MITSUBISHI

MOTION CONTROLLER (SV13/22) (REAL MODE)

Programming Manual

type A171SCPU, A273UHCPU



REVISIONS

1

• The manual number is given on the bottom left of the back cover.

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INTRODUCTION

Thank you for purchasing the Mitsubishi Motion Controller/Personal Machine Controller. This instruction manual describes the handling and precautions of this unit. Incorrect handling will lead to unforeseen events, so we ask that you please read this manual thoroughly and use the unit correctly. Please make sure that this manual is delivered to the final user of the unit and that it is stored for future reference.

Precautions for Safety

Please read this instruction manual and enclosed documents before starting installation, operation, maintenance or inspections to ensure correct usage. Thoroughly understand the machine, safety information and precautions before starting operation.

The safety precautions are ranked as "Warning" and "Caution" in this instruction manual.



When a dangerous situation may occur if handling is mistaken leading to fatal or major injuries.



When a dangerous situation may occur if handling is mistaken leading to medium or minor injuries, or physical damage.

Note that some items described as cautions may lead to major results depending on the situation. In any case, important information that must be observed is described.

For Safe Operations

1. Prevention of electric shocks

(!) WARNING A Never open the front case or terminal covers while the power is ON or the unit is running. as this may lead to electric shocks. $\langle\!\!\!\!\!\!\!\!\!\!\! \rangle$ Never run the unit with the front case or terminal cover removed. The high voltage terminal and charged sections will be exposed and may lead to electric shocks. $\langle\!\langle\!\rangle$ Never open the front case or terminal cover at times other than wiring work or periodic inspections even if the power is OFF. The insides of the control unit and servo amplifier are charged and may lead to electric shocks. $\langle \! \rangle \rangle$ When performing wiring work or inspections, turn the power OFF, wait at least ten minutes, and then check the voltage with a tester, etc. Failing to do so may lead to electric shocks. $\langle\!\!\!\langle\!\rangle$ Always ground the control unit, servo amplifier and servomotor with Class 3 grounding. Do not ground commonly with other devices. $\langle f \rangle$ The wiring work and inspections must be done by a qualified technician. $\langle \! \rangle \rangle$ Wire the units after installing the control unit, servo amplifier and servomotor. Failing to do so may lead to electric shocks or damage. $\langle \! \langle \! \rangle \rangle$ Never operate the switches with wet hands, as this may lead to electric shocks. $\langle \hat{\mathbf{x}} \rangle$ Do not damage, apply excessive stress, place heavy things on or sandwich the cables, as this may lead to electric shocks. $\langle \! \langle \! \rangle \rangle$ Do not touch the control unit, servo amplifier or servomotor terminal blocks while the power is ON, as this may lead to electric shocks. $\langle i \rangle$ Do not touch the internal power supply, internal grounding or signal wires of the control unit and servo amplifier, as this may lead to electric shocks.

2. For fire prevention



3. For injury prevention

- Do not apply a voltage other than that specified in the instruction manual on any terminal. Doing so may lead to destruction or damage.
- A Do not mistake the terminal connections, as this may lead to destruction or damage.
- A Do not mistake the polarity (+/-), as this may lead to destruction or damage.
- ▲ The servo amplifier's heat radiating fins, regenerative resistor and servo amplifier, etc., will be hot while the power is ON and for a short time after the power is turned OFF. Do not touch these parts as doing so may lead to burns.
- Always turn the power OFF before touching the servomotor shaft or coupled machines, as these parts may lead to injuries.
- ▲ Do not go near the machine during test operations or during operations such as teaching. Doing so may lead to injuries.

4. Various precautions

Strictly observe the following precautions. Mistaken handling of the unit may lead to faults, injuries or electric shocks.

