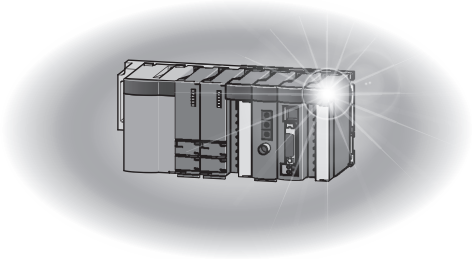
MITSUBISHI ELECTRIC

Mitsubishi Programmable Controller

MELSEC Q series

MELSEC-Q QD73A1 Positioning Module User's Manual

-QD73A1



●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. For the safety precautions of the programmable controller system, refer to the user's manual for the CPU module used.

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 external to the programmable controller to ensure that the entire system operates safely even when a fault occurs in the external power supply or the programmable controller. Failure to do so may result in an accident due to an incorrect output or malfunction.
  (1) When using a servo amplifier with Servo ON signal, connect the signal to the module. When using a servo amplifier whose control cannot be stopped through Servo ON signal, satisfy the following.
  • Analog voltage must be 0V (motor stop) to power off the programmable controller.
  (2) Emergency stop circuits, protection circuits, and protective interlock circuits for conflicting operations (such as forward/reverse rotations or upper/lower limit positioning) must be configured external to the programmable controller.
  (3) OPR (Original Point Return) is controlled by two kinds of data: OPR direction and OPR speed. Deceleration starts when the near-point dog turns on. If an incorrect OPR direction is set, motion control may continue without deceleration. To prevent machine damage caused by this, configure an interlock circuit external to the programmable controller.
- Do not write any data to the "system area" of the buffer memory in the intelligent function module. Also, do not use any "use prohibited" signal as an output signal from the CPU module to the intelligent function module. Doing so may cause malfunction of the programmable controller system.

⚠ CAUTION
● Do not install the connection cables for external I/O signals and for the drive unit together with the main circuit lines, power cables, or load circuit lines of a device other than the programmable controller. Keep a distance of 100mm or more between them. Failure to do so may result in malfunction due to noise, surges, and induction.

[Installation Precautions]

⚠ CAUTION
● Use the programmable controller in an environment that meets the general specifications in the user's manual for the CPU module used. Failure to do so may result in electric shock, fire, malfunction, or damage to or deterioration of the product. ● To mount the module, while pressing the module mounting lever located in the lower part of the module, fully insert the module fixing projection(s) into the hole(s) in the base unit and press the module until it snaps into place. Incorrect mounting may cause malfunction, failure or drop of the module. When using the programmable controller in an environment of frequent vibrations, fix the module with a 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 module, resulting in drop, short circuit, or malfunction. ● Securely connect the drive unit connector and external device connector to the connector on the module. Poor contact may cause incorrect input or output. ● Do not directly touch any conductive parts and electronic components of the module. Doing so can cause malfunction or failure of the module. ● Shut off the external power supply (all phases) used in the system before mounting or removing the module. Failure to do so may result in damage to the product.

[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 cause the module to fail or malfunction.
- After installation and wiring, attach the included terminal cover to the module before turning it on for operation. Failure to do so may result in electric shock.

⚠CAUTION

- Check the rated voltage and terminal layout before wiring to the module, and connect the cables correctly.
  Connecting a power supply with a different voltage rating or incorrect wiring may cause a fire or failure.
- Use applicable solderless terminals and tighten them within the specified torque range.
  If any spade solderless terminal is used, it may be disconnected when the terminal screw comes loose, resulting in failure.
- Tighten the connector screws within the specified torque range.
  Undertightening can cause short circuit, fire, or malfunction.
  Overtightening can damage the screw and/or module, resulting in drop, short circuit, fire, or malfunction.
- Connectors for external devices must be crimped with the tool specified by the manufacturer or must be correctly soldered.
  Incomplete connections may cause short circuit, fire, or malfunction.
- Place the cables in a duct or clamp them.
  If not, dangling cable may swing or inadvertently be pulled, resulting in damage to the module or cables or malfunction due to poor contact.
- When disconnecting the cable from the module, 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 module may result in malfunction or damage to the module or cable.
- Prevent foreign matter such as dust or wire chips from entering the module. Such foreign matter can cause a fire, failure, or malfunction.
- A protective film is attached to the top of the module to prevent foreign matter, such as wire chips, from entering the module during wiring. Do not remove the film during wiring. Remove it for heat dissipation before system operation.

[Startup and Maintenance Precautions]

⚠ WARNING

- Shut off the external power supply (all phases) used in the system before cleaning the module or retightening the connector screws. Failure to do so may result in electric shock.

⚠ CAUTION

- Do not disassemble or modify the module.
  Doing so may cause failure, malfunction, injury, or a fire.
- Shut off the external power supply (all phases) used in the system before mounting or removing a module. Failure to do so may cause the module to fail or malfunction.
- After the first use of the product, do not mount/remove the module to/from the base unit, and the terminal block to/from the module more than 50 times (IEC 61131-2 compliant) respectively. Exceeding the limit may cause malfunction.
- Before testing 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.
- Before handling the module, 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 module to fail or malfunction.

[Precaution during operation]

⚠ CAUTION

- When changing data and operating status, and modifying program of the running programmable controller from an external device such as a personal computer connected to an intelligent function module, read relevant manuals carefully and ensure the safety before operation. Incorrect change or modification may cause system malfunction, damage to the machines, or accidents.

[Disposal Precaution]

⚠ CAUTION

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

●CONDITIONS OF USE FOR THE PRODUCT●

(1) Mitsubishi programmable controller ("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 Mitsubishi MELSEC-Q series programmable controllers.
This manual describes the operating procedure, system configuration, parameter settings, functions, programming, and troubleshooting of the QD73A1 positioning module (hereafter abbreviated as QD73A1).

Before using this product, please read this manual and the relevant manuals carefully and develop familiarity with the functions and performance of the MELSEC-Q series programmable controller to handle the product correctly.
When applying the program examples introduced in this manual to an actual system, ensure the applicability and confirm that it will not cause system control problems.

■Relevant module: QD73A1

Remark

- Unless otherwise specified, this manual describes the program examples in which the I/O numbers of X/Y10 to X/Y2F are assigned for the QD73A1.
  For I/O number assignment, refer to the following manuals.
  - QnUCPU Users Manual (Function Explanation, Program Fundamentals)
  - Qn(H)/QnPH/QnPRHCPU User's Manual (Function Explanation, Program Fundamentals)
- Operating procedures are explained using GX Works2. When using GX Developer, refer to the following.
  Page 275, Appendix 4

COMPLIANCE WITH EMC AND LOW VOLTAGE DIRECTIVES

(1) Method of ensuring compliance

To ensure that Mitsubishi programmable controllers maintain EMC and Low Voltage Directives when incorporated into other machinery or equipment, certain measures may be necessary. Please refer to one of the following manuals.

- QCPU User's Manual (Hardware Design, Maintenance and Inspection)
- Safety Guidelines
  (This manual is included with the CPU module or base unit.)

The CE mark on the side of the programmable controller indicates compliance with EMC and Low Voltage Directives.

(2) Additional measures

To ensure that this product maintains EMC and Low Voltage Directives, please refer to Page 64, Section 4.6.1.

RELEVANT MANUALS

(3) CPU module user's manual

Manual name <manual number (model code)>	Description
QCPU User's Manual (Hardware Design, Maintenance and Inspection) <SH-080483ENG, 13JR73>	Specifications of the hardware (CPU modules, power supply modules, base units, extension cables, and memory cards), system maintenance and inspection, troubleshooting, and error codes
QnUCPU Users Manual (Function Explanation, Program Fundamentals) <SH-080807ENG, 13JZ27>	Functions, methods, and devices for programming
Qn(H)/QnPH/QnPRHCPU User's Manual (Function Explanation, Program Fundamentals) <SH-080808ENG, 13JZ28>	

(4) Operating manual

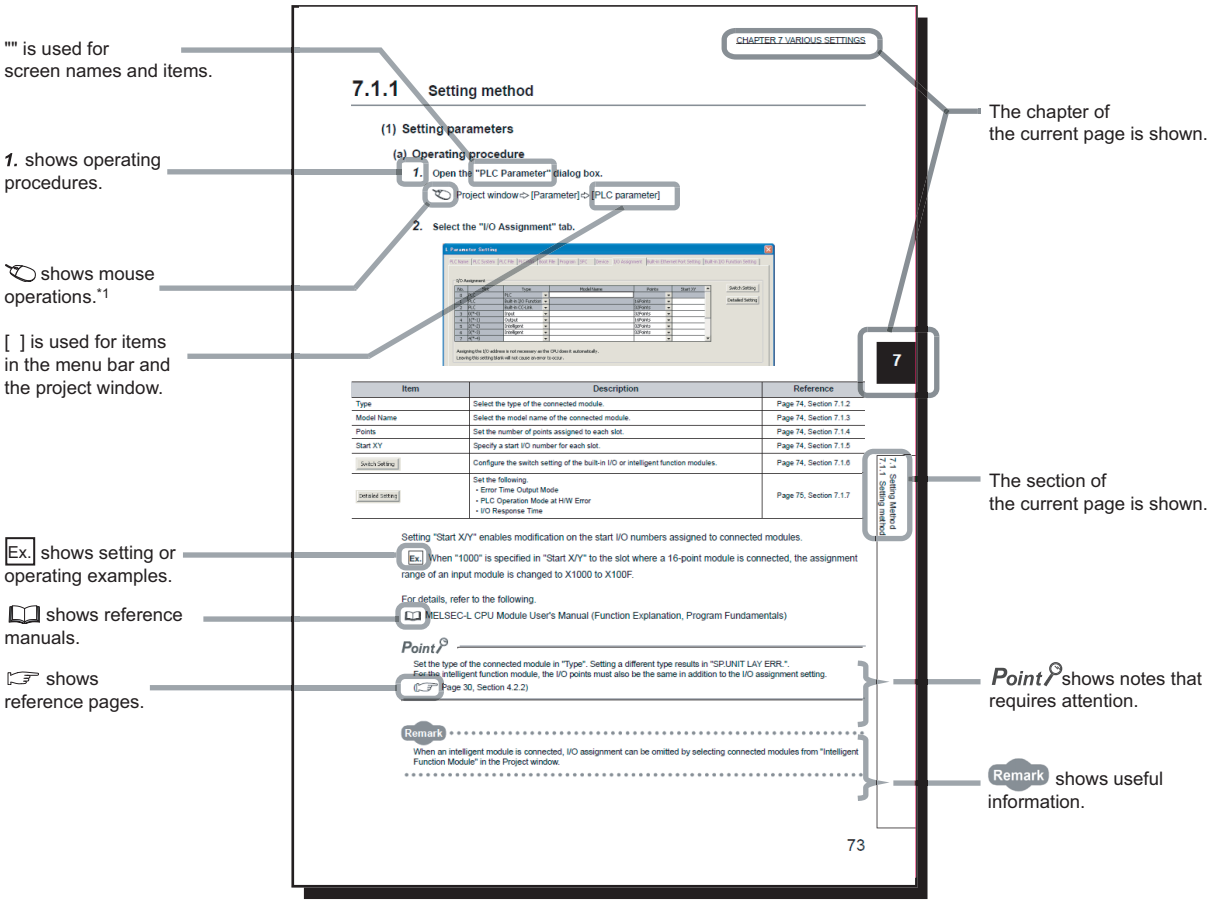
Manual name <manual number (model code)>	Description
GX Works2 Version1 Operating Manual (Common) <SH-080779ENG, 13JU63>	System configuration, parameter settings, and online operations (common to Simple project and Structured project) of GX Works2
GX Developer Version 8 Operating Manual <SH-080373E, 13JU41>	Operating methods of GX Developer, such as programming, printing, monitoring, and debugging

Memo

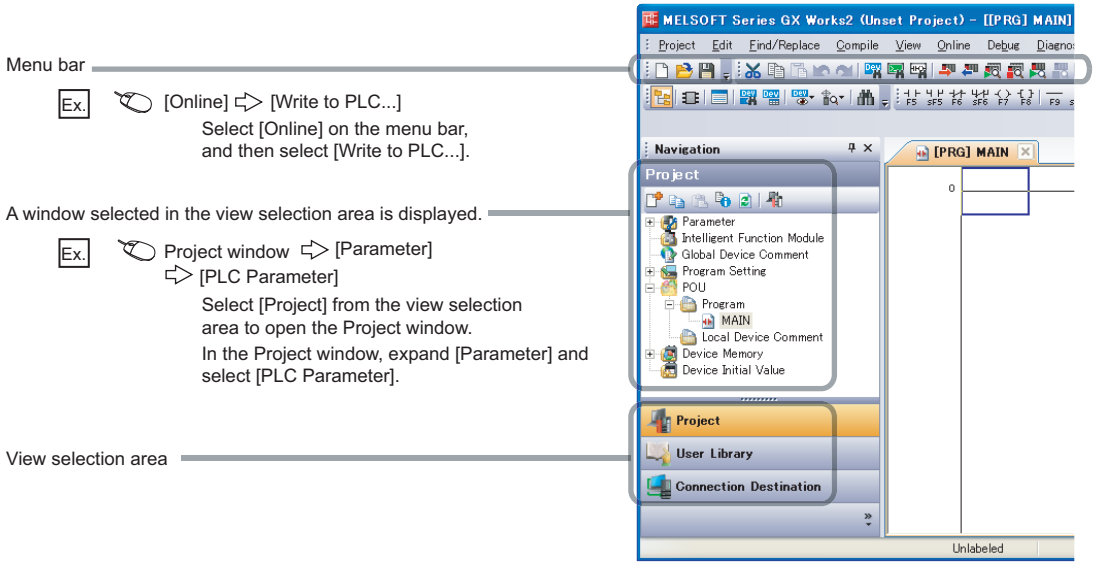
CONTENTS

MANUAL PAGE ORGANIZATION

In this manual, pages are organized and the symbols are used as shown below.
The following illustration is for explanation purpose only, and should not be referred to as an actual documentation.



*1 The mouse operation example is provided below.



The following symbols are used to represent buffer memory areas in this manual. Serial numbers fit in "*".

Symbol	Description
Pr.*	Symbol indicating positioning parameter and OPR parameter item
Da.*	Symbol indicating positioning data item
Md.*	Symbol indicating monitor data item
Cd.*	Symbol indicating control data item

TERMS

Unless otherwise specified, this manual uses the following terms.

Term	Description
QD73A1	The abbreviation for the QD73A1 positioning module
QCPU	Another term for the MELSEC-Q series CPU module
Redundant CPU	A generic term for the Q12PRHCPU and Q25PRHCPU
External input	The abbreviation for input from connectors for external devices
External output	The abbreviation for output to connectors for external devices
Programming tool	Generic term for GX Works2 and GX Developer
GX Works2	The product name of the software package for the MELSEC programmable controllers
GX Developer	
Buffer memory	The memory of an intelligent function module used to store data (such as setting values and monitored values) for communication with a CPU module

For terms related to positioning, refer to the following.

☞Page 278, Appendix 5

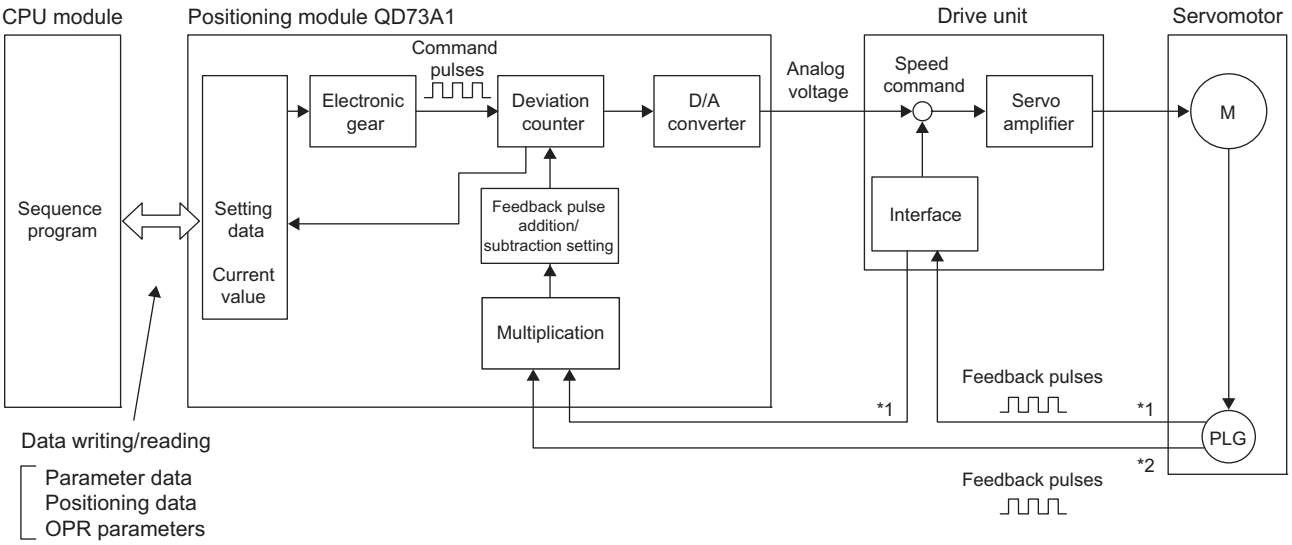
PACKING LIST

The product package contains the following.

Model	Product	Quantity
QD73A1	QD73A1 positioning module	1
QD73A1-U-HW	Before Using the Product	1

CHAPTER 1 OVERVIEW

The QD73A1 possesses a deviation counter and D/A converter inside as in the following figure.



Feedback pulses from the pulse generator (PLG) may be input to the QD73A1 via the drive unit[*1] or directly[*2] depending on the servomotor to be used. Check which method applies in the manual for the servomotor or drive unit to be used.

A system with the QD73A1 operates as follows.

Start	Once a command pulse train for positioning is output, pulses are accumulated in the deviation counter. The integrated value of pulses (accumulated pulses) is converted into DC analog voltage by a D/A converter, then turns into a speed command to a servomotor. The speed command from a drive unit starts servomotor rotation.
Operation	Once the servomotor starts rotating, feedback pulses that are proportional to the number of rotations are generated by a pulse generator (PLG) attached to the servomotor. The generated feedback pulses are subtracted from the accumulated pulses in the deviation counter. The deviation counter continues to rotate the servomotor, maintaining a constant amount of accumulated pulse.
Stop	Once the command pulse output from the QD73A1 stops, the accumulated pulses in the deviation counter decrease, so does the speed. When there is no more accumulated pulse, the servomotor stops.

The rotation speed of a servomotor is proportional to command pulse frequency, while the rotation degree of the servomotor is proportional to the output command pulse amount. By setting feed per pulse beforehand, analog voltage that is proportional to the number of pulses in a pulse train is output, and a workpiece can be moved to the set position. Note that pulse frequency defines the rotation speed of the servomotor (feedrate).

1.1 Features

(1) Analog output type that possesses a deviation counter and D/A converter inside

This module converts command pulse for positioning into analog voltage inside, then outputs a speed command to a servo amplifier.

(2) Compatible with analog input servo amplifiers

A servo amplifier does not require an extra module to convert pulse input into analog voltage; a standard servo amplifier can be used.

(3) Servomotor control using a high-resolution encoder

This module handles up to 1Mpulse/s of pulse input from an encoder. Servomotor control that uses high-speed input pulse signals from a high-resolution encoder improves the accuracy of positioning.

(4) Four types of positioning method

The following control can be executed.

- Position control mode: positioning control and two-phase trapezoidal positioning control
- Speed-position control switch mode: speed-position control switchover and speed control

(5) Zero/gain adjustment through a sequence program

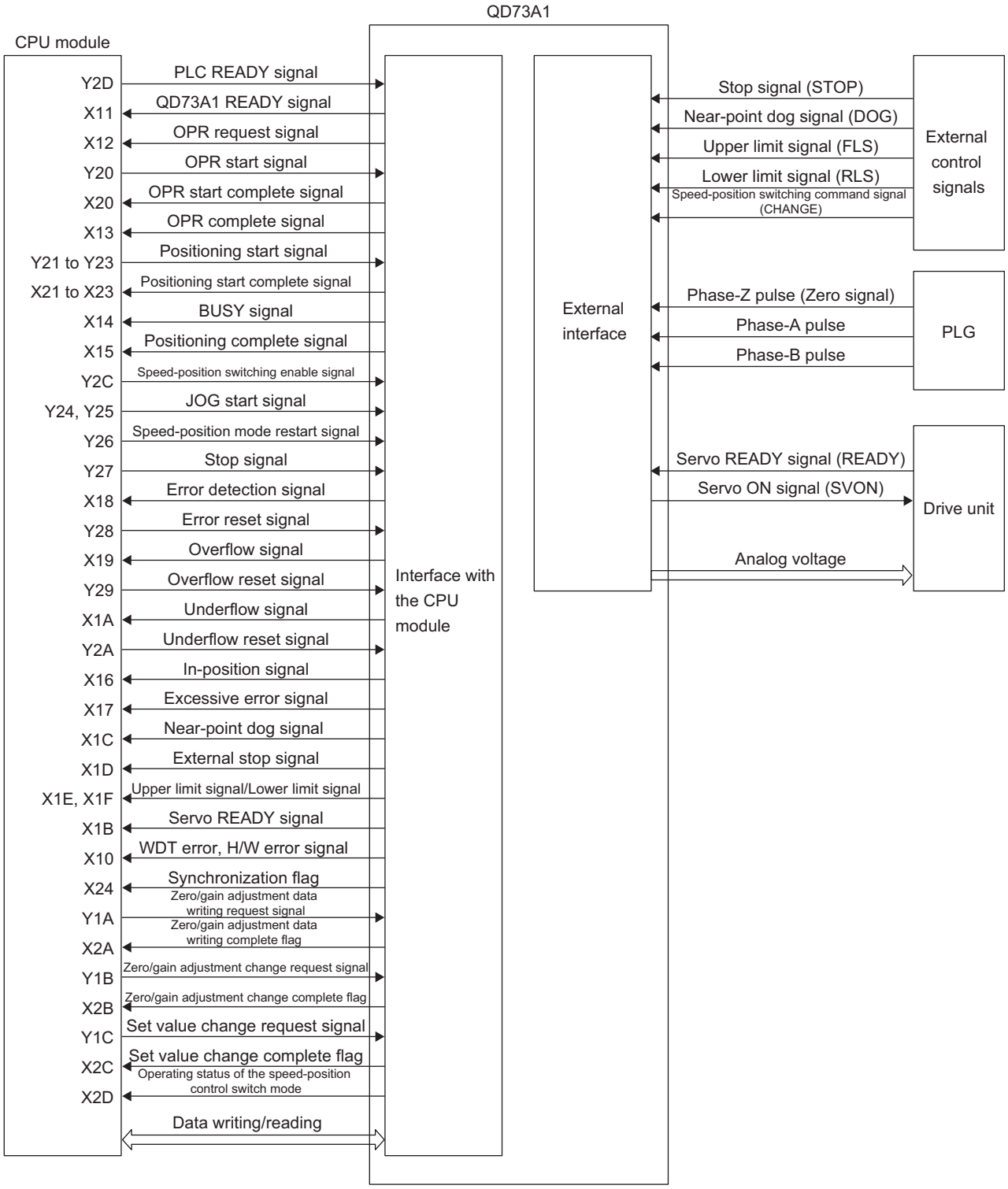
Zero/gain adjustment can be performed through a sequence program. Therefore, the adjustment can be performed without using a switch or checking a LED, saving man-hour.
(Note that zero/gain adjustment can also be performed using switches on the front of the QD73A1.)

(6) Easy setting with GX works2

Sequence programming is reduced since initial settings and the auto refresh setting can be configured on the screen. In addition, the setting status and operating status of the module can be checked easily.

1.2 Signal Transmission Between the QD73A1 and Others

The following figure shows signal transmission between the QD73A1 and a CPU module, and a drive unit.



(1) Between the CPU module and the QD73A1

The CPU module and the QD73A1 transmit control signals and data to each other through the base unit.

Transmitted item	Description	Reference
Control signal	Signals that indicate the QD73A1's status or are related to commands are transmitted.	Page 30, Section 3.4
Data	Data is written to or read from the buffer memory in the QD73A1 by application instructions of the CPU module.	Page 73, CHAPTER 5

(2) Between the drive unit and the QD73A1

Control signals are transmitted between the drive unit and the QD73A1, and speed commands (analog voltage) are output from the QD73A1 to the drive unit.

For details, refer to the following.

☞Page 40, Section 3.5

CHAPTER 2 SYSTEM CONFIGURATION

This chapter describes the system configuration of the QD73A1.

2.1 Applicable Systems

This section describes applicable systems.

(1) Applicable modules and base units, and number of mountable modules

For the applicable CPU modules and base units, and the number of mountable modules, refer to the user's manual for the CPU module used.

Note the following when mounting modules with the CPU module.

- The power supply capacity may become insufficient depending on the combination with other modules or the number of mounted modules.
  Select the power supply capacity according to the modules to be used.
  If the power supply capacity is insufficient, change the combination of the modules.
- Mount the modules within the number of I/O points range of the CPU module.
  Modules can be mounted on any slot within the number of available slots.

(a) When mounted on MELSECNET/H remote I/O station

For an applicable MELSECNET/H remote I/O station and base units, and the number of mountable modules, refer to the Q Corresponding MELSECNET/H Network System Reference Manual (Remote I/O network).

(2) Multiple CPU system

The function version of the first released QD73A1 is B, and the module supports multiple CPU systems.
When using the QD73A1 in a multiple CPU system, refer to the following.

QCPU User's Manual (Multiple CPU System)

(a) Intelligent function module parameters

Write intelligent function module parameters to only the control CPU of the QD73A1.

(3) Online module change

The QD73A1 does not support online module change.

(4) Applicable software packages

The following table lists systems that use the QD73A1 and applicable software packages.
A programming tool is required to use the QD73A1.

Item		Software version	
		GX Developer*1	GX Works2
Q00J/Q00/Q01CPU	Single CPU system	Version 7 or later	Refer to the GX Works2 Version 1 Operating Manual (Common).
	Multiple CPU system	Version 8 or later	
Q02/Q02H/Q06H/Q12H/Q25HCPU	Single CPU system	Version 4 or later	
	Multiple CPU system	Version 6 or later	
Q02PH/Q06PHCPU	Single CPU system	Version 8.68W or later	
	Multiple CPU system		
Q12PH/Q25PHCPU	Single CPU system	Version 7.10L or later	
	Multiple CPU system		
Q12PRH/Q25PRHCPU	Redundant system	Version 8.45X or later	
Q00UJ/Q00U/Q01UCPU	Single CPU system	Version 8.76E or later	
	Multiple CPU system		
Q02U/Q03UD/Q04UDH/Q06UDHCPU	Single CPU system	Version 8.48A or later	
	Multiple CPU system		
Q10UDH/Q20UDHCPU	Single CPU system	Version 8.76E or later	
	Multiple CPU system		
Q13UDH/Q26UDHCPU	Single CPU system	Version 8.62Q or later	
	Multiple CPU system		
Q03UDE/Q04UDEH/Q06UDEH/Q13UDEH/Q26UDEHCPU	Single CPU system	Version 8.68W or later	
	Multiple CPU system		
Q10UDEH/Q20UDEHCPU	Single CPU system	Version 8.76E or later	
	Multiple CPU system		
CPU modules other than the above	Single CPU system	N/A	
	Multiple CPU system		
When mounted on a MELSECNET/H remote I/O station		Version 6 or later	

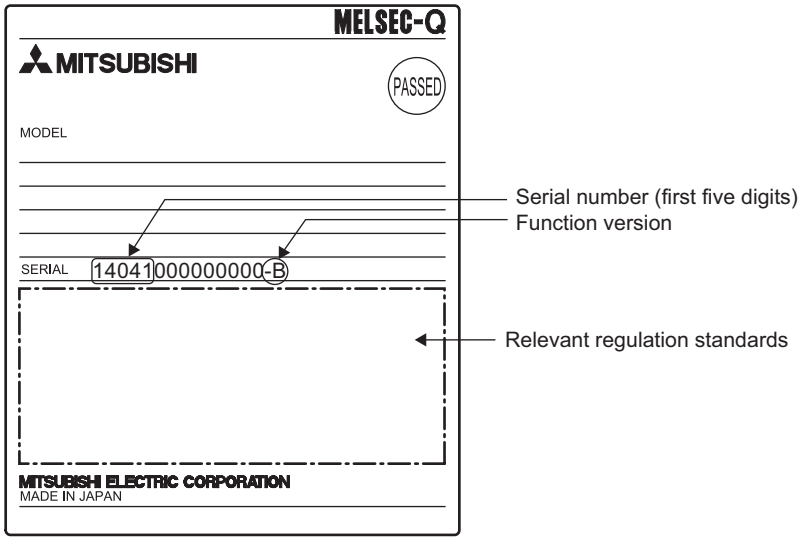
*1 When using GX Developer, configure the initial settings and auto refresh settings with the sequence program.
PROGRAMMING (☞ Page 111, CHAPTER 7)

2.2 How to Check the Function Version and Serial Number

The function version and serial number of the QD73A1 can be checked on the rating plate, front part of the module, or system monitor of the programming tool.

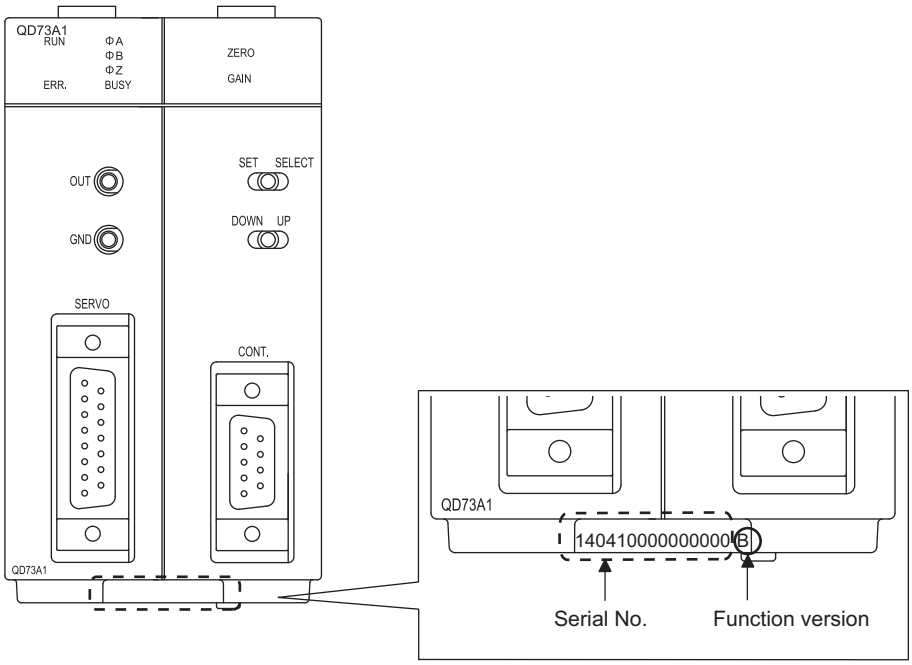
(1) Checking on the rating plate

The rating plate is on the side of the QD73A1.



(2) Checking on the front part (bottom part) of the module

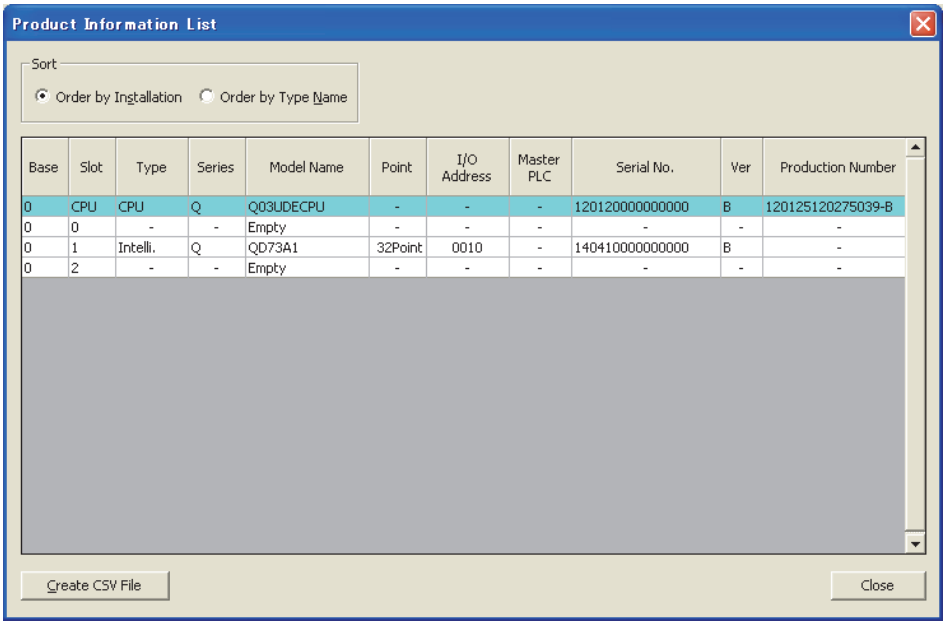
The function version and serial number on the rating plate are also shown on the front part (bottom part) of the module.



(3) Checking on the system monitor

The function version and serial number can be checked on the "Product Information List" window.

[Diagnostics]⇨[System Monitor...]⇨ Product Information List button



Point

- The serial number displayed on the product information list of a programming tool may differ from that on the rating plate and on the front part of the module.
  - The serial number on the rating plate and front part of the module indicates the management information of the product.
  - The serial number displayed on the product information list of a programming tool indicates the function information of the product. The function information of the product is updated when a new function is added.

CHAPTER 3 SPECIFICATIONS

This chapter describes performance specifications, I/O signals from/to the CPU module, and buffer memory specifications of the QD73A1.

For general specifications of the QD73A1, refer to the following.

QCPU User's Manual (Hardware Design, Maintenance and Inspection)

3.1 Performance Specifications

The following table lists performance specifications of the QD73A1.

Item		Specifications
Number of occupied I/O points		48 points (I/O assignment: empty 16 points and intelligent 32 points)
Number of control axes		1 axis
Positioning data	Capacity	1 data
	Setting method	Sequence program
Positioning	Mode	Position control mode Speed-position control switch mode
	System	Position control mode: Selectable from absolute system or incremental system Speed-position control switch mode: Incremental system
	Position command	-2147483648 to 2147483647 (pulse) (signed 32-bit binary)
	Speed command	1 to 4000000 (pulse/s)
	Acceleration	Automatic trapezoidal acceleration/deceleration
	Automatic acceleration/deceleration time	Acceleration time: 2 to 9999 (ms) Deceleration time: 2 to 9999 (ms)
	In-position range	1 to 20479 (pulse)
	Backlash compensation	None
	Error correction function	None
Speed command output		0 to ±10VDC (Adjustable to set in the range of ±5 to ±10VDC)
Positioning feedback pulse input	Pulse frequency	Open collector: 200kpulse/s TTL: 200kpulse/s Differential output: 1Mpulse/s
	Connectable encoder type	Open collector, TTL, or differential output
	Multiplication setting	The number of input feedback pulses can be multiplied by 4, 2, 1, or 1/2.
OPR control		With OP address change An OPR method and OPR direction can be set with the switch setting.
JOG operation		JOG operation can be started by inputting a JOG start signal.
M function		None
Internal current consumption (5VDC)		0.52A
External supply voltage/current terminal block		No external power supply
External dimensions		98(H)mm × 55.2(W)mm × 90(D)mm
Weight		0.20kg
Starting time (from a start request to analog output start)		Absolute system: 1.2ms (same for two-phase trapezoidal positioning) Incremental system: 1.2ms (same for two-phase trapezoidal positioning) JOG operation: 1.2ms OPR (near-point dog method): 1.2ms OPR (count method): 1.2ms

3.2 Number of Parameter Settings

Set initial settings and auto refresh settings of the QD73A1 so that the number of parameters, including those of other intelligent function modules, does not exceed the number of parameters that can be set in the CPU module.
For the maximum number of parameters that can be set in the CPU module, refer to the following.

QCPU User's Manual (Hardware Design, Maintenance and Inspection)

(1) Number of QD73A1 parameters

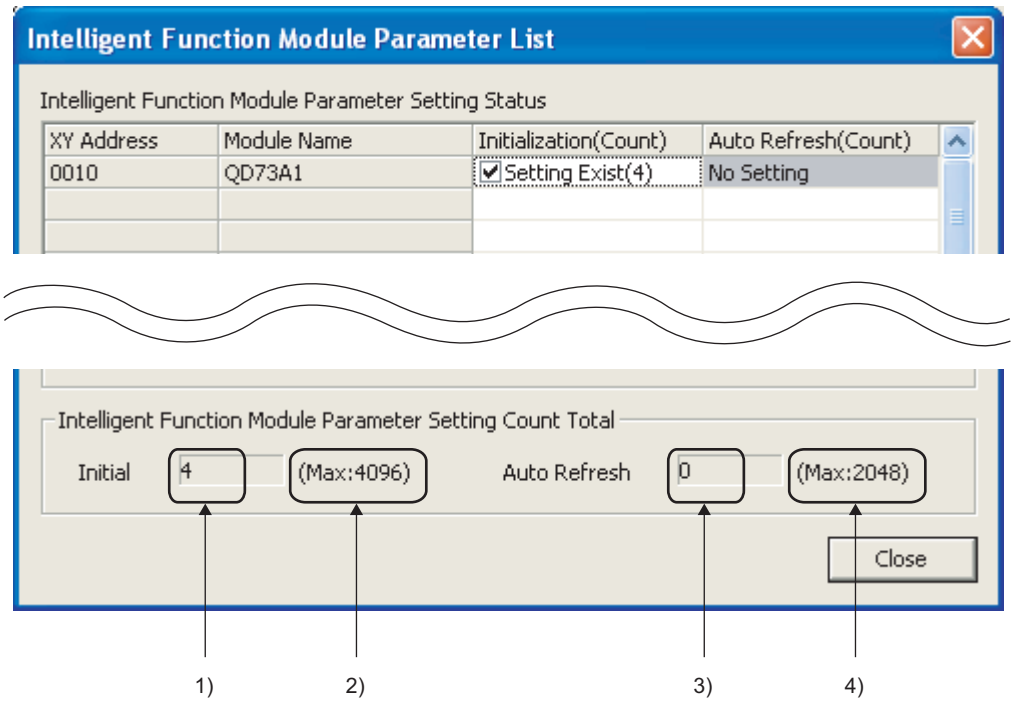
For a QD73A1, the following number of parameters can be set.

Initial setting	Auto refresh setting
4	5

(2) Checking method

The maximum number of parameter settings and the number of parameter settings set for the intelligent function module can be checked on the following.

Project window ⇨ [Intelligent Function Module] ⇨ Right-click
⇨ [Intelligent Function Module Parameter List...]



No.	Description
1)	The total number of parameters in initial settings checked on the window
2)	The maximum number of parameter settings in initial settings
3)	The total number of parameters in the auto refresh setting checked on the window
4)	The maximum number of parameter settings in the auto refresh setting

3.3 List of Functions

This section introduces the functions of the QD73A1.

(1) Main functions

Major positioning functions are as follows.

Item			Description	Reference
OPR control			A workpiece is returned to an original point following an OPR start command, and the current value is corrected as an OP address after the completion of OPR.	Page 178, CHAPTER 8
Major positioning control	Position control mode	Positioning control	Positioning is executed from the current position to a specified position at a specified speed.	Page 191, Section 9.6.1 (1)
		Two-phase trapezoidal positioning control	Positioning is executed to the address specified with " Da.2 Positioning address P1" at " Da.3 Positioning speed V1", then to the address specified with " Da.4 Positioning address P2" at " Da.5 Positioning speed V2" by one positioning start signal.	Page 192, Section 9.6.1 (2)
	Speed-position control switch mode		Operation starts according to the positioning speed set beforehand by one positioning start signal, then the operation switches to position control by Speed-position switching command signal (CHANGE). If the operation stopped by Stop signal after the input of Speed-position switching command signal (CHANGE), the positioning can be continued by requesting a restart. In addition, the positioning address (movement amount) can be changed if it is before the input of Speed-position switching command signal (CHANGE).	Page 195, Section 9.6.2
JOG operation			Positioning is executed in the specified direction at specified speed while a JOG operation command is on. Turning on the signal starts operation at a specified speed and speed control operation can be continued until a stop signal is input.	Page 200, CHAPTER 10

(2) Sub functions

Sub functions compensate or limit control, or add functions at the execution of major positioning functions.

Item		Description	Reference
Functions to compensate control	Electronic gear function	This function controls moving distance and speed by multiplying command pulse output of the QD73A1.	Page 209, Section 11.1
Functions to limit control	Speed limit function	This function limits command speed to the value set in " Pr.5 Speed limit value".	Page 211, Section 11.2
	Stroke limit function	This function controls operation not to execute positioning when a command that moves the workpiece outside the specified stroke limit range is given.	Page 213, Section 11.3
	Upper limit switch (FLS)/lower limit switch (RLS) function	This function decelerates and stops operation according to the detection on limit switches placed at the upper and lower stroke limits.	Page 215, Section 11.4

Item		Description	Reference
Functions to change control details	Current value change function	This function changes the value set in " Md.1 Current feed value" to a specified value.	Page 217, Section 11.5
	Speed change function	This function changes speed during major positioning control or JOG operation.	Page 218, Section 11.6
	Deviation counter clear function	This function clears the accumulated pulses in the deviation counter. When the servomotor power was turned off due to an emergency stop during positioning, clearing the accumulated pulses in the deviation counter prevents servomotor rotation at power recovery.	Page 220, Section 11.7
Other functions	In-position function	This function turns on In-position signal (X16) while the accumulated pulse amount in the deviation counter is within the specified in-position range (1 to 20479pulse). In-position signal (X16) can be used as the signal right before positioning completion.	Page 221, Section 11.8
	Multiplication setting	This function multiplies the feedback pulse frequency from the pulse generator by 4, 2, 1, or 1/2.	Page 104, Section 6.2.3
	Accumulated pulse error detection function	This function outputs an alert and immediately stops the positioning when the accumulated pulses reached the amount specified by the user before the pulses exceed the amount set in "Accumulated pulse setting" in the switch setting and an excessive error occurs.	Page 223, Section 11.9

(3) Common functions

Common functions can be used regardless of control method when necessary.

Item	Description	Reference
Zero/gain adjustment	This function adjusts analog output voltage.	Page 59, Section 4.5
Module status monitor function	This function monitors the module information, switch setting information, and external I/O signal information. The module's detailed information can be displayed on the system monitor of GX Works2.	Page 236, Section 13.1
Error history function	This function monitors the QD73A1's error history stored in the buffer memory.	Page 238, Section 13.2
Module error collection function	This function reports errors that occurred in the QD73A1 to the CPU module. The error information is held in the CPU module memory as a module error history.	Page 239, Section 13.3
Error clear function	This function allows the user to clear errors on the system monitor.	Page 240, Section 13.4

(4) Combination of main function and sub function

◎: Always used together, ○: Can be used together, ×: Cannot be used together

Item			Functions to compensate control	Functions to limit control			Functions to change control details			Other functions		
			Electronic gear function	Speed limit function	Stroke limit function	Upper limit switch (FLS)/ lower limit switch (RLS) function	Current value change function	Speed change function	Deviation counter clear function	In-position function	Multiplication setting	Accumulated pulse error detection function
OPR control			○	○	○	◎	×	×	×	○	○	○
Major positioning control	Position control mode	Positioning control	○	○	○	◎	×	○	×	○	○	○
		Two-phase trapezoidal positioning control	○	○	○	◎	×	○	×	○	○	○
	Speed-position control switch mode		○	○	○	◎	×	○	×	○	○	○
JOG operation			○	○	○	◎	×	○	×	○	○	○

3.4 I/O Signals from/to the CPU Module

This section describes I/O signals of the QD73A1.

3.4.1 I/O signal list

This section describes I/O signal assignment and use of each signal.
The first half of the I/O assignment is empty 16 points, and the second half is intelligent 32 points. When the module is mounted on the slot No.0 and 1 of a main base unit, the device No.Xn0 becomes X10. Although, when the slot No.0 is set as empty 0 point in the I/O assignment setting of GX Works2, the device No.Xn0 becomes X0 (n=0).
Device numbers used in this manual are for the case when the QD73A1 is mounted on the slot No.0 and 1 and when the slot No.0 is empty 16 points.

(1) Input signal list

Input signal (CPU module ← QD73A1)		Input signal (CPU module ← QD73A1)	
Device No.	**Signal name**	**Device No.**	**Signal name**
X10	WDT error, H/W error signal	X20	OPR start complete signal
X11	QD73A1 READY signal	X21	Absolute positioning start complete signal
X12	OPR request signal	X22	Forward start complete signal
X13	OPR complete signal	X23	Reverse start complete signal
X14	BUSY signal	X24	Synchronization flag
X15	Positioning complete signal	X25	Use prohibited
X16	In-position signal	X26	
X17	Excessive error signal	X27	
X18	Error detection signal	X28	
X19	Overflow signal	X29	
X1A	Underflow signal	X2A	Zero/gain adjustment data writing complete flag
X1B	Servo READY signal	X2B	Zero/gain adjustment change complete flag
X1C	Near-point dog signal	X2C	Set value change complete flag
X1D	External stop signal	X2D	Operating status of the speed-position control switch mode
X1E	Upper limit signal	X2E	Use prohibited
X1F	Lower limit signal	X2F	

Point

If a "Use prohibited" area is turned on/off through a sequence program, the QD73A1's function cannot be guaranteed.

(2) Output signal list

Output signal (CPU module → QD73A1)		Output signal (CPU module → QD73A1)	
Device No.	**Signal name**	**Device No.**	**Signal name**
Y10	Use prohibited	Y20	OPR start signal
Y11		Y21	Absolute positioning start signal
Y12		Y22	Forward start signal
Y13		Y23	Reverse start signal
Y14		Y24	Forward JOG start signal
Y15		Y25	Reverse JOG start signal
Y16		Y26	Speed-position mode restart signal
Y17		Y27	Stop signal
Y18		Y28	Error reset signal
Y19		Y29	Overflow reset signal
Y1A	Zero/gain adjustment data writing request signal	Y2A	Underflow reset signal
Y1B	Zero/gain adjustment change request signal	Y2B	Use prohibited
Y1C	Set value change request signal	Y2C	Speed-position switching enable signal
Y1D	Use prohibited	Y2D	PLC READY signal
Y1E		Y2E	Use prohibited
Y1F		Y2F	

Point

If a "Use prohibited" area is turned on/off through a sequence program, the QD73A1's function cannot be guaranteed.

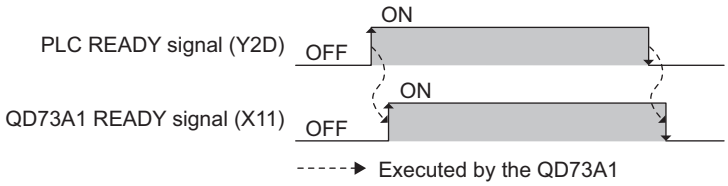
3.4.2 Details of input signals

(1) WDT error, H/W error signal (X10)

This signal turns on when a watchdog timer error is detected through the self-diagnostic function of the QD73A1.
In this case, Servo ON signal (SVON) turns off and analog output becomes 0.

(2) QD73A1 READY signal (X11)

When PLC READY signal (Y2D) is turned on through a sequence program, fixed parameters are checked and this signal turns on.
When PLC READY signal (Y2D) is turned off, this signal turns off.



Use this signal as an interlock in sequence programs.

(3) OPR request signal (X12)

This signal turns on at any of the following timing.

- When the power is turned on
- When the CPU module was reset
- When OPR starts
- When Servo READY signal (READY) turns off while BUSY signal (X14) is on
- When Servo READY signal (READY) turns off while BUSY signal (X14) is off
  (only when "0: Clear the deviation counter when the servo ready signal is OFF." is selected for "Deviation counter clear setting" in the switch setting)

This signal turns off when OPR is completed.
When PLC READY signal (Y2D) is turned on (rising edge), this signal does not turn on.

(4) OPR complete signal (X13)

This signal turns on when OPR is completed.
This signal does not turn on if operation stopped during OPR.
This signal turns off when JOG operation or major positioning control is started.
In the count method, this signal turns off when OPR starts.
This signal turns off when Servo READY signal (READY) turns off (only when "0: Clear the deviation counter when the servo ready signal is OFF." is selected for "Deviation counter clear setting" in the switch setting)

(5) BUSY signal (X14)

This signal turns on when major positioning control, JOG operation, or OPR starts.
This signal turns off when command pulse output is completed.
If positioning is started while BUSY signal (X14) is on, the error "BUSY signal ON at start" (error code: 81) occurs.

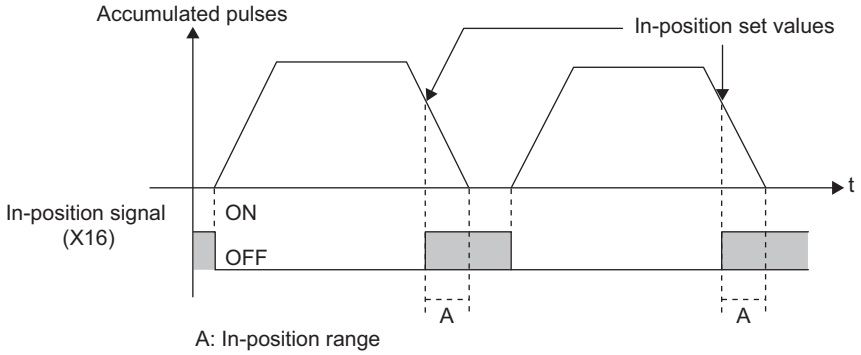
(6) Positioning complete signal (X15)

This signal turns on when major positioning control is completed (completion of command pulse output).
This signal turns off when the next positioning (major positioning control, OPR, or JOG operation) starts.
If major positioning control was cancelled during its operation, this signal does not turn on.
For the operation in case of cancellation of major positioning control, refer to the following.

☞Page 230, Section 12.1

(7) In-position signal (X16)

This signal turns on while the accumulated pulse amount in the deviation counter is within the set range of "Pr.8 In-position range" (1 to ±20479) after deceleration started.
This signal turns off when positioning starts.



Accumulated pulse amount are checked being compared with "Pr.8 In-position range" at the following timing.

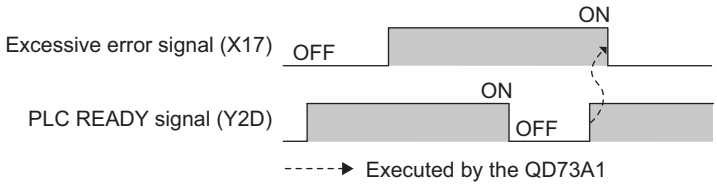
- When the power is turned on
- When automatic deceleration starts in positioning, and thereafter
- When a JOG start signal was turned off and deceleration starts in JOG operation, and thereafter
- When the near-point dog turned on and deceleration to the creep speed starts in OPR, and thereafter

(8) Excessive error signal (X17)

This signal turns on when accumulated pulse amount exceeds the accumulated pulse setting range.
In this case, the QD73A1's status is as follows.

- Analog output voltage: 0V
- Accumulated pulse: Reset to 0
- Servo ON signal (SVON): OFF
- Md.2 Actual current value = Md.1 Current feed value

When PLC READY signal (Y2D) is turned on, this signal turns off.



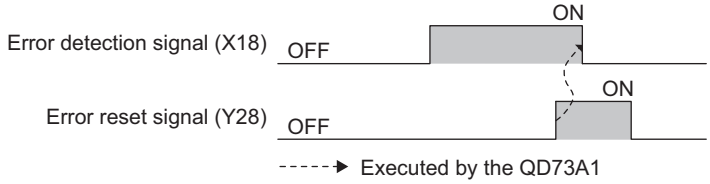
Even if this signal turns on, Error detection signal (X18) does not turn on.
For the accumulated pulse setting range, refer to the following.

☞Page 102, Section 6.2.2

(9) Error detection signal (X18)

When a major or minor error occurs, the corresponding error code is stored in the buffer memory, and this signal turns on.

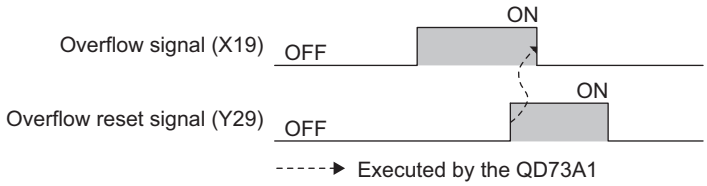
When Error reset signal (Y28) is turned on, this signal turns off.



(10) Overflow signal (X19)

This signal turns on when "Md.1 Current feed value" exceeds 2147483647.

When Overflow reset signal (Y29) is turned on, this signal turns off.

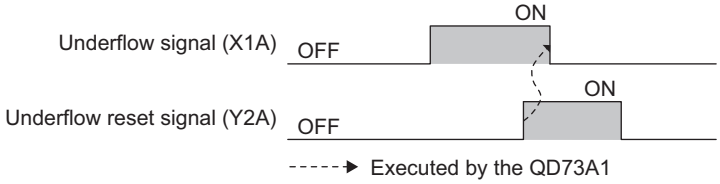


In case of an overflow, "Md.1 Current feed value" changes as follows: 2147483647 → -2147483648

(11) Underflow signal (X1A)

This signal turns on when "Md.1 Current feed value" becomes less than -2147483648.

When Underflow reset signal (Y2A) is turned on, this signal turns off.



In case of an underflow, "Md.1 Current feed value" changes as follows: -2147483648 → 2147483647

(12) Servo READY signal (X1B)

This signal indicates the on/off status of Servo READY signal (READY).

(13) Near-point dog signal (X1C)

This signal indicates the on/off status of Near-point dog signal (DOG).

(14) External stop signal (X1D)

This signal indicates the on/off status of Stop signal (STOP).

(15) Upper limit signal (X1E)

This signal indicates the on/off status of Upper limit signal (FLS).

(16) Lower limit signal (X1F)

This signal indicates the on/off status of Lower limit signal (RLS).

(17)OPR start complete signal (X20)

This signal turns on when OPR process starts after OPR start signal (Y20) was turned on.
When OPR start signal (Y20) is turned off after the start of OPR, this signal turns off.

(18)Absolute positioning start complete signal (X21)

This signal turns on when positioning process starts after Absolute positioning start signal (Y21) was turned on.
When Absolute positioning start signal (Y21) is turned off after the start of the positioning, this signal turns off.

(19)Forward start complete signal (X22)

This signal turns on when positioning process starts after Forward start signal (Y22) was turned on.
When Forward start signal (Y22) is turned off after the start of the positioning, this signal turns off.

(20)Reverse start complete signal (X23)

This signal turns on when positioning process starts after Reverse start signal (Y23) was turned on.
When Reverse start signal (Y23) is turned off after the start of the positioning, this signal turns off.

(21)Synchronization flag (X24)

This signal turns on when the CPU module becomes accessible to the QD73A1 after the power was turned off then on, or after the CPU module was reset.
When the module synchronization setting of the CPU module is set to asynchronous, use this signal as an interlock to access the QD73A1 from a sequence program.

(22)Zero/gain adjustment data writing complete flag (X2A)

This signal turns on when zero/gain adjustment value writing to the QD73A1 is completed after Zero/gain adjustment data writing request signal (Y1A) was turned on.
When Zero/gain adjustment data writing request signal (Y1A) is turned off, this signal turns off.

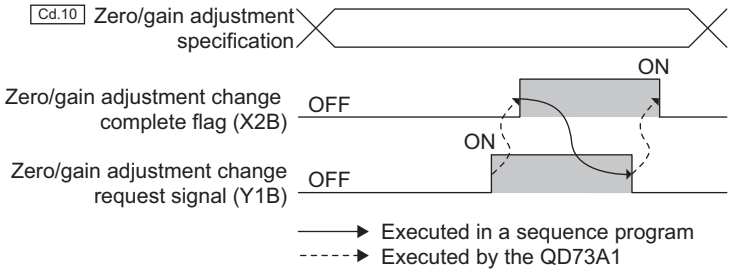
Use this signal as an interlock condition to turn on/off Zero/gain adjustment data writing request signal (Y1A) when writing the zero/gain adjustment value to the QD73A1.
For details on zero/gain adjustment, refer to the following.

☞Page 59, Section 4.5

(23)Zero/gain adjustment change complete flag (X2B)

This signal turns on when zero adjustment and gain adjustment were switched after Zero/gain adjustment change request signal (Y1B) was turned on.

When Zero/gain adjustment change request signal (Y1B) is turned off, this signal turns off.



Use this signal as an interlock condition to turn on/off Zero/gain adjustment change request signal (Y1B) when changing "Cd.10 Zero/gain adjustment specification".

For details on zero/gain adjustment, refer to the following.

☞Page 59, Section 4.5

(24)Set value change complete flag (X2C)

This signal turns on when the analog output value of zero/gain adjustment was changed after Set value change request signal (Y1C) was turned on.

When Set value change request signal (Y1C) is turned off, this signal turns off.

Use this signal as an interlock condition to turn on/off Set value change request signal (Y1C) when performing zero/gain adjustment.

For details on zero/gain adjustment, refer to the following.

☞Page 59, Section 4.5

(25)Operating status of the speed-position control switch mode (X2D)

This signal indicates the operating status in the speed-position control switch mode.

This signal is on during speed control.

This signal is off during position control.

3.4.3 Details of output signals

(1) Zero/gain adjustment data writing request signal (Y1A)

Turn on this signal to write the zero/gain adjustment value to the QD73A1.

For the on/off timing of this signal, refer to the detail of Zero/gain adjustment data writing complete flag (X2A). (☞Page 35, Section 3.4.2 (22))

For details on zero/gain adjustment, refer to the following.

☞Page 59, Section 4.5

(2) Zero/gain adjustment change request signal (Y1B)

Turn on this signal to change zero adjustment and gain adjustment.

For the on/off timing of this signal, refer to the detail of Zero/gain adjustment change complete flag (X2B). (☞Page 36, Section 3.4.2 (23))

For details on zero/gain adjustment, refer to the following.

☞Page 59, Section 4.5

(3) Set value change request signal (Y1C)

Turn on/off this signal to increase/decrease the analog output value at zero/gain adjustment.

The analog output is increased/decreased according to the value set in "Cd.11 Zero/gain adjustment value specification".

For the on/off timing of this signal, refer to the detail of Set value change complete flag (X2C). (☞Page 36, Section 3.4.2 (24))

For details on zero/gain adjustment, refer to the following.

☞Page 59, Section 4.5

(4) OPR start signal (Y20)

Turn on this signal to start OPR.

(5) Absolute positioning start signal (Y21)

Turn on this signal to start absolute system positioning (position control mode).

(6) Forward start signal (Y22)

Turn on this signal to start positioning in the address increasing direction.

The following table describes the consequence of turning on this signal for each type of positioning (major positioning control).

Major positioning control		Consequence of turning on Forward start signal (Y22)
Position control mode	Positioning control	Starts in the address increasing direction (incremental system)
	Two-phase trapezoidal positioning control	
Speed-position control switch mode		Starts in the address increasing direction

(7) Reverse start signal (Y23)

Turn on this signal to start positioning in the address decreasing direction.

The following table describes the consequence of turning on this signal for each type of positioning (major positioning control).

Major positioning control		Consequence of turning on Reverse start signal (Y23)
Position control mode	Positioning control	Starts in the address decreasing direction (incremental system)
	Two-phase trapezoidal positioning control	
Speed-position control switch mode		Starts in the address decreasing direction

(8) Forward JOG start signal (Y24)

Turn on this signal to start JOG operation in the address increasing direction.

The JOG operation continues while this signal is on.

The JOG operation decelerates and stops when this signal is turned off.

(9) Reverse JOG start signal (Y25)

Turn on this signal to start JOG operation in the address decreasing direction.

The JOG operation continues while this signal is on.

The JOG operation decelerates and stops when this signal is turned off.

(10) Speed-position mode restart signal (Y26)

Turn on this signal to restart positioning if it stopped due to Stop signal in the speed-position control switch mode.

(11) Stop signal (Y27)

Turn on this signal to decelerate and stop OPR operation, major positioning operation, or JOG operation.

If this signal is turned on during OPR, Error detection signal (X18) turns on.

(12) Error reset signal (Y28)

Turn on this signal to clear the following buffer memory data to 0 when Error detection signal (X18) is on.

- Md.3 Error code (ERR.1)
- Md.4 Error code (ERR.2)

When this signal is turned on, Error detection signal (X18) turns off.

(13) Overflow reset signal (Y29)

Turn on this signal to turn off Overflow signal (X19) when it is on.

For the on/off timing of this signal, refer to the detail of Overflow signal (X19). (☞Page 34, Section 3.4.2 (10))

(14)Underflow reset signal (Y2A)

Turn on this signal to turn off Underflow signal (X1A) when it is on.

For the on/off timing of this signal, refer to the detail of Underflow signal (X1A). (☞Page 34, Section 3.4.2 (11))

(15)Speed-position switching enable signal (Y2C)

Use this signal to enable/disable Speed-position switching command signal (CHANGE) in the speed-position control switch mode.

Turn on this signal to enable Speed-position switching command signal (CHANGE). Turn off this signal to disable Speed-position switching command signal (CHANGE).

(16)PLC READY signal (Y2D)

This signal notifies the QD73A1 that the CPU module is operating normally.

This signal needs to be turned on beforehand to start OPR, major positioning, or JOG operation.

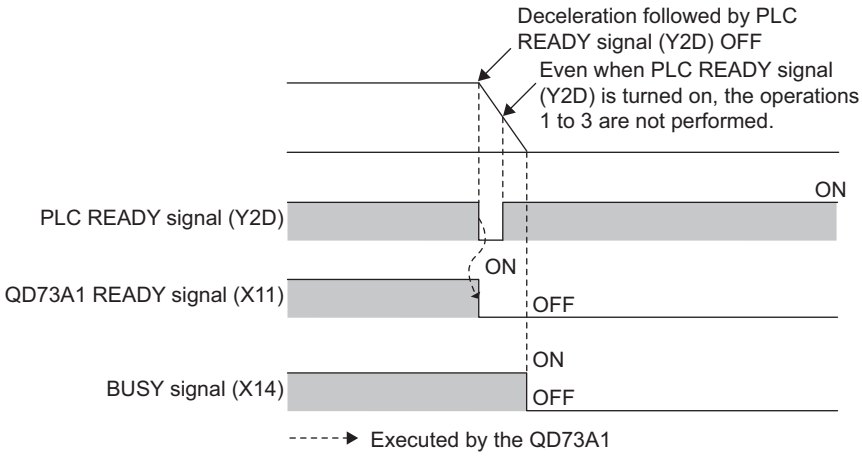
This signal needs to be turned off beforehand to write fixed parameters and OPR parameters.

When this signal is turned on, the QD73A1 performs the following.

- 1: Checking fixed parameters
- 2: Turning on QD73A1 READY signal (X11)
- 3: Turning off Excessive error signal (X17) when it is on

When this signal is turned off while BUSY signal (X14) is on, the QD73A1 processes a deceleration stop.

When this signal is turned on while BUSY signal (X14) is on, the QD73A1 does not perform the operations 1 to 3 above.



3.5 Specifications of I/O Interfaces with External Devices

This section describes I/O interfaces between the QD73A1 and external devices.

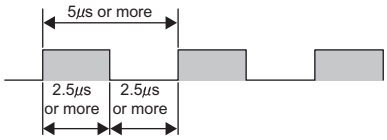
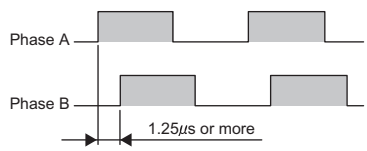
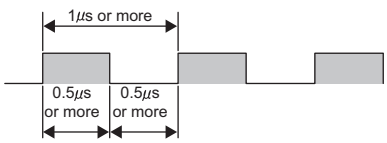
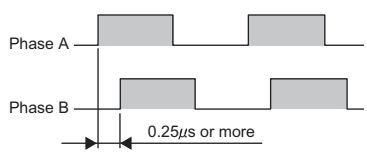
3.5.1 Electrical specifications of I/O signals

This section describes electrical specifications of I/O interfaces between the QD73A1 and external devices.

(1) Input specifications

Signal name		Voltage range/Current consumption	ON voltage	ON current	OFF voltage	OFF current	Pulse frequency
Supply power	Input common	5 to 24VDC/ Max.60mA	—	—	—	—	—
Servo READY signal (READY) Stop signal (STOP) Near-point dog signal (DOG) Upper limit signal (FLS) Lower limit signal (RLS) Speed-position switching command signal (CHANGE)		4.75 to 26.4VDC	3V or higher	2.5mA or higher	1V or lower	0.1mA or lower	—
(Open collector method) Phase-A feedback pulse (PULSE A) Phase-B feedback pulse (PULSE B) Phase-Z feedback pulse (PULSE Z)		10.8 to 14VDC	4V or higher	2.7mA or higher	1V or lower	0.1mA or lower	200kpulse/s or less*1
(TTL method) Phase-A feedback pulse (PULSE A) Phase-B feedback pulse (PULSE B) Phase-Z feedback pulse (PULSE Z)		4.5 to 5.5VDC	2.8V or higher	—	0.8V or lower	—	200kpulse/s or less*1
(Differential output method) Phase-A feedback pulse (PULSE A) Phase-B feedback pulse (PULSE B) Phase-Z feedback pulse (PULSE Z)		—	EIA standard RS-422-A differential line receiver (Equivalent of AM26LS32 (Manufactured by Texas Instruments Inc.))				1Mpulse/s or less*1

*1 The following table shows the pulse width and phase difference depending on pulse frequency.

Pulse frequency	Pulse width (duty ratio: 50%)	Phase difference	
200kpulse/s or less			When the phase A leads the phase B, the positioning address (current value) increases.
1Mpulse/s or less			

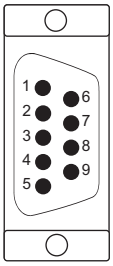
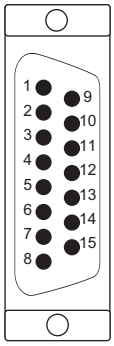
(2) Output specifications

Signal name	Analog output voltage/current	Output method	Load voltage	Load current	Max. voltage drop at ON	Leakage current at OFF
Servo ON signal (SVON)	—	Open collector	4.75 to 26.4VDC	Max.30mA*1	1.0V or lower	0.1mA or lower
Speed command signal (analog signal)	0 to ±10VDC/10mA	—	—	—	—	—

*1 The load current of Servo ON signal (SVON) is 30mA at the maximum. When using a miniature relay, take the load current into consideration.

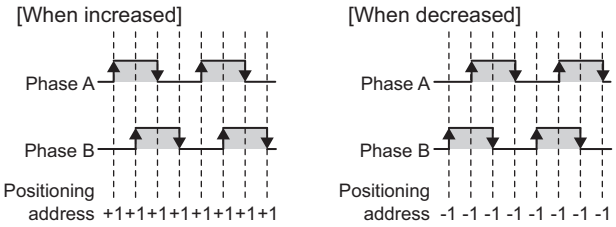
3.5.2 Signal layout for external device connectors

The following table shows signal layouts on external device connectors.

Connector name	Pin arrangement	Pin number	Signal name
CONT.	 Viewed from the front of the module	1	Near-point dog signal (DOG)
		2	Empty
		3	Empty
		4	Empty
		5	Power supply (5 to 24V)
		6	Lower limit signal (RLS)
		7	Upper limit signal (FLS)
		8	Speed-position switching command signal (CHANGE)
		9	Stop signal (STOP)
SERVO	 Viewed from the front of the module	1	Servo READY signal (READY) (+ side)
		2	Servo READY signal (READY) (- side)
		3	Servo ON signal (SVON) (+ side)
		4	Servo ON signal (SVON) (- side)
		5	Phase-B feedback pulse (PULSE B) (+ side)
		6	Phase-Z feedback pulse (PULSE Z) (+ side)
		7	Phase-Z feedback pulse (PULSE Z) (- side)
		8	Empty
		9	Analog GND
		10	Phase-B feedback pulse (PULSE B) (- side)
		11	Phase-A feedback pulse (PULSE A) (- side)
		12	Empty
		13	Phase-A feedback pulse (PULSE A) (+ side)
		14	Speed command signal (- side)
		15	Speed command signal (+ side)

3.5.3 List of I/O signal details

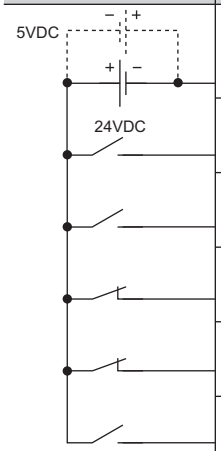
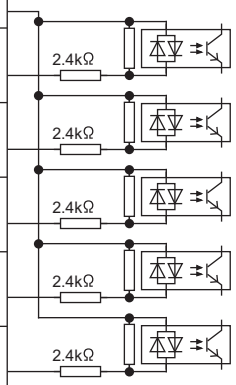
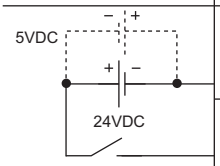
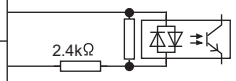
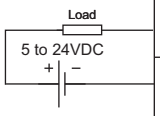
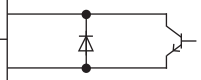
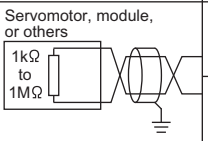
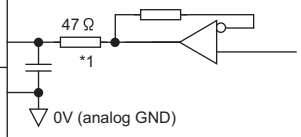
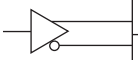
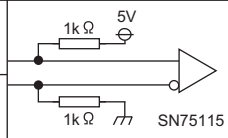
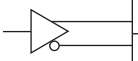
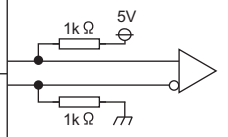
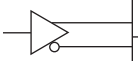
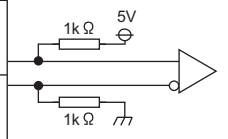
This section describes details of signals that are input or output through external device connectors on the QD73A1.

