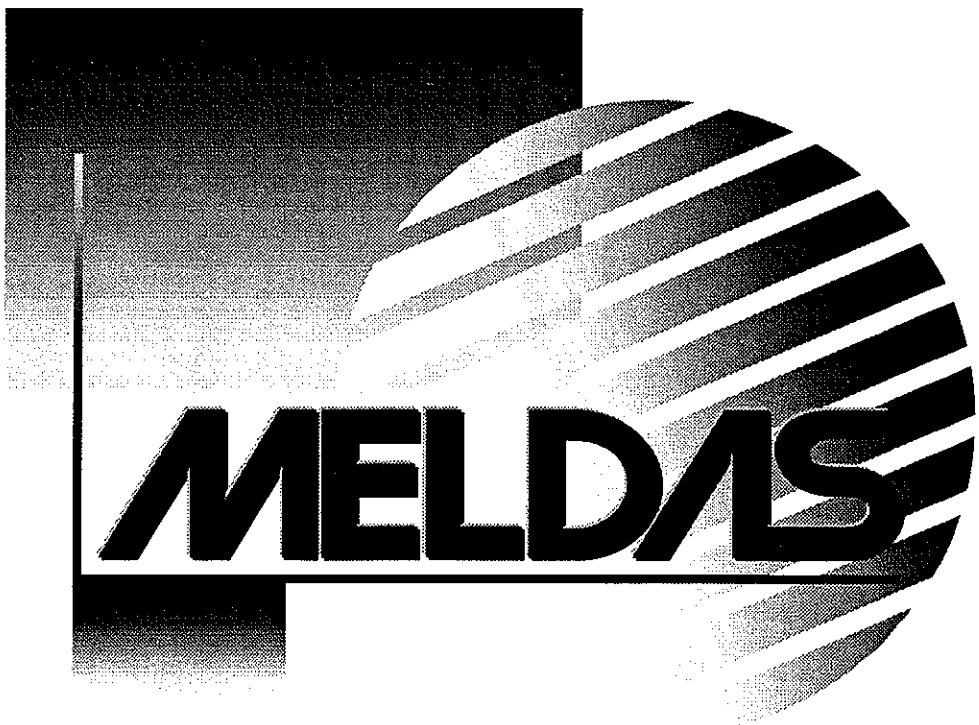
Changes for the Better

MITSUBISHI ELECTRIC

SINGLE-AXIS AMPLIFIER BUILT-IN CONTROLLER MODEL E

INSTRUCTION AND MAINTENANCE MANUAL



BNP-B2071B(ENG)

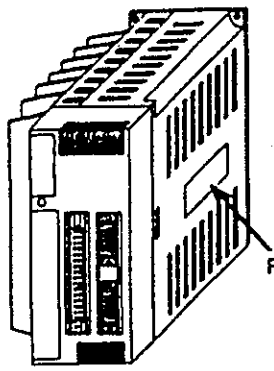
CONTENTS

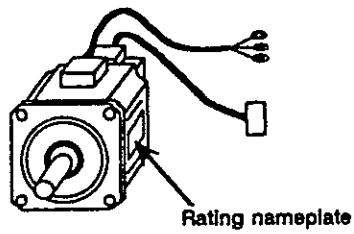
CHAPTER 1 Handling

1.1 Inspection at delivery

First, inspect the rating nameplates for the controller and servomotor, and confirm that the product is as ordered. Refer to the "Combination Table" on the next page to confirm that the controller and servomotor combination is correct.

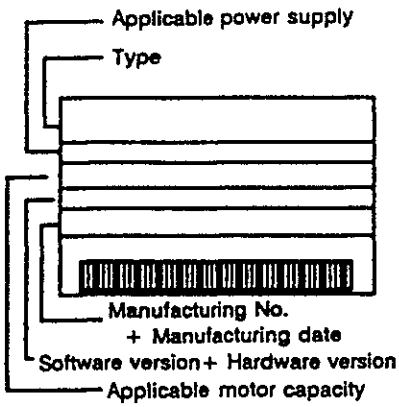
How to read rating nameplate





Controller

Details of rating nameplate



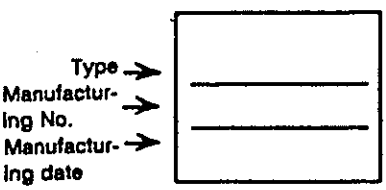
Details of type

F C U A — M P 1 0 — □□

Mitsubishi Single-axis amplifier built-in controller Model E series

Symbol	Rated output (W)
01	0.1kW class
03	0.3kW class
06	0.6kW class
10	1kW class
20	2kW class

Servomotor



H A — S H 1 0 2 B G — Y — K

AC servomotor
HA-ME series
HA-FE series
HA-SE series
HA-FH series
HA-SH series

Symbol	Output
05	0.05kW
1	0.1kW
2	0.2kW
3	0.3kW
4	0.4kW
5	0.5kW
6	0.6kW
8	0.8kW
10	1.0kW
12	1.2kW
15	1.5kW
20	2.0kW

Symbol	Axis end
None	Standard <Note 1>
T	Taper
K	Straight axis with keyway

Symbol	Detector
None	Incremental
Y	Absolute position

Symbol	Reduction gear
None	None
G	Installed

Symbol	Magnetic brake
None	None
B	Installed

Symbol	Rated speed
1	1000 r/min.
2	2000 r/min.
3	3000 r/min.

<Note 1> The HA-FE/H motor has a keyway as a standard.

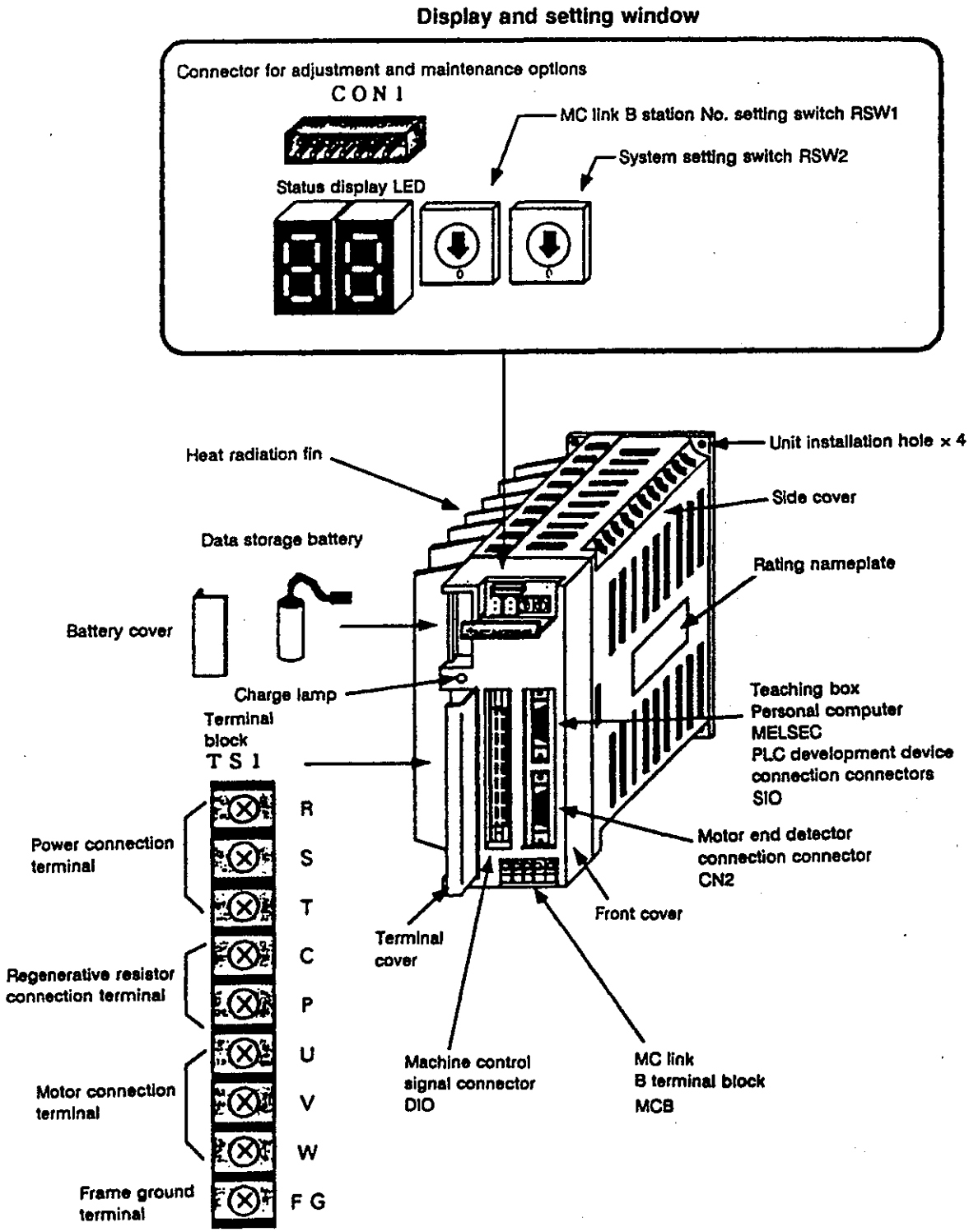
Table of Controller, Servomotor and Regenerative Resistor Combinations

: Standard : Option

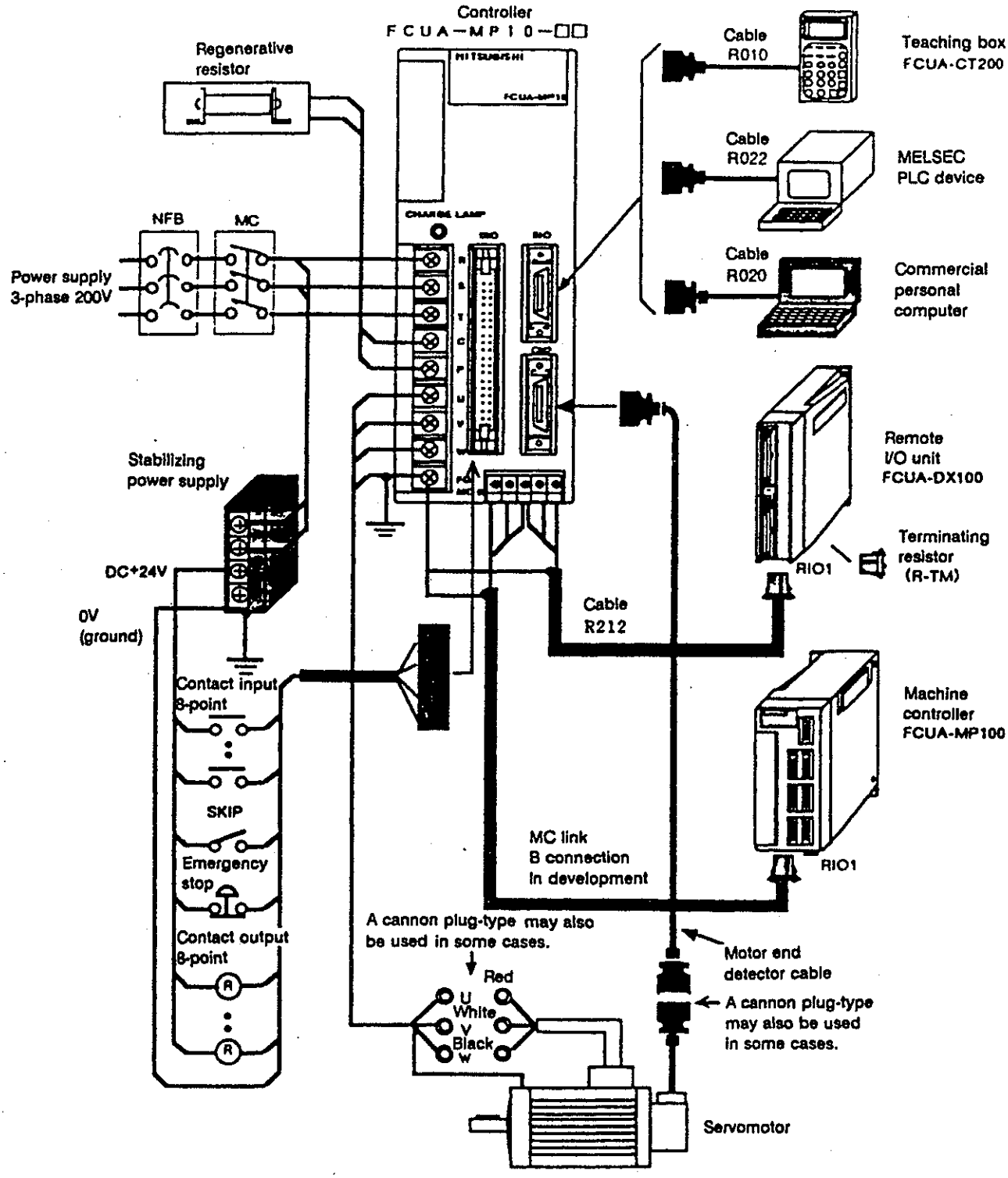
			Controller type FCUA-MP10-				
			01	03	06	10	20
Servomotor	Ultra-low inertia HA-ME series	HA-ME053	0.05kW				
		HA-ME13	0.1kW				
		HA-ME23		0.2kW			
		HA-ME43		0.4kW			
		HA-ME73			0.75kW		
	Low inertia HA-FE series	HA-FE053	0.05kW				
		HA-FE13	0.1kW				
		HA-FE23		0.2kW			
		HA-FE33		0.3kW			
		HA-FE43			0.4kW		
		HA-FE63			0.6kW		
	Low inertia HA-FH series	HA-FH053	0.05kW				
		HA-FH13	0.1kW				
		HA-FH23		0.2kW			
		HA-FH33		0.3kW			
		HA-FH43			0.4kW		
		HA=FH63			0.6kW		
	Medium inertia HA-SE 1000 r/min. series	HA-SE81			0.85kW		
		HA-SE121				1.2kW	
		HA-SE201					2kW
	Medium inertia HA-SE 2000 r/min. series	HA-SE52			0.5kW		
		HA-SE102				1kW	
		HA-SE152				1.5kW	
		HA-SE202					2kW
	Medium inertia HA-SE 3000 r/min. series	HA-SE53			0.5kW		
		HA-SE103				1kW	
		HA-SE153				1.5kW	
		HA-SE203					2kW
	Medium inertia HA-SH 1000 r/min. series	HA-SH81			0.85kW		
		HA-SH121				1.2kW	
		HA-SH201					2kW
	Medium inertia HA-SH 2000 r/min. series	HA-SH52			0.5kW		
		HA-SH102				1kW	
		HA-SH152				1.5kW	
		HA-SH202					2kW
	Medium inertia HA-SH 3000 r/min. series	HA-SH53			0.5kW		
		HA-SH103				1kW	
		HA-SH153				1.5kW	
		HA-SH203					2kW
Regenerative resistor/ regeneration frequency	None (capacitor regeneration)		Note 1				
	MR-RB013	[times/min.]		150	70		
	MR-RB033	[times/min.]		450	200		
	MR-RB033 (Two in parallel)	[times/min.]				64	25

Note 1) There is no limit to the regeneration frequency if the execution torque is within the rated torque range.

1.2 Names and functions of controller parts



1.3 Maximum system configuration and outline of connection



1.4 Precautions for use

Mistaken usage methods and handling may lead to unforeseen accidents or damage. Items to be observed during use are listed below, so please refer to the related items, and correctly use the controller.

[Precautions for maintenance and inspection]

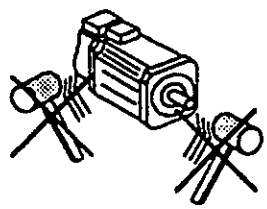
(1) A "high voltage" will remain in the controller for a short while after the power is turned OFF. Do not connect/disconnect any of the cables immediately after turning the power OFF. If the charge lamp on the front of the controller is lit, a high voltage still remains in the controller.
(2) Execution of a meg test on the controller may damage the unit. Use a continuity check with a tester instead of executing a meg test.
(3) Do not disassemble the controller or servomotor. The servomotor end detector cannot be removed. Note that the cover must never be removed.

[Precautions for wire connections]

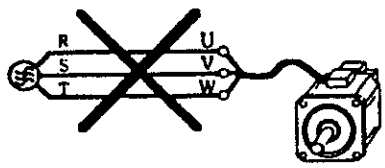
(1) Ground the controller and servomotor grounding terminal in a group on the unit side using the shortest possible distance. Use Class 3 grounding (100Ω or less) to prevent electric shock or malfunctions.
(2) Always match the controller and servomotor U, V and W terminals. The rotation direction cannot be changed by interchanging two wires as is possible in the general purpose motor.
(3) The controller may be damaged if a commercial power supply (200V, etc.) is applied on the controller U, V, and W terminals (terminals for outputting drive to servomotor). Correctly connect the 200V class power supply to the R, S and T terminals. When using a power supply other than 200V class, install a transformer.
(4) Connect an exclusive regenerative resistor to the regenerative resistor terminal C and P, and set the corresponding parameters. If incorrectly set, the controller may be damaged or the resistor may overheat or burn.

[Precautions for handling servomotor]

(1) Do not apply any impact on the servomotor detector. The detector may be damaged if the shaft is hammered or dropped.



(2) Do not directly apply commercial power supply (200V, etc.) on the motor. An excessive current will flow, and the servomotor will be damaged. Always drive the motor with the specified controller combination.



[Operation and sequence]

(1) Use the motor's magnetic brakes only for emergency stop and maintenance. The brakes are designed for holding during a power failure, so if used for braking at each deceleration, they will wear quickly.
(2) When turning the controller power ON again after turning it OFF, wait for the controller's status display LED to go out first.
(3) Connect a non-fuse breaker and magnetic contactor to the power supply R, S and T.

1.5 Installation of controller

The controller and remote I/O are designed to be installed a fully-closed cabinet. When installing in the cabinet, observe the following items.

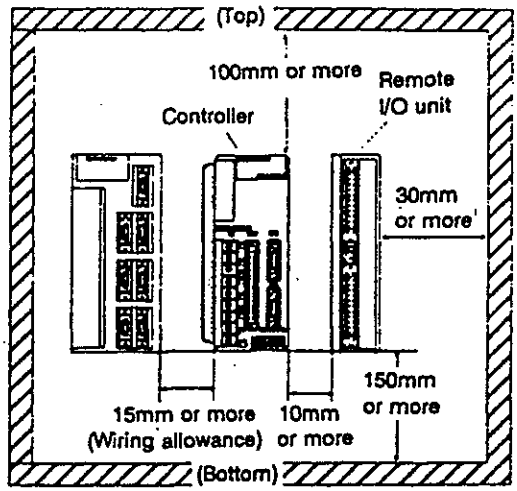
(1) Working environment conditions

- Ambient temperature: 0 to 55°C (with no freezing) <Note>
- Ambient humidity : 90%RH or less (with no dew condensation)
- Vibration : 5.9m/s² {0.6G} or less

<Note> Inner panel temperature specifications. To ensure the servo drive's life and reliability, the average inner panel temperature should be 40°C or less.

(2) Installation direction and clearance

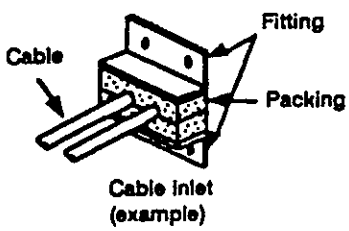
Install each unit so that the front can be seen.
Refer to the drawing on the right, and secure ventilation space around each unit for heat dissipation and wiring.

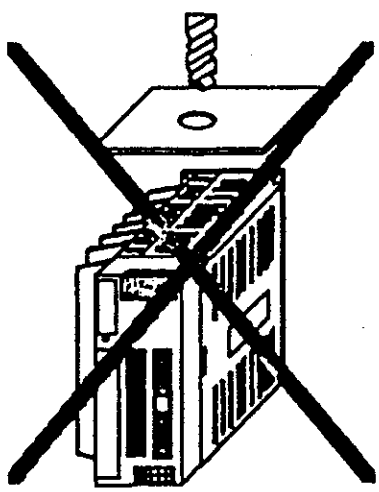


(3) Prevention of foreign matter entry

Enforce the following measures on the cabinet.

- Dust proof and oil proof the cable inlets with packing, etc.
- Take care so that the outdoor air does not enter the inside the unit from the heat dissipation holes, etc.
- Do not block all clearances.
- Securely install the door packing.
- If there is a rear cover, always attach packing.
- Oil will easily accumulate on the top, and may enter the cabinet from the screw holes, so take special measures such as oil proofing packing.
- After installing each unit, avoid machining in the peripheral area. The cutting chips, etc., may adhere to the electronic parts and lead to faults.



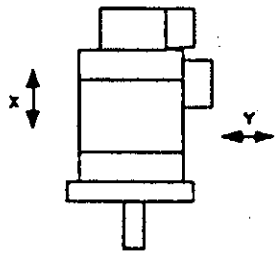


1.6 Installation of servomotor

(1) Working environment conditions

- Ambient temperature: 0 to 40°C (with no freezing)
- Ambient humidity : 80%RH or less (with no dew condensation)
- Vibration : See table below

Motor series	Exciting direction	
	Axial direction (X)	Axial and vertical direction (Y)
HA-ME series	19.6m/s² {2.0G}	19.6m/s² {2.0G}
HA-FE series		
HA-FH series		
HA-SE series	9.8m/s² {1.0G}	24.5m/s² {2.5G}
HA-SH series		



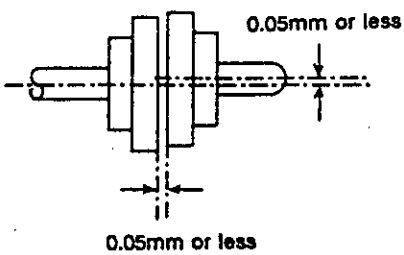
Conditions
1. Motor stationary
2. Installation state

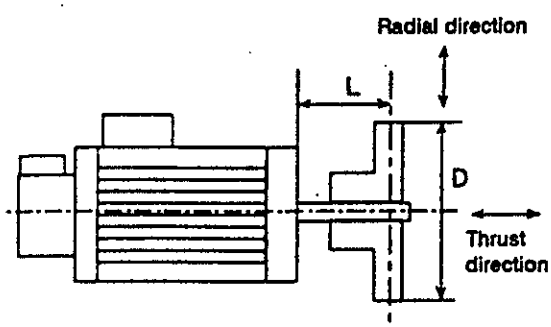
(2) Precautions for mounting load (prevention of shaft impact)

- When mounting a pulley, use the screw hole at the end of the shaft (only for HA-FE motor).
- When removing the pulley, use a pulling tool.

(3) Tolerable load of axis

- Use flexible coupling, and keep the axis center deviation below the tolerable value.
- When using a pulley or sprocket, select a diameter that fits within the tolerable radial load.



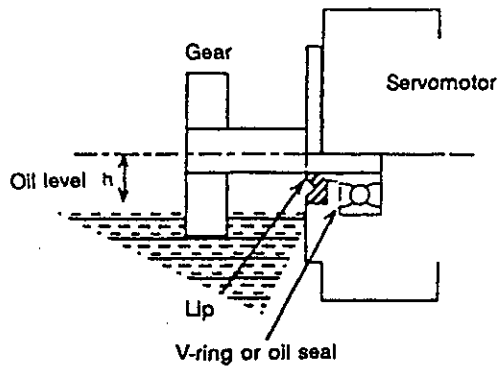


Motor	Tolerable radial load (N)	Tolerable thrust load (N)
HA-F□053	L = 30 108 { 11kgf }	98 { 10kgf }
HA-F□13	L = 30 118 { 12kgf }	98 { 10kgf }
HA-F□23	L = 30 176 { 18kgf }	147 { 15kgf }
HA-F□43/63	L = 40 323 { 33kgf }	284 { 29kgf }
HA-S□52 ~ 152	L = 55 980 { 100kgf }	490 { 50kgf }
HA-S□53 ~ 153		
HA-S□81		
HA-S□121 ~ 201	L = 79 2058 { 210kgf }	980 { 100kgf }
HA-S□202, 203		

(4) Measures against oil and water

- The servomotor does not have a waterproof structure. (JP44)
  Make sure that oil and water do not drop down on the motor.
- When installing in a gear box, secure the heights listed below from the motor shaft's V-ring oil seal to the oil surface. Make breathing holes on the gear box so that the inner pressure does not rise.

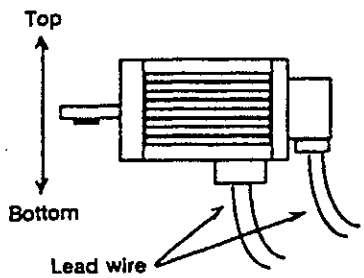
Motor	Oil level height h (mm)
HA・F□053, 13	8
HA・F□12, 33	12
HA・F□43, 63	14
HA・S□52 ~ 152 HA・S□53 ~ 153 HA・S□81	20
HA・S□121 ~ 201 HA・S□202, 203	25



<Note> The HA-ME series motor is not equipped with either a V-ring or oil seal.

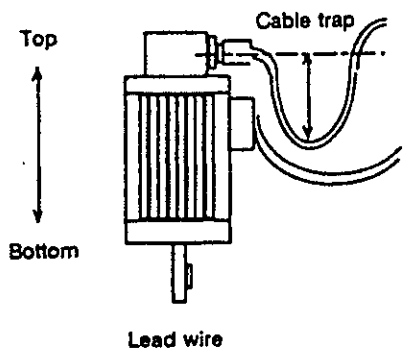
(5) Installation direction

- The motor can be installed horizontally, on the axis end or downward.
- The cables from the motor must be set to face downward.
- When installing vertically, create a cable trap so that oil and water do not reach the motor.
- Oil and water may drip along the cable and adversely affect the motor and detector. Make sure that the cable does not lead in oil and water, and that the cable is not submerged in oil and water pools.
- The standard cannon plug is not waterproof.
  Use a conduit and connector for waterproofing measures.



(6) Cable breakage

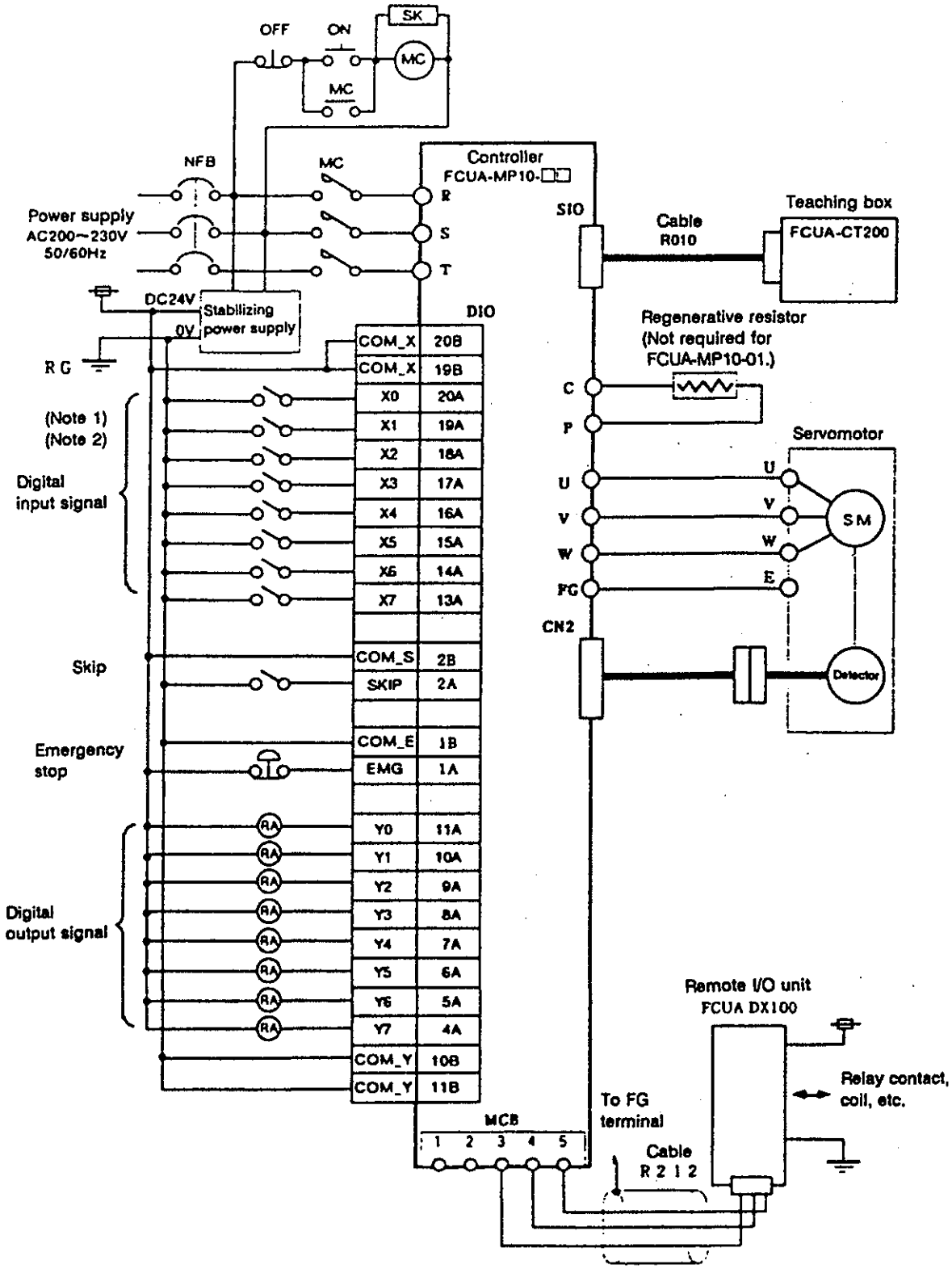
- Make sure that stress is not applied on the cable, and that the cable is not damaged.
- In applications where the motor moves, determine the cable's bending radius from the required curvature life and wire type.



[Memo]

CHAPTER 2 Connections

2.1 Basic connections

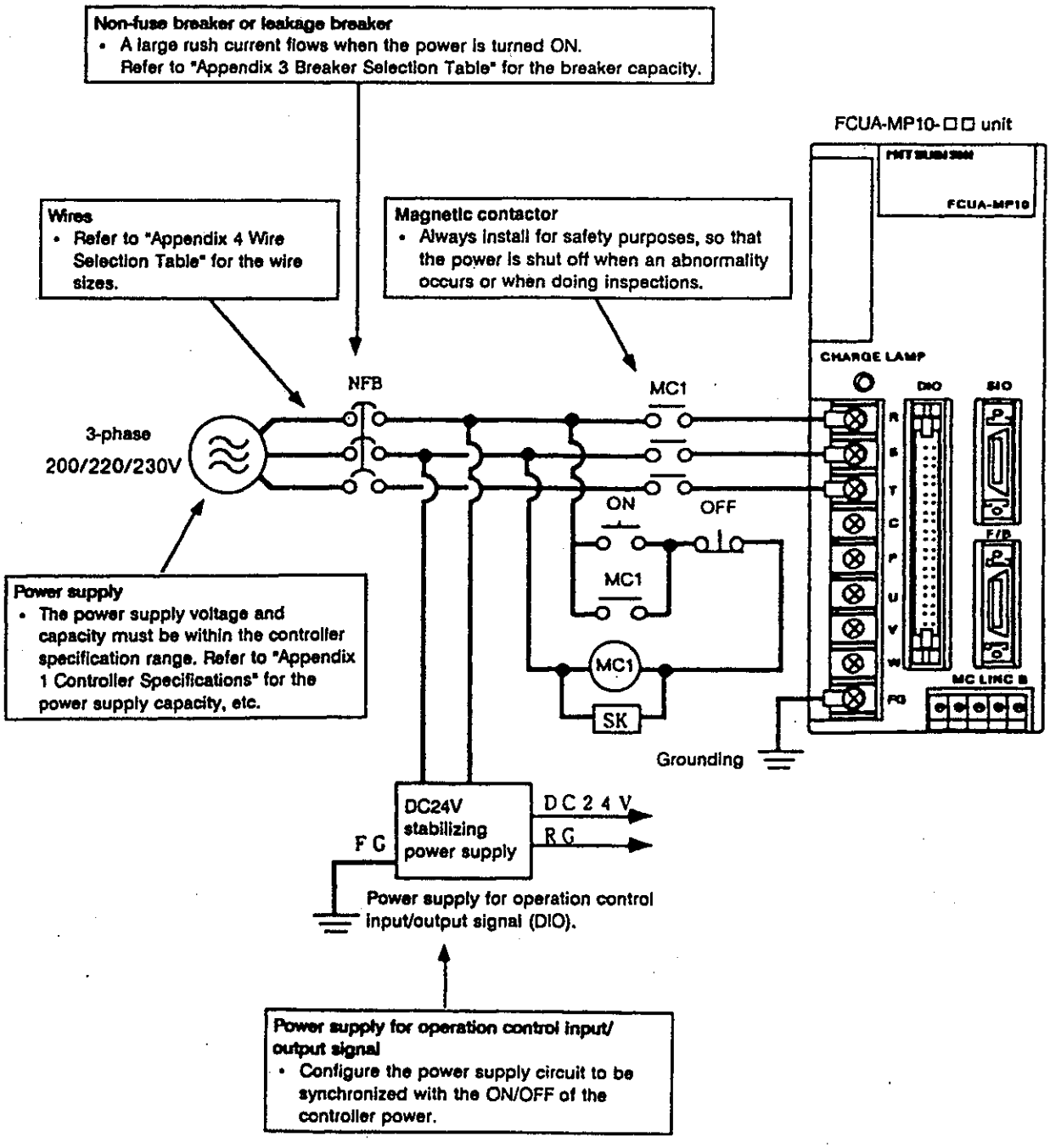


(Note 1) Any of the inputs X0 to X7 can be connected to the common (COM) 24V and 0V (ground).

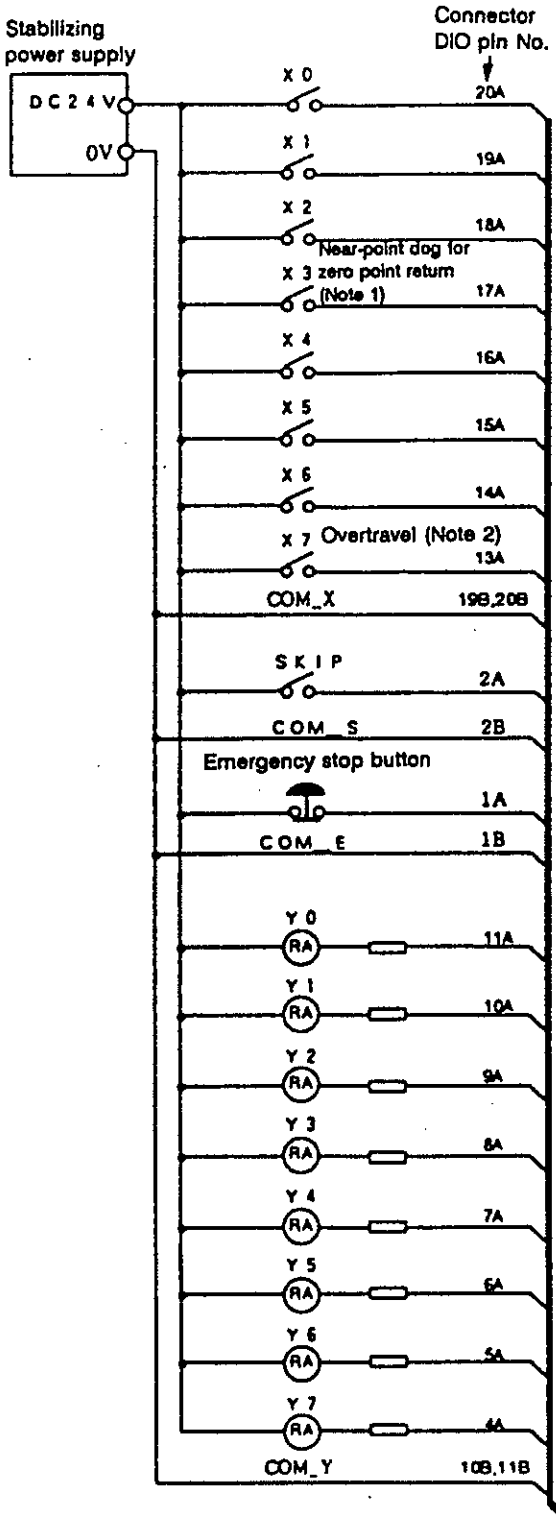
(Note 2) When using the reference point near-point detection signal or stroke end signal, each are fixed to X4 and X7.