(1) System structure

Δ	Always install a leakage breaker on the control unit and servo amplifier power source.			
	If installation of a magnetic contactor for power shut off during an error, etc., is specified in the instruction manual for the servo amplifier, etc., always install the magnetic contactor.			
	Install an external emergency stop circuit so that the operation can be stopped immediately and the power shut off.			
	Use the control unit, servo amplifier, servomotor and regenerative resistor with the combi- nations listed in the instruction manual. Other combinations may lead to fires or faults.			
	If safety standards (ex., robot safety rules, etc.,) apply to the system using the control unit, servo amplifier and servomotor, make sure that the safety standards are satisfied.			
	If the operation during a control unit or servo amplifier error and the safety direction operation of the control unit differ, construct a countermeasure circuit externally of the control unit and servo amplifier.			
	In systems where coasting of the servomotor will be a problem during emergency stop, servo OFF or when the power is shut OFF, use dynamic brakes.			
Δ	Make sure that the system considers the coasting amount even when using dynamic brakes.			
	In systems where perpendicular shaft dropping may be a problem during emergency stop, servo OFF or when the power is shut OFF, use both dynamic brakes and magnetic brakes.			
	The dynamic brakes must be used only during emergency stop and errors where servo OFF occurs. These brakes must not be used for normal braking.			
	The brakes (magnetic brakes) assembled into the servomotor are for holding applications, and must not be used for normal braking.			
	Construct the system so that there is a mechanical allowance allowing stopping even if the stroke end limit switch is passed through at the max. speed.			
	Use wires and cables that have a wire diameter, heat resistance and bending resistance compatible with the system.			

- Δ Use wires and cables within the length of the range described in the instruction manual.
- The ratings and characteristics of the system parts (other than control unit, servo amplifier, servomotor) must be compatible with the control unit, servo amplifier and servomotor.
- Install a cover on the shaft so that the rotary parts of the servomotor are not touched during operation.
- There may be some cases where holding by the magnetic brakes is not possible due to the life or mechanical structure (when the ball screw and servomotor are connected with a timing belt, etc.). Install a stopping device to ensure safety on the machine side.

(2) Parameter settings and programming

- A Set the parameter values to those that are compatible with the control unit, servo amplifier, servomotor and regenerative resistor model and the system application. The protective functions may not function if the settings are incorrect.
- The regenerative resistor model and capacity parameters must be set to values that conform to the operation mode, servo amplifier and servo power unit. The protective functions may not function if the settings are incorrect.
- ▲ Set the mechanical brake output and dynamic brake output validity parameters to values that are compatible with the system application. The protective functions may not function if the settings are incorrect.
- A Set the stroke limit input validity parameter to a value that is compatible with the system application. The protective functions may not function if the setting is incorrect.
- A Set the servomotor encoder type (increment, absolute position type, etc.) parameter to a value that is compatible with the system application. The protective functions may not function if the setting is incorrect.
- A Set the servomotor capacity and type (standard, low-inertia, flat, etc.) parameter to values that are compatible with the system application. The protective functions may not function if the settings are incorrect.
- A Set the servo amplifier capacity and type parameters to values that are compatible with the system application. The protective functions may not function if the settings are incorrect.
- ▲ Use the program commands for the program with the conditions specified in the instruction manual.
- ▲ Set the sequence function program capacity setting, device capacity, latch validity range, I/O assignment setting, and validity of continuous operation during error detection to values that are compatible with the system application. The protective functions may not function if the settings are incorrect.
- Some devices used in the program have fixed applications, so use these with the conditions specified in the instruction manual.
- The input devices and data registers assigned to the link will hold the data previous to when communication is terminated by an error, etc. Thus, an error correspondence interlock program specified in the instruction manual must be used.
- ▲ Use the interlock program specified in the special function unit's instruction manual for the program corresponding to the special function unit.