Signal name	Connector name	Pin number	Signal detail
Phase-A feedback pulse (PULSE A) (+ side) Phase-B feedback pulse (PULSE B) (+ side) Phase-Z feedback pulse (PULSE Z) (+ side)	SERVO	13 5 6	• Feedback pulse signals of encoder's phases A, B, and Z are input. • When the phase A leads the phase B, the positioning address increases at the rising and falling edges of each phase. • When the phase B leads the phase A, the positioning address decreases at the rising and falling edges of each phase.
Phase-A feedback pulse (PULSE A) (- side) Phase-B feedback pulse (PULSE B) (- side) Phase-Z feedback pulse (PULSE Z) (- side)		11 10 7	
Analog GND		9	—
Upper limit signal (FLS)	CONT.	7	• This signal is input from the limit switch placed at stroke upper limit position. • As this signal turns off, positioning stops.
Lower limit signal (RLS)		6	• This signal is input from the limit switch placed at stroke lower limit position. • As this signal turns off, positioning stops.
Near-point dog signal (DOG)		1	• This signal is used for detection on the near-point dog during OPR. • As the near-point dog turns on, this signal is detected.
Stop signal (STOP)		9	• Input this signal to stop positioning. • As this signal is turned on, the QD73A1 cancels the positioning in execution. Once this signal was turned on, the operation does not restart even if this signal is turned off.
Speed-position switching command signal (CHANGE)		8	Input this signal to switch control during the speed-position control switch mode.
Power supply (5 to 24V)		5	This power supply is common to the following signals. • Upper limit signal (FLS) • Lower limit signal (RLS) • Near-point dog signal (DOG) • Stop signal (STOP) • Speed-position switching command signal (CHANGE)

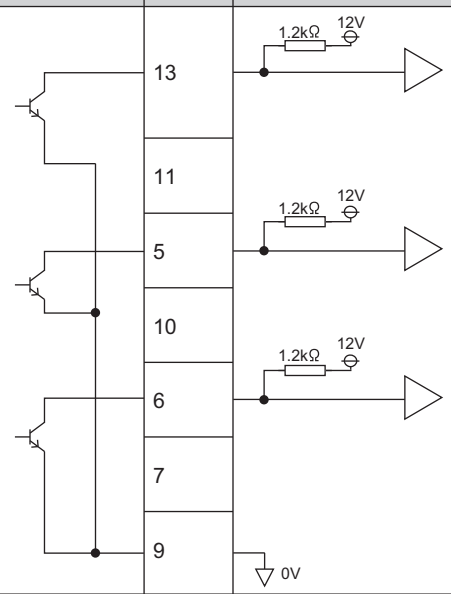
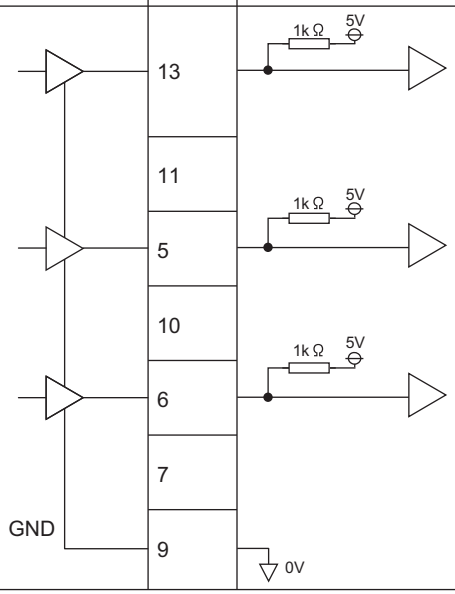
Signal name	Connector name	Pin number	Signal detail
Servo READY signal (READY) (+ side)	SERVO	1	• This signal turns on when the drive unit is ready to operate. • Positioning cannot be started when this signal is off. • If this signal turns off during positioning, the system stops. The system does not operate even if this signal is turned on again.
Servo READY signal (READY) (- side)		2	This line is common to Servo READY signal (READY).
Servo ON signal (SVON) (+ side)		3	• Wire this signal without fail to prevent malfunction of the servomotor. • This signal turns on automatically if there is no hardware error at a system startup. • This signal turns off if an error was detected due to an excessive error or by the QD73A1's self-diagnosis on its hardware.
Servo ON signal (SVON) (- side)		4	This line is common to Servo ON signal (SVON).
Speed command signal (+ side)		15	The analog voltage converted from digital accumulated pulse amount is output.
Speed command signal (- side)		14	This line is common to Speed command signal.

3.5.4 I/O interface internal circuit

This section shows internal circuits of external device interfaces on the QD73A1 in schematic diagrams.

External wiring	Pin No.	Internal circuit	Signal name	Remark
	5		Power supply	Input a voltage of 5 to 24VDC.
	1		Near-point dog signal (DOG)	-
	9		Stop signal (STOP)	-
	7		Upper limit signal (FLS)	If not using these signals, keep them on.
	6		Lower limit signal (RLS)	
	8		Speed-position switching command signal (CHANGE)	-
	1		Servo READY signal (READY)	-
	2			
	3		Servo ON signal (SVON)	-
	4			
	15		Speed command signal	-
	14			
	13		Phase-A feedback pulse	[For differential input] Connect these terminals to the terminal/ connector for pulse output of an encoder.
	11			
	5		Phase-B feedback pulse	
	10			
	6		Phase-Z feedback pulse	
	7			
	9		Analog GND	

*1 When input impedance of the servo amplifier is low, analog output level may become low due to this resistance. If that causes a problem, perform gain adjustment again with the servo amplifier being connected.

External wiring	Pin No.	Internal circuit	Signal name	Remark
	13		Phase-A feedback pulse	[For open collector input] Connect these terminals to the terminal/ connector for pulse output of an encoder. Output is pulled up to 12V inside.
	11			
	5		Phase-B feedback pulse	
	10			
	6		Phase-Z feedback pulse	
	7			
	9		Analog GND	
	13		Phase-A feedback pulse	[For TTL input] Connect these terminals to the terminal/ connector for pulse output of an encoder.
	11			
	5		Phase-B feedback pulse	
	10			
	6		Phase-Z feedback pulse	
	7			
	9		Analog GND	

3.6 Memory Configuration and Use

There are two memories in the QD73A1.

○: Data setting and storage, —: No data setting and storage

Memory configuration	Use	Area configuration						
		Parameter area	Monitor data area	Control data area	Positioning data area	Zero/gain adjustment data area	Reference value storage area for accumulated pulse error detection function	Backup
Buffer memory	Area that can be accessed directly from the CPU module using sequence programs	○	○	○	○	—	—	Data in this memory cannot be backed up. Data are erased if the power is turned off.
Flash ROM	Area used to back up zero/gain adjustment data	—	—	—	—	○	○	Data in this memory can be backed up. Data are kept even if the power is turned off.

The following table describes each memory area.

Area name	Description	Reference
Parameter area	Area used to set and store parameters for positioning, such as positioning parameters and OPR parameters	Page 75, Section 5.2 Page 79, Section 5.3
Monitor data area	Area where operating statuses of a positioning system are stored	Page 85, Section 5.5
Control data area	Area used to set and store data to operate or control a positioning system	Page 89, Section 5.6
Positioning data area	Area used to set and store positioning data	Page 82, Section 5.4
Zero/gain adjustment data area	Area used to set and store data for zero adjustment and gain adjustment	–
Reference value storage area for accumulated pulse error detection function	Area used to store the reference value for the accumulated pulse error detection function	–

3.7 List of Buffer Memory Addresses

This section lists the buffer memory addresses of the QD73A1.

For details on the buffer memory, refer to the following.

☞Page 73, CHAPTER 5

Point

Do not write data to system areas and area where data cannot be written from sequence programs in the buffer memory. Writing data to these areas may cause malfunction.

Address (decimal)	Address (hexadecimal)	Data type*1	Name	Default value *2	Read/ Write *3	Memory area *4	Reference
0	0_H	Positioning parameter (fixed parameter)	Pr.1 Stroke limit upper limit	2147483647	R/W	Parameter area	Page 76, Section 5.2 (1)
1	1_H						
2	2_H		Pr.2 Stroke limit lower limit	0	R/W		
3	3_H						
4	4_H		Pr.3 Numerator of command pulse multiplication for electronic gear	1	R/W		Page 77, Section 5.2 (2)
5	5_H		Pr.4 Denominator of command pulse multiplication for electronic gear	1	R/W		
6 ⋮ 19	6_H ⋮ 13_H	—	System area	—	—	—	—
20	14_H	Positioning parameter (variable parameter)	Pr.5 Speed limit value	200000	R/W	Parameter area	Page 77, Section 5.2 (3)
21	15_H						
22	16_H		Pr.6 Acceleration time	300	R/W		Page 78, Section 5.2 (4)
23	17_H		Pr.7 Deceleration time	300	R/W		
24	18_H		Pr.8 In-position range	5	R/W		Page 78, Section 5.2 (5)
25	19_H		Pr.9 Positioning mode	0	R/W		Page 78, Section 5.2 (6)
26 ⋮ 39	$1A_H$ ⋮ 27_H	—	System area	—	—	—	—

Address (decimal)	Address (hexadecimal)	Data type*1	Name	Default value *2	Read/ Write *3	Memory area *4	Reference
40	28_H	OPR parameter	Pr.10 OP address	0	R/W	Parameter area	Page 79, Section 5.3 (1)
41	29_H						
42	$2A_H$		Pr.11 OPR speed	10000	R/W		Page 79, Section 5.3 (2)
43	$2B_H$						
44	$2C_H$		Pr.12 Creep speed	1000	R/W		Page 80, Section 5.3 (3)
45	$2D_H$						
46	$2E_H$		Pr.13 Setting for the movement amount after near-point dog ON	75	R/W		Page 81, Section 5.3 (4)
47	$2F_H$						
48 ⋮ 79	30_H ⋮ $4F_H$	—	System area	—	—	—	—
80	50_H	Control data (control change area)	Cd.1 New current value	0	R/W	Control data area	Page 89, Section 5.6
81	51_H			0			
82	52_H		Cd.2 New speed value	0	R/W		
83	53_H			0			
84	54_H		Cd.3 JOG speed	0	R/W		
85	55_H			0			
86	56_H		Cd.4 Deviation counter clear command	0	R/W		
87	57_H		Cd.5 Analog output adjustment area 1	0	R/W		
88	58_H		Cd.6 New speed-position movement amount	0	R/W		
89	59_H			0			
90	$5A_H$		Cd.7 Current value change request	0	R/W		
91	$5B_H$		Cd.8 Speed change request	0	R/W		
92	$5C_H$		Cd.9 Analog output adjustment area 2	0	R/W		
93	$5D_H$			0			
94	$5E_H$	control data (zero/gain adjustment area)	Cd.10 Zero/gain adjustment specification	0	R/W		
95	$5F_H$		Cd.11 Zero/gain adjustment value specification	0	R/W		
96	60_H		Cd.12 Factory default zero/gain adjustment value restoration request	0	R/W		
97 ⋮ 99	61_H ⋮ 63_H	—	System area	—	—	—	—

Address (decimal)	Address (hexadecimal)	Data type*1	Name		Default value *2	Read/ Write *3	Memory area *4	Reference
100	64_H	Monitor data (monitor area)	Md.1 Current feed value		0	R	Monitor data area	Page 85, Section 5.5
101	65_H							
102	66_H		Md.2 Actual current value		0	R		
103	67_H							
104	68_H		Md.3 Error code (ERR.1)		0	R		
105	69_H		Md.4 Error code (ERR.2)		0	R		
106	$6A_H$		Md.5 Deviation counter value (address)		0	R		
107	$6B_H$							
108	$6C_H$		Md.6 Movement amount after near-point dog ON		0	R		
109	$6D_H$							
110	$6E_H$		Md.7 Speed-position switching command		0	R		
111	$6F_H$		Md.8 Control mode		0	R		
112	70_H		Md.9 Zero/gain execution status		0	R		
113	71_H		Md.10 Zero/gain adjustment status		0	R		
114	72_H		Md.11 Feedrate		0	R		
115	73_H							
116	74_H		Md.21 Deviation counter value (pulse)		0	R		
117	75_H							
118	76_H		Md.22 Movement amount after near-point dog ON (absolute value)		0	R		
119	77_H							
120	78_H	Monitor data (monitor area)	Record 0	Md.12 Error code	0	R		
121	79_H			Md.13 Error occurrence (Year: Month)	0000_H			
122	$7A_H$			Md.14 Error occurrence (Day: Hour)	0000_H			
123	$7B_H$			Md.15 Error occurrence (Minute: Second)	0000_H			
124	$7C_H$		Record 1	Error code and error occurrence (The same data structure as record 0)	Same as record 0	R		
125	$7D_H$							
126	$7E_H$							
127	$7F_H$							
128	80_H		Record 2	Error code and error occurrence (The same data structure as record 0)	Same as record 0	R		
129	81_H							
130	82_H							
131	83_H							

Address (decimal)	Address (hexadecimal)	Data type*1	Name		Default value *2	Read/ Write *3	Memory area *4	Reference
132	84_H	Monitor data (monitor area)	Record 3	Error code and error occurrence (The same data structure as record 0)	Same as record 0	R	Monitor data area	Page 85, Section 5.5
133	85_H							
134	86_H							
135	87_H							
136	88_H		Record 4	Error code and error occurrence (The same data structure as record 0)	Same as record 0	R		
137	89_H							
138	$8A_H$							
139	$8B_H$							
140	$8C_H$		Record 5	Error code and error occurrence (The same data structure as record 0)	Same as record 0	R		
141	$8D_H$							
142	$8E_H$							
143	$8F_H$							
144	90_H		Record 6	Error code and error occurrence (The same data structure as record 0)	Same as record 0	R		
145	91_H							
146	92_H							
147	93_H							
148	94_H		Record 7	Error code and error occurrence (The same data structure as record 0)	Same as record 0	R		
149	95_H							
150	96_H							
151	97_H							
152	98_H		Record 8	Error code and error occurrence (The same data structure as record 0)	Same as record 0	R		
153	99_H							
154	$9A_H$							
155	$9B_H$							
156	$9C_H$		Record 9	Error code and error occurrence (The same data structure as record 0)	Same as record 0	R		
157	$9D_H$							
158	$9E_H$							
159	$9F_H$							
160	$A0_H$		Record 10	Error code and error occurrence (The same data structure as record 0)	Same as record 0	R		
161	$A1_H$							
162	$A2_H$							
163	$A3_H$							

Address (decimal)	Address (hexadecimal)	Data type*1	Name		Default value *2	Read/ Write *3	Memory area *4	Reference
164	$A4_H$	Monitor data (monitor area)	Record 11	Error code and error occurrence (The same data structure as record 0)	Same as record 0	R	Monitor data area	Page 85, Section 5.5
165	$A5_H$							
166	$A6_H$							
167	$A7_H$							
168	$A8_H$		Record 12	Error code and error occurrence (The same data structure as record 0)	Same as record 0	R		
169	$A9_H$							
170	AA_H							
171	AB_H							
172	AC_H		Record 13	Error code and error occurrence (The same data structure as record 0)	Same as record 0	R		
173	AD_H							
174	AE_H							
175	AF_H							
176	$B0_H$		Record 14	Error code and error occurrence (The same data structure as record 0)	Same as record 0	R		
177	$B1_H$							
178	$B2_H$							
179	$B3_H$							
180	$B4_H$		Record 15	Error code and error occurrence (The same data structure as record 0)	Same as record 0	R		
181	$B5_H$							
182	$B6_H$							
183	$B7_H$							
184	$B8_H$		Md.16 Error history pointer		0	R		
185 ⋮ 199	$B9_H$ ⋮ $C7_H$	—	System area		—	—	—	—
200	$C8_H$	Monitor data (monitor area)	Md.17 Maximum accumulated pulse value		0	R	Monitor data area	Page 85, Section 5.5
201	$C9_H$							
202	CA_H		Md.18 Minimum accumulated pulse value		0	R		
203	CB_H							
204	CC_H		Md.19 Accumulated pulse error detection function status		0	R		
205	CD_H		Md.20 Reference value measurement flag		0	R		
206 ⋮ 300	CE_H ⋮ $12C_H$	—	System area		—	—	—	—

Address (decimal)	Address (hexadecimal)	Data type*1	Name	Default value *2	Read/ Write *3	Memory area *4	Reference
301	$12D_H$	Positioning data	Da.1 Positioning pattern	0	R/W	Positioning data area	Page 82, Section 5.4 (1)
302	$12E_H$		Da.2 Positioning address P1	0	R/W		Page 83, Section 5.4 (2)
303	$12F_H$						
304	130_H		Da.3 Positioning speed V1	0	R/W		Page 84, Section 5.4 (3)
305	131_H						
306	132_H		Da.4 Positioning address P2	0	R/W		Page 84, Section 5.4 (4)
307	133_H						
308	134_H		Da.5 Positioning speed V2	0	R/W		Page 84, Section 5.4 (5)
309	135_H						
310 ⋮ 399	136_H ⋮ $18F_H$	—	System area	—	—	—	—
400	190_H	Control data	Cd.13 Alert output accumulated pulse setting value (maximum value)	0	R/W	Control data area	Page 89, Section 5.6
401	191_H						
402	192_H		Cd.14 Immediate stop accumulated pulse setting value (maximum value)	0	R/W		
403	193_H						
404	194_H		Cd.15 Alert output accumulated pulse setting value (minimum value)	0	R/W		
405	195_H						
406	196_H		Cd.16 Immediate stop accumulated pulse setting value (minimum value)	0	R/W		
407	197_H						
408	198_H		Cd.17 Accumulated pulse setting value selection	0	R/W		
409	199_H		Cd.18 Accumulated pulse error detection request	0	R/W		
410	$19A_H$		Cd.19 Measurement start request	0	R/W		
411	$19B_H$		Cd.20 Reference value write request	0	R/W		
412 ⋮ 1001	$19C_H$ ⋮ $3E9_H$	—	System area	—	—	—	—

*1 For types of data, refer to the following.
Page 73, Section 5.1

*2 Default values are set after the power was turned off and on or the CPU module was reset.

*3 This column indicates whether the data can be read from or written to the buffer memory area through sequence programs.
R: Readable
W: Writable

*4 For the memory configuration, refer to the following.
Page 47, Section 3.6

CHAPTER 4 SETTINGS AND PROCEDURE BEFORE OPERATION

This chapter describes the procedure prior to operation, part names, zero/gain adjustment, and wiring method of the QD73A1.

4.1 Handling Precautions

This section describes the handling precautions for the QD73A1.

- Do not disassemble the module. Doing so may cause failure, malfunction, injury, or a fire.
- Shut off the external power supply (all phases) used in the system before mounting or removing the module. Failure to do so may cause the module to fail or malfunction.
- After the first use of the product, do not mount/remove the module to/from the base unit, and the terminal block to/from the module more than 50 times (IEC 61131-2 compliant) respectively.
  Exceeding the limit may cause malfunction.
- Use the programmable controller in an environment that meets the general specifications in the user's manual for the CPU module used.
  Failure to do so may result in electric shock, fire, malfunction, or damage to or deterioration of the product.
- To mount the module, while pressing the module mounting lever located in the lower part of the module, fully insert the module fixing projection(s) into the hole(s) in the base unit and press the module until it snaps into place.
  Incorrect mounting may cause malfunction, failure or drop of the module.
  When using the programmable controller in an environment of frequent vibrations, fix the module with a screw.
- Tighten the screws such as a module fixing screw within the specified torque range.
  Undertightening can cause drop of the screw, short circuit or malfunction.
  Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.

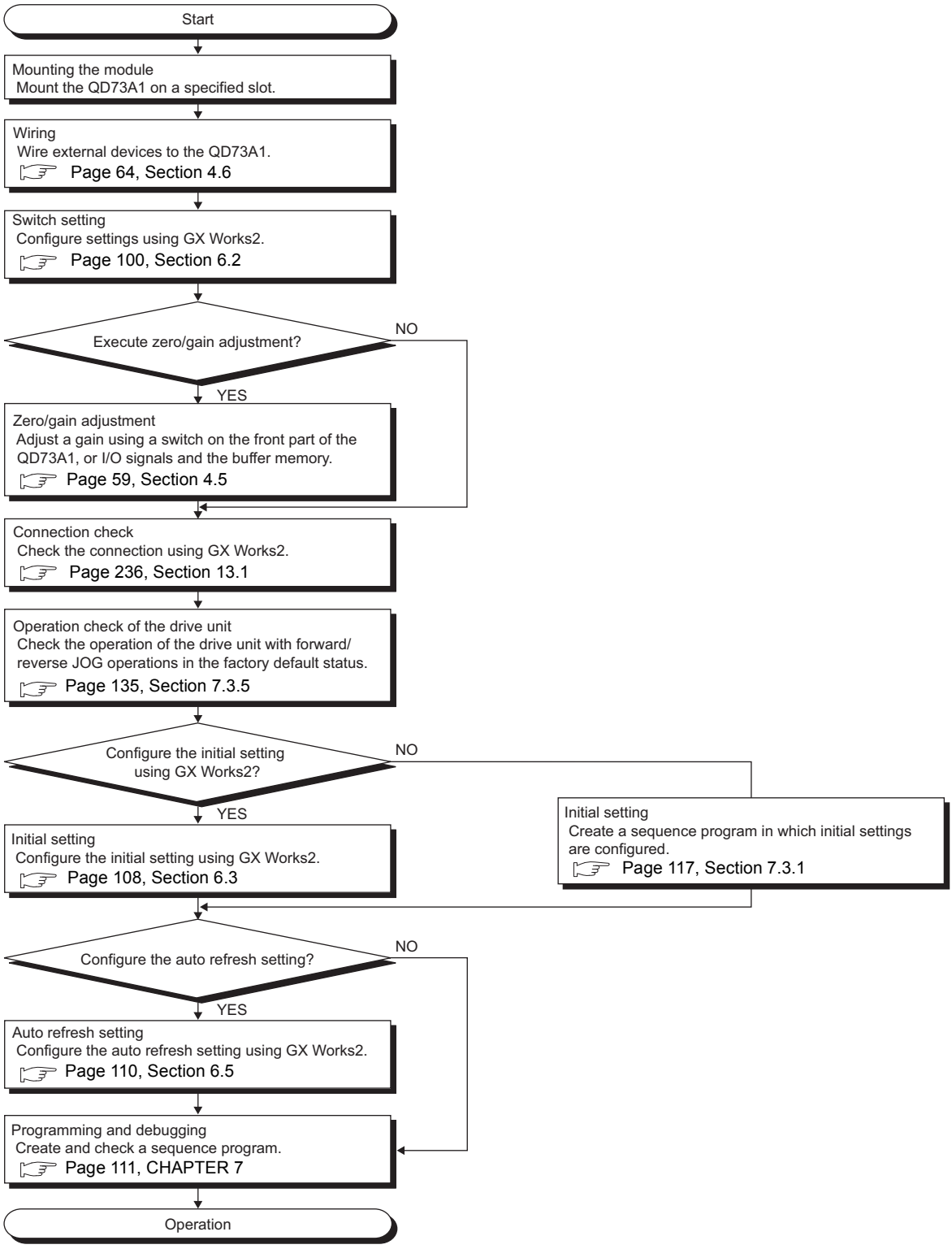
Screw	Tightening torque range
Module fixing screw (M3 screw)*1	0.36 to 0.48N • m
Connector screw (M2.6 screw)	0.20 to 0.29N • m

*1 The module can be easily fixed onto the base unit using the hook at the top of the module.
However, it is recommended to secure the module with the module fixing screw if the module is subject to significant vibration.

- Do not directly touch any conductive parts and electronic components of the module.
  Doing so can cause malfunction or failure of the module.
- Prevent foreign matter such as dust or wire chips from entering the module. Such foreign matter can cause a fire, failure, or malfunction.
- Do not drop the module case, or do not subject it to strong impact.
- Lock the control panel so that only specialists educated in electric installation can open it.

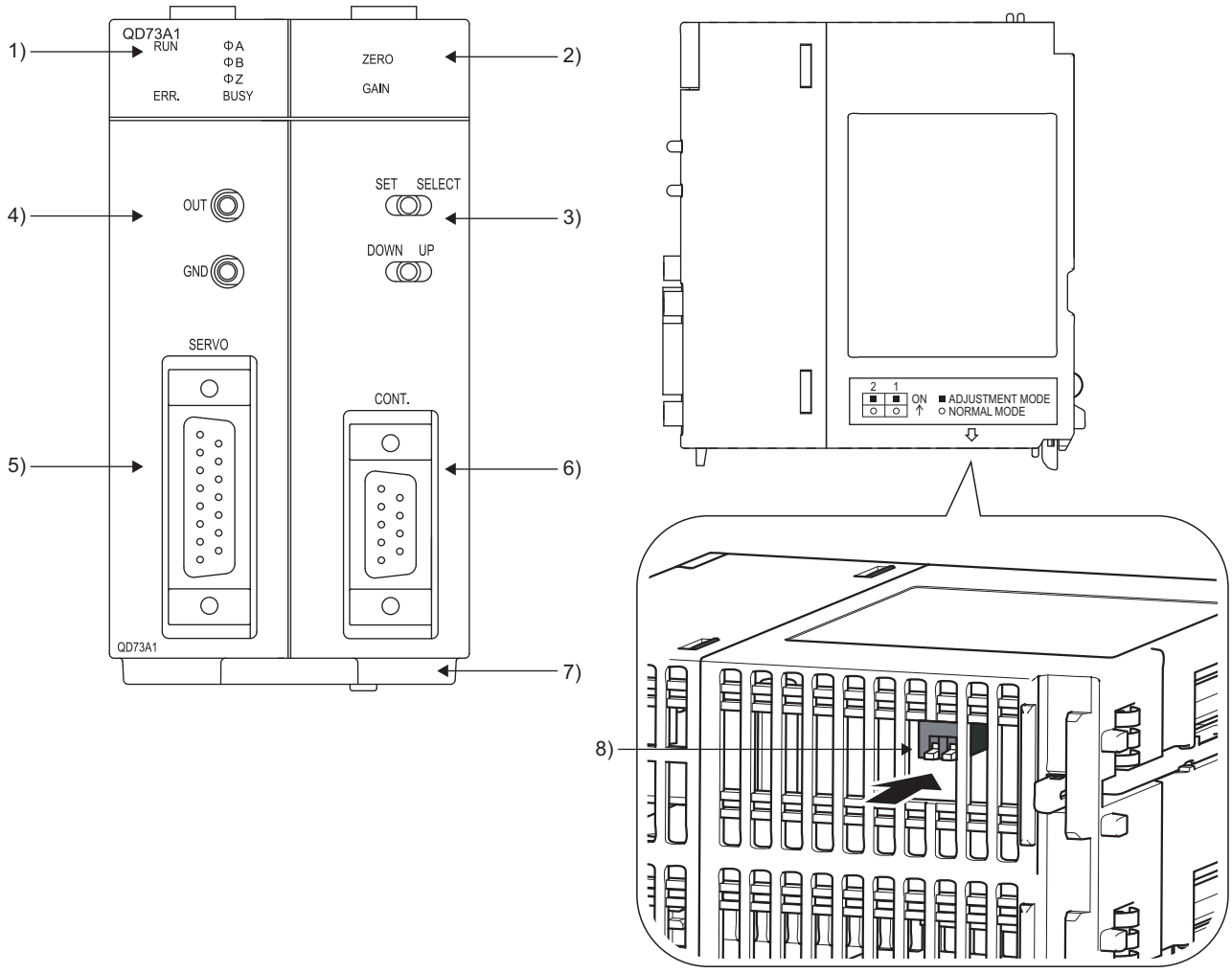
4.2 Settings and Procedure Before Operation

This section shows the procedure before operating the QD73A1.



4.3 Part Names

This section describes the part names of the QD73A1.

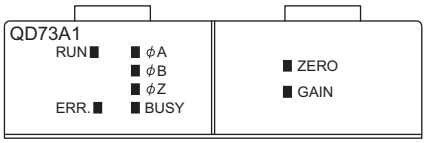


Number	Name	Description	Reference
1)	RUN LED	Indicates the operating status or error status of the QD73A1	Page 58, Section 4.4
	ERR. LED		
	ϕ A LED ϕ B LED ϕ Z LED	Indicates the status of pulses on an encoder input phase A, B, or Z	
	BUSY LED	Indicates the status of BUSY signal (X14) or writing of zero adjustment value and gain adjustment value	
2)	ZERO LED GAIN LED	Indicates the status of zero/gain adjustment	
3)	SELECT/SET switch	A switch for zero adjustment and gain adjustment	Page 61, Section 4.5 (4)
	UP/DOWN switch	A switch to adjust an analog output voltage value	
4)	OUT terminal GND terminal	Check pins to measure analog output voltage (Use these pins for zero/gain adjustment.) [Inside diameter] 2.03mm for both OUT terminal and GND terminal	Page 59, Section 4.5

Number	Name	Description	Reference
5)	SERVO connector	A connector for a drive unit	Page 43, Section 3.5.3 Page 69, Section 4.6.3
6)	CONT. connector	A connector for external control devices	
7)	Serial number display	Displays the serial number of the QD73A1	—
8)	Mode switch	A switch to change the operation mode to the zero/gain adjustment mode. (DIP switch 1 and 2 are off as the factory default.)	Page 61, Section 4.5 (4) (a)

4.4 LED

The LEDs on the front of the QD73A1 indicate the statuses of the module and axis control.



Indication ☐: OFF ■: ON ◆: Flashing	Attention	Description
RUN ☐ ☐ φA ☐ ZERO ☐ φB ☐ GAIN ☐ φZ ERR. ☐ ☐ BUSY	RUN LED: OFF (All the other LEDs are OFF or ON.)	• The power is off. • A hardware error is occurring. • A watchdog timer error is occurring. If the RUN LED does not turn on even after the power was turned off and on, the module may be broken. Replace the module with another module.
RUN ■ ☐ φA ☐ ZERO ☐ φB ☐ GAIN ☐ φZ ERR. ☐ ☐ BUSY	• RUN LED: ON • ERR. LED: OFF	The module is operating normally.
RUN ■ ☐ φA ☐ ZERO ☐ φB ☐ GAIN ☐ φZ ERR. ■ ☐ BUSY	ERR. LED: ON (All the other LEDs are OFF or ON.)	An error is occurring. Read out the error code, and take the corrective action described in the error code list. (☞ Page 252, Section 14.3.4)
RUN ■ ☐ φA ☐ ZERO ☐ φB ☐ GAIN ☐ φZ ERR. ☐ ■ BUSY	BUSY LED: ON (All the other LEDs are OFF or ON.)	Positioning is in execution. The LED turns off when the positioning is completed.
RUN ■ ■ φA ☐ ZERO ■ φB ☐ GAIN ■ φZ ERR. ☐ ☐ BUSY	• φ A LED: ON or flashing • φ B LED: ON or flashing • φ Z LED: ON or flashing	Pulses are input through the pulse input terminals (phase A, B, and Z).
RUN ◆ ☐ φA ■ ZERO ☐ φB ☐ GAIN ☐ φZ ERR. ☐ ☐ BUSY	• RUN LED: Flashing • ZERO LED: ON	Zero adjustment of analog output is being performed. The LED turns off when the zero adjustment is completed.
RUN ◆ ☐ φA ☐ ZERO ☐ φB ■ GAIN ☐ φZ ERR. ☐ ☐ BUSY	• RUN LED: Flashing • GAIN LED: ON	Gain adjustment of analog output is being performed. The LED turns off when the gain adjustment is completed.
RUN ◆ ☐ φA ☐ ZERO ☐ φB ☐ GAIN ☐ φZ ERR. ☐ ■ BUSY	• RUN LED: Flashing • BUSY LED: ON (The ZERO LED is ON during zero adjustment. The GAIN LED is ON during gain adjustment.)	The zero adjustment value and the gain adjustment value are being written. The LED turns off when writing of the zero adjustment value and gain adjustment value is completed.

4.5 Zero/gain Adjustment

Zero/gain adjustment is a process to adjust analog output voltage according to accumulated pulse amount.
Adjust the analog output voltage value according to the analog speed command input of the drive unit used.
Adjust analog output voltage using the check pins on the front of the QD73A1.
For the position of check pins, refer to the following.

☞Page 56, Section 4.3

(1) Zero adjustment

Adjust the analog output voltage of when accumulated pulse amount is "0". The voltage is adjusted to 0V as the factory default. Zero adjustment may vary when the module is connected to a servomotor. In that case, perform zero adjustment again. If the module is used with its zero adjustment being off, the connected servomotor rotates a little when the power is turned on.

(2) Gain adjustment

Adjust the analog output voltage of when accumulated pulse amount is the maximum. In the factory default setting, adjustment is made so that the analog output voltage becomes 10V when accumulated pulse amount is the default value.
Adjust a gain value according to the rated speed command voltage of the drive unit used. The gain value can be adjusted within the range of 5 to 10V.
When changing the accumulated pulse amount at the gain value output from the default value, set the accumulated pulse amount by referring to the following reference values.

Accumulated pulse setting	Accumulated pulse amount (unit: pulse)				Excessive error (unit: pulse)
	Setting range	Default value	Reference value for the setting		
			When the gain value is 5V	When the gain value is 10V	
Initial setting	The initial setting is same as the case where [Selection 4] is set.				
[Selection 1]	-3700 to 3700	3480	-2500 to -2000 2000 to 2500	-3700 to -3250 3250 to 3700	-3701 or less 3701 or more
[Selection 2]	-7400 to 7400	6960	-5000 to -4000 4000 to 5000	-7400 to -6500 6500 to 7400	-7401 or less 7401 or more
[Selection 3]	-11100 to 11100	10440	-7500 to -6000 6000 to 7500	-11100 to -9750 9750 to 11100	-11101 or less 11101 or more
[Selection 4]	-14800 to 14800	13920	-10000 to -8000 8000 to 10000	-14800 to -13000 13000 to 14800	-14801 or less 14801 or more
[Selection 5]	-37000 to 37000	34800	-25000 to -20000 20000 to 25000	-37000 to -32500 32500 to 37000	-37001 or less 37001 or more
[Selection 6]	-74000 to 74000	69600	-50000 to -40000 40000 to 50000	-74000 to -65000 65000 to 74000	-74001 or less 74001 or more
[Selection 7]	-111000 to 111000	104400	-75000 to -60000 60000 to 75000	-111000 to -97500 97500 to 111000	-111001 or less 111001 or more
[Selection 8]	-148000 to 148000	139200	-100000 to -80000 80000 to 100000	-148000 to -130000 130000 to 148000	-148001 or less 148001 or more

Point

- When setting a smaller value than the above reference value (larger value for a negative value) as the accumulated pulse amount at the gain value output, making the setting value too small at a time may cause the hunting of a servomotor. To make the accumulated pulse amount value smaller, check the machine operation and adjust the value.
- To change "Accumulated pulse setting" after the gain adjustment execution where the accumulated pulse amount at the gain value output has been changed from the default value, execute the gain adjustment again.

Gain adjustment can be performed in the following two methods.

- Adjusting with the default accumulated pulse amount
- Adjusting with specified accumulated pulse amount

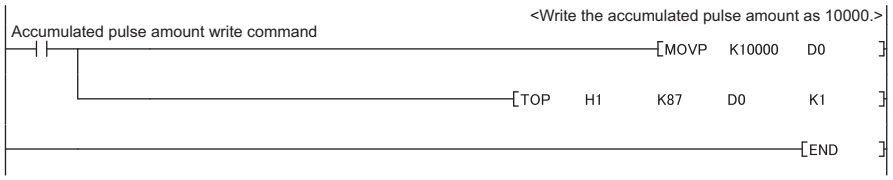
(a) Adjusting gain with the default accumulated pulse amount

Follow the procedure below.

1	Change the operation mode to the zero/gain adjustment mode.
2	Set "Accumulated pulse setting" in the switch setting according to the necessary accumulated pulse amount.
3	Adjust the voltage to be the necessary voltage value between the check pins.

(b) Adjusting gain with specified accumulated pulse amount

Follow the procedure below.

1	Change the operation mode to the zero/gain adjustment mode.
2	Set "Accumulated pulse setting" in the switch setting according to the necessary accumulated pulse amount. (Do not specify amount that exceeds the setting range.)
3	Write the accumulated pulse amount using a sequence program. [When one of the selections 1 to 4 is specified in "Accumulated pulse setting"] Set the specified accumulated pulse amount in " Cd.5 Analog output adjustment area 1".  [When one of the selections 5 to 8 is specified in "Accumulated pulse setting"] Set the specified accumulated pulse amount in " Cd.9 Analog output adjustment area 2". 
4	Adjust the voltage to be the necessary voltage value between the check pins.

(3) Zero/gain adjustment setting range

When performing zero/gain adjustment, satisfy the following two conditions.

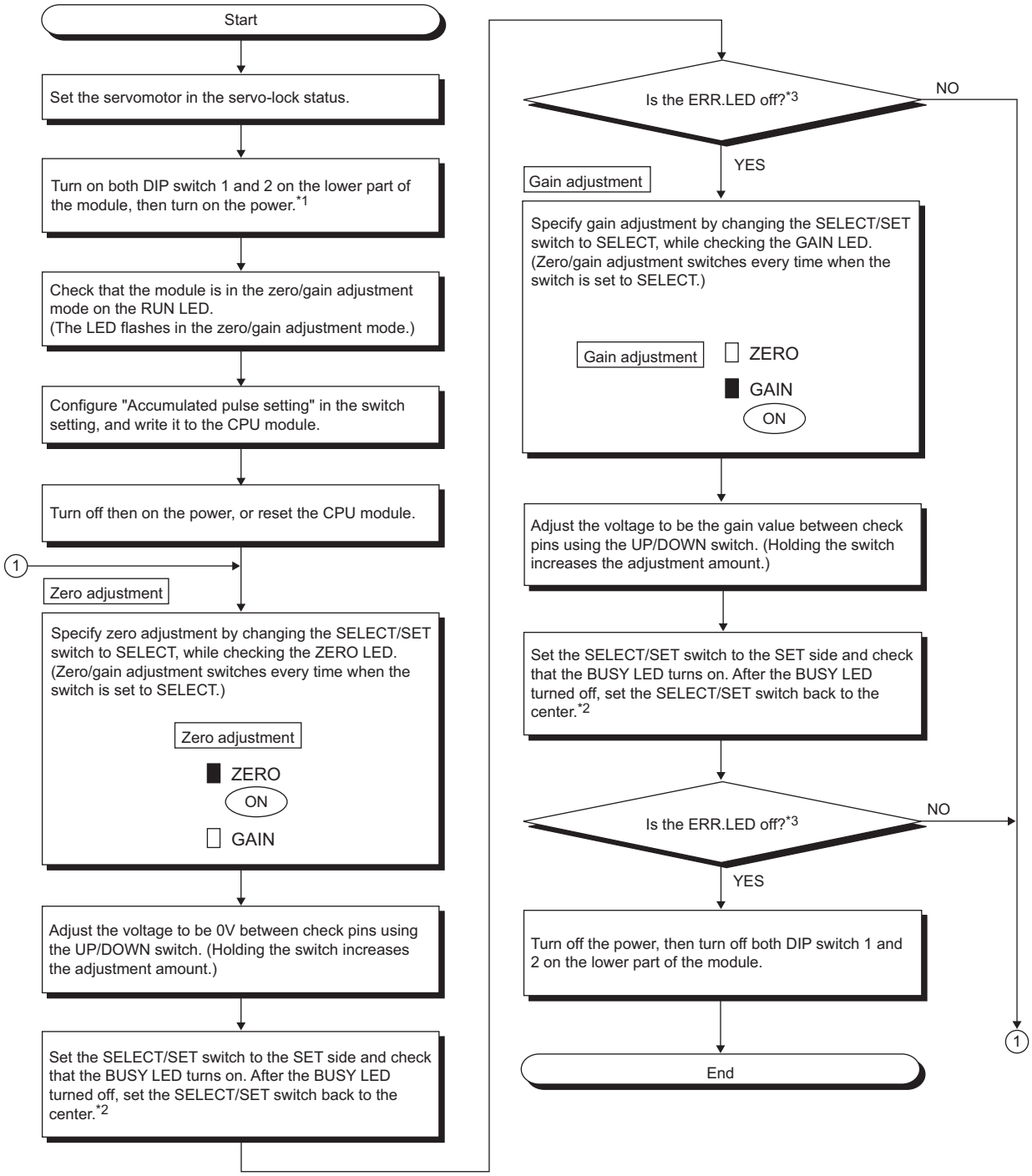
- Setting range: -10 to 10V
- The difference between a gain value and zero value is as follows.

In case of positive accumulated pulse amount	(Gain value) - (Zero value) ≥ 5.0V
In case of negative accumulated pulse amount	(Gain value) - (Zero value) ≤ -5.0V

(4) Setting method

The following are the procedures for zero adjustment and gain adjustment.

(a) When using the switches on the front of the QD73A1

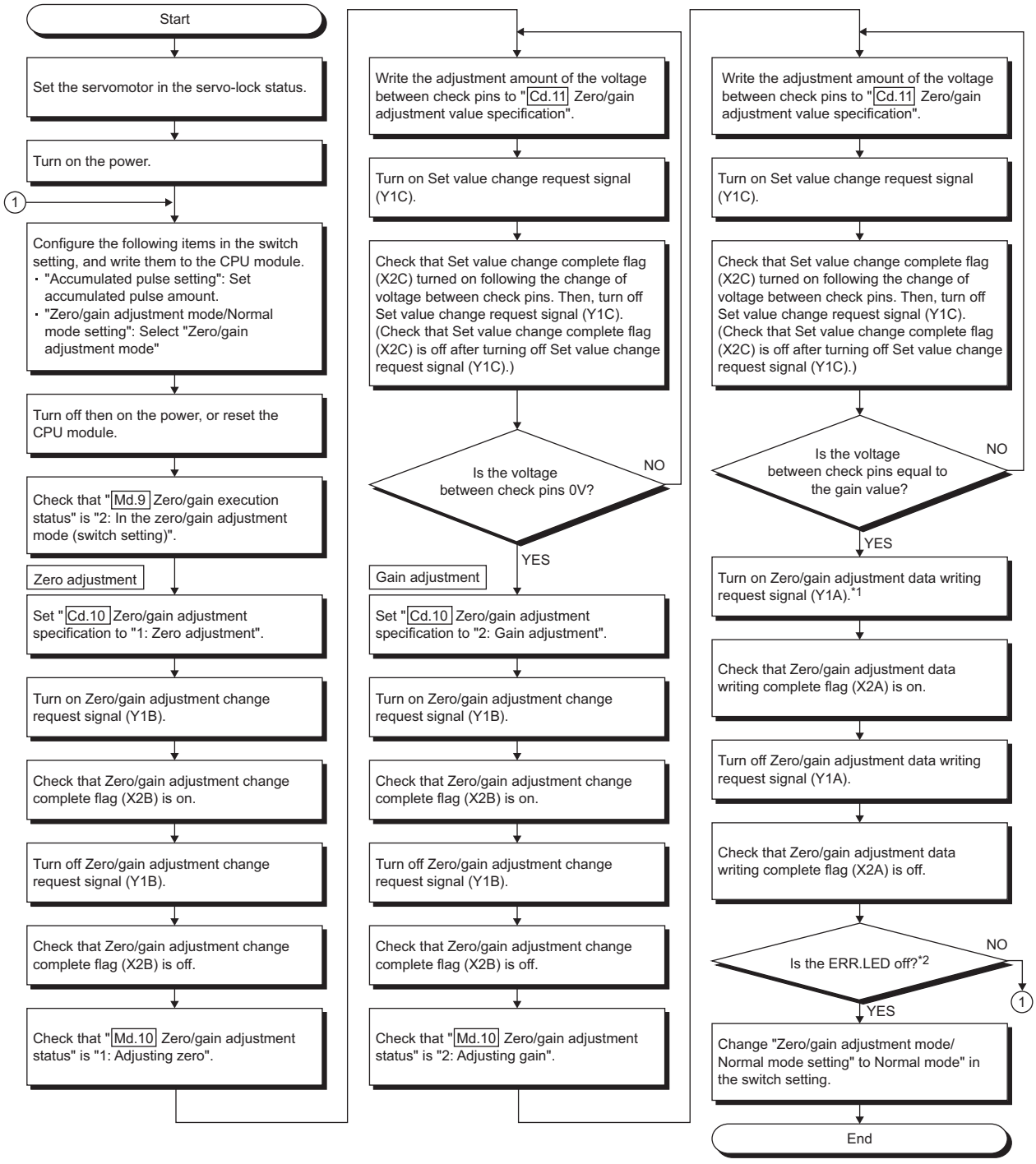


*1 The operation mode cannot be switched to the zero/gain adjustment mode if the power is turned on ahead of turning on DIP switch 1 and 2.

*2 The zero adjustment value and gain adjustment value are recorded in the flash ROM inside the QD73A1 by setting the SELECT/SET switch on the SET side, and they are not erased even at a power-off.

*3 If an error occurs in the zero/gain adjustment mode, the ERR. LED turns on. If the ERR. LED is on, turn on Error reset signal (Y28) then perform zero/gain adjustment again.

(b) When using I/O signals and the buffer memory



*1 The zero adjustment value and gain adjustment value are recorded in the flash ROM inside the QD73A1 by turning on Zero/gain adjustment data writing request signal (Y1A), and they are not erased even at a power-off.

*2 If an error occurs in the zero/gain adjustment mode, the ERR. LED turns on. If the ERR. LED is on, turn on Error reset signal (Y28) then perform zero/gain adjustment again.

(5) Restoring the zero/gain adjustment value of the factory default

Writing "1" in "Cd.12 Factory default zero/gain adjustment value restoration request" restores the zero/gain adjustment value of the factory default. Once the restoration was completed, the QD73A1 sets "0" in "Cd.12 Factory default zero/gain adjustment value restoration request".
Once the restoration was completed, analog output voltage becomes 0V and the QD73A1 sets "1: Adjusting zero" in "Md.10 Zero/gain adjustment status".

Note that "Cd.12 Factory default zero/gain adjustment value restoration request" is usable only in the zero/gain adjustment mode.

Setting item		Setting range	Default value	Execution condition	Buffer memory address (decimal)
Cd.12	Factory default zero/gain adjustment value restoration request	1: Restore the zero/gain adjustment value	0	The module must be in the zero/gain adjustment mode.	96

Point

Zero value and gain value of the factory default are set as below.
- Zero value: 0V
- Gain value: 10V

Note that the values above were set when "Accumulated pulse setting" was the default value (-14800 to 14800pulse).

4.6 Wiring

This section describes precautions on wiring the QD73A1 and external devices, and connection of external device connectors.

4.6.1 Wiring precautions

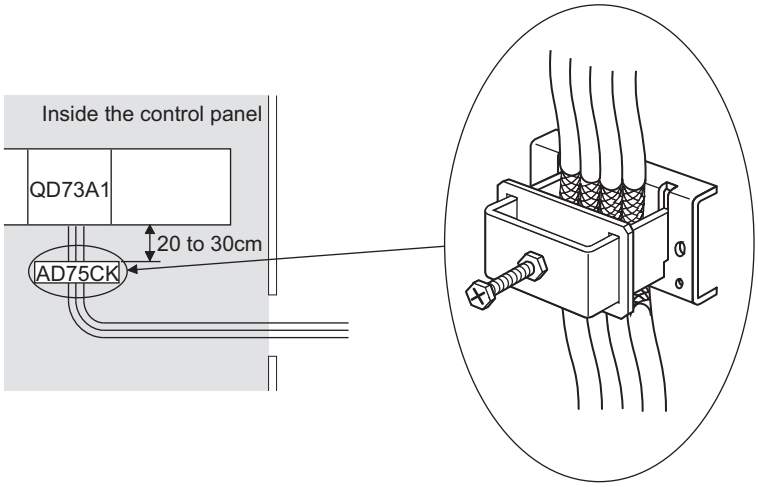
This section describes the precautions on wiring.

- Check the terminal layout beforehand to wire cables to the module correctly.
- Connectors for external devices must be crimped or pressed with the tool specified by the manufacturer, or must be correctly soldered. Incomplete soldering or crimping may result in malfunction.
- Prevent foreign matter such as dust or wire chips from entering the module. Such foreign matter can cause a fire, failure, or malfunction.
- A protective film is attached to the top of the module to prevent foreign matter, such as wire chips, from entering the module during wiring. Do not remove the film during wiring.
  Remove it for heat dissipation before system operation.
- Connect the external device connectors to the connectors on the module and tighten the screws securely.
  Tighten the connector screws within the specified torque range.
  Undertightening can cause short circuit, fire, or malfunction.
  Overtightening can damage the screw and/or module, resulting in drop, short circuit, fire, or malfunction.

Screw	Tightening torque range
Connector screw (M2.6 screw)	0.20 to 0.29N • m

- When disconnecting a cable from the module or the drive unit, do not pull the cable by the cable part.
  Disconnect the cable holding the connector.
  Pulling a cable connected to the module or the drive unit can cause malfunction.
  Such action can also damage the module, drive unit, or cable.
- Do not install the connection cables for external I/O signals and for the drive unit together with the main circuit lines, power cables, or load circuit lines of a device other than the programmable controller. Keep a distance of 100mm or more between them.
  Failure to do so may result in malfunction due to noise, surges, and induction.
- Place the cables in a duct or clamp them. If not, dangling cable may swing or inadvertently be pulled, resulting in damage to the module, drive unit, or cables, or malfunction due to poor contact.

- As a measure against noise, use shielded cables if the cables connected to the module are close (less than 100mm) to a power cable.
  Ground the shields of shielded cables to the control panel securely on the module side.
- To comply with EMC and Low Voltage Directives, ground shielded cables to the control panel using the AD75CK cable clamp (manufactured by Mitsubishi Electric).
  (Ground the shield parts at a point within 20 to 30cm from the module.)



For details on the AD75CK, refer to the following.

AD75CK-type Cable Clamping Instruction Manual

- The length of the cable between the module and the drive unit is 1 to 3m generally. The length depends on the specifications of the drive unit. Review the specifications of the drive unit to be used.
- The length of the cable between the module and the encoder is as listed below generally. The length depends on the specifications of the encoder. Review the specifications of the encoder to be used. Use shielded twisted pair cable for the connection with the encoder.

Encoder output type	Cable length
Differential output type	MAX. 30m
TTL type, open collector type	MAX. 3m

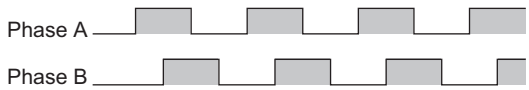
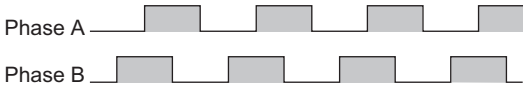
- Connect the module and Servo ON signal of the drive unit without fail. In addition, do not turn on/off Servo ON signal externally. If Servo ON signal is not connected, the motor may rotate even in case of a CPU error.

4.6.2 Precautions when connecting an encoder

This section describes precautions when connecting an encoder.

(1) Operation of the QD73A1 (deviation counter and feedback pulses)

The deviation counter in the QD73A1 counts up and down.
An addition/subtraction switchover can be processed through the phases of feedback pulses.
When "0: Positive voltage is output when the positioning address increases." is set for "Rotation direction setting" in the switch setting.

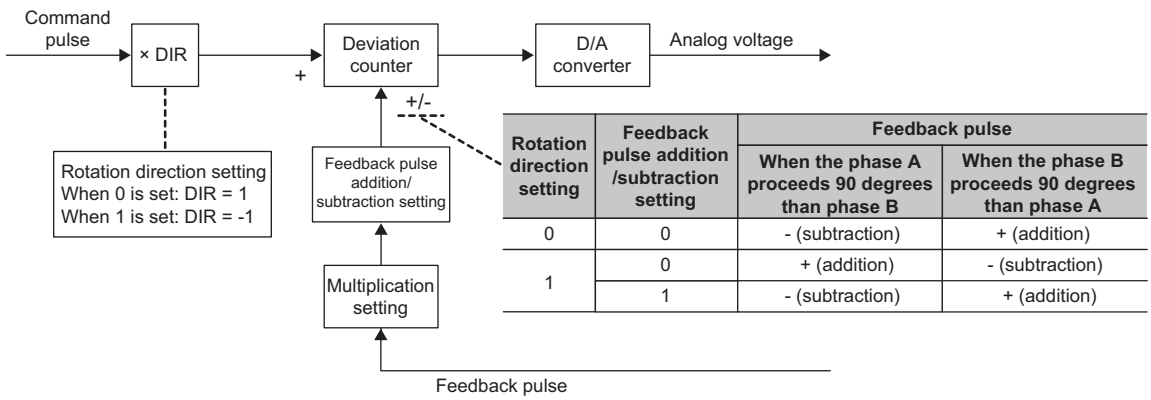
When feedback pulses are input with the phase A leading the phase B by 90°, the number of command pulses is subtracted. This input method is for counting positive command pulses when the speed command is positive voltage (when the motor is rotating forward).	
When feedback pulses are input with the phase B leading the phase A by 90°, the number of command pulses is added. This input method is for counting negative command pulses when the speed command is negative voltage (when the motor is rotating reverse).	

If the sequence of the phase A and phase B is reversed, the number of command pulses and feedback pulses are counted together. This can cause an excessive error of accumulated pulses, resulting in the stop of the control.

(a) Switch setting and the encoder

When "1: Negative voltage is output when the positioning address increases." is set for "Rotation direction setting" in the switch setting, the count process (positive or negative) of the feedback pulses varies depending on "Feed back pulse addition/subtraction setting" of the switch setting as shown below.

Switch setting		Feedback pulse	
"Rotation direction setting"	"Feed back pulse addition/subtraction setting"	When the phase A proceeds 90 degrees than phase B	When the phase B proceeds 90 degrees than phase A
0: Positive voltage is output when the positioning address increases.	-	Subtraction	Addition
1: Negative voltage is output when the positioning address increases.	0: Add when the phase A proceeds 90 degrees than phase B.	Addition	Subtraction
	1: Subtract when the phase A proceeds 90 degrees than phase B.	Subtraction	Addition



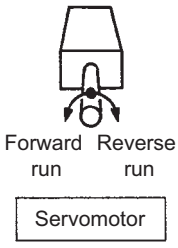
Rotation direction setting	Feedback pulse addition /subtraction setting	Feedback pulse	
		When the phase A proceeds 90 degrees than phase B	When the phase B proceeds 90 degrees than phase A
0	0	- (subtraction)	+ (addition)
1	0	+ (addition)	- (subtraction)
	1	- (subtraction)	+ (addition)

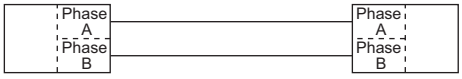
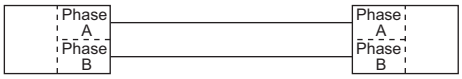
For details on "Rotation direction setting" in the switch setting, refer to the following.

☞Page 101, Section 6.2.1

The connection between the QD73A1 and the encoder varies depending on "Rotation direction setting" and "Feed back pulse addition/subtraction setting" of the switch setting.

Ex. When the rotation directions of the motor and encoder are as below and the motor rotates forward when positive voltage is applied to the servo amplifier

	Suppose the condition of the feedback pulses from the encoder as: the phase A is ahead of the phase B by 90° in case of forward run.

Switch setting		Connection	
Rotation direction setting	**Feed back pulse addition/subtraction setting**		
0: Positive voltage is output when the positioning address increases.	-		When the rotation directions of the motor and the encoder are the same
			When the rotation directions of the motor and the encoder are different
1: Negative voltage is output when the positioning address increases.	0: Add when the phase A proceeds 90 degrees than phase B.		When the rotation directions of the motor and the encoder are the same
			When the rotation directions of the motor and the encoder are different
	1: Subtract when the phase A proceeds 90 degrees than phase B.		When the rotation directions of the motor and the encoder are the same
			When the rotation directions of the motor and the encoder are different

Point

- If the connection of the QD73A1 and the encoder is incorrect, the motor rotates at a power-on and Excessive error signal (X17) turns on.
- To replace the positioning module AD70/A1SD70 with the QD73A1 while using the same equipment of the servo amplifier, encoder, and external wiring in the existing system, check the setting of slide switch 1 (rotation direction setting) of the AD70/A1SD70.
  If the slide switch 1 (rotation direction setting) is off ("Negative voltage is output when the positioning address increases" is set), set "1: Subtract when the phase A proceeds 90 degrees than phase B." for "Feed back pulse addition/subtraction setting" in the switch setting of the QD73A1.

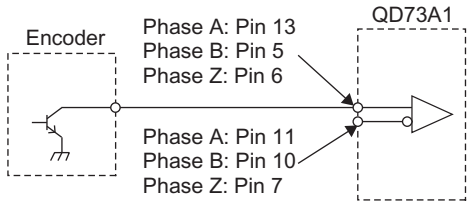
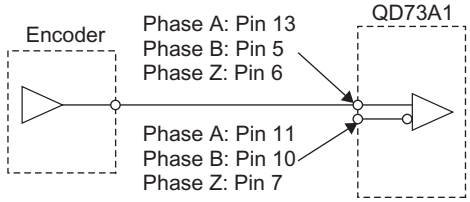
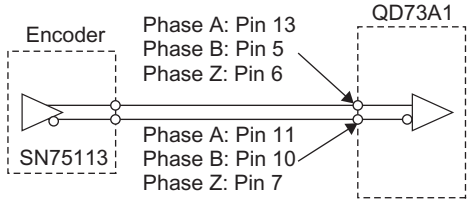
(2) Connection between the QD73A1 and each type of encoder

The following table shows the connection between the QD73A1 and each type of encoder.

Set the output type of the encoder to be used in "Encoder I/F setting" of the switch setting.

For details on "Encoder I/F setting" in the switch setting, refer to the following.

☞Page 100, Section 6.2

Encoder output type	"Encoder I/F setting"	Connection
Open collector output type	Open collector output	
TTL output type	TTL output	
Differential output type	Differential output	

4.6.3 External device connectors

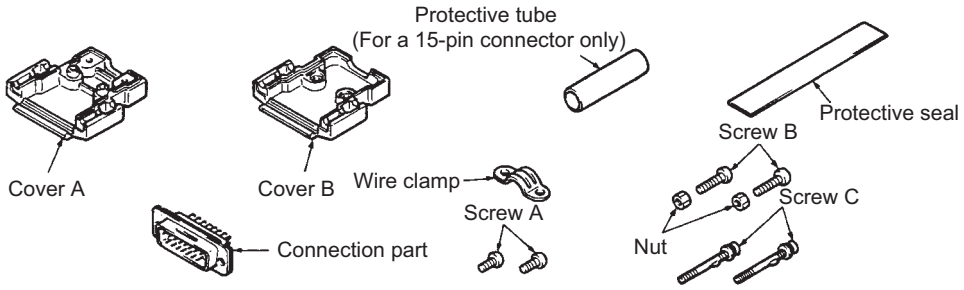
This section describes the assemblage of an external device connector and its connection method.

(1) Assembling a connector

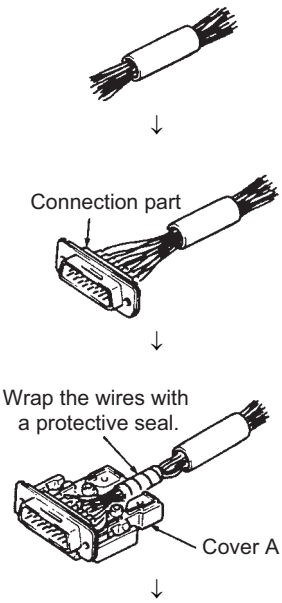
The following connectors are required to connect the QD73A1 and external devices.

- A 9-pin connector (pin type): For the CONT. connector (control signal connection)
- A 15-pin connector (pin type): For the SERVO connector (drive unit connection)

The connectors are composed of the following parts.



Assemble the connectors as follows.



1. **Thread wires through the protection tube (for the 15-pin connector only).**

2. **Solder the wires to the connection part.**

3. **Attach the connection part to cover A, and wrap the protective seal around the part of the wires which contacts the wire clamp.**

4. **Slide the protection tube over the protective seal (for the 15-pin connector only).**

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(From the previous page)

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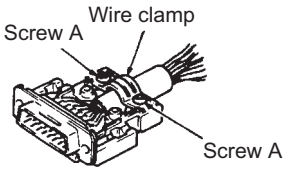

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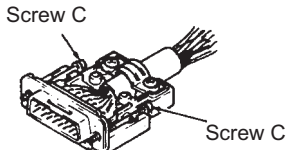

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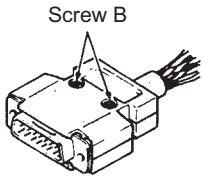

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End

5. **Fix the protective seal part or the protection tube part with the wire clamp using the screws A.**

6. **Attach the screws C to the cover A.**

7. **Put the cover B over the cover A, and fasten them using the screws B and nuts.**

(2) Wiring connectors

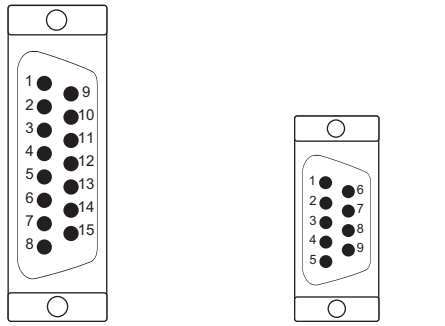
The figure below shows the pin arrangement on the connectors.

Wire pins correctly according to the signal assigned to each pin number.

For details on the signal assigned to each pin number, refer to the following.

☞Page 43, Section 3.5.3

Pin arrangement viewed from the wire side



15-pin connector
[Applies to the SERVO. connector]

9-pin connector
[Applies to the CONT. connector]

(a) Applicable wire size

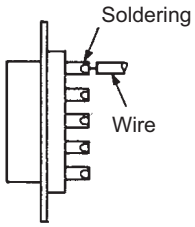
The applicable wire size is 0.3mm^2 or less. If thicker wires are used, the wire clamp cannot be attached.

(b) Connection between the connectors and wires

Solder the wires to the pins.

Strip parts of wire jackets properly to avoid a short circuit due to wire chips or solder chips.

If the signal line is exposed, malfunction may occur due to static electricity. Cover and protect the connector pins with heat shrinkable insulation tubes.



(c) Connector type and the manufacturer

The following table lists applicable 9-pin connector and 15-pin connector. When wiring, use applicable wire and an appropriate tightening torque.

	External wiring connector		Wire			
	Model	**Tightening torque**	**Diameter**	**Type**	**Material**	**Temperature rating**
9-pin connector for external wiring (pin type)	17JE-23090-02(D8A) (manufactured by DDK Ltd.)	0.20 to 0.29N • m	28 to 24AWG	Stranded	Copper	75°C or more
15-pin connector for external wiring (pin type)	17JE-23150-02(D8A) (manufactured by DDK Ltd.)					

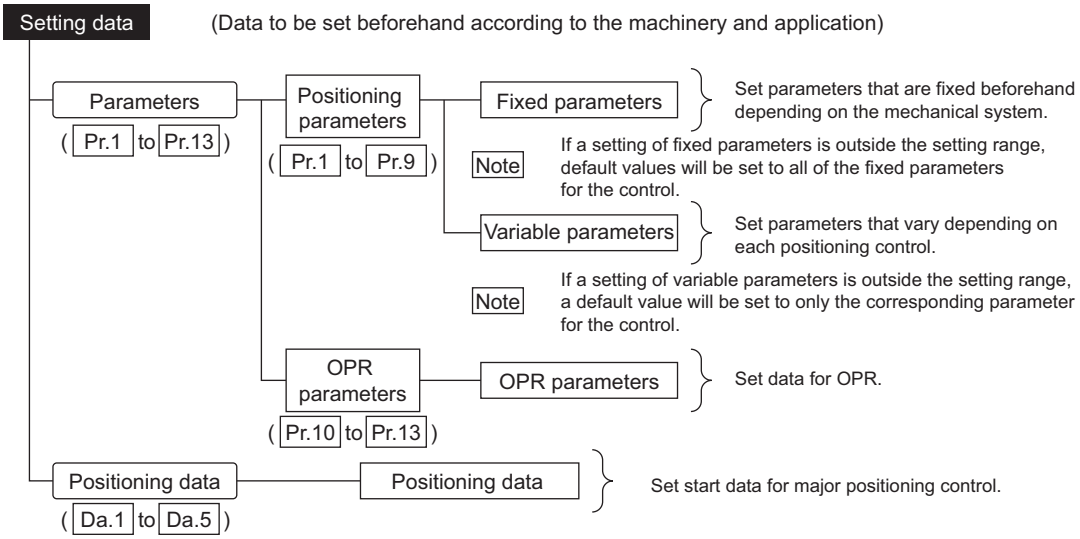
To contact the manufacturer regarding the connectors, refer to the following.
http://www.ddknet.co.jp/English/index.html

CHAPTER 5 DATA USED FOR POSITIONING

This chapter describes parameters and data used for positioning.

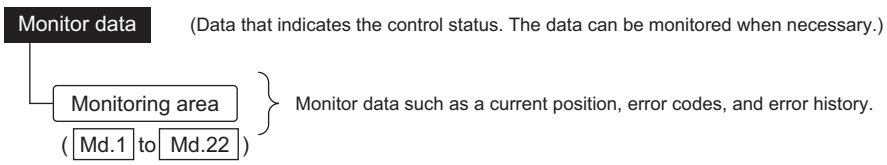
5.1 Types of Data

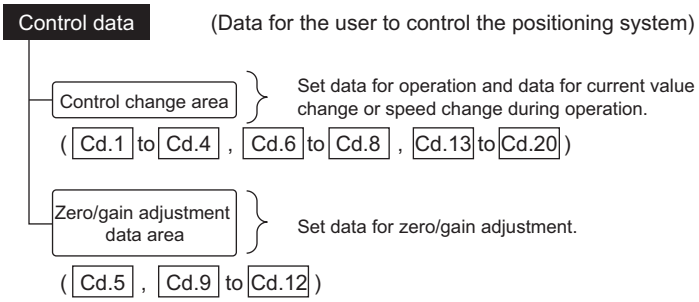
The parameters and data required to carry out control with the QD73A1 include "setting data", "monitor data", and "control data" shown below.



Point

- The data can be set using GX Works2.
- Default values are determined for setting data parameters, and are set as the factory default. Keep the unused parameters to the default.
- Fixed parameters and OPR parameters are activated when PLC READY signal (Y2D) is turned on.
- Variable parameters and positioning data can be changed even when PLC READY signal (Y2D) is on. Although, the change that is made during operation is not reflected since the data set at the start of major positioning control or JOG operation are valid. The change will be reflected at the next start.





Point

Set control data using sequence programs.

5.2 Positioning Parameters

This section describes the details of positioning parameters.

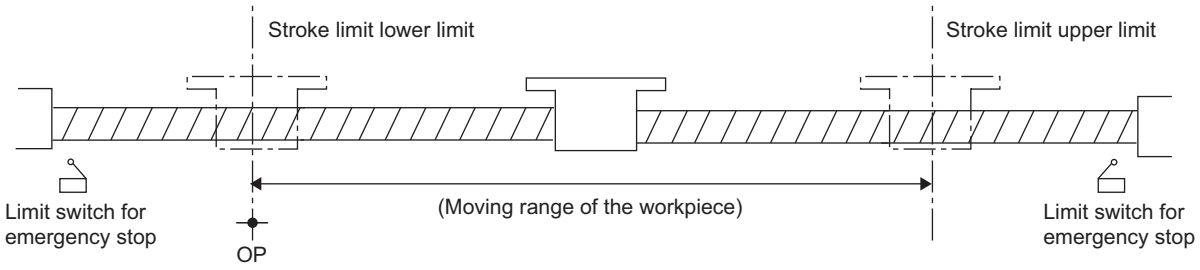
Item			Setting range	Default value	Buffer memory address (decimal)	Reference
Fixed parameter	Pr.1	Stroke limit upper limit	-2147483648 to 2147483647pulse	2147483647pulse	0 1	Page 76, Section 5.2 (1)
	Pr.2	Stroke limit lower limit		0pulse	2 3	
	Pr.3	Numerator of command pulse multiplication for electronic gear (CMX)	1 to 9999 (Satisfy the following condition. 1/50 ≤ CMX/CDV ≤ 50)	1	4	Page 77, Section 5.2 (2)
	Pr.4	Denominator of command pulse multiplication for electronic gear (CDV)			5	
Variable parameter	Pr.5	Speed limit value	10 to 4000000pulse/s (Set in the unit of 10pulse/s.)	200000pulse/s	20 21	Page 77, Section 5.2 (3)
	Pr.6	Acceleration time	2 to 9999ms	300ms	22	Page 78, Section 5.2 (4)
	Pr.7	Deceleration time			23	
	Pr.8	In-position range	1 to 20479pulse	5pulse	24	Page 78, Section 5.2 (5)
	Pr.9	Positioning mode	0: Position control mode 1: Speed-position control switch mode	0: Position control mode	25	Page 78, Section 5.2 (6)

Point

- The set data of fixed parameters are activated when PLC READY signal (Y2D) is turned on, and the error check is executed at the same time.
- Variable parameters can be set any time, but the error check is executed when a start signal is turned on.

(1) Pr.1 Stroke limit upper limit, Pr.2 Stroke limit lower limit

Set the upper and lower limits of the workpiece moving range.



For details on the stroke limit function, refer to the following.

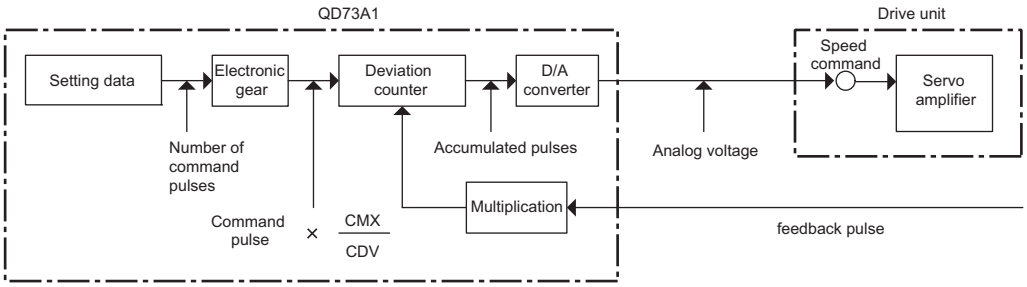
☞Page 213, Section 11.3

Remark

- In general, the OP is set at the lower limit or upper limit of the stroke limit.
- Setting the upper and lower limits of the stroke limit prevents the workpiece to overrun the set range; although, in addition, place emergency stop limit switches (upper limit switch (FLS)/lower limit switch (RLS)) outside and near the stroke limit range.
- The stroke limits are not checked during speed control.
- To disable the stroke limit function, set the same value to " Pr.1 Stroke limit upper limit" and " Pr.2 Stroke limit lower limit".

(2) Pr.3 Numerator of command pulse multiplication for electronic gear, Pr.4 Denominator of command pulse multiplication for electronic gear

Set the numerator (CMX) and denominator (CDV) of command pulse multiplication for electronic gear.



For details on the electronic gear function, refer to the following.

☞Page 209, Section 11.1

Remark

- Machine movement amount per one command pulse can be changed using the command pulse multiplication setting.
- Electronic gear is active on all of OPR control, major positioning control, and JOG operation.
- The module operates with the positioning speed and movement amount that are multiplied by the set value for electronic gear. Satisfy the following condition when setting electronic gear.
  Positioning speed × Electronic gear ≤ 4Mpulse/s
  When the positioning speed value that is multiplied by the set value of electronic gear exceeds "Pr.5 Speed limit value", the limit value is ignored. On the other hand, if the speed exceeds 4Mpulse/s, the error "Outside the command frequency range" (error code: 104) occurs. In this case, the speed is 4Mpulse/s, resulting in a positioning error.
- When there are decimal pulses, the fractions are maintained inside and accumulated for the next command.
- If positioning is continued after the CPU module was reset, a positioning error by the fractions of pulses occurs due to electronic gear (when CMX/CDV ≠ 1). In that case, execute OPR.

(3) Pr.5 Speed limit value

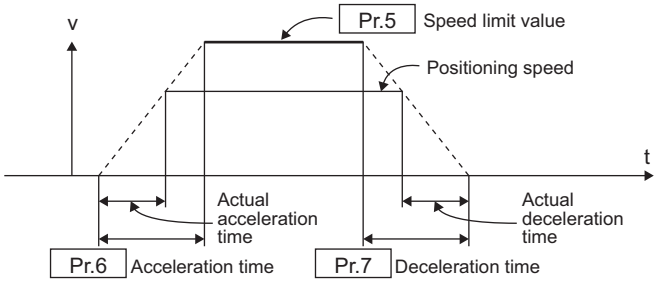
Set the upper limit speed of major positioning control or JOG operation. If command speed that is faster than this limit is specified, the speed is limited to this value.

Remark

- If speed for OPR control is set to the one faster than "Pr.5 Speed limit value", the error "OPR speed Outside the setting range" (error code: 20) occurs at the start of OPR.
- Positioning speed must be limited properly depending on the device and control subject.
- Set a value in a unit of 10 pulses. If a single digit is set, the value is rounded off.