2.2 Connection of power supply

Example of power supply circuit configuration

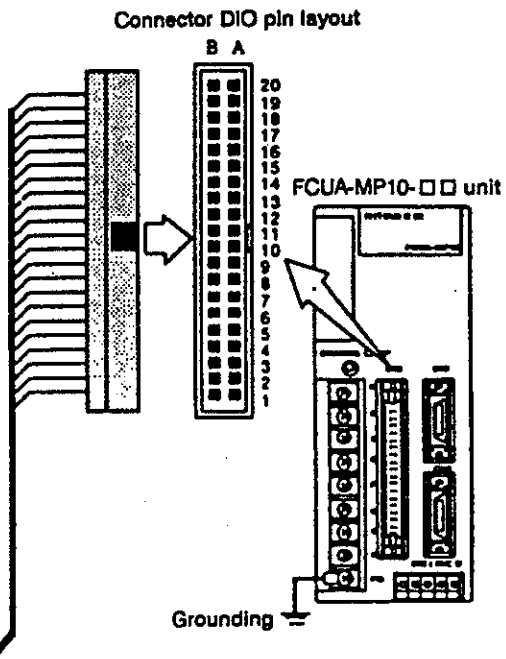


2.3 Connection of digital input/output signal, emergency stop signal, SKIP signal



The digital input/output signal, emergency stop and skip are connected to the connector DIO.
The digital input signals (X0 to X7), emergency stop and SKIP correspond to both the source input method (connect common to 0V) or the sink input method (connect common to +24V). The diagram on the left shows the connectors for the source input method.
The digital output signal is fixed to the sink (open collector) output, and the common is fixed to the 0V (ground) connection.

When using the standard PLC, the digital input signals (X0 to X7) and the digital output signals (Y0 to Y7) are used as the operation control signals. Refer to "6.2 Assignment of digital input/output signal for standard PLC) for the assignment of functions to each digital input/output signal.



(Note 1) The digital input signal X3 is fixed to the input of the near-point dog signal for zero point return. When not using the near-point dog signal, turn the PLC I/F table Y8F (near-point dog ignore) ON with the user PLC program. The near-point dog signal will be ignored, and the input can be used as a general purpose input. The near-point dog signal cannot be assigned to another input pin. The near-point dog signal is handled as a B contact.

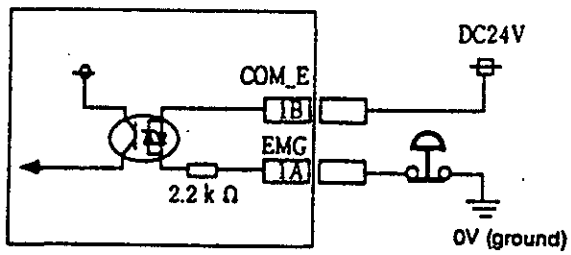
(Note 2) The digital input signal X7 is fixed to the input of the overtravel signal. When not using the overtravel signal, turn the PLC I/F table Y8E (OT ignore) ON with the user PLC program. The overtravel signal will be ignored, and the input can be used as a general purpose input. The overtravel signal cannot be assigned to another input pin. The overtravel signal is handled as a B contact for both the +/- directions.

2.4 Explanation of input/output signal interface

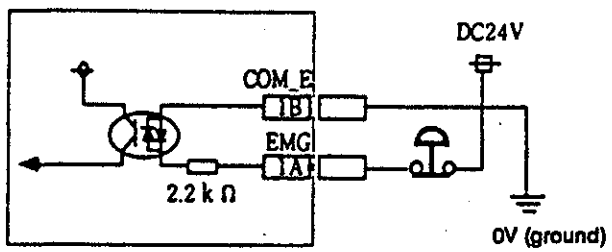
2.4.1 Emergency stop input (EMG)

Either the source input method (common connected to 0V) or the sink input method (common connected to +24V) can be selected for the emergency stop input.
The emergency stop input common (COM_E) is insulated and separated from the other commons. Thus, the "DC24V power supply" for the emergency stop input signal can be separated from the power supplies for the other digital input/output signals.

Input circuit



Connection of "common = DC24V, external contact common = 0V" (sink input)



Connection of "common = 0V, external contact common = 24V" (source input)

Input conditions

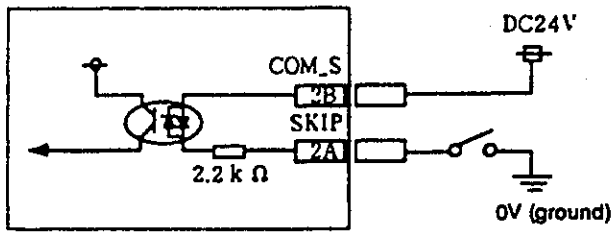
The input signals must be within the ranges of the following conditions.

Max. input voltage	DC26V
Input ON voltage	20V or more
Input OFF voltage	6V or less
Tolerable chattering time	3ms or less
Input signal hold time	40ms or more
External switch contact capacity	+30V or more, 7mA or more

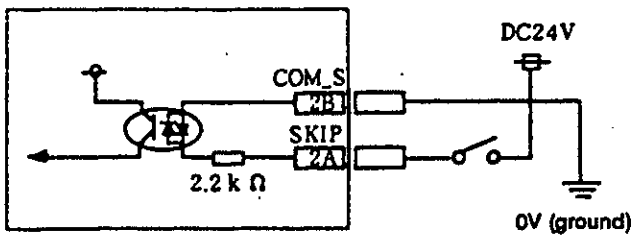
2.4.2 SKIP input

Either the source input method (common connected to 0V) or the sink input method (common connected to +24V) can be selected for the SKIP input.
The SKIP input common (COM_E) is insulated and separated from the other commons. Thus, the "DC24V power supply" for the SKIP input signal can be separated from the power supplies for the other digital input/output signals.

Input circuit



Connection of "common = DC24V" (sink input)



Connection of "common = 0V (ground)" (source input)

Input conditions

Max. input voltage	DC26V
Input ON voltage	20V or more
Input OFF voltage	6V or less
Tolerable chattering time	3ms or less
Input signal hold time	40ms or more
External switch contact capacity	+30V or more, 7mA or more

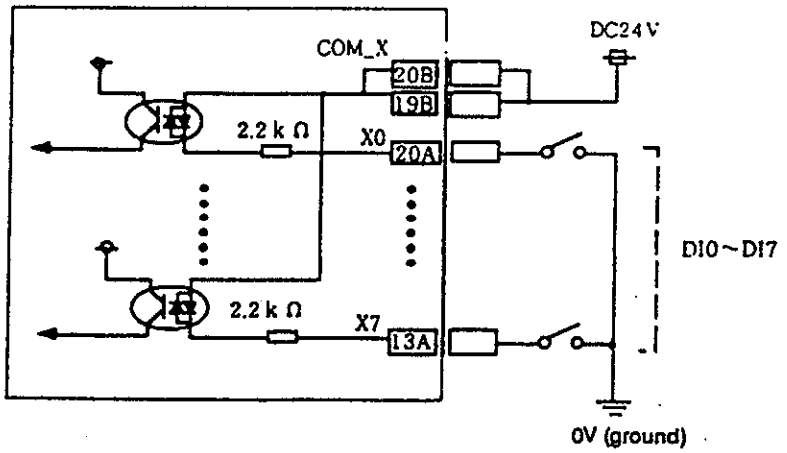
Note

The SKIP signal is used for high-speed signal processing. Take special care so that noise induction, etc., is not generated.

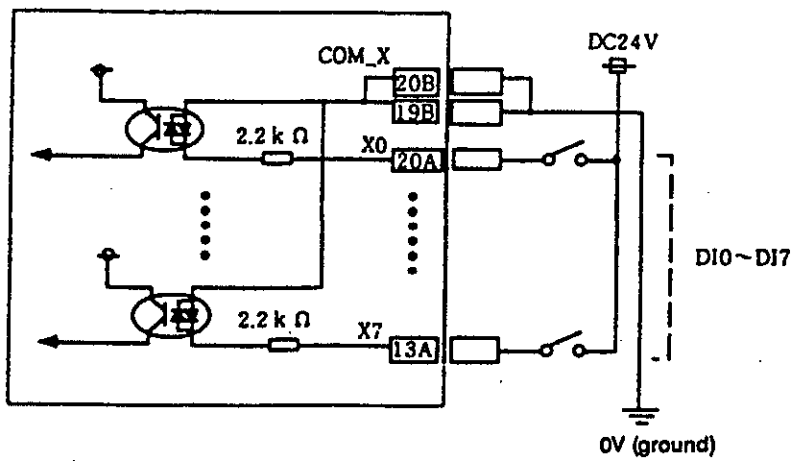
2.4.3 Digital input (X0 to X7)

Either the source input method (common connected to 0V) or the sink input method (common connected to +24V) can be selected for the digital input circuit (X0 to X7). The common COM_X is an 8-point common.

Input circuit



Connection of "common = DC24V" (sink input)



Connection of "common = 0V (ground)" (source input)

Input conditions

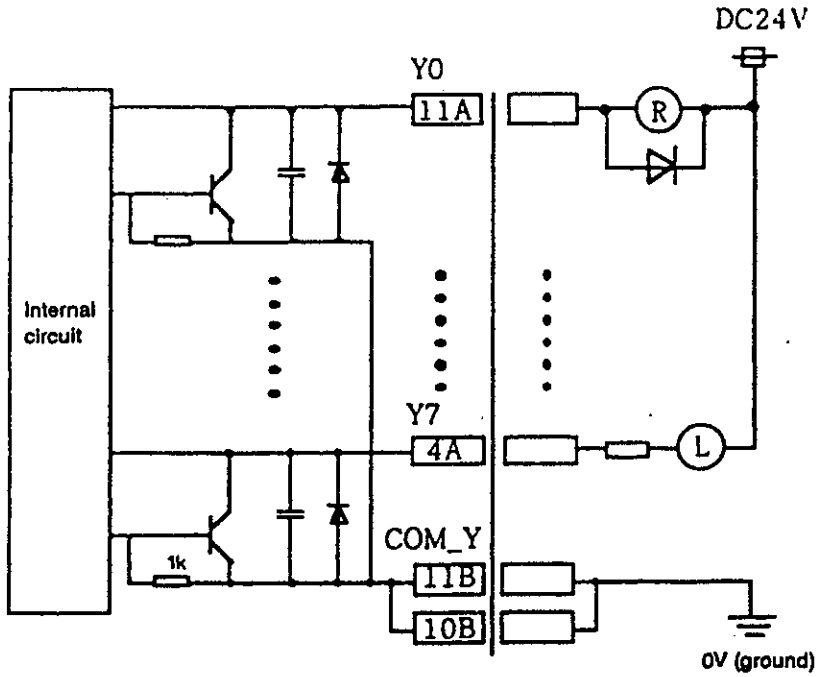
The input signals must be within the ranges of the following conditions.

Max. input voltage	DC26V
Input ON voltage	20V or more
Input OFF voltage	6V or less
Tolerable chattering time	3ms or less
Input signal hold time	40ms or more
External switch contact capacity	+30V or more, 7mA or more

2.4.4 Digital output (Y0 to Y7)

The digital signal output circuit is an all-point sink (open collector) output. Use within the range of the specifications listed below. The common COM-Y is an 8-point common.

Output circuit



Output conditions

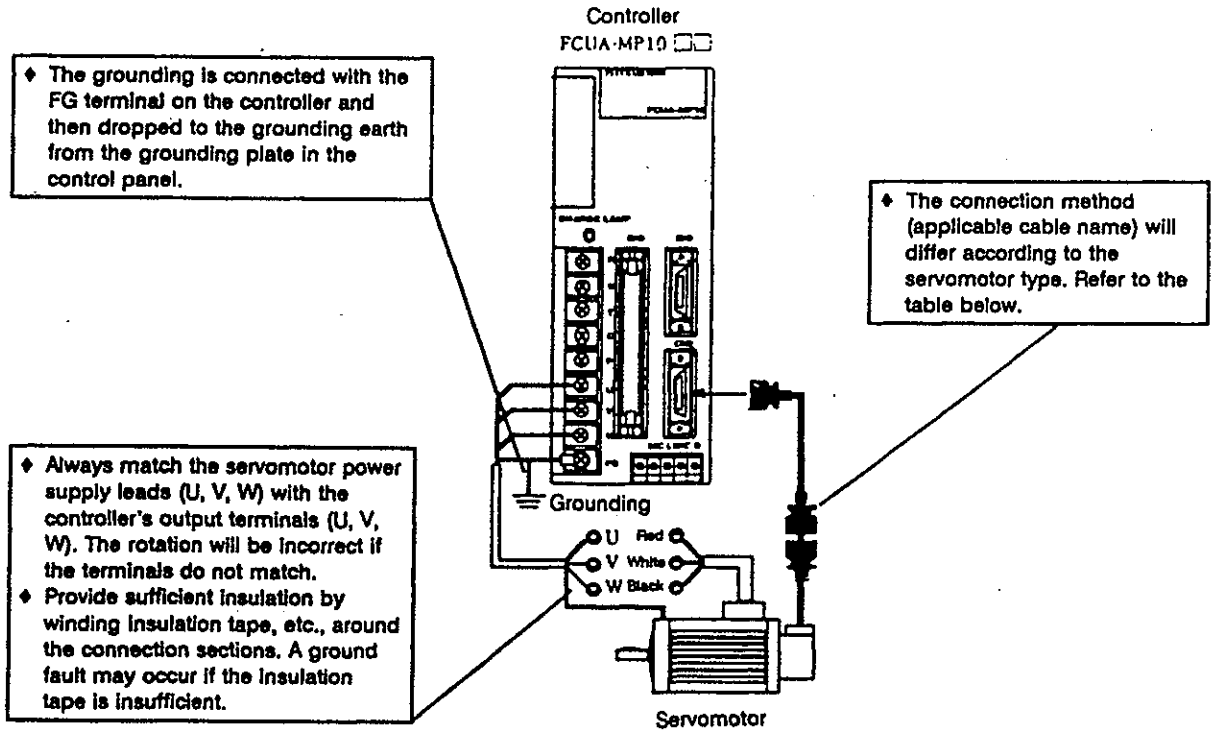
Insulation method	Photocoupler
Rated load voltage	DC +24V
Max. output current	60mA

Note

- When using an inductive load such as a relay, always connect a diode (withstand voltage 100V or more, 100mA or more) in parallel with this load.
- When using a capacity load such as a lamp, always connect a protective resistor (R=150Ω) in serial with the load to limit the rush current. (Make sure that the value is below the above tolerable current including the instantaneous current.)

2.5 Connection of servomotor and detector

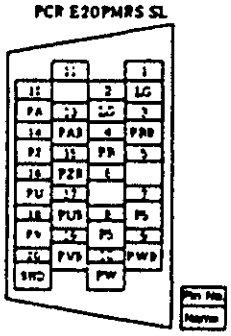
The servomotor's drive lines are connected to the U, V and W terminals on the controller. The shape of the connector used will differ according to the type of servomotor.
The servomotor end detector is connected to connector CN2 on the controller. The cable and shape of the connector used will differ according to the servomotor type and positioning method.



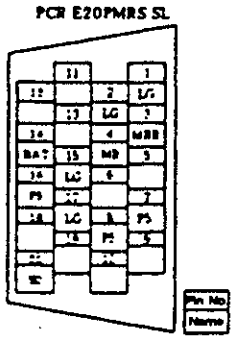
Motor series name	Applicable cable name	Applicable connector set name	Cable side connector name
HA-ME	FCUA-R062	FCUA-CS062	PCR-E20PMRS-SL + PCR-S20PMLA2 (Honda Tsushin)
HA-FE	FCUA-R060	FCUA-CS060	MR-20F MR-20LK2 + MR-R (Honda Tsushin)
HA-FH	FCUA-R061	FCUA-CS061	PCR-E20PMRS-SL + PCR-S20PMLA2 (Honda Tsushin)
HA-SE	FCUA-R074	FCUA-CS050 (Straight) FCUA-CS054 (Angle)	MS3057-12A + MS3108B20-29S (ITT Cannon)
HA-SH	FCUA-R075	FCUA-CS050 (Straight) FCUA-CS054 (Angle)	MS3057-12A + MS3108B20-29S (ITT Cannon)

[Detector connector (motor side) pin layout]

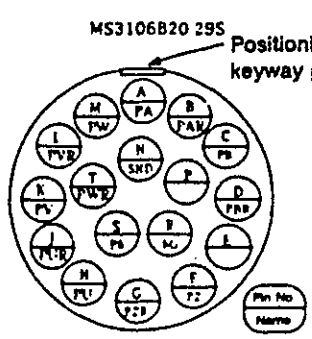
<For HA-FE series>



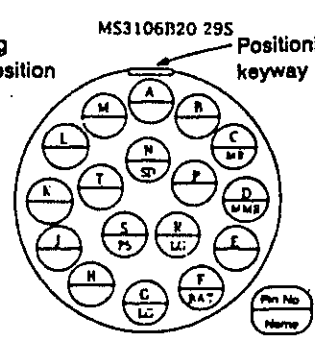
<For HA-FH series>



<For HA-SE series>

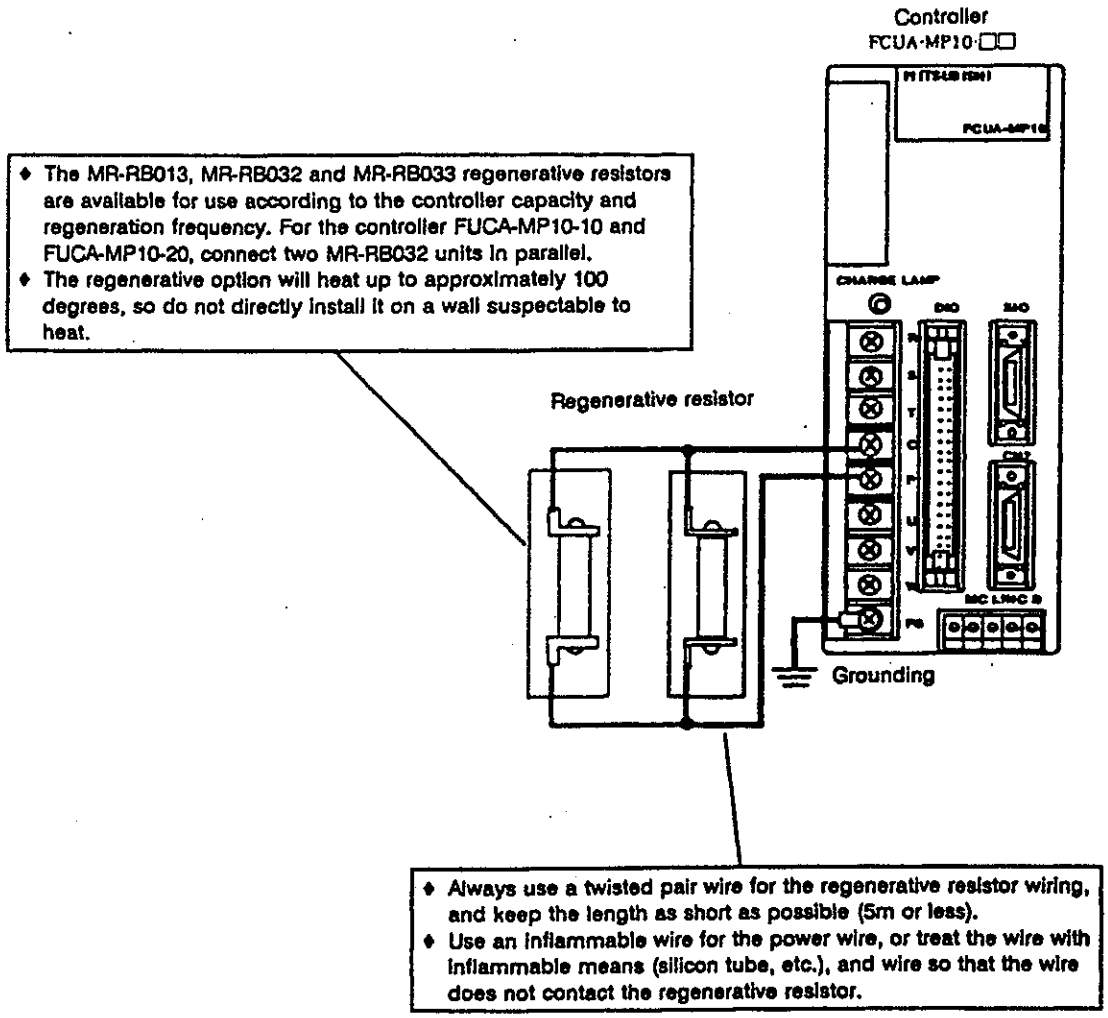


<For HA-SH series>



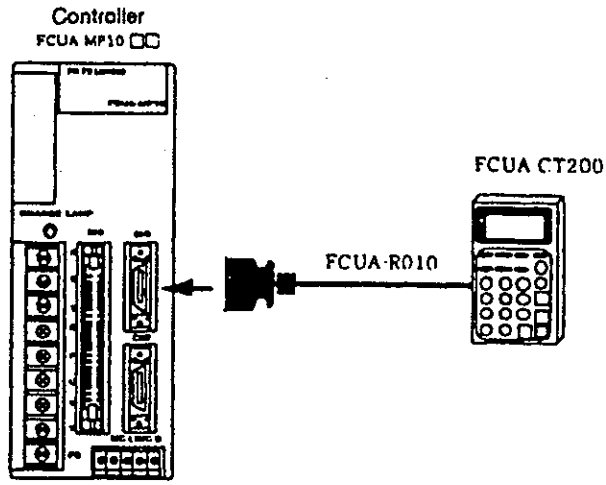
2.6 Connection of regenerative resistor

A regenerative resistor must be connected to the controllers other than the FUCA-MP10-01. The regenerative resistor is connected to the C and P terminals of the controller.



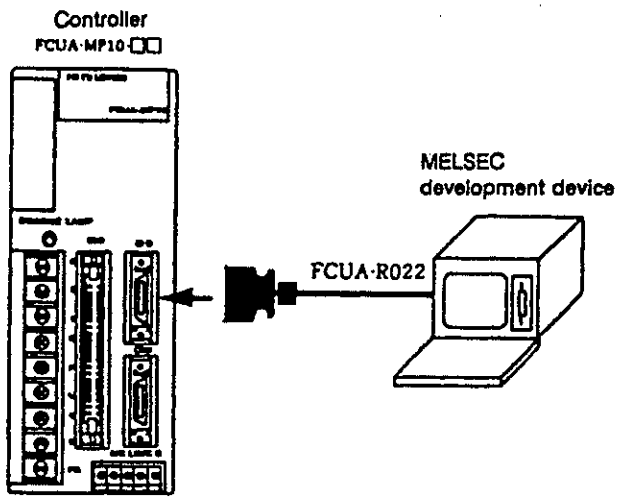
2.7 Connection of teaching box CT200

The man-machine interface "teaching box CT200" used to set the point data parameters and monitor the controller state, etc., is connected to connector SIO. Normally, the CT200 and controller are directly connected with the exclusive cable FCUA-R010. A relay cable can be inserted between the controller and FCUA-R010 cable, but the total length must be a maximum of 15m.



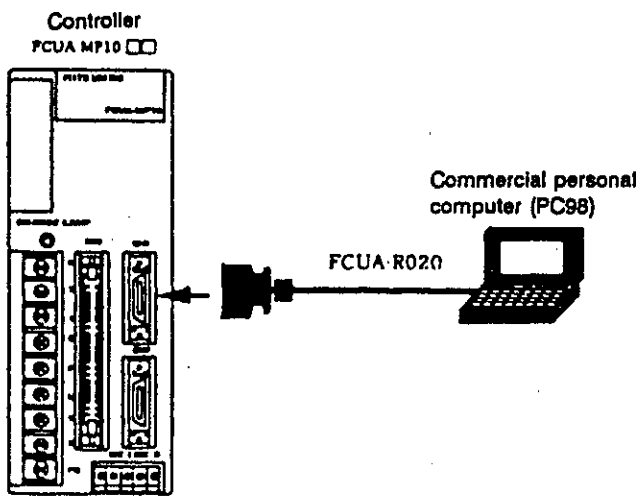
2.8 Connection of MELSEC PLC development device

The development device such as A6GPP, A7PHP or A7HGP, etc., is connected to connector SIO with the exclusive cable R022.



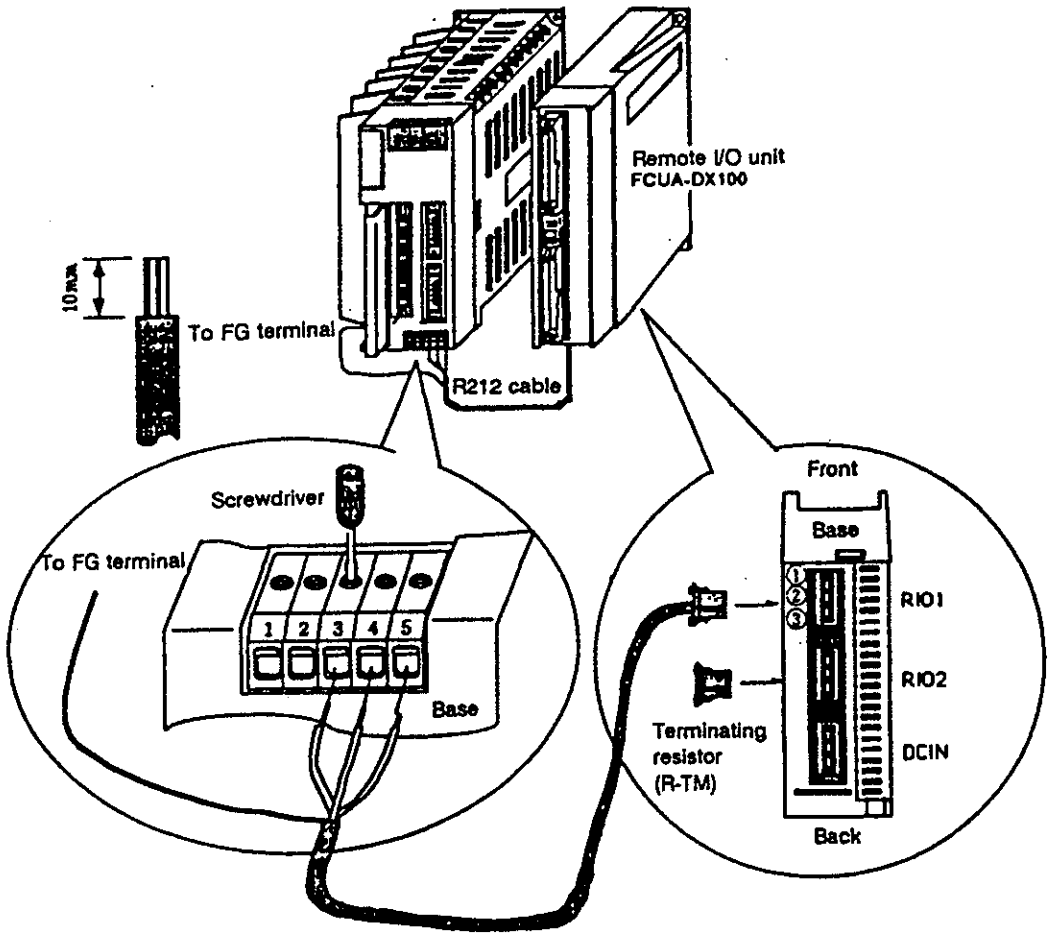
2.9 Connection of commercial personal computer (PC98)

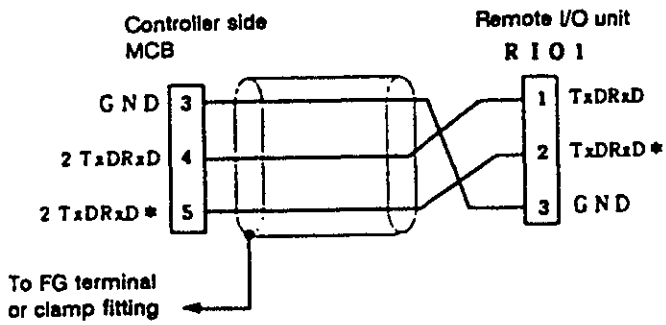
The commercial personal computer (PC98) is connected to connector SIO with the exclusive cable FCUA-R020. Depending on the personal computer specifications, a relay cable can be inserted between the FCUA-R010 cable and personal computer, but the total length of the cable must be a maximum of 15m.



2.10 Connection of remote I/O unit

A remote I/O unit DX100 (option) can be connected with an MC link B (serial link) to expand the digital input/output signals. The connection of the controller and remote I/O unit DX100 is explained in this section. Refer to the "FCUA-DX100 Unit Instruction Manual" for details on how to connect the DIO signal to the DX100. Refer to the "PLC Instruction Manual" for how to use the expanded digital input/output signals.



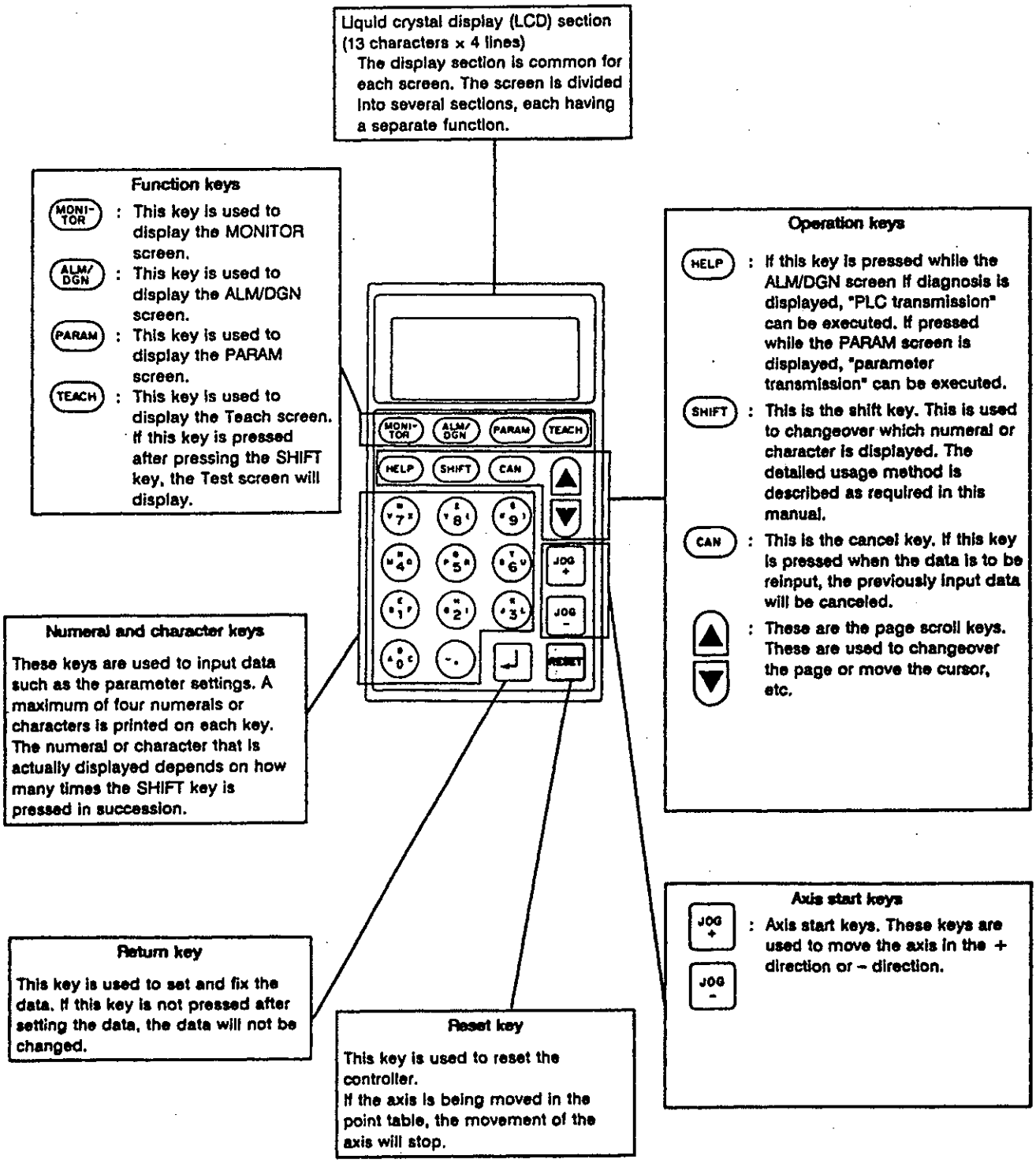


(1) First, connect the MC link B cable R212 to the terminals 3, 4 and 5 on the terminal block MCB at the bottom of the controller. A cable of which the sheath has been peeled can be directly fixed to the MCB terminal.
(2) Next, insert the connector on the other end of the R212 cable into the connector RIO1 on the base of the remote I/O unit.
(3) Connect the R212 cable shield wire to the FG terminal on the controller, or directly connect to FG with a clamp fitting.

CHAPTER 3 Functions and Handling of Teaching Box CT200

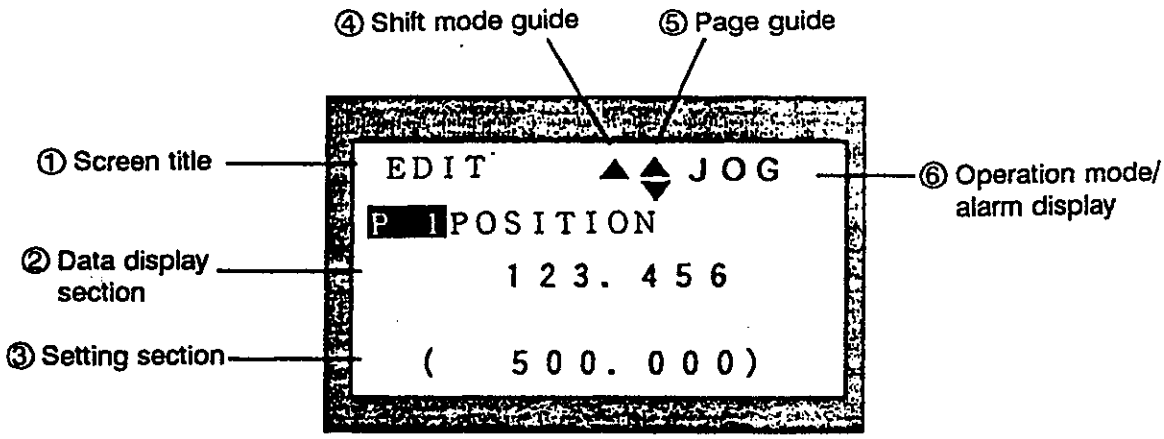
3.1 Appearance and explanation of each key

Outline drawing of FCUA-CT200



3.2 Functions of display section

The details displayed on the LCD are divided according to functions, and some sections are common on many screens. The display functions common on many screens will be described in this section.



① Screen title
The currently selected menu is displayed.

② Data display section
The data corresponding to the menu is displayed.

③ Setting section
The data is set or displayed.

④ Shift mode guide
This indicates that the (SHIFT) has been pressed and the shift mode state is entered.
- When the (SHIFT) is pressed in the no display state, the display will change in the order of "◀ → ▲ → ▶ → no display".
- The state with nothing displayed indicates the shift mode cancel state.

⑤ Page guide
This indicates that there is a previous page or next page.
- ▼ : Indicates that there is a next page. There is no previous page.
- ▲ : Indicates that there is a previous page. There is no next page.
- ▲▼ : Indicates that there is a previous page and next page.
- No display : Indicates that there are no other pages.

⑥ Operation mode/alarm display
The current operation mode is displayed when there is no alarm. If an alarm is occurring, an alarm code (most important code) will be displayed. An operation error message (setting error, etc.) will also display.

