. Confirm that "0" is set in "[Cd.120] Servo parameter operation request".

(Reading is completed.)

4. The read value is set in "[Cd.125] Request data".

- The arrangement of the data to be stored in the buffer memory depends on the object size. For the object size of the data to be read, refer to the servo amplifier instruction manual.



■(4) [Open area → Servo amplifier] Write with specified size

1. Specify the number of parameters to be written and the size (number of bytes) per object for "[Cd.121] Parameter size". Specify the start object of the parameters to be written for "[Cd.122] Parameter offset".

2. Set the data to be written for "[Cd.125] Request data".

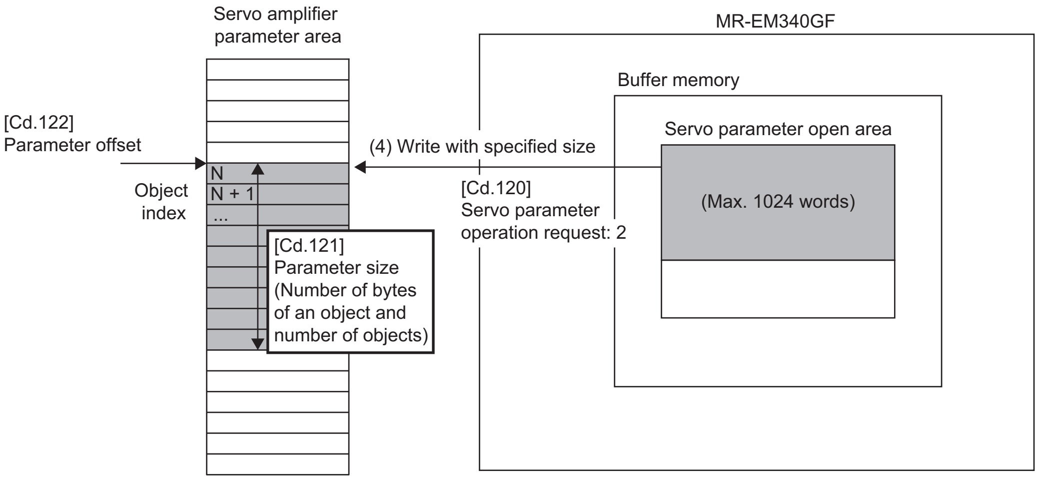
- The arrangement of the data to be stored in the buffer memory depends on the object size. For the object size of the data to be written, refer to the servo amplifier instruction manual.

3. Set "1000" in "[Cd.120] Servo parameter operation request".

- The Simple Motion board writes the parameters using the SDO Download command of SLMP.

4. Check that "0" is set in "[Cd.120] Servo parameter operation request".

(Writing is completed.)



Point

To save the written parameters to the nonvolatile memory of the servo amplifier, operate the Store parameters (1010H) object using the servo transient transmission function. For details, refer to the servo amplifier instruction manual.

Restrictions

■When "[Cd.130] Servo parameter read/write request" is used

- When a request is sent in the following status, "3: Error" is stored in "[Cd.130] Servo parameter read/write request".

- Communication with the servo amplifier is not established or a communication error occurs.
- The servo amplifier does not support the SLMP command.
- An error response is received from the servo amplifier.

- Even though the value of "[Cd.130] Servo parameter read/write request" is changed during a servo parameter transmission, the change is not accepted. Change the value of "[Cd.130] Servo parameter read/write request" after it is set to "0".
- The maximum size of the parameter area that can be transferred is 2 words per axis.

■When "[Cd.120] Servo parameter operation request" is used

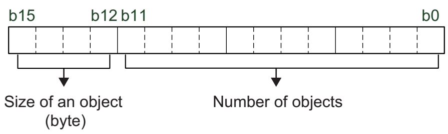
- When a request is sent in the following status, "-1: Operation error" is stored in "[Cd.120] Servo parameter operation request".

- Communication with the servo amplifier is not established or a communication error occurs.
- "[Cd.121] Parameter size" is outside the range.
- The servo amplifier does not support the SLMP command.
- An error response is received from the servo amplifier.

- Even though the value of "[Cd.120] Servo parameter operation request" is changed during a servo parameter transmission, the change is not accepted. Change the value of "[Cd.120] Servo parameter operation request" after it is set to "0".
- The maximum size of the parameter area that can be transferred is 1024 words per axis.
- When both "[Cd.130] Servo parameter read/write request" and "[Cd.120] Servo parameter operation request" are requested at the same time, "[Cd.130] Servo parameter read/write request" is accepted first.

Data list

n: Axis No. - 1

Setting item		Setting details/setting value	Initial value	Buffer memory address
[Cd.130]	Servo parameter read/write request	Set the read request or the write request of a servo parameter. 1: 1 word write request 2: 2 words write request 100: Read request Others: Not request After the processing is completed, "0" is automatically stored. (When the processing fails, "3" is stored.) Fetch cycle: Main cycle	0	4354+100n
[Cd.131]	Parameter No.	Set the object index of the servo parameter to be changed. Fetch cycle: At request	0000H	4355+100n
[Cd.132]	Change data	When the servo parameter is written, set the change value of the servo parameter. When the servo parameter is read, the read value of the servo parameter is stored. Fetch cycle: At request	0	4356+100n 4357+100n
[Cd.120]	Servo parameter operation request	0: No request 1000: Read with specified size (Servo amplifier → Open area) 1001: Write with specified size (Open area → Servo amplifier) After the processing is completed, "0" is automatically stored. (When the processing fails, "-1" is stored.) Fetch cycle: Main cycle	0	533728+2048n
[Cd.121]	Parameter size	Specify the parameter size (number of parameters) to be operated.  Specify the following values according to the setting value of "[Cd.120] Servo parameter operation request". [1000: Read with specified size] • Specify the number of the parameter objects to be read for "Number of objects". (Range: 1 to 1024) • Set "0" for "Size of an object". (Even if another value is set, it is ignored.) [1001: Write with specified size] • Specify the number of the parameter objects to be written for "Number of objects". (Range: 1 to 1024) • Set the number of bytes per object for "Size of an object". (Range: 1 to 15) The maximum size of the parameters to be transferred at once is 1024 words (2048 bytes). For example, the maximum value of "Number of objects" is "512" when "Size of an object" is "4 bytes". Fetch cycle: At request	0	533729+2048n
[Cd.122]	Parameter offset	Specify the start index of the servo parameter object to be operated. Fetch cycle: At request	0	533730+2048n
[Cd.125]	Request data	Servo parameter data to be operated Fetch cycle: At command request	0	533732+2048n ⋮ 534755+2048n

For labels, refer to the following.

☞ Page 437 Axis control data, ☞ Page 448 Control data for slave device operation

9.15 User watchdog function

This function checks errors of the host personal computer.

Control details

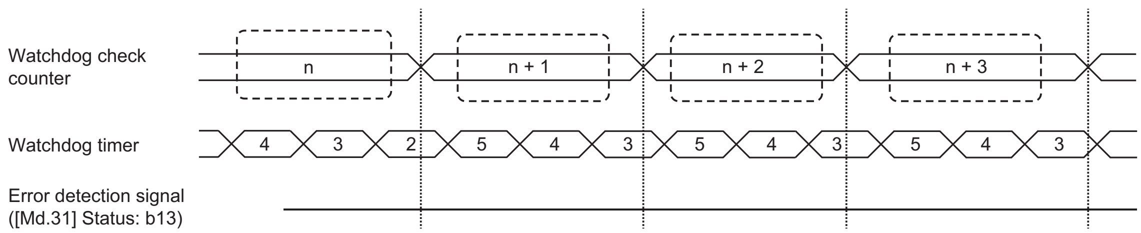
Update the value of "[Cd.1141] Watchdog check counter" on the buffer memory from a user program periodically. If the value of "[Cd.1141] Watchdog check counter" is not updated within the specified time ("[Md.1140] Watchdog timer" is set to "0"), it is regarded as the host personal computer error. The error "Watchdog timer error" (error code: 1E04H) occurs and all axes are stopped.

The Simple Motion board decrements "[Md.1140] Watchdog timer" per operation cycle until the value of "[Cd.1141] Watchdog check counter" is updated. After the value of "[Cd.1141] Watchdog check counter" is updated, the value is returned to the value set in "[Cd.1140] Watchdog timer start counter".

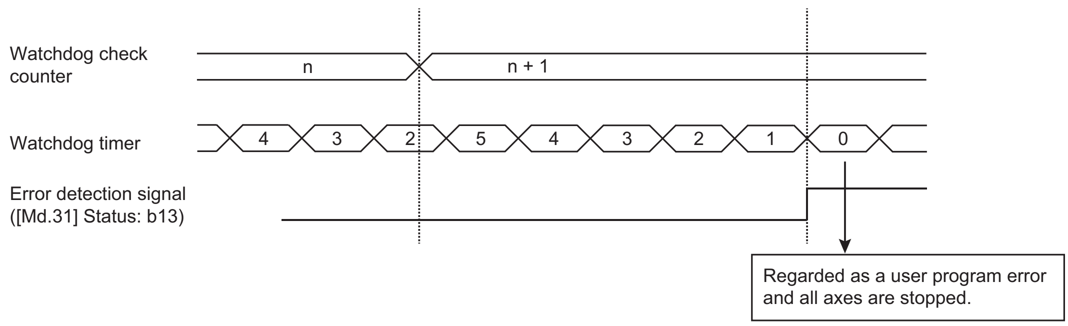
Point

- When "0" is set in "[Cd.1140] Watchdog timer start counter", the user watchdog is not executed.
- To clear the error "Watchdog timer error" (error code: 1E04H), update "[Cd.1141] Watchdog check counter" before error reset. Then, execute error reset.

■Normal operation



■Host personal computer error



User watchdog command

Setting item		Setting details/setting value	initial value	Buffer memory address
[Cd.1140]	Watchdog timer start counter	■Set with a decimal. Set the value at the start of countdown of the watchdog timer. 0 to 65535 Fetch cycle: Operation cycle	0	900000
[Cd.1141]	Watchdog check counter	■Set with a decimal. Set the value from the host personal computer periodically. 0 to 65535 Fetch cycle: Operation cycle	0	900002

For labels, refer to the following.

☞ Page 450 User watchdog control data

[Cd.1140] Watchdog timer start counter

Set the value at the start of countdown of the watchdog timer.

[Cd.1141] Watchdog check counter

Set the value from the host personal computer periodically.

When the watchdog timer is not updated before "0" is set, it is regarded as the host personal computer error and all axes are stopped.

User watchdog monitor

Storage item		Storage details/storage value	initial value	Buffer memory address
[Md.1140]	Watchdog timer	The current watchdog timer is output. 0 to 65535 Refresh cycle: At power supply ON or remote RESET	0	900004

For labels, refer to the following.

☞ Page 450 User watchdog monitor data

[Md.1140] Watchdog timer

The current watchdog timer is output.

Monitoring is carried out with a decimal display.

9.16 Remote operation

This function restarts the Simple Motion board using EM Configurator or API.

Remote RESET

The Simple Motion board can be reset.

Operation

When "1EA5H" is set in "[Cd.1180] Remote RESET start", the buffer memory status is cleared and the backed up execution data is opened. Also, all axes of the slave stations stop and return to the status before the communication starts.

Point

• When the remote RESET is executed, the CC-Link IE communication with the slave station is disconnected.

Operation method (EM Configurator)

Execute the following operation by the watch function.

1. Register "[Cd.1180] Remote RESET start" (U0\G6300100) to the watch function of EM Configurator and write "H1EA5".
2. Wait until "[Cd.1180] Remote RESET start" (U0\G6300100) is set to "0".
3. Wait until the synchronization flag [X1] (bit1 of U0\G6300120) is turned ON.

Point

When performing the Ethernet communication, click the "Start Watching" and restart the watch function of EM Configurator after confirming that 10 seconds have passed since "H1EA5" is set to "[Cd.1180] Remote RESET start". When using the monitor, start the monitor again.

Point

[API library]
To execute the remote RESET, use the MMC_Controller::ResetController method.

System control data

Setting item		Setting details/setting value	Initial value	Buffer memory address
[Cd.1180]	Remote RESET start	Set the remote RESET start. 1EA5H: Start the remote RESET. Other than above: Stop Fetch cycle: After the communication start	0000H	6300100 6300101

For labels, refer to the following.
☞ Page 450 Remote operation control data

Restriction

When the Simple Motion board is installed in the PCI Express slot connected with chipset supported for 6th Generation Intel® Core™ processors (such as Intel® Q170 and H170), do not access to the Simple Motion board via PCI Express using a user program or the monitor or watch function of EM Configurator during the remote RESET.

9.17 Time setting

This function notifies the start time to the Simple Motion board.

The Simple Motion board reflects the external time when the user program READY signal [Y0] is turned ON at the first time after the power supply ON or the remote RESET. The setting time is the number of seconds passed since 0000 hrs, January 1, 1970 in local time. In the case that an event occurs before "[Pr.1160] Startup time" is set or the case that "[Pr.1160] Startup time" is not set, the date and time is set to 0000 hrs, January 1, 2016.

Time setting

Set the following details to the buffer memory address used for the setting of date and time.

Setting item		Setting details/setting value	Initial value	Buffer memory address
[Pr.1160]	Startup time	Set the number of seconds passed since 0000 hrs, January 1, 1970 in local time. 0 to FFFFFFFFH Fetch cycle: At writing the network parameter	00000000H	6300180 : 6300183

For labels, refer to the following.

☞ Page 450 Time setting parameters

Point

[API library]

When the API library is used, perform the time setting automatically in the MMC_Controller::SetUserProgramReady method.

9.18 PCI Express connection

The following shows the specifications and buffer memory map of the Simple Motion board compatible with PCI Express.

PCI Express specifications

The following shows the list of specifications of PCI Express.

Item	Specifications
PCI Express	PCI Express 2.0
Shape [mm(inch)]	Short size (111.15(4.38) × 167.65(6.60))
Link width	×1
Transfer rate	5.0 Gbps
System voltage	+3.3 V

PCI Express memory map

The following shows the buffer memory map of the Simple Motion board.

PCI Express Base Address Register 0		Item	Buffer memory address
+00000000H ⋮ +0000FFFFH	64 kbytes	Not used	—
+00010000H ⋮ +00C142BFH	12228 kbytes	Buffer memory	0 ⋮ 6299999
+00C142C0H ⋮ +00FFFFFFH	4032 kbytes	Buffer memory	6300000 ⋮ 8355839

Point

[API library]

- To access to the Simple Motion board via PCI Express connection, use the MMC_DeviceDriver::Open method and open the device.
- To close the device, use the MMC_DeviceDriver::Close method.

PCI Express link-down detection function

This function detects the link-down of the PCI Express connection between the Simple Motion board and the host personal computer.

Operation at PCI Express link-down detection

When the status is changed to the PCI Express link-down from the PCI Express link-up, the error "PCI Express link-down" (error code: 30FCH) occurs and all axes stop. When "PCI Express link-down" occurs, check the mounting status of the Simple Motion board. If the status is not changed, the Simple Motion board failure might have occurred. Please consult your local Mitsubishi representative.

When the PCI Express link-down occurs, the error "PCI Express link-down" (error code: 30FCH) cannot be checked via PCI Express. Check the error via Ethernet.

PCI Express LED

The connection status of PCI Express can be checked by the PCI Express LED.

■PCI Express link-up

The PCI Express LED of display LEDs (system status) is turned ON (green).

■PCI Express link-down

The PCI Express LED of display LEDs (system status) is turned OFF and the ERR LED is turned ON (red).

9.19 Interrupt function

This function generates an interrupt to the user program when the interrupt factor is detected. The interrupt occurs under the conditions such as positioning complete or the current value, so that the event-driven programming can be performed. There are the following interrupt methods: event interrupt and operation cycle interrupt.

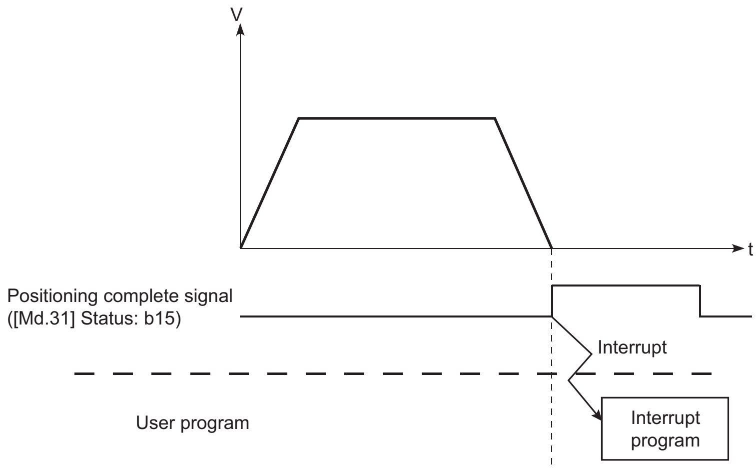
When setting a bit on the buffer memory for the interrupt condition

An interrupt occurs based on the bit status.

Ex.

When the positioning complete signal is set for the interrupt condition

Use "0A: Any one of the bits masked by the interrupt condition judge value 1 is turned ON" for the interrupt condition of "[Pr.1103] Interrupt judge condition". Then, it can confirm that the positioning has been completed by the interrupt function.



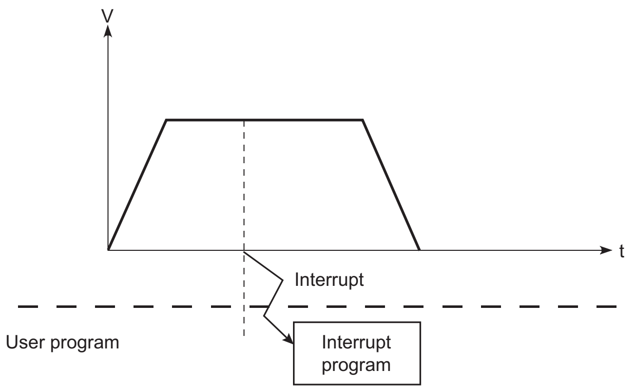
When setting data on the buffer memory for the interrupt condition

An interrupt occurs based on the data on the buffer memory.

Ex.

When the feed current value is set for the interrupt condition

Use "03: Larger than the interrupt condition judge value 1" for the interrupt condition of "[Pr.1103] Interrupt judge condition". Then, it can confirm that the specified position has been passed by the interrupt function.



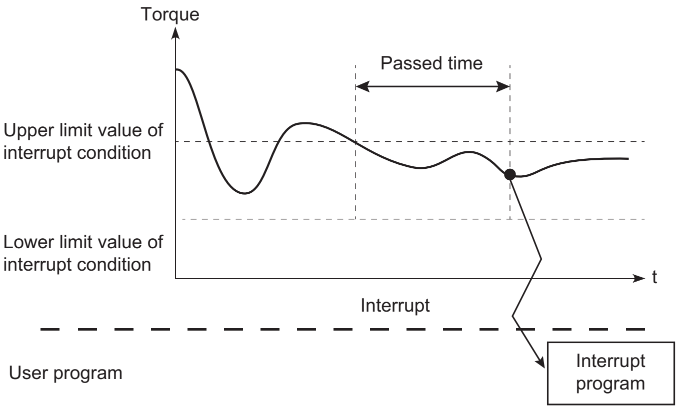
When the interrupt occurs after the fixed time passed

An interrupt occurs after the interrupt condition is satisfied and the fixed time is passed. If the condition is not satisfied after the condition is satisfied once, there are the following 2 methods: the method which performs the new count after the interrupt condition is satisfied again and the method which continues the count.

Ex.

When the interrupt occurs after the torque is converged in the interrupt condition range

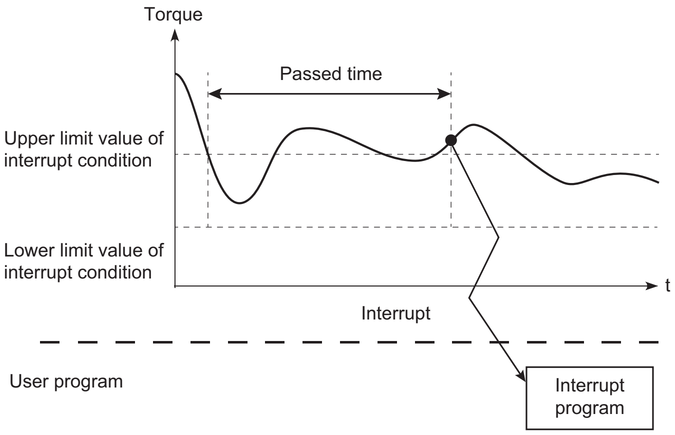
Use "0: Start the new count after the interrupt condition is satisfied again" as the condition for condition completion continuous of "[Pr.1103] Interrupt judge condition". Then, it can confirm that the torque has been converged by the torque control by the interrupt function.



Ex.

When the interrupt occurs after the torque moves to the interrupt condition range once and the fixed time is passed

Use "1: Continue the count" as the condition for condition completion continuous of "[Pr.1103] Interrupt judge condition". Then, it can confirm that the torque has been pressed for the fixed time by the torque control by the interrupt function.



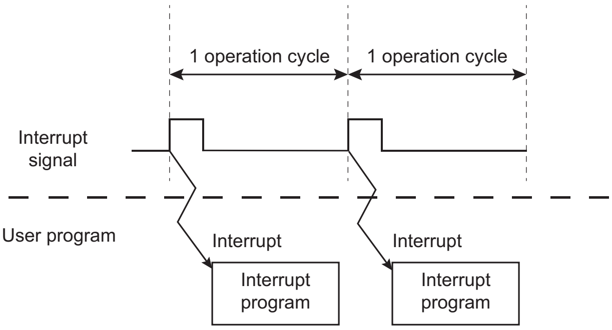
When using the operation cycle interrupt

An interrupt occurs every operation cycle.

Ex.

When using the interrupt in every operation cycle during the direct control

Set the operation cycle interrupt. Then, it can start the interrupt program in every operation cycle.



The following shows the performance specifications.

Item	Performance specifications
Number of interrupt signals	1
Number of interrupt factors	64 points
Interrupt data	Arbitrary buffer memory
Interrupt condition	Event interrupt (11 types) • Equal to the interrupt condition judge value 1 • Not equal to the interrupt condition judge value 1 • Larger than the interrupt condition judge value 1 • Smaller than the interrupt condition judge value 1 • Within the range of the interrupt condition judge value 1, 2 • Outside the range of the interrupt condition judge value 1, 2 • The value masked by the interrupt condition judge value 1 differs from the previous value • All bits masked by the interrupt condition judge value 1 is turned ON • All bits masked by the interrupt condition judge value 1 is turned OFF • Any one of the bits masked by the interrupt condition judge value 1 is turned ON • Any one of the bits masked by the interrupt condition judge value 1 is turned OFF Operation cycle interrupt

The following shows the supported status of the interrupt conditions and the interrupt data conditions.

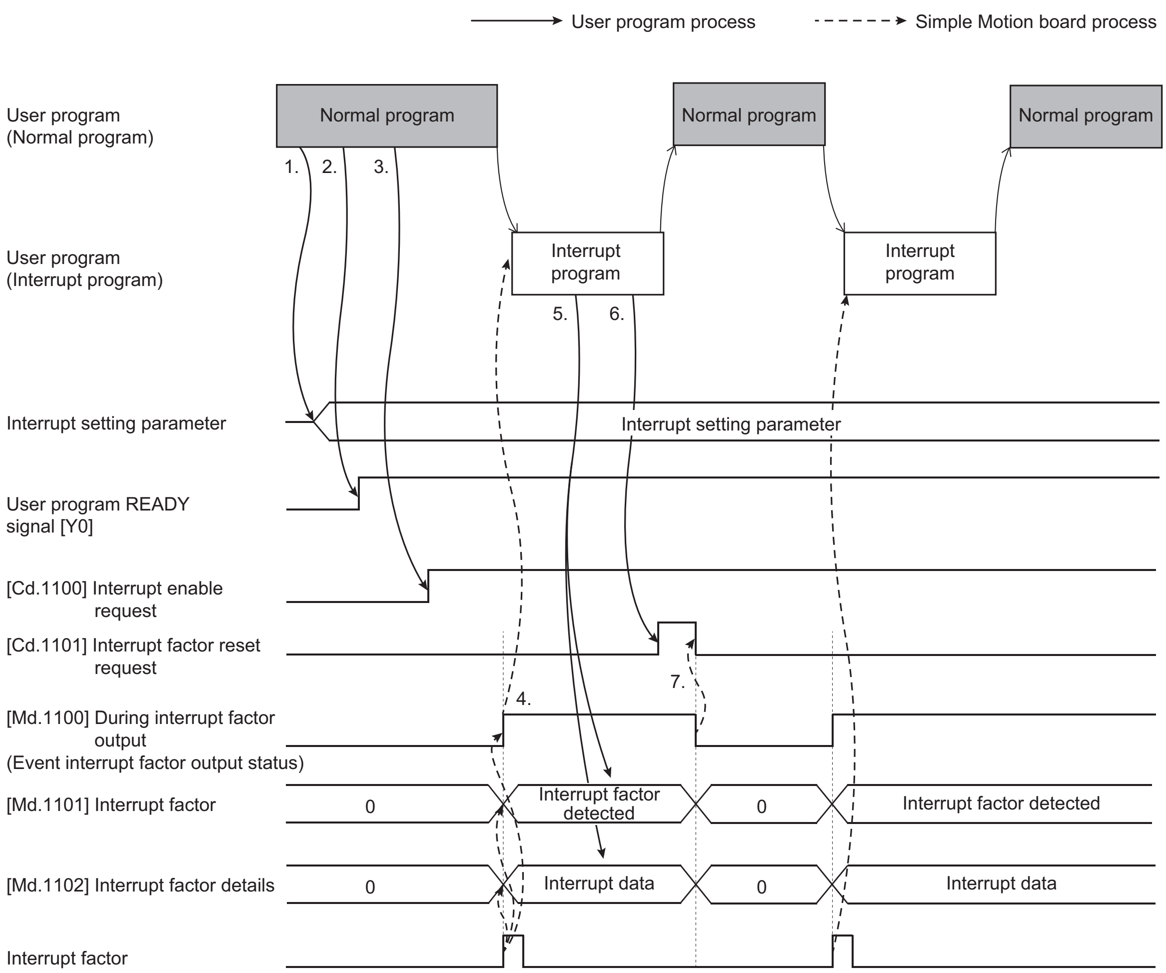
○: Setting possible, ×: Setting not possible

Interrupt condition	Interrupt data condition							
	Interrupt detection timing		Interrupt data size		Signed/Unsigned setting		Factor details output setting	
	Edge detection	Level detection	2 bytes	4 bytes	Signed	Unsigned	Start data	End data
Equal to the interrupt condition judge value 1	○	○	○	○	○	○	○	○
Not equal to the interrupt condition judge value 1	○	○	○	○	○	○	○	○
Larger than the interrupt condition judge value 1	○	○	○	○	○	○	○	○
Smaller than the interrupt condition judge value 1	○	○	○	○	○	○	○	○
Within the range of the interrupt condition judge value 1, 2	○	○	○	○	○	○	○	○
Outside the range of the interrupt condition judge value 1, 2	○	○	○	○	○	○	○	○
The value masked by the interrupt condition judge value 1 differs from the previous value	○	×	○	○	×	○	×	×
All bits masked by the interrupt condition judge value 1 is turned ON	○	○	○	○	×	○	×	×
All bits masked by the interrupt condition judge value 1 is turned OFF	○	○	○	○	×	○	×	×
Any one of the bits masked by the interrupt condition judge value 1 is turned ON	○	○	○	○	×	○	×	×
Any one of the bits masked by the interrupt condition judge value 1 is turned OFF	○	○	○	○	×	○	×	×

Event interrupt factor output

■Event interrupt operation chart

The following shows the operation chart of the interrupt function.



The following shows the procedure from the interrupt function setting to the factor output.

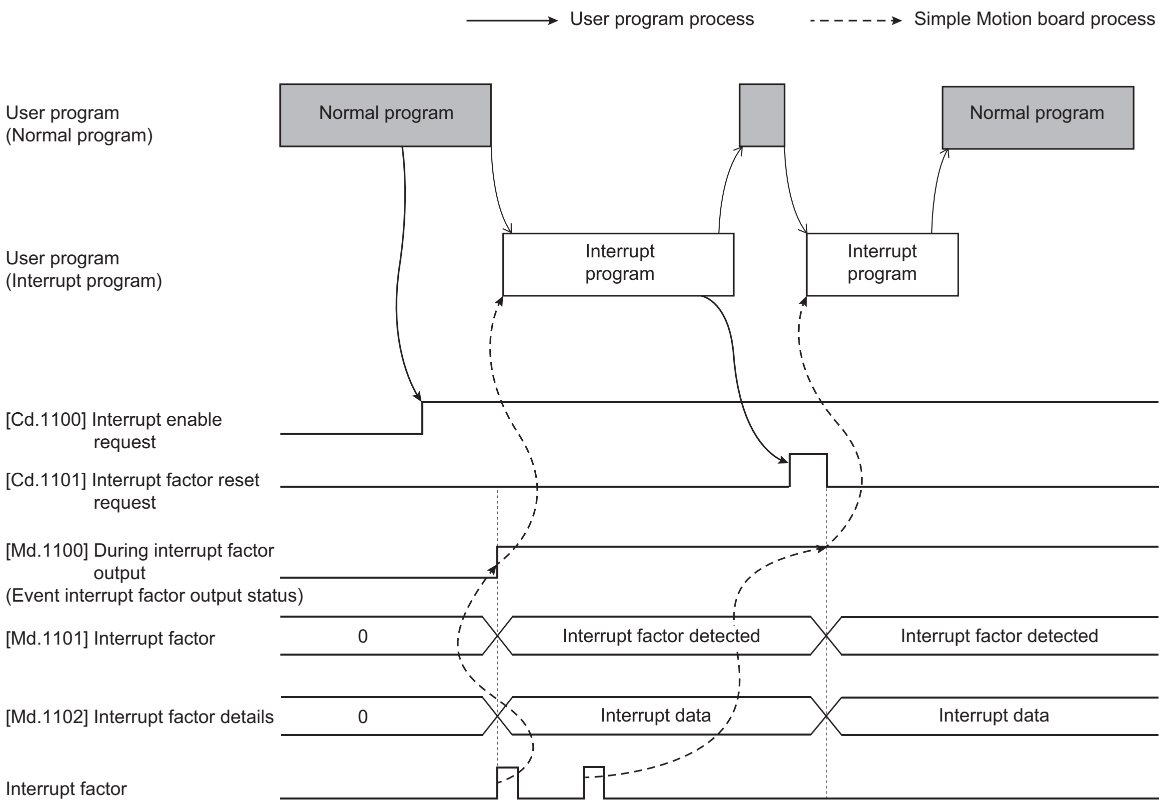
1. Set the interrupt setting parameters configured with "[Pr.1100] Interrupt mode selection", "[Pr.1101] Interrupt factor setting", "[Pr.1102] Interrupt data condition", "[Pr.1103] Interrupt judge condition", "[Pr.1104] Interrupt condition judge value 1", "[Pr.1105] Interrupt condition judge value 2", and "[Pr.1106] Time for condition completion".
2. Turn the user program READY signal [Y0] OFF → ON and enable the parameters.
3. Set "1: Enable" in "[Cd.1100] Interrupt enable request" and enable the interrupt.
4. After the Simple Motion board detects the interrupt factor, output "[Md.1100] During interrupt factor output", "[Md.1101] Interrupt factor", and "[Md.1102] Interrupt factor details". Then, the interrupt occurs.
5. After receiving the interrupt, confirm "[Md.1100] During interrupt factor output", "[Md.1101] Interrupt factor", and "[Md.1102] Interrupt factor details".

The following shows the procedure for clearing the interrupt which has occurred.

6. Set "1: Reset start" in "[Cd.1101] Interrupt factor reset request".
7. The Simple Motion board clears "[Md.1100] During interrupt factor output", "[Md.1101] Interrupt factor", and "[Md.1102] Interrupt factor details". Then, set "0: Reset stop" in "[Cd.1101] Interrupt factor reset request".

■Event interrupt factor hold operation chart

The following shows the operation chart when holding the interrupt factor and outputting the holding factor.



The following shows the procedure for outputting the interrupt factor which has been held.

1. Set "1: Reset start" in "[Cd.1101] Interrupt factor reset request".
2. The Simple Motion board updates "[Md.1100] During interrupt factor output", "[Md.1101] Interrupt factor", and "[Md.1102] Interrupt factor details". Then, set "0: Reset stop" in "[Cd.1101] Interrupt factor reset request".

Point

- When "[Cd.1100] Interrupt enable request" is set to "0: Disable", the interrupt is not output to the user program.
- When another interrupt condition is satisfied while the interrupt factor is output, the interrupt factor is held until the interrupt reset signal is turned ON → OFF.
- When the same interrupt condition is satisfied multiple times during holding, the value output to "[Md.1102] Interrupt factor details" differs depending on "[Pr.1103] Interrupt judge condition". When a value from "01H" to "07H" is set to the interrupt condition of "[Pr.1103] Interrupt judge condition", the first or last value where the condition is satisfied during holding is output according to the specification of the factor details output setting in "[Pr.1102] Interrupt data condition". When a value from "08H" to "0BH" is set to the interrupt condition of "[Pr.1103] Interrupt judge condition", the value of the all bits ON where the condition is satisfied during holding is output.
- When the illegal value is set in "[Pr.1100] Interrupt mode selection", the error "Outside interrupt mode selection setting range" (error code: 1815H) occurs.
- When the illegal value is set in "[Pr.1101] Interrupt factor setting", the error "Interrupt factor setting error" (error code: 1816H) occurs.
- When the illegal value is set in "[Pr.1102] Interrupt data condition", the error "Interrupt data condition setting error" (error code: 1817H) occurs.
- When the illegal value is set in "[Pr.1103] Interrupt judge condition", the error "Interrupt judge condition error" (error code: 1818H) occurs.
- When MSI (message signaled interrupt) is not available and "[Cd.1100] Interrupt enable request" is set to "1: Enable", the error "Interrupt not available" (error code: 1819H) occurs.
- When "[Cd.1100] Interrupt enable request" is set to "1: Enable" and the user program READY signal [Y0] is turned OFF, the interrupt function is disabled. When "[Cd.1100] Interrupt enable request" is set to "1: Enable" and the user program READY signal [Y0] is turned OFF → ON, the interrupt is enabled after the user program READY signal [Y0] is turned ON.
- When the event interrupt factor output status of "[Md.1100] During interrupt factor output" is set to "1: During interrupt factor output" and "[Cd.1100] Interrupt enable request" is set to "0: Disable", clear "[Md.1100] During interrupt factor output", "[Md.1101] Interrupt factor", "[Md.1102] Interrupt factor details", and the held interrupt factor.
- When the interrupt condition is changed as not satisfied → satisfied → not satisfied within a operation cycle, the interrupt does not occur.
- When "[Pr.1102] Interrupt data condition" is set to "_ _0_: 2 bytes" and "[Pr.1104] Interrupt condition judge value 1" or "[Pr.1105] Interrupt condition judge value 2" is set to the value larger than 2 bytes, the error "Interrupt condition judge value setting error" (error code: 181AH) occurs.
- When the interrupt is output multiple times while waiting for passing the time for condition completion, the value output to "[Md.1102] Interrupt factor details" differs depending on "[Pr.1103] Interrupt judge condition". When a value from "01H" to "07H" is set to the interrupt condition of "[Pr.1103] Interrupt judge condition", the value where the condition is satisfied for the first time is output. When a value from "08H" to "0BH" is set to the interrupt condition of "[Pr.1103] Interrupt judge condition", the value of the all bits ON where the condition is satisfied during the time for condition completion is output.

Operation example

The following shows the operation example for setting the command in-position flag ([Md.31] Status: b2) of the axis 1 in "[Pr.1101] Interrupt factor setting" and detecting the interrupt factor at the command in-position leading edge.

Setting item		Setting value	Setting details
[Pr.1100]	Interrupt mode selection	0	Event interrupt
[Pr.1101]	Interrupt factor setting	2417	Set the buffer memory address of the axis 1 "[Md.31] Status".
[Pr.1102]	Interrupt data condition	0100H	Interrupt detection timing: Edge detection Interrupt data: 2 bytes
[Pr.1103]	Interrupt judge condition	0008H	All bits masked by "[Pr.1104] Interrupt condition judge value 1" is turned ON
[Pr.1104]	Interrupt condition judge value 1	00000004H	b2 (Command in-position flag)
[Pr.1105]	Interrupt condition judge value 2	00000000H	Not used
[Pr.1106]	Time for condition completion	0000H	Not used

1. Set the above values in "[Pr.1100] Interrupt mode selection", "[Pr.1101] Interrupt factor setting", "[Pr.1102] Interrupt data condition", "[Pr.1103] Interrupt judge condition", and "[Pr.1104] Interrupt condition judge value 1".
2. Start the interrupt driver.
3. Turn the user program READY signal [Y0] OFF → ON and enable the parameters.
4. Set "1: Enable" in "[Cd.1100] Interrupt enable request" and enable the interrupt.
5. Perform the positioning control.
6. After the command in-position flag ([Md.31] Status: b2) is turned ON and the Simple Motion board detects the interrupt factor, output "[Md.1100] During interrupt factor output", "[Md.1101] Interrupt factor", and "[Md.1102] Interrupt factor details". Then, the interrupt occurs.
7. After receiving the interrupt, confirm the event interrupt factor output status of "[Md.1100] During interrupt factor output" is set to "1: During interrupt factor output", b3 of "[Md.1101] Interrupt factor" is turned ON, and "[Md.1102] Interrupt factor details".
8. Set "1: Reset start" in "[Cd.1101] Interrupt factor reset request".
9. The Simple Motion board clears "[Md.1100] During interrupt factor output", b3 of "[Md.1101] Interrupt factor", and "[Md.1102] Interrupt factor details". Then, set "0: Reset stop" in "[Cd.1101] Interrupt factor reset request".
10. To complete the user program, set "0: Disable" in "[Cd.1100] Interrupt enable request" and complete the interrupt driver.

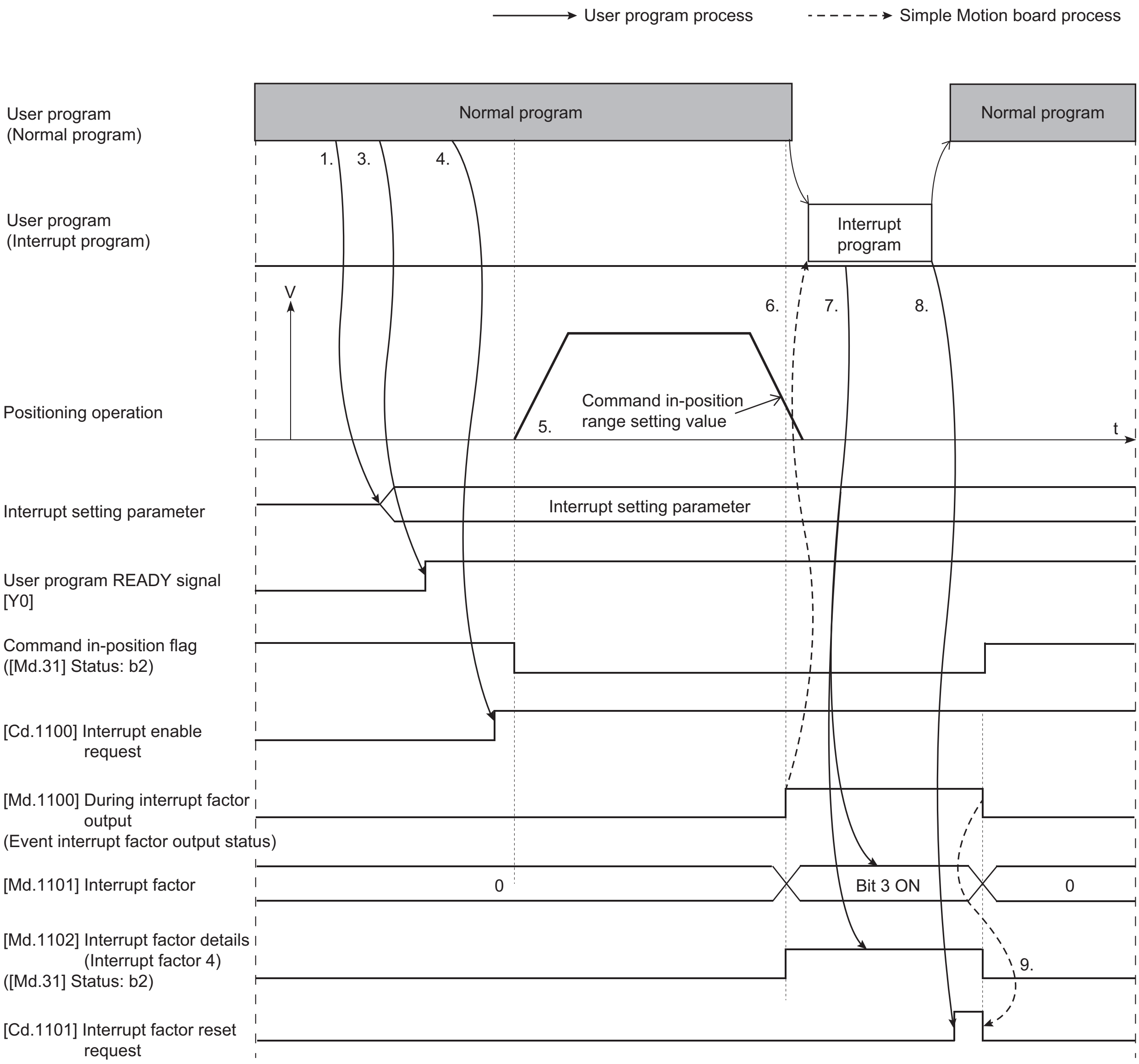
Point

[API library]

- To perform the procedure 1, use the MMC_Controller::SetInterruptParameter method or the MMC_Axis::SetInterruptParameter method. Set "[Pr.1100] Interrupt mode selection" using the MMC_Controller::Interrupt.IntMode method or EM Configurator.
- To perform the procedure 2, use the MMC_DeviceDriver::StartInterrupt method.
- To perform the procedure 3, turn the user program READY signal [Y0] ON using the MMC_Controller::SetUserProgramReady method.
- To perform the procedure 4, use the MMC_Controller::EnableInterrupt method.
- To wait until the interrupt event is set to be the signaled state with the procedure 7, use the MMC_Controller::WaitIntEvent method or the MMC_Axis::WaitIntEvent method.
- The procedure 8 is automatically performed by the API library.
- To perform the procedure 10, use the MMC_Controller::DisableInterrupt method and the MMC_DeviceDriver::EndInterrupt method.
- The interrupt factor Nos. (1 to 8) are used in the internal of the API library. Therefore, those cannot be used in the user program.

■Operation chart

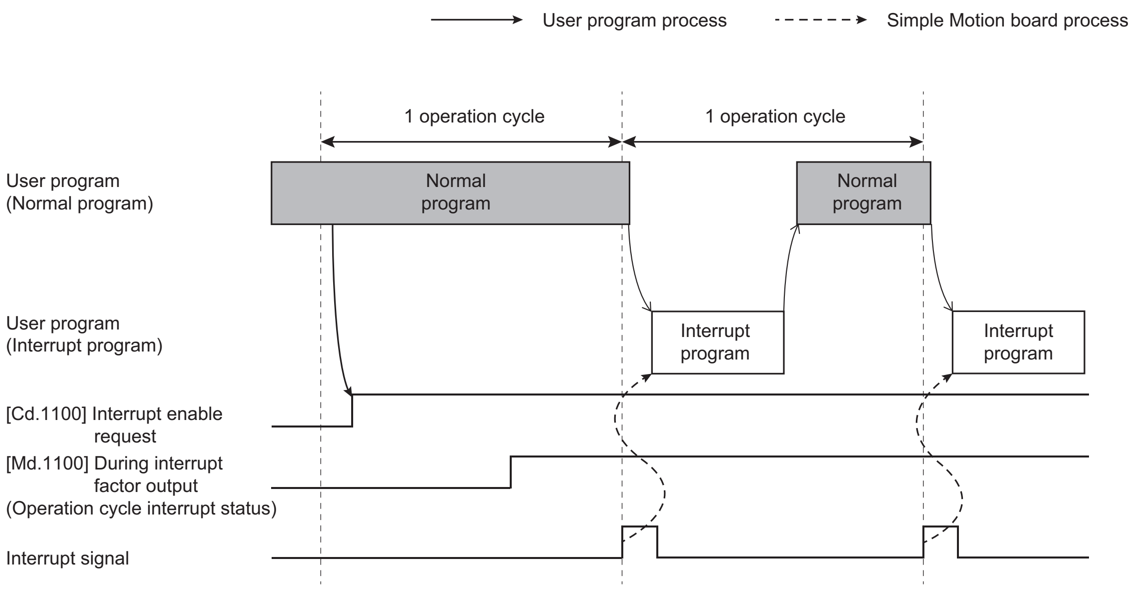
The following shows the operation chart of the procedure above.



Operation cycle interrupt factor output

■Operation cycle interrupt operation chart

The following shows the operation chart of the operation cycle interrupt function.



The following shows the procedure from the setting of the operation cycle interrupt function to the factor output.

1. Set "1: Operation cycle interrupt" in "[Pr.1100] Interrupt mode selection".
2. Start the interrupt driver.
3. Turn the user program READY signal [Y0] OFF → ON and enable the parameters.
4. Register the interrupt callback function.
5. Set "1: Enable" in "[Cd.1100] Interrupt enable request" and enable the interrupt.
6. Execute the interrupt callback function by the operation cycle interrupt.
7. To complete the user program, set "0: Disable" in "[Cd.1100] Interrupt enable request" and clear the interrupt callback function. Then, complete the interrupt driver.

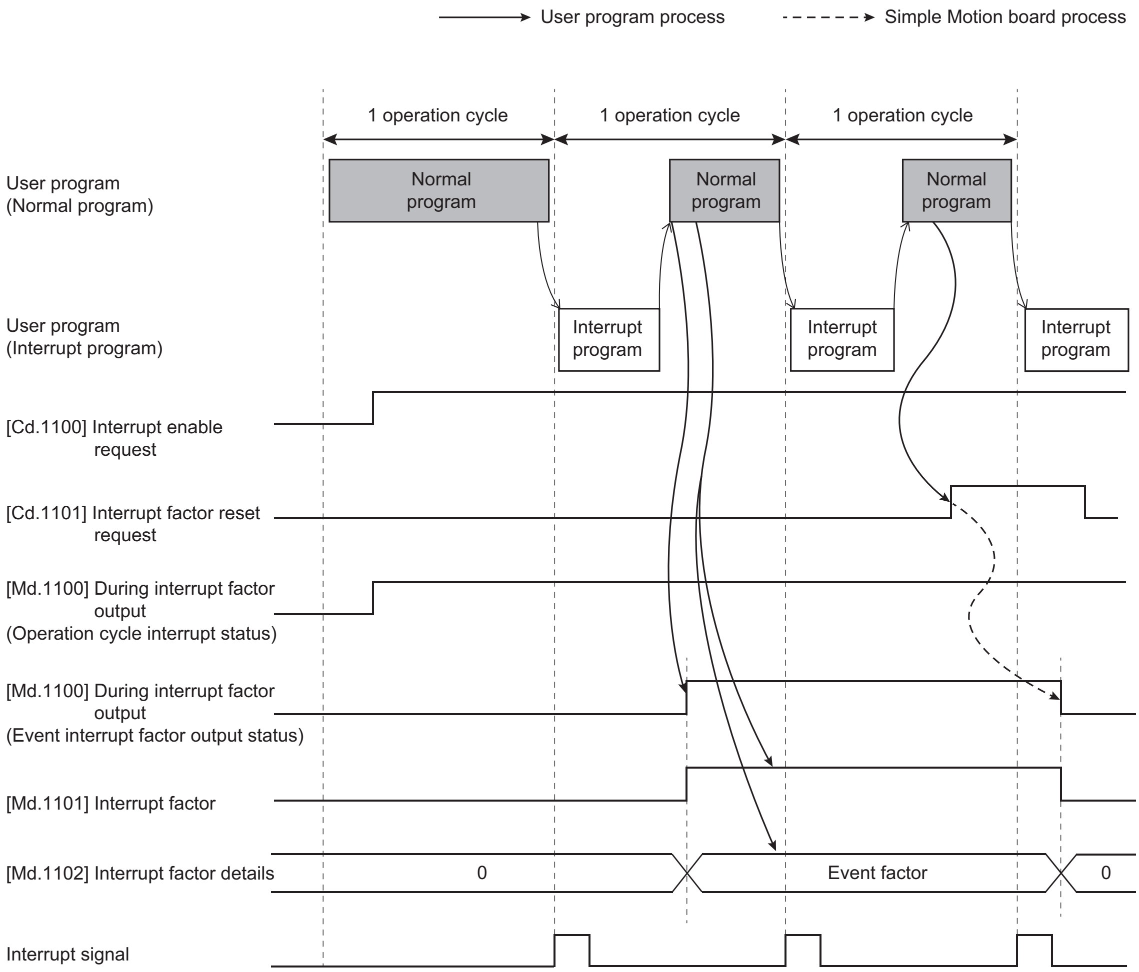
Point

[API library]

- To perform the procedure 1, set it using the MMC_Controller::Interrupt.IntMode method or EM Configurator.
- To perform the procedure 2, use the MMC_DeviceDriver::StartInterrupt method.
- To perform the procedure 3, turn the user program READY signal [Y0] ON using the MMC_Controller::SetUserProgramReady method.
- To perform the procedure 4, use the MMC_Controller::RegisterIntCallback method.
- To perform the procedure 5, use the MMC_Controller::EnableInterrupt method.
- To perform the procedure 7, use the MMC_Controller::DisableInterrupt method, the MMC_Controller::UnregisterIntCallback method, or the MMC_DeviceDriver::EndInterrupt method.
- When OS response of the host personal computer is late due to the load status of the user program, set the operation cycle longer.

■Operation chart when using the event detection

The following shows the operation chart of the operation cycle interrupt function using the event detection.



The following shows the event detection procedure of the user program.

1. Confirm that the event interrupt factor output status of "[Md.1100] During interrupt factor output" is turned ON.
2. The user program confirms "[Md.1101] Interrupt factor" and "[Md.1102] Interrupt factor details".

Point

When the operation cycle interrupt is used, the interrupt at the condition completion does not occur. However, the event can be detected by setting "[Pr.1100] Interrupt mode selection", "[Pr.1101] Interrupt factor setting", "[Pr.1102] Interrupt data condition", "[Pr.1103] Interrupt judge condition", "[Pr.1104] Interrupt condition judge value 1", "[Pr.1105] Interrupt condition judge value 2", and "[Pr.1106] Time for condition completion" and monitoring "[Md.1101] Interrupt factor" referring to "[Md.1100] During interrupt factor output" by the user program.

Point

[API library]
Even while the operation cycle interrupt, it is possible to wait for the event using the MMC_Controller::WaitIntEvent method and the MMC_Axis::WaitIntEvent method.

List of parameters and data

The following shows the configuration of the parameters and data for the interrupt function.

Memory area	Item		
Interrupt setting parameters	[Pr.1100]	Interrupt mode selection	1 point
	[Pr.1101]	Interrupt factor setting (2-word)	64 points
	[Pr.1102]	Interrupt data condition	64 points
	[Pr.1103]	Interrupt judge condition	64 points
	[Pr.1104]	Interrupt condition judge value 1 (2-word)	64 points
	[Pr.1105]	Interrupt condition judge value 2 (2-word)	64 points
	[Pr.1106]	Time for condition completion	64 points
	Interrupt setting 2 to 64		
Interrupt control data	[Cd.1100]	Interrupt enable request	1 point
	[Cd.1101]	Interrupt factor reset request	1 point
Interrupt monitor data	[Md.1100]	During interrupt factor output	1 point
	[Md.1101]	Interrupt factor (4-word)	1 point
	[Md.1102]	Interrupt factor details (1 to 64)	64 points

Interrupt setting parameters

w: Interrupt setting No. - 1

Setting item		Setting details/setting value	Initial value	Buffer memory address
[Pr.1100]	Interrupt mode selection	Select the interrupt mode. 0: Event interrupt 1: Operation cycle interrupt Fetch cycle: User program READY signal [Y0] OFF → ON	0	87680
[Pr.1101]	Interrupt factor setting	Specify the buffer memory address. 0 to 8355839 Fetch cycle: User program READY signal [Y0] OFF → ON	0	87682+12w 87683+12w
[Pr.1102]	Interrupt data condition	• _ _ _×: Interrupt detection timing Set the interrupt detection timing. 0: Edge detection 1: Level detection • _ _× _: Interrupt data size Specify the interrupt data size. 0: 2 bytes 1: 4 bytes • _× _ _: Signed/Unsigned setting Set the data to be used for the interrupt condition signed or unsigned. 0: Signed 1: Unsigned • ×_ _ _: Factor details output setting Set the data to be output when the interrupt factor is held. 0: Start data 1: End data Fetch cycle: User program READY signal [Y0] OFF → ON	0	87684+12w

Setting item		Setting details/setting value	Initial value	Buffer memory address
[Pr.1103]	Interrupt judge condition	• _ _ × ×: Interrupt condition Set the interrupt output condition. 00: Not detected 01: Equal to the interrupt condition judge value 1 02: Not equal to the interrupt condition judge value 1 03: Larger than the interrupt condition judge value 1 04: Smaller than the interrupt condition judge value 1 05: Within the range of the interrupt condition judge value 1, 2 (Larger than the interrupt condition judge value 1 and smaller than the interrupt condition judge value 2) 06: Outside the range of the interrupt condition judge value 1, 2 (Smaller than the interrupt condition judge value 1 or larger than the interrupt condition judge value 2) 07: The value masked by the interrupt condition judge value 1 differs from the previous value*1*2 08: All bits masked by the interrupt condition judge value 1 is turned ON*2 09: All bits masked by the interrupt condition judge value 1 is turned OFF*2 0A: Any one of the bits masked by the interrupt condition judge value 1 is turned ON*2 0B: Any one of the bits masked by the interrupt condition judge value 1 is turned OFF*2 • _× _ _: Condition for condition completion continuous Set the operation when the interrupt condition is not satisfied during passing the time for condition completion. 0: Start the new count after the interrupt condition is satisfied again 1: Continue the count Fetch cycle: User program READY signal [Y0] OFF → ON	0	87685+12w
[Pr.1104]	Interrupt condition judge value 1	Set the data to be used for the interrupt condition. -2147483648 to 2147483647 Fetch cycle: User program READY signal [Y0] OFF → ON	0	87686+12w 87687+12w
[Pr.1105]	Interrupt condition judge value 2		0	87688+12w 87689+12w
[Pr.1106]	Time for condition completion	Specify the time since the interrupt condition is satisfied until the interrupt is output in a unit of ms. Set 0 if not used. 0 to 65535 Fetch cycle: User program READY signal [Y0] OFF → ON	0	87690+12w

*1 The setting of the interrupt detection timing is disabled.

*2 The signed/unsigned setting is set to "Unsigned".

For labels, refer to the following.

☞ Page 450 Interrupt setting parameters

Point

- If the interrupt condition is satisfied when "[Pr.1102] Interrupt data condition" is set to "_ _ _ 0: Edge detection" and "[Cd.1100] Interrupt enable request" is set to "1: Enable", the interrupt occurs at the interrupt condition completion again after the interrupt condition is not satisfied once.
- The judgement of the interrupt condition starts after the next operation cycle where "[Cd.1100] Interrupt enable request" is set to "1: Enable".
- When "[Pr.1106] Time for condition completion" is not the integer multiple of the operation cycle, the interrupt occurs at the timing where it becomes the integer multiple of the operation cycle just after passing the specified time.
- When "0005H" or "0006H" is set to "[Pr.1103] Interrupt judge condition" and the status is set to "an interrupt occurs always" or "an interrupt does not occur" according to the setting of "[Pr.1104] Interrupt condition judge value 1" and "[Pr.1105] Interrupt condition judge value 2", execute the judgement by exchanging "[Pr.1104] Interrupt condition judge value 1" and "[Pr.1105] Interrupt condition judge value 2".
- When the values of "[Pr.1104] Interrupt condition judge value 1" and "[Pr.1105] Interrupt condition judge value 2" are the same, the interrupt condition judgement is not executed.

[Pr.1100] Interrupt mode selection

Select the interrupt mode. To control the user program using an interrupt factor as a trigger, set "0: Event interrupt". To control per operation cycle such as direct operation, set "1: Operation cycle interrupt".

0: Event interrupt

1: Operation cycle interrupt

If a value other than the above is set, the error "Outside interrupt mode selection setting range" (error code: 1815H) occurs.

[Pr.1101] Interrupt factor setting

Specify the buffer memory address to be used for the interrupt condition judgement.

Execute the settings of the interrupt data size of "[Pr.1102] Interrupt data condition" and signed/unsigned depending on the target buffer memory address.

If an illegal value is set, the error "Interrupt factor setting error" (error code: 1816H) occurs.

[Pr.1102] Interrupt data condition

Execute the setting of the data which is to be used for the interrupt condition judgement and the data which executes output.

When any one of the following settings is outside the range of the parameter, the error "Interrupt data condition setting error" (error code: 1817H) occurs.

■Interrupt detection timing

Set the interrupt detection timing.

0: Edge detection

1: Level detection

■Interrupt data size

Specify the size of "[Pr.1101] Interrupt factor setting", "[Pr.1104] Interrupt condition judge value 1", and "[Pr.1105] Interrupt condition judge value 2". Execute the setting according to the data size of the buffer memory address set in "[Pr.1101] Interrupt factor setting".

0: 2 bytes

1: 4 bytes

■Signed/Unsigned setting

Set the data to be used for the interrupt condition signed or unsigned. Execute the setting according to the signed/unsigned setting of the buffer memory address set in "[Pr.1101] Interrupt factor setting".

0: Signed

1: Unsigned

■Factor details output setting

Set the data to be output when the interrupt factor is held. The setting is enabled only when a value from "01H" to "07H" is set to the interrupt condition of "[Pr.1103] Interrupt judge condition".

0: Start data

1: End data

[Pr.1103] Interrupt judge condition

Execute the setting of the interrupt occurrence judgement. If an illegal value is set, the error "Interrupt judge condition error" (error code: 1818H) occurs.

■Interrupt condition

Set the interrupt output condition. To specify data in a unit of word for the interrupt condition, set "01H" to "07H". To specify a bit for the interrupt condition, set "08H" to "0BH". To set both edges of ON/OFF for the interrupt condition, specify "07H".

00: Not detected
01: Equal to the interrupt condition judge value 1
02: Not equal to the interrupt condition judge value 1
03: Larger than the interrupt condition judge value 1
04: Smaller than the interrupt condition judge value 1
05: Within the range of the interrupt condition judge value 1, 2
(Larger than the interrupt condition judge value 1 and smaller than the interrupt condition judge value 2)
06: Outside the range of the interrupt condition judge value 1, 2
(Smaller than the interrupt condition judge value 1 or larger than the interrupt condition judge value 2)
07: The value masked by the interrupt condition judge value 1 differs from the previous value
08: All bits masked by the interrupt condition judge value 1 is turned ON
09: All bits masked by the interrupt condition judge value 1 is turned OFF
0A: Any one of the bits masked by the interrupt condition judge value 1 is turned ON
0B: Any one of the bits masked by the interrupt condition judge value 1 is turned OFF

■Condition for condition completion continuous

Set the operation when the interrupt condition is not satisfied during passing the time for condition completion. It is enabled only when the value larger than 0 is set in "[Pr.1106] Time for condition completion".

0: Start the new count after the interrupt condition is satisfied again
1: Continue the count

[Pr.1104] Interrupt condition judge value 1

Used for the interrupt condition completion judgement. When "01H" to "06H" is set to the interrupt condition of "[Pr.1103] Interrupt judge condition", set the data compared to the buffer memory data. When "07H" to "0BH" is set to the interrupt condition of "[Pr.1103] Interrupt judge condition", set the mask pattern. Set "1" for the bit used as the interrupt condition.
When "[Pr.1102] Interrupt data condition" is set to "_ _ 0 _: 2 bytes" and "[Pr.1104] Interrupt condition judge value 1" is set to the value larger than 2 bytes, the error "Interrupt condition judge value setting error" (error code: 181AH) occurs.

[Pr.1105] Interrupt condition judge value 2

Used for the interrupt condition completion judgement. It is enabled only when "05H" or "06H" is set to the interrupt condition of "[Pr.1103] Interrupt judge condition".
When "[Pr.1102] Interrupt data condition" is set to "_ _ 0 _: 2 bytes" and "[Pr.1105] Interrupt condition judge value 2" is set to the value larger than 2 bytes, the error "Interrupt condition judge value setting error" (error code: 181AH) occurs.

[Pr.1106] Time for condition completion

Specify the time since the interrupt condition is satisfied until the interrupt is output in a unit of ms. When executing this setting, set the condition for condition completion continuous of "[Pr.1103] Interrupt judge condition". Also, if the waiting time until output is not needed, set "0".

Interrupt control data

Setting item		Setting details/setting value	Initial value	Buffer memory address
[Cd.1100]	Interrupt enable request	Set an interrupt enabled or disabled. 0: Disable 1: Enable Fetch cycle: Operation cycle	0	89218
[Cd.1101]	Interrupt factor reset request	Reset an interrupt. Return to "0" automatically after the interrupt factor and the interrupt factor details are cleared during interrupt factor output. 0: Reset stop 1: Reset start Fetch cycle: Operation cycle	0	89219

For labels, refer to the following.

☞ Page 450 Interrupt control data

[Cd.1100] Interrupt enable request

Set an interrupt enabled or disabled. To use the interrupt function, set "1: Enable". If this bit is turned OFF in the state where the event interrupt output status of "[Md.1100] During interrupt factor output" is turned ON, "[Md.1100] During interrupt factor output", "[Md.1101] Interrupt factor", "[Md.1102] Interrupt factor details", and the holding factor are cleared to 0.

0: Disable

1: Enable

[Cd.1101] Interrupt factor reset request

To reset the event which has occurred, set "1: Reset start". Return to "0: Reset stop" automatically after "[Md.1100] During interrupt factor output", "[Md.1101] Interrupt factor", and "[Md.1102] Interrupt factor details" are cleared.

0: Reset stop

1: Reset start

Interrupt monitor data

Storage item		Setting details/setting value	Buffer memory address
[Md.1100]	During interrupt factor output	Notify the interrupt factor status. b0: Event interrupt factor output status 0: Interrupt factor not output 1: During interrupt factor output Refresh cycle: At interrupt detection b1: Operation cycle interrupt status 0: OFF 1: ON (Operation cycle interrupt enabled) Refresh cycle: At interrupt detection b2 to b15: Not used	89220
[Md.1101]	Interrupt factor	Store the detection status of the interrupt factor. b0 to b63: Interrupt factor 1 to 64 detection 0: Interrupt factor not detected 1: Interrupt factor detected Refresh cycle: At interrupt detection	89224 ⋮ 89227
[Md.1102]	Interrupt factor details	Store the data of the buffer memory at the interrupt occurrence. Refresh cycle: At interrupt detection	89232 ⋮ 89359

For labels, refer to the following.
☞ Page 451 Interrupt monitor data

[Md.1100] During interrupt factor output

The area where notifies the interrupt factor status. The b0 outputs the output status of the event interrupt factor. The b1 outputs the status enabled or disabled at the operation cycle interrupt use.

[Md.1101] Interrupt factor

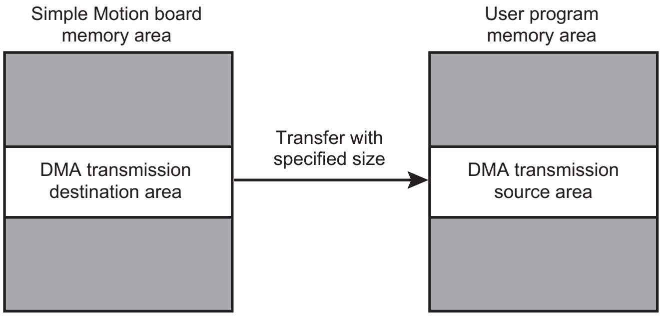
Output the factor satisfied with the interrupt condition.

[Md.1102] Interrupt factor details

When the interrupt condition of "[Pr.1103] Interrupt judge condition" is set to "01H" to "07H", output the value of the interrupt factor at the interrupt occurrence. When the interrupt factor output is held, output the value of the timing set to the factor details output setting of "[Pr.1102] Interrupt data condition".
When the interrupt condition of "[Pr.1103] Interrupt judge condition" is set to "08H" to "0BH", all bits where the interrupt condition is satisfied are turned ON including the holding factor at the interrupt occurrence.

9.20 DMA transmission function

This function transfers the data of the Simple Motion board to the memory area allocated by the user program.
The reading time of the buffer memory from the user program can be shorter by using DMA transmission.
The following shows the operation of DMA transmission use.



Point

[API library]
The setting of DMA transmission and the memory allocation are executed by the API library automatically.

DMA transmission items

The data of the Simple Motion board is transferred to the memory of the user program.

Item		Update timing
Interrupt data	Interrupt factor	Operation cycle
	BUSY signal	
	Error detection	
	Controller in-position flag	
	Axis warning detection	
	Servo ON	
	Lower limit signal	
	Upper limit signal	
Monitor data	Feed current value	
	Actual current value	
	Axis feedrate	
	Motor speed	
	Motor current value	
	Link device (RX000 to RX200, RWr00 to RWr20)	

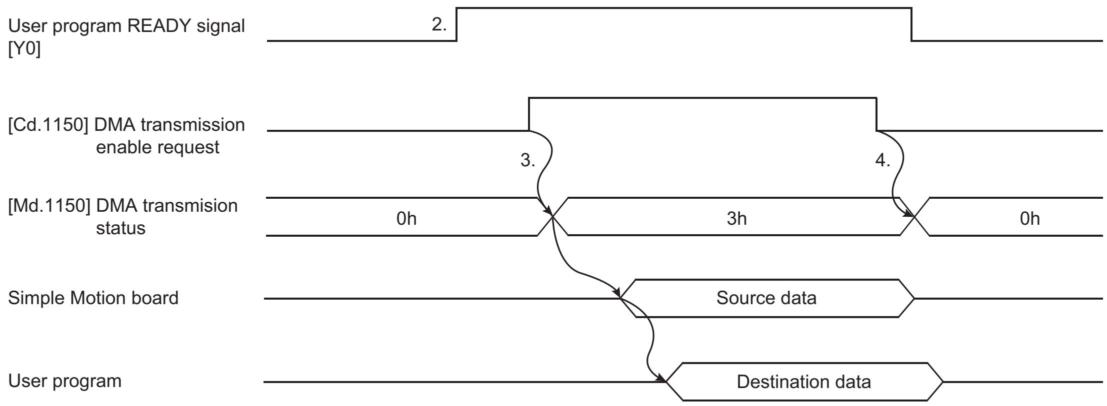
Point

[API library]
When the above items are read by the API library, the reading time can be shorter.

DMA transmission of interrupt data and monitor data

■DMA transmission start and end procedure

The following shows the procedure for enabling DMA transmission.



1. Use the MMC_DeviceDriver::StartDMA method and start the DMA transmission driver.
2. Turn the user program READY signal [Y0] OFF → ON.
3. Set "1: Enable" to "b0: Interrupt data transmission enable request" of "[Cd.1150] DMA transmission enable request" by using the MMC_Controller::EnableDMA method. Confirm that b0 of "[Md.1150] DMA transmission status" is set to "1: Interrupt data transmission enabled" and b1 is set to "1: Monitor data transmission enabled".

The following shows the procedure for DMA transmission.

4. Set "0: Disable" to "b0: Interrupt data transmission enable request" and "b1: Monitor data transmission enable request" of "[Cd.1150] DMA transmission enable request" by using the MMC_Controller::DisableDMA method. Confirm that b0 is set to "0: Interrupt data transmission disabled" and b1 is set to "0: Monitor data transmission disabled" in "[Md.1150] DMA transmission status".
5. Use the MMC_DeviceDriver::EndDMA method and completes the DMA transmission driver.

Point

- Use the continuous area of the user program as the area for DMA transmission. To use the DMA transmission function, the required continuous memory area is 512 bytes or more.
- To complete the user program using DMA transmission, it is required to execute the end processing of DMA transmission function. If the end processing of DMA transmission function is not executed, the host personal computer failure may occur.
- When the user program READY signal [Y0] is turned OFF, the DMA transmission function stops. Furthermore, b0 is set to "0: Interrupt data transmission disabled" and b1 is set to "0: Monitor data transmission disabled" in "[Md.1150] DMA transmission status".
- When the user program READY signal [Y0] is turned OFF → ON in the status where "b0: Interrupt data transmission enable request" of "[Cd.1150] DMA transmission enable request" is set to "1: Enable", b0 of "[Md.1150] DMA transmission status" is set to "1: Interrupt data transmission enabled" after the parameter is enabled. It is the same as "1: Monitor data transmission enabled".

List of data

The following shows the configuration of data for DMA transmission.

Memory area	Item		
DMA transmission control data	[Cd.1150]	DMA transmission enable request	1 point
DMA transmission monitor data	[Md.1150]	DMA transmission status	1 point

DMA transmission control data

Setting item		Setting details/setting value	Initial value	Buffer memory address
[Cd.1150]	DMA transmission enable request	b0: Interrupt data transmission enable request Set DMA transmission enabled or disabled for the interrupt factor detection flag and all axes monitor. 0: Disable 1: Enable Fetch cycle: Operation cycle	0	6300172
		b1: Monitor data transmission enable request Set DMA transmission enabled or disabled. 0: Disable 1: Enable Fetch cycle: Operation cycle		

For labels, refer to the following.

☞ Page 451 DMA transmission control data

[Cd.1150] DMA transmission enable request

To transfer the interrupt data using DMA transmission, set "1: Enable" to b0 of "[Cd.1150] DMA transmission enable request".
To transfer the monitor data using DMA transmission, set "1: Enable" to b1 of "[Cd.1150] DMA transmission enable request".

DMA transmission monitor data

Storage item		Setting details/setting value	Initial value	Buffer memory address
[Md.1150]	DMA transmission status	Notify the status of DMA transmission.	0	6300174
		b0 Notify that interrupt data transmission is available with DMA transmission. 0: Interrupt data transmission disabled 1: Interrupt data transmission enabled Refresh cycle: At interrupt data transmission enabled and disabled switching		
		b1 Notify that monitor data transmission is available with DMA transmission. 0: Monitor data transmission disabled 1: Monitor data transmission enabled Refresh cycle: At interrupt data transmission enabled and disabled switching		

For labels, refer to the following.

☞ Page 451 DMA transmission monitor data

[Md.1150] DMA transmission status

Output the DMA transmission status. When b0 of "[Md.1150] DMA transmission status" is set to "1: Interrupt data transmission enabled", notify that DMA transmission of the interrupt data is enabled.

9.21 Ethernet communication connection

This function connects the Simple Motion board and EM Configurator with the Ethernet cable and performs the communication.
There are the following Ethernet communication connections between the Simple Motion board and EM Configurator: "direct connection" that connects directly and "connection via hub" that connects via hub.

Ethernet communication specifications

The following shows the Ethernet communication specifications.

Item		Communication specifications
Connector for PERIPHERAL	Data transmission speed	100 Mbps (100BASE-TX)
	Communication mode	Full-duplex/half-duplex[*1]
	Transmission method	Base band
	Cable length (maximum) [m (ft.)]	30 (98.43)

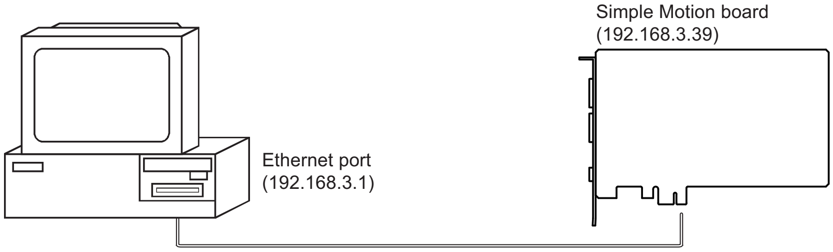
*1 When the half-duplex communication is used, the response time might be longer depending on the external device.

Point

When the host personal computer supports a straight cable, a straight cable can be used. Use a crossover cable for the host personal computer which does not support a straight cable.

Direct connection

The Simple Motion board and EM Configurator can be directly connected only with a single Ethernet cable, without using a hub. In direct connection, communications can be performed simply by the transfer setup, without setting IP address.



Point

Direct connection can cause an unauthorized connection from a remote location.
The direct connection can be prohibited by setting "[Pr.1173] Prohibit the direct connection" which disables the direct connection with MELSOFT.

Precautions

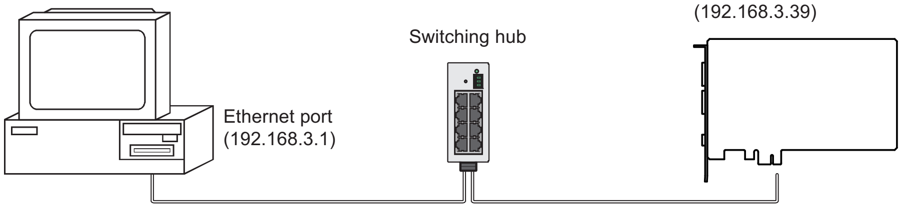
The following shows precautions for direct connection.

■Connection with a LAN network

Do not communicate in direct connection by connecting with a LAN network. The load of the network will be high and the communication of other devices may be affected.

■Connection that is not in direct connection

- Do not set direct connection in the configuration where a Simple Motion board and an external device are connected via hub as following drawing.



- When 2 or more Ethernet ports are set to "Enabled" in the network connection on the host personal computer side, the communication cannot be performed in direct connection. Review the setting of the host personal computer to be "Enabled" only for ports which to be in direct connection and "Disabled" for other Ethernet ports.

■Conditions that disable communication of direct connection

When matching the following conditions, the communication cannot be performed in direct connection.

Review the settings of the Simple Motion board and the host personal computer if the communication cannot be performed.

- When all bits which are corresponded to 0 of the subnet mask on the host personal computer are turned ON or OFF in each bit of the IP address on the Simple Motion board

Ex.

IP address on the Simple Motion board sides: 64. 64.255.255

IP address on the host personal computer side: 64. 64. 1. 1

Subnet mask on the host personal computer side: 255.255. 0. 0

- When all bits which are corresponded to the host address of each class of the IP address on the host personal computer are turned ON or OFF in each bit of the IP address on the Simple Motion board

Ex.

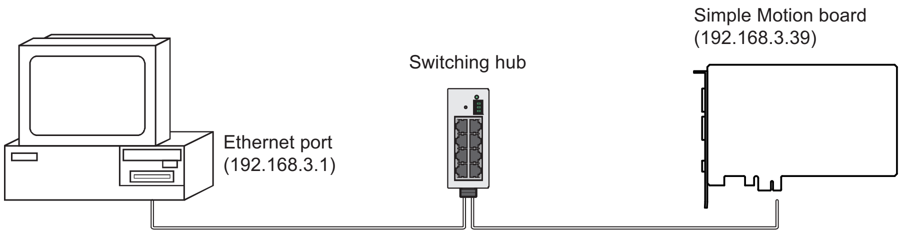
IP address on the Simple Motion board side: 64. 64.255.255

IP address on the host personal computer side: 192.168. 0. 1

Subnet mask on the host personal computer side: 255. 0. 0. 0

Connection via hub

The Simple Motion board and EM Configurator can be connected via hub.



Precautions

The following shows precautions for connection via hub.

- When using the host personal computer which can be connected with a LAN network, set the IP address of the Simple Motion board as same as the IP address of the host personal computer as follows.

Simple Motion board side IP address 192.168.3.39

Set the same IP address
as the host personal computer side

- One device can access one Simple Motion board at the same time.
- Hubs with 100BASE-TX ports can be used. (Use hubs that are compatible with standards of the IEEE802.3 100BASE-TX.)
- An Ethernet cable and a power cable must be wired separately.
- The operation of commercial devices used for the following applications is not guaranteed. Check the operation before using the board.

- Internet (general public line)
- Firewall device(s)
- Broadband router(s)
- Wireless LAN

- Note the followings when communicating with multiple Simple Motion boards and EM Configurator.

- Set the IP addresses separately.
- Open the EM Configurator projects of the number of the Simple Motion boards to be used.

IP address setting

■Setting of the Simple Motion board

Set the IP address setting as follows.

Set the IP address of the Simple Motion board. Change "[Pr.1170] IP address" and "[Pr.1172] Default gateway" if necessary.

Initial value of IP address: 192.168.3.39

■Parameter enabled operation

Set "1" in "[Cd.1170] Ethernet communication parameter backup request" using Ethernet direct connection or PCI Express connection and write parameters. After writing, enable parameters by the power supply of the Simple Motion board ON again or the remote RESET.

Ethernet communication parameters

Setting item		Setting details/setting value	Initial value	Buffer memory address
[Pr.1170]	IP address	■Set with a hexadecimal. Set the IP address of the own node. 0.0.0.1 to 255.255.255.254 Fetch cycle: At power supply ON or remote RESET	192.168.3.39	6300200 6300201
[Pr.1171]	Subnet mask	■Set with a hexadecimal. Set bits to be masked. 0.0.0.1 to 255.255.255.254 Fetch cycle: At power supply ON or remote RESET	255.255.255.0	6300202 6300203
[Pr.1172]	Default gateway	■Set with a hexadecimal. Set the IP address of the default gateway. 0.0.0.1 to 255.255.255.254 Fetch cycle: At power supply ON or remote RESET	192.168.3.254	6300204 6300205
[Pr.1173]	Prohibit the direct connection	■Set with a decimal. Set the direct connection with EM Configurator permitted or prohibited. 0: Connection prohibition 1: Connection permission Fetch cycle: At power supply ON or remote RESET	1	6300206 6300207

For labels, refer to the following.

☞ Page 451 Ethernet communication parameters

[Pr.1170] IP address

Set the IP address of the own node. Endure that the own node and the external device to be communicated with have the same class and subnet address. Set the IP address in the range of class A/class B/class C.

If the IP address is not set, it operates regarded as "192.168.3.39" is set.

Ex.

When 192.168.3.39 is set, the setting value is set as follows.

C0A80327H

[Pr.1171] Subnet mask

Set to determine how many bits of the IP address are used as the network address, which is used to identify the network. Marked bit has been specified from top between the top bit and bit 2. For example, set "255.255.255.0" to assign the upper 24 bits of IP address to the subnet mask.

Ex.

When 255.255.255.0 is set, the setting value is set as follows.

FFFFFF00H

[Pr.1172] Default gateway

Set the IP address of the default gateway (the device which the own node passes through to access a device of another network). Set the subnet address of default gateway so that it is the same with the one of host station.

Ex.

When 192.168.3.254 is set, the setting value is set as follows.

C0A803FEH

[Pr.1173] Prohibit the direct connection

Set the direct connection with EM Configurator permitted or prohibited.

0: Connection prohibition

1: Connection permission

Ethernet communication data

Setting item		Setting details/setting value	Initial value	Buffer memory address
[Cd.1170]	Ethernet communication parameter backup request	■Set with a decimal. Backup the Ethernet communication setting parameters to the Simple Motion board. Store "0" automatically by the Simple Motion board after the writing is completed. 0: Stop writing 1: Start writing Fetch cycle: Operation cycle	0	6300208 6300209

For labels, refer to the following.

☞ Page 451 Ethernet communication control data

[Cd.1170] Ethernet communication parameter backup request

Backup the Ethernet communication setting parameters to the Simple Motion board. The backed up Ethernet communication parameters are reflected at the power supply of the Simple Motion board ON or the remote RESET.

0: Stop writing

1: Start writing

Ethernet communication monitor

Storage item		Storage details/storage value	Initial value	Buffer memory address
[Md.1170]	IP address	Output the IP address set in the Simple Motion board. 0.0.0.1 to 255.255.255.254 Refresh cycle: At power supply ON or remote RESET	192.168.3.39	6300212 6300213
[Md.1171]	Subnet mask	Output the subnet mask set in the Simple Motion board. 0.0.0.1 to 255.255.255.254 Refresh cycle: At power supply ON or remote RESET	255.255.255.0	6300214 6300215
[Md.1172]	Default gateway	Output the default gateway set in the Simple Motion board. 0.0.0.1 to 255.255.255.254 Refresh cycle: At power supply ON or remote RESET	192.168.3.254	6300216 6300217
[Md.1173]	MAC address	Output the MAC address of the Simple Motion board. Fixed Refresh cycle: At power supply ON or remote RESET	xx-xx-xx-xx-xx-xx*1	6300220 : 6300223
[Md.1174]	Link status	Output the link status of the Simple Motion board. 0 to 2 Refresh cycle: At power supply ON or remote RESET	0	6300224 6300225

*1 "xx" is a unique value.

For labels, refer to the following.

☞ Page 451 Ethernet communication monitor data

[Md.1170] IP address

Output the IP address set in the Simple Motion board.

Monitoring is carried out by 1 byte with a hexadecimal display.

Ex.

When 192.168.3.39 is set, the value is displayed as follows.

C0A80327H

[Md.1171] Subnet mask

Output the subnet mask set in the Simple Motion board.

Monitoring is carried out by 1 byte with a hexadecimal display.

Ex.

When 255.255.255.0 is set, the value is displayed as follows.

FFFFFF00H

[Md.1172] Default gateway

Output the default gateway set in the Simple Motion board.

Monitoring is carried out by 1 byte with a hexadecimal display.

Ex.

When 192.168.3.254 is set, the value is displayed as follows.

C0A803FEH

[Md.1173] MAC address

Output the MAC address of the Simple Motion board.

Monitoring is carried out by 1 byte with a hexadecimal display.

Ex.

When 12-34-56-78-90-12 is set, the value is displayed as follows.

Upper: 00001234H

Lower: 56789012H

[Md.1174] Link status

Output the link status of the Simple Motion board.

Monitoring is carried out with a decimal display.

0: Disconnecting

1: Connecting (100 Mbps full-duplex communication)

2: Connecting (100 Mbps half-duplex communication)

10 PARAMETER SETTING

This chapter describes the parameter setting of the Simple Motion board. By setting parameters, the parameter setting by the user program is not needed.
The parameter setting has two types including "Parameter" and "Network Parameter".

10.1 Parameter Setting Procedure

1. Add the Simple Motion board to EM Configurator.

[Project] ⇨ [New] ⇨ [Board Name] ⇨ Select MR-EM340GF ⇨ [OK] button

2. The parameter setting has two types including "Parameter" and "Network Parameter". Select either of them from the tree on the following window.

Navigation window ⇨ "Parameter" or "Network Parameter"

3. Write the settings to the Simple Motion board with EM Configurator or API.

[Online] ⇨ [Write to Board]

4. The settings are reflected by the remote RESET of the Simple Motion board or powering off and on the system.

Point

[API library]
The parameters [Pr.**] can be set by labels of the controller class or axis class. The read timing differs depending on the parameters. Therefore, change the parameters from a user program before read.
Set network parameters using EM Configurator.

10.2 Parameters

Set "Parameter". The "Parameter" includes the following settings.

Parameter	Reference
Common parameters	☞ Page 453 Basic Setting
Basic parameters 1	
Basic parameters 2	
Detailed parameters 1	
Detailed parameters 2	
Home position return parameters	
External input signal assignment parameters	☞ Page 321 Link Device External Signal Assignment Function
External command signal assignment parameters	
Servo cyclic transmission parameters	☞ Page 354 Servo Cyclic Transmission Function

Select "Parameter" from the tree on the following window.

Navigation window ⇨ "Parameter"

10.3 Network Parameters

Set "Network Parameter". The "Network Parameter" includes the following settings.

Network parameter	Reference
System Parameter	Simple Motion Board User's Manual (Network)
Required Settings	
Basic Settings	
Application Settings	

Select "Network Parameter" from the tree on the following window.

Navigation window ⇨ "Network Parameter"

11 SPECIFICATIONS OF I/O SIGNALS WITH USER PROGRAMS

11.1 List of Input/Output Signals with User Programs

The Simple Motion board uses 32 input points and 32 output points for exchanging data with the user program.
The input/output signals of the Simple Motion board are shown below.

Point

- The following input/output Nos. (X/Y) are shown in the case that the start input/output No. of the Simple Motion board is 0.
- The use prohibited signals are used by the system, and cannot be used by a customer. If these devices are used, the function of the Simple Motion board will not be guaranteed.

Signal direction: Simple Motion board → User program				
Device No.	**Signal name**		**Buffer memory address**	**Label**
X0	READY		6300120	MMC_Controller::BitDevice.Ready
X1	Synchronization flag			MMC_Controller::BitDevice.SynchronizationFlag
X2	Use prohibited			—
X3				
X4				
X5				
X6				
X7				
X8				
X9				
XA				
XB				
XC				
XD				
XE				
XF				
X10	Axis 1	BUSY*1	6300121	MMC_Controller::BitDevice.Busy[1] ⋮ MMC_Controller::BitDevice.Busy[16]
X11	Axis 2			
X12	Axis 3			
X13	Axis 4			
X14	Axis 5			
X15	Axis 6			
X16	Axis 7			
X17	Axis 8			
X18	Axis 9			
X19	Axis 10			
X1A	Axis 11			
X1B	Axis 12			
X1C	Axis 13			
X1D	Axis 14			
X1E	Axis 15			
X1F	Axis 16			

Signal direction: User program → Simple Motion board				
Device No.	**Signal name**		**Buffer memory address**	**Label**
Y0	User program READY		6300136	MMC_Controller::BitDevice.UserProgramReady
Y1	All axis servo ON			MMC_Controller::BitDevice.AllAxisServoOn
Y2	Use prohibited			—
Y3				
Y4				
Y5				
Y6				
Y7				
Y8				
Y9				
YA				
YB				
YC				
YD				
YE				
YF				
Y10	Axis 1	Positioning start*1	6300137	MMC_Controller::BitDevice.PositioningStart[1] ⋮ MMC_Controller::BitDevice.PositioningStart[16]
Y11	Axis 2			
Y12	Axis 3			
Y13	Axis 4			
Y14	Axis 5			
Y15	Axis 6			
Y16	Axis 7			
Y17	Axis 8			
Y18	Axis 9			
Y19	Axis 10			
Y1A	Axis 11			
Y1B	Axis 12			
Y1C	Axis 13			
Y1D	Axis 14			
Y1E	Axis 15			
Y1F	Axis 16			

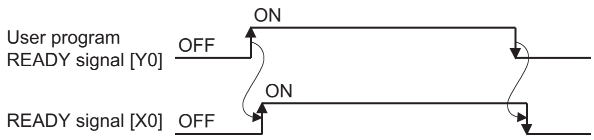
*1 The BUSY signal and positioning start signal, whose axis Nos. exceed the number of controlled axes, cannot be used.