(4) Pr.6 Acceleration time, Pr.7 Deceleration time

- Pr.6 Acceleration time: Set the time takes for speed (0) to reach the value in "Pr.5 Speed limit value".
- Pr.7 Deceleration time: Set the time takes for the speed (the value in "Pr.5 Speed limit value") to reach 0.



Remark

- The parameters are active for OPR control, major positioning control, and JOG operation.
- When the set positioning speed is lower than the value in "Pr.5 Speed limit value", the actual acceleration/deceleration time is shorter than the set value of the parameters.

(5) Pr.8 In-position range

Set the accumulated pulse amount where In-position signal (X16) turns on.

In-position signal (X16) can be used as the signal right before Positioning complete signal (X15).

For details on the in-position function, refer to the following.

☞Page 221, Section 11.8

(6) Pr.9 Positioning mode

Select a control mode of major positioning from the position control mode or the speed-position control switch mode.

Point

If a value other than 0 and 1 is set, the error "Positioning mode Outside the setting range" (error code: 14) occurs. Although, the QD73A1 checks the setting range only for the start by Forward start signal (Y22) or Reverse start signal (Y23). For the start by the following signals, the above error does not occur even if the set value is outside the setting range.

- OPR start signal (Y20)
- Absolute positioning start signal (Y21)
- Forward JOG start signal (Y24)
- Reverse JOG start signal (Y25)

5.3 OPR Parameters

This section describes the details of OPR parameters.

Item		Setting range	Default value	Buffer memory address (decimal)	Reference
Pr.10	OP address	-2147483648 to 2147483647pulse	0pulse	40 41	Page 79, Section 5.3 (1)
Pr.11	OPR speed	1 to 4000000pulse/s	10000pulse/s	42 43	Page 79, Section 5.3 (2)
Pr.12	Creep speed	1 to 4000000pulse/s	1000pulse/s	44 45	Page 80, Section 5.3 (3)
Pr.13	Setting for the movement amount after near-point dog ON	0 to 2147483647pulse	75pulse	46 47	Page 81, Section 5.3 (4)

Point

The set data of OPR parameters are activated when PLC READY signal (Y2D) is turned on, and the error check is executed when OPR start signal (Y20) is turned on.

For details on OPR control, refer to the following.

☞Page 178, CHAPTER 8

(1) Pr.10 OP address

Set the address that is the reference point of major positioning control.

Upon completion of OPR, the set value is stored in the current value monitor ("Md.1 Current feed value" and "Md.2 Actual current value").

(2) Pr.11 OPR speed

Set the speed of OPR control.

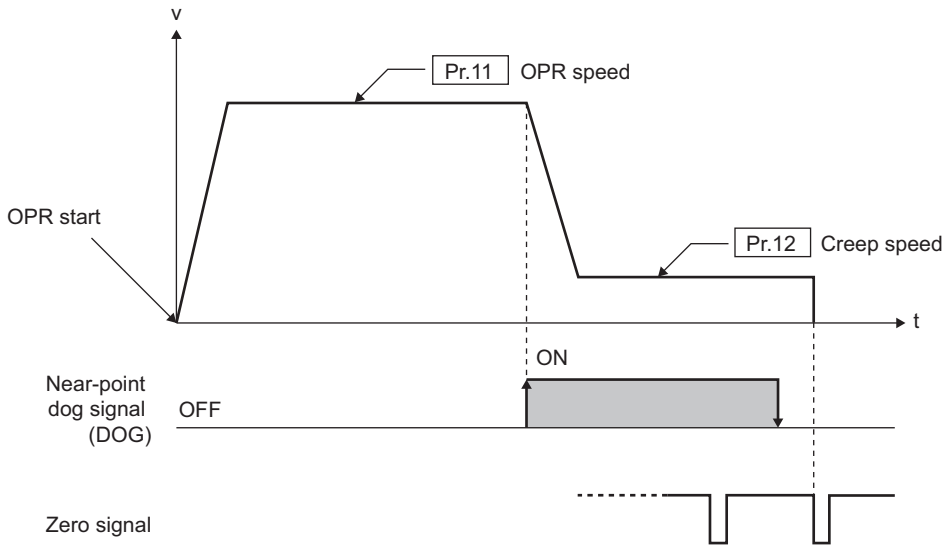
Satisfy the following condition when setting the speed.

Pr.12 Creep speed ≤ Pr.11 OPR speed ≤ Pr.5 Speed limit value

If the OPR speed exceeds "Pr.5 Speed limit value", the error "OPR speed Outside the setting range" (error code: 20) occurs, and the OPR is not executed.

(3) Pr.12 Creep speed

Once the near-point dog turns on, the control decelerates from "Pr.11 OPR speed" and stops. Set the speed of right before the stop, which is a creep speed.



Satisfy the following condition when setting the speed.

Pr.12 Creep speed ≤ Pr.11 OPR speed ≤ Pr.5 Speed limit value

If the creep speed exceeds "Pr.11 OPR speed", the error "Creep speed Outside the setting range" (error code: 21) occurs, and the OPR is not executed.

(4) Pr.13 Setting for the movement amount after near-point dog ON

When the OPR method is the count method, set the movement amount from the position where Near-point dog signal (X1C) turns on to the original point. Set a value equal to or greater than the deceleration distance from the OPR speed to the creep speed.

$$\text{Deceleration distance (pulse)} = \frac{\text{(OPR speed + Creep speed) (pulse/s)}}{1000} \times \frac{\text{Actual deceleration time (ms)}}{2}$$

The following are the setting precautions.

- Set pulse amount so that the position moved from the near-point dog ON does not overlap with Zero signal.
- Calculate deceleration distance without the use of electronic gear.

The following is a setting example.

Ex. When parameters are set as follows.

- Pr.11 OPR speed: 10kpulse/s (default value)
- Pr.12 Creep speed: 1kpulse/s (default value)
- Pr.7 Deceleration time: 300ms (default value)

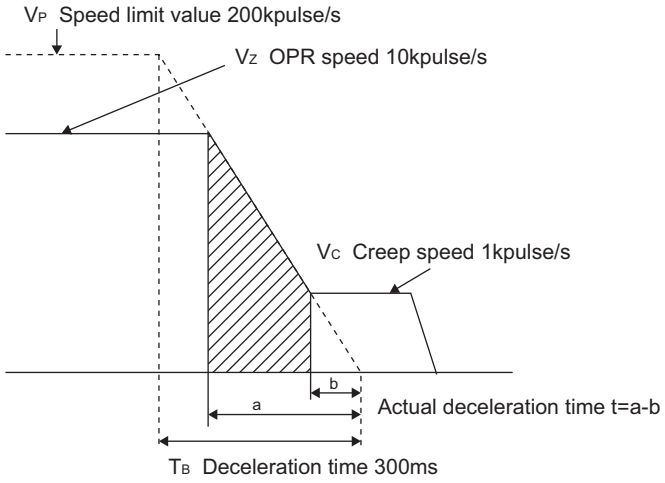
$$\text{Deceleration distance} = \frac{V_Z + V_c}{1000} \times \frac{t}{2}$$

$$= \frac{V_Z + V_c}{1000} \times \frac{1}{2} \times \frac{T_B(V_Z - V_c)}{Vp}$$

$$= \frac{(10k + 1k) \times 300(10k - 1k)}{2000 \times 200k}$$

$$= 74.25$$

$$= 75 \text{ (rounded up to the nearest integer)}$$



Point

When the position where the near-point dog turns on is set near the center of Zero signals, "Pr.13 Setting for the movement amount after near-point dog ON" should be an integral multiple of pulses per one servomotor rotation. Then the position moved after the near-point dog ON does not overlap with Zero signal.
For instance, when the number of pulses per one servomotor rotation is 2000, set 2000 pulses.

5.4 Positioning Data

This section describes the details of positioning data.

Item		Setting range	Default value	Buffer memory address (decimal)	Reference
Da.1	Positioning pattern	0: Positioning control 1: Two-phase trapezoidal positioning control	0: Positioning control	301	Page 82, Section 5.4 (1)
Da.2	Positioning address P1	Absolute system: -2147483648 to 2147483647pulse Incremental system: 0 to 2147483647pulse	0pulse	302 303	Page 83, Section 5.4 (2)
Da.3	Positioning speed V1	1 to 4000000pulse/s	0pulse/s	304 305	Page 84, Section 5.4 (3)
Da.4	Positioning address P2	Absolute system: -2147483648 to 2147483647pulse Incremental system: 0 to 2147483647pulse	0pulse	306 307	Page 84, Section 5.4 (4)
Da.5	Positioning speed V2	1 to 4000000pulse/s	0pulse/s	308 309	Page 84, Section 5.4 (5)

Point

Positioning data can be set any time, but the error check is executed when a positioning start signal (Y21 to Y23) is turned on.

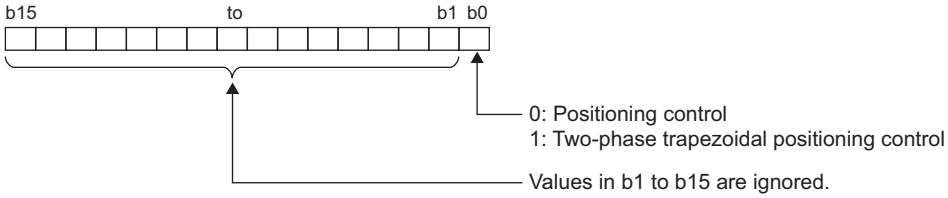
For details on positioning control, two-phase trapezoidal positioning control, and speed-position control switch mode, refer to the following.

☞Page 185, CHAPTER 9

(1) Da.1 Positioning pattern

Select a control pattern of major positioning from "positioning control" or "two-phase trapezoidal positioning control".

When 0 is set in b0, positioning control is specified, and when 1 is set in b0, two-phase trapezoidal positioning control is specified.



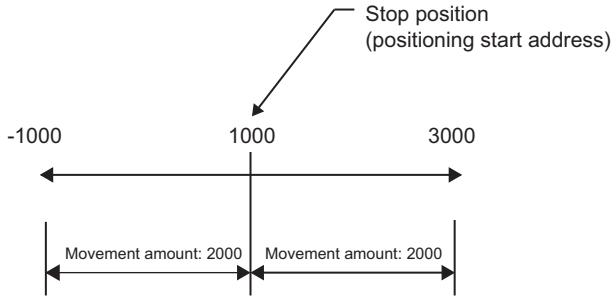
(2) Da.2 Positioning address P1

Set the address that is the destination of major positioning control. The setting range depends on the type of major positioning control.

If the specified positioning address is outside the stroke range, the error "Positioning address Outside the setting range" (error code: 30) occurs, and the positioning does not start.

(a) Absolute system

When the absolute system is selected, set an absolute address (movement amount from the OP).

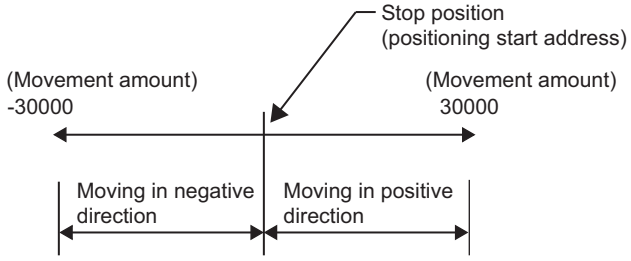


To execute two-phase trapezoidal positioning control in the absolute system, the positioning direction from "Da.2 Positioning address P1" to "Da.4 Positioning address P2" and the positioning direction from the current value to "Da.2 Positioning address P1" must be the same.

If not, the error "Two-phase trapezoidal positioning address error" (error code: 31) occurs, and the two-phase trapezoidal positioning control does not start.

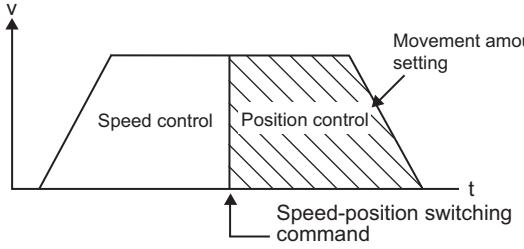
(b) Incremental system

When the incremental system is selected, set movement amount from the current value.



(c) Speed-position control switch mode

Set movement amount of after the shift from speed control to position control.



(3) Da.3 Positioning speed V1

Set the command speed of major positioning control. Set a value equal to or less than "Pr.5 Speed limit value".

If the value exceeds "Pr.5 Speed limit value", the error "Positioning speed Outside the setting range" (error code: 32) occurs, and the command speed is limited to "Pr.5 Speed limit value".

If the specified positioning speed is 0, the error "Positioning speed Outside the setting range" (error code: 32) occurs, and the positioning does not start.

(4) Da.4 Positioning address P2

This setting is enabled only for two-phase trapezoidal positioning control.

Set the destination address of after the move to the address set to "Da.2 Positioning address P1".

For details on "Da.2 Positioning address P1", refer to the following.

☞Page 83, Section 5.4 (2)

(5) Da.5 Positioning speed V2

This setting is enabled only for two-phase trapezoidal positioning control.

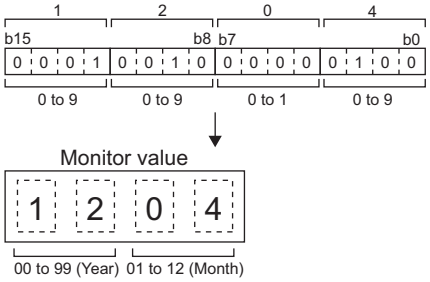
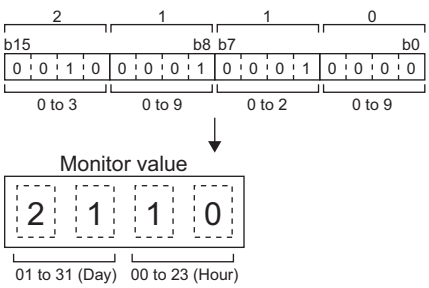
Set the command speed to move to the address set to "Da.4 Positioning address P2".

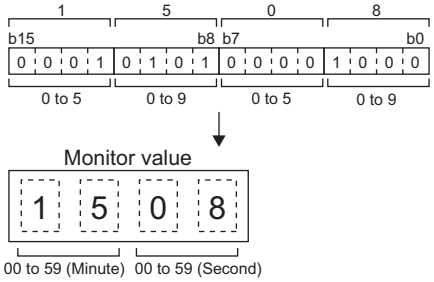
The setting condition is the same as that of "Da.3 Positioning speed V1". (☞Page 84, Section 5.4 (3))

5.5 Monitor Data

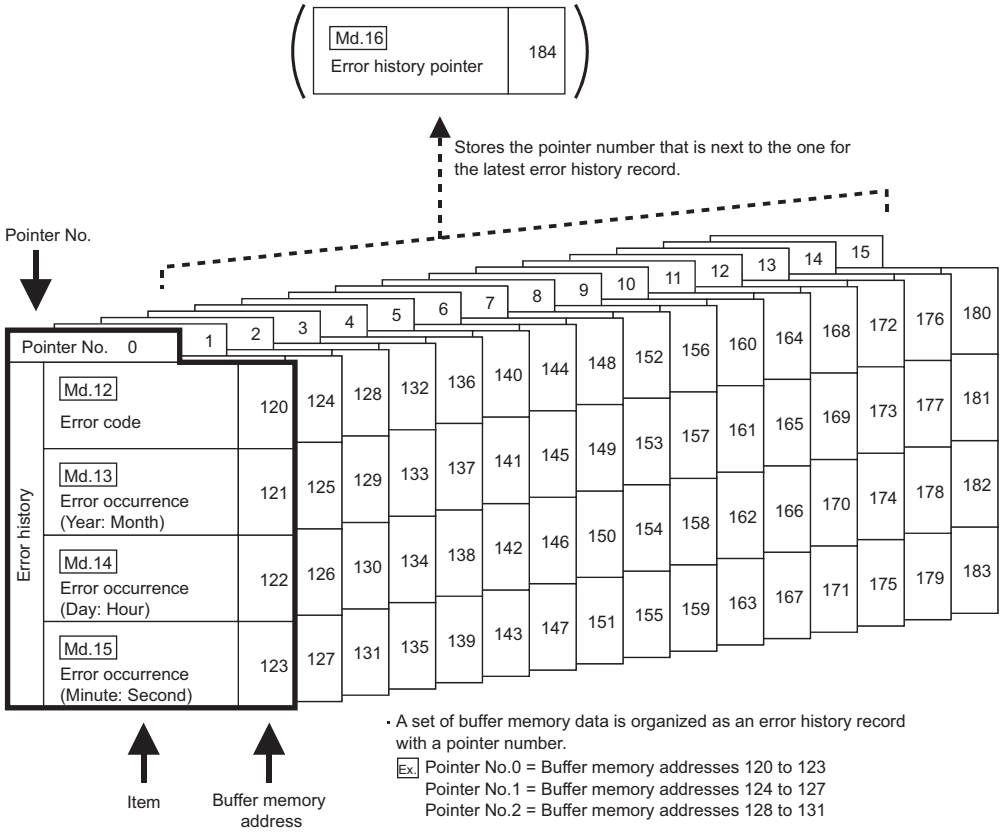
This section describes the details of monitor data.

Item		Description	Default value	Buffer memory address (decimal)
Md.1	Current feed value	• The current commanded position is stored. (different from the actual motor position during operation) • The update cycle is 0.5ms. • When OPR is completed, the value of " Pr.10 OP address" is stored. • When the current value is changed with the current value change function, the changed value is stored. (☞ Page 217, Section 11.5)	0pulse	100 101
Md.2	Actual current value	• The actual servomotor movement amount calculated based on feedback pulses is stored as an actual current value (the number of feedback pulses). (Actual current value = Current feed value - Accumulated pulses in the deviation counter) • The update cycle is 0.5ms.	0pulse	102 103
Md.3	Error code (ERR.1)	• When a minor error occurs, the corresponding error code is stored. • The latest error code is stored at all times. (When a new error occurs, the error code is overwritten.) • When Error reset signal (Y28) is turned on, the error code is cleared to 0. For details on error codes, refer to the following. ☞ Page 250, Section 14.3	0	104
Md.4	Error code (ERR.2)	• When a major error occurs, the corresponding error code is stored. • The latest error code is stored at all times. (When a new error occurs, the error code is overwritten.) • When Error reset signal (Y28) is turned on, the error code is cleared to 0. For details on error codes, refer to the following. ☞ Page 250, Section 14.3	0	105
Md.5	Deviation counter value (address)	• The difference of the current feed value and actual current value is stored as a deviation counter value. • The update cycle is 0.5ms.	0pulse	106 107
Md.6	Movement amount after near-point dog ON	• When OPR starts, "0" is stored. • When OPR is completed, the movement amount from the near-point dog ON to the OPR completion is stored. (Movement amount: Movement amount to OPR completion using near-point dog ON as "0".) The stored value varies depending on feedback pulses input at the OPR as shown below. · When the phase A proceeds 90 degrees than phase B: positive value · When the phase B proceeds 90 degrees than phase A: negative value • The count value is stored for both the near-point dog method and the count method. (Use the value as a reference value for OPR adjustment.)	0pulse	108 109

Item		Description	Default value	Buffer memory address (decimal)
Md.7	Speed-position switching command	The on/off status of Speed-position switching command signal (CHANGE) is stored. 0: Speed-position switching command input OFF 1: Speed-position switching command input ON	0: Speed-position switching command input OFF	110
Md.8	Control mode	The control mode under the speed-position control switch mode is stored. 0: Position control 1: Speed control	0: Position control	111
Md.9	Zero/gain execution status	The execution status of the zero/gain adjustment mode is stored. 0: Not in the zero/gain adjustment mode 1: In the zero/gain adjustment mode (DIP switch) 2: In the zero/gain adjustment mode (switch setting)	0: Not in the zero/gain adjustment mode	112
Md.10	Zero/gain adjustment status	The status of zero/gain adjustment is stored. 0: No zero/gain adjustment 1: Adjusting zero 2: Adjusting gain	0: No zero/gain adjustment	113
Md.11	Feedrate	• The command output speed of the operating workpiece is stored. (May be different from the actual motor speed during operation) • The update cycle is 0.5ms.	0pulse/s	114 115
Md.12	Error code	An error code is stored. For details on error codes, refer to the following. ☞ Page 250, Section 14.3	0	☞ Page 88, Section 5.5 (1)
Md.13	Error occurrence (Year: Month)	The time (year: month) of error detection is stored in BCD code. • b15 to b8: Year • b7 to b0: Month The data can be monitored in hexadecimal. 	0000_H	
Md.14	Error occurrence (Day: Hour)	The time (day: hour) of error detection is stored in BCD code. • b15 to b8: Day • b7 to b0: Hour The data can be monitored in hexadecimal. 	0000_H	

Item		Description	Default value	Buffer memory address (decimal)
Md.15	Error occurrence (Minute: Second)	The time (minute: second) of error detection is stored in BCD code. • b15 to b8: Minute • b7 to b0: Second The data can be monitored in hexadecimal. 	0000_H	Page 88, Section 5.5 (1)
Md.16	Error history pointer	• The pointer No. for the next error record is stored. A value from 0 to 15 is stored. • Even when Error reset signal (Y28) is turned on, the data is not cleared to 0.	0	184
Md.17	Maximum accumulated pulse value	[When the accumulated pulse error detection function is being executed] The reference value that is kept in the flash ROM of the QD73A1 is displayed. [When the reference value is being measured] The maximum/minimum accumulated pulse values are stored when the positioning is executed in the address increasing/decreasing direction. [In other cases] 0 is stored.	0 pulse	200 201
Md.18	Minimum accumulated pulse value		0 pulse	202 203
Md.19	Accumulated pulse error detection function status	The status of the accumulated pulse error detection function is displayed. 0: Normal 1: Accumulated pulse error is being detected 2: Reference value is being measured	0: Normal	204
Md.20	Reference value measurement flag	The status of the reference value measurement is displayed. 0: Unmeasured 1: Measured Check that this area stores 1 before writing data in the flash ROM. This area becomes 0 at the following timing. • When the module is started • When " Cd.18 Accumulated pulse error detection request" is set to 1 and the error detection starts	0: Unmeasured	205
Md.21	Deviation counter value (pulse)	• The difference of the values obtained from "Command pulse × CMX/CDV" and "Number of feedback pulses × Multiplication" is stored as a deviation counter value. • The update cycle is 0.5ms.	0 pulse	116 117
Md.22	Movement amount after near-point dog ON (absolute value)	• When OPR starts, "0" is stored. • When OPR is completed, the movement amount from the near-point dog ON to the OPR completion is stored as an absolute value. (Movement amount: Movement amount to OPR completion using near-point dog ON as "0".) • The count value is stored for both the near-point dog method and the count method. (Use the value as a reference value for OPR adjustment.)	0 pulse	118 119

(1) Buffer memory areas for error occurrence data



- A set of buffer memory data is organized as an error history record with a pointer number.

  Ex. Pointer No.0 = Buffer memory addresses 120 to 123
  Pointer No.1 = Buffer memory addresses 124 to 127
  Pointer No.2 = Buffer memory addresses 128 to 131
  ⋮
  Pointer No.15 = Buffer memory addresses 180 to 183

- Error history records are stored from the pointer No.1 up to No.15. After 16 records are stored, the next record will be assigned the pointer No.0. (The new record replaces the older record.)

5.6 Control Data

This section describes the details of control data.

Item		Description	Setting range	Default value	Buffer memory address (decimal)
Cd.1	New current value	• Set a new current feed value when changing the current value. • Writing data in this area and setting "1" in " Cd.7 Current value change request" changes the value in " Md.1 Current feed value". For details on the current value change function, refer to the following. ☞ Page 217, Section 11.5	-2147483648 to 2147483647pulse	0pulse	80 81
Cd.2	New speed value	• Set a new speed value when changing speed. • Writing data in this area and setting "1" in " Cd.8 Speed change request" executes the speed change. For details on the speed change function, refer to the following. ☞ Page 218, Section 11.6	0 to " Pr.5 Speed limit value" (pulse/s) (Maximum 4000000 pulse/s)	0pulse/s	82 83
Cd.3	JOG speed	• Set JOG speed for JOG operation. • If the value exceeds " Pr.5 Speed limit value", the error "JOG speed Outside the setting range" (error code: 41) occurs, and the speed is limited to " Pr.5 Speed limit value". • If "0" is set in this area and JOG operation is attempted, the error "JOG speed Outside the setting range" (error code: 41) occurs, and the operation does not start. For details on JOG operation, refer to the following. ☞ Page 200, CHAPTER 10	1 to 4000000pulse/s	0pulse/s	84 85

<table>
<tr><th colspan="2">Item</th><th>Description</th><th>Setting range</th><th>Default value</th><th>Buffer memory address (decimal)</th></tr>
<tr><td>Cd.4</td><td>Deviation counter clear command</td><td>• Use this area to clear the accumulated pulses in the deviation counter.
• Write "1" to clear the counter. If a value other than "1" is set, the command is ignored.
• After the deviation counter was cleared, "0" is stored automatically.
• To start positioning after the deviation counter was cleared, check that this area stores "0" and no error is detected before the start.
• When the deviation counter is cleared, " Md.2 Actual current value" changes to the value in " Md.1 Current feed value".
• Data cannot be written while BUSY signal (X14) is on. Check that BUSY signal (X14) is off before writing data. If data writing is attempted while BUSY signal (X14) is on, the error "Deviation counter clear error" (error code: 114) occurs.
For details on the deviation counter clear function, refer to the following.
☞Page 220, Section 11.7</td><td>1: Clear the deviation counter</td><td>0</td><td>86</td></tr>
<tr><td>Cd.5</td><td>Analog output adjustment area 1</td><td>• Set pulse amount to adjust gain with specific accumulated pulse amount.
• This setting is enabled only in the zero/gain adjustment mode.
• Use this area when the default value or one of the selections 1 to 4 is set in "Accumulated pulse setting" in the switch setting. (When one of the selections 5 to 8 is set, use " Cd.9 Analog output adjustment area 2".)
• If the setting is outside the setting range, the error "Analog output adjustment area 1 Outside the setting range" (error code: 125) occurs.
For details on zero/gain adjustment, refer to the following.
☞Page 59, Section 4.5</td><td>Depends on "Accumulated pulse setting" in the switch setting.
<table><tr><th>Accumulated pulse setting</th><th>Setting range (Unit: pulse)</th></tr><tr><td>Selection 1</td><td>-3700 to 3700</td></tr><tr><td>Selection 2</td><td>-7400 to 7400</td></tr><tr><td>Selection 3</td><td>-11100 to 11100</td></tr><tr><td>Default value or selection 4</td><td>-14800 to 14800</td></tr></table></td><td>0</td><td>87</td></tr>
<tr><td>Cd.6</td><td>New speed-position movement amount</td><td>• Set this area to change movement amount of after a switchover to position control in the speed-position control switch mode.
• The set value is reflected at the input of Speed-position switching command signal (CHANGE).
• The setting is cleared to 0 when the next operation starts.
For details on the Speed-position control switch mode, refer to the following.
☞Page 195, Section 9.6.2</td><td>1 to 2147483647pulse</td><td>0pulse</td><td>88
89</td></tr>
</table>

Item		Description	Setting range	Default value	Buffer memory address (decimal)
Cd.7	Current value change request	• Use this area to request a current value change. • After setting "Cd.1 New current value", set "1" in this area. If a value other than "1" is set, the setting is ignored. • After the current value change was accepted, "0" is stored automatically. • A current value change cannot be requested while BUSY signal (X14) is on. Check that BUSY signal (X14) is off before requesting a current value change. • If a current value change is requested while BUSY signal (X14) is on, the error "Current value change error" (error code: 110) occurs. For details on the current value change function, refer to the following. Page 217, Section 11.5	1: Change the current value	0	90
Cd.8	Speed change request	• Use this area to request a speed change. • After setting "Cd.2 New speed value", set "1" in this area. If a value other than "1" is set, the setting is ignored. • After the speed change was accepted, "0" is stored automatically. • If a speed change is requested with "Cd.2 New speed value" exceeding "Pr.5 Speed limit value", the error "New speed value Outside the setting range" (error code: 40) occurs, and the speed after the change is limited to "Pr.5 Speed limit value". For details on the speed change function, refer to the following. Page 218, Section 11.6	1: Change speed	0	91
Cd.9	Analog output adjustment area 2	• Set pulse amount to adjust gain with specific accumulated pulse amount. • This setting is enabled only in the zero/gain adjustment mode. • Use this area when one of the selections 5 to 8 is set in "Accumulated pulse setting" in the switch setting. (When one of the selections 1 to 4 is set, use "Cd.5 Analog output adjustment area 1".) • If the setting is outside the setting range, the error "Analog output adjustment area 2 Outside the setting range" (error code: 126) occurs. For details on zero/gain adjustment, refer to the following. Page 59, Section 4.5	Depends on "Accumulated pulse setting" in the switch setting. Selection 5: -37000 to 37000 Selection 6: -74000 to 74000 Selection 7: -111000 to 111000 Selection 8: -148000 to 148000	0	92 93

Item		Description	Setting range	Default value	Buffer memory address (decimal)
Cd.10	Zero/gain adjustment specification	• Specify "zero adjustment" or "gain adjustment". • When zero/gain adjustment is performed using switches on the front of the QD73A1, the set value is ignored. • If a value other than 0, 1, and 2 is set, the error "Zero/gain adjustment setting error" (error code: 123) occurs. For details on zero/gain adjustment, refer to the following. Page 59, Section 4.5	1: Zero adjustment 2: Gain adjustment	0	94
Cd.11	Zero/gain adjustment value specification	• Use this area to set adjustment amount of the analog output value during zero/gain adjustment. • The analog output value changes by the adjustment amount when Set value change request signal (Y1C) is turned on and off. Ex. When 1000 is set, the analog output value can be adjusted by approximately 0.33V. • When zero/gain adjustment is performed using switches on the front of the QD73A1, the set value is ignored. • If the setting is outside the setting range, the error "Zero/gain adjustment value error" (error code: 124) occurs. For details on zero/gain adjustment, refer to the following. Page 59, Section 4.5	-3000 to 3000	0	95
Cd.12	Factory default zero/gain adjustment value restoration request	• Use this area to restore the zero adjustment value and gain adjustment value to the factory default. • This setting is enabled only in the zero/gain adjustment mode. • If a value other than "1" is set, the setting is ignored. • After the zero/gain adjustment value was restored, "0" is stored automatically.	1: Restore the zero/gain adjustment value	0	96

Item		Description	Setting range	Default value	Buffer memory address (decimal)
Cd.13	Alert output accumulated pulse setting value (maximum value)	The difference between the reference value (maximum value) and the judgment value (alert output accumulated pulses (maximum value)) is set. The relation between this setting and the judgment value is as follows. [If " Cd.17 Accumulated pulse setting value selection" is set to 0] Alert output accumulated pulses (maximum value) = reference value (maximum value) + Cd.13 Alert output accumulated pulse setting value (maximum value) [If " Cd.17 Accumulated pulse setting value selection" is set to 1] Alert output accumulated pulses (maximum value) = reference value (maximum value) + (Cd.13 Alert output accumulated pulse setting value (maximum value) - 1000) × reference value (maximum value) ÷ 1000 For details on the accumulated pulse error detection function, refer to the following. ☞ Page 223, Section 11.9	• If " Cd.17 Accumulated pulse setting value selection" is set to 0: 1 to 148000 pulse • If " Cd.17 Accumulated pulse setting value selection" is set to 1: 1000 to 50000 (× 10^{-3}: Last three digits are the value after the decimal point.)	0	400 401

Item		Description	Setting range	Default value	Buffer memory address (decimal)
Cd.14	Immediate stop accumulated pulse setting value (maximum value)	The difference between the reference value (maximum value) and the judgment value (immediate stop accumulated pulses (maximum value)) is set. The relation between this setting and the judgment value is as follows. [If " Cd.17 Accumulated pulse setting value selection" is set to 0] Immediate stop accumulated pulses (maximum value) = reference value (maximum value) + Cd.14 Immediate stop accumulated pulse setting value (maximum value) [If " Cd.17 Accumulated pulse setting value selection" is set to 1] Immediate stop accumulated pulses (maximum value) = reference value (maximum value) + (Cd.14 Immediate stop accumulated pulse setting value (maximum value) - 1000) × reference value (maximum value) ÷ 1000 For details on the accumulated pulse error detection function, refer to the following. ☞ Page 223, Section 11.9	• If " Cd.17 Accumulated pulse setting value selection" is set to 0: 1 to 148000 pulse • If " Cd.17 Accumulated pulse setting value selection" is set to 1: 1000 to 50000 ($\times 10^{-3}$: Last three digits are the value after the decimal point.)	0	402 403

Item		Description	Setting range	Default value	Buffer memory address (decimal)
Cd.15	Alert output accumulated pulse setting value (minimum value)	The difference between the reference value (minimum value) and the judgment value (alert output accumulated pulses (minimum value)) is set. The relation between this setting and the judgment value is as follows. [If "Cd.17 Accumulated pulse setting value selection" is set to 0] Alert output accumulated pulses (minimum value) = reference value (minimum value) + Cd.15 Alert output accumulated pulse setting value (minimum value) [If "Cd.17 Accumulated pulse setting value selection" is set to 1] Alert output accumulated pulses (minimum value) = reference value (minimum value) + (Cd.15 Alert output accumulated pulse setting value (minimum value) - 1000) × reference value (minimum value) ÷ 1000 For details on the accumulated pulse error detection function, refer to the following. ☞ Page 223, Section 11.9	• If "Cd.17 Accumulated pulse setting value selection" is set to 0: -148000 to -1 pulse • If "Cd.17 Accumulated pulse setting value selection" is set to 1: 1000 to 50000 ($\times 10^{-3}$: Last three digits are the value after the decimal point.)	0	404 405

Item		Description	Setting range	Default value	Buffer memory address (decimal)
Cd.16	Immediate stop accumulated pulse setting value (minimum value)	The difference between the reference value (minimum value) and the judgment value (immediate stop accumulated pulses (minimum value)) is set. The relation between this setting and the judgment value is as follows. [If " Cd.17 Accumulated pulse setting value selection" is set to 0] Immediate stop accumulated pulses (minimum value) = reference value (minimum value) + Cd.16 Immediate stop accumulated pulse setting value (minimum value) [If " Cd.17 Accumulated pulse setting value selection" is set to 1] Immediate stop accumulated pulses (minimum value) = reference value (minimum value) + (Cd.16 Immediate stop accumulated pulse setting value (minimum value) - 1000) × reference value (minimum value) ÷ 1000 For details on the accumulated pulse error detection function, refer to the following. ☞ Page 223, Section 11.9	• If " Cd.17 Accumulated pulse setting value selection" is set to 0: -148000 to -1 pulse • If " Cd.17 Accumulated pulse setting value selection" is set to 1: 1000 to 50000 ($\times 10^{-3}$: Last three digits are the value after the decimal point.)	0	406 407
Cd.17	Accumulated pulse setting value selection	• The setting unit for " Cd.13 Alert output accumulated pulse setting value (maximum value)" to " Cd.16 Immediate stop accumulated pulse setting value (minimum value)" is selected. • If a value other than 0 and 1 is set, the value is regarded as 0. • If this area is set to 1 and the maximum/minimum reference values are set to 0, the error "Accumulated pulse error undetectable" (error code: 131) occurs and the accumulated pulse error detection function does not operate. For details on the accumulated pulse error detection function, refer to the following. ☞ Page 223, Section 11.9	0: Set with pulse 1: Set with magnification	0: Set with pulse	408

Item		Description	Setting range	Default value	Buffer memory address (decimal)
Cd.18	Accumulated pulse error detection request	• Use this area to start/stop the accumulated pulse error detection function. • While this area is set to 1, the accumulated pulse error detection function is executed. However, if the reference value has never been measured, the error "Accumulated pulse error undetectable" (error code: 131) occurs and the function does not operate. • If a value other than 0 and 1 is set, the value is regarded as 0. • If " Cd.19 Measurement start request" is set to 1, the function does not operate even if this area is set to 1. (This request is ignored and after " Cd.19 Measurement start request" is set to 0, the function is executed.) For details on the accumulated pulse error detection function, refer to the following. Page 223, Section 11.9	0: No request 1: Requested	0: No request	409
Cd.19	Measurement start request	• Use this area to measure accumulated pulses used as the reference value to detect an error. • While this area is set to 1, the maximum/minimum accumulated pulse values are measured. • If a value other than 0 and 1 is set, the value is regarded as 0. • If " Cd.18 Accumulated pulse error detection request" is set to 1, the value is not measured even if this area is set to 1. (This request is ignored and after " Cd.18 Accumulated pulse error detection request" is set to 0, the function is executed.) For details on the accumulated pulse error detection function, refer to the following. Page 223, Section 11.9	0: No request 1: Requested	0: No request	410

Item		Description	Setting range	Default value	Buffer memory address (decimal)
Cd.20	Reference value write request	• Use this area to save the measured reference value in the flash ROM of the QD73A1. • When this area setting is changed to 1, the measured reference value is saved in the flash ROM. • When " Md.20 Reference value measurement flag" is set to 1, the value is written to the flash ROM. If " Md.20 Reference value measurement flag" is set to the value other than 1, the error "Reference value write error" (error code: 132) occurs and the value is not written. • The QD73A1 set this area to 0 when the value saving in the flash ROM is completed. This process is the same when an error occurs and the value is not written. For details on the accumulated pulse error detection function, refer to the following. ☞ Page 223, Section 11.9	0: No request 1: Requested	0: No request	411

CHAPTER 6 VARIOUS SETTINGS

This chapter describes setting procedures of the QD73A1.

Point

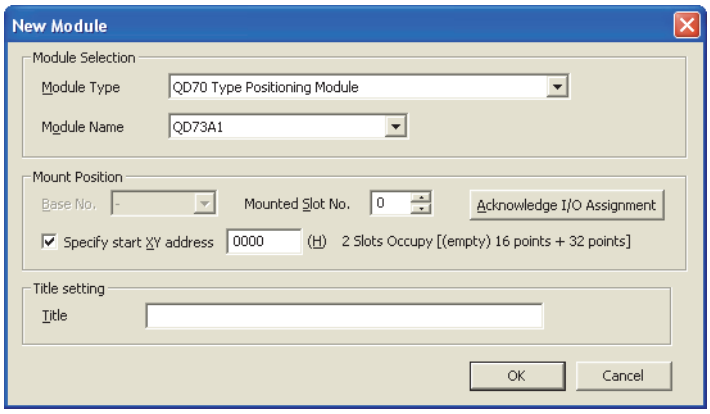
- After writing the contents of the new module, parameter settings, and auto refresh settings into the CPU module, reset the CPU module and switch its status as STOP → RUN → STOP → RUN, or turn off and on the power supply to activate the settings.
- After writing the contents of the switch settings, reset the CPU module or turn off and on the power supply to activate the settings.

6.1 Adding a Module

(1) Addition procedure

Open the "New Module" window.

Project window⇨[Intelligent Function Module]⇨Right-click⇨[New Module...]



Item		Description
Module Selection	Module Type	Set "QD70 Type Positioning Module".
	Module Name	Set the name of the module to mount.
Mount Position	Base No.	Set the base unit where the module is mounted.
	Mounted Slot No.	Set the slot No. where the module is mounted.
	Specify start XY address	The start I/O number (hexadecimal) of the module is set, according to the mounted slot No. Any start I/O number can be set.
Title setting	Title	Set any title.

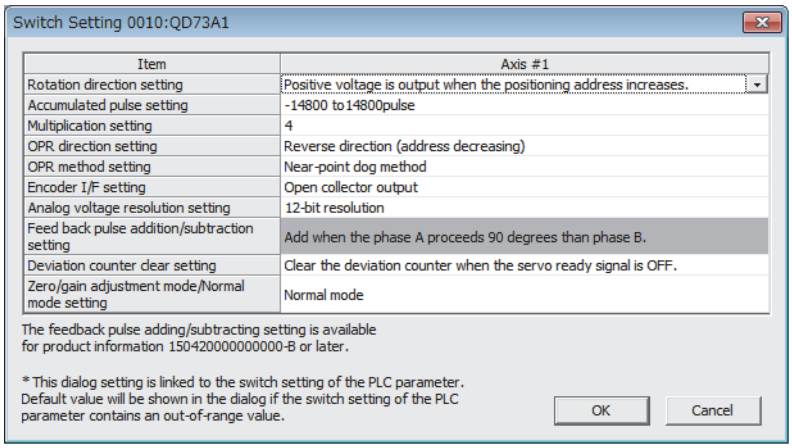
6.2 Switch Setting

Configure settings related to the drive unit and encoder that are connected to the QD73A1.

(1) Setting method

Open the "Switch Setting" window.

Project window⇨[Intelligent Function Module]⇨Module name⇨[Switch Setting]



Item	Description	Setting value	Default value	Reference
Rotation direction setting	Set the rotation direction in which positioning addresses increase.	• Positive voltage is output when the positioning address increases. • Negative voltage is output when the positioning address increases.	Positive voltage is output when the positioning address increases.	Page 101, Section 6.2.1
Accumulated pulse setting	Select the maximum accumulated pulse amount that can be counted in the deviation counter.	• -3700 to 3700 pulse [Selection 1] • -7400 to 7400 pulse [Selection 2] • -11100 to 11100 pulse [Selection 3] • -14800 to 14800 pulse [Selection 4] • -37000 to 37000 pulse [Selection 5] • -74000 to 74000 pulse [Selection 6] • -111000 to 111000 pulse [Selection 7] • -148000 to 148000 pulse [Selection 8]	-14800 to 14800 pulse [Selection 4]	Page 102, Section 6.2.2
Multiplication setting	Set the multiplication rate of feedback pulses from the pulse generator (PLG).	• 4 • 2 • 1 • 1/2	4	Page 104, Section 6.2.3
OPR direction setting	Set the direction in which OPR is executed.	• Reverse direction (address decreasing) • Forward direction (address increasing)	Reverse direction (address decreasing)	Page 104, Section 6.2.4
OPR method setting	Select an OPR method.	• Near-point dog method • Count method	Near-point dog method	Page 104, Section 6.2.5
Encoder I/F setting	Select an encoder output type from open collector, TTL, or differential output.	• Open collector output • TTL output • Differential output	Open collector output	Page 66, Section 4.6.2
Analog voltage resolution setting	Set resolution of analog voltage to be output as a speed command.	• 12-bit resolution • 14-bit resolution • 16-bit resolution	12-bit resolution	Page 105, Section 6.2.7

Item	Description	Setting value	Default value	Reference
Feed back pulse addition/sub-traction setting	Set whether to add or subtract the feedback pulses to/from the deviation counter when the phase A of feedback pulse proceeds 90 degrees than phase B.	• Add when the phase A proceeds 90 degrees than phase B. • Subtract when the phase A proceeds 90 degrees than phase B.	Add when the phase A proceeds 90 degrees than phase B.	Page 106, Section 6.2.8
Deviation counter clear setting	Set whether to clear the deviation counter when Servo READY signal turns off.	• Clear the deviation counter when the servo ready signal is OFF. • Do not clear the deviation counter when the servo ready signal is OFF.	Clear the deviation counter when the servo ready signal is OFF.	Page 107, Section 6.2.9
Zero/gain adjustment mode/Normal mode setting	Select the zero/gain adjustment mode or the normal mode.	• Normal mode • Zero/gain adjustment mode	Normal mode	Page 62, Section 4.5 (4) (b)

6.2.1 Rotation direction setting

Set the direction in which positioning addresses increase.

The rotation direction of a motor depends on the polarity of the voltage to be applied to the servo amplifier.

For details, refer to the manual for the servo amplifier.

For connection between the QD73A1 and an encoder, refer to the following.

☞Page 66, Section 4.6.2

6.2.2 Accumulated pulse setting

Select the maximum accumulated pulse amount that can be counted in the deviation counter.

(1) Calculating accumulated pulse amount

When a servomotor is used, "maximum accumulated pulse amount" obtained by the following formula generates.

$$\text{Maximum accumulated pulse amount} = \frac{\text{Speed command (pulse/s)}}{\text{Position loop gain } (s^{-1})}$$

Configure this setting so that "maximum accumulated pulse amount" stays within the accumulated pulse setting range.

(a) Position loop gain

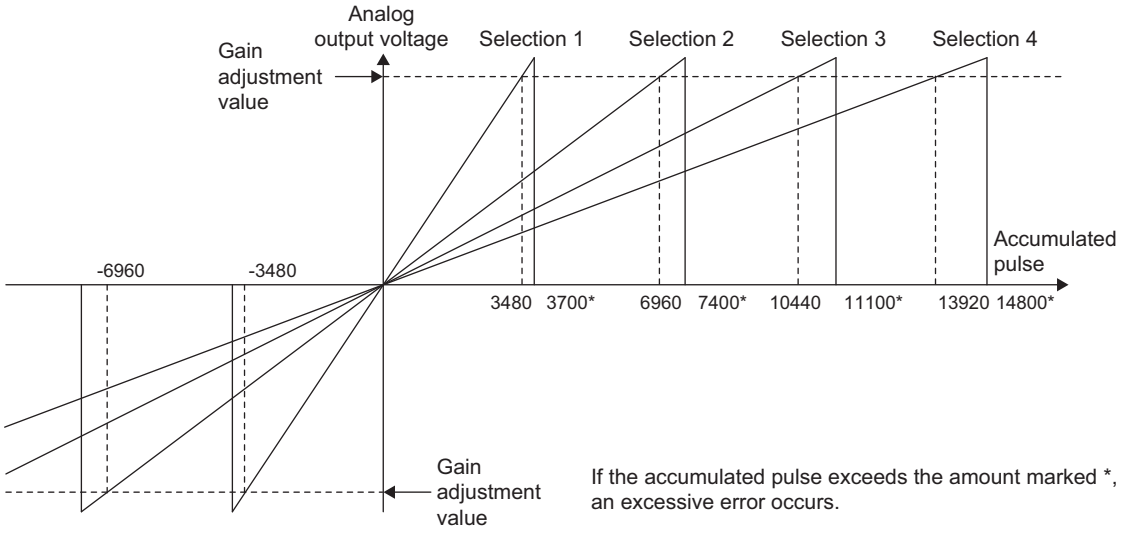
Position loop gain is a parameter to be set on the servomotor side. It effects operation in case of a servomotor stop and pulse amount in the deviation counter during operation.

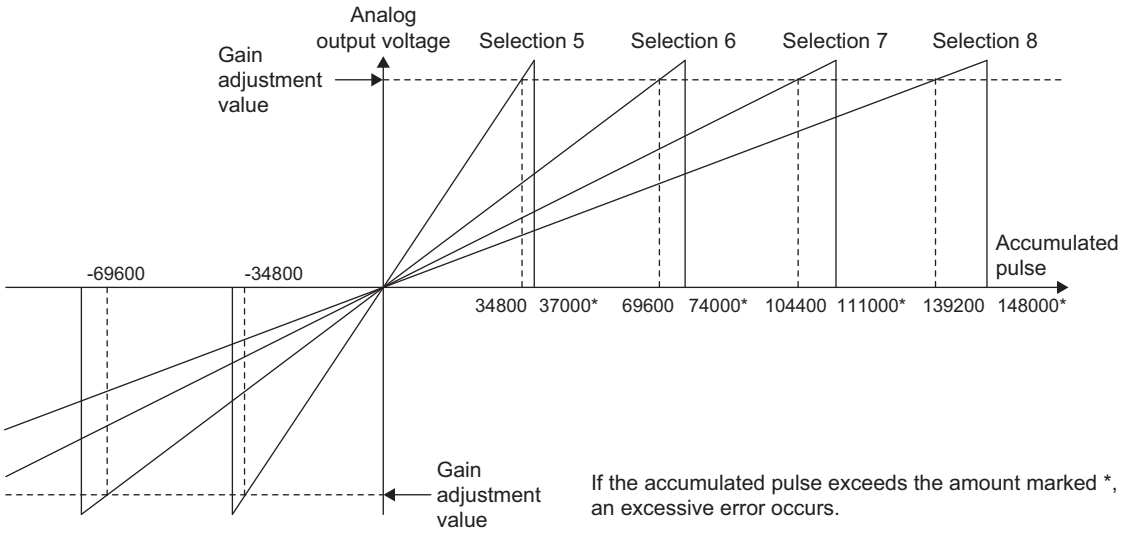
Position loop gain value	Description
Low	Accumulated amount is large, and adjustment time at a stop becomes long.
High	Overshoot becomes large at a stop, or vibration tends to occur during a stop.

Position loop gain is adjusted to 20 to 30s^{-1} normally. Make fine adjustment if necessary.
For details, refer to the manual for the servomotor.

(b) Accumulated pulse amount and analog output voltage from the QD73A1

The analog output voltage from the QD73A1 is controlled in proportion to accumulated pulse amount.





The following is an example of selecting an option in "Accumulated pulse setting".

Ex. Maximum speed: 4Mpulse/s, position loop gain: $30s^{-1}$

$$\text{Accumulated pulse} = \frac{\text{Maximum speed}}{\text{Position loop gain}} = \frac{4000000}{30} = 133333 \text{ pulses}$$

If the number of accumulated pulses is 133333, "-148000 to 148000 pulse" should be selected in "Accumulated pulse setting" so that analog output voltage will not be saturated.

(2) Excessive error

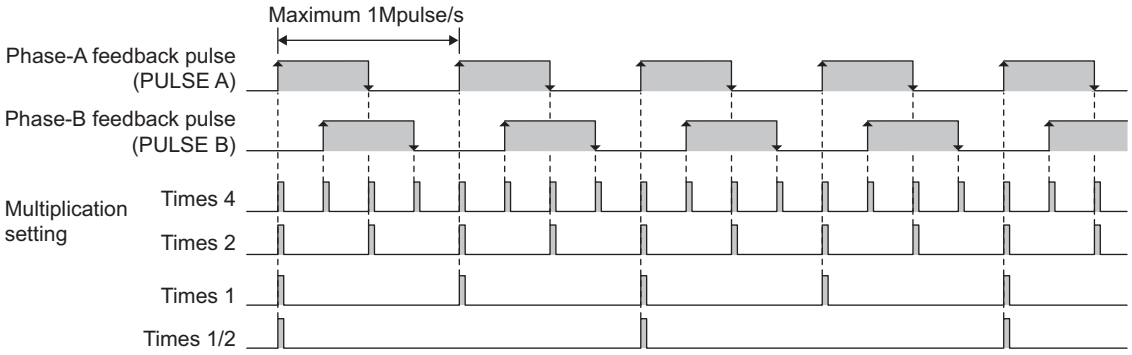
If accumulated pulse amount exceeds an upper limit value (values marked * in Page 103, Section 6.2.2 (1) (b)), an excessive error occurs and the following conditions occur in the system.

- Excessive error signal (X17): ON
- Analog output voltage: 0V
- Accumulated pulses: Reset to 0
- Servo ON signal (SVON): OFF

To reset an excessive error, turn off and on PLC READY signal (Y2D).

6.2.3 Multiplication setting

Set the multiplication rate of feedback pulses from the pulse generator (PLG).
This setting multiplies the feedback pulse count by 4, 2, 1, or 1/2. Use this setting to change movement amount per pulse by 1/4, 1/2, 1, or 2.



6.2.4 OPR direction setting

Set the direction in which OPR is executed.
For OPR control, refer to the following.
☞Page 178, CHAPTER 8

Important
OPR (Original Point Return) is controlled by two kinds of data: OPR direction and OPR speed. Deceleration starts when the near-point dog turns on. If an incorrect OPR direction is set, motion control may continue without deceleration. To prevent machine damage caused by this, configure an interlock circuit external to the programmable controller.

6.2.5 OPR method setting

Select an OPR method.
For OPR control, refer to the following.
☞Page 178, CHAPTER 8

6.2.6 Encoder I/F setting

Select an encoder output type from open collector, TTL, or differential output.

For connection between the QD73A1 and an encoder, refer to the following.

☞Page 66, Section 4.6.2

6.2.7 Analog voltage resolution setting

Set resolution of analog voltage to be output as a speed command.

Point

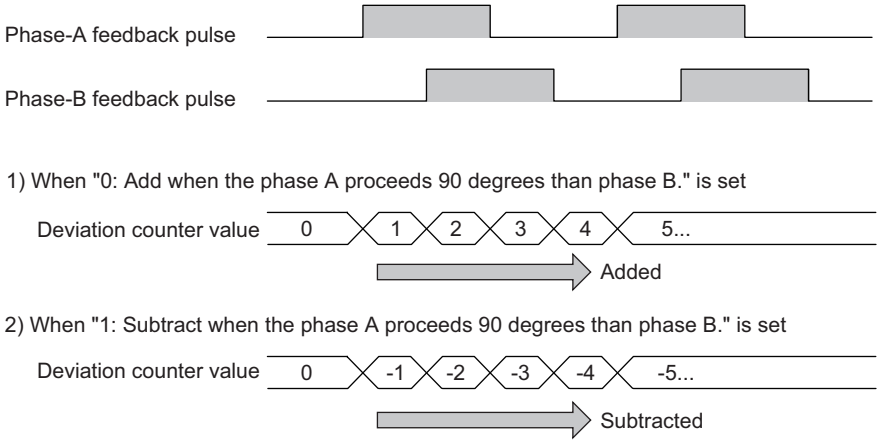
The default value of "Analog voltage resolution setting" is "12-bit resolution". When the analog voltage resolution of the connected drive unit is higher than 12 bits and the motor rotates even with a tiny voltage, the resolution can be set higher (14 bits or 16 bits). In that way, fine control can be achieved.

6.2.8 Feedback pulse addition/subtraction setting

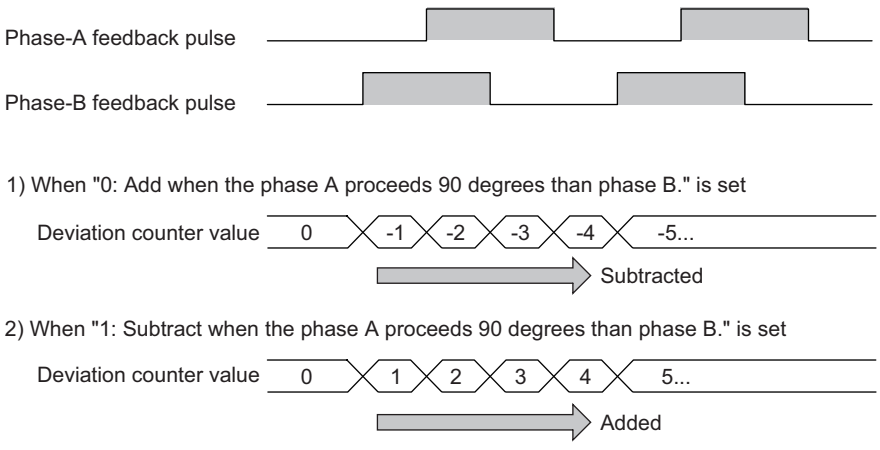
Set whether to add or subtract the feedback pulses to/from the deviation counter when the phase A of feedback pulse proceeds 90 degrees than phase B.
This setting becomes enabled only when "1: Negative voltage is output when the positioning address increases." is set for "Rotation direction setting" in the switch setting. If "0: Positive voltage is output when the positioning address increases." is set, the setting value of "Feed back pulse addition/subtraction setting" is ignored.
For the connection between the QD73A1 and the encoder, refer to the following.
☞Page 66, Section 4.6.2

When the feedback pulses are input, the feedback pulses are added or subtracted to/from the deviation counter (when "Multiplication setting" is 4).

(1) When a feedback pulse whose phase A is ahead of phase B by 90° is input



(2) When a feedback pulse whose phase B is ahead of phase A by 90° is input

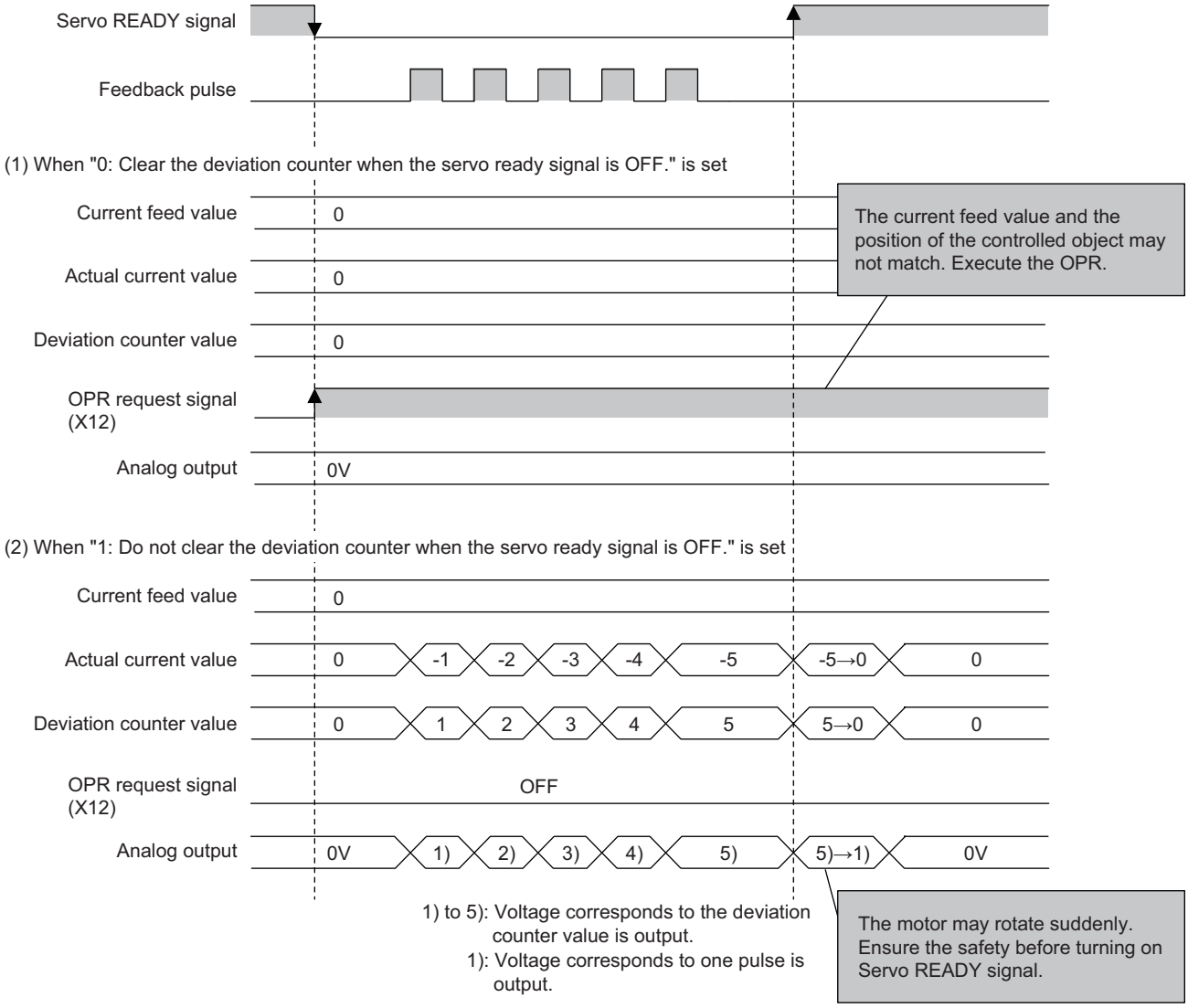


6.2.9 Deviation counter clear setting

Set whether to clear the deviation counter when Servo READY signal turns off.

If "0: Clear the deviation counter when the servo ready signal is OFF." is set, the deviation counter is cleared and OPR request signal turns on when Servo READY signal turns off. After Servo READY signal is turned on, execute OPR before executing the positioning control.

If "1: Do not clear the deviation counter when the servo ready signal is OFF." is set, the deviation counter is not cleared when Servo READY signal turns off. OPR request signal does not turn on as well. When turning on Servo READY signal after that, ensure the system safety in advance because turning on the signal may cause a sudden rotation of the motor.



6.3 Parameter Setting

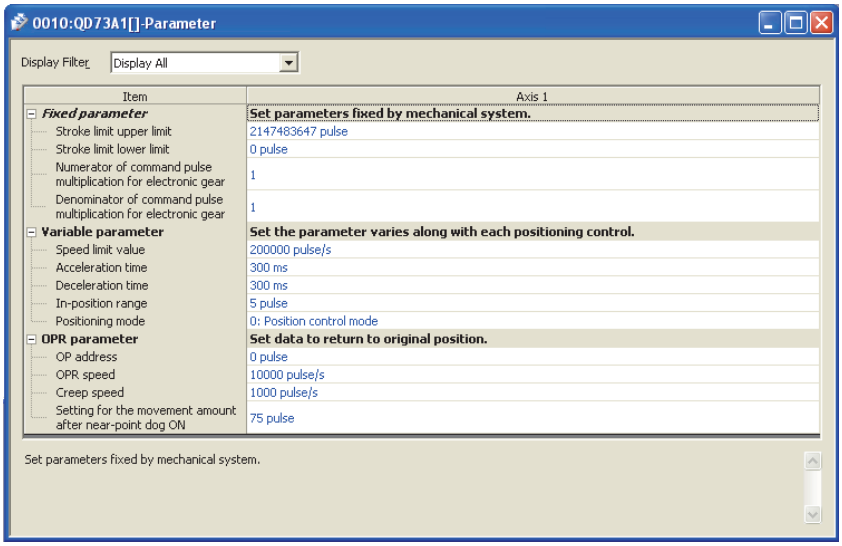
Set positioning parameters and OPR parameters.
Setting parameters on the screen omits the parameter setting in a sequence program.

(1) Setting method

Open the "Parameter" window.

1. Start "Parameter" in the project window.

Project window⇨[Intelligent Function Module]⇨Module name⇨[Parameter]



2. Double-click the item to change the setting, and input the setting value.

- Items to input from the pull-down list
  For "Positioning mode", double-click the item to display the pull-down list. Select an option.
- Items to input from the text box
  Double-click the item to set, and input the setting value.

For details on setting values, refer to the following.

Setting item		Default value	Reference
Fixed parameter	Stroke limit upper limit	2147483647 pulse	Page 76, Section 5.2 (1)
	Stroke limit lower limit	0 pulse	
	Numerator of command pulse multiplication for electronic gear	1	Page 77, Section 5.2 (2)
	Denominator of command pulse multiplication for electronic gear	1	
Variable parameter	Speed limit value	200000 pulse/s	Page 77, Section 5.2 (3)
	Acceleration time	300 ms	Page 78, Section 5.2 (4)
	Deceleration time	300 ms	
	In-position range	5 pulse	Page 78, Section 5.2 (5)
	Positioning mode	0: Position control mode	Page 78, Section 5.2 (6)
OPR parameter	OP address	0 pulse	Page 79, Section 5.3 (1)
	OPR speed	10000 pulse/s	Page 79, Section 5.3 (2)
	Creep speed	1000 pulse/s	Page 80, Section 5.3 (3)
	Setting for the movement amount after near-point dog ON	75 pulse	Page 81, Section 5.3 (4)

6.4 Positioning Data Setting

Set positioning data.

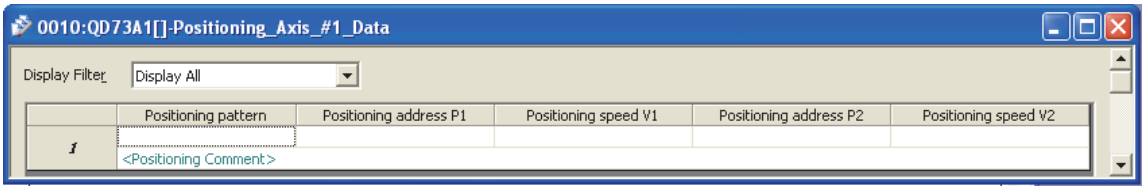
Setting positioning data on the screen omits the positioning data setting in a sequence program.

(1) Setting method

Open the "Positioning_Axis_#1_Data" window.

1. Start "Positioning_Axis_#1_Data" in the project window.

Project window⇨[Intelligent Function Module]⇨Module name⇨[Positioning_Axis_#1_Data]



2. Double-click "Positioning pattern", and set a positioning pattern.

3. Double -click items other than "Positioning pattern", and input setting values.

For details on setting values, refer to the following.

Setting item	Default value	Reference
Positioning pattern	None (empty)	Page 82, Section 5.4 (1)
Positioning address P1		Page 83, Section 5.4 (2)
Positioning speed V1		Page 84, Section 5.4 (3)
Positioning address P2		Page 84, Section 5.4 (4)
Positioning speed V2		Page 84, Section 5.4 (5)

6.5 Auto Refresh

This function transfers data in the buffer memory to specified devices.
The auto refresh setting omits data reading/writing through a program.

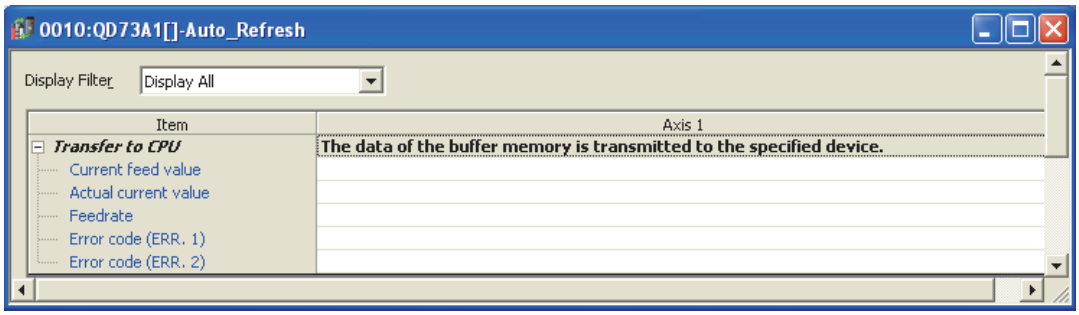
(1) Setting method

Open the "Auto_Refresh" window.

1. Start "Auto_Refresh" in the project window.

Project window⇨[Intelligent Function Module]⇨Module name ⇨[Auto_Refresh]

2. Click the item to set, and input the destination device for auto refresh.



CHAPTER 7 PROGRAMMING

This chapter describes sequence programs of the QD73A1.
When applying the program examples introduced in this chapter to the actual system, ensure the applicability and confirm that they will not cause system control problems.

7.1 Precautions on Programming

(1) At power-on and operation start

At a power-on or operation start, execute OPR to confirm the original point (OP). When an OPR request is issued, take the OPR into consideration.

(2) Near-point dog signal

Use a high-performance near-point dog signal. If Near-point dog signal is not input upon OPR, the workpiece continues to move at the OPR speed.

(3) Measures against an overrun

By setting a stroke limit upper limit and lower limit of the QD73A1, an overrun can be prevented.
Note that this is only when the QD73A1 is operating normally. Set limit switches "upper limit switch" and "lower limit switch" to ensure the safety of the entire system. It is recommended to establish an external circuit through which the motor's power turns off when a limit switch turns on.

(4) Stroke limit upper limit value/lower limit value

Check that proper values are set in "Pr.1 Stroke limit upper limit" and "Pr.2 Stroke limit lower limit".

(5) Emergency stop signal

Establish an emergency stop circuit outside the programmable controllers.

(6) When errors are checked in a sequence program

Turn off PLC READY signal (Y2D) at error detection.

(7) Pr.5 Speed limit value

Check that a proper value is set.

(8) Cd.3 JOG speed

Do not set a large value at the beginning; start operation at lower speed.

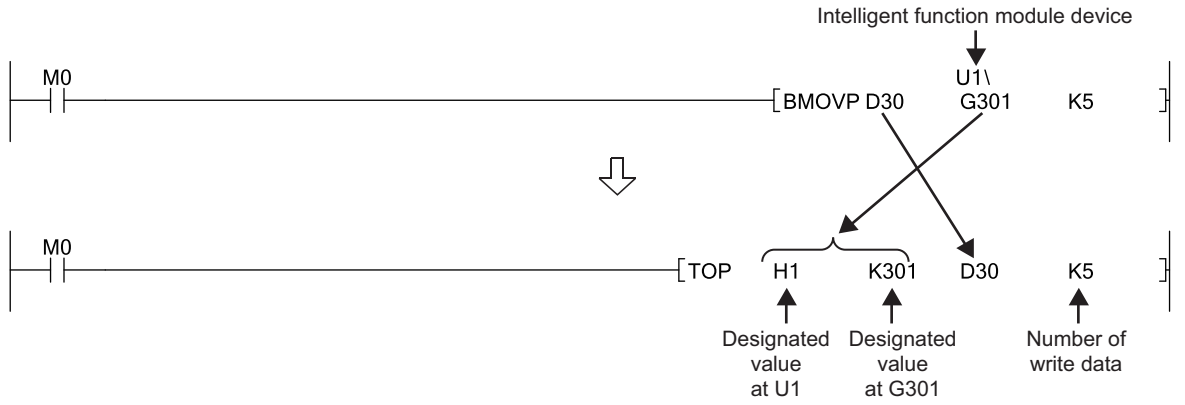
(9) Communication with the QD73A1

There are following ways of communication with the QD73A1 using a sequence program.

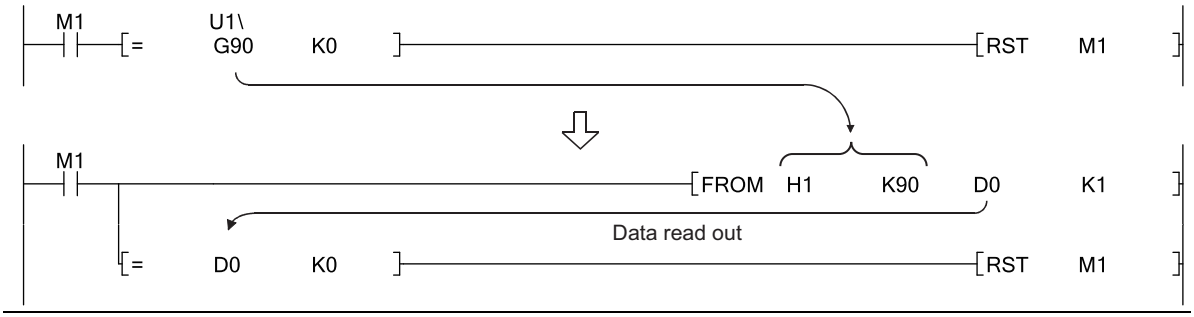
- Communication using intelligent function module devices
- Communication using the FROM/TO instruction

The sequence programs introduced in this chapter uses intelligent function module devices. When using the FROM/TO instruction, change the sequence program as shown below.

When an intelligent function module device is used as the destination side in a circuit using the BMOVP instruction, change the instruction to the TOP instruction.



When an intelligent function module device is used in a circuit using a comparison instruction, change the instruction to the FROM instruction and a comparison instruction.



For intelligent function module devices, refer to the following.

The user's manual (Function Explanation, Program Fundamentals) for the CPU module used.

For details on the instructions used in programs in this chapter, refer to the following.

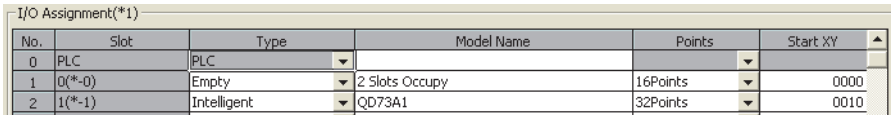
MELSEC-Q/L Programming Manual (Common Instruction)

(10)I/O number assignment for the QD73A1

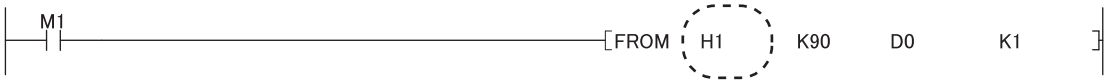
The QD73A1 occupies 48 I/O points of 2 slots.