3.3 Basic operation

3.3.1 Screen selection

Each screen is configured of the function, menu and page levels.
After the initial screen is displayed when the power is turned ON, the monitor POSITION screen will display.

- The function is changed by pressing the required function key.
  When the function is changed over, the menu and page screens selected previously with that function will display.
- The menu is changed by pressing the same function key as the selected function.
  The menu will change to the next menu each time the function key is pressed.
  When the menu is changed, the page selected previously with that menu will display.
- The page is changed by pressing the page scroll keys. When [▲] is pressed, the previous page will display, and when [▼] is pressed, the next page will display.

  This is valid only when there is a page guide displayed. Changeover to the page before the head page and the page after the final page is invalid.

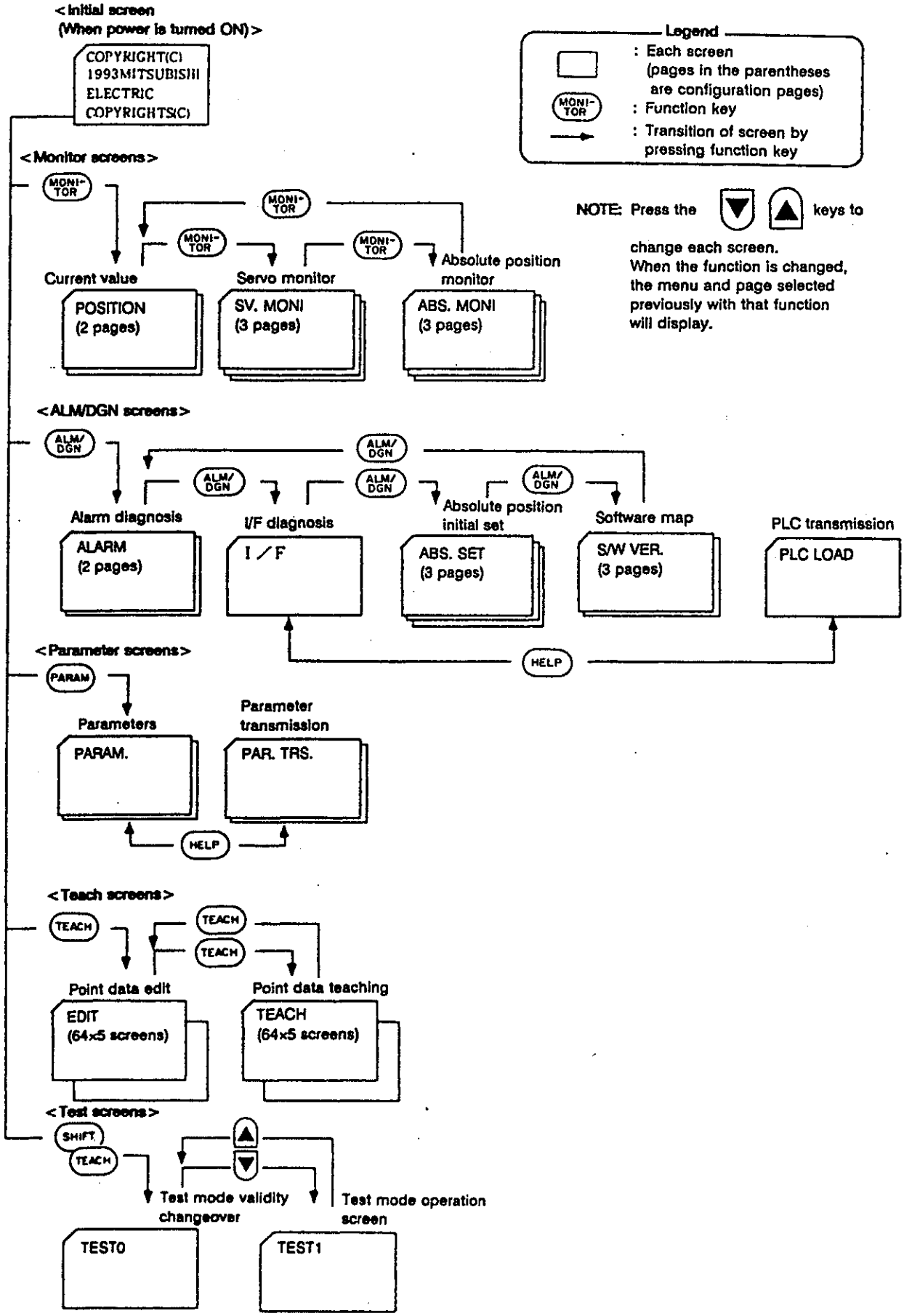
3.3.2 Selection of help screen

The HELP screen is a menu displayed within the currently selected screen, and is changed according to the screen being displayed. The screen display will not change even if the (HELP) key is pressed if no HELP screen is available for the currently displayed screen.

3.3.3 Setting of data

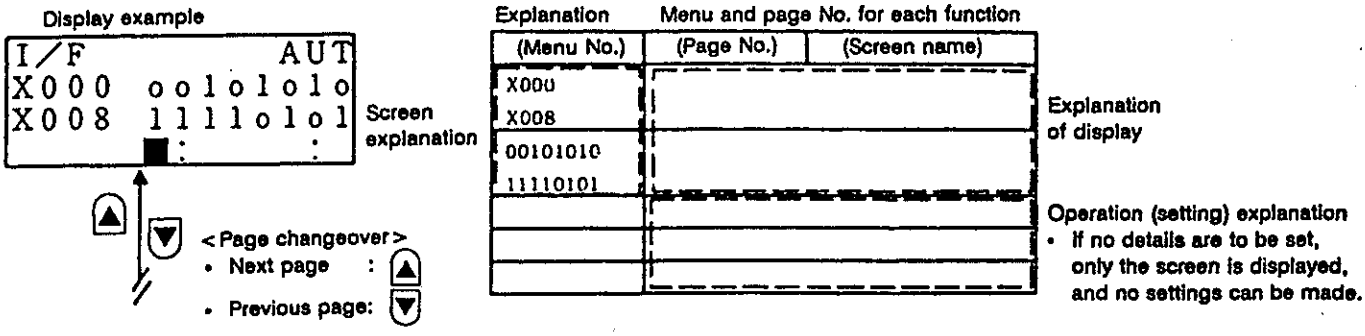
The setting area and cursor will display in the setting section on screens where data can be set.
For normal settings, the numerals or characters are input and then set with the [↵] key. To reset the data, press the (CAN) key. All data input in the setting section will be canceled.

3.4 Types and transition of screen



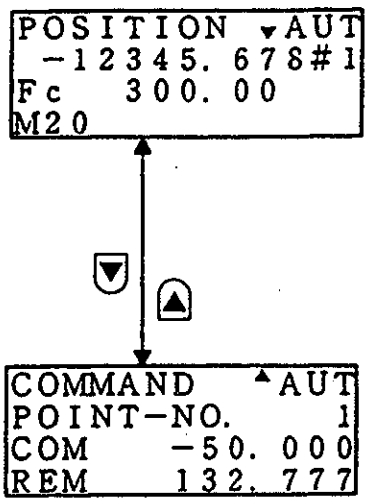
3.5 Detailed explanation of each screen

An example of the screen display is shown on the left, and the details are described on the right.



3.5.1 Monitor screen (Function key MONI-TOR)

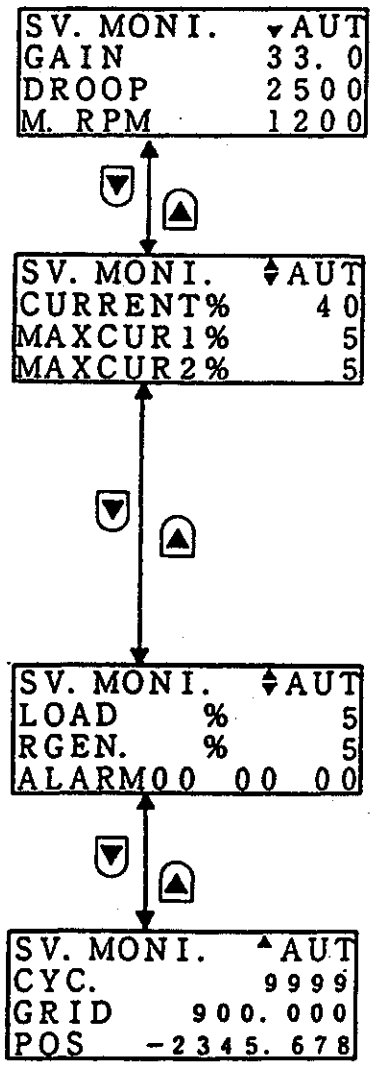
[Current value]



Menu 1	Page 1	Current position information screen
−12345678	Current position	
Fc 300.00	Movement speed	
M20	M output code	
#1	The axis state is displayed. The following displays are used: #1 : The reference point reached state is displayed.][: The servo OFF state is displayed. •| : The OT state is displayed. No mark: State other than the above (moving, etc.)	

Menu 1	Page 2	Command information screen
POINT−NO.2	No. of point currently being executed.	
COM −50.000	Command position	
REM 132.777	Remaining distance	

[Servo Monitor]



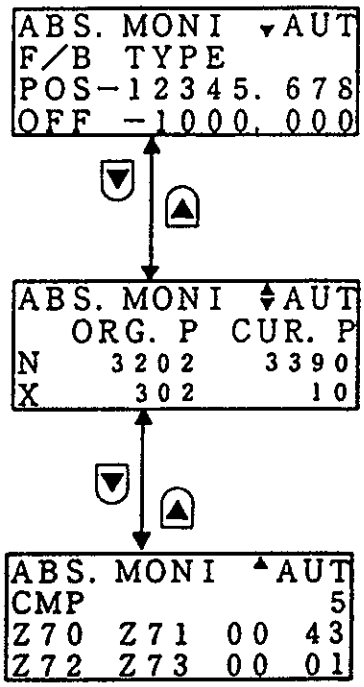
Menu 2	Page 1	Servo monitor information screen
GAIN 33.0	Position loop gain [1/SEC]	
DROOP 2500	Droop amount of position loop [μm] or [min.]	
REM 1200	Motor speed [rpm]	

Menu 2	Page 2	Servo monitor information screen
CURRENT%40	Motor load state Present motor current (Percent to max. rating) [%]	
MAXCUR1%5	Motor load state Max. motor current from power ON to present (Percent to max. rating) [%]	
MAXCUR2%5	Motor load state Average motor current for two seconds. (Percent to max. rating) [%]	

Menu 2	Page 3	Servo monitor information screen
LOAD% 5	Motor load [%]	
RGEN.%5	Regenerative load [%]	
ALARM 00 00 00	Currently occurring servo alarm (Max. 3 alarms)	

Menu 2	Page 4	Servo monitor information screen
CYC.9999	Position within one encoder rotation [pulse]	
GRID 900.000	Distance to grid during dog-type reference point return	
POS -2345.678	Feedback machine position	

[Absolute Position Monitor]



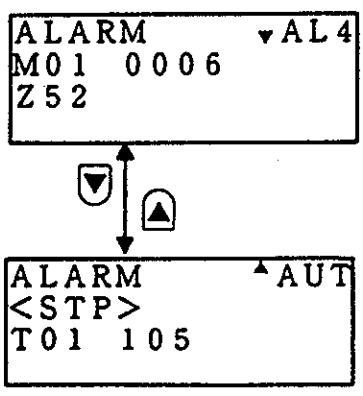
Menu 3	Page 1	Absolute position detection monitor information screen
F/B TYPE ESS	Detection system state ESS : Serial encoder INC : Incremental	
POS -12345.678	Machine position	
OFF -1000.000	Difference of machine position from when power is turned OFF and turned ON	

Menu 3	Page 2	Absolute position detection monitor information screen
ORG.P CUR.P N3202 3390 X 302 10	N/ORG : P: Value of speed detector at absolute position reference point N/CUR : P: Current speed detector value X/ORG.P : Absolute position reference point resolver 1 × value X/CUR.P : Current resolver 1x value	

Menu 3	Page 3	Absolute position detection monitor information screen
CMP 5	Position difference at absolute position compare execution	
Z70Z71 00 43	Display of Z70, Z71 alarm with bit correspondence	
Z72Z73 00 01	Display of Z72, Z73 alarm with bit correspondence	

3.5.2 ALM/DGN Screen (Function key (ALM/DGN))

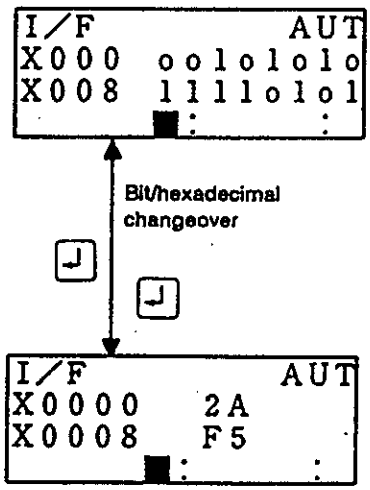
[Alarm Diagnosis]



Menu 1	Page 1	Alarm information screen
M01 0006 Z52	A max. of 3 alarms currently occurring is displayed.	
(SHIFT) + ▲, or ▼	Alarm history display mode is displayed. 24 latest alarms are recorded.	
(SHIFT) + ▼ ▲	Scroll of history display during alarm history display mode.	

Menu 1	Page 2	Alarm information screen
T01 105	Stop code is displayed.	
(SHIFT) + ▲, or ▼	Stop code history display mode is displayed. 12 latest alarms are recorded.	
(SHIFT) + ▼ ▲	Scroll of history display during stop code display mode.	

[I/F Diagnosis]



Menu 2	Page 1	PLC I/F information screen

X000 X008
oo1o1o1o
1111o1o1

Device name
I/F state is displayed with bit correspondence.

<How to read device address and I/F state>

Address	X7	X6	X5	X4	X3	X2	X1	X0
X000	0	0	1	0	1	0	1	0

Address	XF	XE	XD	XC	XB	XA	X9	X8
X008	1	1	1	1	0	1	0	1

2A, F5

I/F state is displayed as a hexadecimal

■ : :

Data setting section

: : :
Forced definition type
Forced definition data
Device No.

<Device No.>
The device No. is set when the device address is changed or for a forced definition. If (-.) (-.) are input, the forced definition will be canceled. If input without setting anything, the data display will alternate between bit/hexadecimal.

<Forced definition data>
Set 1 or 0 for 1-bit data.
Set a hexadecimal for 16-bit data.

<Forced definition type>
Set 1 for one-shot type, and 2 for modal type.

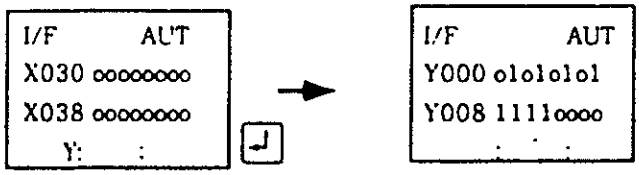
▲ ▼ — The device No. is incremented/decremented.

SHIFT + ▲ — The cursor is moved one setting area to the right.

SHIFT + ▼ — The cursor is moved one to the left.

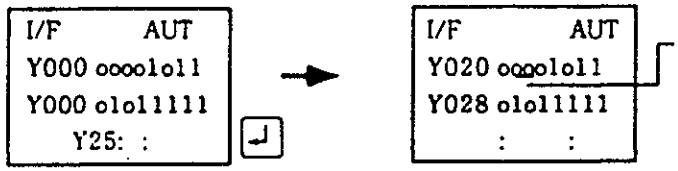
Setting example 1) Changeover of device address.

Input Y [↵] .



If only the device address is set, the head of that device (in this case Y000) will display.

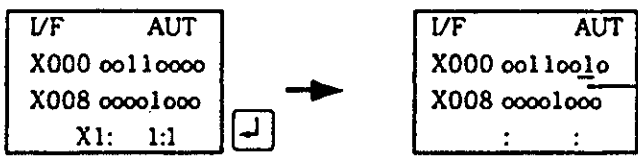
Input [8] [2] [5] [↵].



State of device No. Y25.

Setting example 2) Forced definition of device (one-shot type)

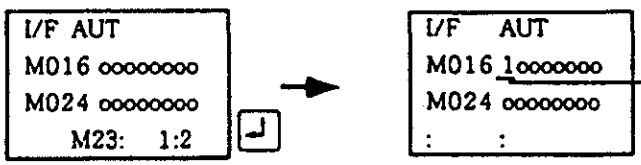
Input [7] [1] [SHIFT] [▲] [1] [SHIFT] [▲] [1] .



The device No. X1 changes from 0 to 1.

Setting example 3) Forced definition of device (modal type)

Input [4] [2] [3] [SHIFT] [▲] [1] [SHIFT] [▲] [2] .

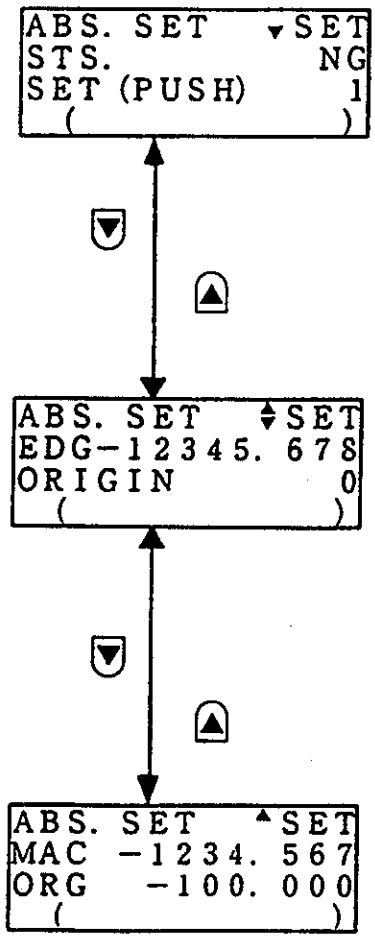


The device No. X23 changes from 0 to 1.

[Note]

1. The one-shot forced definition is processed and defined at the head of one user PLC cycle. Thus, if a command to change the one-shot force defined device is issued in the one user PLC cycle, the remaining will be the results of the sequence process.
2. A maximum of four sets of settings can be made for the modal type forced definition. If forced definition is executed when four sets have already been defined, the oldest setting will be invalidated.
3. Setting 0 for the data will not cancel the setting. The data 0 will be forced defined. To cancel, input [.] [.] [↵] in the address setting section. The forced definition is also canceled when the power is turned OFF/ON.

[Absolute Position Initial Setting]

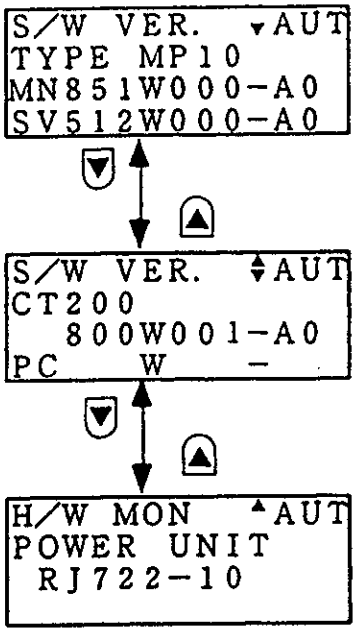


Menu 3	Page 1	Absolute position detection initialization screen
STS. NG	The absolute position detector state is displayed. NG : The absolute position has been lost. COMP: The absolute position has been established. *** : The state is sequentially displayed with the initialization operation.	
SET (PUSH) 1	The initialization start-up state is displayed. The initialization type is displayed in the parentheses.	
( )	Set 1 when starting initialization.	

Menu 3	Page 2	Absolute position detection initialization screen
EDG -1234.567	Distance from machine reference position to first grid	
ORIGIN 0	The reference alignment state is displayed. The alignment starts for the reference point alignment method.	
( )	When 1 is set, that position will be used as the reference point.	

Menu 3	Page 3	Absolute position detection initialization screen
MAC -1234.567	Machine position. [GRID NOT PASSED] is displayed until the grid is passed after the power is turned ON.	
ORG -100.000	The setting value for the "absolute position zero point" parameter.	
( )	The "zero point" parameter (distance to reference position looking from basic machine coordinate system) is set. The reference position can be set to the grid point using the "abspt" parameter.	

[Software Map]



Menu 4	Page 1	Software configuration information screen
TYPE MP10	Type display	
MN851 W000 - A0	System software version	
SV512 W000 - A0	Servo system software version	

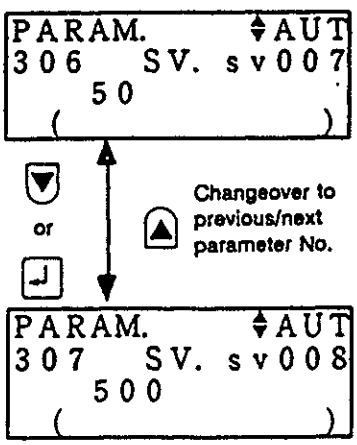
Menu 4	Page 2	Software configuration information screen
CT200 800W001 - A0	Terminal unit software version	
PC	PLC program (user PLC) version	

Menu 4	Page 3	Hardware configuration information screen
POWER UNIT RJ722-10	Power unit card name	

3.5.3 Parameter Screen (Function key PARAM)

[Parameter]

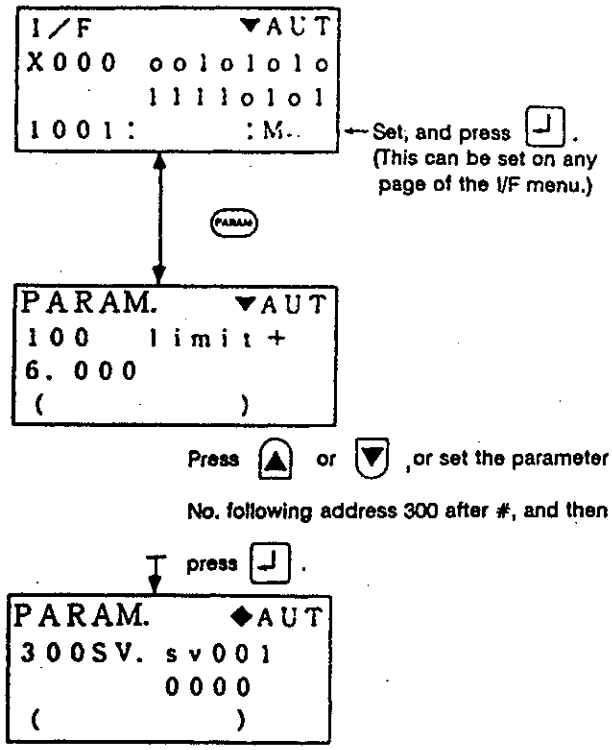
Normally the parameters that can be set from this screen are the address 100 and address 200 parameters.



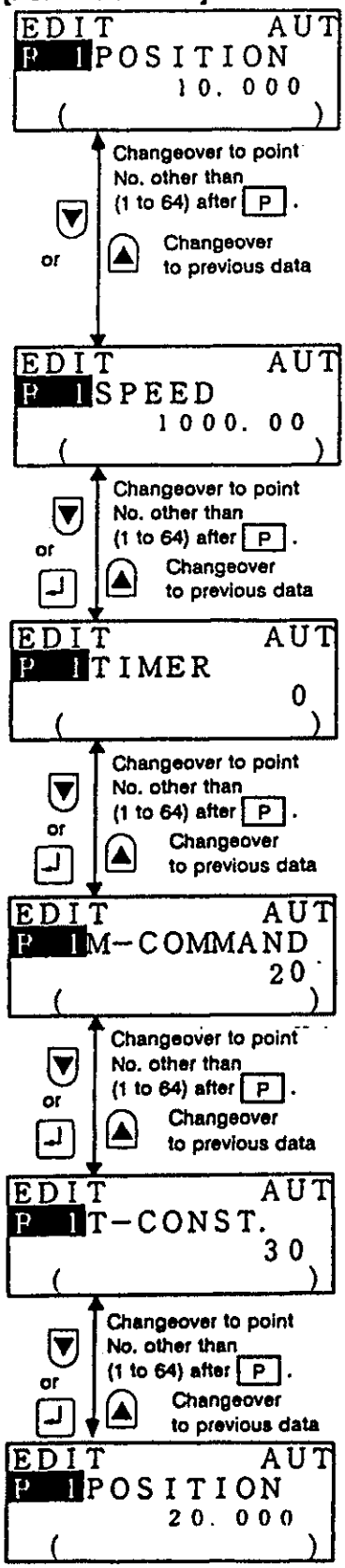
Menu 1	Page 1	Parameter setting display screen
#306SV.sv007	Currently selected parameter No. and title	
50	Current setting value	
( )	The parameter value is set. If # is input at the head, the setting will be handled as a parameter No., and that parameter No. will be called out.	
▲ ▼	The parameter No. is changed to the previous or next parameter No.	
	The next parameter No. will be changed to if ↵ is pressed without setting anything.	

If a parameter following the address 300 parameters must be set, set
(↑) (↓) (←) (→) SHIFT ▲ SHIFT ▲ (→) in the "I/F menu" of the "ALM/DGN screen".
Then, when the parameter screen is displayed, the parameters can be set. Once set, this setting is valid until the power is turned OFF.

[For setting parameters following the address 300 parameters]



[Point Table Edit]



Menu 1	Page 1	Point table setting display screen
P1	Currently selected point No.	
POSITION 10.000	Command position setting value	
( )	Set the command position. If P is input at the head, the value will be handled as a point No., and that point No. will be called out. Changeover to the previous or next data is possible. The next data will be changed to even when [↵] is pressed without setting anything.	
▲ ▼	Changeover to previous/next data.	

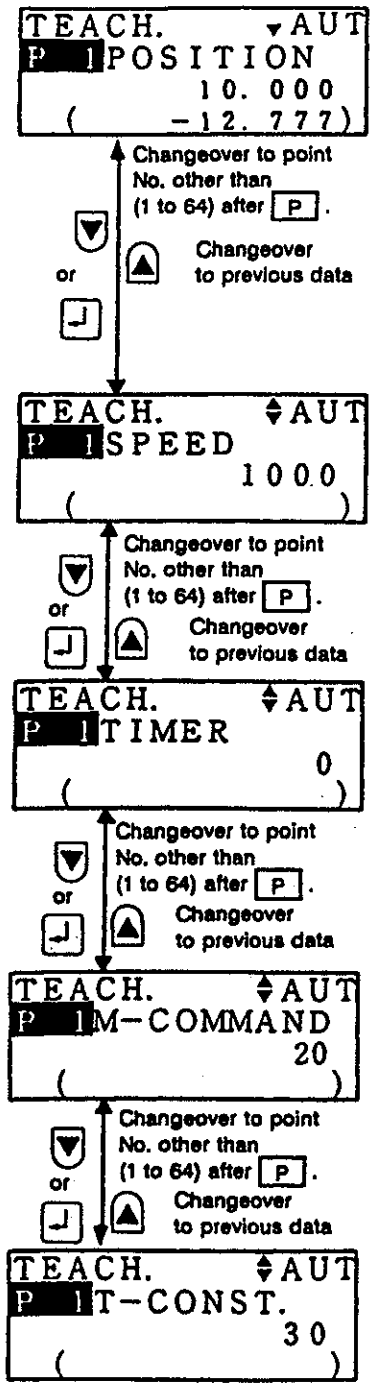
Menu 1	Page 2	Point table setting display screen
P1	Currently selected point No.	
SPEED 1000.00	Speed command setting value [mm/min.]	
( )	The speed command value is set for a direct command. When designating a parameter, set ① to ④ (parameter step 1 to step 4) after ⊖ (minus). The other operations are the same as the command position.	

Menu 1	Page 4	Point table setting display screen
P1	Currently selected point No.	
TIMER 0	Timer setting value [msec]	
( )	The timer value is set. The other operations are the same as the command position.	

Menu 1	Page 3	Point table setting display screen
P1	Currently selected point No.	
M-COMMAND ( )	M code setting value. The output M code is set. The other operations are the same as the command position.	

Menu 1	Page 5	Point table setting display screen
P1	Currently selected point No.	
T-CONST. 30	Acceleration/deceleration time setting value [msec]	
( )	The acceleration/deceleration time is set. The other operations are the same as the command position.	

[Point Table Teaching]



Menu 2	Page 1	Point table, teaching screen
P1	Currently selected point No.	
POSITION 10.000	Command position setting value	
(-12.777)	The machine position is displayed. If [↵] is pressed, the current machine position will be set as the command position. If P is input at the head, the value will be handled as a point No., and that point No. will be called out. Note that the value in parentheses will remain the machine position.	
▲ ▼	Changeover to the previous or next data is possible. The next data will be changed to even when [↵] is pressed without setting anything.	

Menu 2	Page 2	Point table, teaching screen
P1	Currently selected point No.	
SPEED 1000	Speed command setting value [mm/min.]	
( )	The speed command value is set for a direct command. When designating a parameter, set ① to ④ (parameter step 1 to step 4) after ⊖.	

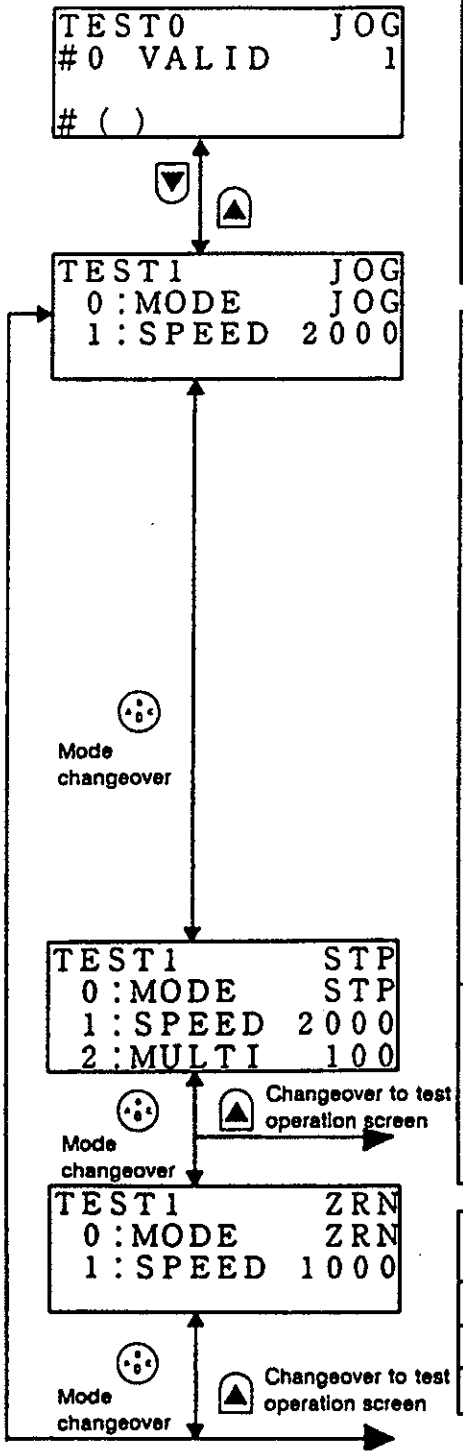
Menu 2	Page 4	Point table, teaching screen
P1	Currently selected point No.	
TIMER 0	Timer setting value [msec]	
( )	The timer value is set. The other operations are the same as the command position.	

Menu 2	Page 3	Point table, teaching screen
P1	Currently selected point No.	
M-COMMAND 20	M code setting value.	
( )	The output M code is set. The other operations are the same as the command position.	

Menu 2	Page 5	Point table, teaching screen
P1	Currently selected point No.	
T-CONST. 30	Acceleration/deceleration time setting value [msec]	
( )	The acceleration/deceleration time is set. The other operations are the same as the command position.	

3.5.4 Test Screen (Function Key SHIFT and TEACH)

[Test Mode Validity Changeover]



Menu 1	Page 1	Test operation changeover screen
#0 VALID 1	The test mode validity is displayed.	
JOG	The operation mode will flicker while the test operation mode is valid.	
# ( )	The test mode validity is changed over. The validity is changed with the ⊙ ↵ . The operation mode will flicker while the mode is valid.	

Menu 1	Page 2	Test operation execution screen
0 : MODE JOG	Current test operation mode (JOG mode)	
1 : SPEED 2000	Current feedrate	
	The setting value will change by pressing each key. " ⊙ " Changes over the test operation mode in each mode. The order is as follows: JOG → STP → ZRN → JOG " ⊙ " and " ⊙ " are used to change the setting values required for each operation mode. The speed setting value will change in the following order each time the ⊙ is pressed. 0 → 50 → 100 → 200 → 500 → 1000 → 2000 → 0 The scale setting value will change in the following order each time the ⊙ is pressed. 1 → 10 → 100 → 1000 → 1	
JOG + JOG −	The axis is started. The movement is valid while the key is pressed down. The axis will start in the + (plus) direction when JOG + is pressed and the − (minus) direction when JOG − is pressed. If the test operation mode is valid, the axis can be started from any screen.	

Menu 1	Page 2	Test operation execution screen (incremental mode)
0 : MODE STP	Incremental feed mode	
1 : SPEED 2000	Current feedrate	
2 : MULTI 100	Current incremental feed scale	

Menu 1	Page 2	Test operation execution screen (reference point return)
0 : MODE STP	Incremental feed mode	
0 : MODE STP	Incremental feed mode	

3.5.5 HELP Screen (Function key HELP)

The screen selected when the HELP is pressed will depend on the currently displayed screen. When the HELP is pressed again, the original screen will display.

[PLC Transmission Screen]

If the HELP is pressed on the I/F screen, the PLC control screen will be selected. Control of the PLC program execution, stop and restart is possible, and the standard PLC program can be read out.

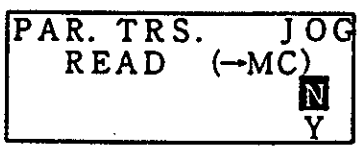
The standard PLC program can be read after ↑ ↑ ↑ ↑ SHIFT ▲ SHIFT ▲ ↑ is set on the "I/F menu" of the "ALM/DGN screen". Once set, the setting is valid until the power is turned OFF.

PARAM	Page 1	Parameter write transfer screen
PLC STOP	The PLC program status is displayed.	
PLC RUN	The current state is highlighted.	
▲ ▼	Cursor moves	
↵ at STOP	The PLC program stops.	
↵ at RUN	The PLC program will restart.	
↵ at LOADING	The standard PLC will be loaded.	

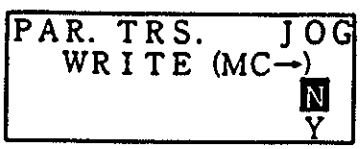
[Parameter transmission screen]

If the HELP is pressed while the PARAM function is selected, the PAR. TRS. screen will be selected. An EEROM is built into the teaching box CT200, and parameters can be transmitted between this unit and the EEROM memory.

PARAM	Page 1	Parameter transmission screen
▲ ▼	Movement of READ and WRITE cursor.	
Set cursor to READ, ↵ and press	Parameter read from teaching box is designated.	
Set cursor to WRITE, ↵ and press	Parameter write to the teaching box is designated.	



PARAM	Page 2	Parameter read transmission screen
▲ ▼	Movement of Y and N cursor.	
↵ at Y	Parameter reading starts.	
↵ at N	The transmission is not executed, and the screen returns to page 1.	



PARAM	Page 2	Parameter write transmission screen
▲ ▼	Movement of Y and N cursor.	
↵ at Y	Parameter writing starts.	
↵ at N	The transmission is not executed, and the screen returns to page 1.	