Point

- The M code ON signal, error detection signal, start complete signal and positioning complete signal are assigned to the bit of "[Md.31] Status".
- The axis stop signal, forward run JOG start signal, reverse run JOG start signal, execution prohibition flag are assigned to the buffer memory [Cd.180] to [Cd.183].

11.2 Details of Input Signals

The ON/OFF timing and conditions of the input signals are shown below.

Device No.	Signal name			Details
X0	READY		ON: READY OFF: Not READY/Watch dog timer error	• When the user program READY signal [Y0] turns from OFF to ON, the parameter setting range is checked. If no error is found, this signal turns ON. • When the user program READY signal [Y0] turns OFF, this signal turns OFF. • When watch dog timer error occurs, this signal turns OFF. • This signal is used for interlock in a user program, etc. 
X1	Synchronization flag		OFF: Board access disabled ON: Board access enabled	• After the power supply of the Simple Motion board is turned ON or the remote RESET, this signal turns ON if the access from the host personal computer to the Simple Motion board is possible.
X10 X11 X12 X13 X14 X15 X16 X17 X18 X19 X1A X1B X1C X1D X1E X1F	Axis 1 Axis 2 Axis 3 Axis 4 Axis 5 Axis 6 Axis 7 Axis 8 Axis 9 Axis 10 Axis 11 Axis 12 Axis 13 Axis 14 Axis 15 Axis 16	BUSY*1	OFF: Not BUSY ON: BUSY	• This signal turns ON at the start of positioning, home position return or JOG operation. It turns OFF when the "[Da.9] Dwell time/JUMP destination positioning data No." has passed after positioning stops. (This signal remains ON during positioning.) • This signal turns OFF when the positioning is stopped with step operation. • During manual pulse generator operation, this signal turns ON while the "[Cd.21] Manual pulse generator enable flag" is ON. • This signal turns OFF at error completion or positioning stop.

*1 The BUSY signal, whose axis No. exceeds the number of controlled axes, cannot be used.

Point

The BUSY signal turns ON even when position control of movement amount 0 is executed. However, since the ON time is short, the ON status may not to be detected in the user program.

11.3 Details of Output Signals

The ON/OFF timing and conditions of the output signals are shown below.

Device No.	Signal name			Details
Y0	User program READY		OFF: User program READY OFF ON: User program READY ON	(a) This signal notifies the Simple Motion board that the user program is normal. • It is turned ON/OFF with the user program. (b) When the data (parameter, etc.) are changed, this signal is turned OFF depending on the parameter. (☞ Page 578 Memory Configuration and Data Process) (c)The following processes are carried out when this signal turns from OFF to ON. • The parameter setting range is checked. • The READY signal [X0] turns ON. (d) The following processes are carried out when this signal turns from ON to OFF. In these cases, the OFF time should be set to 100 ms or more. • The READY signal [X0] turns OFF. • The operating axis stops. • The M code ON signal ([Md.31] Status: b12) for each axis turns OFF, and "0" is stored in "[Md.25] Valid M code". (e) When parameters or positioning data (No.1 to 600) are written from the user program to the flash ROM, this signal will turn OFF.
Y1	All axis servo ON		OFF: Servo OFF ON: Servo ON	• All the servo amplifiers connected to the Simple Motion board are set to ON or OFF.
Y10 Y11 Y12 Y13 Y14 Y15 Y16 Y17 Y18 Y19 Y1A Y1B Y1C Y1D Y1E Y1F	Axis 1 Axis 2 Axis 3 Axis 4 Axis 5 Axis 6 Axis 7 Axis 8 Axis 9 Axis 10 Axis 11 Axis 12 Axis 13 Axis 14 Axis 15 Axis 16	Positioning start*1	OFF: Positioning start not requested ON: Positioning start requested	• Home position return operation or positioning operation is started. • The positioning start signal is valid at the rising edge, and the operation is started. • When this signal turns ON during BUSY, the warning "Start during operation" (warning code: 0900H) will occur.

*1 The positioning signal, whose axis No. exceeds the number of controlled axes, cannot be used.

12 DATA USED FOR POSITIONING CONTROL

The parameters and data used to carry out positioning control with the Simple Motion board are explained in this chapter.
With the positioning system using the Simple Motion board, the various parameters and data explained in this chapter are used for control. The parameters and data include parameters set according to the device configuration, such as the system configuration, and parameters and data set according to each control.
Read this section thoroughly and make settings according to each control or application.

12.1 Types of Data

Parameters and data required for control

The parameters and data required to carry out control with the Simple Motion board include the "setting data", "monitor data" and "control data" shown below.

Setting data

The data is set beforehand according to the machine and application. Set the data with user programs or EM Configurator.
The data set for the buffer memory can also be saved in the flash ROM or internal memory (nonvolatile) in the Simple Motion board.
The setting data is classified as follows.

<table>
<tr><th colspan="2">Classification</th><th>Item</th><th>Description</th></tr>
<tr><td rowspan="14">Parameters</td><td colspan="2">Servo network composition parameters</td><td>Parameters for the network.
Set the device to be used and the network according to the system configuration.</td></tr>
<tr><td colspan="2">Common parameters</td><td>Parameters that are independent of axes and related to the overall system.
Set according to the system configuration when the system is started up.</td></tr>
<tr><td rowspan="4">Positioning parameters</td><td>Basic parameters 1[*1]</td><td rowspan="2">Set according to the machine and applicable motor when the system is started up.</td></tr>
<tr><td>Basic parameters 2</td></tr>
<tr><td>Detailed parameters 1</td><td rowspan="2">Set according to the system configuration when the system is started up.</td></tr>
<tr><td>Detailed parameters 2[*2]</td></tr>
<tr><td rowspan="2">Home position return parameters</td><td>Home position return basic parameters</td><td rowspan="2">Set the values required for carrying out home position return control.</td></tr>
<tr><td>Home position return detailed parameters</td></tr>
<tr><td colspan="2">Link device external signal assignment parameters</td><td>Set according to the network configuration when the system is started up.</td></tr>
<tr><td colspan="2">Servo object specification parameters</td><td>Set the data that is determined by the specification of the servo being used when the system is started up.</td></tr>
<tr><td colspan="2">Interrupt setting parameters</td><td>Set the parameters for interrupt function.</td></tr>
<tr><td colspan="2">Time setting parameters</td><td>Set the time at communication start.</td></tr>
<tr><td colspan="2">Direct control setting parameter</td><td>Set the parameters for direct control.</td></tr>
<tr><td colspan="2" style="display:none"></td></tr>
<tr><td>Mark detection</td><td colspan="2">Mark detection setting parameters</td><td>Set the parameters for mark detection.</td></tr>
<tr><td>Positioning data</td><td colspan="2">Positioning data</td><td>Set the data for "major positioning control".</td></tr>
<tr><td rowspan="3">Block start data</td><td colspan="2">Block start data</td><td>Set the block start data for "high-level positioning control".</td></tr>
<tr><td colspan="2">Condition data</td><td>Set the condition data for "high-level positioning control".</td></tr>
<tr><td colspan="2">Memo data</td><td>Set the condition judgment values for the condition data used in "high-level positioning control".</td></tr>
<tr><td rowspan="4">Synchronous control parameters</td><td colspan="2">Servo input axis parameters</td><td rowspan="4">Set the parameters for synchronous control.</td></tr>
<tr><td colspan="2">Synchronous encoder axis parameters</td></tr>
<tr><td colspan="2">Synchronous encoder axis parameters via link device</td></tr>
<tr><td colspan="2">Synchronous parameters</td></tr>
<tr><td colspan="3">Cam data</td><td>Set the cam data to be used for synchronous control.</td></tr>
</table>

*1 If the setting of the basic parameters 1 is incorrect, the rotation direction may be reversed, or no operation may take place.
*2 Detailed parameters 2 are data items for using the functions of Simple Motion board to the fullest. Set as required.

- The following methods are available for data setting. In this manual, the method using EM Configurator will be explained. (Refer to the next "Point".)

• Set using EM Configurator. • Create the user program for data setting and execute it.

- The basic parameters 1, detailed parameters 1, home position return parameters, "[Pr.83] Speed control 10 × multiplier setting for degree axis", "[Pr.90] Operation setting for speed-torque control mode", "[Pr.122] Manual pulse generator speed limit mode" and "[Pr.123] Manual pulse generator speed limit value" become valid when the user program READY signal [Y0] turns from OFF to ON.
- The basic parameters 2, detailed parameters 2 (excluding "[Pr.83] Speed control 10 × multiplier setting for degree axis", "[Pr.90] Operation setting for speed-torque control mode", "[Pr.122] Manual pulse generator speed limit mode" and "[Pr.123] Manual pulse generator speed limit value") become valid immediately when they are written to the buffer memory, regardless of the state of the user program READY signal [Y0].
- Even when the user program READY signal [Y0] is ON, the values or contents of the following can be changed: basic parameters 2, detailed parameters 2, positioning data, and block start data.
- The only valid data assigned to basic parameter 2, detailed parameter 2, positioning data or block start data are the data read at the moment when a positioning or JOG operation is started. Once the operation has started, any modification to the data is ignored. Exceptionally, however, modifications to the following are valid even when they are made during a positioning operation: acceleration time 0 to 3, deceleration time 0 to 3, and external command function.

Setting data that can be changed during operation	Details
Acceleration time 0 to 3, deceleration time 0 to 3	Positioning data are pre-read and pre-analyzed. Modifications to the data four or more steps after the current step are valid.
External command function selection	The value at the time of detection is valid.

Point

- The "setting data" is created for each axis.
- The "setting data" parameters have determined default values, and are set to the default values before shipment from the factory. (Parameters related to axes that are not used are left at the default value.)
- The "setting data" can be initialized with EM Configurator or the user program.

Monitor data

The data indicates the control status. The data is stored in the buffer memory. Monitor the data as necessary.

The monitor data is classified as follows.

Item	Description
System monitor data	Monitors the specifications and the operation history of Simple Motion board.
Axis monitor data	Monitors the data related to the operating axis, such as the current position and speed.
Servo network composition status	Monitors the data related to the current network state.
Synchronous control data	Monitors the data for synchronous control.
Mark detection monitor data	Monitors the data for mark detection.
Monitor area for slave device operation	Monitors the data of when slave devices are operated.
Interrupt monitor data	Monitors the data for interrupt function.
User watchdog monitor data	Monitors the data for user watchdog.
Controller in-position monitor data	Monitors the data for controller in-position.
DMA transmission monitor data	Monitors the data for DMA transmission.
Ethernet communication monitor data	Monitors the data for Ethernet communication.
Direct control monitor data	Monitors the data for direct control.

- The following methods are available for data monitoring:

  - Set using EM Configurator.
  - Create the user program for monitoring and execute it.

- In this manual, the method using EM Configurator will be explained.

Control data

The data is used by users to control the positioning system.

The control data is classified as follows.

Item	Description
System control data	Writes/initializes the "positioning data" in the Simple Motion board. Sets the setting for operation of all axes.
Axis control data	Makes settings related to the operation, and controls the speed change during operation, and stops/restarts the operation for each axis. Output signals (axis stop signal, JOG start signal and execution prohibition flag) from the host personal computer to the Simple Motion board.
Synchronous control data	Sets the data for synchronous control.
Mark detection control data	Sets the data for mark detection control.
Control data for slave device operation	Sets the control data to operate slave devices.
Interrupt control data	Sets the data for interrupt function.
User watchdog control data	Sets the data for user watchdog.
DMA transmission control data	Sets the data for DMA transmission.
Remote operation control data	Sets the data for remote operation.
Ethernet communication control data	Sets the data for Ethernet communication.
Control data for direct control	Sets the data for diect control.

- Control using the control data is carried out with the user program. "[Cd.41] Deceleration start flag valid" is valid for only the value at the time when the user program READY signal [Y0] turns from OFF to ON.

Setting items for servo network composition parameters

The setting items for the "servo network composition parameters" are shown below.

Servo network composition parameter		Remark
[Pr.100]	Connected device	Sets the slave device supporting the motion mode for which axis control is performed by the Simple Motion board.
[Pr.101]	Virtual servo amplifier setting	Sets if use as virtual servo amplifier axis. It will be read when the power supply is ON.

Setting items for common parameters

The setting items for the "common parameters" are shown below. The "common parameters" are independent of axes and related to the overall system.

○: Set as required ("—" when not required)

Common parameter		Home position return control	Major positioning control			
			Position control			
			1-axis linear control 2/3/4-axis linear interpolation control	1/2/3/4-axis fixed-feed control	2-axis circular interpolation control	3-axis helical interpolation control
[Pr.82]	Forced stop valid/invalid selection	○	○	○	○	○
[Pr.152]	Maximum number of control axes	○	○	○	○	○

○: Set as required ("—" when not required)

Common parameter		Major positioning control			
		1 to 4 axis speed control	Speed-position or position-speed control	Other control	
				Current value changing	JUMP instruction, NOP instruction, LOOP to LEND
[Pr.82]	Forced stop valid/invalid selection	○	○	○	○
[Pr.152]	Maximum number of control axes	○	○	○	○

○: Set as required ("—" when not required)

—: Setting not required (When the value is the default value or within the setting range, there is no problem.)

Common parameter		Manual control			Expansion control	Related sub function
		Manual pulse generator operation	Inching operation	JOG operation	Speed-torque control	
[Pr.82]	Forced stop valid/invalid selection	○	○	○	○	☞ Page 247 Forced stop function
[Pr.152]	Maximum number of control axes	○	○	○	○	—

Setting items for positioning parameters

The setting items for the "positioning parameters" are shown below. The "positioning parameters" are set for each axis for all controls achieved by the Simple Motion board.

Home position return control

◎: Always set, ○: Set as required ("—" when not required), △: Setting restricted, ×: Setting not possible
—: Setting not required (When the value is the default value or within the setting range, there is no problem.)

Positioning parameter		Home position return control
Basic parameters 1	[Pr.1] Unit setting	◎
	[Pr.2] Number of pulses per rotation (AP) (Unit: pulse)	◎
	[Pr.3] Movement amount per rotation (AL)	◎
	[Pr.4] Unit magnification (AM)	◎
	[Pr.7] Bias speed at start	○
Basic parameters 2	[Pr.8] Speed limit value	◎
	[Pr.9] Acceleration time 0	◎
	[Pr.10] Deceleration time 0	◎
Detailed parameters 1	[Pr.11] Backlash compensation amount	○
	[Pr.12] Software stroke limit upper limit value	—
	[Pr.13] Software stroke limit lower limit value	—
	[Pr.14] Software stroke limit selection	—
	[Pr.15] Software stroke limit valid/invalid setting	—
	[Pr.16] Command in-position width	—
	[Pr.17] Torque limit setting value	△
	[Pr.18] M code ON signal output timing	—
	[Pr.19] Speed switching mode	—
	[Pr.20] Interpolation speed designation method	—
	[Pr.21] Feed current value during speed control	—
	[Pr.22] Input signal logic selection	◎
	[Pr.81] Speed-position function selection	—
	[Pr.116] FLS signal selection	○
	[Pr.117] RLS signal selection	○
	[Pr.118] DOG signal selection	○
	[Pr.119] STOP signal selection	○

Positioning parameter		Home position return control
Detailed parameters 2	[Pr.25] Acceleration time 1	○
	[Pr.26] Acceleration time 2	○
	[Pr.27] Acceleration time 3	○
	[Pr.28] Deceleration time 1	○
	[Pr.29] Deceleration time 2	○
	[Pr.30] Deceleration time 3	○
	[Pr.31] JOG speed limit value	—
	[Pr.32] JOG operation acceleration time selection	—
	[Pr.33] JOG operation deceleration time selection	—
	[Pr.34] Acceleration/deceleration process selection	○
	[Pr.35] S-curve ratio	○
	[Pr.36] Rapid stop deceleration time	○
	[Pr.37] Stop group 1 rapid stop selection	○
	[Pr.38] Stop group 2 rapid stop selection	○
	[Pr.39] Stop group 3 rapid stop selection	○
	[Pr.40] Positioning complete signal output time	—
	[Pr.41] Allowable circular interpolation error width	—
	[Pr.83] Speed control 10 × multiplier setting for degree axis	○
	[Pr.84] Restart allowable range when servo OFF to ON	○
	[Pr.90] Operation setting for speed-torque control mode	—
	[Pr.122] Manual pulse generator speed limit mode	—
	[Pr.123] Manual pulse generator speed limit value	—

Major positioning control

◎: Always set, ○: Set as required ("—" when not required), △: Setting restricted, ×: Setting not possible

—: Setting not required (When the value is the default value or within the setting range, there is no problem.)

Positioning parameter		Major positioning control							
		Position control				1 to 4 axis speed control	Speed-position or position-speed control	Other control	
		1-axis linear control 2/3/4-axis linear interpolation control	1/2/3/4-axis fixed-feed control	2-axis circular interpolation control	3-axis helical interpolation control			Current value changing	JUMP instruction, NOP instruction, LOOP to LEND
Basic parameters 1	[Pr.1] Unit setting	◎	◎	△	△	◎	◎	◎	◎
	[Pr.2] Number of pulses per rotation (AP) (Unit: pulse)	◎	◎	◎	◎	◎	◎	◎	◎
	[Pr.3] Movement amount per rotation (AL)	◎	◎	◎	◎	◎	◎	◎	◎
	[Pr.4] Unit magnification (AM)	◎	◎	◎	◎	◎	◎	◎	◎
	[Pr.7] Bias speed at start	○	○	○	○	○	○	—	—
Basic parameters 2	[Pr.8] Speed limit value	◎	◎	◎	◎	◎	◎	—	—
	[Pr.9] Acceleration time 0	◎	◎	◎	◎	◎	◎	—	—
	[Pr.10] Deceleration time 0	◎	◎	◎	◎	◎	◎	—	—

12

Positioning parameter		Major positioning control							
		Position control				1 to 4 axis speed control	Speed-position or position-speed control	Other control	
		1-axis linear control 2/3/4-axis linear interpolation control	1/2/3/4-axis fixed-feed control	2-axis circular interpolation control	3-axis helical interpolation control			Current value changing	JUMP instruction, NOP instruction, LOOP to LEND
Detailed parameters 1	[Pr.11] Backlash compensation amount	○	○	○	○	○	○	—	—
	[Pr.12] Software stroke limit upper limit value	○	○	○	○	○	○	○	—
	[Pr.13] Software stroke limit lower limit value	○	○	○	○	○	○	○	—
	[Pr.14] Software stroke limit selection	○	○	○	○	○	○	○	—
	[Pr.15] Software stroke limit valid/invalid setting	—	—	—	—	—	—	—	—
	[Pr.16] Command in-position width	○	○	○	○	—	○	—	—
	[Pr.17] Torque limit setting value	○	○	○	○	○	○	—	—
	[Pr.18] M code ON signal output timing	○	○	○	○	○	○	○	—
	[Pr.19] Speed switching mode	○	○	○	○	—	—	—	—
	[Pr.20] Interpolation speed designation method	△	△	△	△	△	—	—	—
	[Pr.21] Feed current value during speed control	—	—	—	—	○	○	—	—
	[Pr.22] Input signal logic selection	◎	◎	◎	◎	◎	◎	◎	◎
	[Pr.81] Speed-position function selection	—	—	—	—	—	◎	—	—
	[Pr.116] FLS signal selection	○	○	○	○	○	○	—	—
	[Pr.117] RLS signal selection	○	○	○	○	○	○	—	—
	[Pr.118] DOG signal selection	—	—	—	○	—	○	—	—
	[Pr.119] STOP signal selection	○	○	○	○	○	○	○	○

Positioning parameter		Major positioning control							
		Position control				1 to 4 axis speed control	Speed-position or position-speed control	Other control	
		1-axis linear control 2/3/4-axis linear interpolation control	1/2/3/4-axis fixed-feed control	2-axis circular interpolation control	3-axis helical interpolation control			Current value changing	JUMP instruction, NOP instruction, LOOP to LEND
Detailed parameters 2	[Pr.25] Acceleration time 1	○	○	○	○	○	○	—	—
	[Pr.26] Acceleration time 2	○	○	○	○	○	○	—	—
	[Pr.27] Acceleration time 3	○	○	○	○	○	○	—	—
	[Pr.28] Deceleration time 1	○	○	○	○	○	○	—	—
	[Pr.29] Deceleration time 2	○	○	○	○	○	○	—	—
	[Pr.30] Deceleration time 3	○	○	○	○	○	○	—	—
	[Pr.31] JOG speed limit value	—	—	—	—	—	—	—	—
	[Pr.32] JOG operation acceleration time selection	—	—	—	—	—	—	—	—
	[Pr.33] JOG operation deceleration time selection	—	—	—	—	—	—	—	—
	[Pr.34] Acceleration/ deceleration process selection	○	○	○	○	○	○	—	—
	[Pr.35] S-curve ratio	○	○	○	○	○	○	—	—
	[Pr.36] Rapid stop deceleration time	○	○	○	○	○	○	—	—
	[Pr.37] Stop group 1 rapid stop selection	○	○	○	○	○	○	—	—
	[Pr.38] Stop group 2 rapid stop selection	○	○	○	○	○	○	—	—
	[Pr.39] Stop group 3 rapid stop selection	○	○	○	○	○	○	—	—
	[Pr.40] Positioning complete signal output time	○	○	○	○	○	○	○	—

Positioning parameter		Major positioning control							
		Position control				1 to 4 axis speed control	Speed-position or position-speed control	Other control	
		1-axis linear control 2/3/4-axis linear interpolation control	1/2/3/4-axis fixed-feed control	2-axis circular interpolation control	3-axis helical interpolation control			Current value changing	JUMP instruction, NOP instruction, LOOP to LEND
Detailed parameters 2	[Pr.41] Allowable circular interpolation error width	—	—	○	○	—	—	—	—
	[Pr.83] Speed control 10 × multiplier setting for degree axis	○	○	○	○	○	○	—	—
	[Pr.84] Restart allowable range when servo OFF to ON	○	○	○	○	○	○	○	○
	[Pr.90] Operation setting for speed-torque control mode	—	—	—	—	—	—	—	—
	[Pr.122] Manual pulse generator speed limit mode	—	—	—	—	—	—	—	—
	[Pr.123] Manual pulse generator speed limit value	—	—	—	—	—	—	—	—

Manual control

◎: Always set, ○: Set as required ("—" when not required), △: Setting restricted, ×: Setting not possible

—: Setting not required (When the value is the default value or within the setting range, there is no problem.)

Positioning parameter		Manual control		
		Manual pulse generator operation	Inching operation	JOG operation
Basic parameters 1	[Pr.1] Unit setting	◎	◎	◎
	[Pr.2] Number of pulses per rotation (AP) (Unit: pulse)	◎	◎	◎
	[Pr.3] Movement amount per rotation (AL)	◎	◎	◎
	[Pr.4] Unit magnification (AM)	◎	◎	◎
	[Pr.7] Bias speed at start	—	—	○
Basic parameters 2	[Pr.8] Speed limit value	—	◎	◎
	[Pr.9] Acceleration time 0	—	—	◎
	[Pr.10] Deceleration time 0	—	—	◎
Detailed parameters 1	[Pr.11] Backlash compensation amount	○	○	○
	[Pr.12] Software stroke limit upper limit value	○	○	○
	[Pr.13] Software stroke limit lower limit value	○	○	○
	[Pr.14] Software stroke limit selection	○	○	○
	[Pr.15] Software stroke limit valid/invalid setting	○	○	○
	[Pr.16] Command in-position width	—	—	—
	[Pr.17] Torque limit setting value	△	△	△
	[Pr.18] M code ON signal output timing	—	—	—
	[Pr.19] Speed switching mode	—	—	—
	[Pr.20] Interpolation speed designation method	—	—	—
	[Pr.21] Feed current value during speed control	—	—	—
	[Pr.22] Input signal logic selection	◎	◎	◎
	[Pr.81] Speed-position function selection	—	—	—
	[Pr.116] FLS signal selection	○	○	○
	[Pr.117] RLS signal selection	○	○	○
	[Pr.118] DOG signal selection	—	—	—
	[Pr.119] STOP signal selection	○	○	○

12

Positioning parameter		Manual control		
		Manual pulse generator operation	Inching operation	JOG operation
Detailed parameters 2	[Pr.25] Acceleration time 1	—	—	○
	[Pr.26] Acceleration time 2	—	—	○
	[Pr.27] Acceleration time 3	—	—	○
	[Pr.28] Deceleration time 1	—	—	○
	[Pr.29] Deceleration time 2	—	—	○
	[Pr.30] Deceleration time 3	—	—	○
	[Pr.31] JOG speed limit value	—	◎	◎
	[Pr.32] JOG operation acceleration time selection	—	—	◎
	[Pr.33] JOG operation deceleration time selection	—	—	◎
	[Pr.34] Acceleration/deceleration process selection	—	—	○
	[Pr.35] S-curve ratio	—	—	○
	[Pr.36] Rapid stop deceleration time	—	—	○
	[Pr.37] Stop group 1 rapid stop selection	—	—	○
	[Pr.38] Stop group 2 rapid stop selection	—	—	○
	[Pr.39] Stop group 3 rapid stop selection	—	—	○
	[Pr.40] Positioning complete signal output time	—	—	—
	[Pr.41] Allowable circular interpolation error width	—	—	—
	[Pr.83] Speed control 10 × multiplier setting for degree axis	○	○	○
	[Pr.84] Restart allowable range when servo OFF to ON	○	○	○
	[Pr.90] Operation setting for speed-torque control mode	—	—	—
	[Pr.122] Manual pulse generator speed limit mode	○	—	—
	[Pr.123] Manual pulse generator speed limit value	○	—	—

Expansion control

◎: Always set, ○: Set as required ("—" when not required), △: Setting restricted, ×: Setting not possible

—: Setting not required (When the value is the default value or within the setting range, there is no problem.)

Positioning parameter		Expansion control
		Speed-torque control
Basic parameters 1	[Pr.1] Unit setting	◎
	[Pr.2] Number of pulses per rotation (AP) (Unit: pulse)	◎
	[Pr.3] Movement amount per rotation (AL)	◎
	[Pr.4] Unit magnification (AM)	◎
	[Pr.7] Bias speed at start	×
Basic parameters 2	[Pr.8] Speed limit value	◎
	[Pr.9] Acceleration time 0	—
	[Pr.10] Deceleration time 0	—
Detailed parameters 1	[Pr.11] Backlash compensation amount	—
	[Pr.12] Software stroke limit upper limit value	○
	[Pr.13] Software stroke limit lower limit value	○
	[Pr.14] Software stroke limit selection	○
	[Pr.15] Software stroke limit valid/invalid setting	—
	[Pr.16] Command in-position width	—
	[Pr.17] Torque limit setting value	○
	[Pr.18] M code ON signal output timing	—
	[Pr.19] Speed switching mode	—
	[Pr.20] Interpolation speed designation method	—
	[Pr.21] Feed current value during speed control	—
	[Pr.22] Input signal logic selection	◎
	[Pr.81] Speed-position function selection	—
	[Pr.116] FLS signal selection	○
	[Pr.117] RLS signal selection	○
	[Pr.118] DOG signal selection	—
	[Pr.119] STOP signal selection	○
Detailed parameters 2	[Pr.25] Acceleration time 1	—
	[Pr.26] Acceleration time 2	—
	[Pr.27] Acceleration time 3	—
	[Pr.28] Deceleration time 1	—
	[Pr.29] Deceleration time 2	—
	[Pr.30] Deceleration time 3	—
	[Pr.31] JOG speed limit value	—
	[Pr.32] JOG operation acceleration time selection	—
	[Pr.33] JOG operation deceleration time selection	—
	[Pr.34] Acceleration/deceleration process selection	—
	[Pr.35] S-curve ratio	—
	[Pr.36] Rapid stop deceleration time	—
	[Pr.37] Stop group 1 rapid stop selection	—
	[Pr.38] Stop group 2 rapid stop selection	—
	[Pr.39] Stop group 3 rapid stop selection	—
	[Pr.40] Positioning complete signal output time	—
	[Pr.41] Allowable circular interpolation error width	—
	[Pr.83] Speed control 10 × multiplier setting for degree axis	○
	[Pr.84] Restart allowable range when servo OFF to ON	—
	[Pr.90] Operation setting for speed-torque control mode	○
	[Pr.122] Manual pulse generator speed limit mode	—
	[Pr.123] Manual pulse generator speed limit value	—

Checking the positioning parameters

[Pr.1] to [Pr.90], [Pr.116] to [Pr.119], [Pr.122], [Pr.123] are checked with the following timing.

- When the "user program READY signal [Y0]" output from the host personal computer to the Simple Motion board changes from OFF to ON

Point

"High-level positioning control" is carried out in combination with the "major positioning control".
Refer to the "major positioning control" parameter settings for details on the parameters required for "high-level positioning control".

Setting items for home position return parameters

When carrying out "home position return control", the "home position return parameters" must be set. The setting items for the "home position return parameters" are shown below.

The "home position return parameters" are set for each axis.

◎: Always set

○: Set as required

—: Setting not required (When the value is the default value or within the setting range, there is no problem.)

Home position return parameters			Machine home position return control	Fast home position return control
Home position return basic parameters	[Pr.43]	Home position return method	Driver home position return method	—
	[Pr.44]	Home position return direction	○*1	—
	[Pr.45]	Home position address	◎	◎
	[Pr.46]	Home position return speed	—	◎
Home position return detailed parameters	[Pr.51]	Home position return acceleration time selection	—	◎
	[Pr.52]	Home position return deceleration time selection	—	◎
	[Pr.55]	Operation setting for incompletion of home position return	○	—

*1 The home position return operation follows the home position return direction set in the driver (servo amplifier) and does not refer to "[Pr.44] Home position return direction". However, "[Pr.44] Home position return direction" must be set when using the backlash compensation function.
When the positioning is executed in the reverse direction against "[Pr.44] Home position return direction", the backlash compensation is executed in the axis operation such as positioning after the driver home position return. Set the same direction to "[Pr.44] Home position return direction" of the Simple Motion board and the last home position return direction of the driver (servo amplifier).

Checking the home position return parameters

[Pr.43] to [Pr.55] are checked with the following timing.

- When the "user program READY signal [Y0]" changes from OFF to ON

Setting items for positioning data

Positioning data must be set for carrying out any "major positioning control". The table below lists the items to be set for producing the positioning data.

One to 600 positioning data items can be set for each axis.

◎: Always set

○: Set as required ("—" when not required)

×: Setting not possible (If set, the error "Continuous path control not possible" (error code: 1A1EH to 1A20H) will occur at start.)

△: Setting limited

—: Setting not required (When the value is the default value or within the setting range, there is no problem.)

Positioning data			Position control				1 to 4 axis speed control
			1-axis linear control 2/3/4-axis linear interpolation control	1-axis fixed-feed control, 2/3/4-axis fixed-feed control	2-axis circular interpolation control	3-axis helical interpolation control	
[Da.1]	Operation pattern	Independent positioning control (Positioning complete)	◎	◎	◎	◎	◎
		Continuous positioning control	◎	◎	◎	◎	×
		Continuous path control	◎	×	◎	◎	×
[Da.2]	Control method		Linear 1 Linear 2 Linear 3 Linear 4 *1	Fixed-feed 1 Fixed-feed 2 Fixed-feed 3 Fixed-feed 4	Circular sub Circular right Circular left *1	Helical sub Helical right Helical left *1	Forward run speed 1 Reverse run speed 1 Forward run speed 2 Reverse run speed 2 Forward run speed 3 Reverse run speed 3 Forward run speed 4 Reverse run speed 4
[Da.3]	Acceleration time No.		◎	◎	◎	◎	◎
[Da.4]	Deceleration time No.		◎	◎	◎	◎	◎
[Da.6]	Positioning address/ movement amount		◎	◎	◎	◎	—
[Da.7]	Arc address		—	—	◎	◎	—
[Da.8]	Command speed		◎	◎	◎	◎	◎
[Da.9]	Dwell time/JUMP destination positioning data No.		○	○	○	○	—
[Da.10]	M code/Condition data No./ Number of LOOP to LEND repetitions/Number of pitches		○	○	○	○*2	○
[Da.20]	Axis to be interpolated 1		◎: 2 axes, 3 axes, 4 axes, —: 1 axis				
[Da.21]	Axis to be interpolated 2		◎: 3 axes, 4 axes, —: 1 axis, 2 axes				
[Da.22]	Axis to be interpolated 3		◎: 4 axes, —: 1 axis, 2 axes, 3 axes				
[Da.27]	M code ON signal output timing		○	○	○	○	○
[Da.28]	ABS direction in degrees		○	○	○	○	○
[Da.29]	Interpolation speed designation method		△	△	△	△	△

*1 Two control systems are available: the absolute (ABS) system and incremental (INC) system.

*2 Set an M code for the reference axis and set the number of pitches for the linear interpolation axis.

◎: Always set

○: Set as required ("—" when not required)

×: Setting not possible (If set, the error "Continuous path control not possible" (error code: 1A1EH to 1A20H) will occur at start.)

—: Setting not required (When the value is the default value or within the setting range, there is no problem.)

Positioning data			Speed-position switching control	Position-speed switching control
[Da.1]	Operation pattern	Independent positioning control (Positioning complete)	◎	◎
		Continuous positioning control	◎	×
		Continuous path control	×	×
[Da.2]	Control method		Forward run speed/position Reverse run speed/position *1	Forward run position/speed Reverse run position/speed
[Da.3]	Acceleration time No.		◎	◎
[Da.4]	Deceleration time No.		◎	◎
[Da.6]	Positioning address/movement amount		◎	◎
[Da.7]	Arc address		—	—
[Da.8]	Command speed		◎	◎
[Da.9]	Dwell time/JUMP destination positioning data No.		○	○
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches		○	○
[Da.20]	Axis to be interpolated 1		—	—
[Da.21]	Axis to be interpolated 2		—	—
[Da.22]	Axis to be interpolated 3		—	—
[Da.27]	M code ON signal output timing		○	○
[Da.28]	ABS direction in degrees		○	○
[Da.29]	Interpolation speed designation method		—	—

*1 Two control systems are available: the absolute (ABS) system and incremental (INC) system.

◎: Always set

○: Set as required ("—" when not required)

×: Setting not possible (If set, the error "Continuous path control not possible" (error code: 1A1EH to 1A20H) will occur at start.)

—: Setting not required (When the value is the default value or within the setting range, there is no problem.)

Positioning data			Other control				
			NOP instruction	**Current value changing**	**JUMP instruction**	**LOOP**	**LEND**
[Da.1]	Operation pattern	Independent positioning control (Positioning complete)	—	◎	—	—	—
		Continuous positioning control	—	◎	—	—	—
		Continuous path control	—	×	—	—	—
[Da.2]	Control method		NOP	Current value changing	JUMP instruction	LOOP	LEND
[Da.3]	Acceleration time No.		—	—	—	—	—
[Da.4]	Deceleration time No.		—	—	—	—	—
[Da.6]	Positioning address/movement amount		—	New address	—	—	—
[Da.7]	Arc address		—	—	—	—	—
[Da.8]	Command speed		—	—	—	—	—
[Da.9]	Dwell time/JUMP destination positioning data No.		—	—	JUMP destination positioning data No.	—	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches		—	○	JUMP condition data No.	Number of LOOP to LEND repetitions	—
[Da.20]	Axis to be interpolated 1		—	—	—	—	—
[Da.21]	Axis to be interpolated 2		—	—	—	—	—
[Da.22]	Axis to be interpolated 3		—	—	—	—	—
[Da.27]	M code ON signal output timing		—	○	—	—	—
[Da.28]	ABS direction in degrees		○	○	○	○	○
[Da.29]	Interpolation speed designation method		—	—	—	—	—

Checking the positioning data

[Da.1] to [Da.10], [Da.20] to [Da.22], [Da.27] to [Da.29] are checked at the following timings:

- Startup of a positioning operation

Setting items for block start data

The "block start data" must be set when carrying out "high-level positioning control". The setting items for the "block start data" are shown below.
Up to 50 points of "block start data" can be set for each axis.
○: Set as required ("—" when not required)
—: Setting not required (When the value is the default value or within the setting range, there is no problem.)

Block start data		Block start (Normal start)	Condition start	Wait start	Simultaneous start	Repeated start (FOR loop)	Repeated start (FOR condition)
[Da.11]	Shape (end/continue)	○	○	○	○	○	○
[Da.12]	Start data No.	○	○	○	○	○	○
[Da.13]	Special start instruction	—	○	○	○	○	○
[Da.14]	Parameter	—	○	○	○	○	○

Checking the block start data

[Da.11] to [Da.14] are checked with the following timing.

- When "Block start data" starts

Setting items for condition data

When carrying out "high-level positioning control" or using the JUMP instruction in the "major positioning control", the "condition data" must be set as required. The setting items for the "condition data" are shown below.
Up to 10 "condition data" items can be set for each axis.
○: Set as required ("—" when not required)
△: Setting limited
—: Setting not required (When the value is the default value or within the setting range, there is no problem.)

Condition data		Major positioning control		High-level positioning control					
		Other than JUMP instruction	JUMP instruction	Block start (Normal start)	Condition start	Wait start	Simultaneous start	Repeated start (FOR loop)	Repeated start (FOR condition)
[Da.15]	Condition target	—	○	—	○	○	○	—	○
[Da.16]	Condition operator	—	○	—	○	○	○	—	○
[Da.17]	Address	—	△	—	△	△	—	—	△
[Da.18]	Parameter 1	—	○	—	○	○	△	—	○
[Da.19]	Parameter 2	—	△	—	△	△	△	—	△
[Da.23]	Number of simultaneous starting axes	—	—	—	—	—	○	—	—
[Da.24]	Simultaneous starting axis No.1	—	—	—	—	—	○	—	—
[Da.25]	Simultaneous starting axis No.2	—	—	—	—	—	○	—	—
[Da.26]	Simultaneous starting axis No.3	—	—	—	—	—	○	—	—

Checking the condition data

[Da.15] to [Da.19], [Da.23] to [Da.26] are checked with the following timing.

- When "Block start data" starts
- When "JUMP instruction" starts

Types and roles of monitor data

The monitor data area in the buffer memory stores data relating to the operating state of the positioning system, which are monitored as required while the positioning system is operating.
The following data are available for monitoring.

Item	Description
System monitoring	Monitoring of the specification and operation history of Simple Motion board (system monitor data [Md.1], [Md.3] to [Md.8], [Md.19], [Md.50], [Md.51], [Md.54], [Md.59], [Md.60], [Md.130] to [Md.135], [Md.138], [Md.1200], servo network composition status [Md.105])
Axis operation monitoring	Monitoring of the current position and speed, and other data related to the movements of axes (axis monitor data [Md.20] to [Md.48], [Md.62], [Md.101] to [Md.104], [Md.108], [Md.114], [Md.117], [Md.119], [Md.120], [Md.122], [Md.123], [Md.503], [Md.514], [Md.900], [Md.1130], [Md.1132])

Monitoring the system

■Monitoring the positioning system operation history

Monitoring details			Corresponding item
Monitor whether the system is in the test mode.			[Md.1] In test mode flag
History of data that started an operation.	Start information		[Md.3] Start information
	Start No.		[Md.4] Start No.
	Start*1	Year: month	[Md.54] Start (Year: month)
		Day: hour	[Md.5] Start (Day: hour)
		Minute: second	[Md.6] Start (Minute: second)
		ms	[Md.60] Start (ms)
	Error upon starting		[Md.7] Error judgment
	Pointer No. next to the pointer No. where the latest history is stored		[Md.8] Start history pointer
Number of write accesses to the flash ROM after the power is switched ON.	Number of write accesses to flash ROM		[Md.19] Number of write accesses to flash ROM
Forced stop input signal (EMI) turn ON/OFF.	Forced stop input signal (EMI) information		[Md.50] Forced stop input
Monitor whether the system is in amplifier-less operation.			[Md.51] Amplifier-less operation mode status
Store the Simple Motion board information.			[Md.59] Module information
Monitor the first five digits of product information of the Simple Motion board.			[Md.130] F/W version
Monitor the RUN status of digital oscilloscope.			[Md.131] Digital oscilloscope running flag
Monitor the current operation cycle.			[Md.132] Operation cycle setting
Monitor whether the operation cycle time exceeds operation cycle.			[Md.133] Operation cycle over flag
Monitor the time that took for operation every operation cycle.			[Md.134] Operation time
Monitor the maximum value of operation time every time after the power supply of the Simple Motion board is turned ON.			[Md.135] Maximum operation time
Monitor the production No. of the Simple Motion board.			[Md.138] Production No.
Monitor the board ID information of the Simple Motion board.			[Md.1200] Board information

*1 Displays a value set by the clock function of the host personal computer.

Monitoring the axis operation state

■Monitoring the position

Monitor details	Corresponding item
Monitor the current feed machine value.	[Md.21] Feed machine value
Monitor the feed current value.	[Md.20] Feed current value
Monitor the current target value.	[Md.32] Target value

■Monitoring the speed

<table>
<tr><th colspan="4">Monitor details</th><th>Corresponding item</th></tr>
<tr><td rowspan="5">Monitor the current speed.</td><td colspan="2">During independent axis control</td><td>Indicates the speed of each axis.</td><td rowspan="3">[Md.22] Feedrate</td></tr>
<tr><td rowspan="2">During interpolation control</td><td>When "0: Composite speed" is set for "[Pr.20] Interpolation speed designation method"</td><td>Indicates the composite speed.</td></tr>
<tr><td>When "1: Reference axis speed" is set for "[Pr.20] Interpolation speed designation method"</td><td>Indicates the reference axis speed.</td></tr>
<tr><td colspan="3">Monitor "[Da.8] Command speed" currently being executed.</td><td>[Md.27] Current speed</td></tr>
<tr><td colspan="3">Constantly indicates the speed of each axis.</td><td>[Md.28] Axis feedrate</td></tr>
<tr><td colspan="4">Monitor the current target speed.</td><td>[Md.33] Target speed</td></tr>
<tr><td colspan="4">Monitor the command speed at speed control mode in the speed-torque control.</td><td>[Md.122] Speed during command</td></tr>
</table>

12

■Monitoring the status of servo amplifier

<table>
<tr><th>Monitor details</th><th>Corresponding item</th></tr>
<tr><td>Monitor the real current value "feed current value - (command pulse - feedback pulse)".</td><td>[Md.101] Real current value</td></tr>
<tr><td>Monitor the pulse droop.</td><td>[Md.102] Deviation counter value</td></tr>
<tr><td>Monitor the motor speed of servo motor.</td><td>[Md.103] Motor rotation speed</td></tr>
<tr><td>Monitor the current value of servo motor.</td><td>[Md.104] Motor current value</td></tr>
<tr><td>Monitor the servo amplifier type of each axis.</td><td>[Md.105] Connected device</td></tr>
<tr><td rowspan="2">Monitor the status (servo status) of servo amplifier.</td><td>[Md.108] Servo status1</td></tr>
<tr><td>[Md.119] Servo status2</td></tr>
<tr><td>Monitor the alarm of servo amplifier.</td><td>[Md.114] Servo alarm</td></tr>
<tr><td>Monitor CiA402 Statusword of servo amplifier.</td><td>[Md.117] Statusword</td></tr>
<tr><td>Monitor the home position return operating status of servo amplifier.</td><td>[Md.514] Home position return operating status</td></tr>
</table>

■Monitoring the state

Monitor details	Corresponding item
Monitor the latest error code that occurred with the axis.	[Md.23] Axis error No.
Monitor the latest warning code that occurred with the axis.	[Md.24] Axis warning No.
Monitor the valid M codes.	[Md.25] Valid M code
Monitor the axis operation state.	[Md.26] Axis operation status
Monitor the movement amount after the current position control switching when using "speed-position switching control".	[Md.29] Speed-position switching control positioning movement amount
Monitor the external input/output signal and flag.	[Md.30] External input signal
	[Md.31] Status
Monitor the current torque limit value.	[Md.35] Torque limit stored value/forward torque limit stored value
	[Md.120] Reverse torque limit stored value
Monitor the "instruction code" of the special start data when using special start.	[Md.36] Special start data instruction code setting value
Monitor the "instruction parameter" of the special start data when using special start.	[Md.37] Special start data instruction parameter setting value
Monitor the "start data No." of the special start data when using special start.	[Md.38] Start positioning data No. setting value
Monitor whether the speed is being limited.	[Md.39] In speed limit flag
Monitor whether the speed is being changed.	[Md.40] In speed change processing flag
Monitor the remaining number of repetitions (special start).	[Md.41] Special start repetition counter
Monitor the remaining number of repetitions (control system).	[Md.42] Control system repetition counter
Monitor the "start data" point currently being executed.	[Md.43] Start data pointer being executed
Monitor the "positioning data No." currently being executed.	[Md.44] Positioning data No. being executed
Monitor the block No.	[Md.45] Block No. being executed
Monitor the "positioning data No." executed last.	[Md.46] Last executed positioning data No.
Monitor the positioning data currently being executed.	[Md.47] Positioning data being executed
Monitor switching from the constant speed status or acceleration status to the deceleration status during position control whose operation pattern is "Positioning complete".	[Md.48] Deceleration start flag
Monitor the carrying over movement amount which exceeds "[Pr.123] Manual pulse generator speed limit value".	[Md.62] Amount of the manual pulser driving carrying over movement
Monitor the command torque at torque control mode in the speed-torque control.	[Md.123] Torque during command
Monitor the positioning data analysis status.	[Md.503] Pre-reading data analysis status
Monitor the status of the external command signals assigned to link devices.	[Md.900] External command signal monitor
Monitor the error detection status of "[Md.31] Status" of all axes from b0 in order of the axis Nos.	[Md.1130] Error detection (all axes)
Monitor the axis warning detection status of "[Md.31] Status" of all axes from b0 in order of the axis Nos.	[Md.1132] Axis warning detection (all axes)

Types and roles of control data

Operation of the positioning system is achieved through the execution of necessary controls. (Data required for controls are given through the default values when the power is switched ON, which can be modified as required by the user program.)
Items that can be controlled are described below.

Controlling the system data	Setting and resetting "setting data" of Simple Motion board. (system control data [Cd.1], [Cd.2])
Controlling the operation	Setting operation parameters, changing speed during operation, interrupting or restarting operation, etc. (system control data [Cd.41], [Cd.42], [Cd.44], [Cd.137], [Cd.158], axis control data [Cd.3] to [Cd.40], [Cd.43], [Cd.45], [Cd.46], [Cd.100], [Cd.101], [Cd.108], [Cd.112], [Cd.113], [Cd.130], [Cd.136], [Cd.138] to [Cd.146], [Cd.180] to [Cd.183])

12

Controlling the system data

■Setting and resetting the setting data

Control details	Controlled data item
Write setting data from buffer memory to flash ROM.	[Cd.1] Flash ROM write request
Reset (initialize) parameters.	[Cd.2] Parameter initialization request

Controlling the operation

■Controlling the operation

Control details	Corresponding item
Set which positioning to execute (start No.).	[Cd.3] Positioning start No.
Set start point No. for executing block start.	[Cd.4] Positioning starting point No.
Clear (reset) the axis error ([Md.23]) and warning ([Md.24]).	[Cd.5] Axis error reset
Issue instruction to restart (When axis operation is stopped).	[Cd.6] Restart command
Stop continuous control.	[Cd.18] Interrupt request during continuous operation
Set start data No. of own axis at multiple axes simultaneous starting.	[Cd.30] Simultaneous starting own axis start data No.
Set start data No.1 for axes that start up simultaneously.	[Cd.31] Simultaneous starting axis start data No.1
Set start data No.2 for axes that start up simultaneously.	[Cd.32] Simultaneous starting axis start data No.2
Set start data No.3 for axes that start up simultaneously.	[Cd.33] Simultaneous starting axis start data No.3
Stop (deceleration stop) the current positioning operation and execute the next positioning operation.	[Cd.37] Skip command
Specify write destination for teaching results.	[Cd.38] Teaching data selection
Specify data to be taught.	[Cd.39] Teaching positioning data No.
Set number of simultaneous starting axes and target axis.	[Cd.43] Simultaneous starting axis
Set the status of the external input signal (upper/lower limit switch signal, proximity dog signal, stop signal).	[Cd.44] External input signal operation device (Axis 1 to 16)
Set the information of the forced stop to the buffer memory.	[Cd.158] Forced stop input
Stop axis in control.	[Cd.180] Axis stop
Execute start request of JOG operation or inching operation.	[Cd.181] Forward run JOG start
	[Cd.182] Reverse run JOG start
Execute pre-reading at positioning start.	[Cd.183] Execution prohibition flag

■Controlling operation per step

Control details	Corresponding item
Set unit to carry out step.	[Cd.34] Step mode
Stop positioning operation after each operation.	[Cd.35] Step valid flag
Continuous operation from stopped step.	[Cd.36] Step start information

■Controlling the speed

Control details	Corresponding item
When changing acceleration time during speed change, set new acceleration time.	[Cd.10] New acceleration time value
When changing deceleration time during speed change, set new deceleration time.	[Cd.11] New deceleration time value
Set acceleration/deceleration time validity during speed change.	[Cd.12] Acceleration/deceleration time change value during speed change, enable/disable
Change positioning operation speed between 0 and 300% range.	[Cd.13] Positioning operation speed override
Set new speed when changing speed during operation.	[Cd.14] New speed value
Issue instruction to change speed in operation to [Cd.14] value. (Only during positioning operation and JOG operation).	[Cd.15] Speed change request
Set inching movement amount.	[Cd.16] Inching movement amount
Set JOG speed.	[Cd.17] JOG speed

■Change operation mode

Control details	Corresponding item
Change operation mode.	[Cd.137] Amplifier-less operation mode switching request

■Making settings related to operation

Control details	Corresponding item
Turn M code ON signal OFF.	[Cd.7] M code OFF request
Validate external command signal.	[Cd.8] External command valid
Set new value when changing current value.	[Cd.9] New current value
Change home position return request flag from "ON to OFF".	[Cd.19] Home position return request flag OFF request
Set scale per pulse of number of input pulses from manual pulse generator.	[Cd.20] Manual pulse generator 1 pulse input magnification
Set manual pulse generator operation validity.	[Cd.21] Manual pulse generator enable flag
Change "[Md.35] Torque limit stored value/forward torque limit stored value".	[Cd.22] New torque value/forward new torque value
Change movement amount for position control during speed-position switching control (INC mode).	[Cd.23] Speed-position switching control movement amount change register
Validate switching signal set in "[Cd.45] Speed-position switching device selection".	[Cd.24] Speed-position switching enable flag
Change speed for speed control during position-speed switching control.	[Cd.25] Position-speed switching control speed change register
Validate switching signal set in "[Cd.45] Speed-position switching device selection".	[Cd.26] Position-speed switching enable flag
Set new positioning address when changing target position during positioning.	[Cd.27] Target position change value (New address)
Set new speed when changing target position during positioning.	[Cd.28] Target position change value (New speed)
Set up a flag when target position is changed during positioning.	[Cd.29] Target position change request flag
Set absolute (ABS) moving direction in degrees.	[Cd.40] ABS direction in degrees
Set whether "[Md.48] Deceleration start flag" is valid or invalid.	[Cd.41] Deceleration start flag valid
Set the stop command processing for deceleration stop function (deceleration curve re-processing/ deceleration curve continuation).	[Cd.42] Stop command processing for deceleration stop selection
Set the device used for speed-position switching.	[Cd.45] Speed-position switching device selection
Switch speed-position control.	[Cd.46] Speed-position switching command
Turn the servo OFF for each axis.	[Cd.100] Servo OFF command
Set torque limit value.	[Cd.101] Torque output setting value
Set whether gain switching is execution or not.	[Cd.108] Gain switching command flag
Set "same setting/individual setting" of the forward torque limit value or reverse torque limit value in the torque change function.	[Cd.112] Torque change function switching request
Change "[Md.120] Reverse torque limit stored value".	[Cd.113] New reverse torque value
Set the PI-PID switching to servo amplifier.	[Cd.136] PI-PID switching request

Control details		Corresponding item
Speed-torque control	Switch the control mode.	[Cd.138] Control mode switching request
	Set the control mode to switch.	[Cd.139] Control mode setting
	Set the command speed during speed control mode.	[Cd.140] Command speed at speed control mode
	Set the acceleration time during speed control mode.	[Cd.141] Acceleration time at speed control mode
	Set the deceleration time during speed control mode.	[Cd.142] Deceleration time at speed control mode
	Set the command torque during torque control mode.	[Cd.143] Command torque at torque control mode
	Set the time constant at driving of torque control mode.	[Cd.144] Torque time constant at torque control mode (Forward direction)
	Set the time constant at regeneration of torque control mode.	[Cd.145] Torque time constant at torque control mode (Negative direction)
	Set the speed limit value during torque control mode.	[Cd.146] Speed limit value at torque control mode

12.2 List of Buffer Memory Addresses

The following shows the relation between the buffer memory addresses and the various items.
Do not use the buffer memory address that not been described here for a "Maker setting".
For the list of buffer memory addresses for positioning data, refer to the "EM Configurator Help" of EM Configurator.
Refer to the following for the list of buffer memory addresses for synchronous control.
Simple Motion Board User's Manual (Advanced Synchronous Control)
Refer to the following for the list of buffer memory addresses for the network.
Simple Motion Board User's Manual (Network)
If a label is used for some different classes, the class that is used more frequently is shown in the following lists.

Point

[API library]
To read and write the data of buffer memory using buffer memory addresses, use the MMC_DeviceDriver::SetBufferMemory method and the MMC_DeviceDriver::GetBufferMemory method.

[Basic setting]

■Common parameters

Item		Buffer memory address	Label
[Pr.82]	Forced stop valid/invalid selection	35	MMC_Axis::AxPrm.ForcedStopSetting
[Pr.152]	Maximum number of control axes	58003	MMC_Controller::CmnPrm.MaxAxes

■Positioning parameters: Basic parameters 1

n: Axis No. - 1

Item		Buffer memory address	Label
[Pr.1]	Unit setting	0+150n	MMC_Axis::AxPrm.Unit
[Pr.2]	Number of pulses per rotation (AP)	2+150n 3+150n	MMC_Axis::AxPrm.PulsesPerRotation
[Pr.3]	Movement amount per rotation (AL)	4+150n 5+150n	MMC_Axis::AxPrm.MovementAmountPerRotation
[Pr.4]	Unit magnification (AM)	1+150n	MMC_Axis::AxPrm.UnitMagnification
[Pr.7]	Bias speed at start	6+150n 7+150n	MMC_Axis::AxPrm.BiasSpeed

■Positioning parameters: Basic parameters 2

n: Axis No. - 1

Item		Buffer memory address	Label
[Pr.8]	Speed limit value	10+150n 11+150n	MMC_Axis::AxPrm.SpeedLimitValue
[Pr.9]	Acceleration time 0	12+150n 13+150n	MMC_Axis::AxPrm.AccelerationTime0
[Pr.10]	Deceleration time 0	14+150n 15+150n	MMC_Axis::AxPrm.DecelerationTime0

■Positioning parameters: Detailed parameters 1

n: Axis No. - 1

Item		Buffer memory address	Label
[Pr.11]	Backlash compensation amount	17+150n	MMC_Axis::AxPrm.BacklashAmount
[Pr.12]	Software stroke limit upper limit value	18+150n 19+150n	MMC_Axis::AxPrm.SoftwareStrokeUpperLimit
[Pr.13]	Software stroke limit lower limit value	20+150n 21+150n	MMC_Axis::AxPrm.SoftwareStrokeLowerLimit
[Pr.14]	Software stroke limit selection	22+150n	MMC_Axis::AxPrm.SoftwareStrokeLimitMode
[Pr.15]	Software stroke limit valid/invalid setting	23+150n	MMC_Axis::AxPrm.ManualControlSoftwareStrokeLimitValid

Item			Buffer memory address	Label
[Pr.16]	Command in-position width		24+150n 25+150n	MMC_Axis::AxPrm.CommandInPositionWidth
[Pr.17]	Torque limit setting value		26+150n	MMC_Axis::AxPrm.TorqueLimit
[Pr.18]	M code ON signal output timing		27+150n	MMC_Axis::AxPrm.M_CodeOutputTiming
[Pr.19]	Speed switching mode		28+150n	MMC_Axis::AxPrm.SpeedSwitchingMode
[Pr.20]	Interpolation speed designation method		29+150n	MMC_Axis::AxPrm.InterpolationSpeedDesignation
[Pr.21]	Feed current value during speed control		30+150n	MMC_Axis::AxPrm.V_CommandPosition
[Pr.22]	Input signal logic selection		31+150n	MMC_Axis::AxPrm.InputSignalLogic
	b0	Lower limit		MMC_Axis::AxPrm.SignalLogic_RLS
	b1	Upper limit		MMC_Axis::AxPrm.SignalLogic_FLS
	b3	Stop signal		MMC_Axis::AxPrm.SignalLogic_STOP
	b6	Proximity dog signal		MMC_Axis::AxPrm.SignalLogic_DOG
[Pr.81]	Speed-position function selection		34+150n	MMC_Axis::AxPrm.VP_Mode
[Pr.116]	FLS signal selection		116+150n	MMC_Axis::AxPrm.FLS_SignalSelection
[Pr.117]	RLS signal selection		117+150n	MMC_Axis::AxPrm.RLS_SignalSelection
[Pr.118]	DOG signal selection		118+150n	MMC_Axis::AxPrm.DOG_SignalSelection
[Pr.119]	STOP signal selection		119+150n	MMC_Axis::AxPrm.STOP_SignalSelection

■Positioning parameters: Detailed parameters 2

n: Axis No. - 1

Item		Buffer memory address	Label
[Pr.25]	Acceleration time 1	36+150n 37+150n	MMC_Axis::AxPrm.AccelerationTime1
[Pr.26]	Acceleration time 2	38+150n 39+150n	MMC_Axis::AxPrm.AccelerationTime2
[Pr.27]	Acceleration time 3	40+150n 41+150n	MMC_Axis::AxPrm.AccelerationTime3
[Pr.28]	Deceleration time 1	42+150n 43+150n	MMC_Axis::AxPrm.DecelerationTime1
[Pr.29]	Deceleration time 2	44+150n 45+150n	MMC_Axis::AxPrm.DecelerationTime2
[Pr.30]	Deceleration time 3	46+150n 47+150n	MMC_Axis::AxPrm.DecelerationTime3
[Pr.31]	JOG speed limit value	48+150n 49+150n	MMC_Axis::AxPrm.JogSpeedLimit
[Pr.32]	JOG operation acceleration time selection	50+150n	MMC_Axis::AxPrm.JogAccelerationTime
[Pr.33]	JOG operation deceleration time selection	51+150n	MMC_Axis::AxPrm.JogDecelerationTime
[Pr.34]	Acceleration/deceleration process selection	52+150n	MMC_Axis::AxPrm.AccelerationDecelerationMode
[Pr.35]	S-curve ratio	53+150n	MMC_Axis::AxPrm.S_CurveRatio
[Pr.36]	Rapid stop deceleration time	54+150n 55+150n	MMC_Axis::AxPrm.RapidStopDecelerationTime
[Pr.37]	Stop group 1 rapid stop selection	56+150n	MMC_Axis::AxPrm.StopGroup1RapidStop
[Pr.38]	Stop group 2 rapid stop selection	57+150n	MMC_Axis::AxPrm.StopGroup2RapidStop
[Pr.39]	Stop group 3 rapid stop selection	58+150n	MMC_Axis::AxPrm.StopGroup3RapidStop
[Pr.40]	Positioning complete signal output time	59+150n	MMC_Axis::AxPrm.PositioningCompleteOutputTime
[Pr.41]	Allowable circular interpolation error width	60+150n 61+150n	MMC_Axis::AxPrm.CircularInterpolationErrorRange
[Pr.83]	Speed control 10 × multiplier setting for degree axis	63+150n	MMC_Axis::AxPrm.DegreeAxisSpeedMode
[Pr.84]	Restart allowable range when servo OFF to ON	64+150n 65+150n	MMC_Axis::AxPrm.RestartAllowableRange
[Pr.90]	Operation setting for speed-torque control mode	68+150n	MMC_Axis::AxPrm.SpdTrq_Operation
[Pr.122]	Manual pulse generator speed limit mode	121+150n	MMC_Axis::AxPrm.MPG_SpeedLimitMode
[Pr.123]	Manual pulse generator speed limit value	122+150n 123+150n	MMC_Axis::AxPrm.MPG_SpeedLimitValue

■Home position return parameters: Home position return basic parameters

n: Axis No. - 1

Item		Buffer memory address	Label
[Pr.43]	Home position return method	70+150n	MMC_Axis::AxPrm.HomingMethod
[Pr.44]	Home position return direction	71+150n	MMC_Axis::AxPrm.HomingDirection
[Pr.45]	Home position address	72+150n 73+150n	MMC_Axis::AxPrm.HomePosition
[Pr.46]	Home position return speed	74+150n 75+150n	MMC_Axis::AxPrm.HomingSpeed

■Home position return parameters: Home position return detailed parameters

n: Axis No. - 1

Item		Buffer memory address	Label
[Pr.51]	Home position return acceleration time selection	82+150n	MMC_Axis::AxPrm.HomingAccelerationTime
[Pr.52]	Home position return deceleration time selection	83+150n	MMC_Axis::AxPrm.HomingDecelerationTime
[Pr.55]	Operation setting for incompletion of home position return	87+150n	MMC_Axis::AxPrm.HomingIncompletionMode

[Monitor data]

■System monitor data

p: Pointer No. - 1

Item			Buffer memory address	Label
[Md.1]	In test mode flag		4000	MMC_Controller::SysMntr1.TestModeStatus
[Md.3]	Start information	Start history*1	87010+10p	MMC_Controller::StartHistory.Data[p].StartInfo
[Md.4]	Start No.		87011+10p	MMC_Controller::StartHistory.Data[p].StartNo
[Md.54]	Start (Year: month)		87012+10p	MMC_Controller::StartHistory.Data[p].StartYearMonth
[Md.5]	Start (Day: hour)		87013+10p	MMC_Controller::StartHistory.Data[p].StartDayHour
[Md.6]	Start (Minute: second)		87014+10p	MMC_Controller::StartHistory.Data[p].StartMinSec
[Md.60]	Start (ms)		87015+10p	MMC_Controller::StartHistory.Data[p].StartMsec
[Md.7]	Error judgment		87016+10p	MMC_Controller::StartHistory.Data[p].ErrorNo
[Md.8]	Start history pointer		87000	MMC_Controller::StartHistory.Info.StartHistoryPointer
[Md.19]	Number of write accesses to flash ROM		4224 4225	MMC_Controller::SysMntr1.FlashRomWriteCount
[Md.50]	Forced stop input		4231	MMC_Controller::SysMntr1.ForcedStopInput
[Md.51]	Amplifier-less operation mode status		4232	MMC_Controller::SysMntr1.AmplifierLessOperationStatus
[Md.59]	Module information		31332	MMC_Controller::SysMntr2.ModuleInformation
[Md.130]	F/W version		4006 4007	MMC_Controller::SysMntr1.FW_Version
[Md.131]	Digital oscilloscope running flag		4011	MMC_Controller::SysMntr1.DigitalOscilloscopeStatus
[Md.132]	Operation cycle setting		4238	MMC_Controller::SysMntr1.OperationCycle
[Md.133]	Operation cycle over flag		4239	MMC_Controller::SysMntr1.OperationCycleOver
[Md.134]	Operation time		4008	MMC_Controller::SysMntr1.OperationTime
[Md.135]	Maximum operation time		4009	MMC_Controller::SysMntr1.MaximumOperationTime
[Md.138]	Production No.		6300012 ⋮ 6300019	MMC_Controller::BoardMntr.ProductionNo[0] ⋮ MMC_Controller::BoardMntr.ProductionNo[15]
[Md.700]	Virtual servo amplifier connected station monitor		60900	MMC_EM340GF::SysMntr3.VirtualSv
[Md.1200]	Board information		6300000	MMC_Controller::BoardMntr.BoardInfo

*1 Displays a value set by the clock function of the host personal computer.

■Axis monitor data

n: Axis No. - 1

Item			Buffer memory address	Label
[Md.20]	Feed current value		2400+100n 2401+100n	MMC_Axis::AxMntr.CommandPosition
[Md.21]	Feed machine value		2402+100n 2403+100n	MMC_Axis::AxMntr.MachineCommandPosition
[Md.22]	Feedrate		2404+100n 2405+100n	MMC_Axis::AxMntr.CommandSpeed
[Md.23]	Axis error No.		2406+100n	MMC_Axis::AxMntr.AxisErrorNo
[Md.24]	Axis warning No.		2407+100n	MMC_Axis::AxMntr.AxisWarningNo
[Md.25]	Valid M code		2408+100n	MMC_Axis::AxMntr.M_Code
[Md.26]	Axis operation status		2409+100n	MMC_Axis::AxMntr.AxisOperationStatus
[Md.27]	Current speed		2410+100n 2411+100n	MMC_Axis::AxMntr.CurrentSpeed
[Md.28]	Axis feedrate		2412+100n 2413+100n	MMC_Axis::AxMntr.AxisCommandSpeed
[Md.29]	Speed-position switching control positioning movement amount		2414+100n 2415+100n	MMC_Axis::AxMntr.VP_MovementAmount
[Md.30]	External input signal		2416+100n	MMC_Axis::AxMntr.ExternalInputSignal
	b0	Lower limit signal		MMC_Axis::AxMntr.RLS_Signal
	b1	Upper limit signal		MMC_Axis::AxMntr.FLS_Signal
	b3	Stop signal		MMC_Axis::AxMntr.STOP_Signal
	b4	External command signal/switching signal		MMC_Axis::AxMntr.CHG_Signal
	b6	Proximity dog signal		MMC_Axis::AxMntr.DOG_Signal
[Md.31]	Status		2417+100n	MMC_Axis::AxMntr.Status
	b0	In speed control flag		MMC_Axis::AxMntr.Status_SpeedControl
	b1	Speed-position switching latch flag		MMC_Axis::AxMntr.Status_VP_Latch
	b2	Command in-position flag		MMC_Axis::AxMntr.Status_CommandInPosition
	b3	Home position return request flag		MMC_Axis::AxMntr.Status_HomingRequest
	b4	Home position return complete flag		MMC_Axis::AxMntr.Status_HomingComplete
	b5	Position-speed switching latch flag		MMC_Axis::AxMntr.Status_PV_Latch
	b9	Axis warning detection		MMC_Axis::AxMntr.Status_Warning
	b10	Speed change 0 flag		MMC_Axis::AxMntr.Status_SpeedChange0
	b12	M code ON		MMC_Axis::AxMntr.Status_M_Code
	b13	Error detection		MMC_Axis::AxMntr.Status_Error
	b14	Start complete		MMC_Axis::AxMntr.Status_PositioningStart
	b15	Positioning complete		MMC_Axis::AxMntr.Status_PositioningComplete
[Md.32]	Target value		2418+100n 2419+100n	MMC_Axis::AxMntr.TargetPosition
[Md.33]	Target speed		2420+100n 2421+100n	MMC_Axis::AxMntr.TargetSpeed
[Md.35]	Torque limit stored value/forward torque limit stored value		2426+100n	MMC_Axis::AxMntr.ForwardTorqueLimit
[Md.36]	Special start data instruction code setting value		2427+100n	MMC_Axis::AxMntr.SpecialStartInstructionCode
[Md.37]	Special start data instruction parameter setting value		2428+100n	MMC_Axis::AxMntr.SpecialStartInstructionParameter
[Md.38]	Start positioning data No. setting value		2429+100n	MMC_Axis::AxMntr.StartPositioningDataNo
[Md.39]	In speed limit flag		2430+100n	MMC_Axis::AxMntr.InSpeedLimitFlag
[Md.40]	In speed change processing flag		2431+100n	MMC_Axis::AxMntr.InSpeedChangeFlag
[Md.41]	Special start repetition counter		2432+100n	MMC_Axis::AxMntr.SpecialStartRepetitionCounter
[Md.42]	Control system repetition counter		2433+100n	MMC_Axis::AxMntr.ControlSystemRepetitionCounter
[Md.43]	Start data pointer being executed		2434+100n	MMC_Axis::AxMntr.CurrentStartDataPointer
[Md.44]	Positioning data No. being executed		2435+100n	MMC_Axis::AxMntr.CurrentPositioningDataNo
[Md.45]	Block No. being executed		2436+100n	MMC_Axis::AxMntr.CurrentBlockNo

Item			Buffer memory address	Label
[Md.46]	Last executed positioning data No.		2437+100n	MMC_Axis::AxMntr.LatestPositioningDataNo
[Md.47]	Positioning data being executed	Positioning identifier	2438+100n	MMC_Axis::AxMntr.CurrentPositioningIdentifier
		M code	2439+100n	MMC_Axis::AxMntr.CurrentM_Code
		Dwell time	2440+100n	MMC_Axis::AxMntr.CurrentDwellTime
		Positioning option	2441+100n	MMC_Axis::AxMntr.PositioningOption
		Command speed	2442+100n 2443+100n	MMC_Axis::AxMntr.CurrentCommandSpeed
		Positioning address	2444+100n 2445+100n	MMC_Axis::AxMntr.CurrentPositioningAddress
		Arc address	2446+100n 2447+100n	MMC_Axis::AxMntr.CurrentArcAddress
		Axis to be interpolated	2496+100n 2497+100n	MMC_Axis::AxMntr.CurrentInterpolatedAxis
[Md.48]	Deceleration start flag		2499+100n	MMC_Axis::AxMntr.DecelerationStartFlag
[Md.62]	Amount of the manual pulser driving carrying over movement		2422+100n 2423+100n	MMC_Axis::AxMntr.MPG_CarryoverMovementAmount
[Md.101]	Real current value		2450+100n 2451+100n	MMC_Axis::AxMntr.ActualPosition
[Md.102]	Deviation counter value		2452+100n 2453+100n	MMC_Axis::AxMntr.DeviationCounter
[Md.103]	Motor rotation speed		2454+100n 2455+100n	MMC_Axis::AxMntr.MotorRotationSpeed
[Md.104]	Motor current value		2456+100n	MMC_Axis::AxMntr.MotorCurrentValue
[Md.108]	Servo status1		2477+100n	MMC_Axis::AxMntr.ServoStatus1
	b0	READY ON		MMC_Axis::AxMntr.ServoStatus1_Ready
	b1	Servo ON		MMC_Axis::AxMntr.ServoStatus1_Servo
	b2, b3	Control mode		MMC_Axis::AxMntr.ServoStatus1_ControlMode[0] ⋮ MMC_Axis::AxMntr.ServoStatus1_ControlMode[1]
	b4	Gain switching		MMC_Axis::AxMntr.ServoStatus1_GainSwitching
	b5	Fully closed loop control		MMC_Axis::AxMntr.ServoStatus1_FullyClosedLoopControlSwitching
	b7	Servo alarm		MMC_Axis::AxMntr.ServoStatus1_Alarm
	b12	In-position		MMC_Axis::AxMntr.ServoStatus1_InPosition
	b13	Torque limit		MMC_Axis::AxMntr.ServoStatus1_TorqueLimit
	b14	Absolute position lost		MMC_Axis::AxMntr.ServoStatus1_AbsolutePositionLost
	b15	Servo warning		MMC_Axis::AxMntr.ServoStatus1_Warning
[Md.114]	Servo alarm		2488+100n	MMC_Axis::AxMntr.ServoAlarm
[Md.117]	Statusword		2482+100n	MMC_Axis::AxMntr.Statusword
[Md.119]	Servo status2		2476+100n	MMC_Axis::AxMntr.ServoStatus2
	b0	Zero point pass		MMC_Axis::AxMntr.ServoStatus2_ZeroPointPass
	b3	Zero speed		MMC_Axis::AxMntr.ServoStatus2_ZeroSpeed
	b4	Speed limit		MMC_Axis::AxMntr.ServoStatus2_SpeedLimit
	b8	PID control		MMC_Axis::AxMntr.ServoStatus2_PID_Control
[Md.120]	Reverse torque limit stored value		2491+100n	MMC_Axis::AxMntr.ReverseTorqueLimit
[Md.122]	Speed during command		2492+100n 2493+100n	MMC_Axis::AxMntr.SpeedDuringCommand
[Md.123]	Torque during command		2494+100n	MMC_Axis::AxMntr.TorqueDuringCommand
[Md.503]	Pre-reading data analysis status		59303+100n	MMC_Axis::AxMntr2.PreReadingAnalysisStatus
[Md.514]	Home position return operating status		2457+100n	MMC_Axis::AxMntr.HomingOpreationStatus
[Md.1130]	Error detection (all axes)		90800	MMC_Controller::AllAxMntr.ErrorAllAxis
[Md.1132]	Axis warning detection (all axes)		90804	MMC_Controller::AllAxMntr.WarningAllAxis

■Servo network composition status

Item		Buffer memory address	Label
[Md.105]	Connected device	58660+32n 58661+32n	MMC_Controller::SvNetMntr[0].ConnectedDevice ⋮ MMC_Controller::SvNetMntr[19].ConnectedDevice

[Control data]

■System control data

n: Axis No. - 1

Item		Buffer memory address	Label
[Cd.1]	Flash ROM write request	5900	MMC_Controller::SysCtrl.WriteFlashRom
[Cd.2]	Parameter initialization request	5901	MMC_Controller::SysCtrl.InitializeParameter
[Cd.41]	Deceleration start flag valid	5905	MMC_Controller::SysCtrl.DecelerationFlagValid
[Cd.42]	Stop command processing for deceleration stop selection	5907	MMC_Controller::SysCtrl.DecelerationStopMode
[Cd.44]	External input signal operation device (Axis 1 to 16)	5928 5929 5930 5931	MMC_Controller::SysCtrl.ExternalInputOperationDevice1 MMC_Controller::SysCtrl.ExternalInputOperationDevice2 MMC_Controller::SysCtrl.ExternalInputOperationDevice3 MMC_Controller::SysCtrl.ExternalInputOperationDevice4
[Cd.137]	Amplifier-less operation mode switching request	5926	MMC_Controller::SysCtrl.SwitchAmplifierLessMode
[Cd.158]	Forced stop input	5945	MMC_Controller::SysCtrl.ForcedStopInput
[Cd.700]	Virtual servo amplifier operation command	5952	MMC_Controller::SysCtrl.VartualSvOparation
[Cd.701]	Virtual servo amplifier operation station specification	5954	MMC_Controller::SysCtrl.VartualSvOparationStation

■Axis control data

n: Axis No. - 1

Item		Buffer memory address	Label
[Cd.3]	Positioning start No.	4300+100n	MMC_Axis::AxCtrl1.PositioningStartNo
[Cd.4]	Positioning starting point No.	4301+100n	MMC_Axis::AxCtrl1.PositioningStartingPointNo
[Cd.5]	Axis error reset	4302+100n	MMC_Axis::AxCtrl1.ResetAxisError
[Cd.6]	Restart command	4303+100n	MMC_Axis::AxCtrl1.Restart
[Cd.7]	M code OFF request	4304+100n	MMC_Axis::AxCtrl1.Clear_M_Code
[Cd.8]	External command valid	4305+100n	MMC_Axis::AxCtrl1.ExternalCommandValid
[Cd.9]	New current value	4306+100n 4307+100n	MMC_Axis::AxCtrl1.NewPosition
[Cd.10]	New acceleration time value	4308+100n 4309+100n	MMC_Axis::AxCtrl1.NewAccelerationTime
[Cd.11]	New deceleration time value	4310+100n 4311+100n	MMC_Axis::AxCtrl1.NewDecelerationTime
[Cd.12]	Acceleration/deceleration time change value during speed change, enable/disable	4312+100n	MMC_Axis::AxCtrl1.AccelerationTimeChangeValid
[Cd.13]	Positioning operation speed override	4313+100n	MMC_Axis::AxCtrl1.Override
[Cd.14]	New speed value	4314+100n 4315+100n	MMC_Axis::AxCtrl1.NewSpeed
[Cd.15]	Speed change request	4316+100n	MMC_Axis::AxCtrl1.ChangeSpeed
[Cd.16]	Inching movement amount	4317+100n	MMC_Axis::AxCtrl1.InchingMovementAmount
[Cd.17]	JOG speed	4318+100n 4319+100n	MMC_Axis::AxCtrl1.JOG_Speed
[Cd.18]	Interrupt request during continuous operation	4320+100n	MMC_Axis::AxCtrl1.InterruptOperation
[Cd.19]	Home position return request flag OFF request	4321+100n	MMC_Axis::AxCtrl1.ClearHomingRequestFlag
[Cd.20]	Manual pulse generator 1 pulse input magnification	4322+100n 4323+100n	MMC_Axis::AxCtrl1.MPG_InputMagnification
[Cd.21]	Manual pulse generator enable flag	4324+100n	MMC_Axis::AxCtrl1.EnableMPG

Item		Buffer memory address	Label
[Cd.22]	New torque value/forward new torque value	4325+100n	MMC_Axis::AxCtrl1.ForwardNewTorque
[Cd.23]	Speed-position switching control movement amount change register	4326+100n 4327+100n	MMC_Axis::AxCtrl1.VP_NewMovementAmount
[Cd.24]	Speed-position switching enable flag	4328+100n	MMC_Axis::AxCtrl1.EnableVP_Switching
[Cd.25]	Position-speed switching control speed change register	4330+100n 4331+100n	MMC_Axis::AxCtrl1.PV_NewSpeed
[Cd.26]	Position-speed switching enable flag	4332+100n	MMC_Axis::AxCtrl1.EnablePV_Switching
[Cd.27]	Target position change value (New address)	4334+100n 4335+100n	MMC_Axis::AxCtrl1.TargetNewPosition
[Cd.28]	Target position change value (New speed)	4336+100n 4337+100n	MMC_Axis::AxCtrl1.TargetNewSpeed
[Cd.29]	Target position change request flag	4338+100n	MMC_Axis::AxCtrl1.ChangeTargetPosition
[Cd.30]	Simultaneous starting own axis start data No.	4340+100n	MMC_Axis::AxCtrl1.SimultaneousStartNo
[Cd.31]	Simultaneous starting axis start data No.1	4341+100n	MMC_Axis::AxCtrl1.SimultaneousStartNoAxis1
[Cd.32]	Simultaneous starting axis start data No.2	4342+100n	MMC_Axis::AxCtrl1.SimultaneousStartNoAxis2
[Cd.33]	Simultaneous starting axis start data No.3	4343+100n	MMC_Axis::AxCtrl1.SimultaneousStartNoAxis3
[Cd.34]	Step mode	4344+100n	MMC_Axis::AxCtrl1.StepMode
[Cd.35]	Step valid flag	4345+100n	MMC_Axis::AxCtrl1.StepValid
[Cd.36]	Step start information	4346+100n	MMC_Axis::AxCtrl1.StepStartInformation
[Cd.37]	Skip command	4347+100n	MMC_Axis::AxCtrl1.Skip
[Cd.38]	Teaching data selection	4348+100n	MMC_Axis::AxCtrl1.TeachingDataSelection
[Cd.39]	Teaching positioning data No.	4349+100n	MMC_Axis::AxCtrl1.TeachingPositioningDataNo
[Cd.40]	ABS direction in degrees	4350+100n	MMC_Axis::AxCtrl1.ABS_DirectionInDegrees
[Cd.43]	Simultaneous starting axis	4368+100n 4369+100n	MMC_Axis::AxCtrl1.SimultaneousStartAxis
[Cd.45]	Speed-position switching device selection	4366+100n	MMC_Axis::AxCtrl1.VP_PV_Device
[Cd.46]	Speed-position switching command	4367+100n	MMC_Axis::AxCtrl1.SwitchVP_PV
[Cd.100]	Servo OFF command	4351+100n	MMC_Axis::AxCtrl1.RequestServoOff
[Cd.101]	Torque output setting value	4352+100n	MMC_Axis::AxCtrl1.TorqueOutputValue
[Cd.108]	Gain switching command flag	4359+100n	MMC_Axis::AxCtrl1.ChangeGain
[Cd.112]	Torque change function switching request	4363+100n	MMC_Axis::AxCtrl1.SwitchTorqueFunction
[Cd.113]	New reverse torque value	4364+100n	MMC_Axis::AxCtrl1.ReverseNewTorque
[Cd.130]	Servo parameter read/write request	4354+100n	MMC_Axis::AxCtrl1.ReadWriteServoParameter
[Cd.131]	Parameter No. (Object index for servo parameters to be changed)	4355+100n	MMC_Axis::AxCtrl1.ServoParameterNo
[Cd.132]	Change data	4356+100n 4357+100n	MMC_Axis::AxCtrl1.ChangeData
[Cd.136]	PI-PID switching request	4365+100n	MMC_Axis::AxCtrl1.SwitchPI_PID
[Cd.138]	Control mode switching request	4374+100n	MMC_Axis::AxCtrl1.SwitchControlMode
[Cd.139]	Control mode setting	4375+100n	MMC_Axis::AxCtrl1.ControlModeSetting
[Cd.140]	Command speed at speed control mode	4376+100n 4377+100n	MMC_Axis::AxCtrl1.Spd_CommandSpeed
[Cd.141]	Acceleration time at speed control mode	4378+100n	MMC_Axis::AxCtrl1.Spd_AccelerationTime
[Cd.142]	Deceleration time at speed control mode	4379+100n	MMC_Axis::AxCtrl1.Spd_DecelerationTime
[Cd.143]	Command torque at torque control mode	4380+100n	MMC_Axis::AxCtrl1.Trq_CommandTorque
[Cd.144]	Torque time constant at torque control mode (Forward direction)	4381+100n	MMC_Axis::AxCtrl1.Trq_TorqueTimeConstDrivingMode
[Cd.145]	Torque time constant at torque control mode (Negative direction)	4382+100n	MMC_Axis::AxCtrl1.Trq_TorqueTimeConstRegenerativeMode
[Cd.146]	Speed limit value at torque control mode	4384+100n 4385+100n	MMC_Axis::AxCtrl1.Trq_SpeedLimit
[Cd.180]	Axis stop	30100+10n	MMC_Axis::AxCtrl2.StopAxis
[Cd.181]	Forward run JOG start	30101+10n	MMC_Axis::AxCtrl2.StartForwardJOG
[Cd.182]	Reverse run JOG start	30102+10n	MMC_Axis::AxCtrl2.StartReverseJOG
[Cd.183]	Execution prohibition flag	30103+10n	MMC_Axis::AxCtrl2.ProhibitPositioning

[Positioning data]

■Positioning data

n: Axis No. - 1

Memory area	Item			Buffer memory address	Label
Positioning data No.1	[Da.1]	Operation pattern	Positioning identifier	6000+1000n	MMC_Axis::PositData1.PositDataEle1[0].Identifier
	[Da.2]	Control method			
	[Da.3]	Acceleration time No.			
	[Da.4]	Deceleration time No.			
	[Da.6]	Positioning address/movement amount		6006+1000n 6007+1000n	MMC_Axis::PositData1.PositDataEle1[0].Position_MovementAmount
	[Da.7]	Arc address		6008+1000n 6009+1000n	MMC_Axis::PositData1.PositDataEle1[0].ArcPosition
	[Da.8]	Command speed		6004+1000n 6005+1000n	MMC_Axis::PositData1.PositDataEle1[0].CommandSpeed
	[Da.9]	Dwell time/JUMP destination positioning data No.		6002+1000n	MMC_Axis::PositData1.PositDataEle1[0].DwellTime
	[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches		6001+1000n	MMC_Axis::PositData1.PositDataEle1[0].M_Code
	[Da.20]	Axis to be interpolated No.1	Axis to be interpolated	71000+1000n 71001+1000n	MMC_Axis::PositData2.PositDataEle2[0].InterpolationAxis
	[Da.21]	Axis to be interpolated No.2			
	[Da.22]	Axis to be interpolated No.3			
	[Da.27]	M code ON signal output timing	Positioning option	6003+1000n	MMC_Axis::PositData1.PositDataEle1[0].Option
	[Da.28]	ABS direction in degrees			
	[Da.29]	Interpolation speed designation method			
⋮	⋮			⋮	⋮
No.100	[Da.1]	Operation pattern	Positioning identifier	6900+1000n	MMC_Axis::PositData1.PositDataEle1[99].Identifier
	[Da.2]	Control method			
	[Da.3]	Acceleration time No.			
	[Da.4]	Deceleration time No.			
	[Da.6]	Positioning address/movement amount		6996+1000n 6997+1000n	MMC_Axis::PositData1.PositDataEle1[99].Position_MovementAmount
	[Da.7]	Arc address		6998+1000n 6999+1000n	MMC_Axis::PositData1.PositDataEle1[99].ArcPosition
	[Da.8]	Command speed		6994+1000n 6995+1000n	MMC_Axis::PositData1.PositDataEle1[99].CommandSpeed
	[Da.9]	Dwell time/JUMP destination positioning data No.		6992+1000n	MMC_Axis::PositData1.PositDataEle1[99].DwellTime
	[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches		6991+1000n	MMC_Axis::PositData1.PositDataEle1[99].M_Code
	[Da.20]	Axis to be interpolated No.1	Axis to be interpolated	71990+1000n 71991+1000n	MMC_Axis::PositData2.PositDataEle2[99].InterpolationAxis
	[Da.21]	Axis to be interpolated No.2			
	[Da.22]	Axis to be interpolated No.3			
	[Da.27]	M code ON signal output timing	Positioning option	6993+1000n	MMC_Axis::PositData1.PositDataEle1[99].Option
	[Da.28]	ABS direction in degrees			
	[Da.29]	Interpolation speed designation method			

Memory area	Item			Buffer memory address	Label
No.101	[Da.1]	Operation pattern	Positioning identifier	200000+5000n	MMC_Axis::PositData1.PositDataEle1[100].Identifier
	[Da.2]	Control method			
	[Da.3]	Acceleration time No.			
	[Da.4]	Deceleration time No.			
	[Da.6]	Positioning address/movement amount		200006+5000n 200007+5000n	MMC_Axis::PositData1.PositDataEle1[100].Position_MovementAmount
	[Da.7]	Arc address		200008+5000n 200009+5000n	MMC_Axis::PositData1.PositDataEle1[100].ArcPosition
	[Da.8]	Command speed		200004+5000n 200005+5000n	MMC_Axis::PositData1.PositDataEle1[100].CommandSpeed
	[Da.9]	Dwell time/JUMP destination positioning data No.		200002+5000n	MMC_Axis::PositData1.PositDataEle1[100].DwellTime
	[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches		200001+5000n	MMC_Axis::PositData1.PositDataEle1[100].M_Code
	[Da.20]	Axis to be interpolated No.1	Axis to be interpolated	280000+5000n 280001+5000n	MMC_Axis::PositData2.PositDataEle2[100].InterpolationAxis
	[Da.21]	Axis to be interpolated No.2			
	[Da.22]	Axis to be interpolated No.3			
	[Da.27]	M code ON signal output timing	Positioning option	200003+5000n	MMC_Axis::PositData1.PositDataEle1[100].Option
	[Da.28]	ABS direction in degrees			
	[Da.29]	Interpolation speed designation method			
⋮	⋮			⋮	⋮
No.600	[Da.1]	Operation pattern	Positioning identifier	204990+5000n	MMC_Axis::PositData1.PositDataEle1[599].Identifier
	[Da.2]	Control method			
	[Da.3]	Acceleration time No.			
	[Da.4]	Deceleration time No.			
	[Da.6]	Positioning address/movement amount		204996+5000n 204997+5000n	MMC_Axis::PositData1.PositDataEle1[599].Position_MovementAmount
	[Da.7]	Arc address		204998+5000n 204999+5000n	MMC_Axis::PositData1.PositDataEle1[599].ArcPosition
	[Da.8]	Command speed		204994+5000n 204995+5000n	MMC_Axis::PositData1.PositDataEle1[599].CommandSpeed
	[Da.9]	Dwell time/JUMP destination positioning data No.		204992+5000n	MMC_Axis::PositData1.PositDataEle1[599].DwellTime
	[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches		204991+5000n	MMC_Axis::PositData1.PositDataEle1[599].M_Code
	[Da.20]	Axis to be interpolated No.1	Axis to be interpolated	284990+5000n 284991+5000n	MMC_Axis::PositData2.PositDataEle2[599].InterpolationAxis
	[Da.21]	Axis to be interpolated No.2			
	[Da.22]	Axis to be interpolated No.3			
	[Da.27]	M code ON signal output timing	Positioning option	204993+5000n	MMC_Axis::PositData1.PositDataEle1[599].Option
	[Da.28]	ABS direction in degrees			
	[Da.29]	Interpolation speed designation method			

[Block start data]

■Positioning data (Block start data)

n: Axis No. - 1

Memory area	Item				Buffer memory address	Label
Start block 0	Block start data 1st point	[Da.11] [Da.12]	Shape Start data No.		22000+400n	MMC_Axis::BlockStartData.StartBlock[0].StartData.Shape_StartDataNo[0]
		[Da.13] [Da.14]	Special start instruction Parameter		22050+400n	MMC_Axis::BlockStartData.StartBlock[0].StartData.SpecialStartParameter[0]
	⋮				⋮	⋮
	Block start data 50th point	[Da.11] [Da.12]	Shape Start data No.		22049+400n	MMC_Axis::BlockStartData.StartBlock[0].StartData.Shape_StartDataNo[49]
		[Da.13] [Da.14]	Special start instruction Parameter		22099+400n	MMC_Axis::BlockStartData.StartBlock[0].StartData.SpecialStartParameter[49]
	Condition data No.1	[Da.15]	Condition target		22100+400n	MMC_Axis::BlockStartData.StartBlock[0].ConditionData[0].Condition
		[Da.16]	Condition operator			
		[Da.17]	Address		22102+400n 22103+400n	MMC_Axis::BlockStartData.StartBlock[0].ConditionData[0].BufferMemoryNo
		[Da.18]	Parameter 1		22104+400n 22105+400n	MMC_Axis::BlockStartData.StartBlock[0].ConditionData[0].Parameter1
		[Da.19]	Parameter 2		22106+400n 22107+400n	MMC_Axis::BlockStartData.StartBlock[0].ConditionData[0].Parameter2
		[Da.23]	Number of simultaneous starting axes	Simultaneous starting axis	22108+400n 22109+400n	MMC_Axis::BlockStartData.StartBlock[0].ConditionData[0].SimultaneousStartAxis
		[Da.24]	Simultaneous starting axis No.1			
		[Da.25]	Simultaneous starting axis No.2			
		[Da.26]	Simultaneous starting axis No.3			
	⋮				⋮	⋮
	Condition data No.10	[Da.15]	Condition target		22190+400n	MMC_Axis::BlockStartData.StartBlock[0].ConditionData[9].Condition
		[Da.16]	Condition operator			
		[Da.17]	Address		22192+400n 22193+400n	MMC_Axis::BlockStartData.StartBlock[0].ConditionData[9].BufferMemoryNo
		[Da.18]	Parameter 1		22194+400n 22195+400n	MMC_Axis::BlockStartData.StartBlock[0].ConditionData[9].Parameter1
		[Da.19]	Parameter 2		22196+400n 22197+400n	MMC_Axis::BlockStartData.StartBlock[0].ConditionData[9].Parameter2
		[Da.23]	Number of simultaneous starting axes	Simultaneous starting axis	22198+400n 22199+400n	MMC_Axis::BlockStartData.StartBlock[0].ConditionData[9].SimultaneousStartAxis
		[Da.24]	Simultaneous starting axis No.1			
		[Da.25]	Simultaneous starting axis No.2			
		[Da.26]	Simultaneous starting axis No.3			

Memory area	Item	Buffer memory address	Label
Start block 1	Block start data	22200+400n ⋮ 22299+400n	MMC_Axis::BlockStartData.StartBlock[1].StartData.Shape_StartDataNo[0] MMC_Axis::BlockStartData.StartBlock[1].StartData.SpecialStartParameter[0] ⋮ MMC_Axis::BlockStartData.StartBlock[1].StartData.Shape_StartDataNo[49] MMC_Axis::BlockStartData.StartBlock[1].StartData.SpecialStartParameter[49]
	Condition data	22300+400n ⋮ 22399+400n	MMC_Axis::BlockStartData.StartBlock[1].ConditionData[0].Condition MMC_Axis::BlockStartData.StartBlock[1].ConditionData[0].BufferMemoryNo MMC_Axis::BlockStartData.StartBlock[1].ConditionData[0].Parameter1 MMC_Axis::BlockStartData.StartBlock[1].ConditionData[0].Parameter2 MMC_Axis::BlockStartData.StartBlock[1].ConditionData[0].SimultaneousStartAxis ⋮ MMC_Axis::BlockStartData.StartBlock[1].ConditionData[9].Condition MMC_Axis::BlockStartData.StartBlock[1].ConditionData[9].BufferMemoryNo MMC_Axis::BlockStartData.StartBlock[1].ConditionData[9].Parameter1 MMC_Axis::BlockStartData.StartBlock[1].ConditionData[9].Parameter2 MMC_Axis::BlockStartData.StartBlock[1].ConditionData[9].SimultaneousStartAxis
Start block 2	Block start data	360000+600n ⋮ 360099+600n	MMC_Axis::BlockStartData.StartBlock[2].StartData.Shape_StartDataNo[0] MMC_Axis::BlockStartData.StartBlock[2].StartData.SpecialStartParameter[0] ⋮ MMC_Axis::BlockStartData.StartBlock[2].StartData.Shape_StartDataNo[49] MMC_Axis::BlockStartData.StartBlock[2].StartData.SpecialStartParameter[49]
	Condition data	360100+600n ⋮ 360199+600n	MMC_Axis::BlockStartData.StartBlock[2].ConditionData[0].Condition MMC_Axis::BlockStartData.StartBlock[2].ConditionData[0].BufferMemoryNo MMC_Axis::BlockStartData.StartBlock[2].ConditionData[0].Parameter1 MMC_Axis::BlockStartData.StartBlock[2].ConditionData[0].Parameter2 MMC_Axis::BlockStartData.StartBlock[2].ConditionData[0].SimultaneousStartAxis ⋮ MMC_Axis::BlockStartData.StartBlock[2].ConditionData[9].Condition MMC_Axis::BlockStartData.StartBlock[2].ConditionData[9].BufferMemoryNo MMC_Axis::BlockStartData.StartBlock[2].ConditionData[9].Parameter1 MMC_Axis::BlockStartData.StartBlock[2].ConditionData[9].Parameter2 MMC_Axis::BlockStartData.StartBlock[2].ConditionData[9].SimultaneousStartAxis

Memory area	Item	Buffer memory address	Label
Start block 3	Block start data	360200+600n ⋮ 360299+600n	MMC_Axis::BlockStartData.StartBlock[3].StartData.Shape_StartDataNo[0] MMC_Axis::BlockStartData.StartBlock[3].StartData.SpecialStartParameter[0] ⋮ MMC_Axis::BlockStartData.StartBlock[3].StartData.Shape_StartDataNo[49] MMC_Axis::BlockStartData.StartBlock[3].StartData.SpecialStartParameter[49]
	Condition data	360300+600n ⋮ 360399+600n	MMC_Axis::BlockStartData.StartBlock[3].ConditionData[0].Condition MMC_Axis::BlockStartData.StartBlock[3].ConditionData[0].BufferMemoryNo MMC_Axis::BlockStartData.StartBlock[3].ConditionData[0].Parameter1 MMC_Axis::BlockStartData.StartBlock[3].ConditionData[0].Parameter2 MMC_Axis::BlockStartData.StartBlock[3].ConditionData[0].SimultaneousStartAxis ⋮ MMC_Axis::BlockStartData.StartBlock[3].ConditionData[9].Condition MMC_Axis::BlockStartData.StartBlock[3].ConditionData[9].BufferMemoryNo MMC_Axis::BlockStartData.StartBlock[3].ConditionData[9].Parameter1 MMC_Axis::BlockStartData.StartBlock[3].ConditionData[9].Parameter2 MMC_Axis::BlockStartData.StartBlock[3].ConditionData[9].SimultaneousStartAxis
Start block 4	Block start data	360400+600n ⋮ 360499+600n	MMC_Axis::BlockStartData.StartBlock[4].StartData.Shape_StartDataNo[0] MMC_Axis::BlockStartData.StartBlock[4].StartData.SpecialStartParameter[0] ⋮ MMC_Axis::BlockStartData.StartBlock[4].StartData.Shape_StartDataNo[49] MMC_Axis::BlockStartData.StartBlock[4].StartData.SpecialStartParameter[49]
	Condition data	360500+600n ⋮ 360599+600n	MMC_Axis::BlockStartData.StartBlock[4].ConditionData[0].Condition MMC_Axis::BlockStartData.StartBlock[4].ConditionData[0].BufferMemoryNo MMC_Axis::BlockStartData.StartBlock[4].ConditionData[0].Parameter1 MMC_Axis::BlockStartData.StartBlock[4].ConditionData[0].Parameter2 MMC_Axis::BlockStartData.StartBlock[4].ConditionData[0].SimultaneousStartAxis ⋮ MMC_Axis::BlockStartData.StartBlock[4].ConditionData[9].Condition MMC_Axis::BlockStartData.StartBlock[4].ConditionData[9].BufferMemoryNo MMC_Axis::BlockStartData.StartBlock[4].ConditionData[9].Parameter1 MMC_Axis::BlockStartData.StartBlock[4].ConditionData[9].Parameter2 MMC_Axis::BlockStartData.StartBlock[4].ConditionData[9].SimultaneousStartAxis

Controller in-position

The following shows the relation between the buffer memory addresses for controller in-position and the various items.