(3) Transportation and installation

 Transport the product with the correct method according to the weight. Use the servomotor suspension bolts only for the transportation of the servomotor. Do not transport the servomotor with machine installed on it. Do not stack products past the limit. 					
When transporting the control unit or servo amplifier, never hold the connected wire cables.					
\bigwedge When transporting the servomotor, never hold the cables, shaft or detector.					
A When transporting the control unit or servo amplifier, never hold the front case as it fall off.					
When transporting, installing or removing the control unit or servo amplifier, never hold edges.					
Install the unit according to the instruction manual in a place where the weight ca withstood.					
▲ Do not get on or place heavy objects on the product.					
Always observe the installation direction.					
Keep the designated clearance between the control unit or servo amplifier and control p inner surface or the control unit and servo amplifier, control unit or servo amplifier and c devices.					
▲ Do not install or operate control units, servo amplifiers or servomotors that are damage that have missing parts.					
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A Do not allow conductive matter such as screw or cutting chips or combustible matter as oil enter the control unit, servo amplifier or servomotor.					
The control unit, servo amplifier and servomotor are precision machines, so do not dro apply strong impacts on them.					
A Securely fix the control unit and servo amplifier to the machine according to the instru- manual. If the fixing is insufficient, these may come off during operation.					
Always install the servomotor with reduction gears in the designated direction. Failing to do so may lead to oil leaks.					
⚠ Store and use the unit in the following environmental conditions.					
Environment					
Control unit/servo amplifier Servomotor					
Ambient 0°C to +55°C 0°C to +40°C					
temperature (With no freezing) (With no freezing)					
Ambient humidityAccording to each instruction manual.80%RH or less (With no dew condensation)					
Storage According to each instruction -20°C to +65°C manual.					
Atmosphere Indoors (where not subject to direct sunlight). No corrosive gases, flammable gases, oil mist or dust must exist.					
Altitude 1000m or less above sea level.					
Vibration According to each instruction manual.					

- ▲ When coupling with the synchronization encoder or servomotor shaft end, do not apply impact such as by hitting with a hammer. Doing so may lead to detector damage.
- ▲ Do not apply a load larger than the tolerable load onto the servomotor shaft. Doing so may lead to shaft breakage.
- ▲ When not using the unit for a long time, disconnect the power line from the control unit or servo amplifier.
- Δ Place the control unit and servo amplifier in static electricity preventing vinyl bags and store.
- \triangle When storing for a long time, contact the Service Center or Service Station.

(4) Wiring

- ▲ Correctly and securely wire the wires. Reconfirm the connections for mistakes and the terminal screws for tightness after wiring. Failing to do so may lead to run away of the servomotor.
- After wiring, install the protective covers such as the terminal covers to the original positions.
- ▲ Do not install a phase advancing capacitor, surge absorber or radio noise filter (option FR-BIF) on the output side of the servo amplifier.
- ▲ Correctly connect the output side (terminals U, V, W). Incorrect connections will lead the servomotor to operate abnormally.
- Δ Do not connect a commercial power supply to the servomotor, as this may lead to trouble.
- ▲ Do not mistake the direction of the surge absorbing diode installed on the DC relay for the control signal output of brake signals, etc. Incorrect installation may lead to signals not being output when trouble occurs or the protective functions not functioning.
- ▲ Do not connect or disconnect the connection cables between each unit, the encoder cable or sequence expansion cable while the power is ON.



- A Securely tighten the cable connector fixing screws and fixing mechanisms. Insufficient fixing may lead to the cables combing off during operation.
- \triangle Do not bundle the power line or cables.

(5) Trial operation and adjustment

- ▲ Confirm and adjust the program and each parameter before operation. Unpredictable movements may occur depending on the machine.
- \triangle Extreme adjustments and changes may lead to unstable operation, so never make them.
- When using the absolute position system function, on starting up, and when the controller or absolute value motor has been replaced, always perform a home position return.

(6) Usage methods

	▲ Immediately turn OFF the power if smoke, abnormal sounds or odors are emitted from the control unit, servo amplifier or servomotor.					
⚠	Always execute a test operation before starting actual operations after the program or parameters have been changed or after maintenance and inspection.					
\triangle	The units must be disas	ssembled and repaired by a qualified technician.				
\triangle	Do not make any modif	ications to the unit.				
	Keep the effect or magnetic obstacles to a minimum by installing a noise filter or by using wire shields, etc. Magnetic obstacles may affect the electronic devices used near the control unit or servo amplifier.					
\triangle	Δ Use the units with the following conditions.					
	item Conditions					
	Input power According to the separate instruction manual.					
	Input frequency According to the separate instruction manual.					
	Tolerable momentary power failure According to the separate instruction manual.					