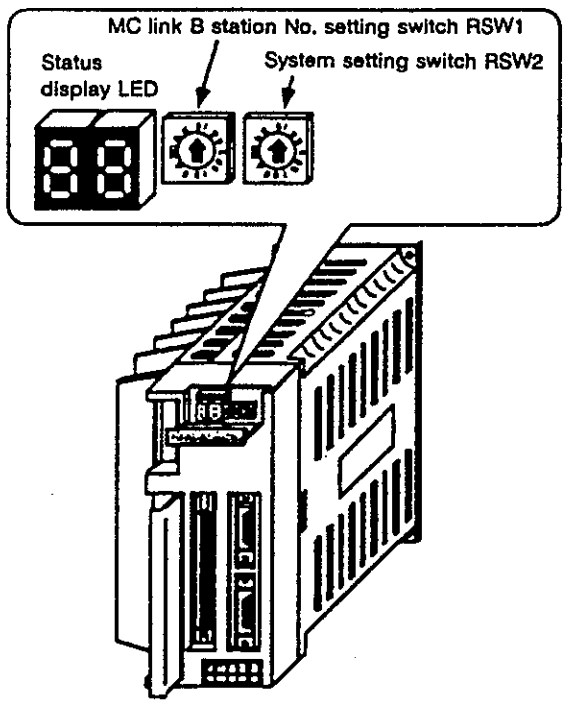
[Memo]

CHAPTER 4 Controller Setup

4.1 Setting of rotary switches

Set the rotary switches RSW1 and RSW2 to the target operation mode before turning the power ON. Rotary switch RSW1 is used to set the channel when the MELDAS M500 series or "machine controller model N" is connected with an MC link B. If using with the normal independent operation, leave the setting at the default "0". Refer to the MELDAS M500 series or machine controller model N Connection Manuals for the setting method when connecting the MELDAS M500 series or machine controller model N/W with an MC link B.

Rotary switch RSW2 is used for setting the system mode. Refer to the following table, and set the switch to the target mode. This switch must be changed according to the device connected, etc. This switch can be changed while the power is ON.



RSW2 setting value	Valid mode
0	Normal mode (default setting)
1	PLC stop
2	When connecting MELSEC development device
3	When connecting personal computer
4	When using SW□NX-GPPA with personal computer
5	For maintenance (Note 1)
6	Initialization of back up data (Note 2)
7	
8	
9	
A	
B	For maintenance (Note 1)
C	
D	
E	
F	

(Note 1) Settings 5 and 7 to F are for maintenance and are normally not used.
(Note 2) The back up data initialization will be executed when the power is turned ON again. When this mode is executed, the default settings will be set in all parameters, and all point data will be cleared. Normally, this setting is not used. Refer to the next section for details on how to use this.

4.1.1 Initialization of backup data

This function returns all parameters backed up in the controller to the default values and clears all point tables. This function is used when the backup data has been destroyed such as when a battery alarm has occurred. Normally this function is not used.

[Backup data initialization procedure]

After setting rotary switch RSW2 to "6", turn the power ON again. The memory operation check, setting of all parameters to initial data and clearing of the point table will be automatically executed in sequence by the controller. When all processes have been successfully completed, the "status display LED" on the front of the control will display "OH". (If an error is detected during the memory operation check, "88" or "-3", etc., will display.)

After the operation, set the rotary switch to "0", and turn the power ON again. The system will restart.

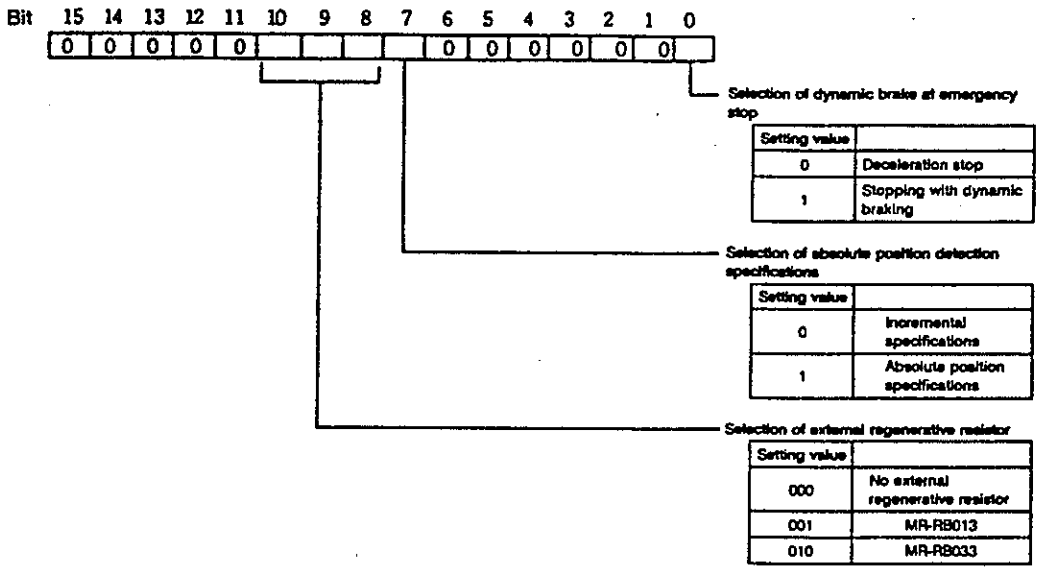
4.2 Setting of parameters

The parameters are largely classified into the "servo parameters", "user parameters" and "PLC parameters". Basic operations can be executed if the "servo parameters" are set to the servomotor and machine to be used. The setting of the "servo parameters" will be described in this section. The other parameters are described in "Chapter 6 Operation" and "Chapter 7 Usage of each function".
The parameters are set with the teaching box CT200. Refer to "Chapter 3 Functions and handling of teaching box CT200" for details on the setting method.
Standard values are set in each parameter as the default settings. The default parameters are listed in "Appendix 2.1 Parameter List" for reference.

4.2.1 Parameter to be set according to servo specifications (position detection method, motor, etc.)

(1) Set parameter #300 SV.sv001 to the position detection method, dynamic brake and regenerative resistor being used.
Functions are assigned in bit units as shown below for this parameter. Input to the controller is executed as a hexadecimal.

Configuration of servo specification parameters



Note

If the regenerative resistor actually being used and the parameter setting value differ, an over-regeneration alarm may occur, or the regenerative resistor may abnormally heat up.

(2) Refer to the following code tables and set parameter #301 SV.sv002 to the type code of the servomotor being used.

Motor type	Code
HA-ME053	339C
HA-ME13	339D
HA-ME23	339E
HA-ME43	3390
HA-ME73	3391

Motor type	Code
HA-FE053	337C
HA-FE13	337D
HA-FE23	337E
HA-FE33	337F
HA-FE43	3370
HA-FE63	3371
HA-FH053	227C
HA-FH13	227D
HA-FH23	227E
HA-FH33	227F
HA-FH43	2270
HA-FH63	2271

Motor type	Code
HA-SE81	33A0
HA-SE121	33A1
HA-SE201	33A2
HA-SE52	33B0
HA-SE102	33B1
HA-SE152	33BA
HA-SE202	33B2
HA-SE53	33C0
HA-SE103	33C1
HA-SE153	33CA
HA-SE203	33C2

Motor type	Code
HA-SH81	22A0
HA-SH121	22A1
HA-SH201	22A2
HA-SH52	22B0
HA-SH102	22B1
HA-SH152	22BA
HA-SH202	22B2
HA-SH53	22C0
HA-SH103	22C1
HA-SE153	22CA
HA-SH203	22C2

4.2.2 Servo parameters set according to machine specifications

Parameters SV.sv003, SV.sv004, SV.sv005 and CCW must be set according to the specifications of the machine driven by the servo.

Parameter No.	Parameter name	Function
#302	SV.sv003	Motor side gear ratio
#303	SV.sv004	Machine side gear ratio
#304	SV.sv005	Ball screw pitch
#359	CCW	Motor rotation direction

[When using ball screw]

(i) Cut off the fractions of the servo motor side gear ratio and set in SV.sv003 (#302), and the motor side gear ratio in SV.sv004 (#303).

(ii) Set the pitch of the balls crew being used in SV.sv005 (#304). The unit is [mm/rev].

(iii) This is a parameter used to match the command direction and machine movement direction. If the motor forward run direction and machine movement + (plus) direction do not match, set "1".

Example) When the geared deceleration ratio is 18/30, the motor ball screw pitch is 10mm, and the forward run direction and machine movement + (plus) direction do not match.

Parameter No.	Parameter name	Setting value
#302	SV.sv003	3
#304	SV.sv004	5
#305	SV.sv005	10
#359	CCW	1

[When using rotary axis]

(i) Cut off the fractions of the servo motor side gear ratio and set in Sv.sv003, and the motor side gear ratio in SV.sv004.

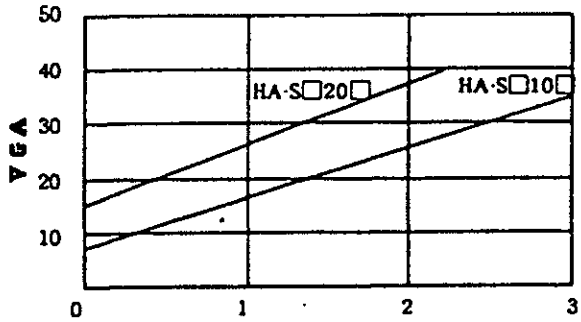
(ii) Set 360 in SV.sv005.

Example) When the geared deceleration ratio is 1/1, and the forward run direction and machine movement + (plus) direction match.

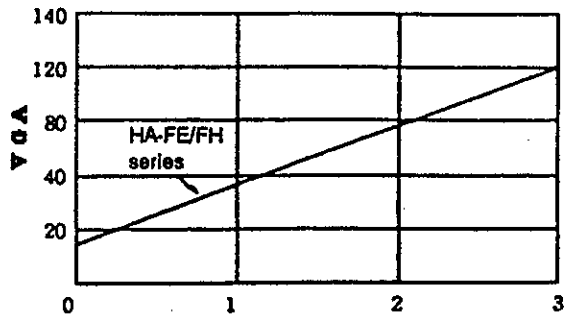
Parameter No.	Parameter name	Setting value
#302	SV.sv003	1
#304	SV.sv004	1
#305	SV.sv005	360
#359	CCW	0

4.2.3 Parameters set according to machine load inertia

The speed loop gain VG1 is matched with the machine inertia and set in parameter #310 SV.sv011. Set the initial value while referring to the following diagrams. Note that the values in the diagram are for when the motor and load are coupled. If gears, etc., are inserted, or depending on the coupling method, vibration may occur even at below the setting value. In this case, decrease the value 50 at a time from the value where the vibration occurs.



Load inertia scale
(Load inertia/motor inertia)



Load inertia scale
(Load inertia/motor inertia)

4.2.4 Parameters set according to machine operation state

The max. error width is set in parameter #320 SV.sv021 and parameter #324 SV.sv025. If the error of the machine position in regard to the position command becomes larger than the value set in this parameter, the protection function will assume that an error has occurred in the machine and will function. The servomotor will enter the emergency stop state. There should be no problem with the standard setting values shown below, but if the machine load is large and an excessive error occurs with the standard setting value, gradually increase and adjust the setting value.
The alarm will not be detected if "0" is set.

SV.sv021 (#320) Maximum error during servo ON	Setting range: 1 to 32767mm
SV.sv025 (#324) Maximum error during servo OFF	
Calculation of standard setting value $SV.sv021 = SV.sv025 = \frac{\text{Rapid traverse rate (mm/min)}}{60 \times PGN1} \times 0.5\ (mm)$	

4.2.5 Parameter in which determined values are set

The values set in parameters #305 SV.sv006 to #315 SV.sv016 differ according to each motor. Refer to the following tables, and set the value that corresponds to the motor being used.

Parameter \ Motor		HA-ME						HA-FE/HA-FH					
		053	13	23	33	43	73	053	13	23	33	43	63
#305	SV.sv 006	0	0	0	0	0	0	0	0	0	0	0	0
#306	SV.sv 007	50	50	50	50	50	50	50	50	50	50	50	50
#307	SV.sv 008	500	500	500	500	500	500	500	500	500	500	500	500
#308	SV.sv 009	33	33	33	33	33	33	33	33	33	33	33	33
#309	SV.sv 010	0	0	0	0	0	0	0	0	0	0	0	0
#310	SV.sv 011	10	10	10	10	10	10	15	15	15	15	15	15
#311	SV.sv 012	682	682	682	682	682	682	682	682	682	682	682	682
#312	SV.sv 013	2048	2048	2048	2048	2048	2048	2048	2048	2048	2048	2048	2048
#313	SV.sv 014	2048	2048	2048	2048	2048	2048	2048	2048	2048	2048	2048	2048
#314	SV.sv 015	256	256	256	256	256	256	256	256	512	512	512	512
#315	SV.sv 016	256	256	256	256	256	256	256	256	512	512	512	512

Parameter \ Motor		HA-SE/HA-SH										
		081	121	201	52	102	152	202	53	103	153	203
#305	SV.sv 006	0	0	0	0	0	0	0	0	0	0	0
#306	SV.sv 007	50	50	50	50	50	50	50	50	50	50	50
#307	SV.sv 008	500	500	500	500	500	500	500	500	500	500	500
#308	SV.sv 009	33	33	33	33	33	33	33	33	33	33	33
#309	SV.sv 010	0	0	0	0	0	0	0	0	0	0	0
#310	SV.sv 011	70	150	150	70	70	70	70	70	70	70	150
#311	SV.sv 012	682	682	682	682	682	682	682	682	682	682	682
#312	SV.sv 013	8192	4096	4096	2048	2048	2048	2048	2048	2048	2048	1024
#313	SV.sv 014	8192	4096	4096	2048	2048	2048	2048	2048	2048	2048	1024
#314	SV.sv 015	1024	1024	512	256	256	256	256	128	128	128	128
#315	SV.sv 016	1024	1024	512	256	256	256	256	128	128	128	128

[Memo]

CHAPTER 5 Creation of Point Tables

5.1 Outline of point tables

The Mitsubishi single-axis built-in controller "Model E" uses a point table method that allows the positioning program to be created easily.

The point table method handles the positioning operation to a certain position as one unit, collects the information required for the operation and handles that as point data. The point data is arranged in order and executed as a point table. Thus, the group of data or point table is the program.

A standard of 8 points (max. 64 points with conditions) can be created for the point table, and positioning operations for up to 8 points (max. 64 points) can be set.

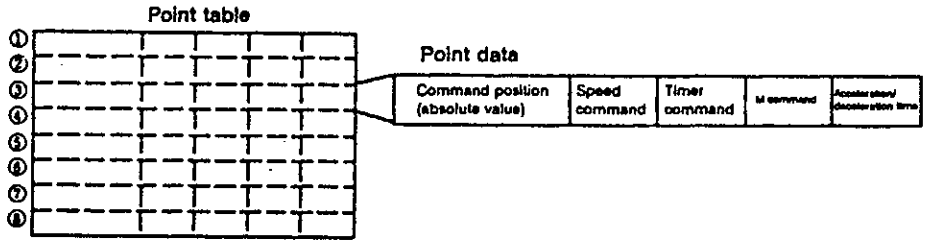
The programming is done with the teaching unit CT200. Using the teaching function, the position commands can be easily input in the point data with the teaching unit CT200.

5.2 Point table specifications

Item		Specification
No. of tables		1
No. of points		Standard: 8 points (range that point Nos. can be designated in standard PLC) Max. 64 points (range of which multi-point continuous operation is possible)
Point inner-command items		Position command, speed command, timer command, M command, acceleration/deceleration time
	Position command	Position information command according to absolute position command
	Timer command	Timer time command after positioning
	Speed command	Designation of command speed
	M command	2-digit M command acceleration/deceleration time that is output
	Acceleration/deceleration time	Designation of acceleration/deceleration time

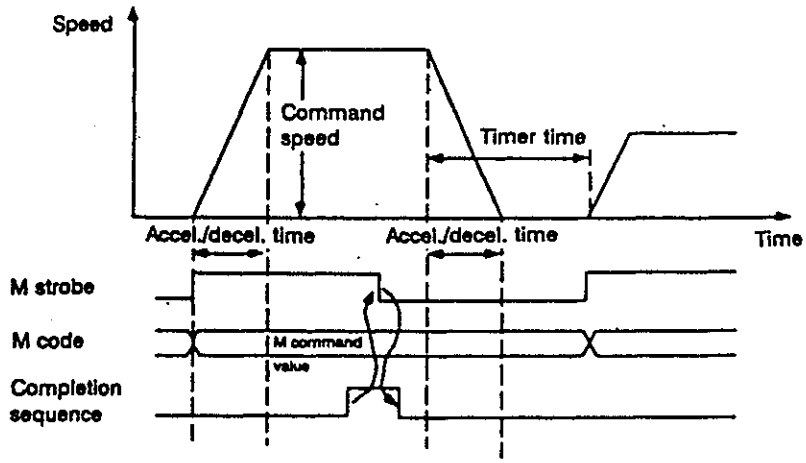
5.3 Configuration of point table

One movement is a point table unit. One point table is configured of the following data.



The following movement takes place according to this point information.

* The acceleration/deceleration pattern is selected with the parameters.



5.4 Detailed explanation of point data

[Command position]

- The target coordinate values for the axis movement are commanded with absolute positions. The setting unit is μm.
- The commanded coordinate value is the coordinate that uses 0 for the machine zero point (reference point).

[Speed command]

- The movement speed is designated with [mm/min.].
- The data can be indirectly set with reset parameters instead of direct data designation. There are four levels of speed parameters available. If the –1 to –4 data is set, the axis will move with the speed set for the parameters shown below.

Setting value	Selected parameter
–1	#332 speed 1
–2	#333 speed 2
–3	#334 speed 3
–4	#335 speed 4

[M command]

- When the command starts, the M code and strobe signal of the values set here will be output.
- The completion signal must be input for completion, and the completion wait state will be entered after positioning is completed until the completion signal is input.
- The following data (M codes) are reserved in the system and have special meanings.
  * The strobe signal and M code are output for M90 to M98.

M command value	Function	Operation
-1	No M code	The M code and strobe signal is not output, so the completion signal does not need to be input. (The M code will retain the previous output.)
90	Reference point return	The position command and speed command for the point data where 90 is set will be ignored, and the axis will perform reference point return with the reference point return speed set in the parameters.
91	Skip	The point data execution (axis movement) will be completed when the skip signal is input or when the torque limit (current limit) is reached. During continuous operation, if the completion signal is input the next point data will be executed.
92	Absolute position compare	When using an absolute position system, the absolute position detection system position detection will be confirmed after the positioning is completed.
93	Reserved	Do not use
94	Reserved	
95	Reserved	
96	Reserved	
97	Reserved	
98	Reserved	
99	Repeat	During multi-point operation, the program will be repeated from the operation start point to the point set in 99. <Note> The strobe signal will not be output.

[Timer command]

- The time to wait from after positioning is completed to when movement starts to the next point is commanded with a [msec] unit.
- If the following data is set, there will be special meanings.

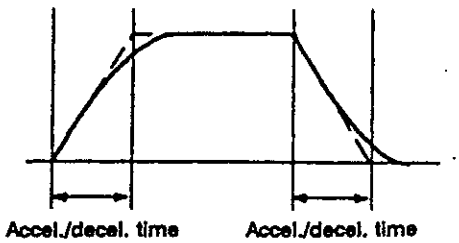
Timer setting value	Operation
0	The positioning completion is confirmed with the command system, and then execution of the next point is moved to. The next point will be moved to quickly, but the servo droop (servo tracking delay) will remain.
-1	The positioning completion is confirmed with in-position, and then execution of the next point is moved to. The movement to the next point will be delayed, but accurate positioning will be possible.
-2	The execution of the next point will be moved to without decelerating and stopping.

[Acceleration/deceleration time]

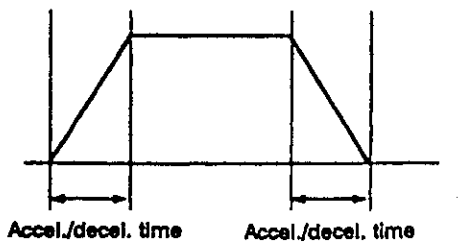
- The acceleration/deceleration time (time constant) is set with a [msec] unit. The acceleration/deceleration time is the same, and the time until the commanded speed is reached is designated.
- The acceleration/deceleration pattern is selected with parameter #360 (smgst).

#360 smgst setting value	Selected acceleration/deceleration pattern
0	Exponential acceleration/deceleration
1	Linear acceleration/deceleration
F	Soft acceleration/deceleration

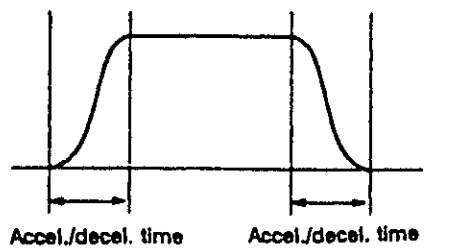
Exponential acceleration/deceleration



Linear acceleration/deceleration



Soft acceleration/deceleration



5.5 Point table and operation

The data set in the point table can be operated with single-point or multi-point operation.

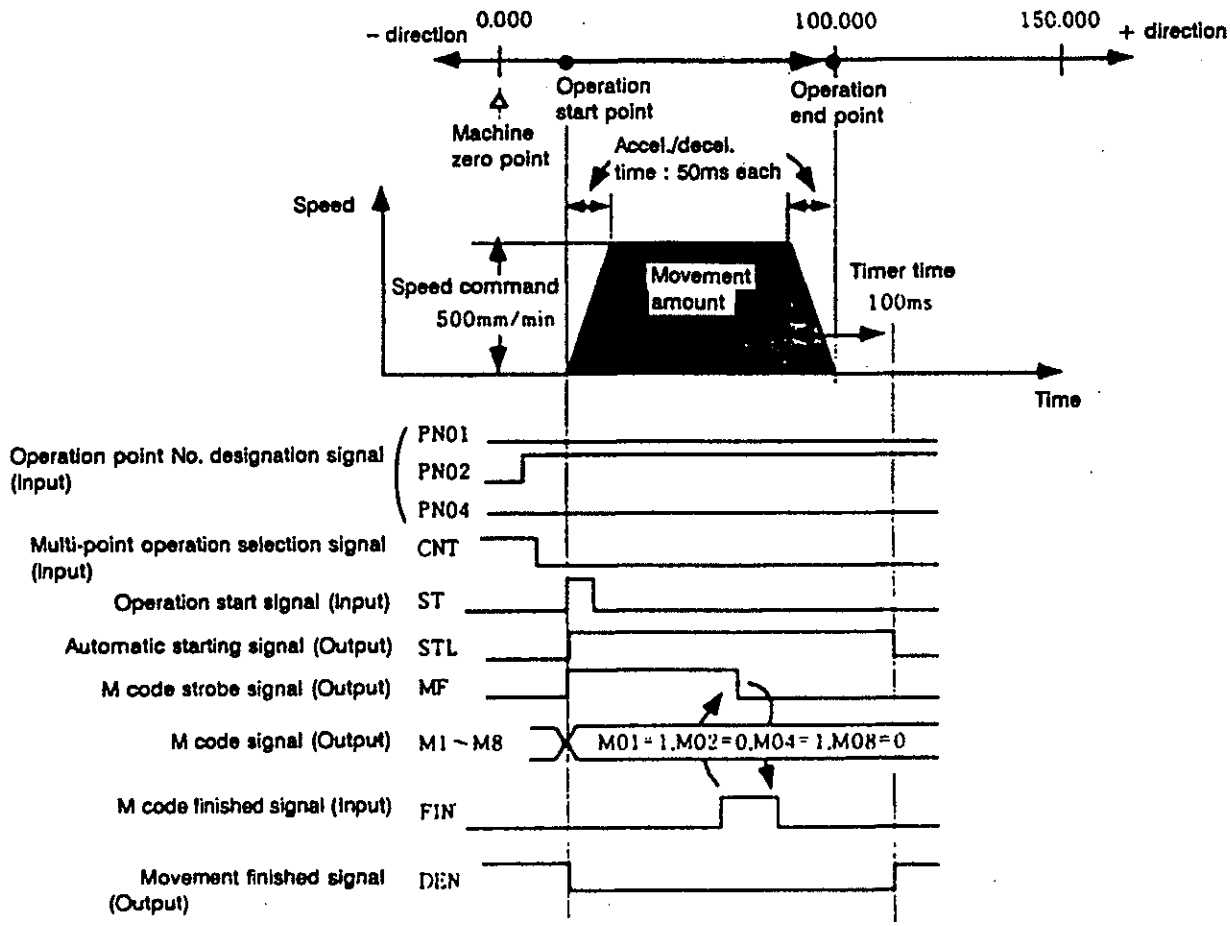
5.5.1 Single-point operation

When the point No. is designated and the start signal input, only the point data set in the designated point No. will be executed. The controller will enter the block stop state and will end the command when execution of the command is completed.
When executing single-point operation, turn the continuous operation signal CNT (digital input signal X3_ operation mode 4 in standard PLC) OFF. An example of designating point No. 3 and inputting the start signal is shown below for single-point operation.

Example: Single-point movement to point 3

Setting of point table 3
- Position command: 100 [mm]
- Speed command : 500 [mm/min]
- Timer command : 100 [msec]
- M command : 5
- Accel./decel. time : 50 [msec]

Parameter #360 smgst : 1



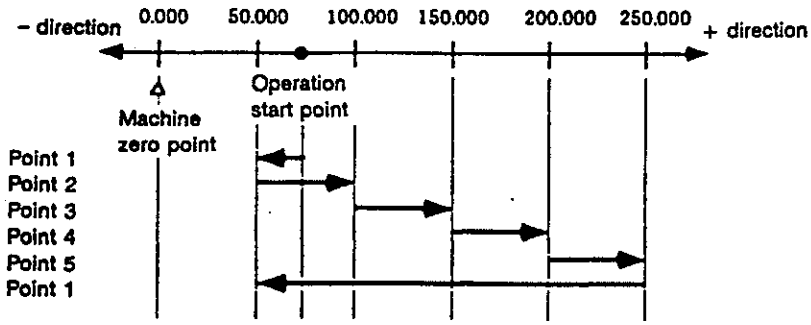
The axis will move from the current value to the position designated in point table 3. After movement, the timer time set will be counted, and then the block stop state will be entered.

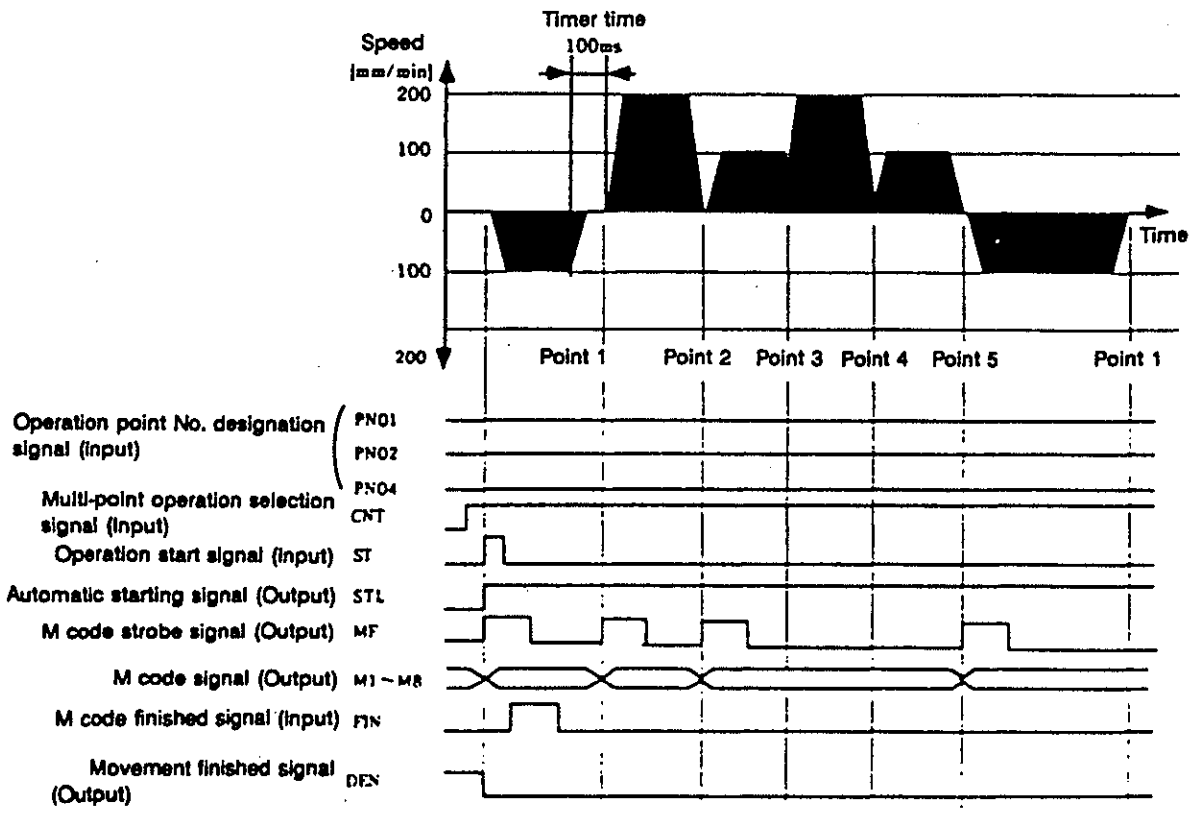
5.5.2 Multi-point operation

After the multi-point operation signal (CNT) is turned ON and the point No. is designated, the program will continuously be executed from the point data set in the designated point No. when the start signal is turned ON. After the execution of one point data is completed, the operation will be continued based on the point data of the next point No. However, if a value other than "-1" is set for the M command of each point, the completion signal must be input for each point.
The continuous operation will end at the point before the point where all point data is set to "0".
If the operation from the point No. where operation is started to the final end point, set "99" for the M command of the final point data.
An example of the operation when the start point is set as "1" for the multi-point operation is shown below.

Example: Multi-point (continuous) operation from point data 1

	Position command	Speed command	Timer time	M command	Accel./decel. time
Point 1	50.000	100	100	50	50
Point 2	100.000	200	-1	1	50
Point 3	150.000	100	-2	2	100
Point 4	200.000	200	0	-1	50
Point 5	250.000	100	-1	99	50
Point 6	0.000	0	0	0	0
Point 7	0.000	0	0	0	0





5.6 Point table and rotary axis operation

The point table position command is commanded with an absolute value from the zero point. However, as the coordinate system has a range of 0 deg. to 359.999 deg. for the rotary axis, special handling must be done to continuously rotate the axis 360 deg. or more.
The rotary axis has a function "rotary axis short cut control" used to automatically determine the direction in which the rotation (movement) amount is low when positioning to the commanded position (angle). The validity of the "rotary axis short cut control" is selected with parameter #200 (R short).
The relation of the 360 deg. or more rotation and "rotary axis short cut control" is shown below.

	When #200 R shout = 0	When #200 R shout = 1
Rotation direction	The axis rotates in the direction according to the sign of the point data position command.	The short cut direction is automatically determined, and the axis rotates in that direction. If the movement amount is 180 deg., the sign of the position command will be followed.
Movement amount	The axis moves "position command – current position". (The axis rotates this amount even when the amount is 360 deg. or more.)	The axis rotates with a short cut to the command position clamped at 360 deg. Thus, a rotation exceeding 180 deg. will not take place.

5.7 Input of point table to controller

The point table is input and edited with teaching box CT200. The setting and display are done in units of one data. With the teaching function, the position moved to with manual operation can be easily set as the point table command position using the teaching box CT200.
Refer to "Chapter 3 Operation of teaching box CT200" for the setting and display methods.

CHAPTER 6 Operation

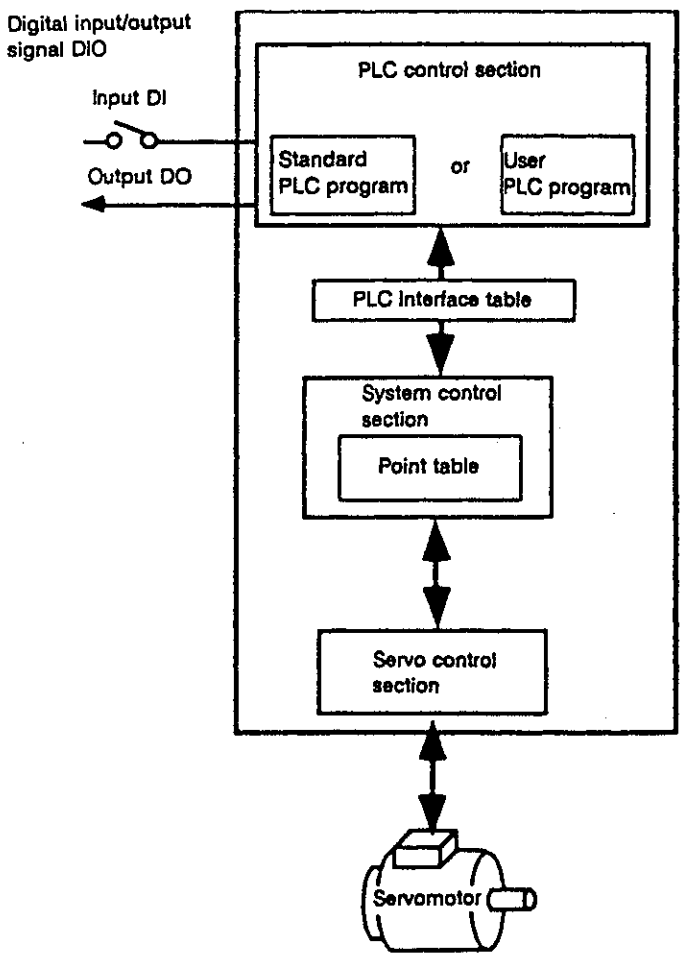
6.1 Outline of operation control

The Mitsubishi single-axis amplifier built-in controller "Model E" is configured of the control blocks "PLC control section", "System control section" and "Servo control section" as shown below. Operations including starting and stopping are started after the PLC analyzes the signal input from the controller and outputs a command to the "system control section". The operation status signal, etc., output from the "system control section" is output to the controller via the "PLC control section". The transfer of commands and signals between the "PLC control section" and "system control section" is done via the PLC interface table in the controller.

The "PLC control section" operates according to the "standard PLC program" set as a default, or according to the "user PLC program" created by the user. The "standard PLC program" can be randomly edited, and used as the base for creating the "user PLC program". The default state can be returned to with the touch of a button.

This chapter will describe the operation method using the standard PLC.

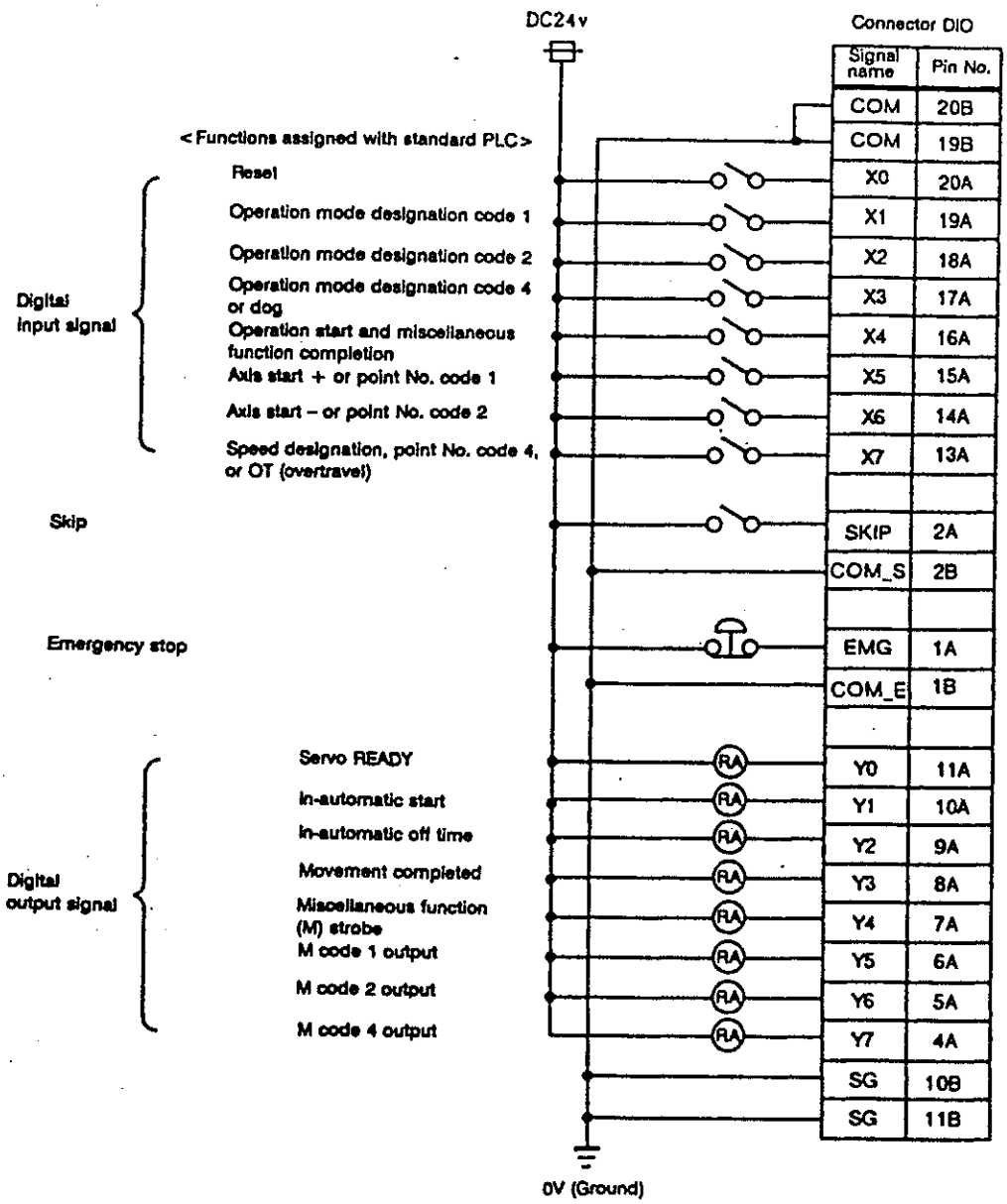
Refer to the separate material "PLC Instruction Manual (BNP-B2072)" for how to create the "user PLC program". Refer to "Chapter 3 Functions and handling of CT200" in this instruction manual for details on how to read out the standard PLC.