■Controller in-position parameters

Item		Buffer memory address	Label
[Pr.1190]	Controller in-position range	900020 ⋮ 900035	MMC_Controller::ControllerInPosition.Range[0] ⋮ MMC_Controller::ControllerInPosition.Range[15] MMC_Axis::ControllerInPositionRange

■Controller in-position monitor data

Item		Buffer memory address	Label
[Md.1131]	Controller in-position flag (all axes)	90802	MMC_Controller::AllAxMntr.ControllerInPositionAllAxis
[Md.1190]	Controller in-position flag	900052 ⋮ 900067	MMC_Controller::ControllerInPosition.Flag[0] ⋮ MMC_Controller::ControllerInPosition.Flag[15] MMC_Axis::ControllerInPositionFlag

Link device external signal assignment

The following shows the relation between the buffer memory addresses for link device external signal assignment and the various items.

■Link device external signal assignment parameters (bit device)

n: Axis No. - 1

Item		Buffer memory address	Label
[Pr.900]	Forced stop signal (EMI): Link device type	440000+320n	MMC_J4GF::LinkDevCHGBit.EMI.Type
[Pr.901]	Forced stop signal (EMI): Link device start No.	440001+320n	MMC_J4GF::LinkDevCHGBit.EMI.FirstNo
[Pr.902]	Forced stop signal (EMI): Link device bit specification	440002+320n	MMC_J4GF::LinkDevCHGBit.EMI.BitSpecification
[Pr.903]	Forced stop signal (EMI): Link device logic setting	440003+320n	MMC_J4GF::LinkDevCHGBit.EMI.LogicSetting
[Pr.910]	Upper limit signal (FLS): Link device type	440010+320n	MMC_J4GF::LinkDevCHGBit.FLS.Type
[Pr.911]	Upper limit signal (FLS): Link device start No.	440011+320n	MMC_J4GF::LinkDevCHGBit.FLS.FirstNo
[Pr.912]	Upper limit signal (FLS): Link device bit specification	440012+320n	MMC_J4GF::LinkDevCHGBit.FLS.BitSpecification
[Pr.913]	Upper limit signal (FLS): Link device logic setting	440013+320n	MMC_J4GF::LinkDevCHGBit.FLS.LogicSetting
[Pr.920]	Lower limit signal (RLS): Link device type	440020+320n	MMC_J4GF::LinkDevCHGBit.RLS.Type
[Pr.921]	Lower limit signal (RLS): Link device start No.	440021+320n	MMC_J4GF::LinkDevCHGBit.RLS.FirstNo
[Pr.922]	Lower limit signal (RLS): Link device bit specification	440022+320n	MMC_J4GF::LinkDevCHGBit.RLS.BitSpecification
[Pr.923]	Lower limit signal (RLS): Link device logic setting	440023+320n	MMC_J4GF::LinkDevCHGBit.RLS.LogicSetting
[Pr.930]	Proximity dog signal (DOG): Link device type	440030+320n	MMC_J4GF::LinkDevCHGBit.DOG.Type
[Pr.931]	Proximity dog signal (DOG): Link device start No.	440031+320n	MMC_J4GF::LinkDevCHGBit.DOG.FirstNo
[Pr.932]	Proximity dog signal (DOG): Link device bit specification	440032+320n	MMC_J4GF::LinkDevCHGBit.DOG.BitSpecification
[Pr.933]	Proximity dog signal (DOG): Link device logic setting	440033+320n	MMC_J4GF::LinkDevCHGBit.DOG.LogicSetting
[Pr.940]	Stop signal (STOP): Link device type	440040+320n	MMC_J4GF::LinkDevCHGBit.STOP.Type
[Pr.941]	Stop signal (STOP): Link device start No.	440041+320n	MMC_J4GF::LinkDevCHGBit.STOP.FirstNo
[Pr.942]	Stop signal (STOP): Link device bit specification	440042+320n	MMC_J4GF::LinkDevCHGBit.STOP.BitSpecification
[Pr.943]	Stop signal (STOP): Link device logic setting	440043+320n	MMC_J4GF::LinkDevCHGBit.STOP.LogicSetting
[Pr.950]	External positioning start request: Link device type	440050+320n	MMC_J4GF::LinkDevCHGBit.PositStartReq.Type
[Pr.951]	External positioning start request: Link device start No.	440051+320n	MMC_J4GF::LinkDevCHGBit.PositStartReq.FirstNo
[Pr.952]	External positioning start request: Link device bit specification	440052+320n	MMC_J4GF::LinkDevCHGBit.PositStartReq.BitSpecification
[Pr.953]	External positioning start request: Link device logic setting	440053+320n	MMC_J4GF::LinkDevCHGBit.PositStartReq.LogicSetting
[Pr.960]	External speed change request: Link device type	440060+320n	MMC_J4GF::LinkDevCHGBit.ChangeSpeedReq.Type
[Pr.961]	External speed change request: Link device start No.	440061+320n	MMC_J4GF::LinkDevCHGBit.ChangeSpeedReq.FirstNo
[Pr.962]	External speed change request: Link device bit specification	440062+320n	MMC_J4GF::LinkDevCHGBit.ChangeSpeedReq.BitSpecification

Item		Buffer memory address	Label
[Pr.963]	External speed change request: Link device logic setting	440063+320n	MMC_J4GF::LinkDevCHGBit.ChangeSpeedReq.LogicSetting
[Pr.970]	Skip request: Link device type	440070+320n	MMC_J4GF::LinkDevCHGBit.SkipReq.Type
[Pr.971]	Skip request: Link device start No.	440071+320n	MMC_J4GF::LinkDevCHGBit.SkipReq.FirstNo
[Pr.972]	Skip request: Link device bit specification	440072+320n	MMC_J4GF::LinkDevCHGBit.SkipReq.BitSpecification
[Pr.973]	Skip request: Link device logic setting	440073+320n	MMC_J4GF::LinkDevCHGBit.SkipReq.LogicSetting
[Pr.980]	Speed-position control switching request: Link device type	440080+320n	MMC_J4GF::LinkDevCHGBit.VP_Req.Type
[Pr.981]	Speed-position control switching request: Link device start No.	440081+320n	MMC_J4GF::LinkDevCHGBit.VP_Req.FirstNo
[Pr.982]	Speed-position control switching request: Link device bit specification	440082+320n	MMC_J4GF::LinkDevCHGBit.VP_Req.BitSpecification
[Pr.983]	Speed-position control switching request: Link device logic setting	440083+320n	MMC_J4GF::LinkDevCHGBit.VP_Req.LogicSetting
[Pr.990]	Main shaft clutch control request: Link device type	440090+320n	MMC_J4GF::LinkDevCHGBit.MainShaftClutchControlReq.Type
[Pr.991]	Main shaft clutch control request: Link device start No.	440091+320n	MMC_J4GF::LinkDevCHGBit.MainShaftClutchControlReq.FirstNo
[Pr.992]	Main shaft clutch control request: Link device bit specification	440092+320n	MMC_J4GF::LinkDevCHGBit.MainShaftClutchControlReq.BitSpecification
[Pr.993]	Main shaft clutch control request: Link device logic setting	440093+320n	MMC_J4GF::LinkDevCHGBit.MainShaftClutchControlReq.LogicSetting
[Pr.1000]	Auxiliary shaft clutch control request: Link device type	440100+320n	MMC_J4GF::LinkDevCHGBit.AuxShaftClutchControlReq.Type
[Pr.1001]	Auxiliary shaft clutch control request: Link device start No.	440101+320n	MMC_J4GF::LinkDevCHGBit.AuxShaftClutchControlReq.FirstNo
[Pr.1002]	Auxiliary shaft clutch control request: Link device bit specification	440102+320n	MMC_J4GF::LinkDevCHGBit.AuxShaftClutchControlReq.BitSpecification
[Pr.1003]	Auxiliary shaft clutch control request: Link device logic setting	440103+320n	MMC_J4GF::LinkDevCHGBit.AuxShaftClutchControlReq.LogicSetting
[Pr.1020]	Block No.7000 start request: Link device type	440120+320n	MMC_J4GF::LinkDevCHGBit.Block7000StartReq.Type
[Pr.1021]	Block No.7000 start request: Link device start No.	440121+320n	MMC_J4GF::LinkDevCHGBit.Block7000StartReq.FirstNo
[Pr.1022]	Block No.7000 start request: Link device bit specification	440122+320n	MMC_J4GF::LinkDevCHGBit.Block7000StartReq.BitSpecification
[Pr.1023]	Block No.7000 start request: Link device logic setting	440123+320n	MMC_J4GF::LinkDevCHGBit.Block7000StartReq.LogicSetting
[Pr.1030]	Block No.7001 start request: Link device type	440130+320n	MMC_J4GF::LinkDevCHGBit.Block7001StartReq.Type
[Pr.1031]	Block No.7001 start request: Link device start No.	440131+320n	MMC_J4GF::LinkDevCHGBit.Block7001StartReq.FirstNo
[Pr.1032]	Block No.7001 start request: Link device bit specification	440132+320n	MMC_J4GF::LinkDevCHGBit.Block7001StartReq.BitSpecification
[Pr.1033]	Block No.7001 start request: Link device logic setting	440133+320n	MMC_J4GF::LinkDevCHGBit.Block7001StartReq.LogicSetting
[Pr.1040]	Block No.7002 start request: Link device type	440140+320n	MMC_J4GF::LinkDevCHGBit.Block7002StartReq.Type
[Pr.1041]	Block No.7002 start request: Link device start No.	440141+320n	MMC_J4GF::LinkDevCHGBit.Block7002StartReq.FirstNo
[Pr.1042]	Block No.7002 start request: Link device bit specification	440142+320n	MMC_J4GF::LinkDevCHGBit.Block7002StartReq.BitSpecification
[Pr.1043]	Block No.7002 start request: Link device logic setting	440143+320n	MMC_J4GF::LinkDevCHGBit.Block7002StartReq.LogicSetting
[Pr.1050]	Block No.7003 start request: Link device type	440150+320n	MMC_J4GF::LinkDevCHGBit.Block7003StartReq.Type
[Pr.1051]	Block No.7003 start request: Link device start No.	440151+320n	MMC_J4GF::LinkDevCHGBit.Block7003StartReq.FirstNo
[Pr.1052]	Block No.7003 start request: Link device bit specification	440152+320n	MMC_J4GF::LinkDevCHGBit.Block7003StartReq.BitSpecification
[Pr.1053]	Block No.7003 start request: Link device logic setting	440153+320n	MMC_J4GF::LinkDevCHGBit.Block7003StartReq.LogicSetting
[Pr.1060]	Block No.7004 start request: Link device type	440160+320n	MMC_J4GF::LinkDevCHGBit.Block7004StartReq.Type
[Pr.1061]	Block No.7004 start request: Link device start No.	440161+320n	MMC_J4GF::LinkDevCHGBit.Block7004StartReq.FirstNo
[Pr.1062]	Block No.7004 start request: Link device bit specification	440162+320n	MMC_J4GF::LinkDevCHGBit.Block7004StartReq.BitSpecification
[Pr.1063]	Block No.7004 start request: Link device logic setting	440163+320n	MMC_J4GF::LinkDevCHGBit.Block7004StartReq.LogicSetting

■Link device external signal assignment parameters (word device)

n: Axis No. - 1

Item		Buffer memory address	Label
[Pr.700]	Manual pulse generator input: Link device type	450240+100n	MMC_J4GF::LinkDevCHGWord.MPG.Type
[Pr.701]	Manual pulse generator input: Link device start No.	450241+100n	MMC_J4GF::LinkDevCHGWord.MPG.FirstNo
[Pr.702]	Manual pulse generator input: Link device count direction setting	450246+100n	MMC_J4GF::LinkDevCHGWord.MPG.CntDirection
[Pr.703]	Manual pulse generator input: Ring counter maximum value	450242+100n 450243+100n	MMC_J4GF::LinkDevCHGWord.MPG.CntMax
[Pr.704]	Manual pulse generator input: Ring counter minimum value	450244+100n 450245+100n	MMC_J4GF::LinkDevCHGWord.MPG.CntMin

■Axis monitor

n: Axis No. - 1

Item		Buffer memory address	Label
[Md.900]	External command signal monitor	59328+100n	MMC_Axis::AxMntr2.ExternalSignalMonitor

Servo network composition parameters

The following shows the relation between the buffer memory addresses of servo network composition parameters and the various items.

The setting range is different depending on the servo amplifier model. Refer to each servo amplifier instruction manual for details.

■Servo network composition parameters

n: Axis No. - 1

Item		Buffer memory address	Label
[Pr.100]	Connected device	58020+32n 58021+32n	MMC_Controller::SvNetPrm[0].ConnectedDevice ⋮ MMC_Controller::SvNetPrm[19].ConnectedDevice
[Pr.101]	Virtual servo amplifier setting	58022+32n	MMC_Controller::SvNetPrm[0].VirtualSvSetting ⋮ MMC_Controller::SvNetPrm[19].VirtualSvSetting

Mark detection function

The following shows the relation between the buffer memory addresses for mark detection function and the various items.

■Mark detection setting parameters

k: Mark detection setting No. - 1

Item		Buffer memory address	Label
[Pr.801]	Mark detection signal compensation time	54001+20k	MMC_Axis::MarkSignalPrm.CompensationTime
[Pr.802]	Mark detection data type	54002+20k	MMC_Axis::MarkSignalPrm.Type
[Pr.803]	Mark detection data axis No.	54003+20k	MMC_Axis::MarkSignalPrm.AxisNo
[Pr.804]	Mark detection data buffer memory No.	54004+20k 54005+20k	MMC_Axis::MarkSignalPrm.BufferMemoryNo
[Pr.805]	Latch data range upper limit value	54006+20k 54007+20k	MMC_Axis::MarkSignalPrm.LatchDataRangeUpperLimit
[Pr.806]	Latch data range lower limit value	54008+20k 54009+20k	MMC_Axis::MarkSignalPrm.LatchDataRangeLowerLimit
[Pr.807]	Mark detection mode setting	54010+20k	MMC_Axis::MarkSignalPrm.DetectionMode
[Pr.808]	Mark detection signal link device type	54011+20k	MMC_Axis::MarkSignalPrm.LinkDeviceType
[Pr.809]	Mark detection signal link device No.	54012+20k	MMC_Axis::MarkSignalPrm.LinkDeviceNo
[Pr.810]	Mark detection signal link device bit specification	54013+20k	MMC_Axis::MarkSignalPrm.LinkDeviceBitSpecification
[Pr.811]	Mark detection signal detection direction setting	54014+20k	MMC_Axis::MarkSignalPrm.DetectionDirection

■Mark detection control data

k: Mark detection setting No. - 1

Item		Buffer memory address	Label
[Cd.800]	Number of mark detection clear request	54640+10k	MMC_Axis::MarkSignalCtrl.ClearDetectionNumber
[Cd.801]	Mark detection invalid flag	54641+10k	MMC_Axis::MarkSignalCtrl.InvalidDetection
[Cd.802]	Latch data range change request	54642+10k	MMC_Axis::MarkSignalCtrl.ChangeLatchDataRange

■Mark detection monitor data

k: Mark detection setting No. - 1

Item			Buffer memory address	Label
[Md.800]	Number of mark detection		54960+80k	MMC_Axis::MarkSignalMntr.DetectionCounter
[Md.801]	Mark detection data storage area (1 to 32)	1	54962+80k 54963+80k	MMC_Axis::MarkSignalMntr.DetectionData[0] ⋮ MMC_Axis::MarkSignalMntr.DetectionData[31]
		2	54964+80k 54965+80k	
		3	54966+80k 54967+80k	
		⋮	⋮	
		32	55024+80k 55025+80k	
[Md.802]	Mark detection signal monitor		54961+80k	MMC_Axis::MarkSignalMntr.DetectionMonitor

Slave device operation

The following shows the relation between the buffer memory addresses for slave device operation and the various items.

■Control data for slave device operation

n: Axis No. - 1

Item		Buffer memory address	Label
[Cd.120]	Servo parameter operation request	533728+2048n	MMC_J4GF::SlaveControl.SvPrmReq
[Cd.121]	Parameter size	533729+2048n	MMC_J4GF::SlaveControl.Size
[Cd.122]	Parameter offset	533730+2048n	MMC_J4GF::SlaveControl.Offset
[Cd.125]	Request data	533732+2048n ⋮ 534755+2048n	MMC_J4GF::SlaveControl.ReqData[0] ⋮ MMC_J4GF::SlaveControl.ReqData[1023]
[Cd.160]	Command send request 1	534796+2048n	MMC_J4GF::SlaveControl.SendReq1
[Cd.161]	Command send request 2	534797+2048n	MMC_J4GF::SlaveControl.SendReq2
[Cd.162]	Command send request 3	534798+2048n	MMC_J4GF::SlaveControl.SendReq3
[Cd.163]	Command send request 4	534799+2048n	MMC_J4GF::SlaveControl.SendReq4
[Cd.164]	Optional SDO transfer data 1	534800+2048n ⋮ 534862+2048n	MMC_J4GF::SlaveControl.AnySDOSend1[0] ⋮ MMC_J4GF::SlaveControl.AnySDOSend1[62]
[Cd.165]	Optional SDO transfer data 2	534864+2048n ⋮ 534926+2048n	MMC_J4GF::SlaveControl.AnySDOSend2[0] ⋮ MMC_J4GF::SlaveControl.AnySDOSend2[62]
[Cd.166]	Optional SDO transfer data 3	534928+2048n ⋮ 534990+2048n	MMC_J4GF::SlaveControl.AnySDOSend3[0] ⋮ MMC_J4GF::SlaveControl.AnySDOSend3[62]
[Cd.167]	Optional SDO transfer data 4	534992+2048n ⋮ 535054+2048n	MMC_J4GF::SlaveControl.AnySDOSend4[0] ⋮ MMC_J4GF::SlaveControl.AnySDOSend4[62]
[Cd.170]	Optional send PDO data 1	534768+2048n 534769+2048n 534770+2048n 534771+2048n	MMC_J4GF::SlaveControl.AnySendPDOData1[0] ⋮ MMC_J4GF::SlaveControl.AnySendPDOData1[1]
[Cd.171]	Optional send PDO data 2	534772+2048n 534773+2048n 534774+2048n 534775+2048n	MMC_J4GF::SlaveControl.AnySendPDOData2[0] ⋮ MMC_J4GF::SlaveControl.AnySendPDOData2[1]
[Cd.172]	Optional send PDO data 3	534776+2048n 534777+2048n 534778+2048n 534779+2048n	MMC_J4GF::SlaveControl.AnySendPDOData3[0] ⋮ MMC_J4GF::SlaveControl.AnySendPDOData3[1]
[Cd.173]	Optional send PDO data 4	534780+2048n 534781+2048n 534782+2048n 534783+2048n	MMC_J4GF::SlaveControl.AnySendPDOData4[0] ⋮ MMC_J4GF::SlaveControl.AnySendPDOData4[1]

■Monitor data for slave device operation

n: Axis No. - 1

Item		Buffer memory address	Label
[Md.160]	Optional SDO transfer result 1	468192+2048n 468193+2048n	MMC_J4GF::SlaveMonitor.AnySDOResult1
[Md.161]	Optional SDO transfer result 2	468194+2048n 468195+2048n	MMC_J4GF::SlaveMonitor.AnySDOResult2
[Md.162]	Optional SDO transfer result 3	468196+2048n 468197+2048n	MMC_J4GF::SlaveMonitor.AnySDOResult3
[Md.163]	Optional SDO transfer result 4	468198+2048n 468199+2048n	MMC_J4GF::SlaveMonitor.AnySDOResult4
[Md.164]	Optional SDO transfer status 1	468200+2048n	MMC_J4GF::SlaveMonitor.AnySDOStatus1
[Md.165]	Optional SDO transfer status 2	468201+2048n	MMC_J4GF::SlaveMonitor.AnySDOStatus2
[Md.166]	Optional SDO transfer status 3	468202+2048n	MMC_J4GF::SlaveMonitor.AnySDOStatus3
[Md.167]	Optional SDO transfer status 4	468203+2048n	MMC_J4GF::SlaveMonitor.AnySDOStatus4

Item		Buffer memory address	Label
[Md.170]	Optional receive PDO data 1	468204+2048n 468205+2048n 468206+2048n 468207+2048n	MMC_J4GF::SlaveMonitor.AnyRecvPDOData1[0] : MMC_J4GF::SlaveMonitor.AnyRecvPDOData1[1]
[Md.171]	Optional receive PDO data 2	468208+2048n 468209+2048n 468210+2048n 468211+2048n	MMC_J4GF::SlaveMonitor.AnyRecvPDOData2[0] : MMC_J4GF::SlaveMonitor.AnyRecvPDOData2[1]
[Md.172]	Optional receive PDO data 3	468212+2048n 468213+2048n 468214+2048n 468215+2048n	MMC_J4GF::SlaveMonitor.AnyRecvPDOData3[0] : MMC_J4GF::SlaveMonitor.AnyRecvPDOData3[1]
[Md.173]	Optional receive PDO data 4	468216+2048n 468217+2048n 468218+2048n 468219+2048n	MMC_J4GF::SlaveMonitor.AnyRecvPDOData4[0] : MMC_J4GF::SlaveMonitor.AnyRecvPDOData4[1]
[Md.190]	Controller current value restoration completion status	468232+2048n	MMC_J4GF::SlaveMonitor.RestorationStatus

Servo object specification area

The following shows the relation between the buffer memory addresses for servo object specification area and the various items.

■Servo object specification parameters

n: Axis No. - 1

Item		Buffer memory address	Label
[Pr.500]	Optional send PDO 1	460000+256n 460001+256n	MMC_J4GF::ServoObject.AnySendPDO1
[Pr.501]	Optional send PDO 2	460002+256n 460003+256n	MMC_J4GF::ServoObject.AnySendPDO2
[Pr.502]	Optional send PDO 3	460004+256n 460005+256n	MMC_J4GF::ServoObject.AnySendPDO3
[Pr.503]	Optional send PDO 4	460006+256n 460007+256n	MMC_J4GF::ServoObject.AnySendPDO4
[Pr.506]	Optional receive PDO 1	460012+256n 460013+256n	MMC_J4GF::ServoObject.AnyRecvPDO1
[Pr.507]	Optional receive PDO 2	460014+256n 460015+256n	MMC_J4GF::ServoObject.AnyRecvPDO2
[Pr.508]	Optional receive PDO 3	460016+256n 460017+256n	MMC_J4GF::ServoObject.AnyRecvPDO3
[Pr.509]	Optional receive PDO 4	460018+256n 460019+256n	MMC_J4GF::ServoObject.AnyRecvPDO4
[Pr.512]	Optional SDO 1	460024+256n 460025+256n	MMC_J4GF::ServoObject.AnySDO1
[Pr.513]	Optional SDO 2	460026+256n 460027+256n	MMC_J4GF::ServoObject.AnySDO2
[Pr.514]	Optional SDO 3	460028+256n 460029+256n	MMC_J4GF::ServoObject.AnySDO3
[Pr.515]	Optional SDO 4	460030+256n 460031+256n	MMC_J4GF::ServoObject.AnySDO4

User watchdog

The following shows the relation between the buffer memory addresses for user watchdog and the various items.

■User watchdog control data

Item		Buffer memory address	Label
[Cd.1140]	Watchdog timer start counter	900000	MMC_Controller::UserWatchDog.StartCounter
[Cd.1141]	Watchdog check counter	900002	MMC_Controller::UserWatchDog.CheckCounter

■User watchdog monitor data

Item		Buffer memory address	Label
[Md.1140]	Watchdog timer	900004	MMC_Controller::UserWatchDog.Timer

Remote operation

The following shows the relation between the buffer memory addresses for remote operation and the various items.

■Remote operation control data

Item		Buffer memory address	Label
[Cd.1180]	Remote RESET start	6300100 6300101	MMC_Controller::RemoteOperation.Reset

Time setting

The following shows the relation between the buffer memory addresses for time setting and the various items.

■Time setting parameters

Item		Buffer memory address	Label
[Pr.1160]	Startup time	6300180 ⋮ 6300183	MMC_Controller::TimeSetting.StartupTime

Interrupt function

The following shows the relation between the buffer memory addresses for interrupt function and the various items.

■Interrupt setting parameters

w: Interrupt setting No. - 1

Item		Buffer memory address	Label
[Pr.1100]	Interrupt mode selection	87680	MMC_Axis::Interrupt.IntMode
[Pr.1101]	Interrupt factor setting	87682+12w 87683+12w	MMC_Axis::Interrupt.InterruptPrm[w].IntFactor
[Pr.1102]	Interrupt data condition	87684+12w	MMC_Axis::Interrupt.InterruptPrm[w].IntDataCondition
[Pr.1103]	Interrupt judge condition	87685+12w	MMC_Axis::Interrupt.InterruptPrm[w].IntJudgeCondition
[Pr.1104]	Interrupt condition judge value 1	87686+12w 87687+12w	MMC_Axis::Interrupt.InterruptPrm[w].IntJudgeValue[0] ⋮ MMC_Axis::Interrupt.InterruptPrm[w].IntJudgeValue[1]
[Pr.1105]	Interrupt condition judge value 2	87688+12w 87689+12w	
[Pr.1106]	Time for condition completion	87690+12w	MMC_Axis::Interrupt.InterruptPrm[w].IntTime

■Interrupt control data

Item		Buffer memory address	Label
[Cd.1100]	Interrupt enable request	89218	MMC_Axis::Interrupt.InterruptCmd.IntEnable
[Cd.1101]	Interrupt factor reset request	89219	MMC_Axis::Interrupt.InterruptCmd.IntReset

■Interrupt monitor data

Item		Buffer memory address	Label
[Md.1100]	During interrupt factor output	89220	MMC_Axis::Interrupt.InterruptMntr.IntFactorOut[0] ⋮ MMC_Axis::Interrupt.InterruptMntr.IntFactorOut[3]
[Md.1101]	Interrupt factor	89224 ⋮ 89227	MMC_Axis::Interrupt.InterruptMntr.IntFactor[0] ⋮ MMC_Axis::Interrupt.InterruptMntr.IntFactor[1]
[Md.1102]	Interrupt factor details	89232 ⋮ 89359	MMC_Axis::Interrupt.InterruptMntr.IntFactorDetail[0] ⋮ MMC_Axis::Interrupt.InterruptMntr.IntFactorDetail[63]

DMA transmission function

The following shows the relation between the buffer memory addresses for DMA transmission function and the various items.

■DMA transmission control data

Item		Buffer memory address	Label
[Cd.1150]	DMA transmission enable request	6300172	MMC_Controller::DmaTransfer.EnableRequest

■DMA transmission monitor data

Item		Buffer memory address	Label
[Md.1150]	DMA transmission status	6300174	MMC_Controller::DmaTransfer.Status

Ethernet communication connection

The following shows the relation between the buffer memory addresses for Ethernet communication connection and the various items.

■Ethernet communication parameters

Item		Buffer memory address	Label
[Pr.1170]	IP address	6300200 6300201	MMC_EM340GF::Ethernet.EthernetPrm.IP_Address
[Pr.1171]	Subnet mask	6300202 6300203	MMC_EM340GF::Ethernet.EthernetPrm.SubnetMask
[Pr.1172]	Default gateway	6300204 6300205	MMC_EM340GF::Ethernet.EthernetPrm.DefaultGateway
[Pr.1173]	Prohibit the direct connection	6300206 6300207	MMC_EM340GF::Ethernet.EthernetPrm.DirectAccessInValidate

■Ethernet communication control data

Item		Buffer memory address	Label
[Cd.1170]	Ethernet communication parameter backup request	6300208 6300209	MMC_EM340GF::Ethernet.EthernetCmd.BackupRequest

■Ethernet communication monitor data

Item		Buffer memory address	Label
[Md.1170]	IP address	6300212 6300213	MMC_EM340GF::Ethernet.EthernetMntr.IP_Address
[Md.1171]	Subnet mask	6300214 6300215	MMC_EM340GF::Ethernet.EthernetMntr.SubnetMask
[Md.1172]	Default gateway	6300216 6300217	MMC_EM340GF::Ethernet.EthernetMntr.DefaultGateway
[Md.1173]	MAC address	6300220 ⋮ 6300223	MMC_EM340GF::Ethernet.EthernetMntr.MAC_Address
[Md.1174]	Link status	6300224 6300225	MMC_EM340GF::Ethernet.EthernetMntr.LinkStatus

Direct control

The following shows the relation between the buffer memory addresses for direct control and the various items.

■Direct control setting parameter

n: Axis No. - 1

Item		Buffer memory address	Label
[Pr.1210]	Direct control number of used buffers	91000+20n	MMC_Controller::DirectCtrl.DirectCtrlPrm[0].UseBufferNumber ⋮ MMC_Controller::DirectCtrl.DirectCtrlPrm[15].UseBufferNumber

■Control data for direct control

n: Axis No. - 1

Item		Buffer memory address	Label
[Cd.1210]	Direct control start request	91640+20n	MMC_Controller::DirectCtrl.DirectCtrlData[0].StartReq ⋮ MMC_Controller::DirectCtrl.DirectCtrlData[15].StartReq
[Cd.1212]	Direct control writing complete buffer No. (position control)	91642+20n	MMC_Controller::DirectCtrl.DirectCtrlData[0].WriteBufferNumberPos ⋮ MMC_Controller::DirectCtrl.DirectCtrlData[15].WriteBufferNumberPos
[Cd.1220]	Direct control command buffer (position control)	91960+120n	MMC_Controller::DirectCtrl.DirectCtrlCmdBuff[0].DirectCtrlCmdBuffPos.PositionCommandData ⋮ MMC_Controller::DirectCtrl.DirectCtrlCmdBuff[15].DirectCtrlCmdBuffPos.PositionCommandData

■Direct control monitor data

n: Axis No. - 1

Item		Buffer memory address	Label
[Md.1134]	Direct control enable flag (all axes)	90808	MMC_Controller::AllAxMntr.DirectCtrlEnableFlagAllAxis
[Md.1210]	Direct control operation status	91320+20n	MMC_Controller::DirectCtrl.DirectCtrlMntr[0].OperationStatus ⋮ MMC_Controller::DirectCtrl.DirectCtrlMntr[15].OperationStatus
[Md.1211]	Direct control enable flag	91321+20n	MMC_Controller::DirectCtrl.DirectCtrlMntr[0].EnableFlag ⋮ MMC_Controller::DirectCtrl.DirectCtrlMntr[15].EnableFlag
[Md.1212]	Direct control buffer No. being executed (position control)	91322+20n	MMC_Controller::DirectCtrl.DirectCtrlMntr[0].CurrentBufferNumberPos ⋮ MMC_Controller::DirectCtrl.DirectCtrlMntr[15].CurrentBufferNumberPos
[Md.1213]	Direct control maximum buffer No. (position control)	91323+20n	MMC_Controller::DirectCtrl.DirectCtrlMntr[0].MaximumBufferNumberPos ⋮ MMC_Controller::DirectCtrl.DirectCtrlMntr[15].MaximumBufferNumberPos

12.3 Basic Setting

The setting items of the setting data are explained in this section.

Servo network composition parameters

n: Axis No. - 1

Item		Setting details	Default value	Buffer memory address
[Pr.100]	Connected device	Used to set the slave device supporting the motion mode for which axis control is performed by the Simple Motion board. [POINT] • Be sure to set up the connected device. Axes cannot be controlled by the initial value "0" in default value.	0	58020+32n 58021+32n
[Pr.101]	Virtual servo amplifier setting	Used to set if use as virtual servo amplifier axis.	0	58022+32n

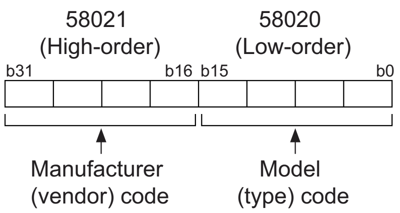
For labels, refer to the following.

☞ Page 446 Servo network composition parameters

[Pr.100] Connected device

■Identification code

Set the slave device supporting the motion mode for which axis control is performed by the Simple Motion board.



Refer to the manual of each slave device for the manufacturer (vendor) code.

Point

- For the slave device for which axis control is performed by the Simple Motion board, the synchronous communication is valid regardless of the setting of "Network Synchronous Communication" in the network configuration settings of EM Configurator.
- Set the slave device for which axis control is performed by the Simple Motion board within the range from 1 to 16 stations in the network configuration settings of EM Configurator.

When a setting value different from the value of the connected device is set or a slave device which does not operate in the motion mode is connected, the error "Connected device setting error" (error code: 193EH) is output.

[Pr.101] Virtual servo amplifier setting

Set if use as virtual servo amplifier axis.

0: Use real servo amplifier

1: Use as virtual servo amplifier

Common parameters

Item	Setting value, setting range		Default value	Buffer memory address
	Value set with EM Configurator	Value set with a user program		
[Pr.82] Forced stop valid/invalid selection	0: Valid (External input signal)	0	0	35
	1: Invalid	1		
	2: Valid (Buffer memory)	2		
	3: Valid (Link device)	3		
[Pr.152] Maximum number of control axes	0: No setting	0	0	58003
	1 to 16: Maximum number of control axes	1 to 16		

For labels, refer to the following.

☞ Page 432 Common parameters

[Pr.82] Forced stop valid/invalid selection

Set the forced stop valid/invalid.

All axes of the servo amplifier are made to batch forced stop when the forced stop input signal is turned on after the forced stop valid/invalid selection is set to "0: Valid (External input signal)", "2: Valid (Buffer memory)", or "3: Valid (Link device)". The error "Servo READY signal OFF during operation" (error code: 1902H) does not occur if the forced input signal is turned on during operation.

Forced stop valid/invalid selection	Setting value
"Valid (External input signal)" (Forced stop from the external input signal is used.)	0
"Invalid" (Forced stop is not used.)	1
"Valid (Buffer memory)" (Forced stop from the buffer memory is used.)	2
"Valid (Link device)" (Forced stop from the link device is used.)	3

Point

- If the setting is other than 0 to 3, the error "Forced stop valid/invalid setting error" (error code: 1B71H) occurs.
- The "[Md.50] Forced stop input" is stored "1" by setting "Forced stop valid/invalid selection" to invalid.

[Pr.152] Maximum number of control axes

Set the maximum number of control axes.

Maximum number of control axes	Setting value
No setting (Controls with the maximum number of control axes for each module.)	0
Maximum number of control axes (Controls the axes until the set axis No.)	1 to 16

- When the maximum number of control axes exceeds the maximum number of control axes of the Simple Motion board, the warning "Outside maximum number of control axes" (warning code: 093AH) occurs and the module is controlled as set with "0: No setting". (The warning occurs in the axis 1.)
- When "[Pr.100] Connected device" is set with a value other than "0: No setting" in the axis which is out of the maximum number of control axes, the warning "Outside control axis setting" (warning code: 093BH) occurs to these axes and the axes does not communicate with servo amplifiers. (The servo amplifier's LED display remains "Ab".)

12

Point

- In this parameter, the value set in the flash ROM of the Simple Motion board is valid at the power supply of the Simple Motion board ON or the remote RESET. Fetch by the user program READY signal OFF to ON is not executed. Execute flash ROM writing to change the value after setting a value to buffer memory. (It is necessary to establish the value at the power supply ON of the Simple Motion board or the remote RESET.)
- The servo input axis (synchronous control) and virtual servo amplifier of the axes which are out of the maximum number of control axes are out of the target.
- This parameter is used when the number of actual used control axes is less than the maximum number of control axes of each module and to suppress the operation cycle.

Basic parameters1

This section describes the details on the basic parameter 1.

n: Axis No. - 1

Item		Setting value, setting range		Default value	Buffer memory address
		Value set with EM Configurator	Value set with a user program		
[Pr.1] Unit setting		0: mm	0	3	0+150n
		1: inch	1		
		2: degree	2		
		3: pulse	3		
Movement amount per pulse	[Pr.2] Number of pulses per rotation (AP) (Unit: pulse)	1 to 200000000	1 to 200000000	20000	2+150n 3+150n
	[Pr.3] Movement amount per rotation (AL)	The setting value range differs according to the "[Pr.1] Unit setting".		20000	4+150n 5+150n
	[Pr.4] Unit magnification (AM)	1: 1 times	1	1	1+150n
		10: 10 times	10		
		100: 100 times	100		
		1000: 1000 times	1000		
[Pr.7] Bias speed at start		The setting value range differs according to the "[Pr.1] Unit setting".		0	6+150n 7+150n

For labels, refer to the following.

☞ Page 432 Positioning parameters: Basic parameters 1

[Pr.1] Unit setting

Set the unit used for defining positioning operations. Choose from the following units depending on the type of the control target: mm, inch, degree, or pulse. Different units can be defined for different axes.

Ex.

Different units (mm, inch, degree, and pulse) are applicable to different systems:

- mm or inch: X-Y table, conveyor (Select mm or inch depending on the machine specifications.)
- degree: Rotating body (360 degrees/rotation)
- pulse: X-Y table, conveyor

Point

When you change the unit, note that the values of other parameters and data will not be changed automatically.

After changing the unit, check if the parameter and data values are within the allowable range.

Set "degree" to exercise speed-position switching control (ABS mode).

[Pr.2] to [Pr.4] Electronic gear (Movement amount per pulse)

Mechanical system value used when the Simple Motion board performs positioning control.

The settings are made using [Pr.2] to [Pr.4].

The electronic gear is expressed by the following equation.

$$\text{Electronic gear} = \frac{\text{[Pr.2] Number of pulses per rotation (AP)}}{\text{[Pr.3] Movement amount per rotation (AL)} \times \text{[Pr.4] Unit magnification (AM)}}$$

When positioning has been performed, an error (mechanical system error) may be produced between the specified movement amount and the actual movement amount.

The error can be compensated by adjusting the value set in electronic gear.

☞ Page 222 Electronic gear function

Point

- The result of below calculation (round up after decimal point) is a minimum pulse when the feed current value is updated at follow up processing. (The movement amount for droop pulse is reflected as the feed current value when the droop pulse becomes more than above calculated value in pulse unit of motor end.)

[Pr.2] Number of pulses per rotation (AP) / ([Pr.3] Movement amount per rotation (AL) × [Pr.4] Unit magnification (AM) [pulse]

Refer to the following for the follow up processing.

☞ Page 306 Follow up function

[Pr.2] Number of pulses per rotation (AP)

Set the number of pulses required for a complete rotation of the motor shaft.

[Pr.3] Movement amount per rotation (AL), [Pr.4] Unit magnification (AM)

The amount how the workpiece moves with one motor rotation is determined by the mechanical structure.

If the worm gear lead (μm/rev) is PB and the deceleration rate is 1/n, then

Movement amount per rotation (AL) = PB × 1/n

However, the maximum value that can be set for this "movement amount per rotation (AL)" parameter is 20000000.0 μm (20 m). Set the "movement amount per rotation (AL)" as shown below so that the "movement amount per rotation (AL)" does not exceed this maximum value.

Movement amount per rotation (AL)

= PB × 1/n

= Movement amount per rotation (AL) × Unit magnification (AM)*1

*1 The unit magnification (AM) is a value of 1, 10, 100 or 1000. If the "PB × 1/n" value exceeds 20000000.0 μm (20 m), adjust with the unit magnification so that the "movement amount per rotation (AL)" does not exceed 20000000.0 μm (20 m).

[Pr.1] setting value	Value set with EM Configurator (unit)	Value set with a user program (unit)
0: mm	0.1 to 20000000.0 (μm)	1 to 200000000 ($\times 10^{-1}$ μm)
1: inch	0.00001 to 2000.00000 (inch)	1 to 200000000 ($\times 10^{-5}$ inch)
2: degree	0.00001 to 2000.00000 (degree)	1 to 200000000 ($\times 10^{-5}$ degree)
3: pulse	1 to 200000000 (pulse)	1 to 200000000 (pulse)

Refer to the following for information about electric gear.

☞ Page 222 Electronic gear function

[Pr.7] Bias speed at start

Set the bias speed (minimum speed) upon starting. When using a stepping motor, etc., set it to start the motor smoothly. (If the motor speed at start is low, the stepping motor does not start smoothly.)

The specified "bias speed at start" will be valid during the following operations:

- Positioning operation
- Home position return operation
- JOG operation

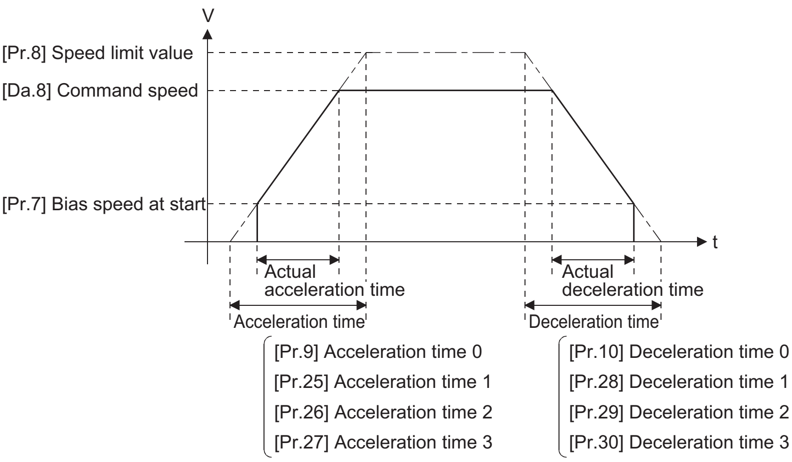
Set the value that the bias speed should not exceed "[Pr.8] Speed limit value".

[Pr.1] setting value	Value set with EM Configurator (unit)	Value set with a user program (unit)
0: mm	0.00 to 20000000.00 (mm/min)	0 to 2000000000 ($\times 10^{-2}$ mm/min)
1: inch	0.000 to 2000000.000 (inch/min)	0 to 2000000000 ($\times 10^{-3}$ inch/min)
2: degree	0.000 to 2000000.000 (degree/min)[*1]	0 to 2000000000 ($\times 10^{-3}$ degree/min)[*2]
3: pulse	0 to 1000000000 (pulse/s)	0 to 1000000000 (pulse/s)

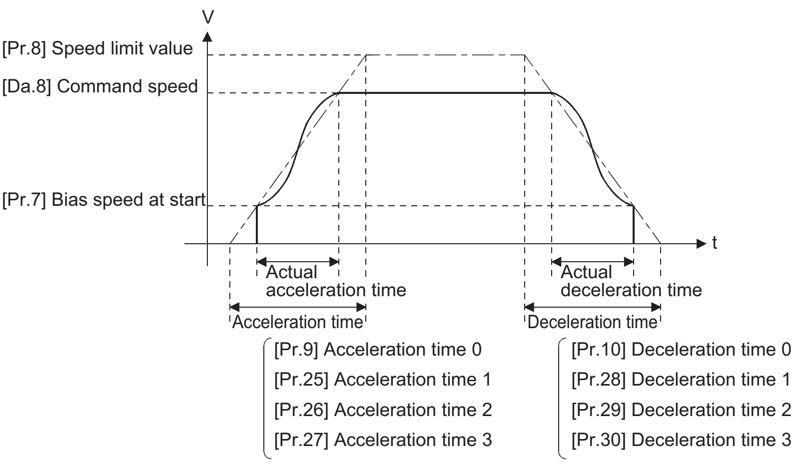
*1 Range of speed limit value when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is set to valid: 0.00 to 20000000.00 (degree/min)

*2 Range of speed limit value when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is set to valid: 0 to 2000000000 ($\times 10^{-2}$ degree/min)

Trapezoidal acceleration/deceleration (S-curve ratio is 0%)



S-curve acceleration/deceleration (S-curve ratio is other than 0%)



Point

For the 2-axis or more interpolation control, the bias speed at start is applied by the setting of "[Pr.20] Interpolation speed designation method".

- "0: Composite speed": Bias speed at start set to the reference axis is applied to the composite command speed.
- "1: Reference axis speed": Bias speed at start is applied to the reference axis.

■Precautionary notes

- "[Pr.7] Bias speed at start" is valid regardless of motor type. Set "0" when using the motor other than the stepping motor. Otherwise, it may cause vibration or impact even though an error does not occur.
- Set "[Pr.7] Bias speed at start" according to the specification of stepping motor driver. If the setting is outside the range, it may cause the following troubles by rapid speed change or overload.

- Stepping motor steps out.
- An error occurs in the stepping motor driver.

- In synchronous control, when "[Pr.7] Bias speed at start" is set to the servo input axis, the bias speed at start is applied to the servo input axis. Note that the unexpected operation might be generated to the output axis.
- Set "[Pr.7] Bias speed at start" within the following range.

"[Pr.8] Speed limit value" ≥ "[Pr.46] Home position return speed" ≥ "[Pr.7] Bias speed at start"

- If the data ("[Da.8] Command speed" of positioning data, "[Da.8] Command speed" of next point for continuous path control, or "[Cd.14] New speed value" for speed change function) is less than "[Pr.7] Bias speed at start", the warning "Below bias speed" (warning code: 0908H) will occur and it will operate at "[Pr.7] Bias speed at start".
- When using S-curve acceleration/deceleration processing and bias speed at start together, S-curve acceleration/deceleration processing is carried out based on the acceleration/deceleration time set by user, "[Pr.8] Speed limit value" and "[Pr.35] S-curve ratio" (1 to 100%) in the section of acceleration/deceleration from bias speed at start to command speed.

Basic parameters2

This section describes the details on the basic parameter 2.

n: Axis No. - 1

Item	Setting value, setting range		Default value	Buffer memory address
	Value set with EM Configurator	Value set with a user program		
[Pr.8] Speed limit value	The setting range differs depending on the "[Pr.1] Unit setting".		200000	10+150n 11+150n
[Pr.9] Acceleration time 0	1 to 8388608 (ms)	1 to 8388608 (ms)	1000	12+150n 13+150n
[Pr.10] Deceleration time 0	1 to 8388608 (ms)	1 to 8388608 (ms)	1000	14+150n 15+150n

For labels, refer to the following.

☞ Page 432 Positioning parameters: Basic parameters 2

[Pr.8] Speed limit value

Set the maximum speed during positioning, home position return and speed-torque operations.

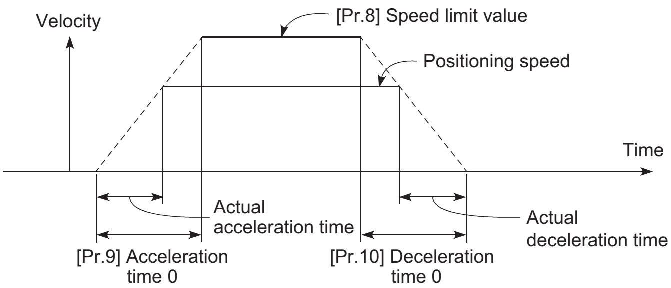
[Pr.1] setting value	Value set with EM Configurator (unit)	Value set with a user program (unit)
0: mm	0.01 to 20000000.00 (mm/min)	1 to 2000000000 ($\times 10^{-2}$ mm/min)
1: inch	0.001 to 2000000.000 (inch/min)	1 to 2000000000 ($\times 10^{-3}$ inch/min)
2: degree	0.001 to 2000000.000 (degree/min)*1	1 to 2000000000 ($\times 10^{-3}$ degree/min)*2
3: pulse	1 to 1000000000 (pulse/s)	1 to 1000000000 (pulse/s)

*1 Range of speed limit value when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is set to valid: 0.01 to 20000000.00 (degree/min).

*2 Range of speed limit value when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is set to valid: 1 to 2000000000 ($\times 10^{-2}$ degree/min)

[Pr.9] Acceleration time 0, [Pr.10] Deceleration time 0

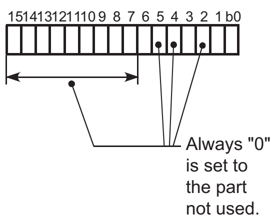
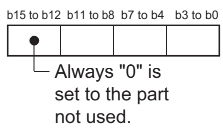
"[Pr.9] Acceleration time 0" specifies the time for the speed to increase from zero to the "[Pr.8] Speed limit value" ("[Pr.31] JOG speed limit value" at JOG operation control). "[Pr.10] Deceleration time 0" specifies the time for the speed to decrease from the "[Pr.8] Speed limit value" ("[Pr.31] JOG speed limit value" at JOG operation control) to zero.



- If the positioning speed is set lower than the parameter-defined speed limit value, the actual acceleration/deceleration time will be relatively short. Thus, set the maximum positioning speed equal to or only a little lower than the parameter-defined speed limit value.
- These settings are valid for home position return, positioning and JOG operations.
- When the positioning involves interpolation, the acceleration/deceleration time defined for the reference axis is valid.

Detailed parameters1

n: Axis No. - 1h

Item	Setting value, setting range: Value set with EM Configurator	Setting value, setting range: Value set with a user program	Default value	Buffer memory address
[Pr.11] Backlash compensation amount	The setting value range differs according to the "[Pr.1] Unit setting".		0	17+150n
[Pr.12] Software stroke limit upper limit value			2147483647	18+150n 19+150n
[Pr.13] Software stroke limit lower limit value			-2147483648	20+150n 21+150n
[Pr.14] Software stroke limit selection	0: Apply software stroke limit on feed current value	0	0	22+150n
	1: Apply software stroke limit on feed machine value	1		
[Pr.15] Software stroke limit valid/invalid setting	0: Software stroke limit valid during JOG operation, inching operation and manual pulse generator operation	0	0	23+150n
	1: Software stroke limit invalid during JOG operation, inching operation and manual pulse generator operation	1		
[Pr.16] Command in-position width	The setting value range differs depending on the "[Pr.1] Unit setting".		100	24+150n 25+150n
[Pr.17] Torque limit setting value	0.1 to 1000.0 (%)	1 to 10000 (× 0.1%)	3000	26+150n
[Pr.18] M code ON signal output timing	0: WITH mode	0	0	27+150n
	1: AFTER mode	1		
[Pr.19] Speed switching mode	0: Standard speed switching mode	0	0	28+150n
	1: Front-loading speed switching mode	1		
[Pr.20] Interpolation speed designation method	0: Composite speed	0	0	29+150n
	1: Reference axis speed	1		
[Pr.21] Feed current value during speed control	0: Do not update feed current value	0	0	30+150n
	1: Update feed current value	1		
	2: Clear feed current value to zero	2		
[Pr.22] Input signal logic selection	b0 Lower limit b1 Upper limit b2 Not used b3 Stop signal b4 Not used b5 Not used b6 Proximity dog signal b7 to b15 Not used 0: Negative logic 1: Positive logic		0	31+150n
[Pr.81] Speed-position function selection	0: Speed-position switching control (INC mode)	0	0	34+150n
	2: Speed-position switching control (ABS mode)	2		
[Pr.116] FLS signal selection	b0 to b3: Input type 1 (0001H): Servo amplifier[*1] 2 (0002H): Buffer memory 3 (0003H): Link device 15 (000FH): Invalid b12 to b15: Not used		000FH	116+150n
[Pr.117] RLS signal selection			000FH	117+150n
[Pr.118] DOG signal selection			000FH	118+150n
[Pr.119] STOP signal selection			0002H	119+150n

*1 The setting is not available in "[Pr.119] STOP signal selection".

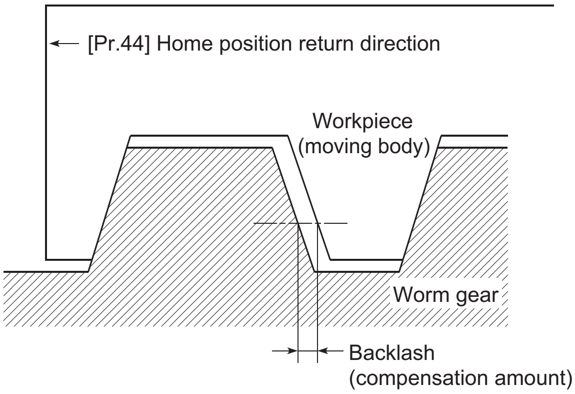
For labels, refer to the following.

☞ Page 432 Positioning parameters: Detailed parameters 1

[Pr.11] Backlash compensation amount

The error that occurs due to backlash when moving the machine via gears can be compensated.

(When the backlash compensation amount is set, commands equivalent to the compensation amount will be output each time the direction changes during positioning.)



- The backlash compensation is valid after machine home position return. Thus, if the backlash compensation amount is set or changed, always carry out machine home position return once.
- "[Pr.2] Number of pulses per rotation (AP)", "[Pr.3] Movement amount per rotation (AL)", "[Pr.4] Unit magnification (AM)" and "[Pr.11] Backlash compensation amount" which satisfies the following (1) can be set up.

$$0 \leq \frac{(\text{[Pr.11] Backlash compensation amount}) \times (\text{[Pr.2] Number of pulses per rotation (AP)})}{(\text{[Pr.3] Movement amount per rotation (AL)}) \times (\text{[Pr.4] Unit magnification (AM)})} (= A) \leq 4194303 \text{ (pulse): (1)}$$

(round down after decimal point)

The error "Backlash compensation amount error" (error code: 1AA0H) occurs when the setting is outside the range of the calculation result of (1).

A servo alarm (error code: 2031, 2035, etc.) may occur by kinds of servo amplifier (servomotor), load inertia moment and the amount of command of a cycle time (Simple Motion board) even if the setting is within the calculation result of (1).

Reduce the setting value of "[Pr.11] Backlash compensation amount" if a servo alarm occurs. Use the value of the following (2) as a measure that a servo alarm does not occur.

$$A \leq \frac{(\text{Maximum motor speed (r/min)}) \times 1.2 \times (\text{Encoder resolution (pulse/rev)}) \times (\text{Operation cycle (ms)})}{60 \text{ (s)} \times 1000 \text{ (ms)}} \text{ (pulse): (2)}$$

[Pr.1] setting value	Value set with EM Configurator (unit)	Value set with a user program (unit)*1
0: mm	0 to 6553.5 (μm)	0 to 65535 ($\times 10^{-1}$ μm)
1: inch	0 to 0.65535 (inch)	0 to 65535 ($\times 10^{-5}$ inch)
2: degree	0 to 0.65535 (degree)	0 to 65535 ($\times 10^{-5}$ degree)
3: pulse	0 to 65535 (pulse)	0 to 65535 (pulse)

*1 0 to 32767: Set as a decimal
32768 to 65535: Convert into hexadecimal and set

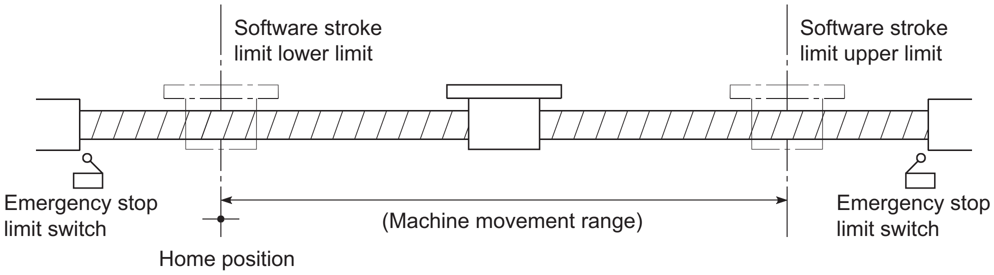
[Pr.12] Software stroke limit upper limit value

Set the upper limit for the machine's movement range during positioning control.

[Pr.1] setting value	Value set with EM Configurator (unit)	Value set with a user program (unit)
0: mm	-214748364.8 to 214748364.7 (μm)	-2147483648 to 2147483647 ($\times 10^{-1}$ μm)
1: inch	-21474.83648 to 21474.83647 (inch)	-2147483648 to 2147483647 ($\times 10^{-5}$ inch)
2: degree	0 to 359.99999 (degree)	0 to 35999999 ($\times 10^{-5}$ degree)
3: pulse	-2147483648 to 2147483647 (pulse)	-2147483648 to 2147483647 (pulse)

[Pr.13] Software stroke limit lower limit value

Set the lower limit for the machine's movement range during positioning control.



- Generally, the home position is set at the lower limit or upper limit of the stroke limit.
- By setting the upper limit value or lower limit value of the software stroke limit, overrun can be prevented in the software. However, an emergency stop limit switch must be installed nearby outside the range. To invalidate the software stroke limit, set the setting value to "upper limit value = lower limit value". (If it is within the setting range, the setting value can be anything.) When the unit is "degree", the software stroke limit check is invalid during speed control (including the speed control in speed-position and position-speed switching control) or during manual control.

[Pr.14] Software stroke limit selection

Set whether to apply the software stroke limit on the "feed current value" or the "feed machine value". The software stroke limit will be validated according to the set value. To invalidate the software stroke limit, set the setting value to "feed current value".

When "2: degree" is set in "[Pr.1] Unit setting", set the setting value of software stroke limit to "feed current value". The error "Software stroke limit selection" (error code: 1AA5H) will occur if "feed machine value" is set.

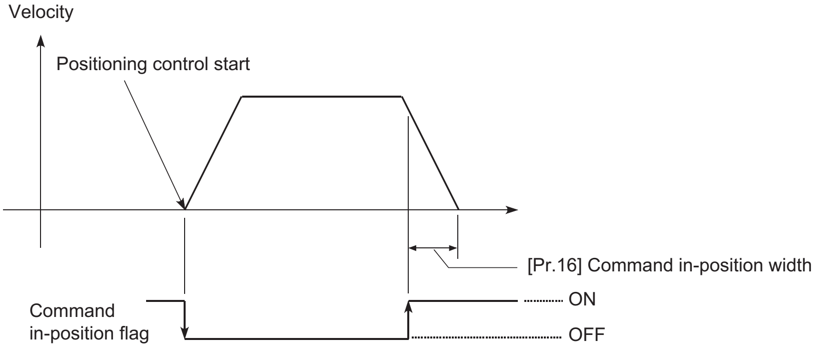
[Pr.15] Software stroke limit valid/invalid setting

Set whether to validate the software stroke limit during JOG/Inching operation and manual pulse generator operation.

[Pr.16] Command in-position width

Set the remaining distance that turns the command in-position flag ON.

When the remaining distance to the stop position during the automatic deceleration of positioning control becomes equal to or less than the value set in the command in-position width, the command in-position flag turns ON.



[Pr.1] setting value	Value set with EM Configurator (unit)	Value set with a user program (unit)
0: mm	0.1 to 214748364.7 (μm)	1 to 2147483647 ($\times 10^{-1}$ μm)
1: inch	0.00001 to 21474.83647 (inch)	1 to 2147483647 ($\times 10^{-5}$ inch)
2: degree	0.00001 to 21474.83647 (degree)	1 to 2147483647 ($\times 10^{-5}$ degree)
3: pulse	1 to 2147483647 (pulse)	1 to 2147483647 (pulse)

[Pr.17] Torque limit setting value

Set the maximum value of the torque generated by the servomotor as a percentage between 0.1 and 1000.0%.

The torque limit function limits the torque generated by the servomotor within the set range.

If the torque required for control exceeds the torque limit value, it is controlled with the set torque limit value.

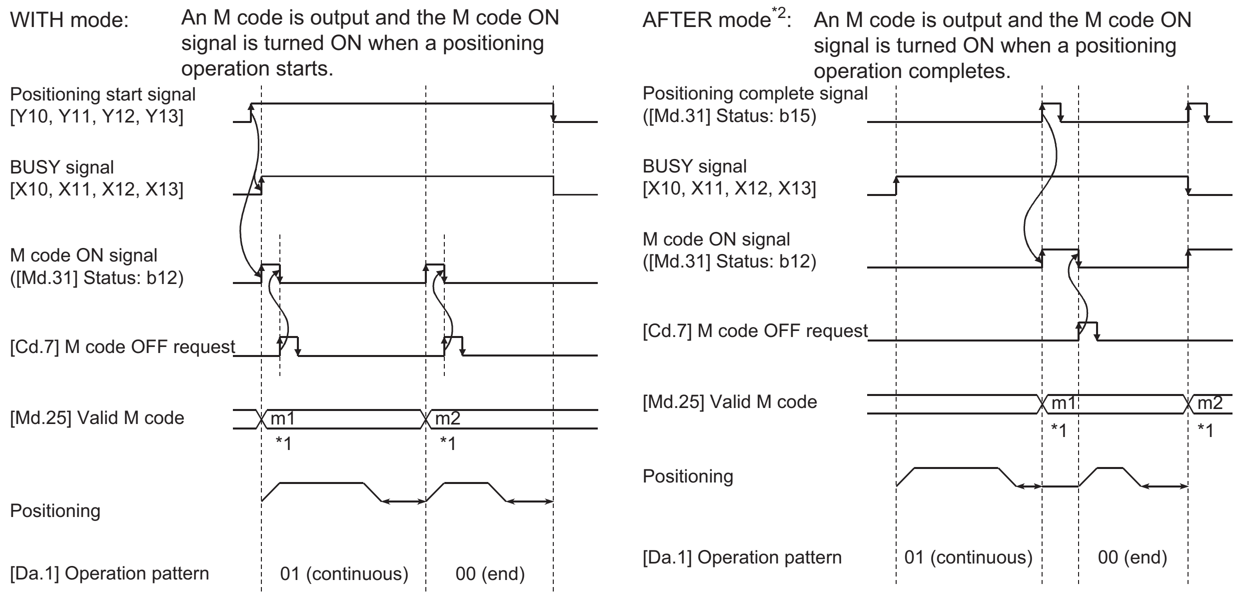
☞ Page 232 Torque limit function

[Pr.18] M code ON signal output timing

This parameter sets the M code ON signal output timing.

Choose either WITH mode or AFTER mode as the M code ON signal output timing.

■Axis 1 to 4 operation example



*1 m1 and m2 indicate set M codes.

*2 If AFTER mode is used with speed control, an M code will not be output and the M code ON signal will not be turned ON.

An M code is a number between 0 and 65535 that can be assigned to each positioning data ([Da.10]).

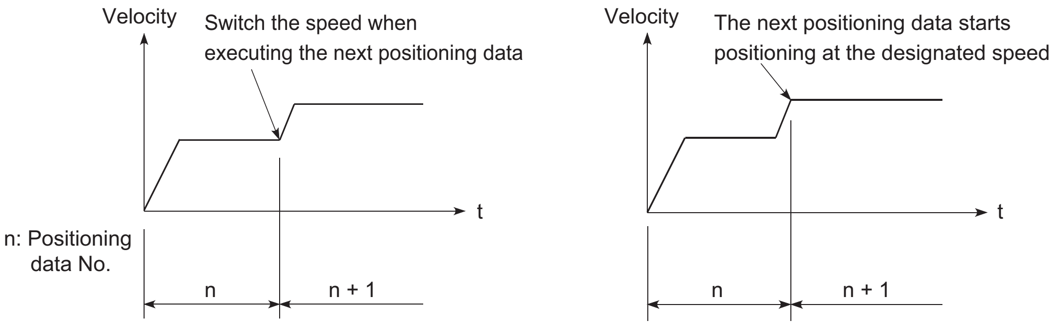
The user program can be coded to read an M code from the buffer memory address specified by "[Md.25] Valid M code" whenever the M code ON signal turns ON so that a command for the sub work (e.g. clamping, drilling, or tool change) associated with the M code can be issued.

- The M code ON signal output timing can be set to each positioning data using the positioning option of the positioning data ([Da.27]).

[Pr.19] Speed switching mode

Set whether to switch the speed switching mode with the standard switching or front-loading switching mode.

Setting value	Details
0: Standard switching	Switch the speed when executing the next positioning data.
1: Front-loading switching	The speed switches at the end of the positioning data currently being executed.

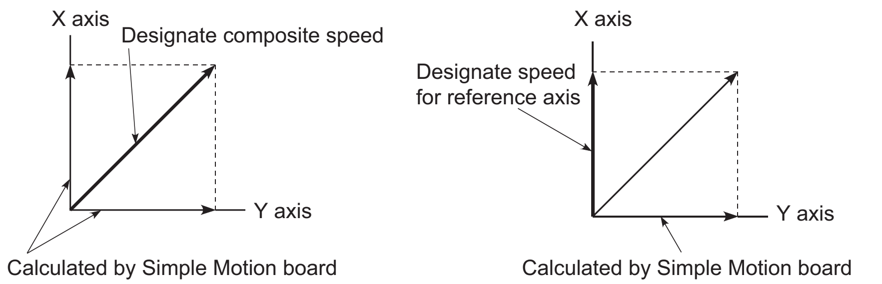


<For standard switching> <For front-loading switching>

[Pr.20] Interpolation speed designation method

When carrying out linear interpolation/circular interpolation, set whether to designate the composite speed or reference axis speed.

Setting value	Details
0: Composite speed	The movement speed for the control target is designated, and the speed for each axis is calculated by the Simple Motion board.
1: Reference axis speed	The axis speed set for the reference axis is designated, and the speed for the other axis carrying out interpolation is calculated by the Simple Motion board.



<When composite speed is designated> <When reference axis speed is designated>

Point

When the 4-axis linear interpolation or 2 to 4-axis speed control is performed, specify the reference axis speed.
If the composite speed is specified, the error "Interpolation mode error" (error code: 199AH) occurs when the positioning operation starts.
When the 2-axis circular interpolation control or 3-axis helical interpolation control is performed, specify the composite speed. If the reference axis speed is specified, the error "Interpolation mode error" (error code: 199BH) occurs when the positioning operation starts.

[Pr.21] Feed current value during speed control

Specify whether you wish to enable or disable the update of "[Md.20] Feed current value" while operations are performed under the speed control (including the speed control in speed-position and position-speed switching control).

Setting value	Details
0: The update of the feed current value is disabled	The feed current value will not change. (The value at the beginning of the speed control will be kept.)
1: The update of the feed current value is enabled	The feed current value will be updated. (The feed current value will change from the initial.)
2: The feed current value is cleared to zero	The feed current value will be set initially to zero and change from zero while the speed control is in effect.

Point

- When the speed control is performed over two to four axes, the choice between enabling and disabling the update of "[Md.20] Feed current value" depends on how the reference axis is set.
- Set "1" to exercise speed-position switching control (ABS mode).

[Pr.22] Input signal logic selection

Set the input signal logic that matches the signaling specification of the external input signal (upper/lower limit switch, proximity dog) of servo amplifier connected to the Simple Motion board or "[Cd.44] External input signal operation device (Axis 1 to 16)".

■Negative logic

- The current is not flowed through the input signal contact.

- FLS, RLS: Limit signal ON
- DOG, DI, STOP: Invalid

- The current is flowed through the input signal contact.

- FLS, RLS: Limit signal OFF
- DOG, DI, STOP: Valid

■Positive logic

Opposite the concept of negative logic.

Point

- A mismatch in the signal logic will disable normal operation. Be careful of this when you change from the default value.
- When using the servo amplifier input, the logic selection setting for FLS/RLS is ignored. (The LSP/LSN input is used for the MR-J4-GF.)

[Pr.81] Speed-position function selection

Select the mode of speed-position switching control.

0: INC mode

2: ABS mode

Point

If the setting is other than 0 and 2, operation is performed in the INC mode with the setting regarded as 0.

[Pr.116] to [Pr.119] FLS/RLS/DOG/STOP signal selection

■Input type

Set the input type whose external input signal (upper/lower limit signal (FLS/RLS), proximity dog signal (DOG) or stop signal (STOP)) is used.

1 (0001H): Servo amplifier*1 (Uses the external input signal of the servo amplifier.)

2 (0002H): Buffer memory (Uses the buffer memory of the Simple Motion board.)

3 (0003H): Link device (Uses link devices.)

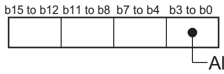
15 (000FH): Invalid (Does not use the external input signal.)

*1 The setting is not available in "[Pr.119] STOP signal selection". If it is set, the error "STOP signal selection error" (error code: 1AD3H) occurs and the user program READY signal [Y0] is not turned ON.

Detailed parameters2

n: Axis No. - 1

Item	Setting value, setting range		Default value	Buffer memory address
	Value set with EM Configurator	Value set with a user program		
[Pr.25] Acceleration time 1	1 to 8388608 (ms)	1 to 8388608 (ms)	1000	36+150n 37+150n
[Pr.26] Acceleration time 2				38+150n 39+150n
[Pr.27] Acceleration time 3				40+150n 41+150n
[Pr.28] Deceleration time 1				42+150n 43+150n
[Pr.29] Deceleration time 2				44+150n 45+150n
[Pr.30] Deceleration time 3				46+150n 47+150n
[Pr.31] JOG speed limit value	The setting range differs depending on the "[Pr.1] Unit setting".		20000	48+150n 49+150n
[Pr.32] JOG operation acceleration time selection	0: [Pr.9] Acceleration time 0	0	0	50+150n
	1: [Pr.25] Acceleration time 1	1		
	2: [Pr.26] Acceleration time 2	2		
	3: [Pr.27] Acceleration time 3	3		
[Pr.33] JOG operation deceleration time selection	0: [Pr.10] Deceleration time 0	0	0	51+150n
	1: [Pr.28] Deceleration time 1	1		
	2: [Pr.29] Deceleration time 2	2		
	3: [Pr.30] Deceleration time 3	3		
[Pr.34] Acceleration/deceleration process selection	0: Trapezoid acceleration/deceleration process	0	0	52+150n
	1: S-curve acceleration/deceleration process	1		
[Pr.35] S-curve ratio	1 to 100 (%)	1 to 100 (%)	100	53+150n
[Pr.36] Rapid stop deceleration time	1 to 8388608 (ms)	1 to 8388608 (ms)	1000	54+150n 55+150n
[Pr.37] Stop group 1 rapid stop selection	0: Normal deceleration stop	0	0	56+150n
	1: Rapid stop	1		
[Pr.38] Stop group 2 rapid stop selection	0: Normal deceleration stop	0		57+150n
	1: Rapid stop	1		
[Pr.39] Stop group 3 rapid stop selection	0: Normal deceleration stop	0		58+150n
	1: Rapid stop	1		
[Pr.40] Positioning complete signal output time	0 to 65535 (ms)	0 to 65535 (ms) 0 to 32767: Set as a decimal 32768 to 65535: Convert into hexadecimal and set	300	59+150n
[Pr.41] Allowable circular interpolation error width	The setting value range differs depending on the "[Pr.1] Unit setting".		100	60+150n 61+150n
[Pr.83] Speed control 10 × multiplier setting for degree axis	0: Invalid	0	0	63+150n
	1: Valid	1		
[Pr.84] Restart allowable range when servo OFF to ON	0, 1 to 327680 [pulse] 0: restart not allowed		0	64+150n 65+150n

<table>
<tr><th rowspan="2">Item</th><th colspan="3">Setting value, setting range</th><th rowspan="2">Default value</th><th rowspan="2">Buffer memory address</th></tr>
<tr><th colspan="2">Value set with EM Configurator</th><th>Value set with a user program</th></tr>
<tr><td rowspan="4">[Pr.90]
Operation setting for speed-torque control mode</td><td>b0 to b3</td><td>Not used</td><td rowspan="4">
Always "0" is set to the part not used.</td><td rowspan="4">0000H</td><td rowspan="4">68+150n</td></tr>
<tr><td>b4 to b7</td><td>Torque initial value selection
0: Command torque
1: Feedback torque</td></tr>
<tr><td>b8 to b11</td><td>Speed initial value selection
0: Command speed
1: Feedback speed
2: Automatic selection</td></tr>
<tr><td>b12 to b15</td><td>Condition selection at mode switching
0: Check the switching conditions in Simple Motion board
1: According to the servo amplifier specification</td></tr>
<tr><td>[Pr.122]
Manual pulse generator speed limit mode</td><td colspan="2">0: Don't hold speed limit
1: Don't output over value of speed limit
2: Output over value of speed limit later</td><td>0
1
2</td><td>0</td><td>121+150n</td></tr>
<tr><td>[Pr.123]
Manual pulse generator speed limit value</td><td colspan="3">The setting value range differs depending on the "[Pr.1] Unit setting".</td><td>20000</td><td>122+150n
123+150n</td></tr>
</table>

For labels, refer to the following.

☞ Page 433 Positioning parameters: Detailed parameters 2

[Pr.25] Acceleration time 1 to [Pr.27] Acceleration time 3

These parameters set the time for the speed to increase from zero to the "[Pr.8] Speed limit value" ("[Pr.31] JOG speed limit value" at JOG operation control) during a positioning operation.

[Pr.28] Deceleration time 1 to [Pr.30] Deceleration time 3

These parameters set the time for the speed to decrease from the "[Pr.8] Speed limit value" ("[Pr.31] JOG speed limit value" at JOG operation control) to zero during a positioning operation.

[Pr.31] JOG speed limit value

Set the maximum speed for JOG operation.

[Pr.1] setting value	Value set with EM Configurator (unit)	Value set with a user program (unit)
0: mm	0.01 to 20000000.00 (mm/min)	1 to 2000000000 ($\times 10^{-2}$ mm/min)
1: inch	0.001 to 2000000.000 (inch/min)	1 to 2000000000 ($\times 10^{-3}$ inch/min)
2: degree	0.001 to 2000000.000 (degree/min)*1	1 to 2000000000 ($\times 10^{-3}$ degree/min)*2
3: pulse	1 to 1000000000 (pulse/s)	1 to 1000000000 (pulse/s)

*1 The range of JOG speed limit value when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: 0.01 to 20000000.00 (degree/min)

*2 The range of JOG speed limit value when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: 1 to 2000000000 ($\times 10^{-2}$ degree/min)

Point

Set the "JOG speed limit value" to a value less than "[Pr.8] Speed limit value". If the "speed limit value" is exceeded, the error "JOG speed limit value error" (error code: 1AB7H) will occur.

[Pr.32] JOG operation acceleration time selection

Set which of "acceleration time 0 to 3" to use for the acceleration time during JOG operation.

0: Use value set in "[Pr.9] Acceleration time 0".

1: Use value set in "[Pr.25] Acceleration time 1".

2: Use value set in "[Pr.26] Acceleration time 2".

3: Use value set in "[Pr.27] Acceleration time 3".

[Pr.33] JOG operation deceleration time selection

Set which of "deceleration time 0 to 3" to use for the deceleration time during JOG operation.

0: Use value set in "[Pr.10] Deceleration time 0".

1: Use value set in "[Pr.28] Deceleration time 1".

2: Use value set in "[Pr.29] Deceleration time 2".

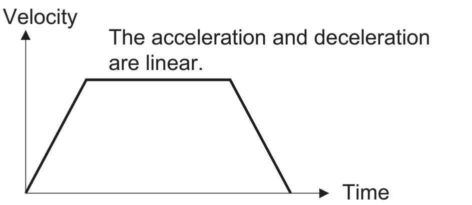
3: Use value set in "[Pr.30] Deceleration time 3".

[Pr.34] Acceleration/deceleration process selection

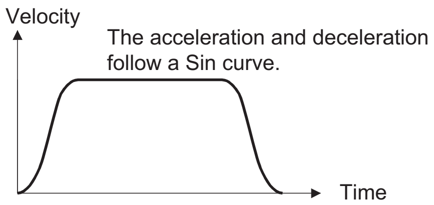
Set whether to use trapezoid acceleration/deceleration or S-curve acceleration/deceleration for the acceleration/deceleration process.

Refer to the following for details.