(7) Remedies for errors



(8) Maintenance, inspection and part replacement

- $extstyle \Delta
 extstyle Perform the daily and periodic inspections according to the instruction manual.$
- Perform maintenance and inspection after backing up the program and parameters for the control unit and servo amplifier.
- ⚠️ Do not place fingers or hands in the clearance when opening or closing any opening.
- $\underline{\Lambda}$ Periodically replace consumable parts such as batteries according to the instruction manual.

⚠	Do not touch the lead sections such as ICs or the connector contacts.
⚠	Do not place the control unit or servo amplifier on metal that may cause a power leakage or wood, plastic or vinyl that may cause static electricity buildup.
	Do not perform a megger test (insulation resistance measurement) during inspection.
Δ	When replacing the control unit or servo amplifier, always set the new unit settings correctly.
	When the controller or absolute value motor has been replaced, carry out a home position return operation using one of the following methods, otherwise position displacement could occur.
	 After writing the servo data to the PC using peripheral device software, switch on the power again, then perform a home position return operation.
	 Using the backup function of the peripheral device software, load the data backed up before replacement.
Δ	After maintenance and inspections are completed, confirm that the position detection of the absolute position detector function is correct.
\triangle	Do not short circuit, charge, overheat, incinerate or disassemble the batteries.
	The electrolytic capacitor will generate gas during a fault, so do not place your face near the control unit or servo amplifier.
	The electrolytic capacitor and fan will deteriorate. Periodically change these to prevent secondary damage from faults. Replacements can be made by the Service Center or Service Station.

(9) Disposal

- \triangle Dispose of this unit as general industrial waste.
- Δ Do not disassemble the control unit, servo amplifier or servomotor parts.
- \triangle Dispose of the battery according to local laws and regulations.

(10) General cautions



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1. GENERAL DESCRIPTION

This manual describes the positioning control parameters required to execute positioning control with the motion controller (SV13/22), the devices used specifically for positioning, and the method used for positioning.

The positioning control capabilities of the motion controller (SV13/22) are indicated in the table below.

Applicable CPU	Number of Axes Controlled in Positioning Control
A171SCPU	4
A273UHCPU (8 axis specification)	8
A273UHCPU (32 axis specification)	3

In this manual, the CPUs cited in the table above are collectively referred to as "servo system CPUs".

The following software packages are used to make system settings, and to set, test, and monitor parameters and servo programs.

SW2SRX-GSV13PE software package

.....Abbreviated to "GSV13PE"

SW2SRX-GSV22PE software package

.....Abbreviated to "GSV22PE"

- Men designing the system, provide external protective and safety circuits to ensure safety in the event of trouble with the motion controller.
- There are electronic components which are susceptible to the effects of static electricity mounted on the printed circuit board. When handling printed circuit boards with bare hands you must ground your body or the work bench. Do not touch current-carrying or electric parts of the equipment with bare hands.
- A Make parameter settings within the ranges stated in this manual.
- ▲ Use the program instructions that are used in programs in accordance with the conditions stipulated in this manual.
- ▲ Some devices for use in programs have fixed applications: they must be used in accordance with the conditions stipulated in this manual.

Conventions Used in this Manual

Positioning signals are always indicated in the following order: signal for A171SCPU \rightarrow signal for A273UHCPU (8 axis specification) \rightarrow signal for A273UHCPU (32 axis specification). If only one positioning signal is indicated, this means that the signal is used in common by all three CPUs. The explanatory text is written with reference to the A171SCPU: if you are not using an A171SCPU, the positioning signals in the text should be read as the positioning signals for the CPU you are using.

(For the positioning signals used with each CPU, refer to Appendix 6.)

A273UHCPU (8 axis specification)



00 **: Error code Applies to

Applies to

A171SCPU

A171SCPU

The limit ewitch output enable command is used to enable limit switch output. • ON....... The limit switch output ON/OFF pattern can be output. • OFF.......Unit switch output goes OFF.