(a) Default I/O number assignment

Set the first half to "Empty 16 points" and the second half to "Intelligent 32 points" in GX Works2.

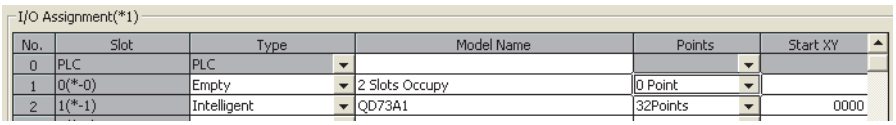


When executing the FROM/TO instruction on the QD73A1, use the I/O number assigned to the second half (slot) of the QD73A1.



(b) When the first half (slot) is "Empty 0 point"

At the I/O assignment in GX Works2, the 16 points in the first half can be saved by setting the first half to "Empty 0 point".



When executing the FROM/TO instruction on the QD73A1, use the I/O number assigned to the second half (slot) of the QD73A1.

7.2 Programs for Positioning

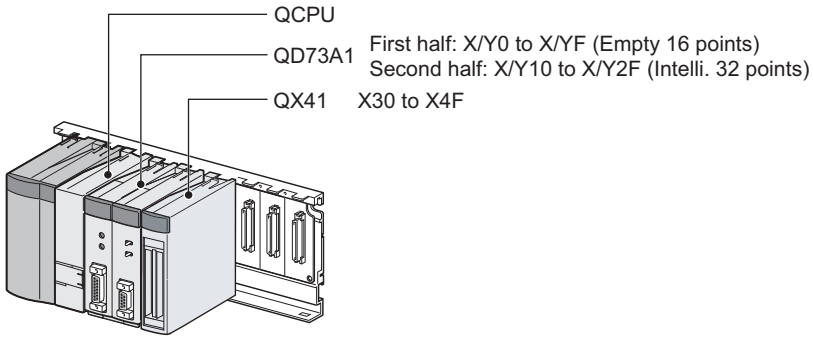
Follow the procedure below when creating programs that execute positioning using the QD73A1.

Procedure	Program	Reference
1	Parameter setting Create a program for parameter setting.	Page 117, Section 7.3.1 Page 149, Section 7.4.1
2	OPR Create a program for one of the following. • Near-point dog method • Count method	Page 119, Section 7.3.2 Page 151, Section 7.4.2
3	Start program Create programs for the following depending on the control to be executed. • Positioning control • Two-phase trapezoidal positioning control • Speed-position control switch mode • Speed control operation • Fixed-feed operation • JOG operation	Page 125, Section 7.3.3 Page 133, Section 7.3.4 Page 135, Section 7.3.5 Page 157, Section 7.4.3 Page 167, Section 7.4.4 Page 170, Section 7.4.5
4	Sub program Create programs for the following depending on the control to be executed. • Current value change • Speed change • Deviation counter clear	Page 137, Section 7.3.6 Page 172, Section 7.4.6
5	Stop program Create a program for stopping control.	Page 141, Section 7.3.7 Page 177, Section 7.4.7

7.3 When Using the Module in a Standard System Configuration

This section introduces program examples where the following system configuration applies.

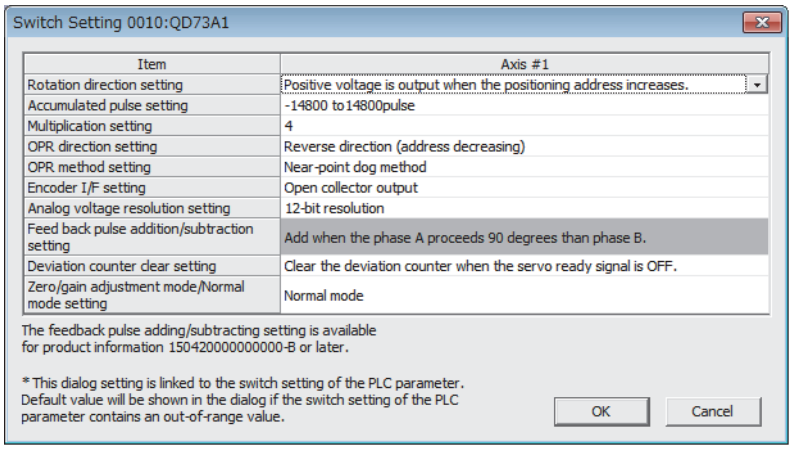
(1) System configuration



(2) Switch setting

Configure the switch setting as follows.

Project window⇨[Intelligent Function Module]⇨[QD73A1]⇨[Switch Setting]

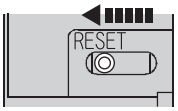


Item	Setting value
Rotation direction setting	Set this item according to the system to be used.
Accumulated pulse setting	Set this item according to the system to be used.
Multiplication setting	Set this item according to the system to be used.
OPR direction setting	Set this item according to the system to be used.
OPR method setting	Set the near-point dog method or the count method.
Encoder I/F setting	Set this item according to the system to be used.
Analog voltage resolution setting	Set this item according to the system to be used.
Feed back pulse addition/subtraction setting	Set this item according to the system to be used.
Deviation counter clear setting	Set this item according to the system to be used.
Zero/gain adjustment mode/Normal mode setting	Set "Normal mode".

(3) Writing parameters

Write the set parameters to the CPU module, then reset the CPU module or turn off and on the power supply of the programmable controller.

[Online]⇨[Write to PLC...]



or Power off → on

(4) I/O signals of the QD73A1

Refer to Page 30, Section 3.4.1. I/O signals used in program examples are assigned as in the list on Page 30, Section 3.4.1.

(5) Program example

Refer to the following.

Program example	Reference
Parameter setting program	Page 117, Section 7.3.1
Near-point dog method OPR program	Page 119, Section 7.3.2 (1)
Count method OPR program	Page 122, Section 7.3.2 (2)
Positioning control program	Page 125, Section 7.3.3 (1)
Two-phase trapezoidal positioning control program	Page 127, Section 7.3.3 (2)
Speed-position control switch mode program	Page 129, Section 7.3.3 (3)
Speed control operation program	Page 131, Section 7.3.3 (4)
Fixed-feed operation program	Page 133, Section 7.3.4
JOG operation program	Page 135, Section 7.3.5
Current value change program	Page 137, Section 7.3.6 (1)
Speed change program	Page 138, Section 7.3.6 (2)
Deviation counter clearing program	Page 140, Section 7.3.6 (3)
Stop program during positioning	Page 141, Section 7.3.7

7.3.1 Parameter setting program

This program sets fixed parameters and variable parameters.

Point

Parameters described in this section can be set through GX Works2 also. (Page 108, Section 6.3)
The sequence program in this section is unnecessary when the parameters were set through GX Works2.

(1) Program detail

- The following fixed parameters are set once the CPU module is in the RUN status.

Item	Setting detail
Pr.1 Stroke limit upper limit	20000000pulse
Pr.2 Stroke limit lower limit	0pulse
Pr.3 Numerator of command pulse multiplication for electronic gear	1
Pr.4 Denominator of command pulse multiplication for electronic gear	1

- As X30 is turned on, the following variable parameters are set.

Item	Setting detail
Pr.5 Speed limit value	30000pulse
Pr.6 Acceleration time	400ms
Pr.7 Deceleration time	250ms
Pr.8 In-position range	10pulse
Pr.9 Positioning mode	0: Position control mode

(2) Execution condition

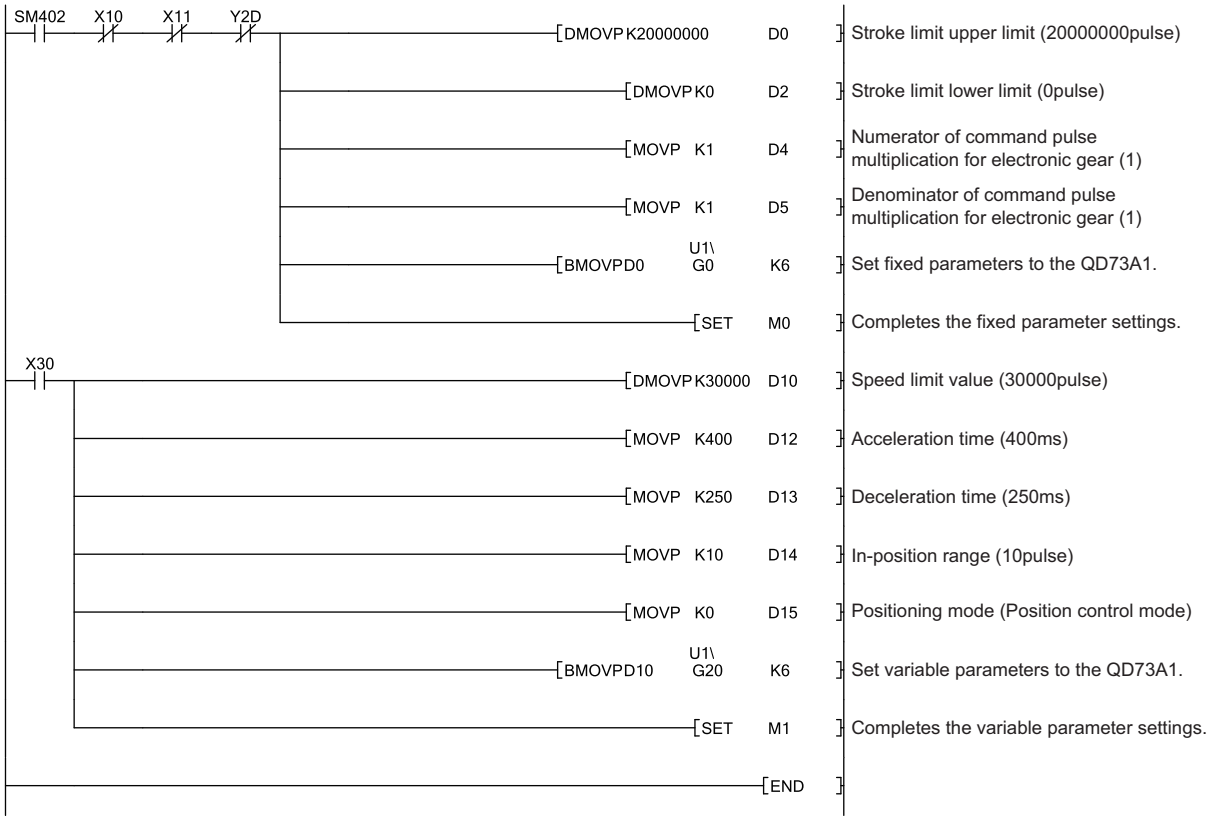
Check item		Condition
I/O signal	WDT error, H/W error signal (X10)	OFF
	QD73A1 READY signal (X11)	OFF
	PLC READY signal (Y2D)	OFF

(3) Device used by the user

Device	Description
X30	Variable parameter setting command
D0	Stroke limit upper limit (lower 16 bits)
D1	Stroke limit upper limit (upper 16 bits)
D2	Stroke limit lower limit (lower 16 bits)
D3	Stroke limit lower limit (upper 16 bits)
D4	Numerator of command pulse multiplication for electronic gear
D5	Denominator of command pulse multiplication for electronic gear
D10	Speed limit value (lower 16 bits)
D11	Speed limit value (upper 16 bits)

Device	Description
D12	Acceleration time
D13	Deceleration time
D14	In-position range
D15	Positioning mode
M0	Fixed parameter setting memory
M1	Variable parameter setting memory
SM402	Turns on for one scan once the CPU module is in the RUN status

(4) Program example



7.3.2 OPR program

Programs in this section execute OPR in the near-point dog method or the count method.

(1) Near-point dog method OPR program

This program executes OPR in the near-point dog method. Suppose that fixed parameters and variable parameters are already set. (☞ Page 117, Section 7.3.1)

(a) Program detail

- The following OPR parameters are written once the CPU module is in the RUN status, and PLC READY signal (Y2D) turns on.

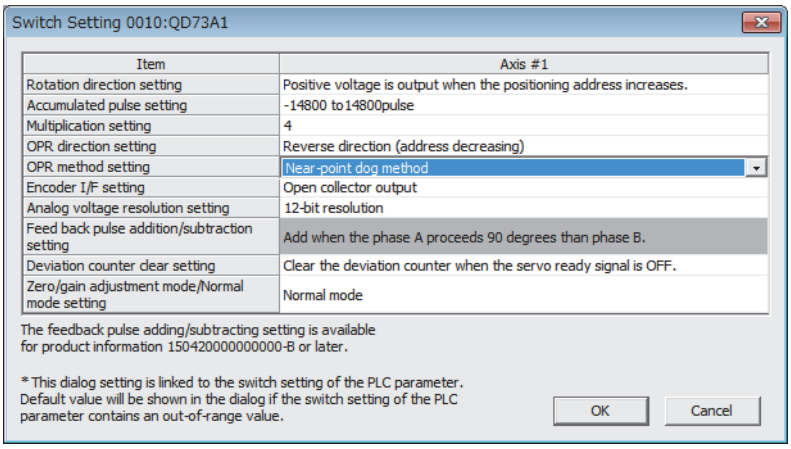
Item	Setting detail
Pr.10 OP address	100pulse
Pr.11 OPR speed	5000pulse/s
Pr.12 Creep speed	500pulse/s

- As X31 is turned on after PLC READY signal (Y2D) turned on, the module executes OPR.

(b) Switch setting

Before executing the program, set "Near-point dog method" to "OPR method setting".

Project window⇨[Intelligent Function Module]⇨[QD73A1]⇨[Switch Setting]



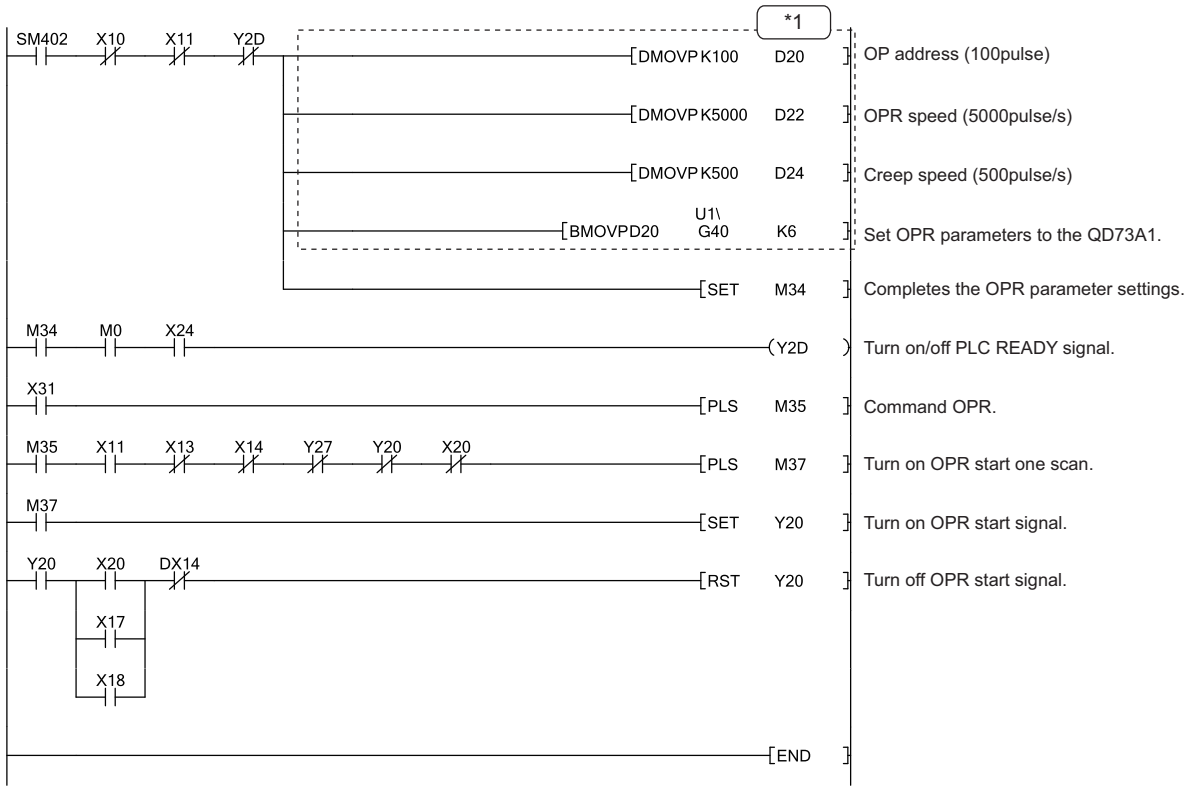
(c) Execution condition

Check item		Condition
External I/O signal	Servo READY signal (READY)	ON
	Stop signal (STOP)	OFF
	Upper limit signal (FLS)	ON
	Lower limit signal (RLS)	ON
	Near-point dog signal (DOG)	OFF
I/O signal	WDT error, H/W error signal (X10)	OFF
	QD73A1 READY signal (X11)	OFF
	OPR complete signal (X13)	OFF
	BUSY signal (X14)	OFF
	Excessive error signal (X17)	OFF
	Error detection signal (X18)	OFF
	OPR start complete signal (X20)	OFF
	Synchronization flag (X24)	ON
	OPR start signal (Y20)	OFF
	Stop signal (Y27)	OFF
	PLC READY signal (Y2D)	OFF
Buffer memory	OPR parameters	No error

(d) Device used by the user

Device	Description
X31	OPR command
D20	OP address (lower 16 bits)
D21	OP address (upper 16 bits)
D22	OPR speed (lower 16 bits)
D23	OPR speed (upper 16 bits)
D24	Creep speed (lower 16 bits)
D25	Creep speed (upper 16 bits)
M0	Fixed parameter setting memory
M34	OPR parameter setting memory
M35	OPR request
M37	OPR command pulse
SM402	Turns on for one scan once the CPU module is in the RUN status

(e) Program example



*1 OPR parameters can be set through GX Works2 also. (☞ Page 108, Section 6.3)
The sequence program that sets OPR parameters is unnecessary when the parameters were set through GX Works2.

(2) Count method OPR program

This program executes OPR in the count method. Suppose that fixed parameters and variable parameters are already set. (Page 117, Section 7.3.1)

(a) Program detail

- The following OPR parameters are written once the CPU module is in the RUN status, and PLC READY signal (Y2D) turns on.

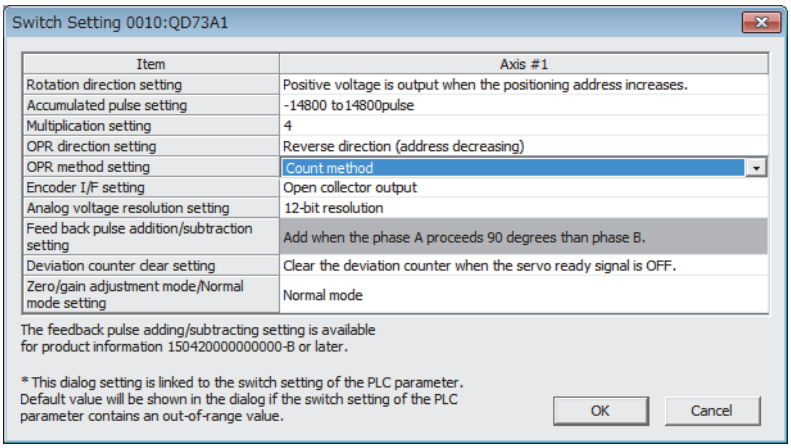
Item	Setting detail
Pr.10 OP address	100pulse
Pr.11 OPR speed	5000pulse/s
Pr.12 Creep speed	500pulse/s
Pr.13 Setting for the movement amount after near-point dog ON	2000pulse

- As X31 is turned on after PLC READY signal (Y2D) turned on, the module executes OPR.

(b) Switch setting

Before executing the program, set "Count method" to "OPR method setting".

Project window⇨[Intelligent Function Module]⇨[QD73A1]⇨[Switch Setting]



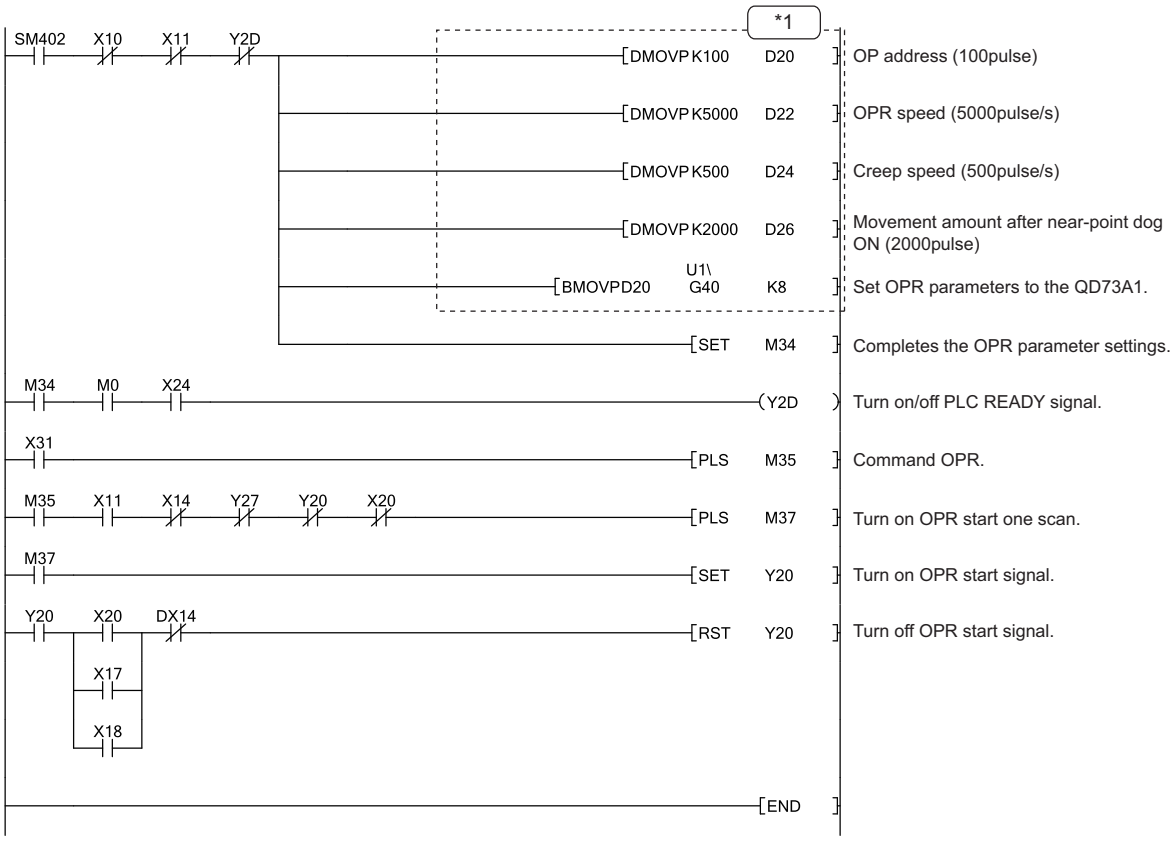
(c) Execution condition

Check item		Condition
External I/O signal	Servo READY signal (READY)	ON
	Stop signal (STOP)	OFF
	Upper limit signal (FLS)	ON
	Lower limit signal (RLS)	ON
I/O signal	WDT error, H/W error signal (X10)	OFF
	QD73A1 READY signal (X11)	OFF
	BUSY signal (X14)	OFF
	Excessive error signal (X17)	OFF
	Error detection signal (X18)	OFF
	OPR start complete signal (X20)	OFF
	Synchronization flag (X24)	ON
	OPR start signal (Y20)	OFF
	Stop signal (Y27)	OFF
	PLC READY signal (Y2D)	OFF
Buffer memory	OPR parameters	No error

(d) Device used by the user

Device	Description
X31	OPR command
D20	OP address (lower 16 bits)
D21	OP address (upper 16 bits)
D22	OPR speed (lower 16 bits)
D23	OPR speed (upper 16 bits)
D24	Creep speed (lower 16 bits)
D25	Creep speed (upper 16 bits)
D26	Movement amount after near-point dog ON (lower 16 bits)
D27	Movement amount after near-point dog ON (upper 16 bits)
M0	Fixed parameter setting memory
M34	OPR parameter setting memory
M35	OPR request
M37	OPR command pulse
SM402	Turns on for one scan once the CPU module is in the RUN status

(e) Program example



*1 OPR parameters can be set through GX Works2 also. (☞ Page 108, Section 6.3)
The sequence program that sets OPR parameters is unnecessary when the parameters were set through GX Works2.

7.3.3 Major positioning control program

Programs in this section execute major positioning control.

(1) Positioning control program

This program executes positioning control in the absolute system. Suppose that the parameter setting and OPR were completed. (☞Page 117, Section 7.3.1, Page 119, Section 7.3.2)

(a) Program detail

- As X33 is turned on, the following positioning data are written.

Item	Setting detail
Da.1 Positioning pattern	0: Positioning control
Da.2 Positioning address P1	100000pulse
Da.3 Positioning speed V1	10000pulse/s

- As X34 is turned on, the module executes positioning control in the absolute system.

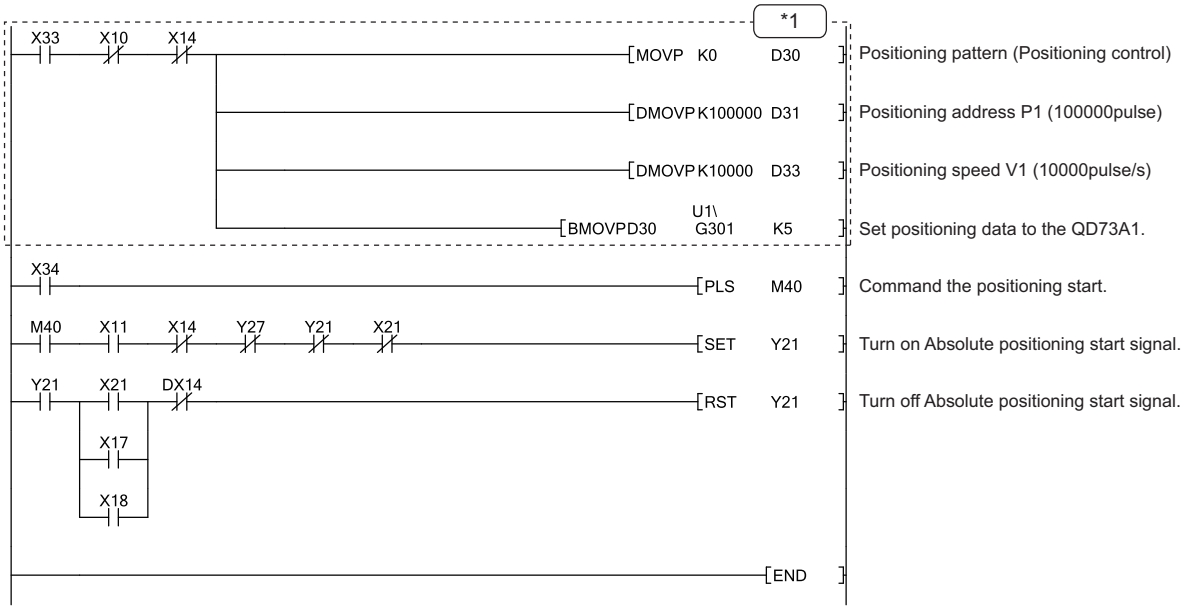
(b) Execution condition

Check item		Condition	Note
External I/O signal	Servo READY signal (READY)	ON	—
	Stop signal (STOP)	OFF	
	Upper limit signal (FLS)	ON	
	Lower limit signal (RLS)	ON	
I/O signal	WDT error, H/W error signal (X10)	OFF	—
	QD73A1 READY signal (X11)	ON	
	BUSY signal (X14)	OFF	
	Excessive error signal (X17)	OFF	
	Error detection signal (X18)	OFF	
	Absolute positioning start complete signal (X21)	OFF	
	Synchronization flag (X24)	ON	
	Absolute positioning start signal (Y21)	OFF	
	Stop signal (Y27)	OFF	
	PLC READY signal (Y2D)	ON	
Buffer memory	Positioning data	No error	When the positioning speed is set exceeding "Pr.5 Speed limit value", the positioning is executed at "Pr.5 Speed limit value".

(c) Device used by the user

Device	Description
X33	Positioning data write command
X34	Positioning start command
D30	Positioning pattern
D31	Positioning address P1 (lower 16 bits)
D32	Positioning address P1 (upper 16 bits)
D33	Positioning speed V1 (lower 16 bits)
D34	Positioning speed V1 (upper 16 bits)
M40	Positioning start command pulse

(d) Program example



*1 Positioning data can be set through GX Works2 also. (☞ Page 109, Section 6.4)
The sequence program that sets positioning data is unnecessary when the data were set through GX Works2.

(2) Two-phase trapezoidal positioning control program

This program executes two-phase trapezoidal positioning control in the absolute system. Suppose that the parameter setting and OPR were completed. (☞Page 117, Section 7.3.1, Page 119, Section 7.3.2)

(a) Program detail

- As X35 is turned on, the following positioning data are written.

Item	Setting detail
Da.1 Positioning pattern	1: Two-phase trapezoidal positioning control
Da.2 Positioning address P1	100000pulse
Da.3 Positioning speed V1	10000pulse/s
Da.4 Positioning address P2	150000pulse
Da.5 Positioning speed V2	12000pulse/s

- As X36 is turned on, the module executes two-phase trapezoidal positioning control in the absolute system.

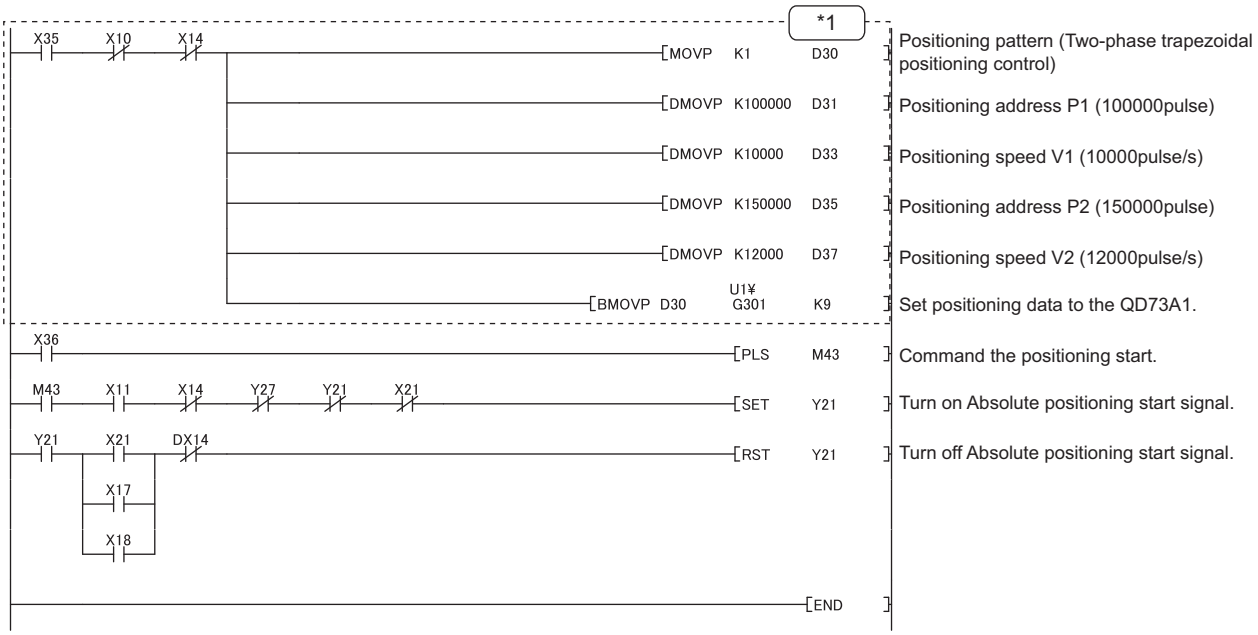
(b) Execution condition

The execution condition is the same as that of positioning control program. (☞Page 125, Section 7.3.3 (1) (b))

(c) Device used by the user

Device	Description
X35	Positioning data write command
X36	Two-phase trapezoidal positioning control start command
D30	Positioning pattern
D31	Positioning address P1 (lower 16 bits)
D32	Positioning address P1 (upper 16 bits)
D33	Positioning speed V1 (lower 16 bits)
D34	Positioning speed V1 (upper 16 bits)
D35	Positioning address P2 (lower 16 bits)
D36	Positioning address P2 (upper 16 bits)
D37	Positioning speed V2 (lower 16 bits)
D38	Positioning speed V2 (upper 16 bits)
M43	Two-phase trapezoidal positioning control start command pulse

(d) Program example



*1 Positioning data can be set through GX Works2 also. (☞ Page 109, Section 6.4)
The sequence program that sets positioning data is unnecessary when the data were set through GX Works2.

(3) Speed-position control switch mode program

This program switches the positioning mode to the "speed-position control switch mode". Suppose that the parameter setting and OPR were completed. (☞Page 117, Section 7.3.1, Page 119, Section 7.3.2)

(a) Program detail

- As X37 is turned on, the positioning mode is set to "speed-position control switch mode".
- As X38 is turned on, the following positioning data are written.

Item	Setting detail
Da.2 Positioning address P1	5000pulse
Da.3 Positioning speed V1	1000pulse/s

- As X39 is turned on, the module starts speed control. The module switches the operation to position control following an external control switch command.
- As X3B is turned on, the module restarts operation in case that the operation was stopped following a stop signal input.

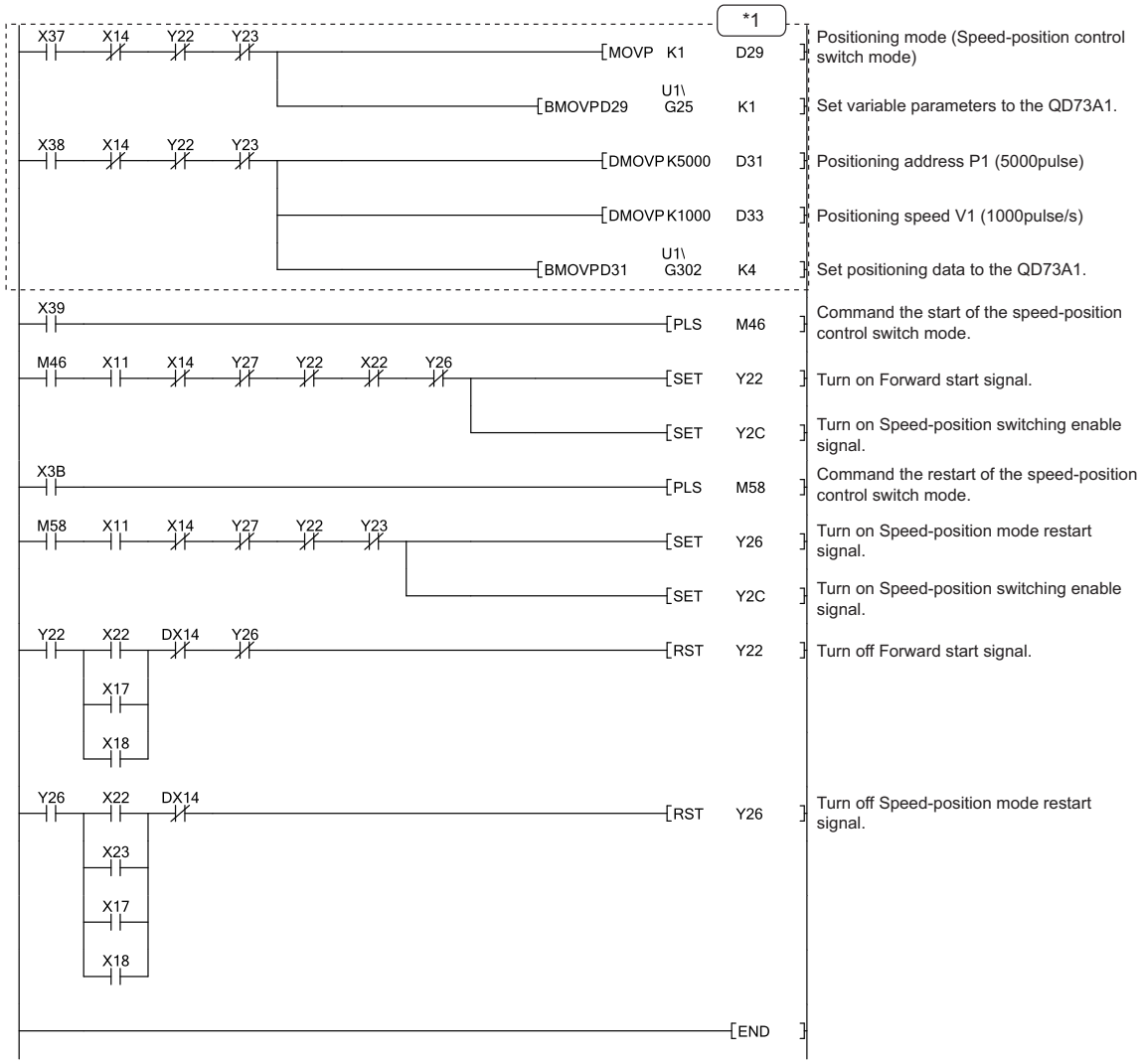
(b) Execution condition

Check item		Condition	Note
External I/O signal	Servo READY signal (READY)	ON	—
	Stop signal (STOP)	OFF	
	Upper limit signal (FLS)	ON	
	Lower limit signal (RLS)	ON	
I/O signal	QD73A1 READY signal (X11)	ON	—
	BUSY signal (X14)	OFF	
	Excessive error signal (X17)	OFF	
	Error detection signal (X18)	OFF	
	Forward start complete signal (X22)	OFF	
	Synchronization flag (X24)	ON	
	Forward start signal (Y22)	OFF	
	Reverse start signal (Y23)	OFF	
	Speed-position mode restart signal (Y26)	OFF	
	Stop signal (Y27)	OFF	
	Speed-position switching enable signal (Y2C)	OFF	
	PLC READY signal (Y2D)	ON	
Buffer memory	Positioning data	No error	When the positioning speed is set exceeding " Pr.5 Speed limit value", the positioning is executed at " Pr.5 Speed limit value".

(c) Device used by the user

Device	Description
X37	Variable parameter change command
X38	Positioning data write command
X39	Speed-position control positioning start command
X3B	Speed-position control positioning restart command
D29	Positioning mode
D31	Positioning address P1 (lower 16 bits)
D32	Positioning address P1 (upper 16 bits)
D33	Positioning speed V1 (lower 16 bits)
D34	Positioning speed V1 (upper 16 bits)
M46	Speed-position control positioning start command pulse
M58	Speed-position control positioning restart command pulse

(d) Program example



*1 Variable parameters and positioning data can be set through GX Works2 also. (Page 108, Section 6.3, Page 109, Section 6.4)
The sequence program that sets variable parameters and positioning data is unnecessary when the data were set through GX Works2.

(4) Speed control operation program

This program executes speed control using the speed control function of the speed-position control switch mode. Suppose that parameters are already set. (☞Page 117, Section 7.3.1)

(a) Program detail

- As X3C is turned on, the positioning mode is set to "speed-position control switch mode".
- As X3D is turned on, the following positioning data is written.

Item	Setting detail
Da.3 Positioning speed V1	1000pulse/s

- As X3E is turned on, the module starts speed control of forward run. As X3F is turned on, the module starts speed control of reverse run.

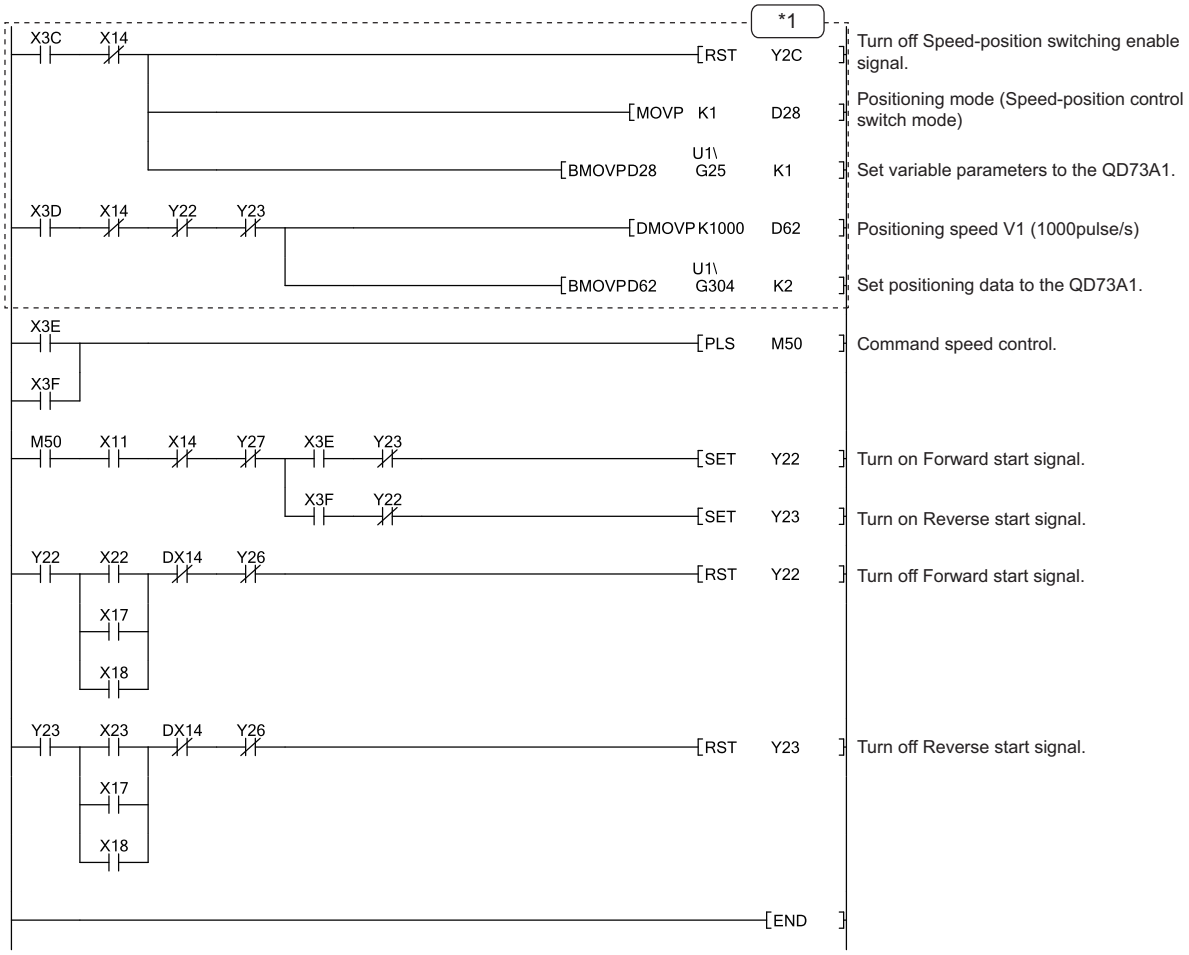
(b) Execution condition

Check item		Condition	Note
External I/O signal	Servo READY signal (READY)	ON	—
	Stop signal (STOP)	OFF	
	Upper limit signal (FLS)	ON	
	Lower limit signal (RLS)	ON	
I/O signal	QD73A1 READY signal (X11)	ON	—
	BUSY signal (X14)	OFF	
	Excessive error signal (X17)	OFF	
	Error detection signal (X18)	OFF	
	Forward start complete signal (X22)	OFF	
	Reverse start complete signal (X23)	OFF	
	Synchronization flag (X24)	ON	
	Forward start signal (Y22)	OFF	
	Reverse start signal (Y23)	OFF	
	Speed-position mode restart signal (Y26)	OFF	
	Stop signal (Y27)	OFF	
	Speed-position switching enable signal (Y2C)	OFF	
	PLC READY signal (Y2D)	ON	
Buffer memory	Positioning data	No error	When the positioning speed is set exceeding " Pr.5 Speed limit value", the positioning is executed at " Pr.5 Speed limit value".

(c) Device used by the user

Device	Description
X3C	Speed control operation change command
X3D	Positioning data write command
X3E	Forward run command
X3F	Reverse run command
D28	Positioning mode
D62	Positioning speed V1 (lower 16 bits)
D63	Positioning speed V1 (upper 16 bits)
M50	Speed control command pulse

(d) Program example



*1 Variable parameters and positioning data can be set through GX Works2 also. (Page 108, Section 6.3, Page 109, Section 6.4)
The sequence program that sets variable parameters and positioning data is unnecessary when the data were set through GX Works2.

7.3.4 Fixed-feed operation program

This program executes positioning in the address increasing direction according to the specified movement amount and speed. Execute fixed-feed operation by turning on Fixed-feed start command repeatedly. Use the current value change function and positioning start in the absolute system. Suppose that parameter setting and OPR were completed. (☞Page 117, Section 7.3.1, Page 119, Section 7.3.2)

(1) Program detail

- As X40 is turned on, the following positioning data are written.

Item	Setting detail
Da.2 Positioning address P1	20000pulse
Da.3 Positioning speed V1	1000pulse/s

- As X41 is turned on, the module starts fixed-feed operation.

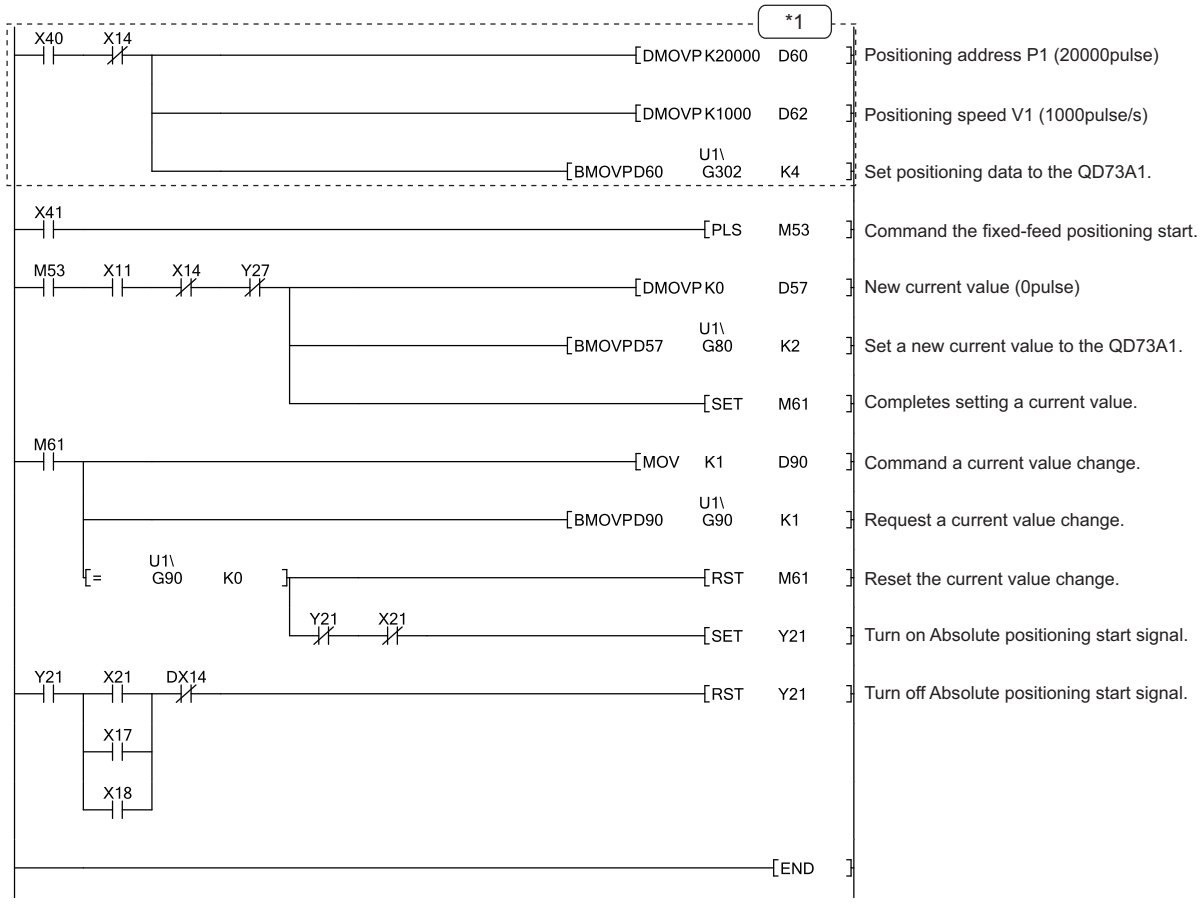
(2) Execution condition

Check item		Condition	Note
External I/O signal	Servo READY signal (READY)	ON	—
	Stop signal (STOP)	OFF	
	Upper limit signal (FLS)	ON	
	Lower limit signal (RLS)	ON	
I/O signal	QD73A1 READY signal (X11)	ON	—
	BUSY signal (X14)	OFF	
	Excessive error signal (X17)	OFF	
	Error detection signal (X18)	OFF	
	Absolute positioning start complete signal (X21)	OFF	
	Synchronization flag (X24)	ON	
	Absolute positioning start signal (Y21)	OFF	
	Stop signal (Y27)	OFF	
	PLC READY signal (Y2D)	ON	
Buffer memory	Positioning data	No error	When the positioning speed is set exceeding " Pr.5 Speed limit value", the positioning is executed at " Pr.5 Speed limit value".

(3) Device used by the user

Device	Description
X40	Fixed-feed positioning data write command
X41	Fixed-feed start command
D57	New current value (lower 16 bits)
D58	New current value (upper 16 bits)
D60	Positioning address P1 (lower 16 bits)
D61	Positioning address P1 (upper 16 bits)
D62	Positioning speed V1 (lower 16 bits)
D63	Positioning speed V1 (upper 16 bits)
D90	Current value change request
M53	Fixed-feed positioning data write command pulse
M61	Current value change command

(4) Program example



*1 Positioning data can be set through GX Works2 also. (☞ Page 109, Section 6.4)
The sequence program that sets positioning data is unnecessary when the data were set through GX Works2.

7.3.5 JOG operation program

This program executes JOG operation while a JOG start command is on. Suppose that parameters are already set. (☞Page 117, Section 7.3.1)

(1) Program detail

- As X42 is turned on, JOG speed is written.

Item	Setting detail
Cd.3 JOG speed	10000pulse/s

- As X43 is turned on, the module executes forward JOG operation. As X44 is turned on, the module executes reverse JOG operation.

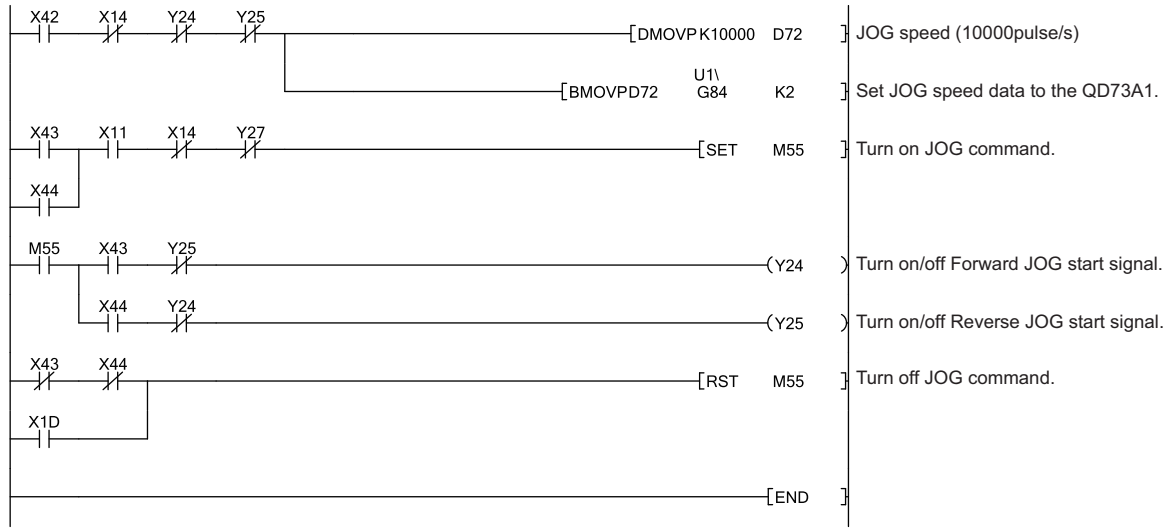
(2) Execution condition

Check item		Condition	Note
External I/O signal	Servo READY signal (READY)	ON	—
	Stop signal (STOP)	OFF	
	Upper limit signal (FLS)	ON	
	Lower limit signal (RLS)	ON	
I/O signal	QD73A1 READY signal (X11)	ON	—
	BUSY signal (X14)	OFF	
	External stop signal (X1D)	OFF	
	Synchronization flag (X24)	ON	
	Forward JOG start signal (Y24)	OFF	
	Reverse JOG start signal (Y25)	OFF	
	Stop signal (Y27)	OFF	
	PLC READY signal (Y2D)	ON	
Buffer memory	Cd.3 JOG speed	No error	When " Cd.3 JOG speed" is set exceeding " Pr.5 Speed limit value", the operation is executed at " Pr.5 Speed limit value".

(3) Device used by the user

Device	Description
X42	JOG speed write command
X43	Forward JOG command
X44	Reverse JOG command
D72	JOG speed (lower 16 bits)
D73	JOG speed (upper 16 bits)
M55	JOG command

(4) Program example



7.3.6 Control change program

(1) Current value change program

This program changes the current value to "0".

(a) Program detail

As X45 is turned on, the current value is changed.

Item	Setting detail
Cd.1 New current value	0pulse

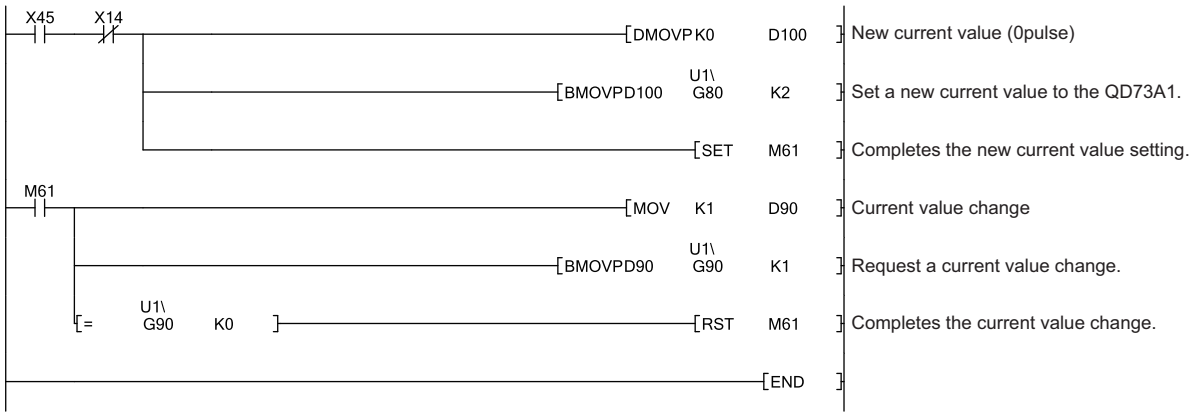
(b) Execution condition

Check item		Condition	Note
I/O signal	WDT error, H/W error signal (X10)	OFF	—
	BUSY signal (X14)	OFF	
	Error detection signal (X18)	OFF	
	Synchronization flag (X24)	ON	

(c) Device used by the user

Device	Description
X45	Current value change command
D100	New current value (lower 16 bits)
D101	New current value (upper 16 bits)
D90	Current value change request
M61	Current value change

(d) Program example



(2) Speed change program

This program changes positioning speed.

(a) Program detail

As X46 is turned on, positioning speed is changed.

Item	Setting detail
Cd.2 New speed value	50000pulse/s

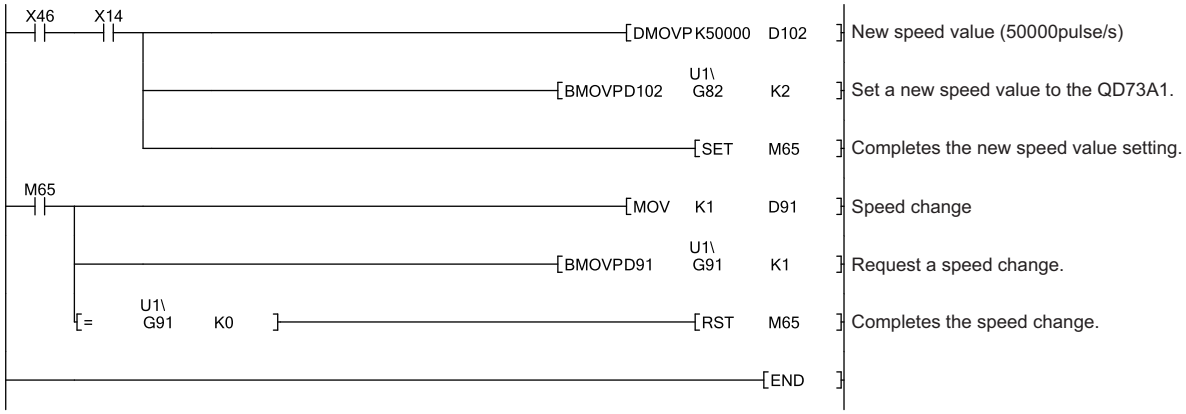
(b) Execution condition

Check item		Condition	Note
External I/O signal	Servo READY signal (READY)	ON	—
	Stop signal (STOP)	OFF	
	Upper limit signal (FLS)	ON	
	Lower limit signal (RLS)	ON	
I/O signal	WDT error, H/W error signal (X10)	OFF	—
	QD73A1 READY signal (X11)	ON	
	BUSY signal (X14)	ON	
	Excessive error signal (X17)	OFF	
	Error detection signal (X18)	OFF	
	Synchronization flag (X24)	ON	
	Stop signal (Y27)	OFF	
	PLC READY signal (Y2D)	ON	
Buffer memory	Cd.2 New speed value	No error	When " Cd.2 New speed value" is set exceeding " Pr.5 Speed limit value", the operation is executed at " Pr.5 Speed limit value".

(c) Device used by the user

Device	Description
X46	Speed change command
D102	New speed value (lower 16 bits)
D103	New speed value (upper 16 bits)
D91	Speed change request
M65	Speed change

(d) Program example



(3) Deviation counter clearing program

This program clears the deviation counter to 0.

(a) Program detail

As X47 is turned on, the deviation counter is cleared to 0.

Item	Setting detail
Cd.4 Deviation counter clear command	1: Clear the deviation counter

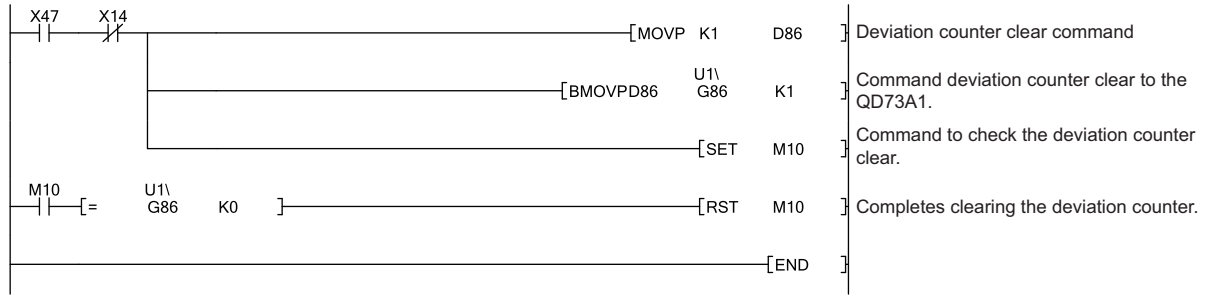
(b) Execution condition

Check item		Condition	Note
I/O signal	WDT error, H/W error signal (X10)	OFF	—
	BUSY signal (X14)	OFF	
	Error detection signal (X18)	OFF	
	Synchronization flag (X24)	ON	

(c) Device used by the user

Device	Description
X47	Deviation counter clear command
D86	Deviation counter clear request
M10	Deviation counter clearing completion check

(d) Program example



7.3.7 Stop program during positioning

This program stops the positioning in execution.

(a) Program detail

As X3A is turned on, the module stops the positioning in execution.

(b) Device used by the user

Device	Description
X3A	Stop command

(c) Program example

7.4 When Using the Module in a Remote I/O Network

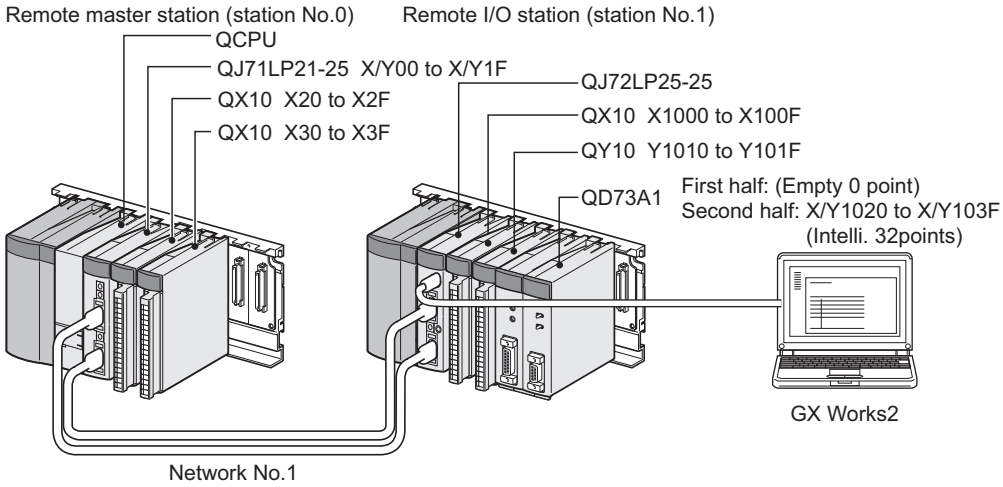
This section introduces program examples of when the QD73A1 is used in a MELSECNET/H remote I/O network.

Point

For details on a MELSECNET/H remote I/O network, refer to the following.

Q Corresponding MELSECNET/H Network System Reference Manual (Remote I/O network)

(1) System configuration

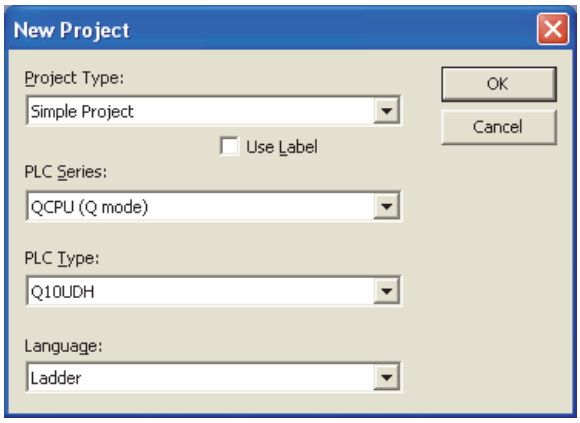


(2) Setting on the master station

1. Create a project on GX Works2.

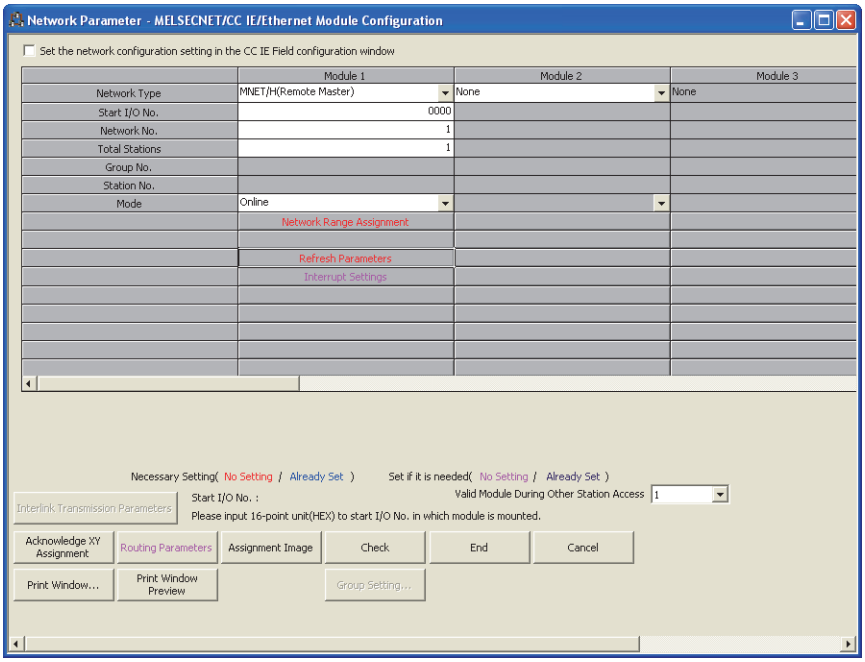
Select "QCPU (Q mode)" for "PLC Series", and select the CPU module used for "PLC Type".

[Project]⇨[New...]



2. Display the network parameter setting window, and configure the setting as follows.

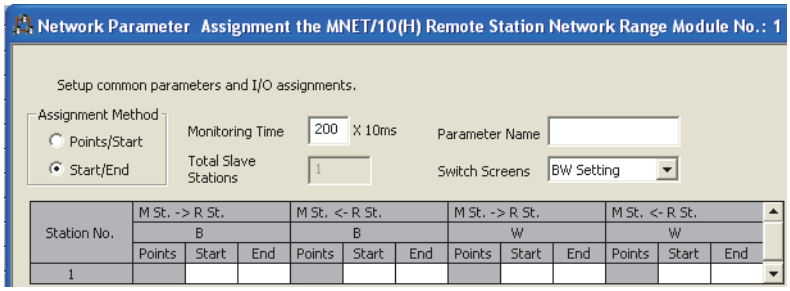
Project window⇨[Parameter]⇨[Network Parameter]
⇨[Ethernet/CC IE/MELSECNET]



3. **Display the network range assignment setting window, and configure the setting as follows.**

Project window➪[Parameter]➪[Network Parameter]

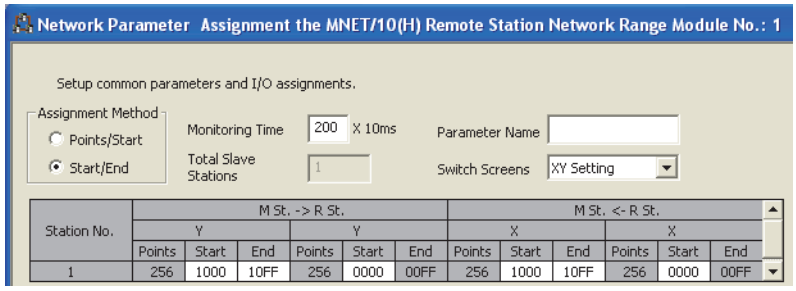
➪[Ethernet/CC IE/MELSECNET]➪ Network Range Assignment button



Project window➪[Parameter]➪[Network Parameter]

➪[Ethernet/CC IE/MELSECNET]➪ Network Range Assignment button➪"Switch Screens"

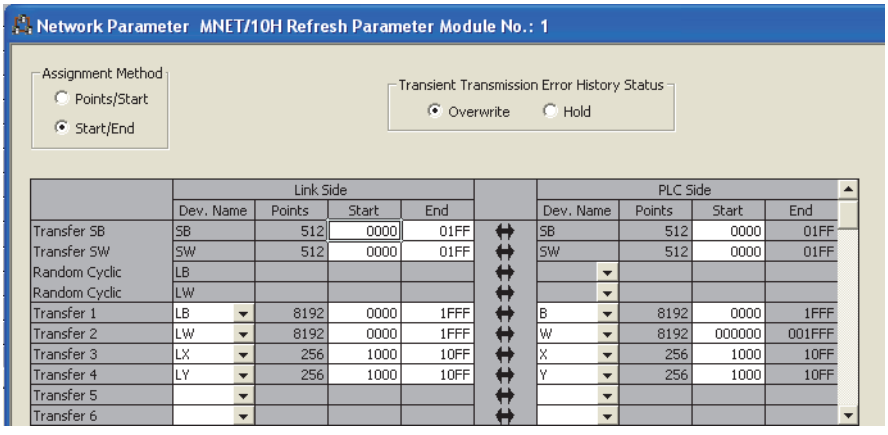
➪"XY Setting"



4. **Display the refresh parameter setting window, and configure the setting as follows.**

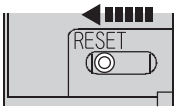
Project window➪[Parameter]➪[Network Parameter]

➪[Ethernet/CC IE/MELSECNET]➪ Refresh Parameters button



5. **Write the set parameters to the CPU module on the master station. Then reset the CPU module or turn off and on the power supply of the programmable controller.**

[Online]➪[Write to PLC...]



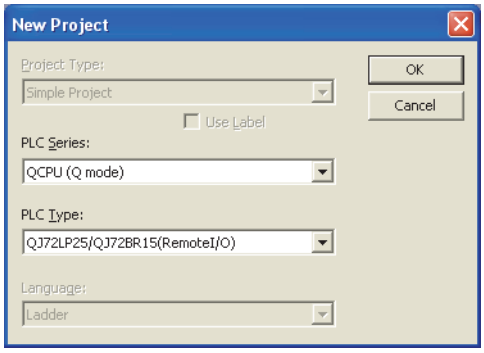
or Power off → on

(3) Setting on the remote I/O station

1. Create a project on GX Works2.

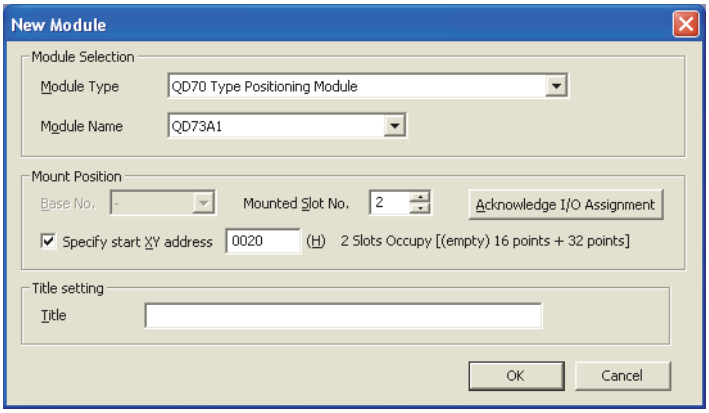
Select "QCPU (Q mode)" for "PLC Series", and select "QJ72LP25/QJ72BR15(RemoteI/O)" for "PLC Type".

[Project]⇨[New...]



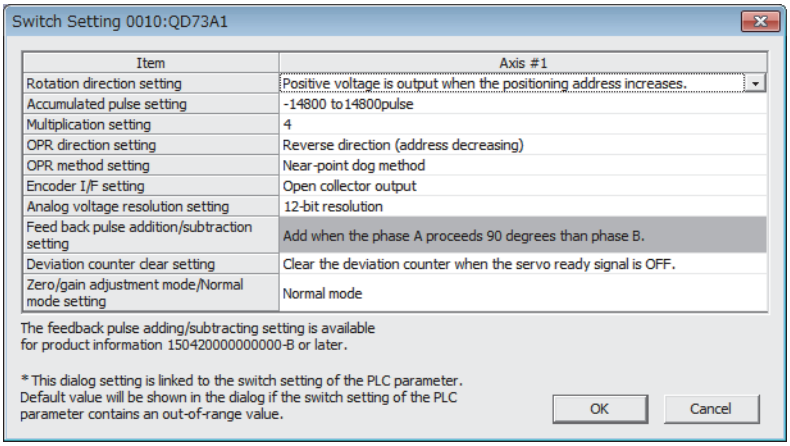
2. Add the QD73A1 to the project on GX Works2.