☞ Page 294 Acceleration/deceleration processing function



<Trapezoid acceleration/deceleration>

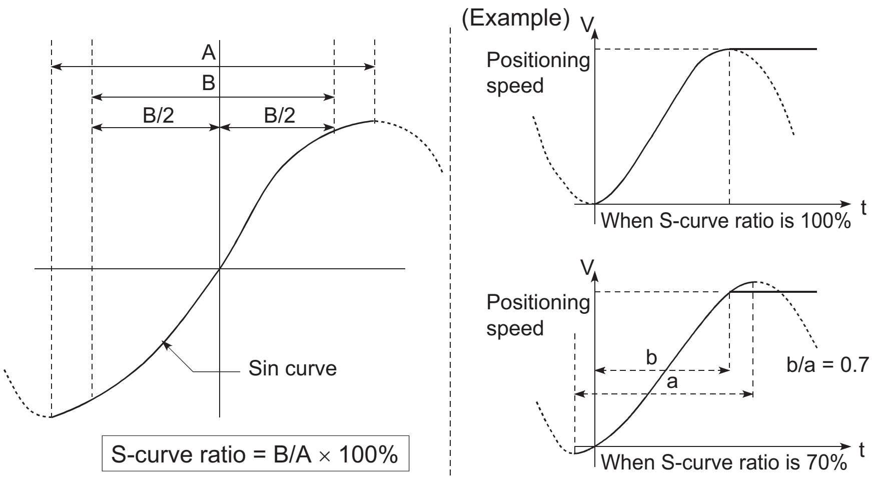


<S-curve acceleration/deceleration>

[Pr.35] S-curve ratio

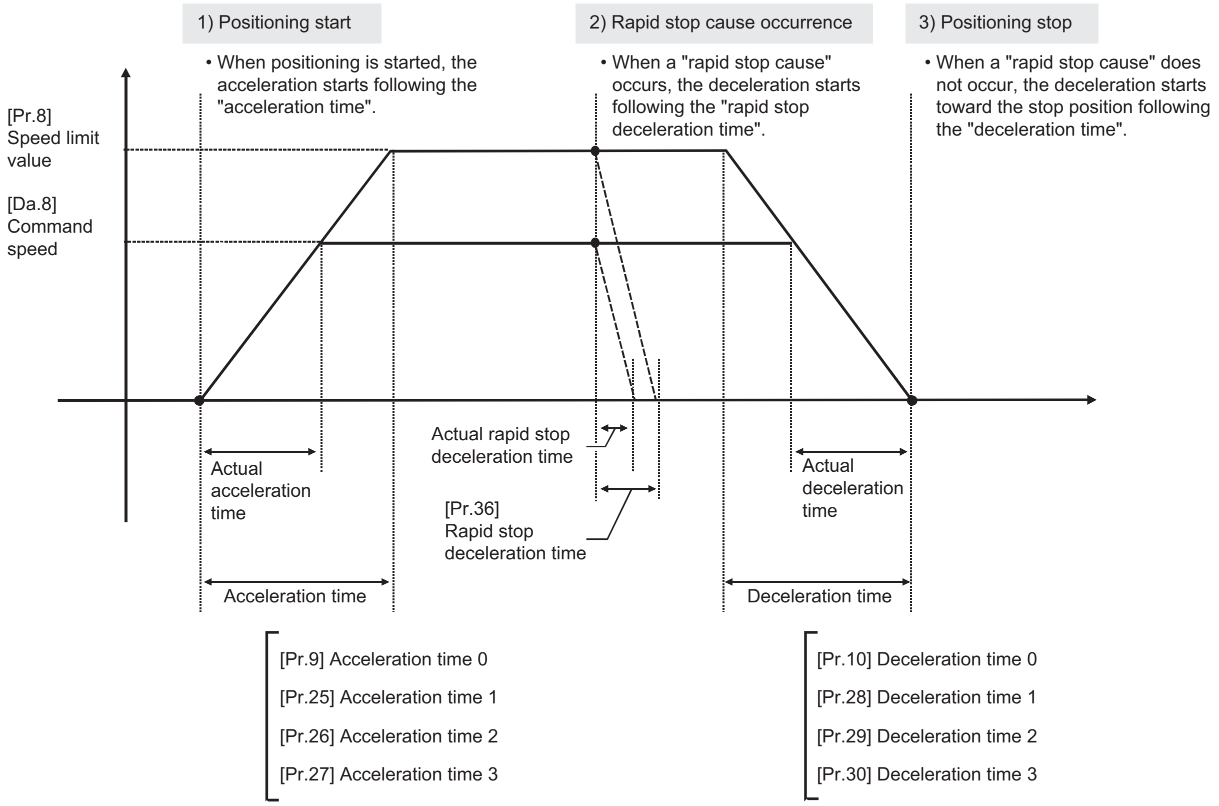
Set the S-curve ratio (1 to 100%) for carrying out the S-curve acceleration/deceleration process.

The S-curve ratio indicates where to draw the acceleration/deceleration curve using the Sin curve as shown below.



[Pr.36] Rapid stop deceleration time

Set the time to reach speed 0 from "[Pr.8] Speed limit value" ("[Pr.31] JOG speed limit value" at JOG operation control) during the rapid stop. The illustration below shows the relationships with other parameters.



[Pr.37] to [Pr.39] Stop group 1/2/3 rapid stop selection

Set the method to stop when the stop causes in the following stop groups occur.

Stop group	Details
Stop group 1	Stop with hardware stroke limit
Stop group 2	Error occurrence of the host personal computer, user program READY signal [Y0] OFF
Stop group 3	Axis stop signal from the host personal computer, Error occurrence (excludes errors in stop groups 1 and 2: includes only the software stroke limit errors during JOG operation, speed control, speed-position switching control, and position-speed switching control)

The methods of stopping include "0: Normal deceleration stop" and "1: Rapid stop".

If "1: Rapid stop" is selected, the axis will rapidly decelerate to a stop when the stop cause occurs.

12

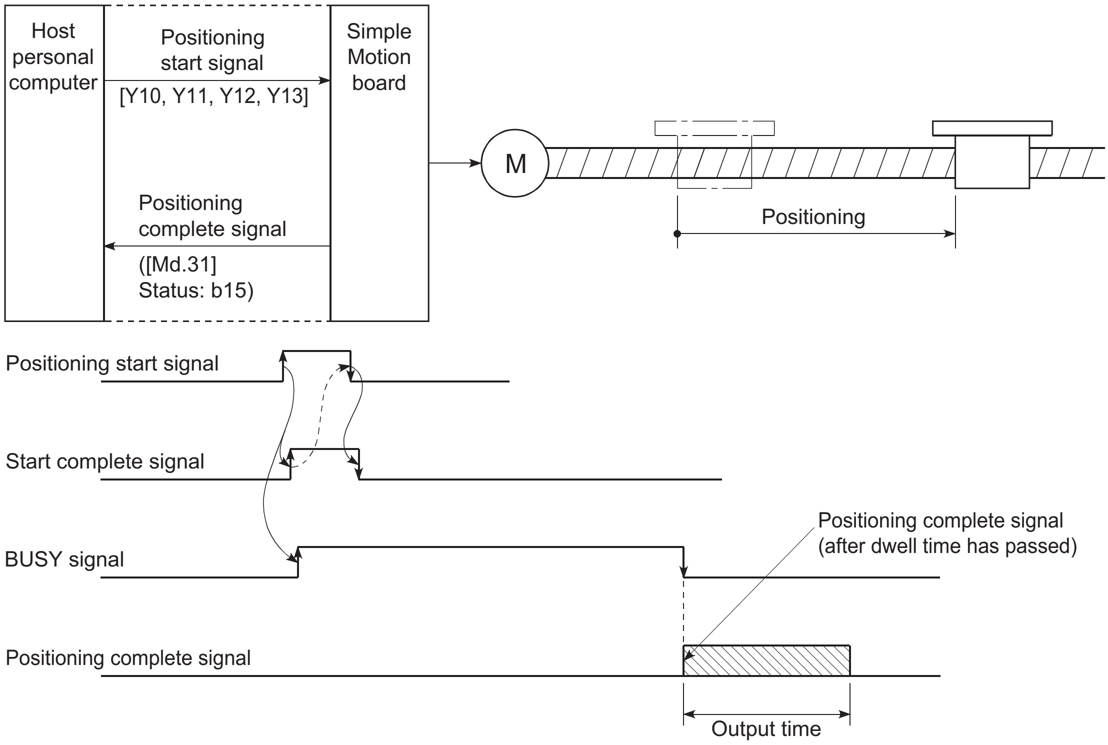
[Pr.40] Positioning complete signal output time

Set the output time of the positioning complete signal output from the Simple Motion board.

A positioning completes when the specified dwell time has passed after the Simple Motion board had terminated the command output.

For the interpolation control, the positioning completed signal of interpolation axis is output only during the time set to the reference axis.

■Axis 1 to 4 operation example



[Pr.41] Allowable circular interpolation error width

The allowable error range of the calculated arc path and end point address is set.*1

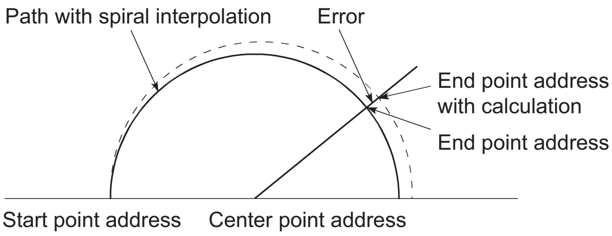
If the error of the calculated arc path and end point address is within the set range, circular interpolation will be carried out to the set end point address while compensating the error with spiral interpolation.

The allowable circular interpolation error width is set in the following axis buffer memory addresses.

Ex.

· If axis 1 is the reference axis, set in the axis 1 buffer memory addresses [60, 61].

· If axis 4 is the reference axis, set in the axis 4 buffer memory addresses [510, 511].



*1 In 2-axis circular interpolation control with center point designation, the arc path calculated with the start point address and center point address and the end point address may deviate.

[Pr.1] setting value	Value set with EM Configurator (unit)	Value set with a user program (unit)
0: mm	0 to 10000.0 (μm)	0 to 100000 (× 10^{-1} μm)
1: inch	0 to 1.00000 (inch)	0 to 100000 (× 10^{-5} inch)
2: degree	0 to 1.00000 (degree)	0 to 100000 (× 10^{-5} degree)
3: pulse	0 to 100000 (pulse)	0 to 100000 (pulse)

[Pr.83] Speed control 10 x multiplier setting for degree axis

Set the speed control 10 × multiplier setting for degree axis when you use command speed and speed limit value set by the positioning data and the parameter at "[Pr.1] Unit setting" setup degree by ten times at the speed.

0: Invalid

1: Valid

Normally, the speed specification range is 0.001 to 2000000.000 [degree/min], but it will be decupled and become 0.01 to 20000000.00 [degree/min] by setting "[Pr.83] Speed control 10 × multiplier setting for degree axis" to valid.

Refer to the following for details on the speed control 10 × multiplier setting for degree axis.

☞ Page 299 Speed control 10 x multiplier setting for degree axis function

[Pr.83] setting value	Value set with EM Configurator (unit)	Value set with a user program (unit)
0: Invalid	0.001 to 2000000.000 (degree/min)	1 to 2000000000 (× 10^{-3} degree/min)
1: Valid	0.01 to 20000000.00 (degree/min)	1 to 2000000000 (× 10^{-2} degree/min)

Point

"[Pr.83] Speed control 10 × multiplier setting for degree axis" is included in detailed parameters 2. However, it will be valid at the leading edge (OFF to ON) of the user program READY signal [Y0].

[Pr.84] Restart allowable range when servo OFF to ON

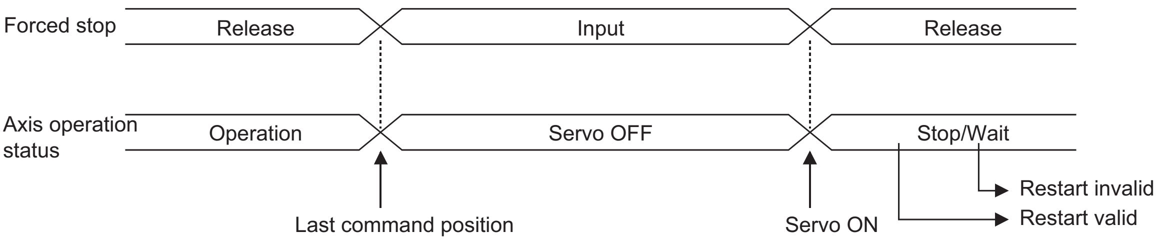
■Restart function at switching servo OFF to ON

The restart function at switching servo OFF to ON performs continuous positioning operation (positioning start, restart) when switching servo OFF to ON while the Simple Motion board is stopped (including forced stop, servo forced stop).

Restart at switching servo OFF to ON can be performed when the difference between the last command position of Simple Motion board at stop and the current value at switching servo OFF to ON is equal to or less than the value set in the buffer memory for the restart allowable range setting.

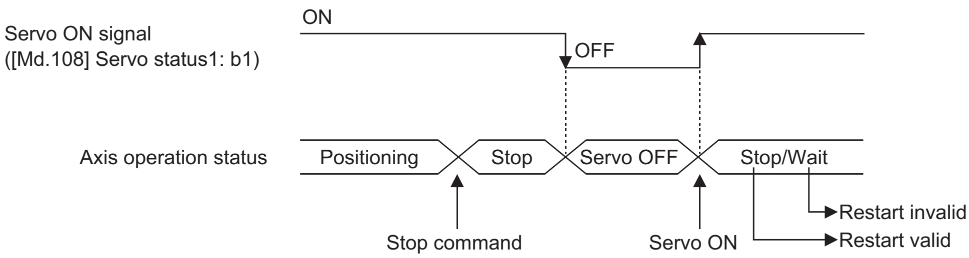
- Servo emergency stop processing

- When the difference between the last command position of Simple Motion board at the forced stop input or the servo forced stop input and the current value at the forced stop release or the servo forced stop release is equal to or less than the value set in the buffer memory for the restart allowable range setting, the positioning operation is judged as stopped and can be restarted.
- When the difference between the last command position of Simple Motion board at the forced stop input or the servo forced stop input and the current value at the forced stop release or the servo forced stop release is greater than the value set in the buffer memory for the restart allowable range setting, the positioning operation is judged as on-standby and cannot be restarted.



- Processing at switching the servo ON signal from OFF to ON

- When the difference between the last command position of Simple Motion board at switching the servo ON signal from ON to OFF and the current value at switching the servo ON signal from OFF to ON is equal to or less than the value set in the buffer memory for the restart allowable range setting, the positioning operation is judged as stopped and can be restarted.
- When the difference between the last command position of Simple Motion board at switching the servo ON signal from ON to OFF and the current value at switching the servo ON signal from OFF to ON is greater than the value set in the buffer memory for the restart allowable range setting, the positioning operation is judged as on-standby and cannot be restarted.



■Setting method

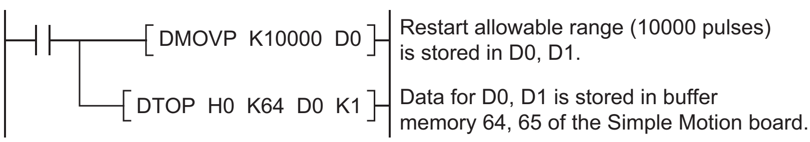
For performing restart at switching servo OFF to ON, set the restart allowable range in the following buffer memory.

n: Axis No. - 1

Item	Setting range	Default value	Buffer memory address
[Pr.84] Restart allowable range when servo OFF to ON	0, 1 to 327680 [pulse] 0: restart not allowed	0	64+150n 65+150n

- Setting example

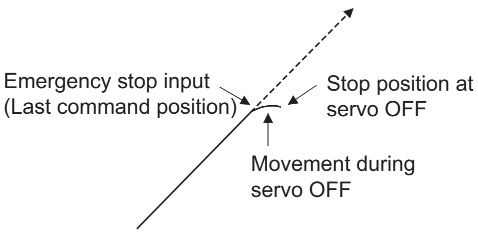
A user program to set the restart allowable range for axis 1 to 10000 pulses is shown below.



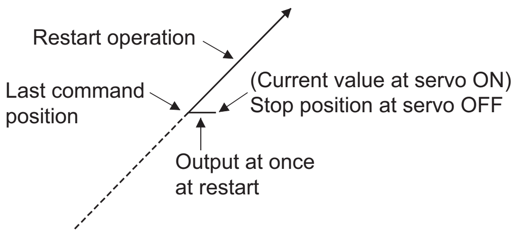
Point

- The difference between the last command position at servo OFF and the current value at servo ON is output at once at the first restart. If the restart allowable range is large at this time, an overload may occur on the servo side. Set a value which does not affect the mechanical system by output once to the restart allowable range when switching servo OFF to ON.
- The restart at switching servo OFF to ON is valid only at switching servo OFF to ON at the first time. At the second time or later, the setting for restart allowable range when switching servo OFF to ON is disregarded.
- Execute servo OFF when the mechanical system is in complete stop state. The restart at switching servo OFF to ON cannot be applied to a system in which the mechanical system is operated by external pressure or other force during servo OFF.
- Restart can be executed only while the axis operation status is "stop". Restart cannot be executed when the axis operation status is other than "stop".
- When the user program READY signal is switched from OFF to ON during servo OFF, restart cannot be executed. If restart is requested, the warning "Restart not possible" (warning code: 0902H) occurs.
- Do not restart while a stop command is ON. When restart is executed during a stop, the error "Stop signal ON at start" (error code: 1908H) occurs and the axis operation status becomes "ERR". Therefore, restart cannot be performed even if the error is reset.
- Restart can also be executed while the positioning start signal is ON. However, do not set the positioning start signal from OFF to ON during a stop. If the positioning start signal is switched from OFF to ON, positioning is performed from the positioning data No. set in "[Cd.3] Positioning start No." or from the positioning data No. of the specified point.
- When positioning is terminated by a continuous-operation interrupt request, restart cannot be performed. If a restart request is executed, the warning "Restart not possible" (warning code: 0902H) occurs.

[Operation at emergency stop input]



[Operation at restart]



[Pr.90] Operation setting for speed-torque control mode

Operation setting of the speed control mode or torque control mode at the speed-torque control is executed.

■Torque initial value selection

Set the torque initial value at switching to torque control mode.

Setting value	Details
0: Command torque	Command torque value at switching. (following axis control data) Switching to torque control mode: "[Cd.143] Command torque at torque control mode"
1: Feedback torque	Motor torque value at switching.

■Speed initial value selection

Set the initial speed at switching from position control mode to speed control mode.

Setting value	Details
0: Command speed	Speed that position command at switching is converted into the motor speed.
1: Feedback speed	Motor speed received from servo amplifier at switching
2: Automatic selection	At switching from position control mode to speed control mode, operation is the same as "0: Command speed".

■Condition selection at mode switching

Set the valid/invalid of switching conditions for switching control mode.

0: Check the switching conditions in Simple Motion board

1: According to the servo amplifier specification

Point

- The "Operation setting for speed-torque control mode" is included in detailed parameters 2. However, it will be valid at the leading edge (OFF to ON) of the user program READY signal [Y0].
- Set as follows to switch the control mode without waiting for the servo motor to stop. Note that it may cause vibration or impact at control switching.

Set "Condition selection at mode switching (b12 to b15)" to "1: According to the servo amplifier specification". When using the MR-J4-GF, set "ZSP disabled selection at control switching" of the servo parameter "Function selection C-E (PC76)" to "1: Disabled".

[Pr.122] Manual pulse generator speed limit mode

Set how to output when the output by manual pulse generator operation exceeds "[Pr.123] Manual pulse generator speed limit value".

0: Don't hold speed limit

1: Don't output over value of speed limit

2: Output over value of speed limit later

Point

The "Manual pulse generator speed limit mode" is included in detailed parameters 2. However, it will be valid at the leading edge (OFF to ON) of the user program READY signal [Y0].

[Pr.123] Manual pulse generator speed limit value

Set the maximum speed during manual pulse generator operation.

Point

- The "Manual pulse generator speed limit value" is included in detailed parameters 2. However, it will be valid at the leading edge (OFF to ON) of the user program READY signal [Y0].
- Set the "Manual pulse generator speed limit value" to a value less than "[Pr.8] Speed limit value". If the "speed limit value" is exceeded, the error "Manual pulse generator speed limit value error" (error code: 1ABAH) will occur.

Home position return basic parameters

n: Axis No. - 1

Item	Setting value, setting range		Default value	Buffer memory address
	Value set with EM Configurator	Value set with a user program		
[Pr.43] Home position return method	8: Driver home position return method	8	8	70+150n
[Pr.44] Home position return direction	0: Positive direction (address increment direction)	0	0	71+150n
	1: Negative direction (address decrement direction)	1		
[Pr.45] Home position address	The setting value range differs depending on the "[Pr.1] Unit setting".		0	72+150n 73+150n
[Pr.46] Home position return speed			1	74+150n 75+150n

For labels, refer to the following.

☞ Page 434 Home position return parameters: Home position return basic parameters

[Pr.43] Home position return method

Set the "home position return method" for carrying out machine home position return.

Setting value	Details	Reference
8: Driver home position return method	Carry out the home position return operation on the driver side. The home position return operation and parameters depend on the specifications of the driver.	☞ Page 38 Driver home position return method

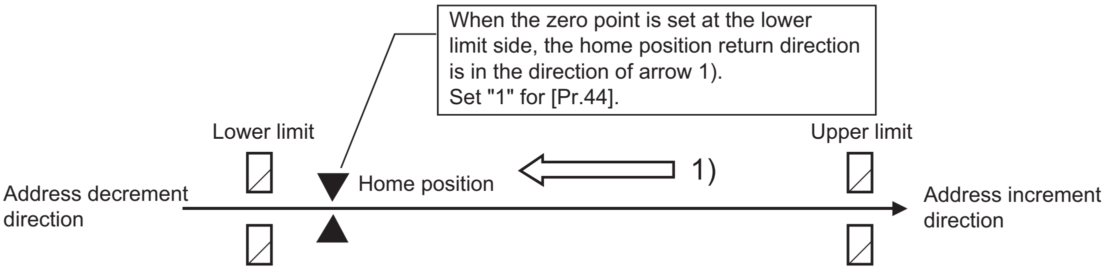
When setting the home position return method that cannot be executed, the error "Home position return method invalid" (error code: 1979H) occurs and the home position return is not executed.

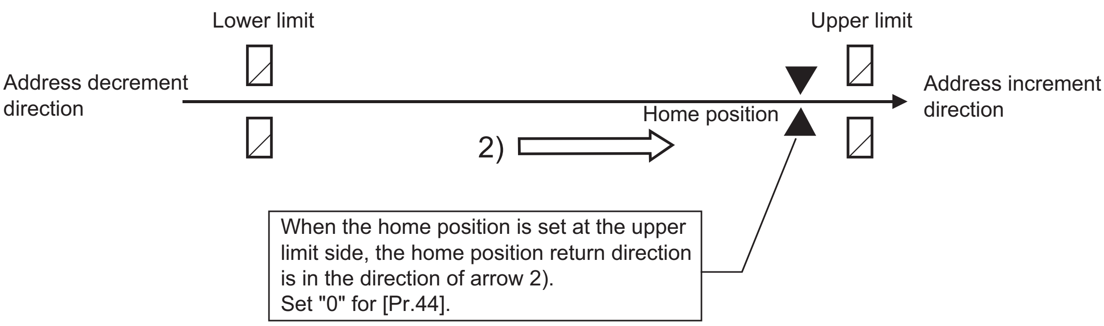
[Pr.44] Home position return direction

Set the direction to start movement when starting machine home position return.

Setting value	Details
0: Positive direction (address increment direction)	Moves in the direction that the address increments. (Arrow 2))
1: Negative direction (address decrement direction)	Moves in the direction that the address decrements. (Arrow 1))

Normally, the home position is set near the lower limit or the upper limit, so "[Pr.44] Home position return direction" is set as shown below.





[Pr.45] Home position address

Set the address used as the reference point for positioning control (ABS system).

(When the machine home position return is completed, the stop position address is changed to the address set in "[Pr.45] Home position address". At the same time, the "[Pr.45] Home position address" is stored in "[Md.20] Feed current value" and "[Md.21] Feed machine value".)

[Pr.1] setting value	Value set with EM Configurator (unit)	Value set with a user program (unit)
0: mm	-214748364.8 to 214748364.7 (μm)	-2147483648 to 2147483647 ($\times 10^{-1}$ μm)
1: inch	-21474.83648 to 21474.83647 (inch)	-2147483648 to 2147483647 ($\times 10^{-5}$ inch)
2: degree	0 to 359.99999 (degree)	0 to 35999999 ($\times 10^{-5}$ degree)
3: pulse	-2147483648 to 2147483647 (pulse)	-2147483648 to 2147483647 (pulse)

[Pr.46] Home position return speed

Set the speed for home position return.

Fast home position return is carried out at the home position return speed.

[Pr.1] setting value	Value set with EM Configurator (unit)	Value set with a user program (unit)
0: mm	0.01 to 20000000.00 (mm/min)	1 to 2000000000 ($\times 10^{-2}$ mm/min)
1: inch	0.001 to 2000000.000 (inch/min)	1 to 2000000000 ($\times 10^{-3}$ inch/min)
2: degree	0.001 to 2000000.000 (degree/min)*1	1 to 2000000000 ($\times 10^{-3}$ degree/min)*2
3: pulse	1 to 1000000000 (pulse/s)	1 to 1000000000 (pulse/s)

*1 The range of home position return speed when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: 0.01 to 20000000.00 (degree/min)

*2 The range of home position return speed when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: 1 to 2000000000 ($\times 10^{-2}$ degree/min)

Point

Set the "home position return speed" to less than "[Pr.8] Speed limit value". If the "speed limit value" is exceeded, the error "Outside speed limit value range" (error code: 1A69H) will occur, and home position return will not be executed.

Home position return detailed parameters

n: Axis No. - 1

Item	Setting value, setting range		Default value	Buffer memory address
	Value set with EM Configurator	Value set with a user program		
[Pr.51] Home position return acceleration time selection	0: [Pr.9] Acceleration time 0	0	0	82+150n
	1: [Pr.25] Acceleration time 1	1		
	2: [Pr.26] Acceleration time 2	2		
	3: [Pr.27] Acceleration time 3	3		
[Pr.52] Home position return deceleration time selection	0: [Pr.10] Deceleration time 0	0	0	83+150n
	1: [Pr.28] Deceleration time 1	1		
	2: [Pr.29] Deceleration time 2	2		
	3: [Pr.30] Deceleration time 3	3		
[Pr.55] Operation setting for incompletion of home position return	0: Positioning control is not executed.	0	0	87+150n
	1: Positioning control is executed.	1		

For labels, refer to the following.

☞ Page 434 Home position return parameters: Home position return detailed parameters

[Pr.51] Home position return acceleration time selection

Set which of "acceleration time 0 to 3" to use for the acceleration time during home position return.

0: Use the value set in "[Pr.9] Acceleration time 0".

1: Use the value set in "[Pr.25] Acceleration time 1".

2: Use the value set in "[Pr.26] Acceleration time 2".

3: Use the value set in "[Pr.27] Acceleration time 3".

This setting is valid only at fast home position return.

[Pr.52] Home position return deceleration time selection

Set which of "deceleration time 0 to 3" to use for the deceleration time during home position return.

0: Use the value set in "[Pr.10] Deceleration time 0".

1: Use the value set in "[Pr.28] Deceleration time 1".

2: Use the value set in "[Pr.29] Deceleration time 2".

3: Use the value set in "[Pr.30] Deceleration time 3".

This setting is valid only at fast home position return.

[Pr.55] Operation setting for incompletion of home position return

Set whether the positioning control is executed or not (When the home position return request flag is ON.).

0: Positioning control is not executed.

1: Positioning control is executed.

- When the home position return request flag is ON, selecting "0: Positioning control is not executed" will result in the error "Start at home position return incomplete" (error code: 19A6H), and positioning control will not be performed. At this time, operation with the manual control (JOG operation, inching operation, manual pulse generator operation) is available. The positioning control can be executed even if the home position return request flag is ON when selecting "1: Positioning control is executed".
- The following shows whether the positioning control is possible to start/restart or not when selecting "0: Positioning control is not executed".

12

Start possible	Machine home position return, JOG operation, inching operation, manual pulse generator operation, and current value changing using current value changing start No. (9003)
Start/restart impossible control	When the following cases at block start, condition start, wait start, repeated start, multiple axes simultaneous start and pre-reading start 1-axis linear control, 2/3/4-axis linear interpolation control, 1/2/3/4-axis fixed-feed control, 2-axis circular interpolation control (with sub point designation/center point designation), 3-axis helical interpolation control (with sub point designation/center point designation), 1/2/3/4-axis speed control, speed-position switching control (INC mode/ ABS mode), position-speed switching control, and current value changing using current value changing (No.1 to 600)

- When the home position return request flag is ON, starting the fast home position return will result in the error "Home position return request ON" (error code: 1945H) despite the setting value of "Operation setting for incompletion of home position return", and the fast home position return will not be executed.

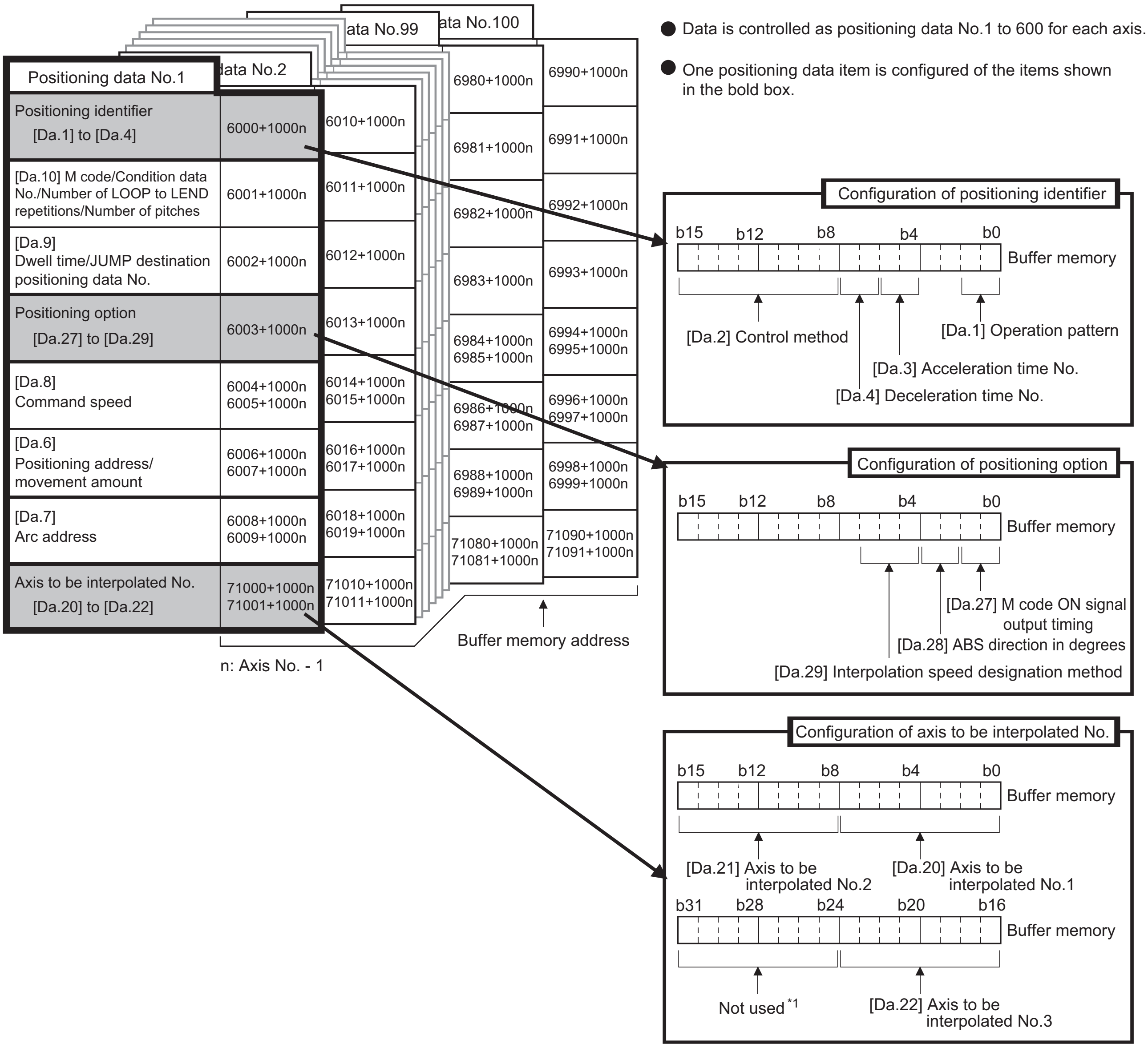
⚠CAUTION

- Do not execute the positioning control in home position return request signal ON for the axis which uses in the positioning control. Failure to observe this could lead to an accident such as a collision.

12.4 Positioning Data

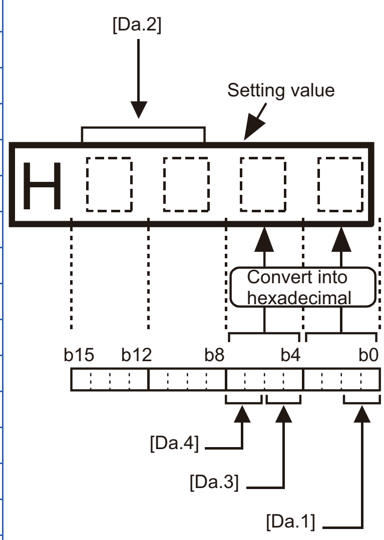
Before explaining the positioning data setting items [Da.1] to [Da.10], [Da.20] to [Da.22], [Da.27] to [Da.29], the configuration of the positioning data is shown below.

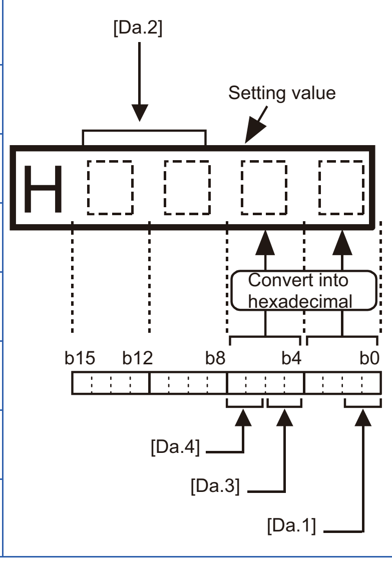
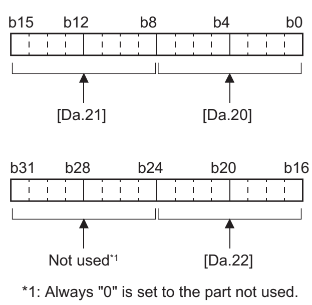
The positioning data stored in the buffer memory of the Simple Motion board is the following configuration.

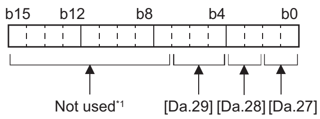


*1 Always "0" is set to the part not used.

The following explains the positioning data setting items [Da.1] to [Da.10], [Da.20] to [Da.22] and [Da.27] to [Da.29]. (The buffer memory addresses shown are those of the "positioning data No.1".)
n: Axis No. - 1

Item		Setting value			Default value	Buffer memory address
		Value set with EM Configurator	Value set with a user program			
Positioning identifier	[Da.1] Operation pattern	00: Positioning complete	00		0000H	6000+1000n
		01: Continuous positioning control	01			
		11: Continuous path control	11			
	[Da.2] Control method	01H: ABS Linear 1	01H			
		02H: INC Linear 1	02H			
		03H: Feed 1	03H			
		04H: FWD V1	04H			
		05H: RVS V1	05H			
		06H: FWD V/P	06H			
		07H: RVS V/P	07H			
		08H: FWD P/V	08H			
		09H: RVS P/V	09H			
		0AH: ABS Linear 2	0AH			
		0BH: INC Linear 2	0BH			
		0CH: Feed 2	0CH			
		0DH: ABS ArcMP	0DH			
		0EH: INC ArcMP	0EH			
		0FH: ABS ArcRGT	0FH			
		10H: ABS ArcLFT	10H			
		11H: INC ArcRGT	11H			
		12H: INC ArcLFT	12H			
		13H: FWD V2	13H			
		14H: RVS V2	14H			
		15H: ABS Linear 3	15H			
		16H: INC Linear 3	16H			
		17H: Feed 3	17H			
		18H: FWD V3	18H			
		19H: RVS V3	19H			
		1AH: ABS Linear 4	1AH			
		1BH: INC Linear 4	1BH			
		1CH: Feed 4	1CH			
		1DH: FWD V4	1DH			
		1EH: RVS V4	1EH			
		20H: Helical interpolation control with sub point specified (ABS)	20H			
		21H: Helical interpolation control with sub point specified (INC)	21H			
		22H: Helical interpolation control with center point specified (ABS, CW)	22H			
		23H: Helical interpolation control with center point specified (ABS, CCW)	23H			
		24H: Helical interpolation control with center point specified (INC, CW)	24H			
		25H: Helical interpolation control with center point specified (INC, CCW)	25H			
		80H: NOP	80H			
		81H: Address CHG	81H			
		82H: JUMP	82H			
		83H: LOOP	83H			
		84H: LEND	84H			

Item		Setting value			Default value	Buffer memory address
		Value set with EM Configurator	Value set with a user program			
Positioning identifier	[Da.3] Acceleration time No.	0: [Pr.9] Acceleration time 0	00		0000H	6000+1000n
		1: [Pr.25] Acceleration time 1	01			
		2: [Pr.26] Acceleration time 2	10			
		3: [Pr.27] Acceleration time 3	11			
	[Da.4] Deceleration time No.	0: [Pr.10] Deceleration time 0	00			
		1: [Pr.28] Deceleration time 1	01			
		2: [Pr.29] Deceleration time 2	10			
		3: [Pr.30] Deceleration time 3	11			
[Da.6] Positioning address/ movement amount		The setting value range differs according to the "[Da.2] Control method".			0	6006+1000n 6007+1000n
[Da.7] Arc address					0	6008+1000n 6009+1000n
[Da.8] Command speed		The setting value range differs depending on the "[Pr.1] Unit setting".			0	6004+1000n 6005+1000n
		-1: Current speed (Speed set for previous positioning data No.)	-1			
[Da.9] Dwell time/ JUMP destination positioning data No.	Dwell time	The setting value range differs according to the "[Da.2] Control method".			0	6002+1000n
	JUMP destination positioning data No.					
[Da.10] M code/ Condition data No./ Number of LOOP to LEND repetitions/ Number of pitches	M code				0	6001+1000n
	Condition data No.					
	Number of LOOP to LEND repetitions					
Axis to be interpolated	[Da.20] Axis to be interpolated No.1	0: Axis 1 selected 1: Axis 2 selected 2: Axis 3 selected 3: Axis 4 selected 4: Axis 5 selected	0H 1H 2H 3H 4H		0000H	71000+1000n 71001+1000n
	[Da.21] Axis to be interpolated No.2	5: Axis 6 selected 6: Axis 7 selected 7: Axis 8 selected 8: Axis 9 selected 9: Axis 10 selected	5H 6H 7H 8H 9H			
	[Da.22] Axis to be interpolated No.3	A: Axis 11 selected B: Axis 12 selected C: Axis 13 selected D: Axis 14 selected E: Axis 15 selected F: Axis 16 selected	AH BH CH DH EH FH			

Item		Setting value			Default value	Buffer memory address
		Value set with EM Configurator	Value set with a user program			
Positioning option	[Da.27] M code ON signal output timing	0: Uses the setting value of "[Pr.18] M code ON signal output timing". 1: WITH mode 2: AFTER mode	0 1 2	 *1: Always "0" is set to the part not used.	0000H	6003+1000n
	[Da.28] ABS direction in degrees	0: Uses the setting value of "[Cd.40] ABS direction in degrees". 1: ABS circular right 2: ABS circular left 3: Takes a shortcut. (Specified direction ignored.)	0 1 2 3			
	[Da.29] Interpolation speed designation method	0: Uses the setting value of "[Pr.20] Interpolation speed designation method". 1: Composite speed 2: Reference axis speed	0 1 2			

For labels, refer to the following.

☞ Page 439 Positioning data

[Da.1] Operation pattern

The operation pattern designates whether positioning of a certain data No. is to be ended with just that data, or whether the positioning for the next data No. is to be carried out in succession.

Operation pattern	Setting value	Details
Positioning complete	00	Set to execute positioning to the designated address, and then complete positioning.
Continuous positioning control	01	Positioning is carried out successively in order of data Nos. with one start signal. The operation halts at each position indicated by a positioning data.
Continuous path control	11	Positioning is carried out successively in order of data Nos. with one start signal. The operation does not stop at each positioning data.

[Da.2] Control method

Set the "control method" for carrying out positioning control.

Point

- When "JUMP instruction" is set for the control method, the "[Da.9] Dwell time/JUMP destination positioning data No." and "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" setting details will differ.
- In case you selected "LOOP" as the control method, the "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" should be set differently from other cases.
- Refer to the following for details on the control methods.

☞ Page 44 MAJOR POSITIONING CONTROL

- If "degree" is set for "[Pr.1] Unit setting", 2-axis circular interpolation control and 3-axis helical interpolation control cannot be carried out. (The error "Circular interpolation not possible" (error code: 199FH) will occur when executed.)

[Da.3] Acceleration time No.

Set which of "acceleration time 0 to 3" to use for the acceleration time during positioning.

0: Use the value set in "[Pr.9] Acceleration time 0".

1: Use the value set in "[Pr.25] Acceleration time 1".

2: Use the value set in "[Pr.26] Acceleration time 2".

3: Use the value set in "[Pr.27] Acceleration time 3".

[Da.4] Deceleration time No.

Set which of "deceleration time 0 to 3" to use for the deceleration time during positioning.

0: Use the value set in "[Pr.10] Deceleration time 0".

1: Use the value set in "[Pr.28] Deceleration time 1".

2: Use the value set in "[Pr.29] Deceleration time 2".

3: Use the value set in "[Pr.30] Deceleration time 3".

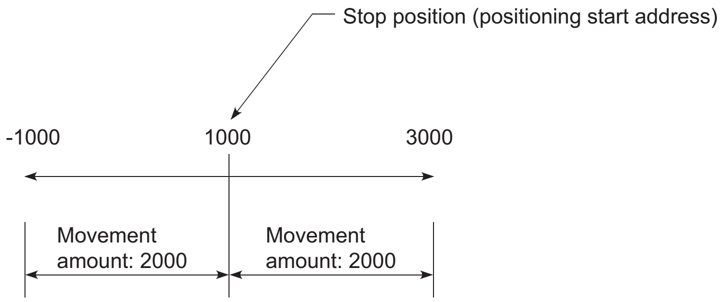
[Da.6] Positioning address/movement amount

Set the address to be used as the target value for positioning control.

The setting value range differs according to the "[Da.2] Control method".

■Absolute (ABS) system, current value changing

- The setting value (positioning address) for the ABS system and current value changing is set with an absolute address (address from home position).

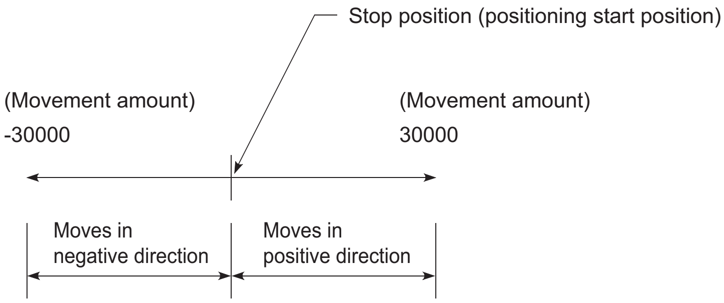


■Incremental (INC) system, fixed-feed 1, fixed-feed 2, fixed-feed 3, fixed-feed 4

- The setting value (movement amount) for the INC system is set as a movement amount with sign.

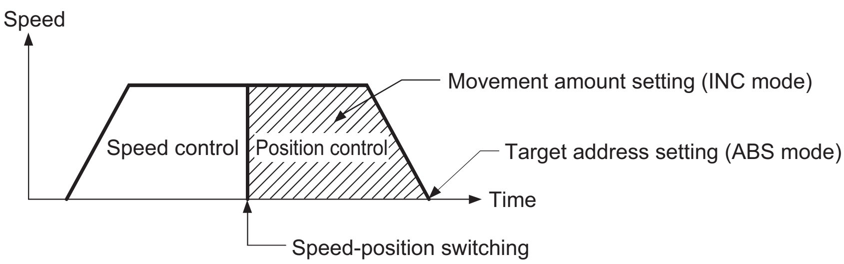
When movement amount is positive: Moves in the positive direction (address increment direction)

When movement amount is negative: Moves in the negative direction (address decrement direction)



■Speed-position switching control

- INC mode: Set the amount of movement after the switching from speed control to position control.
- ABS mode: Set the absolute address which will be the target value after speed control is switched to position control. (The unit is "degree" only)



■Position-speed switching control

- Set the amount of movement before the switching from position control to speed control.

● When "[Pr.1] Unit setting" is "mm"

The table below lists the control methods that require the setting of the positioning address or movement amount and the associated setting ranges.

(With any control method excluded from the table below, neither the positioning address nor the movement amount needs to be set.)

[Da.2] setting value	Value set with EM Configurator (μm)	Value set with a user program*1 ($\times 10^{-1}$ μm)
ABS Linear 1: 01H ABS Linear 2: 0AH ABS Linear 3: 15H ABS Linear 4: 1AH Current value changing: 81H	• Set the address -214748364.8 to 214748364.7	• Set the address -2147483648 to 2147483647
INC Linear 1: 02H INC Linear 2: 0BH INC Linear 3: 16H INC Linear 4: 1BH Fixed-feed 1: 03H Fixed-feed 2: 0CH Fixed-feed 3: 17H Fixed-feed 4: 1CH	• Set the movement amount -214748364.8 to 214748364.7	• Set the movement amount -2147483648 to 2147483647
Forward run speed/position: 06H Reverse run speed/position: 07H Forward run position/speed: 08H Reverse run position/speed: 09H	• Set the movement amount 0 to 214748364.7	• Set the movement amount 0 to 2147483647
ABS circular sub: 0DH ABS circular right: 0FH ABS circular left: 10H	• Set the address -214748364.8 to 214748364.7	• Set the address -2147483648 to 2147483647
INC circular sub: 0EH INC circular right: 11H INC circular left: 12H	• Set the movement amount -214748364.8 to 214748364.7	• Set the movement amount -2147483648 to 2147483647
ABS helical sub: 20H ABS helical right: 22H ABS helical left: 23H	• Set the address -214748364.8 to 214748364.7	• Set the address -2147483648 to 2147483647
INC helical sub: 21H INC helical right: 24H INC helical left: 25H	• Set the movement amount -214748364.8 to 214748364.7	• Set the movement amount -2147483648 to 2147483647

*1 Set an integer because the user program cannot handle fractions.
(The value will be converted properly within the system.)

● When "[Pr.1] Unit setting" is "degree"

The table below lists the control methods that require the setting of the positioning address or movement amount and the associated setting ranges.

(With any control method excluded from the table below, neither the positioning address nor the movement amount needs to be set.)

[Da.2] setting value	Value set with EM Configurator (degree)	Value set with a user program*1 ($\times 10^{-5}$ degree)
ABS Linear 1: 01H ABS Linear 2: 0AH ABS Linear 3: 15H ABS Linear 4: 1AH Current value changing: 81H	• Set the address 0 to 359.99999	• Set the address 0 to 35999999
INC Linear 1: 02H INC Linear 2: 0BH INC Linear 3: 16H INC Linear 4: 1BH Fixed-feed 1: 03H Fixed-feed 2: 0CH Fixed-feed 3: 17H Fixed-feed 4: 1CH	• Set the movement amount -21474.83648 to 21474.83647	• Set the movement amount -2147483648 to 2147483647*2
Forward run speed/position: 06H Reverse run speed/position: 07H	In INC mode • Set the movement amount 0 to 21474.83647 In ABS mode • Set the address 0 to 359.99999	In INC mode • Set the movement amount 0 to 2147483647 In ABS mode • Set the address 0 to 35999999
Forward run position/speed: 08H Reverse run position/speed: 09H	• Set the movement amount 0 to 21474.83647	• Set the movement amount 0 to 2147483647
ABS helical sub: 20H*3 ABS helical right: 22H*3 ABS helical left: 23H*3	• Set the address 0 to 359.99999	• Set the address 0 to 35999999
INC helical sub: 21H*3 INC helical right: 24H*3 INC helical left: 25H*3	• Set the movement amount -21474.83648 to 21474.83647	• Set the movement amount -2147483648 to 2147483647*2

*1 Set an integer because the user program cannot handle fractions.
(The value will be converted properly within the system.)

*2 When the software stroke limit is valid, -35999999 to 35999999 is set.

*3 The axis where "degree" can be set in the 3-axis helical interpolation control is only the linear interpolation axis.

● When "[Pr.1] Unit setting" is "pulse"

The table below lists the control methods that require the setting of the positioning address or movement amount and the associated setting ranges.

(With any control method excluded from the table below, neither the positioning address nor the movement amount needs to be set.)

[Da.2] setting value	Value set with EM Configurator (pulse)	Value set with a user program (pulse)
ABS Linear 1: 01H ABS Linear 2: 0AH ABS Linear 3: 15H ABS Linear 4: 1AH Current value changing: 81H	• Set the address -2147483648 to 2147483647	• Set the address -2147483648 to 2147483647
INC Linear 1: 02H INC Linear 2: 0BH INC Linear 3: 16H INC Linear 4: 1BH Fixed-feed 1: 03H Fixed-feed 2: 0CH Fixed-feed 3: 17H Fixed-feed 4: 1CH	• Set the movement amount -2147483648 to 2147483647	• Set the movement amount -2147483648 to 2147483647
Forward run speed/position: 06H Reverse run speed/position: 07H Forward run position/speed: 08H Reverse run position/speed: 09H	• Set the movement amount 0 to 2147483647	• Set the movement amount 0 to 2147483647
ABS circular sub: 0DH ABS circular right: 0FH ABS circular left: 10H	• Set the address -2147483648 to 2147483647	• Set the address -2147483648 to 2147483647
INC circular sub: 0EH INC circular right: 11H INC circular left: 12H	• Set the movement amount -2147483648 to 2147483647	• Set the movement amount -2147483648 to 2147483647
ABS helical sub: 20H ABS helical right: 22H ABS helical left: 23H	• Set the address -2147483648 to 2147483647	• Set the address -2147483648 to 2147483647
INC helical sub: 21H INC helical right: 24H INC helical left: 25H	• Set the movement amount -2147483648 to 2147483647	• Set the movement amount -2147483648 to 2147483647

● When "[Pr.1] Unit setting" is "inch"

The table below lists the control methods that require the setting of the positioning address or movement amount and the associated setting ranges.

(With any control method excluded from the table below, neither the positioning address nor the movement amount needs to be set.)

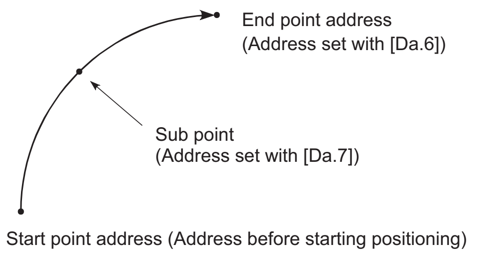
[Da.2] setting value	Value set with EM Configurator (inch)	Value set with a user program*1 ($\times 10^{-5}$ inch)
ABS Linear 1: 01H ABS Linear 2: 0AH ABS Linear 3: 15H ABS Linear 4: 1AH Current value changing: 81H	• Set the address -21474.83648 to 21474.83647	• Set the address -2147483648 to 2147483647
INC Linear 1: 02H INC Linear 2: 0BH INC Linear 3: 16H INC Linear 4: 1BH Fixed-feed 1: 03H Fixed-feed 2: 0CH Fixed-feed 3: 17H Fixed-feed 4: 1CH	• Set the movement amount -21474.83648 to 21474.83647	• Set the movement amount -2147483648 to 2147483647
Forward run speed/position: 06H Reverse run speed/position: 07H Forward run position/speed: 08H Reverse run position/speed: 09H	• Set the movement amount 0 to 21474.83647	• Set the movement amount 0 to 2147483647
ABS circular sub: 0DH ABS circular right: 0FH ABS circular left: 10H	• Set the address -21474.83648 to 21474.83647	• Set the address -2147483648 to 2147483647
INC circular sub: 0EH INC circular right: 11H INC circular left: 12H	• Set the movement amount -21474.83648 to 21474.83647	• Set the movement amount -2147483648 to 2147483647
ABS helical sub: 20H ABS helical right: 22H ABS helical left: 23H	• Set the address -21474.83648 to 21474.83647	• Set the address -2147483648 to 2147483647
INC helical sub: 21H INC helical right: 24H INC helical left: 25H	• Set the movement amount -21474.83648 to 21474.83647	• Set the movement amount -2147483648 to 2147483647

*1 Set an integer because the user program cannot handle fractions.
(The value will be converted properly within the system.)

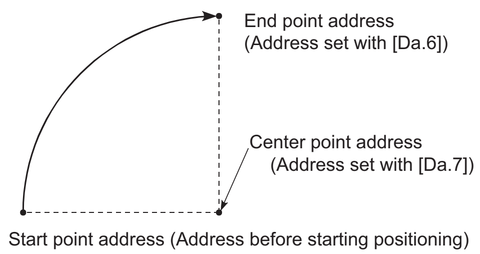
[Da.7] Arc address

The arc address is data required only when carrying out 2-axis circular interpolation control or 3-axis helical interpolation control.

- When carrying out circular interpolation with sub point designation, set the sub point (passing point) address as the arc address.
- When carrying out circular interpolation with center point designation, set the center point address of the arc as the arc address.



<(1) Circular interpolation with sub point designation>



<(2) Circular interpolation with center point designation>

When not carrying out 2-axis circular interpolation control or 3-axis helical interpolation control, the value set in "[Da.7] Arc address" will be invalid.

■When "[Pr.1] Unit setting" is "mm"

The table below lists the control methods that require the setting of the arc address and shows the setting range.
(With any control method excluded from the table below, the arc address does not need to be set.)

[Da.2] setting value	Value set with EM Configurator (μm)	Value set with a user program[*1] (× 10^{-1} μm)
ABS circular sub: 0DH ABS circular right: 0FH ABS circular left: 10H	• Set the address -214748364.8 to 214748364.7[*2]	• Set the address -2147483648 to 2147483647
INC circular sub: 0EH INC circular right: 11H INC circular left: 12H	• Set the movement amount -214748364.8 to 214748364.7[*2]	• Set the movement amount -2147483648 to 2147483647[*2]
ABS helical sub: 20H ABS helical right: 22H ABS helical left: 23H	• Set the address -214748364.8 to 214748364.7	• Set the address -2147483648 to 2147483647
INC helical sub: 21H INC helical right: 24H INC helical left: 25H	• Set the movement amount -214748364.8 to 214748364.7[*2]	• Set the movement amount -2147483648 to 2147483647

*1 Set an integer because the user program cannot handle fractions.
(The value will be converted properly within the system.)

*2 Note that the maximum radius that 2-axis circular interpolation control is possible is 536870912 (× 10^{-1} μm), although the setting value can be input within the range shown in the above table, as an arc address.

■When "[Pr.1] Unit setting" is "degree"

No control method requires the setting of the arc address by "degree".

■When "[Pr.1] Unit setting" is "pulse"

The table below lists the control methods that require the setting of the arc address and shows the setting range.
(With any control method excluded from the table below, the arc address does not need to be set.)

[Da.2] setting value	Value set with EM Configurator (pulse)	Value set with a user program (pulse)
ABS circular sub: 0DH ABS circular right: 0FH ABS circular left: 10H	• Set the address -2147483648 to 2147483647[*1]	• Set the address -2147483648 to 2147483647
INC circular sub: 0EH INC circular right: 11H INC circular left: 12H	• Set the movement amount -2147483648 to 2147483647[*1]	• Set the movement amount -2147483648 to 2147483647[*1]
ABS helical sub: 20H ABS helical right: 22H ABS helical left: 23H	• Set the address -2147483648 to 2147483647	• Set the address -2147483648 to 2147483647
INC helical sub: 21H INC helical right: 24H INC helical left: 25H	• Set the movement amount -2147483648 to 2147483647[*1]	• Set the movement amount -2147483648 to 2147483647[*1]

*1 Note that the maximum radius that 2-axis circular interpolation control is possible is 536870912 (pulse), although the setting value can be input within the range shown in the above table, as an arc address.

■When "[Pr.1] Unit setting" is "inch"

The table below lists the control methods that require the setting of the arc address and shows the setting range.
(With any control method excluded from the table below, the arc address does not need to be set.)

[Da.2] setting value	Value set with EM Configurator (inch)	Value set with a user program*1 ($\times 10^{-5}$ inch)
ABS circular sub: 0DH ABS circular right: 0FH ABS circular left: 10H	• Set the address -21474.83648 to 21474.83647*2	• Set the address -2147483648 to 2147483647
INC circular sub: 0EH INC circular right: 11H INC circular left: 12H	• Set the movement amount -21474.83648 to 21474.83647*2	• Set the movement amount -2147483648 to 2147483647*2
ABS helical sub: 20H ABS helical right: 22H ABS helical left: 23H	• Set the address -21474.83648 to 21474.83647	• Set the address -2147483648 to 2147483647
INC helical sub: 21H INC helical right: 24H INC helical left: 25H	• Set the movement amount -21474.83648 to 21474.83647*2	• Set the movement amount -2147483648 to 2147483647*2

*1 Set an integer because the user program cannot handle fractions.
(The value will be converted properly within the system.)

*2 Note that the maximum radius that 2-axis circular interpolation control is possible is 536870912 ($\times 10^{-5}$ inch), although the setting value can be input within the range shown in the above table, as an arc address.

[Da.8] Command speed

Set the command speed for positioning.

- If the set command speed exceeds "[Pr.8] Speed limit value", positioning will be carried out at the speed limit value.
- If "-1" is set for the command speed, the current speed (speed set for previous positioning data No.) will be used for positioning control. Use the current speed for uniform speed control, etc. If "-1" is set for continuing positioning data, and the speed is changed, the following speed will also change.

Note that when starting positioning, if the "-1" speed is set for the positioning data that carries out positioning control first, the error "No command speed" (error code: 1A12H) will occur, and the positioning will not start.

Refer to the following for details on the errors.

☞ Page 625 List of Error Codes

[Pr.1] setting value	Value set with EM Configurator (unit)	Value set with a user program (unit)
0: mm	0.01 to 20000000.00 (mm/min)	1 to 2000000000 ($\times 10^{-2}$ mm/min)
1: inch	0.001 to 2000000.000 (inch/min)	1 to 2000000000 ($\times 10^{-3}$ inch/min)
2: degree	0.001 to 2000000.000 (degree/min)*1	1 to 2000000000 ($\times 10^{-3}$ degree/min)*2
3: pulse	1 to 1000000000 (pulse/s)	1 to 1000000000 (pulse/s)

*1 The range of command speed when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: 0.01 to 20000000.00 (degree/min)

*2 The range of command speed when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: 1 to 2000000000 ($\times 10^{-2}$ degree/min)

[Da.9] Dwell time/JUMP destination positioning data No.

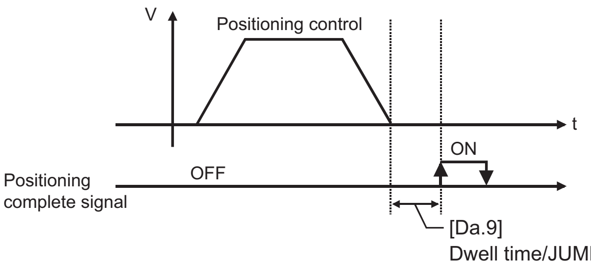
Set the "dwell time" or "positioning data No." corresponding to the "[Da.2] Control method".

- When a method other than "JUMP instruction" is set for "[Da.2] Control method": Set the "dwell time".
- When "JUMP instruction" is set for "[Da.2] Control method": Set the "positioning data No." for the JUMP destination.

When the "dwell time" is set, the setting details of the "dwell time" will be as follows according to "[Da.1] Operation pattern".

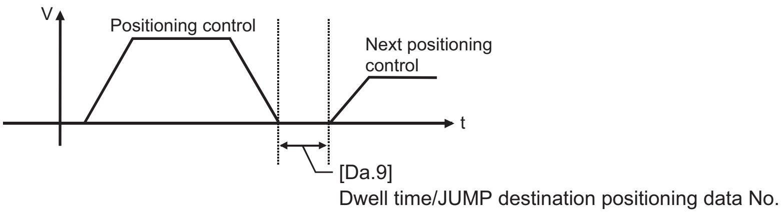
■When "[Da.1] Operation pattern" in "00: Positioning complete"

- Set the time from when the positioning ends to when the "positioning complete signal" turns ON as the "dwell time".



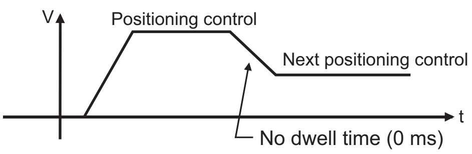
■When "[Da.1] Operation pattern" is "01: Continuous positioning control"

- Set the time from when positioning control ends to when the next positioning control starts as the "dwell time".



■When "[Da.1] Operation pattern" is "11: Continuous path control"

- The setting value is irrelevant to the control. (The "dwell time" is 0 ms.)



[Da.2] setting value	Setting item	Value set with EM Configurator	Value set with a user program
JUMP instruction: 82H	Positioning data No.	1 to 600	1 to 600
Other than JUMP instruction	Dwell time	0 to 65535 (ms)	0 to 65535 (ms)

[Da.10] M code/Condition data No./No. of LOOP to LEND repetitions/No. of pitches

Set an "M code", a "condition data No.", the "Number of LOOP to LEND repetitions" or the "Number of pitches" depending on how the "[Da.2] Control method" is set.*1

*1 The condition data specifies the condition for the JUMP instruction to be executed. (A JUMP will take place when the condition is satisfied.)

■If a method other than "JUMP instruction", "LOOP", and "3-axis helical interpolation control" is selected as the "[Da.2] Control method"

Set an "M code".

If no "M code" needs to be output, set "0" (default value).

■If "JUMP instruction" or "LOOP" is selected as the "[Da.2] Control method"

Set the "condition data No." for JUMP.

- 0: Unconditional JUMP to the positioning data specified by [Da.9].
- 1 to 10: JUMP performed according to the condition data No. specified (a number between 1 and 10). Make sure that you specify the number of LOOP to LEND repetitions by a number other than "0". The error "Control method LOOP setting error" (error code: 1A33H) will occur if you specify "0".

■If "3-axis helical interpolation control" is selected as the "[Da.2] Control method"

Set the number of pitches for the linear interpolation axis. The rotation speed of the circular interpolation is set with the number of pitch.

[Da.2] setting value	Setting item	Value set with EM Configurator	Value set with a user program
JUMP instruction: 82H	Condition data No.	0 to 10	0 to 10
Helical interpolation: 20H to 25H	Number of pitches	0 to 999	0 to 999
LOOP: 83H	Repetition count	1 to 65535	1 to 65535
Other than the above	M code	0 to 65535	0 to 65535

[Da.20] Axis to be interpolated No.1 to [Da.22] Axis to be interpolated No.3

Set the axis to be interpolated to execute the 2 to 4-axis interpolation operation. Set the circular interpolation axis and the linear interpolation axis to execute the 3-axis helical interpolation control.

2-axis interpolation	Set the target axis No. in "[Da.20] Axis to be interpolated No.1".
3-axis interpolation	Set the target axis No. in "[Da.20] Axis to be interpolated No.1" and "[Da.21] Axis to be interpolated No.2".
4-axis interpolation	Set the target axis No. in "[Da.20] Axis to be interpolated No.1" to "[Da.22] Axis to be interpolated No.3".
3-axis helical interpolation	Set the circular interpolation axis in "[Da.20] Axis to be interpolated No.1" and the linear interpolation axis No. in "[Da.21] Axis to be interpolated No.2".

Set the axis set as axis to be interpolated.

0: Axis 1	8: Axis 9
1: Axis 2	9: Axis 10
2: Axis 3	A: Axis 11
3: Axis 4	B: Axis 12
4: Axis 5	C: Axis 13
5: Axis 6	D: Axis 14
6: Axis 7	E: Axis 15
7: Axis 8	F: Axis 16

Point

- Do not specify the own axis No. or the value outside the range. Otherwise, the error "Illegal interpolation description command" (error code: 1A22H) will occur during the program execution.
- When the same axis No. or axis No. of own axis is set to multiple axis to be interpolated No., the error "Illegal interpolation description command" (error code: 1A22H) will occur during the program execution.)
- Do not specify the axis to be interpolated No.2 and axis to be interpolated No.3 for 2-axis interpolation, and do not specify the axis to be interpolated No.3 for 3-axis interpolation. The setting value is ignored.

[Da.27] M code ON signal output timing

Set the M code ON signal output timing to each positioning data.

Refer to the following for setting details.

☞ Page 464 [Pr.18] M code ON signal output timing

0: Uses the setting value of "[Pr.18] M code ON signal output timing".

1: WITH mode

2: AFTER mode

[Da.28] ABS direction in degrees

Set "[Cd.40] ABS direction in degrees" to each positioning data.

Refer to the following for setting details.

☞ Page 465 [Pr.20] Interpolation speed designation method

0: Uses the setting value of "[Cd.40] ABS direction in degrees".

1: ABS circular right

2: ABS circular left

3: Takes a shortcut. (Specified direction ignored.)

[Da.29] Interpolation speed designation method

Set the interpolation speed designation method to each positioning data.

Refer to the following for setting details.

☞ Page 465 [Pr.20] Interpolation speed designation method

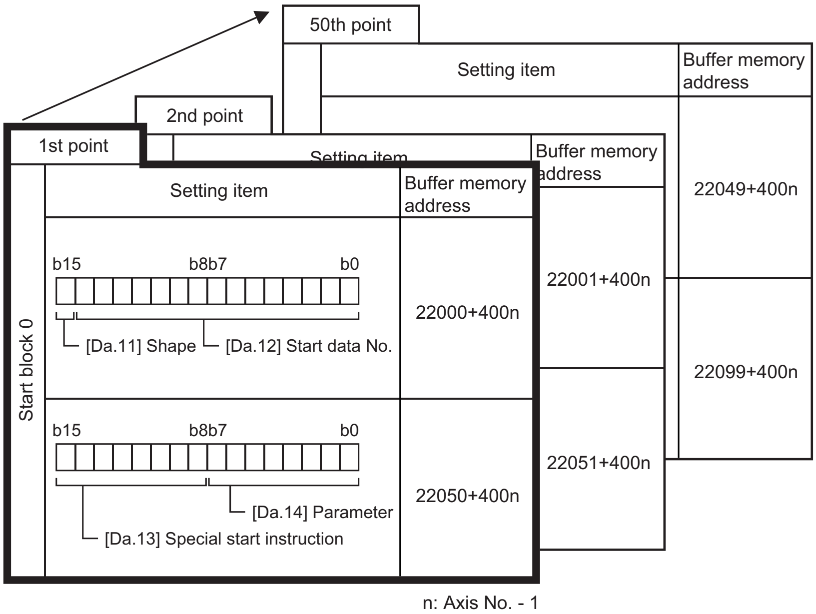
0: Uses the setting value of "[Pr.20] Interpolation speed designation method".

1: Composite speed

2: Reference axis speed

12.5 Block Start Data

Before explaining the block start data setting items [Da.11] to [Da.14], the configuration of the block start data is shown below.
The block start data stored in the buffer memory of the Simple Motion board is the following configuration.



- Up to 50 block start data points can be set (stored) for each axis in the buffer memory addresses shown on the left.
- Items in a single unit of block start data are shown included in a bold frame.
- Each axis has five start blocks (block Nos. 0 to 4).

The following explains the block start data setting items [Da.11] to [Da.14]. (The buffer memory addresses shown are those of the "1st point block start data (block No.7000)".)

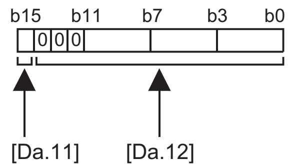
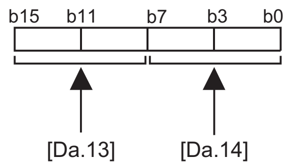
Point

- To perform a high-level positioning control using block start data, set a number between 7000 and 7004 to the "[Cd.3] Positioning start No." and use the "[Cd.4] Positioning starting point No." to specify a point No. between 1 and 50, a position counted from the beginning of the block.
- The number between 7000 and 7004 specified here is called the "block No.".
- With the Simple Motion board, up to 50 "block start data" points and up to 10 "condition data" items can be assigned to each "block No.".

Block No.*1	Axis	Block start data	Condition	Buffer memory	EM Configurator
7000	Axis 1	Start block 0	Condition data (1 to 10)	Supports the settings	Supports the settings
	⋮		⋮		
	Axis 16		Condition data (1 to 10)		
7001	Axis 1	Start block 1	Condition data (1 to 10)		
	⋮		⋮		
	Axis 16		Condition data (1 to 10)		
7002	Axis 1	Start block 2	Condition data (1 to 10)		
	⋮		⋮		
	Axis 16		Condition data (1 to 10)		
7003	Axis 1	Start block 3	Condition data (1 to 10)		
	⋮		⋮		
	Axis 16		Condition data (1 to 10)		
7004	Axis 1	Start block 4	Condition data (1 to 10)		
	⋮		⋮		
	Axis 16		Condition data (1 to 10)		

*1 Setting cannot be made when the "Pre-reading start function" is used. If you set any of Nos. 7000 to 7004 and perform the Pre-reading start function, the error "Outside start No. range" (error code: 19A3H)" will occur.
Refer to the following for details.
☞ Page 268 Pre-reading start function

n: Axis No. - 1

Item	Setting value			Default value	Buffer memory address
	Value set with EM Configurator	Value set with a user program			
[Da.11] Shape	0: End	0		0000H	22000+400n
	1: Continue	1			
[Da.12] Start data No.	Positioning data No: 1 to 600 (01H to 258H)	01H to 258H			
[Da.13] Special start instruction	0: Block start (normal start)	00H		0000H	22050+400n
	1: Condition start	01H			
	2: Wait start	02H			
	3: Simultaneous start	03H			
	4: FOR loop	04H			
	5: FOR condition	05H			
	6: NEXT start	06H			
[Da.14] Parameter	Condition data No.: 1 to 10 (01H to 0AH) Number of repetitions: 0 to 255 (00H to FFH)	00H to FFH			

For labels, refer to the following.

☞ Page 441 Positioning data (Block start data)

[Da.11] Shape

Set whether to carry out only the local "block start data" and then end control, or to execute the "block start data" set in the next point.

Setting value	Setting details
0: End	Execute the designated point's "block start data", and then complete the control.
1: Continue	Execute the designated point's "block start data", and after completing control, execute the next point's "block start data".

[Da.12] Start data No.

Set the "positioning data No." designated with the "block start data".

[Da.13] Special start instruction

Set the "special start instruction" for using "high-level positioning control". (Set how to start the positioning data set in "[Da.12] Start data No.".)

Setting value	Setting details
00H: Block start (Normal start)	Execute the random block positioning data in the set order with one start.
01H: Condition start	Carry out the condition judgment set in "condition data" for the designated positioning data, and when the conditions are established, execute the "block start data". If not established, ignore that "block start data", and then execute the next point's "block start data".
02H: Wait start	Carry out the condition judgment set in "condition data" for the designated positioning data, and when the conditions are established, execute the "block start data". If not established, stop the control (wait) until the conditions are established.
03H: Simultaneous start	Simultaneous execute (output command at same timing) the positioning data with the No. designated for the axis designated in the "condition data". Up to four axes can start simultaneously.
04H: Repeated start (FOR loop)	Repeat the program from the block start data with the "FOR loop" to the block start data with "NEXT" for the designated number of times.
05H: Repeated start (FOR condition)	Repeat the program from the block start data with the "FOR condition" to the block start data with "NEXT" until the conditions set in the "condition data" are established.
06H: NEXT start	Set the end of the repetition when "04H: Repetition start (FOR loop)" or "05H: Repetition start (FOR condition)" is set.

Refer to the following for details on the control.

☞ Page 140 HIGH-LEVEL POSITIONING CONTROL

[Da.14] Parameter

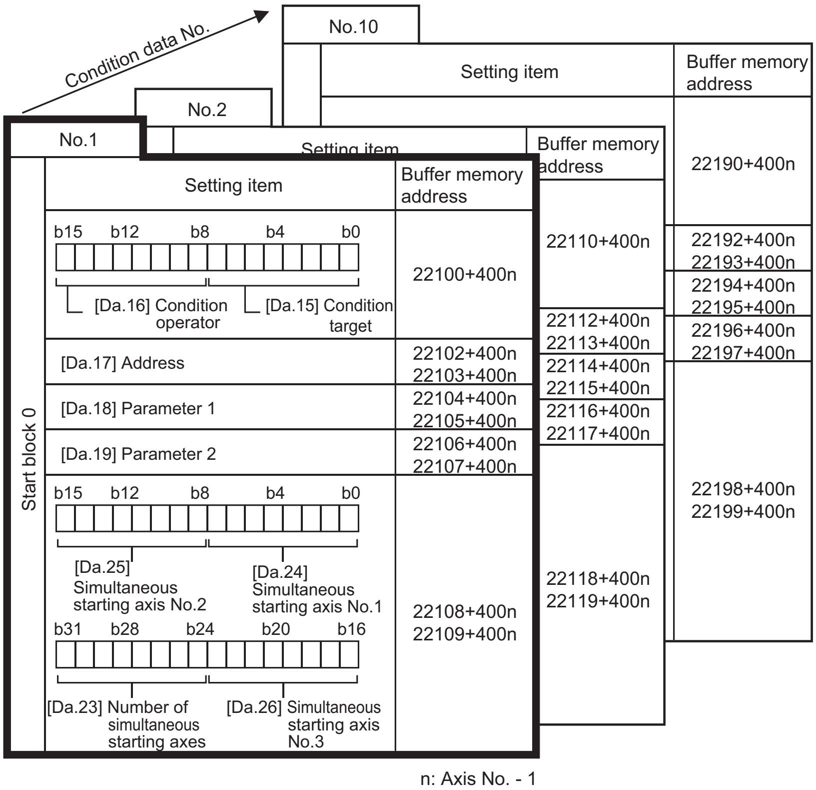
Set the value as required for "[Da.13] Special start instruction".

[Da.13] Special start instruction	Setting value	Setting details
Block start (Normal start)	—	Not used. (There is no need to set.)
Condition start	1 to 10	Set the condition data No. (Data No. of "condition data" is set up for the condition judgment.) (Refer to ☞ Page 499 Condition Data for details on the condition data.)
Wait start		
Simultaneous start		
Repeated start (FOR loop)	0 to 255	Set the number of repetitions.
Repeated start (FOR condition)	1 to 10	Set the condition data No. (Data No. of "condition data" is set up for the condition judgment.)

12.6 Condition Data

Before explaining the condition data setting items [Da.15] to [Da.19] and [Da.23] to [Da.26], the configuration of the condition data is shown below.

The condition data stored in the buffer memory of the Simple Motion board is the following configuration.



- Up to 10 condition data points can be set (stored) for each block No. in the buffer memory addresses shown on the left.
- Items in a single unit of condition data are shown included in a bold frame.
- Each axis has five start blocks (block Nos. 0 to 4).

12

The following explains the condition data setting items [Da.15] to [Da.19] and [Da.23] to [Da.26]. (The buffer memory addresses shown are those of the "condition data No.1 (block No.7000)".)

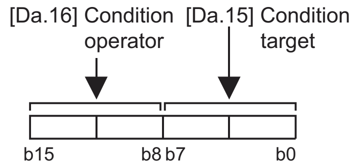
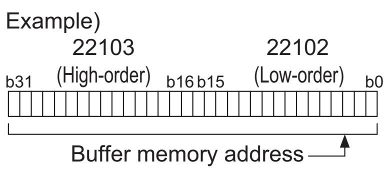
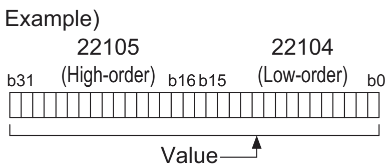
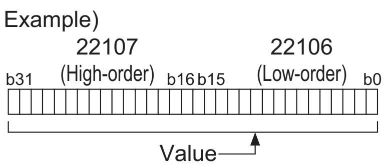
Point

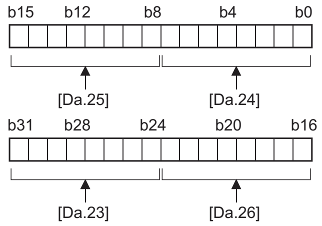
- To perform a high-level positioning control using block start data, set a number between 7000 and 7004 to the "[Cd.3] Positioning start No." and use the "[Cd.4] Positioning starting point No." to specify a point No. between 1 and 50, a position counted from the beginning of the block.
- The number between 7000 and 7004 specified here is called the "block No.".
- With the Simple Motion board, up to 50 "block start data" points and up to 10 "condition data" items can be assigned to each "block No.".

Block No.*1	Axis	Block start data	Condition	Buffer memory	EM Configurator
7000	Axis 1	Start block 0	Condition data (1 to 10)	Supports the settings	Supports the settings
	⋮		⋮		
	Axis 16		Condition data (1 to 10)		
7001	Axis 1	Start block 1	Condition data (1 to 10)		
	⋮		⋮		
	Axis 16		Condition data (1 to 10)		
7002	Axis 1	Start block 2	Condition data (1 to 10)		
	⋮		⋮		
	Axis 16		Condition data (1 to 10)		
7003	Axis 1	Start block 3	Condition data (1 to 10)		
	⋮		⋮		
	Axis 16		Condition data (1 to 10)		
7004	Axis 1	Start block 4	Condition data (1 to 10)		
	⋮		⋮		
	Axis 16		Condition data (1 to 10)		

*1 Setting cannot be made when the "Pre-reading start function" is used. If you set any of Nos. 7000 to 7004 and perform the Pre-reading start function, the error "Outside start No. range" (error code: 19A3H) will occur.
Refer to the following for details.
☞ Page 268 Pre-reading start function

n: Axis No. - 1

Item		Setting value			Default value	Buffer memory address
		Value set with EM Configurator	Value set with a user program			
Condition identifier	[Da.15] Condition target	01: Device X	01H		0000H	22100+400n
		02: Device Y	02H			
		03: Buffer memory (1-word)	03H			
		04: Buffer memory (2-word)	04H			
		05: Positioning data No.	05H			
		11: RX (1-bit)	11H			
		12: RY (1-bit)	12H			
		13: RWr (1-bit)	13H			
		14: RWw (1-bit)	14H			
		21: RX (1-word)	21H			
		22: RY (1-word)	22H			
		23: RWr (1-word)	23H			
		24: RWw (1-word)	24H			
		31: RX (2-word)	31H			
		32: RY (2-word)	32H			
		33: RWr (2-word)	33H			
		34: RWw (2-word)	34H			
	[Da.16] Condition operator	01: ** = P1	01H			
		02: ** ≠ P1	02H			
		03: ** ≤ P1	03H			
		04: ** ≥ P1	04H			
		05: P1 ≤ ** ≤ P2	05H			
		06: ** ≤ P1, P2 ≤ **	06H			
		07: DEV = ON	07H			
		08: DEV = OFF	08H			
[Da.17] Address		Buffer memory address			0000H	22102+400n 22103+400n
[Da.18] Parameter 1		Value			0000H	22104+400n 22105+400n
[Da.19] Parameter 2		Value			0000H	22106+400n 22107+400n

<table>
<tr><th colspan="2" rowspan="2">Item</th><th colspan="3">Setting value</th><th rowspan="2">Default value</th><th rowspan="2">Buffer memory address</th></tr>
<tr><th>Value set with EM Configurator</th><th colspan="2">Value set with a user program</th></tr>
<tr><td rowspan="4">Simultaneous starting axis</td><td>[Da.23] Number of simultaneous starting axes</td><td>2: 2 axes
3: 3 axes
4: 4 axes</td><td>2H
3H
4H</td><td rowspan="4">
</td><td rowspan="4">0000H</td><td rowspan="4">22108+400n
22109+400n</td></tr>
<tr><td>[Da.24] Simultaneous starting axis No.1</td><td rowspan="3">0: Axis 1 selected
1: Axis 2 selected
2: Axis 3 selected
3: Axis 4 selected
4: Axis 5 selected
5: Axis 6 selected
6: Axis 7 selected
7: Axis 8 selected
8: Axis 9 selected
9: Axis 10 selected
A: Axis 11 selected
B: Axis 12 selected
C: Axis 13 selected
D: Axis 14 selected
E: Axis 15 selected
F: Axis 16 selected</td><td rowspan="3">0H
1H
2H
3H
4H
5H
6H
7H
8H
9H
AH
BH
CH
DH
EH
FH</td></tr>
<tr><td>[Da.25] Simultaneous starting axis No.2</td></tr>
<tr><td>[Da.26] Simultaneous starting axis No.3</td></tr>
</table>

For labels, refer to the following.

☞ Page 441 Positioning data (Block start data)

[Da.15] Condition target

Set the condition target as required for each control.

Setting value	Setting details
01H: Device X	Set the state (ON/OFF) of an I/O signal as a condition.
02H: Device Y	
03H: Buffer memory (1-word)	Set the value stored in the buffer memory as a condition. 03H: The target buffer memory is "1-word (16 bits)" 04H: The target buffer memory is "2-word (32 bits)"
04H: Buffer memory (2-word)	
05H: Positioning data No.	Select only for "simultaneous start".
11H: RX (1-bit)	Set the state (ON/OFF) of a link device as a condition.
12H: RY (1-bit)	
13H: RWr (1-bit)	
14H: RWw (1-bit)	
21H: RX (1-word)	Set the value stored in the link device as a condition. 21H to 24H: The target link device is "1-word (16 bits)" 31H to 34H: The target link device is "2-word (32 bits)"
22H: RY (1-word)	
23H: RWr (1-word)	
24H: RWw (1-word)	
31H: RX (2-word)	
32H: RY (2-word)	
33H: RWr (2-word)	
34H: RWw (2-word)	

[Da.16] Condition operator

Set the condition operator as required for the "[Da.15] Condition target".

[Da.15] Condition target	Setting value	Setting details
01H: Device X 02H: Device Y 11H: RX (1-bit) 12H: RY (1-bit) 13H: RWr (1-bit) 14H: RWw (1-bit)	07H: DEV = ON	When the state (ON/OFF) of an I/O signal or link device is set as a condition, select ON or OFF as the trigger.
	08H: DEV = OFF	
03H: Buffer memory (1-word) 04H: Buffer memory (2-word) 21H: RX (1-word) 22H: RY (1-word) 23H: RWr (1-word) 24H: RWw (1-word) 31H: RX (2-word) 32H: RY (2-word) 33H: RWr (2-word) 34H: RWw (2-word)	01H: ** = P1	Select how to use the value (**) in the buffer memory or link device as a part of the condition.
	02H: ** ≠ P1	
	03H: ** ≤ P1	
	04H: ** ≥ P1	
	05H: P1 ≤ ** ≤ P2	
	06H: ** ≤ P1, P2 ≤ **	

[Da.17] Address

Set the address as required for the "[Da.15] Condition target".

[Da.15] Condition target	Setting value	Setting details
01H: Device X	—	Not used. (There is no need to set.)
02H: Device Y		
03H: Buffer memory (1-word)	Value (Buffer memory address)	Set the target "buffer memory address". (For 2-word, set the low-order buffer memory address.)
04H: Buffer memory (2-word)		
05H: Positioning data No.	—	Not used. (There is no need to set.)
11H: RX (1-bit)	Value (Link device No.)	Set the target "link device start No.". (For 2-word, set the low-order link device.)
12H: RY (1-bit)		
13H: RWr (1-bit)		
14H: RWw (1-bit)		
21H: RX (1-word)		
22H: RY (1-word)		
23H: RWr (1-word)		
24H: RWw (1-word)		
31H: RX (2-word)		
32H: RY (2-word)		
33H: RWr (2-word)		
34H: RWw (2-word)		

[Da.18] Parameter 1

Set the parameters as required for the "[Da.16] Condition operator" and "[Da.23] Number of simultaneous starting axes".

[Da.16] Condition operator	[Da.23] Number of simultaneous starting axes	Setting value	Setting details
01H: ** = P1	—	Value	The value of P1 should be equal to or smaller than the value of P2. (P1 ≤ P2) If P1 is greater than P2 (P1 > P2), the error "Condition data error" (error code: 1A00H to 1A05H) will occur.
02H: ** ≠ P1			
03H: ** ≤ P1			
04H: ** ≥ P1			
05H: P1 ≤ ** ≤ P2			
06H: ** ≤ P1, P2 ≤ **			
07H: DEV = ON		Value (bit No.)	Set the device bit No. X: 0H to 1H, 10H to 1FH, Y: 0H, 1H, 10H to 1FH RWr (1-bit), RWw (1-bit): 0 to F
08H: DEV = OFF			
—	2 to 4	Value (positioning data No.)	Set the positioning data No. for starting axis set in "[Da.24] Simultaneous starting axis No.1" and/or "[Da.25] Simultaneous starting axis No.2". Low-order 16-bit: Simultaneous starting axis No.1 positioning data No.1 to 600 (01H to 258H) High-order 16-bit: Simultaneous starting axis No.2 positioning data No.1 to 600 (01H to 258H)

[Da.19] Parameter 2

Set the parameters as required for the "[Da.16] Condition operator" and "[Da.23] Number of simultaneous starting axes".

[Da.16] Condition operator	[Da.23] Number of simultaneous starting axes	Setting value	Setting details
01H: ** = P1	—	—	Not used. (No need to be set.)
02H: ** ≠ P1			
03H: ** ≤ P1			
04H: ** ≥ P1			
05H: P1 ≤ ** ≤ P2		Value	The value of P2 should be equal to or greater than the value of P1. (P1 ≤ P2) If P1 is greater than P2 (P1 > P2), the error "Condition data error" (error code: 1A00H to 1A05H) will occur.
06H: ** ≤ P1, P2 ≤ **			
07H: DEV = ON		—	Not used. (No need to be set.)
08H: DEV = OFF			
—	2 to 3		
	4	Value (positioning data No.)	Set the positioning data No. for starting axis set in "[Da.26] Simultaneous starting axis No.3" Low-order 16-bit: Simultaneous starting axis No.3 positioning data No.1 to 600 (01H to 258H) High-order 16-bit: Not used (Set "0")

[Da.23] Number of simultaneous starting axes

Set the number of simultaneous starting axes to execute the simultaneous start.

Number of axes	Details
2	Simultaneous start by 2 axes of the starting axis and axis set in "[Da.24] Simultaneous starting axis No.1".
3	Simultaneous start by 3 axes of the starting axis and axis set in "[Da.24] Simultaneous starting axis No.1" and "[Da.25] Simultaneous starting axis No.2".
4	Simultaneous start by 4 axes of the starting axis and axis set in "[Da.24] Simultaneous starting axis No.1" to "[Da.26] Simultaneous starting axis No.3".

[Da.24] Simultaneous starting axis No.1 to [Da.26] Simultaneous starting axis No.3

Set the simultaneous starting axis to execute the 2 to 4-axis simultaneous start.

Simultaneous starting axis	Details
2-axis interpolation	Set the target axis No. in "[Da.24] Simultaneous starting axis No.1".
3-axis interpolation	Set the target axis No. in "[Da.24] Simultaneous starting axis No.1" and "[Da.25] Simultaneous starting axis No.2".
4-axis interpolation	Set the target axis No. in "[Da.24] Simultaneous starting axis No.1" to "[Da.26] Simultaneous starting axis No.3".

Set the axis set as simultaneous starting axis.