3.1.26 Error reset con d 8418m7/Yn7/432m7h

> The error reset command is used to clear the minor error code or major error code storage area of an axis for which the error detection signal has come ON (M16m7: ON), and reset the error detection signal (M16m7). d Error detection (M16m7) OFF OF Error reset (M18m7) Minor enor code storage ~ 00

3.1.27 Servo error reset command @itam&Yn&M32mitt

Major e: area

mor code storage

The serve error reset command is used to clear the serve error code storage area of an axis for which the serve error detection signal has come ON ((M16m8: ON), and reset the serve error detection signal (M16m8).



POINT

Do not turn the error reset command (M18m7/Yn7/M32m7) or servo error reset command (M18m8/Yn8/M32m8) ON with a PLS com-mand. If a PLS command is used, it will not be possible to reset the error or serve error.

REMARK

or error code, major error code, and servo error code a For details on ----ndix 2

3-18

An example system configuration for the motion controller (SV13/22) is shown below.

[When Using A171SCPU]



In the servo amplifier configuration indicated below, a maximum of 4 axes can be controlled in positioning control.

• MR-H-B/MR-J-B/MR-J2-B servo amplifiers only (Max. 4 axes)

[Note]

(1) One extension base unit can be connected to a servo system CPU.

(2) The extension base units which can be used are the following:

- A1S65B (extension power supply plus 5 slots)
- A1S68B (extension power supply plus 8 slots)
- (3) When the power supply to the servo system CPU is switched ON and OFF, erroneous process outputs may temporarily be made due to the delay between the servo system CPU power supply and the external power supply for processing (especially DC), and the difference in startup times.

For example, if the power supply to the servo system CPU comes on after the external power supply for processing comes on at a DC output module, the DC output module may temporarily give erroneous outputs when the power to the servo system CPU comes on. Accordingly a circuit that ensures that the power supply to the servo system CPU comes on first should be constructed.

1. GENERAL DESCRIPTION



With the servo amplifier configurations indicated below, positioning control of up to 8 axes is possible.

- (1) AC motor drive modules + MR-H-B/MR-J-B/MR-J2-B (max. 8 axes) + servo amplifiers (max. 8 axes) + (max. 8 axes)

- (2) AC motor drive modules onlyMain base units only
 - (max. 8 axes)
 - Main base unit + motion extension base unit <total of 8 axes> (max. 8 axes) (max. 8 axes)
- (3) MR-H-B/MR-J-B/MR-J2-B amplifiers only (max. 8 axes)





With the servo amplifier configurations indicated below, positioning control of up to 32 axes is possible.

(1) AC motor MR-H-B/MR-J-B/MR-J2-B drive modules + servo amplifiers <total of 32 axes> (max. 16 axes) * (max. 32 axes)

• An AC motor drive module can control a total of 16 axes, including main base units and motion extension base units.

(2) MR-H-B/MR-J-B/MR-J2-B servo amplifiers only (max. 32 axes)

In the text of this manual, "AC motor drive module" is abbreviated to ADU. MR-H-B/MR-J-B/MR-J2-B servo amplifiers are abbreviated to MR-[]-B. ADUs and MR-[]-Bs are collectively referred to as servo amplifiers.

[Notes]

- (1) A servo system CPU can be connected to a maximum of one motion extension base unit when using an A273UHCPU (8 axis specification) or four motion extension base units when using an A273UHCPU (32 axis specification).
- (2) The motion extension base units which can be used are indicated below.
 - A255B (control power supply not required)
 A268B (control power supply required)
 However, the maximum total of ADUs (in terms of the number of controlled axes) that can be connected to one servo system CPU is 8 axes for an A273UHCPU (8 axis specification) and 32 axes for an A273UHCPU (32 axis specification).
- (3) When the power supply to the servo system CPU is switched ON and OFF, erroneous process outputs may temporarily be made due to the delay between the servo system CPU power supply and the external power supply for processing (especially DC), and the difference in startup times.

For example, if the power supply to the servo system CPU comes on after the external power supply for processing comes on at a DC output module, the DC output module may temporarily give erroneous outputs when the power to the servo system CPU comes on. Accordingly a circuit that ensures that the power supply to the servo system CPU comes on first should be constructed.