Project window⇨[Intelligent Function Module]⇨Right-click⇨[New Module...]



3. Display the QD73A1's switch setting window, and configure the setting as follows.

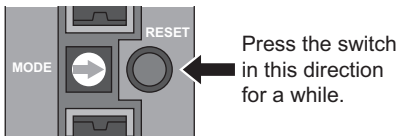
Project window⇨[Intelligent Function Module]⇨[QD73A1]⇨[Switch Setting]



Item	Setting value
Rotation direction setting	Set this item according to the system to be used.
Accumulated pulse setting	Set this item according to the system to be used.
Multiplication setting	Set this item according to the system to be used.
OPR direction setting	Set this item according to the system to be used.
OPR method setting	Set the near-point dog method or the count method.
Encoder I/F setting	Set this item according to the system to be used.
Analog voltage resolution setting	Set this item according to the system to be used.
Feed back pulse addition/subtraction setting	Set this item according to the system to be used.
Deviation counter clear setting	Set this item according to the system to be used.
Zero/gain adjustment mode/Normal mode setting	Set "Normal mode".

4. Write the set parameters to the remote I/O module, then reset the remote I/O module.

[Online]⇨[Write to PLC...]



(4) I/O signals of the QD73A1

The following is the I/O signal assignment viewed from the master station side.

(a) Input signal list

Input signal (CPU module ← QD73A1)		Input signal (CPU module ← QD73A1)	
Device No.	**Signal name**	**Device No.**	**Signal name**
X1020	WDT error, H/W error signal	X1030	OPR start complete signal
X1021	QD73A1 READY signal	X1031	Absolute positioning start complete signal
X1022	OPR request signal	X1032	Forward start complete signal
X1023	OPR complete signal	X1033	Reverse start complete signal
X1024	BUSY signal	X1034	Synchronization flag
X1025	Positioning complete signal	X1035	Use prohibited
X1026	In-position signal	X1036	
X1027	Excessive error signal	X1037	
X1028	Error detection signal	X1038	
X1029	Overflow signal	X1039	
X102A	Underflow signal	X103A	Zero/gain adjustment data writing complete flag
X102B	Servo READY signal	X103B	Zero/gain adjustment change complete flag
X102C	Near-point dog signal	X103C	Set value change complete flag
X102D	External stop signal	X103D	Operating status of the speed-position control switch mode
X102E	Upper limit signal	X103E	Use prohibited
X102F	Lower limit signal	X103F	

(5) Output signal list

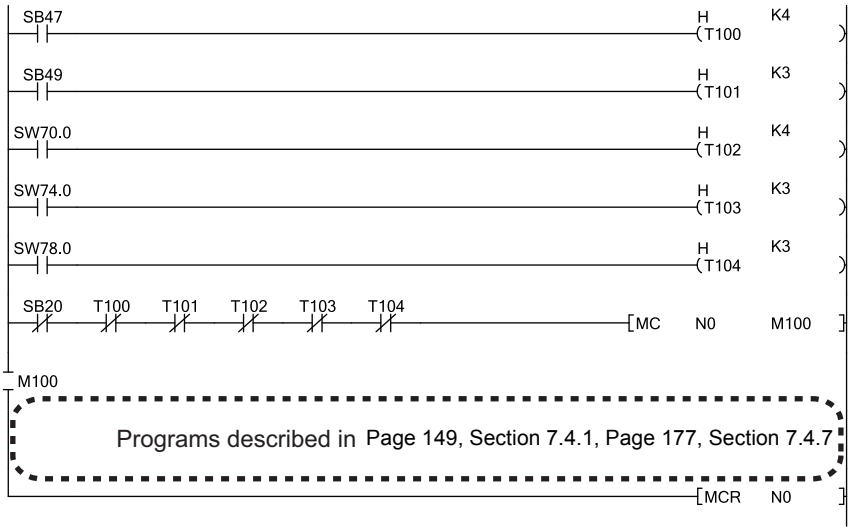
Output signal (CPU module → QD73A1)		Output signal (CPU module → QD73A1)	
Device No.	**Signal name**	**Device No.**	**Signal name**
Y1020	Use prohibited	Y1030	OPR start signal
Y1021		Y1031	Absolute positioning start signal
Y1022		Y1032	Forward start signal
Y1023		Y1033	Reverse start signal
Y1024		Y1034	Forward JOG start signal
Y1025		Y1035	Reverse JOG start signal
Y1026		Y1036	Speed-position mode restart signal
Y1027		Y1037	Stop signal
Y1028		Y1038	Error reset signal
Y1029		Y1039	Overflow reset signal
Y102A	Zero/gain adjustment data writing request signal	Y103A	Underflow reset signal
Y102B	Zero/gain adjustment change request signal	Y103B	Use prohibited
Y102C	Set value change request signal	Y103C	Speed-position switching enable signal
Y102D	Use prohibited	Y103D	PLC READY signal
Y102E		Y103E	Use prohibited
Y102F		Y103F	

Point

If a "Use prohibited" area is turned on/off through a sequence program, the QD73A1's function cannot be guaranteed.

(6) Interlock program of MELSECNET/H remote I/O network

For programs introduced in Page 149, Section 7.4.1 to Page 177, Section 7.4.7, make interlocks using data link status of the own station and the other station as shown below.



(7) Program example

Refer to the following.

Program example	Reference
Parameter setting program	Page 149, Section 7.4.1
Near-point dog method OPR program	Page 151, Section 7.4.2 (1)
Count method OPR program	Page 154, Section 7.4.2 (2)
Positioning control program	Page 157, Section 7.4.3 (1)
Two-phase trapezoidal positioning control program	Page 159, Section 7.4.3 (2)
Speed-position control switch mode program	Page 161, Section 7.4.3 (3)
Speed control operation program	Page 164, Section 7.4.3 (4)
Fixed-feed operation program	Page 167, Section 7.4.4
JOG operation program	Page 170, Section 7.4.5
Current value change program	Page 172, Section 7.4.6 (1)
Speed change program	Page 174, Section 7.4.6 (2)
Deviation counter clearing program	Page 176, Section 7.4.6 (3)
Stop program during positioning	Page 177, Section 7.4.7

7.4.1 Parameter setting program

This program sets fixed parameters and variable parameters.

Point

Parameters described in this section can be set through GX Works2 also. (Page 108, Section 6.3)
The sequence program in this section is unnecessary when the parameters were set through GX Works2.

(1) Program detail

- As X20 is turned on, the following fixed parameters are set.

Item	Setting detail
Pr.1 Stroke limit upper limit	20000000pulse
Pr.2 Stroke limit lower limit	0pulse
Pr.3 Numerator of command pulse multiplication for electronic gear	1
Pr.4 Denominator of command pulse multiplication for electronic gear	1

- As X21 is turned on, the following variable parameters are set.

Item	Setting detail
Pr.5 Speed limit value	30000pulse
Pr.6 Acceleration time	400ms
Pr.7 Deceleration time	250ms
Pr.8 In-position range	10pulse
Pr.9 Positioning mode	0: Position control mode

(2) Execution condition

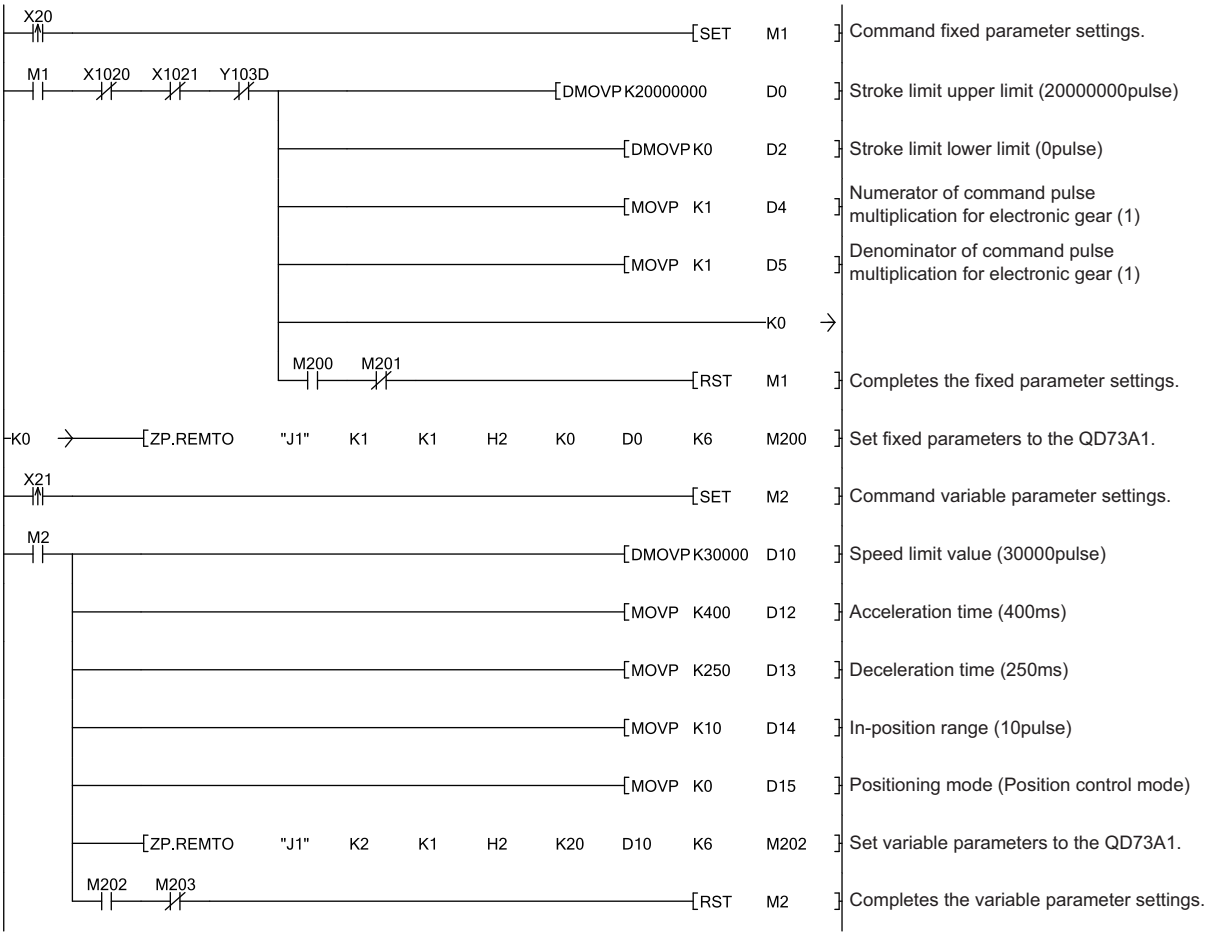
Check item		Condition
I/O signal	WDT error, H/W error signal (X1020)	OFF
	QD73A1 READY signal (X1021)	OFF
	PLC READY signal (Y103D)	OFF

(3) Device used by the user

Device	Description
X20	Fixed parameter setting command
X21	Variable parameter setting command
D0	Stroke limit upper limit (lower 16 bits)
D1	Stroke limit upper limit (upper 16 bits)
D2	Stroke limit lower limit (lower 16 bits)
D3	Stroke limit lower limit (upper 16 bits)
D4	Numerator of command pulse multiplication for electronic gear
D5	Denominator of command pulse multiplication for electronic gear
D10	Speed limit value (lower 16 bits)

Device	Description
D11	Speed limit value (upper 16 bits)
D12	Acceleration time
D13	Deceleration time
D14	In-position range
D15	Positioning mode
M1	Fixed parameter setting memory
M2	Variable parameter setting memory
M200	Z(P).REMTO instruction completion
M201	Z(P).REMTO instruction failure
M202	Z(P).REMTO instruction completion
M203	Z(P).REMTO instruction failure

(4) Program example



7.4.2 OPR program

Programs in this section execute OPR in the near-point dog method or the count method.

(1) Near-point dog method OPR program

This program executes OPR in the near-point dog method. Suppose that fixed parameters and variable parameters are already set. (☞ Page 149, Section 7.4.1)

(a) Program detail

- As X22 is turned on, the following OPR parameters are written and PLC READY signal (Y103D) turns on.

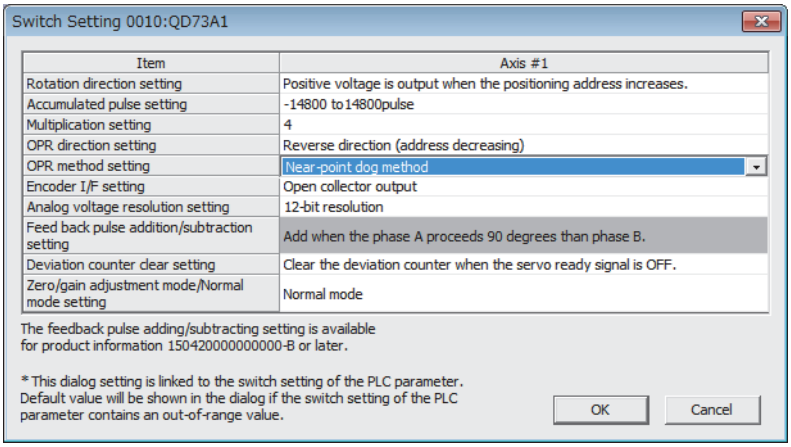
Item	Setting detail
Pr.10 OP address	100pulse
Pr.11 OPR speed	5000pulse/s
Pr.12 Creep speed	500pulse/s

- As X23 is turned on after PLC READY signal (Y103D) turned on, the module executes OPR.

(b) Switch setting

Before executing the program, set "Near-point dog method" to "OPR method setting".

Project window⇨[Intelligent Function Module]⇨[QD73A1]⇨[Switch Setting]



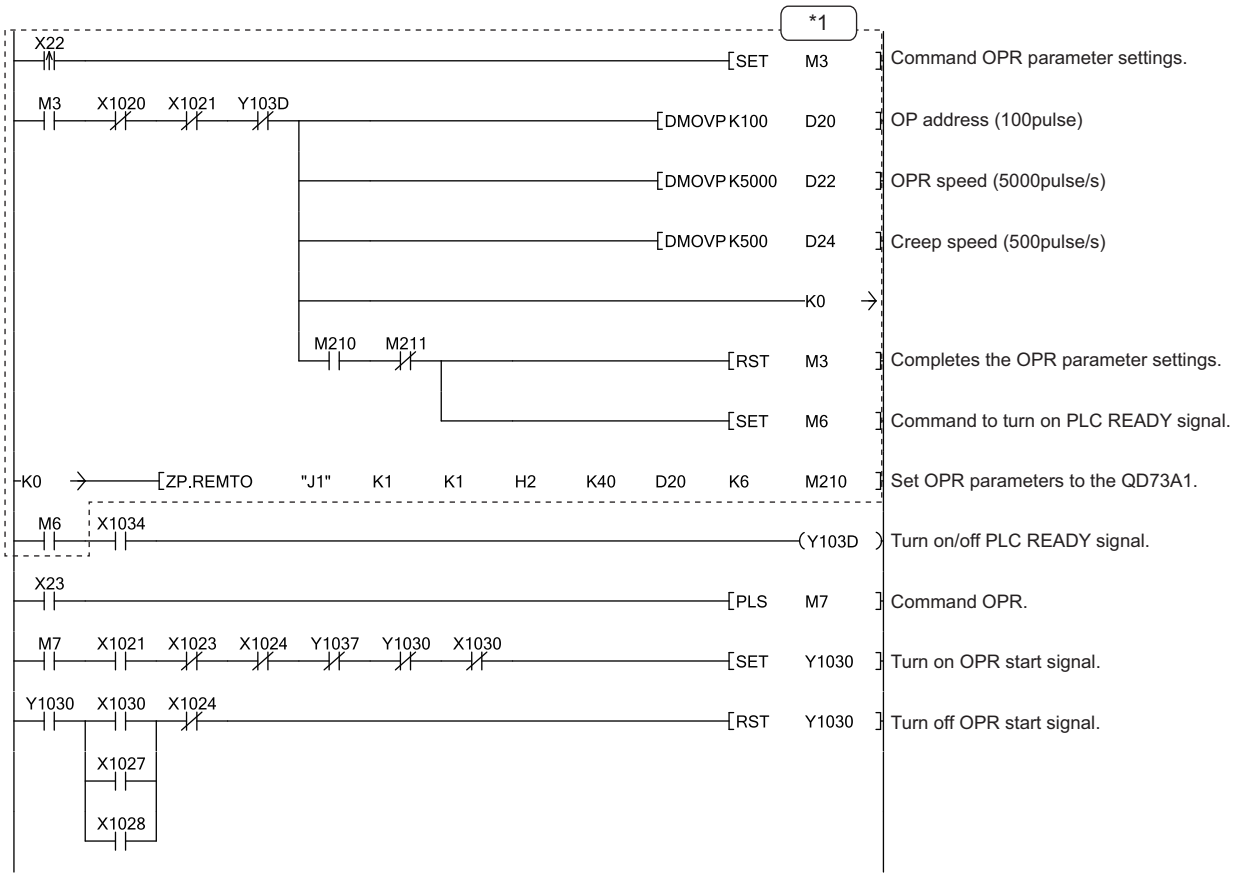
(c) Execution condition

Check item		Condition
External I/O signal	Servo READY signal (READY)	ON
	Stop signal (STOP)	OFF
	Upper limit signal (FLS)	ON
	Lower limit signal (RLS)	ON
	Near-point dog signal (DOG)	OFF
I/O signal	WDT error, H/W error signal (X1020)	OFF
	QD73A1 READY signal (X1021)	OFF
	OPR complete signal (X1023)	OFF
	BUSY signal (X1024)	OFF
	Excessive error signal (X1027)	OFF
	Error detection signal (X1028)	OFF
	OPR start complete signal (X1030)	OFF
	Synchronization flag (X1034)	ON
	OPR start signal (Y1030)	OFF
	Stop signal (Y1037)	OFF
	PLC READY signal (Y103D)	OFF
Buffer memory	OPR parameters	No error

(d) Device used by the user

Device	Description
X22	OPR parameter setting command
X23	OPR command
D20	OP address (lower 16 bits)
D21	OP address (upper 16 bits)
D22	OPR speed (lower 16 bits)
D23	OPR speed (upper 16 bits)
D24	Creep speed (lower 16 bits)
D25	Creep speed (upper 16 bits)
M3	OPR parameter writing
M6	OPR parameter setting memory
M7	OPR command pulse
M210	Z(P).REMTO instruction completion
M211	Z(P).REMTO instruction failure

(e) Program example



*1 OPR parameters can be set through GX Works2 also. (☞ Page 108, Section 6.3)
The sequence program that sets OPR parameters is unnecessary when the parameters were set through GX Works2.

(2) Count method OPR program

This program executes OPR in the count method. Suppose that fixed parameters and variable parameters are already set. (Page 149, Section 7.4.1)

(a) Program detail

- As X22 is turned on, the following OPR parameters are written and PLC READY signal (Y103D) turns on.

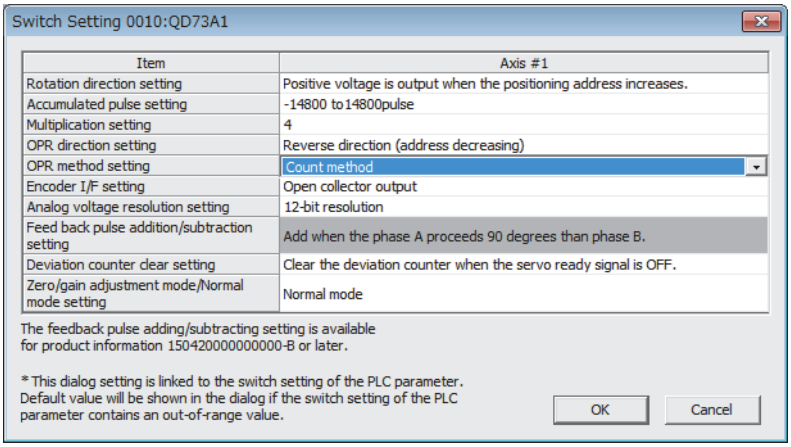
Item	Setting detail
Pr.10 OP address	100pulse
Pr.11 OPR speed	5000pulse/s
Pr.12 Creep speed	500pulse/s
Pr.13 Setting for the movement amount after near-point dog ON	2000pulse

- As X24 is turned on after PLC READY signal (Y103D) turned on, the module executes OPR.

(b) Switch setting

Before executing the program, set "Count method" to "OPR method setting".

Project window⇨[Intelligent Function Module]⇨[QD73A1]⇨[Switch Setting]



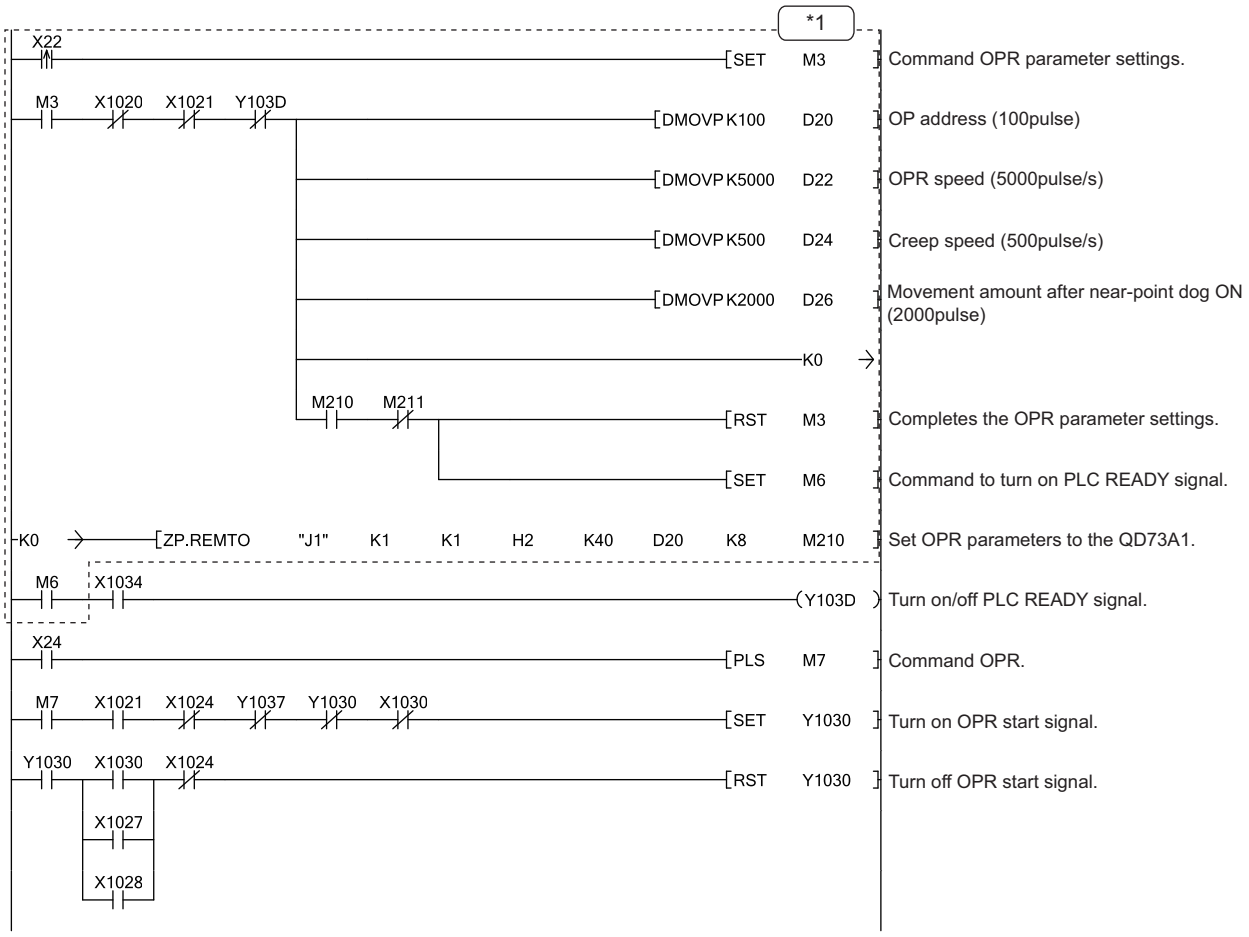
(c) Execution condition

Check item		Condition
External I/O signal	Servo READY signal (READY)	ON
	Stop signal (STOP)	OFF
	Upper limit signal (FLS)	ON
	Lower limit signal (RLS)	ON
I/O signal	WDT error, H/W error signal (X1020)	OFF
	QD73A1 READY signal (X1021)	OFF
	BUSY signal (X1024)	OFF
	Excessive error signal (X1027)	OFF
	Error detection signal (X1028)	OFF
	OPR start complete signal (X1030)	OFF
	Synchronization flag (X1034)	ON
	OPR start signal (Y1030)	OFF
	Stop signal (Y1037)	OFF
	PLC READY signal (Y103D)	OFF
Buffer memory	OPR parameters	No error

(d) Device used by the user

Device	Description
X22	OPR parameter setting command
X24	OPR command
D20	OP address (lower 16 bits)
D21	OP address (upper 16 bits)
D22	OPR speed (lower 16 bits)
D23	OPR speed (upper 16 bits)
D24	Creep speed (lower 16 bits)
D25	Creep speed (upper 16 bits)
D26	Movement amount after near-point dog ON (lower 16 bits)
D27	Movement amount after near-point dog ON (upper 16 bits)
M3	OPR parameter writing
M6	OPR parameter setting memory
M7	OPR command pulse
M210	Z(P).REMTO instruction completion
M211	Z(P).REMTO instruction failure

(e) Program example



*1 OPR parameters can be set through GX Works2 also. (☞ Page 108, Section 6.3)
The sequence program that sets OPR parameters is unnecessary when the parameters were set through GX Works2.

7.4.3 Major positioning control program

Programs in this section execute major positioning control.

(1) Positioning control program

This program executes positioning control in the absolute system. Suppose that the parameter setting and OPR were completed. (☞Page 149, Section 7.4.1, Page 151, Section 7.4.2)

(a) Program detail

- As X25 is turned on, the following positioning data are written.

Item	Setting detail
Da.1 Positioning pattern	0: Positioning control
Da.2 Positioning address P1	100000pulse
Da.3 Positioning speed V1	10000pulse/s

- As X26 is turned on, the module executes positioning control in the absolute system.

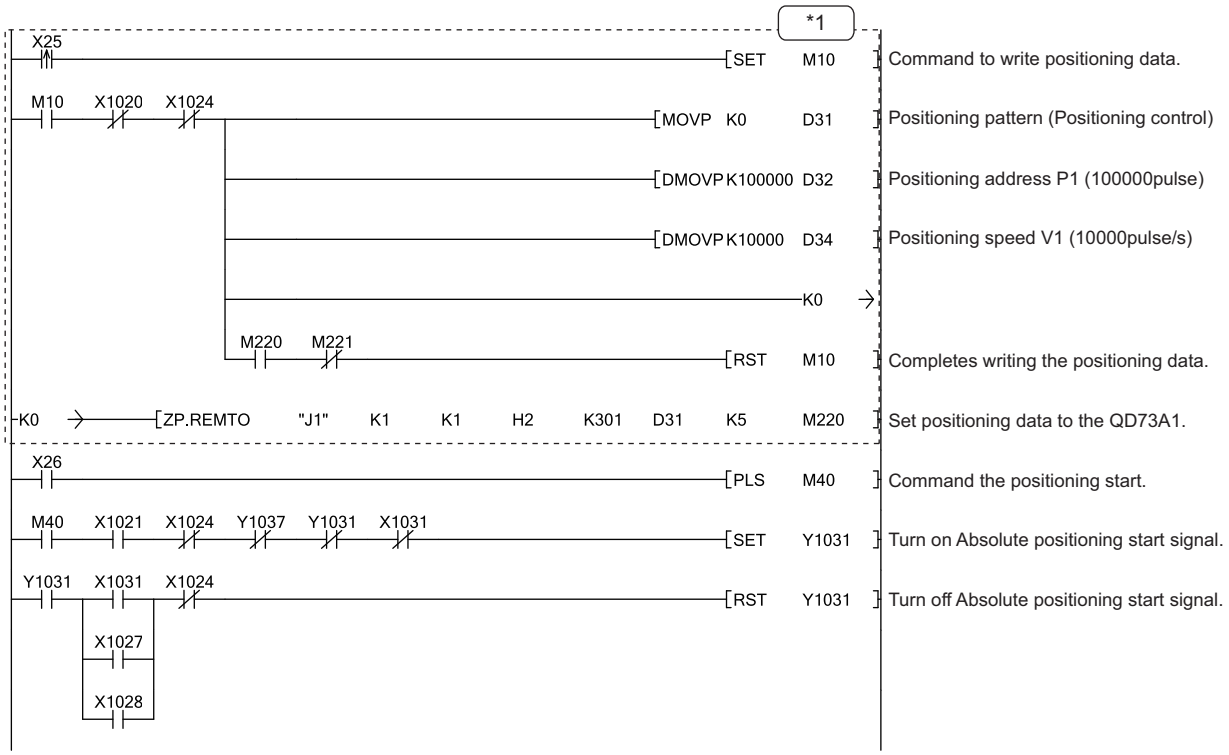
(b) Execution condition

Check item		Condition	Note
External I/O signal	Servo READY signal (READY)	ON	—
	Stop signal (STOP)	OFF	
	Upper limit signal (FLS)	ON	
	Lower limit signal (RLS)	ON	
I/O signal	WDT error, H/W error signal (X1020)	OFF	—
	QD73A1 READY signal (X1021)	ON	
	BUSY signal (X1024)	OFF	
	Excessive error signal (X1027)	OFF	
	Error detection signal (X1028)	OFF	
	Absolute positioning start complete signal (X1031)	OFF	
	Synchronization flag (X1034)	ON	
	Absolute positioning start signal (Y1031)	OFF	
	Stop signal (Y1037)	OFF	
	PLC READY signal (Y103D)	ON	
Buffer memory	Positioning data	No error	When the positioning speed is set exceeding " Pr.5 Speed limit value", the positioning is executed at " Pr.5 Speed limit value".

(c) Device used by the user

Device	Description
X25	Positioning data write command
X26	Positioning start command
D31	Positioning pattern
D32	Positioning address P1 (lower 16 bits)
D33	Positioning address P1 (upper 16 bits)
D34	Positioning speed V1 (lower 16 bits)
D35	Positioning speed V1 (upper 16 bits)
M10	Positioning data writing
M40	Positioning start command pulse
M220	Z(P).REMTO instruction completion
M221	Z(P).REMTO instruction failure

(d) Program example



*1 Positioning data can be set through GX Works2 also. (☞ Page 109, Section 6.4)
The sequence program that sets positioning data is unnecessary when the data were set through GX Works2.

(2) Two-phase trapezoidal positioning control program

This program executes two-phase trapezoidal positioning control in the absolute system. Suppose that the parameter setting and OPR were completed. (☞Page 149, Section 7.4.1, Page 151, Section 7.4.2)

(a) Program detail

- As X27 is turned on, the following positioning data are written.

Item	Setting detail
Da.1 Positioning pattern	1: Two-phase trapezoidal positioning control
Da.2 Positioning address P1	100000pulse
Da.3 Positioning speed V1	10000pulse/s
Da.4 Positioning address P2	150000pulse
Da.5 Positioning speed V2	12000pulse/s

- As X28 is turned on, the module executes two-phase trapezoidal positioning control in the absolute system.

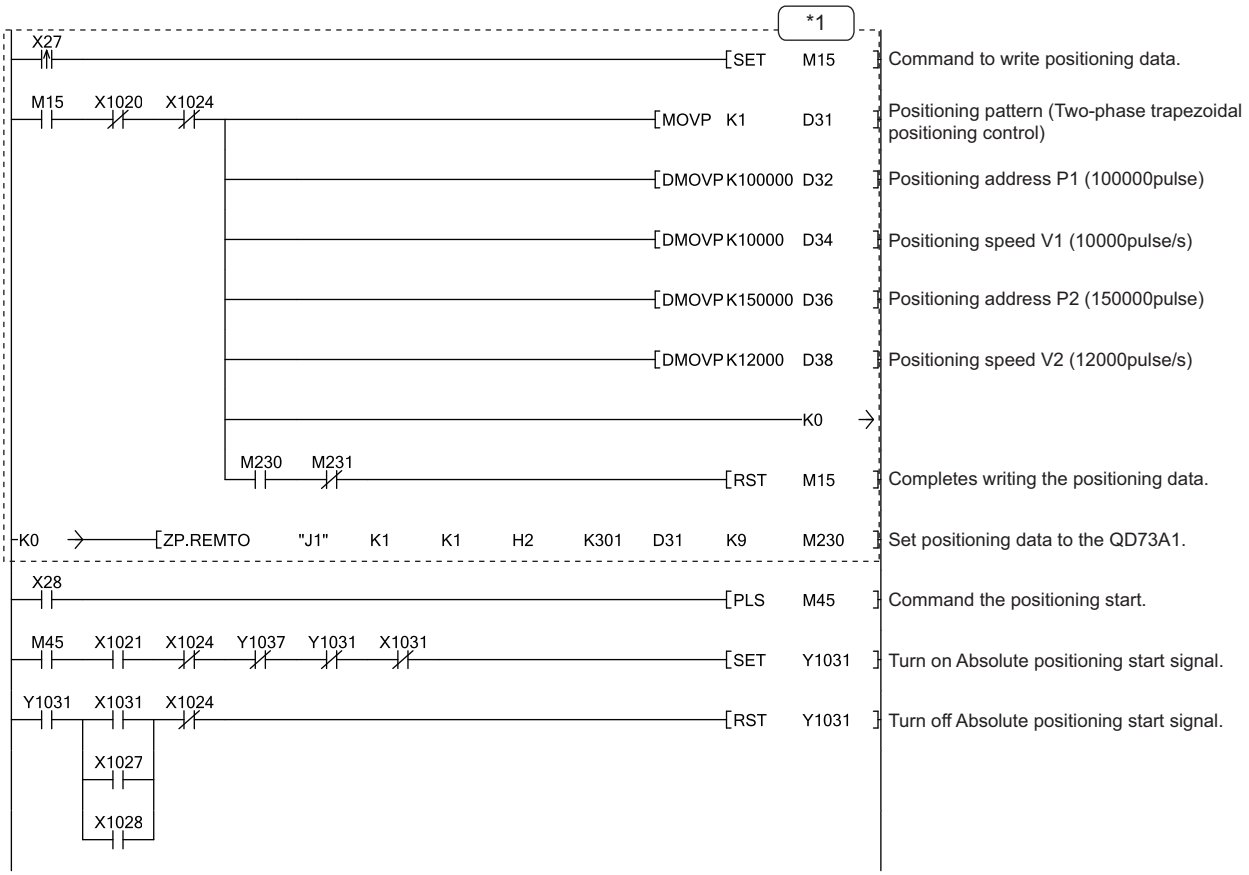
(b) Execution condition

The execution condition is the same as that of positioning control program. (☞Page 157, Section 7.4.3 (1) (b))

(c) Device used by the user

Device	Description
X27	Positioning data write command
X28	Two-phase trapezoidal positioning control start command
D31	Positioning pattern
D32	Positioning address P1 (lower 16 bits)
D33	Positioning address P1 (upper 16 bits)
D34	Positioning speed V1 (lower 16 bits)
D35	Positioning speed V1 (upper 16 bits)
D36	Positioning address P2 (lower 16 bits)
D37	Positioning address P2 (upper 16 bits)
D38	Positioning speed V2 (lower 16 bits)
D39	Positioning speed V2 (upper 16 bits)
M15	Positioning data writing
M45	Two-phase trapezoidal positioning control start command pulse
M230	Z(P).REMTO instruction completion
M231	Z(P).REMTO instruction failure

(d) Program example



*1 Positioning data can be set through GX Works2 also. (☞ Page 109, Section 6.4)
The sequence program that sets positioning data is unnecessary when the data were set through GX Works2.

(3) Speed-position control switch mode program

This program switches the positioning mode to the "speed-position control switch mode". Suppose that the parameter setting and OPR were completed. (☞Page 149, Section 7.4.1, Page 151, Section 7.4.2)

(a) Program detail

- As X29 is turned on, the positioning mode is set to "speed-position control switch mode".
- As X2A is turned on, the following positioning data are written.

Item	Setting detail
Da.2 Positioning address P1	5000pulse
Da.3 Positioning speed V1	1000pulse/s

- As X2B is turned on, the module starts speed control. The module switches the operation to position control following an external control switch command.
- As X2D is turned on, the module restarts operation in case that the operation was stopped following a stop signal input.

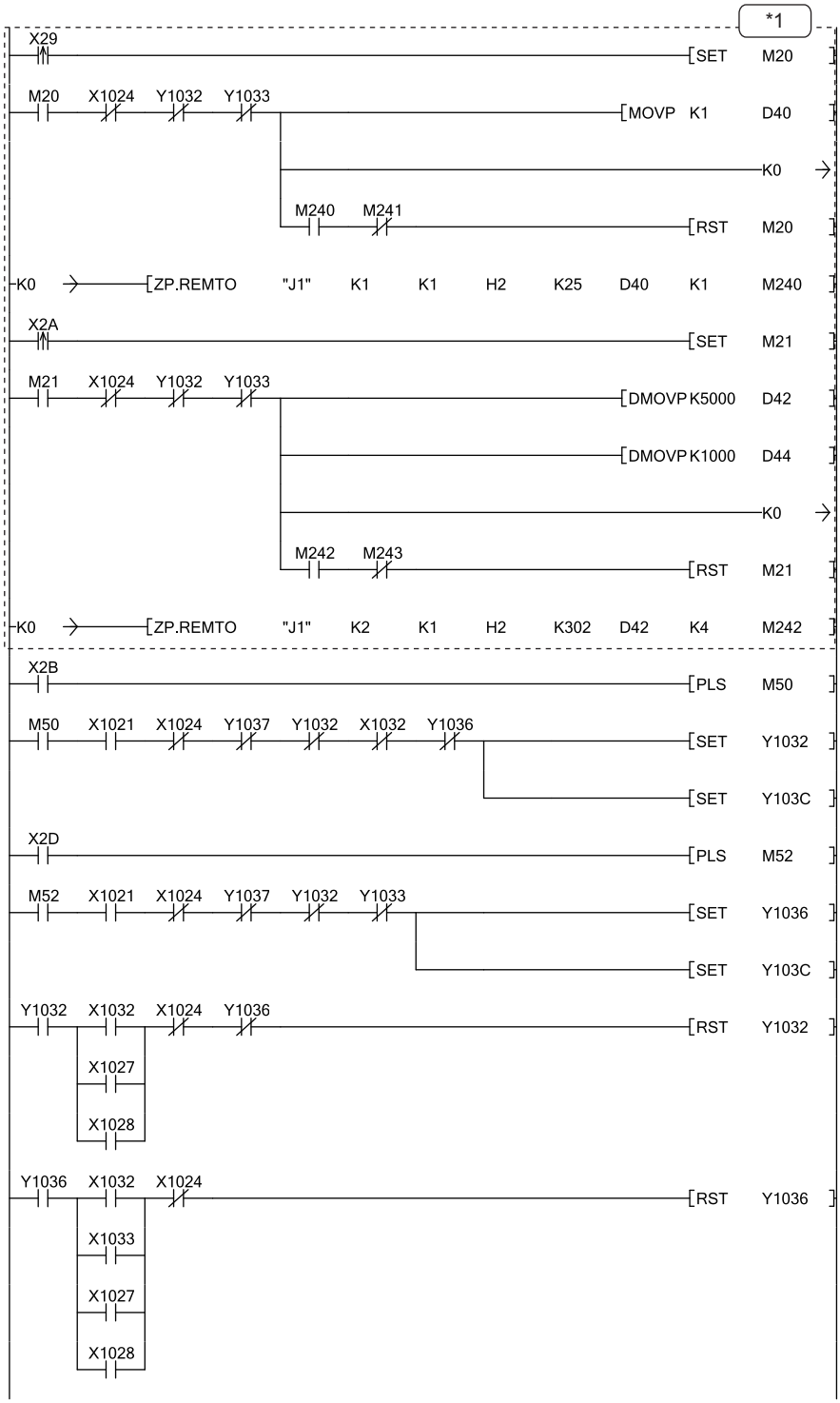
(b) Execution condition

Check item		Condition	Note
External I/O signal	Servo READY signal (READY)	ON	—
	Stop signal (STOP)	OFF	
	Upper limit signal (FLS)	ON	
	Lower limit signal (RLS)	ON	
I/O signal	QD73A1 READY signal (X1021)	ON	—
	BUSY signal (X1024)	OFF	
	Excessive error signal (X1027)	OFF	
	Error detection signal (X1028)	OFF	
	Forward start complete signal (X1032)	OFF	
	Synchronization flag (X1034)	ON	
	Forward start signal (Y1032)	OFF	
	Reverse start signal (Y1033)	OFF	
	Speed-position mode restart signal (Y1036)	OFF	
	Stop signal (Y1037)	OFF	
	Speed-position switching enable signal (Y103C)	OFF	
	PLC READY signal (Y103D)	ON	
Buffer memory	Positioning data	No error	When the positioning speed is set exceeding " Pr.5 Speed limit value", the positioning is executed at " Pr.5 Speed limit value".

(c) Device used by the user

Device	Description
X29	Variable parameter change command
X2A	Positioning data write command
X2B	Speed-position control positioning start command
X2D	Speed-position control positioning restart command
D40	Positioning mode
D42	Positioning address P1 (lower 16 bits)
D43	Positioning address P1 (upper 16 bits)
D44	Positioning speed V1 (lower 16 bits)
D45	Positioning speed V1 (upper 16 bits)
M20	Variable parameter change
M21	Positioning data writing
M50	Speed-position control positioning start command pulse
M52	Speed-position control positioning restart command pulse
M240	Z(P).REMTO instruction completion
M241	Z(P).REMTO instruction failure
M242	Z(P).REMTO instruction completion
M243	Z(P).REMTO instruction failure

(d) Program example



*1 Variable parameters and positioning data can be set through GX Works2 also. (☞ Page 108, Section 6.3, Page 109, Section 6.4)
The sequence program that sets variable parameters and positioning data is unnecessary when the data were set through GX Works2.

(4) Speed control operation program

This program executes speed control using the speed control function of the speed-position control switch mode. Suppose that parameters are already set. (☞Page 149, Section 7.4.1)

(a) Program detail

- As X2E is turned on, the positioning mode is set to "speed-position control switch mode".
- As X2F is turned on, the following positioning data is written.

Item	Setting detail
Da.3 Positioning speed V1	1000pulse/s

- As X30 is turned on, the module starts speed control of forward run. As X31 is turned on, the module starts speed control of reverse run.

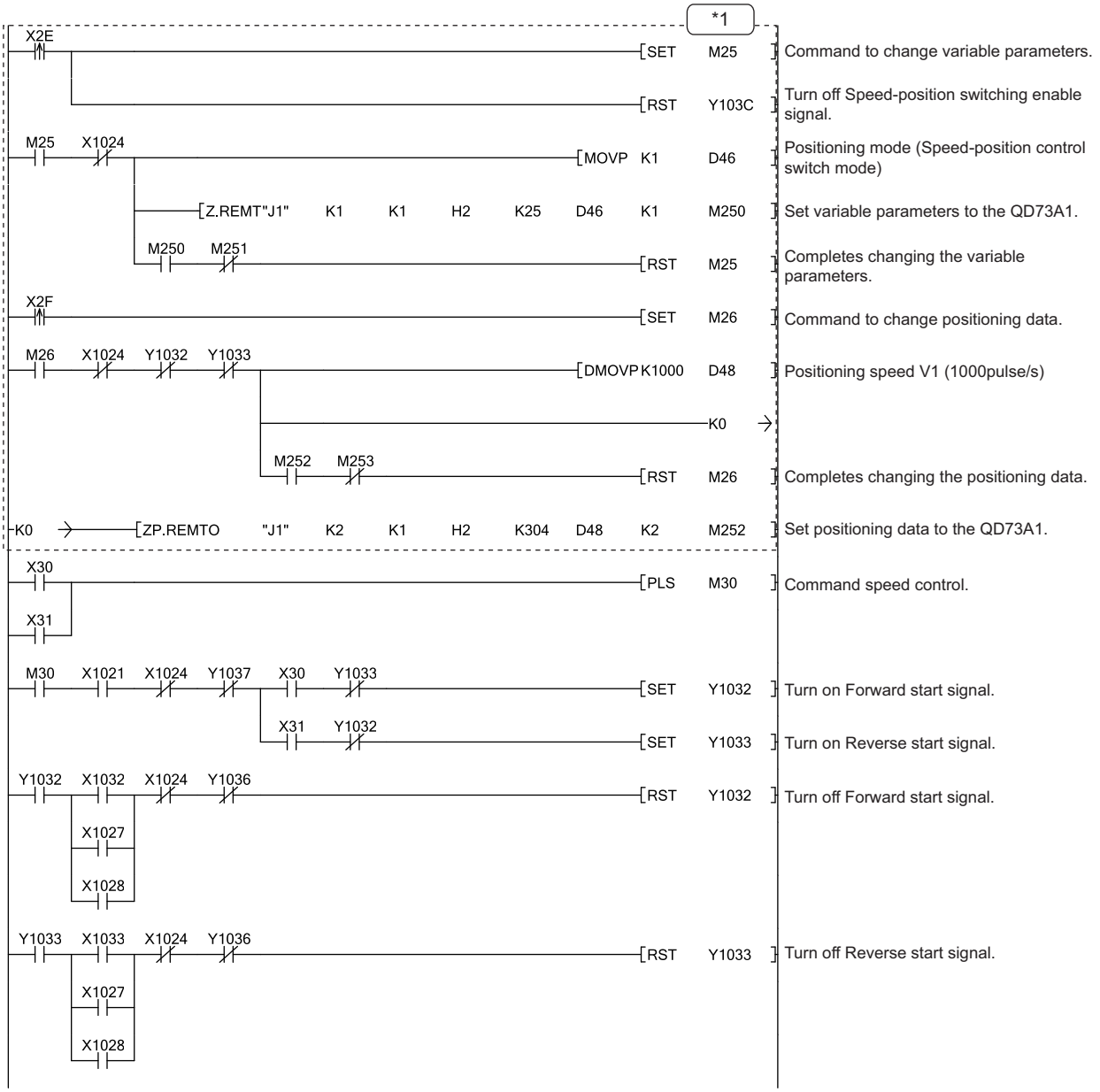
(b) Execution condition

Check item		Condition	Note
External I/O signal	Servo READY signal (READY)	ON	—
	Stop signal (STOP)	OFF	
	Upper limit signal (FLS)	ON	
	Lower limit signal (RLS)	ON	
I/O signal	QD73A1 READY signal (X1021)	ON	—
	BUSY signal (X1024)	OFF	
	Excessive error signal (X1027)	OFF	
	Error detection signal (X1028)	OFF	
	Forward start complete signal (X1032)	OFF	
	Reverse start complete signal (X1033)	OFF	
	Synchronization flag (X1034)	ON	
	Forward start signal (Y1032)	OFF	
	Reverse start signal (Y1033)	OFF	
	Speed-position mode restart signal (Y1036)	OFF	
	Stop signal (Y1037)	OFF	
	Speed-position switching enable signal (Y103C)	OFF	
	PLC READY signal (Y103D)	ON	
Buffer memory	Positioning data	No error	When the positioning speed is set exceeding "Pr.5 Speed limit value", the positioning is executed at "Pr.5 Speed limit value".

(c) Device used by the user

Device	Description
X2E	Variable parameter change command
X2F	Positioning data write command
X30	Forward run command
X31	Reverse run command
D46	Positioning mode
D48	Positioning speed V1 (lower 16 bits)
D49	Positioning speed V1 (upper 16 bits)
M25	Variable parameter change
M26	Positioning data writing
M30	Speed control command pulse
M250	Z(P).REMTO instruction completion
M251	Z(P).REMTO instruction failure
M252	Z(P).REMTO instruction completion
M253	Z(P).REMTO instruction failure

(d) Program example



*1 Variable parameters and positioning data can be set through GX Works2 also. (☞ Page 108, Section 6.3, Page 109, Section 6.4)
The sequence program that sets variable parameters and positioning data is unnecessary when the data were set through GX Works2.

7.4.4 Fixed-feed operation program

This program executes positioning in the address increasing direction according to the specified movement amount and speed. Execute fixed-feed operation by turning on Fixed-feed start command repeatedly. Use the current value change function and positioning start in the absolute system. Suppose that parameter setting and OPR were completed. (☞Page 149, Section 7.4.1, Page 151, Section 7.4.2)

(1) Program detail

- As X32 is turned on, the following positioning data are written.

Item	Setting detail
Da.2 Positioning address P1	20000pulse
Da.3 Positioning speed V1	1000pulse/s

- As X33 is turned on, the module starts fixed-feed operation.

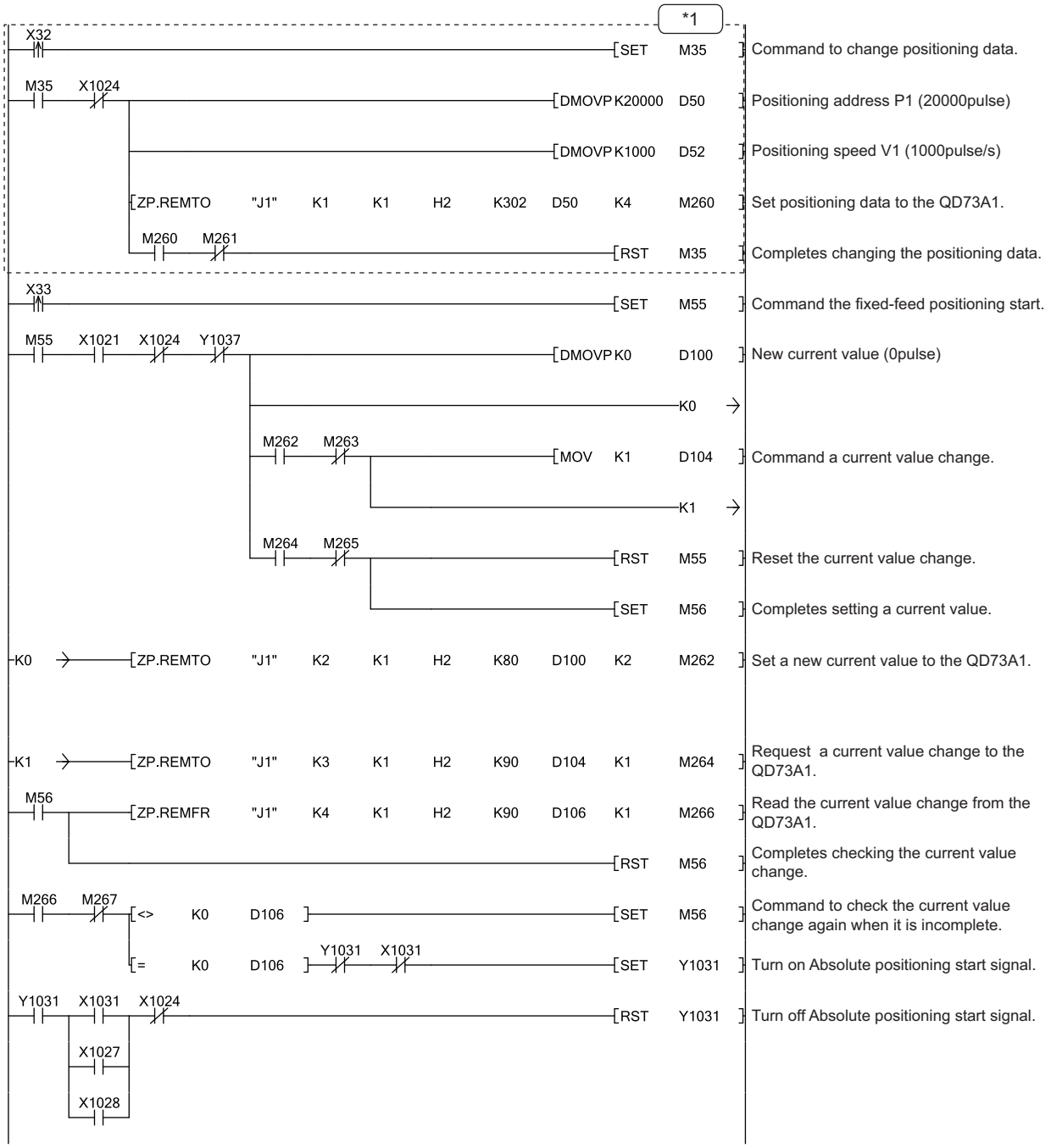
(2) Execution condition

Check item		Condition	Note
External I/O signal	Servo READY signal (READY)	ON	—
	Stop signal (STOP)	OFF	
	Upper limit signal (FLS)	ON	
	Lower limit signal (RLS)	ON	
I/O signal	QD73A1 READY signal (X1021)	ON	—
	BUSY signal (X1024)	OFF	
	Excessive error signal (X1027)	OFF	
	Error detection signal (X1028)	OFF	
	Absolute positioning start complete signal (X1031)	OFF	
	Synchronization flag (X1034)	ON	
	Absolute positioning start signal (Y1031)	OFF	
	Stop signal (Y1037)	OFF	
	PLC READY signal (Y103D)	ON	
Buffer memory	Positioning data	No error	When the positioning speed is set exceeding " Pr.5 Speed limit value", the positioning is executed at " Pr.5 Speed limit value".

(3) Device used by the user

Device	Description
X32	Fixed-feed positioning data write command
X33	Fixed-feed start command
D50	Positioning address P1 (lower 16 bits)
D51	Positioning address P1 (upper 16 bits)
D52	Positioning speed V1 (lower 16 bits)
D53	Positioning speed V1 (upper 16 bits)
D100	New current value (lower 16 bits)
D101	New current value (upper 16 bits)
D104	Current value change request
D106	Current value change result check
M35	Variable parameter change
M55	Fixed-feed positioning data write command pulse
M56	Current value change result reading
M260	Z(P).REMTO instruction completion
M261	Z(P).REMTO instruction failure
M262	Z(P).REMTO instruction completion
M263	Z(P).REMTO instruction failure
M264	Z(P).REMTO instruction completion
M265	Z(P).REMTO instruction failure
M266	Z(P).REMFR instruction completion
M267	Z(P).REMFR instruction failure

(4) Program example



*1 Positioning data can be set through GX Works2 also. (☞ Page 109, Section 6.4)
The sequence program that sets positioning data is unnecessary when the data were set through GX Works2.

7.4.5 JOG operation program

This program executes JOG operation while a JOG start command is on. Suppose that parameters are already set. (☞Page 149, Section 7.4.1)

(1) Program detail

- As X34 is turned on, JOG speed is written.

Item	Setting detail
Cd.3 JOG speed	10000pulse/s

- As X35 is turned on, the module executes forward JOG operation. As X36 is turned on, the module executes reverse JOG operation.

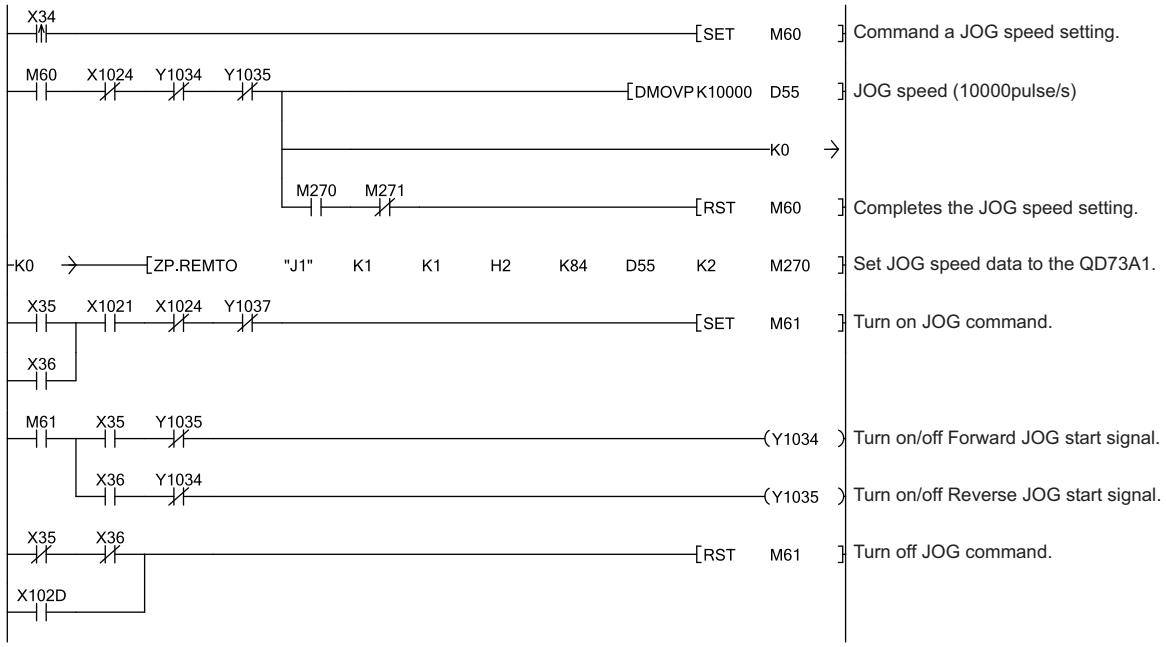
(2) Execution condition

Check item		Condition	Note
External I/O signal	Servo READY signal (READY)	ON	—
	Stop signal (STOP)	OFF	
	Upper limit signal (FLS)	ON	
	Lower limit signal (RLS)	ON	
I/O signal	QD73A1 READY signal (X1021)	ON	—
	BUSY signal (X1024)	OFF	
	External stop signal (X102D)	OFF	
	Synchronization flag (X1034)	ON	
	Forward JOG start signal (Y1034)	OFF	
	Reverse JOG start signal (Y1035)	OFF	
	Stop signal (Y1037)	OFF	
	PLC READY signal (Y103D)	ON	
Buffer memory	Cd.3 JOG speed	No error	When "Cd.3 JOG speed" is set exceeding "Pr.5 Speed limit value", the operation is executed at "Pr.5 Speed limit value".

(3) Device used by the user

Device	Description
X34	JOG speed write command
X35	Forward JOG command
X36	Reverse JOG command
D55	JOG speed (lower 16 bits)
D56	JOG speed (upper 16 bits)
M60	JOG speed writing
M61	JOG command
M270	Z(P).REMTO instruction completion
M271	Z(P).REMTO instruction failure

(4) Program example



7.4.6 Control change program

(1) Current value change program

This program changes the current value to "0".

(a) Program detail

As X37 is turned on, the current value is changed.

Item	Setting detail
Cd.1 New current value	0pulse

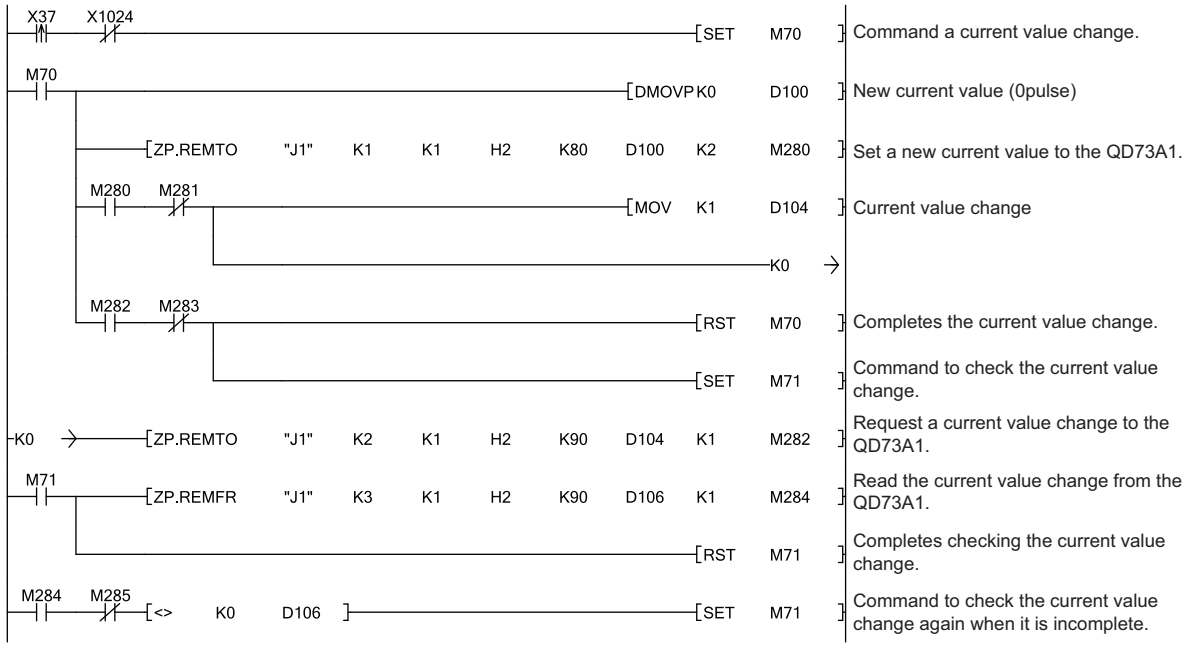
(b) Execution condition

Check item		Condition	Note
I/O signal	WDT error, H/W error signal (X1020)	OFF	—
	BUSY signal (X1024)	OFF	
	Error detection signal (X1028)	OFF	
	Synchronization flag (X1034)	ON	

(c) Device used by the user

Device	Description
X37	Current value change command
D100	New current value (lower 16 bits)
D101	New current value (upper 16 bits)
D104	Current value change request
D106	Current value change result check
M70	Variable parameter change
M71	Positioning data change
M280	Z(P).REMTO instruction completion
M281	Z(P).REMTO instruction failure
M282	Z(P).REMTO instruction completion
M283	Z(P).REMTO instruction failure
M284	Z(P).REMFR instruction completion
M285	Z(P).REMFR instruction failure

(d) Program example



(2) Speed change program

This program changes positioning speed.

(a) Program detail

As X38 is turned on, positioning speed is changed.

Item	Setting detail
Cd.2 New speed value	50000pulse/s

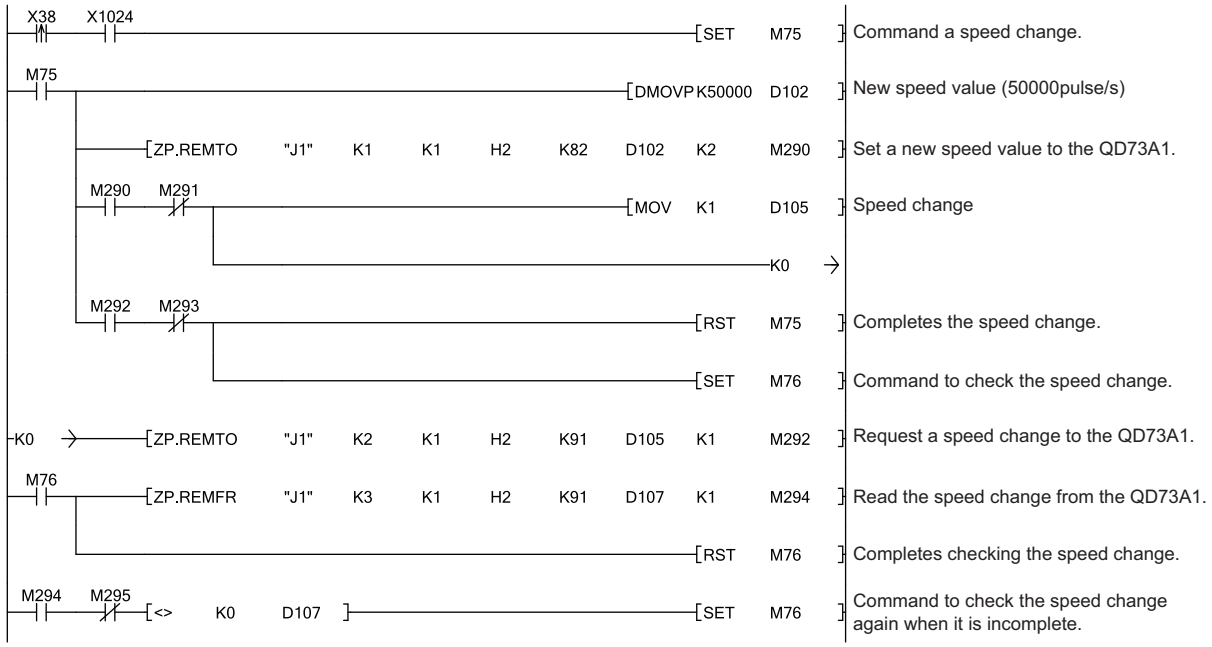
(b) Execution condition

Check item		Condition	Note
External I/O signal	Servo READY signal (READY)	ON	—
	Stop signal (STOP)	OFF	
	Upper limit signal (FLS)	ON	
	Lower limit signal (RLS)	ON	
I/O signal	WDT error, H/W error signal (X1020)	OFF	—
	QD73A1 READY signal (X1021)	ON	
	BUSY signal (X1024)	ON	
	Excessive error signal (X1027)	OFF	
	Error detection signal (X1028)	OFF	
	Synchronization flag (X1034)	ON	
	Stop signal (Y1037)	OFF	
	PLC READY signal (Y103D)	ON	
Buffer memory	Cd.2 New speed value	No error	When " Cd.2 New speed value" is set exceeding " Pr.5 Speed limit value", the operation is executed at " Pr.5 Speed limit value".

(c) Device used by the user

Device	Description
X38	Speed change command
D102	New speed value (lower 16 bits)
D103	New speed value (upper 16 bits)
D105	Speed change request
D107	Speed change result check
M75	Speed change
M76	Speed change request check
M290	Z(P).REMTO instruction completion
M291	Z(P).REMTO instruction failure
M292	Z(P).REMTO instruction completion
M293	Z(P).REMTO instruction failure
M294	Z(P).REMFR instruction completion
M295	Z(P).REMFR instruction failure

(d) Program example



(3) Deviation counter clearing program

This program clears the deviation counter to 0.

(a) Program detail

As X39 is turned on, the deviation counter is cleared to 0.

Item	Setting detail
Cd.4 Deviation counter clear command	1: Clear the deviation counter

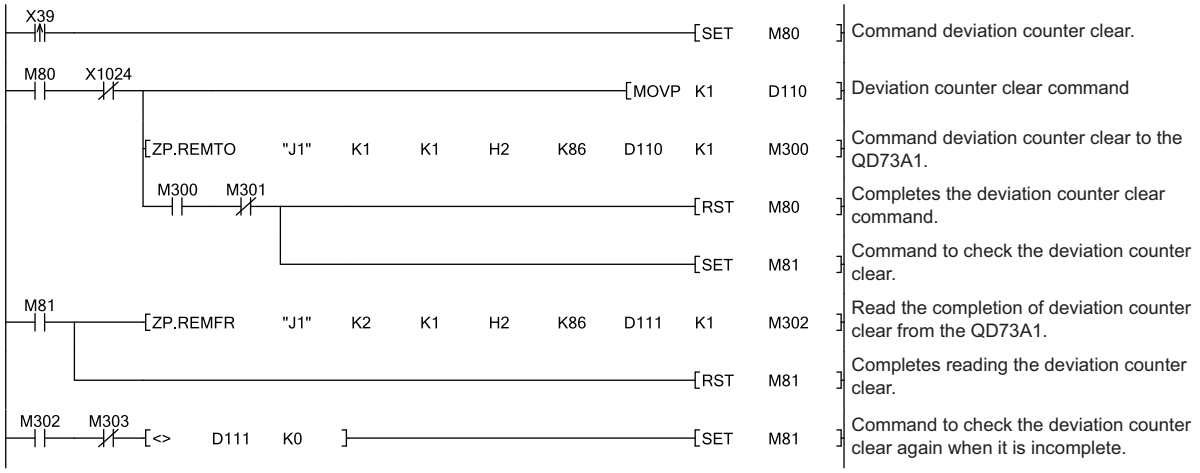
(b) Execution condition

Check item		Condition	Note
I/O signal	WDT error, H/W error signal (X1020)	OFF	—
	BUSY signal (X1024)	OFF	
	Error detection signal (X1028)	OFF	
	Synchronization flag (X1034)	ON	

(c) Device used by the user

Device	Description
X39	Deviation counter clear command
D110	Deviation counter clear request
D111	Deviation counter clearing result check
M80	Deviation counter clear
M81	Deviation counter clearing completion check
M300	Z(P).REMTO instruction completion
M301	Z(P).REMTO instruction failure
M302	Z(P).REMFR instruction completion
M303	Z(P).REMFR instruction failure

(d) Program example



7.4.7 Stop program during positioning

This program stops the positioning in execution.

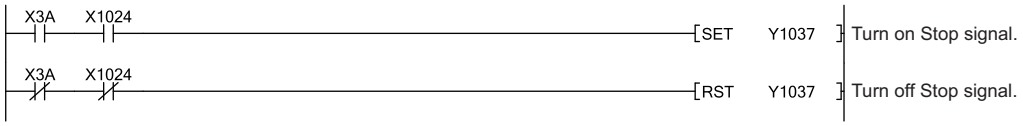
(a) Program detail

As X3A is turned on, the module stops the positioning in execution.

(b) Device used by the user

Device	Description
X3A	Stop command

(c) Program example



CHAPTER 8 OPR CONTROL

This chapter describes OPR control.

8.1 Overview of OPR Control

In "OPR control", a starting point (or OP) of major positioning control is set, and positioning is executed toward the original point. Use this control to return a machine system at a position other than its OP to the OP when the QD73A1 turned on OPR request signal (X12) at power-on, or after a positioning stop.
OPR request signal (X12) turns on at the following timings.