0: Axis 1	8: Axis 9
1: Axis 2	9: Axis 10
2: Axis 3	A: Axis 11
3: Axis 4	B: Axis 12
4: Axis 5	C: Axis 13
5: Axis 6	D: Axis 14
6: Axis 7	E: Axis 15
7: Axis 8	F: Axis 16

Point

- Do not specify the own axis No. or the value outside the range. Otherwise, the error "Condition data error" (error code: 1A00H to 1A05H) will occur during the program execution.
- When the same axis No. is set to multiple simultaneous starting axis Nos. or the value outside the range is set to the number of simultaneous starting axes, the error "Condition data error" (error code: 1A00H to 1A05H) will occur during the program execution.
- Do not specify the simultaneous starting axis No.2 and simultaneous starting axis No.3 for 2-axis simultaneously start, and not specify the simultaneous starting axis No.3 for 3-axis simultaneously start. The setting value is ignored.

12.7 Monitor Data

The setting items of the monitor data are explained in this section.

System monitor data

Unless noted in particular, the monitor value is saved as binary data.

Item		Default value
[Md.1] In test mode flag		0
Start history (Up to 64 records can be stored)	[Md.3] Start information	0000H
	[Md.4] Start No.	0000H
	[Md.54] Start (Year: month)	0000H
	[Md.5] Start (Day: hour)	0000H
	[Md.6] Start (Minute: second)	0000H
	[Md.60] Start (ms)	0000H
	[Md.7] Error judgment	0000H
	[Md.8] Start history pointer	0000H
[Md.19] Number of write accesses to flash ROM		0
[Md.50] Forced stop input		0
[Md.51] Amplifier-less operation mode status		0
[Md.59] Module information		6000H
[Md.130] F/W version		Factory-set product information
[Md.131] Digital oscilloscope running flag		0
[Md.132] Operation cycle setting		0000H
[Md.133] Operation cycle over flag		0
[Md.134] Operation time		0
[Md.135] Maximum operation time		0
[Md.138] Production No.		Factory-set product No.
[Md.700] Virtual servo amplifier connected station monitor		0
[Md.1200] Board information		0

For labels, refer to the following.

☞ Page 434 System monitor data

[Md.1] In test mode flag

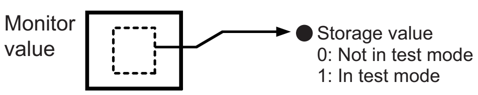
Whether the mode is the test mode from EM Configurator or not is stored.

- When not in test mode: OFF
- When in test mode: ON

Refresh cycle: Immediate

■Reading the monitor value

- Monitoring is carried out with a decimal display.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

[Md.3] Start information

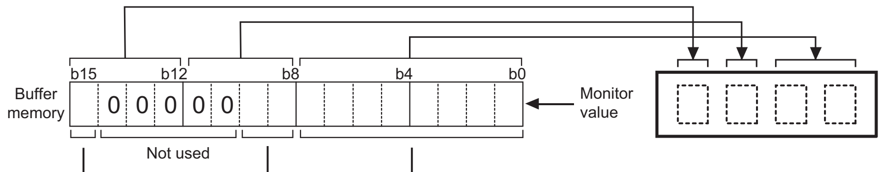
This area stores the start information (restart flag, start origin, and start axis):

- Restart flag: Indicates whether the operation has or has not been halted and restarted.
- Start origin: Indicates the source of the start signal.
- Start axis: Indicates the started axis.

Refresh cycle: At start

■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.



● Start axis

Stored contents	Stored value
Axis 1	1
Axis 2	2
Axis 3	3
Axis 4	4
Axis 5	5
⋮	⋮
Axis 16	10

● Start origin

Stored contents	Stored value
Host personal computer	00
External signal	01
EM Configurator	10

● Restart flag

Stored contents	Stored value
Restart flag OFF	0
Restart flag ON	1

Point

If a start signal is issued against an operating axis, a record relating to this event may be output before a record relating to an earlier start signal is output.

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

[Md.4] Start No.

The start No. is stored.

At start from the test mode, the stored value differs depending on the number of operation axes. Refer to the following for details.

☞ Page 361 Test mode

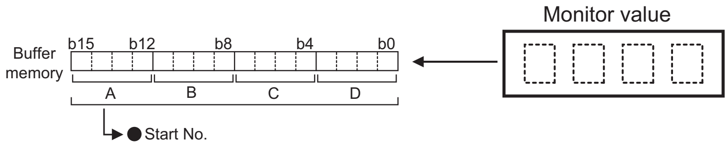
1 axis: 1

2 to 4 axes: Simultaneous starting of multiple axes (9004)

Refresh cycle: At start

■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.



Stored contents	Storage value A	B	C	D	Reference (Decimal)
Positioning operation	0	0	0	1	001
	to				to
	0	2	5	8	600
	1	B	5	8	7000
	1	B	5	9	7001
	1	B	5	A	7002
	1	B	5	B	7003
	1	B	5	C	7004
JOG operation	2	3	3	2	9010
Manual pulse generator	2	3	3	3	9011
Machine home position return	2	3	2	9	9001
Fast home position return	2	3	2	A	9002
Current value changing	2	3	2	B	9003
Simultaneous start	2	3	2	C	9004
Synchronous control operation	2	3	3	C	9020
Position control mode → speed control mode switching	2	3	4	6	9030
Position control mode → torque control mode switching	2	3	4	7	9031
Speed control mode → torque control mode switching	2	3	4	8	9032
Torque control mode → speed control mode switching	2	3	4	9	9033
Speed control mode → position control mode switching	2	3	4	A	9034
Torque control mode → position control mode switching	2	3	4	B	9035
Outside the range of control mode setting	2	3	4	C	9036
Direct control operation	2	3	5	A	9050

Point

If a start signal is issued against an operating axis, a record relating to this event may be output before a record relating to an earlier start signal is output.

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

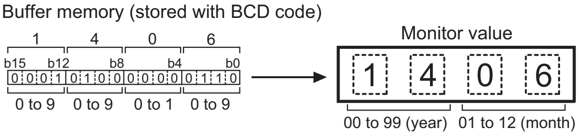
[Md.54] Start (Year: month)

The starting time (Year: month) is stored.

Refresh cycle: At start

■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.



Point

If a start signal is issued against an operating axis, a record relating to this event may be output before a record relating to an earlier start signal is output.

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

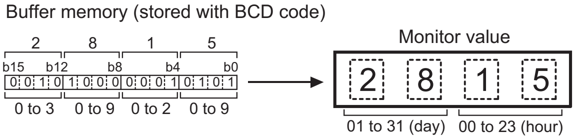
[Md.5] Start (Day: hour)

The starting time (Day: hour) is stored.

Refresh cycle: At start

■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.



Point

If a start signal is issued against an operating axis, a record relating to this event may be output before a record relating to an earlier start signal is output.

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

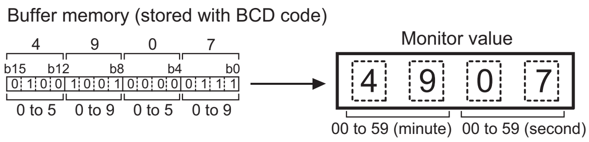
[Md.6] Start (Minute: second)

The starting time (Minute: second) is stored.

Refresh cycle: At start

■Reading the monitor value

• Monitoring is carried out with a hexadecimal display.



Point

If a start signal is issued against an operating axis, a record relating to this event may be output before a record relating to an earlier start signal is output.

• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

[Md.60] Start (ms)

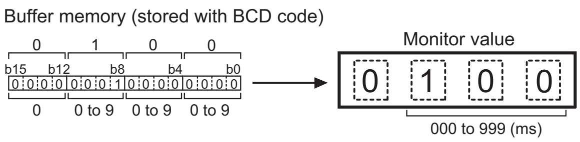
The starting time (ms) is stored.

000 (ms) to 999 (ms)

Refresh cycle: At start

■Reading the monitor value

• Monitoring is carried out with a hexadecimal display.



Point

If a start signal is issued against an operating axis, a record relating to this event may be output before a record relating to an earlier start signal is output.

• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

[Md.7] Error judgment

This area stores the following results of the error judgment performed upon starting:

- Warning flag

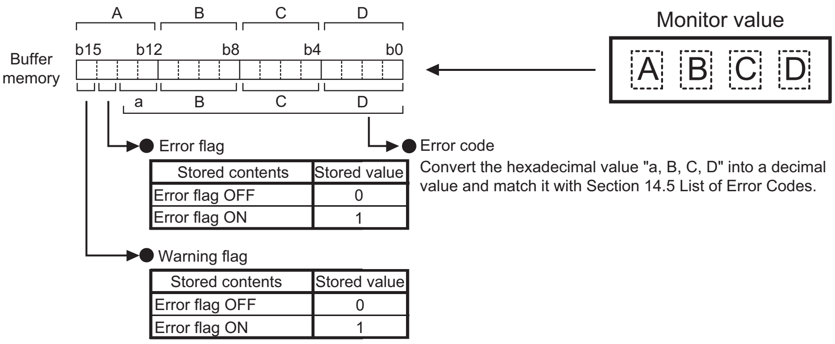
BUSY start
Control mode switching during BUSY
Control mode switching during zero speed OFF
Outside control mode range
Control mode switching

- Error flag
- Error code

Refresh cycle: At start

■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.



Point

If a start signal is issued against an operating axis, a record relating to this event may be output before a record relating to an earlier start signal is output.

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

[Md.8] Start history pointer

Indicates a pointer No. that is next to the pointer No. assigned to the latest of the existing start history records.

Refresh cycle: At start

■Reading the monitor value

- Monitoring is carried out with a decimal display.

Point

If a start signal is issued against an operating axis, a record relating to this event may be output before a record relating to an earlier start signal is output.

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

[Md.19] Number of write accesses to flash ROM

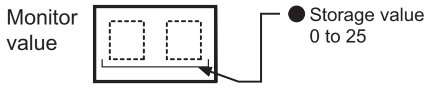
Stores the number of write accesses to the flash ROM after the power is switched ON.

The count is cleared to "0" when the number of write accesses reaches 26 and an error reset operation is performed.

Refresh cycle: Immediate

■Reading the monitor value

• Monitoring is carried out with a decimal display.



• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

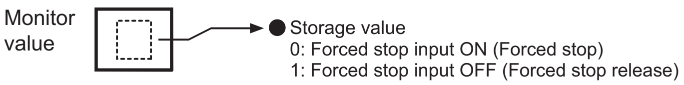
[Md.50] Forced stop input

This area stores the states (ON/OFF) of forced stop input.

Refresh cycle: Operation cycle

■Reading the monitor value

• Monitoring is carried out with a decimal display.



• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

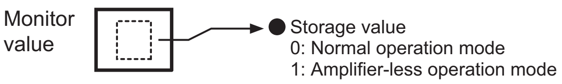
[Md.51] Amplifier-less operation mode status

Indicates a current operation mode.

Refresh cycle: Immediate

■Reading the monitor value

• Monitoring is carried out with a decimal display.



• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

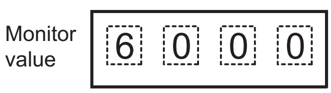
[Md.59] Module information

Stores the Simple Motion board information.

Refresh cycle: At power supply ON

■Reading the monitor value

• Monitoring is carried out with a hexadecimal display.



• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

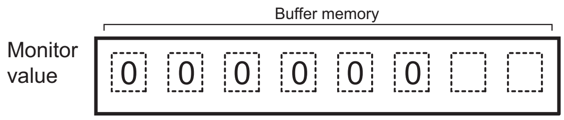
[Md.130] F/W version

Stores the first two digits of the Simple Motion board product information.

Refresh cycle: At power supply ON

■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

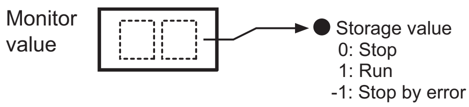
[Md.131] Digital oscilloscope running flag

Stores the RUN status of digital oscilloscope.

Refresh cycle: Main cycle

■Reading the monitor value

- Monitoring is carried out with a decimal display.



Point

- When an error occurs in setting data of digital oscilloscope at power supply ON, "-1: Stop by error" is stored. Write the setting again using EM Configurator.
- When the offline digital oscilloscope function is validated, "1: Run" is stored from the start of the Simple Motion board. If EM Configurator is not compatible with the offline digital oscilloscope function, the operation to set "0: Stop" cannot be executed. Therefore, update to the latest EM Configurator.

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

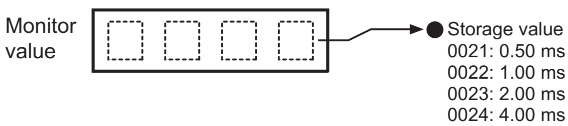
[Md.132] Operation cycle setting

Stores the current operation cycle.

Refresh cycle: At power supply ON

■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

[Md.133] Operation cycle over flag

This flag turns ON when the operation cycle time exceeds operation cycle.

Refresh cycle: Immediate

■Reading the monitor value

- Monitoring is carried out with a decimal display.

Point

Latch status of operation cycle over is indicated. When this flag turns ON, correct the positioning detail or change the operation cycle longer than current setting.

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

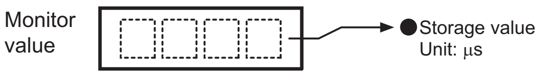
[Md.134] Operation time

Stores the time that took for operation every operation cycle.

Refresh cycle: Operation cycle

■Reading the monitor value

- Monitoring is carried out with a decimal display.



Point

When digital oscilloscope is executed in the following conditions, operation cycle will increase about 30 μs.

- Probe data: 16CH
- Bit data: 16CH
- Trigger data: 8CH
- Sampling cycle: Same as operation cycle

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

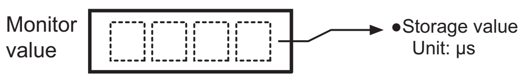
[Md.135] Maximum operation time

Stores the maximum value of operation time every time after the power supply of the Simple Motion board is turned ON.

Refresh cycle: Immediate

■Reading the monitor value

- Monitoring is carried out with a decimal display.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

[Md.138]Production No.

Stores the production No. of the Simple Motion board.

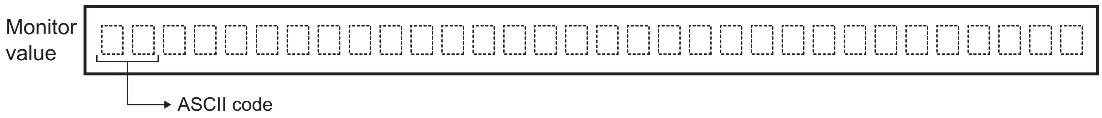
Fetch cycle: At power supply ON

Point

A different value is stored by each board.

■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

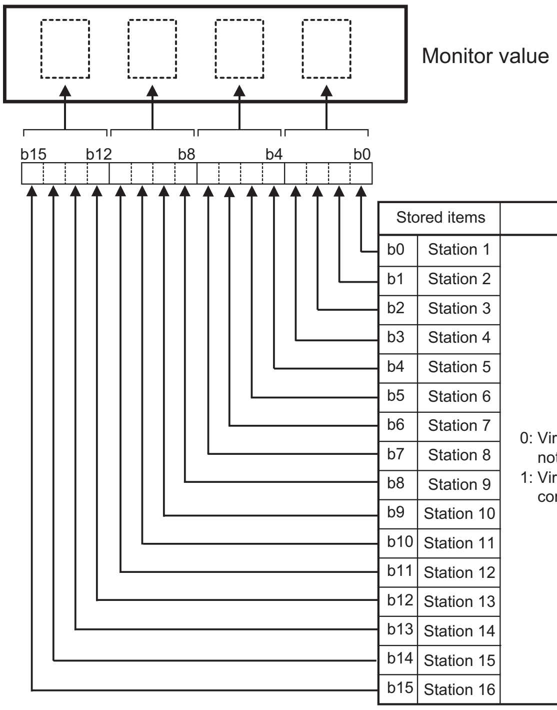
[Md.700] Virtual servo amplifier connected station monitor

Stores the station where a virtual servo amplifier is connected.

Refresh cycle: Operation cycle

■Reading the monitor value

- Monitoring is carried out with a decimal display.



Stored items		Meaning
b0	Station 1	0: Virtual servo amplifier not connected 1: Virtual servo amplifier connected
b1	Station 2	
b2	Station 3	
b3	Station 4	
b4	Station 5	
b5	Station 6	
b6	Station 7	
b7	Station 8	
b8	Station 9	
b9	Station 10	
b10	Station 11	
b11	Station 12	
b12	Station 13	
b13	Station 14	
b14	Station 15	
b15	Station 16	

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

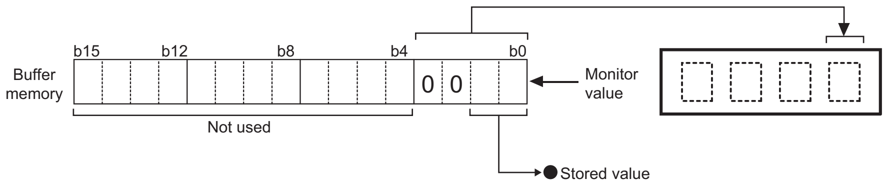
[Md.1200] Board information

Stores the board ID information of the Simple Motion board.

Fetch cycle: At power supply ON

■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.



Stored contents	Stored value
Board ID 0	00
Board ID 1	01
Board ID 2	10
Board ID 3	11

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

Axis monitor data

Item	Default value
[Md.20] Feed current value	0000H
[Md.21] Feed machine value	0000H
[Md.22] Feedrate	0000H
[Md.23] Axis error No.	0000H
[Md.24] Axis warning No.	0000H
[Md.25] Valid M code	0
[Md.26] Axis operation status	0
[Md.27] Current speed	0
[Md.28] Axis feedrate	0000H
[Md.29] Speed-position switching control positioning movement amount	0000H
[Md.30] External input signal	0000H
[Md.31] Status	0008H
[Md.32] Target value	0
[Md.33] Target speed	0000H
[Md.35] Torque limit stored value/forward torque limit stored value	0
[Md.36] Special start data instruction code setting value	0
[Md.37] Special start data instruction parameter setting value	0
[Md.38] Start positioning data No. setting value	0
[Md.39] In speed limit flag	0
[Md.40] In speed change processing flag	0
[Md.41] Special start repetition counter	0
[Md.42] Control system repetition counter	0000H
[Md.43] Start data pointer being executed	0
[Md.44] Positioning data No. being executed	0
[Md.45] Block No. being executed	0
[Md.46] Last executed positioning data No.	0
[Md.47] Positioning data being executed	0
[Md.48] Deceleration start flag	0
[Md.62] Amount of the manual pulser driving carrying over movement	0
[Md.101] Real current value	0000H
[Md.102] Deviation counter value	0000H
[Md.103] Motor rotation speed	0000H
[Md.104] Motor current value	0
[Md.108] Servo status1	0000H
[Md.114] Servo alarm	0000H
[Md.117] Statusword	0000H
[Md.119] Servo status2	0000H
[Md.120] Reverse torque limit stored value	0
[Md.122] Speed during command	0
[Md.123] Torque during command	0
[Md.503] Pre-reading data analysis status	0
[Md.514] Home position return operating status	FFFFH
[Md.1130] Error detection (all axes)	0
[Md.1132] Axis warning detection (all axes)	0

For labels, refer to the following.

☞ Page 435 Axis monitor data

[Md.20] Feed current value

The currently commanded address is stored. (Different from the actual motor position during operation)

The current position address is stored.

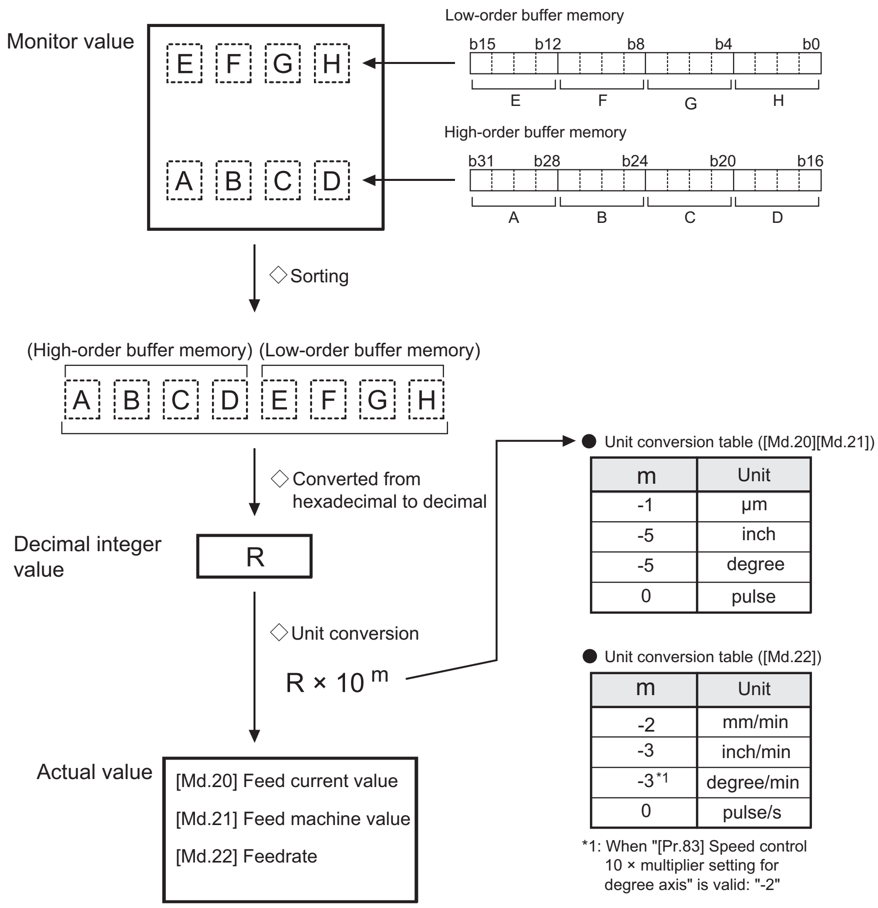
If "degree" is selected as the unit, the addresses will have a ring structure for values between 0 and 359.99999°.

- The home position address is stored when the machine home position return is completed.
- When the current value is changed with the current value changing function, the changed value is stored.

Refresh cycle: Operation cycle

■Reading the monitor value

- Monitoring is carried out with a hexadecimal.



● Unit conversion table ([Md.20][Md.21])

m	Unit
-1	μm
-5	inch
-5	degree
0	pulse

● Unit conversion table ([Md.22])

m	Unit
-2	mm/min
-3	inch/min
-3*1	degree/min
0	pulse/s

*1: When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: "-2"

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.21] Feed machine value

The address of the current position according to the machine coordinates will be stored. (Different from the actual motor position during operation)

Note that the current value changing function will not change the feed machine value.

Under the speed control mode, the feed machine value is constantly updated always, irrespective of the parameter setting.

The value will not be cleared to "0" at the beginning of fixed-feed control.

Even if "degree" is selected as the unit, the addresses will become a cumulative value. (They will not have a ring structure for values between 0 and 359.99999°). However, the feed machine value is restored with cumulating the feed machine value before the power supply OFF (the rounded value within the range of 0 to 359.99999°) to the movement amount during the power supply OFF at the communication start with servo amplifier after the power supply of the Simple Motion board ON or the remote RESET.

- Machine coordinates: Characteristic coordinates determined with machine

Refresh cycle: Operation cycle

■Reading the monitor value

Refer to "[Md.20] Feed current value".

☞ Page 519 [Md.20] Feed current value

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.22] Feedrate

The speed of the operating workpiece is stored. (May be different from the actual motor speed during operation)

- During interpolation operation, the speed is stored in the following manner.

Reference axis	Composite speed or reference axis speed (Set with [Pr.20])
Interpolation axis	0

Refresh cycle: Operation cycle

Point

In case of the single axis operation, "[Md.22] Feedrate" and "[Md.28] Axis feedrate" are identical.

In the composite mode of the interpolation operation, "[Md.22] Feedrate" is a speed in a composite direction and "[Md.28] Axis feedrate" is that in each axial direction.

■Reading the monitor value

Refer to "[Md.20] Feed current value".

☞ Page 519 [Md.20] Feed current value

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.23] Axis error No.

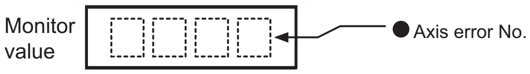
When an axis error is detected, the error code corresponding to the error details is stored.

- The latest error code is always stored. (When a new axis error occurs, the error code is overwritten.)
- When "[Cd.5] Axis error reset" (axis control data) turns ON, the axis error No. is cleared (set to 0).

Refresh cycle: Immediate

■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.24] Axis warning No.

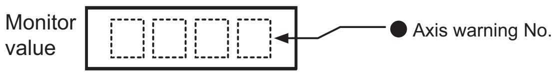
Whenever an axis warning is reported, a related warning code is stored.

- This area stores the latest warning code always. (Whenever an axis warning is reported, a new warning code replaces the stored warning code.)
- When the "[Cd.5] Axis error reset" (axis control data) is set to ON, the axis warning No. is cleared to "0".

Refresh cycle: Immediate

■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.25] Valid M code

This area stores an M code that is currently active (i.e. set to the positioning data relating to the current operation).

When the user program READY signal [Y0] is OFF, the value is set to "0".

Refresh cycle: Immediate

■Reading the monitor value

- Monitoring is carried out with a decimal display.

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

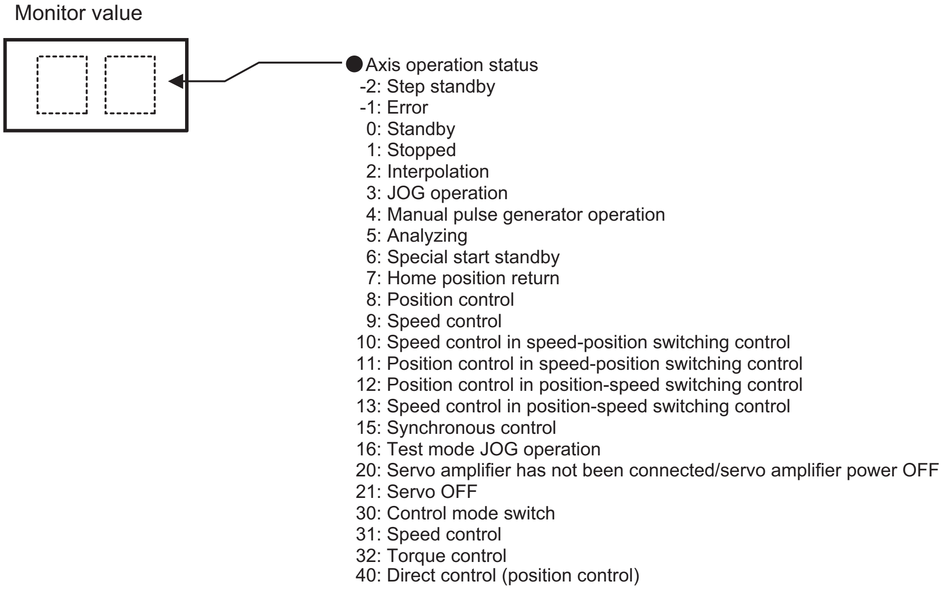
[Md.26] Axis operation status

This area stores the axis operation status.

Refresh cycle: Immediate

■Reading the monitor value

- Monitoring is carried out with a decimal display.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.27] Current speed

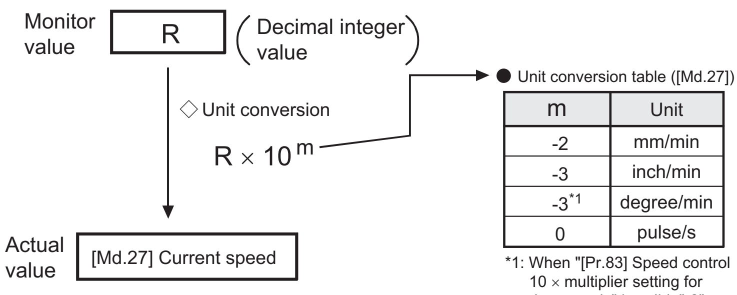
The "[Da.8] Command speed" used by the positioning data currently being executed is stored.

- If "[Da.8] Command speed" is set to "-1", this area stores the command speed set by the positioning data used one step earlier.
- If "[Da.8] Command speed" is set to a value other than "-1", this area stores the command speed set by the current positioning data.
- When speed change function is executed, this area stores "[Cd.14] New speed value". (For details of change speed function, refer to ☞ Page 250 Speed change function)

Refresh cycle: Immediate

■Reading the monitor value

- Monitoring is carried out with a decimal display.



m	Unit
-2	mm/min
-3	inch/min
-3*1	degree/min
0	pulse/s

*1: When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: "-2"

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.28] Axis feedrate

- The speed which is actually output as a command at that time in each axis is stored. (May be different from the actual motor speed)"0" is stored when the axis is at a stop. (☞ Page 520 [Md.22] Feedrate)

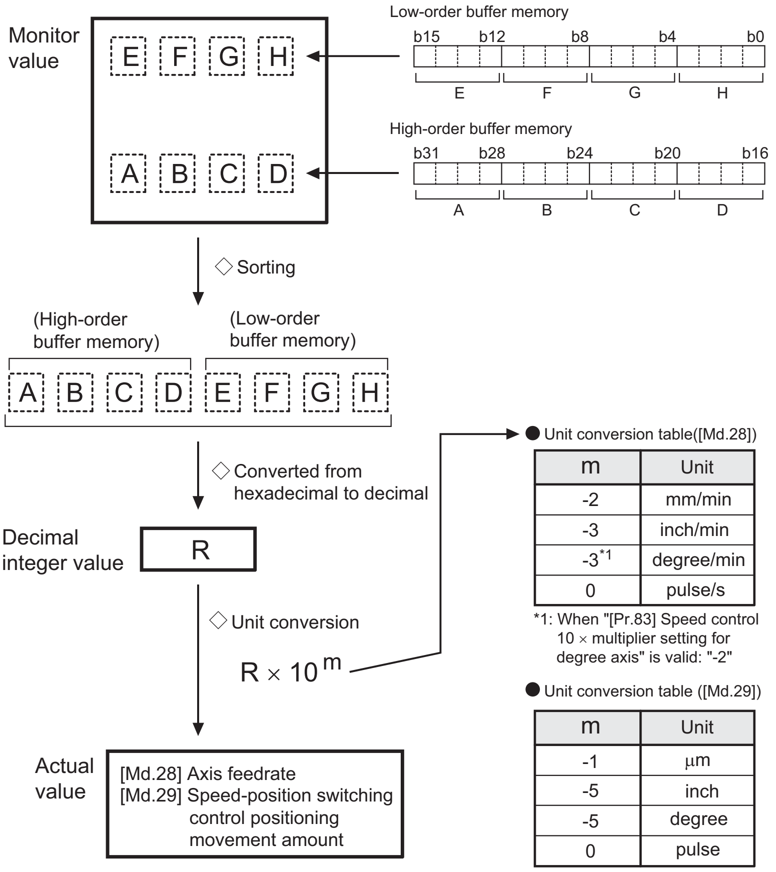
Refresh cycle: Operation cycle

■Reading the monitor value

Refer to the following.

☞ Page 519 [Md.20] Feed current value

- Monitoring is carried out with a hexadecimal.



● Unit conversion table([Md.28])

m	Unit
-2	mm/min
-3	inch/min
-3*1	degree/min
0	pulse/s

*1: When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: "-2"

● Unit conversion table ([Md.29])

m	Unit
-1	µm
-5	inch
-5	degree
0	pulse

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.29] Speed-position switching control positioning movement amount

- The movement amount for the position control to end after changing to position control with the speed-position switching control is stored. When the control method is "Reverse run: position/speed", the negative value is stored.

Refresh cycle: Immediate

■Reading the monitor value

Refer to "[Md.28] Axis feedrate".

☞ Page 523 [Md.28] Axis feedrate

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.30] External input signal

The state (ON/OFF) of the external input signal is stored.

The following items are stored.

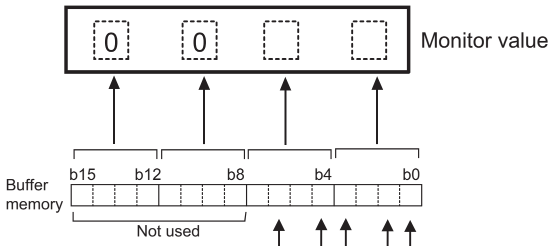
- Lower limit signal*1
- Upper limit signal*1
- Stop signal*1
- External command signal/switching signal
- Proximity dog signal*1

*1 This area stores the states of the external input signal (Simple Motion board), external input signal (servo amplifier) or buffer memory of Simple Motion board set by "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection", "[Pr.118] DOG signal selection", and "[Pr.119] STOP signal selection".

Refresh cycle: Operation cycle

■Reading the monitor value

- Monitoring is carried out with a hexadecimal.



	Stored items	Default value	Meaning
b0	Lower limit signal	0	0: OFF 1: ON
b1	Upper limit signal	0	
b2	Not used	0	
b3	Stop signal	0	
b4	External command signal/switching signal	0	
b5	Not used	0	
b6	Proximity dog signal	0	
b7	Not used	0	

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.31] Status

This area stores the states (ON/OFF) of various flags.

Information on the following flags is stored.

■In speed control flag

This signal that comes ON under the speed control can be used to judge whether the operation is performed under the speed control or position control. The signal goes OFF when the power is switched ON, under the position control, and during JOG operation or manual pulse generator operation. During the speed-position or position-speed switching control, this signal comes ON only when the speed control is in effect. During the speed-position switching control, this signal goes OFF when the speed-position switching signal executes a switching over from speed control to position control. During the position-speed switching control, this signal comes ON when the position-speed switching signal executes a switching over from position control to speed control.

■Speed-position switching latch flag

This signal is used during the speed-position switching control for interlocking the movement amount change function. During the speed-position switching control, this signal comes ON when position control takes over. This signal goes OFF when the next positioning data is processed, and during JOG operation or manual pulse generator operation.

■Command in-position flag

This signal is ON when the remaining distance is equal to or less than the command in-position range (set by a detailed parameter). This signal remains OFF with data that specify the continuous path control (P11) as the operation pattern. The state of this signal is monitored every operation cycle except when the monitoring is canceled under the speed control or while the speed control is in effect during the speed-position or position-speed switching control. While operations are performed with interpolation, this signal comes ON only in respect of the starting axis. (This signal goes OFF in respect of all axes upon starting.)

■Home position return request flag

This signal comes ON when the power is switched ON, when the absolute system has not been set, when the machine home position return has not been executed at the absolute position system, when a machine home position return operation starts. This signal goes OFF when a machine home position return operation completes.
(For details of home position return request flag, refer to ☞ Page 34 Outline of Home Position Return Control.)

12

■Home position return complete flag

This signal comes ON when a machine home position return operation completes normally. This signal goes OFF when the operation start.

■Position-speed switching latch flag

This signal is used during the position-speed switching control for interlocking the command speed change function. During the position-speed switching control, this signal comes ON when speed control takes over. This signal goes OFF when the next positioning data is processed, and during JOG operation or manual pulse generator operation.

■Axis warning detection flag

This signal comes On when an axis warning is reported and goes OFF when the axis error reset signal comes ON.

■Speed change 0 flag

This signal comes ON when the speed is "0" by the speed change or override. Otherwise, it goes OFF.

■M code ON

In the WITH mode, this signal turns ON when the positioning data operation is started. In the AFTER mode, this signal turns ON when the positioning data operation is completed.
This signal turns OFF with the "[Cd.7] M code OFF request".
When M code is not designated (when "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" is "0"), this signal will remain OFF.
With using continuous path control for the positioning operation, the positioning will continue even when this signal does not turn OFF.
However, the warning "M code ON signal ON" (warning code: 0992H) will occur.
When the user program READY signal [Y0] turns OFF, the M code ON signal will also turn OFF.
If operation is started while the M code is ON, the error "M code ON signal start" (error code: 19A0H) will occur.

■Error detection

This signal turns ON when an error (☞ Page 625 List of Error Codes), and turns OFF when the error is reset on "[Cd.5] Axis error reset".

■Start complete

This signal turns ON when the positioning start signal turns ON and the Simple Motion board starts the positioning process. (The start complete signal also turns ON during home position return control.)

■Positioning complete

This signal turns ON for the time set in "[Pr.40] Positioning complete signal output time" from the instant when the positioning control for each positioning data No. is completed.

For the interpolation control, the positioning complete signal of interpolation axis turns ON during the time set to the reference axis.

(It does not turn ON when "[Pr.40] Positioning complete signal output time" is "0".)

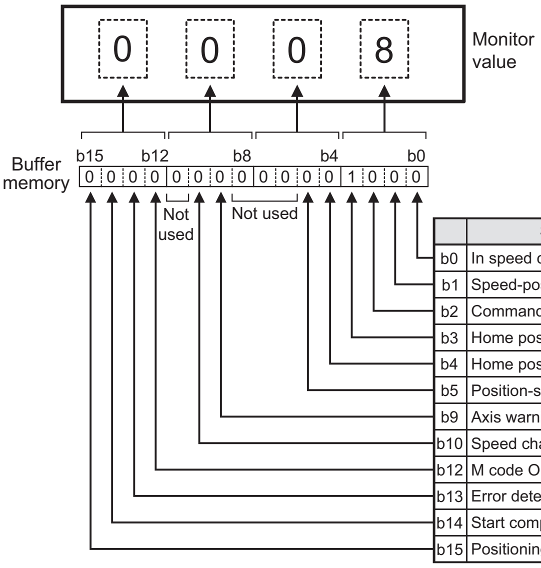
If positioning (including home position return), JOG/Inching operation, or manual pulse generator operation is started while this signal is ON, the signal will turn OFF.

This signal will not turn ON when speed control or positioning is canceled midway.

Refresh cycle: Immediate

■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.



	Stored items	Default value	Meaning
b0	In speed control flag	0	0: OFF 1: ON
b1	Speed-position switching latch flag	0	
b2	Command in-position flag	0	
b3	Home position return request flag	1	
b4	Home position return complete flag	0	
b5	Position-speed switching latch flag	0	
b9	Axis warning detection	0	
b10	Speed change 0 flag	0	
b12	M code ON	0	
b13	Error detection	0	
b14	Start complete	0	
b15	Positioning complete	0	

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.32] Target value

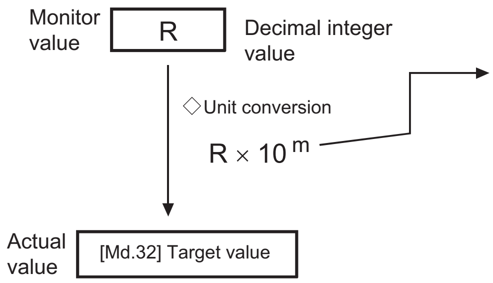
This area stores the target value ([Da.6] Positioning address/movement amount) for a positioning operation.

- At the beginning of positioning control and current value changing: Stores the value of "[Da.6] Positioning address/movement amount".
- At the home position shift operation of home position return control: Stores the value of home position shift amount.
- At other times: Stores "0".

Refresh cycle: Immediate

■Reading the monitor value

- Monitoring is carried out with a decimal display.



●Unit conversion table ([Md.32])

m	Unit
-1	μm
-5	inch
-5	degree
0	pulse

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

12

[Md.33] Target speed

- During operation with positioning data: The actual target speed, considering the override and speed limit value, etc., is stored. "0" is stored when positioning is completed.
- During interpolation of position control: The composite speed or reference axis speed is stored in the reference axis address, and "0" is stored in the interpolation axis address.
- During interpolation of speed control: The target speeds of each axis are stored in the monitor of the reference axis and interpolation axis.
- During JOG operation: The actual target speed, considering the JOG speed limit value for the JOG speed, is stored.
- During manual pulse generator operation: "0" is stored.

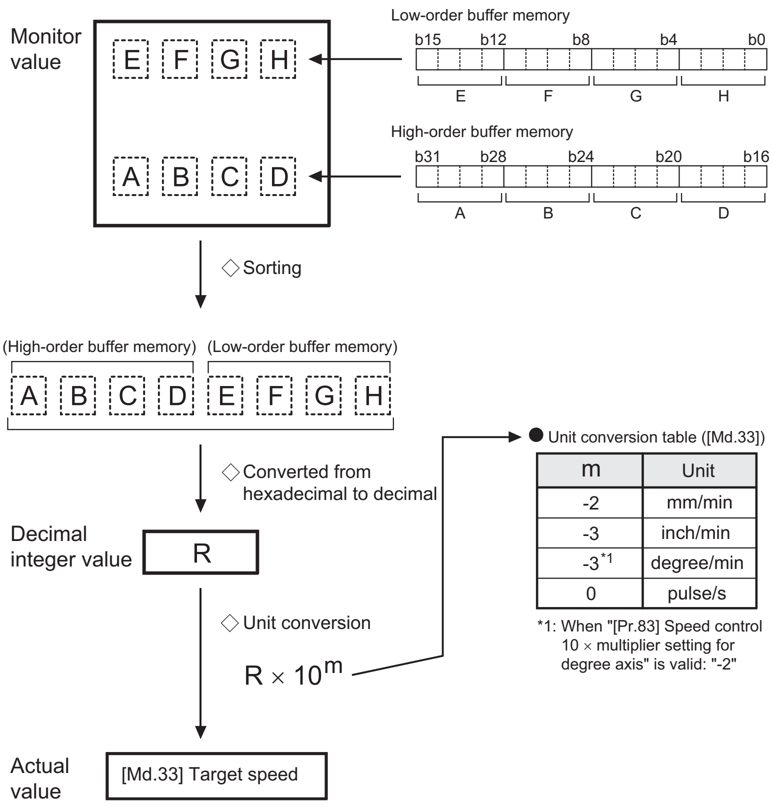
Refresh cycle: Immediate

Point

The target speed is when an override is made to the command speed.
When the speed limit value is overridden, the target speed is restricted to the speed limit value. The target speed changes every time data is switched, but does not change in an acceleration/deceleration state inside each piece of data (changes with the speed change because the target speed changes.)

■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.



m	Unit
-2	mm/min
-3	inch/min
-3*1	degree/min
0	pulse/s

*1: When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: "-2"

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.35] Torque limit stored value/forward torque limit stored value

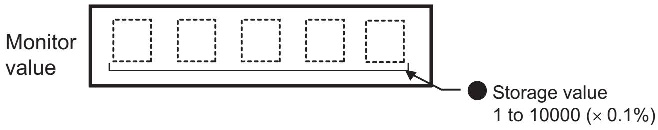
"[Pr.17] Torque limit setting value", "[Cd.101] Torque output setting value", or "[Cd.22] New torque value/forward new torque value" is stored.

- During positioning start, JOG operation start, manual pulse generator operation: "[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value" is stored.
- When a value is set in "[Cd.22] New torque value/forward new torque value" during operation: "[Cd.22] New torque value/forward new torque value" is stored.

Refresh cycle: Immediate

■Reading the monitor value

- Monitoring is carried out with a decimal display.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

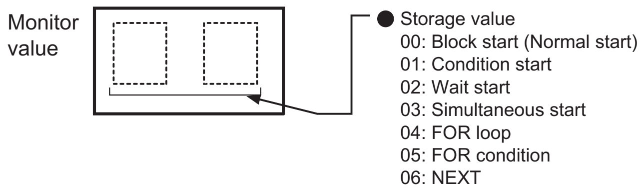
[Md.36] Special start data instruction code setting value

- The "instruction code" used with special start and indicated by the start data pointer currently being executed is stored.

Refresh cycle: Immediate

■Reading the monitor value

- Monitoring is carried out with a decimal display.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.37] Special start data instruction parameter setting value

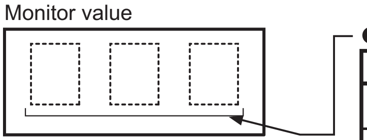
- The "instruction parameter" used with special start and indicated by the start data pointer currently being executed is stored. The stored value differs according to the value set for [Md.36].

Refresh cycle: Immediate

■Reading the monitor value

- Monitoring is carried out with a decimal display.

Monitor value



● Storage value

Setting value of [Md.36]	Stored contents	Stored value
00 06	None	None
01 02 03 05	Condition data No.	1 to 10
04	Number of repetitions	0 to 255

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

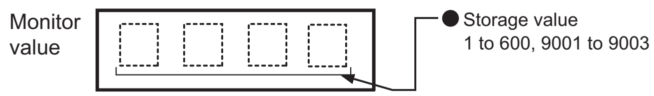
[Md.38] Start positioning data No. setting value

- The "positioning data No." indicated by the start data pointer currently being executed is stored.

Refresh cycle: Immediate

■Reading the monitor value

- Monitoring is carried out with a decimal display.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

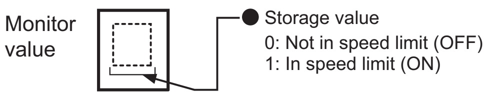
[Md.39] In speed limit flag

- If the speed exceeds the "[Pr.8] Speed limit value" ("[Pr.31] JOG speed limit value" at JOG operation control) due to a speed change or override, the speed limit functions, and the in speed limit flag turns ON.
- When the speed drops to less than "[Pr.8] Speed limit value" ("[Pr.31] JOG speed limit value" at JOG operation control), or when the axis stops, the in speed limit flag turns OFF.

Refresh cycle: Immediate

■Reading the monitor value

- Monitoring is carried out with a decimal display.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

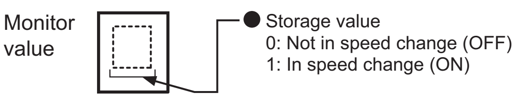
[Md.40] In speed change processing flag

- The speed change process flag turns ON when the speed is changed during positioning control.
- After the speed change process is completed or when deceleration starts with the stop signal during the speed change process, the in speed change process flag turns OFF.

Refresh cycle: Immediate

■Reading the monitor value

- Monitoring is carried out with a decimal display.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

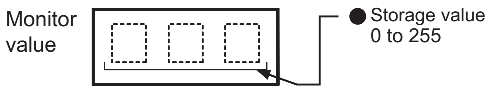
[Md.41] Special start repetition counter

- This area stores the remaining number of repetitions during "repetitions" specific to special starting.
- The count is decremented by one (-1) at the loop end.
- The control comes out of the loop when the count reaches "0".
- This area stores "0" within an infinite loop.

Refresh cycle: Immediate

■Reading the monitor value

- Monitoring is carried out with a decimal display.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

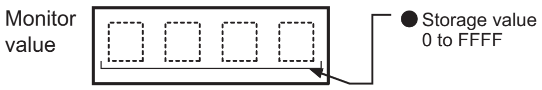
[Md.42] Control system repetition counter

- This area stores the remaining number of repetitions during "repetitions" specific to control system.
- The count is decremented by one (-1) at the loop start.
- The loop is terminated with the positioning data of the control method "LEND", after the counter becomes "0".

Refresh cycle: Immediate

■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

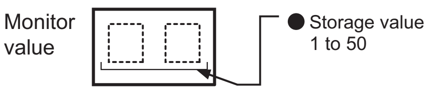
[Md.43] Start data pointer being executed

- This area stores a point No. (1 to 50) attached to the start data currently being executed.
- This area stores "0" after completion of a positioning operation.

Refresh cycle: Immediate

■Reading the monitor value

- Monitoring is carried out with a decimal display.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

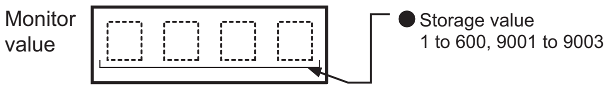
[Md.44] Positioning data No. being executed

- This area stores a positioning data No. attached to the positioning data currently being executed.
- This area stores "0" when the JOG/inching operation is executed.
- This area stores "1" during the JOG operation or the positioning operation from the test mode. For details, refer to ☞ Page 361 Test mode.

Refresh cycle: Immediate

■Reading the monitor value

- Monitoring is carried out with a decimal display.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

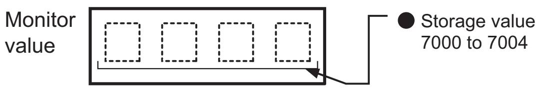
[Md.45] Block No. being executed

- When the operation is controlled by "block start data", this area stores a block No. (7000 to 7004) attached to the block currently being executed.
- At other times, this area stores "0".

Refresh cycle: At start

■Reading the monitor value

- Monitoring is carried out with a decimal display.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

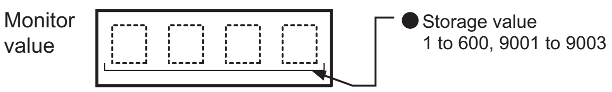
[Md.46] Last executed positioning data No.

- This area stores the positioning data No. attached to the positioning data that was executed last time.
- The value is retained until a new positioning operation is executed.
- This area stores "0" when the JOG/inching operation is executed.
- This area stores "1" when the JOG operation or the positioning operation from the test mode is executed. For details, refer to ☞ Page 361 Test mode.

Refresh cycle: Immediate

■Reading the monitor value

- Monitoring is carried out with a decimal display.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.47] Positioning data being executed

- The details of the positioning data currently being executed (positioning data No. given by [Md.44]) are stored in the buffer memory addresses.
- "04h" or "05h" is stored in the control method of the positioning identifier during the JOG operation from the test mode. For details, refer to ☞ Page 361 Test mode.

Refresh cycle: Immediate

■Reading the monitor value

Information is stored in the storage addresses:

Stored item	Reference
Positioning identifier	☞ Page 485 [Da.1] Operation pattern to ☞ Page 486 [Da.4] Deceleration time No.
Positioning address	☞ Page 486 [Da.6] Positioning address/movement amount
Arc address	☞ Page 490 [Da.7] Arc address
Command speed	☞ Page 492 [Da.8] Command speed
Dwell time	☞ Page 493 [Da.9] Dwell time/JUMP destination positioning data No.
M code	☞ Page 494 [Da.10] M code/Condition data No./No. of LOOP to LEND repetitions/No. of pitches
Axis to be interpolated	☞ Page 494 [Da.20] Axis to be interpolated No.1 to [Da.22] Axis to be interpolated No.3
Positioning option	☞ Page 495 [Da.27] M code ON signal output timing to ☞ Page 495 [Da.29] Interpolation speed designation method

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.48] Deceleration start flag

- "1" is stored when the constant speed status or acceleration status switches to the deceleration status during position control whose operation pattern is "Positioning complete".
- "0" is stored at the next operation start or manual pulse generator operation enable.

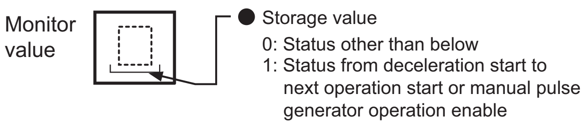
Refresh cycle: Immediate

Point

This parameter is possible to monitor when "[Cd.41] Deceleration start flag valid" is valid.

■Reading the monitor value

- Monitoring is carried out with a decimal display.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

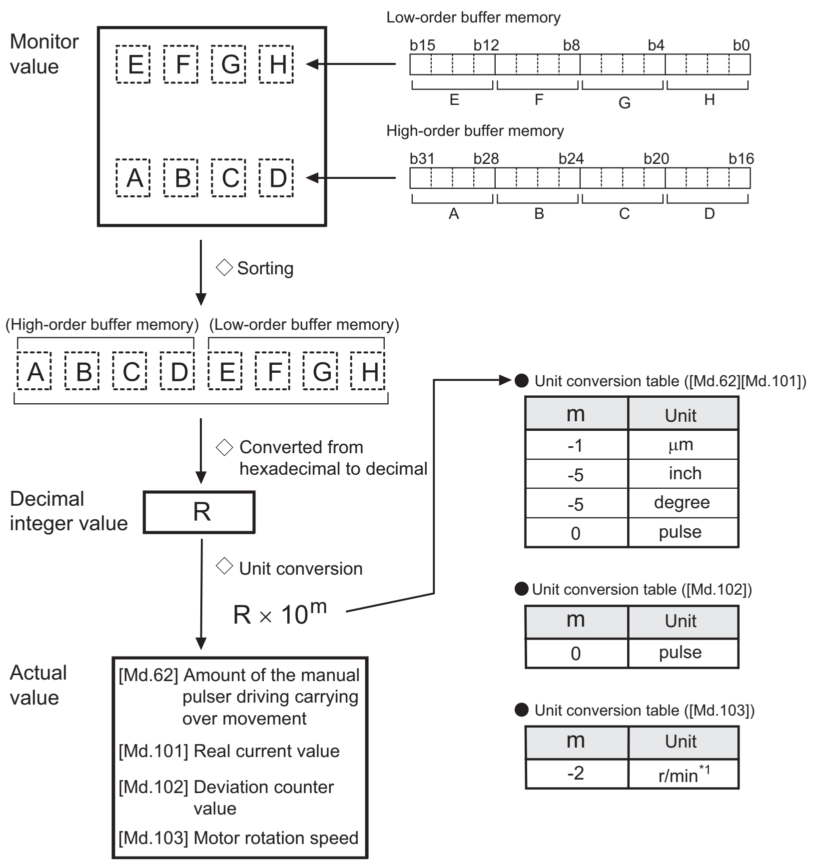
[Md.62] Amount of the manual pulser driving carrying over movement

• When "2: Output over value of speed limit later" is set in "[Pr.122] Manual pulse generator speed limit mode", this area stores the carrying over movement amount which exceeds "[Pr.123] Manual pulse generator speed limit value".

Refresh cycle: Immediate

■Reading the monitor value

• Monitoring is carried out with a hexadecimal display.



● Unit conversion table ([Md.62][Md.101])

m	Unit
-1	μm
-5	inch
-5	degree
0	pulse

● Unit conversion table ([Md.102])

m	Unit
0	pulse

● Unit conversion table ([Md.103])

m	Unit
-2	r/min*1

*1 The unit is mm/s at linear servo use.

• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.101] Real current value

• This area stores the current value "feed current value - (command pulse - feedback pulse)".

For setting units

Ex.

mm

(Buffer memory × 0.1) μm

Refresh cycle: Operation cycle

■Reading the monitor value

Refer to the following.

☞ Page 534 [Md.62] Amount of the manual pulser driving carrying over movement

• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.102] Deviation counter value

- This area stores the droop pulse.

(Buffer memory details) pulse

Refresh cycle: Operation cycle

■Reading the monitor value

Refer to the following.

☞ Page 534 [Md.62] Amount of the manual pulser driving carrying over movement

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.103] Motor rotation speed

- This area stores the motor speed updated in real time.

(Buffer memory × 0.01) r/min*1

*1 The unit is mm/s at linear servo use.

Refresh cycle: Operation cycle

■Reading the monitor value

Refer to the following.

☞ Page 534 [Md.62] Amount of the manual pulser driving carrying over movement

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.104] Motor current value

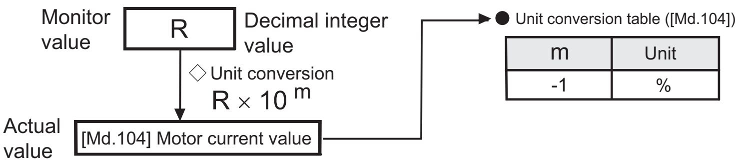
- This area stores the current value of the motor.

(Buffer memory × 0.1)%

Refresh cycle: Operation cycle

■Reading the monitor value

- Monitoring is carried out with a decimal display.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.108] Servo status1

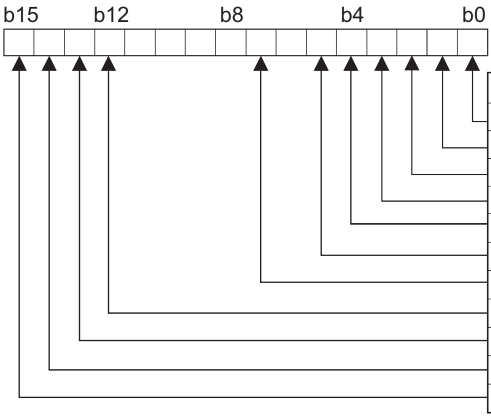
This area stores the servo status1.

- READY ON: Indicates the ready ON/OFF.
- Servo ON: Indicates the servo ON/OFF.
- Control mode: Indicates the control mode of the servo amplifier.
- Gain switching: Turns ON during the gain switching.
- Fully closed loop control: Turns ON during the fully closed loop control.
- Servo alarm: Turns ON during the servo alarm.
- In-position: The dwell pulse turns ON within the servo parameter "in-position".
- Torque limit: Turns ON when the servo amplifier is having the torque restricted.
- Absolute position lost: Turns ON when the servo amplifier is lost the absolute position.
- Servo warning: Turns ON during the servo warning.

Refresh cycle: Operation cycle

■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.



Stored items		Meaning
b0	READY ON	0: OFF 1: ON
b1	Servo ON	
b2 b3	Control mode*1	
b4	Gain switching	
b5	Fully closed loop control	
b7	Servo alarm	
b12	In-position	
b13	Torque limit	
b14	Absolute position lost	
b15	Servo warning	

*1: Control mode

b2	b3	Control mode
0	0	Position control mode
1	0	Speed control mode
0	1	Torque control mode

Point

- When the forced stop of controller and servo amplifier occurs, the servo warning is turned ON. When the forced stop is reset, the servo warning is turned OFF.
- When the control mode status of the servo amplifier (Modes of operation display: 6061h) is not CSV or CST, "Position control mode" is stored.

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

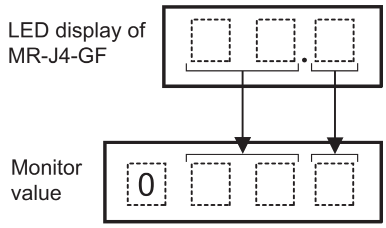
[Md.114] Servo alarm

- This area stores the servo alarm code and servo warning code displayed in LED of servo amplifier.
- When the "[Cd.5] Axis error reset" (axis control data) is set to ON after remove the error factor of servo amplifier side, the servo alarm is cleared (set to 0).

Refresh cycle: Immediate

■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

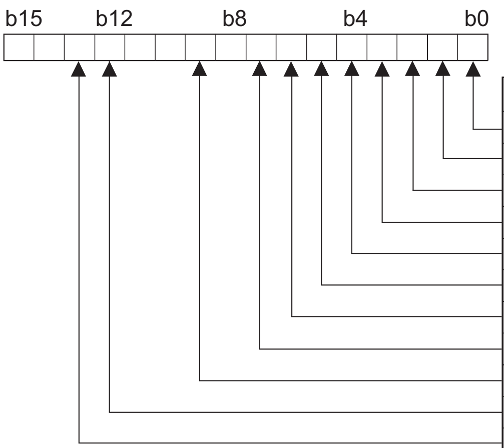
[Md.117] Statusword

- This area stores Statusword.

Refresh cycle: Operation cycle

■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.



Stored items		Meaning
b0	Ready to switch on	0: OFF 1: ON
b1	Switched on	
b2	Operation enabled	
b3	Fault	
b4	Voltage enabled	
b5	Quick stop	
b6	Switch on disabled	
b7	Warning	
b9	Remote	
b12	Operation mode specific	
b13		

- Buffer memory address.

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.119] Servo status2

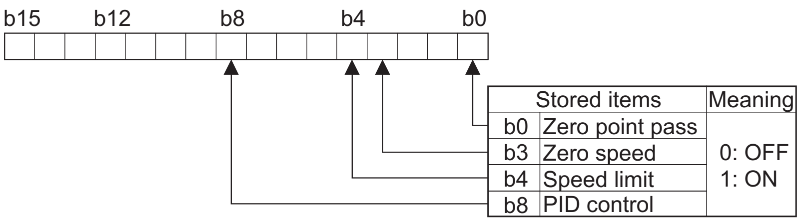
This area stores the servo status2.

- Zero point pass: Turns ON if the zero point of the encoder has been passed even once.
- Zero speed: Turns ON when the motor speed is lower than the servo parameter "zero speed."
- Speed limit: Turns ON during the speed limit in torque control mode.
- PID control: Turns ON when the servo amplifier is PID control.

Refresh cycle: Operation cycle

■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.120] Reverse torque limit stored value

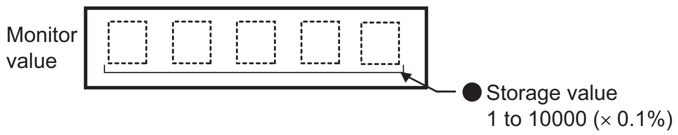
"[Pr.17] Torque limit setting value", "[Cd.101] Torque output setting value", or "[Cd.113] New reverse torque value" is stored.

- At the positioning start/JOG operation start/manual pulse generator operation: "[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value" is stored.
- When a value is set in "[Cd.22] New torque value/forward new torque value" or "[Cd.113] New reverse torque value" during operation.: "[Cd.22] New torque value/forward new torque value" is stored when "0" is set in "[Cd.112] Torque change function switching request". "[Cd.113] New reverse torque value" is stored when "1" is set in "[Cd.112] Torque change function switching request".

Refresh cycle: Immediate

■Reading the monitor value

- Monitoring is carried out with a decimal display.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

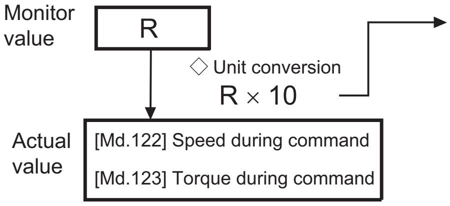
[Md.122] Speed during command

- This area stores the command speed during speed control mode.
- "0" is stored other than during speed control mode.

Refresh cycle: Operation cycle (Speed control mode only)

■Reading the monitor value

- Monitoring is carried out with a decimal display.



● Unit conversion table ([Md.122])

m	Unit
-2	mm/min
-3	inch/min
-3*1	degree/min
0	pulse/s

*1: When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: "-2"

● Unit conversion table ([Md.123])

m	Unit
-1	%

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.123] Torque during command

- This area stores the command torque during torque control mode. (Buffer memory × 0.1)%
- "0" is stored other than during torque control mode.

Refresh cycle: Operation cycle (Torque control mode only)

■Reading the monitor value

Refer to "[Md.122] Speed during command".

☞ Page 539 [Md.122] Speed during command

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.503] Pre-reading data analysis status

Use this monitor when using the pre-reading start function.

- This area stores the positioning data analysis status.

Refresh cycle: Operation cycle

■Reading the monitor value

- Monitoring is carried out with a decimal display.

● Pre-reading data analysis status
0: Standby
1: Analyzing
2: Completed

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

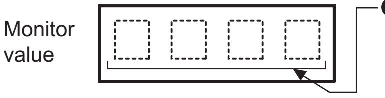
[Md.514] Home position return operating status

This area stores the home position return operating status.

Refresh cycle: Operation cycle

■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.



● Storage value

Storage value	Status
FFFFH	The servo amplifier is not set to the home position return mode
0000H	Homing procedure is in progress
0001H	Homing procedure is interrupted or not started
0002H	Homing is attained, but target is not reached
0003H	Homing procedure is completed successfully
0004H	Homing error occurred, velocity is not 0
0005H	Homing error occurred, velocity is 0

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

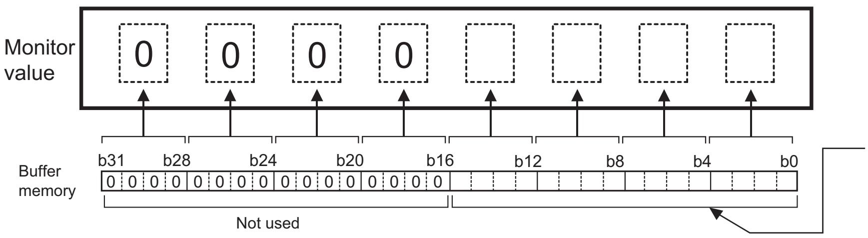
[Md.1130] Error detection (all axes)

This area stores the error detection status of "[Md.31] Status" of all axes from b0 in order of the axis Nos. When the error occurs and the corresponding bit is turned ON, turn it OFF by "[Cd.5] Axis error reset" of each axis.

Refresh cycle: Operation cycle

■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.



● Storage value

	Stored items	Initial value	Meaning
b0	Axis 1	0	0: OFF 1: ON
b1	Axis 2		
b2	Axis 3		
b3	Axis 4		
b4	Axis 5		
⋮	⋮		
b15	Axis 16		

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

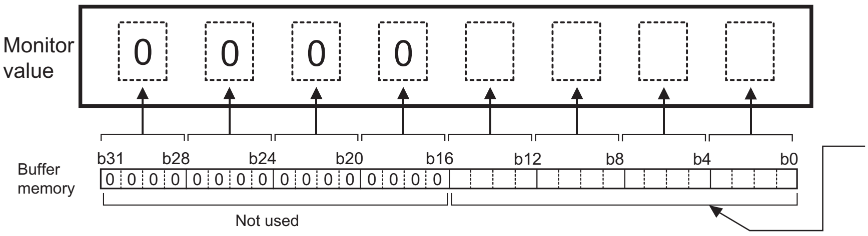
[Md.1132] Axis warning detection (all axes)

This area stores the axis warning detection status of "[Md.31] Status" of all axes from b0 in order of the axis Nos. When the axis warning occurs and the corresponding bit is turned ON, turn it OFF by "[Cd.5] Axis error reset" of each axis.

Refresh cycle: Operation cycle

■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.



● Storage value

	Stored items	Initial value	Meaning
b0	Axis 1	0	0: OFF 1: ON
b1	Axis 2		
b2	Axis 3		
b3	Axis 4		
b4	Axis 5		
⋮	⋮		
b15	Axis 16		

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

Servo network composition status

Item	Default value
[Md.105] Connected device	0

For labels, refer to the following.

☞ Page 437 Servo network composition status

[Md.105] Connected device

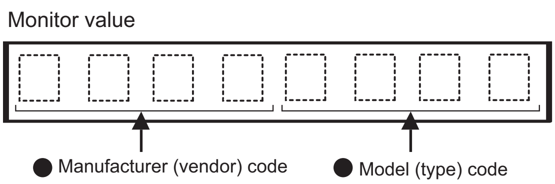
This area stores the manufacturer (vendor) ID and model (type) code of each axis when the power of the connected device operating in the motion mode is turned ON.

It is not cleared if the power of the connected device is turned OFF.

Refresh cycle: Servo amplifier's power supply ON

■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.



Refer to the manual of each slave device for the manufacturer (vendor) code.

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Servo network composition status

12.8 Control Data

The setting items of the control data are explained in this section.

System control data

Item	Default value
[Cd.1] Flash ROM write request	0
[Cd.2] Parameter initialization request	0
[Cd.41] Deceleration start flag valid	0
[Cd.42] Stop command processing for deceleration stop selection	0
[Cd.44] External input signal operation device (Axis 1 to 16)	0000H
[Cd.137] Amplifier-less operation mode switching request	0000H
[Cd.158] Forced stop input	0000H
[Cd.700] Virtual servo amplifier operation command	0000H
[Cd.701] Virtual servo amplifier operation station specification	0000H

For labels, refer to the following.

☞ Page 437 System control data

[Cd.1] Flash ROM write request

- Writes not only "positioning data (No.1 to 600)" and "block start data (No.7000 to 7004)" stored in the buffer memory/ internal memory area, but also "parameters" to the flash ROM/internal memory (nonvolatile).

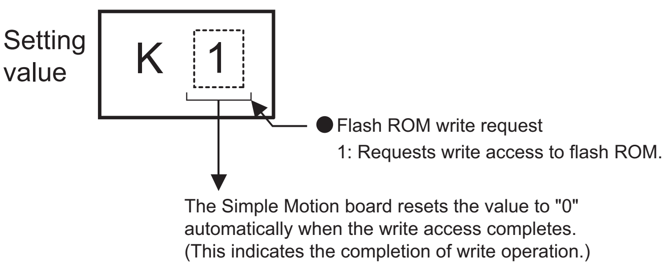
Fetch cycle: 116 [ms]

Point

- Do not turn the power supply of the Simple Motion board OFF or execute the remote RESET while writing to the flash ROM. If the power is turned OFF or the remote RESET is executed to forcibly end the process, the data backed up in the flash ROM will be lost.
- Do not write the data to the buffer memory before writing to the flash ROM is completed.
- The number of writes to the flash ROM with the user program is 25 max. while the power is turned ON. Writing to the flash ROM beyond 25 times will cause the error "Flash ROM write number error" (error code: 1080H). Refer to ☞ Page 625 List of Error Codes for details.
- Monitoring is the number of writes to the flash ROM after the power is switched ON by the "[Md.19] Number of write accesses to flash ROM".

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 System control data

[Cd.2] Parameter initialization request

- Requests initialization of setting data.

Refer to the following for initialized setting data.

☞ Page 308 Parameter Initialization Function

Initialization: Resetting of setting data to default values

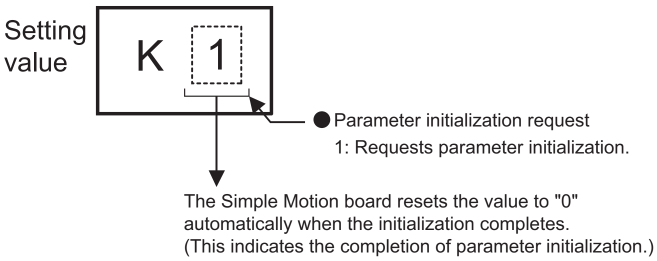
Fetch cycle: 116 [ms]

Point

After completing the initialization of setting data, switch the power supply of the Simple Motion board ON or execute the remote RESET.

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 System control data

[Cd.41] Deceleration start flag valid

- Sets whether "[Md.48] Deceleration start flag" is made valid or invalid.

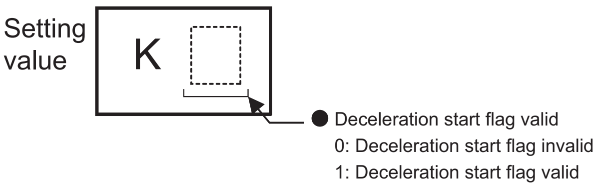
Fetch cycle: At user program READY ON

Point

The "[Cd.41] Deceleration start flag valid" become valid when the user program READY signal [Y0] turns from OFF to ON.

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 System control data

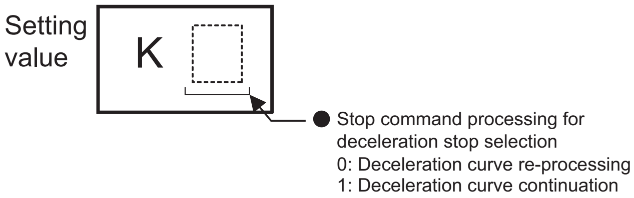
[Cd.42] Stop command processing for deceleration stop selection

- Sets the stop command processing for deceleration stop function (deceleration curve re-processing/deceleration curve continuation).

Fetch cycle: At deceleration stop causes occurrence

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 System control data

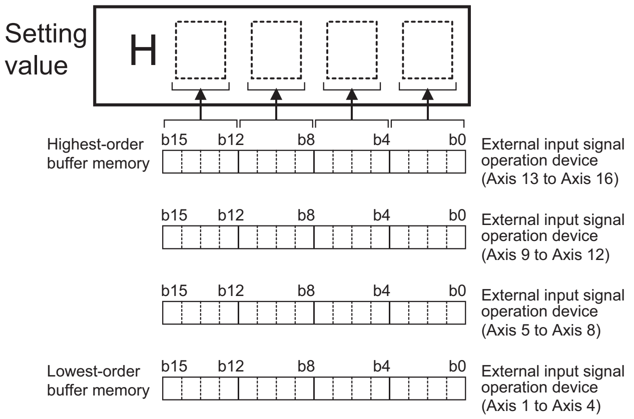
[Cd.44] External input signal operation device (Axis 1 to 16)

- Operates the external input signal status (Upper/lower limit signal, proximity dog signal, stop signal) of the Simple Motion board when "2" is set in "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection", "[Pr.118] DOG signal selection", and "[Pr.119] STOP signal selection".

Fetch cycle: Operation cycle

■Setting value

- Set with a hexadecimal.



Buffer memory	Setting item	Default value	Meaning
b0	Axis 1 Upper limit signal (FLS)	0	"[Pr.22] Input signal logic selection" is negative logic 0: ON 1: OFF
b1	Axis 1 Lower limit signal (RLS)	0	
b2	Axis 1 Proximity dog signal (DOG)	0	
b3	Axis 1 STOP signal (STOP)	0	
b4	Axis 2 Upper limit signal (FLS)	0	
b5	Axis 2 Lower limit signal (RLS)	0	
b6	Axis 2 Proximity dog signal (DOG)	0	
b7	Axis 2 STOP signal (STOP)	0	
b8	Axis 3 Upper limit signal (FLS)	0	
b9	Axis 3 Lower limit signal (RLS)	0	
b10	Axis 3 Proximity dog signal (DOG)	0	
b11	Axis 3 STOP signal (STOP)	0	
b12	Axis 4 Upper limit signal (FLS)	0	
b13	Axis 4 Lower limit signal (RLS)	0	
b14	Axis 4 Proximity dog signal (DOG)	0	
b15	Axis 4 STOP signal (STOP)	0	
b0	Axis 5 Upper limit signal (FLS)	0	"[Pr.22] Input signal logic selection" is positive logic 0: ON 1: OFF
b1	Axis 5 Lower limit signal (RLS)	0	
b2	Axis 5 Proximity dog signal (DOG)	0	
b3	Axis 5 STOP signal (STOP)	0	
b4	Axis 6 Upper limit signal (FLS)	0	
b5	Axis 6 Lower limit signal (RLS)	0	
b6	Axis 6 Proximity dog signal (DOG)	0	
b7	Axis 6 STOP signal (STOP)	0	
b8	Axis 7 Upper limit signal (FLS)	0	
b9	Axis 7 Lower limit signal (RLS)	0	
b10	Axis 7 Proximity dog signal (DOG)	0	
b11	Axis 7 STOP signal (STOP)	0	
b12	Axis 8 Upper limit signal (FLS)	0	
b13	Axis 8 Lower limit signal (RLS)	0	
b14	Axis 8 Proximity dog signal (DOG)	0	
b15	Axis 8 STOP signal (STOP)	0	

Buffer memory	Setting item	Default value	Meaning
b0	Axis 9 Upper limit signal (FLS)	0	"[Pr.22] Input signal logic selection" is negative logic 0: ON 1: OFF
b1	Axis 9 Lower limit signal (RLS)	0	
b2	Axis 9 Proximity dog signal (DOG)	0	
b3	Axis 9 STOP signal (STOP)	0	
b4	Axis 10 Upper limit signal (FLS)	0	
b5	Axis 10 Lower limit signal (RLS)	0	
b6	Axis 10 Proximity dog signal (DOG)	0	
b7	Axis 10 STOP signal (STOP)	0	
b8	Axis 11 Upper limit signal (FLS)	0	
b9	Axis 11 Lower limit signal (RLS)	0	
b10	Axis 11 Proximity dog signal (DOG)	0	
b11	Axis 11 STOP signal (STOP)	0	
b12	Axis 12 Upper limit signal (FLS)	0	
b13	Axis 12 Lower limit signal (RLS)	0	
b14	Axis 12 Proximity dog signal (DOG)	0	
b15	Axis 12 STOP signal (STOP)	0	
b0	Axis 13 Upper limit signal (FLS)	0	"[Pr.22] Input signal logic selection" is positive logic 0: ON 1: OFF
b1	Axis 13 Lower limit signal (RLS)	0	
b2	Axis 13 Proximity dog signal (DOG)	0	
b3	Axis 13 STOP signal (STOP)	0	
b4	Axis 14 Upper limit signal (FLS)	0	
b5	Axis 14 Lower limit signal (RLS)	0	
b6	Axis 14 Proximity dog signal (DOG)	0	
b7	Axis 14 STOP signal (STOP)	0	
b8	Axis 15 Upper limit signal (FLS)	0	
b9	Axis 15 Lower limit signal (RLS)	0	
b10	Axis 15 Proximity dog signal (DOG)	0	
b11	Axis 15 STOP signal (STOP)	0	
b12	Axis 16 Upper limit signal (FLS)	0	
b13	Axis 16 Lower limit signal (RLS)	0	
b14	Axis 16 Proximity dog signal (DOG)	0	
b15	Axis 16 STOP signal (STOP)	0	

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 System control data

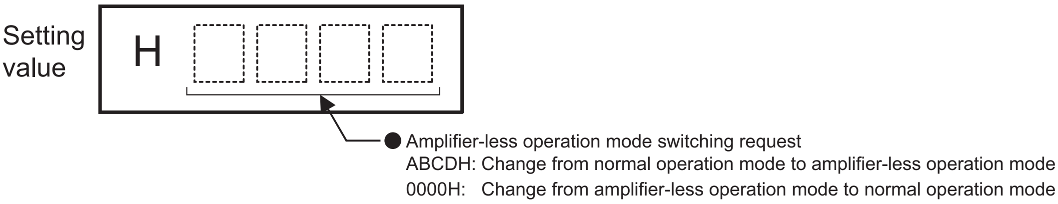
[Cd.137] Amplifier-less operation mode switching request

- Sets the switching request of the normal operation mode and amplifier-less operation mode.

Fetch cycle: Operation cycle

■Setting value

- Set with a hexadecimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 System control data

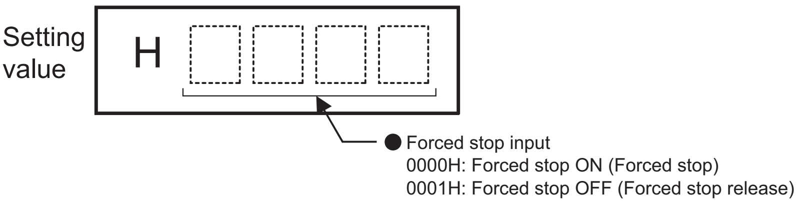
[Cd.158] Forced stop input

- Sets the forced stop information.

Fetch cycle: Operation cycle

■Setting value

- Set with a hexadecimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 System control data

[Cd.700] Virtual servo amplifier operation command

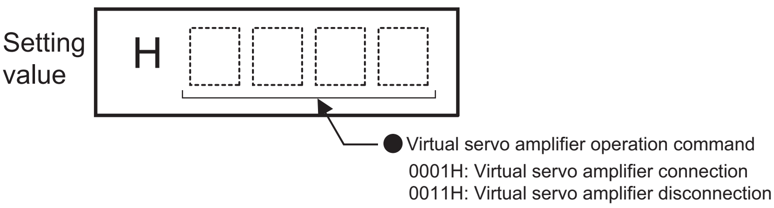
Set the operation request according to an operation.

Fetch cycle: 16.0 [ms]

■Setting value

- Set with a hexadecimal.

After the processing is completed, "0" is stored.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 System control data

[Cd.701] Virtual servo amplifier operation station specification

Set a station No. where a virtual servo amplifier is connected or disconnected by the virtual servo amplifier operation command.

Fetch cycle: At request

Point

- The following requests are ignored.

[Connection request]

Virtual servo amplifier connection request for a station where a virtual servo amplifier has already been connected

Virtual servo amplifier connection request for a station where a virtual servo amplifier cannot be connected

[Disconnection request]

Virtual servo amplifier disconnection request for a station where no virtual servo amplifier is connected

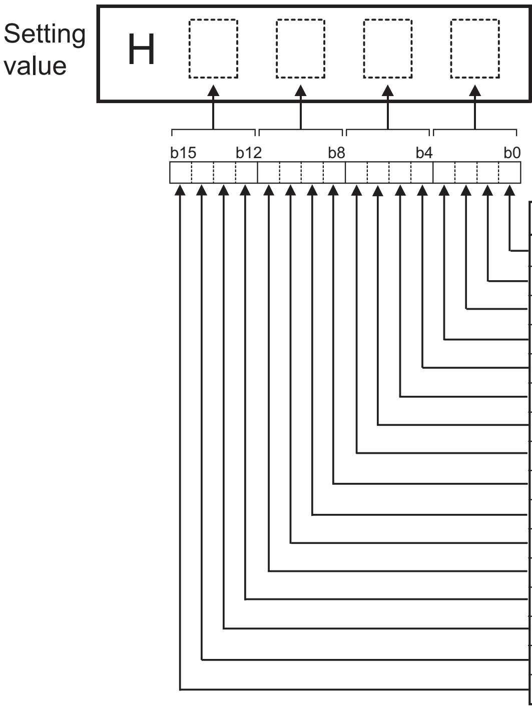
Virtual servo amplifier disconnection request for a station where only virtual servo amplifiers can be connected

- If the following request is issued, the warning "Virtual servo amplifier operation warning" (warning code: 0C84H) occurs and the target axis is not connected or disconnected.

Virtual servo amplifier connection/disconnection request for a station where "Baton pass status of each station" (SW00A0 to SW00A7) is set to "Baton pass normal station"

■Setting value

- Set with a hexadecimal.



Stored items		Meaning
b0	Station 1	0: Connection/disconnection not commanded 1: Connection/disconnection commanded
b1	Station 2	
b2	Station 3	
b3	Station 4	
b4	Station 5	
b5	Station 6	
b6	Station 7	
b7	Station 8	
b8	Station 9	
b9	Station 10	
b10	Station 11	
b11	Station 12	
b12	Station 13	
b13	Station 14	
b14	Station 15	
b15	Station 16	

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 System control data

Axis control data

Item	Default value
[Cd.3] Positioning start No.	0
[Cd.4] Positioning starting point No.	0
[Cd.5] Axis error reset	0
[Cd.6] Restart command	0
[Cd.7] M code OFF request	0
[Cd.8] External command valid	0
[Cd.9] New current value	0
[Cd.10] New acceleration time value	0
[Cd.11] New deceleration time value	0
[Cd.12] Acceleration/deceleration time change value during speed change, enable/disable	0
[Cd.13] Positioning operation speed override	100
[Cd.14] New speed value	0
[Cd.15] Speed change request	0
[Cd.16] Inching movement amount	0
[Cd.17] JOG speed	0
[Cd.18] Interrupt request during continuous operation	0
[Cd.19] Home position return request flag OFF request	0
[Cd.20] Manual pulse generator 1 pulse input magnification	1
[Cd.21] Manual pulse generator enable flag	0
[Cd.22] New torque value/forward new torque value	0
[Cd.23] Speed-position switching control movement amount change register	0
[Cd.24] Speed-position switching enable flag	0
[Cd.25] Position-speed switching control speed change register	0
[Cd.26] Position-speed switching enable flag	0
[Cd.27] Target position change value (New address)	0
[Cd.28] Target position change value (New speed)	0
[Cd.29] Target position change request flag	0
[Cd.30] Simultaneous starting own axis start data No.	0
[Cd.31] Simultaneous starting axis start data No.1	0
[Cd.32] Simultaneous starting axis start data No.2	0
[Cd.33] Simultaneous starting axis start data No.3	0
[Cd.34] Step mode	0
[Cd.35] Step valid flag	0
[Cd.36] Step start information	0
[Cd.37] Skip command	0
[Cd.38] Teaching data selection	0
[Cd.39] Teaching positioning data No.	0
[Cd.40] ABS direction in degrees	0
[Cd.43] Simultaneous starting axis	0000H
[Cd.45] Speed-position switching device selection	3
[Cd.46] Speed-position switching command	0
[Cd.100] Servo OFF command	0
[Cd.101] Torque output setting value	0
[Cd.108] Gain switching command flag	0
[Cd.112] Torque change function switching request	0
[Cd.113] New reverse torque value	0
[Cd.130] Servo parameter read/write request	0
[Cd.131] Parameter No. (Object index for servo parameters to be changed)	0000H
[Cd.132] Change data	0
[Cd.136] PI-PID switching request	0
[Cd.138] Control mode switching request	0

Item	Default value
[Cd.139] Control mode setting	0
[Cd.140] Command speed at speed control mode	0
[Cd.141] Acceleration time at speed control mode	1000
[Cd.142] Deceleration time at speed control mode	1000
[Cd.143] Command torque at torque control mode	0
[Cd.144] Torque time constant at torque control mode (Forward direction)	1000
[Cd.145] Torque time constant at torque control mode (Negative direction)	1000
[Cd.146] Speed limit value at torque control mode	1
[Cd.180] Axis stop	0
[Cd.181] Forward run JOG start	0
[Cd.182] Reverse run JOG start	0
[Cd.183] Execution prohibition flag	0

For labels, refer to the following.

☞ Page 437 Axis control data

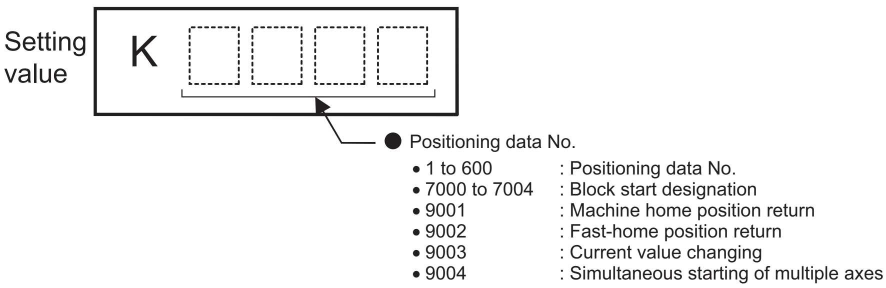
[Cd.3] Positioning start No.

- Sets the positioning start No. (Only 1 to 600 for the Pre-reading start function. For details, refer to ☞ Page 268 Pre-reading start function.)

Fetch cycle: At start

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

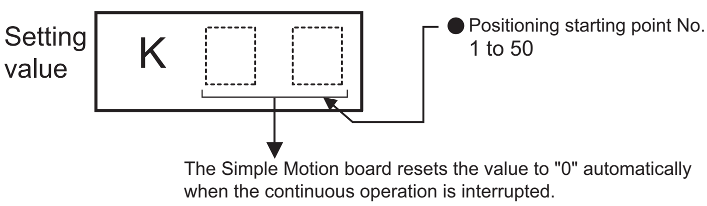
[Cd.4] Positioning starting point No.

- Sets a "starting point No." (1 to 50) if block start data is used for positioning. (Handled as "1" if the value other than 1 to 50 is set.)

Fetch cycle: At start

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

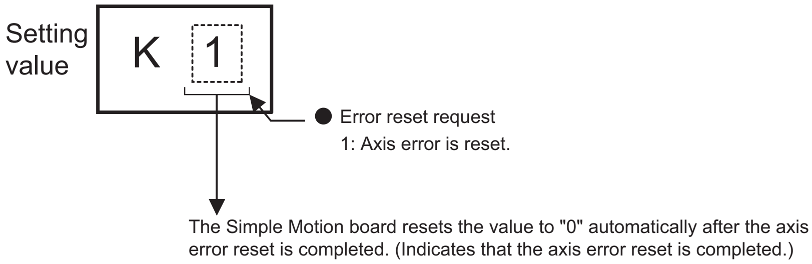
[Cd.5] Axis error reset

- Clears the axis error detection, axis error No., axis warning detection and axis warning No.
- When the axis operation state of Simple Motion board is "in error occurrence", the error is cleared and the Simple Motion board is returned to the "waiting" state.
- Clears the both of Simple Motion board errors and servo amplifier alarms by axis error reset. (Some servo amplifier alarms cannot be reset even if error reset is requested. At the time, "0" is not stored in [Cd.5] by the Simple Motion board. It remains "1". Set "0" in [Cd.5] and then set "1" to execute the error reset again by user side. For details, refer to each servo amplifier instruction manual.)
- The error cannot be reset during a forced stop. Execute the axis error reset after the forced stop is released.