1.1 Positioning Control by the Servo System CPU

A servo system CPU can execute positioning control and sequence control for 4 axes when using an A171SCPU, 8 axes when using an A273UHCPU (8 axis specification), and 32 axes when using an A273UHCPU (32 axis specification), by means of a CPU for multi-axis positioning control (hereafter called the "PCPU") and a CPU for sequence control (hereafter called the "SCPU").

Sequence control capabilities are equivalent to those of A1S series CPUs when using an A171SCPU, and to those of A3U series CPUs when using an A273UHCPU (8 or 32 axis specification).

- (1) Control handled by the SCPU
 - (a) Sequence control

The SCPU controls I/O modules and special function modules in accordance with the sequence program.

(The method for executing a sequence program is the same as for an A1SCPU or A3UCPU).

- (b) Start of positioning in accordance with sequence program, and setting of positioning data
 - 1) The SCPU requests execution of servo programs by means of the DSFRP instruction (up to 3 axes for interpolation) or the SVST instruction (up to 4 axes for interpolation).
 - 2) It changes present values and speed by means of the DSFLP instruction or GHGA/CHGV instruction.
 - 3) It executes JOG operation.
 - 4) It sets the data required to execute manual pulse generator operation.
- (2) Control handled by the PCPU
 - (a) The PCPU executes servo programs whose execution is requested by a DSFRP/SVST instruction issued by the sequence program, and performs the set positioning control.
 - (b) It changes the feed present value or positioning speed at the servo side in accordance with the present values or speeds set by DSFLP/ CHGA/CHGV instructions issued by the sequence program.
 - (c) It executes positioning when the manual pulse generator is used.
 - (d) It executes the teaching designated with the teaching unit (A30TU).

[Executing Positioning Control with a Servo System CPU]

The servo system CPU executes positioning control in accordance with the servo programs designated by the sequence program of the SCPU. An overview of the method used for positioning control is presented below.



Servo System CPU System

- (1) Servo programs and positioning control parameters are set using a peripheral device.
- (2) Positioning is started by the sequence program (DSFRP/SVST instruction).
 - (a) The servo program number and controlled axis number are designated by the DSFRP/SVST instruction.
 - 1) The servo program number can be set either directly or indirectly.
 - 2) The controlled axis number can only be set directly.
- (3) The positioning specified by the designated servo program is executed.

1. GENERAL DESCRIPTION



REMARK

- *1: Any of the following peripheral devices, running the GSV13PE/GSV22PE software, can be used.
 - An IBM PC/AT or 100% compatible machine in which PC-DOS 5.0 or a later version has been installed (hereafter called an "IBM PC")
 - An A271DVP man/machine control module in which PC-DOS 5.0 or a later version has been installed (hereafter called an "A271DVP")

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[Executing JOG Operation with a Servo System CPU]

The servo system CPU can be used to perform JOG operation on a designated axis in accordance with a sequence program. An overview of JOG operation is presented below.



Servo System CPU System

- (1) Set the positioning control parameters using a peripheral device.
- (2) Using the sequence program, set the JOG speed in the JOG operation speed setting register for each axis.
- (3) JOG operation is executed while the JOG operation execution fkag (M1802 or M1803)² is kept ON by the sequence program. (When A171SCPU is used)
 - M1802.....Forward JOG operation
 - M1803.....Reverse JOG operation

1. GENERAL DESCRIPTION



REMARKS

ł

- *1: Any of the following peripheral devices, running the GSV13PE/GSV22PE software, can be used.
 - IBM PC
 - A271DVP
- *2: Set the JOG operation execution flag that corresponds to the axis number in the table below. <When using A171SCPU>

Axis No.	Forward rotation	Reverse rotation
1	M1802	M1803
2	M1822	M1823
3	M1842	M1843
4	M1862	M1863

[Executing Manual Pulse Generator Operation with a Servo System CPU]

When executing positioning control with a manual pulse generator connected to an A171SENC (if using an A171SCPU) or A273EX (if using an A273UHCPU (8/32 axis specification)), manual pulse generator operation must be enabled by the sequence program.

An overview of positioning control using manual pulse generator operation is presented below.