- When the power is turned on
- When the CPU module was reset
- When OPR starts
- When Servo READY signal (READY) turns off while BUSY signal (X14) is on
- When Servo READY signal (READY) turns off while BUSY signal (X14) is off
  (only when "0: Clear the deviation counter when the servo ready signal is OFF." is selected for "Deviation counter clear setting" in the switch setting)

(1) OPR method

The QD73A1 has two OPR methods so that an OP can be established in the optimum method (determination of the OP position, or OPR completion) depending on the positioning system configuration or the application.
Set an OPR method in the switch setting. For the setting method, refer to the following.
☞Page 100, Section 6.2

OPR method	Operation detail	Reference
Near-point dog method	As the near-point dog turns on, deceleration starts. (The speed decelerates to " Pr.12 Creep speed".) After the near-point dog turned off, the OPR is completed at the operation stop with the first Zero signal*1, specifying the position as the OP.	Page 179, Section 8.2
Count method	As the near-point dog turns on, deceleration starts and the machine moves at " Pr.12 Creep speed". From the position where the near-point dog turned on, the machine moves the distance set in " Pr.13 Setting for the movement amount after near-point dog ON". Then, the OPR is completed at the operation stop with the first Zero signal*1.	Page 181, Section 8.3

*1 Signal that is output as a single pulse at one motor revolution (e.g. Z-phase signal output from the drive unit)

(2) External I/O signals used for OPR control

◎: Necessary ○: Necessary as required

OPR method	Signal required for control		
	Near-point dog signal (DOG)	Zero signal	Upper limit signal (FLS)/Lower limit signal (RLS)
Near-point dog method	◎	◎	○
Count method	◎	◎	○

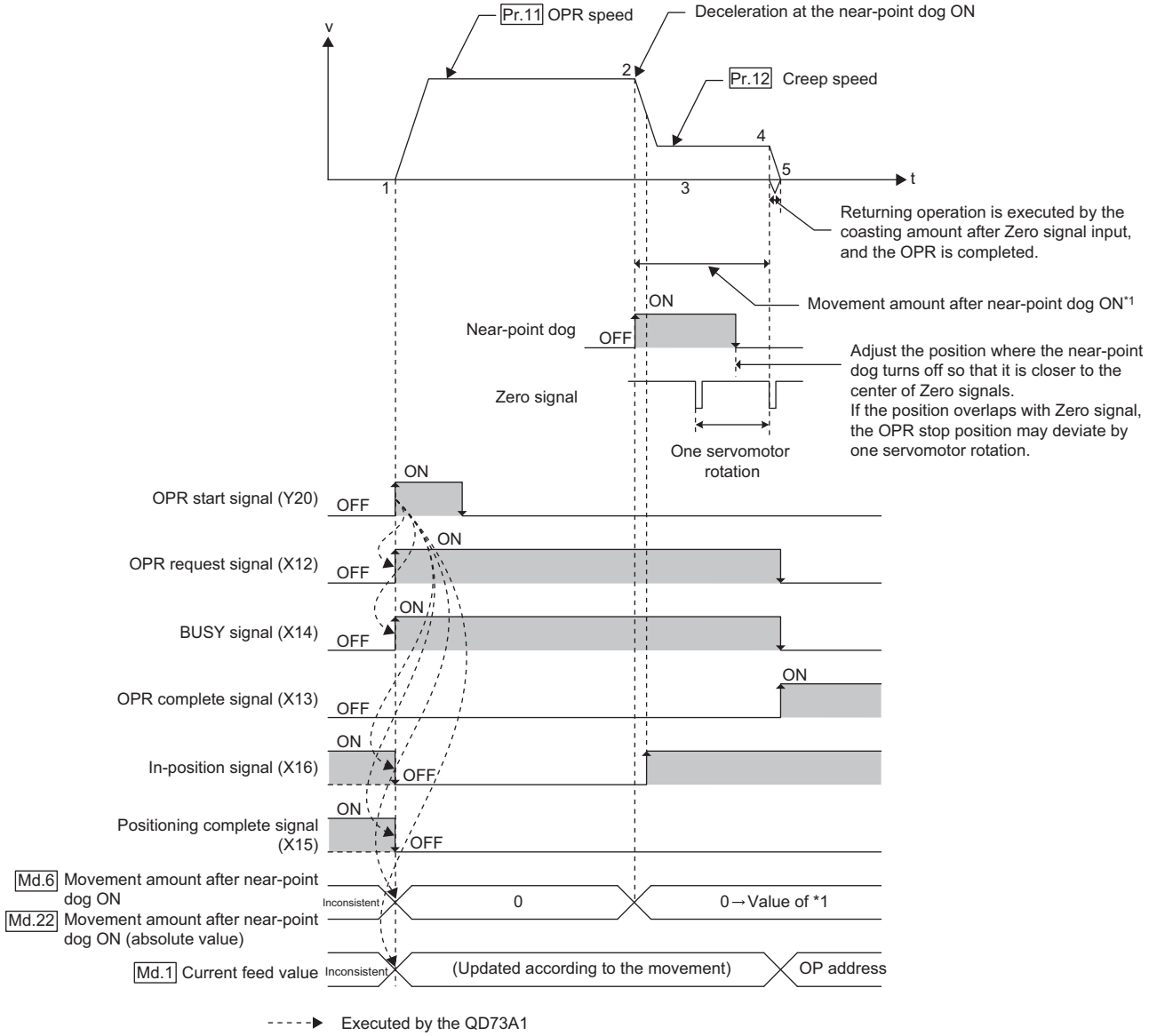
8.2 Near-point Dog Method

This section describes the operation overview of an OPR method, "near-point dog method".

(1) Operation chart

1	OPR starts. (Acceleration starts in the direction set on "OPR direction setting" in the switch setting, and the machine moves at " Pr.11 OPR speed".)
2	As the near-point dog turns on, deceleration starts.
3	The machine decelerates to " Pr.12 Creep speed", and subsequently moves at the creep speed. (The near-point dog must be on during the deceleration. If the near-point dog turns off during the deceleration, the OPR is completed at the first Zero signal input after the near-point dog OFF.)
4	Output from the QD73A1 stops at the first Zero signal after the near-point dog OFF.
5	Returning operation is executed by the coasting amount after Zero signal input, then OPR complete signal (X13) turns on and OPR request signal (X12) turns off.

As in the following figure, after the near-point dog turned off, the position of the first Zero signal from the pulse generator becomes the OP.



(2) Precautions during operation

(a) Another OPR after the completion of OPR

If another OPR is attempted after the completion of OPR, the error "OPR complete signal ON at start" (error code: 84) occurs.

(b) Positions of the near-point dog OFF and Zero signal

If the position where the near-point dog turns off is close to Zero signal, the Zero signal may be misread, resulting in deviation of OP by one servomotor rotation. Adjust the position where the near-point dog turns off so that it becomes closer to the center of Zero signals.

(c) OPR start from the near-point dog ON position

If an OPR start is attempted from the near-point dog ON position, the error "Near-point dog signal ON at start" (error code: 74) occurs.
Return the workpiece to a position away from the near-point dog using JOG operation, then execute OPR.

(d) Another OPR after the reset of the CPU module

If the CPU module was reset after OPR control was completed and the near-point dog turned off, another OPR can be started; however, the operation is executed at "Pr.11 OPR speed" to the position of the upper limit switch (FLS) or the lower limit switch (RLS) since there is no near-point dog placed in the OPR direction.

(e) Outside the stroke limit range

If the workpiece moved outside the stroke limit range, the error "Outside the stroke limit range" (error code: 100) occurs; although, the operation continues. In this case, the OPR is completed normally if the near-point dog is placed on the OPR direction.

8.3 Count Method

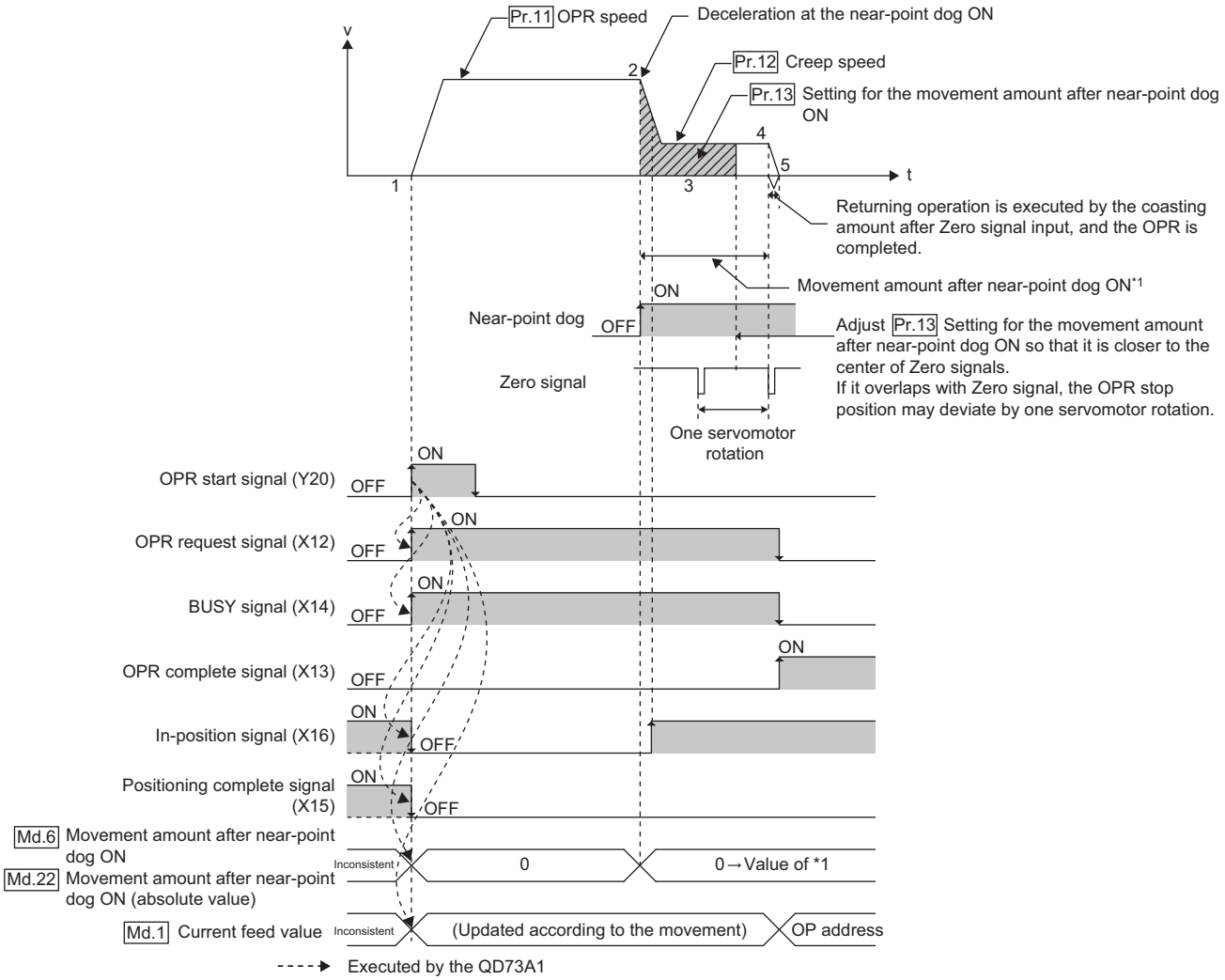
This section describes the operation overview of an OPR method, "count method".
OPR in the count method can be executed also in case of the following.

- OPR on the near-point dog ON
- Another OPR after completion of OPR

(1) Operation chart

1	OPR starts. (Acceleration starts in the direction set on "OPR direction setting" in the switch setting, and the machine moves at " Pr.11 OPR speed".)
2	As the near-point dog turns on, deceleration starts.
3	The machine decelerates to " Pr.12 Creep speed", and subsequently moves at the creep speed.
4	Output from the QD73A1 stops at the first Zero signal after the machine moved by the amount set in " Pr.13 Setting for the movement amount after near-point dog ON".
5	Returning operation is executed by the coasting amount after Zero signal input, then OPR complete signal (X13) turns on and OPR request signal (X12) turns off.

As in the following figure, after the machine moved the amount set in " Pr.13 Setting for the movement amount after near-point dog ON", the position of the first Zero signal from the pulse generator becomes the OP.



(2) Precautions during operation

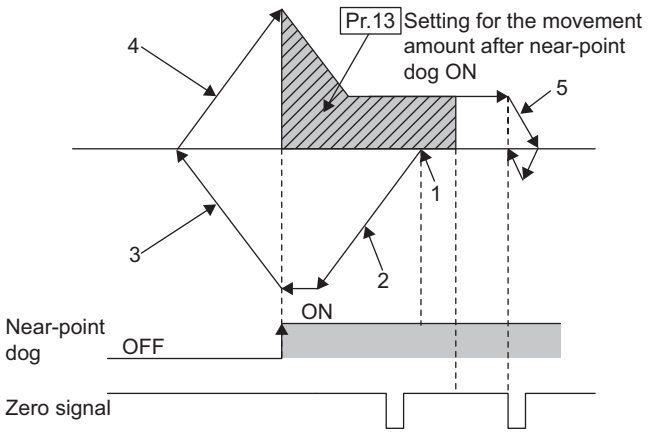
(a) Pr.13 Setting for the movement amount after near-point dog ON

If "Pr.13 Setting for the movement amount after near-point dog ON" is smaller than the deceleration distance from "Pr.11 OPR speed" to "Pr.12 Creep speed", the error "Setting for the movement amount after near-point dog ON Outside the setting range" (error code: 22) occurs, and the OPR does not start.

In addition, if the position after the move according to "Pr.13 Setting for the movement amount after near-point dog ON" is close to Zero signal, the Zero signal may be misread, resulting in deviation of OP by one servomotor rotation. Set "Pr.13 Setting for the movement amount after near-point dog ON" so that the position after the move becomes closer to the center of Zero signals.

(b) OPR start while near-point dog is on

The operation is as follows.



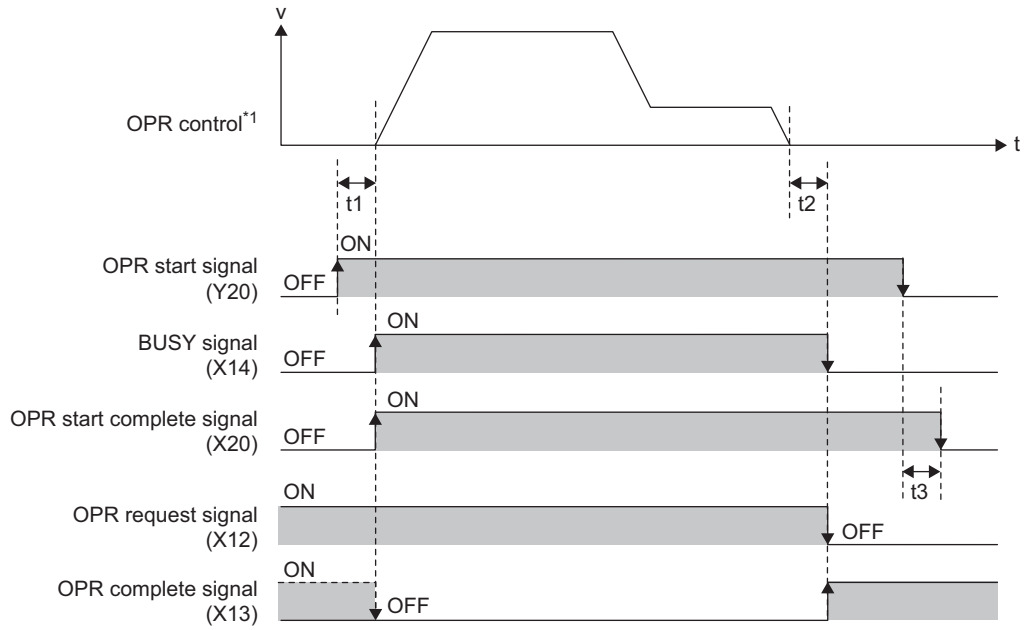
1	OPR starts.
2	The workpiece moves in the direction that is opposite from the specified OPR direction at "Pr.11 OPR speed".
3	As the near-point dog turns off, deceleration starts.
4	After an operation stop, OPR starts in the specified OPR direction.
5	As the near-point dog turns on, the workpiece moves the amount set in "Pr.13 Setting for the movement amount after near-point dog ON". Then, the OPR is completed at the first Zero signal after the move.

(c) Outside the stroke limit range

If the workpiece moved outside the stroke limit range, the error "Outside the stroke limit range" (error code: 100) occurs; although, the operation continues. In this case, the OPR is completed normally if the near-point dog is placed on the OPR direction.

8.4 Operation Timing and Processing Time of OPR Control

This section explains the operation timing and processing time of OPR control.



*1 This is an indication of internal commands, and does not match with the actual analog output waveform.

The following values apply to t1 to t3.

t1	t2	t3
0.7 to 1.2ms	0 to 0.5ms	0 to 0.5ms

8.5 OPR Parameter Setting

For the QD73A1 to execute OPR, OPR parameters must be set. If the data are not set, default values are used for control.
The default values are set also when the power was turned off and on, or when the CPU module was reset.
The following table lists the OPR parameters to be set, setting condition, and check timing.

Setting item		Setting range	Default value	Setting condition	Check timing of the set data	Buffer memory address (decimal)
Pr.10	OP address	-2147483648 to 2147483647 pulse	0 pulse	PLC READY signal (Y2D) must be off.	When OPR start signal (Y20) is turned on	40 41
Pr.11	OPR speed	1 to 4000000pulse/s	10000pulse/s			42 43
Pr.12	Creep speed	1 to 4000000pulse/s	1000pulse/s			44 45
Pr.13	Setting for the movement amount after near-point dog ON (set only for the count method)	0 to 2147483647pulse	75 pulse			46 47

CHAPTER 9 MAJOR POSITIONING CONTROL

"Major positioning control" is executed using "variable parameters" and "positioning data" stored in the QD73A1. The position control mode or the speed-position control switch mode is executed by setting a variable parameter " Pr.9 Positioning mode" and a positioning data item " Da.1 Positioning pattern" and by starting the positioning data.

9.1 Overview of Major Positioning Control

The following types of "major positioning control" are executed when a positioning start signal (Y21 to Y23) is turned on.

Major positioning control		Start signal	Description	Reference
Position control mode	Positioning control	• Absolute positioning start signal (Y21) • Forward start signal (Y22) (incremental positioning) • Reverse start signal (Y23) (incremental positioning)	Positioning is executed from the current position to a specified position at a specified speed. [Buffer memory setting] • Pr.9 Positioning mode: 0 • Da.1 Positioning pattern: 0	Page 191, Section 9.6.1 (1)
	Two-phase trapezoidal positioning control		Positioning is executed to the address specified with " Da.2 Positioning address P1" at " Da.3 Positioning speed V1", then to the address specified with " Da.4 Positioning address P2" at " Da.5 Positioning speed V2" by one positioning start signal. [Buffer memory setting] • Pr.9 Positioning mode: 0 • Da.1 Positioning pattern: 1	Page 192, Section 9.6.1 (2)
Speed-position control switch mode		• Forward start signal (Y22) (Speed-position control switchover) • Reverse start signal (Y23) (Speed-position control switchover)	Operation starts according to the positioning speed set beforehand by one positioning start signal, then the operation switches to position control by Speed-position switching command signal (CHANGE). If the operation stopped by Stop signal after the input of Speed-position switching command signal (CHANGE), the positioning can be continued by requesting a restart. In addition, the positioning address (movement amount) can be changed if it is before the input of Speed-position switching command signal (CHANGE). [Buffer memory setting] • Pr.9 Positioning mode: 1 • Da.1 Positioning pattern: 0	Page 195, Section 9.6.2

9.2 Data Required for Major Positioning Control

This section describes "positioning data" required for "major positioning control".

(1) Composition of positioning data and setting details

Positioning data		Setting detail
Da.1	Positioning pattern	Select a control pattern of major positioning from "positioning control" or "two-phase trapezoidal positioning control".
Da.2	Positioning address P1	Set the address that is the destination of major positioning control.
Da.3	Positioning speed V1	Set the command speed of major positioning control.
Da.4	Positioning address P2	In two-phase trapezoidal positioning control, set the destination address of after the move to the address set to " Da.2 Positioning address P1".
Da.5	Positioning speed V2	In two-phase trapezoidal positioning control, set the command speed to move to the address set to " Da.4 Positioning address P2".

The settings of Da.1 to Da.5 depend on " Pr.9 Positioning mode" and " Da.1 Positioning pattern".
(☞ Page 187, Section 9.3)

(2) Sub functions for major positioning control

For details on "sub functions" that can be combined with major positioning control, refer to the following.
☞ Page 29, Section 3.3 (4)
For details on each sub function, refer to the following.
☞ Page 208, CHAPTER 11

9.3 Relation Between Each Control and Positioning Data

Setting items and details of positioning data depend on the settings of a positioning data item "Da.1 Positioning pattern" and a variable parameter "Pr.9 Positioning mode".
The following table shows the positioning data setting items for each type of control.

Positioning data			Settings of "Pr.9 Positioning mode"	
			0: Position control mode	1: Speed-position control switch mode
Da.1	Positioning pattern	0: Positioning control	◎	—
		1: Two-phase trapezoidal positioning control	◎	—
Da.2	Positioning address P1		◎	◎
Da.3	Positioning speed V1		◎	◎
Da.4	Positioning address P2		○	—
Da.5	Positioning speed V2		○	—

◎: Set always
○: Set only for two-phase trapezoidal positioning control
—: Setting not required (The setting is ignored. Use the default value or a value that does not cause an error.)

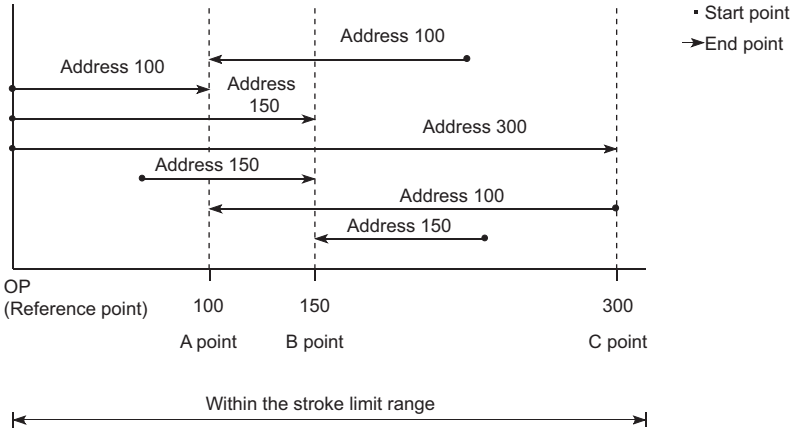
For details on each control and setting, refer to the following.
☞Page 190, Section 9.6

9.4 Specifying a Positioning Address

This section describes systems to specify a position for control using positioning data.

(1) Absolute system

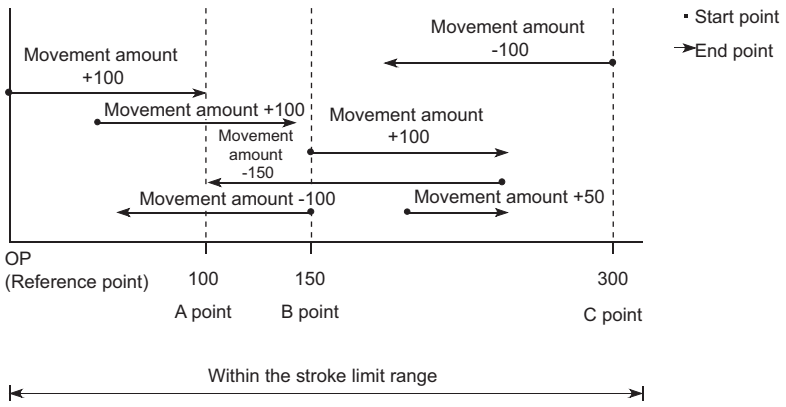
Positioning is executed using the current address as the start address and the address set with "Da.2 Positioning address P1" as the end address.



(2) Incremental system

Positioning is executed from the current address (start address) by the movement amount set in "Da.2 Positioning address P1".

The moving direction depends on the start signal to turn on: Forward start signal (Y22) or Reverse start signal (Y23).



9.5 Checking the Current Value

In the QD73A1, two types of address are used to indicate position.

(1) Addresses to be used

The two types of address, "current feed value" and "actual current value", are stored to the monitor data area. They can be monitored when necessary.

Item	Description	Update cycle
Current feed value	• This is the value stored in " Md.1 Current feed value". • The address established through OPR is the value of reference. • The address can be changed through a current value change.	0.5ms
Actual current value	• This is the value stored in " Md.2 Actual current value". • The actual servomotor movement amount calculated based on feedback pulses is stored as an actual current value (the number of feedback pulses). (Actual current value = Current feed value - Accumulated pulses in the deviation counter)	

(2) Precaution

When the value stored in " Md.1 Current feed value" or " Md.2 Actual current value" is used for control, the update timing of the buffer memory area may be in error by 0.5ms.

9.6 Details of Major Positioning Control

This section describes details on the position control mode (positioning control and two-phase trapezoidal positioning control) and the speed-position control switch mode.

(1) Precautions

(a) Dwell-time function

The QD73A1 does not have the dwell-time function. When dwell-time is necessary, start the next operation using the timer in the sequence program once the specified period of time passed after Positioning complete signal (X15) turned on.

(b) Combined use of incremental system and absolute system

The QD73A1 controls the current value during positioning. If incremental system positioning or combined positioning of incremental system and absolute system is repeated, the workpiece may move outside the stroke limit range and an error may occur. If an error occurs, change the current value to the one within the stroke limit range.

(2) Stop and restart during positioning

Refer to the following.

☞Page 230, CHAPTER 12

9.6.1 Position control mode

In the position control mode, positioning is executed toward the positioning address specified with positioning data at the specified speed.

There are two types of control in the position control mode.

- Positioning control (☞Page 191, Section 9.6.1 (1))
- Two-phase trapezoidal positioning control (☞Page 192, Section 9.6.1 (2))

There are two systems to specify a positioning address: the absolute system in which a positioning end address is specified and the incremental system in which movement amount from a start address to an end address is specified. Specify the absolute system or the incremental system using one of the following start signals.

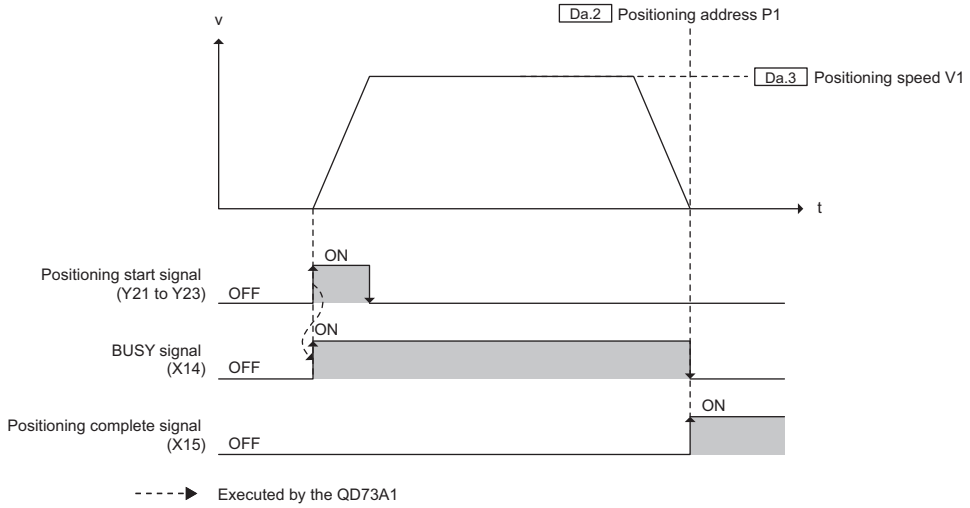
Start signal	Positioning system
Absolute positioning start signal (Y21)	Positioning start in the absolute system
Forward start signal (Y22)	Forward start in the incremental system (address increasing)
Reverse start signal (Y23)	Reverse start in the incremental system (address decreasing)

(1) Positioning control

Set a positioning address and positioning speed for this type of control. Absolute system positioning or incremental system positioning is executed by a positioning start command.

(a) Operation of positioning control

The operation is as follows.



(b) Positioning data setting

The following table lists the positioning data to be set, setting condition, and check timing.

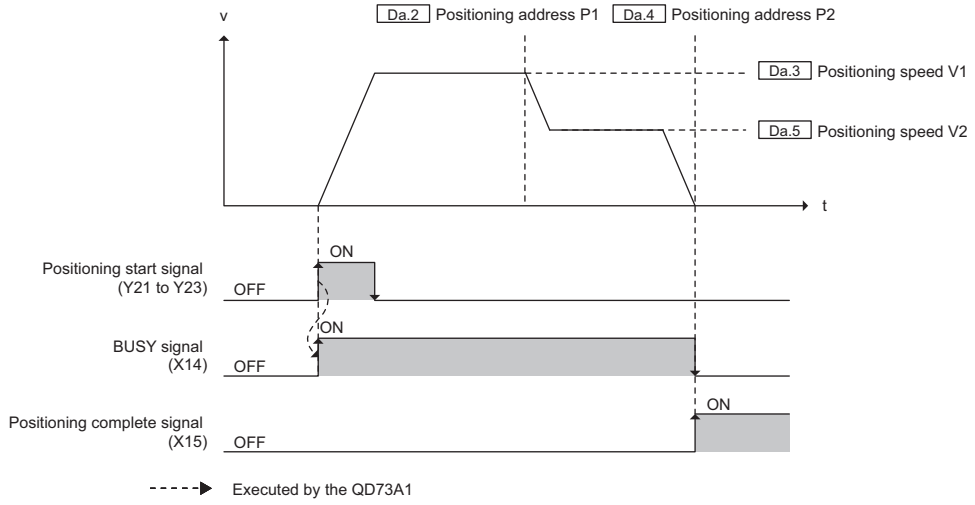
Setting item		Setting range	Default value	Setting condition	Check timing of the set data	Buffer memory address (decimal)
Da.1	Positioning pattern	0: Positioning control 1: Two-phase trapezoidal positioning control	0	The data can be set anytime. Note that the set data at the rise (ON) of a positioning start signal (Y21 to Y23) are used for the operation. If the data are written when BUSY signal (X14) is on, the data will be accepted at the rise (ON) of the next positioning start signal (Y21 to Y23).	When a positioning start signal (Y21 to Y23) is turned on	301
Da.2	Positioning address P1 (movement amount for the incremental system)	Absolute system: -2147483648 to 2147483647pulse Incremental system: 0 to 2147483647pulse	0pulse			302 303
Da.3	Positioning speed V1	1 to 4000000pulse/s	0pulse/s			304 305

(2) Two-phase trapezoidal positioning control

Set positioning addresses (P1 and P2) and positioning speed (V1 and V2) for this type of control. Positioning of the absolute system or the incremental system is executed first to the positioning address P1 at the positioning speed V1, then to the positioning address P2 at the positioning speed V2 by one positioning start command.

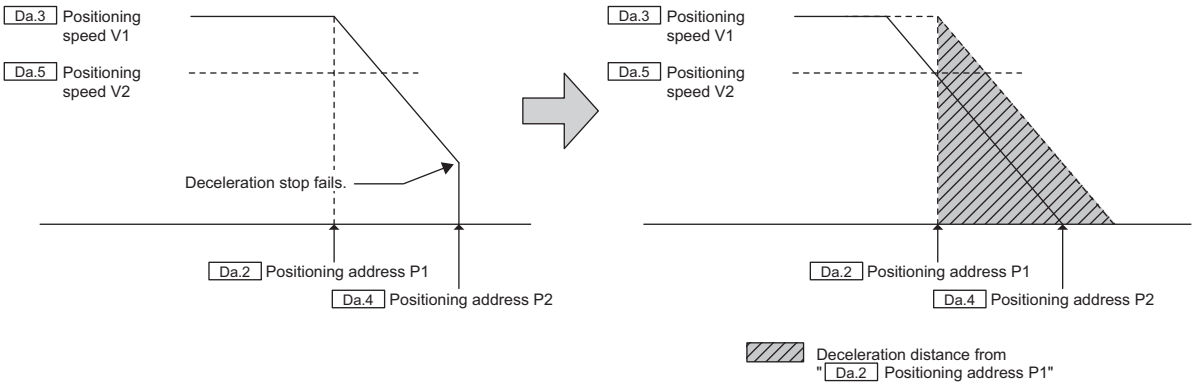
(a) Operation of two-phase trapezoidal positioning control

The operation is as follows.



(b) Deceleration distance

If the movement amount from the positioning address P1 to the positioning address P2 is less than the deceleration distance from the positioning address P1, two-phase trapezoidal positioning control is not formed. In this case, the deceleration from the positioning speed V1 starts before the workpiece reaches the positioning address P1 so that the operation stops at the positioning address P2.



To execute two-phase trapezoidal positioning, set the positioning data so that the deceleration distance from the positioning address P1 does not exceed the movement amount from the positioning address P1 to the positioning address P2.

(c) Two-phase trapezoidal positioning control in the absolute system

To execute two-phase trapezoidal positioning control in the absolute system, the positioning direction from "Da.2 Positioning address P1" to "Da.4 Positioning address P2" and the positioning direction from the current value to "Da.2 Positioning address P1" must be the same.
If not, the error "Two-phase trapezoidal positioning address error" (error code: 31) occurs, and the two-phase trapezoidal positioning control does not start.

Setting example		Moving direction from the current value to the positioning address P1	
Da.2 Positioning address P1	Da.4 Positioning address P2	Address increasing direction	Address decreasing direction
10000	5000	Error	Positioning executed
10000	15000	Positioning executed	Error

(d) Positioning speed V1 and V2

Any value within the setting range can be set in "Da.3 Positioning speed V1" and "Da.5 Positioning speed V2" regardless the relation between the two setting values.

(e) Positioning data setting

The following table lists the positioning data to be set, setting condition, and check timing.

Setting item		Setting range	Default value	Setting condition	Check timing of the set data	Buffer memory address (decimal)
Da.1	Positioning pattern	0: Positioning control 1: Two-phase trapezoidal positioning control	0	The data can be set anytime. Note that the set data at the rise (ON) of a positioning start signal (Y21 to Y23) are used for the operation. If the data are written when BUSY signal (X14) is on, the data will be accepted at the rise (ON) of the next positioning start signal (Y21 to Y23).	When a positioning start signal (Y21 to Y23) is turned on	301
Da.2	Positioning address P1 (movement amount for the incremental system)	Absolute system: -2147483648 to 2147483647pulse Incremental system: 0 to 2147483647pulse	0pulse			302 303
Da.3	Positioning speed V1	1 to 4000000pulse/s	0pulse/s			304 305
Da.4	Positioning address P2 (movement amount for the incremental system)	Absolute system: -2147483648 to 2147483647pulse Incremental system: 0 to 2147483647pulse	0pulse			306 307
Da.5	Positioning speed V2	1 to 4000000pulse/s	0pulse/s			308 309

9.6.2 Speed-position control switch mode

In the speed-position control switch mode, pulses that correspond to the specified positioning speed are output in the direction specified by a start signal. Then, once Speed-position switching command signal (CHANGE) is input, the operation switches to position control with the specified movement amount.
The speed-position control switch mode operates with the incremental system in which movement amount from a start address to an end address is specified.
Specify a forward start or a reverse start using one of the following signals.

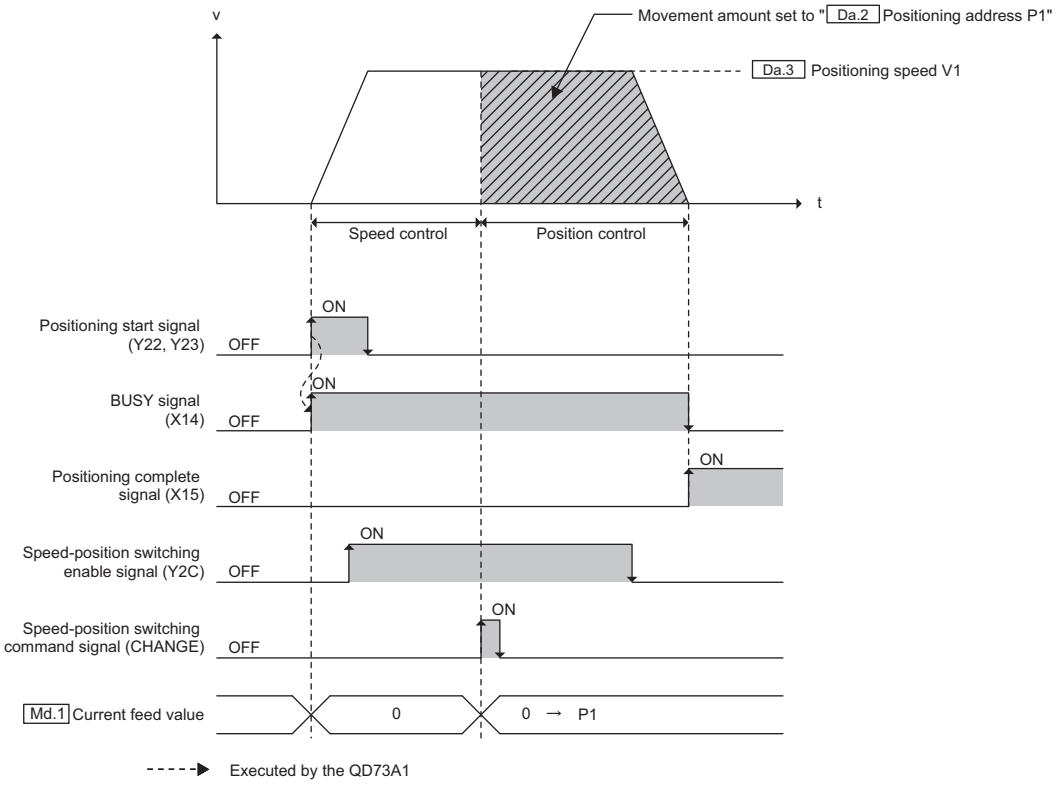
Start signal	Positioning system
Forward start signal (Y22)	Forward start (address increasing)
Reverse start signal (Y23)	Reverse start (address decreasing)

(1) Switchover from speed control to position control

To switch the operation from speed control to position control, Speed-position switching enable signal (Y2C) must be turned on before inputting Speed-position switching command signal (CHANGE).
If Speed-position switching command signal (CHANGE) is input when Speed-position switching enable signal (Y2C) is off, the speed control continues without being switched to position control. The operation switches to position control when Speed-position switching command signal (CHANGE) is input after Speed-position switching enable signal (Y2C) was turned on.

(2) Operation of the speed-position control switch mode

The operation is as follows.

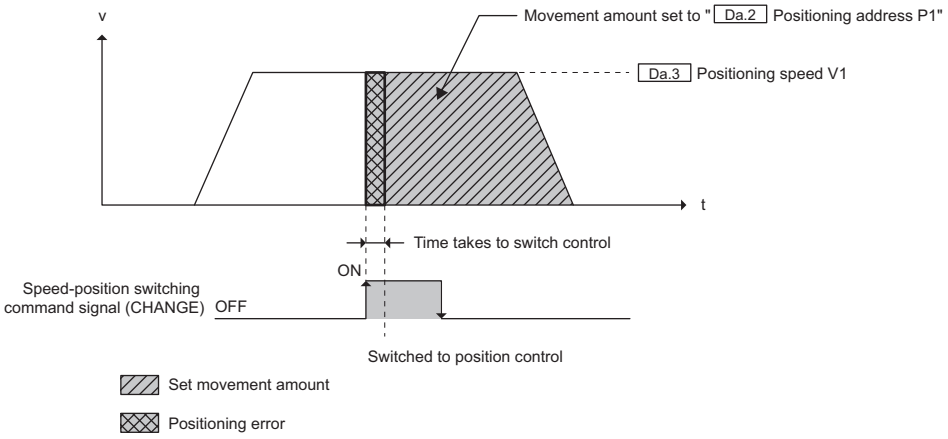


(3) "Md.1 Current feed value" and "Md.2 Actual current value"

In "Md.1 Current feed value" and "Md.2 Actual current value", 0 is set at the start of the speed-position control switch mode, and the settings are not updated during speed control.
They are updated once the operation switched to position control by the input of Speed-position switching command signal (CHANGE).

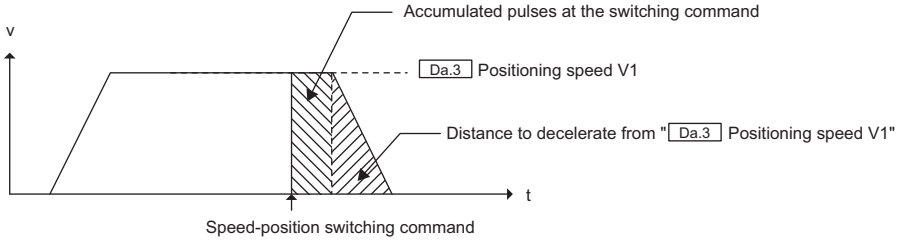
(4) Positioning error in the speed-position control switch mode

In the speed-position control switch mode, operation switches to position control by an input of Speed-position switching command signal (CHANGE) during speed control. The process from the signal input to the completion of switchover to position control takes some time, resulting in a positioning error by pulses output during the process.
The process time varies by approximately 2ms including the response delay of Speed-position switching command signal (CHANGE).



(5) "Da.2 Positioning address P1"

Set "Da.2 Positioning address P1" so that its setting value becomes greater than the value of the distance obtained using the following formula. If not, the positioning stops exceeding the specified movement amount.



$$\text{Da.2 Positioning address P1} > \text{(Accumulated pulses at the switching command)} + \text{(Distance to decelerate from Da.3 Positioning speed V1)}$$

$$= \frac{\text{Da.3 Positioning speed V1}}{\text{Position loop gain}} + \frac{1}{2} \times \text{Actual deceleration time} \times \text{Da.3 Positioning speed V1}$$

(6) Two-phase trapezoidal positioning control and speed-position control switchover

A speed-position control switchover cannot be performed in two-phase trapezoidal positioning control.

Point

Input Speed-position switching command signal (CHANGE) at the area where the speed is stable (constant speed status). When a servomotor is used, the actual movement amount after the switchover to position control is "Set movement amount + Accumulated pulse amount". If the signal is input during acceleration or deceleration, the operation stop position varies due to the variation in the accumulated pulse amount.

(7) Parameter and positioning data setting

The following table lists the parameter and positioning data to be set, setting condition, and check timing. Set other parameters if necessary.

Setting item		Setting range	Default value	Setting condition	Check timing of the set data	Buffer memory address (decimal)
Pr.9	Positioning mode	0: Position control mode 1: Speed-position control switch mode	0	The data can be set anytime. Note that the set data at the rise (ON) of a positioning start signal (Y22, Y23) are used for the operation. If the data are written when BUSY signal (X14) is on, the data will be accepted at the rise (ON) of the next positioning start signal (Y22, Y23).	When a positioning start signal (Y22, Y23) is turned on	25
Da.2	Positioning address P1 (movement amount)	0 to 2147483647pulse	0pulse			302 303
Da.3	Positioning speed V1	1 to 4000000pulse/s	0pulse/s			304 305

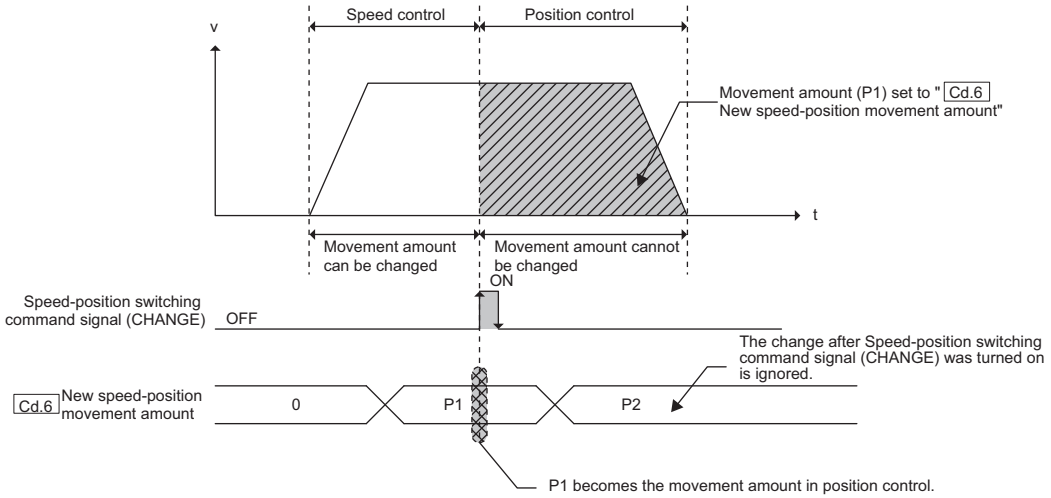
(8) Speed-position movement amount change

The movement amount for position control can be changed during speed control of the speed-position control switch mode.

Set the new movement amount in "Cd.6 New speed-position movement amount" using a sequence program during speed control. The value in "Cd.6 New speed-position movement amount" is reflected as the movement amount for position control at the input of Speed-position switching command signal (CHANGE).

(a) Operation of a speed-position movement amount change

The operation is as follows.



(b) Cd.6 New speed-position movement amount

The setting is cleared to 0 when the next operation starts.

(c) Data setting

The following table lists the data to be set, setting condition, and check timing.

Setting item		Setting range	Default value	Setting condition	Check timing of the set data	Buffer memory address (decimal)
Cd.6	New speed-position movement amount	1 to 2147483647pulse	0pulse	The data can be set when BUSY signal (X14) is on during speed control, and besides before the input of Speed-position switching command signal (CHANGE).	At the input of Speed-position switching command signal (CHANGE)	88 89

If "Cd.6 New speed-position movement amount" is a value that moves the workpiece outside the stroke limit range, the error "Movement outside the stroke limit range" (error code: 87) occurs at the input of Speed-position switching command signal (CHANGE), and the set new movement amount is ignored. (The value in "Da.2 Positioning address P1" (movement amount) is used.)

(9) Operation of speed control

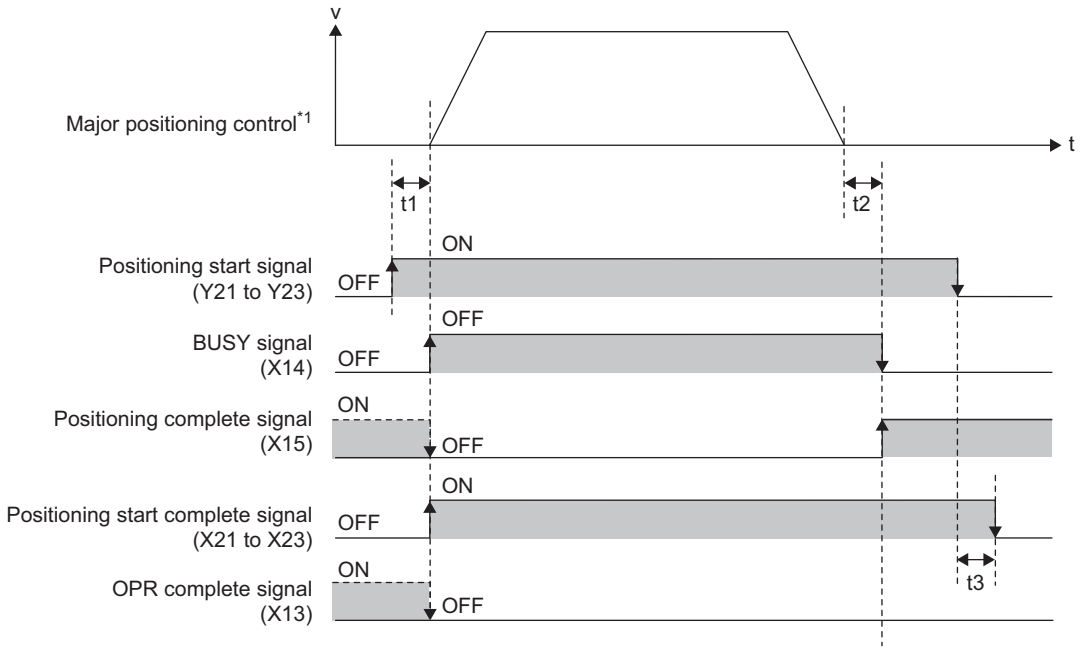
Operation can stay as speed control in the speed-position control switch mode when one of the following conditions is satisfied.

- Not to input Speed-position switching command signal (CHANGE)
- Not to turn on Speed-position switching enable signal (Y2C)

During speed control, the stroke limit function cannot be used since "Md.1 Current feed value" is not updated. A stroke range is from the lower limit switch (RLS) to the upper limit switch (FLS).

9.7 Operation Timing and Processing Time of Major Positioning Control

This section explains the operation timing and processing time of major positioning control.



*1 This is an indication of internal commands, and does not match with the actual analog output waveform.

The following values apply to t1 to t3.

t1	t2	t3
0.7 to 1.2ms	0 to 0.5ms	0 to 0.5ms

CHAPTER 10 JOG OPERATION

The QD73A1's "JOG operation" can move the workpiece without using positioning data, but according to signal inputs and specified movement amount. Use this function for the following.

- To check the connection of a positioning system
- To obtain the address of positioning data
- To move the workpiece in the direction where a limit signal turns on if operation stopped when a limit signal turned off

"JOG operation" moves the workpiece in the specified direction at the specified speed while Forward JOG start signal (Y24) or Reverse JOG start signal (Y25) is on.

10.1 Operation of JOG Operation

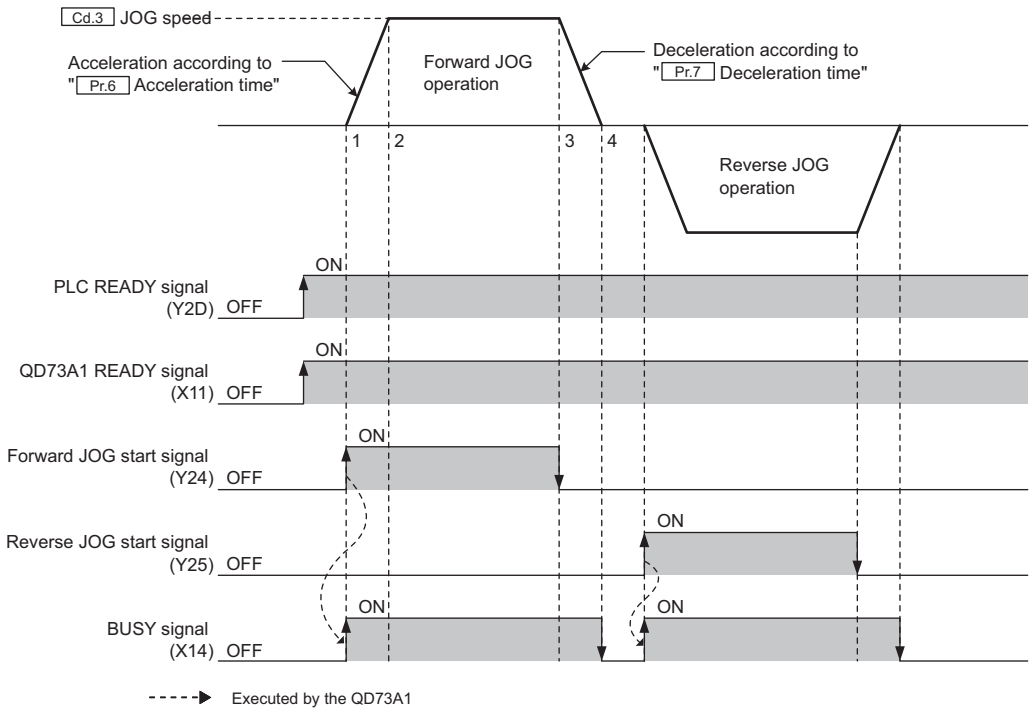
Once JOG speed is set and while a JOG start signal is turned on through a sequence program, the QD73A1 executes JOG operation in the specified direction by outputting analog voltage to the drive unit.
Choose forward run or reverse run using JOG start signals.

Start signal	Operation direction
Forward JOG start signal (Y24)	Address increasing direction
Reverse JOG start signal (Y25)	Address decreasing direction

(1) Operation of JOG operation

The following is an example of JOG operation.

1	As a JOG start signal is turned on, acceleration starts in the specified direction according to " Pr.6 Acceleration time". BUSY signal (X14) turns on at this time.
2	As the accelerating operation reaches the speed set in " Cd.3 JOG speed", the move continues maintaining the speed. The workpiece moves at the constant speed between 2 to 3 in the graph below.
3	As the JOG start signal is turned off, deceleration starts from the speed set in " Cd.3 JOG speed" according to " Pr.7 Deceleration time".
4	As the speed reaches 0, the operation stops. BUSY signal (X14) turns off at this time.

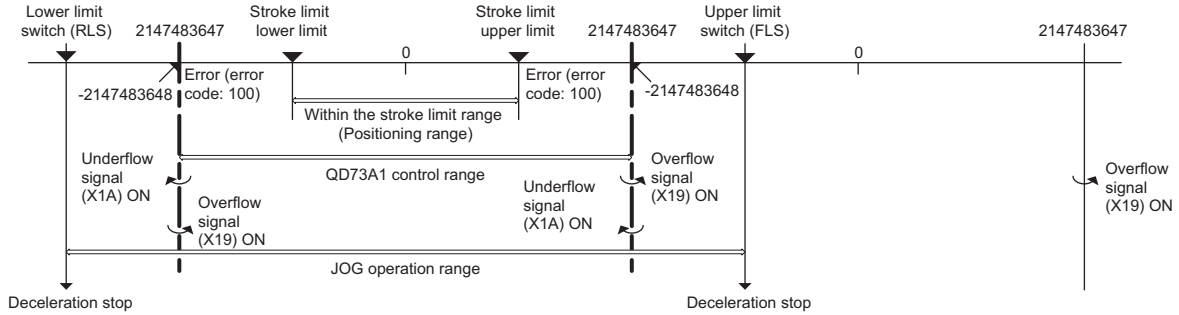


Speed can be changed by writing data to the control change area of the buffer memory using a sequence program.
For details, refer to the following.

☞Page 218, Section 11.6

(2) Range of JOG operation

The following figure shows the range of JOG operation.



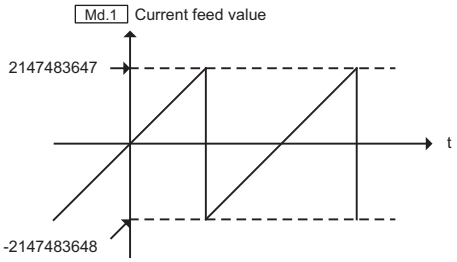
(a) Range in which JOG operation can be executed

JOG operation can be executed within the range between the upper limit switch (FLS) and the lower limit switch (RLS). Note that the stroke limit upper limit and lower limit are ignored in JOG operation.

JOG operation decelerates and stops if Upper limit signal (FLS) or Lower limit signal (RLS) turned off during the operation.

(b) When " Md.1 Current feed value" exceeded the QD73A1's control range during JOG operation

When the current feed value exceeded the QD73A1's control range (-2147483648 to 2147483647), Overflow signal (X19) or Underflow signal (X1A) turns on, and " Md.1 Current feed value" varies again as in the following figure.



Reset Overflow signal (X19) or Underflow signal (X1A) by turning on Overflow reset signal (Y29) or Underflow reset signal (Y2A).

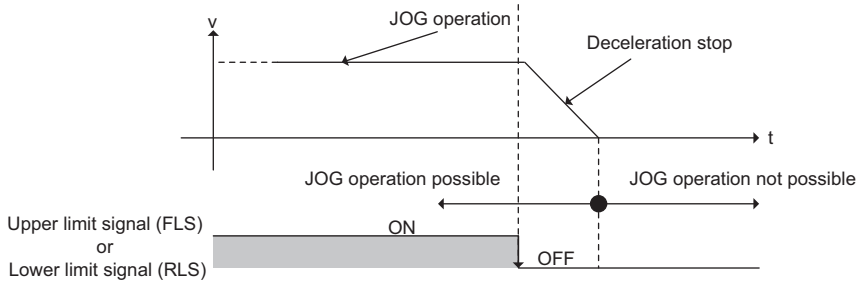
(c) When the stroke limit range was exceeded during JOG operation

The error "Outside the stroke limit range" (error code: 100) occurs.

(d) When the upper limit switch (FLS) or the lower limit switch (RLS) turned off

The error "Upper limit signal OFF while BUSY" (error code: 91) or the error "Lower limit signal OFF while BUSY" (error code: 92) occurs.

If operation decelerated and stopped due to the upper limit switch (FLS) or the lower limit switch (RLS), JOG operation can be executed in the opposite direction (direction back to the normal range) after resetting the error. (If the JOG start signal for the erroneous direction is turned on, the error occurs again.)

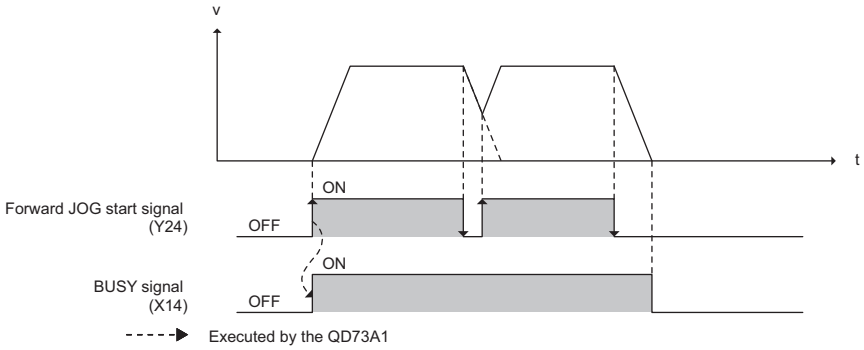


(3) Precautions during operation

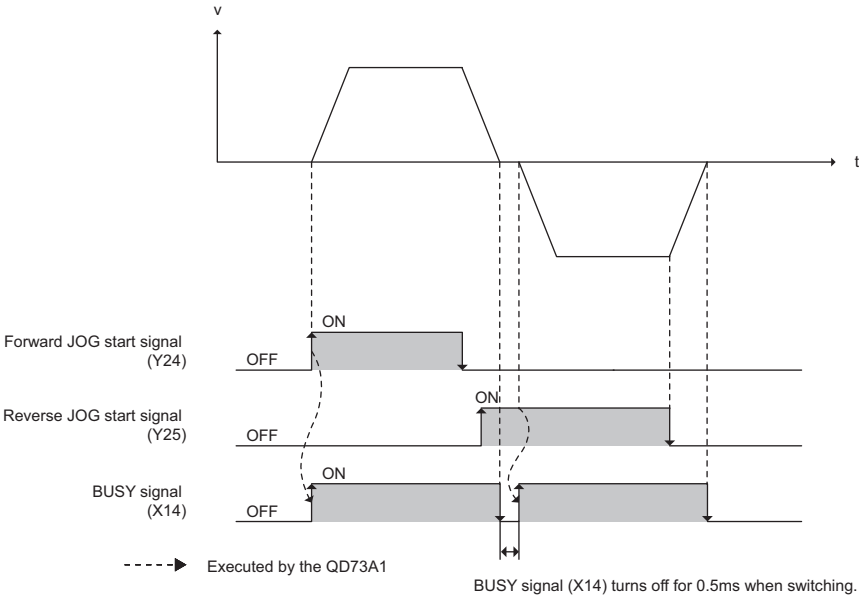
- Set a small value in "Cd.3 JOG speed" first to check the operation, then change it to greater values gradually for safe operation.
- If "Cd.3 JOG speed" is 0, the error "JOG speed Outside the setting range" (error code: 41) occurs, and the JOG operation does not start.
- If "Cd.3 JOG speed" exceeds "Pr.5 Speed limit value", the operation is executed at the speed set in "Pr.5 Speed limit value", but the error "JOG speed Outside the setting range" (error code: 41) occurs.

(4) JOG start timing

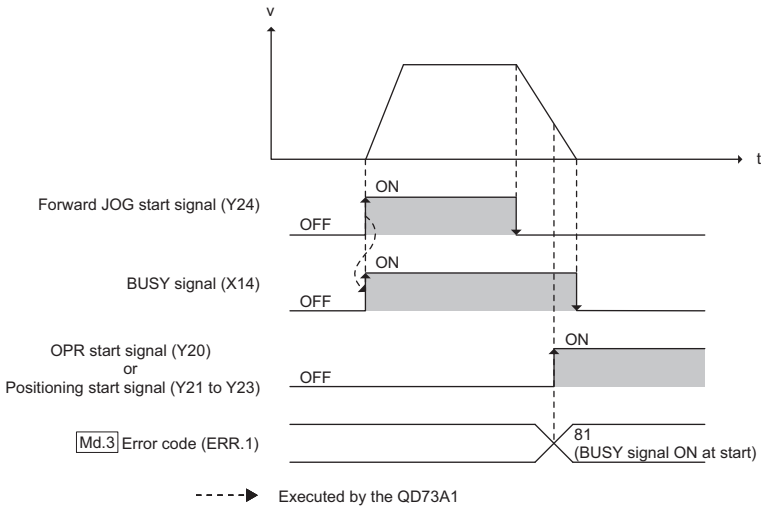
- During deceleration after a JOG start signal was turned off, if the JOG start signal for the same direction is turned on, JOG operation starts again accelerating its speed.



- During deceleration after a JOG start signal was turned off, if the JOG start signal for the opposite direction is turned on, JOG operation starts in the opposite direction after the completion of deceleration.



- During deceleration after a JOG start signal was turned off, if OPR start signal (Y20) or a positioning start signal (Y21 to Y23) is turned on, an error occurs and the operation does not start.



- If the JOG start signal for the opposite direction is turned on during JOG operation, the error "BUSY signal ON at start" (error code: 81) occurs and the operation in the opposite direction is not executed.
- If Forward JOG start signal (Y24) and Reverse JOG start signal (Y25) are turned on at the same time, the error "BUSY signal ON at start" (error code: 81) occurs and forward JOG operation is executed.

(5) Sub functions for JOG operation

For details on "sub functions" that can be combined with JOG operation, refer to the following.

☞Page 29, Section 3.3 (4)

For details on each sub function, refer to the following.

☞Page 208, CHAPTER 11

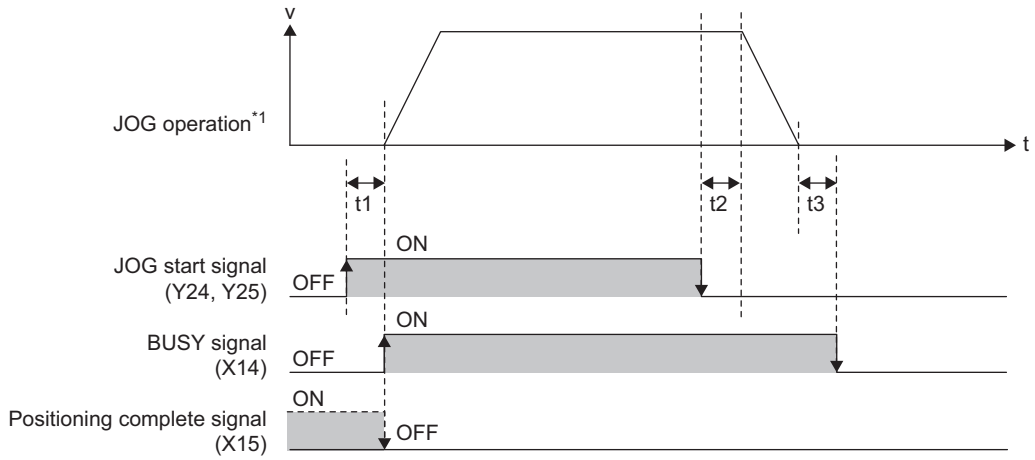
(6) Monitoring JOG operation

To directly monitor the buffer memory using GX Works2, refer to the following.

☞Page 89, Section 5.6

10.2 Operation Timing and Processing Time of JOG Operation

This section explains the operation timing and processing time of JOG operation.



*1 This is an indication of internal commands, and does not match with the actual analog output waveform.

The following values apply to t1 to t3.

t1	t2	t3
0.7 to 1.2ms	0 to 0.5ms	0 to 0.5ms

10.3 Data Setting for JOG Operation

To execute JOG operation, certain data must be set and stored in the buffer memory areas.
The following table lists the JOG data to be set, setting condition, and check timing.

Setting item		Setting range	Default value	Setting condition	Check timing of the set data	Buffer memory address (decimal)
Cd.3	JOG speed	1 to 4000000pulse/s	0pulse/s	The data can be set anytime. Note that the set data at the rise (ON) of a JOG start signal (Y24, Y25) are used for the operation. If the data are written when BUSY signal (X14) is on, the data will be accepted at the rise (ON) of the next JOG start signal (Y24, Y25).	When a JOG start signal (Y24, Y25) is turned on	84 85
Pr.5	Speed limit value	10 to 4000000pulse/s (Set in the unit of 10pulse/s.)	200000 pulse/s			20 21
Pr.6	Acceleration time	2 to 9999ms	300ms			22
Pr.7	Deceleration time					23

CHAPTER 11 CONTROL SUB FUNCTIONS

Functions referred to as "sub function" compensate or limit control, or add functions at the execution of major positioning functions. Execute these sub functions by setting parameters or through a sequence program for them. The following functions are referred to as "sub function".

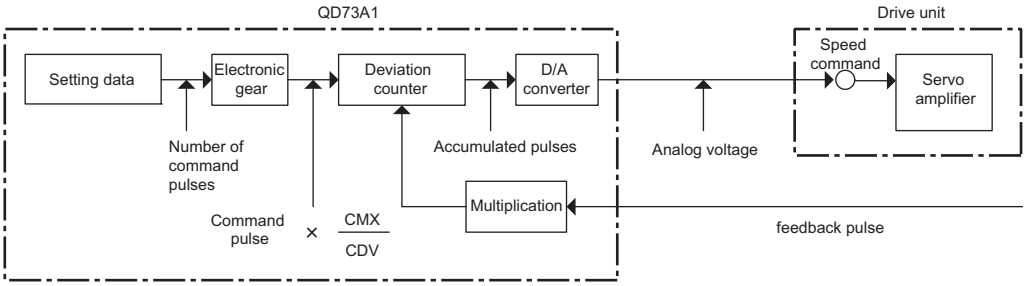
Sub function		Description	Reference
Functions to compensate control	Electronic gear function	This function controls moving distance and speed by multiplying command pulse output of the QD73A1.	Page 209, Section 11.1
Functions to limit control	Speed limit function	This function limits command speed to the value set in "Pr.5 Speed limit value".	Page 211, Section 11.2
	Stroke limit function	This function controls operation not to execute positioning when a command that moves the workpiece outside the specified stroke limit range is given.	Page 213, Section 11.3
	Upper limit switch (FLS)/lower limit switch (RLS) function	This function decelerates and stops operation according to the detection on limit switches placed at the upper and lower stroke limits.	Page 215, Section 11.4
Functions to change control details	Current value change function	This function changes the value set in "Md.1 Current feed value" to a specified value.	Page 217, Section 11.5
	Speed change function	This function changes speed during major positioning control or JOG operation.	Page 218, Section 11.6
	Deviation counter clear function	This function clears the accumulated pulses in the deviation counter. When the servomotor power was turned off due to an emergency stop during positioning, clearing the accumulated pulses in the deviation counter prevents servomotor rotation at power recovery.	Page 220, Section 11.7
Other functions	In-position function	This function turns on In-position signal (X16) while the accumulated pulse amount in the deviation counter is within the specified in-position range (1 to 20479pulse). In-position signal (X16) can be used as the signal right before positioning completion.	Page 221, Section 11.8
	Accumulated pulse error detection function	This function outputs an alert and immediately stops the positioning when the accumulated pulses reached the amount specified by the user before the pulses exceed the amount set in "Accumulated pulse setting" in the switch setting and an excessive error occurs.	Page 223, Section 11.9

11.1 Electronic Gear Function

The "electronic gear function" controls machine movement amount per one command pulse by multiplying command pulse output of the QD73A1.
Positioning is much more flexible with the use of this function, eliminating the process of selecting a detector according to the machine system.

(1) Details of the electronic gear function

Machine movement amount per one pulse is adjusted inside the QD73A1.
Electronic gear is active on all of OPR control, major positioning control, and JOG operation.



Set numerator and denominator of command pulse multiplication for electronic gear to parameters.
Satisfy the following condition when setting a numerator (CMX) and a denominator (CDV).

$$\frac{1}{50} \leqq \frac{CMX}{CDV} \leqq 50$$

If the setting range is exceeded, the error "Denominator of command pulse multiplication for electronic gear Outside the setting range" (error code: 3) occurs.
When the electronic gear function is used, positioning speed and movement amount are multiplied by the specified value.
When there are decimal pulses, the fractions are maintained inside and accumulated for the next command.
The following is an example of the use of electronic gear.

Ex. A positioning system using the following worm gear

- Worm gear lead: 10mm
- Feedback pulses from the servomotor: 12000pulse/rev

When the electronic gear function is not used, the feed rate (movement amount per pulse) has fractions.

$$\Delta \ell = \frac{10}{12000} = 0.000833 \cdots \text{mm/pulse}$$

In this system, the fractions can be avoided using the electronic gear function and setting numerator and denominator as follows: CMX/CDV = 12

$$\Delta \ell' = \frac{10}{12000} \times 12 = 0.01\text{mm/pulse}$$

(2) Precautions for control

- Execute OPR without fail after resetting the CPU module. If not, a positioning error occurs by the fractions of electronic gear that were not output during positioning before the CPU reset.
- When the positioning speed value that was multiplied by the set value of electronic gear exceeds the speed limit value, the limit value is ignored. On the other hand, if the speed exceeds 4Mpulse/s, the maximum value of command frequency, the error "Outside the command frequency range" (error code: 104) occurs. In this case, the speed is 4Mpulse/s, resulting in a positioning error. To avoid this case, satisfy the following condition when setting positioning speed and electronic gear: Positioning speed × Electronic gear ≤ 4Mpulse/s

(3) Setting the electronic gear function

The following table lists the data to be set, setting condition, and check timing.

Setting item		Setting range	Default value	Setting condition	Check timing of the set data	Buffer memory address (decimal)
Pr.3	Numerator of command pulse multiplication for electronic gear (CMX)	1 to 9999	1	PLC READY signal (Y2D) must be off.	When PLC READY signal (Y2D) is turned on	4
Pr.4	Denominator of command pulse multiplication for electronic gear (CDV)		1			5

11.2 Speed Limit Function

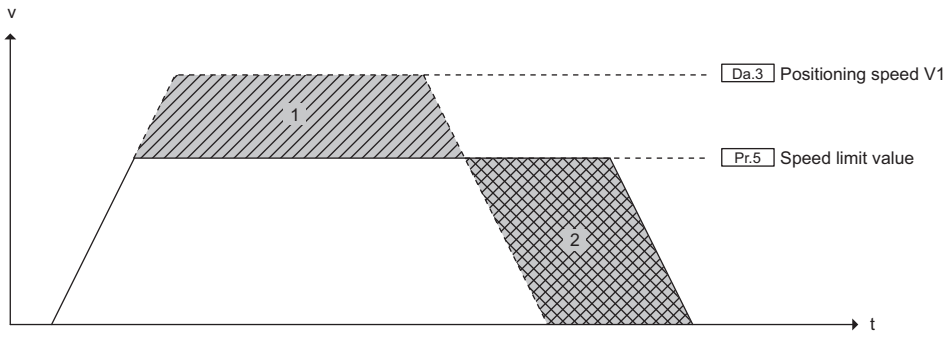
The "speed limit function" limits command speed to the value set in "Pr.5 Speed limit value" when command speed during major positioning control or JOG operation exceeds "Pr.5 Speed limit value".

(1) Control detail

This function is active on major positioning control and JOG operation.

When the value set in "Pr.5 Speed limit value" is exceeded in each control, command speed is limited to "Pr.5 Speed limit value".

The operation of the speed limit function is as follows.



In the figure above, the speed set in "Pr.5 Speed limit value" is output since "Da.3 Positioning speed V1" is faster than "Pr.5 Speed limit value". In this case, the movement amount that was not output because of the speed limit (1 in the figure) is output later (2 in the figure), delaying the positioning completion.

(2) Precautions for control

Set positioning speed and JOG speed to a value equal to or less than "Pr.5 Speed limit value". If "Pr.5 Speed limit value" is exceeded, command speed is limited to "Pr.5 Speed limit value".

Also, set OPR speed to a value equal to or less than "Pr.5 Speed limit value". If "Pr.5 Speed limit value" is exceeded, the error "OPR speed Outside the setting range" (error code: 20) occurs at the start of OPR.

(3) Setting the speed limit function

The following table lists the data to be set, setting condition, and check timing.

Setting item		Setting range	Default value	Setting condition	Check timing of the set data	Buffer memory address (decimal)
Pr.5	Speed limit value	10 to 4000000pulse/s (Set in the unit of 10pulse/s.)	200000 pulse/s	The data can be set anytime. Note that the set data at the rise (ON) of a start signal is used for the operation. If the data is written when BUSY signal (X14) is on, the data will be accepted at the rise (ON) of the next start signal.	• When a positioning start signal (Y21 to Y23) is turned on • When a JOG start signal (Y24, Y25) is turned on • When OPR start signal (Y20) is turned on	20 21

Point

Set " Pr.5 Speed limit value" in a unit of 10 pulses. If a single digit is set, the value is rounded off.