Fetch cycle: 16.0 [ms]

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

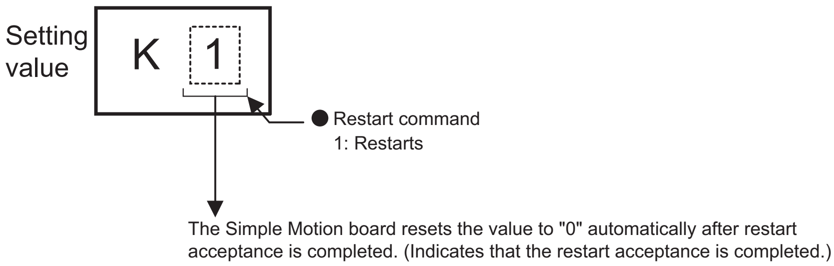
[Cd.6] Restart command

- When "1" is set in [Cd.6] after the positioning is stopped for any reason (while the axis operation state is "stopped"), the positioning will be carried out again from the stop position to the end point of the stopped positioning data.

Fetch cycle: 16.0 [ms]

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

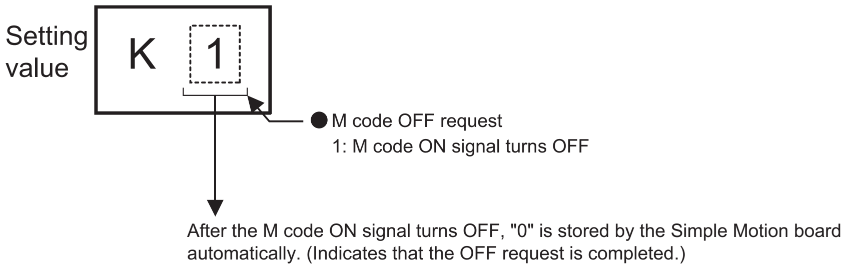
[Cd.7] M code OFF request

• The M code ON signal turns OFF.

Fetch cycle: Operation cycle

■Setting value

• Set with a decimal.



• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

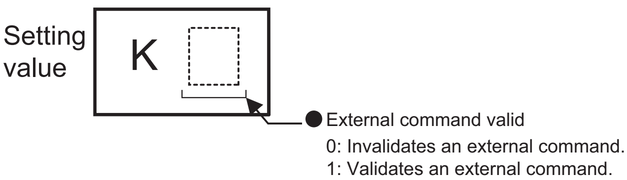
[Cd.8] External command valid

• Validates or invalidates external command signals.

Fetch cycle: At request by external command signal

■Setting value

• Set with a decimal.



• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.9] New current value

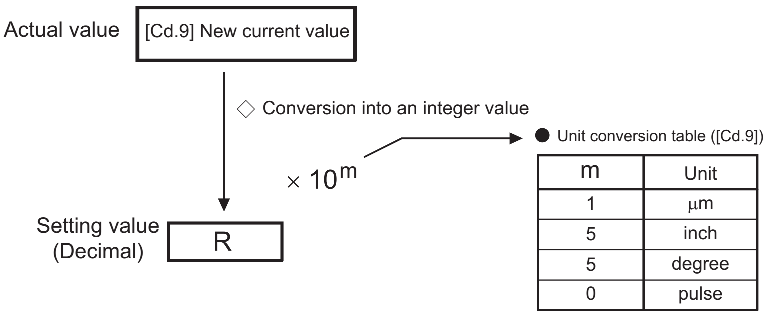
- When changing the "Feed current value" using the start No. "9003", use this data item to specify a new feed value.
- The setting value range differs according to the "[Pr.1] Unit setting".

[Pr.1] Unit setting	mm ($\times 10^{-1}$ μm)	inch ($\times 10^{-5}$ inch)	degree ($\times 10^{-5}$ degree)	pulse (pulse)
Setting range	-2147483648 to 2147483647	-2147483648 to 2147483647	0 to 35999999	-2147483648 to 2147483647

Fetch cycle: At change request

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.10] New acceleration time value

- When changing the acceleration time during a speed change, use this data item to specify a new acceleration time.

Setting range of [Cd.10] (unit)
0 to 8388608 (ms)

Fetch cycle: At change request

■Setting value

- Set with a decimal.

Setting value: [Cd.10] New acceleration time value / [Cd.11] New deceleration time value

Example: When the "[Cd.10] New acceleration time value" is set as "60000 ms", the buffer memory stores "60000".

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.11] New deceleration time value

• When changing the deceleration time during a speed change, use this data item to specify a new deceleration time.

Setting range of [Cd.11] (unit)
0 to 8388608 (ms)

Fetch cycle: At change request

■Setting value

Refer to "[Cd.10] New acceleration time value".

☞ Page 553 [Cd.10] New acceleration time value

• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.12] Accel/decel[*1] time change value during speed change, enable/disable

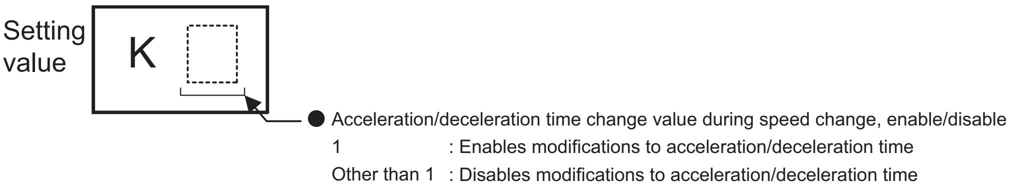
*1 "Accel/decel" is an abbreviation for "Acceleration/deceleration".

• Enables or disables modifications to the acceleration/deceleration time during a speed change.

Fetch cycle: At change request

■Setting value

• Set with a decimal.



• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.13] Positioning operation speed override

• To use the positioning operation speed override function, use this data item to specify an "override" value.

If the command speed is set to less than the minimum unit using the override function, the speed is raised to the minimum unit and the warning "Less than minimum speed" (warning code: 0904H) occurs.

If the override value "0 (%)" is set, the speed is set to "0" and the speed change 0 flag is set to "1". At the time, the warning "Less than minimum speed" (warning code: 0904H) does not occur.

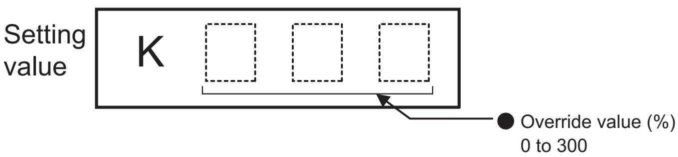
For details of the override function, refer to the following.

☞ Page 256 Override function

Fetch cycle: Operation cycle

■Setting value

• Set with a decimal.



• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.14] New speed value

- When changing the speed, use this data item to specify a new speed.
- The operation halts if you specify "0".
- The setting value range differs according to the "[Pr.1] Unit setting".

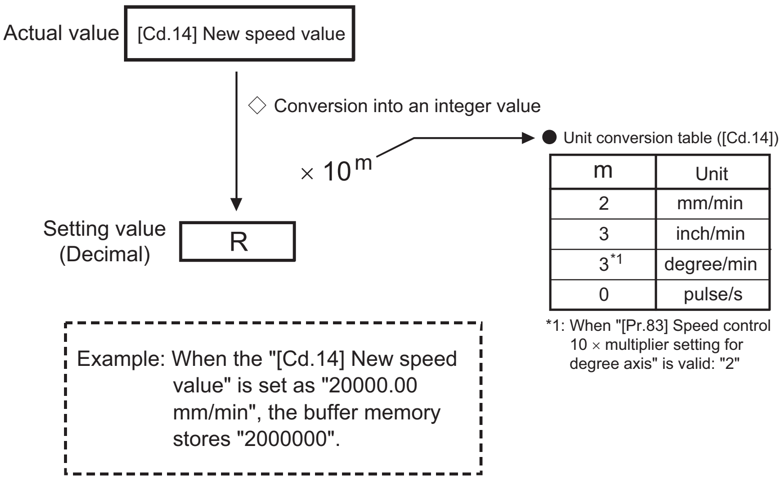
[Pr.1] Unit setting	mm ($\times 10^{-2}$ mm/min)	inch ($\times 10^{-3}$ inch/min)	degree*1 ($\times 10^{-3}$ degree/min)	pulse (pulse/s)
Setting range	0 to 2000000000	0 to 2000000000	0 to 2000000000	0 to 1000000000

*1 When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid, the setting range is 0 to 2000000000 ($\times 10^{-2}$ degree/min).

Fetch cycle: At change request

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

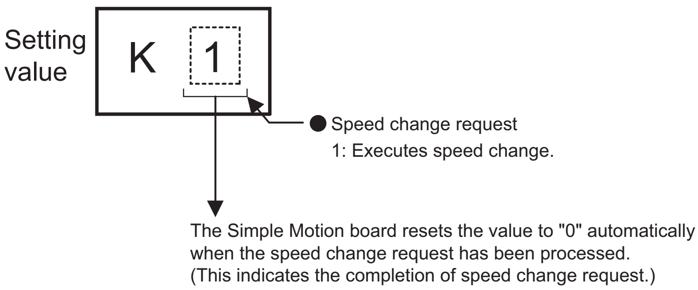
[Cd.15] Speed change request

After setting the "[Cd.14] New speed value", set this data item to "1" to execute the speed change (through validating the new speed value).

Fetch cycle: Operation cycle

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.16] Inching movement amount

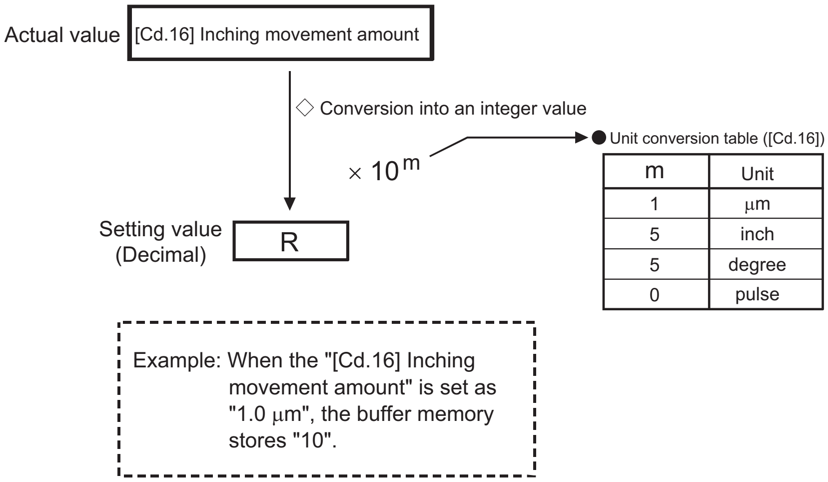
- Use this data item to set the amount of movement by inching.
- The machine performs a JOG operation if "0" is set.
- Set a value within the following range:

[Pr.1] Unit setting	mm ($\times 10^{-1}$ µm)	inch ($\times 10^{-5}$ inch)	degree ($\times 10^{-5}$ degree)	pulse (pulse)
Setting range	0 to 65535	0 to 65535	0 to 65535	0 to 65535

Fetch cycle: At start

■Setting value

- Set with a decimal.



m	Unit
1	µm
5	inch
5	degree
0	pulse

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.17] JOG speed

- Use this data item to set the JOG speed.
- The setting value range differs according to the "[Pr.1] Unit setting".

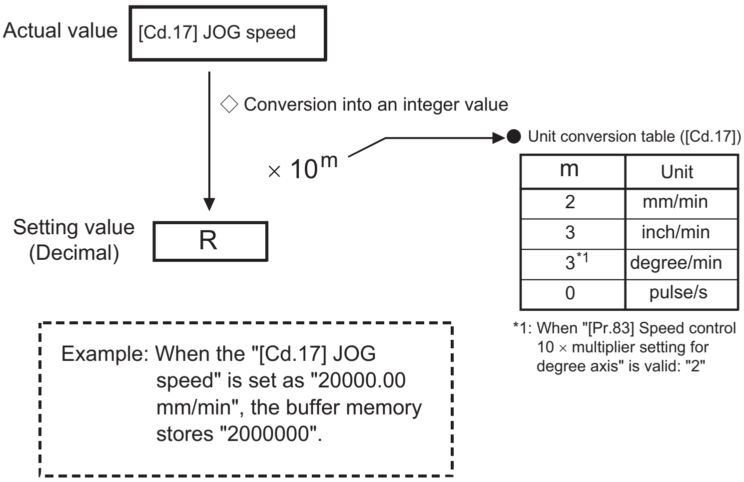
[Pr.1] Unit setting	mm (× 10^{-2} mm/min)	inch (× 10^{-3} inch/min)	degree*1 (× 10^{-3} degree/min)	pulse (pulse/s)
Setting range	1 to 2000000000	1 to 2000000000	1 to 2000000000	1 to 1000000000

*1 When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid, the setting range is 1 to 2000000000 (× 10^{-2} degree/min).

Fetch cycle: At start

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

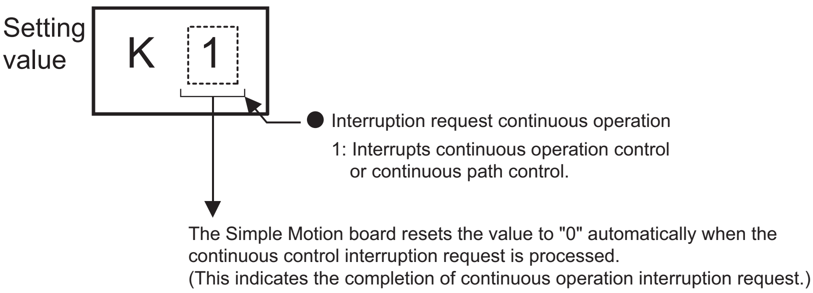
[Cd.18] Interrupt request during continuous operation

- To interrupt a continuous operation, set "1" to this data item.
- After processing the interruption request ("1"), the Simple Motion board automatically resets the value to "0".

Fetch cycle: Operation cycle

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.19] Home position return request flag OFF request

• The user program can use this data item to forcibly turn the home position return request flag from ON to OFF.

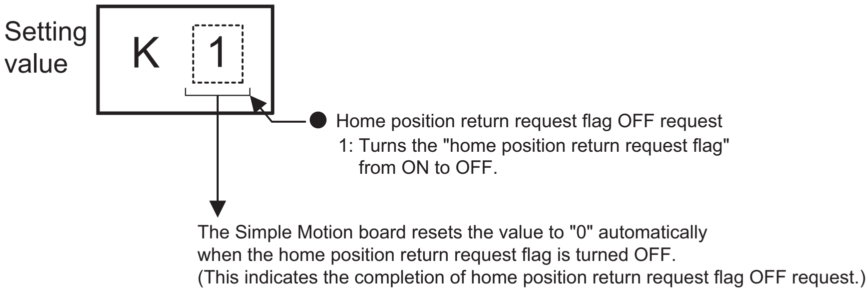
Fetch cycle: 16.0 [ms]

Point

This parameter is made valid when the increment system is valid.

■Setting value

• Set with a decimal.



• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.20] Manual pulse generator 1 pulse input magnification

• This data item determines the factor by which the number of pulses from the manual pulse generator is magnified.

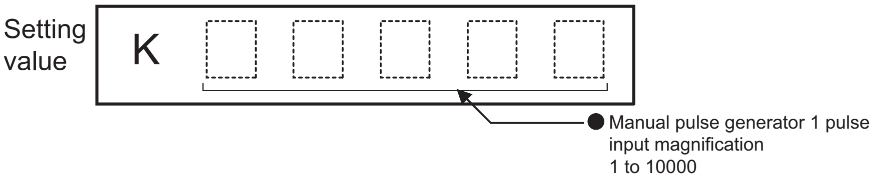
• Value "0": read as "1".

• Value "10001 or more" or negative value: read as "10000".

Fetch cycle: Operation cycle (At manual pulse generator enabled)

■Setting value

• Set with a decimal.



• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

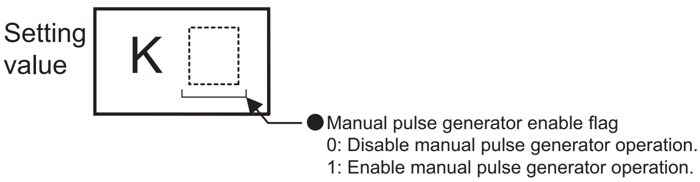
[Cd.21] Manual pulse generator enable flag

• This data item enables or disables operations using a manual pulse generator.

Fetch cycle: Operation cycle

■Setting value

• Set with a decimal.



• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

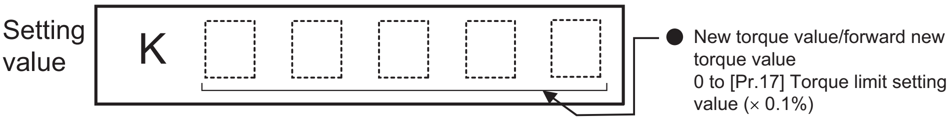
[Cd.22] New torque value/forward new torque value

- When "0" is set to "[Cd.112] Torque change function switching request", a new torque limit value is set. (This value is set to the forward torque limit value and reverse torque limit value.) When "1" is set to "[Cd.112] Torque change function switching request", a new forward torque limit value is set.
- Set a value within "0" to "[Pr.17] Torque limit setting value". Set a ratio against the rated torque in 0.1% unit. (The new torque value is invalid when "0" is set, and "[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value" becomes valid. The range of torque change is 1 to "[Pr.17] Torque limit setting value".)

Fetch cycle: Operation cycle

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.23] Speed-position switching control movement amount change register

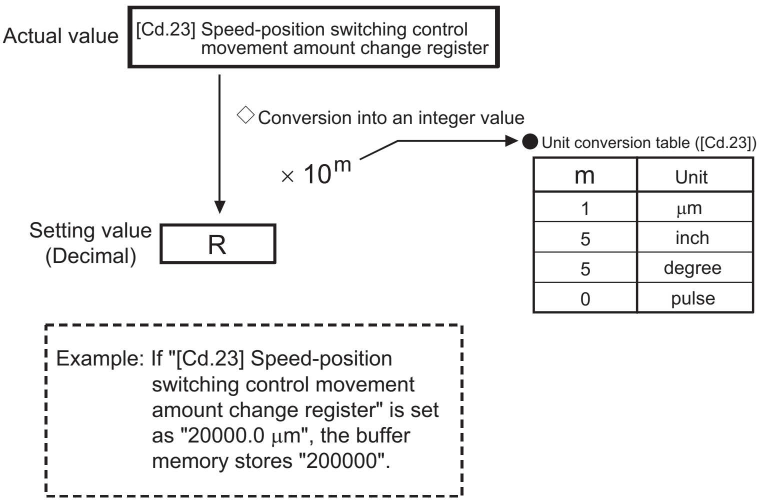
- During the speed control stage of the speed-position switching control (INC mode), it is possible to change the specification of the movement amount during the position control stage. For that, use this data item to specify a new movement amount.
- The new movement amount has to be set during the speed control stage of the speed-position switching control (INC mode).
- The value is reset to "0" when the next operation starts.
- Set a value within the following range:

[Pr.1] Unit setting	mm ($\times 10^{-1}$ µm)	inch ($\times 10^{-5}$ inch)	degree ($\times 10^{-5}$ degree)	pulse (pulse)
Setting range	0 to 2147483647	0 to 2147483647	0 to 2147483647	0 to 2147483647

Fetch cycle: At switching request

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

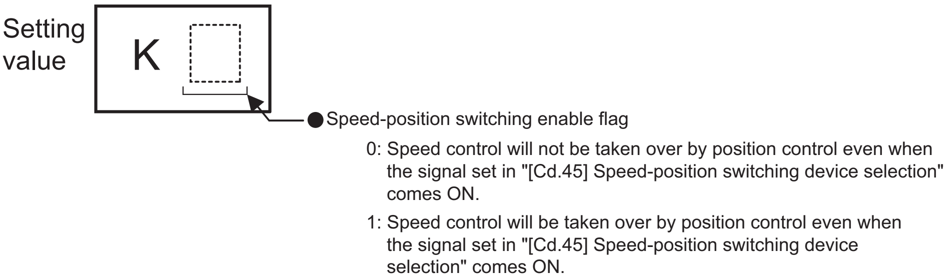
[Cd.24] Speed-position switching enable flag

- Sets whether the switching signal set in "[Cd.45] Speed-position switching device selection" is enabled or not.

Fetch cycle: At switching request

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.25] Position-speed switching control speed change register

- During the position control stage of the position-speed switching control, it is possible to change the specification of the speed during the speed control stage. For that, use this data item to specify a new speed.
- The new speed has to be set during the position control stage of the position-speed switching control.
- The value is reset to "0" when the next operation starts.
- The setting value range differs according to the "[Pr.1] Unit setting".

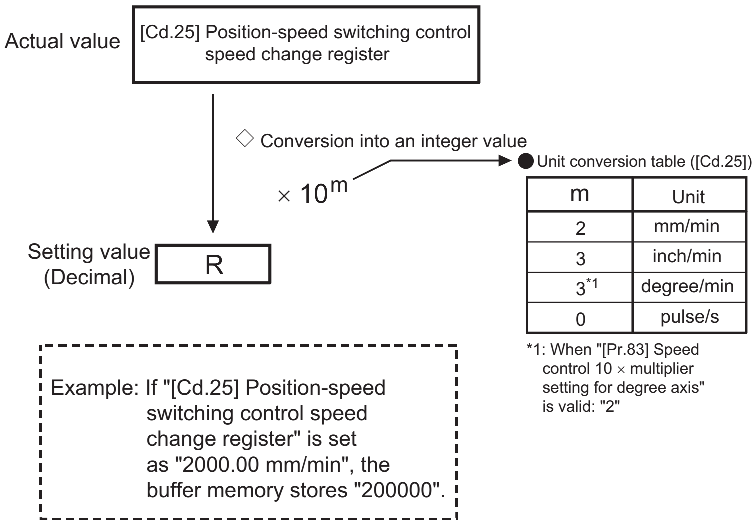
[Pr.1] Unit setting	mm (× 10^{-2} mm/min)	inch (× 10^{-3} inch/min)	degree*1 (× 10^{-3} degree/min)	pulse (pulse/s)
Setting range	0 to 2000000000	0 to 2000000000	0 to 2000000000	0 to 1000000000

*1 When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid, the setting range is 0 to 2000000000 (× 10^{-2} degree/min).

Fetch cycle: At switching request

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

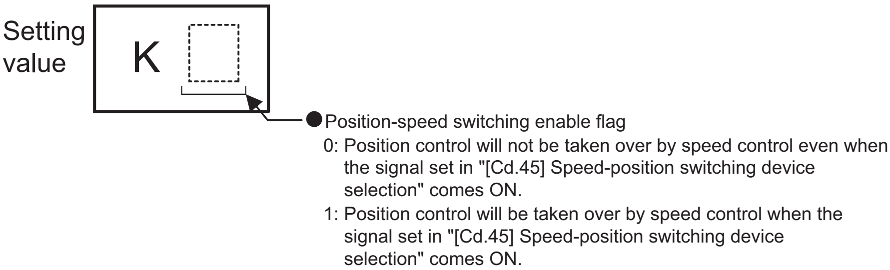
[Cd.26] Position-speed switching enable flag

• Sets whether the switching signal set in "[Cd.45] Speed-position switching device selection" is enabled or not.

Fetch cycle: At switching request

■Setting value

• Set with a decimal.



• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.27] Target position change value (New address)

• When changing the target position during a positioning operation, use this data item to specify a new positioning address.

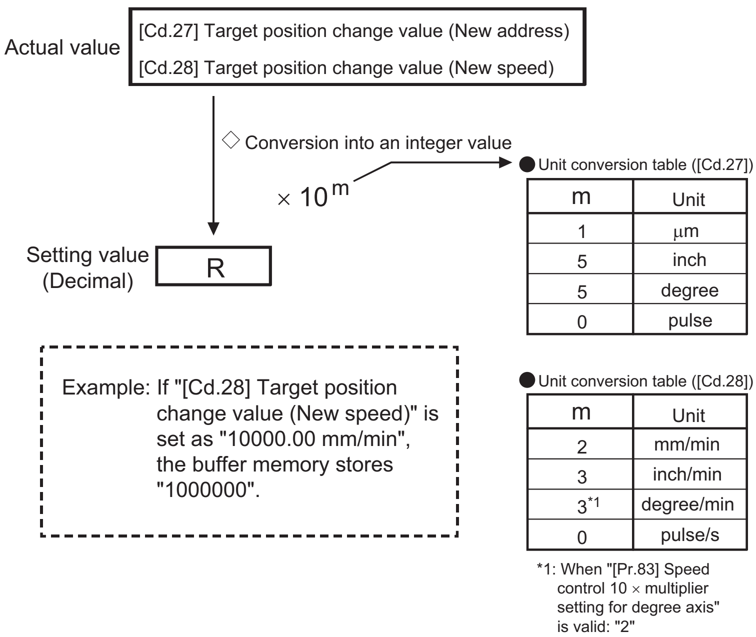
• The setting value range differs according to the "[Pr.1] Unit setting".

[Pr.1] Unit setting	mm ($\times 10^{-1}$ μm)	inch ($\times 10^{-5}$ inch)	degree ($\times 10^{-5}$ degree)	pulse (pulse)
ABS	-2147483648 to 2147483647	-2147483648 to 2147483647	0 to 35999999	-2147483648 to 2147483647
INC	-2147483648 to 2147483647	-2147483648 to 2147483647	-2147483648 to 2147483647	-2147483648 to 2147483647

Fetch cycle: At change request

■Setting value

• Set with a decimal.



Unit conversion table ([Cd.27])

m	Unit
1	μm
5	inch
5	degree
0	pulse

Unit conversion table ([Cd.28])

m	Unit
2	mm/min
3	inch/min
3*1	degree/min
0	pulse/s

*1: When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: "2"

• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.28] Target position change value (New speed)

- When changing the target position during a positioning operation, use this data item to specify a new speed.
- The speed will not change if "0" is set.
- The setting value range differs according to the "[Pr.1] Unit setting".

[Pr.1] Unit setting	mm ($\times 10^{-2}$ mm/min)	inch ($\times 10^{-3}$ inch/min)	degree*1 ($\times 10^{-3}$ degree/min)	pulse (pulse/s)
Setting range	0 to 2000000000	0 to 2000000000	0 to 2000000000	0 to 1000000000

*1 When "[Pr.83] Speed control 10 $\times$ multiplier setting for degree axis" is valid, the setting range is 0 to 2000000000 ($\times 10^{-2}$ degree/min).

Fetch cycle: At change request

■Setting value

Refer to "[Cd.27] Target position change value (New address)".

☞ Page 561 [Cd.27] Target position change value (New address)

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

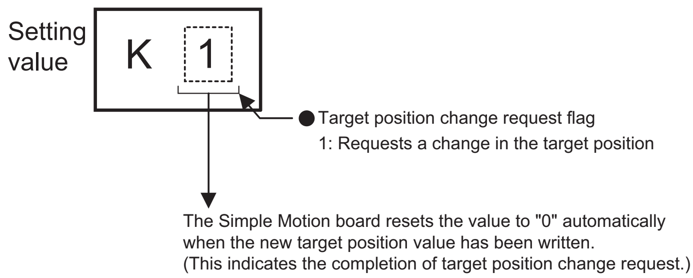
[Cd.29] Target position change request flag

- Requests a change in the target position during a positioning operation.

Fetch cycle: Operation cycle

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

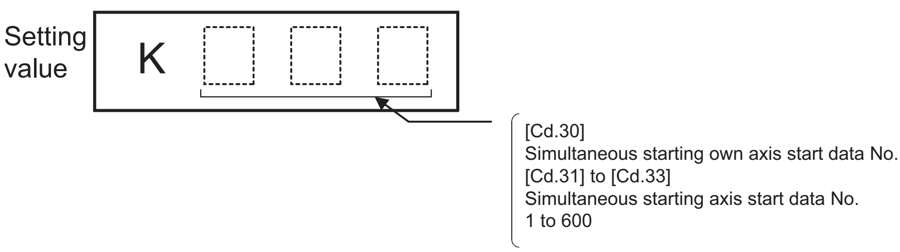
[Cd.30] Simultaneous starting own axis start data No.

- Use this data item to specify a start data No. of own axis at multiple axes simultaneous starting.

Fetch cycle: At start

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.31] Simultaneous starting axis start data No.1

- Use this data item to specify a start data No.1 for each axis that starts simultaneously.

Fetch cycle: At start

■Setting value

Refer to "[Cd.30] Simultaneous starting own axis start data No.".

☞ Page 562 [Cd.30] Simultaneous starting own axis start data No.

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.32] Simultaneous starting axis start data No.2

- Use this data item to specify a start data No.2 for each axis that starts simultaneously.

Point

For 2 axis simultaneous starting, the axis setting is not required. (Setting value is ignored.)

Fetch cycle: At start

■Setting value

Refer to "[Cd.30] Simultaneous starting own axis start data No.".

☞ Page 562 [Cd.30] Simultaneous starting own axis start data No.

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.33] Simultaneous starting axis start data No.3

- Use this data item to specify a start data No.3 for each axis that starts simultaneously.

Point

For 2 axis simultaneous starting and 3 axis simultaneous starting, the axis setting is not required. (Setting value is ignored.)

Fetch cycle: At start

■Setting value

Refer to "[Cd.30] Simultaneous starting own axis start data No.".

☞ Page 562 [Cd.30] Simultaneous starting own axis start data No.

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

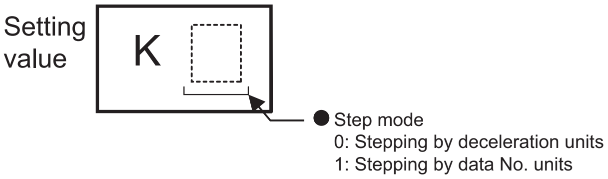
[Cd.34] Step mode

- To perform a step operation, use this data item to specify the units by which the stepping should be performed.

Fetch cycle: At start

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

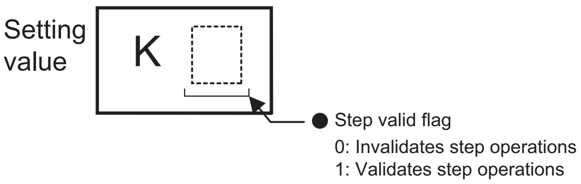
[Cd.35] Step valid flag

- This data item validates or invalidates step operations.

Fetch cycle: At start

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

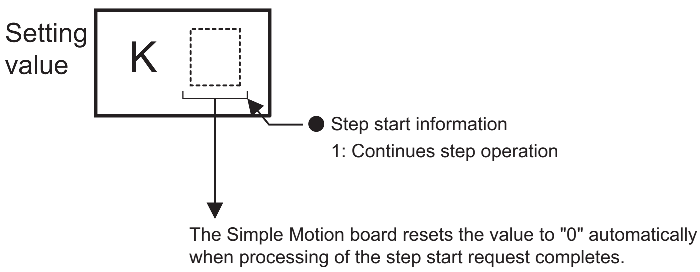
[Cd.36] Step start information

- To continue the step operation when the step function is used, set "1" in the data item.

Fetch cycle: 16.0 [ms]

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

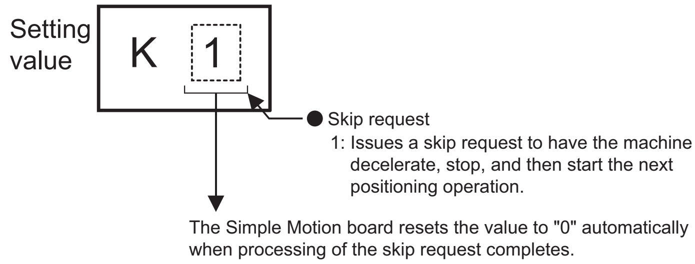
[Cd.37] Skip command

- To skip the current positioning operation, set "1" in this data item.

Fetch cycle: Operation cycle (During positioning operation)

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

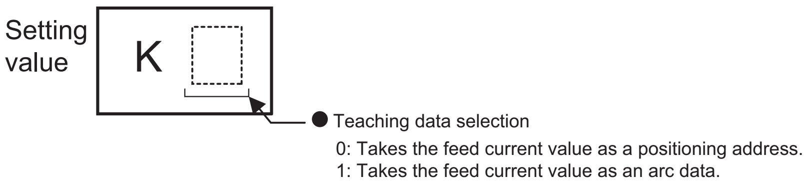
[Cd.38] Teaching data selection

- This data item specifies the teaching result write destination.
- Data are cleared to zero when the teaching ends.

Fetch cycle: At operation request

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

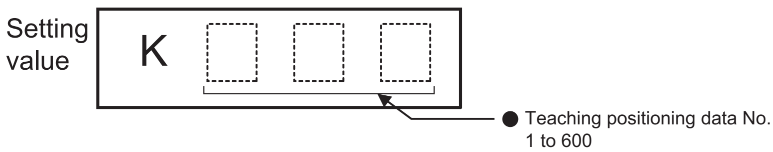
[Cd.39] Teaching positioning data No.

- This data item specifies data to be produced by teaching.
- If a value between 1 and 600 is set, a teaching operation is done.
- The value is cleared to "0" when the Simple Motion board is initialized, when a teaching operation completes, and when an illegal value (601 or higher) is entered.

Fetch cycle: 116 [ms]

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

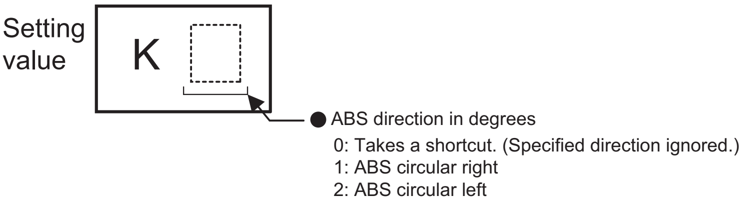
[Cd.40] ABS direction in degrees

- This data item specifies the ABS moving direction carrying out the position control when "degree" is selected as the unit.

Fetch cycle: At start

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.43] Simultaneous starting axis

- Set the number of simultaneous starting axes and target axis. When "2" is set to the number of simultaneous starting axes, set the target axis No. to the simultaneous starting axis No.1. When "3" is set to the number of simultaneous starting axes, set the target axis No. to the simultaneous starting axis No.1 and 2. When "4" is set to the number of simultaneous starting axes, set the target axis No. to the simultaneous starting axis No.1 to 3.
- When the same axis No. or axis No. of own axis is set to the multiple simultaneous starting axis No, or the value outside the range is set to the number of simultaneous starting axes, the error "Error before simultaneous start" (error code: 1990H, 1991H) occurs and the operation is not executed.

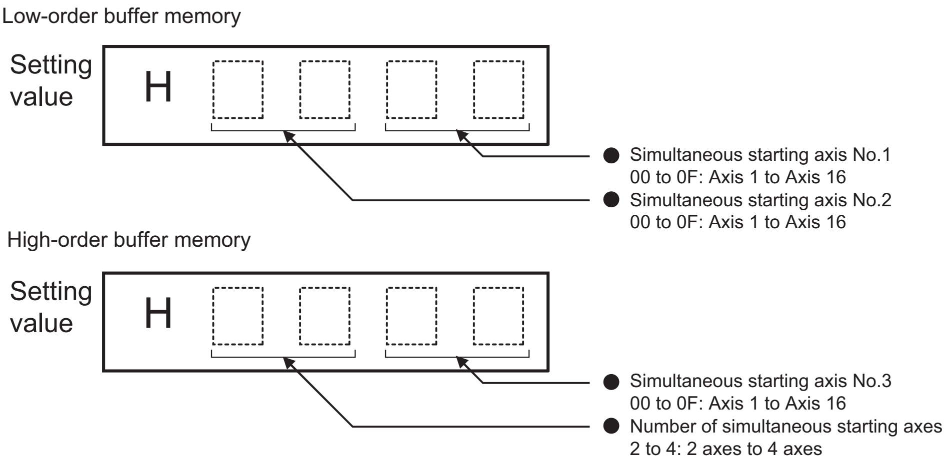
Point

Do not set the simultaneous starting axis No.2 and 3 for 2-axis interpolation, and do not set the simultaneous starting axis No.3 for 3-axis interpolation. The setting value is ignored.

Fetch cycle: At start

■Setting value

- Set with a hexadecimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.45] Speed-position switching device selection

- Select the device used for speed-position switching.

Point

If the setting is outside the range at start, operation is performed with the setting regarded as "3".

Fetch cycle: At positioning start for speed-position switching control/position-speed switching control

■Setting value

- Set with a decimal.

Setting value K

● Speed-position switching device selection
<Speed-position switching control>
1: Use the proximity dog signal for switching from speed control to position control
2: Use "[Cd.46] Speed-position switching command" for switching from speed control to position control
3: Use the link device for switching from speed control to position control
<Position-speed switching control>
1: Use the proximity dog signal for switching from position control to speed control
2: Use "[Cd.46] Speed-position switching command" for switching from position control to speed control
3: Use the link device for switching from position control to speed control

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.46] Speed-position switching command

- Speed-position control switching is performed when "2" is set in "[Cd.45] Speed-position switching device selection". Other than setting value is ignored.

Point

This parameter is made valid only when "2" is set in "[Cd.45] Speed-position switching device selection" at start.

Fetch cycle: Inter-module synchronization cycle

■Setting value

- Set with a decimal.

Setting value K

● Speed-position switching command
<Speed-position switching control>
0: Not switch from speed control to position control
1: Switch from speed control to position control
<Position-speed switching control>
0: Not switch from position control to speed control
1: Switch from position control to speed control

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.100] Servo OFF command

- Executes servo OFF for each axis.

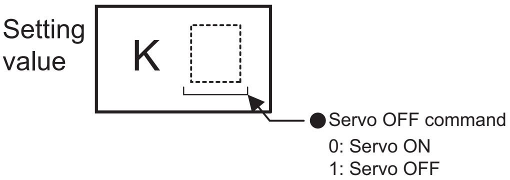
Fetch cycle: Operation cycle

Point

To execute servo ON for axes other than axis 1 being servo OFF, write "1" to storage buffer memory address of axis 1 and then turn ON all axis servo ON [Y1] signal.

■Setting value

- Set with a decimal.



Valid only during servo ON for all axes.

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.101] Torque output setting value

- Sets the torque output value. Set a ratio against the rated torque in 0.1% unit.

Fetch cycle: At start

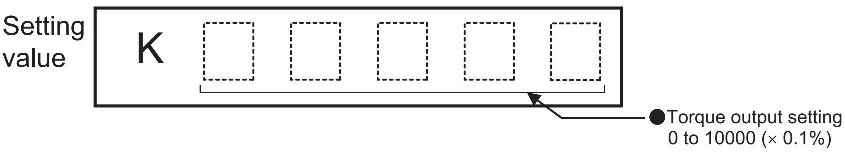
Point

- If the "[Cd.101] Torque output setting value" is "0", the "[Pr.17] Torque limit setting value" will be its value.
- If a value beside "0" is set in the "[Cd.101] Torque output setting value", the torque generated by the servomotor will be limited by that value.
- The "[Pr.17] Torque limit setting value" of the detailed parameter becomes effective at the user program READY signal leading edge.
- The "[Cd.101] Torque output setting value" (refer to the start) axis control data can be changed at all times. Therefore in the "[Cd.101] Torque output setting value" is used when you must change.

(☞ Page 261 Torque change function)

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.108] Gain switching command flag

- The command required to carry out "gain switching" of the servo amplifier from the Simple Motion board.

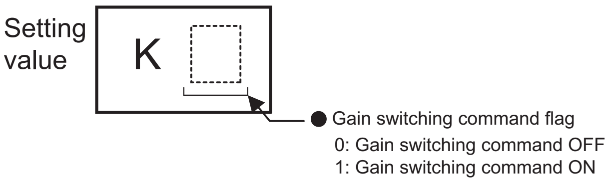
Fetch cycle: Operation cycle

Point

If the setting is other than "0" and "1", operation is performed in the "gain switching" with the setting regard as "0".
Refer to each servo amplifier instruction manual.

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.112] Torque change function switching request

- Sets "same setting/individual setting" of the forward torque limit value or reverse torque limit value in the torque change function.

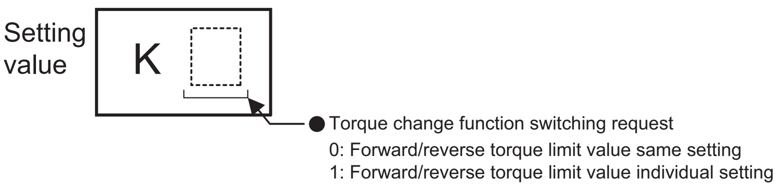
Fetch cycle: Operation cycle

Point

- Set "0" normally. (when the forward torque limit value and reverse torque limit value are not divided.)
- When a value except "1" is set, it operates as "forward/reverse torque limit value same setting".

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

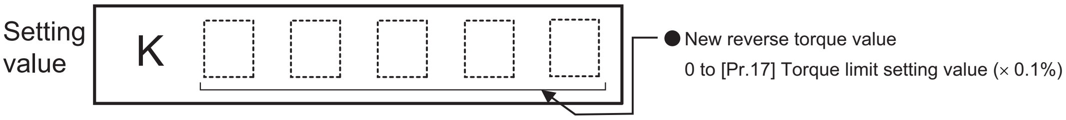
[Cd.113] New reverse torque value

- "1" is set in "[Cd.112] Torque change function switching request", a new reverse torque limit value is set. (when "0" is set in "[Cd.112] Torque change function switching request", the setting value is invalid.)
- Set a value within "0" to "[Pr.17] Torque limit setting value". Set a ratio against the rated torque in 0.1% unit. (The new torque value is invalid when "0" is set, and "[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value" becomes valid. The range of torque change is 1 to "[Pr.17] Torque limit setting value".

Fetch cycle: Operation cycle

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.130] Servo parameter read/write request

- Set the read request or the write request of a servo parameter.

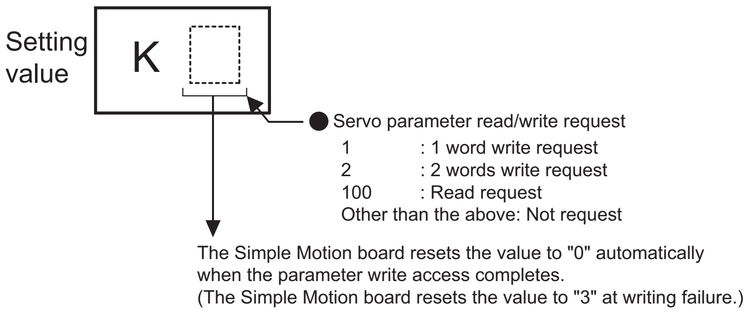
To set the read request, set "100" after setting "[Cd.131] Parameter No. (Object index for servo parameters to be changed)".
To set the write request, set "1" or "2" after setting "[Cd.131] Parameter No. (Object index for servo parameters to be changed)" and "[Cd.132] Change data".

Fetch cycle: Main cycle*1

*1 Cycle of processing executed at free time except for the positioning control. It changes by status of axis start.

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.131] Parameter No. (Object index for servo parameters to be changed)

- Set the object index corresponding to the servo parameter to be changed.

Fetch cycle: At change request

■Setting value

- Refer to the servo amplifier instruction manual for the object index list.
- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.132] Change data

- Set the change value of servo parameter set in "[Cd.131] Parameter No. (Object index for servo parameters to be changed)".

Fetch cycle: At change request

■Setting value

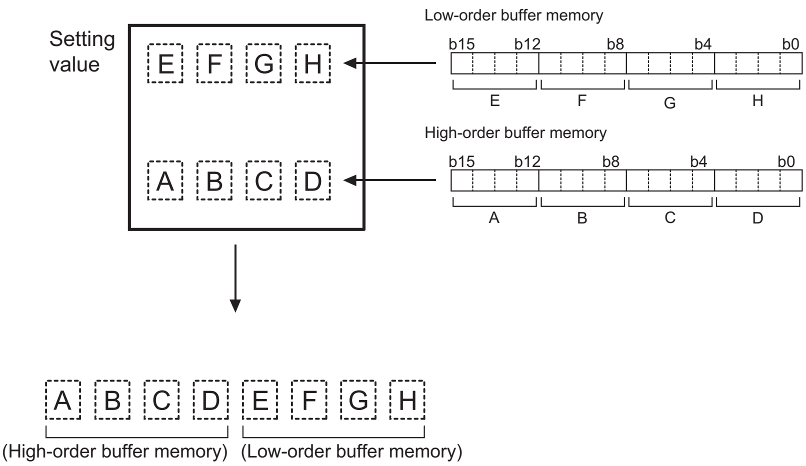
- Set with a decimal or hexadecimal.

[1 word write request]

When "1" is set in "[Cd.130] Servo parameter read/write request", set the change value to low-order buffer memory. The value set to high-order buffer memory is invalid.

[2 words write request]

When "2" is set in "[Cd.130] Servo parameter read/write request", set the change value to high-order buffer memory and low-order buffer memory.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

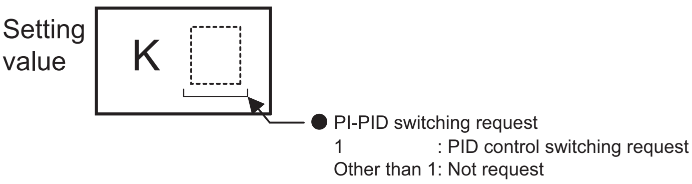
[Cd.136] PI-PID switching request

- Set the PI-PID switching to servo amplifier.

Fetch cycle: Operation cycle

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

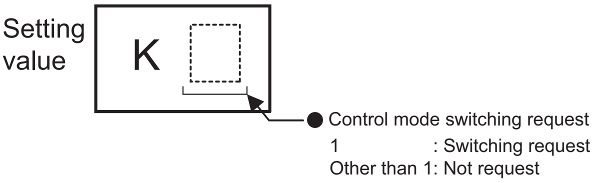
[Cd.138] Control mode switching request

- Request the control mode switching. Set "1" after setting "[Cd.139] Control mode setting".
- The Simple Motion board sets "0" at completion of control mode switching.

Fetch cycle: Operation cycle

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

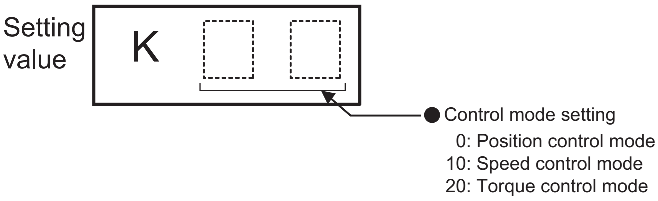
[Cd.139] Control mode setting

- Set the control mode to be changed in the speed-torque control.

Fetch cycle: At control mode switching

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.140] Command speed at speed control mode

- Set the command speed at speed control mode.
- The setting value range differs according to the "[Pr.1] Unit setting".

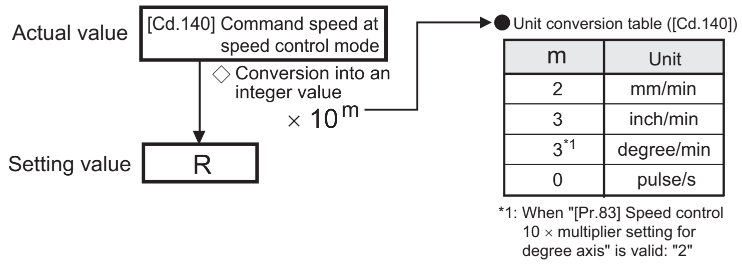
[Pr.1] Unit setting	mm (× 10^{-2} mm/min)	inch (× 10^{-3} inch/min)	degree[*1] (× 10^{-3} degree/min)	pulse (pulse/s)
Setting range	-2000000000 to 2000000000	-2000000000 to 2000000000	-2000000000 to 2000000000	-1000000000 to 1000000000

*1 When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid, the setting range is -2000000000 to 2000000000 (× 10^{-2} degree/min).

Fetch cycle: Operation cycle (At speed control mode)

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.141] Acceleration time at speed control mode

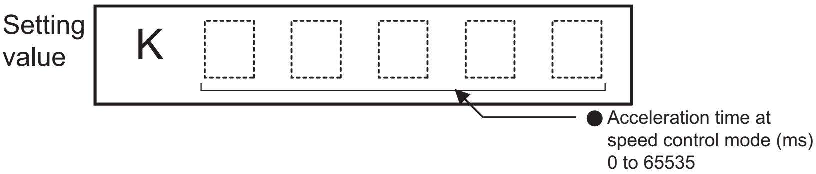
- Set the acceleration time at speed control mode. (Set the time for the speed to increase from "0" to "[Pr.8] Speed limit value".)

0 to 65535 (ms)

Fetch cycle: At control mode switching

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.142] Deceleration time at speed control mode

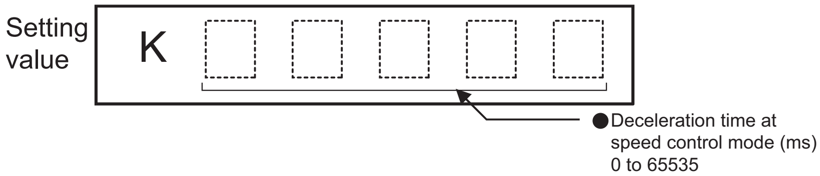
- Set the deceleration time at speed control mode. (Set the time for the speed to decrease from "[Pr.8] Speed limit value" to "0".)

0 to 65535 (ms)

Fetch cycle: At control mode switching

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.143] Command torque at torque control mode

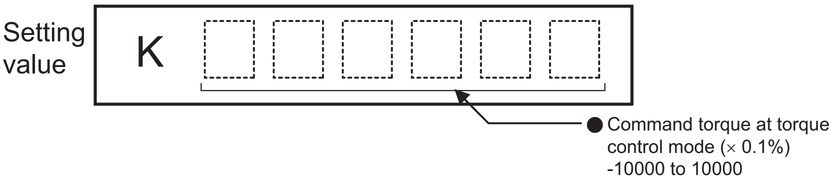
- Set the command torque at torque control mode. Set a ratio against the rated torque in 0.1% unit.

-10000 to 10000 (× 0.1%)

Fetch cycle: Operation cycle (At torque control mode)

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.144] Torque time constant at torque control mode (Forward direction)

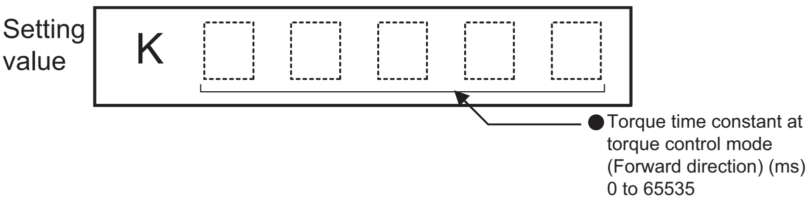
- Set the time constant at driving during torque control mode. (Set the time for the torque to increase from "0" to "[Pr.17] Torque limit setting value".)

0 to 65535 (ms)

Fetch cycle: At control mode switching

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.145] Torque time constant at torque control mode (Negative direction)

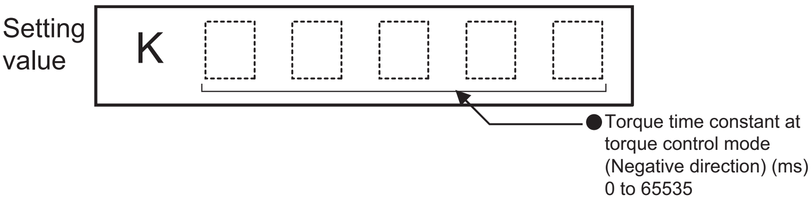
- Set the time constant at regeneration during torque control mode. (Set the time for the torque to decrease from "[Pr.17] Torque limit setting value" to "0".)

0 to 65535 (ms)

Fetch cycle: At control mode switching

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

[Cd.146] Speed limit value at torque control mode

- Set the speed limit value at torque control mode.
- The setting value range differs according to the "[Pr.1] Unit setting".

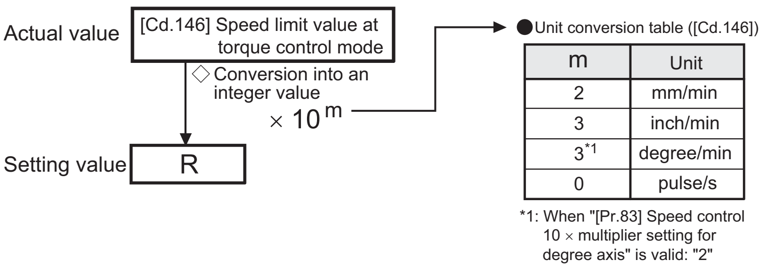
[Pr.1] Unit setting	mm ($\times 10^{-2}$ mm/min)	inch ($\times 10^{-3}$ inch/min)	degree*1 ($\times 10^{-3}$ degree/min)	pulse (pulse/s)
Setting range	0 to 2000000000	0 to 2000000000	0 to 2000000000	0 to 1000000000

*1 When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid, the setting range is 0 to 2000000000 ($\times 10^{-2}$ degree/min).

Fetch cycle: Operation cycle (At torque control mode)

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

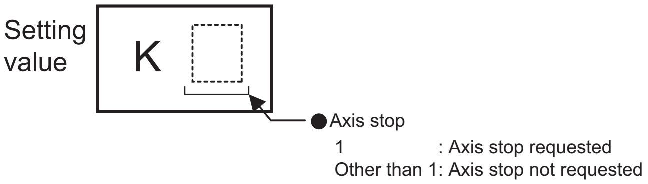
[Cd.180] Axis stop

- When the axis stop signal turns ON, the home position return control, positioning control, JOG operation, inching operation, manual pulse generator operation, speed-torque control, etc. will stop.
- By turning the axis stop signal ON during positioning operation, the positioning operation will be "stopped".
- Whether to decelerate stop or rapidly stop can be selected with "[Pr.39] Stop group 3 rapid stop selection".
- During interpolation control of the positioning operation, if the axis stop signal of any axis turns ON, all axes in the interpolation control will decelerate and stop.

Fetch cycle: Operation cycle

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

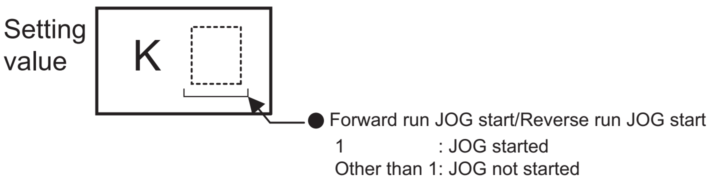
[Cd.181] Forward run JOG start, [Cd.182] Reverse run JOG start

- When the JOG start signal is ON, JOG operation will be carried out at the "[Cd.17] JOG speed". When the JOG start signal turns OFF, the operation will decelerate and stop.
- When inching movement amount is set, the designated movement amount is output for one operation cycle and then the operation stops.

Fetch cycle: Operation cycle

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

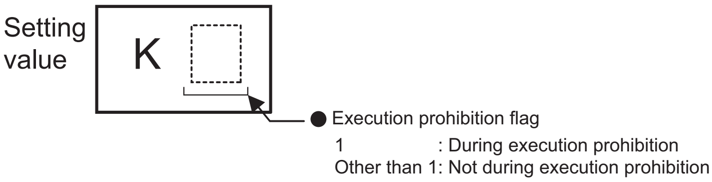
[Cd.183] Execution prohibition flag

- If the execution prohibition flag is ON when the positioning start signal turns ON, positioning control does not start until the execution prohibition flag turns OFF. Used with the "Pre-reading start function". (☞ Page 268 Pre-reading start function)

Fetch cycle: At start

■Setting value

- Set with a decimal.



- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

12.9 Memory Configuration and Data Process

The memory configuration and data transmission of Simple Motion board are explained in this section.
The Simple Motion board is configured of four memories. By understanding the configuration and roles of two memories, the internal data transmission process of Simple Motion board, such as "when the power is turned ON" or "when the user program READY signal changes from OFF to ON", can be easily understood. This also allows the transmission process to be carried out correctly when saving or changing the data.

Configuration and roles

The Simple Motion board is configured of the following four memories.
○: Setting and storage area provided, Not possible: Data is lost when power is turned OFF.
—: Setting and storage area not provided, Possible: Data is held even when power is turned OFF.

Memory configuration	Role	Area configuration			
		Parameter area	Monitor data area	Control data area	Positioning data area (No.1 to 600)
Buffer memory	Area that can be directly accessed with a user program with a host personal computer	○	○	○	○
Internal memory	Area that can be set only using buffer memory	—	—	—	—
Flash ROM	Area for backing up data required for positioning	○	—	—	○
Internal memory (nonvolatile)	Area for backing up cam data	—	—	—	—

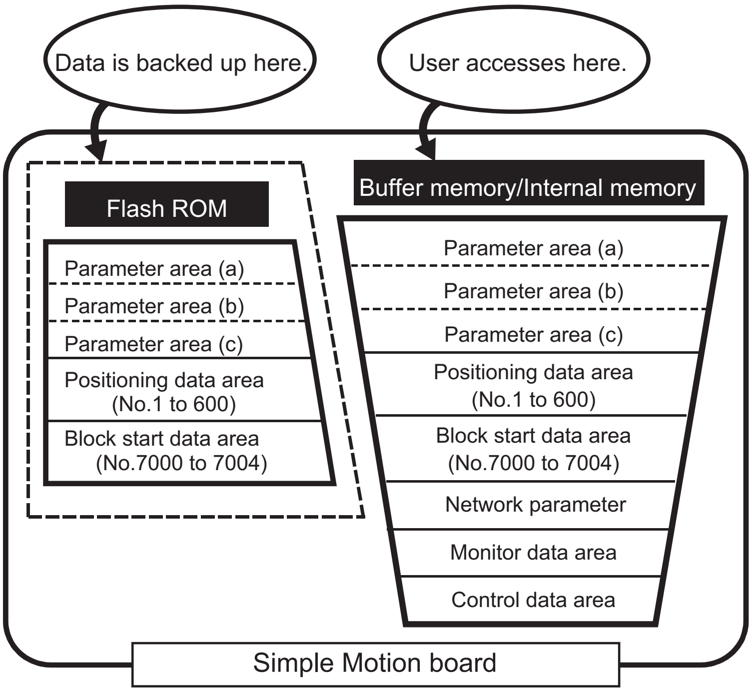
Memory configuration	Role	Area configuration			Backup
		Block start data area (No.7000 to 7004)	Synchronous control area	Cam area	
Buffer memory	Area that can be directly accessed with a user program with a host personal computer	○	○	—	Not possible
Internal memory	Area that can be set only using buffer memory	—	—	○	Not possible
Flash ROM	Area for backing up data required for positioning	○	○*1	—	Possible
Internal memory (nonvolatile)	Area for backing up cam data	—	—	○	Possible

*1 Parameter only

Details of areas

Area name	Description
Parameter area	Area where parameters, such as positioning parameters and home position return parameters, required for positioning control are set and stored.
Monitor data area	Area where the operation status of positioning system is stored.
Control data area	Area where data for operating and controlling positioning system is set and stored.
Positioning data area (No.1 to 600)	Area where positioning data No.1 to 600 is set and stored.
Block start data area (No.7000 to 7004)	Area where information required only when carrying out block No.7000 to 7004 high-level positioning is set and stored.
Synchronous control area[*1]	Area where parameters and control data required for synchronous control are set and stored. Also, the operation status of synchronous control is stored.
Cam area[*1]	Area where cam data, etc. are set and stored. There are cam storage area and cam open area.

*1 Refer to the following for details of synchronous control area and cam area.
Simple Motion Board User's Manual (Advanced Synchronous Control)



Area name	Description	
Parameter area (a)	Parameters validated when user program READY signal [Y0] changes from OFF to ON	[Pr.1] to [Pr.7], [Pr.11] to [Pr.22], [Pr.43] to [Pr.46], [Pr.51], [Pr.52], [Pr.55], [Pr.81] to [Pr.83], [Pr.90], [Pr.100], [Pr.101], [Pr.116] to [Pr.119], [Pr.122], [Pr.123], [Pr.700] to [Pr.704], [Pr.801], [Pr.805] to [Pr.807], [Pr.900] to [Pr.903], [Pr.910] to [Pr.913], [Pr.920] to [Pr.923], [Pr.930] to [Pr.933], [Pr.940] to [Pr.943], [Pr.950] to [Pr.953], [Pr.960] to [Pr.963], [Pr.970] to [Pr.973], [Pr.980] to [Pr.983], [Pr.990] to [Pr.993], [Pr.1000] to [Pr.1003], [Pr.1020] to [Pr.1023], [Pr.1030] to [Pr.1033], [Pr.1040] to [Pr.1043], [Pr.1050] to [Pr.1053], [Pr.1060] to [Pr.1063], [Pr.1100] to [Pr.1106], [Pr.1190], [Pr.1210]
Parameter area (b)	Parameters validated after parameter writing (validated when the next control is started after parameter writing)	[Pr.8] to [Pr.10], [Pr.25] to [Pr.41], [Pr.84]
Parameter area (c)	Parameters validated with power supply ON/ remote RESET	[Pr.100], [Pr.101], [Pr.116] to [Pr.119], [Pr.152], [Pr.500] to [Pr.509], [Pr.801] to [Pr.811], [Pr.1170] to [Pr.1173]

Buffer memory area configuration

The buffer memory of Simple Motion board is configured of the following types of areas.

n: Axis No. - 1

k: Mark detection setting No. - 1

j: Synchronous encoder axis No. - 1

w: Interrupt setting No. - 1

Buffer memory area configuration		Buffer memory address*1	Writing possibility
Parameter area	Servo network composition parameter	58020+32n to 58022+32n	Possible
	Common parameter	35, 58003	
	Basic parameter	0+150n to 15+150n	
	Detailed parameter	17+150n to 68+150n, 116+150n to 123+150n	
	Home position return basic parameter	70+150n to 75+150n	
	Home position return detailed parameter	82+150n to 87+150n	
	Mark detection setting parameter	54001+20k to 54019+20k	
	Link device external signal assignment parameter	440000+320n to 440319+320n 450240+100n to 450339+100n	
	Servo object specification parameter	460000+256n to 460255+256n	
	Interrupt setting parameter	87680, 87682+12w to 87690+12w	
	Controller in-position parameter	900020 to 900035	
	Time setting parameter	6300180	
	Ethernet communication parameter	6300200 to 6300207	
	Direct control setting parameter	91000+20n	
Monitor data area	System monitor	4000 to 4299 31300 to 31549 60900 to 60949 87000 to 87649 6300000, 6300012 to 6300019	Not possible
	Axis monitor	2400+100n to 2499+100n 59303+100n, 59328+100n 90800 to 90804, 90808	
	Servo network composition monitor	58660+32n to 59299+32n	
	Mark detection monitor data	54960+80k to 55039+80k	
	Monitor for slave device operation	468192+2048n to 468255+2048n	
	Interrupt monitor	89220 to 89358	
	User watchdog monitor	900004	
	Controller in-position monitor	900052 to 900067	
	DMA transmission monitor	6300174 to 6300176	
	Ethernet communication monitor	6300212 to 6300224	
	Direct control monitor	91320+20n to 91323+20n	
Control data area	System control data	5900 to 5999	Possible
	Axis control data	4300+100n to 4399+100n 30100+10n to 30109+10n	
	Mark detection control data	54640+10k to 54649+10k	
	Control data for slave device operation	533728+2048n to 535066+2048n	
	Interrupt control data	89218, 89219	
	User watchdog control data	900000 to 900002	
	DMA transmission control data	6300172	
	Remote operation control data	6300100	
	Ethernet communication control data	6300208	
	Control data for direct control	91640+20n, 91642+20n, 91960+120n	

Buffer memory area configuration		Buffer memory address*1	Writing possibility
Positioning data area (No.1 to 100)	Positioning data	6000+1000n to 6999+1000n 71000+1000n, 71001+1000n	Possible
Positioning data area (No.101 to 600)		200000+5000n to 204999+5000n 280000+5000n to 284999+5000n	
Block start data area (No.7000)	Block start data	22000+400n to 22049+400n	
		22050+400n to 22099+400n	
	Condition data	22100+400n to 22199+400n	
Block start data area (No.7001)	Block start data	22200+400n to 22249+400n	
		22250+400n to 22299+400n	
	Condition data	22300+400n to 22399+400n	
Block start data area (No.7002)	Block start data	360000+600n to 360099+600n	
	Condition data	360100+600n to 360199+600n	
Block start data area (No.7003)	Block start data	360200+600n to 360599+600n	
	Condition data		
Block start data area (No.7004)	Block start data		
	Condition data		
Synchronous control area*2	Servo input axis parameter	32800+10n to 32805+10n	Possible
	Servo input axis monitor data	33120+10n to 33127+10n	Not possible
	Synchronous encoder axis parameter	34720+20j to 34735+20j	Possible
	Synchronous encoder axis control data	35040+10j to 35047+10j	Possible
	Synchronous encoder axis monitor data	35200+20j to 35212+20j	Not possible
	Synchronous encoder axis parameter via link device	35520+20j to 35539+20j	Possible
	Synchronous control system control data	36320, 36322	Possible
	Synchronous parameter	36400+200n to 36513+200n	Possible
	Synchronous control monitor data	42800+40n to 42835+40n	Not possible
	Control data for synchronous control	44080+20n to 44090+20n	Possible
	Cam operation control data	53780 to 53791, 600000 to 866295	Possible
	Cam operation monitor data	53800 to 53801	Not possible
CC-Link IE Field Network area*3	Link device (RX)	100000 to 101023	Possible
	Link device (RY)	101024 to 102047	Not possible
	Link device (RWw)	102048 to 110239	Possible
	Link device (RWr)	110240 to 118431	Not possible
	Link device (SB)	118432 to 118463	Possible/Not possible
	Link device (SW)	118464 to 118975	Possible/Not possible
	System area	118976 to 119455, 119698 to 119711, 119954 to 119967, 120210 to 120223, 120466 to 120511, 120516 to 120519, 120537 to 120543, 120548 to 120551, 120569 to 120575, 124416 to 124479, 124496 to 129967, 130345 to 130351, 130473 to 165535	Not possible
	Slave station offset/size information	119456 to 119697, 119712 to 119953, 119968 to 120209, 120224 to 120465	Not possible
	Station information	120512 to 120515, 120520 to 120536, 120544 to 120547, 120552 to 120568, 120576 to 124415	Not possible
I/O signal area	I/O signal area	6300120, 6300121, 6300136, 6300137	Possible

*1 Use of skipped address Nos. is prohibited. If used, the system may not operate correctly.

*2 For details, refer to the following.
Simple Motion Board User's Manual (Advanced Synchronous Control)

*3 For details, refer to the following.
Simple Motion Board User's Manual (Network)

12

Data transmission timing

The parameters of the Simple Motion board are classified as "Parameter" or "Network parameter". Each parameter is reflected in the buffer memory of the Simple Motion board at the following reflection timing.

Parameter reflection timing	Operation	Parameter setting value reflected in the buffer memory	
		Network parameter*1	Parameter*2
Power ON	Power ON	Parameter set with EM Configurator*3	Parameter stored in the Simple Motion board
Simple Motion board initialization	[Cd.2] Module initialization request	Initial value (factory-set value)	

*1 Some "Network parameters" are reflected in the Simple Motion board by turning the user program READY signal [Y0] from OFF to ON.

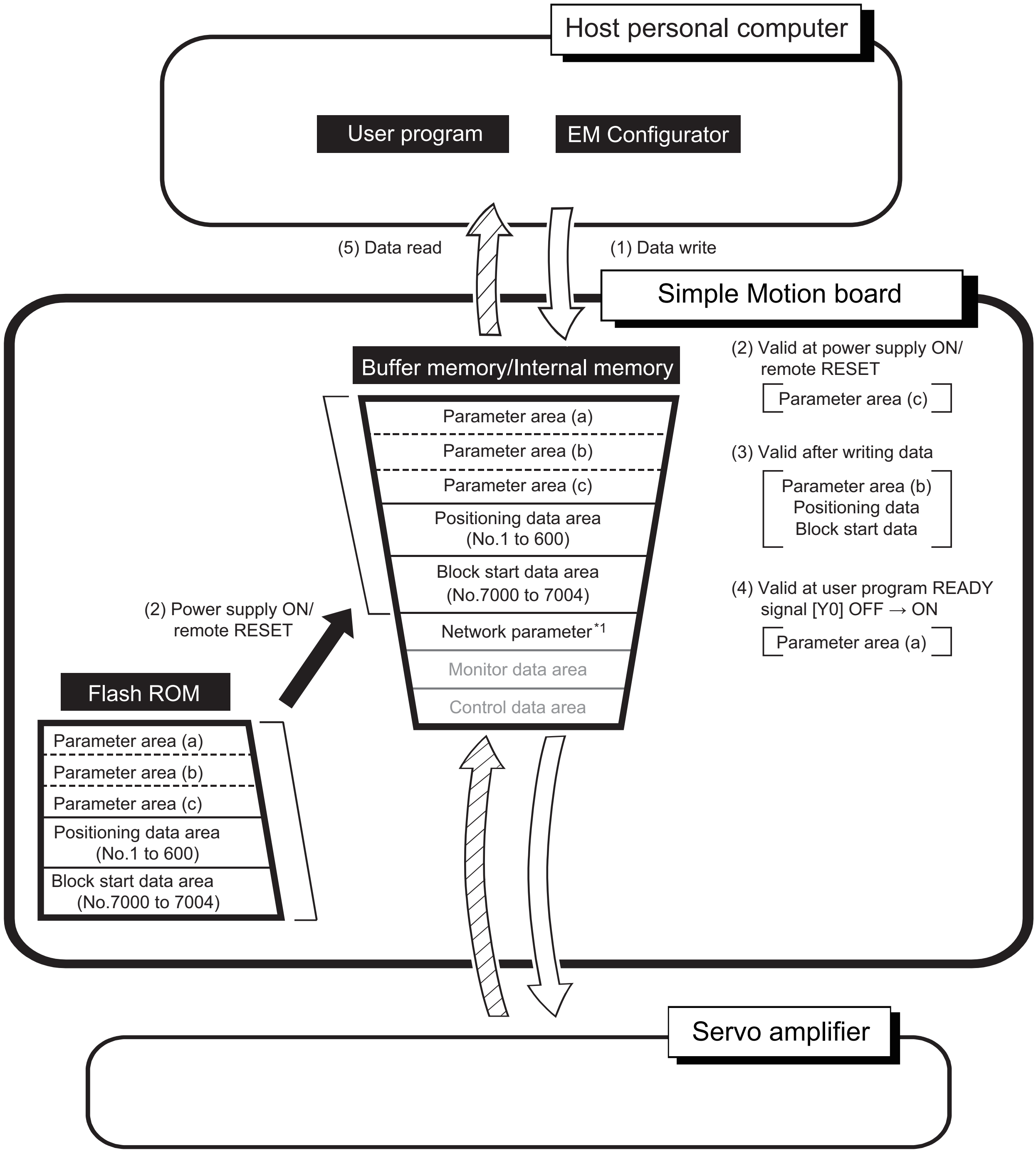
*2 When no parameter to be reflected exists at the reflection timing, refer to the following.

☞ Page 584 (1) Data write

*3 When parameters are not set with EM Configurator, the initial values are reflected.

Data transmission process

The data is transmitted between the memories of Simple Motion board with steps (1) to (10) shown below.
The data transmission patterns correspond to the numbers (1) to (10) in the following drawings.



*1 It can be read and written by EM Configurator only.

(1) Data write

The data is written to "parameter area (a)", "parameter area (b)", "parameter area (c)", "positioning data" and "block start data" using the user program.

Point

To establish the registration to the buffer memory/internal memory, write the flash ROM.
For details, refer to the following.
☞ Page 586 (6) Writing the flash ROM by a request from the user program, ☞ Page 586 (7) Writing the flash ROM by a request from EM Configurator

(2) Valid at power supply ON/remote RESET

The data written by (1) is validated at the power supply ON or the remote RESET.
It indicates "parameter area (c)". For details, refer to the following.
☞ Page 579 Details of areas

(3) Valid after writing data

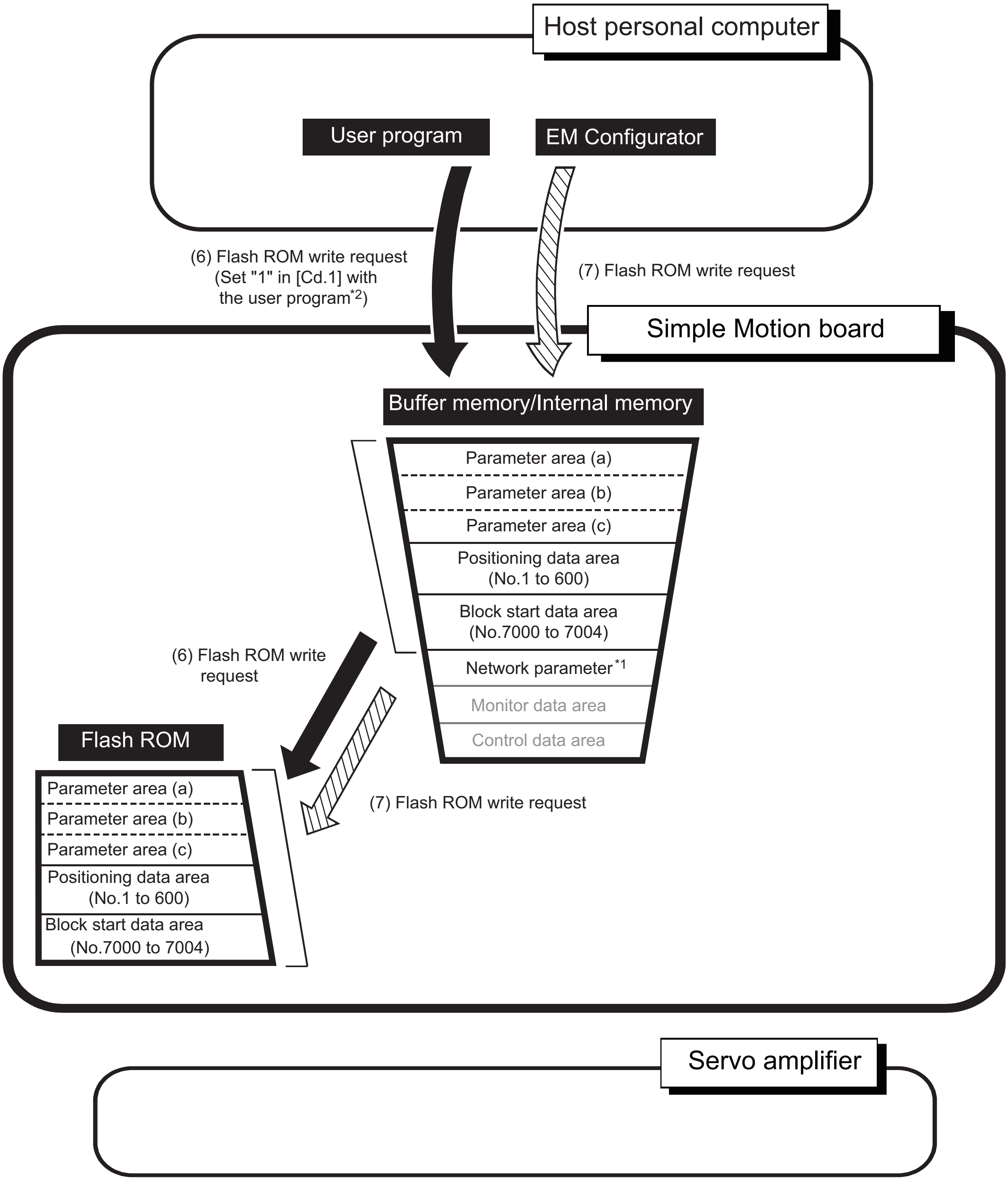
The data written by (1) is validated immediately after writing.
It indicates "parameter area (b)", "positioning data", and "block start data".
Refer to the following for details of "parameter area (b)".
☞ Page 579 Details of areas

(4) Valid at user program READY signal [Y0] OFF → ON

The data written by (1) is validated after the user program READY signal [Y0] is turned from OFF to ON.
It indicates "parameter area (a)". For details, refer to the following.
☞ Page 579 Details of areas

(5) Data read

The data can be read using the user program.



*1 It can be read and written by EM Configurator only.

*2 MMC_Contoller::SysCtrl.WriteFlashRom

(6) Writing the flash ROM by a request from the user program

The following transmission process is carried out by setting "1" in "[Cd.1] Flash ROM write request" using the user program "MMC_Contoller::SysCtrl.WriteFlashRom".

- The "parameters", "positioning data (No.1 to 600)" and "block start data (No.7000 to 7004)" in the buffer memory/internal memory area are transmitted to the flash ROM.

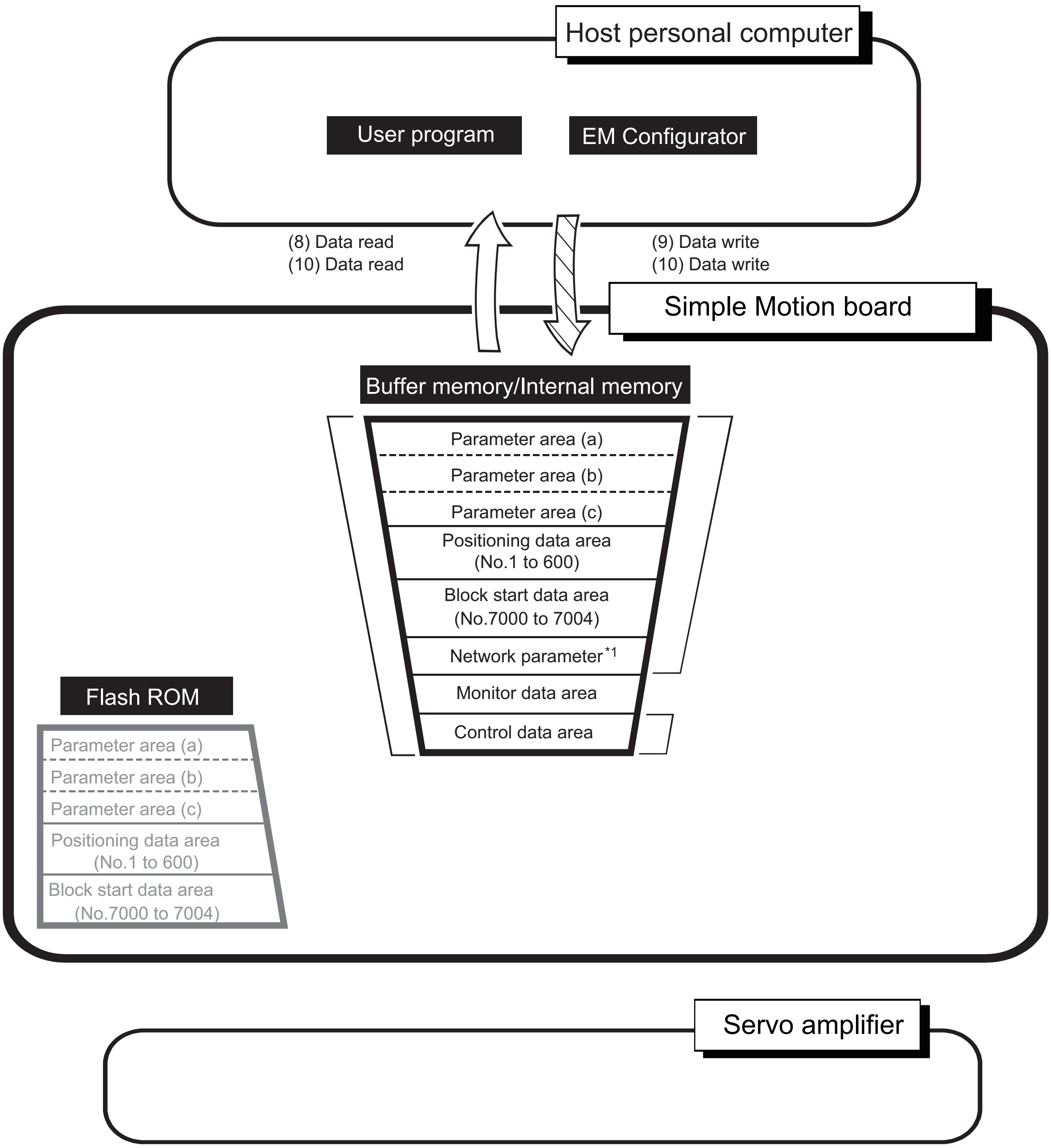
(7) Writing the flash ROM by a request from EM Configurator

The following transmission processes are carried out with the [flash ROM write request] from EM Configurator. This transmission process is the same as (6) above.

- The "parameters", "positioning data (No.1 to 600)" and "block start data (No.7000 to 7004)" in the buffer memory/internal memory area are transmitted to the flash ROM.

Point

- Do not turn the power supply of the Simple Motion board OFF or execute the remote RESET while writing to the flash ROM. If the power supply of the Simple Motion board is turned OFF or the remote RESET is executed to forcibly end the process, the data backed up in the flash ROM will be lost.
- Do not write the data to the buffer memory/internal memory before writing to the flash ROM is completed.
- The number of writes to the flash ROM with the user program is 25 max. while the power is turned ON. Writing to the flash ROM beyond 25 times will cause the error "Flash ROM write number error" (error code: 1080H). Refer to ☞ Page 625 List of Error Codes for details.
- Monitoring is the number of writes to the flash ROM after power supply ON by the "[Md.19] Number of write accesses to flash ROM".



*1 It can be read and written by EM Configurator only.

(8) Reading data from buffer memory/internal memory to EM Configurator

The following transmission processes are carried out with the [Read from Board] from EM Configurator.

- The "parameters", "positioning data (No.1 to 600)", "block start data (No.7000 to 7004)", "network parameters" and "control data" in the buffer memory/internal memory area are transmitted to EM Configurator via the host personal computer.

The following transmission processes are carried out with the [Monitor] from EM Configurator.

- The "monitor data" in the buffer memory area is transmitted to EM Configurator via the host personal computer.

(9) Writing data from EM Configurator to buffer memory/internal memory

The following transmission processes are carried out with the [Write to Board] from EM Configurator.

- The "parameters", "positioning data (No.1 to 600)", "block start data (No.7000 to 7004)", "network parameters" and "control data" in EM Configurator are transmitted to the buffer memory/internal memory via the host personal computer.

At this time, when [Write to the Flash ROM] is set with EM Configurator, the transmission processes indicated with "(7) Writing the flash ROM by a request from EM Configurator" are carried out.

(10) Reading/Writing data from a user program to buffer memory/internal memory

For details, refer to the following.

📖Simple Motion Board Use's Manual (API Library)

13 PROGRAMMING

This chapter describes the user programs required to carry out positioning control with the Simple Motion board.
The user program required for control is created allowing for the "start conditions", "start time chart", "device settings" and general control configuration. (The parameters, positioning data, block start data and condition data, etc., must be set in the Simple Motion board according to the control to be executed, and a setting program for the control data or a start program for the various controls must be created.)

13.1 Precautions for Creating User Program

The common precautions to be taken when writing data from the host personal computer to the buffer memory of the Simple Motion board are described below.

Reading/writing the data

When rewriting the positioning data during continuous path control or continuous positioning control, rewrite the data four positioning data items before the actual execution. If the positioning data is not rewritten before the positioning data four items earlier is executed, the process will be carried out as if the data was not rewritten.

Restrictions to speed change execution interval

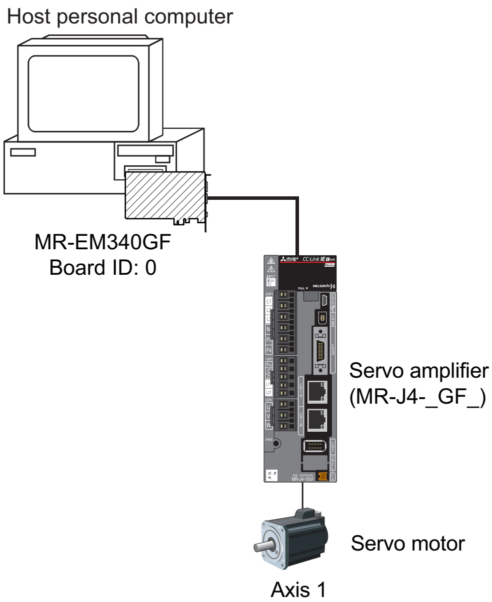
Be sure there is an interval between the speed changes of 10 ms or more when carrying out consecutive speed changes by the speed change function or override function with the Simple Motion board.

Process during overrun

Overrun is prevented by the setting of the upper and lower stroke limits with the detailed parameter 1. However, this applies only when the Simple Motion board is operating correctly. It is recommended to create an external circuit including a boundary limit switch to ensure the whole system safety as follows: the external circuit that turns OFF the main circuit power of the servo amplifier when the boundary limit switch operates.

System configuration

The following figure shows the system configuration used for the user program examples.



13.2 List of Labels Used

In the user program examples, the following labels are used.