6.2 Assignment of digital input/output signals when using standard PLC

The digital input/output signals are assigned to the operation control signal as shown below when using the standard PLC.

Connection when input common is grounded



Note

- The functions assigned to X3 change according to the setting of the PLC bit selection parameter #675. (Refer to the explanation on the next page.)
- The functions assigned to X4 to X7 change according to the operation mode selected with X0 to X2. (Refer to the explanation on the next page.)
- The input signals X0 to X7, skip and emergency stop commons can be connected to DC24V and ground. The skip and emergency stop commons are both independent, but the X0 to X7 commons are common. The explanatory diagrams in this chapter show the connection when the input common is grounded.

[Assignment of special functions to digital input signal (connector DIO)]

(1) When using for zero point return [near-point dog signal]

X3 (pin 17A) is the exclusive input.

When not using the near-point dog signal is not used in the standard PLC program, set the parameter "PLC bit selection 1 bit 0 (near-point dog ignore) to "1". The near-point dog signal will be ignored, and can be used for the input of the "operation mode designation code 4".

When not using the "near-point dog signal" in the user PLC program, turn Y8F (near-point dog ignore) in the PLC I/F table ON with the program. The near-point dog signal will be ignored, and the common can be used for general purpose input.

The "near-point dog signal" cannot be assigned to other input pins. The near-point dog signal is handled as a B contact.

(2) When using "Overtravel (OT)"

X7 (pin 13A) is the exclusive input.

When not using "overtravel" in the standard PLC program, set the parameter "PLC bit selection 1 (#675) bit 1 (OT ignore)" to "1". The overtravel signal will be ignored, and the common can be used for the "point No. code 4" or "speed designation".

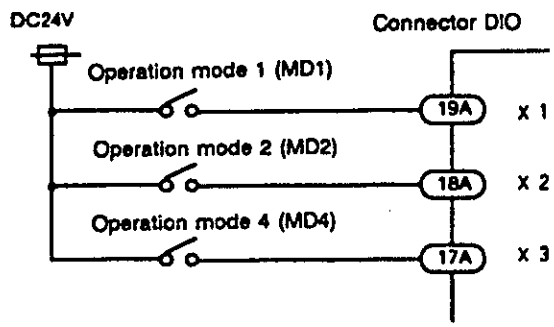
When not using "overtravel" in the user PLC program, turn Y8E (OT ignore) in the PLC I/F table ON with the program. The overtravel signal will be ignored, and the common can be used as a general purpose input.

The "overtravel signal" cannot be assigned to another input pin. The overtravel signal is handled as a B contact for both the +/– directions.

6.3 Selection of operation mode with standard PLC

The operation mode selection method using the standard PLC is as shown below.

- When using the standard PLC, the mode is selected with the operation control signals (DIO) input X1, X2 and X3 combination.
- X1, X2 and X3 are assigned respectively to pins 19A, 18A and 17A of the connector DIO.



0: Contact OFF, 1: Contact ON

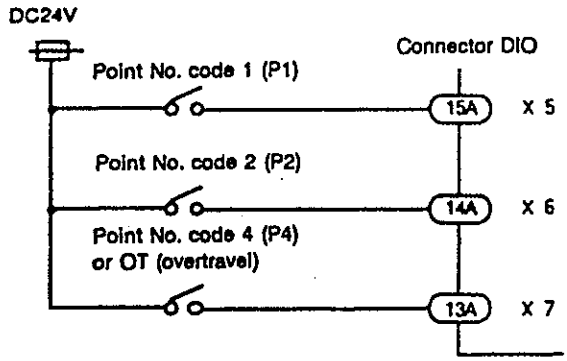
X3 (MD4)	X2 (MD2)	X2 (MD1)	Selection operation mode
0	0	0	Point table single-point operation
0	0	1	Point table multi-point continuous operation
0	1	0	Reference point (zero point) return
0	1	1	Jog
1	0	0	Step
1	0	1	Automatic initialization
1	1	0	
1	1	1	

Note) When "near-point dog" is ignored.

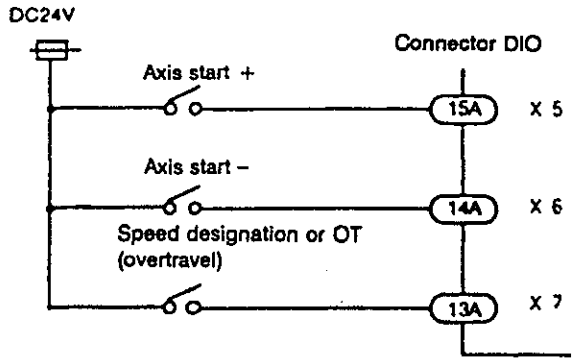
[Digital input signals of which assigned function changes according to operation mode]

The functions assigned to digital signals (DI) X5, X6 and X7 change as shown below according to the operation mode selected with the standard PLC.

For point table single-point/multi-point continuous mode



For reference point return/jog mode



6.4 Functions of each operation mode and starting procedures

[Point table operation mode]

This mode automatically operates the program according to the point table. Before starting, designate the No. of the point table where operation is to be started, and input the start signal. The designated point table will move to the designated position.

Whether the next point table is to be continuously executed (multi-point continuous mode) or if the operation is to be completed and stopped (single-point mode) is controlled by the standard PLC's operation mode signal. In the continuous mode, the operation will continue to the final point table defined. In the single-point mode, the operation will stop after the designated point table is executed. To execute another point table, change the point table No., and input the start signal again.

Refer to "Chapter 5 Creation of point table" for details on the point tables.

[PLC operation mode]

With this mode, a point table is created from the user PLC program in the same manner as the point table operation, and the operation is executed according to this data. The multi-point continuous mode or single-point mode can also be used in this mode.

In the point table mode, the data is fixed, but in the PLC operation mode, the point data can be freely rewritten with the user PLC program. Thus, the operation has some degree of freedom to it.

Point tables for a maximum of 8 points are prepared in the PLC file register for the PLC mode.

Refer to "PLC Instruction Manual (BNP-B2072)" for details.

[Zero point return]

If the movement direction and speed are designated in the zero point return mode, the axis can be returned (moved) to the reference point (machine zero point). Refer to "Chapter 7, 7.1 Reference point return function" for details.

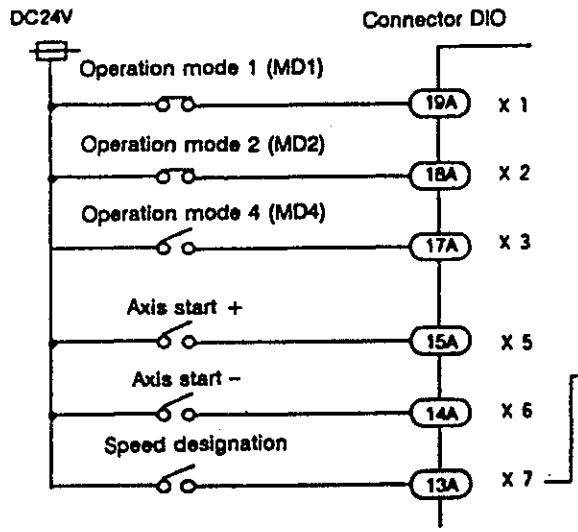
[JOG feed mode]

If the speed is designated and then the "axis start +" or "axis start –" signal is turned ON in the JOG mode, the axis will start moving. The axis will immediately decelerate and stop when the "axis start +" or "axis start –" signal is turned OFF.

The axis feedrate (manual feedrate) in the JOG mode is set and selected with parameter speed 1 (#332) or parameter speed 2 (#333).

In the standard PLC, "axis start +" is assigned to X5, "axis start –" to X6 and the feedrate parameter selection to X7.

The axis will not move when "axis start +" and "axis start –" are turned ON simultaneously.



Note

- When using X7 as overtravel (OT), parameter speed 2 (#333) will always be selected.
- When using X7 as the speed selection signal, set parameter plcbit_1 (#675) bit_1 to "1". In this case, the OT signal will be ignored.

0: Contact OFF, 1: Contact ON

Speed designation (X7)	Selected speed parameter
0	speed2 (#333)
1	speed1 (#332)

[Incremental feed mode]

Inching feed will be executed when the "axis start +" or "axis signal –" signal is turned on after the scale is designated.

The feed scale is a signal that designated the inch movement amount, and is assigned to X7 in the standard PLC. The inching will take place at 10[μm] when OFF and 100[μm] when ON. A user PLC must be created to change the feedrate, etc. Refer to "PLC Instruction Manual (BNP-B2072)" for details.

CHAPTER 7 Usage of Each Function

The Mitsubishi single-axis amplifier built-in controller Model E defines the basic functions required for axis control with the point table. In this chapter the specific functions and protective functions used that are defined with means other than the point table will be described. Refer to "Chapter 5 Creation of Point Table" for details on how to use the point table.

7.1 Reference point return function

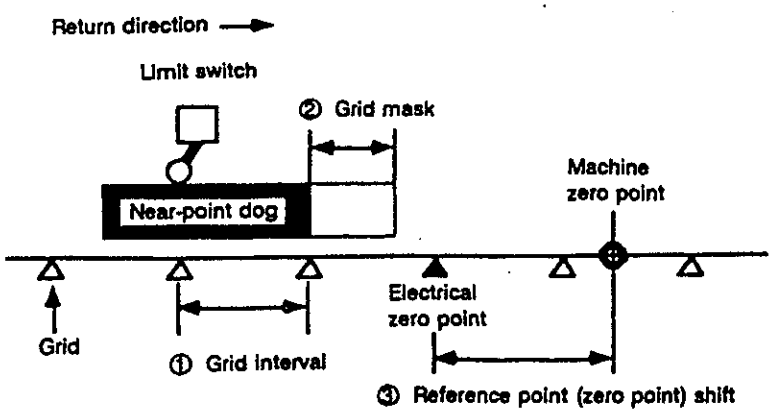
The axis can be returned to a position (reference point) set characteristically for the machine.
Either the dog-type reference point return or memory-type reference point return method can be used.

7.1.1 Dog-type reference (zero point) return

This method is used to initialize the incremental position detection system or absolute position detection system.

[Dog-type reference point return operation]

The machine has grid points at a specific pitch per rotation of the position detector.
When reference point return is executed, the first grid point after the near-point dog of these grid points is left (limit switch for near-point detector is turned ON/OFF), and the axis is reference point returned to this position. This point is called the electrical zero point.
The machine has a characteristic machine zero point, so the machine zero point and electrical zero point must be matched. This is called reference point shift.



The following items are used in the adjustment of the reference point return.

① Setting of grid interval
For the absolute position detection, there is an interval per detector rotation. For the incremental position detection, the interval is calculated with the following expression based on the grid interval per detector rotation.

$$\text{Grid interval [mm]} = \frac{\text{Movement amount per motor rotation}}{2^n}$$

n: Grid interval constant

② Setting of grid mask
The position where the limit switch is left from must be near the center of the grid interval or a position deviation will occur during reference point return. The position deviation can be prevented by setting the grid mask.

③ Setting of reference point shift
The electrical zero point is shifted and matched to the machine zero point.

★ The reference point return adjustment must always be done in the following order.

Setting of grid interval (parameter #339.grspc)	→	Setting of grid mask (parameter #338.grd mask)	→	Setting of reference point shift (parameter #340.ZRN shift)

[Setting of grid interval]

(1) Incremental detector

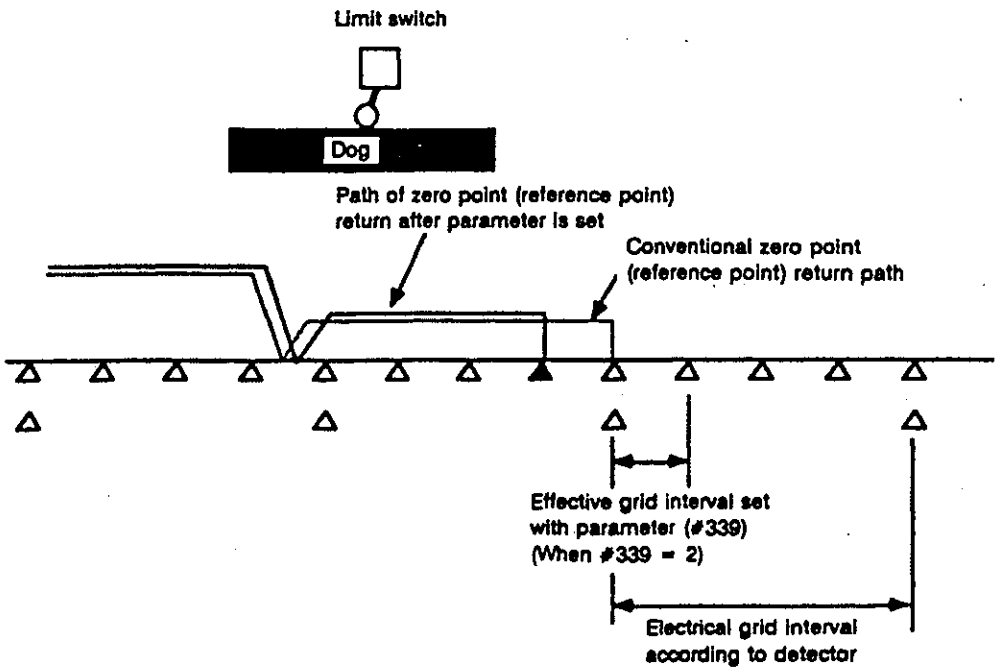
For the incremental position detector, the grid interval can be set shorter than the actual grid interval. In this case, the distance from when the dog is left to when the electrical zero point is reached is shortened, and the time required for reference point return can be shortened.

$$\text{Effective grid interval } \tau = \frac{\text{Movement amount per motor rotation}}{2^n}$$

n: Parameter (#339) setting value

Normally, the grid interval and pitch are the same as there is one grid point per motor rotation. Parameter (#339) is used to shorten this interval, and is set with a division (0 to 4) of the electrical grid interval.

(Note 1) Set the grid interval with a dividable number.
(Note 2) Always set "0" for the absolute position detection system.



(2) **Absolute position detection**

The grid interval for the absolute position detection is limited to the electrical grid. The electrical grid cannot be divided with the parameters.

<Grid interval for absolute position specifications>

$$\text{Grid interval } \tau = \text{Ball screw pitch} \times \frac{\text{No. of motor side gear teeth}}{\text{No. of ball screw side gear teeth}}$$

[Setting of grid mask]

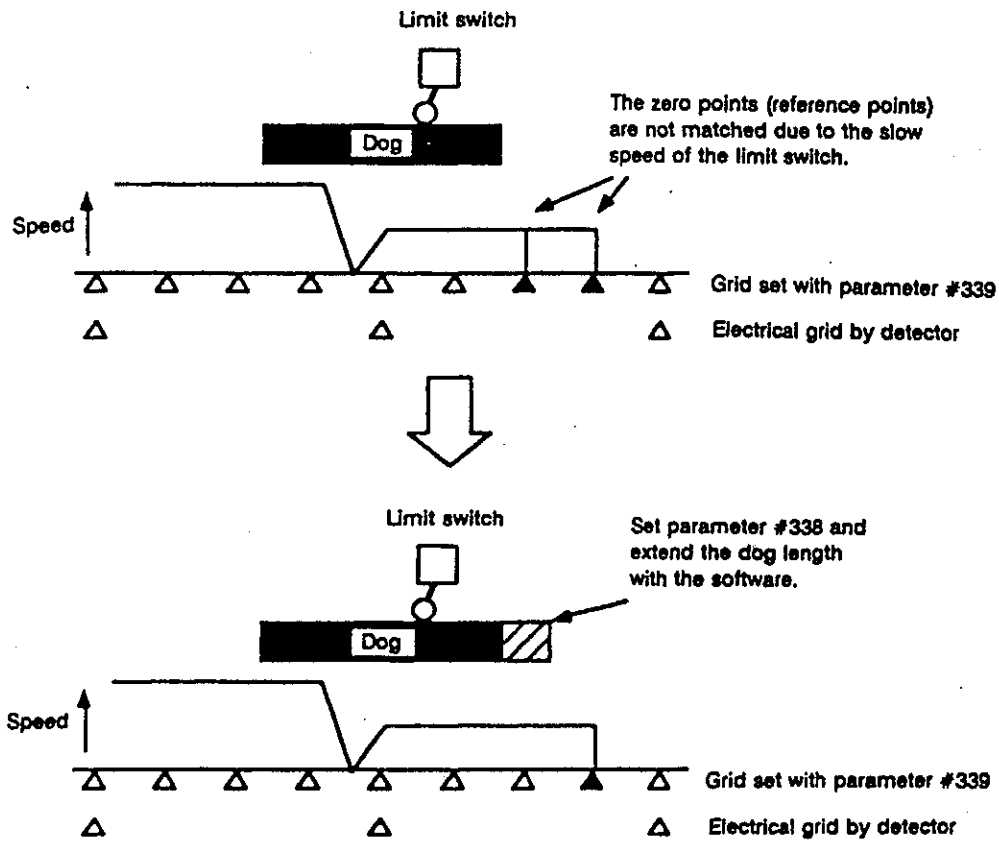
(1) **Setting**

The first grid point after the dog is kicked is the reference point. However, if there is a grid point where the dog is kicked, the reference point may be the grid point where the dog was kicked or may be the next grid point due to the slow speed of the limit switch operation. As a result, the reference point return position will deviate.

Thus, the position that the dog is kicked must be at the center of the grid interval.

The dog or detector installation can be changed to adjust the position, but by setting a grid mask with parameter #338, the grid point will be ignored when in the set grid mask position. As a result, the dog will be lengthened by the grid mask amount.

This allows the position where the dog is kicked to be set at the center of the grid interval.



(2) **Method of measuring grid mask amount**

① Confirm that the parameter zero point (reference point) shift amount and the grid shift amount are zero.

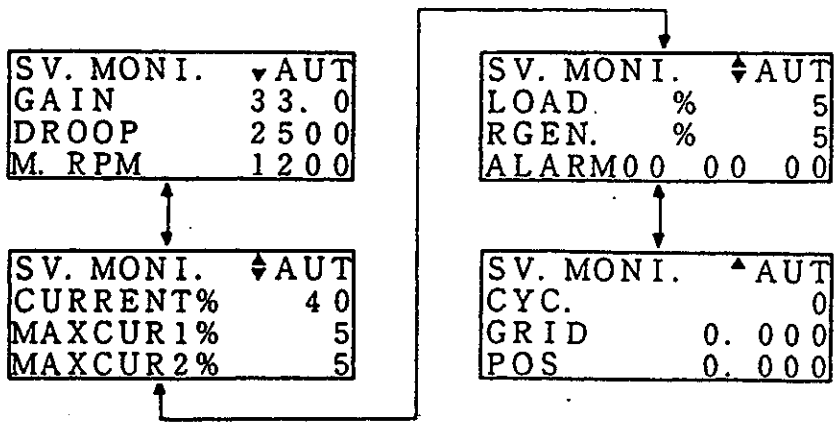
② Turn the controller power OFF and ON once.

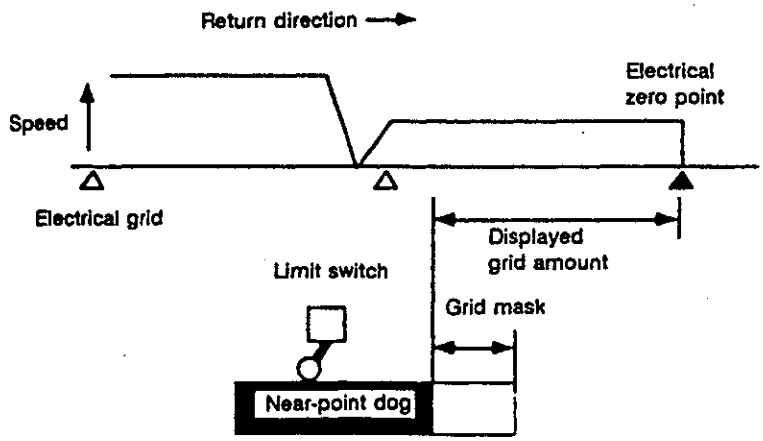
③ Execute manual zero point return.

④ Confirm that zero point return has been completed. (The zero point reached signal is ON.)

⑤ Display the SV.MONI.screen on the teaching box.
Read the grid amount value. This value is the distance from when the limit switch leaves the dog to the first grid point.

<SV.MONI. screens>





⑥ Example of grid mask amount setting

Displayed grid amount = 1.7mm

Grid interval = 2mm

$$\text{Grid mask amount} = \text{Displayed grid amount} - \frac{\text{Grid interval}}{2} = 1.7 - \frac{2}{2} = 0.7$$

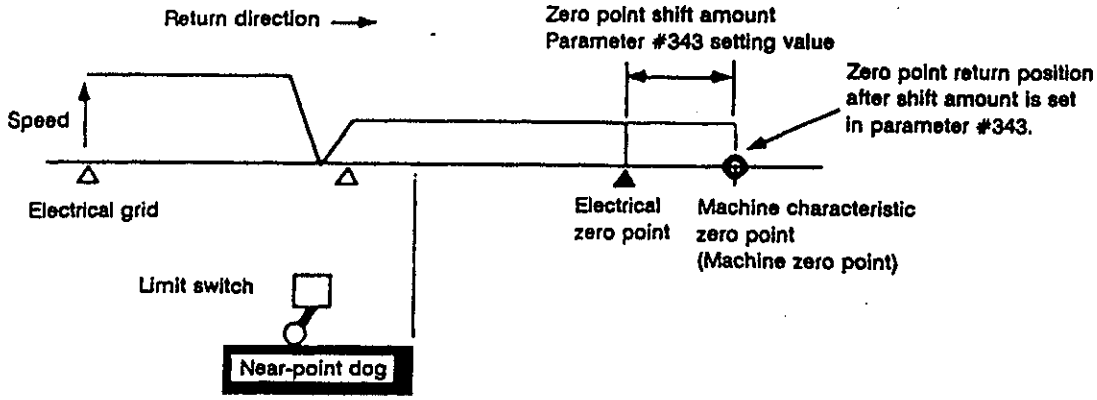
Thus, the grid mask amount will be 0.7mm (parameter #338 setting value: 700μm).

⑦ Set the grid mask amount in the parameter

(Note 1) If the grid mask is set, the displayed grid amount will be the distance from the grid mask to the grid point.

[Setting of zero point shift amount]

In the zero point return based on the grid point as explained on the last page, the zero point is fixed by the installation position of the detector. In the machine, the zero point (machine zero point) characteristic to the machine is determined, so the zero point is shifted so that the machine zero point position and grid zero point position match. The shift amount direction is the zero point return direction.



[Setting of zero point return creep speed]

In the dog-type zero point return if the zero point dog signal is input when moving to the zero point with the zero point return command (return speed), the axis will decelerate, and the grid point (electrical zero point) will be obtained with the specified creep speed.

If the creep speed is too fast in this case, the grid point may not be read correctly or zero point deviation may occur due to an inconsistency in the zero point dog off point timing.

The method for obtaining the speed limit and the recommended value for the standard grid interval is shown below.

L > (Grid amount) < (Grid interval)

$$L = (\frac{1}{G} + 0.02) \times F_D \times 20$$

G : Gain (Standard value: 33)
F_D : Creep speed (mm/min.) * Set with parameter #337
L : Coasting rate (mm)

The above expression may not be satisfied in some cases depending on the creep speed size. In that case, obtain an adequate creep speed F_D with the following expression.

$$F_D \text{ (mm/min.)} \leq \frac{\text{Grid interval}}{(\frac{1}{G} + 0.02) \times 20 \times 2}$$

<Recommended values for creep speed>

Grid interval (mm)	Creep speed limit value (mm/min.)	Recommended value for creep speed (mm/min.)
1	500	100 ~ 300
2	1000	100 ~ 300
4	2000	100 ~ 300
8	4000	100 ~ 500
10	5000	100 ~ 500
12	6000	100 ~ 500
14	7000	100 ~ 500
16	8000	100 ~ 500
18	9000	100 ~ 500
20	10000	100 ~ 500

<Note>
The limit value will increase in the calculations, but as the acceleration/deceleration of the creep speed is done in steps, if the deceleration speed is fast, a mechanical shock or other abnormality may occur. Thus, use the value within the recommended value.

[Zero point return parameters and setting order]

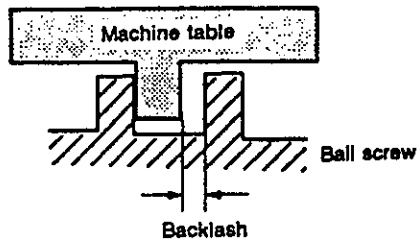
Operation order	Parameter No.	Parameter function
1	#354	Validity of zero point return
2	#356	Setting of zero point return direction
3	#339	Setting of grid interval
4	#337	Setting of creep speed
5	#336	Setting of feedrate during zero point return
6	#338	Setting of grid mask
7	#340	Setting of machine zero point shift amount
8	#343	Setting of coordinate system zero point

7.1.2 Memory-type high-speed zero point (reference point) return

This function registers the zero point (reference point) for the incremental system in the controller memory, and executes high-speed zero point return. The first zero point return after the power is turned ON is executed with dog-type, and the second and following returns are done with memory-type. The dog-type zero point return can be executed each time when the parameter DogtypeM (#102) is set.

7.2 Backlash compensation function

The error (backlash) that occurs when the machine system movement direction is reversed can be compensated.
The compensation amount specified with the feedback pulse unit of the position detector is set in parameter #365 backlash. The setting range is 0 to ±9999μm.



7.3 External control functions

The functions used to control the controller operation with external signals are described in this section. Each signal is assigned in the "PLC interface table", and is input to the controller via the standard PLC program or user PLC program.

7.3.1 Controller reset

This function initializes the controller. This signal is assigned to Y98 in the "PLC interface table".
When using the standard PLC, this signal is input from pin 20A (X0) of the controller's "connector DIO".
When this signal is input, the following reset operations will take place.

1) The axis movement decelerates and stops.
2) The resettable alarms are reset.
3) The M strobe is reset.
4) The point table operation and PLC operation stop.
5) The resetting signal is output.
   The operations interrupted by this signal cannot be resumed.

7.3.2 Automatic operation off

This function stops the point table operation and PLC operation, and enters the operation in the off state. This signal is assigned to Y91 in the "PLC interface table". This signal has a B contact specifications, and when the signal is turned OFF the operation will be stopped and will not resume even when the signal is turned ON again.
The following operations will be executed when this signal is turned OFF.

1) The axis movement decelerates and stops.
2) The timer being executed will hold the timer counter and stop.

7.4 Status output function

The signal output functions that notify the controller state to an external source are described in this section. Each signal is assigned in the "PLC interface table", and is output to an external source via the standard PLC program or user PLC program.

7.4.1 Servo READY

This function notifies an external source that the controller is in the servomotor operation READY state. This signal turns ON when the servo system enters the READY state.
This signal is assigned to X80 in the "PLC interface table". When using the standard PLC, this signal is output to an external source from pin 11A of the controller's "connector DIO".

7.4.2 In-automatic start

This function notifies an external source that the controller is in the automatic start state. This signal turns ON when the point table operation and PLC operation are being executed.
This signal is assigned to X92 in the "PLC interface table". When using the standard PLC, this signal is output to an external source from pin 10A of the controller's "connector DIO".
This signal will turn OFF when the operation is stopped or interrupted with the controller reset signal or feed hold signal, etc. This signal will also turn OFF when the last point No. in the point table is completed.

7.4.3 In-automatic off

This function notifies an external source that the controller is in the automatic operation off state. This signal turns ON when both the point table operation and PLC operation are not being executed. This signal will also turn ON when the operation mode is changed to the manual mode.
This signal is assigned to X94 in the "PLC interface table". When using the standard PLC, this signal is output to an external source from pin 9A of the controller's "connector DIO".

7.4.4 In-alarm

This function notifies an external source that the controller has detected an alarm. This signal will turn ON when the controller detects an alarm.
This signal is assigned to X98 to X9B in the "PLC interface table".
The following signals in the "PLC interface table" will also turn ON depending on the alarm type.

1) Servo alarm (X98)
2) System alarm (X99)
3) Program error (X9A)
4) Operation error (X9B)

7.4.5 Battery alarm

This function notifies an external source that there is an error in the data backup battery. The battery is checked for errors when the power is turned ON, and if an error is found, this signal will turn ON.
This signal is assigned to X9C in the "PLC interface table".

7.4.6 In-reset

This function notifies an external source that the controller is being reset. This signal will turn ON when the controller is being reset.
This signal is assigned to X95 in the "PLC interface table".

7.4.7 Movement command completion

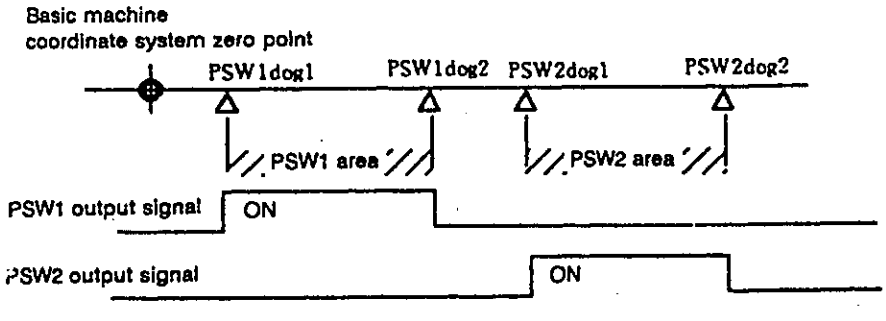
This function notifies an external source that the movement command in the point table operation and PLC operation has been completed. This signal will turn ON when the movement command is completed. This is used to process the M command, etc., after movement is completed.
This signal is assigned to X96 in the "PLC interface table". When using the standard PLC, this signal is output to an external source from pin 8A (Y3) of the controller's "connector DIO".

7.4.8 Position switches

This function notifies an external source of the machine position. A range of up to 8 points can be set in the parameters, and when the machine position is in the set range, this signal will turn ON. This can be used for area signals.
This signal is assigned to XB8 to XBF in the "PLC interface table".
The machine position area can be determined with two methods. One method is to judge with the command system machine position. The area is judged ahead of the actual machine position during movement. (The servo droop is not considered.) The other method is to judge with the feedback system machine position, and the area is judged from the actual machine position. (The servo droop is considered.) With this method the area judgment signal is output slightly slower than the actual machine position.
The method to be used to judge the area can be set per position switch with the parameters.

[Setting of position switches]

The area is set in the parameters PSWndog1 and PSWndog2 (n = 1 to 8). The judgment method is set in parameter PSWncheck (n = 1 to 8).



Position switch name	Area setting parameter		Area judgment method	Signal output address
PSW1	#401 PSW1dog1	#402 PSW1dog2	#400 PSW1check	XB8
PSW2	#404 PSW2dog1	#405 PSW2dog2	#403 PSW2check	XB9
PSW3	#407 PSW3dog1	#408 PSW3dog2	#406 PSW3check	XBA
PSW4	#410 PSW4dog1	#411 PSW4dog2	#409 PSW4check	XBB
PSW5	#413 PSW5dog1	#414 PSW5dog2	#412 PSW5check	XBC
PSW6	#416 PSW6dog1	#417 PSW6dog2	#415 PSW6check	XBD
PSW7	#419 PSW7dog1	#420 PSW7dog2	#418 PSW7check	XBE
PSW8	#422 PSW8dog1	#423 PSW8dog2	#421 PSW8check	XBF

0: Judgment with command value
1: Judgment with position feedback

Sets the distance from the zero point

7.4.9 Power OFF movement over

This function notifies an external source that the tolerable error of the machine positions when the power is turned OFF and when turned ON in the absolute position detection system has been exceeded. This signal will turn ON with a warning if the machine position when the power is turned ON exceeds the tolerable error.

This signal is assigned to X9D in the "PLC interface table".

The tolerable error of the machine positions when the power is turned OFF and when turned ON is set in parameter #351 ABScheck.

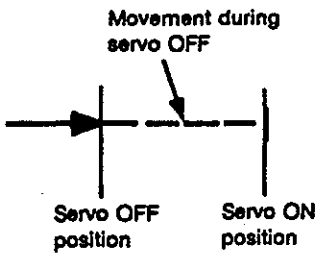
7.5 Axis control functions

7.5.1 Servo OFF

This function shuts off the servomotor power. When the movement axis is mechanically clamped, this function will prevent the servomotor from being overloaded due to the clamp force.
Whether to compensate the movement amount during servo OFF (return to the original position) or to update the machine position when the servo ON state is entered from servo OFF can be selected with parameter #357svof.

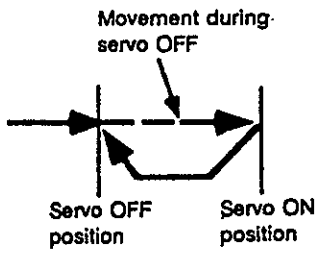
Parameter #357svof setting value	Operation during servo ON
0	The movement amount during servo OFF is reflected on the machine position counter. (Error is not compensated.)
1	Return to the position where the servo turned OFF. (Error is compensated).

When parameter #357 = 0



The movement amount during servo OFF is reflected on the machine position counter.

When parameter #357 = 1



Return to the position where the servo turned OFF.

7.5.2 Follow-up function

This function monitors the movement of the machine during the emergency stop state, and automatically updates the machine position. Thus, reference point return does not need to be re-executed after emergency stop.

7.5.3 Torque limit function

This function limits the current output to the motor and limits the motor torque.
The current limit value is a percentage (1% to 500%) of the motor's rated current, and is set in parameters #316 SV.sv017, #318 SV.sv019 and #319 SV.sv020. Which value set in the parameters that is validated is determined by turning Y88 and Y89 in the PLC interface table ON with the PLC program. When using the standard PLC, #316 SV.sv017 is always valid.

Y88	Y89	Parameter for which set current limit value is valid.
OFF	OFF	#316 SV.sv017 Current limit (normal)
OFF	ON	#318 SV.sv019 Current limit 1
ON	OFF	#319 SV.sv020 Current limit 2
ON	ON	———

7.5.4 Skip function

This function interrupts the operation with the skip conditions. Either the exclusive skip input (connector SIO) or the current limit reach is valid for the skip condition.
Set M91 in the M command of the point table to validate the skip function. The skip function will be validated, and the normal point table operation will be executed until the skip conditions are reached. M91 is output with a strobe signal.
In the single-point mode, the motor will decelerate and stop immediately when the skip conditions are reached. The machine position at this time will be registered as the skip coordinates.
In the multiple-point mode, the point data being executed will be interrupted when the skip conditions are reached, and the next point data will be executed.
If the skip conditions are not reached even when the command position is reached, the same operation as the normal point table operation will be executed. If the skip function is valid and the skip conditions are already reached when the execution of the point table is started, the operation will be interrupted immediately. (The axis will not move.)