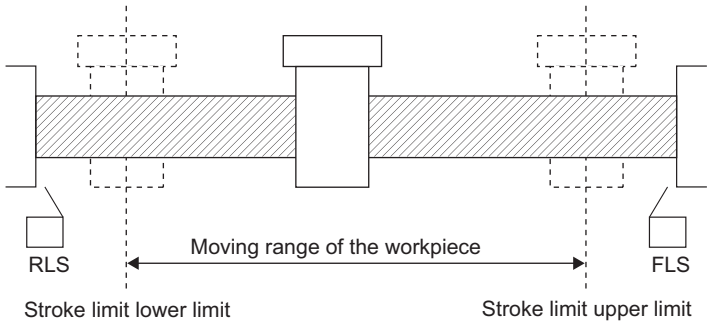
Ex. For instance, if "1999" is set, the operation is executed with a speed limit value of "1990".

11.3 Stroke Limit Function

The "stroke limit function" controls operation not to execute positioning when a command that moves the workpiece outside the specified stroke limit range is given.

(1) Control detail

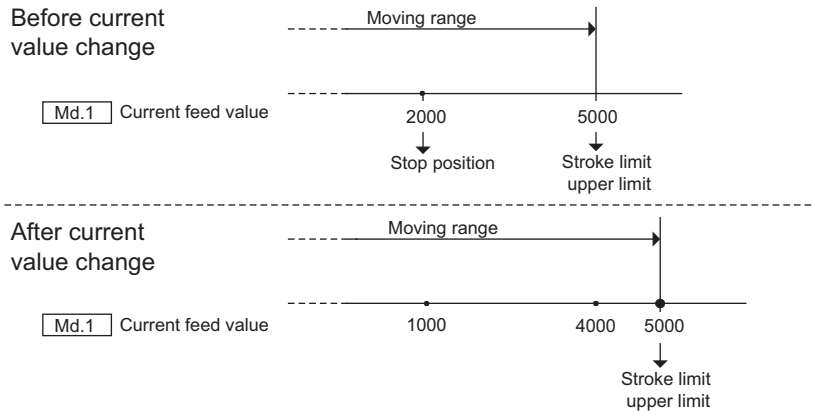
This function limits the moving range of the workpiece.
The following figure shows a moving range of a workpiece when the stroke limit function is used.



The following is an example in which a moving range of a workpiece changes following a current value change.

Ex. When the current stop position is 2000 and the stroke limit upper limit is set to 5000

As the current value is changed from 2000 to 1000, "Md.1 Current feed value" changes to 1000, expanding the moving range of the workpiece.



(2) Stroke limit check details and processing for each control

The following table describes stroke limit checks and processing in case of an error that are performed by the QD73A1.

Check number	Check detail	Processing in case of an error
1	If a current value is outside the stroke limit range*1, the module reports an error. (The module checks "Md.1 Current feed value".)	The module turns on Error detection signal (X18), and reports the error "Outside the stroke limit range at start" (error code: 83).
2	If a positioning address setting is outside the stroke limit range*1, the module reports an error. (The module checks "Da.2 Positioning address P1".)	The module turns on Error detection signal (X18), and reports the error "Positioning address Outside the setting range" (error code: 30).
3	If a current value exceeds the stroke limit range*1, the module reports an error. (The module checks "Md.1 Current feed value".)	The module turns on Error detection signal (X18), and reports the error "Outside the stroke limit range" (error code: 100).

*1 The range from "Pr.1 Stroke limit upper limit" to "Pr.2 Stroke limit lower limit"

The following table describes the corresponding stroke limit check for each control.

Control			Stroke limit check
OPR control			Stroke limit check 3 is performed.
Major positioning control	Position control mode	Positioning control	Stroke limit check 1 and 2 are performed.
		Two-phase trapezoidal positioning control	
	Speed-position control switch mode		
JOG operation			Stroke limit check 3 is performed.
Current value change			No stroke limit check is performed.

(3) Precaution for control

To execute the stroke limit function normally, OPR must be executed beforehand.

(4) Setting the stroke limit function

The following table lists the data to be set, setting condition, and check timing.

Setting item		Setting range	Default value	Setting condition	Check timing of the set data	Buffer memory address (decimal)
Pr.1	Stroke limit upper limit	-2147483648 to 2147483647 pulse	2147483647 pulse	PLC READY signal (Y2D) must be off.	When PLC READY signal (Y2D) is turned on	0 1
Pr.2	Stroke limit lower limit		0pulse			2 3

(5) Disabling the stroke limit function

Set values as follows.

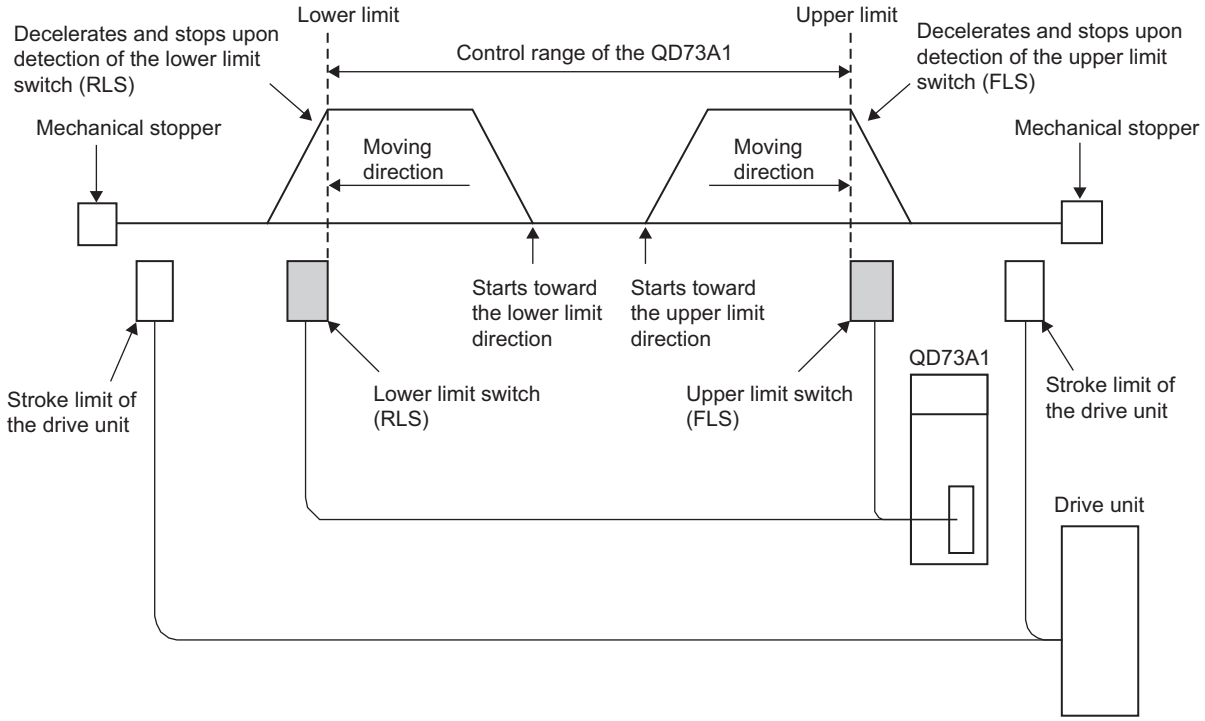
Pr.1 Stroke limit upper limit = Pr.2 Stroke limit lower limit

11.4 Upper Limit Switch (FLS)/Lower Limit Switch (RLS) Function

The "upper limit switch (FLS)/lower limit switch (RLS) function" decelerates and stops operation according to signal inputs from limit switches that are placed at the upper and lower limits of the machine's movable range.
This function prevents the machine from being damaged by stopping the operation before the workpiece reaches the upper or lower limit of the moving range, which is a physical limit that the QD73A1 can handle.
Normally, upper limit switch (FLS) and lower limit switch (RLS) are placed inside the stroke limits (stroke ends) of the drive unit, so that the operation is stopped before the workpiece reaches a stroke limit (stroke end) of the drive unit.

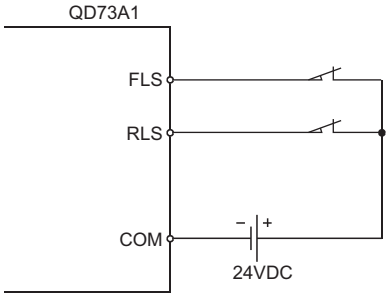
(1) Control detail

The following figure shows the operation of the upper limit switch (FLS)/lower limit switch (RLS) function.



(2) Wiring upper limit switch (FLS) and lower limit switch (RLS)

To use the upper limit switch (FLS)/lower limit switch (RLS) function, wire the QD73A1's terminals for Upper limit signal (FLS) and Lower limit signal (RLS) as in the following figure.



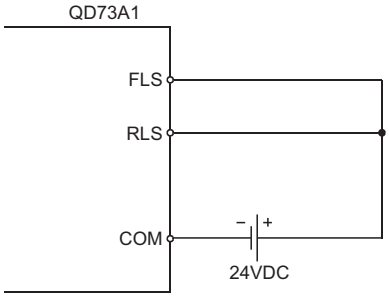
When wiring the terminals, set the switch that is placed on the direction in which "Md.1 Current feed value" increases as an upper limit switch (FLS), and the switch that is placed on the direction in which "Md.1 Current feed value" decreases as a lower limit switch (RLS).
If the upper and lower limit switches are wired opposite, the upper limit switch (FLS)/lower limit switch (RLS) function does not operate normally, and the motor does not stop.

(3) Precautions for control

- OPR control, major positioning control, and JOG operation cannot be started from the area where the upper limit switch (FLS) had detected overrange in the direction where "Md.1 Current feed value" increases. Also, OPR control, major positioning control, and JOG operation cannot be started from the area where the lower limit switch (RLS) had detected overrange in the direction where "Md.1 Current feed value" decreases. To start operation again, move the workpiece to a position within the control range of the QD73A1 using JOG operation.
- If the wiring between Upper limit signal (FLS) and COM terminal or between Lower limit signal (RLS) and COM terminal is open (including the case that the terminals are not wired), the QD73A1 cannot execute positioning.

(4) When the upper limit switch (FLS)/lower limit switch (RLS) function is not used

Wire the QD73A1's terminals for Upper limit signal (FLS) and Lower limit signal (RLS) as in the following figure.



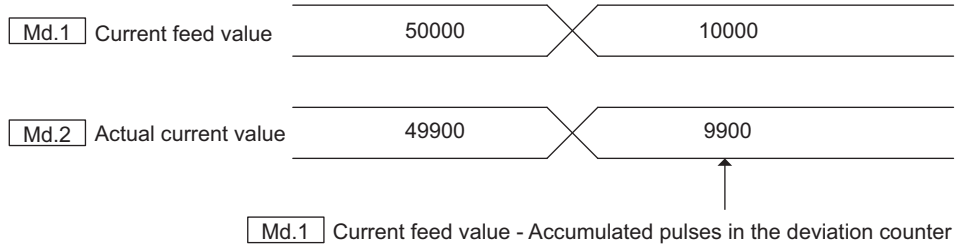
11.5 Current Value Change Function

The "current value change function" changes the value set in "Md.1 Current feed value" to a specified value.
Use this function when operation cannot be started due to a current feed value outside the stroke range, or to change the current value.

(1) Control detail

As a new address is set in "Cd.1 New current value" and "1" is written in "Cd.7 Current value change request", "Md.1 Current feed value" changes to the value set in "Cd.1 New current value".

"Md.2 Actual current value" is equal to "Md.1 Current feed value - Accumulated pulses in the deviation counter". When the accumulated pulse amount in the deviation counter is 0, "Md.1 Current feed value" is equal to "Md.2 Actual current value".



(2) Precautions for control

- If "1" is set in "Cd.7 Current value change request" when BUSY signal (X14) is on, the error "Current value change error" (error code: 110) occurs and the current value is not changed.
- If the current value is changed to a value outside the stroke limit range, an error does not occur.

(3) Data setting and the execution condition of the function

The following table lists the data to be set and the condition to execute the current value change function.

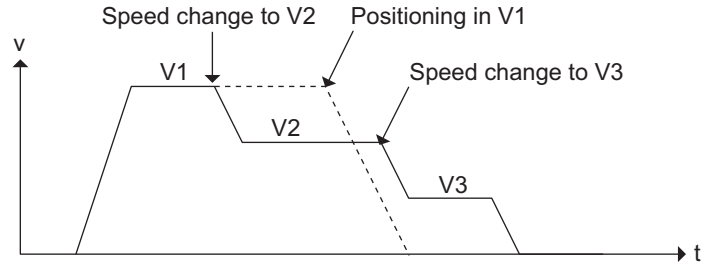
Setting item		Setting range	Default value	Execution condition of the current value change function	Buffer memory address (decimal)
Cd.1	New current value	-2147483648 to 2147483647pulse	0pulse	BUSY signal (X14) must be off.	80 81
Cd.7	Current value change request	1: Change the current value	0		90

11.6 Speed Change Function

The "speed change function" changes the speed of the operation in process to a specified speed at a specified timing. Set a new speed value to the buffer memory and request the speed change.

(1) Control detail

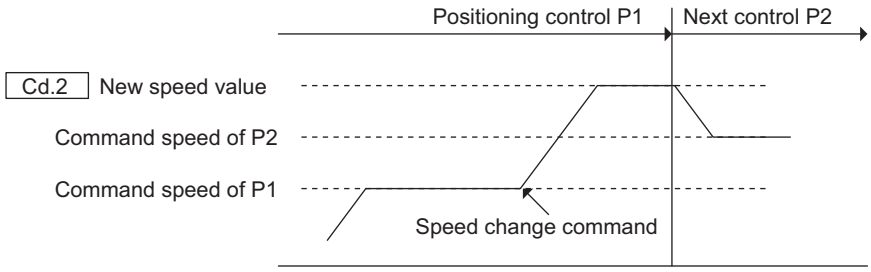
The following figure shows the operation of speed changes.



(2) Precautions for control

(a) Speed change during two-phase trapezoidal positioning control

- A speed change requested during two-phase trapezoidal positioning control is reflected to the command speed (Da.3 , Da.5) of the next positioning data.



- If the remaining distance is not enough to change speed, the speed cannot be changed during two-phase trapezoidal positioning control.

(b) Timing at which speed cannot be changed

Speed cannot be changed at the following timings.

- During deceleration following a stop command
- During OPR
  (The error "Speed change error (OPR)" (error code: 111) occurs.)
- During automatic deceleration in major positioning control
  (The error "Speed change error (Positioning)" (error code: 112) occurs.)
- During deceleration stop of JOG operation following a change (from on to off) of a JOG start signal (Y24, Y25)
  (The error "Speed change error (JOG)" (error code: 113) occurs.)

(c) New speed and "Pr.5 Speed limit value"

When the value set in "Cd.2 New speed value" exceeds "Pr.5 Speed limit value", the positioning is operated at "Pr.5 Speed limit value".

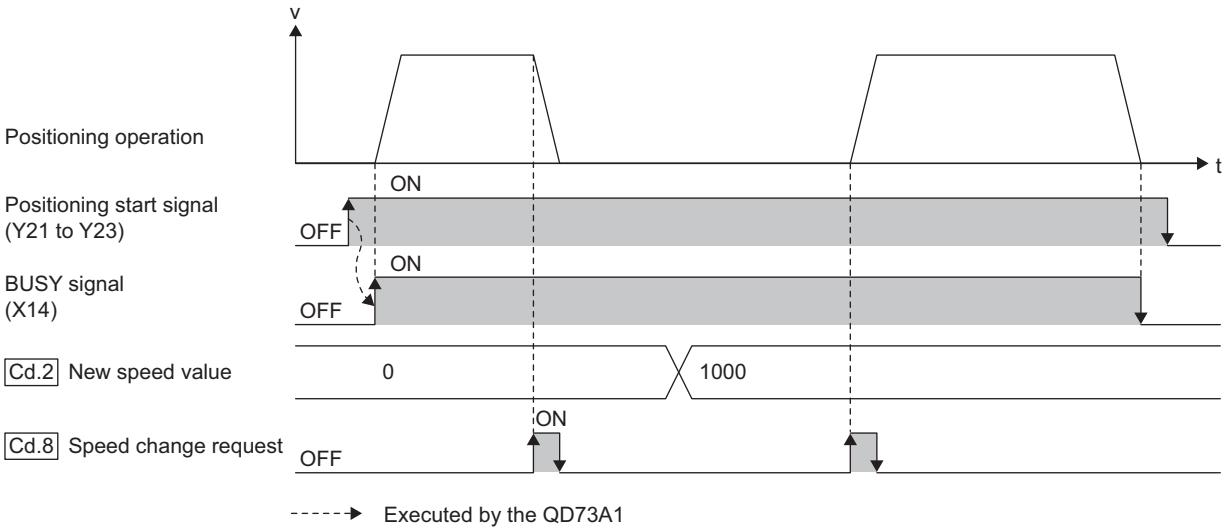
(d) Successive speed changes

To change speed successively, set an interval of 10ms or more between each speed change. If there are not enough intervals between speed changes, the QD73A1 may not be able to follow the requests and process the commands normally.

(e) When "0" is set in "Cd.2 New speed value"

When "0" is set in "Cd.2 New speed value" and a speed change is requested, the axis stops. Though, BUSY signal (X14) stays on. (Inputting Stop signal turns off BUSY signal (X14).)

To activate the axis again, set a value other than "0" in "Cd.2 New speed value" and request the speed change.



(3) Data setting and the execution condition of the function

The following table lists the data to be set and the condition to execute the speed change function.

Setting item		Setting range	Default value	Execution condition of the speed change function	Buffer memory address (decimal)
Cd.2	New speed value	0 to "Pr.5 Speed limit value" (pulse/s) (Maximum 4000000 pulse/s)	0pulse/s	BUSY signal (X14) must be on. Note that speed cannot be changed at the following. • After the start of automatic deceleration • After the input of Stop signal (Y27) or Stop signal (STOP) • After a JOG start signal (Y24, Y25) was turned off during JOG operation • During OPR	82 83
Cd.8	Speed change request	1: Change speed	0		91

11.7 Deviation Counter Clear Function

The "deviation counter clear function" clears the accumulated pulses in the deviation counter to 0.
When the servomotor power was turned off due to an emergency stop during positioning, clearing the accumulated pulses in the deviation counter to 0 prevents servomotor rotation at power recovery.

(1) Precautions for control

(a) Start after clearing deviation counter

To start positioning after clearing the deviation counter, check the following two points.

- The value in "Cd.4 Deviation counter clear command" changed to 0.
- No error is occurring.

(b) "Md.2 Actual current value" and "Md.1 Current feed value"

- When the deviation counter is cleared, "Md.2 Actual current value" changes to the value in "Md.1 Current feed value".
- To change "Md.1 Current feed value" of after clearing the deviation counter to "Md.2 Actual current value" of before clearing the deviation counter, follow the procedure below.

1	Read out the value in "Md.2 Actual current value".
2	Write the read value to "Cd.1 New current value".
3	Clear the deviation counter.
4	Change the current value.

(2) Data setting and the execution condition of the function

The following table lists the data to be set and the condition to execute the deviation counter clear function.

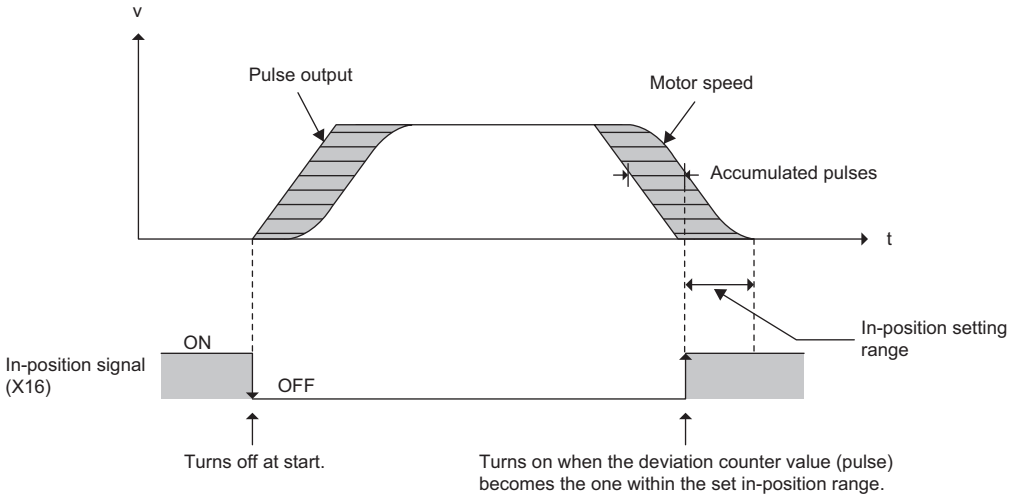
Setting item		Setting range	Default value	Execution condition of the deviation counter clear function	Buffer memory address (decimal)
Cd.4	Deviation counter clear command	1: Clear the deviation counter	0	BUSY signal (X14) must be off.	86

11.8 In-position Function

The "in-position function" turns on In-position signal (X16) while the accumulated pulse amount in the deviation counter is within the specified in-position range (1 to 20479pulse) after deceleration started.
In-position signal (X16) can be used as the signal right before positioning completion.

(1) Control detail

In-position signal (X16) turns on when the accumulated pulse amount in the deviation counter becomes equal to the value set in "Pr.8 In-position range" and stays on till the next start.



Accumulated pulse amount is checked with the in-position range every 0.5ms.

(2) Precautions for control

(a) During speed control in the speed-position control switch mode

Accumulated pulse amount is not checked with the in-position range.

(b) Timing at which In-position signal (X16) turns off

In-position signal (X16) turns off at the following timings.

- When OPR starts
- When positioning control starts
- When two-phase trapezoidal positioning control starts
- When the speed-position control switch mode starts
- When JOG operation starts

(3) Setting the in-position function

The following table lists the data to be set, setting condition, and check timing.

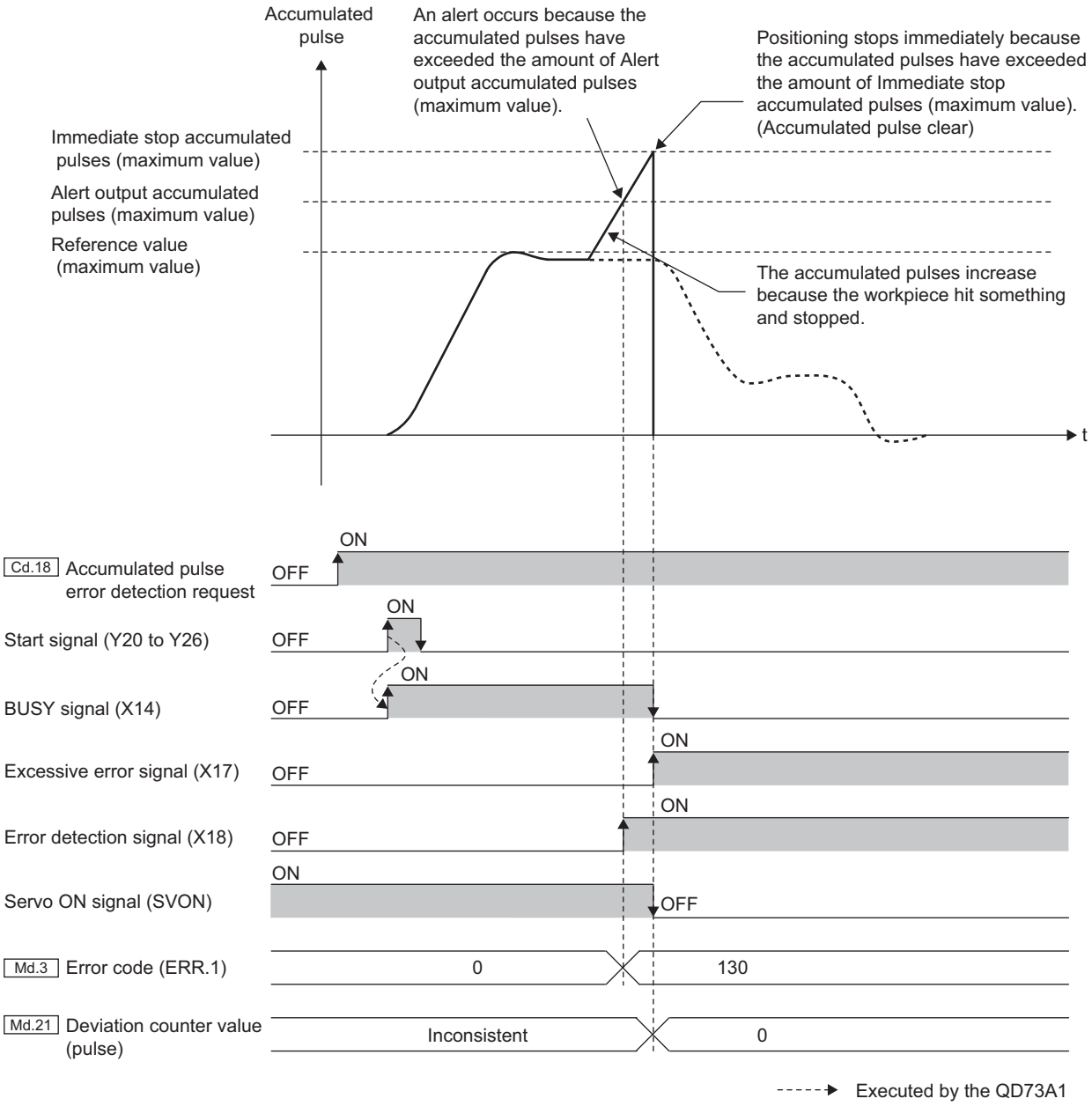
Setting item		Setting range	Default value	Setting condition	Check timing of the set data	Buffer memory address (decimal)
Pr.8	In-position range	1 to 20479pulse	5pulse	The data can be set anytime. Note that the set data at the rise (ON) of a start signal is used for the operation. If the data is written when BUSY signal (X14) is on, the data will be accepted at the rise (ON) of the next start signal.	• When a positioning start signal (Y21 to Y23) is turned on • When a JOG start signal (Y24, Y25) is turned on • When OPR start signal (Y20) is turned on	24

11.9 Accumulated Pulse Error Detection Function

The accumulated pulse error detection function outputs an alert and immediately stops the positioning when the accumulated pulses reached the amount specified by the user before the pulses exceed the amount set in "Accumulated pulse setting" in the switch setting and an excessive error occurs.
This function enables to detect abnormal operating status in early stages and minimize the influence on the mechanical system.

(1) Control details

The following figures show the operation of the accumulated pulse error detection function.



(a) Alert output

The QD73A1 compares accumulated pulses that are output during the positioning with alert output accumulated pulses. If accumulated pulses exceed the amount of the alert output accumulated pulses, the error "Accumulated pulse alert" (error code: 130) occurs. (Even after the error occurs, the positioning continues.)

(b) Immediate stop processing

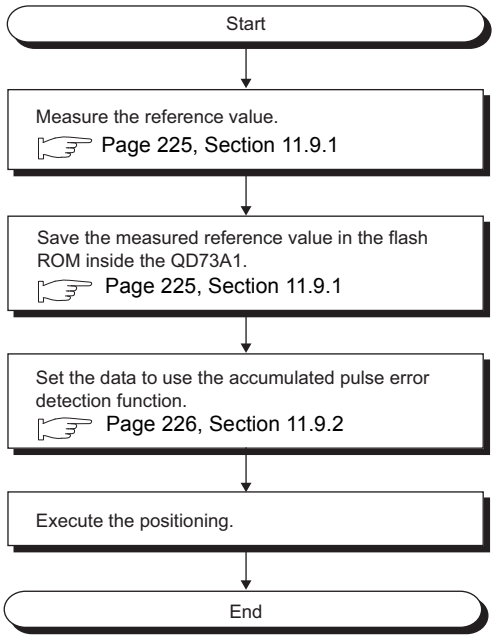
The QD73A1 compares accumulated pulses that are output during the positioning with immediate stop accumulated pulses. If accumulated pulses exceed the amount of the immediate stop accumulated pulses, the QD73A1 performs the following processing and stops the positioning.

- Excessive error signal (X17): ON
- Accumulated pulse: Clear to 0
- Servo ON signal (SVON): OFF
- BUSY signal (X14): OFF (Positioning complete signal (X15) does not turn on.)

Turn on PLC READY signal (Y2D) to restore the positioning (In the same way as when an excessive error occurs).

(2) Executing procedure

The following is the executing procedure of the accumulated pulse error detection function.



11.9.1 Measuring and saving the reference value in the flash ROM

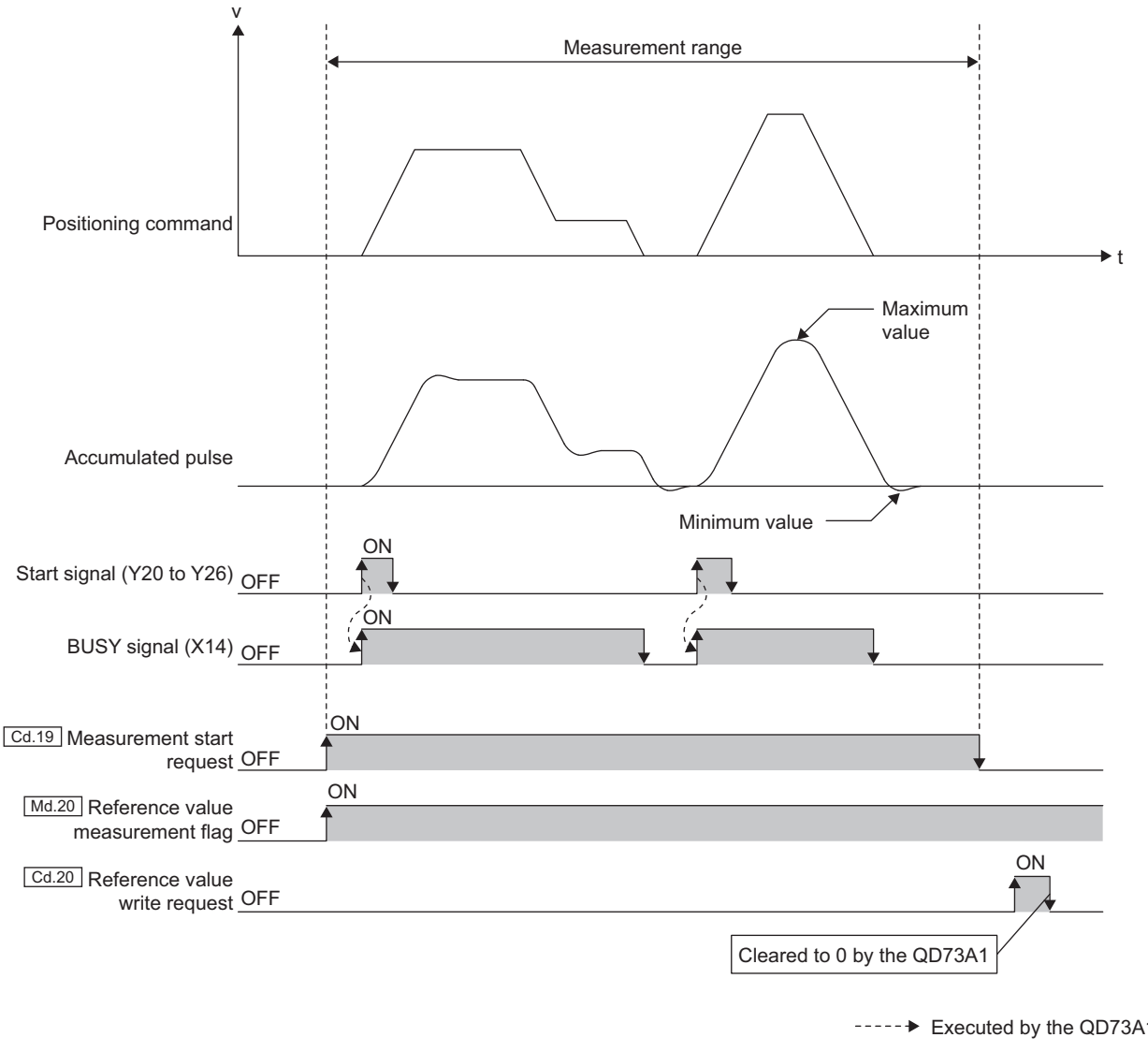
Before using the accumulated pulse error detection function, the reference value needs to be measured to detect errors.

Reference value means the maximum/minimum accumulated pulse values that are output when the QD73A1 is operating normally.

The QD73A1 obtains the judgment value for alert output and immediate stop and carry out control using the reference value, alert output accumulated pulse setting value, and immediate stop accumulated pulse setting value.

Executing procedure is as follows.

1. **Set "Cd.19 Measurement start request" to "1: Requested" and start the reference value measurement.**
   The QD73A1 monitors the status of accumulated pulses and measures the maximum/minimum values while "Cd.19 Measurement start request" is set to 1.
2. **Set "Cd.20 Reference value write request" to "1: Requested" when "Md.20 Reference value measurement flag" is set to "1: Measured".**
   The QD73A1 saves the measured maximum/minimum values in the flash ROM when "Cd.20 Reference value write request" is set to 1.



11.9.2 Setting the accumulated pulse error detection function

Set the values of "Cd.13 Alert output accumulated pulse setting value (maximum value)" to "Cd.16 Immediate stop accumulated pulse setting value (minimum value)", and set "Cd.18 Accumulated pulse error detection request" to 1 to execute the accumulated pulse error detection function. Set the data required for control in the sequence program. The following table lists the data to be set, setting condition, and check timing.

Setting item		Setting range	Default value	Setting condition	Check timing of the set data	Buffer memory address (decimal)
Cd.13	Alert output accumulated pulse setting value (maximum value)*1*2	• If "Cd.17 Accumulated pulse setting value selection" is set to 0: 1 to 148000 pulse • If "Cd.17 Accumulated pulse setting value selection" is set to 1: 1000 to 50000 (× 10^{-3})	0	The data can be set anytime.	When accumulated pulse error detection is requested (When "Cd.18 Accumulated pulse error detection request" is changed from 0 to 1.)	400 401
Cd.14	Immediate stop accumulated pulse setting value (maximum value)*1*2		0			402 403
Cd.15	Alert output accumulated pulse setting value (minimum value)*1*2	• If "Cd.17 Accumulated pulse setting value selection" is set to 0: -148000 to -1 pulse • If "Cd.17 Accumulated pulse setting value selection" is set to 1: 1000 to 50000 (× 10^{-3})	0			404 405
Cd.16	Immediate stop accumulated pulse setting value (minimum value)*1*2		0			406 407
Cd.17	Accumulated pulse setting value selection	0: Set with pulse 1: Set with magnification	0: Set with pulse			408
Cd.18	Accumulated pulse error detection request*3	0: No request 1: Requested	0: No request	"Cd.19 Measurement start request" must be set to 0.	—	409
Cd.19	Measurement start request*3	0: No request 1: Requested	0: No request	"Cd.18 Accumulated pulse error detection request" must be set to 0.	—	410
Cd.20	Reference value write request*3	0: No request 1: Requested	0: No request	"Md.20 Reference value measurement flag" must be set to 1.	—	411

*1 Set both alert output accumulated pulse setting value and immediate stop accumulated pulse setting value. If either of the values is set to 0, the accumulated pulse error detection function does not operate. The error "Accumulated pulse error undetectable" (error code: 131) occurs.

*2 If either of the maximum value and minimum value is set properly, the accumulated pulse error detection function operates. The error detection is not executed for the unset side.

*3 Each request is detected on a cycle of 0.5ms.

(1) Alert output accumulated pulses and immediate stop accumulated pulses

Alert output accumulated pulses (accumulated pulses set to output an alert) and immediate stop accumulated pulses (accumulated pulses set to stop the positioning immediately) are set by combining the following values.

- Reference value
- Alert output accumulated pulse setting value (Cd.13 , Cd.15)
- Immediate stop accumulated pulse setting value (Cd.14 , Cd.16)
- Cd.17 Accumulated pulse setting value selection

(2) If " Cd.17 Accumulated pulse setting value selection" is set to "0: Set with pulse"

Alert output accumulated pulses and immediate stop accumulated pulses can be obtained as follows:

Alert output accumulated pulses = reference value + alert output accumulated pulse setting value
Immediate stop accumulated pulses = reference value + immediate stop accumulated pulse setting value

(a) When the value is outside the setting range

The accumulated pulse error detection function does not operate.

(b) Alert output accumulated pulse setting value and immediate stop accumulated pulse setting value

The value of alert output accumulated pulses (maximum value) is calculated using the value of

" Cd.14 Immediate stop accumulated pulse setting value (maximum value)" at the following condition:

" Cd.13 Alert output accumulated pulse setting value (maximum value)" > " Cd.14 Immediate stop accumulated pulse setting value (maximum value)"

The value of alert output accumulated pulses (minimum value) is calculated using the value of

" Cd.16 Immediate stop accumulated pulse setting value (minimum value)" at the following condition:

" Cd.15 Alert output accumulated pulse setting value (minimum value)" < " Cd.16 Immediate stop accumulated pulse setting value (minimum value)"

Ex. When the setting values are as follows:

- Cd.13 Alert output accumulated pulse setting value (maximum value): 1200
- Cd.14 Immediate stop accumulated pulse setting value (maximum value): 1100

  Both alert output accumulated pulses and immediate stop accumulated pulses are judged by the reference value + 1100 pulse. Thus, an alert is output and the positioning stops simultaneously.

(c) Alert output accumulated pulse setting value, immediate stop accumulated pulse setting value, and "Accumulated pulse setting" in the switch setting

The setting range of "Cd.13 Alert output accumulated pulse setting value (maximum value)" is 1 to 148000 (the range of "Cd.15 Alert output accumulated pulse setting value (minimum value)" is -148000 to -1). However, when the alert output accumulated pulses exceed the amount of "Accumulated pulse setting" in the switch setting, an alert is output according to the setting of "Accumulated pulse setting".

The above is applicable to "Cd.14 Immediate stop accumulated pulse setting value (maximum value)" and "Cd.16 Immediate stop accumulated pulse setting value (minimum value)".

Ex. When the measured reference value (maximum value) is 2000 and the setting values are as follows:

- "Accumulated pulse setting" in the switch setting: -3700 to 3700 [selection 1]
- Cd.13 Alert output accumulated pulse setting value (maximum value): 3000

The calculated value of alert output accumulated pulses (maximum value) is 5000 (2000 + 3000). However, the value of alert output accumulated pulses (maximum value) becomes 3700 because the calculated value exceeds the amount of "Accumulated pulse setting"

(3) If "Cd.17 Accumulated pulse setting value selection" is set to "1: Set with magnification"

Alert output accumulated pulses and immediate stop accumulated pulses can be obtained as follows:

Alert output accumulated pulses = reference value + (Alert output accumulated pulse setting value - 1000) × reference value ÷ 1000
Immediate stop accumulated pulses = reference value + (immediate stop accumulated pulse setting value - 1000) × reference value ÷ 1000

Last three digits of the setting value indicate the value after the decimal point.

Ex. When the alert output accumulated pulse setting value is 1234, the alert output accumulated pulses can be obtained by multiplying the reference value by 1.234.

(a) When the value is outside the setting range

The accumulated pulse error detection function does not operate.

(b) Alert output accumulated pulse setting value and immediate stop accumulated pulse setting value

The value of alert output accumulated pulses (maximum value) is calculated using the value of "Cd.14 Immediate stop accumulated pulse setting value (maximum value)" at the following condition:

"Cd.13 Alert output accumulated pulse setting value (maximum value)" > "Cd.14 Immediate stop accumulated pulse setting value (maximum value)"

The value of alert output accumulated pulses (minimum value) is calculated using the value of "Cd.16 Immediate stop accumulated pulse setting value (minimum value)" at the following condition:

"Cd.15 Alert output accumulated pulse setting value (minimum value)" > "Cd.16 Immediate stop accumulated pulse setting value (minimum value)"

Ex. When the setting values are as follows:

- Cd.13 Alert output accumulated pulse setting value (maximum value): 1200
- Cd.14 Immediate stop accumulated pulse setting value (maximum value): 1100

  Both alert output accumulated pulses and immediate stop accumulated pulses are judged by accumulated pulses that are 1.1 times of the reference value (maximum value). Thus, an alert is output and the positioning stops simultaneously.

(c) Alert output accumulated pulse setting value, immediate stop accumulated pulse setting value, and "Accumulated pulse setting" in the switch setting

The setting range of "Cd.13 Alert output accumulated pulse setting value (maximum value)" and "Cd.15 Alert output accumulated pulse setting value (minimum value)" is 1000 to 50000 (1 to 50 times). However, when the alert output accumulated pulses exceed the amount of "Accumulated pulse setting" in the switch setting, an alert is output according to the setting of "Accumulated pulse setting"

The above is applicable to "Cd.14 Immediate stop accumulated pulse setting value (maximum value)" and "Cd.16 Immediate stop accumulated pulse setting value (minimum value)".

Ex. When the measured reference value (maximum value) is 2000 and the setting values are as follows:

- "Accumulated pulse setting" in the switch setting: -3700 to 3700 [selection 1]
- Cd.13 Alert output accumulated pulse setting value (maximum value): 3000 (3 times)

The calculated value of alert output accumulated pulses (maximum value) is 6000 (2000 + (3000 - 1000) × 2000 ÷ 1000). However, the value of alert output accumulated pulses (maximum value) becomes 3700 because the calculated value exceeds the amount of "Accumulated pulse setting"

CHAPTER 12 STOPPING AND RESTARTING CONTROL

This chapter describes stops and restarts of control.

12.1 Stopping Control

This section describes control stops.

The QD73A1 stops control in case of the following.

- When each control ended normally
- When Servo READY signal (READY) turned off
- When an error occurred in the CPU module
- When PLC READY signal (Y2D) was turned off
- When an error occurred in the QD73A1
- When control was stopped intentionally (turning on Stop signal (Y27) or inputting Stop signal (STOP))
- When the upper limit switch (FLS) or the lower limit switch (RLS) turned off
- When the power supply was turned off

(1) Cause of a stop and process of stopping

The following table describes causes of stops and the subsequent processing (except the stop in case of normal completion of positioning).

Cause of stop		Status of Error detection signal (X18)	Error	Process of stop
Forced stop	Servo READY signal (READY) turned off.*1	ON	Servo READY OFF while BUSY (error code: 90)	Free run
	The power supply was turned off.	—	—	
Fatal stop	The upper limit switch (FLS) turned off.	ON	Upper limit signal OFF while BUSY (error code: 91)	Deceleration stop
	The lower limit switch (RLS) turned off.		Lower limit signal OFF while BUSY (error code: 92)	
Emergency stop	PLC READY signal (Y2D) was turned off.	ON	PLC READY signal OFF during operation (error code: 105)*2	
			PLC READY signal OFF during OPR (error code: 103)*3	
Intentional stop	Stop signal (STOP) was input.	ON*3	External stop signal ON during OPR (error code: 93)*3	
	Stop signal (Y27) was turned on.		STOP signal ON during OPR (error code: 102)*3	

*1 The operation varies as shown below depending on "Deviation counter clear setting" in the switch setting.
If "0: Clear the deviation counter when the servo ready signal is OFF." is set, the analog output voltage becomes the value on which zero adjustment was made at the timing when Servo READY signal (READY) has turned off.
If "1: Do not clear the deviation counter when the servo ready signal is OFF." is set, the analog output voltage equivalent to the accumulated pulses in the deviation counter is output.

*2 Only during major positioning control or JOG operation

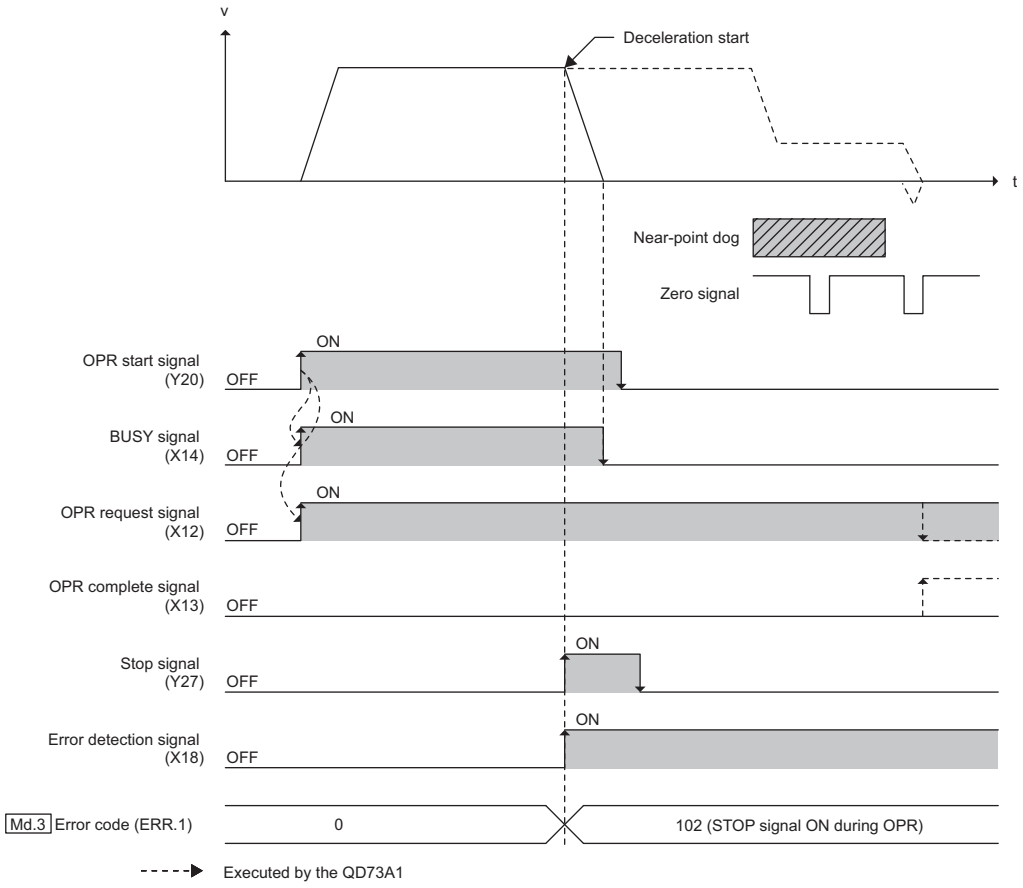
*3 Only during OPR

Point

An emergency stop circuit should be built outside the programmable controller.

(2) Stop during OPR

If an error (a cause of a stop) occurs during OPR, a deceleration stop starts at the error occurrence.
At the completion of the deceleration stop, OPR request signal (X12) stays on. Also, OPR complete signal (X13) does not turn on since the OPR was not completed normally.
The following figure is the timing chart of when Stop signal (Y27) is turned on during OPR.



(3) Stop during major positioning control or JOG operation

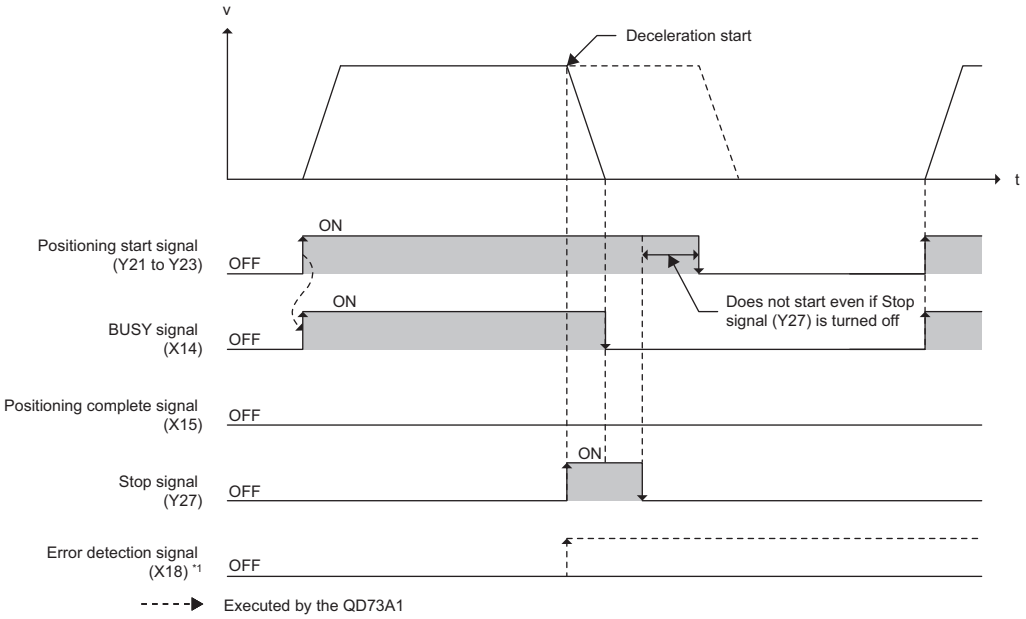
(a) Stop before deceleration start of major positioning control or JOG operation

If an error (a cause of a stop) occurs prior to a start of deceleration during major positioning control or JOG operation, a deceleration stop starts at the error occurrence. The deceleration speed depends on "Pr.7 Deceleration time" and "Pr.5 Speed limit value".

Positioning complete signal (X15) does not turn on at the completion of the deceleration stop.

Also, the next positioning does not start even if the error is resolved while the start signal is on. The start signal must be turned off and on.

The following figure is the timing chart of when Stop signal (Y27) is turned on during positioning control.



*1 Error detection signal (X18) does not turn on in case of a stop following a change (from off to on) of Stop signal (Y27) or an input of Stop signal (STOP). Error detection signal (X18) turns on due to the following.

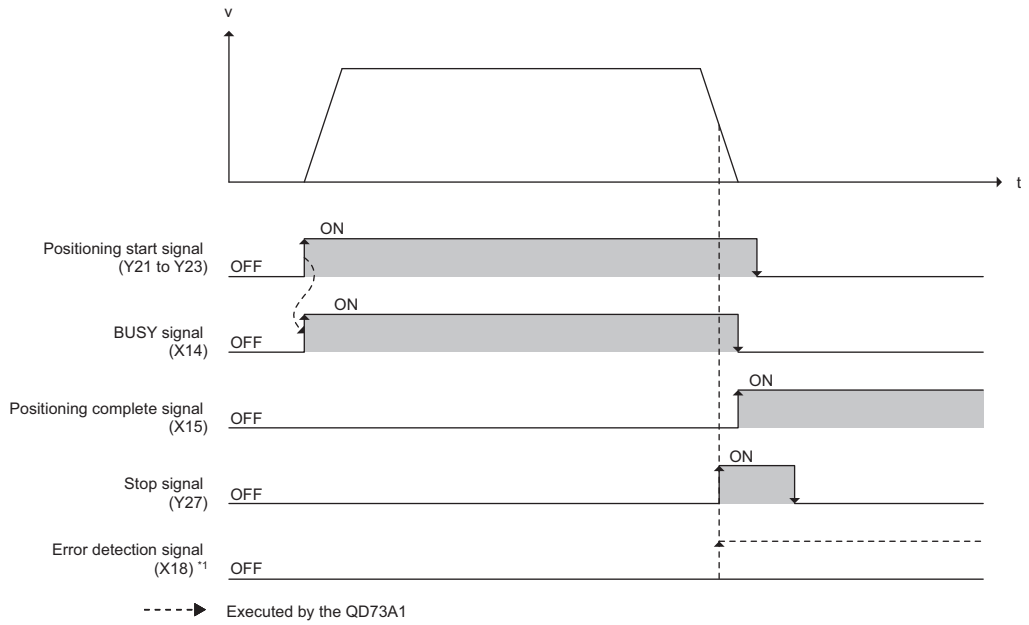
- Servo READY signal (READY) turned off.
- PLC READY signal (Y2D) was turned off.
- Upper limit signal (FLS) turned off.
- Lower limit signal (RLS) turned off.

(b) Stop during deceleration of major positioning control or JOG operation

If an error (a cause of a stop) occurs during deceleration of major positioning control or JOG operation, the deceleration continues and the operation stops since it is toward completion of the positioning or is following a change (from on to off) of a JOG start signal (Y24, Y25). In case of major positioning control, Positioning complete signal (X15) turns on at its completion.

This process is the same for a stop with an error.

The following figure is the timing chart of when Stop signal (Y27) is turned on during deceleration of positioning control.



*1 Error detection signal (X18) does not turn on in case of a stop following a change (from off to on) of Stop signal (Y27) or an input of Stop signal (STOP). Error detection signal (X18) turns on due to the following.

- Servo READY signal (READY) turned off.
- PLC READY signal (Y2D) was turned off.
- Upper limit signal (FLS) turned off.
- Lower limit signal (RLS) turned off.

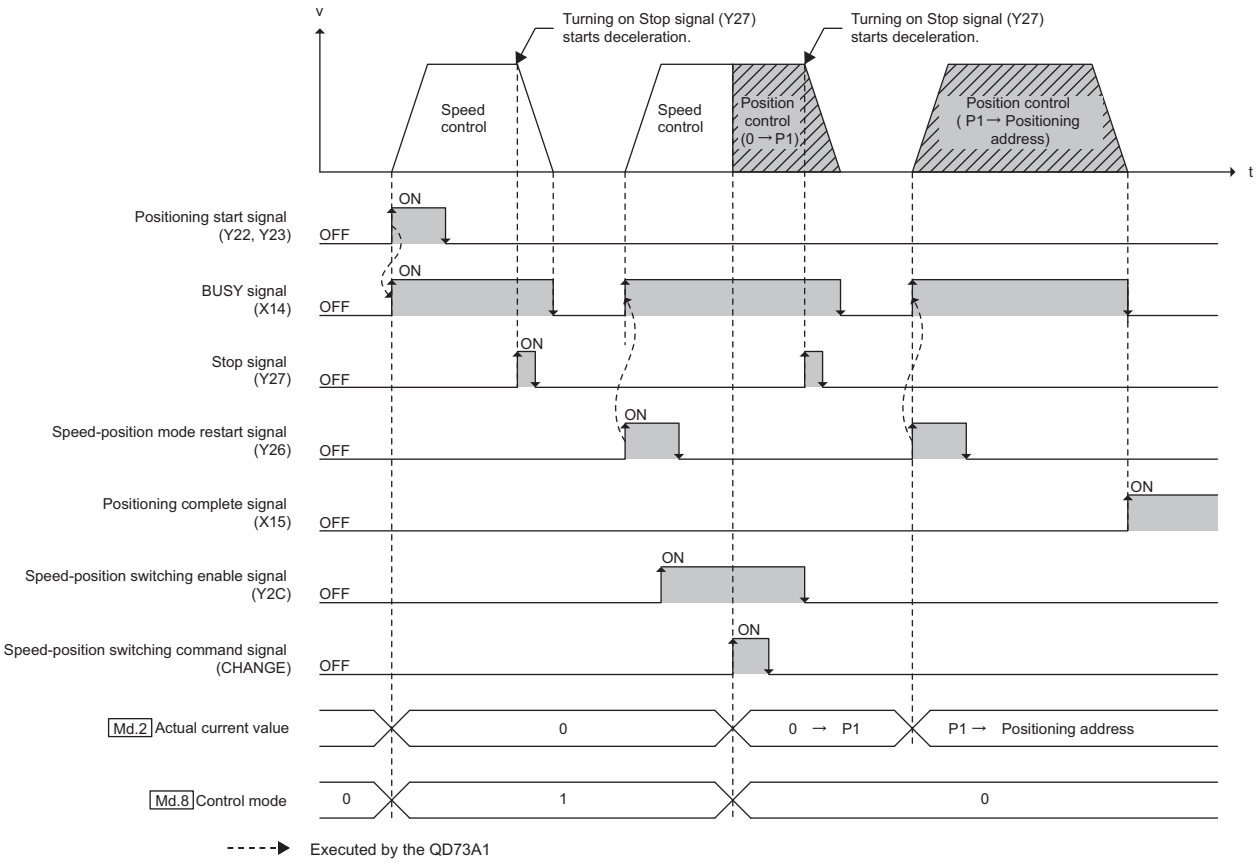
12.2 Restarting the Speed-position Control Switch Mode

After a deceleration stop following Stop signal, the operation of the speed-position control switch mode before the stop can be restarted by turning on Speed-position mode restart signal (Y26).

(1) Control detail

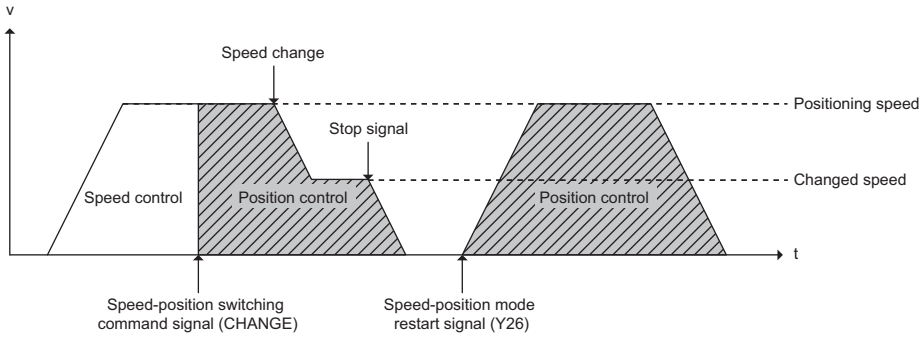
(a) When positioning is stopped using Stop signal (Y27) or Stop signal (STOP)

The positioning before the stop can be restarted by turning on Speed-position mode restart signal (Y26).
The following figure shows the timing at which the speed-position control switch mode restarts.



(b) When speed is changed during positioning

After a stop following the input of Stop signal (STOP), if Speed-position mode restart signal (Y26) is turned on, the positioning restarts according to the positioning speed set in the positioning data. The positioning does not restart at the new speed.



(c) Precautions for control

- The following table indicates settings and start signal conditions to restart control. If Speed-position mode restart signal (Y26) is turned on in a condition "Restart possible", the error "Restart error" (error code: 85) occurs.

○: Restart possible
×: Restart not possible

Start signal	"Pr.9 Positioning mode"	
	0: Position control mode	1: Speed-position control switch mode
OPR start signal (Y20)	×	×
Absolute positioning start signal (Y21)	×	×
Forward start signal (Y22)	×	○
Reverse start signal (Y23)	×	○

- In the speed-position control switch mode, if Speed-position mode restart signal (Y26) is turned on in a status other than stop, the error "Restart error" (error code: 85) occurs and the axis does not act.

CHAPTER 13 COMMON FUNCTIONS

Functions referred to as "common function" can be used regardless of control method when necessary.
Common functions can be used on GX Works2.

13.1 Module Status Monitor Function

The "module status monitor function" monitors the module information, switch setting information, and external I/O signal information. The module's detailed information can be displayed on the system monitor of GX Works2.

(1) Hardware LED information

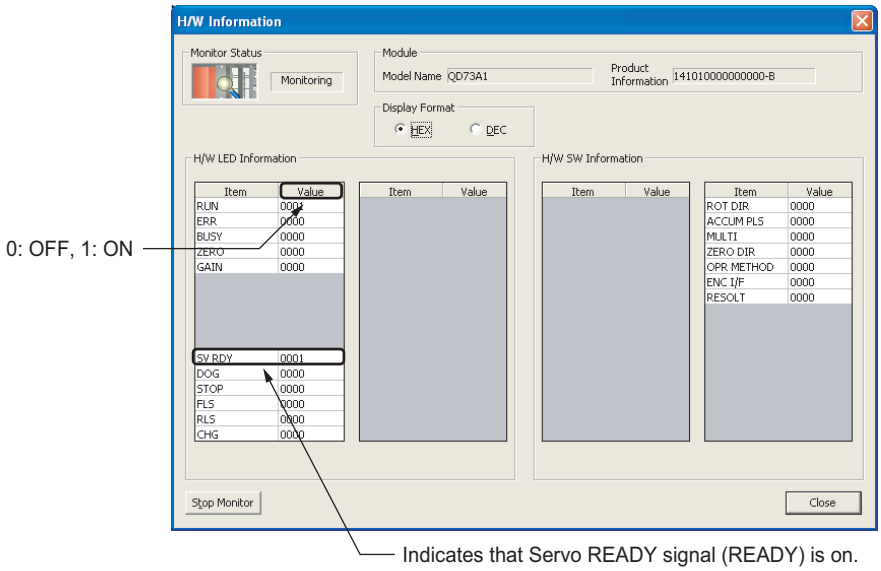
The following LED statuses are displayed.

Item	Value	Condition to be 0001_H
RUN	• 0000_H: Indicates that the LED is off. • 0001_H: Indicates that the LED is on.	Operating normally (same as the RUN LED)
ERR		Error occurrence
BUSY		During positioning
ZERO		Adjusting zero
GAIN		Adjusting gain
SV RDY		Servo READY signal (READY) ON
DOG		Near-point dog signal (DOG) ON
STOP		Stop signal (STOP) ON
FLS		Upper limit signal (FLS) ON
RLS		Lower limit signal (RLS) ON
CHG		Speed-position switching command signal (CHANGE) ON

(2) Hardware switch information

The following switch setting statuses are displayed.

Item	Switch setting	Value
ROT DIR	Rotation direction setting	Refer to Page 276, Appendix 4.1 (2).
ACCUM PLS	Accumulated pulse setting	
MULTI	Multiplication setting	
ZERO DIR	OPR direction setting	
OPR METHOD	OPR method setting	
ENC I/F	Encoder I/F setting	
RESOLT	Analog voltage resolution setting	

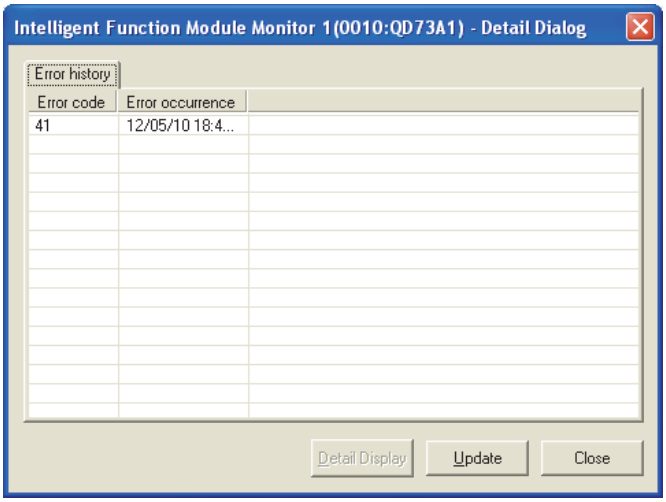


For details on the system monitor of GX Works2, refer to the following.

GX Works2 Version1 Operating Manual (Common)

13.2 Error History Function

This function monitors the QD73A1's error history stored in the buffer memory.
The error history of past 16 records can be monitored. Once 16 records are stored, the next record overwrites the oldest record. Therefore, the latest 16 errors are stored at all times.



To check the error history, the QD73A1 needs to be registered in the intelligent function module monitor window. For how to register the module in the intelligent function module monitor window and to display the details of the history, refer to the following.

GX Works2 Version1 Operating Manual (Intelligent Function Module)

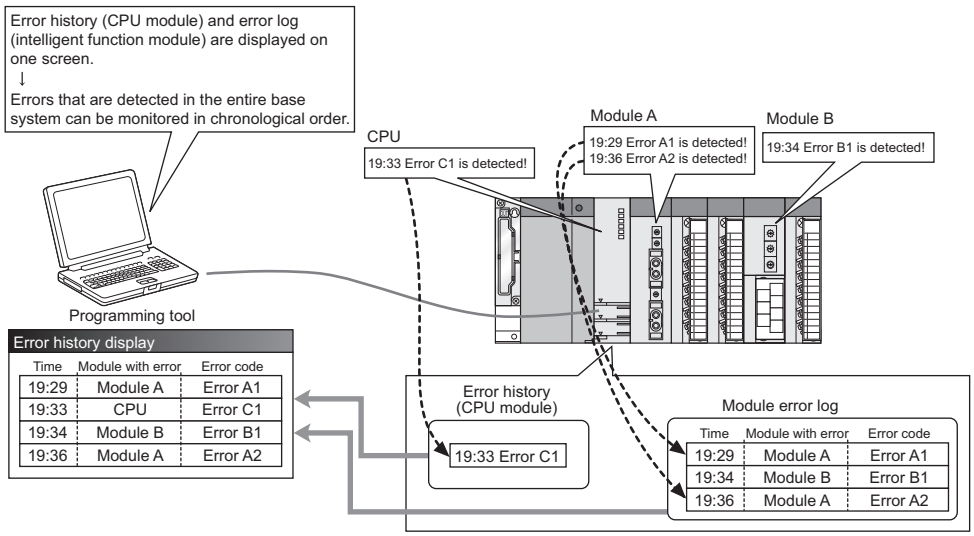
To monitor the error history directly through the buffer memory, refer to the following.

Page 85, Section 5.5

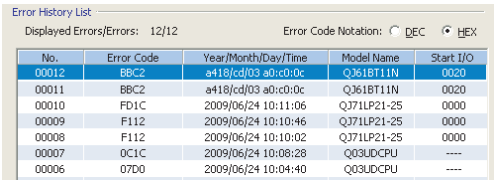
13.3 Module Error Collection Function

Errors that occurred in the QD73A1 are collected into the CPU module.

The error information of the QD73A1 module is held in a CPU module memory as a module error history, even when the power is turned off or the CPU module is reset.



[Example of screen display]



For details on the module error collection function, refer to the following.

☞Page 241, Section 14.1

13.4 Error Clear Function

When an error occurs, the error can be cleared on the system monitor.

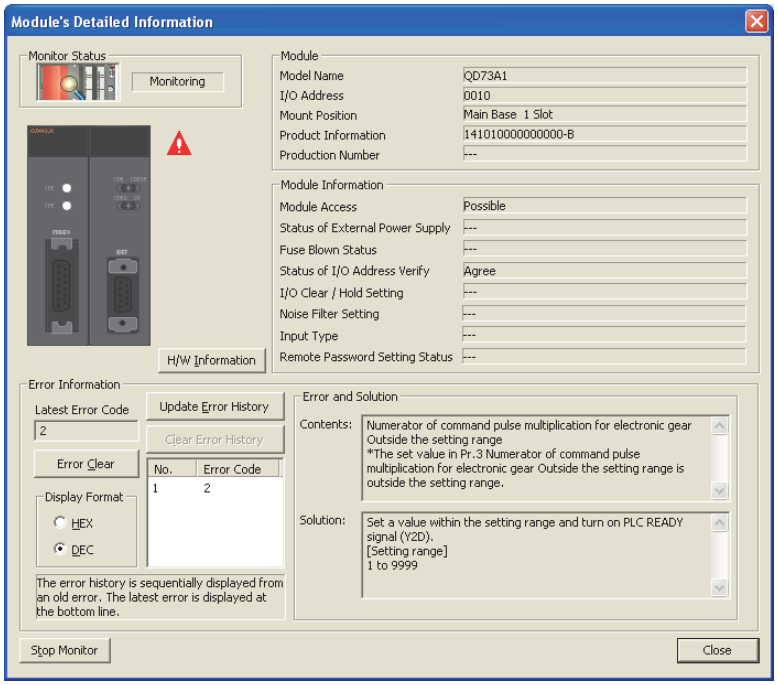
By clicking the Error Clear button in the system monitor, the error codes stored in "Md.3 Error code (ERR.1)" and "Md.4 Error code (ERR.2)" are cleared, and the ERR. LED turns off. This operation is the same as the one that uses Error reset signal (Y28).

However, the error history cannot be cleared with the button.

For the error clearing method using Error reset signal (Y28), refer to the following.

☞ Page 38, Section 3.4.3 (12)

[Diagnostics]⇨[System Monitor...]⇨Error module



CHAPTER 14 TROUBLESHOOTING

This chapter describes errors that may occur in the QD73A1 and troubleshooting for them.

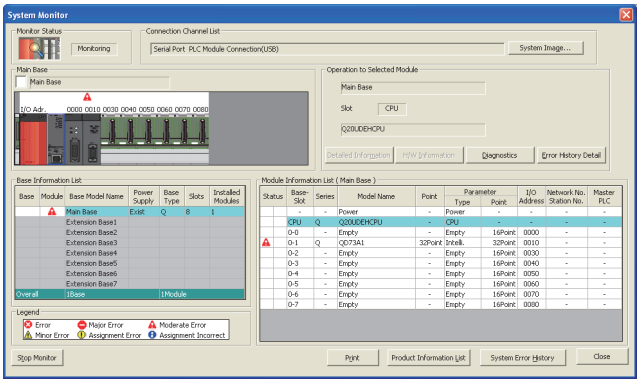
14.1 Checking an Error on GX Works2

The error codes that occurred in the QD73A1 can be checked by the following.
Choose a method depending on the purpose and application.

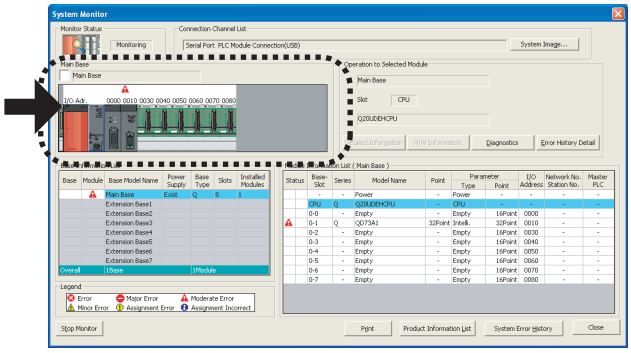
- Checking on the "Module's Detailed Information" window
- Checking on the "Error History" window

(1) Checking on the "Module's Detailed Information" window

Follow the procedure below.



↓



↓

(To the next page)

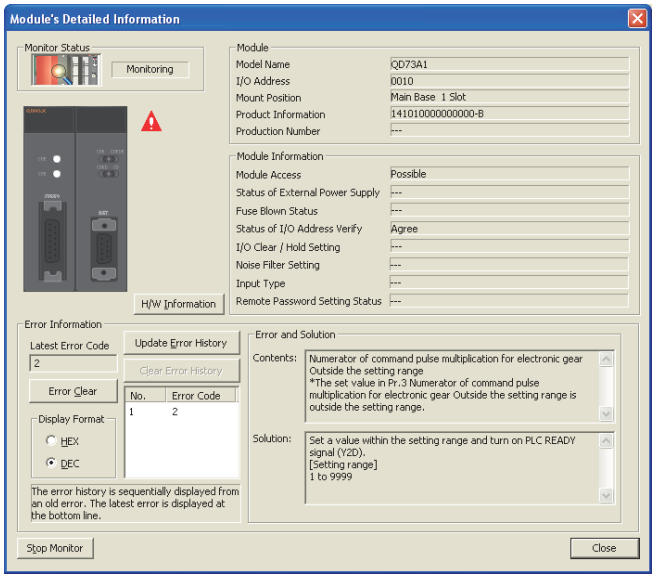
1. **Connect GX Works2 to the CPU module, and display the "System Monitor" window.**

[Diagnostics]⇨[System Monitor...]

2. **After confirming that an error is displayed on the QD73A1, select the QD73A1 and click the** Detailed Information **button.**

When an error is indicated on a module other than the QD73A1, refer to the user's manual for the module and take a corrective action.