Classification	Label name/Method name	Description
Label	MMC_Axis::AxPrm.Unit	RW: [Pr.1] Unit setting
	MMC_Axis:AxPrm.PulsesPerRotation	RW: [Pr.2] Number of pulses per rotation (AP)
	MMC_Axis::AxPrm.MovementAmountPerRotation	RW: [Pr.3] Movement amount per rotation (AL)
	MMC_Axis::AxPrm.UnitMagnification	RW: [Pr.4] Unit magnification (AM)
	MMC_Axis::AxPrm.HomingDirection	RW: [Pr.44] Home position return direction
	MMC_Axis::AxPrm.HomePosition	RW: [Pr.45] Home position address
	MMC_Axis::AxPrm.HomingSpeed	RW: [Pr.46] Home position return speed
	MMC_Axis::AxPrm.SoftwareStrokeUpperLimit	RW: [Pr.12] Software stroke limit upper limit value
	MMC_Axis::AxPrm.SoftwareStrokeLowerLimit	RW: [Pr.13] Software stroke limit lower limit value
	MMC_Axis::AxPrm.V_CommandPosition	RW: [Pr.21] Feed current value during speed control
	MMC_Axis::AxPrm.VP_Mode	RW: [Pr.81] Speed-position function selection
	MMC_Controller::BitDevice.PositioningStart	RW: Positioning start (Axis No.1 to 16)
	MMC_Axis::AxMntr.Status_PositioningStart	R: [Md.31] Status Start complete
	MMC_Controller::BitDevice.Busy	R: BUSY (Axis No.1 to 16)
	MMC_Axis::AxMntr.Status_HomingRequest	R: [Md.31] Status Home position return request flag
	MMC_Axis::AxCtrl1.ClearHomingRequestFlag	RW: [Cd.19] Home position return request flag OFF request
	MMC_Axis::AxCtrl1.ExternalCommandValid	RW: [Cd.8] External command valid
	MMC_Controller::BitDevice.Ready	R: READY
	MMC_Controller::BitDevice.AllAxisServoOn	RW: All axis servo ON
	MMC_Axis::AxCtrl1.VP_NewMovementAmount	RW: [Cd.23] Speed-position switching control movement amount change register
	MMC_Axis::AxCtrl1.EnableVP_Switching	RW: [Cd.24] Speed-position switching enable flag
	MMC_Axis::AxCtrl1.EnablePV_Switching	RW: [Cd.26] Position-speed switching enable flag
	MMC_Axis::AxMntr.Status_M_Code	R: [Md.31] M code ON
	MMC_Axis::AxCtrl1.Clear_M_Code	RW: [Cd.7] M code OFF request
	MMC_Axis::AxCtrl1.Override	RW: [Cd.13] Positioning operation speed override
	MMC_Axis::AxMntr.TargetSpeed	R: [Md.33] Target speed
	MMC_Axis::AxCtrl1.ForwardNewTorque	RW: [Cd.22] New torque value/forward new torque value
	MMC_Axis::AxCtrl1.StepMode	RW: [Cd.34] Step mode
	MMC_Axis::AxCtrl1.StepValid	RW: [Cd.35] Step valid flag
	MMC_Axis::AxMntr.AxisOperationStatus	R: [Md.26] Axis operation status
	MMC_Axis::AxCtrl1.StepStartInformation	RW: [Cd.36] Step start information
	MMC_Axis::AxCtrl1.Skip	RW: [Cd.37] Skip command
	MMC_Axis::AxCtrl1.TeachingDataSelection	RW: [Cd.38] Teaching data selection
	MMC_Axis::AxCtrl1.TeachingPositioningDataNo	RW: [Cd.39] Teaching positioning data No.
	MMC_Axis::AxCtrl1.InterruptOperation	RW: [Cd.18] Interrupt request during continuous operation
	MMC_Axis:AxMntr.Status_Warning	R: [Md.31] Status Warning detection
	MMC_Axis::AxMntr.AxisWarningNo	R: [Md.24] Axis warning No.
	MMC_Axis::AxMntr.Status_Error	R: [Md.31] Status Error detection
	MMC_Axis::AxMntr.AxisErrorNo	R: [Md.23] Axis error No.

Classification	Label name/Method name	Description
Method	MMC_Axis::SetPositioningData	Sets the positioning data.
	MMC_Axis::SetBlockStartData	Sets the block start data.
	MMC_Controller::SetUserProgramReady	Sets the user program READY signal [Y0].
	MMC_Axis::StartPositioning	Starts positioning control.
	MMC_Axis::WaitPositioningDone	Waits until completion of positioning control.
	MMC_Axis::StartJog	Starts JOG operation.
	MMC_Axis::StopJog	Stops JOG operation.
	MMC_Axis::StartInching	Starts inching operation.
	MMC_Axis::EnableMPG	Enables manual pulse generator operation.
	MMC_Axis::DisableMPG	Disables manual pulse generator operation.
	MMC_Axis::ChangeSpeed	Changes speed and acceleration/deceleration time.
	MMC_Axis::ChangePosition	Changes target position and command speed.
	MMC_Axis::RestartPositioning	Restarts stopped axis.
	MMC_Controller::InitializeParameter	Returns parameters to their initial factory values.
	MMC_Controller::BackupParameter	Performs backup of execution data (parameters, etc.)
	MMC_Axis::ResetError	Performs error reset.
	MMC_Axis::StopPositioning	Stops axis.

13.3 Creating a User Program

The "positioning control operation program" actually used is explained in this section.

General configuration of user program

The general configuration of the positioning control operation program is shown below.

No.	User program name	Remark
1a	Basic parameter setting	• The user program is not required when the parameter, positioning data, and block start data are set using EM Configurator. • The setting of the home position return parameters is not required when the machine home position return control is not executed.
1b	Home position return parameter setting program	
1c	Unit "degree" setting program	
2	Positioning data setting program	
3	Block start data setting program	
4	Home position return request OFF program	Not required when the fast home position return is executed.
5	External command function valid setting program	—
6	User program READY signal ON program	
7	All axis servo ON program	
8	Positioning start No. setting program/Positioning start program	
9	M code OFF program	Not required when the M code output function is not used.
10	JOG operation setting program/JOG operation execution program	Not required when the JOG operation is not used.
11	Inching operation setting program/Inching operation execution program	Not required when the inching operation is not used.
12	Manual pulse generator operation program	Not required when the manual pulse generator operation is not used.
13	Speed change program	Add the user program as necessary.
14	Override program	
15	Acceleration/deceleration time change program	
16	Torque change program	
17	Step operation program	
18	Skip program	
19	Teaching program	
20	Continuous operation interrupt program	
21	Target position change program	
22	Restart program	
23	Parameter initialization program	
24	Flash ROM write program	
25	Error reset program	
26	Axis stop program	—

13.4 Positioning Program Examples

Parameter setting program

The program is not required when the parameter is set by "Network Parameter" using EM Configurator.

■Setting for basic parameter 1 (axis 1)

C++

```
void SetBasicParameters1Sample( MMC_Axis *axis1 )
{
    axis1->AxPrm.Unit = 0;                                /* Pr.1: Unit setting                         */
    axis1->AxPrm.PulsesPerRotation = 4194304;             /* Pr.2: Number of pulses per rotation (AP)   */
    axis1->AxPrm.MovementAmountPerRotation = 250000;      /* Pr.3: Movement amount per rotation (AL)    */
    axis1->AxPrm.UnitMagnification = 1;                   /* Pr.4: Unit magnification (AM)              */
}
```

■Setting for home position return basic parameter (axis 1)

C++

```
void SetHomePositionReturnParametersSample( MMC_Axis *axis1 )
{
    axis1->AxPrm.Unit = 0;                                /* Pr.1: Unit setting                         */
    axis1->AxPrm.PulsesPerRotation = 4194304;             /* Pr.2: Number of pulses per rotation (AP)   */
    axis1->AxPrm.MovementAmountPerRotation = 250000;      /* Pr.3: Movement amount per rotation (AL)    */
    axis1->AxPrm.UnitMagnification = 1;                   /* Pr.4: Unit magnification (AM)              */
}
```

■Unit "degree" setting (axis 1) program

C++

```
void SetDegreeAxisParametersSample( MMC_Axis *axis1 )
{
    axis1->AxPrm.Unit = 2;                                /* Pr.1 : Unit setting                            */
    axis1->AxPrm.SoftwareStrokeUpperLimit = 0;            /* Pr.12: Software stroke limit upper limit value  */
    axis1->AxPrm.SoftwareStrokeLowerLimit = 0;            /* Pr.13: Software stroke limit lower limit value  */
    axis1->AxPrm.V_CommandPosition = 1;                   /* Pr.21: Feed current value during speed control  */
    axis1->AxPrm.VP_Mode = 2;                             /* Pr.81: Speed-position function selection        */
}
```

Positioning data setting program

The program is not required when the data is set by "Positioning Data" using EM Configurator.

C++

```
void SetPositioningDataSample( MMC_Axis *axis1 )
{
    unsigned long retCode;
    MMST_PositioningData positioningData = {0};

    /* Setting of positioning data No.1 *//* Set only the item required to be changed */
    positioningData.OperationPattern = 0;              /* Operation pattern                      */
    positioningData.ControlMethod = 0x01;              /* Control method                         */
    positioningData.AccelerationTimeNo = 0;            /* Acceleration time No.                  */
    positioningData.DecelerationTimeNo = 0;            /* Deceleration time No.                  */
    positioningData.PositioningAddress = -10000;       /* Positioning address/movement amount    */
    positioningData.ArcAddress = 0;                    /* Arc address                            */
    positioningData.CommandSpeed = 2000;               /* Command speed                          */
    positioningData.DwellTime = 300;                   /* Dwell time                             */
    positioningData.Mcode = 0;                         /* M code                                 */
    positioningData.InterpolatedAxisNo1 = 0;           /* Axis to be interpolated No.1           */
    positioningData.InterpolatedAxisNo2 = 0;           /* Axis to be interpolated No.2           */
    positioningData.InterpolatedAxisNo3 = 0;           /* Axis to be interpolated No.3           */
    positioningData.McodeOnTiming = 0;                 /* M code ON signal output timing         */
    positioningData.AbsDirectionInDegrees = 0;         /* ABS direction in degrees               */
    positioningData.InterpolationSpeed = 0;            /* Interpolation speed designation method */

    retCode = axis1->SetPositioningData( 1, positioningData );
    if( retCode != MMC_OK ) { /* Error process */ }
}
```

Block start data setting program

The program is not required when the data is set by "Block Start Data" using EM Configurator.

C++

```
void SetBlockPositioningDataSample( MMC_Axis *axis1 )
{
    unsigned long retCode;
    MMST_BlockStartData blockStartData[5] = {0};

    /* Setting of block start data No.1 */
    blockStartData[0].Shape = 1;                        /* Shape                    */
    blockStartData[0].StartDataNo = 1;                  /* Start data No.           */
    blockStartData[0].SpecialStartInstruction = 0;      /* Special start instruction */
    blockStartData[0].Parameter = 0;                    /* Parameter                */

    /* Setting of block start data No.2 */
    blockStartData[1].Shape = 1;                        /* Shape                    */
    blockStartData[1].StartDataNo = 2;                  /* Start data No.           */
    blockStartData[1].SpecialStartInstruction = 0;      /* Special start instruction */
    blockStartData[1].Parameter = 0;                    /* Parameter                */

    /* Setting of block start data No.3 */
    blockStartData[2].Shape = 1;                        /* Shape                    */
    blockStartData[2].StartDataNo = 5;                  /* Start data No.           */
    blockStartData[2].SpecialStartInstruction = 0;      /* Special start instruction */
    blockStartData[2].Parameter = 0;                    /* Parameter                */

    /* Setting of block start data No.4 */
    blockStartData[3].Shape = 1;                        /* Shape                    */
    blockStartData[3].StartDataNo = 10;                 /* Start data No.           */
    blockStartData[3].SpecialStartInstruction = 0;      /* Special start instruction */
    blockStartData[3].Parameter = 0;                    /* Parameter                */

    /* Setting of block start data No.5 */
    blockStartData[4].Shape = 0;                        /* Shape                    */
    blockStartData[4].StartDataNo = 15;                 /* Start data No.           */
    blockStartData[4].SpecialStartInstruction = 0;      /* Special start instruction */
    blockStartData[4].Parameter = 0;                    /* Parameter                */

    for( int n = 1; n <= 5; n++ )
    {
        /* Set block start data */
        retCode = axis1->SetBlockStartData( 0, n, blockStartData[n-1] );
        if( retCode != MMC_OK ) { /* Error process */ }
    }
}
```

Home position return request OFF program

The program is not required when "1: Positioning control is executed." is set in "[Pr.55] Operation setting for incompletion of home position return" by "Home Position Return Detailed Parameters" using EM Configurator.

C++

```
unsigned long HomingRequestFlagOffSample( MMC_Axis *axis1 )
{
    unsigned long retCode;

    if( ( axis1->PositioningStart == MMC_OFF ) &&
        ( axis1->AxMntr.Status_PositioningStart == MMC_OFF ) &&
        ( axis1->Busy == MMC_OFF ) )
    {
        if( axis1->AxMntr.Status_HomingRequest != MMC_OFF )
        {
            /* Home position return request flag OFF request */
            axis1->AxCtrl1.ClearHomingRequestFlag = 1;

            /* Wait until the home position return request flag OFF request is set to 0 */
            retCode = axis1->AxCtrl1.ClearHomingRequestFlag.Wait( MMC_WAIT_EQUAL, 0, 1000 );
            if( retCode != MMC_OK ) { /* Error process */ }

            return( MMC_OK );
        }
    }

    return( MMC_NG );
}
```

External command function valid setting program

C++

```
void ExternalCommandVaildSample( MMC_Axis *axis1, bool reqFlag )
{
    {
        /* External command invalid */
        axis1->AxCtrl1.ExternalCommandValid = 0;
    }
    else
    {
    /* External command valid */
        axis1->AxCtrl1.ExternalCommandValid = 1;
    }
}
```

User program READY signal ON program

C++

```
void UserProgramReadySample( MMC_Controller *controller, MMC_Axis *axis1 )
{
    unsigned long retCode;

    /* Set basic parameter 1 */
    SetBasicParameters1Sample( axis1 );

    /* Set home position return parameter */
    SetHomePositionReturnParametersSample( axis1 );

    /* Turn user program READY ON */
    retCode = controller->SetUserProgramReady( MMC_ON );
    if( retCode != MMC_OK ) { /* Error process */ }
}
```

All axis servo ON program

C++

```
void AllAxisServoOnSample( MMC_Controller *controller )
{
    if( controller->BitDevice.Ready != MMC_OFF )
        {
        /* All axis servo ON */
        controller->BitDevice.AllAxisServoOn = MMC_ON;
    }
}
```

Positioning start No. setting program/Positioning start program

■Machine home position return

C++

```
void StartHomePositionReturnSample( MMC_Axis* axis1 )
{
    unsigned long retCode;

    /* Start machine home position return */
    retCode = axis1->StartPositioning( MMC_STNO_HOMING );
    if( retCode != MMC_OK ) { /* Error process */ }

    /* Wait until machine home position return is completed */
    retCode = axis1->WaitPositioningDone( MMC_POSITIONING_DONE_INP, 10000 );
    if( retCode != MMC_OK ) { /* Error process */ }
}
```

■Fast home position return

C++

```
void StartFastHomePositionReturnSample( MMC_Axis* axis1 )
{
    unsigned long retCode;

    /* Start fast home position return */
    retCode = axis1->StartPositioning( MMC_STNO_FAST_HOMING );
    if( retCode != MMC_OK ) { /* Error process */ }

    /* Wait until fast home position return is completed */
    retCode = axis1->WaitPositioningDone( MMC_POSITIONING_DONE_INP, 10000 );
    if( retCode != MMC_OK ) { /* Error process */ }

}
```

■Positioning with positioning data No.1

C++

```
void StartPositioningSample( MMC_Axis* axis1 )
{
    unsigned long retCode;

    /* Positioning with positioning data No.1 */
    retCode = axis1->StartPositioning( 1 );
    if( retCode != MMC_OK ) { /* Error process */ }

    /* Wait until positioning control is completed */
    retCode = axis1->WaitPositioningDone( MMC_POSITIONING_DONE_INP, 10000 );
    if( retCode != MMC_OK ) { /* Error process */ }

}
```

■Speed-position switching operation (Positioning data No.2)

In the ABS mode, new movement amount is not needed to be written.

C++

```
void VelocityPositionSwitchingSample( MMC_Axis* axis1, long movAmount )
{
    unsigned long retCode;
    MMST_PositioningData positioningData = {0};

    /* Setting of positioning data No.2 */
    positioningData.OperationPattern = 0;          /* Operation pattern                   */
    positioningData.ControlMethod = 0x06;          /* Control method                      */
    positioningData.AccelerationTimeNo = 0;        /* Acceleration time No.               */
    positioningData.DecelerationTimeNo = 0;        /* Deceleration time No.               */
    positioningData.PositioningAddress = 2500;     /* Positioning address/movement amount */
    positioningData.CommandSpeed = 18000;          /* Command speed                       */
    positioningData.DwellTime = 0;                 /* Dwell time                          */

    retCode = axis1->SetPositioningData( 2, positioningData );
    if( retCode != MMC_OK ) { /* Error process */ }

    /* Set speed-position switching control speed change register */
    axis1->AxCtrl1.VP_NewMovementAmount = movAmount;

    /* Positioning by positioning data No.2 */
    retCode = axis1->StartPositioning( 2 );
    if( retCode != MMC_OK ) { /* Error process */ }

    /* Enable speed-position switching */
    axis1->AxCtrl1.EnableVP_Switching = 1;

    /* Wait until positioning control is completed */
    retCode = axis1->WaitPositioningDone( MMC_POSITIONING_DONE_INP, 10000 );
    if( retCode != MMC_OK ) { /* Error process */ }

    /* Clear speed-position switching enable */
    axis1->AxCtrl1.EnableVP_Switching = 0;


}
```

■Position-speed switching operation (Positioning data No.3)

C++

```
void PositionVelocitySwitchingSample( MMC_Axis* axis1, long movAmount )
{
    unsigned long retCode;
    MMST_PositioningData positioningData = {0};

    /* Setting of positioning data No.3 */
    positioningData.OperationPattern = 0;           /* Operation pattern                   */
    positioningData.ControlMethod = 0x08;           /* Control method                      */
    positioningData.AccelerationTimeNo = 0;         /* Acceleration time No.               */
    positioningData.DecelerationTimeNo = 0;         /* Deceleration time No.               */
    positioningData.PositioningAddress = 2000;      /* Positioning address/movement amount */
    positioningData.CommandSpeed = 18000;           /* Command speed                       */
    positioningData.DwellTime = 300;                /* Dwell time                          */

    retCode = axis1->SetPositioningData( 3, positioningData );
    if( retCode != MMC_OK ) { /* Error process */ }

    /* Set position-speed switching control speed change register */
    axis1->AxCtrl1.VP_NewMovementAmount = movAmount;

    /* Positioning by positioning data No.3 */
    retCode = axis1->StartPositioning( 3 );
    if( retCode != MMC_OK ) { /* Error process */ }

    /* Enable position-speed switching */
    axis1->AxCtrl1.EnablePV_Switching = 1;

    /* Arbitrary process */

    /* Axis stop */
    retCode = axis1->StopPositioning();
    if( retCode != MMC_OK ) { /* Error process */ }

    /* Wait until positioning control is completed */
    retCode = axis1->WaitPositioningDone( MMC_POSITIONING_DONE_BUSY, 10000 );
    if( retCode != MMC_OK ) { /* Error process */ }

    /* Clear position-speed switching enable */
    axis1->AxCtrl1.EnablePV_Switching = 0;
}
```

■High-level positioning control

C++

```
void StartBlockPositioningSample( MMC_Axis *axis1 )
{
    unsigned long retCode;

    /* Start positioning control */
    retCode = axis1->StartBlockPositioning( 0, 1 );
    if( retCode != MMC_OK ) { /* Error process */ }

    /* Wait until positioning control is completed */
    retCode = axis1->WaitPositioningDone( MMC_POSITIONING_DONE_INP, 10000 );
    if( retCode != MMC_OK ) { /* Error process */ }
}
```

M code OFF program

C++

```
void ClearMcodeSample( MMC_Axis *axis1 )
{
    if( axis1->AxMntr.Status_M_Code != MMC_OFF )
    {
        axis1->AxCtrl1.Clear_M_Code = 1;
    }
}
```

JOG operation setting program/JOG operation execution program

C++

```
void StartJogSample( MMC_Axis *axis1 )
{
    unsigned long retCode;

    /* Start JOG operation */
    retCode = axis1->StartJog( 10000 );
    if( retCode != MMC_OK ) { /* Error process */ }

    /* Arbitrary process */

    retCode = axis1->StopJog();
    if( retCode != MMC_OK ) { /* Error process */ }

    /* Wait until positioning control is completed */
    retCode = axis1->WaitPositioningDone( MMC_POSITIONING_DONE_BUSY, 10000 );
    if( retCode != MMC_OK ) { /* Error process */ }
}
```

Inching operation setting program/Inching operation execution program

C++

```
void StartInchingSample( MMC_Axis *axis1 )
{
    unsigned long retCode;

    /* Start inching operation */
    retCode = axis1->StartInching( 10 );
    if( retCode != MMC_OK ) { /* Error process */ }

    /* Not required to wait for completion */
}
```

Manual pulse generator operation program

C++

```
void StartMPGSample( MMC_Axis *axis1 )
{
    unsigned long retCode;

    /* Enable manual pulse generator operation */
    retCode = axis1->EnableMPG();
    if( retCode != MMC_OK ) { /* Error process */ }

    /* Wait until BUSY is set */
    retCode = axis1->Busy.Wait( MMC_WAIT_EQUAL, MMC_ON, 1000 );
    if( retCode != MMC_OK ) { /* Error process */ }

    /* Arbitrary process */

    /* Disable manual pulse generator operation */
    retCode = axis1->DisableMPG();
    if( retCode != MMC_OK ) { /* Error process */ }
}
```

Speed change program

C++

```
void ChangeSpeedSample( MMC_Axis *axis1 )
{
    unsigned long retCode;

    /* Change speed */
    retCode = axis1->ChangeSpeed( 20000, 0, 0 );
    if( retCode != MMC_OK ) { /* Error process */ }
}
```

Override program

C++

```
void OverrideSample( MMC_Axis *axis1 )
{
    if( axis1->Busy != MMC_OFF )
    {
        /* Set positioning operation speed override */
        axis1->AxCtrl1.Override = 20;
    }
}
```

Acceleration/deceleration time change program

C++

```
void ChangeAccDecTimeSample( MMC_Axis *axis1 )
{
    unsigned long retCode;

    /* Change acceleration/deceleration time */
    retCode = axis1->ChangeSpeed( axis1->AxMntr.TargetSpeed, 200, 100 );
    if( retCode != MMC_OK ) { /* Error process */ }
}
```

Torque change program

C++

```
void ChangeTorqueSample( MMC_Axis *axis1 )
{
    if( axis1->Busy != MMC_OFF )
    {
        /* Set new torque value/forward new torque value */
        axis1->AxCtrl1.ForwardNewTorque = 1000;
    }
}
```

Step operation program

C++

```
void StepOperationSample( MMC_Axis *axis1 )
{
    unsigned long retCode;

    /* Step valid flag: Execute step operation */
    axis1->AxCtrl1.StepValid = 1;

    /* Set step mode */
    axis1->AxCtrl1.StepMode = 1;

    /* Positioning by positioning data No.1 (continuous operation) */
    retCode = axis1->StartPositioning( 1 );
    if( retCode != MMC_OK ) { /* Error process */ }

    while( 1 )
    {
        /* Wait until positioning control is completed */
        retCode = axis1->WaitPositioningDone( MMC_POSITIONING_DONE_BUSY, 10000 );
        if( retCode != MMC_OK ) { /* Error process */ }

        /* Arbitrary process */

        if( axis1->AxMntr.AxisOperationStatus != -2 )/* Axis operation status is not in step standby status */
        {
            break;
        }

        /* Execute step operation */
        axis1->AxCtrl1.StepStartInformation = 1;

        /* Wait for step operation acceptance */
        axis1->AxCtrl1.StepStartInformation.Wait( MMC_WAIT_EQUAL, 0, 1000 );
        if( retCode != MMC_OK ) { /* Error process */ }
    }

    /* Step valid flag: Invalidates step operations */
    axis1->AxCtrl1.StepValid = 0;
}
```

Skip program

C++

```
void SkipSample( MMC_Axis *axis1 )
{
    unsigned long retCode;

    if( axis1->Busy != MMC_OFF )
    {
        /* Skip command */
        axis1->AxCtrl1.Skip = 1;

        /* Wait for skip operation acceptance */
        retCode = axis1->AxCtrl1.Skip.Wait( MMC_WAIT_EQUAL, 0, 1000 );
        if( retCode != MMC_OK ) { /* Error process */ }
    }
}
```

Teaching program

C++

```
void TeachingSample( MMC_Axis *axis1 )
{
    unsigned long retCode;

    if( axis1->Busy != MMC_ON )
    {
        /* Select teaching data */
        axis1->AxCtrl1.TeachingDataSelection = 0;

        /* Teaching positioning data No. */
        axis1->AxCtrl1.TeachingPositioningDataNo = 1;

        /* Wait until teaching positioning data No. is set to 0 */
        retCode = axis1->AxCtrl1.TeachingPositioningDataNo.Wait( MMC_WAIT_EQUAL, 0, 1000 );
        if( retCode != MMC_OK ) { /* Error process */ }
    }
}
```

Continuous operation interrupt program

C++

```
void StopContinuousOperationSample( MMC_Axis *axis1 )
{
    if( axis1->Busy != MMC_OFF )
    {
        /* Interrupt request during continuous operation */
        axis1->AxCtrl1.InterruptOperation = 1;
    }
}
```

Target position change program

C++

```
void ChangeTargetPositionSample( MMC_Axis *axis1 )
{
    unsigned long retCode;

    /* Target position change */
    retCode = axis1->ChangePosition( 3000, 1000000, 1000 );
    if( retCode != MMC_OK ) { /* Error process */ }
}
```

Restart program

C++

```
void RestartSample( MMC_Axis *axis1 )
{
    unsigned long retCode;

    /* Restart */
    retCode = axis1->RestartPositioning();
    if( retCode != MMC_OK ) { /* Error process */ }
}
```

Parameter initialization program

C++

```
void InitializeParameterSample( MMC_Controller *controller )
{
    unsigned long retCode;

    /* Parameter initialization */
    retCode = controller->InitializeParameter();
    if( retCode != MMC_OK ) { /* Error process */ }
}
```

Flash ROM write program

C++

```
void WriteFlashSample( MMC_Controller *controller )
{
    unsigned long retCode;

    /* Write to flash ROM */
    retCode = controller->BackupParameter();
    if( retCode != MMC_OK ) { /* Error process */ }
}
```

Error reset program

C++

```
void ResetErrorSample( MMC_Axis *axis1 )
{
    unsigned long  retCode;
    unsigned short warningNo = 0x0000;
    unsigned short errorNo = 0x0000;
    bool resetReq = MMC_OFF;

    /* Axis warning detection */
    if( axis1->AxMntr.Status_Warning != MMC_OFF )
    {
        warningNo = axis1->AxMntr.AxisWarningNo;
        resetReq = MMC_ON;
    }

    /* Axis error detection */
    if( axis1->AxMntr.Status_Error != MMC_OFF )
    {
        errorNo = axis1->AxMntr.AxisErrorNo;
        resetReq = MMC_ON;
    }

    /* Error reset */
    if( resetReq != MMC_OFF )
    {
        retCode = axis1->ResetError();
        if( retCode != MMC_OK ) { /* Error process */ }
    }
}
```

Axis stop program

C++

```
void StopPositioningSample( MMC_Axis *axis1 )
{
    unsigned long retCode;

    /* Axis stop */
    retCode = axis1->StopPositioning();
    if( retCode != MMC_OK ) { /* Error process */ }

    /* Wait until positioning control is completed */
    retCode = axis1->WaitPositioningDone( MMC_POSITIONING_DONE_BUSY, 10000 );
    if( retCode != MMC_OK ) { /* Error process */ }
}
```

13

14 TROUBLESHOOTING

This chapter describes details of error occurred by using the Simple Motion board and troubleshooting.

14.1 Troubleshooting Procedure

When a trouble occurs, execute the troubleshooting in the order shown below.

1. Check that the Simple Motion board is mounted correctly.
2. Check the LEDs of the Simple Motion board and the host personal computer.
3. Check the LED status of the Simple Motion board to confirm whether an error does not occur. (☞ Page 606 Troubleshooting using the LEDs)
4. Check whether an error does not occur in the Simple Motion board by confirming the axis error No. or the axis warning No. using EM Configurator. (☞ Page 609 Troubleshooting using the Simple Motion board status)

Troubleshooting using the LEDs

Primary diagnostics can be executed without EM Configurator by checking the status of the LED display, so that the range of the trouble cause can be reduced.
The following shows the correspondence relation between each LED and status of the Simple Motion board.

LED Display

□: OFF, ■: ON, ●: Flashing

LED	Status	LED display	Description	Remedy
Connector LEDs for PERIPHERAL	Indicates the LAN data communication status.	LINK ■	Link-up	—
		LINK ●	Data communication being performed	
		LINK □	Link-down	Check the connection status of the Ethernet cable connected with the Simple Motion board and the connection status of the connected devices.
	Indicates the LAN communication speed.	SPEED ■	100 Mbps	—
		SPEED □	10 Mbps	Use a device that supports 100 Mbps.
Connector LEDs for CC-Link IE Field	Indicates the port status.	L.ER ■	Abnormal data received	Refer to the following. 📖Simple Motion Board User's Manual (Network)
		L.ER □	Normal data received	
	Indicates the link status.	LINK ■	Link-up	
		LINK □	Link-down	

LED	Status	LED display	Description	Remedy
Display LEDs (CC-Link IE)	Indicates the operation status.	RUN ■	Normal operation	—
		RUN □	Error	If the RUN LED is not ON after the power is turned ON from OFF or the remote RESET is executed, the Simple Motion board might be faulty. Therefore, it is required to exchange the Simple Motion board.
	Indicates the Simple Motion board error status.	ERR ■	All stations error detection or error[*1] occurrence	Check the error code by the axis error No., and take a measure against the error described in the list of error codes.
		ERR ●	Flashing (500 ms interval): A data link faulty station detected Flashing (200 ms interval): Error[*1]	
		ERR □	Normal operation	—
	Indicates the data link status.	D LINK ■	Data link (cyclic transmission being performed)	Refer to the following. 📖Simple Motion Board User's Manual (Network)
		D LINK ●	Data link (cyclic transmission stopped)	
		D LINK □	Data link not performed (disconnection)	
	Indicates the receive data and line error status.	L.ERR ■	Abnormal data received	
		L.ERR □	Normal data received	
Display LEDs (System status)	Indicates the PCI Express communication status.	PCI Express ■	PCI Express link-up	—
		PCI Express □	PCI Express link-down	Check the connection status of the PCI Express bus connected with the Simple Motion board.
	Indicates the Simple Motion board status.	RUN ■	Power supply ON	—
		RUN ●	Communicating with slave stations	
		RUN □	Error	Check the error code by the axis error No., and take a measure against the error described in the list of error codes.
	Indicates the Simple Motion board operation error.	ERR ■	Error	
		ERR □	Normal operation	—

*1 Network control or Motion control.

When the RUN LED turns off

Check item	Action
Is the power supplied for the host personal computer?	Check that the voltage supplied to the host personal computer is within the rated range.
Is the host personal computer capacity sufficient?	Calculate the total current consumption of the host personal computer and check that the power supply capacity is not insufficient.
Is the Simple Motion board connected with the host personal computer correctly?	Check the state of connection with the Simple Motion board.

If there is no problem on the above check items, a hardware failure may have occurred. Turn the power supply of the Simple Motion board OFF to ON or execute the remote RESET and check that the RUN LED turns on.
If not, the possible cause is a Simple Motion board failure. Please consult your local Mitsubishi representative, explaining a detailed description of the problem.

When the ERR LED flashes

Check item	Action
Is there a moderate error?	• An error may have occurred in the host personal computer. Check the error occurred in the host personal computer and take a corrective action. • A hardware failure may have occurred. Turn the power supply of the Simple Motion board OFF to ON or execute the remote RESET and check that the RUN LED turns on. If not, the possible cause is a Simple Motion board failure. Please consult your local Mitsubishi representative, explaining a detailed description of the problem.

When the ERR LED turns on

Check item	Action
Is there a synchronous encoder axis error?	Check the error code and take a corrective action.

Other than those above

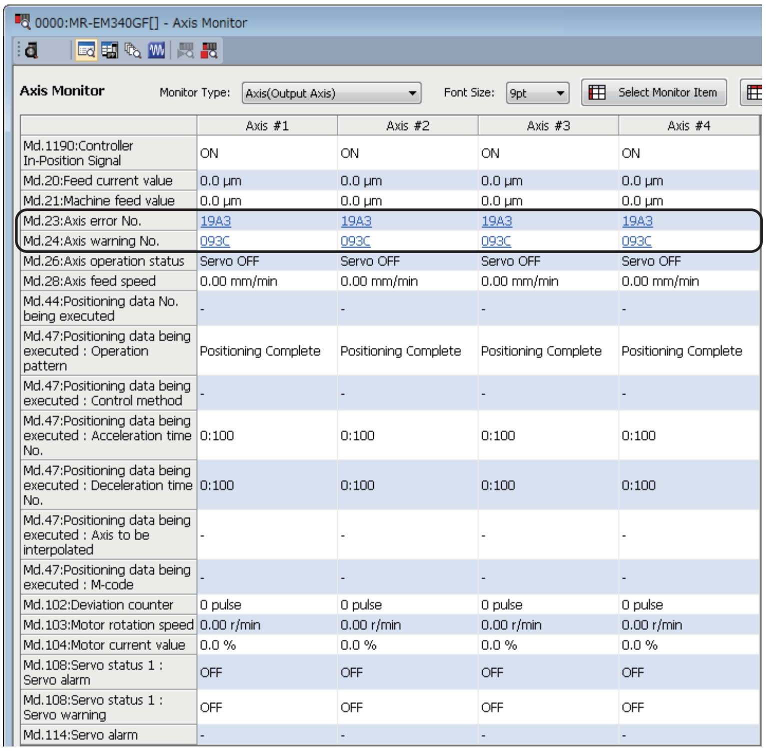
Turn the power supply of the Simple Motion board OFF to ON or execute the remote RESET and check that the Simple Motion board is in the normal status.
If the status is not changed, the possible cause is a Simple Motion board failure. Please consult your local Mitsubishi representative, explaining a detailed description of the problem.

Troubleshooting using the Simple Motion board status

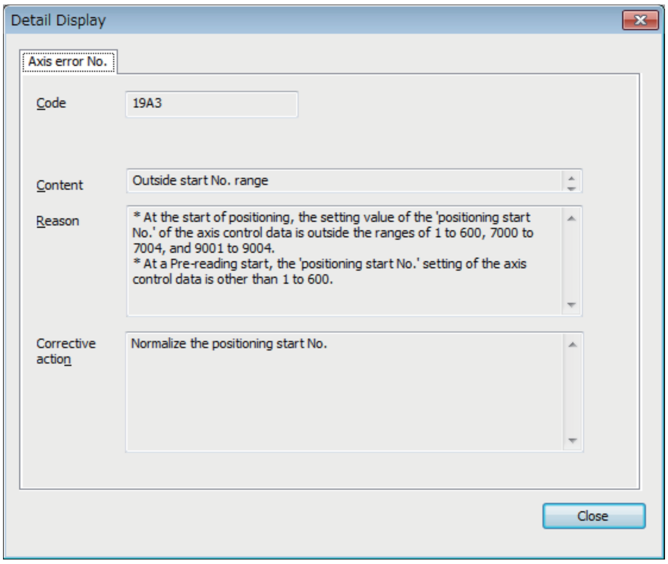
Error codes and warning codes occurred in the Simple Motion board can be checked by confirming the axis error No. or the axis warning No. using EM Configurator.

1. Check the "[Md.23] Axis error No." or "[Md.24] Axis warning No." using EM Configurator.

Navigation window ⇨ "Simple Motion Monitor" ⇨ "Board Monitor" ⇨ "Axis Monitor" ⇨ "[Md.23] Axis error No." or "[Md.24] Axis warning No."



2. Click the displayed axis error No. or axis warning No. and confirm the details.



14.2 Troubleshooting by Symptom

Troubleshooting when a motor does not rotate

Check items and corrective actions for troubleshooting when a motor does not rotate are described below.

Check item	Action
Is the user program READY signal turned ON?	Review the user program to turn ON the user program READY signal.
Is the servo amplifier powered ON?	Power on the servo amplifier.
Is there an error in the servo amplifier?	Check the error code of the servo amplifier and take a corrective action.
Is the wiring between the Simple Motion board and servo amplifier correct?	Check the wiring between the Simple Motion board and servo amplifier, and correct it.
Is the wiring between the servo amplifier and motor correct?	Check the wiring between the servo amplifier and motor, and correct it.
Is the wiring of the limit signal correct?	Check the wiring and logic setting of the limit signal, and correct the wiring.
Is there an error in the Simple Motion board? (ERR LED is on or flashing)	Check the error code and take a corrective action.
Isn't the value in "[Md.26] Axis operation status" "1: stopped"?	• Review the stop program. • Review whether the stop signal (STOP) is not input erroneously.
Is the value in "[Md.20] Feed current value" changed after positioning control is performed?	Review the start program.
Is the cumulative pulse of servo amplifier changed after positioning control is performed?	Refer to each servo amplifier instruction manual and check that the function to suppress the motor rotation is not working.

If a motor does not rotate even after the above items are checked, the possible cause is a Simple Motion board failure. Please consult your local Mitsubishi representative, explaining a detailed description of the problem.

Troubleshooting when a motor does not rotate as intended.

Check items and corrective actions for troubleshooting when a motor does not rotate as intended are described below.

■When a motor rotates only in the opposite direction

Check item	Action
Is the value in "Rotation direction selection/travel direction selection (PA14)" correct?	Check that the value in "Rotation direction selection/travel direction selection (PA14)" matches the settings of servo amplifier. When "Rotation direction selection/travel direction selection (PA14)" has been changed, turn the servo amplifier power supply ON again from OFF or reset the controller, and execute the home position return.

■When a motor does not rotate at the set speed

Check item	Action
Does the value in "[Md.28] Axis feedrate"*1 indicate the set speed?	[When "[Md.28] Axis feedrate"*1 indicates the set speed] • Check that the values in "[Pr.2] Number of pulses per rotation (AP)", "[Pr.3] Movement amount per rotation (AL)", and "[Pr.4] Unit magnification (AM)" meet the system. • When the servo amplifier has the electronic gear function, check that the settings meet the system.
	[When "[Md.28] Axis feedrate"*1 does not indicate the set speed] • Check that the speed is not limited by the value in "[Pr.8] Speed limit value". • In the JOG operation, check that the speed is not limited by the value in "[Pr.31] JOG speed limit value". • In the JOG operation, check that Forward run JOG start signal [Cd.181] and Reverse run JOG start signal [Cd.182] do not repeatedly turn ON and OFF.

*1 Speed control mode: "[Md.122] Speed during command"

■When the set position is not reached

Check item	Action
Does the value in "[Md.20] Feed current value" indicate the intended position when the motor stops?	[When the position set in "[Md.20] Feed current value" is reached] • Check that the values in "[Pr.2] Number of pulses per rotation (AP)", "[Pr.3] Movement amount per rotation (AL)", and "[Pr.4] Unit magnification (AM)" meet the system. • When the servo amplifier has the electronic gear function, check that the settings meet the system.
	[When the position set in "[Md.20] Feed current value" is not reached] • Check that the motor is not stopped by Axis stop signal [Cd.180]. If a motor is stopped by the stop command, the value "1: stopped" is stored in "[Md.26] Axis operation status".

14.3 Error and Warning Details

Error type

Errors detected by the Simple Motion board include parameter setting range errors, errors at operation start or during operation and errors detected by servo amplifier.

Simple Motion board detection parameter setting range errors

The parameters are checked when the power is turned ON and at the rising edge (OFF → ON) of the user program READY signal [Y0]. An error will occur if there is a mistake in the parameter setting details at that time.
When this kind of error occurs, the READY signal [X0] does not turn ON.
To cancel this kind of error, set the correct value in the parameter for which the error occurred, and then turn ON the user program READY signal [Y0].

Simple Motion board detection errors at operation start or during operation

The errors that occur at operation start or during operation such as the positioning control, JOG operation, or manual pulse generator operation. If an axis error occurs during interpolation operation, the error code will be stored in both the reference axis and the interpolation axis.
Note that the axis error No. will be stored only in the reference axis during analysis of the positioning data set in each point of the positioning start data table in the following cases.

- When the interpolation axis is BUSY.
- When the error occurs in positioning data or parameters unrelated to interpolation control.

If the error occurs at the simultaneous start of a positioning operation, the axis error storage details will differ depending on whether the error occurred before or after the simultaneous start.

- If the error (illegal axis No., other axis BUSY, etc.) occurs before the simultaneous start, the error "Error before simultaneous start" (error code: 1990H to 1991H) will occur for the start axis.
- If the error (positioning data error, software stroke limit error, etc.) occurs after the simultaneous start, an error code corresponding to the axis in which the error occurred will be stored. Because a simultaneous start cannot be carried out due to this, the error "Simultaneous start not possible" (error code: 199EH) will be stored in all axes in which an error has not occurred.

The axis operation status will be displayed as "error occurring" for axes in which an error occurred.
If an error occurs during operation, any moving axes will deceleration stop, and their operation status will be displayed as "error occurring".
All axes will decelerate to a stop during interpolation operations, even if the error occurs in only one axis.

Servo amplifier detection errors

The errors that occur when the hardware error of the servo amplifier or servo motor or the servo parameter error occurs.
The servo is turned off at the error occurrence and the axis stops.
Remove the error factor and reset the error, reset the controller, or turn the servo amplifier power supply ON again from OFF.

Error code classification

Item	Error code	Classification of errors
Minor errors	1800H to 185FH	System error
	1860H to 18BFH	Dedicated instruction errors
	18C0H to 18FFH	Inter-module synchronization errors
	1900H to 193FH	Positioning control common errors
	1940H to 197FH	Home position return errors
	1980H to 198FH	JOG, inching and manual pulse generator operation errors
	1990H to 19EFH	Positioning operation errors
	19F0H to 19FFH	Block start data errors
	1A00H to 1A0FH	Condition data errors
	1A10H to 1A5FH	Positioning data errors
	1A60H to 1A9FH	Basic parameter errors
	1AA0H to 1AFFH	Detailed parameter errors
	1B00H to 1B3FH	Home position return parameter errors
	1B40H to 1B9FH	Expansion/Common parameter errors
	1BA0H to 1BDFH	Synchronous control input axis errors
	1BE0H to 1C3FH	Synchronous control output axis errors
	1C80H to 1CBFH	Errors for servo amplifier, inverter, amplifier manufactured by other companies, and head module
	1CC0H to 1CCFH	Link device external signal assignment errors
Moderate errors	3000H to 30FFH	Initial process errors

Error storage

When an error occurs, the error detection signal turns ON, and the error code corresponding to the error details is stored in "[Md.23] Axis error No.". Note that there is a delay of up to operation cycle after the error detection signal turns ON until the error code is stored.

When an alarm occurs on servo amplifier, the alarm No. displayed in LED of servo amplifier is stored in "[Md.114] Servo alarm". Check the error details and remedies with "[Md.114] Servo alarm".

Axis No.	Error detection signal	Error code	Servo alarm
1	[Md.31] Status: b13	[Md.23] Axis error No.[*1]	[Md.114] Servo alarm
2			
3			
4			
5			
⋮			
16			

*1 A new error code is stored in "[Md.23] Axis error No." every time an error occurs.

Point

When any error that is independent of an axis is detected, it is stored in the axis error No. of axis 1.
(These errors are stored in the axis error No. of axis 1 for the system which does not use the axis 1.)

For the synchronous encoder axis, "b4: Error detection flag" of "[Md.325] Synchronous encoder axis status" for target axis turns ON, and the input axis error No. is stored in "[Md.326] Synchronous encoder axis error No.".

Warning type

Warnings detected by the Simple Motion board include system warnings, axis warnings and warnings detected by servo amplifier.

Simple Motion board detection system warnings

- System control data setting warnings: An axis warning for axis 1 will occur.
- Positioning data setting warnings: An axis warning for each axis will occur. Note that a warning will occur for the reference axis when an interpolation designation or axis setting warning occurs.

Simple Motion board detection axis warnings

- Axis warnings that occur at operation start or during operation such as the positioning operation, JOG operation or manual pulse generator operation.
- Axis warnings that occur due to system warnings: The axis operation status does not change even though an axis warning occurs.

Servo amplifier detection warnings

The warnings that occur when the hardware error of the servo amplifier or servo motor occurs or the servo parameter is inapplicable.

The servo may not be turned off depending on the warning. However, an error occurs or the operation cannot be executed normally if the warning is remained.

When the warning cause is removed, the warning is automatically released in the servo amplifier. However, the state that the warning occurs is continued in the Simple Motion board.

Reset it as necessary.

Warning code classification

Item	Warning code	Classification of warnings
Warnings	0900H to 093FH	Positioning control common warnings
	0980H to 098FH	JOG, inching and manual pulse generator operation warnings
	0990H to 09EFH	Positioning operation warnings
	09F0H to 09FFH	Block start data warnings
	0A10H to 0A5FH	Positioning data warnings
	0BA0H to 0BDFH	Synchronous control input axis warnings
	0BE0H to 0C3FH	Synchronous control output axis warnings
	0C40H to 0C7FH	Cam data operation warnings
	0C80H to 0CBFH	Warnings for servo amplifier, inverter, amplifier manufactured by other companies, and head module
	0CC0H to 0CCFH	Inter-module synchronization cycle warnings
	0CD0H to 0CDFH	Link device external signal assignment warnings

Warning storage

When an axis warning occurs, the warning code corresponding to the warning details is stored in "[Md.24] Axis warning No.".

When an axis warning occurs in a positioning operation, etc., axis warning detection ([Md.31] Status: b9) for axis status storage turns ON.

When a warning occurs on servo amplifier, the warning No. displayed in LED of servo amplifier is stored in "[Md.114] Servo alarm". Check the warning details and remedies with "[Md.114] Servo alarm".

Warning detection signal	Warning code	Servo alarm
[Md.31] Status: b9	[Md.24] Axis warning No.*1	[Md.114] Servo alarm

*1 A new warning code is stored in "[Md.24] Axis warning No." every time a warning occurs.

For the synchronous encoder axis, "b5: Warning detection flag" of "[Md.325] Synchronous encoder axis status" for target axis turns ON, and the input axis warning No. is stored in "[Md.327] Synchronous encoder axis warning No.".

Clearing errors and warnings

Remove the cause of error or warning following the actions described in the sections below before canceling an error or warning state by resetting the error.

☞ Page 615 List of Warning Codes, Page 625 List of Error Codes

How to clear errors or warnings

An error or warning state is canceled after the following processing is carried out by setting "1" in "[Cd.5] Axis error reset".

- Axis error detection signal is turned OFF.
- "[Md.23] Axis error No." is cleared.
- "[Md.24] Axis warning No." is cleared.
- "[Md.26] Axis operation status" is changed from "Error" to "Standby".
- "Axis warning detection ([Md.31] Status: b9)" is turned OFF.

Point

When servo amplifier alarms cannot be reset even if error reset is requested, "0" is not stored in "[Cd.5] Axis error reset" by Simple Motion board. It remains "1". Set "0" in "[Cd.5] Axis error reset" and then set "1" to execute the error reset again by user side.

For the synchronous encoder axis, an error or warning state is canceled after the following processing is carried out by setting "1" in "[Cd.323] Synchronous encoder axis error reset" for target axis.

- "b4: Error detection flag" of "[Md.325] Synchronous encoder axis status" is turned OFF.
- "[Md.326] Synchronous encoder axis error No." is cleared.
- "b5: Warning detection flag" of "[Md.325] Synchronous encoder axis status" is turned OFF.
- "[Md.327] Synchronous encoder axis warning No." is cleared.

14.4 List of Warning Codes

Simple Motion board detection warning

Warning code (Hexadecimal)	Warning name	Error details and causes	Remedy
0900H	Start during operation	• The start request is issued while the axis is BUSY. • Positioning was started during speed control mode/ torque control mode. [Operation status at warning occurrence] Position control mode: The operation continues. Speed control mode/torque control mode: The operation continues. (Positioning start is not executed.) Direct control: Direct control continues. (Positioning start is not executed.)	• Normalize the start request ON timing. • When in speed control mode/torque control mode, start positioning after switching to the position control mode. • When in direct control, start positioning after switching to the standard control.
0902H	Restart not possible	The restart command is issued when the axis operation status is not "Stopped". [Operation status at warning occurrence] Continues the operation.	Normalize the start request ON timing. (Do not issue the restart command when the axis operation status is not stopped.)
0903H	Teaching in BUSY	The teaching request is issued while the axis is BUSY. [Operation status at warning occurrence] The warning is issued for the axis designated at the time of the teaching request.	Carry out the teaching request when the axis is not BUSY.
0904H	Less than minimum speed	The overridden speed becomes "0". [Operation status at warning occurrence] The system is controlled with the currently executing unit of 1.	Prevent the overridden speed from being reduced to 0.
0905H	In user program READY	The request for writing to the flash ROM is issued when the user program READY is turned ON. [Operation status at warning occurrence] The warning for axis 1 is issued.	Request to write when the user program READY signal [Y0] is OFF.
0906H	Illegal override value	A value other than 0 to 300 is set for the override value. [Operation status at warning occurrence] When a setting value is 301 or more: Controlled at 300.	Set a value within the setting range.
0907H	Outside new torque value range/outside forward new torque value range	A new torque value/forward new torque value exceeds the torque limit setting value.*1 [Operation status at warning occurrence] The torque change is not carried out.	Set a new torque value/forward new torque value equal to or less than the torque limit setting value.
0908H	Below bias speed	The command speed is below the bias speed at start. [Operation status at warning occurrence] Operates by the bias speed at start.	Re-set the command speed/bias speed at start so that the command speed is equal to or larger than the bias speed at start.
092EH	Mark detection link device start No. specification	The corresponding station does not exist in link device that has been set to mark detection signal link device start No. [Operation status at warning occurrence] The setting No. of which the mark detection setting parameter is outside the range is invalid.	Review the mark detection signal link device start No. setting.
092FH	Mark detection link device bit specification	Bit other than 0 to F has been specified in mark detection signal link device. [Operation status at warning occurrence] The setting No. of which the mark detection setting parameter is outside the range is invalid.	Review the mark detection signal link device bit No. setting.
0932H	Outside new reverse torque value range	A new reverse torque value exceeds the torque limit setting value. [Operation status at warning occurrence] The torque change is not carried out.	Set a value which does not exceed the torque limit setting value as the new reverse torque value.
0933H	Servo cyclic transmission setting warning	The size setting over 5 bytes of servo cyclic transmission is incorrect. [Operation status at warning occurrence] The servo cyclic transmission is not performed.	• The specification of data over 5 bytes will be set to "[Pr.500] Optional send PDO1" or "[Pr.502] Optional send PDO3", and "0" will be set to "[Pr.501] Optional send PDO2" or "[Pr.503] Optional send PDO4". • The specification of data over 5 bytes will be set to "[Pr.506] Optional receive PDO1" or "[Pr.508] Optional receive PDO3", and "0" will be set to "[Pr.507] Optional receive PDO2" or "[Pr.509] Optional receive PDO4".

Warning code (Hexadecimal)	Warning name	Error details and causes	Remedy
0936H	Outside mark detection signal setting range	The mark detection signal setting is outside the range. [Operation status at warning occurrence] The setting No. of which the mark detection setting parameter is outside the range is invalid.	Set a value within the setting range.
0937H	Outside mark detection data type setting range	The mark detection data type setting is outside the range. [Operation status at warning occurrence] The setting No. of which the mark detection setting parameter is outside the range is invalid.	Set a value within the setting range.
0938H	Outside mark detection data axis No. setting range	When the mark detection data type setting is not "Optional 2 word buffer memory", the mark detection data type setting is outside the range. [Operation status at warning occurrence] The setting No. of which the mark detection setting parameter is outside the range is invalid.	Set a value within the setting range.
0939H	Outside mark detection data buffer memory No. setting range	When the mark detection data type setting is "Optional 2 word buffer memory", the mark detection data buffer memory No. is outside the range or odd number. [Operation status at warning occurrence] The setting No. of which the mark detection setting parameter is outside the range is invalid.	Set a value with an even number within the setting range.
093AH	Outside maximum number of control axes	The common parameter "[Pr.152] Maximum number of control axes" exceeds the number of control axes of Simple Motion board. [Operation status at warning occurrence] Controlled as "0: No setting".	Set the maximum number of control axes less than the number of control axes of Simple Motion board.
093BH	Outside control axis setting	"[Pr.100] Connected device" is set to the axis that exceeded the "[Pr.152] Maximum number of control axes". [Operation status at warning occurrence] The communication with the connected device is not executed.	Correct the "[Pr.152] Maximum number of control axes" or "[Pr.100] Connected device".
093CH	Home position return data incorrect	• The backup data for absolute position restoration is illegal. • The home position return has never been executed after the system start. • The home position return is started, but not completed correctly. • "Absolute position erased" in the driver is detected. • "Rotation direction selection (PA14)" of the servo parameter has been changed. [Operation status at warning occurrence] The operation continues.	Execute home position return.
0980H	Speed change during deceleration	The speed change request is issued during deceleration stop with JOG start signal OFF. [Operation status at warning occurrence] The speed change is not carried out.	Do not carry out the JOG speed change during deceleration with the JOG start signal OFF.
0981H	JOG speed limit value	The JOG speed[*2] exceeds the JOG speed limit value at start. [Operation status at warning occurrence] • When the speed exceeds the JOG speed limit, the JOG operation is carried out with the JOG speed limit value. • While the speed is limited by the JOG speed limit value, the "[Md.39] In speed limit flag" is turned ON.	Set a value within the setting range.
0982H	JOG speed limit value	The new speed value[*2] exceeds the JOG speed limit value when the speed is changed during operation. [Operation status at warning occurrence] • When the speed exceeds the JOG speed limit, the JOG operation is carried out with the JOG speed limit value. • While the speed is limited by the JOG speed limit value, the "[Md.39] In speed limit flag" is turned ON.	Set a value within the setting range.

Warning code (Hexadecimal)	Warning name	Error details and causes	Remedy
0988H	Outside manual pulse generator input magnification range	The manual pulse generator 1 pulse input magnification is set to 0, 10001 or more, or negative value. [Operation status at warning occurrence] • When input magnification is set at 10001 or more, or negative value: Re-set to 10000. • When input magnification is set at 0: Re-set to 1.	Set the manual pulse generator 1 pulse input magnification to within the setting range.
0989H	Outside manual pulse generator speed limit value	The manual pulse generator speed exceeds "[Pr.123] Manual pulse generator speed limit value". [Operation status at warning occurrence] • When the speed exceeds the detailed parameter 2 "Manual pulse generator speed limit value", the manual pulse generator operation is executed following the detailed parameter 2 "Manual pulse generator speed limit mode". • "In speed limit flag" is turned ON while the speed is controlled with the detailed parameter 2 "Manual pulse generator speed limit value".	Adjust speed of manual pulse generator or "[Cd.20] Manual pulse generator 1 pulse input magnification" not to exceed the speed limit value.
0990H	Deceleration/stop speed change	The speed change request is issued during deceleration stop. [Operation status at warning occurrence] The speed change is not carried out.	Do not carry out the speed change during deceleration with a stop command, during stoppage, or during automatic deceleration with position control.
0991H	Speed limit value over	• Setting speeds*2 exceed the speed limit value when starting/restarting the positioning or when changing the speed at the positioning*3. (At the interpolation control, either of reference axes or interpolation axes exceeds the speed limit value.) • "[Cd.140] Command speed at speed control mode" exceeds "[Pr.8] Speed limit value" during the speed control mode. • "[Cd.146] Speed limit value at torque control mode" exceeds "[Pr.8] Speed limit value" during the torque control mode. [Operation status at warning occurrence] [Position control mode] • The speed is controlled with the speed limit value. • The "[Md.39] In speed limit flag" is turned ON. [Speed control mode/Torque control mode] • The speed is controlled with the speed limit value. (The "[Md.39] In speed limit flag" is not turned ON.)	Review each speed so that setting speeds do not exceed the speed limit value.
0992H	M code ON signal ON	The M code ON signal is turned ON when the positioning data is executed. [Operation status at warning occurrence] Continues executing the positioning data.	Normalize the ON and OFF timings of the "M code OFF request".
0993H	Speed-position switching (during acceleration) signal ON	The switching signal for speed-position switching control (INC mode) is turned ON during acceleration. [Operation status at warning occurrence] The operation is continued.	Do not turn ON the speed-position switching signal during acceleration.
0994H	Insufficient remaining distance	At a continuous operation interrupt request, the distance required deceleration stop is not long enough. [Operation status at warning occurrence] • When a command speed is changed: Change to a value as near a new speed value as possible. • When a target position is changed: Adjust the speed to a value as near the command speed as possible, and then change to a target position. (When the operation pattern is a continuous path control, ignore the operations stated above.)	Give a request at the position where there is an enough remaining distance.
0995H	Insufficient remaining distance	At a speed change request, the remaining distance is shorter than the distance required for speed change. [Operation status at warning occurrence] • When a command speed is changed: Change to a value as near a new speed value as possible. • When a target position is changed: Adjust the speed to a value as near the command speed as possible, and then change to a target position. (When the operation pattern is a continuous path control, ignore the operations stated above.)	Give a request at the position where there is an enough remaining distance.

Warning code (Hexadecimal)	Warning name	Error details and causes	Remedy
0996H	Step not possible	Code 1 is set for the step start information when the step is outside standby. [Operation status at warning occurrence] The step will not start.	Do not set a "1" to the step start information when the step is not in standby state.
0997H	Illegal external command function	The detailed parameter 2 "External command function selection" setting range is exceeded. [Operation status at warning occurrence] Even if the external command signal is turned ON, the system will not perform anything.	Set the detailed parameter 2 "External command function selection" to within the setting range.
0998H	Insufficient movement amount	The movement amount is not large enough for automatic deceleration. [Operation status at warning occurrence] The system stops immediately after it reaches the positioning address.	Set a decelerating address or a movement amount to the positioning data.
0999H	Illegal teaching data No.	The positioning data No. is set outside the setting range. [Operation status at warning occurrence] Teaching is not carried out when the setting value is 0 or 601 or more. (The setting value is automatically reset to "0" by the Simple Motion board even when a "0" or "601" or more is set.)	Set the positioning data No. to within the setting range.
099AH	Illegal teaching data selection	The teaching data selection set value is outside the setting range. [Operation status at warning occurrence] Teaching is not carried out.	Set the teaching data selection set value to within the setting range.
099BH	Target position change not possible	• A target position change request was given for the control method other than ABS1 and INC1. • A target position change request was given during speed control mode or torque control mode. [Operation status at warning occurrence] The target position change is not carried out.	Do not turn ON the target position change request in the following cases. • A control method other than ABS1 and INC1 is used. • During speed control mode • During torque control mode
099CH	Target position change not possible	A target position change request is turned ON during continuous path control. [Operation status at warning occurrence] The target position change is not carried out.	Do not turn ON the target position change request when an operating pattern "continuous path control" is used.
099DH	Target position change not possible	A target position change request was given during deceleration to a stop. [Operation status at warning occurrence] The target position change is not carried out.	Do not turn ON the target position change request during deceleration stop.
099EH	Target position change not possible	A target position change request was issued when speed change 0 flag ([Md.31] Status: b10) was ON. [Operation status at warning occurrence] The target position change is not carried out.	Do not turn ON the target position change request when speed change 0 flag ([Md.31] Status: b10) is ON.
099FH	Target position change not possible	"[Cd.27] Target position change value (New address)" is outside the software stroke limit range (+). [Operation status at warning occurrence] The target position change is not carried out.	Correct the setting value.
09A0H	Target position change not possible	"[Cd.27] Target position change value (New address)" is outside the software stroke limit range (-). [Operation status at warning occurrence] The target position change is not carried out.	Correct the setting value.
09A1H	Target position change not possible	"[Cd.27] Target position change value (New address)" is out of range (0 to 359.99999 [degree]). [Operation status at warning occurrence] The target position change is not carried out.	Correct the setting value.
09E4H	Torque limit value over	A value exceeding "[Pr.17] Torque limit setting value" is set to "[Cd.143] Command torque at torque control mode" at torque control mode. [Operation status at warning occurrence] The torque is controlled with the torque limit setting value.	Review the setting value so that the setting torque is not exceeded the torque limit setting value.

Warning code (Hexadecimal)	Warning name	Error details and causes	Remedy
09E5H	Torque initial value selection invalid	At switching the control mode, the servo parameter "Function selection C-B POL reflection selection at torque control (PC29)" is "0: Enabled" on the axis that set feedback torque into the torque initial value selection. [Operation status at warning occurrence] The initial value selection is controlled as the command torque.	• Use a servo amplifier which supports the servo parameter "Function selection C-B POL reflection selection at torque control (PC29)" and set (PC29) to "1: Disabled". • At switching the control mode, set the torque initial value selection to command torque.
09E6H	Control mode switching during BUSY	Control mode switching was executed from the position control mode to the speed control mode/torque control mode while BUSY was turned ON. [Operation status at warning occurrence] The control mode is not switched. (Positioning during operation continues.)	Switch the control mode after turning BUSY OFF.
09E7H	Control mode switching during zero speed OFF	Control mode was changed when "Zero speed" ([Md.119] Servo status2) was turned OFF. [Operation status at warning occurrence] The control mode is not switched. (Current operation continues.)	Switch the control mode after turning "Zero speed" ([Md.119] Servo status2) ON.
09E8H	Outside control mode range	Control mode switching request was performed by specifying a value outside the range for "[Cd.139] Control mode setting". [Operation status at warning occurrence] The control mode is not switched. (Current operation continues.)	Switch the control mode after setting a value within the range for "[Cd.139] Control mode setting".
09E9H	Control mode switching	Control mode switching request was performed during the control mode switching. [Operation status at warning occurrence] Control mode switching request is not accepted.	Carry out the control mode switching request after completing the control mode switching.
09EAH	Illegal control mode switching	Switching to the speed/torque control mode is requested to the axis which does not support the control mode switching. [Operation status at warning occurrence] Control mode switching request is not accepted.	Do not use the speed/torque control to the axis which does not support the control mode switching.
09F0H	No operation termination setting	In the positioning by block starting, the 50th point of the positioning start data is set to CONTINUE. [Operation status at warning occurrence] The operation is terminated.	Set the operation termination to the 50th point.
09F1H	FOR to NEXT nest construction	FOR to NEXT is nested. [Operation status at warning occurrence] The operation is continued.	Make 1 nest construction for FOR to NEXT.
0A10H	Outside command speed range	• The speed change value is outside the setting range when changing the speed during operation*4 • "[Cd.140] Command speed at speed control mode" is outside the setting range during the speed control mode. • "[Cd.146] Speed limit value at torque control mode" is outside the setting range during the torque control mode. [Operation status at warning occurrence] • The speed change value is controlled as the "maximum value within the setting range". • The "[Md.39] In speed limit flag" is turned ON.	• Set the speed change value to within the setting range. • Set "[Cd.140] Command speed at speed control mode" to within the setting range during the speed control mode. • Set "[Cd.146] Speed limit value at torque control mode" to within the setting range during the torque control mode.
0C81H	Incompatible device	Incompatible device is connected. [Operation status at warning occurrence] The operation continues.	Please contact with our sales representative.
0C83H	SLMP communication warning	Object cannot be acquired because error was detected in SLMP communication after connecting to amplifier. [Operation status at warning occurrence] The operation continues.	• Check the Abort Code and take corrective actions according to causes. • Check the object content used in specified servo object area. (Refer to the driver instruction manual for Abort Code details and object available to be sent.)

Warning code (Hexadecimal)	Warning name	Error details and causes	Remedy
0C84H	Virtual servo amplifier operation warning	Virtual servo amplifier connection/disconnection has already been executed to stations that connected with network. [Operation status at warning occurrence] The virtual servo amplifier is not connected or disconnected.	Please execute virtual servo amplifier connection/ disconnection after the corresponding station disconnected from network.
0CC0H	Inter-module synchronization cycle time over	The cyclic processing did not finish before the start timing for the next inter-module synchronization cycle. [Operation status at warning occurrence] The operation continues.	Set the inter-module synchronization cycle to longer than the current value.
0E00H	Board ID setting error	The switch 4 of the board ID setting switch is turned ON. [Operation status at warning occurrence] The system stops.	Turn OFF the power supply of the host personal computer and review the setting of the board ID setting switch.
0E01H	Direct control stop error	The stop signal is turned ON when the switching condition of direct control is not satisfied. [Operation status at warning occurrence] Direct control continues.	Review the stop signal ON timing.

*1 When the torque change function is used with the individual setting for new torque value and new reverse torque value, it indicates outside forward new torque value.

*2 This speed is a value in which override value is considered when override function is used. ("[Cd.13] Positioning operation speed override" is set other than 100 [%].)

*3 The speed change by position-speed switching control, target position change function, or override function is contained.

*4 The speed change by position-speed switching control or target position change function is contained.

Warnings related to synchronous control are described below.

Warning code (Hexadecimal)	Warning name	Error details and causes	Remedy
0BD0H	Input axis phase compensation amount over	Phase compensation amount of input axis is equal or lower than the minimum value (-2147483648), or exceeding the maximum value (2147483647). [Operation status at warning occurrence] The input axis operation continues. It is controlled with the minimum or maximum value.	• Set a smaller phase compensation advance time. • Decrease the input axis speed.
0BD1H	Input axis rotation direction restriction amount over	Rotation direction restriction amount of input axis is equal or lower than the minimum value (-2147483648), or exceeding the maximum value (2147483647). [Operation status at warning occurrence] The input axis operation continues. It is controlled with the minimum or maximum value.	• Confirm the enabled direction of the rotation direction restriction setting. (The setting may be reversed.) • Check if the input axis moves to the reverse direction of the enabled direction.
0BD2H	Input axis speed display over	Monitor speed display of input axis is equal or lower than the minimum value (-2147483648), or exceeding the maximum value (2147483647). [Operation status at warning occurrence] The input axis operation continues. The minimum or maximum value is displayed as the speed display of monitor data.	• Set a lower value if the number of decimal places for speed command setting is available in the input axis setting. • Switch the units from minute to second if the speed command time unit setting is available in the input axis setting. • Decrease the input axis speed.
0BD3H	Synchronous encoder via servo amplifier battery warning	Voltage of the servo amplifier battery connected with a synchronous encoder decreased to 3.2 V or less. [Operation status at warning occurrence] The synchronous encoder control continues.	Replace the battery.
0BE4H	Outside main shaft clutch control setting range	• The synchronous parameter "[Pr.405] Main shaft clutch control setting" was set to outside the setting range during the synchronous control. • The synchronous parameter "[Pr.405] Main shaft clutch control setting" was set from a setting other than "No Clutch" to "No Clutch" during the synchronous control. [Operation status at warning occurrence] Synchronous control continues by the previous main shaft clutch control setting.	• Set a value within the range. • Do not change the settings other than "No Clutch" to "No Clutch".
0BF4H	Outside auxiliary shaft clutch control setting range	• The synchronous parameter "[Pr.422] Auxiliary shaft clutch control setting" was set to outside the setting range during the synchronous control. • The synchronous parameter "[Pr.422] Auxiliary shaft clutch control setting" was set from a setting other than "No Clutch" to "No Clutch" during the synchronous control. [Operation status at warning occurrence] Synchronous control continues by the previous auxiliary shaft clutch control setting.	• Set a value within the range. • Do not change the settings other than "No Clutch" to "No Clutch".
0BFAH	Outside speed change ratio denominator range	The synchronous parameter "[Pr.437] Speed change ratio: Denominator" is set to 0 or lower during synchronous control. [Operation status at warning occurrence] Synchronous control continues by the previous speed change ratio (Denominator).	Set a value within the range of 1 to 2147483647.
0BFBH	Outside cam No. range	The synchronous parameter "[Pr.440] Cam No." is set to other than 0 to 1024 during synchronous control. [Operation status at warning occurrence] Synchronous control continues by the previous cam No.	Set a value within the range of 0 to 1024.
0BFCH	Cam not registered	When changing the synchronous parameter "[Pr.440] Cam No.", the cam data of the changed cam No. does not exist on the Cam open area during synchronous control. [Operation status at warning occurrence] Synchronous control continues by the previous cam No.	Specify the cam No. of an existing cam data.
0C12H	Cam axis length per cycle outside range	Set the value of synchronous parameter "Cam axis length per cycle" ([Pr.439]) less than 0. [Operation status at warning occurrence] Synchronous control continues by the previous cam axis length per cycle.	Set a value within the range of 1 to 2147483647.

Warning code (Hexadecimal)	Warning name	Error details and causes	Remedy
0C14H	Cam axis phase compensation amount over	Phase compensation amount of cam axis is equal or lower than the minimum value (-2147483648), or exceeding the maximum value (2147483647). [Operation status at warning occurrence] Synchronous control continues. The operation is controlled with the minimum or maximum value.	• Set a smaller cam axis phase compensation advance time. • Decrease the cam axis input value speed.
0C15H	Cam axis length per cycle change invalid	"Cam axis length per cycle" ([Pr.439]) will be changed when the cam data which is stroke ratio data format and the cam data starting point is other than 0 is used in synchronous controlling. [Operation status at warning occurrence] Synchronous control continues by the previous cam axis length per cycle.	Use the cam data which the cam data starting position is 0.
0C40H	Outside operation cam No. range	"[Cd.601] Operation cam No." is other than 1 to 1024. [Operation status at warning occurrence] Cam data writing/reading is not executed.	Set a value within the range of 1 to 1024.
0C41H	Read cam not registered	Cam data of the specified cam No. does not exist on the cam open area during the cam data reading operation. [Operation status at warning occurrence] Cam data writing/reading is not executed.	• Specify the cam No. of an existing cam data. • When writing the cam data from EM Configurator, execute the power supply ON again/remote RESET or transfer the cam and open the cam data on cam open area.
0C42H	Outside cam data first position range	• "[Cd.602] Cam data first position" is outside the range of "1 to Cam resolution" for the stroke ratio data format cam. • "[Cd.602] Cam data first position" is outside the range of "0 to (Coordinate number - 1)" for the coordinate data format cam. [Operation status at warning occurrence] Cam data writing/reading is not executed.	• Set a value within the range of "1 to Cam resolution" for the stroke ratio data format cam. • Set a value within the range of "0 to (Coordinate number - 1)" for the coordinate data format cam.
0C43H	Outside number of cam data operation points range	• "[Cd.603] Number of cam data operation points" is outside the range of 1 to 32768 for the stroke ratio data format cam. • "[Cd.603] Number of cam data operation points" is outside the range of 1 to 65535 for the coordinate data format cam. • First position and number of operation points which exceed the cam resolution or coordinate number are set during the cam data writing operation. [Operation status at warning occurrence] Cam data writing/reading is not executed.	• Set a value within the range of 1 to 32768 for the stroke ratio data format cam. • Set a value within the range of 1 to 65535 for the coordinate data format cam. • Set "Cam data first position + (Number of cam data operation points - 1)" not to exceed the cam resolution. • Set "Cam data first position + (Number of cam data operation points - 1)" not to exceed the number of coordinates.
0C44H	Outside cam data format range	• "Cam data method" ([Cd.604]) is outside the setting range during the cam data writing operation. • The cam data created by a free-form curve is read during the cam data reading (cam storage area) operation. [Operation status at warning occurrence] Cam data writing/reading is not executed.	• Set within the range. • Do not read the cam data created by a free-form curve.
0C45H	Outside cam resolution/coordinate number range	• "[Cd.605] Cam resolution/coordinate number" is other than "256/512/1024/2048/4096/8192/16384/32768" for the stroke ratio data format cam during the cam data writing operation. • "[Cd.605] Cam resolution/coordinate number" is outside the range of "2 to 65535" for the coordinate data format cam during the cam data writing operation. [Operation status at warning occurrence] Cam data writing/reading is not executed.	• Set a value within the range of "256/512/1024/ 2048/ 4096/8192/16384/32768" for the stroke ratio data format cam. • Set a value within the range of 2 to 65535 for the coordinate data format cam.
0C46H	Outside cam data starting position range	"[Cd.606] Cam data starting point" is outside the range from "0 to (Cam resolution - 1)" during the cam data writing operation. [Operation status at warning occurrence] Cam data writing/reading is not executed.	Set a value within the range of "0 to (Cam resolution - 1)".

Warning code (Hexadecimal)	Warning name	Error details and causes	Remedy
0C47H	Cam storage area capacity over	• The free area in the cam storage area is insufficient during the cam data writing operation. • The writable area is insufficient due to the decoupling of free area. [Operation status at warning occurrence] Cam data writing/reading is not executed.	• Decrease the number of cam data (number of cams, cam resolution, and coordinate number). • Erase the cam data and rewrite it.
0C48H	Cam open area capacity over	• The free area in the cam open area is insufficient during the cam data writing operation. • The writable area is insufficient due to the decoupling of free area. [Operation status at warning occurrence] Cam data writing/reading is not executed.	• Decrease the number of cam data (number of cams, cam resolution, and coordinate number). • Erase the cam data and rewrite it.
0C49H	Coordinate data error	• Input value of coordinate data is a negative value during the cam data writing operation. • Input value of coordinate data is not "$X_n < X_{n+1}$" during the cam data writing operation. [Operation status at warning occurrence] Cam data writing/reading is not executed.	• Set the Input value of coordinate data to 0 or more. • Set the Input value of coordinate data to "$X_n < X_{n+1}$".
0C50H	Outside cam auto-generation cam No. range	"[Cd.609] Cam auto-generation cam No." is outside the range of 1 to 1024. [Operation status at warning occurrence] Cam auto-generation is not executed.	Set a value within the range of 1 to 1024.
0C51H	Outside cam auto-generation type range	"[Cd.610] Cam auto-generation type" is outside the setting range. [Operation status at warning occurrence] Cam auto-generation is not executed.	Set within the range.
0C52H	Cam auto-generation cam storage area capacity over	• The free area in the cam storage area is insufficient. • The writable area is insufficient due to the decoupling of free area. [Operation status at warning occurrence] Cam auto-generation is not executed.	• Decrease the number of cam data (number of cams, cam resolution, and coordinate number). • Erase the cam data and rewrite it.
0C53H	Cam auto-generation cam open area capacity over	• The free area in the cam open area is insufficient. • The writable area is insufficient due to the decoupling of free area. [Operation status at warning occurrence] Cam auto-generation is not executed.	• Decrease the number of cam data (number of cams, cam resolution, and coordinate number). • Erase the cam data and rewrite it.
0C54H	Outside cam auto-generation value range	"[Cd.611] Cam auto-generation data" is outside the setting range. [Operation status at warning occurrence] Cam auto-generation is not executed.	Set a value within the setting range for the cam auto-generation.
0C55H	Cam auto-generation calculation disable	"[Cd.611] Cam auto-generation data" is set to the value that the cam pattern cannot be generated. (Such as when the sheet synchronization width is larger than the sheet length in the cam for a rotary cutter) [Operation status at warning occurrence] Cam auto-generation is not executed.	Review the setting value of the cam auto-generation data.
0C60H	Outside cam position calculation cam No. range	"[Cd.613] Cam position calculation: Cam No." is outside the range of 0 to 1024. [Operation status at warning occurrence] Cam position calculation is not executed.	Set a value within the range of 0 to 1024.
0C61H	Cam position calculation cam not registered	Cam data of the specified cam No. does not exist on the cam open area during the cam position calculation. [Operation status at warning occurrence] Cam position calculation is not executed.	• Specify the cam No. of an existing cam data. • When writing the cam data from EM Configurator, execute the power supply ON again/remote RESET or transfer the cam and open the cam data on cam open area.
0C62H	Outside cam position calculation cam axis length per cycle range	"[Cd.615] Cam position calculation: Cam axis length per cycle" is set to 0 or lower. [Operation status at warning occurrence] Cam position calculation is not executed.	Set a value within the range of 1 to 2147483647.
0C63H	Outside cam position calculation cam axis current value per cycle range	"[Cd.617] Cam position calculation: Cam axis current value per cycle" is outside the range of 0 to "Cam axis length per cycle". [Operation status at warning occurrence] Cam position calculation is not executed.	Set a value within the range of 0 to "Cam axis length per cycle".

Warning code (Hexadecimal)	Warning name	Error details and causes	Remedy
0C64H	Cam position calculation cam axis 1 cycle current value calculation disable	Corresponding cam axis current value per cycle could not be calculated during cam axis current value per cycle calculation. (Occurs in reciprocated cam pattern) [Operation status at warning occurrence] Cam position calculation is not executed.	Set "[Cd.614] Cam position calculation: Stroke amount", "[Cd.616] Cam position calculation: Cam reference position", and "[Cd.618] Cam position calculation: Cam axis feed current value" within the range of reciprocated cam pattern stroke.

Servo amplifier detection warning

For details of servo amplifier detection warnings, refer to each servo amplifier instruction manual.

14.5 List of Error Codes

Simple Motion board detection error

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
0000H	Normal	—	—
1080H	Flash ROM write number error	Data is written to the flash ROM continuously 25 times or more. [Operation status at error occurrence] The system does not write data to the flash ROM.	Do not write data continuously to the flash ROM. (Using "[Md.19]", the number of flash ROM write times can be monitored.) (If this error has occurred in a proper using method, writing is enabled by resetting the error, switching power OFF, then ON, or executing remote RESET.)
1810H	Connection failure	A connection failure was detected in the network. [Operation status at error occurrence] The operation is continued.	Correct the wiring status.
1815H	Outside interrupt mode selection setting range	An illegal value is set in "[Pr.1100] Interrupt mode selection". [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value and turn the user program READY signal [Y0] from OFF to ON.
1816H	Interrupt factor setting error	An illegal value is set in "[Pr.1101] Interrupt factor setting". [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value and turn the user program READY signal [Y0] from OFF to ON.
1817H	Interrupt data condition setting error	An illegal value is set in "[Pr.1102] Interrupt data condition". [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value and turn the user program READY signal [Y0] from OFF to ON.
1818H	Interrupt judge condition error	An illegal value is set in "[Pr.1103] Interrupt judge condition". [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value and turn the user program READY signal [Y0] from OFF to ON.
1819H	Interrupt not available	"[Cd.1100] Interrupt enable request" is enabled when the MSI (message signaled interrupt) is not available. [Operation status at error occurrence] The interrupt to the user program does not occur.	Install the EM Software Development Kit.
181AH	Interrupt condition judge value setting error	"[Pr.1102] Interrupt data condition" is 2 bytes and the value more than 2 bytes is set in "[Pr.1104] Interrupt condition judge value 1" or "[Pr.1105] Interrupt condition judge value 2". [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Review the parameter setting and turn the user program READY signal [Y0] from OFF to ON.
18B0H	Error when switching from normal operation mode to amplifier-less operation mode	Input signals other than synchronization flag [X1] are ON when switching from the normal operation mode to the amplifier-less operation mode. [Operation status at error occurrence] The operation mode is not changed.	Switch the operation mode after confirming that all input signals other than synchronization flag [X1] are OFF.
18B1H	Error when switching from amplifier-less operation mode to normal operation mode	Input signals other than synchronization flag [X1] are ON when switching from the amplifier-less operation mode to the normal operation mode. [Operation status at error occurrence] The operation mode is not changed.	Switch the operation mode after confirming that all input signals other than synchronization flag [X1] are OFF.
18C0H	Unit synchronization cycle setting unsupported	The setting value of unit synchronization cycle is unsupported. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Set any one of "0.5 ms", "1.0 ms", "2.0 ms" or "4.0 ms" for inter-module synchronous cycle and switch the power on again or execute remote RESET.
18D0H	Control slave station inter-module synchronization target mismatch	The network synchronization communication setting in the network configuration setting of the master station does not match the network synchronization communication setting of the controlled slave station (synchronization enable/disabled). [Operation status at error occurrence] The cyclic communication is executed asynchronously.	• Set the "Network Synchronous Communication" for the corresponding local station to the "Synchronous" in "Network Configuration" under "Basic Settings" of the master station. • Set the corresponding module to the same setting as the master station using the local station's inter-module synchronization setting.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
18D2H	Synchronous watch dog counter error	Proper communication was not possible between the CC-Link IE Field Network synchronization slaves. [Operation status at error occurrence] The operation is continued.	• Set the inter-module synchronization cycle to longer than the current value in "Inter-module Synchronization Cycle Setting". • Check if the switching hub and the cables are connected properly.
1900H	User program READY OFF during operation	The user program READY signal [Y0] is turned OFF during operation. [Operation status at error occurrence] The system stops with the setting (deceleration stop/ rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 2). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Review the user program which turns ON/OFF user program READY signal [Y0].
1902H	Servo READY signal OFF during operation	The servo READY signal is turned OFF during operation. [Operation status at error occurrence] During operation: The system stops immediately.	Check the servo amplifier power, wiring with the servo amplifier, and connection of connectors.
1903H	Test mode faults during operation	The host personal computer cannot communicate with the Simple Motion board. [Operation status at error occurrence] The system stops with the setting (deceleration stop/ rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 2). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Check that there is no error on the host personal computer side I/F to which a cable is connected.
1904H	Hardware stroke limit (+)	Start is requested when the hardware stroke limit (upper limit signal FLS) is turned OFF. [Operation status at error occurrence] The system does not start.	• Check the wiring of upper limit signal FLS. • Check if the specification of the limit switch and the setting of the "[Pr.22] Input signal logic selection" match. • If hardware stroke limit (limit switch) is unnecessary system for installation, wire to always turn ON the upper limit signal (FLS) input of the Simple Motion board.
1905H	Hardware stroke limit (+)	The hardware stroke limit (upper limit signal FLS) is turned OFF during operation. [Operation status at error occurrence] The system stops with the setting (deceleration stop/ rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 1). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	After making an axis error reset, perform manual control operation to move the axis to the other position in order that the upper limit signal (FLS) will not turn OFF.
1906H	Hardware stroke limit (-)	Start is requested when the hardware stroke limit (lower limit signal RLS) is turned OFF. [Operation status at error occurrence] The system does not start.	• Check the wiring of lower limit signal RLS. • Check if the specification of the limit switch and the setting of the "[Pr.22] Input signal logic selection" match. • If hardware stroke limit (limit switch) is unnecessary system for installation, wire to always turn ON the lower limit signal (RLS) input of the Simple Motion board.
1907H	Hardware stroke limit (-)	The hardware stroke limit (lower limit signal RLS) is turned OFF during operation. [Operation status at error occurrence] The system stops with the setting (deceleration stop/ rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 1). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	After making an axis error reset, perform manual control operation to move the axis to the other position in order that the lower limit signal (RLS) will not turn OFF.
1908H	Stop signal ON at start	Start is requested when a stop signal is turned ON. [Operation status at error occurrence] The system does not start.	After clearing the stop command status, then review the timing of start.
1909H	Stop signal ON at start	Start is requested when an external stop is turned ON. [Operation status at error occurrence] The system does not start.	After clearing the external stop signal, then review the timing of start.
190AH	User program READY OFF → ON during BUSY	The user program READY signal is turned from OFF to ON when BUSY signal is turned ON. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Turn ON the user program READY signal [Y0] with the BUSY signals of all axes OFF.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
190BH	Unsupported servo amplifier connection	A servo amplifier/driver which is not supported is connected. [Operation status at error occurrence] The target axis is not connected to the servo amplifier.	Connect supported servo amplifier/driver.
1920H	Start not possible	Start is requested when start is not possible in the axis operation state. [Operation status at error occurrence] The system does not start positioning.	Do not request the start when the axis operation state is other than "0: Standby", "1: Stopped", and "-2: Step standby".
1921H	Start not possible	Start is requested when the "[Md.26] Axis operation status" is "-1: Error". [Operation status at error occurrence] The system does not start positioning.	Do not request the start when the axis operation state is other than "0: Standby", "1: Stopped", and "-2: Step standby".
1922H	Start not possible	Start is requested when the "[Md.26] Axis operation status" is "20: Servo amplifier has not been connected/ servo amplifier power OFF". [Operation status at error occurrence] The system does not start positioning.	Do not request the start when the axis operation state is other than "0: Standby", "1: Stopped", and "-2: Step standby".
1923H	Start not possible	Start is requested when the "[Md.26] Axis operation status" is "21: Servo OFF". [Operation status at error occurrence] The system does not start positioning.	Do not request the start when the axis operation state is other than "0: Standby", "1: Stopped", and "-2: Step standby".
1924H	Start not possible	Start is requested when communication with servo amplifier is error. [Operation status at error occurrence] The system does not start positioning.	Check the wiring with the servo amplifier and connection of connectors.
1925H	Start not possible	Start is requested when the "[Md.26] Axis operation status" in the axis to be interpolated is "-1: Error", "20: Servo amplifier has not been connected/servo amplifier power OFF", and "21: Servo OFF". [Operation status at error occurrence] The system does not start positioning.	Do not request the start when the "[Md.26] Axis operation status" in the axis to be interpolated is other than "0: Standby", "1: Stopped", and "-2: Step standby".
1926H	Start not possible	• Start is requested when "[Cd.100] Servo OFF command" is turned ON. • Start is requested when current value restoration is uncompleted. • Start is requested when the servo amplifier external input signal select error occurs. [Operation status at error occurrence] The system does not start positioning.	• Set "0: Servo ON" in the "[Cd.100] Servo OFF command". • Execute the start request after checking the completion of "[Md.190] Controller current value restoration completion status". • Execute the start request after removing the servo amplifier external input signal select error.
1927H	Start not possible	Start is requested when the servo alarm occurs. [Operation status at error occurrence] The system does not start positioning.	Reset the error after removing the servo alarm referring to the "Servo Amplifier Instruction Manual".
1928H	Start not possible	Start is requested during the forced stop of controller. [Operation status at error occurrence] The system does not start positioning.	Remove the cause of forced stop.
1929H	Start not possible	Start is requested when the servo READY signal is turned OFF. [Operation status at error occurrence] The system does not start positioning.	Do not request the start when the servo READY signal is turned OFF.
1931H	Flash ROM write error	Data is not written to the flash ROM. [Operation status at error occurrence] At start: The system does not operate.	The flash ROM is expected to be at the end of its writable life.
1932H	Flash ROM sum check error	While data is written to the flash ROM, the power is turned OFF or remote RESET is executed. [Operation status at error occurrence] At start: The system does not operate.	Reset the parameter and write it to a Flash ROM again.
1933H	Flash ROM sum check error	While data is written to the flash ROM in the synchronous control area, the power is turned OFF or remote RESET is executed. [Operation status at error occurrence] At start: The system does not operate.	Reset the parameter and write to the flash ROM again.
1934H	Synchronous restoration data sum check error	Synchronous restoration data reading is failure. [Operation status at error occurrence] The synchronous control initial value cannot be restored.	The internal memory (nonvolatile) is expected to be at the end of its writable life. Exchange the Simple Motion board.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1938H	Parameter acquisition error	Parameter can not be loaded. (Data error) [Operation status at error occurrence] The initial value is set to the buffer memory.	Switch the power on again or execute remote RESET after writing the parameter.
193EH	Connected device setting error	• The setting value (vendor ID, identification code) of the "[Pr.100] Connected device" and the actually connected device is mismatch. • An unsupported device is connected with synchronous communication function. • The control mode of the connected device is not the cyclic synchronous position mode. • The points of RWr or RWw in network configuration setting is incorrect. • An amplifier which not set in network configuration setting is connected. [Operation status at error occurrence] The communication with the connected device of target axis is not executed.	• Match the setting value of the "[Pr.100] Connected device" to the actually connected device. • Check if the connected device is set in network configuration setting. • Check if the corresponding connected device supports the synchronous communication. • Check if the parameter used in servo cyclic transmission is set correctly.
193FH	Operation cycle time over error	The calculation process time of the positioning etc. exceeds the operation cycle. [Operation status at error occurrence] The operation continues.	Review the content of the positioning or operation cycle setting (inter-module synchronization cycle setting value) longer than the current setting.
1945H	Home position return request ON	The home position return request flag is turned ON when a fast-home position return is started (positioning start No.9002). [Operation status at error occurrence] The fast-home position return does not start.	Execute the machine home position return (positioning start No.9001).
1946H	Home position return restart not possible	The restart command is turned ON after the machine home position return is stopped using a stop signal. [Operation status at error occurrence] The restart is not carried out.	Start the machine home position return (positioning start No.9001) again.
1975H	ABS reference point read error	• The data is not loaded from the servo amplifier properly upon the home position return. • The in-position flag is not turned ON within 1.5 seconds after the home position return is completed. [Operation status at error occurrence] The home position return does not complete.	• Execute home position return again. • Adjust the servo gain and in-position range, and execute home position return again.
1979H	Home position return method invalid	Home position return is started with the home position return method which is not supported by the connected device. [Operation status at error occurrence] The home position return does not start.	Correct to the available home position return method.
1980H	Outside JOG speed range	At the time of JOG starting, the JOG speed comes out of a specified range. [Operation status at error occurrence] The JOG operation is not carried out when the JOG speed is outside the setting range at the time of JOG start.	Bring the JOG speed into the setting range.
1981H	Inching movement amount error	The inching movement amount dose not satisfy the setting conditions*1. (The setting value is large.) [Operation status at error occurrence] The inching operation is not carried out when the inching movement amount exceeds a JOG speed limit at the time of inching start.	Set a smaller inching movement amount so that the setting condition is satisfied.
1982H	Overcarrying movement amount overflow in manual pulse generator	The movement amount which exceeds the detailed parameter 2 "Manual pulse generator speed limit value" is generated continuously and the "Amount of the manual pulser driving carrying over movement" exceeds tolerance (-2147483648 to 2147483647). [Operation status at error occurrence] The system decelerates to a stop.	• Adjust input pulses so as not to occur the movement amount, which exceeds the detailed parameter 2 "Manual pulse generator speed limit value", continuously. • Change the detailed parameter 2 "Manual pulse generator speed limit mode" to a value other than "2: Output over value of speed limit later".
1983H	Manual pulse generator connection station via link device undetected	The link device that set as manual pulse generator was unconnected or disconnected. [Operation status at error occurrence] A manual pulse generator operation is not carried out.	Check the connection status of the target station.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1990H	Error before simultaneous start	<When multiple axes are started and controlled simultaneously> • The partner axis for simultaneous start is BUSY. • The partner axis for simultaneous start is not present. [Operation status at error occurrence] At start: The system does not operate. During operation: The operation is terminated.	Normalize the simultaneous starting axis.
1991H	Error before simultaneous start	<When multiple axes are started and controlled simultaneously> • The same axis No. is set to multiple simultaneous starting axes. • The own axis No. is set to a simultaneous starting axis. • The number of simultaneous starting axes is outside the setting range of 2 to 4. • The "Simultaneous starting axis start data No." of the start axis is 0 or is outside the setting range. • The "Simultaneous starting axis start data No." of the start axis and the partner axis for simultaneous start is 0 or is outside the setting range. [Operation status at error occurrence] At start: The system does not operate. During operation: The operation is terminated.	Normalize the simultaneous starting own axis start data No. and the simultaneous starting axis start data No. (1 to 3).
1993H	Software stroke limit +	The command position exceeds the upper limit of the software stroke limit. [Operation status at error occurrence] At operation start: The system does not operate. During operation: • The system stops immediately when the positioning address during position control (including position control in speed-position switching control or position-speed switching control) is switched to the data outside the software stroke limit range. • During speed control (including speed control in speed-position switching control or position-speed switching control), the system stops at the setting (normal deceleration stop only) of rapid stop selection (stop group 3) in the detailed parameter 2 when the feed current value or feed machine value during manual control is outside the software stroke limit range. At speed control mode/torque control mode: The system switches to the position control mode and stops immediately when the feed current value is outside the software stroke limit range.	At operation start: Set the feed current value within the software stroke limit by the manual control operation. At speed control mode/torque control mode: Review the operation so that the feed current value does not exceed the software stroke limit.
1994H	Software stroke limit +	The new current value exceeds the upper limit of the software stroke limit. [Operation status at error occurrence] In the analysis of new current value: Current value is not changed.	Set the new current value within the software stroke limit.