7.6 Protection functions

The functions used to protect the machine, etc., driven by the Mitsubishi single-axis amplifier built-in controller Model E are described in this section.

7.6.1 Emergency stop

Emergency stop is a function that stops all commands, and decelerates and stops the machine movement.
The emergency stop function will operate in the following cases.

(1) When the external emergency stop is input. <Note 1>
(2) When the controller detects an undervoltage.
(3) When a servo alarm occurs.
(4) When an error occurs in the communication by the MC link B. <Note 2>

<Note 1> The emergency stop signal (ENG) is a B contact signal input from pin 1A of "connector DIO". When this signal turns OFF, the controller will operate the emergency stop function.

<Note 2> This is valid only when a remote I/O, etc., is connected with the MC link B.

[Deceleration control during emergency stop]

If the emergency stop function is operated, the controller will decelerate the motor according to the time constant set in parameter #307 SV.sv008. When the motor speed reaches 10rev/min. or less or if the timeout time set is reached after deceleration, the dynamic brakes will be applied, and the servomotor will stop.
The same value as the normal acceleration time constant can be set for the deceleration time constant, but if the value is longer (max. setting 5 sec.), the motor can be stopped with less shock.

1. For motor with magnetic brake
   Select the step stop. Dynamic stop can also be selected.
2. When parameter #300 SV.sv001 bit 0 is set to "1"
   Deceleration control will not be applied, and the motor will dynamically stop from the start. The dynamic resistor may burn out if this is used frequently, so take care.
   The braking distance may be longer than when stopped with deceleration stop.

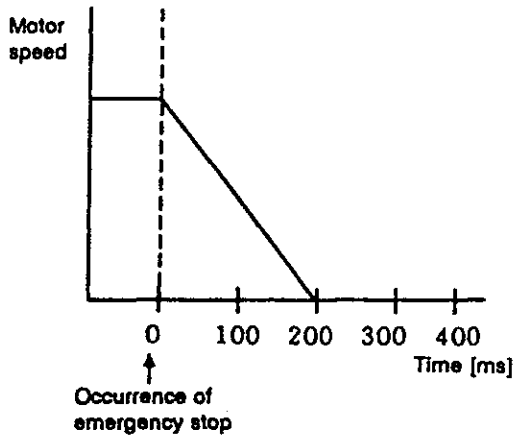
<Note 3> When using the servomotor with magnetic brake, select position loop step stop or dynamic stop for the deceleration stop.

[Parameters that control deceleration during emergency stop]

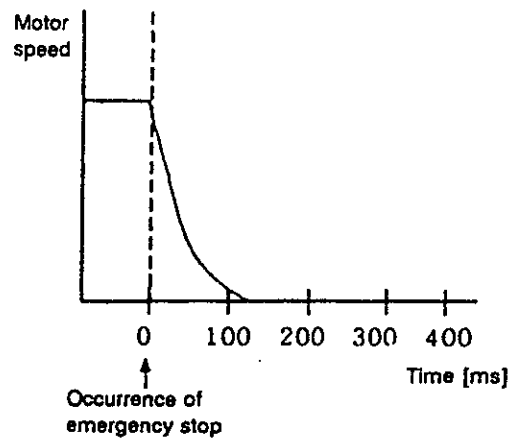
#307 SV.sv008: Deceleration control time constant (max. 5000ms)

- The deceleration stop time constant is set.
- When using the motor with magnetic brake always set 0 (step stop) or dynamic stop (set parameter #300 SV.sv001 bit 0 to "1").

When #307 SV.sv008 = 20.0



When #307 SV.sv008 = 0



<Note 4> If an alarm in which the motor cannot be controlled occurs, deceleration control cannot be executed. In this case, the dynamic brakes will function simultaneously with the occurrence of the alarm.
(Refer to the Alarm List for the alarms in which deceleration cannot be controlled.)

<Note 5> If the controller detects an undervoltage due to a power cut off or power failure, the motor will decelerate with the energy accumulated in the controller's capacitor. However, depending on the deceleration control time constant and motor load inertia, the dynamic brakes may function during the deceleration control.

<Note 6> Always select the position loop step stop for axes with the mechanical brake.
(Input 0 in parameter #307 SV008.)

<Note 7> The emergency stop state cannot be canceled during deceleration control.

<Note 8> If the deceleration time constant is increased, avoid cutting off the power with the external emergency stop switch.

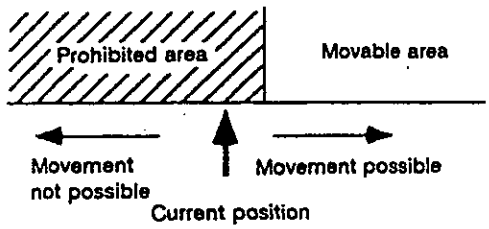
7.6.2 Stroke end

If a limit switch and dog are set in the machine, this function will stop the machine movement when the limit switch kicks the dog. An alarm will be output simultaneously.
Connect the limit switch signal (stroke end signal) to pin 13A (X7) of the controller's "connector DIO". The input signal is handled as a B contact, and the + and – directions are common.
The controller registers the axis movement direction just before the stroke end signal is input, and the axis can be fed in the reverse direction with the manual mode or can be escaped with the dog. The alarm state will be canceled simultaneously. If the alarm is still activated, the program operation will be prohibited, and feeding the axis in that direction will not be possible even in the manual mode.

7.6.3 Soft limit

This is a memory-type stroke end function. The movable range is set in parameters #100 limi+, #101 limi–, #341 OT+ and #342 OT– with coordinate values. The limit or OT range that is narrower is valid. The point that differs with the stroke end is that with the soft limit the movement can be decelerated and stopped before the limit point.

The setting range is –99999.999 to +99999.999mm. If the max. value and min. value are set to the same data, the soft limit function will be invalidated.



7.6.4 Interlock

When the interlock signal turns OFF, the machine movement will immediately decelerate and stop. The movement will immediately resume when the signal is turned ON.

There is a manual interlock signal that is valid during manual operation, and an automatic interlock signal that is valid during automatic operation. Both signals have + direction and – direction signals. Each is assigned in the "PLC interface table", and function when turned ON with the user PLC program. Refer to the following table for the assignment of each signal in the "PLC interface table".

Device	Abbr.	Signal name
Y82	* + AIT	Automatic interlock (+)
Y83	* – AIT	Automatic interlock (–)
Y84	* + MIT	Manual interlock (+)
Y85	* – MIT	Manual interlock (–)

This signal is handled as a B contact. The interlock will function when the signal turns OFF.

7.6.5 Edit lock

This function protects the internal data. If the "edit lock" assigned to YB8 to YBC in the "PLC interface table" is turned OFF in the user PLC program, rewriting of the point table and parameters, etc., will be prohibited. This signal is handled as a B contact. The edit lock will function when the signal turns OFF.

(Refer to the PLC Instruction Manual BNP-B2072 for details.)

7.7 Absolute position detection function

7.7.1 Outline of absolute position system

The absolute position detection function is a system that allows automatic operation immediately after turning the power ON without executing zero point return by detecting the machine movement while the power is cut off. Multiple checks such as mutual check of the feedback amount from the detector and check of the absolute position at the machine characteristic point are done, so the reliability is extremely high.
The machine zero point must be determined and the absolute position set even for the absolute position detection system. There are two methods to set the absolute position.

(1) Dog-type absolute position detection
The absolute position is set by executing dog-type zero point return.

(2) Dog-less type absolute position detection
The absolute position is set by setting random coordinates at random positions without using the dog. The following two methods can be used to determine the reference position for this type.

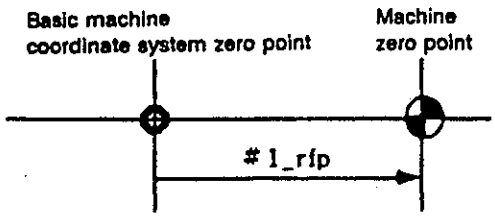
- Machine stopper method — Manual stopper method, Automatic stopper method
- Reference point alignment method

[Method for validating absolute position detection system]
(1) Confirm that a motor that corresponds to the absolute position detection system is being used.
(2) Set parameter #300 SV.sv001 bit 7 to "1".
(3) Set parameter #355 abson to "1", and validate the absolute position detection function.
After the above is confirmed and set, and the power is turned ON again, the absolute position detection system will be validated. However, the absolute position is not set, so the absolute position detection alarm (Z70 0001) will occur. This is not a fault, and is an alarm canceled when the absolute position is set with the following procedures.

7.7.2 Absolute position system coordinate system

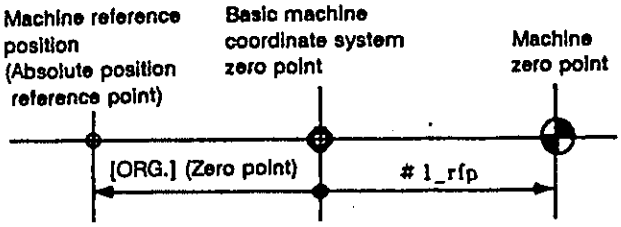
(1) For dog-type absolute position detection
The basic coordinate system is created at a position referring to the zero point (reference point) and where the parameter #343 #1_fef sign is reversed.

- The zero point refers to the machine zero point determined with dog-type zero point return.
- The basic machine zero point is the position used as the point table command position zero point (0 point).



(2) For dog-less absolute position detection

The basic machine coordinate system is created at a position referring to the machine reference position (machine end or reference point) or the absolute position reference point (grid point just before machine position) and in which the sign for the "zero point" parameter is reversed. The machine zero point is created at the parameter #343 #1_rfp position referring to the basic machine system zero point.

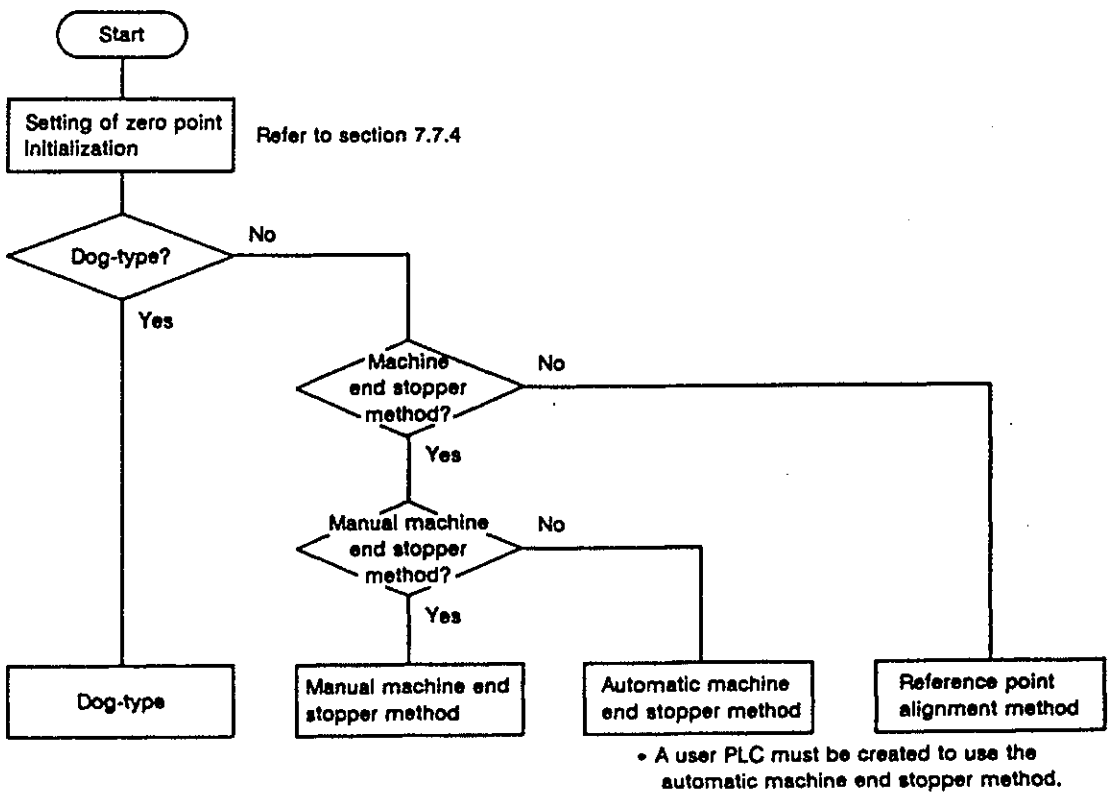


* [ORG.] : Coordinate position of the machine reference position or the absolute position reference point looking from the basic machine coordinate system zero point. Set on the [ABS.SET] screen on the teaching box CT200.
* #1_rfp : Coordinate of machine zero point looking from basic machine coordinate system zero point.

(Note) Whether the [ORG.] parameter is to be the coordinates of the machine reference position looking from the basic machine coordinate system zero point or the coordinates of the absolute position reference point is selected with parameter #425 abspt.

7.7.3 Start-up of absolute position system

The zero point must be initialized to start-up the absolute position detection system. When the zero point is initialized, the coordinate system can be set, and operation can be executed.
Using the following flow chart as a guideline, start-up the absolute position detection system.



[Operation when absolute position is not set]

If the zero point has not been initialized even once or if the absolute position is lot, the following alarms will display. The controller coordinate system will be unstable in this state, so the limits shown in the following table will be applied on each mode.

Alarm : Z70 Absolute position illegal
Z71 Detector section error

* This alarm may occur when the power is turned ON for the first time or immediately after the detector cable is disconnected.
This is also caused when the voltage of the capacitor for backing up the memory detector has dropped. Turn the power ON again, and cancel the alarm.

Operation mode	Absolute position detection method		
	Dog-type	Dog-less type	
		With stopper	Without stopper
Point table operation PLC operation	Movement commands not possible (Note 1)	Movement commands not possible (Note 1)	Movement commands not possible (Note 1)
Jog feed	Valid	Valid	Valid
Incremental feed	Valid	Valid	Valid
Zero point return	Valid	Start-up not possible (Note 2)	Start-up not possible (Note 2)
Automatic initialization	———	Valid	———

(Note 1) Program error "P30 ZERO POINT INCOMPLETE AXIS FOUND" will occur.
(Note 2) If the axis is started without setting the absolute position, the operation error "M01 0024" will occur.

7.7.4 Selection of zero point initialization method

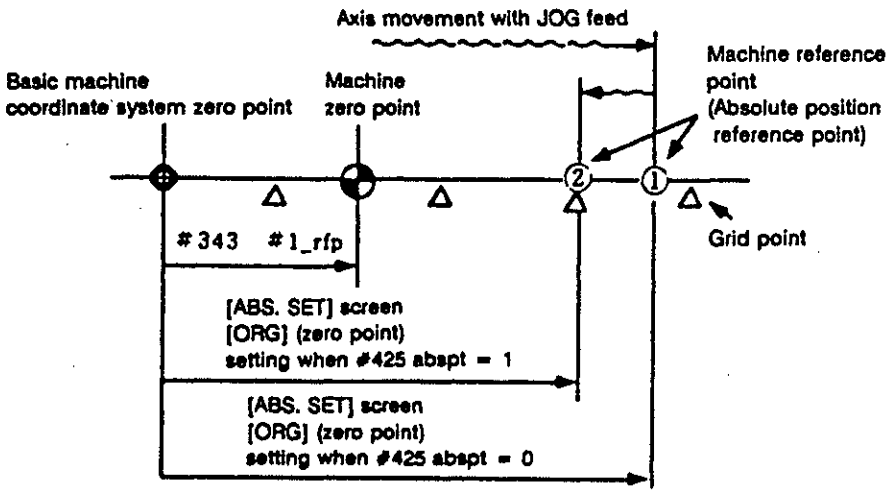
The zero point initialization method is set with the following parameters.

(1) Selection of dog-less/dog-type absolute position detection

#344 ABSdog 0 : Dog-less type absolute position detection
1 : Dog-type absolute position detection

(2) Machine end stopper method

#345 ABS stopr 0 : Machine end stopper method
1 : Reference point alignment method

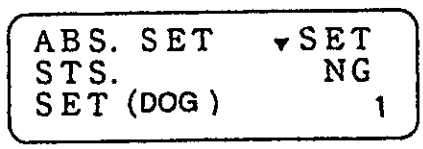


Before determining the basic machine coordinate system zero point, the absolute position reference point is set to ① or ② shown above with parameter #425 abspt.
When "abspt=0", the basic machine coordinate zero point is determined referring to the position randomly stopped at with JOG feed.
When "abspt=1", the basic machine coordinate zero point is determined referring to the grid point (electrical zero point) just before the position randomly stopped at with JOG feed.

7.7.5 Zero point initialization for dog-type absolute position detection

The zero point is initialized by executing dog-type zero point return with the manual zero point return mode or automatic zero point return command (M90). The execution stage of the initialization is shown in the "STS." displayed on the [ABS.SET] screen of the teaching box CT200.

Teaching box CT200 screen



— Operation procedure —

Operation procedure	[STS.] display
1. Select the [ABS. SET] screen.	• [NG] will display when the absolute position is lost. • [COMP] will display when the absolute position is set.
2. Confirm that the initialization method is [DOG]. (The display on the [ABS.SET] screen must be set to [DOG].)	
3. Execute manual or automatic zero point return.	[ORG RTN]
4. When the zero point is reached, the basic machine coordinate system will be set. The absolute position is set at this stage, and the zero point initialization is completed.	[COMP]

(Note) If the dog-type zero point return execution is interrupted by resetting, etc., the [STS.] display will display the previous state (COMP or NG).

7.7.6 Zero point initialization for dog-less type absolute position detection

The zero point is initialized using the teaching box CT200 [ABS.SET] screen, and JOG feed or incremental feed. The execution stage of initialization will display in [STS.] on the [ABS.SET] screen.

(1) Machine end stopper method

The manual initialization and automatic initialization methods can be used in the machine end stopper method.

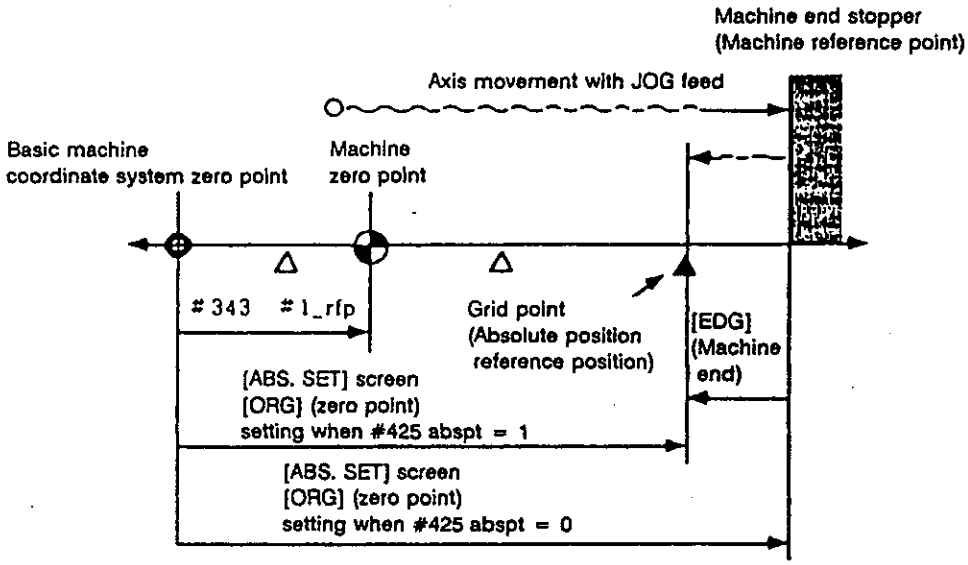
[Manual initialization]

This is a method in which the axis is pressed against the machine end stopper, and is done using JOG feed or incremental feed.

The motor current limit value for stopping is set in parameter #317 SV.sv018 to limit the motor's output torque before initializing the zero point with the stopper.

— Operation procedure —

Operation procedure	[STS.] display
1. Select the [ABS.SET] screen.	• [NG] will display when the absolute position is lost. • [COMP] will display when the absolute position is set.
2. Select the JOG or incremental mode.	
3. Confirm that the initialization method is set to [PUSH]. (The [ABS. SET] screen display is [PUSH].)	
4. Set "1" in [SET] on the [ABS.SET] screen.	
5. Set [ORG] on page 3 of the [ABS.SET] screen.	[STOPPER]
6. Press against the machine end stopper.	
7. Confirm that the [STS.] display is [RELEASE]. (When pressed against the machine end stopper and the current limit is reached for a set time, the display will change to [RELEASE] and the distance between the machine end and grid just passed will display at [EDG] (machine end) on page 2 of the [ABS.SET] screen.)	[RELEASE]
8. Move in the direction opposite the stopper direction.	[REF]
9. The movement will automatically stop when the previous grid is reached. • The basic coordinate system will automatically be set. The absolute position is set at this state.	[COMP]
10. This completes the zero point initialization.	



Manual initialization operation diagram

(Note 1) "0" cannot be set for [SET] in the [ABS.SET] screen. This will be set to "0" when the power is turned ON again. When this display is set to "1", the message "SET" will appear on the operation status display section, and the point table operation and PLC operation will be interlocked.

(Note 2) [ORG] (zero point) can be set at any stage as long as [SET] is set to "1".

(Note 3) When executing zero point initialization, the grid point must be passed once after the power is turned ON. If the grid point has not been passed, "NOT PASSED" will display in [MAC]. In this case, return the axis to a point where the motor shaft will rotate one or more times, and then repeat from step 6.

(Note 4) If the first grid point is within the grid mask (parameter #338 grd_mask) during the reference point return in step 9, the axis will stop at the next grid point. Note that zero point shift (parameter #340 ZRNshift) is invalid.

(2) Automatic initialization

This is a method in which the axis is pressed against the machine end stopper, and has the following features.

- Pressing is executed each time with equal conditions (feedrate, distance), so inconsistencies in the zero point position can be reduced.
- Part of the operation can be automated to make zero point initialization easier.

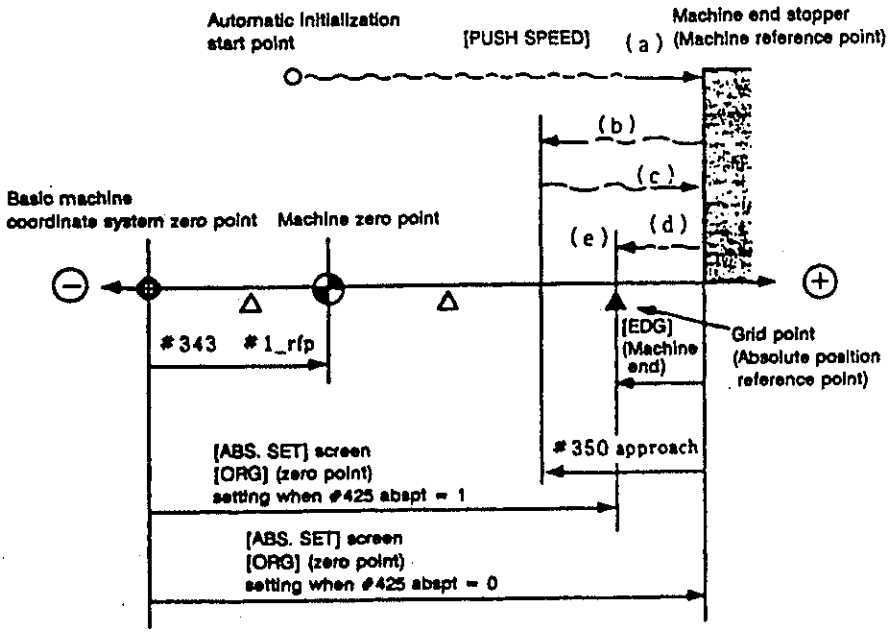
The following parameters are set before zero point initialization.

#317 SV.sv018 : Current limit value when initialization is valid
#349 Push_F : Feedrate when initialization is valid
#350 approach : The point where the second pressing is started for automatic initialization is set. If this parameter is set to "0", the machine zero point will be the start point.

- The automatic initialization function can be used when validated in the PLC program, etc., by the machine maker. Confirm with the machine specifications.

— Operation procedure —

Operation procedure	[STS.] display
1. Select the [ABS.SET] screen.	• [NG] will display when the absolute position is lost. • [COMP] will display when the absolute position is set.
2. Select the automatic set mode.	
3. Confirm that the initialization method is set to [PUSH]. (The [ABS. SET] screen display is [PUSH].)	
4. Set "1" in [SET] on the [ABS.SET] screen.	[STRT]
5. Set [ORG] on page 3 of the [ABS.SET] screen.	
6. Move the axis with the JOG mode. • (Axis movement is possible only in the direction (machine end stopper direction) indicated with a sign at [ORG] (zero point).)	[STOPPER 1]
7. a) Move in the machine end stopper direction with [PUSH SPEED].	
b) When pressed against the machine end stopper and the current limit is reached for a set time, the axis will start moving toward the approach point with the [PUSH SPEED].	[ORG RTN]
c) After the approach point is reached, the axis will move in the machine end stopper direction at the [PUSH SPEED].	[STOPPER 2]
d) When pressed against the machine end stopper and the current limit is reached for a set time, the axis will move to the previous grid at the [PUSH SPEED].	[REF]
e) The axis will stop when the previous grid is reached. • The basic machine coordinate system will automatically be set. The absolute position is set at this state.	[COMP]



Automatic initialization operation diagram

(Note 1) "0" cannot be set for [SET] in the [ABS.SET] screen. This will be set to "0" when the power is turned ON again. When this display is set to "1", the message "SET" will appear on the operation status display section, and the point table operation and PLC operation will be interlocked.

(Note 2) [ORG] (zero point) can be set at any stage as long as [SET] is set to "1".

(Note 3) When executing zero point initialization, the grid point must be passed once after the power is turned ON. If the grid point has not been passed, "NOT PASSED" will display in [MAC]. In this case, return the axis to a point where the motor shaft will rotate one or more times, and then repeat from step 6.

(Note 4) The acceleration/deceleration during movement at the pushing speed will be stepped.

(Note 5) The machine zero point will be the approach point when "0" is set for parameter #350 approach.

(Note 6) The automatic initialization will be interrupted after start-up in the following cases. When interrupted, the [STS.] will change to [STRT], so repeat from step 6.

- When a new absolute position detection alarm has occurred.
- When READY is turned OFF.
- When the operation mode is changed.
- When reset.

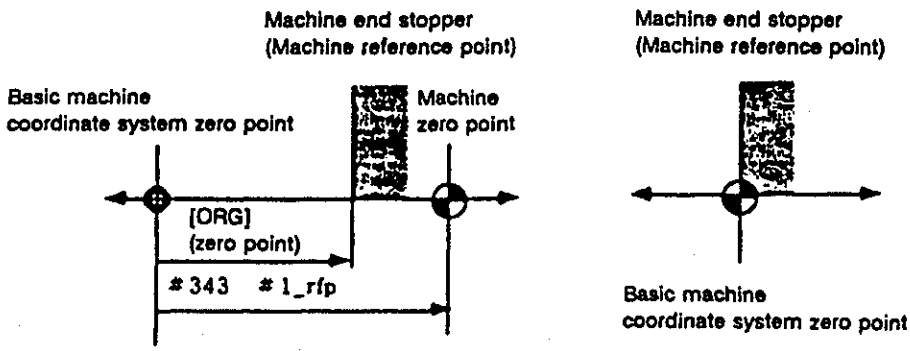
If [STS.] is [COMP] before automatic initialization is started, and the power is turned ON again without resuming operation, [STS.] will change to [COMP].

(Note 7) If the first grid point is within the grid mask (parameter #338 grd_mask) during the reference point return in step 7 (e), the axis will stop at the next grid point. Note that zero point shift (parameter #340 ZRNshift) is invalid.

(Note 8) Automatic initialization will not start in the following cases. The message "START NG" will appear if starting is attempted.

- When [SET] on the [ABS] screen is not set.
- When the [ORG] (zero point) setting is incorrect.
- When the push speed (parameter #349 puch_F) is not set.
- When alarm "Z71 0005 Detector section error" has occurred.

Of the above cases, if the [ORG] (zero point) setting is incorrect, the [ORG] (zero point) and parameter "#343 #1_rfp" relation is incorrect. In other words, if the [ORG] (zero point) setting is smaller than parameter "#343 #1_rfp", the machine end stopper will exist between the basic machine coordinate system zero point and machine zero point. Thus, automatic initialization cannot be started. When [ORG] (zero point) is set to "0", the machine stopper direction will not be set, so the automatic initialization will not start.

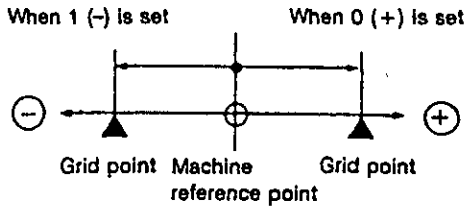


Explanatory diagram of when starting automatic initialization is not possible

[Reference point alignment method]

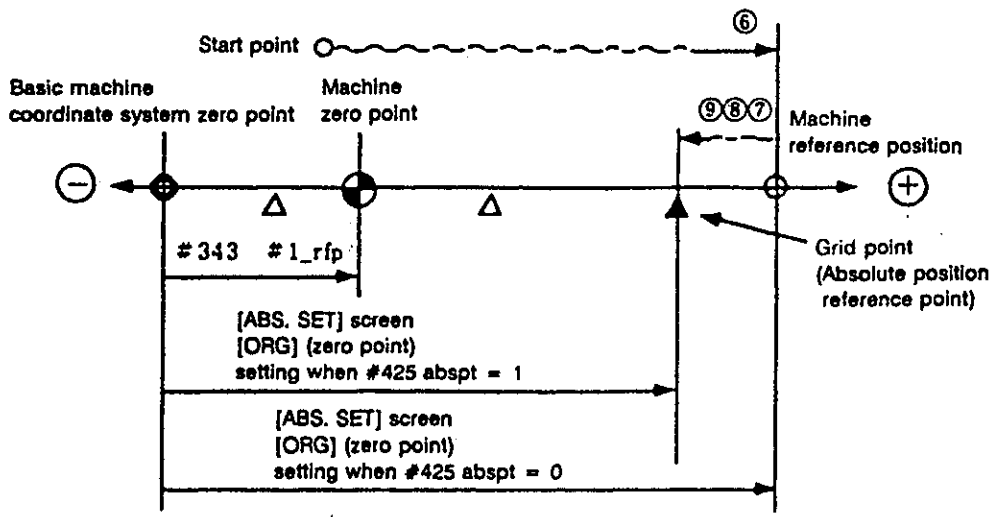
This method aligns the points with the machine reference point, and is operated with JOG feed.
The following parameter must be set before zero point initialization.

- #346 ABS_dir : Reference (–) direction
  The absolute position reference point (previous grid) direction looking from the machine reference point is set.



— Operation procedure —

Operation procedure	[STS.] display
1. Select the [ABS.SET] screen.	• [NG] will display when the absolute position is lost. • [COMP] will display when the absolute position is set.
2. Select the JOG mode.	
3. Confirm that the initialization method is set to [NO PUSH]. (The [ABS. SET] screen display is [NO PUSH].)	
4. Set "1" in [SET] on the [ABS.SET] screen.	[ORIGIN]
5. Set [ORG] on page 3 of the [ABS.SET] screen.	
6. Move the axis to the machine reference position with the JOG mode.	
7. Set "1" in [REF].	
8. Move the axis in the same direction as the sign in [EDG] on the [ABS.SET] screen.	[REF]
9. The axis will automatically stop when the first grid is reached. • The basic machine coordinate system will automatically be set. The absolute position is set at this state.	[COMP]



Reference point alignment operation diagram

(Note 1) "0" cannot be set for [SET] in the [ABS.SET] screen. This will be set to "0" when the power is turned ON again. When this display is set to "1", the message "SET" will appear on the operation status display section, and the point table operation and PLC operation will be interlocked.

(Note 2) [ORG] (zero point) can be set at any stage as long as [SET] is set to "1".

(Note 3) When executing zero point initialization, the grid point must be passed once after the power is turned ON. If the grid point has not been passed, "NOT PASSED" will display in [MAC]. In this case, return the axis to a point where the motor shaft will rotate one or more times, and then repeat from step 6.

(Note 4) If the first grid point is within the grid mask (parameter #338 grd_mask) during the reference point return in step 9, the axis will stop at the next grid point. Note that zero point shift (parameter #340 ZRNshift) is invalid.

CHAPTER 8 Servo Adjustment

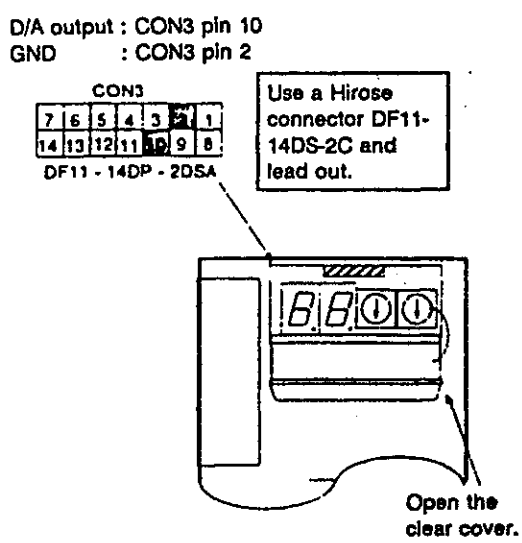
8.1 Measurement of data for adjustment

"Model E" has one channel built-in for the D/A converter that converts the various data in the controller to 0 to 10V analog data and outputs it. This is used for adjusting the servo system.

The D/A converted signals are output to connector CON1 located in the display and setting window. Refer to the diagram on the right for the pin assignments of connector CON1.

The signals measured by the D/A converter are selected with parameter SV031 (parameter No. #330). The scale of the output signal to the measured data is set with parameter SV032 (parameter No. #331).

#330SV.sv031 : Selection of measurement signal
#331SV.sv032 : Selection of output scale



[Setting of measurement data]

Data set in SV.sv031	Signal output from A/D converter
0	Test waveform (saw-tooth wave) Amplitude: 0 to 10V, Frequency: 228ms
1	Test waveform (square-wave) Amplitude: 2.5 to 7.5V, Frequency: 455ms
2	Speed feedback
3	Current feedback
4	Current command
5	Position droop 1
6	Position droop 2
7	Speed command

[Setting of output scale]

The output scale is set in parameter SV032.

The voltage expressed with the following expression is output to the D/A output.

$$\text{Analog output voltage (V)} = \text{Setting scale} \times \frac{\text{Output scale}}{256} \times 0.079 + 5$$

8.2 Characteristics improvement

8.2.1 Optimizing adjustment of cycle time

To adjust the cycle time, the following factors must be adjusted.

- Feedrate : The positioning speed is affected.
- Acceleration/deceleration time: Time to reach feedrate.
- In-position width : The completion time of the movement command to each point is affected.
- Position loop gain : The settling time of the movement command to each point is affected.

[Optimizing adjustment of feedrate and acceleration/deceleration time]

When shortening the acceleration/deceleration time, adjust with the following procedure.

- Adjustment item : Feedrate, acceleration/deceleration time (in point table)
- Confirmation data : MAXCUR2 in CT200 SV.MONI. screen.
- Confirmation method : Execute approximately five reciprocations, and confirm that MAXCUR2 does not exceed 300%.

[Setting of in-position width]

The servomotor drive has a response lag time, but a "stop settling time" is required for the motor to actually stop after the command speed reaches zero. The movement command to the next point is generated after it is confirmed that the machine is within the "in-position width" range.

Thus, the accuracy required for the machine must be set for the in-position width.

If the accuracy is too high, the cycle time will increase.

#306 SV.sv007: Set the in-position width with a μm unit.

8.2.2 Measures against vibration

If the vibration is irritating when the machine is touched by hand, or if vibration or abnormal noise occurs during feed, perform the following measures.

(1) Lower #310 SV.sv011 (speed loop gain) by 50 at a time.

(2) Set the machine resonance filter (parameter #328 SV.sv029).

- Measure the machine resonance frequency, and set the vibration frequency to be suppressed. (Valid range: 100 to 500Hz.)