(From the previous page)
↓

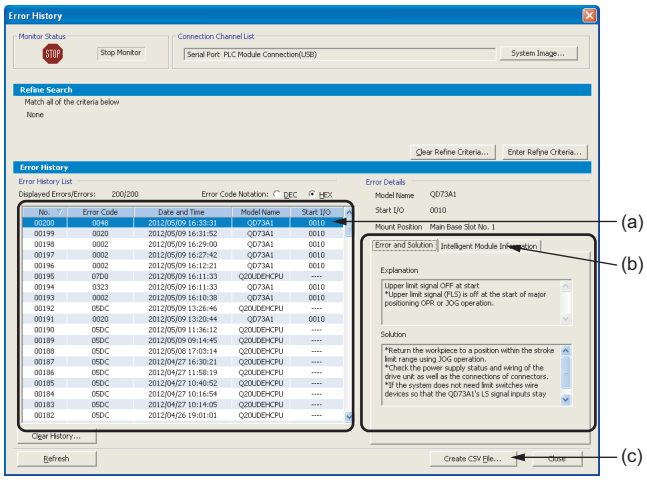


3. **Click the Detailed Information button to display the "Module's Detailed Information" window.**
The error detail and solution can be checked under "Error and Solution"

(2) Checking on the "Error History" window

An error history that includes errors in the QD73A1 and other modules is displayed in a list, and it can be output to a CSV file. The error codes and the error occurrence time can be checked even after the power was turned off and on or the CPU module was reset.

[Diagnostics] ⇨ [System Monitor...] ⇨ System Error History button



(a) Error History List

Error logs of modules are displayed in a list.

(b) Error and Solution, Intelligent Module Information

- Error and Solution: Displays the detail and corrective action for the error selected on "Error History List".
- Intelligent Module Information: Displays the QD73A1's status at the occurrence of the error selected on "Error History List".

For the QD73A1, the following are displayed.

Item	Description
Current feed value	The current value at the time of the error occurrence is stored.
Actual current value	The actual current value at the time of the error occurrence is stored.
State of the input signal (Xn0 to XnF)	The status of input signals (X0 to XF) at the time of error occurrence is stored (in hexadecimal).
State of the input signal (X(n+1)0 to X(n+1)F)	The status of input signals (X10 to X1F) at the time of error occurrence is stored (in hexadecimal).
State of the output signal (Yn0 to YnF)	The status of output signals (Y0 to YF) at the time of error occurrence is stored (in hexadecimal).
State of the output signal (Y(n+1)0 to Y(n+1)F)	The status of output signals (Y10 to Y1F) at the time of error occurrence is stored (in hexadecimal).
WDT error H/W error signal	The statuses of input signals (X) at the time of error occurrence are stored.
QD73A1 READY signal	
OPR request signal	
OPR complete signal	
BUSY signal	
Positioning complete signal	
In-position signal	
Excessive error signal	
Error detection signal	
Overflow signal	
Underflow signal	
Servo READY signal	
Near-point dog signal	
External stop signal	
Upper limit signal	
Lower limit signal	
OPR start complete signal	
Absolute positioning start complete signal	
Forward start complete signal	
Reverse start complete signal	
Synchronization flag	
Zero/gain adjustment data writing complete flag	
Zero/gain adjustment change complete flag	
Set value change complete signal	
Operating status of the speed-position control switch mode	

(c) Button to create a CSV file

An error history is output to a CSV file.

Point

If errors occur in the QD73A1 frequently, "*HST.LOSS*" may be displayed under "Error Code" instead of an actual error code.

No.	Error Code	Date and Time	Model Name	Start I/O
00126	*HST.LOSS*	2012/02/15 14:22:49	QD73A1	0010
00125	0C4E	2012/02/15 14:10:30	Q10UDHCPU	----

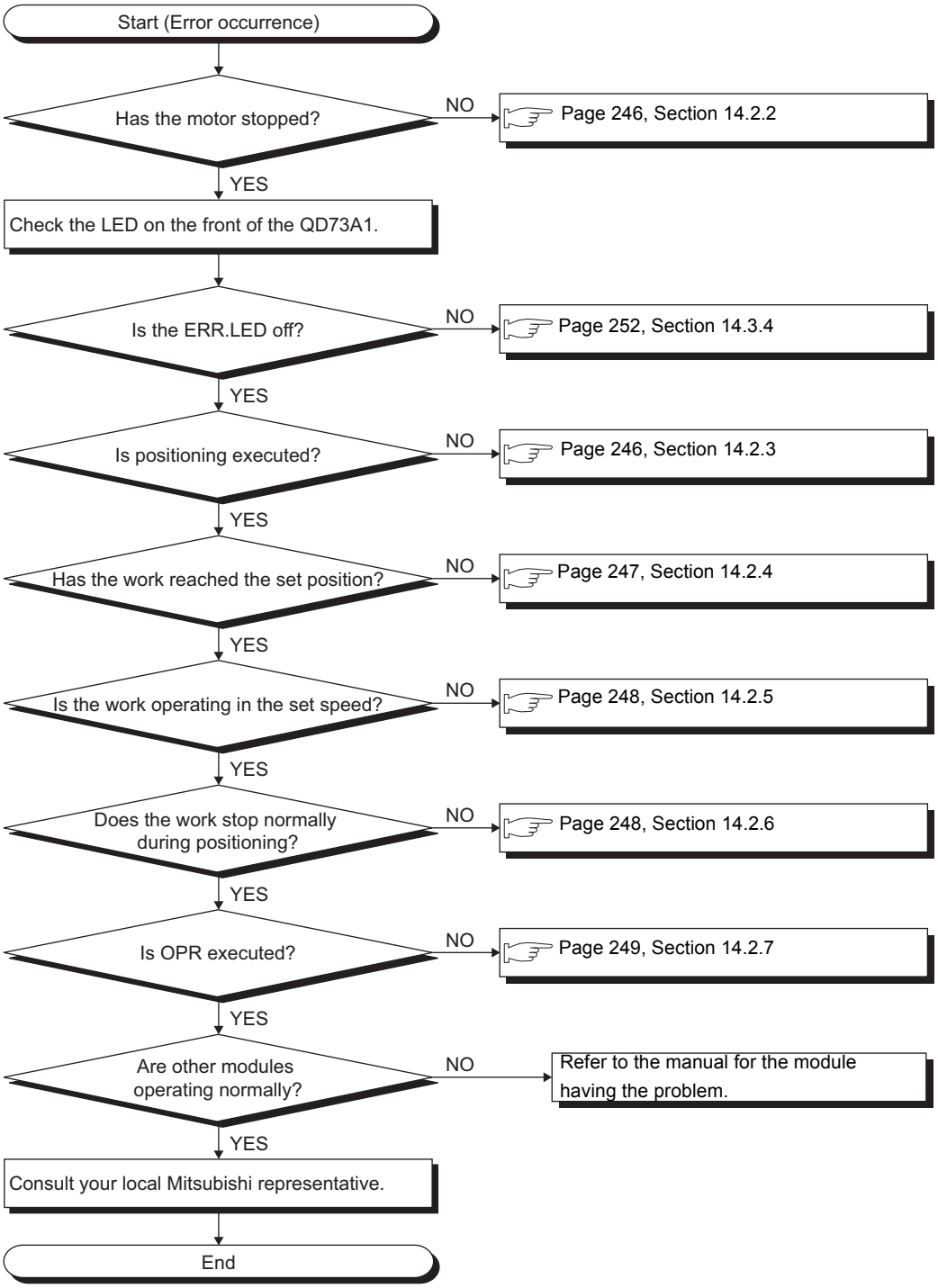
If "*HST.LOSS*" is displayed frequently, set a large value for the number of errors collected per scan under the "PLC RAS" tab in "PLC Parameter". For the setting, refer to the following.

The user's manual (Function Explanation, Program Fundamentals) for the CPU module used

14.2 Troubleshooting

14.2.1 Troubleshooting procedure

This section shows the troubleshooting procedure for the QD73A1.



14.2.2 When the motor does not stop

Check item	Action
Is the QD73A1's zero adjustment performed properly?	Perform zero adjustment. (☞ Page 59, Section 4.5)
Is the servo amplifier's zero adjustment performed properly?	Refer to the manual for the servo amplifier, and perform zero adjustment.
Is a large value set to the gain value of the servo amplifier?	Refer to the manual for the servo amplifier, and adjust the gain value of the servo amplifier to a proper value.
Are the speed command terminal on the QD73A1 and the servo amplifier connected properly? (when the motor does not stop even though the speed command from the QD73A1 is 0V)	Connect the speed command terminals properly.
Is there noise effect?	• Place signal lines away from power cables. • Use shielded twisted pair cables for signal lines. • Ground cables without fail. • Place the motor away from noise source.

14.2.3 When positioning cannot be executed

Check item	Action
Is PLC READY signal (Y2D) off?	Turn on PLC READY signal (Y2D).
Is Servo READY signal (X1B) off?	• Turn on Servo READY signal. • Check if there is any error on the servo amplifier. • Check if the QD73A1 and the servo amplifier are wired properly.
Is the ERR. LED on?	Read out the error code, and take the corrective action described in the error code list. (☞ Page 252, Section 14.3.4)
Is the BUSY LED off?	[Double-check the sequence program.] • Check if an interlock is made at a start. • Check if Stop signal (Y27) is on. • Check if the start is kept reset. • Check if the start signal is kept on.
	[Check the QD73A1's status.] • Check if the QD73A1 is mounted on the base unit properly. • Check if the position setting is proper.
Is Excessive error signal (X17) on?	The accumulated pulse amount is outside the setting range. • Check if the accumulated pulse setting is proper. (☞ Page 102, Section 6.2.2) • Check if the multiplication setting is proper. (☞ Page 104, Section 6.2.3) • Check if the encoder I/F setting is proper. (☞ Page 105, Section 6.2.6) • Check if the gain adjustment is proper. (☞ Page 59, Section 4.5) • Check if the QD73A1 and the encoder are connected properly. (☞ Page 66, Section 4.6.2)
Is External stop signal (X1D) on?	• Check if Stop signal (Y27) is on. • Check if Stop signal (STOP) is on.
Is WDT error, H/W error signal (X10) on?	If WDT error, H/W error signal (X10) stays on even after resetting the CPU module, please consult your local Mitsubishi representative.
Are the QD73A1 and the drive unit connected properly?	Check if the QD73A1 and the drive unit are wired properly.

Check item	Action
Is proper wave output displayed when the QD73A1's speed command terminal is connected to an oscilloscope?	If proper wave output is not displayed, please consult your local Mitsubishi representative.
Is proper wave output displayed when the drive unit's encoder output terminal is connected to an oscilloscope?	

14.2.4 When a positioning error occurs

Check item	Action
Do the position errors occur by regular amount?	[Double-check the parameters.] • Check if the set position is proper according to the machine position. • Check the positioning parameters and positioning data. • Check the accumulated pulse setting. (☞ Page 102, Section 6.2.2) • Check the multiplication setting. (☞ Page 104, Section 6.2.3)
	[Double-check the sequence program.] • Check if a proper address is set. • Check if a proper value is set for a current value change. • Check if a stop signal is input. • Check if the set movement amount is too small for operation in the speed-position control switch mode.
Is the motor rotating smoothly?	Check if the feedback pulse frequency is within 1Mpulse/s using an oscilloscope.
Is there noise effect?	• Place signal lines away from power cables. • Use shielded twisted pair cables for signal lines. • Ground cables without fail. • Place each device in the system away from noise source.

14.2.5 When the positioning speed is different from the specified speed

Check item	Action
Are the positioning data set properly?	Set proper positioning data.
Is the set positioning speed value greater than "Pr.5 Speed limit value"?	Set a positioning speed value that is smaller than "Pr.5 Speed limit value".
Is the accumulated pulse setting proper?	Calculate the maximum accumulated pulse amount, and review the accumulated pulse setting. (☞ Page 102, Section 6.2.2)
Is the zero/gain adjustment proper?	Perform zero/gain adjustment again. (☞ Page 59, Section 4.5)
Is the multiplication setting proper?	Configure the multiplication setting properly. (☞ Page 104, Section 6.2.3)
Is the servo amplifier set properly?	Refer to the manual for the servo amplifier, and set the servo amplifier properly.
Is a speed change executed?	Review the sequence program to see if the speed change is necessary.
Is proper wave output displayed when the QD73A1's speed command terminal is connected to an oscilloscope?	If proper wave output is not displayed, please consult your local Mitsubishi representative.
Is proper wave output displayed when the drive unit's encoder output terminal is connected to an oscilloscope?	

14.2.6 When operation stops abnormally during positioning

Check item	Action
Is there an error on the servo amplifier?	Refer to the manual for the servo amplifier, and check the error detail.
Is Stop signal (Y27) on?	Review the sequence program to see if Stop signal (Y27) needs to be turned on.
Is Stop signal (STOP) on?	Check if Stop signal (STOP) is wired properly.
Is Excessive error signal (X17) on?	The accumulated pulse amount is outside the setting range. Check if the accumulated pulse setting is proper. (☞ Page 102, Section 6.2.2)
Is there noise effect?	• Place signal lines away from power cables. • Use shielded twisted pair cables for signal lines. • Ground cables without fail. • Place each device in the system away from noise source.

14.2.7 OPR error

(1) When OPR cannot be completed

Check item	Action
Does Near-point dog signal (DOG) stay off?	Check if Near-point dog signal (DOG) is wired properly.
Does the speed change to the creep speed after Near-point dog signal (DOG) turned on?	The QD73A1 may be broken. Please consult your local Mitsubishi representative.
Does analog output from the QD73A1 continue after a Zero signal input?	
Does Zero signal stay off?	Check if Zero signal is wired properly.

(2) When the OP position is in error

Check item	Action
Do the position errors occur by regular amount?	[Near-point dog method] If the position where the near-point dog turns off is near the position of a Zero signal input, the Zero signal input may be misread. Adjust the position where the near-point dog turns off to be closer to the center of Zero signals.
	[Count method] If the position after the move according to " Pr.13 Setting for the movement amount after near-point dog ON" is near the position of a Zero signal input, the Zero signal input may be misread. Adjust " Pr.13 Setting for the movement amount after near-point dog ON" so that the position after the move becomes closer to the center of Zero signals.
Is the OPR completed near the position where Near-point dog signal (DOG) turns on?	Near-point dog signal (DOG) may be chattering. Use a high-performance near-point dog.
Is the OPR in the near-point dog method completed even though the near-point dog did not turn off?	The contact or wiring of the near-point dog is not proper. Check the wiring.
In the near-point dog method, is the movement amount after near-point dog ON more than that of normal OPR completion by one or more servomotor rotation?	Near-point dog signal (DOG) may be chattering when it turns off. Use a high-performance near-point dog.

14.3 Details of Errors

14.3.1 Types of errors

The errors detected in the QD73A1 are categorized into five types.

(1) Setting data range error

The QD73A1 checks parameters with the setting ranges at the following timings, and detects an error when a data is outside the setting range. If an error occurs, the corresponding data must be changed to a value within the setting range.

Setting data	Check timing
Fixed parameters	When PLC READY signal (Y2D) is turned on
Variable parameters	When a positioning start signal (Y21 to Y23) is turned on
	When a JOG start signal (Y24, Y25) is turned on
	When OPR start signal (Y20) is turned on
OPR parameters	When OPR start signal (Y20) is turned on
Positioning data	When a positioning start signal (Y21 to Y23) is turned on
Control change areas	Before the execution of a control change

(2) Start error

Start error is a type of errors that occur at a start of OPR control, major positioning control, or JOG operation. Operation does not start if an error occurs.

(3) Operation error

Operation error is a type of errors that occur during OPR control, major positioning control, or JOG operation. If an error occurs, operation decelerates and stops or continues without decelerating depending on the error detail.

For the operation at the error occurrence, refer to the following.

(☞Page 252, Section 14.3.4)

(4) Control change error

Control change error is a type of errors that occur at a control change during positioning.

The data for the control change is ignored if an error occurs.

(5) Zero/gain adjustment error

Zero/gain adjustment error is a type of errors that occur during zero/gain adjustment.

The details of the zero/gain adjustment are not reflected in the QD73A1 if an error occurs. Eliminate the error cause, and perform zero/gain adjustment again.

14.3.2 Storage of errors

When an error occurs in the QD73A1, the corresponding error code is stored in the buffer memory.

(1) ERR.1 and ERR.2

Errors are classified into ERR.1 and ERR.2 depending on the error details.

Error classification	Description
ERR.1 (minor errors)	Errors caused due to sequence programs. Check the error code, and eliminate the error cause by correcting the sequence program.
ERR.2 (major errors)	Hardware errors or errors caused due to control commands from external input signals. Check the error code, and eliminate the error cause on an external input signal.

(2) Buffer memory areas for error codes

The latest error codes are stored in the following buffer memory areas every time an error occurs, deleting the previous error codes. When there is no error or when the errors were reset, "0" is stored.

Error classification	Buffer memory area name	Buffer memory address	Corresponding error detection signal
ERR.1 (minor errors)	Md.3 Error code (ERR.1)	104	Error detection signal (X18)
ERR.2 (major errors)	Md.4 Error code (ERR.2)	105	

14.3.3 Error reset

Eliminate the error cause according to the corrective action described in the error code list (☞Page 252, Section 14.3.4), then cancel the error status by turning on Error reset signal (Y28).
At the time, the QD73A1 operates as follows.

1	Clears " Md.3 Error code (ERR.1)" to 0.
2	Clears " Md.4 Error code (ERR.2)" to 0.
3	Turns off Error detection signal (X18).

14.3.4 Error code list

The following table describes error details and corrective actions.

Error category	Error code (decimal)	Error classification	Error name	Description	Operation at the error occurrence	Action
Setting data range error (Fixed parameter)	1	ERR.1	Stroke limit lower limit	The set value in "Pr.2 Stroke limit lower limit" is outside -2147483648 to "Pr.1 Stroke limit upper limit".	If a setting is outside the setting range, the error occurs and all of the fixed parameters use the default values for the control.	Set a value within the setting range, and turn on PLC READY signal (Y2D).
	2		Numerator of command pulse multiplication for electronic gear Outside the setting range	The set value in "Pr.3 Numerator of command pulse multiplication for electronic gear" is outside the setting range.		Set a value within the setting range, and turn on PLC READY signal (Y2D). [Setting range] 1 to 9999
	3		Denominator of command pulse multiplication for electronic gear Outside the setting range	The set value in "Pr.4 Denominator of command pulse multiplication for electronic gear" is outside the setting range.		Set a value within the setting range, and turn on PLC READY signal (Y2D). [Setting range] 1 to 9999, and besides $1/50 \leq CMX/CDV \leq 50$
Setting data range error (Variable parameter)	10		Speed limit value Outside the setting range	The set value in "Pr.5 Speed limit value" is outside the setting range.	Only the setting with the error uses the default value for control.	Set a value within the setting range. [Setting range] 10 to 4000000pulse/s
	11		Acceleration time Outside the setting range	The set value in "Pr.6 Acceleration time" is outside the setting range.		Set a value within the setting range. [Setting range] 2 to 9999ms
	12		Deceleration time Outside the setting range	The set value in "Pr.7 Deceleration time" is outside the setting range.		Set a value within the setting range. [Setting range] 2 to 9999ms
	13		In-position range Outside the setting range	The set value in "Pr.8 In-position range" is outside the setting range.		Set a value within the setting range. [Setting range] 1 to 20479pulse
	14		Positioning mode Outside the setting range	The set value in "Pr.9 Positioning mode" is other than 0 and 1.		Set a value within the setting range.

Error category	Error code (decimal)	Error classification	Error name	Description	Operation at the error occurrence	Action
Setting data range error (OPR parameter)	20	ERR.1	OPR speed Outside the setting range	The set value in "Pr.11 OPR speed" is outside the setting range.	If a setting is outside the setting range, the OPR does not start.	Set a value within the setting range. [Setting range] 1 to "Pr.5 Speed limit value" (pulse/s)
	21		Creep speed Outside the setting range	The set value in "Pr.12 Creep speed" is outside the setting range.		Set a value within the setting range. [Setting range] 1 to "Pr.11 OPR speed" (pulse/s)
	22		Setting for the movement amount after near-point dog ON Outside the setting range	The set value in "Pr.13 Setting for the movement amount after near-point dog ON" is outside the setting range.		Set a value within the setting range. [Setting range] Deceleration distance from "Pr.11 OPR speed" to "Pr.12 Creep speed" < "Pr.13 Setting for the movement amount after near-point dog ON" (This condition is checked only in the count method.)
Setting data range error (Positioning data)	30		Positioning address Outside the setting range	• The positioning end point is outside the stroke limit range. • The set value of positioning address in the incremental system is a negative value at the start.	The positioning does not start.	• Set the positioning end point within the stroke limit range. • Do not set a negative value to the positioning address in the incremental system at the start.
	31		Two-phase trapezoidal positioning address error	For two-phase trapezoidal positioning control in the absolute system, the moving direction from P1 to P2 is different from the direction used to reach P1.		Do not change the moving direction for P1 to P2 from the direction used to reach P1.

Error category	Error code (decimal)	Error classification	Error name	Description	Operation at the error occurrence	Action
Setting data range error (Positioning data)	32	ERR.1	Positioning speed Outside the setting range	The positioning speed is outside the setting range.	The positioning does not start when the set value is 0. In case of an error due to a set value other than 0, the positioning is controlled with "Pr.5 Speed limit value".	Set a value within the setting range. [Setting range] 1 to "Pr.5 Speed limit value" (pulse/s)
Setting data range error (Control change area)	40		New speed value Outside the setting range	The set value in "Cd.2 New speed value" is outside the setting range in positioning operation.		Set a value within the setting range. [Setting range] 0 to "Pr.5 Speed limit value" (pulse/s)
Setting data range error (Control change area)	41		JOG speed Outside the setting range	The set value in "Cd.3 JOG speed" is outside the setting range.		Set a value within the setting range. [Setting range] 1 to "Pr.5 Speed limit value" (pulse/s)
Start error	70	ERR.2	Servo READY OFF at start	Servo READY signal (READY) is off at the start of major positioning, OPR, or JOG operation.	The operation does not start.	• Check the power supply status and wiring of the drive unit, as well as the connections of connectors. • When using a drive unit without Servo READY output, wire devices so that the QD73A1's Servo READY signal (READY) input stays on.
	71		External stop signal ON at start	Stop signal (STOP) is on at the start of major positioning, OPR, or JOG operation.		Turn off Stop signal (STOP).
	72		Upper limit signal OFF at start	Upper limit signal (FLS) is off at the start of major positioning, OPR, or JOG operation.		• Return the workpiece to a position within the stroke limit range using JOG operation. • Check the power supply status and wiring of the drive unit, as well as the connections of connectors. • If the system does not need limit switches, wire devices so that the QD73A1's LS signal inputs stay on.
	73		Lower limit signal OFF at start	Lower limit signal (RLS) is off at the start of major positioning, OPR, or JOG operation.		

Error category	Error code (decimal)	Error classification	Error name	Description	Operation at the error occurrence	Action
Start error	74	ERR.2	Near-point dog signal ON at start	Near-point dog signal (DOG) is on at the start of OPR in the near-point dog method.	The operation does not start.	Return the workpiece to a position away from the near-point dog using JOG operation or major positioning, then execute OPR.
	80	ERR.1	READY signal OFF at start (PLC READY signal OFF at start)	QD73A1 READY signal (X11) or PLC READY signal (Y2D) is off at the start of major positioning, OPR, or JOG operation.		Turn on PLC READY signal (Y2D).
	81		BUSY signal ON at start	An operation start is attempted when BUSY signal (X14) is on.		Make an interlock using a sequence program so that no operation starts when BUSY signal (X14) is on.
	82		STOP signal ON at start	An operation start is attempted when Stop signal (Y27) is on.		Turn off Stop signal (Y27), and start the operation again.
	83		Outside the stroke limit range at start	An operation start is attempted when the workpiece is outside the stroke limit range.		• Return the workpiece to a position within the stroke limit range using JOG operation. • Execute OPR. • Set the workpiece to a position within the stroke limit range by changing the current value.
	84		OPR complete signal ON at start	An OPR start is attempted when OPR complete signal (X13) is on.		• OPR cannot be started in succession (only in the near-point dog method). • Move the workpiece to the position before the near-point dog using JOG operation or major positioning, then start another OPR.

Error category	Error code (decimal)	Error classification	Error name	Description	Operation at the error occurrence	Action
Start error	85	ERR.1	Restart error	Speed-position mode restart signal (Y26) was turned on when positioning was complete in the speed-position control switch mode.	The operation does not start.	Start operation using Forward start signal (Y22) or Reverse start signal (Y23).
				Speed-position mode restart signal (Y26) was turned on in the position control mode.		Start operation using Absolute positioning start signal (Y21), Forward start signal (Y22), or Reverse start signal (Y23).
Operation error	87	ERR.1	Movement outside the stroke limit range	A movement amount change was attempted with a value that moves the workpiece outside the stroke limit range.	The movement amount does not change.	Set movement amount so that the workpiece is positioned within the stroke limit range after the move.
	90	ERR.2	Servo READY OFF while BUSY	Servo READY signal (READY) turned off during major positioning, OPR, or JOG operation.	The operation runs freely.	Check the drive unit, and turn on Servo READY signal (READY).
	91		Upper limit signal OFF while BUSY	Upper limit signal (FLS) turned off during major positioning, OPR, or JOG operation.	The operation decelerates and stops.	Return the workpiece to a position within the stroke limit range using JOG operation.
	92		Lower limit signal OFF while BUSY	Lower limit signal (RLS) turned off during major positioning, OPR, or JOG operation.		

Error category	Error code (decimal)	Error classification	Error name	Description	Operation at the error occurrence	Action
Operation error	93	ERR.2	External stop signal ON during OPR	Stop signal (STOP) turned on during OPR.	The operation decelerates and stops.	• Start OPR if the workpiece stops when the near-point dog turns on in the count method. • In the near-point dog method, if the workpiece stops after the near-point dog turns on, return the workpiece to the position before the near-point dog turns on using JOG operation or major positioning, and then start OPR. • Start OPR if the workpiece stops before the near-point dog turns on.
	100	ERR.1	Outside the stroke limit range	The current value exceeded the stroke limit range during OPR or JOG operation.	The OPR or JOG operation continues.	Return the workpiece to a position within the stroke limit range using JOG operation.
	102		STOP signal ON during OPR	Stop signal (Y27) was turned on during OPR.	The operation decelerates and stops.	• Start OPR if the workpiece stops when the near-point dog turns on in the count method. • In the near-point dog method, if the workpiece stops after the near-point dog turns on, return the workpiece to the position before the near-point dog turns on using JOG operation or major positioning, and then start OPR. • Start OPR if the workpiece stops before the near-point dog turns on.
	103		PLC READY signal OFF during OPR	PLC READY signal (Y2D) was turned off during OPR.		
	104		Outside the command frequency range	The command frequency exceeded 4Mpulse/s due to the electronic gear setting.	The speed is limited to 4Mpulse/s or lower.	Change the speed to 4Mpulse/s or lower.

Error category	Error code (decimal)	Error classification	Error name	Description	Operation at the error occurrence	Action
Operation error	105	ERR.1	PLC READY signal OFF during operation	PLC READY signal (Y2D) was turned off during major positioning or JOG operation.	The operation decelerates and stops.	Turn on PLC READY signal (Y2D).
Control change error during operation	110		Current value change error	A current value change is attempted when BUSY signal (X14) is on.	The control change is ignored.	Make an interlock using a sequence program.
	111		Speed change error (OPR)	A speed change was attempted during OPR.		
	112		Speed change error (Positioning)	A speed change was attempted at the start of automatic deceleration of major positioning or thereafter.		Correct the sequence program so that the speed is changed before the start of automatic deceleration of major positioning.
	113		Speed change error (JOG)	A speed change was attempted after JOG start signal (Y24, Y25) was turned off in JOG operation.		Make an interlock using a sequence program.
	114		Deviation counter clear error	Deviation counter clearing is attempted when BUSY signal (X14) is on.		

Error category	Error code (decimal)	Error classification	Error name	Description	Operation at the error occurrence	Action
Zero/gain adjustment error	120	ERR.1	Flash ROM write exceeded	For zero/gain adjustment, a setting value has been consecutively written to the flash ROM more than 25 times.	The zero/gain adjustment values are not reflected.	Turn off and on the power supply, or reset the CPU module or the error.
	121		Flash ROM write error	For zero/gain adjustment, the setting value could not be written in the flash ROM.		Try writing the value again. If the error occurs again, a failure might have occurred on the module. Please consult your local Mitsubishi representative.
	122		Zero adjustment error	For zero/gain adjustment, the zero adjustment value is equal to or greater than the gain adjustment value.		Set the values so that they meet the following condition: Zero adjustment value < Gain adjustment value
	123		Zero/gain adjustment setting error	The set value in "Cd.10 Zero/gain adjustment specification" is outside the setting range.		Set a value within the setting range (1, 2) in "Cd.10 Zero/gain adjustment specification".
	124		Zero/gain adjustment value error	The set value in "Cd.11 Zero/gain adjustment value specification" is outside the setting range.		Set a value within the setting range (-3000 to 3000) in "Cd.11 Zero/gain adjustment value specification".

Error category	Error code (decimal)	Error classification	Error name	Description	Operation at the error occurrence	Action
Zero/gain adjustment error	125	ERR.1	Analog output adjustment area 1 Outside the setting range	The set value in "Cd.5 Analog output adjustment area 1" is outside the setting range.	The zero/gain adjustment values are not reflected.	Set a value within the setting range. [Setting range] Depends on "Accumulated pulse setting" in the switch setting. (Unit: pulse) • Selection 1: -3700 to 3700 • Selection 2: -7400 to 7400 • Selection 3: -11100 to 11100 • Default value, selection 4: -14800 to 14800
	126		Analog output adjustment area 2 Outside the setting range	The set value in "Cd.9 Analog output adjustment area 2" is outside the setting range.		Set a value within the setting range. [Setting range] Depends on "Accumulated pulse setting" in the switch setting. (Unit: pulse) • Selection 5: -37000 to 37000 • Selection 6: -74000 to 74000 • Selection 7: -111000 to 111000 • Selection 8: -148000 to 148000

Error category	Error code (decimal)	Error classification	Error name	Description	Operation at the error occurrence	Action
Accumulated pulse error detection function error	130	ERR.1	Accumulated pulse alert	Accumulated pulses reached the alert level.	The positioning continues.	—
	131		Accumulated pulse error undetectable	• The number of accumulated pulses used as the reference of the accumulated pulse error detection function is unmeasured. • Either of the values in "Cd.13 Alert output accumulated pulse setting value (maximum value)" and "Cd.14 Immediate stop accumulated pulse setting value (maximum value)" is outside the setting range. Moreover, either of the values in "Cd.15 Alert output accumulated pulse setting value (minimum value)" and "Cd.16 Immediate stop accumulated pulse setting value (minimum value)" is outside the setting range. • "Cd.17 Accumulated pulse setting value selection" is set to 1 and the maximum/minimum reference values are set to 0.	The accumulated pulse error detection function is not executed.	• Measure the reference value and then, execute the accumulated pulse error detection function. • Set the values of "Cd.13 Alert output accumulated pulse setting value (maximum value)" to "Cd.16 Immediate stop accumulated pulse setting value (minimum value)" within the setting range. • Change the value of "Cd.17 Accumulated pulse setting value selection" to 0 and review the setting values of "Cd.13 Alert output accumulated pulse setting value (maximum value)" to "Cd.16 Immediate stop accumulated pulse setting value (minimum value)".
	132		Reference value write error	"Cd.20 Reference value write request" was set to 1 when the measurement was not being executed ("Md.20 Reference value measurement flag" was set to 0).	The reference value is not written to the flash ROM.	Measure the reference value and then, write the value. (Write the value when "Md.20 Reference value measurement flag" is set to 1.)

Error category	Error code (decimal)	Error classification	Error name	Description	Operation at the error occurrence	Action
Accumulated pulse error detection function error	133	ERR.1	Flash ROM write exceeded	The measured reference value has been consecutively written to the flash ROM more than 25 times.	The measured reference value is not saved in the flash ROM.	Turn off and on the power supply or reset the CPU module, or clear the error.
	134		Flash ROM write error	The measured reference value could not be written in the flash ROM.		Write the value again. If the error occurs again, a failure might have occurred on the module. Please consult your local Mitsubishi representative.
I/F error	800	ERR.2	Hold error	The setting for the QD73A1 is "Hold" on a CPU module's parameter "Error Time Output Mode".	The module does not operate.	Set "Clear" to the CPU module's parameter "Error Time Output Mode".
	803		Programmable controller CPU error	The CPU has a problem.	At start: The module does not operate. During operation: The operation decelerates and stops.	Check the error occurring on the CPU module, and refer to the user's manual for the CPU module used.
Fatal error	900		Hardware error 1	The hardware has a problem.	The system stops.	Turn off and on the power supply. If the error occurs again, a failure might have occurred on the module. Please consult your local Mitsubishi representative.
	999		Hardware error 2			

APPENDICES

Appendix 1 Functions Added or Changed

Appendix 1.1 Functions added

The following lists the functions added to the QD73A1 and corresponding product information.

Function	QD73A1 product information (first five digits)	Reference
Accumulated pulse error detection function	14082 or later	Page 223, Section 11.9
Feedback pulse addition/subtraction setting	15042 or later	Page 106, Section 6.2.8
Deviation counter clear setting		Page 107, Section 6.2.9
Deviation counter value (pulse) monitor		Page 85, Section 5.5
Movement amount after near-point dog ON (absolute value)	16082 or later	Page 85, Section 5.5

Appendix 1.2 Functions changed

The following lists the changed function of the QD73A1 and corresponding product information.

Function	QD73A1 product information (first five digits)	Reference
Switch setting	15042 or later	Page 276, Appendix 4.1 (2)

(1) Switch setting

The feedback pulse addition/subtraction setting and the deviation counter clear setting can be configured in the switch setting.

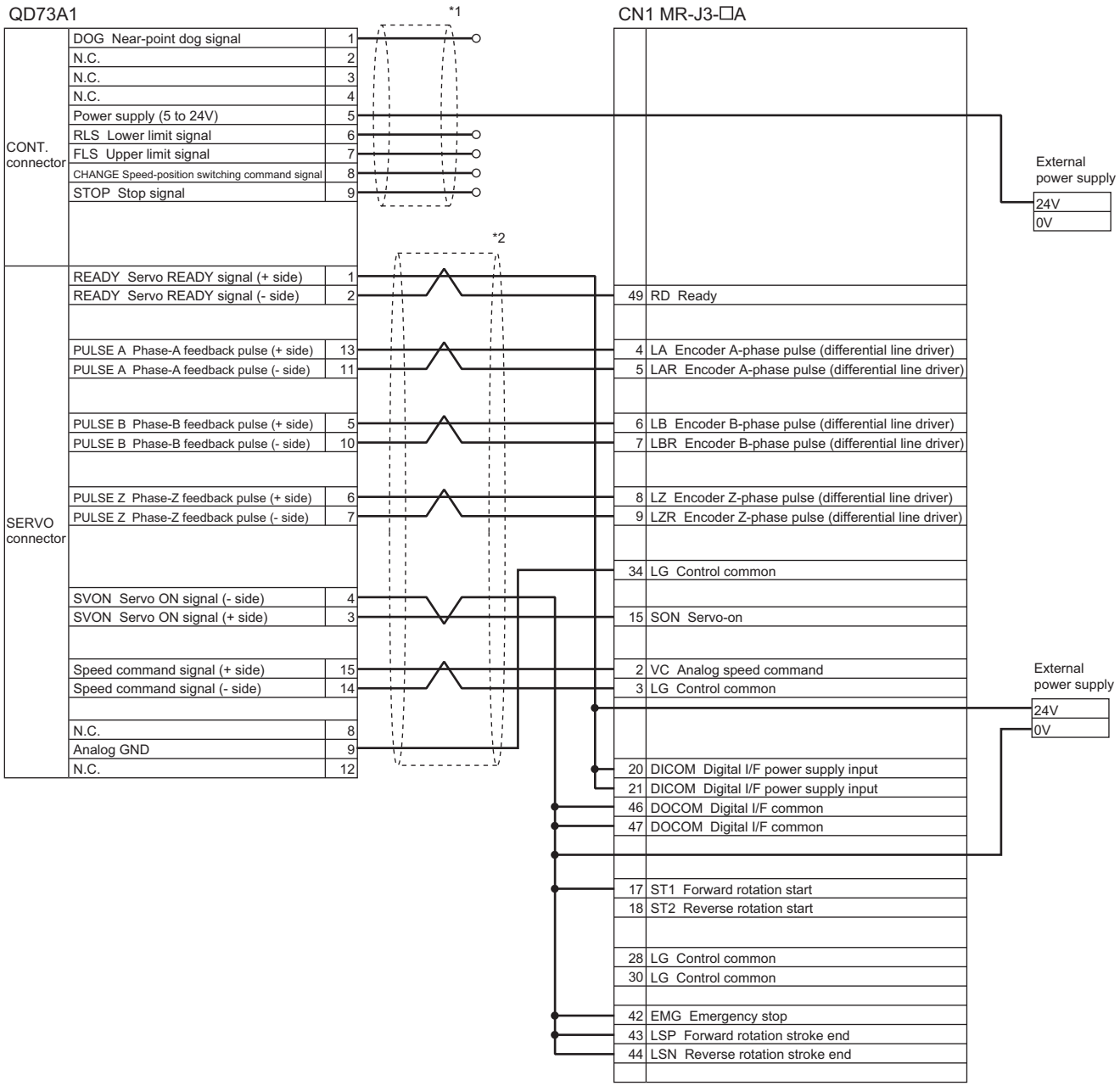
(a) When the QD73A1 that does not support the changed function is used

The feedback pulse addition/subtraction setting and the deviation counter clear setting cannot be configured in the switch setting.

Appendix 2 Connection Examples

Appendix 2.1 Example of connection with a servo amplifier manufactured by Mitsubishi Electric Corporation

(1) Connection with MR-J3□A (Differential driver)



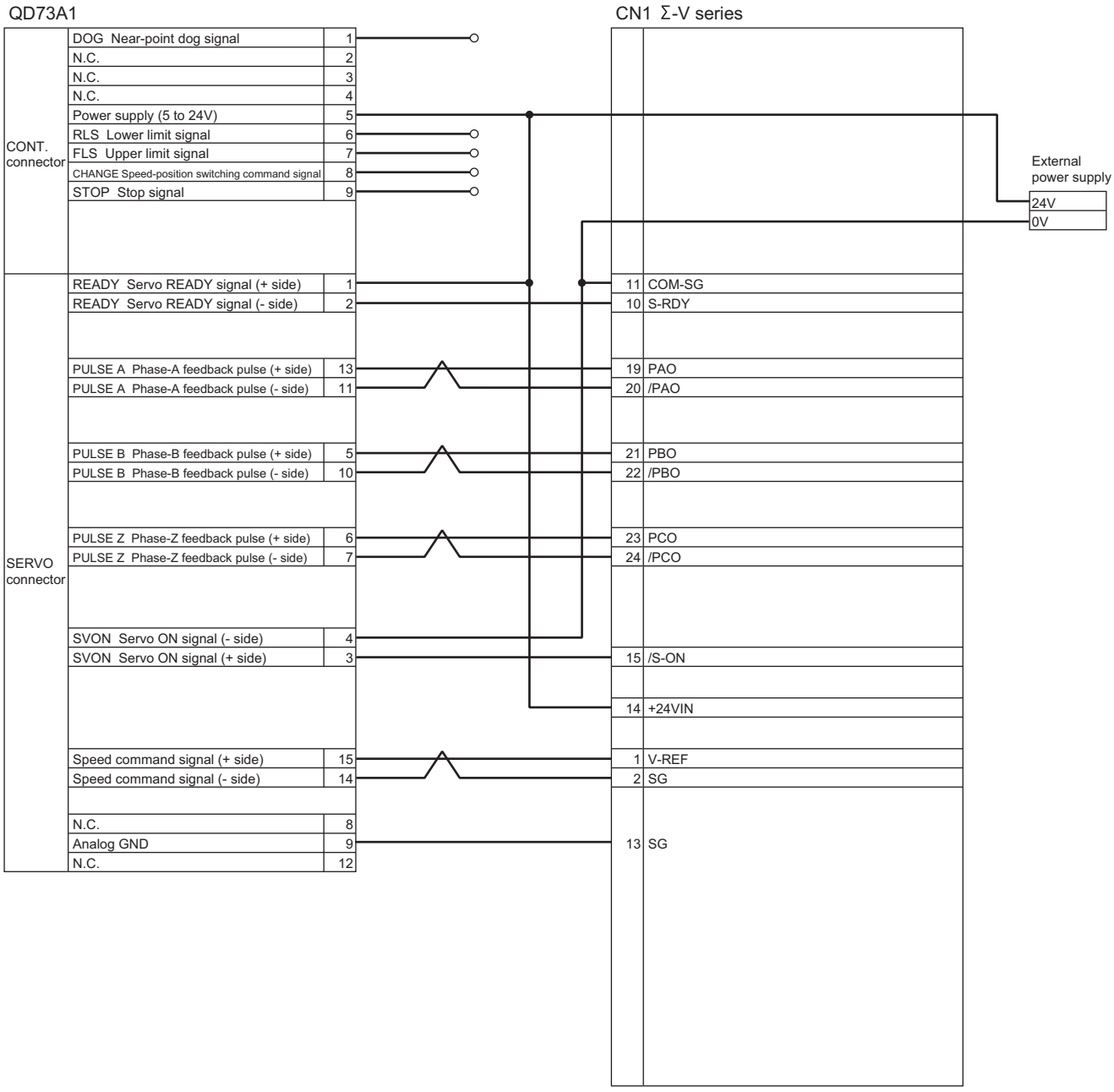
*1 indicates use of shielded cables. Use shielded cables for wiring.

*2 indicates use of shielded twisted pair cables. Use shielded twisted pair cables for wiring.

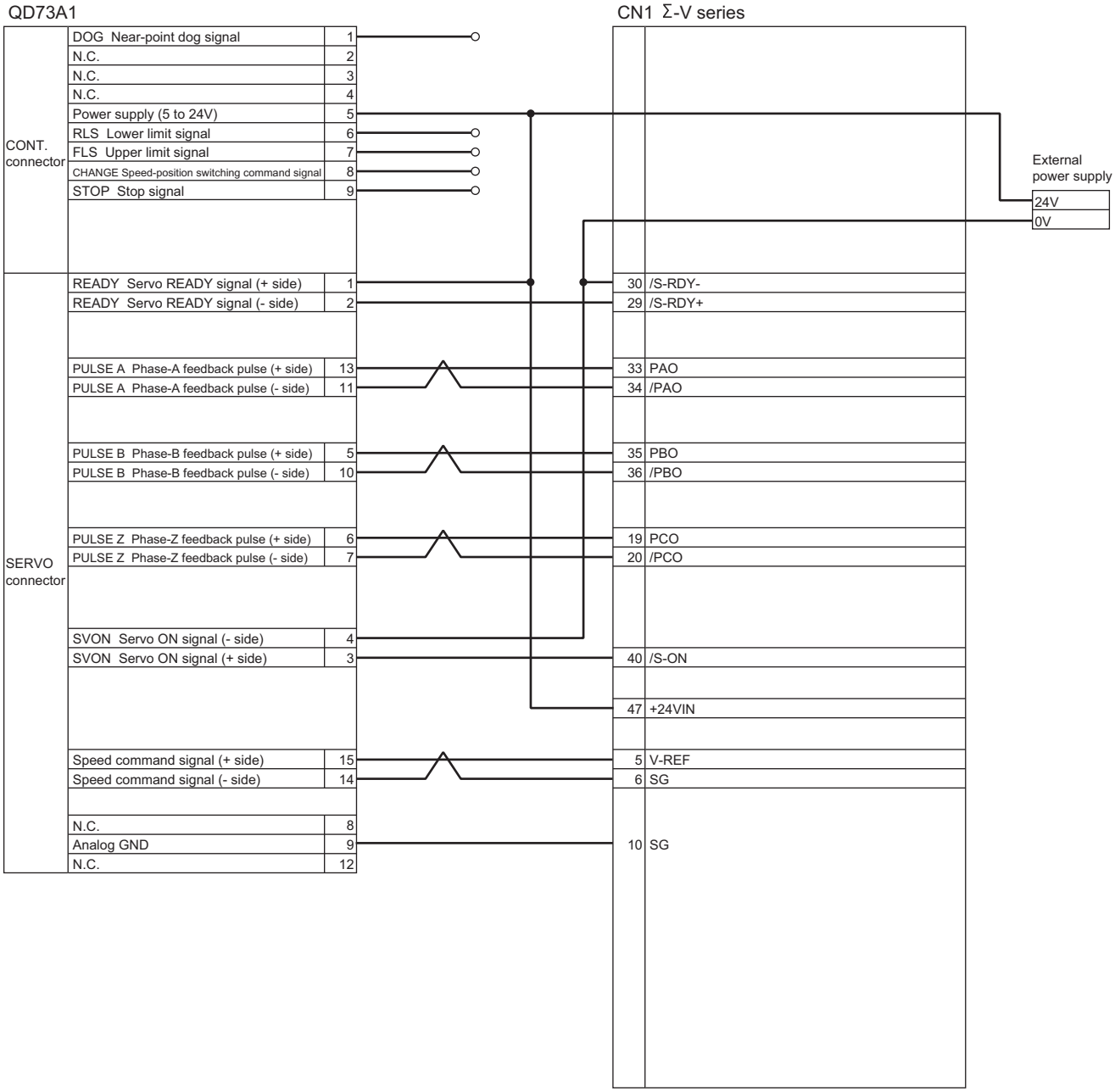
Appendix 2.2 Example of connection with a servo amplifier manufactured by YASKAWA Electric Corporation

(1) Connection with Σ-V series (Differential driver)

• For DC power supply input type



• For AC power supply input type



Appendix 3 Comparison of the QD73A1 and the AD70/A1SD70

(1) Performance specification comparison

Item		Specifications		
		QD73A1	AD70	A1SD70
Number of occupied I/O points		48 points (I/O assignment: empty 16 points and intelligent 32 points)	32 points (special 32 points)	48 points (I/O assignment: empty 16 points and special 32 points)
Positioning	Speed command	1 to 4000000(pulse/s)	1 to 400000(pulse/s)	
	In-position range	1 to 20479pulse	1 to 2047pulse	
Positioning feedback pulse input	Pulse frequency	Open collector: 200kpulse/s TTL: 200kpulse/s Differential output: 1Mpulse/s	Open collector: 100kpulse/s TTL: 100kpulse/s Differential output: 100kpulse/s	
OPR control		With OPR address change OPR method and OPR direction depend on the parameter setting.	With OPR address change OPR method and OPR direction depend on the switch setting.	
Internal current consumption		5VDC 0.52A	5VDC 0.3A	
External supply voltage/current terminal block		No external power supply	+15VDC 0.2A, -15VDC, 0.02A	
External dimensions		98(H)mm × 55.2(W)mm × 90(D)mm	250(H)mm × 37.5(W)mm × 119(D)mm	130(H)mm × 69.5(W)mm × 93.6(D)mm
Weight		0.20kg	0.5kg	0.4kg
Starting time (from a start request to analog output start)		Absolute system: 1.2ms (same for two-phase trapezoidal positioning) Incremental system: 1.2ms (same for two-phase trapezoidal positioning) JOG operation: 1.2ms OPR (near-point dog method): 1.2ms OPR (count method): 1.2ms	Absolute system: 4.4ms (additional 0.2ms for two-phase trapezoidal positioning) Incremental system: 4.5ms (additional 0.2ms for two-phase trapezoidal positioning) JOG operation: 4.3ms OPR (near-point dog method): 4.4ms OPR (count method): 5.1ms	

Item	Specifications		
	QD73A1	AD70	A1SD70
LED	RUN	None	
	ERR.	ERR.1/ERR.2 (Minor/major error)	
	ZERO	None	
	GAIN	None	
	None (check with X signal)	SV RDY (Servo READY signal)	
	None (check with X signal)	DOG (Near-point dog signal)	
	None (check with X signal)	STOP (Stop signal)	
	None (check with X signal)	FLS (Upper limit signal)	
	None (check with X signal)	RLS (Lower limit signal)	
	None (check with X signal)	IN-POS. (In-position)	
	None (check in the buffer memory)	POLE (Deviation counter polarity)	
	None (check in the buffer memory)	2^N (Deviation counter value)	
	None (check with Y signal)	PC RDY (PLC READY signal)	
	None (check with X signal)	ZERO (OPR request signal)	
	None (check with X signal)	EEX (Excessive error)	
	None (check with X signal)	WDT ERR. (Hardware error)	
	None (check with X signal)	V-MODE (Operating status)	
Zero/gain adjustment	• Adjustment using the UP/DOWN switch • Adjustment using the buffer memory	Adjustment using volumes	
Mode switch	Intelligent function module switch	DIP switch	

All the other specifications are the same.

(2) Function comparison

○: Usable ×: Unusable

Function			QD73A1	AD70/A1SD70	Difference
OPR control			○	○	[Movement amount after near-point dog ON (buffer memory)] • QD73A1: The movement amount where the OPR direction is reflected is stored in Md.6 Movement amount after near-point dog ON, which is the same buffer memory address as the AD70/A1SD70. The absolute value of movement amount is stored in Md.22 Movement amount after near-point dog ON (absolute value) • AD70/A1SD70: The absolute value of movement amount is stored.
Major positioning control	Position control mode	Positioning control	○	○	[Buffer memory addresses for positioning data] Refer to the following. ☞ Page 273, Appendix 3 (5)
		Two-phase trapezoidal positioning control	○	○	
	Speed-position control switch mode		○	○	[Buffer memory addresses for positioning data] Refer to the following. ☞ Page 273, Appendix 3 (5) [New speed-position movement amount (buffer memory)] • QD73A1: The setting is cleared to 0 when the next operation starts. • AD70/A1SD70: The value written during speed control is reflected. [Stroke limit range] • QD73A1: 1 to 2147483647 • AD70/A1SD70: Stroke limit lower limit to upper limit
JOG operation			○	○	—
Electronic gear function			○	○	—
Speed limit function			○	○	—
Stroke limit function			○	○	—
Upper limit switch (FLS)/lower limit switch (RLS) function			○	○	—
Current value change function			○	○	[Procedure] • QD73A1: The current value can be changed by setting "1" in "Current value change request". • AD70/A1SD70: The current value can be changed by writing a new current value in the buffer memory.
Speed change function			○	○	[Procedure] • QD73A1: Speed can be changed by setting "1" in "Speed change request". • AD70/A1SD70: Speed can be changed by writing a new speed value in the buffer memory.
Deviation counter clear function			○	○	—
In-position function			○	○	—
Multiplication setting			○	○	—

Function	QD73A1	AD70/A1SD70	Difference
Accumulated pulse error detection function	○	×	—
Zero/gain adjustment	○	○	[Method] • QD73A1: Switches on the front of the QD73A1 or a sequence program • AD70/A1SD70: Switches on the AD70/A1SD70
Module status monitor function	○	×	—
Error history function	○	×	—
Module error collection function	○	×	—
Error clear function	○	×	—

Remark

Positioning execution time (BUSY signal (X14) ON to Positioning complete signal (X15) ON) of the QD73A1 and AD70/A1SD70 may be different since their internal processing methods are different.
As a result, the timing when In-position signal (X16) turns on may also vary.
Adjust positioning execution time using the following methods if the difference of the execution time (or the timing when In-position signal (X16) turns on) affects the system.

- Adjusting the QD73A1's positioning parameter "Pr.6 Acceleration time" or "Pr.7 Deceleration time"
- Increasing gain by changing the accumulated pulse amount setting through the QD73A1's zero/gain adjustment

(3) Error code comparison

○: Usable ×: Unusable

Error code	Error name	QD73A1	AD70/A1SD70
60	Write in the buffer memory prohibited	×	○
61		×	○
62		×	○
86	Mode setting error	×	○
120	Flash ROM write exceeded	○	×
121	Flash ROM write error	○	×
122	Zero adjustment error	○	×
123	Zero/gain adjustment setting error	○	×
124	Zero/gain adjustment value error	○	×
125	Analog output adjustment area 1 Outside the setting range	○	×
126	Analog output adjustment area 2 Outside the setting range	○	×
130	Accumulated pulse alert	○	×
131	Accumulated pulse error undetectable	○	×
132	Reference value write error	○	×
133	Flash ROM write exceeded	○	×
134	Flash ROM write error	○	×
800	Hold error	○	×
803	Programmable controller CPU error	○	×
900	Hardware error 1	○	×
999	Hardware error 2	○	×

All the other error codes are the same.

(4) Input (X)/output (Y) comparison

○: Usable ×: Unusable

Device No.*1	Signal name	QD73A1	AD70/A1SD70
X20	OPR start complete signal	○	×
X21	Absolute positioning start complete signal	○	×
X22	Forward start complete signal	○	×
X23	Reverse start complete signal	○	×
X24	Synchronization flag	○	×
X2A	Zero/gain adjustment data writing complete flag	○	×
X2B	Zero/gain adjustment change complete flag	○	×
X2C	Set value change complete flag	○	×
X2D	Operating status of the speed-position control switch mode	○	×
Y1A	Zero/gain adjustment data writing request signal	○	×
Y1B	Zero/gain adjustment change request signal	○	×
Y1C	Set value change request signal	○	×

*1 For assignment to X/Y10 to X/Y2F

All the other I/O signals are the same.

(5) Buffer memory address comparison

Buffer memory area name	Buffer memory address (decimal)	
	QD73A1	AD70/A1SD70
Current value change request	90	—
Speed change request	91	—
Analog output adjustment area 2	92	—
	93	—
Zero/gain adjustment specification	94	—
Zero/gain adjustment value specification	95	—
Factory default zero/gain adjustment value restoration request	96	—
Zero/gain execution status	112	—
Zero/gain adjustment status	113	—
Feedrate	114	—
	115	—
Deviation counter value (pulse)	116	—
	117	—
Movement amount after near-point dog ON (absolute value)	118	—
	119	—
Error history (0 to 16)	120 to 183	—
Error history pointer	184	—
Maximum accumulated pulse value	200	—
	201	—
Minimum accumulated pulse value	202	—
	203	—
Accumulated pulse error detection function status	204	—
Reference value measurement flag	205	—
Positioning pattern	301	60
Positioning address P1	302	61
	303	62
Positioning speed V1	304	63
	305	64
Positioning address P2	306	65
	307	66
Positioning speed V2	308	67
	309	68
Alert output accumulated pulse setting value (maximum value)	400	—
	401	—
Immediate stop accumulated pulse setting value (maximum value)	402	—
	403	—
Alert output accumulated pulse setting value (minimum value)	404	—
	405	—
Immediate stop accumulated pulse setting value (minimum value)	406	—
	407	—
Accumulated pulse setting value selection	408	—
Accumulated pulse error detection request	409	—

Buffer memory area name	Buffer memory address (decimal)	
	QD73A1	AD70/A1SD70
Measurement start request	410	—
Reference value write request	411	—

All the other buffer memory addresses are the same.

(6) External I/O signal comparison

Input/output	Signal name		Description	
			QD73A1	AD70/A1SD70
Input	Power supply	Terminal block	None	±15VDC (±14.55 to ±15.45V)
Output	(Open collector method) Phase-A feedback pulse (PULSE A) Phase-B feedback pulse (PULSE B) Phase-Z feedback pulse (PULSE Z)		• Pulse frequency: 200kpulse/s or less • ON voltage: 4V or higher • OFF voltage: 1V or lower	• Pulse frequency: 100kpulse/s or less • ON voltage: 4V or higher • OFF voltage: 1V or lower
	(TTL method) Phase-A feedback pulse (PULSE A) Phase-B feedback pulse (PULSE B) Phase-Z feedback pulse (PULSE Z)		• Pulse frequency: 200kpulse/s or less • ON voltage: 2.8V or higher • OFF voltage: 0.8V or lower	• Pulse frequency: 100kpulse/s or less • ON voltage: 2.8V or higher • OFF voltage: 0.8V or lower
	(Differential output method) Phase-A feedback pulse (PULSE A) Phase-B feedback pulse (PULSE B) Phase-Z feedback pulse (PULSE Z)		Pulse frequency: 1Mpulse/s or less	Pulse frequency: 100kpulse/s or less

All the other external I/O signals are the same.

Appendix 4 When Using GX Developer

This section describes the operating procedure of GX Developer.

When using GX Developer, configure the parameter settings and the auto refresh settings with the sequence program.

- PROGRAMMING (☞Page 111, CHAPTER 7)

(1) Applicable software versions

For applicable software versions, refer to the following.

☞Page 22, Section 2.1 (4)

Appendix 4.1 Operation of GX Developer

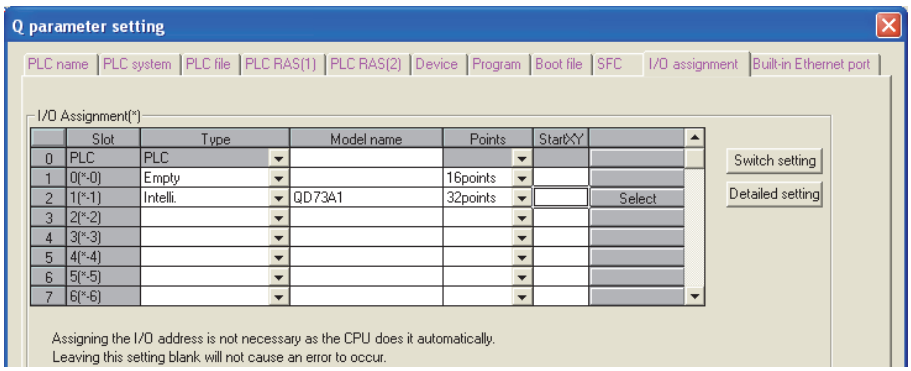
Configure the following settings when using GX Developer.

Window name	Application	Reference
I/O assignment	Set the type of the module to be mounted and the I/O signal range.	Page 275, Appendix 4 (1)
Intelligent function module switch setting	Configure the switch setting of the intelligent function module.	Page 276, Appendix 4 (2)

(1) I/O assignment

Configure the setting on "I/O assignment" in "PLC parameter".

Parameter⇨[PLC parameter]⇨[I/O assignment]

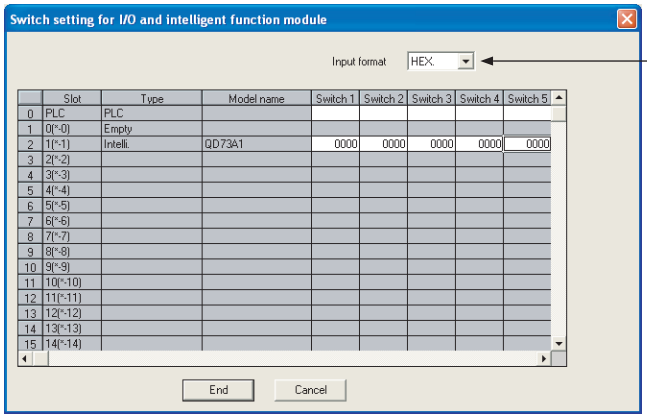


Item	Description
Type	Select "Intelli.".
Model name	Enter the model name of the module.
Points	The QD73A1 uses two slots. Select "Empty" and "0point" or "16points" for the first slot. Select "Intelli." and "32points" for the second slot.
StartXY	Enter any start I/O number of the QD73A1.

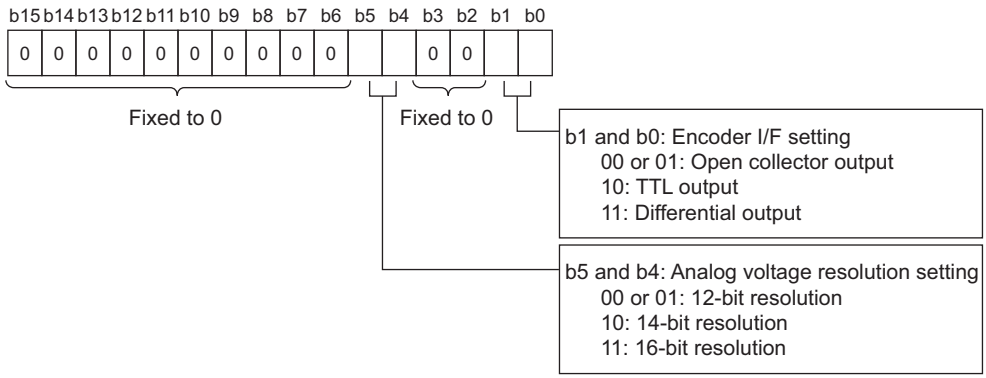
(2) Intelligent function module switch setting

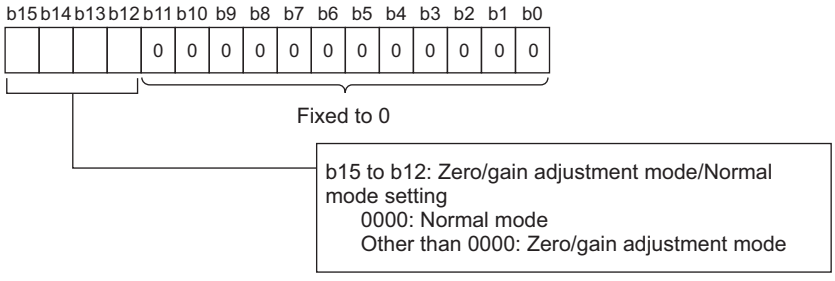
Configure the setting on "Switch setting" in "PLC parameter".

Parameter ⇨ [PLC parameter] ⇨ [I/O assignment] ⇨ Click the Switch setting button.



Item	Setting detail				
Switch 1	Bit				
	b0				Rotation direction setting
	0				Positive voltage is output when the positioning address increases.
	1				Negative voltage is output when the positioning address increases.
	b3		b2	b1	—
	0		0	0	Fixed to 0 (Empty) When a value is set, the value is ignored.
	b7	b6	b5	b4	Accumulated pulse setting (unit: pulse)*1
	0	0	0	0	-14800 to 14800 (default value)
	0	0	0	1	-3700 to 3700 [Selection 1]
	0	0	1	0	-7400 to 7400 [Selection 2]
	0	0	1	1	-11100 to 11100 [Selection 3]
	0	1	0	0	-14800 to 14800 [Selection 4]
	0	1	0	1	-37000 to 37000 [Selection 5]
	0	1	1	0	-74000 to 74000 [Selection 6]
	0	1	1	1	-111000 to 111000 [Selection 7]
	1	0	0	0	-148000 to 148000 [Selection 8]
	b9		b8		Multiplication setting
	0		0		4
	0		1		2
	1		0		1
	1		1		1/2
	b11		b10		—
	0		0		Fixed to 0 (Empty) When a value is set, the value is ignored.
	b12				OPR direction setting
	0				Reverse direction (address decreasing)
	1				Forward direction (address increasing)
	b13				OPR method setting
	0				Near-point dog method
	1				Count method
	b15		b14		—
	0		0		Fixed to 0 (Empty) When a value is set, the value is ignored.

<table>
<tr><th>Item</th><th colspan="2">Setting detail</th></tr>
<tr><td>Switch 2</td><td colspan="2">Encoder I/F setting and Analog voltage resolution setting
 

"00 or 01" means that the setting is valid with either value.
When a value is set in b15 to b6, b3, or b2, the value is ignored.</td></tr>
<tr><td rowspan="9">Switch 3</td><td>Bit</td><td>Setting detail</td></tr>
<tr><td>b0</td><td>Feedback pulse addition/subtraction setting*2</td></tr>
<tr><td>0</td><td>Add when the phase A proceeds 90 degrees than phase B.</td></tr>
<tr><td>1</td><td>Subtract when the phase A proceeds 90 degrees than phase B.</td></tr>
<tr><td>b3 to b1</td><td>-</td></tr>
<tr><td>0</td><td>Fixed to 0 (Empty)
When a value is set, the value is ignored.</td></tr>
<tr><td>b4</td><td>Deviation counter clear setting</td></tr>
<tr><td>0</td><td>Clear the deviation counter when Servo READY signal turns off.</td></tr>
<tr><td>1</td><td>Do not clear the deviation counter when Servo READY signal turns off.</td></tr>
<tr><td>b15 to b5</td><td>-</td></tr>
<tr><td>0</td><td>Fixed to 0 (Empty)
When a value is set, the value is ignored.</td></tr>
<tr><td>Switch 4</td><td colspan="2">Zero/gain adjustment mode/Normal mode setting
 

When a value is set in b11 to b0, the value is ignored.</td></tr>
<tr><td>Switch 5</td><td colspan="2">Fixed to 0 (Empty)
When a value is set, the value is ignored.</td></tr>
</table>

*1 When setting values (values in b7 to b4 of Switch 1) are 1111_H to 1001_H, the setting becomes the same as the one for the default value (0000_H)

*2 The setting becomes enabled only when "1: Negative voltage is output when the positioning address increases." is set for "Rotation direction setting" of Switch 1. When "0: Positive voltage is output when the positioning address increases." is set, the setting value of "Feedback pulse addition/subtraction setting" is ignored.

Appendix 5 Terms

(1) Encoder

One of the pulse generators that converts input data into binary data (on and off)

(2) Near-point dog

A switch used in positioning systems, which is placed before the original point of a workpiece. When this switch turns on, the feedrate is switched to creep speed. Therefore, there is time required for the deceleration from the federate to the creep speed while this switch is on.

(3) Servo on

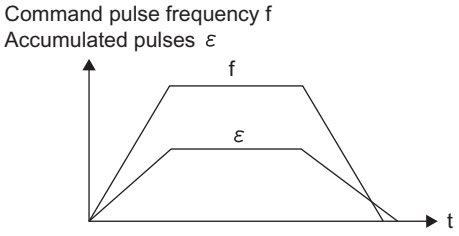
A signal that indicates the normal status of a servo amplifier. A servo amplifier is operable only when it is normal and this signal is on.

(4) Servomotor

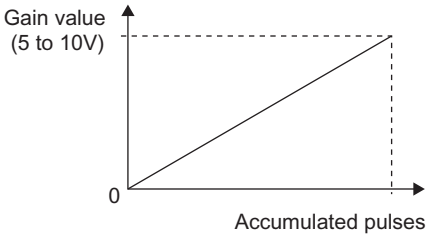
A motor that rotates according to a command. This motor is highly responsive, therefore frequent and rapid start and stop are available with high precision. DC and AC type motors are available as well as high power motors. Feedback control is available with the included pulse generator that detects the number of rotations.

(5) Accumulated pulse

Pulses that are accumulated in the deviation counter inside the QD73A1. The difference between command pulses and feedback pulses becomes accumulated pulses.
Accumulated pulses that are proportional to the command pulse frequency are constantly output while the QD73A1 is operating. The number of accumulated pulses becomes "0" when positioning is completed.



The analog output voltage value from the QD73A1 is proportional to the number of accumulated pulses.



(6) Drive unit (servo amplifier)

A generic term for drive units that support analog voltage inputs. The commands that are output from the QD73A1 are low voltage. This unit is used to amplify the energy and activate a motor. The unit, also called a servo amplifier, is an accessory on a servomotor.

(7) Pulse generator

A device that generates pulses. For example, by attaching this device on a motor axis, pulses can be generated by the rotation of the axis.

(8) Feedback pulse

Pulses that are fed back from the encoder to the QD73A1 according to the motor's actual rotation amount (rotation degree)

(9) Deviation counter

A counter that counts up and down the difference between the number of command pulses and feedback pulses. The difference between command pulses and feedback pulses are accumulated in the deviation counter as "accumulated pulses". The number of accumulated pulses in the deviation counter becomes "0" when positioning is completed.

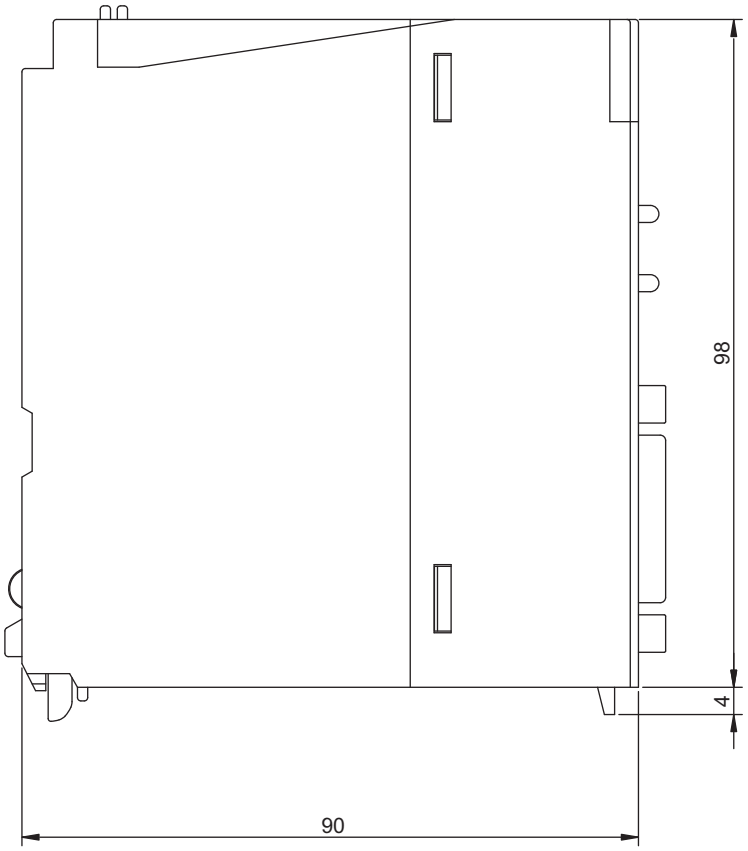
(10) Zero signal

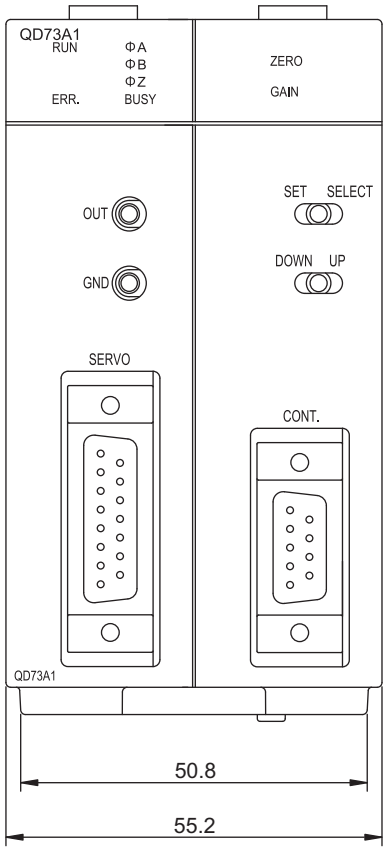
PG0 of a pulse generator (encoder), that is detected once in one rotation

(11) Workpiece

A generic term for various objects being controlled, including moving objects such as tools

Appendix 6 External Dimensions





(Unit: mm)

Memo

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REVISIONS

*The manual number is given on the bottom left of the back cover.

Print date	*Manual number	Revision
July 2012	SH(NA)-081075ENG-A	First edition
November 2012	SH(NA)-081075ENG-B	The accumulated pulse error detection function is added.
September 2014	SH(NA)-081075ENG-C	The feedback pulse addition/subtraction setting, deviation counter clear setting, and deviation counter value monitor are added. The movement amount after near-point dog ON (absolute value) is added and external wiring diagrams are corrected.

Japanese manual version SH-081074-F

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 of damages caused by any cause found not to be the responsibility of Mitsubishi, loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products, special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products, 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.

SH(NA)-081075ENG-C(1409)MEE
MODEL: QD73A1-U-E
MODEL CODE: 13JZ69

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