14

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1995H	Software stroke limit -	The command position exceeds the lower limit of the software stroke limit. [Operation status at error occurrence] At operation start: The system does not operate. During operation: • The system stops immediately when the positioning address during position control (including position control in speed-position switching control or position-speed switching control) is switched to the data outside the software stroke limit range. • During speed control (including speed control in speed-position switching control or position-speed switching control), the system stops at the setting (normal deceleration stop only) of rapid stop selection (stop group 3) in the detailed parameter 2 when the feed current value or feed machine value during manual control is outside the software stroke limit range. At speed control mode/torque control mode: The system switches to the position control mode and stops immediately when the feed current value is outside the software stroke limit range.	At operation start: Set the feed current value within the software stroke limit by the manual control operation. At speed control mode/torque control mode: Review the operation so that the feed current value does not exceed the software stroke limit.
1996H	Software stroke limit -	The new current value exceeds the lower limit of the software stroke limit. [Operation status at error occurrence] In the analysis of new current value: Current value is not changed.	Set the new current value within the software stroke limit.
1997H	Outside new current value range	The new current address is outside the ranges of 0 to 359.99999, where the control unit is set to "degree". [Operation status at error occurrence] Current value is not changed.	Bring the new current value into the setting range.
1998H	Interpolation while interpolation axis BUSY	Interpolation is started during the operation of the interpolation axis. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the control method.
1999H	Unit group unmatched	The reference and interpolation axis units are different at the parameter "interpolation speed designation method" setting of "composite speed". [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the positioning data or change the parameter "Unit setting" of the axis to be interpolated.
199AH	Interpolation mode error	For starting, a composite speed is designated in the reference axis parameter "Interpolation speed designation method" using the speed interpolation control or 4-axis linear interpolation control. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Set the "Interpolation speed designation method" correctly.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
199BH	Interpolation mode error	For starting, a reference axis speed is designated in the reference axis parameter "Interpolation speed designation method" using the circular interpolation control. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Set the "Interpolation speed designation method" correctly.
199CH	Control method setting error	• The control method setting value is outside the setting range. • The number of control axes or the axis to be interpolated differs from the previous data when continuous positioning control or continuous path control is to be exercised for continuously. • The NOP instruction was set to the control method of positioning data No.600. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the control method, axis to be interpolated or parameter.
199EH	Simultaneous start not possible	Among the axes to be started simultaneously, there is an axis on which an error other than this error occurs. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	In the error history, check the axis where the error other than this error occurred, and remove the error factor. Correct the block start data and positioning data.
199FH	Circular interpolation not possible	Circular interpolation is carried out on an axis in the unit of degree. [Operation status at error occurrence] The operation is terminated.	Correct the control method.
19A0H	M code ON signal start	The positioning start is carried out when an M code ON signal is turned ON. [Operation status at error occurrence] The system does not operate at start.	After turning OFF the M code ON signal, start the system.
19A1H	User program READY OFF start	The positioning start is carried out when the user program READY signal [Y0] is turned OFF. [Operation status at error occurrence] The system does not operate at start.	Check the user program which turns ON/OFF the user program READY signal [Y0], and turn ON the user program READY signal. Then start the system.
19A2H	READY OFF start	The positioning start is carried out when the READY signal [X0] is turned OFF. [Operation status at error occurrence] The system does not operate at start.	Check the READY ON signal, and then start the system.
19A3H	Outside start No. range	• At the start of positioning, the setting value of the "positioning start No." of the axis control data is outside the ranges of 1 to 600, 7000 to 7004, and 9001 to 9004. • At a Pre-reading start, the "positioning start No." setting of the axis control data is other than 1 to 600. [Operation status at error occurrence] The system does not operate at start.	Normalize the positioning start No.

14

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
19A4H	Illegal setting of ABS direction in unit of degree	The setting value of the "[Cd.40] ABS direction in degrees" is outside the setting range when the software stroke limit is invalid. [Operation status at error occurrence] At start: The system does not operate. During operation: The system decelerates to a stop. (Note that, in the continuous positioning control and continuous path control, the system continues operating with the setting set at the time of start even if the setting is changed during the operation.)	Correct the "[Cd.40] ABS direction in degrees".
19A5H	Illegal setting of ABS direction in unit of degree	The setting value of the "[Cd.40] ABS direction in degrees" is set other than "0" when the software stroke limit is valid. [Operation status at error occurrence] At start: The system does not operate. During operation: The system decelerates to a stop. (Note that, in the continuous positioning control and continuous path control, the system continues operating with the setting set at the time of start even if the setting is changed during the operation.)	• Set "0" when the software stroke limits are valid. • Invalidate the software stroke limit. (To invalidate, set the software stroke limit upper limit value to the software stroke limit lower limit value.)
19A6H	Start at home position return incomplete	• When executing operation setting at home position return incomplete, positioning was started at home position return request ON. • When executing operation setting at home position return incomplete, control mode switching was executed at home position return request ON. [Operation status at error occurrence] At start: The system does not operate. At control mode switching: The mode is not changed.	• Start after the home position return is executed. • Switch the control mode after the home position return is executed. • For systems which can operate the positioning control and speed-torque control though the home position return request is ON, set "1" to the setting value of the operation setting at home position return incomplete.
19F0H	Illegal condition data No.	The condition data No. is outside the setting range when a block using the condition data is started by a special starting (conditional start, wait start, simultaneous start, FOR (condition)). (1 ≤ Condition data No. ≤ 10) [Operation status at error occurrence] The operation is terminated.	Review the condition data No.
19F1H	Error before simultaneous start	<When blocks are started simultaneously> The partner axis for simultaneous start is BUSY. [Operation status at error occurrence] At start: The system does not operate. During operation: The operation is terminated.	Normalize the simultaneous starting axis.
19F2H	Special start instruction error	No applicable special start instruction is present. [Operation status at error occurrence] The operation is terminated.	Correct the instruction code of the special start.
1A00H	Condition data error	The condition setting values are not set or outside the setting range. [Operation status at error occurrence] The operation is terminated.	Normalize the block start data.
1A01H	Condition data error	The condition operator setting values are not set or outside the setting range. [Operation status at error occurrence] The operation is terminated.	Normalize the block start data.
1A02H	Condition data error	The condition operator is a bit operator, and the parameter 1 is 32 or more. [Operation status at error occurrence] The operation is terminated.	Normalize the block start data.
1A03H	Condition data error	An unusable condition operator is set for the set condition. [Operation status at error occurrence] The operation is terminated.	Normalize the block start data.
1A04H	Condition data error	• The conditional operator has been [parameter 1 is greater than parameter 2] with 05H (P1 ≤ ** ≤ P2). • The conditional operator has been [parameter 1 is greater than parameter 2] with 06H (** ≤ P1, P2 ≤ **). [Operation status at error occurrence] The operation is terminated.	Normalize the block start data.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1A05H	Condition data error	• The setting value of "address" is outside the setting range when the condition target is set to "Buffer memory (1-word/2-word)". (1-word: 0 to 8355839, 2-word: 0 to 8355838) • The corresponding station does not exist in link device that has been specified with the setting value of "address" when the condition target is set to "RX (1 bit/1-word/2-word)", "RY (1 bit/1-word/2-word)", "RWr (1 bit/1-word/2-word)", or "RWw (1 bit/1-word/2-word)". [Operation status at error occurrence] The operation is terminated.	Normalize the block start data.
1A0CH	Condition data error	The same axis No. is set in "[Da.24] Simultaneous starting axis No.1", [Da.25] Simultaneous starting axis No.2" and [Da.26] Simultaneous starting axis No.3". [Operation status at error occurrence] The operation is terminated.	Normalize the block start data.
1A0DH	Condition data error	The axis No. is set in "[Da.24] Simultaneous starting axis No.1", [Da.25] Simultaneous starting axis No.2" and [Da.26] Simultaneous starting axis No.3", that is larger than the common parameter "[Pr.152] Maximum number of control axes". [Operation status at error occurrence] The operation is terminated.	Normalize the block start data.s
1A0EH	Condition data error	The self axis is set in "[Da.24] Simultaneous starting axis No.1", [Da.25] Simultaneous starting axis No.2" and [Da.26] Simultaneous starting axis No.3". [Operation status at error occurrence] The operation is terminated.	Normalize the block start data.
1A0FH	Condition data error	The "[Da.23] Number of simultaneous starting axes" is outside the setting range, or the "[Da.23] Number of simultaneous starting axes" is larger than the "[Pr.152] Maximum number of control axes". [Operation status at error occurrence] The operation is terminated.	Normalize the block start data.
1A10H	Illegal data No.	The designation of a JUMP destination is executed currently. [Operation status at error occurrence] The positioning data is not executed.	Normalize the positioning data.
1A11H	Illegal data No.	• The positioning data No. tried to be executed is outside the ranges of 1 to 600, 7000 to 7004, and 9001 to 9004. • The designation of a JUMP destination is outside the ranges of 1 to 600. [Operation status at error occurrence] The positioning data is not executed.	Normalize the positioning data.
1A12H	No command speed	At the start of positioning, a current speed (-1) is set for the command speed of the positioning data to be initially executed. [Operation status at error occurrence] The operation does not start at positioning start.	Normalize the positioning data.
1A13H	No command speed	The current speed is set by speed control. [Operation status at error occurrence] The operation does not start at positioning start.	Normalize the positioning data.
1A14H	No command speed	The current speed is set for speed-position or position-speed switching control. [Operation status at error occurrence] The operation does not start at positioning start.	Normalize the positioning data.
1A15H	Outside linear movement amount range	When "[Pr.20] Interpolation speed designation method" performs a linear interpolation in setting a "composite speed", the axis movement amount for each positioning data exceeds 1073741824(2^{30}). [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops immediately.	Review the positioning address.

14

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1A16H	Outside linear movement amount range	The positioning address is -360.00000 or less or 360.00000 or more using INC instruction, where the control unit is set to "degree" and "[Pr.12] Software stroke limit upper limit value" is not equal to "[Pr.13] Software stroke limit lower limit value". [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops immediately.	Review the positioning address.
1A17H	Large arc error deviation	When an arc is interpolated by the designation of the center point, a difference between a radius of start point—center point and a radius of end point—center point exceeds the parameter "Circular interpolation error allowable limit". [Operation status at error occurrence] At start: The circular interpolation control by center point designation is not executed. During operation: The system stops immediately.	• Correct the center point address (arc address) • Correct the end address (positioning address) • Correct the circular interpolation error allowable limit value.
1A18H	Software stroke limit +	The setting value of the "[Da.6] Positioning address/ movement amount" exceeds "[Pr.12] Software stroke limit upper limit value". [Operation status at error occurrence] At operation start: The system does not operate. In the analysis of new current value: Current value is not changed. During operation: • The system stops immediately when the positioning address during position control (including position control in speed-position switching control or position-speed switching control) is switched to the data outside the software stroke limit range. • During speed control (including speed control in speed-position switching control or position-speed switching control), the system stops at the setting (normal deceleration stop only) of rapid stop selection (stop group 3) in the detailed parameter 2 when the feed current value or feed machine value during manual control is outside the software stroke limit range. At speed control mode/torque control mode: The system switches to the position control mode and stops immediately when the feed current value is outside the software stroke limit range.	At operation start, during operation: Correct the "[Da.6] Positioning address/movement amount". At operation start: Set the feed current value within the software stroke limit by the manual control operation.
1A19H	Software stroke limit +	In the circular interpolation with sub points designated, the sub point exceeds "[Pr.12] Software stroke limit upper limit value". [Operation status at error occurrence] At operation start: The system does not start.	At operation start, during operation: Correct the "[Da.6] Positioning address/movement amount" and the "[Da.7] Arc address". At operation start: Set the feed current value within the software stroke limit by the manual control operation.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1A1AH	Software stroke limit -	The setting value of the "[Da.6] Positioning address/ movement amount" exceeds "[Pr.13] Software stroke limit lower limit value". [Operation status at error occurrence] At operation start: The system does not operate. In the analysis of new current value: Current value is not changed. During operation: • The system stops immediately when the positioning address during position control (including position control in speed-position switching control or position-speed switching control) is switched to the data outside the software stroke limit range. • During speed control (including speed control in speed-position switching control or position-speed switching control), the system stops at the setting (normal deceleration stop only) of rapid stop selection (stop group 3) in the detailed parameter 2 when the feed current value or feed machine value during manual control is outside the software stroke limit range. At speed control mode/torque control mode: The system switches to the position control mode and stops immediately when the feed current value is outside the software stroke limit range.	At operation start, during operation: Correct the "[Da.6] Positioning address/movement amount". At operation start: Set the feed current value within the software stroke limit by the manual control operation.
1A1BH	Software stroke limit -	In the circular interpolation with sub points designated, the sub point exceeds "[Pr.13] Software stroke limit lower limit value". [Operation status at error occurrence] At operation start: The system does not start.	At operation start, during operation: Correct the "[Da.6] Positioning address/movement amount" and the "[Da.7] Arc address". At operation start: Set the feed current value within the software stroke limit by the manual control operation.
1A1CH	New current value not possible	The control method sets an operation pattern (continuous path control) using new current positioning data. [Operation status at error occurrence] Current value is not changed.	• Do not designate a current value changing using the positioning data following the continuous path control. • Do not designate positioning data following continuous path control using a "current value changing".
1A1DH	New current value not possible	The operation pattern sets a "new current value" in the control method using the data following the "continuous path control" positioning data. [Operation status at error occurrence] Current value is not changed.	• Do not designate a current value changing using the positioning data following the continuous path control. • Do not designate positioning data following continuous path control using a "current value changing".
1A1EH	Continuous path control not possible	"[Da.1] Operation pattern" is "Continuous positioning control" or "Continuous path control" when "[Da.2] Control method" is "Speed control" or "Position-speed switching control". [Operation status at error occurrence] The system does not operate at start.	Correct the "[Da.1] Operation pattern" or "[Da.2] Control method".
1A1FH	Continuous path control not possible	"[Da.1] Operation pattern" is "Continuous path control" when "[Da.2] Control method" is "Fixed-feed" or "Speed-position switching control". [Operation status at error occurrence] The system does not operate at start.	Correct the "[Da.1] Operation pattern" or "[Da.2] Control method".
1A20H	Continuous path control not possible	"[Da.1] Operation pattern" is "Continuous path control" when "[Da.2] Control method" is "Speed control", "Fixed-feed", "Position-speed switching control" or "Speed-position switching control". [Operation status at error occurrence] The system does not operate at start.	Correct the "[Da.1] Operation pattern" or "[Da.2] Control method".
1A21H	Outside operation pattern range	The operation pattern set value is 2. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the operation pattern.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1A22H	Illegal interpolation description command	In the interpolation control, the axis to be interpolated is set as follows: • The self axis • Not present axis • The axis No. exceeds the maximum number of control axes. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	• Correct the "[Da.2] Control method". • Correct the axis to be interpolated. • Correct the maximum number of control axes.
1A23H	Command speed setting error	The command speed is outside the setting range. Linear interpolation, circular interpolation: Reference axis is outside the setting range. Speed control interpolation: Either of reference axis and interpolation axis is outside the speed range. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the command speed.
1A24H	Control method setting error	The control method setting value is outside the setting range. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the control method, axis to be interpolated or parameter.
1A25H	Control method setting error	The number of control axes or the axis to be interpolated differs from the previous data when continuous positioning control or continuous path control is to be exercised for continuously. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the control method, axis to be interpolated or parameter.
1A26H	Control method setting error	The NOP instruction was set to the control method of positioning data No.600. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the control method, axis to be interpolated or parameter.
1A27H	Sub point setting error	Start point is equal to sub point in the circular interpolation with sub points designated. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops immediately.	Correct the sub address (arc address).
1A28H	Sub point setting error	End point is equal to sub point in the circular interpolation with sub points designated. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops immediately.	Correct the sub address (arc address).

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1A29H	Sub point setting error	Start point, end point, and sub point are in line with each other in the circular interpolation with sub points designated. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops immediately.	Correct the sub address (arc address).
1A2AH	Sub point setting error	Sub point address is outside the range of -2147483648 to 2147483647 in the circular interpolation with sub points designated. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops immediately.	Correct the sub address (arc address).
1A2BH	End point setting error	Start point is equal to end point in the circular interpolation with sub points designated. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops immediately.	Correct the end address (positioning address).
1A2CH	End point setting error	End point address is outside the range of -2147483648 to 2147483647 in the circular interpolation with auxiliary point designation and center point designation. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops immediately.	Correct the end address (positioning address).
1A2DH	Center point setting error	Start point is equal to center point in the circular interpolation with center point designation. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops immediately.	Correct the center point address (arc address).
1A2EH	Center point setting error	End point is equal to center point in the circular interpolation with center point designation. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops immediately.	Correct the center point address (arc address).
1A2FH	Center point setting error	Center point address is outside the range of -2147483648 to 2147483647 in the circular interpolation with center point designation. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops immediately.	Correct the center point address (arc address).
1A30H	Outside address range	In the speed-position switching control and the position-speed switching control, the setting value of a positioning address is negative. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the positioning address.
1A31H	Outside address range	In ABS1, ABS2, ABS3 and ABS4, the setting value of a positioning address is outside the range of 0 to 359.99999 degrees. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the positioning address.
1A32H	Outside radius range	The arc radius exceeds 536870912. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops immediately.	Correct the positioning data.
1A33H	Control method LOOP setting error	A "0" is set in the repeating times of the control method "LOOP". [Operation status at error occurrence] The operation is terminated.	Set 1 to 65535 in the repeating time of LOOP.

14

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1A34H	M code ON timing error	The setting value of the positioning data "[Da.27] M code ON signal output timing" is outside the setting range. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3).	Correct the setting range of the "[Da.27] M code ON signal output timing" within "0 to 2".
1A35H	Interpolation speed designation method error	The setting value of the positioning data "[Da.29] Interpolation speed designation method" is outside the setting range. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3).	Correct the setting range of the "[Da.29] Interpolation speed designation method" within "0 to 2".
1A36H	Outside number of pitch	The number of pitches set in "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" of the linear axis is outside the setting range when the helical interpolation control has been performed. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3).	Correct the number of pitches set in "[Da.10] M code/ Condition data No./Number of LOOP to LEND repetitions/Number of pitches" of the linear axis within "0 to 999".
1A37H	Sub point setting error	The sub point address is outside the range of -2147483648 to 2147483647 when the circular interpolation control or helical interpolation control has been performed with the sub point being specified. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops immediately.	Correct the sub address (arc address).
1A60H	Outside unit setting range	The set value of the basic parameter 1 "Unit setting" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1A61H	Outside pulse number per rotation range	The set value of the basic parameter 1 "Number of pulses per rotation" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1A62H	Outside movement amount per rotation range	The set value of the basic parameter 1 "Movement amount per rotation" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1A63H	Outside unit magnification range	• The set value of the basic parameter 1 "Unit magnification" is outside the setting range. • "Movement amount per rotation (AL)" × "Unit magnification (AM)" exceeds 2147483648. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	• Set AL and AM values which make "Movement amount per rotation (AL)" × "Unit magnification (AM)" within 2147483647, and then turn the user program READY signal [Y0] from OFF to ON. • With the setting brought into the setting range, turn the user program READY signal [Y0] from OFF to ON.
1A66H	Outside bias speed range	The setting value of the basic parameter 1 "Bias speed at start" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1A67H	Outside bias speed range	The bias speed exceeds the speed limit value. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Set the bias speed equal to or less than the speed limit value and turn the user program READY signal [Y0] from OFF to ON.
1A69H	Outside speed limit value range	The setting value of the basic parameter 2 "[Pr.8] Speed limit value" is outside the setting range. [Operation status at error occurrence] When the user program READY signal [Y0] is turned from OFF to ON: READY signal [X0] is not turned ON. At start: The system does not operate.	When the user program READY signal [Y0] is not turned ON after the setting is set within the setting range, turn the user program READY signal [Y0] from OFF to ON.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1A6AH	Outside speed limit value range	The setting value of the basic parameter 2 "[Pr.8] Speed limit value" exceeds the command speed limit value. [Operation status at error occurrence] When the user program READY signal [Y0] is turned from OFF to ON: READY signal [X0] is not turned ON. At start: The system does not operate.	After the speed limit value is set so as not to exceed the command speed limit value, turn the user program READY signal [Y0] from OFF to ON.
1A6BH	Outside acceleration time 0 range	The setting value of the basic parameter 2 "Acceleration time 0" is outside the setting range. [Operation status at error occurrence] When the user program READY signal [Y0] is turned from OFF to ON: READY signal [X0] is not turned ON. At start: The system does not operate.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1A6CH	Outside deceleration time 0 range	The setting value of the basic parameter 2 "Deceleration time 0" is outside the setting range. [Operation status at error occurrence] When the user program READY signal [Y0] is turned from OFF to ON: READY signal [X0] is not turned ON. At start: The system does not operate.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1AA0H	Backlash compensation amount error	The calculation result of the following equation is smaller than 0 or larger than 4194304. $0 \leq \frac{[Pr.11] \times [Pr.2]}{[Pr.3] \times [Pr.4]} \leq 4194303$ [Operation status at error occurrence] The READY signal [X0] is not turned ON.	"[Pr.2] Number of pulses per rotation (AP)", "[Pr.3] Movement amount per rotation (AL)", "[Pr.4] Unit magnification (AM)", "[Pr.11] Backlash compensation amount" Review the items above.
1AA1H	Software stroke limit upper limit	In the unit of "degree", the setting value of the detailed parameter 1 "Software stroke limit upper limit value" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1AA2H	Software stroke limit upper limit	In a unit other than "degree", the software stroke limit upper limit value is smaller than the setting value of the software stroke limit lower limit value. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	In a unit other than "degree", set so that the "[Pr.13] Software stroke limit lower limit value" is smaller than the "[Pr.12] Software stroke limit upper limit value", turn the user program READY signal [Y0] from OFF to ON.
1AA3H	Software stroke limit lower limit	In the unit of "degree", the setting value of the detailed parameter 1 "Software stroke limit lower limit value" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1AA4H	Software stroke limit lower limit	In a unit other than "degree", the software stroke limit upper limit value is smaller than the setting value of the software stroke limit lower limit value. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	In a unit other than "degree", set so that the "[Pr.13] Software stroke limit lower limit value" is smaller than the "[Pr.12] Software stroke limit upper limit value", turn the user program READY signal [Y0] from OFF to ON.
1AA5H	Software stroke limit selection	• The setting value of the detailed parameter 1 "Software stroke limit selection" is outside the setting range. • In the unit of "degree", "1: Apply software stroke limit on feed machine value" is set. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	• Bring the setting into the setting range. • In the unit of "degree", set "0: Apply software stroke limit on feed current value".
1AA6H	Software stroke limit valid/invalid setting	The setting value of the detailed parameter 1 "Software stroke limit valid/invalid setting" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1AA7H	Command in-position width	The setting value of the detailed parameter 1 "Command in-position width" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1AA8H	Illegal torque limit setting value	The setting value of the detailed parameter 1 "Torque limit setting value" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1AA9H	M code ON timing error	The setting value of the detailed parameter 1 "M code ON signal output timing" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1AAAH	Speed switching mode error	The setting value of the detailed parameter 1 "Speed switching mode" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1AABH	Interpolation speed designation method error	The setting value of the detailed parameter 1 "Interpolation speed designation method" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1AACH	Current value update request error	The setting value of the detailed parameter 1 "feed current value during speed control" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1AAEH	Speed-position function selection error	The detailed parameter 1 "Speed-position function selection" is preset to 2 and the following three conditions are not satisfied: • Unit is "degree". • Software stroke limits are invalid. • Update feed current value. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	• Speed-position switching control (ABS mode) should satisfy the conditions given on the left. • When speed-position switching control (ABS mode) is not to be exercised, set 0 to speed-position function selection and turn the user program READY signal [Y0] from OFF to ON.
1AB1H	Acceleration time 1 setting error	The setting value of the detailed parameter 2 "Acceleration time 1" is outside the setting range. [Operation status at error occurrence] When the user program READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1AB2H	Acceleration time 2 setting error	The setting value of the detailed parameter 2 "Acceleration time 2" is outside the setting range. [Operation status at error occurrence] When the user program READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1AB3H	Acceleration time 3 setting error	The setting value of the detailed parameter 2 "Acceleration time 3" is outside the setting range. [Operation status at error occurrence] When the user program READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1AB4H	Deceleration time 1 setting error	The setting value of the detailed parameter 2 "Deceleration time 1" is outside the setting range. [Operation status at error occurrence] When the user program READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1AB5H	Deceleration time 2 setting error	The setting value of the detailed parameter 2 "Deceleration time 2" is outside the setting range. [Operation status at error occurrence] When the user program READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1AB6H	Deceleration time 3 setting error	The setting value of the detailed parameter 2 "Deceleration time 3" is outside the setting range. [Operation status at error occurrence] When the user program READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1AB7H	JOG speed limit value error	The setting value of the detailed parameter 2 "[Pr.31] JOG speed limit value" is outside the setting range. [Operation status at error occurrence] When the user program READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON. At start: The system does not start.	When the user program READY signal [Y0] is not turned ON after the setting value is corrected, turn the user program READY signal [Y0] from OFF to ON.
1AB8H	JOG speed limit value error	The setting value of the detailed parameter 2 "[Pr.31] JOG speed limit value" exceeds the "[Pr.8] Speed limit value". [Operation status at error occurrence] When the user program READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON. At start: The system does not start.	When the user program READY signal [Y0] is not turned ON after the setting value is set to equal to or less than the "[Pr.8] Speed limit value", turn the user program READY signal [Y0] from OFF to ON.
1AB9H	JOG speed limit value error	The setting value of the detailed parameter 2 "[Pr.31] JOG speed limit value" is smaller than the "[Pr.7] Bias speed at start". [Operation status at error occurrence] When the user program READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON. At start: The system does not start.	When the user program READY signal [Y0] is not turned ON after the setting value is set to equal to or more than the "[Pr.7] Bias speed at start", turn the user program READY signal [Y0] from OFF to ON.
1ABAH	Manual pulse generator speed limit value error	The setting value of the detailed parameter 2 "Manual pulse generator speed limit value" is outside the setting range. [Operation status at error occurrence] At the power on or when the user program READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON. At start: The system does not operate.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1ABBH	Manual pulse generator speed limit value error	The setting value of the detailed parameter 2 "Manual pulse generator speed limit value" exceeds the "speed limit value". [Operation status at error occurrence] At the power on or when the power supply is turned from OFF to ON, or the user program READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON. At start: The system does not operate.	Correct the setting value to be equal to the speed limit value or less.
1ABCH	JOG acceleration time selection setting error	The setting value of the detailed parameter 2 "JOG operation acceleration time selection" is outside the setting range. [Operation status at error occurrence] When the user program READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1ABDH	JOG deceleration time selection setting error	The setting value of the detailed parameter 2 "JOG operation deceleration time selection" is outside the setting range. [Operation status at error occurrence] When the user program READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1ABEH	Acceleration/ deceleration process selection setting error	The setting value of the detailed parameter 2 "Acceleration/deceleration process selection" is outside the setting range. [Operation status at error occurrence] When the user program READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1ABFH	S-curve ratio setting error	The setting value of the detailed parameter 2 "S-curve ratio" is outside the setting range. [Operation status at error occurrence] When the user program READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1AC0H	Illegal rapid stop deceleration time	The setting value of the detailed parameter 2 "Rapid stop deceleration time" is outside the setting range. [Operation status at error occurrence] When the user program READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1AC1H	Stop group 1 rapid stop selection error	The setting value of the detailed parameter 2 "Stop group 1 rapid stop selection" is outside the setting range. [Operation status at error occurrence] When the user program READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1AC2H	Stop group 2 rapid stop selection error	The setting value of the detailed parameter 2 "Stop group 2 rapid stop selection" is outside the setting range. [Operation status at error occurrence] When the user program READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1AC3H	Stop group 3 rapid stop selection error	The setting value of the detailed parameter 2 "Stop group 3 rapid stop selection" is outside the setting range. [Operation status at error occurrence] When the user program READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1AC4H	Outside allowance circular interpolation error width	The setting value of the detailed parameter 2 "Allowance circular interpolation error width" is outside the setting range. [Operation status at error occurrence] When the user program READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1AC5H	External command function selection error	The setting value of the detailed parameter 2 "External command function selection" is outside the setting range. [Operation status at error occurrence] When the user program READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1AC6H	Manual pulse generator speed limit mode error	The setting value of the detailed parameter 2 "[Pr.122] Manual pulse generator speed limit mode" is outside the setting range. [Operation status at error occurrence] At the power on or when the user program READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON. At start: The system does not operate.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1ACAH	External input signal selection error	The setting value of the detailed parameter 1 "External input signal selection" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1ACBH	Input signal logic selection setting error	The setting values of the detailed parameter 1 "Input signal logic selection" are different in the axis that uses the same input signal. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	With the setting of the axis is matched, turn the user program READY signal [Y0] from OFF to ON.
1ACCH	Restart allowable range error	The setting value of the detailed parameter 2 "Restart allowable range when servo OFF to ON" is outside the setting range. [Operation status at error occurrence] When the user program READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 Rapid stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1ACDH	Speed control 10 × multiplier setting for degree axis error	The setting value of the detailed parameter 2 "Speed control 10 × multiplier setting for degree axis" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1ACEH	Operation setting for speed-torque control mode error	The setting value of the detailed parameter 2 "Operation setting for speed-torque control mode" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1ACFH	External command signal selection error	The setting value of the detailed parameter 2 "External command signal selection" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1AD0H	FLS signal selection error	The setting value of the detailed parameter 1 "FLS signal selection" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1AD1H	RLS signal selection error	The setting value of the detailed parameter 1 "RLS signal selection" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1AD2H	DOG signal selection error	The setting value of the detailed parameter 1 "DOG signal selection" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1AD3H	STOP signal selection error	The setting value of the detailed parameter 1 "STOP signal selection" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1AD4H	Servo amplifier external input signal select error	When the servo amplifier is connected, an error occurs in the consistency diagnosis for the external signal input settings of the Simple Motion board and the servo amplifier. [Operation status at error occurrence] The servo does not power ON.	Review the external input signal settings of the servo amplifier and the Simple Motion board. (Refer to the servo amplifier instruction manual for the external input signal setting.)
1B00H	Home position return method error	The setting value of the home position return basic parameter "Home position return method" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1B01H	Home position return direction error	The setting value of the home position return basic parameter "Home position return direction" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1B02H	Home position address setting error	The setting value of the home position return basic parameter "Home position address" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1B03H	Home position return speed error	The setting value of the home position return basic parameter "[Pr.46] Home position return speed" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1B04H	Home position return speed error	The setting value of the home position return basic parameter "[Pr.46] Home position return speed" exceeds the "[Pr.8] Speed limit value". [Operation status at error occurrence] The READY signal [X0] is not turned ON.	After the setting value is set to equal to or less than the "[Pr.8] Speed limit value", turn the user program READY signal [Y0] from OFF to ON.
1B05H	Home position return speed error	The setting value of the home position return basic parameter "[Pr.46] Home position return speed" is smaller than "[Pr.7] Bias speed at start". [Operation status at error occurrence] The READY signal [X0] is not turned ON.	After the setting value is set to equal to or more than "[Pr.7] Bias speed at start", turn the user program READY signal [Y0] from OFF to ON.
1B09H	Home position return retry error	The setting value of the home position return basic parameter "Home position return retry" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1B0AH	Setting for the movement amount after proximity dog ON error	The setting value of the home position return detailed parameter "Setting for the movement amount after proximity dog ON" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1B0BH	Home position return acceleration time selection error	The setting value of the home position return detailed parameter "Home position return acceleration time selection" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1B0CH	Home position return deceleration time selection error	The setting value of the home position return detailed parameter "Home position return deceleration time selection" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1B0DH	Home position return torque limit value error	The setting value of the home position return detailed parameter "Home position return torque limit value" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1B0EH	Home position return torque limit value error	The home position return detailed parameter "Home position return torque limit value" has exceeded the detailed parameter 1 "Torque limit setting value". [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1B10H	Speed designation during home position shift error	The setting value of the home position return detailed parameter "Speed designation during home position shift" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1B11H	Operation setting for incompletion of home position return error	The setting value of the home position return detailed parameter "Operation setting for incompletion of home position return" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1B70H	Manual pulse generator/ Incremental synchronous encoder input selection error	The setting value of the detailed parameter 1 "Manual pulse generator/Incremental synchronous encoder input selection" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1B71H	Forced stop valid/ invalid setting error	The setting value of the detailed parameter 1 "Forced stop valid/invalid setting" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1B72H	Manual pulse generator/ Incremental synchronous encoder input type selection error	The setting value of the detailed parameter 2 "Manual pulse generator/Incremental synchronous encoder input type selection" is outside the setting range. [Operation status at error occurrence] The communication between servo amplifiers of target axis is not executed. (The servo amplifier's LED display remains "Ab".)	Correct the setting value, turn the user program READY signal [Y0] from OFF to ON.
1B73H	Operation cycle setting error	The setting value of the common parameter "Operation cycle setting" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Turn the power on again or execute the remote RESET. Correct the setting value and turn the user program READY signal [Y0] ON.
1B78H	Servo parameter PD41 setting error	Servo parameter PD41 (Stroke limit enabling condition selection) is not set to "1: Enabled only for home position return mode". [Operation status at error occurrence] The communication with the corresponding servo amplifier is not executed.	Set "1: Enabled only for home position return mode" in the servo parameter PD41 (Stroke limit enabling condition selection).
1C82H	WDT error	The Simple Motion board detects the WDT error of the driver. [Operation status at error occurrence] The system stops immediately.	Replace the driver in which the WDT occurred.
1C83H	Unsupported operation cycle	The setting value of the operation cycle to which amplifier does not correspond is set up. [Operation status at error occurrence] The system stops immediately.	Turn the power on again or execute the remote RESET, and turn the user program READY signal [Y0] ON with the setting brought into the supported range.
1CB2H	SLMP communication error	The connection is disconnected for error is detected in the SLMP communication during amplifier connecting. [Operation status at error occurrence] The communication with the corresponding servo amplifier is not executed.	• Check the Abort Code and take corrective actions according to causes. • Check the object content used in servo cyclic transmission. (Refer to the driver instruction manual for Abort Code details and object available to be sent.)
1CB3H	Servo object specification error	The object size specification of the servo object specification data is outside the setting range. [Operation status at error occurrence] The communication with the corresponding servo amplifier is not executed.	Review the parameter setting.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1CBDH	Connection servo amplifier speed unit setting error	The unsupported speed unit (SI unit velocity) is connected to the set servo amplifier. [Operation status at error occurrence] The communication with the corresponding servo amplifier is not executed.	Please refer to the "Servo Amplifier Instruction Manual" to change the speed unit to (0.01 r/min) or (0.01 mm/s).
1CC0H	Outside link device start No. range	The corresponding station does not exist in link device. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Review the link device start No. setting.
1CC1H	Outside the link device bit specification range	Bit other than 0 to F is specified. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Review the setting of link device bit specification.
1CC2H	Outside the link device maximum/minimum value specification range	The maximum value in the ring counter range is set smaller than the minimum value. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Review the maximum value/minimum value of ring counter.
1E04H	Watchdog timer error	An user program error is detected. [Operation status at error occurrence] The system stops immediately.	Review the user program so that the value of the watchdog check counter ([Cd.1141]) is updated within the time specified by the watchdog timer start counter ([Cd.1140]).
1E05H	Direct control setting error	Direct control setting parameter error is detected. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Review the setting and turn the user program READY signal [Y0] from OFF to ON.
1E06H	Direct control start not possible	The switching condition of direct control is not satisfied. [Operation status at error occurrence] Switching to direct control is not executed.	Review the switching condition of direct control.
1E07H	Direct control speed limit value over	The speed exceeds the parameter maxinum value of the speed limit value during direct control. [Operation status at error occurrence] Direct control is stopped immediately and switched to the standard control.	Review the position command data.
1E08H	Direct control command buffer over	The buffer No. being written is set outside the range of the command buffer No. during direct control. [Operation status at error occurrence] Direct control is stopped immediately and switched to the standard control.	Review the buffer No. being written.
2221H	Network parameters error	The set value is out of the range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Review the parameter setting.
2600H	Inter-module synchronization process error	The cyclic processing does not finish before the start timing for the next inter-module synchronization cycle. [Operation status at error occurrence] The READY signal [X0] does not turn ON when the user program READY signal [Y0] changes from OFF to ON.	• Increase the value set in "Inter-module Synchronization Cycle Setting" so that the link scan time does not exceed the inter-module synchronization cycle. • Reduce the number of cyclic assignment points and the number of connected slave modules, and decrease the link scan time.
3000H	Inter-module synchronization parameter error	A station in which "Station Type" is set to "Submaster station" is set in "Network Configuration Settings" of "Basic Settings". [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct parameter shown in cause.
3001H	Faults	Hardware is faulty. [Operation status at error occurrence] The system stops.	• Take measures against noise. • Turn the power supply ON again. If the same error is displayed again, the hardware fault might occur in the Simple Motion board. Please consult your sales representative.
3002H	Internal circuit fault	Hardware is faulty. [Operation status at error occurrence] The system stops.	• Take measures against noise. • Turn the power supply ON again. If the same error is displayed again, the hardware fault might occur in the Simple Motion board. Please consult your sales representative.
3010H	F/W error	Hardware is faulty. [Operation status at error occurrence] The system stops.	Replace the Simple Motion board.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
3031H	Station No. duplication detection	• A station with the same station No. was found in the same network. • Multiple master stations and submaster stations were detected in the same network. [Operation status at error occurrence] The data link is stopped.	Correct the station No. or station type of the station where the error was detected.
3060H	Inter-module synchronization cycle mismatch	The inter-module synchronization cycle setting does not match the master station setting. [Operation status at error occurrence] The operation is carried out according to "CPU Module Operation Setting at Error Detection (Moderate)" of "I/O Assignment Setting" in the system parameter setting. Stop: The READY signal [X0] is always OFF. Continue: The READY signal [X0] does not turn ON when the user program READY signal [Y0] changes from OFF to ON.	Correct the parameter so that all modules performing inter-module synchronization have the same frequency setting.
3061H	Inter-module synchronization target mismatch	The network synchronization communication setting in the network configuration setting of the master station does not match the inter-module synchronization target module of the own station. [Operation status at error occurrence] The operation is carried out according to "CPU Module Operation Setting at Error Detection (Moderate)" of "I/O Assignment Setting" in the system parameter setting. Stop: The READY signal [X0] is always OFF. Continue: The READY signal [X0] does not turn ON when the user program READY signal [Y0] changes from OFF to ON.	Check the network configuration setting and check if inter-module synchronization is set.
3062H	Inter-module synchronization signal failure via network	Inter-module synchronization cycle failure occurred between networks. [Operation status at error occurrence] The operation is carried out according to "CPU Module Operation Setting at Error Detection (Moderate)" of "I/O Assignment Setting" in the system parameter setting. Stop: The READY signal [X0] is always OFF. Continue: The READY signal [X0] does not turn ON when the user program READY signal [Y0] changes from OFF to ON.	• Check the network status and take corrective action using the CC-Link IE Field Network diagnostics of EM Configurator. • Check if the switching hub and the cables are connected properly. • If the request source is another network, check if the routing parameters are set correctly, and take corrective action. • If the error occurs again even after taking the above, please consult your local Mitsubishi representative.
30FCH	PCI Express link-down	Link-down of the PCI Express bus connection occurs. [Operation status at error occurrence] The system stops immediately.	Review the PCI Express bus connection status of the host personal computer and the Simple Motion board.
3C00H	Hardware failure	A hardware failure was detected. [Operation status at error occurrence] The system stops.	• Set the inter-module synchronization cycle to longer than the current value. • Take measures against noise. • Turn the power supply ON again. If the same error is displayed again, the hardware fault might occur. Please consult your sales representative.
3C01H	Hardware failure	A hardware failure was detected. [Operation status at error occurrence] The system stops.	• Take measures against noise. • Turn the power supply ON again. If the same error is displayed again, the hardware fault might occur. Please consult your sales representative.
3C02H	Hardware failure	A hardware failure was detected. [Operation status at error occurrence] The system stops.	• Take measures against noise. • Turn the power supply ON again. If the same error is displayed again, the hardware fault might occur. Please consult your sales representative.
3C03H	Hardware failure	A hardware failure was detected. [Operation status at error occurrence] The system stops.	• Take measures against noise. • Turn the power supply ON again. If the same error is displayed again, the hardware fault might occur. Please consult your sales representative.
3C0FH	Hardware failure	A hardware failure was detected. [Operation status at error occurrence] The system stops.	• Take measures against noise. • Turn the power supply ON again. If the same error is displayed again, the hardware fault might occur. Please consult your sales representative.
3C10H	Hardware failure	A hardware failure was detected. [Operation status at error occurrence] The system stops.	• Take measures against noise. • Turn the power supply ON again. If the same error is displayed again, the hardware fault might occur. Please consult your sales representative.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
3C11H	Hardware failure	A hardware failure was detected. [Operation status at error occurrence] The system stops.	• Take measures against noise. • Turn the power supply ON again. If the same error is displayed again, the hardware fault might occur. Please consult your sales representative.
3C14H	Hardware failure	A hardware failure was detected. [Operation status at error occurrence] The system stops.	Turn the power supply ON again. If the same error is displayed again, the hardware fault might occur. Please consult your sales representative.
3C2FH	Memory error	An error was detected in the memory. [Operation status at error occurrence] The system stops.	Turn the power supply ON again. If the same error is displayed again, the hardware fault might occur. Please consult your sales representative.
3E00H	Network module error	An error was detected in the network module. [Operation status at error occurrence] The system stops.	Turn the power supply ON again. If the same error is displayed again, the hardware fault might occur. Please consult your sales representative.
3E01H	Own station network type error	Network type of the own station is unexpected setting. [Operation status at error occurrence] The system stops.	Rewrite the module parameter and start the communication. If the same error is displayed again, the hardware fault might occur. Please consult your sales representative.

*1 Setting condition: "[Cd.16] Inching movement amount × (A) ≤ [Pr.31] JOG speed limit value"
Use the following values for (A).

Unit setting	Operation cycle			
	0.50 ms	1.00 ms	2.00 ms	4.00 ms
When unit is set to pulse	2000	1000	500	250
When unit is set to degree and "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid	120	60	30	15
When unit setting is other than the above	1200	600	300	150

Errors related to synchronous control are described below.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1BA0H	Outside input axis type setting range	Setting values of input axis parameters "[Pr.300] Servo input axis type" and "[Pr.320] Synchronous encoder axis type" are outside the setting range. [Operation status at error occurrence] The setting becomes invalid for input axis.	Set a value within the setting range.
1BA1H	Outside input axis unit setting range	Setting value of the input axis parameter "[Pr.321] Synchronous encoder axis unit setting" is outside the setting range. [Operation status at error occurrence] The setting becomes invalid for input axis.	Set a value within the setting range.
1BA2H	Outside input axis unit conversion denominator range	The input axis parameter "[Pr.323] Synchronous encoder axis unit conversion: Denominator" is set to 0 or lower. [Operation status at error occurrence] The setting becomes invalid for input axis.	Set a value within the range of 1 to 2147483647.
1BA3H	Outside input axis length per cycle range	The input axis parameter "[Pr.324] Synchronous encoder axis length per cycle" is set to 0 or lower. [Operation status at error occurrence] The setting becomes invalid for input axis.	Set a value within the range of 1 to 2147483647.
1BA4H	Outside input axis smoothing time constant range	The input axis parameters "[Pr.301] Servo input axis smoothing time constant" and "[Pr.325] Synchronous encoder axis smoothing time constant" are set other than 0 to 5000. [Operation status at error occurrence] The setting becomes invalid for input axis.	Set a value within the range of 0 to 5000.
1BA5H	Outside input axis rotation direction restriction setting range	The input axis parameters "[Pr.304] Servo input axis rotation direction restriction" and "[Pr.328] Synchronous encoder axis rotation direction restriction" are set other than 0 to 2. [Operation status at error occurrence] The setting becomes invalid for input axis.	Set a value within the range of 0 to 2.
1BA6H	Input axis unit conversion overflow	Internal operation overflow occurred because the unit conversion ratio (unit conversion: Numerator/unit conversion: Denominator) of the input axis is too large. [Operation status at error occurrence] The input axis operation is immediately stopped, and a connection becomes invalid.	• Set a smaller unit conversion ratio (unit conversion: Numerator/unit conversion: Denominator) of the input axis. • Decrease the input axis speed.
1BA7H	Speed-position switching control start in servo input axis not possible	When the input axis parameter "[Pr.300] Servo input axis type" is feed current value or read current value, the speed-position switching control is started with the detailed parameter 1 "[Pr.21] Feed current value during speed control" set to other than "1: Update of feed current value". [Operation status at error occurrence] The speed-position switching control does not start.	• Set "[Pr.300] Servo input axis type" to "Servo command value" or "Feedback value". • Set "[Pr.21] Feed current value during speed control" to "1: Update of feed current value".
1BA8H	Synchronous encoder via servo amplifier communication error	• The hardware of the synchronous encoder or the servo amplifier is faulty. • The synchronous encoder cable is disconnected. • Communication to the synchronous encoder cannot be established. [Operation status at error occurrence] The connection of synchronous encoder axis becomes invalid.	• Replace the synchronous encoder or the servo amplifier. • Check the synchronous encoder cable. • Check the connected synchronous encoder. • Check whether the synchronous encoder cable is faulty.
1BA9H	Synchronous encoder via servo amplifier battery error	The battery which the servo amplifier connected synchronous encoder is empty or the battery is disconnected. [Operation status at error occurrence] The synchronous encoder control continues.	Replace the battery or check the battery connection of the servo amplifier.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1BAAH	Synchronous encoder via servo amplifier invalid error	• In system construction, the unset up servo amplifier axis is set as the synchronous encoder via servo amplifier. • The servo amplifier axis set as synchronous encoder via servo amplifier is not supported with scale measurement mode. • The servo amplifier axis set as synchronous encoder via servo amplifier is connected to the linear scale. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	With remove causes, switch the power on again or execute the remote RESET.
1BAEH	Synchronous encoder connection station via link device undetected	The link device which set as the synchronous encoder axis input is unconnected with the corresponding station or disconnected. [Operation status at error occurrence] The synchronous encoder axis start is not executed.	Check the connection status of the target station.
1BE0H	Outside main input axis No. range	• Setting value of the synchronous parameter "[Pr.400] Main input axis No." is outside the setting range. • The same servo input axis No. as the output axis is set in the synchronous parameter "[Pr.400] Main input axis No.". [Operation status at error occurrence] Synchronous control does not start.	• Set within the range. • Do not set up the same servo input axis No. as the output axis.
1BE1H	Outside sub input axis No. range	• Setting value of the synchronous parameter "[Pr.401] Sub input axis No." is outside the setting range. • The same servo input axis No. as the output axis is set in the synchronous parameter "[Pr.401] Sub input axis No.". [Operation status at error occurrence] Synchronous control does not start.	• Set within the range. • Do not set up the same servo input axis No. as the output axis.
1BE2H	Outside main shaft gear: denominator range	The synchronous parameter "[Pr.404] Main shaft gear: Denominator" is set to 0 or lower. [Operation status at error occurrence] Synchronous control does not start.	Set a value within the range of 1 to 2147483647.
1BE3H	Main shaft gear operation overflow	Overflow (sign reversion) occurred in input values, because the main shaft gear ratio is too large. [Operation status at error occurrence] Synchronous control is immediately stopped.	• Set a smaller absolute value for the synchronous parameter "[Pr.403] Main shaft gear: Numerator". • Set a larger value for the synchronous parameter "[Pr.404] Main shaft gear: Denominator". • Decrease the input axis speed.
1BE4H	Outside main shaft clutch control setting range	Setting value of the synchronous parameter "[Pr.405] Main shaft clutch control setting" is outside the setting range. [Operation status at error occurrence] Synchronous control does not start.	Set within the range.
1BE5H	Outside main shaft clutch reference address setting range	Setting value of the synchronous parameter "[Pr.406] Main shaft clutch reference address setting" is outside the setting range. [Operation status at error occurrence] Synchronous control does not start.	Set within the range.
1BE6H	Outside main shaft clutch smoothing method range	Setting value of the synchronous parameter "[Pr.411] Main shaft clutch smoothing method" is outside the setting range. [Operation status at error occurrence] Synchronous control does not start.	Set within the range.
1BE7H	Outside main shaft clutch smoothing time constant range	Setting value of the synchronous parameter "[Pr.412] Main shaft clutch smoothing time constant" is outside the setting range. [Operation status at error occurrence] Synchronous control does not start.	Set within the range.
1BE8H	Composite main shaft gear operation overflow	The composite value is overflowed (sign reverse) because the input values of main input axis and sub input axis are large. [Operation status at error occurrence] Synchronous control is immediately stopped.	Lower the input values of main input axis and sub input axis.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1BF0H	Outside auxiliary shaft No. range	• Setting value of the synchronous parameter "[Pr.418] Auxiliary shaft axis No." is outside the setting range. • The same servo input axis No. as the output axis is set in the synchronous parameter "[Pr.418] Auxiliary shaft axis No.". [Operation status at error occurrence] Synchronous control does not start.	• Set within the range. • Do not set the same servo input axis No. of the output axis.
1BF2H	Outside auxiliary shaft gear: denominator range	The synchronous parameter "[Pr.421] Auxiliary shaft gear: Denominator" is set to 0 or lower. [Operation status at error occurrence] Synchronous control does not start.	Set a value within the range of 1 to 2147483647.
1BF3H	Auxiliary shaft gear operation overflow	Overflow (sign reversion) occurred in input values, because the auxiliary shaft gear ratio is too large. [Operation status at error occurrence] Synchronous control is immediately stopped.	• Set a smaller absolute value for the synchronous parameter "[Pr.420] Auxiliary shaft gear: Numerator". • Set a larger value for the synchronous parameter "[Pr.421] Auxiliary shaft gear: Denominator". • Decrease the input axis speed.
1BF4H	Outside auxiliary shaft clutch control setting range	Setting value of the synchronous parameter "[Pr.422] Auxiliary shaft clutch control setting" is outside the setting range. [Operation status at error occurrence] Synchronous control does not start.	Set within the range.
1BF5H	Outside auxiliary shaft clutch reference address setting range	Setting value of the synchronous parameter "[Pr.423] Auxiliary shaft clutch reference address setting" is outside the setting range. [Operation status at error occurrence] Synchronous control does not start.	Set within the range.
1BF6H	Outside auxiliary shaft clutch smoothing method range	Setting value of the synchronous parameter "[Pr.428] Auxiliary shaft clutch smoothing method" is outside the setting range. [Operation status at error occurrence] Synchronous control does not start.	Set within the range.
1BF7H	Outside auxiliary shaft clutch smoothing time constant range	Setting value of the synchronous parameter "[Pr.429] Auxiliary shaft clutch smoothing time constant" is outside the setting range. [Operation status at error occurrence] Synchronous control does not start.	Set within the range.
1BF8H	Composite auxiliary shaft gear operation overflow	The composite value is overflowed (sign reverse) because the input values of main shaft and auxiliary shaft are large. [Operation status at error occurrence] Synchronous control is immediately stopped.	Lower the input values of main shaft and auxiliary shaft.
1C00H	Outside speed change gear range	Setting value of the synchronous parameter "[Pr.434] Speed change gear" is outside the setting range. [Operation status at error occurrence] Synchronous control does not start.	Set within the range.
1C01H	Outside speed change ratio: denominator range	The synchronous parameter "[Pr.437] Speed change ratio: Denominator" is set to 0 or lower. [Operation status at error occurrence] Synchronous control does not start.	Set a value within the range of 1 to 2147483647.
1C02H	Outside speed change gear smoothing time constant range	The synchronous parameter "[Pr.435] Speed change gear smoothing time constant" is set other than 0 to 5000. [Operation status at error occurrence] Synchronous control does not start.	Set a value within the range of 0 to 5000.
1C03H	Speed change gear overflow	Overflow (sign reversion) occurred in input values, because the speed change ratio of speed change gear is too large. [Operation status at error occurrence] Synchronous control is immediately stopped.	• Set a smaller absolute value for the synchronous parameter "[Pr.436] Speed change ratio: Numerator". • Set a larger value for the synchronous parameter "[Pr.437] Speed change ratio: Denominator". • Decrease the input axis speed.
1C10H	Outside cam No. range	The synchronous parameter "[Pr.440] Cam No." is set to other than 0 to 256. [Operation status at error occurrence] Synchronous control does not start.	Set a value within the range of 0 to 256.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1C11H	Cam not registered	Cam data specified in the synchronous parameter "[Pr.440] Cam No." does not exist on the cam open area. [Operation status at error occurrence] Synchronous control does not start.	Specify the cam No. of an existing cam data.
1C12H	Cam axis length per cycle outside range	The synchronous parameter "[Pr.439] Cam axis length per cycle" is set to 0 or lower. [Operation status at error occurrence] Synchronous control does not start.	Set a value within the range of 1 to 2147483647.
1C13H	Outside output axis smoothing time constant range	The synchronous parameter "[Pr.447] Output axis smoothing time constant" is set to other than 0 to 5000. [Operation status at error occurrence] Synchronous control does not start.	Set a value within the range of 0 to 5000.
1C20H	Outside setting method of current value per cycle after main shaft gear range	The synchronous parameter "[Pr.460] Setting method of current value per cycle after main shaft gear" is set to other than 0 to 2. [Operation status at error occurrence] Synchronous control does not start.	Set a value within the range of 0 to 2.
1C21H	Outside current value per cycle after main shaft gear (Initial setting) range	The synchronous parameter "[Pr.465] Current value per cycle after main shaft gear (Initial setting)" is other than 0 to (Cam axis length per cycle - 1). [Operation status at error occurrence] Synchronous control does not start.	Set within the range of 0 to (Cam axis length per cycle - 1).
1C22H	Outside setting method of current value per cycle after auxiliary shaft gear range	The synchronous parameter "[Pr.461] Setting method of current value per cycle after auxiliary shaft gear" is set to other than 0 to 2. [Operation status at error occurrence] Synchronous control does not start.	Set a value within the range of 0 to 2.
1C23H	Outside current value per cycle after auxiliary shaft gear (Initial setting) range	The synchronous parameter "[Pr.466] Current value per cycle after auxiliary shaft gear (Initial setting)" is other than 0 to (Cam axis length per cycle - 1). [Operation status at error occurrence] Synchronous control does not start.	Set within the range of 0 to (Cam axis length per cycle - 1).
1C24H	Outside cam axis position restoration object range	The synchronous parameter "[Pr.462] Cam axis position restoration object" is set to other than 0 to 2. [Operation status at error occurrence] Synchronous control does not start.	Set a value within the range of 0 to 2.
1C25H	Outside setting method of cam reference position range	The synchronous parameter "[Pr.463] Setting method of cam reference position " is set to other than 0 to 2. [Operation status at error occurrence] Synchronous control does not start.	Set a value within the range of 0 to 2.
1C26H	Outside setting method of cam axis current value per cycle range	• The synchronous parameter "[Pr.464] Setting method of cam axis current value per cycle" is set to other than 0 to 3. • "3: Current value per cycle after auxiliary shaft gear" is established when the auxiliary shaft does not exist. [Operation status at error occurrence] Synchronous control does not start.	• Set a value within the range of 0 to 3. • Set other than "3: Current value per cycle after auxiliary shaft gear" when the auxiliary shaft does not exist.
1C27H	Outside cam axis current value per cycle (Initial setting) range	The synchronous parameter "[Pr.468] Cam axis current value per cycle (Initial setting)" is set other than 0 to (Cam axis length per cycle - 1). [Operation status at error occurrence] Synchronous control does not start.	Set within the range of 0 to (Cam axis length per cycle - 1).
1C28H	Cam axis current value per cycle restoration disable	Cam axis current value per cycle corresponding to the feed current value at synchronous control start could not be restored when the synchronous parameter "[Pr.462] Cam axis position restoration object" was "0: Cam axis current value per cycle restoration". (Occurs in reciprocated cam pattern) [Operation status at error occurrence] Synchronous control does not start.	• Start synchronous control after moving the feed current value as to fit within the stroke of two-way operation cam pattern. • Set the cam reference position as to fit within the stroke of two-way operation cam pattern.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1C29H	Cam axis feed current value restoration disable	Restoration could not be completed when the synchronous parameter "[Pr.462] Cam axis position restoration object" was "2: Cam axis feed current value restoration", because the difference between the restored cam axis feed current value and the feed current value at synchronous control start (pulse command unit) was larger than the servo parameter "In-position range". [Operation status at error occurrence] Synchronous control does not start.	• Start synchronous control after calculating the cam axis feed current value to be restored, using the cam position calculation function, and moving the feed current value. • Set a larger setting value for the servo parameter "In-position range", if the current value is extremely small (such as 0).

Servo amplifier detection error

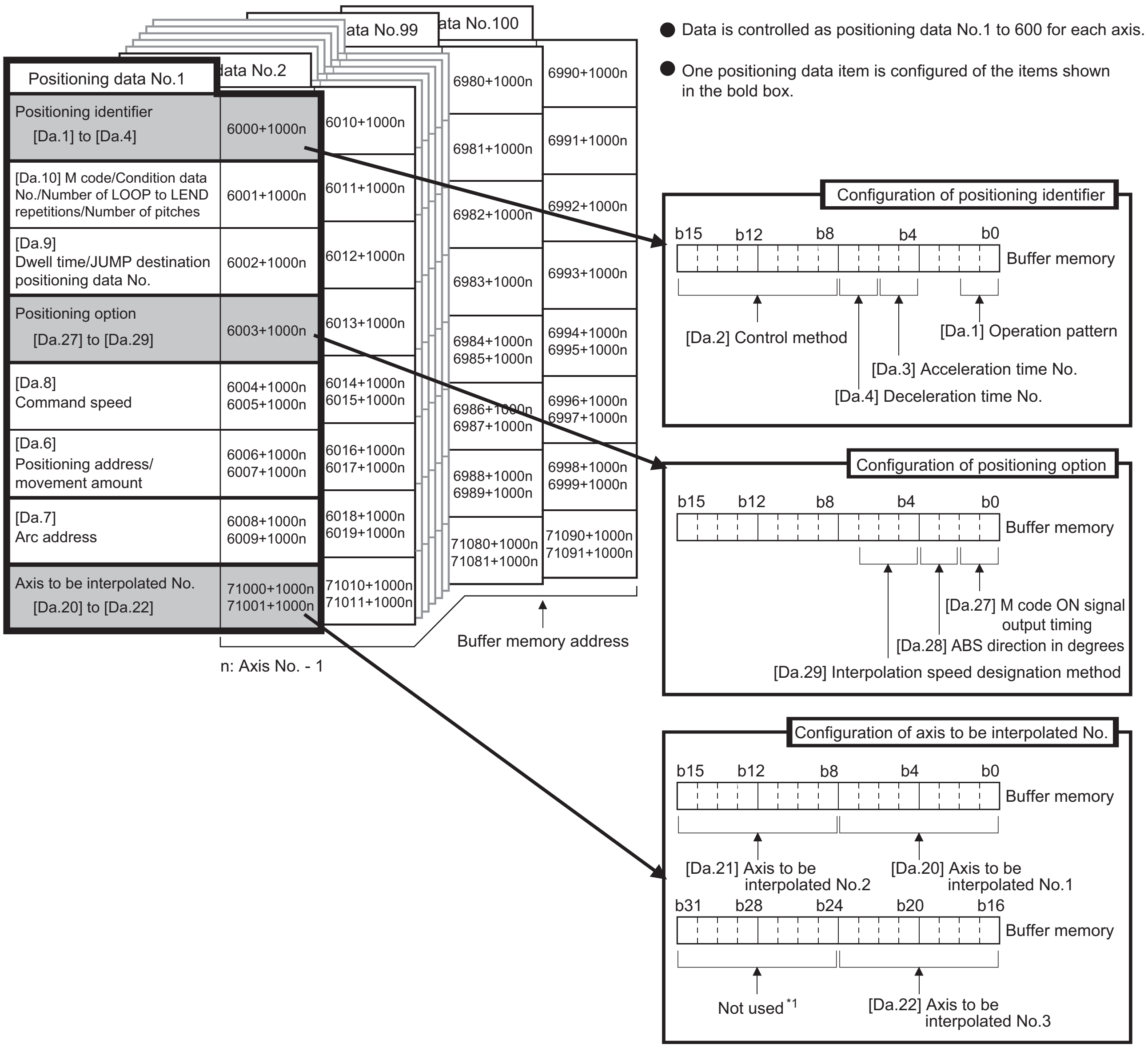
For details of servo amplifier detection errors, refer to each servo amplifier instruction manual.

Appendix 1 How to Find Buffer Memory Addresses

This section describes how to find the buffer memory addresses of positioning data, block start data, and condition data.

Positioning data

Positioning data has the following structure.



*1 Always "0" is set to the part not used.

When setting positioning data using a user program, determine buffer memory addresses using the following calculation formula and set the addresses.

- 6000*2 + (1000 × (Ax - 1)) + 10 × (N - 1) + S

*2 The value is 71000 when setting "[Da.20]" to "[Da.22]".

For each variable, substitute a number following the description below.

Variable	Description
Ax	The axis No. of the buffer memory address to be determined. Substitute a number from 1 to 16.
N	The positioning data No. of the buffer memory address to be determined. Substitute a number from 1 to 100.
S	Substitute one of the following numbers according to the buffer memory address to be determined. • Positioning identifier ([Da.1] to [Da.4], [Da.20] to [Da.22]): 0 • [Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches: 1 • [Da.9] Dwell time/JUMP destination positioning data No.: 2 • Positioning option ([Da.27] to [Da.29]): 3 • [Da.8] Command speed (lower 16 bits): 4 • [Da.8] Command speed (upper 16 bits): 5 • [Da.6] Positioning address/movement amount (lower 16 bits): 6 • [Da.6] Positioning address/movement amount (upper 16 bits): 7 • [Da.7] Arc address (lower 16 bits): 8 • [Da.7] Arc address (upper 16 bits): 9

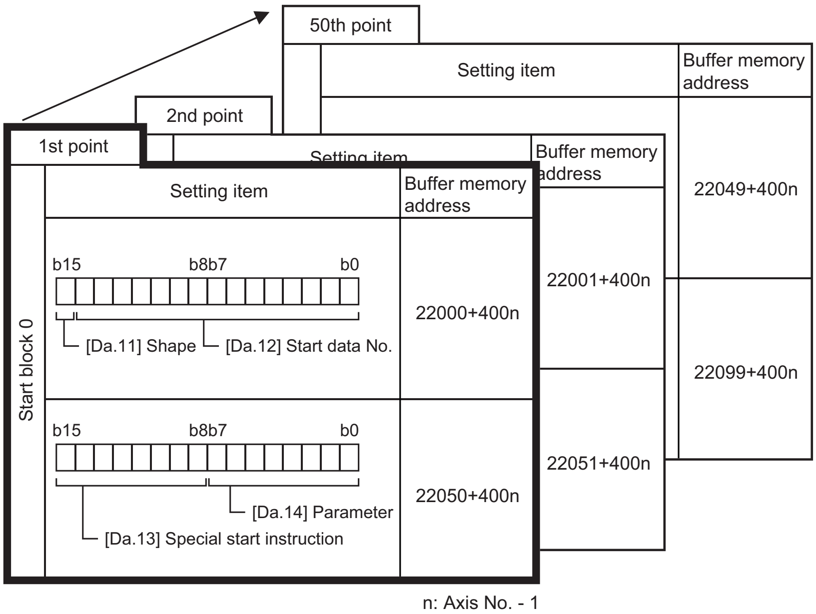
Ex.

When the buffer memory address of "[Da.9] Dwell time/JUMP destination positioning data No." of the positioning data No.1 of axis 2 is determined

$6000 + (1000 \times (2 - 1)) + 10 \times (1 - 1) + 2 = 7002$

Block start data

Block start data consists of five start blocks from Start block 0 to 4, and the block start data of 1 to 50 points is assigned to each block. The start blocks are assigned to each axis. Block start data has the following structure.



● Up to 50 block start data points can be set (stored) for each axis in the buffer memory addresses shown on the left.

● Items in a single unit of block start data are shown included in a bold frame.

● Each axis has five start blocks (block Nos. 0 to 4).

When setting block start data using a user program, determine buffer memory addresses using the following calculation formula and set the addresses.

■[Da.11] Shape, [Da.12] Start data No.

Use the following calculation formula.

- $22000 + (400 \times (Ax - 1)) + (200 \times M) + (P - 1)$

For each variable, substitute a number following the description below.

Variable	Description
Ax	The axis No. of the buffer memory address to be determined. Substitute a number from 1 to 16.
M	The start block No. of the buffer memory address to be determined. Substitute a number from 0 to 4.
P	The block start data point of the buffer memory address to be determined. Substitute a number from 1 to 50.

Ex.

When the buffer memory address that satisfies the following conditions is determined

- Axis 3
- Start block No.2
- Block start data point: 40

22000 + (400 × (3 - 1)) + (200 × 2) + (40 - 1) = 23239

■[Da.13] Special start instruction, [Da.14] Parameter

Use the following calculation formula.

- 22050 + (400 × (Ax - 1)) + (200 × M) + (P - 1)

For each variable, substitute a number following the description below.

Variable	Description
Ax	The axis No. of the buffer memory address to be determined. Substitute a number from 1 to 16.
M	The start block No. of the buffer memory address to be determined. Substitute a number from 0 to 4.
P	The block start data point of the buffer memory address to be determined. Substitute a number from 1 to 50.

Ex.

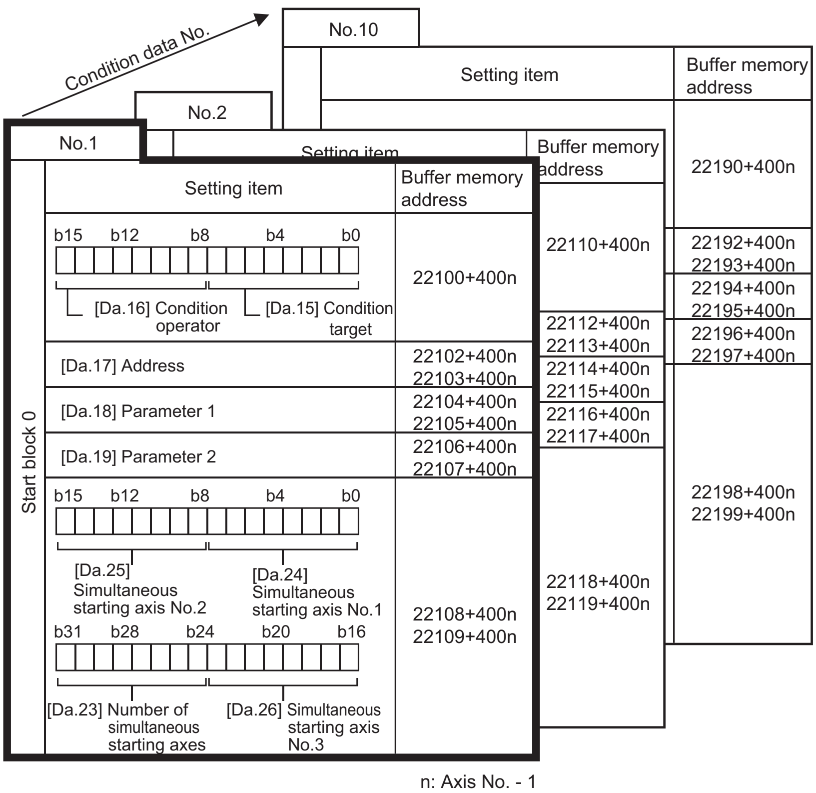
When the buffer memory address that satisfies the following conditions is determined

- Axis 2
- Start block No.1
- Block start data point: 25

22050 + (400 × (2 - 1)) + (200 × 1) + (25 - 1) = 22674

Condition data

Condition data consists of five start blocks from Start block 0 to 4, and the condition data No.1 to 10 are assigned to each block. The start blocks are assigned to each axis. Condition data has the following structure.



- Up to 10 condition data points can be set (stored) for each block No. in the buffer memory addresses shown on the left.
- Items in a single unit of condition data are shown included in a bold frame.
- Each axis has five start blocks (block Nos. 0 to 4).

When setting block start data using a user program, determine buffer memory addresses using the following calculation formula and set the addresses.

- 22100 + (400 × (Ax - 1)) + (200 × M) + (10 × (Q - 1)) + R

For each variable, substitute a number following the description below.

Variable	Description
Ax	The axis No. of the buffer memory address to be determined. Substitute a number from 1 to 16.
M	The start block No. of the buffer memory address to be determined. Substitute a number from 0 to 4.
Q	The condition data No. of the buffer memory address to be determined. Substitute a number from 1 to 10.
R	Substitute one of the following numbers according to the buffer memory address to be determined. • [Da.15] Condition target: 0 • [Da.16] Condition operator: 0 • [Da.17] Address (lower 16 bits): 2 • [Da.17] Address (upper 16 bits): 3 • [Da.18] Parameter 1 (lower 16 bits): 4 • [Da.18] Parameter 1 (upper 16 bits): 5 • [Da.19] Parameter 2 (lower 16 bits): 6 • [Da.19] Parameter 2 (upper 16 bits): 7 • [Da.23] to [Da.26] Simultaneous starting axis (lower 16 bits): 8 • [Da.23] to [Da.26] Simultaneous starting axis (upper 16 bits): 9

Ex.

When the buffer memory address that satisfies the following conditions is determined

- Axis 4
- Start block No.3
- Condition data No.5
- [Da.19] Parameter 2 (lower 16 bits)

$22100 + (400 \times (4 - 1)) + (200 \times 3) + (10 \times (5 - 1)) + 6 = 23946$

Appendix 2 Restrictions by the version

There are restrictions in the function that can be used by the software of the Simple Motion board and the version of EM Software Development Kit.

The combination of each version and function is shown below.

Function	Software version	EM Software Development Kit	Reference
Event history	Ver.02 or later	Ver.1.005F or later	☞ Page 348 Event History Function
CC-Link IE Field Network diagnostics			📖Simple Motion Board User's Manual (Network)
Direct control			☞ Page 202 Direct Control

A

MEMO

INDEX

0 to 9

3-axis helical interpolation control with sub point designation (ABS helical sub). 93
3-axis helical interpolation control with sub point designation (INC helical sub) 95

A

ABS direction in degrees 485,495,566
ABS helical right, ABS helical left 100
Acceleration time 460,468,469
Acceleration time at speed control mode 573
Acceleration time No. 484,485
Acceleration/deceleration process selection 468,470
Acceleration/deceleration time change value during speed change, enable/disable 554
Address 501,504
Allowable circular interpolation error width . . 468,473
Amount of the manual pulser driving carrying over movement 534
Amplifier-less operation mode status. 513
Amplifier-less operation mode switching request 547
Arc address 484,490
Axis error No. 521
Axis error reset 551
Axis feedrate 523
Axis operation status 522
Axis stop 576
Axis to be interpolated No. 484,494
Axis warning detection (all axes). 541
Axis warning No.. 521

B

Backlash compensation amount 461,462
Bias speed at start 456,458
Block No. being executed 532
Board information 517

C

Change data. 571
Command in-position width 461,463
Command speed 484,492
Command speed at speed control mode 573
Command torque at torque control mode. 574
Condition operator 501,503
Condition target 501,503
Connected device 453,542
Control method 483,485
Control mode setting 572
Control mode switching request 572
Control system repetition counter 531
Current speed. 522

D

Deceleration start flag 533
Deceleration start flag valid 544
Deceleration time 460,468,469
Deceleration time at speed control mode. 574
Deceleration time No. 484,486
Deviation counter value 535
Digital oscilloscope running flag 514
Direct control buffer No. being executed (position control) 216,217
Direct control command buffer (position control). .215
Direct control enable flag. 216
Direct control enable flag (all axes). 216
Direct control maximum buffer No. (position control) 216,217
Direct control number of used buffers 214
Direct control operation status 216
Direct control start request. 215
Direct control writing complete buffer No. (position control) 215
DOG signal selection .461
Dwell time/JUMP destination positioning data No. 484,493

E

Electronic gear (Movement amount per pulse) . . .457
Error detection (all axes) 540
Error judgment 512
Execution prohibition flag. 577
External command valid 552
External input signal .524
External input signal operation device (Axis 1 to 16) 546

F

F/W version 514
Feed current value 519
Feed current value during speed control . . . 461,466
Feed machine value .520
Feedrate 520
Flash ROM write request. 543
FLS signal selection .461
FLS/RLS/DOG/STOP signal selection. 467
Forced stop input 513,547
Forced stop valid/invalid selection 454
Forward run JOG start. 576

G

Gain switching command flag 569

H

Home position address 477,478
Home position return acceleration time selection 480
Home position return deceleration time selection 480
Home position return direction 477,478
Home position return method 477
Home position return operating status. 540
Home position return request flag OFF request . .558

I

Home position return speed 477,479

I

In speed change processing flag. 530
In speed limit flag 530
In test mode flag 507
INC helical right, INC helical left 102
Inching movement amount 556
Input signal logic selection 461,466
Interpolation speed designation method
. . . . 461,465,485,495
Interrupt request during continuous operation. . . 557

J

JOG operation acceleration time selection . . 468,470
JOG operation deceleration time selection. . 468,470
JOG speed. 557
JOG speed limit value 468,469

L

Last executed positioning data No. 532
Latch data range change request 346
Latch data range lower limit value. 342,344
Latch data range upper limit value 342,344

M

M code OFF request 552
M code ON signal output timing . . 461,464,485,495
M code/Condition data No./Number of LOOP to LEND
repetitions/Number of pitches 484,494
Manual pulse generator 1 pulse input magnification
. . . . 558
Manual pulse generator enable flag 558
Manual pulse generator speed limit mode . . 469,476
Manual pulse generator speed limit value . . 469,476
Mark detection data axis No. 342,343
Mark detection data buffer memory No.. 342,344
Mark detection data storage area (1 to 32). 347
Mark detection data type 342,343
Mark detection invalid flag 346
Mark detection mode setting 342,344
Mark detection signal compensation time . . 342,343
Mark detection signal detection direction setting
. . . . 342,345
Mark detection signal link device bit specification
. . . . 342,345
Mark detection signal link device No.. 342,345
Mark detection signal link device type 342,345
Mark detection signal monitor. 347
Maximum number of control axes 454,455
Maximum operation time 515
Module information 513
Motor current value 535
Motor rotation speed 535
Movement amount per rotation (AL) 456,457

N

New acceleration time value. 553
New current value 553
New deceleration time value 554
New reverse torque value 570
New speed value 555
New torque value/forward new torque value 559
Number of mark detection 347
Number of mark detection clear request 346
Number of pulses per rotation (AP). 456,457
Number of simultaneous starting axes 502,505
Number of write accesses to flash ROM 513

O

Operation cycle over flag. 515
Operation cycle setting 514
Operation pattern 483,485
Operation setting for incompletion of home position
return 480,481
Operation setting for speed-torque control mode
. . . . 469,476
Operation time 515

P

Parameter 497,498
Parameter 1 501,504
Parameter 2 501,505
Parameter initialization request 544
Parameter No. 570
PI-PID switching request 571
Positioning address/movement amount. . . . 484,486
Positioning complete signal output time. . . . 468,472
Positioning data being executed. 533
Positioning data No. being executed. 532
Positioning operation speed override 554
Positioning start No. .550
Positioning starting point No. 550
Position-speed switching control speed change
register 560
Position-speed switching enable flag 561
Pre-reading data analysis status. 539
Production No. 516

R

Rapid stop deceleration time 468,471
Real current value 534
Restart allowable range when servo OFF to ON
. . . . 468,474
Restart command 551
Reverse run JOG start 576
Reverse torque limit stored value 538
RLS signal selection .461

S

S-curve ratio 468,470
Servo alarm 537
Servo OFF command .568
Servo parameter read/write request 570
Servo status1 536
Servo status2 538
Shape 497
Simultaneous starting axis 566
Simultaneous starting axis No. 502,506
Simultaneous starting axis start data No.1. 563
Simultaneous starting axis start data No.2. 563
Simultaneous starting axis start data No.3. 563
Simultaneous starting own axis start data No. . . .562

Skip command 565
Software stroke limit lower limit value 461,463
Software stroke limit selection 461,463
Software stroke limit upper limit value 461,462
Software stroke limit valid/invalid setting . . . 461,463
Special start data instruction code setting value
. . . . 529
Special start data instruction parameter setting value
. . . . 529
Special start instruction 497
Special start repetition counter 531
Speed change request. 555
Speed control 10 x multiplier setting for degree axis
. . . . 468,473
Speed during command. 539
Speed limit value 460
Speed limit value at torque control mode 575
Speed switching mode. 461,465
Speed-position function selection 461,466
Speed-position switching command 567
Speed-position switching control movement amount
change register. 559
Speed-position switching control positioning
movement amount 523
Speed-position switching device selection 567
Speed-position switching enable flag. 560
Start (Day: hour) 510
Start (Minute: second) 511
Start (ms). 511
Start (Year: month) 510
Start data No. 497
Start data pointer being executed 531
Start history pointer 512
Start information 508
Start No. 509
Start positioning data No. setting value 530
Status 524
Statusword. 537
Step mode 564
Step start information 564
Step valid flag. 564
Stop command processing for deceleration stop
selection 545
Stop group 468,471
STOP signal selection 461

T

Target position change request flag 562
Target position change value (New address) . . . 561
Target position change value (New speed) 562
Target speed 528
Target value 527
Teaching data selection. 565
Teaching positioning data No. 565
Torque change function switching request 569
Torque during command 539
Torque limit setting value 461,464
Torque limit stored value/forward torque limit stored
value 529
Torque output setting value 568
Torque time constant at torque control mode (Forward
direction) 574
Torque time constant at torque control mode (Negative
direction) 575

U

Unit magnification (AM) 456,457
Unit setting. 456

V

Valid M code 521
Virtual servo amplifier connected station monitor .516
Virtual servo amplifier operation command 547
Virtual servo amplifier operation station specification
. 548
Virtual servo amplifier setting 453

I

REVISIONS

*The manual number is given on the bottom left of the back cover.

Revision date	*Manual number	Description
August 2016	IB(NA)-0300324-A	First edition
June 2017	IB(NA)-0300324-B	■Added functions Event history function, Direct control, CC-Link IE Field Network diagnostics ■Added or modified parts SAFETY PRECAUTIONS, TERMS, Section 1.1, 2.1, 3.1, 3.2, 4.1, 4.3, 4.4, 5.3, Chapter 7, Section 7.3, 8.1, 8.2, 8.3, 8.4, 8.7, 8.8, 9.1, 9.4, 9.7, 9.8, 9.9, 9.10, 9.20, 9.21, 12.1, 12.2, 12.3, 12.4, 12.6, 12.7, 12.8, 12.9, 14.4, 14.5, Appendix1, 2
January 2024	IB(NA)-0300324-C	■Added or modified parts INFORMATION AND SERVICES, TRADEMARKS

Japanese manual number: IB-0300323-C

WARRANTY

Please confirm the following product warranty details before using this product.

1. Gratis Warranty Term and Gratis Warranty Range

If any faults or defects (hereinafter "Failure") found to be the responsibility of Mitsubishi occurs during use of the product within the gratis warranty term, the product shall be repaired at no cost via the sales representative or Mitsubishi Service Company.

However, if repairs are required onsite at domestic or overseas location, expenses to send an engineer will be solely at the customer's discretion. Mitsubishi shall not be held responsible for any re-commissioning, maintenance, or testing on-site that involves replacement of the failed module.

[Gratis Warranty Term]

The gratis warranty term of the product shall be for one year after the date of purchase or delivery to a designated place. Note that after manufacture and shipment from Mitsubishi, the maximum distribution period shall be six (6) months, and the longest gratis warranty term after manufacturing shall be eighteen (18) months. The gratis warranty term of repair parts shall not exceed the gratis warranty term before repairs.

[Gratis Warranty Range]

(1) The range shall be limited to normal use within the usage state, usage methods and usage environment, etc., which follow the conditions and precautions, etc., given in the instruction manual, user's manual and caution labels on the product.

(2) Even within the gratis warranty term, repairs shall be charged for in the following cases.

1. Failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by the user's hardware or software design.
2. Failure caused by unapproved modifications, etc., to the product by the user.
3. When the Mitsubishi product is assembled into a user's device, Failure that could have been avoided if functions or structures, judged as necessary in the legal safety measures the user's device is subject to or as necessary by industry standards, had been provided.
4. Failure that could have been avoided if consumable parts (battery, backlight, fuse, etc.) designated in the instruction manual had been correctly serviced or replaced.
5. Failure caused by external irresistible forces such as fires or abnormal voltages, and Failure caused by force majeure such as earthquakes, lightning, wind and water damage.
6. Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
7. Any other failure found not to be the responsibility of Mitsubishi or that admitted not to be so by the user.

2. Onerous repair term after discontinuation of production

(1) Mitsubishi shall accept onerous product repairs for seven (7) years after production of the product is discontinued. Discontinuation of production shall be notified with Mitsubishi Technical Bulletins, etc.

(2) Product supply (including repair parts) is not available after production is discontinued.

3. Overseas service

Overseas, repairs shall be accepted by Mitsubishi's local overseas FA Center. Note that the repair conditions at each FA Center may differ.

4. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to:

(1) Damages caused by any cause found not to be the responsibility of Mitsubishi.

(2) Loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products.

(3) Special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products.

(4) Replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Changes in product specifications

The specifications given in the catalogs, manuals or technical documents are subject to change without prior notice.

INFORMATION AND SERVICES

For further information and services, please contact your local Mitsubishi Electric sales office or representative.
Visit our website to find our locations worldwide.

MITSUBISHI ELECTRIC Factory Automation Global Website
Locations Worldwide
www.MitsubishiElectric.com/fa/about-us/overseas/

TRADEMARKS

Ethernet is a registered trademark of Fuji Xerox Co., Ltd. in Japan.
Intel Core is either a trademark or a registered trademark of Intel Corporation and its subsidiaries in the United States and/or other countries.
Microsoft, Windows, Visual C++, and Visual Studio are trademarks of the Microsoft group of companies.
PCI Express is either a registered trademark or a trademark of PCI-SIG.
The company names, system names and product names mentioned in this manual are either registered trademarks or trademarks of their respective companies.
In some cases, trademark symbols such as '™' or '®' are not specified in this manual.

IB(NA)-0300324-C

IB(NA)-0300324-C(2401)MEE
MODEL: EM340-U-APP-E
MODEL CODE: 1XB048

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE: TOKYO BLDG., 2-7-3, MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN
NAGOYA WORKS: 1-14, YADA-MINAMI 5-CHOME, HIGASHI-KU, NAGOYA 461-8670, JAPAN