CHAPTER 9 Maintenance and Inspection

9.1 Unit replacement

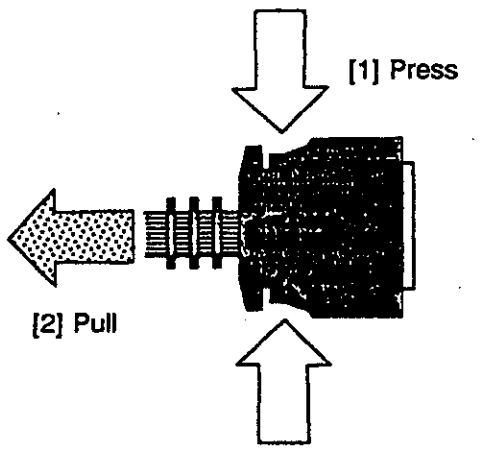
9.1.1 Preparation for unit replacement

Observe the following points when replacing the unit.

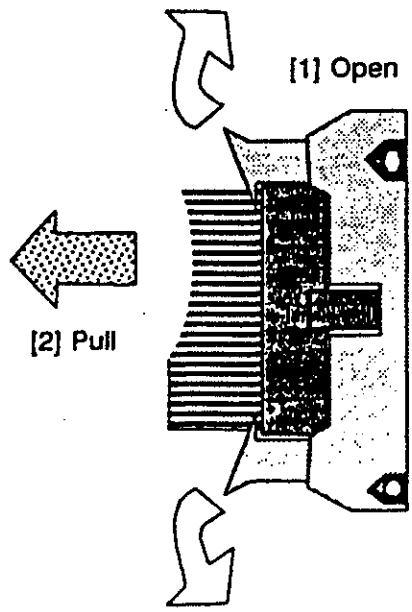
(1) Turn OFF the entire system power, including the power for the peripheral devices.
(2) When the power is turned OFF, a high voltage will still remain in the controller. Do not touch the unit's terminal block or regenerative resistor for at least three to four minutes after the power is turned OFF.
(3) Disconnect all cables connected to the unit.

If the work is done without turning the power OFF, the correct units or peripheral devices may be damaged, and the work will be hazardous.
If cables are connected, disconnect them with the following procedures.

For a connector having the following shape, press the connector with a thumb and forefinger in the direction of the arrow, and pull out.



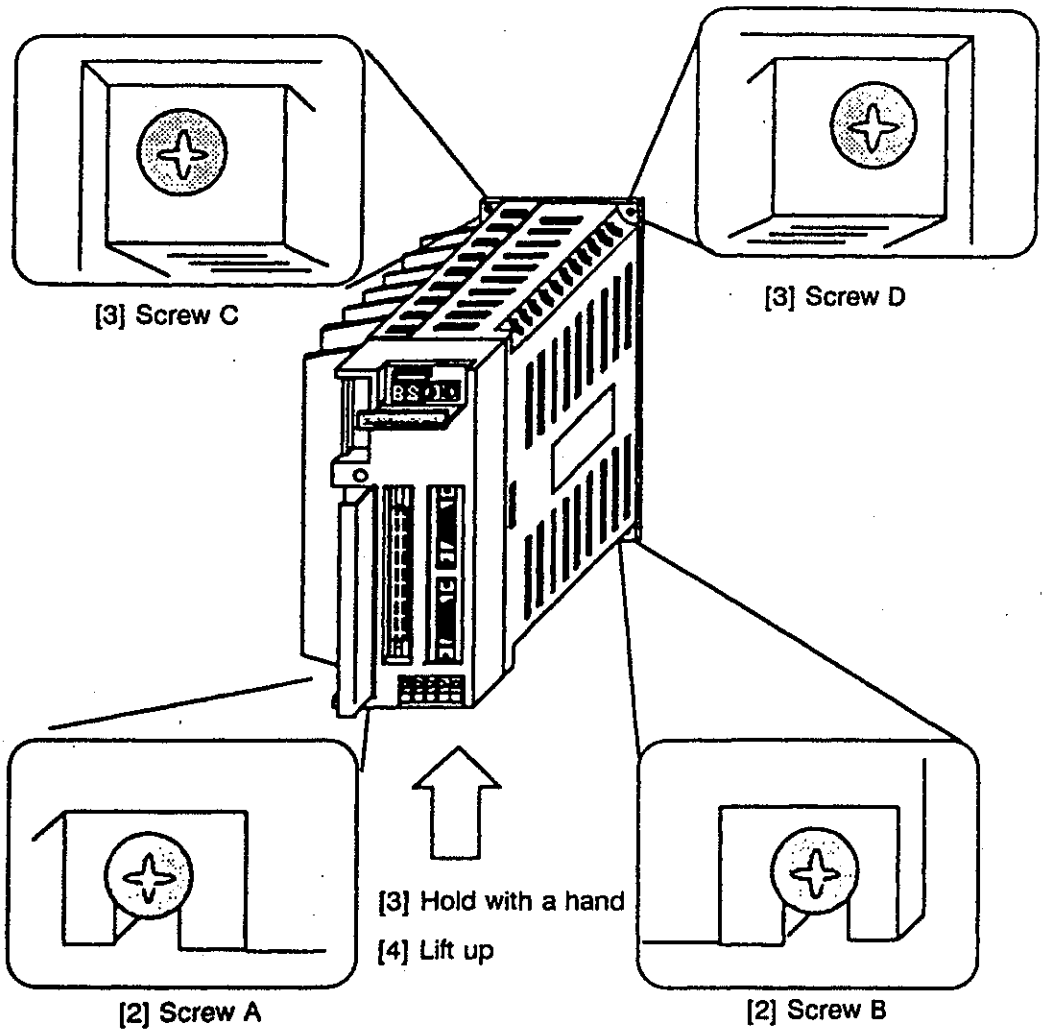
For the digital input/output (DIO) connector, open the clasps in the direction of the arrows, and then pull out.



9.1.2 Unit replacement method

The method for replacing the control unit is described below.

[1] Disconnect all cables on the front and bottom.
[2] Loosen screws A and B. (They do not need to be removed.)
[3] While holding the unit with a hand, remove screws C and D.
[4] Lift the unit upward.



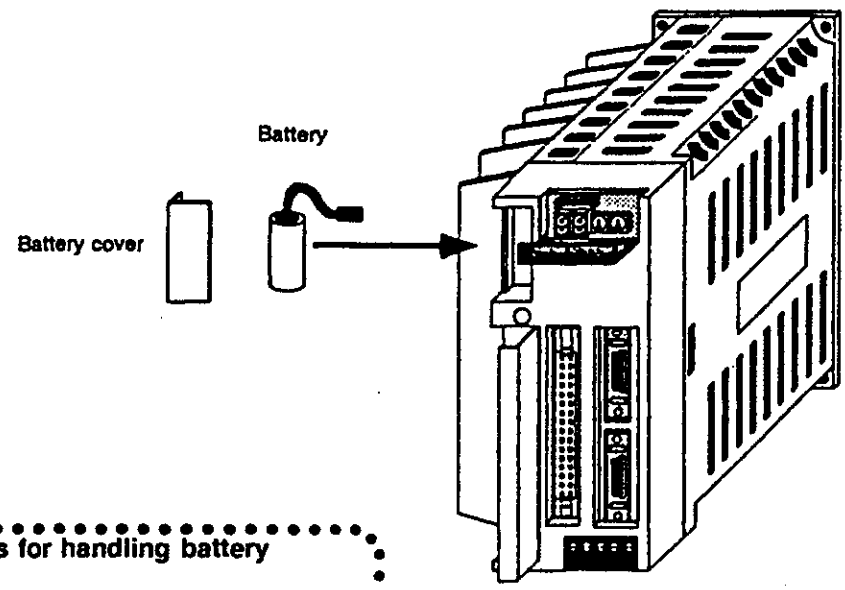
9.2 Battery replacement

The data such as parameters and machining programs that must be backed up while the power is OFF, is backed up with a lithium battery installed in a battery holder in the control unit.

Applicable battery	ER6 with connector (Toshiba-made for Mitsubishi specifications)
Initial battery voltage	3.6V
Voltage drop detection voltage	2.8V (Battery drop)
	2.6V (Battery error)
Battery backup time	5 years
	(At room temperature.
	The life will be shortened if the temperature is high.)
Life of battery itself	5 years

(Replace the battery if the battery drop is displayed. It will take approximately 100 hours at room temperature until the battery error is displayed. If the battery error displays, the internal data may be damaged.)
The control unit power must be turned OFF when replacing the battery. Replace the battery within 10 minutes after turning the power OFF. (If the battery is not connected within 10 minutes, the data being backed up may be destroyed.)

(1) Open the control unit's battery cover.
(2) Remove the battery from the battery holder.
(3) Pull out the connector connected to the battery from the PCB in the control unit.
(4) Insert the connector connected to the new battery into the connector on the unit's PCB.
(5) Place the battery in the battery holder.
(6) Close the battery cover.



Precautions for handling battery

- Do not disassemble the battery.
- Do not place the battery in fire or water.
- Do not pressurize or deform the battery.
- This is a primary battery, so do not charge it.
- Dispose of the used battery as industrial waste.

9.3 Troubleshooting

If a trouble occurs in the operation, the accurate cause must be found so that adequate measures can be taken. Perform the following check for this.
Confirm "when", "when doing what", "what kind of trouble" and "how frequently" the trouble occurred. Also check how many years the machine has been operated, and how many hours a day it is used.

(1) When?
- What time did the trouble occur?
- How long had passed after the power was turned ON?

(2) When doing what?
- What was the operation procedure?
- What were the operations before and after?
- What was the display unit screen?
- What was the peripheral device state?

(3) What kind of trouble?
- What was displayed on the controller display or teaching box CT200?

(4) How frequently?
- Does the trouble occur many times in a day?
- Does the trouble occur when the peripheral devices are operating?
- Does the same trouble occur when the same operation is done? Can the trouble be repeated?
- Does the same trouble occur when the conditions are changed?

(5) Others
- Are the cables bent or stepped on?
- Are the joints of the cables and connectors weak?
- Was a continuity test done on the cables?
- Are any of the terminal block or connector screws loose?
- Is any oil or cutting fluid splattering on the cables?
- Was a cable disconnected while the power was ON?
- Is any cable overheated?
  [Often most trouble occurs due to fluctuation in the power voltage or noise from the communication cable.]
- Is the power voltage always correct?
- Is the power frequency always correct?
- Does the voltage fluctuate depending on the time?
- Does the voltage drop momentarily when a peripheral device starts operation?
- Was there an instantaneous power failure before the trouble?
- Have measures against noise been taken for each unit?
- Are the communication and power system cables separated and laid?
- Is the communication cable shield sufficient?
  [The trouble may also occur due to sudden temperature changes or vibration and impact, although this is rare.]
- Are the ambient temperature and humidity adequate?
- Is the fan in the panel where the unit is stored running?
- Is the panel fixed on a flat and stable floor with little vibration?

9.4 Various alarm displays and measures

Various self-diagnosis functions are built into the Mitsubishi single-axis amplifier built-in controller Model-E. When these self-diagnosis functions detect an error, the alarm class code and alarm No. will be displayed on the teaching box's ALARM screen and the 7-segment LED on the upper front of the controller. The 7-segment LED will alternate in the order of [A][L] → No. of alarms → Alarm class → Alarm No. The alarm class and alarm No. corresponding to the detected error will be displayed on the teaching box CT200.

9.4.1 Alarm class

The alarms are classified as shown below.

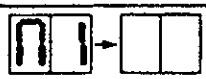
Class	Class code	Type	Example of display on teaching box CT200		Example of display on 7-segment LED	
					Alarm class display	Alarm No. display
Servo alarm	S01	Servo error	S01	0031		
	S02	Initial parameter error	S02	0037		
	S03	Servo error	S03	0046		
	S51	Parameter warning	S51	0093		
	S52	Servo warning	S52	00E4		
Operation	M01	Operation error	M01	0102		
Stop code	T01	Automatic start not possible	T01	0105		
	T02	Automatic operation off	T02	0202		
	T03	Block stop	T03	0301		
	T10	Waiting for completion	T10	0001		
System alarm	Z70	Absolute position illegal	Z70	0001		
	Z71	Detector error	Z71	0004		
	Z72	Position compare error	Z72	0003		
	Z73	Absolute position warning	Z73	0001		
	Z55	Remote I/O OFF	Z55			
	Z56	PLC ladder conversion error	Z56			
	Z57	Battery voltage drop	Z57	0001		
Emergency stop	EMG	Emergency stop	901	0005		
Point table	P	Program alarm	P21			

9.4.2 Explanation of servo alarms

No.		Item	Details	Stopping method	Reset
S1	13	Software process error	The software data process did not end within the correct time.	D	PR
	16	Magnet pole position detection error	One of the differential inputs U, V and W phase for the magnet pole position detection signal were both set to "H" or "L".	S	PR
	17	A/D converter error	The AD converter for current detection did not function correctly during initialization.	D	PR
	18	Serial detector initial communication error	An error occurred in the serial communication with the detector when the NC power was turned ON.	I	PR
	1F	Power PCB ID error	A different type of power PCB is registered.	I	PR
	20	No feedback signal	One of the differential inputs A, B and Z phase for the detector installed on the end of the motor were both "H" or "L".	D	PR
	25	Absolute position lost	The absolute position data in the absolute value detector was lost.	I	PR
	2B	Detector memory error	A data error was found in the circuit memory in the detector.	I	PR
	2C	Detector LED error	An error occurred in the LED in the detector.	D	PR
	2D	Detector data error	An error was found in the analog signal in the detector.	D	PR
	2F	Serial detector communication error	An error occurred in the serial communication with the detector.	D	PR
	30	Over-regeneration	Overheating of the regenerative resistor was detected.	S	PR
	31	Overspeed	The motor speed reached 1.2 times the rated speed.	S	PR
	32	Power module error	An overcurrent was detected in the IPM used in the main circuit of the servo drive.	D	PR
	33	Overvoltage	The bus-wire voltage in the driver exceeded 400V.	D	PR
	35	Data error	The movement command data from the NC is abnormally high.	S	PR
	3A	Overcurrent	An excessive current flowed to the motor.	D	PR
	3B	Power module overheat	Overheating of the IPM used in the main circuit of the servo drive was detected.	D	PR
	42	Feedback error 1	A pulse skip occurred in the detector feedback pulse.	S	PR
S2	37	Initial parameter error	An error was found in the parameter setting.	I	PR
S3	46	Motor overheat	The thermal protector for the motor or detector functioned.	S	NR
	50	Overload 1	The motor current flowed for the time that the overload detection level (parameter OLL) exceeded the overload time constant (parameter OLT).	S	NR
	51	Overload 2	A current command that is 95% or more of the max. output current continued for one second or more.	D	NR
	52	Excessive error 1 (servo ON)	The actual position in regard to the command exceeded the excessive error width 1 (parameter OD1) during servo ON.	D	NR
	53	Excessive error 2 (servo OFF)	The actual position in regard to the command exceeded the excessive error width 2 (parameter OD2) during servo OFF.	D	NR
S52	93	Initial absolute position fluctuation			PR
	9E	Multi-rotation counter warning			*
	9F	Battery voltage drop			*
	E3	Absolute position counter warning			*
S51	E4	Parameter error warning			*

(Note 1) Stop method S: Deceleration control stop D: Dynamic brake stop I: Initial alarm (before motor starts)
(Note 2) Reset PR: Power ON reset NR: System reset

9.4.3 Operation errors

M01 Operation error CT200 : M01 □□□□ (The display □□□□ is the alarm No.) Unit: 	Alarms caused by operation mistakes or machine trouble during operation are displayed.

Alarm No.		Details	Remedy
CT200	Unit		
0001	01	**Near-point insufficient axis found** During reference point return, the axis did not stop on the near-point dog and instead passed the dog.	• Increase the near-point dog length. • Delay the reference point return speed.
0002	02	**Z-phase not passed** The Z-phase was not passed during the initial reference point return after the power was turned ON.	• Move one detector rotation or more in the reverse direction of the reference point, and then re-attempt reference point return.
0003	03	**Reference point return direction illegal axis found** During manual reference point return, the axis was fed in the direction opposite the return direction.	• The selection of the axis selection keys – and + is incorrect. The error will be canceled when the axis is fed in the correct direction.
0004	04	**External interlock axis found** The interlock function is valid (interlock signal turned ON) and the interlock state was entered.	• The interlock function is validated, so invalidate it and then start operations. • Confirm the machine side sequence. • Check the interlock signal wire for breakage.
0005	05	**Internal interlock axis found** The internal interlock is applied.	• The servo OFF function is valid, so cancel it and then start again.
0006	06	**Hardware stroke end** The stroke end function is valid (input signal turned ON).	• The stroke end limit switch is functioning (is at stroke end), so move the machine with manual operations. • Check the stroke end signal wire for breakage. • Check the limit switch for faults.
0007	07	**Software stroke end** The stored stroke limit function is functioning.	• The machine is at the stroke end, so move it with manual operation. • If the stored stroke limit parameter setting is incorrect, reset it.
0024	24	**Absolute position alarm detected, zero point return not possible** The reference point return signal was input while an absolute position alarm was detected.	• Zero point return can be executed after the absolute position detection alarm is canceled.
0025	25	**Resetting zero point return, zero point return not possible** The reference point return signal was input during zero point initial reset in the absolute position detection system.	• Zero point return can be executed after zero point initialization is completed.

Alarm No.		Details	Remedy
CT200	Unit		
0101	101	**No operation mode** Override zero The cutting feed or rapid traverse override is set to zero.	• Check the input mode signal wire for breakage. • Check the mode selection switch for faults. • Confirm the sequence program.
0102	102	**External feedrate zero** The "manual feedrate" switch on the machine's operation panel is set to zero during jog mode and automatic dry run.	• The error will be canceled when the "feed override" switch is set to a setting other than zero. • If the setting of the "cutting feed override" switch is other than zero, check the signal wire for a short circuit. • Confirm the sequence program.
0103	103	**Block start interlock** The block start interlock signal is ON.	• The error will be canceled when the manual feedrate is set to a setting other than zero. • If the manual feedrate is set to a setting other than zero, check the signal wire connector for a short circuit. • Confirm the sequence program.
0109	109	**No command point No.** More than nine point Nos. were designated when starting PLC operation.	• Check the ON conditions for this signal in the PLC program (ladder). • Designate the point No. from 1 to 8.

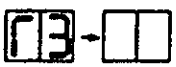
9.4.4 Controller stop causes

T01 Automatic operation not possible CT200 : T01 □□□□ (The display □□□□ is the alarm No.) Unit:	Automatic operation cannot be executed when attempted.

Alarm No.		Details	Remedy
CT200	Unit		
0102	02	**Ready OFF** Automatic start-up is not possible as the controller is not in the READY ON state.	• This is caused by another alarm, so remedy according to the respective alarm.
0103	03	**Resetting** Automatic start-up is not possible because the reset signal is input.	• Turn the reset input signal OFF. • Confirm the sequence program.
0104	04	**Automatic operation off signal ON** The "feed hold switch" on the machine operation panel is ON (valid).	• Review the "feed hold" switch. The feed hold switch is a B contact. • Check the feed hold signal wire for breakage. • Confirm the sequence program.
0107	07	**No operation mode** The automatic operation mode is not selected.	• Select the automatic operation mode (single-point, multi-point continuous). • Check the mode selection signal wire for short circuits (single-point, multi-point continuous) or for breakage.
0108	08	**Operation mode duplicate** Two or more automatic operation modes are selected.	• Check the mode selection signal wire for short circuits (single-point, multi-point continuous). • Check the switch for a fault. • Confirm the sequence program.
0109	09	**Operation mode change** Another automatic operation mode was entered from the automatic operation mode.	• Return to the original automatic operation mode and then execute automatic start-up.
0138	38	**Absolute position detection alarm, axis start not possible** The automatic start-up signal was input during an absolute position detection alarm.	• Cancel the absolute position detection alarm, and then execute automatic start-up.
0139	39	**Initializing zero point, start not possible** The automatic start signal was input during initialization of the zero point in the absolute position detection system.	• Start automatic operation after the absolute position zero point initialization is completed.
0150	50	**Command point No. illegal** More than nine point Nos. were designated when starting PLC operation.	• Designate the point No. from 1 to 8.

T02 Automatic operation off	The automatic operation was turned OFF for some reason during execution.
CT200 : T02 □□□□ (The display □□□□ is the alarm No.)	
Unit: 	

Alarm No.		Details	Remedy
CT200	Unit		
0201	01	**Hardware stroke end axis found** The axis is at the stroke end.	• Manually move the axis from the stroke end limit switch. • The point data must be corrected.
0202	02	**Software stroke end axis found** The axis is at the stored stroke limit.	• Manually move the axis. • The point table must be corrected.
0203	03	**Reset signal ON** Reset has been input.	• Operation has been interrupted, so designate the point No., and restart operation.
0204	04	**Automatic operation off signal ON** The "feed hold" switch is ON.	• Automatic operation can be resumed with the "cycle start" switch.
0205	05	**Operation mode change** The operation mode was changed to the manual mode during automatic operation.	• Return to the original automatic operation mode, and resume automatic operation with the "cycle start" switch.
0215	15	**Absolute position detection alarm stop** An absolute position detection alarm has occurred.	• Cancel the absolute position detection alarm.

T03 Block stop	After one point on the point table was executed during automatic operation, the program stopped.
CT200 : T03 □□□□ (The display □□□□ is the alarm No.)	
Unit: 	

Alarm No.		Details	Remedy
CT200	Unit		
0301	01	**Continuous operation OFF** The continuous operation OFF switch on the machine operation panel is OFF.	• Turn the start switch ON to resume automatic operation.
0303	03	**Automatic mode change** Another automatic operation mode was entered from the automatic operation mode.	• Return to the original automatic operation mode and then resume automatic operation with the start switch.
0304	04	**Point string program end**	

T10 Waiting for completion CT200 : T10 □□□□ (The display □□ is the wait status) Unit:	This indicates that the completion of one point on the point table is being waited for during automatic operation.

0 0 □□

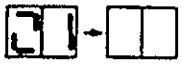
Status No.	0	1	2	3	4	5	6	7
M function completion wait		O		O		O		O
Deceleration wait			O	O			O	O

Status No.	0	1
Executing timer		O

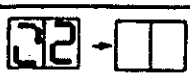
9.4.5 System alarm

Z70 Absolute position illegal CT200 : Z70 □□□□ (The display □□□□ is the alarm No.) Unit:	These alarms are displayed when the absolute position data in the absolute position detection system has been lost.

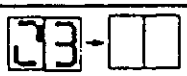
Alarm No.		Details	Remedy
CT200	Unit		
0001	01	Zero point initialization is not completed.	• Execute zero point initialization.
0002	02	The absolute position reference point data registered by the controller has been lost.	• Input the parameter tape and turn the power ON again. If this alarm goes out when the power is turned ON, and the actual machine position and machine value indicated by the NC are the same, the absolute position has been correctly restored. • If the correct absolute position cannot be restored with the above procedure, execute zero point initialization.
0003	03	The parameters used to detect the absolute position have been changed or lost.	• Correctly set the parameters, turn the power ON, and then execute zero point initialization.
0004	04	The grid point was not reached with the zero point initialization operation, and the initialization was not completed.	• Set "0" in #0 [ABS. SET] of the [ABS.POS] screen, and then execute zero point initialization.
0005	05	The alarm was canceled with parameter input.	• Turn the power ON again.

Z71 Detector error	These alarms are displayed when a detector error is detected in the absolute position detection system.
CT200 : Z71 □□□□ (The display □□□□ is the alarm No.)	
Unit: 	

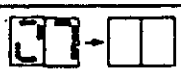
Alarm No.		Details	Remedy
CT200	Unit		
0001	01	The power voltage for the absolute position counter memory in the absolute position detector has dropped to 2.3±0.2V or less. This is the voltage of the capacitor in the detector instead of the battery in the controller.	• After removing the cause of the alarm, execute zero point initialization.
0004	04	The absolute position was moved during absolute position configuration.	

Z72 Position compare error	These alarms are displayed when the detector absolute position and controller coordinates are compared and an error is detected in the absolute position detection system.
CT200 : Z72 □□□□ (The display □□□□ is the alarm No.)	
Unit: 	

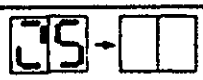
Alarm No.		Details	Remedy
CT200	Unit		
0001	01	An error occurred when comparing the position during "M90" reference point return.	• Using the handle, move two or more grids. If the "Z71 Detector error 0003" occurs, the detector is faulty. If this alarm does not occur, check the tolerable value parameter. (Parameter # "M90width" and # "M92width".) If this parameter is small, the alarm will occur depending on the combination with the machine. Change the value to a larger value, and turn the power ON again. (Note that the maximum value is the value set in parameter #306 "sv007".)
0002	02	An error occurred when comparing the position during "M92" execution.	

Z73 Absolute position warning CT200 : Z73 □□□□ (The display □□□□ is the alarm No.) Unit: 	This indicates a warning in the absolute position detection system.

Alarm No.		Details	Remedy
CT200	Unit		
0001	01	The data holding voltage in the absolute position detector dropped to 2.8V or less.	• Check the detector cable for breakage.
0003	03	**Absolute position counter warning** The contents of the absolute position counter have been destroyed due to a controller battery error or detector cable breakage, etc.	

Z57 Battery voltage drop CT200 : Z57 00□□ (The display 00□□ is the alarm No.) Unit: 	The voltage of the battery for saving various data in the controller has dropped.

Alarm No.		Details	Remedy
CT200	Unit		
0001	01	Battery warning	• Replace the battery.
0003	03	**Battery alarm** The backup data is destroyed.	• Replace the battery. • Re-input the parameters, point data and user PLC program.

Z55 Remote I/O OFF CT200 : Z55 00□□ (The display 00□□ is the alarm No.) Unit: 	This displays when communication with the remote I/O unit is not possible.

Alarm No.		Details	Remedy
CT200	Unit		
0001	01	Communication with the remote I/O unit has been cut off.	• Check the remote I/O connection cable and remote I/O power supply.

Z56 Ladder conversion error	This displays when a PLC ladder program not within the specifications range has been transmitted.
CT200 : Z56 00□□ (The display 00□□ is the alarm No.)	
Unit: 	

Alarm No.		Details	Remedy
CT200	Unit		
0001	01	A device that cannot be used is being used.	• Remove the device that cannot be used.
0002	02	There is a device that is exceeding the usage range.	• Correct the device to the range that can be used.
0003	03	Both of the above items have occurred.	• Enforce both of the items above.

9.4.6 Emergency stop causes

EMG Emergency stop	This indicates the emergency stop cause.
Display (The display □□□□ is the alarm No.)	
CT200: EMG 00□□	
Unit: 91 → □□	

0□□ Alarm No.

○ : Alarm cause

Alarm No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
									○	○	○	○	○	○	○	○
					○	○	○	○					○	○	○	○
Battery alarm			○	○			○	○			○	○			○	○
PLC stop		○		○		○		○		○		○		○		○

Alarm No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
									○	○	○	○	○	○	○	○
PLC emergency stop					○	○	○	○					○	○	○	○
			○	○			○	○			○	○			○	○
External emergency stop		○		○		○		○		○		○		○		○

Alarm No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
									○	○	○	○	○	○	○	○
					○	○	○	○					○	○	○	○
Servo alarm 2			○	○			○	○			○	○			○	○
Servo alarm 1		○		○		○		○		○		○		○		○

Emergency stop cause	Details	Remedy
Servo alarm 2	The servo alarm "S" Servo error:NR" has occurred.	• Remove the cause of the alarm, and then cancel the alarm with the reset key.
Servo alarm 1	The servo alarm "S" Servo error:PR" has occurred.	• Remove the cause of the alarm, and then cancel the alarm by turning the power OFF and ON.
User PLC emergency stop	Emergency stop was input from the user PLC.	• This alarm is limited to when the user PLC is being used. The PC emergency stop input signal (Y21F) was input from the I/F screen.
External emergency stop	External emergency stop was input.	• Confirm the external emergency stop signal. (Confirm whether X9 is input on the I/F screen.)
PLC stop	The user PLC has stopped.	• Confirm that the rotary switch in the display and setting window is set to "0".

9.4.7 Point table definition error

Error No.		Details	Remedy
CT200	Unit		
P10	P0 10	**Point table error** The point table is not correct.	• Review the program.
P11	P0 11	**Command value over** The point data setting range was exceeded.	• Review the point data.
P21	P0 21	**No speed command** The feedrate command is not input.	• Command the speed.
P30	P0 30	**Reference point return incomplete** Zero point return has not been executed.	• Execute reference point return.

9.4.8 Setting error

Error No.		Details
CT200		
E01	Setting error	• The setting data is inadequate. When alphabetic characters have been input when only numerals can be input, etc. • The data was input without setting the setting No. (#).
E02	Data range over	• The setting data exceeds the setting range.
E05	In PLC RUN	• The PLC program cannot be edited or input during PLC execution.
E21	Setting not possible during operation	• Data change for the parameters, etc., was attempted during operation.
E24	In PLC RUN	• The PLC program was input while the PLC was not stopped.
E84	Data illegal	• The correct parameters were not memorized by the CT200 during CT200 parameter read.
E89	Transmission error	• A non-measurable error occurred when writing the parameters to the teaching box CT200.
E92	Communication error EEPROM defect	• The EEPROM in the teaching box CT200 is defective. • An error occurred in the communication data between the teaching box CT200 and controller.

[Memo]

APPENDIXES

Appendix 1 Controller Specifications

[Configuration of controller and related unit types and names]

FCUA – MP10 – 01

- Output capacity (Only for controller)
  - 01 : 100W class
  - 03 : 300W class
  - 06 : 600W class
  - 10 : 1000W class
  - 20 : 2000W class
- MP10 : Mitsubishi single-axis amplifier built-in controller Model E series
- CT200 : Teaching box
- DX100 : Remote I/O unit

Table of servomotor, regenerative resistor and controller combinations

: Standard : Option

			Controller type FCUA-MP10-				
			01	03	06	10	20
Servomotor	Ultra-low inertia HA-ME series	HA-ME053	50W				
		HA-ME13	100W				
		HA-ME23		200W			
		HA-ME43		400W			
		HA-ME73			750W		
	Low inertia HA-FE/FH series	HA-FE/FH053	50W				
		HA-FE/FH13	100W				
		HA-FE/FH23		200W			
		HA-FE/FH33		300W			
		HA-FE/FH43			400W		
		HA-FE/FH63			600W		
	Medium inertia HA-SE/SH 1000r/min. series	HA-SE/SH81			850W		
		HA-SE/SH121				1200W	
		HA-SE/SH201					2000W
	Medium inertia HA-SE/SH 2000r/min. series	HA-SE/SH52			500W		
		HA-SE/SH102				1000W	
		HA-SE/SH152				1500W	
		HA-SE/SH202					2000W
	Medium inertia HA-SE/SH 3000r/min series	HA-SE/SH53			500W		
		HA-SE/SH103				1000W	
		HA-SE/SH153				1500W	
		HA-SE/SH203					2000W
Regenerative resistor			Regeneration times (times/min.)				
	None (capacitor regeneration)		Note 1				
	MR-RB013			150	70		
	MR-RB033			450	200		
	MR-RB033 (Two in parallel)					64	25

Note 1) There is no limit to the regeneration frequency is the execution torque is within the rated torque range.

[General Specifications]

Type FCUA			MP10-01	MP10-03	MP10-06	MP10-10	MP10-20	DX100	CT200
AC power supply	Voltage/frequency		3-phase AC200~230V 50/60Hz					—	—
	Tolerable voltage fluctuation		AC170~253V (50/60Hz)					—	—
	Tolerable frequency fluctuation		Within ±5%					—	—
	Power facility capacity	(kVA)	0.3	0.7	1.1	1.7	3.5	—	—
DC power supply	Voltage		DC24V						—
	Tolerable voltage fluctuation		Within ±5%						—
	Ripple		±5% (p – p)						—
	Power capacity		1A (Note 2)					Note 3)	Note 4)
Continuous output current		(Arms)	1.4	3.0	5.0	8.8	14.0	—	—
Maximum output current		(Arms)	3.9	8.1	17.0	28.0	42.0	—	—
Control method			Sinusoidal wave PWM control					—	—
Regeneration method			Capacitor regenera-tion	External resistor regeneration				—	—
	Regenerative resistor type	Standard	Note 1)	MR-RB013		MR-RB033 Two in parallel		—	—
		Option		MR-RB033				—	—
	Tolerable regeneration frequency (times/min.)	Standard	Note 1)	150	70	64	25	—	—
		Option		450	200			—	—
Recommended load moment of inertia			10 times or less of motor moment of inertia (Note, when using for a machine tool, 2.5 times or less of motor moment of inertia.)					—	—
Environment	Ambient temperature		0 to +55°C (with no freezing), storage: –20 to +65°C						
	Ambient humidity		90%RH or less (with no dew condensation)						
	Atmosphere		No corrosive gases or dust						
	Altitude		1000m or less						
	Vibration		5.9m/s (0.6G) or less						
Structure			Open type (in-panel cooling method)						Fully closed type

Note 1) There is no limit to the regeneration frequency is the execution torque is within the rated torque range.
Note 2) This is the power for driving the external devices such as the relays, connected to the digital input/output interface.
Note 3) Maintain a capacity that ensures 0.7A (internal control circuit) + 2.25A (total of current consumed by connected relays, etc.)
Note 4) The power is supplied from the controller (FCUA-MP10). A power supply device does not need to be prepared specially.

Appendix 2.1 Parameter List

Parameter No.	Display title	Parameter details	Initial value
#100	limit⁺	Soft limit + side	1.000
#101	limit⁻	Soft limit – side	1.000
#102	DegtypeM	Dog-type per time manual reference point return	0
#200	R short	Rotary axis short cut	0
#300	SV.sv 001	Servo parameter SPEC	0000
#301	SV.sv 002	Servo parameter MTYPE	337C
#302	SV.sv 003	Servo parameter PC1 : Motor side gear ratio	1
#303	SV.sv 004	Servo parameter PC2 : Machine side gear ratio	1
#304	SV.sv 005	Servo parameter PIT. : Ball screw pitch	10
#305	SV.sv 006	Servo parameter (Not used)	0
#306	SV.sv 007	Servo parameter INP : In-position detection width	50
#307	SV.sv 008	Servo parameter EMGt	500
#308	SV.sv 009	Servo parameter PGN1 : Position loop gain	33
#309	SV.sv 010	Servo parameter PGN2 : Set 4-times PGN1 when using SHG	0
#310	SV.sv 011	Servo parameter VGN : Speed loop gain	15
#311	SV.sv 012	Servo parameter VIA : Speed loop advance compensation	682
#312	Sv.sv 013	Servo parameter IQA : q axis current loop advance compensation	2048
#313	SV.sv 014	Servo parameter IDA : d axis current loop advance compensation	2048
#314	SV.sv 015	Servo parameter IQG : q axis current loop gain	512
#315	SV.sv 016	Servo parameter IDG : d axis current loop gain	512
#316	SV.sv 017	Servo parameter IL0 : Current limit (normal)	500
#317	SV.sv 018	Servo parameter IL1 : Initialization stopper current limit	500
#318	SV.sv 019	Servo parameter IL2 : Current limit 1	500
#319	SV.sv 020	Servo parameter IL3 : Current limit 2	500
#320	SV.sv 021	Servo parameter OD0 : Excessive error width (normal)	5
#321	SV.sv 022	Servo parameter OD1 : Excessive error width during stopper	5
#322	SV.sv 023	Servo parameter OD2 : Excessive error width 1	5
#323	SV.sv 024	Servo parameter OD3 : Excessive error width 2	5
#324	SV.sv 025	Servo parameter ODS : Excessive error width during servo OFF	5
#325	SV.sv 026	Servo parameter (Not used)	0
#326	SV.sv 027	Servo parameter (Not used)	0
#327	SV.sv 028	Servo parameter (Not used)	0
#328	SV.sv 029	Servo parameter FHz	0
#329	SV.sv 030	Servo parameter SSF	0
#330	SV.sv 031	Servo parameter DACH : D/A output selection	0
#331	SV.sv 032	Servo parameter DAMP : D/A output scale	0

Parameter No.	Display title	Parameter details	Initial value
#332	speed 1	Speed designation 1 (Clamp speed)	2000
#333	speed 2	Speed designation 2	1000
#334	speed 3	Speed designation 3	1000
#335	speed 4	Speed designation 4	1000
#336	ZRN speed	Reference point return speed	2000
#337	ZRN creep	Reference point return creep speed	100
#338	grd mask	Grid mask amount	0
#339	grspc	Grid interval	0
#340	ZRN shift	Reference point shift amount	0
#341	OT^+	Overtravel + side	1000
#342	OT^-	Overtravel – side	10.000
#343	#1_rfp	Machine coordinate system offset	0
#344	ABS Dog	Absolute position detection Parameter dog-type initialization	0
#345	ABS stopr	No stopper	0
#346	ABS dir	Reference point Z direction	0
#347	M90 width	Reference point return compare width	50
#348	M02 width	M02 compare width	50
#349	push F	Automatic initialization stopper speed	100
#350	approach	Automatic initialization approach amount	10.000
#351	ABScheck	Power off movement tolerable value	0.000
#352	$nearref^+$	Zero point near-width + side	10.000
#353	nearref	Zero point near-width – side	10.000
#354	noref	No zero point	0
#355	abson	Absolute position detection	1
#356	dir(-)	Reference point direction –	0
#357	svof	Servo OFF error correction	0
#358	rotary	Rotary axis	0
#359	ccw	Motor polarity CCW	0
#360	smgst	Acceleration/deceleration pattern timing	1
#361	time.L	Linear acceleration/deceleration time constant	70
#362	time. S2	Soft acceleration/deceleration time constant 2	1
#363	time. S3	Soft acceleration/deceleration time constant 3	0
#364	time. EXP	(Soft acceleration/deceleration time constant)	100
#365	backlash	Backlash	0
#400	PSW1 dog1	PSW1 Area 1	0
#401	PSW1 dog2	PSW1 Area 2	0
#402	PSW1 chck	PSW1 Area judgment FB method	0
#403	PSW2 dog1	PSW2 Area 1	0
#404	PSW2 dog2	PSW2 Area 1	0
#405	PSW2 chck	PSW2 Area judgment FB method	0
#406	PSW3 dog1	PSW3 Area 1	0
#407	PSW3 dog2	PSW3 Area 2	0
#408	PSW3 chck	PSW3 Area judgment FB method	0

Parameter No.	Display title	Parameter details	Initial value
#409	PSW4 dog1	PSW4 Area 1	0
#410	PSW4 dog2	PSW4 Area 2	0
#411	PSW4 chck	PSW4 Area judgment FB method	0
#412	PSW5 dog1	PSW5 Area 1	0
#413	PSW5 dog2	PSW5 Area 2	0
#414	PSW5 chck	PSW5 Area judgment FB method	0
#415	PSW6 dog1	PSW6 Area 1	0
#416	PSW6 dog2	PSW6 Area 2	0
#417	PSW6 chck	PSW6 Area judgment FB method	0
#418	PSW7 dog1	PSW7 Area 1	0
#419	PSW7 dog2	PSW7 Area 2	0
#420	PSW7 chck	PSW7 Area judgment FB method	0
#421	PSW8 dog1	PSW8 Area 1	0
#422	PSW8 dog2	PSW8 Area 2	0
#423	PSW8 chck	PSW8 Area judgment FB method	0
#424	cunit	Input setting unit	0
#425	abspt	Absolute position detection Reference point parameter reference selection	0
#426	lang	Display language selection	0
#500	plcCst016	PLC constant 16	0
#501	plcCst015	PLC constant 15	0
#502	plcCst014	PLC constant 14	0
#503	plcCst013	PLC constant 13	0
#504	plcCst012	PLC constant 12	0
#505	plcCst011	PLC constant 11	0
#506	plcCst010	PLC constant 10	0
#507	plcCst009	PLC constant 9	0
#508	plcCst008	PLC constant 8	0
#509	plcCst007	PLC constant 7	0
#510	plcCst006	PLC constant 6	0
#511	plcCst005	PLC constant 5	0
#512	plcCst004	PLC constant 4	0
#513	plcCst003	PLC constant 3	0
#514	plcCst002	PLC constant 2	0
#515	plcCst001	PLC constant 1	0
#516	plc T 103	PLC timer 103	0
#517	plc T 102	PLC timer 102	0
#518	plc T 101	PLC timer 101	0
#519	plc T 100	PLC timer 100	0
#520	plc T 099	PLC timer 99	0
#521	plc T 098	PLC timer 98	0
#522	plc T 097	PLC timer 97	0
#523	plc T 096	PLC timer 96	0
#524	plc T 095	PLC timer 95	0

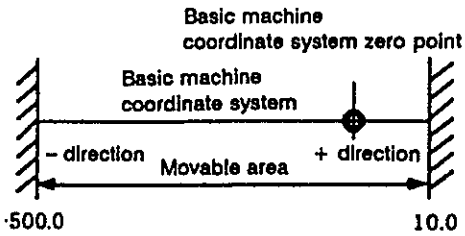
Parameter No.	Display title	Parameter details	Initial value
#525	plc T 094	PLC timer 94	0
#526	plc T 093	PLC timer 93	0
#527	plc T 092	PLC timer 92	0
#528	plc T 091	PLC timer 91	0
#529	plc T 090	PLC timer 90	0
#530	plc T 089	PLC timer 89	0
#531	plc T 088	PLC timer 88	0
#532	plc T 087	PLC timer 87	0
#533	plc T 086	PLC timer 86	0
#534	plc T 085	PLC timer 85	0
#535	plc T 084	PLC timer 84	0
#536	plc T 083	PLC timer 83	0
#537	plc T 082	PLC timer 82	0
#538	plc T 081	PLC timer 81	0
#539	plc T 080	PLC timer 80	0
#540	plc T 079	PLC timer 79	0
#541	plc T 078	PLC timer 78	0
#542	plc T 077	PLC timer 77	0
#543	plc T 076	PLC timer 76	0
#544	plc T 075	PLC timer 75	0
#545	plc T 074	PLC timer 74	0
#546	plc T 073	PLC timer 73	0
#547	plc T 072	PLC timer 72	0
#548	plc T 071	PLC timer 71	0
#549	plc T 070	PLC timer 70	0
#550	plc T 069	PLC timer 69	0
#551	plc T 068	PLC timer 68	0
#552	plc T 067	PLC timer 67	0
#553	plc T 066	PLC timer 66	0
#554	plc T 065	PLC timer 65	0
#555	plc T 064	PLC timer 64	0
#556	plc T 063	PLC timer 63	0
#557	plc T 062	PLC timer 62	0
#558	plc T 061	PLC timer 61	0
#559	plc T 060	PLC timer 60	0
#560	plc T 059	PLC timer 59	0
#561	plc T 058	PLC timer 58	0
#562	plc T 057	PLC timer 57	0
#563	plc T 056	PLC timer 56	0
#564	plc T 055	PLC timer 55	0
#565	plc T 054	PLC timer 54	0
#566	plc T 053	PLC timer 53	0
#567	plc T 052	PLC timer 52	0

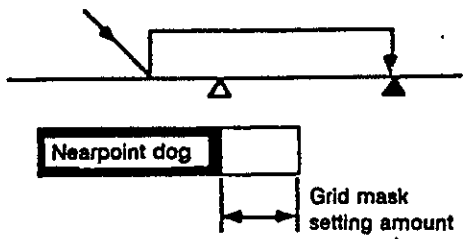
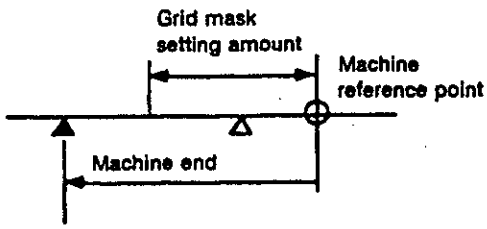
Parameter No.	Display title	Parameter details	Initial value
#568	plc T 051	PLC timer 51	0
#569	plc T 050	PLC timer 50	0
#570	plc T 049	PLC timer 49	0
#571	plc T 048	PLC timer 48	0
#572	plc T 047	PLC timer 47	0
#573	plc T 046	PLC timer 46	0
#574	plc T 045	PLC timer 45	0
#575	plc T 044	PLC timer 44	0
#576	plc T 043	PLC timer 43	0
#577	plc T 042	PLC timer 42	0
#578	plc T 041	PLC timer 41	0
#579	plc T 040	PLC timer 40	0
#580	plc T 039	PLC timer 39	0
#581	plc T 038	PLC timer 38	0
#582	plc T 037	PLC timer 37	0
#583	plc T 036	PLC timer 36	0
#584	plc T 035	PLC timer 35	0
#585	plc T 034	PLC timer 34	0
#586	plc T 033	PLC timer 33	0
#587	plc T 032	PLC timer 32	0
#588	plc T 031	PLC timer 31	0
#589	plc T 030	PLC timer 30	0
#590	plc T 029	PLC timer 29	0
#591	plc T 028	PLC timer 28	0
#592	plc T 027	PLC timer 27	0
#593	plc T 026	PLC timer 26	0
#594	plc T 025	PLC timer 25	0
#595	plc T 024	PLC timer 24	0
#596	plc T 023	PLC timer 23	0
#597	plc T 022	PLC timer 22	0
#598	plc T 021	PLC timer 21	0
#599	plc T 020	PLC timer 20	0
#600	plc T 019	PLC timer 19	0
#601	plc T 018	PLC timer 18	0
#602	plc T 017	PLC timer 17	0
#603	plc T 016	PLC timer 16	0
#604	plc T 015	PLC timer 15	0
#605	plc T 014	PLC timer 14	0
#606	plc T 013	PLC timer 13	0
#607	plc T 012	PLC timer 12	0
#608	plc T 011	PLC timer 11	0
#609	plc T 010	PLC timer 10	0
#610	plc T 009	PLC timer 9	0

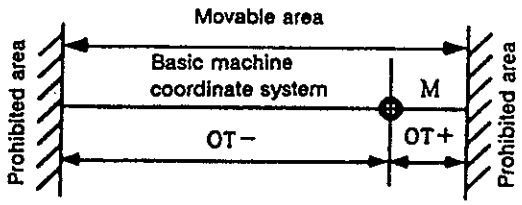
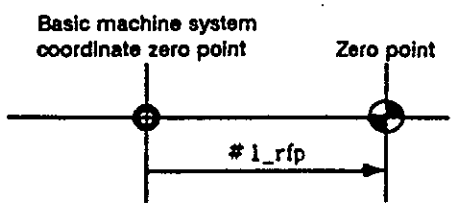
Parameter No.	Display title	Parameter details	Initial value
#611	plc T 008	PLC timer 8	0
#612	plc T 007	PLC timer 7	0
#613	plc T 006	PLC timer 6	0
#614	plc T 005	PLC timer 5	0
#615	plc T 004	PLC timer 4	0
#616	plc T 003	PLC timer 3	0
#617	plc T 002	PLC timer 2	0
#618	plc T 001	PLC timer 1	0
#619	plc T 000	PLC timer 0	0
#620	plc C 023	PLC counter 23	0
#621	plc C 022	PLC counter 22	0
#622	plc C 021	PLC counter 21	0
#623	plc C 020	PLC counter 20	0
#624	plc C 019	PLC counter 19	0
#625	plc C 018	PLC counter 18	0
#626	plc C 017	PLC counter 17	0
#627	plc C 016	PLC counter 16	0
#628	plc C 015	PLC counter 15	0
#629	plc C 014	PLC counter 14	0
#630	plc C 013	PLC counter 13	0
#631	plc C 012	PLC counter 12	0
#632	plc C 011	PLC counter 11	0
#633	plc C 010	PLC counter 10	0
#634	plc C 009	PLC counter 9	0
#635	plc C 008	PLC counter 8	0
#636	plc C 007	PLC counter 7	0
#637	plc C 006	PLC counter 6	0
#638	plc C 005	PLC counter 5	0
#639	plc C 004	PLC counter 4	0
#640	plc C 003	PLC counter 3	0
#641	plc C 002	PLC counter 2	0
#642	plc C 001	PLC counter 1	0
#643	plc C 000	PLC counter 0	0
#644	plc bit 32	PLC bit selection 32	00000000
#645	plc bit 31	PLC bit selection 31	00000000
#646	plc bit 30	PLC bit selection 30	00000000
#647	plc bit 29	PLC bit selection 29	00000000
#648	plc bit 28	PLC bit selection 28	00000000
#649	plc bit 27	PLC bit selection 27	00000000
#650	plc bit 26	PLC bit selection 26	00000000
#651	plc bit 25	PLC bit selection 25	00000000
#652	plc bit 24	PLC bit selection 24	00000000
#653	plc bit 23	PLC bit selection 23	00000000

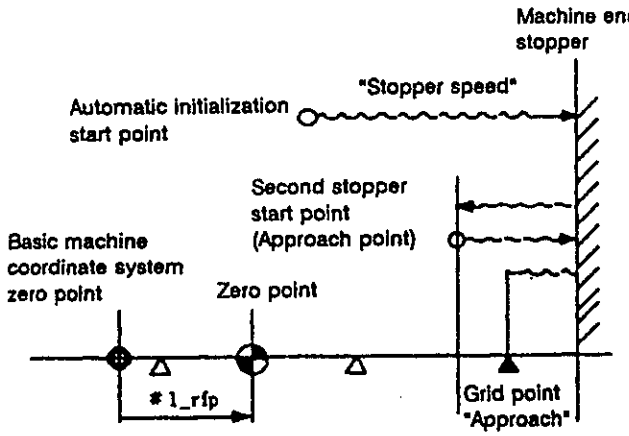
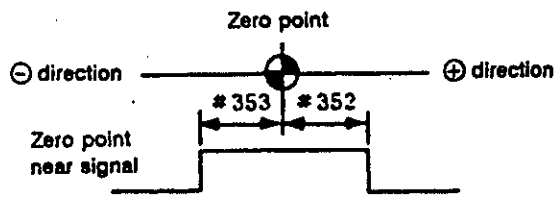
Parameter No.	Display title	Parameter details	Initial value
#654	plc bit 22	PLC bit selection 22	00000000
#655	plc bit 21	PLC bit selection 21	00000000
#656	plc bit 20	PLC bit selection 20	00000000
#657	plc bit 19	PLC bit selection 19	00000000
#658	plc bit 18	PLC bit selection 18	00000000
#659	plc bit 17	PLC bit selection 17	00000000
#660	plc bit 16	PLC bit selection 16	00000000
#661	plc bit 15	PLC bit selection 15	00000000
#662	plc bit 14	PLC bit selection 14	00000000
#663	plc bit 13	PLC bit selection 13	00000000
#664	plc bit 12	PLC bit selection 12	00000000
#665	plc bit 11	PLC bit selection 11	00000000
#666	plc bit 10	PLC bit selection 10	00000000
#667	plc bit 9	PLC bit selection 9	00000000
#668	plc bit 8	PLC bit selection 8	00000000
#669	plc bit 7	PLC bit selection 7	00000000
#670	plc bit 6	PLC bit selection 6	00000000
#671	plc bit 5	PLC bit selection 5	00000000
#672	plc bit 4	PLC bit selection 4	00000000
#673	plc bit 3	PLC bit selection 3	00000000
#674	plc bit 2	PLC bit selection 2	00000000
#675	plc bit 1	PLC bit selection 1	00000000

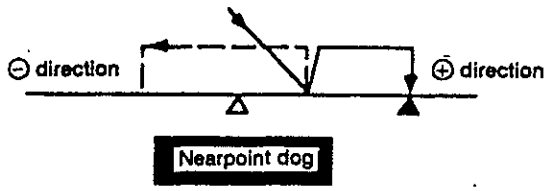
Appendix 2.2 Parameter Explanation Table

<table>
<tr><th>Parameter No.</th><th>Display title</th><th>Details</th><th>Setting range (unit)</th></tr>
<tr><td>#100
#101</td><td>limit⁺
limit⁻</td><td>The movable range in the negative and positive directions from the basic machine coordinate system is set per axis.
<Example> #100 = 10.000 #101 = 500.000
 
</td><td>±99999.999(mm)
This function will be invalidated if the same value (other than 0) is set for #100 and #101.
(Example)
#100 = 1.000
#101 = 1.000</td></tr>
<tr><td>#102</td><td>DogtypeM</td><td>(1) For incremental detection system
The manual reference point return method is set.
(2) For dog-type absolute position detection system
The manual reference point return method is set.
Normally 0 is set. Reference point return when zero point initialization is incomplete will be the dog-type regardless of this parameter. If initialization is to be executed again after being completed once, change this setting to 1, and execute reference point return.
(Note) This parameter is invalid for the dog-less absolute position detection system.</td><td>0:High-speed return
1:Dog-type return</td></tr>
<tr><td>#200</td><td>R short</td><td>The validity of short cut control is set for the rotary axis specifications.
If short cut is valid, the positioning direction within ±180° will be automatically determined in regard to the coordinates commanded in the point string data, and positioning will be executed.</td><td>0: Invalid
1: Valid</td></tr>
<tr><td>#332
#333
#334
#335</td><td>speed1
speed2
speed3
speed4</td><td>The speed parameters are set.
When –1 to –4 is set in the point table feedrate, the corresponding parameter speed will be selected as the effective speed.
<table>
<tr><th>Point table setting value</th><th>Effective speed</th></tr>
<tr><td>–1</td><td>speed1</td></tr>
<tr><td>–2</td><td>speed2</td></tr>
<tr><td>–3</td><td>speed3</td></tr>
<tr><td>–4</td><td>speed4</td></tr>
</table>
In the manual mode, if the parameter speed selection method signal is validated, the parameter speed is selected as the manual feedrate.
<table>
<tr><th>Speed parameter selection signal</th><th>Effective manual feedrate</th></tr>
<tr><td>0</td><td>speed2</td></tr>
<tr><td>1</td><td>speed1</td></tr>
</table>
Speed1 is also handled as the clamp speed, and a speed command exceeding this speed cannot be issued in any case.</td><td>0 to 1000000
(mm/min)</td></tr>
</table>

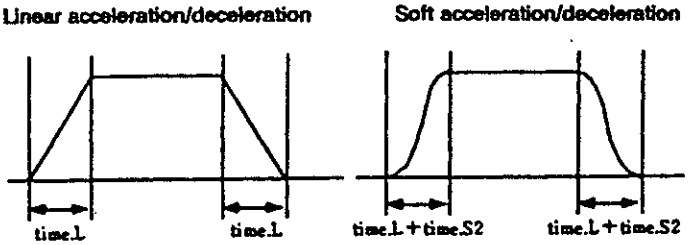
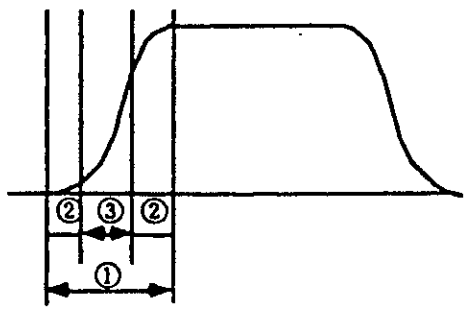
Parameter No.	Display title	Details	Setting range (unit)
#336	ZRN speed	The feedrate for the dog-type reference point return command in the incremental detection system or the dog-type zero point initialization in the absolute position detection system is set.	0 to 1000000 (mm/min)
#337	ZRN creep	The approach speed to the reference point after deceleration stop due to dog detection is defined for the dog-type reference point return command in the incremental detection system and the dog-type zero point return initialization in the absolute position detection system.	0 to 1000000 (mm/min)
#338	grdmask	(1) The interval to ignore the grid point when the near-point dog OFF signal is near the grid point is set for the dog-type reference point return command in the incremental detection system and the dog-type zero point return initialization in the absolute position detection system.  (2) The interval to ignore the grid point near the machine reference position (or machine end stopper) when executing zero point initialization in the dog-less absolute position detection system is set.  **(Note)** The valid range of the grid mask is the distance for one grid.	0 to 65535 (μm)
#339	grspc	Normally there is one grid point per motor rotation, so the grid interval and pitch are the same. This parameter allows the interval decreased, and is set with a division of the electrical grid interval. Effective grid interval = $\frac{\text{Pitch (mm)}}{2^n}$ n : Grid interval **(Note 1)** Set a divisor in which the grid interval can be divided. **(Note 2)** Always set "0" for the absolute position detection system.	0 to 4 (division)

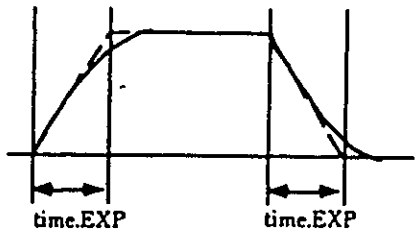
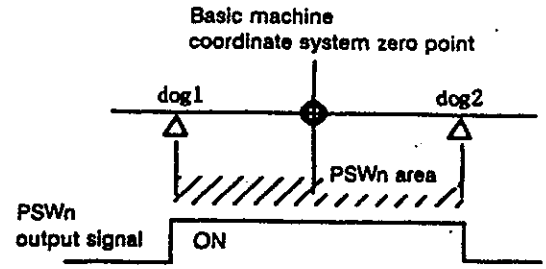
Parameter No.	Display title	Details	Setting range (unit)
#340	ZRN shift	The distance from the electrical zero point detection position to the actual machine reference position is set for the dog-type reference point return command in the incremental detection system and the dog-type zero point return initialization in the absolute position detection system.	0 to 65535 (μm)
#341 #342	OT+ OT−	The soft limit area based on the basic machine coordinate zero point is set.  **(Note)** Mechanically #100 and #101 are the same, but this parameter is for the set maker. The narrower parameter will be valid.	±99999.999 (mm)
#343	#1_rfp	The basic machine coordinate system zero point is set. The reference point and machine coordinate can be shifted. The setting is made in the direction of the reference point looking from the basic machine coordinate zero point.  	±99999.999 (mm)
#344	ABS Dog	The absolute position detection method is selected. 0 : Dog-less absolute position detection 1 : Dog-type absolute position detection	0/1
#345	ABS stopr	The method of determining the reference position during dog-less absolute position detection is selected. 0 : Machine end stopper method 1 : Reference point alignment method	0/1
#346	ABS dir	The absolute position reference point (previous grid point) direction looking from the machine reference position is set for the reference point alignment method. 0 : + 1 : −	0/1
#347 #348	M90 width M92 width	If M90 or M02 is commanded for the point string data's M command, absolute position compare will be executed after positioning. The tolerable values for the comparison are set here. If the setting value is 0, the position comparison will not be executed. The setting value is usually set to approximately the in-position width.	0 to 65535 (μm)

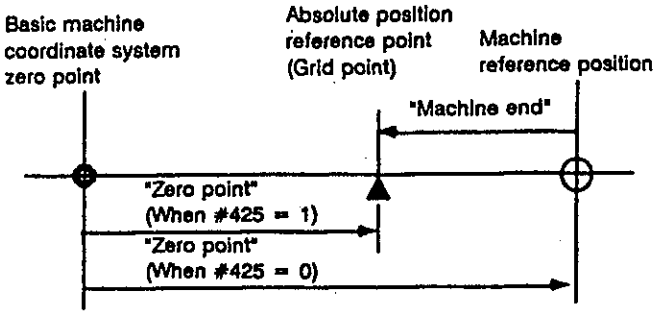
Parameter No.	Display title	Details	Setting range (unit)
#349	push F	The feedrate for automatic initialization is set. The feedrate will be applied from when automatic initialization is started to when the axis stops at the grid point.	1 to 999 (mm/min)
#350	approach	The point to start the second pushing during automatic initialization is set. The zero point will be the approach point when this parameter is set to "0". 	0 to 999.999 (mm)
#351	ABS check	The tolerable value of the difference (displayed as "OFF" on the [ABS.MONI] screen) of the machine positions when the power is turned OFF and when turn ON is set. **(Note)** If "0" is set, the "Power OFF movement amount" will not be checked.	0 to 99999.999(mm) Set with an absolute amount
#352 #353	near ref+ near ref-	The width to output the zero point near signal using the reference point as the base point is set. (If both + and – are set to "0", both the positive and negative will be output in the grid width ranges.) 	0 to 32.767 (mm) Set with an absolute amount
#354	noref	This is designated when the axis does not have a reference point. Reference point return will not be required before starting automatic operation.	0: When axis has reference point 1: When axis does not have reference point

<table>
<tr><th>Parameter No.</th><th>Display title</th><th>Details</th><th>Setting range (unit)</th></tr>
<tr><td>#355</td><td>abson</td><td>The validity of the absolute position detection system is selected.
To validate the absolute position detection system, servo parameter #300 SV001 bit 7 must be validated in addition to this parameter.</td><td>0: Invalid
1: Valid</td></tr>
<tr><td>#356</td><td>dir (–)</td><td>Whether the reference point position is to the (–) direction or (+) direction of the near-point dog is set for dog-type reference point return command in the incremental detection system and the dog-type zero point return initialization in the absolute position detection system.
 

The direction of entry to the near-point dog can be either + or –.</td><td>0: + direction
1: – direction</td></tr>
<tr><td>#357</td><td>svof</td><td>This defines whether to correct the error during servo OFF.
If "1: Correct error" is selected, the amount moved during servo OFF will be retracted during servo ON.</td><td>0: Do not correct error
1: Correct error</td></tr>
<tr><td>#358</td><td>rotary</td><td>This defines whether the axis is linear or rotary.
If the rotary axis is selected, the coordinate system will be 0° to 360°, and infinite rotation will be possible.</td><td>0: Linear axis
1: Rotary axis</td></tr>
<tr><td>#359</td><td>ccw</td><td>This defines the rotary direction looking from the motor shaft end for the forward direction command.</td><td>0: cw
1: ccw</td></tr>
<tr><td>#360</td><td>smgst</td><td>The acceleration/deceleration pattern is selected.
The acceleration/deceleration pattern selected with this parameter will be valid for all automatic and manual axis movement.
The time constant settings corresponding to each acceleration/deceleration pattern in the manual mode are as shown below.
<table><tr><th>Acceleration/ deceleration pattern</th><th>Corresponding time constant parameter</th></tr><tr><td>Linear acceleration/ deceleration</td><td>#361 time_L</td></tr><tr><td>Soft acceleration/ deceleration</td><td>#361 time_L,
#362 time_S2, #363 time_S3</td></tr><tr><td>Exponential acceleration/ deceleration</td><td>#364 time_EXP</td></tr></table>• In the automatic operation mode, the value set in the point table will be followed.</td><td>0: Exponential
1: Linear
F: Soft</td></tr>
</table>

Parameter No.	Display title	Details	Setting range (unit)
#361	time.L	The linear and soft acceleration/deceleration time constants for the manual mode are set. In linear acceleration/deceleration, the time constant of the acceleration/deceleration will be applied. In soft acceleration/deceleration, the first stage time constant will be applied, and the total acceleration/deceleration time constant will be the total time of #361 (time.L) + #362 (time.S2).  * In the automatic operation mode, the acceleration/ deceleration time set in the point table will be followed.	0 to 9999 (msec)
#362	time.S2	The second stage of the soft acceleration/deceleration time constant for the manual mode is set. The guideline is a value that is approx. 60% of the first stage time constant. The total acceleration/deceleration time constant will be the total time of #361 (time.L) and #362 (time.S2). The acceleration/deceleration pattern can be continuously changed with the setting ratio of #361 (time.L) and #362 (time.S2).  ①(Acceleration/deceleration time constant) = #361 (time.L) + #362 (time.S2) ②(Non-linear section time constant) = #362 (time.S2) ③(Linear section) = #361 (time.L) – #362 (time.S2) The deceleration pattern will be a line target of the acceleration pattern. If #362 (time.S2) is set to 0, the pattern will be equivalent to the linear acceleration/deceleration pattern. * In the automatic operation mode, the acceleration/ deceleration time set in the point table will be followed.	0 to 9999 (msec)
#363	time.S3	This is currently not used. Set to 0.	0

Parameter No.	Display title	Details	Setting range (unit)
#364	time.EXP	The exponential acceleration/deceleration time constant for the manual mode is set.  * In the automatic operation mode, the acceleration/ deceleration time set in the point table will be followed.	0 to 9999 (msec)
#365	backlash	The backlash compensation amount is set.	0 to 9999 (μm)
#400 ~ #423	pswndog1 pswndog2 pswnchck	The position switch area and detection standard are set.  pswndog1 and pswndog2 (area setting) are set using the basic machine coordinate system zero point as a reference. • The size relation of the dog1 and dog2 is irrelevant. • Setting of just the + side area or the – side area is possible. pswnchck (detection reference) is set to changeover the machine position reference for judging the area. The area is judged based on the respective machine coordinates for the command system when set to "0" and the feedback system when set to "1". The command system machine position includes the position droop amount after the acceleration/deceleration process, and during movement, the droop amount will be updated before the actual machine position. The feedback system machine position is updated according to the feedback from the detector, and is equivalent to the actual machine position. However, there will be a delay as the signals for the judgment process and signal process, etc., are detected, and the signal will be detected after the actual position. Select the detection reference for each position switch according to the applicable case.	Area ±99999.999 (μm) Detection reference 0:Command system 1:F/B system
#424	cunit	The setting input unit to the teaching box CT200 is changed over.	0: 0.001mm 1: 0.01mm 2: 0.001mm 3: 1mm

<table>
<tr><th>Parameter No.</th><th>Display title</th><th>Details</th><th>Setting range (unit)</th></tr>
<tr><td>#425</td><td>abspt</td><td>This selects whether the "zero point" parameter for dog-less absolute position detection is to be the coordinate value of the machine reference position or the coordinate value of the absolute position reference point.
0 : Machine reference position/
1 : Absolute position reference point
 
</td><td>0/1</td></tr>
<tr><td>#426</td><td>lang</td><td>The language displayed on the teaching box CT200 is selected.</td><td>0: Japanese
1: English</td></tr>
<tr><td>#500
~ #515</td><td>plcCst16
~ plcCst1</td><td>The data is set with the parameters that can be used with the user PLC. The correspondence of the file register set is as follows: Refer to the PLC Instruction Manual for further details. All data is backed up.
<table>
<tr><th>Parameter No.</th><th>Display title</th><th>Corresponding file register</th></tr>
<tr><td>#500</td><td>plcCst16</td><td>R366, R367</td></tr>
<tr><td>#501</td><td>plcCst15</td><td>R364, R365</td></tr>
<tr><td>.
.
#515</td><td>.
.
plcCst1</td><td>.
.
R336, R337</td></tr>
</table>
For example if 100000 (186A0h) is set in #500 (plcCst16), the following will be set.
<table>
<tr><td>R336</td><td>Low-order = 86A0</td></tr>
<tr><td>R367</td><td>High-order = 0001</td></tr>
</table></td><td>±99999999</td></tr>
<tr><td>#516
~ #523</td><td>plc T 103
~ plc T 96</td><td>This is a cumulative timer used by the PLC program in which the min. setting unit is 0.1sec.
When the input conditions are established, the count starts, and when the setting value is counted to, the timer contact will turn ON.
Even if the input conditions are not established, the current address (count value) is held, and the state of the contact does not change.
The count value is set to 0 with the RST command, and the contact is turned OFF.
8 points from T96 to T103.</td><td>0 to 65535</td></tr>
</table>

Parameter No.	Display title	Details	Setting range (unit)
#524 ~ #603	plc T 95 ~ plc T 16	This is a timer used by the PLC program in which the min. setting unit is 0.1sec. When the input conditions are established, the count starts, and when the setting value is counted to, the timer contact will turn ON. If the input conditions are not established, the count value will be set to 0. 80 points from T16 to T95.	0 to 65535 0 to 65535
#604 ~ 619	plc T 15 ~ plc T 0	This is a timer in which the min. setting unit is 0.1sec. When the input conditions are established, the count starts, and when the setting value is counted to, the timer contact will turn ON. If the input conditions are not established, the count value will be set to 0. 16 points from T0 to T15.	0 to 32767
#620 ~ #643	plc C 23 ~ plc C 0	The counter detects the start-up of the input conditions with an addition expression and counts. The count value will not be cleared even when the input conditions are turned OFF. The count value will be set to 0 with the RST command. 24 points from C0 to C23.	
#644 ~ #675	plcbit32 ~ plcbit 1	There are bit selection parameters in which the parameters that can be used by the user PLC are set with bits. The set data is set by the PLC's R register and is backed up. If a bit operation is executed in the sequence program, the contents of the R register will be transmitted to the temporary memory (M) with the MOV command, and used. If data corresponding to the bit selection is set in the R register with a MOV command, etc., the data will be backed up. Note that the display will not change at that time, so select another screen, and then display the screen again. The bit selection parameters #16 to #32 are used by the set maker and Mitsubishi, so the contents are fixed. The correspondence with the set file registers is as follows.	

<table>
<tr><th>Parameter No.</th><th>Display title</th><th>Details</th><th>Setting range (unit)</th></tr>
<tr><td></td><td></td><td>Refer to the PLC Instruction Manual for further details.
<table>
<tr><th>Parameter No.</th><th>Display title</th><th>Corresponding file register</th></tr>
<tr><td>#644</td><td>plc bit 32</td><td>R383-High side</td></tr>
<tr><td>#645</td><td>plc bit31</td><td>R383-Low side</td></tr>
<tr><td>#646
.
.</td><td>plc bit30
.
.</td><td>R382-H
.
.</td></tr>
<tr><td>#674</td><td>plc bit2</td><td>R368-H</td></tr>
<tr><td>#675</td><td>plc bit1</td><td>R368-L</td></tr>
</table>
Details of bit selection parameters
<table>
<tr><th>Symbol name</th><th>#659 R376L</th><th>#658 R376H</th></tr>
<tr><td>7</td><td></td><td></td></tr>
<tr><td>6</td><td></td><td></td></tr>
<tr><td>5</td><td></td><td></td></tr>
<tr><td>4</td><td></td><td></td></tr>
<tr><td>3</td><td>Counter C hold</td><td></td></tr>
<tr><td>2</td><td>Cumulative timer T hold</td><td></td></tr>
<tr><td>1</td><td>PLC counter program valid</td><td></td></tr>
<tr><td>0</td><td>PLC timer program valid</td><td></td></tr>
</table></td><td></td></tr>
</table>

Appendix 3 Non-fuse Breaker and Magnetic Contactor Selection Table

Controller	Power facility capacity (kVA)	Non-fuse breaker	Magnetic contactor
FCUA-MP10-01	0.3	NF30 type 5A	S-K10
FCUA-MP10-03	0.7	NF30 type 10A	
FCUA-MP10-06	1.1	NF30 type 10A	
FCUA-MP10-10	1.7	NF30 type 15A	
FCUA-MP10-20	3.5	NF30 type 20A	S-K18

Appendix 4 Wire Size Selection Table

Controller	Wire (mm^2)				Terminal block
	R, S, T	U, V, W	P, C	Magnetic brake	Screw size
FCUA-MP10-01	2	2	2	1.25	M35 D ≤ 7
FCUA-MP10-03	2	2	2		
FCUA-MP10-06	2	2	2		
FCUA-MP10-10	2	2	2		
FCUA-MP10-20	3.5	3.5	2		

Mitsubishi Single-Axis Amplifier Built-in Controller Model E
Instruction and Maintenance Manual

Sub-No.	Revision date	Revision details
*	July 19, 1994	First edition
A	Sept. 16, 1994	1) Correction of "2.4.3 Digital Input" Input circuit explanatory diagram 2) Correction of "4.2 Parameter setting" 3) Addition of "7.7 Absolute position detection function" 4) Addition of "Appendix 2.2 Parameter list"
B	Nov. 15, 1994	1) Revision of mistake in "Compatible regenerative resistor type" 2) Revision of "2.10 Remote I/O unit connection" cable name 3) Revision of mistake in "7.7.5 Reference point alignment method" screen display. 4) Revision of mistake in parameter #424 in "Appendix 2.2 Parameter Explanation Table"

MITSUBISHI ELECTRIC CORPORATION
HEAD OFFICE : MITSUBISHI DENKI BLDG., 2-2-3, MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN

MODEL	MODEL E
MODEL CODE	008—234
Manual No.	BNP-B2071B(ENG)

Specifications subject to change without notice.
Printed in Japan on recycled paper.

(0210) MEE