Servo System CPU System

- (1) Set the manual pulse generator used, operated axis number, and magnification for 1 pulse input by using the sequence program.
- (2) Turn the manual pulse generator operation enable flag ON by using the sequence program.

..... manual pulse generator operation enabled

- (3) Perform positioning by operating the manual pulse generator.
- (4) Turn the manual pulse generator operation enable flag OFF by using the sequence program.

..... manual pulse generator operation completed

1. GENERAL DESCRIPTION

/



(1) Positioning control parameters

The positioning control parameters are classified into the seven types shown below.

Parameter data can be set and corrected interactively by using a peripheral device.

- (a) System settings The system settings set the modules used, axis numbers, etc. For details, see Section 4.1.
 - 1) Base unit setting
 - 2) Amplifier setting (MR-[]-B)
 - 3) Servomotor setting
 - 4) Position detection method setting
 - 5) Axis number setting
 - 6) Regenerative resistor used/not used setting
 - 7) Dynamic brake unit used/not used setting
 - 8) Servo input module/other optional module used/not used setting
- (b) Fixed parameters

The following data is set for each axis as the fixed parameters: the settings are predetermined by, for example, the mechanical system. The settings are used for purposes including calculation of the designated position when positioning control is executed. For details, see Section 4.2.

- 1) Units for positioning control
- 2) Number of pulses per motor revolution
- 3) Travel value per motor revolution
- 4) Unit magnification
- 5) Backlash compensation amount
- 6) Upper/lower stroke limit values
- 7) Command in-position range
- 8) Limit switch output used/not used setting
- (c) Servo parameters

The following data are set for each axis as the servo parameters: the settings are predetermined by the type of servomotor connected. These parameters are set to control the servomotors during positioning control.

For details, see Section 4.3.

- 1) Amplifier setting
- 2) Regenerative resistor used/not used
- 3) External dynamic brake
- 4) Motor type
- 5) Motor capacity
- 6) Motor rpm
- 7) Number of feedback pulses
- 8) Direction of rotation
- 9) Auto tuning
- 10) Servo responsibility setting
- 11) Load inertia ratio
- 12) Position control gain 1, 2
- 13) Speed control gain 1, 2
- 14) Speed integral compensation
- 15) Feed forward gain

16) In-position range

(When using MR-[]-B)

- 1) Amplifier setting
- 2) Regenerative resistor used/not used
- 3) External dynamic brake used/not used
- 4) Motor type
- 5) Motor capacity
- 6) Motor rpm
- 7) Number of feedback pulses
- 8) Direction of rotation
- 9) Automatic tuning
- 10) Servo responsibility setting
- 11) Load inertia ratio
- 12) Position control gain 1
- 13) Speed control gain 1
- 14) Position control gain 2
- 15) Speed control gain 2
- 16) Speed integral compensation
- 17) Notch filter
- 18) Feed forward gain
- 19) In-position range
- 20) Electromagnetic brake sequence
- 21) Monitor output mode
 - Monitor 1
 - Monitor 2
- 22) Optional function 1
 - Carrier frequency selection
 - External emergency stop signal
 - Encoder type setting
- 23) Optional function 2
 - No-motor operation selection
 - Electromagnetic brake interlock output timing
 - Microvibration suppression function selection
 - Motor lock operation
- 24) Monitor output 1 offset
- 25) Monitor output 2 offset
- 26) Pre-alarm data selection
 - Sampling time selection
 - Data selection 1
 - Data selection 2
- 27) Zero speed

1

- 28) Excessive error alarm level
- 29) Optional function 5
 - PI-PID control switching
 - Servo read character
 - Dynamic brake
- 30) PI-PID switching position droop
- 31) Torque control compensation factor
- 32) Speed differential compensation

(d) Home position return data

The following data are set for each axis as the home position return data, which is used when a home position return is executed. For details, see Section 7.21.

- 1) Home position return direction
- 2) Home position return method
- 3) Home position address
- 4) Home position return speed
- 5) Creep speed
- 6) Travel after near-zero point dog
- 7) Parameter block number
- (e) JOG operation data

The following data are set for each axis as the JOG operation data, which is used when positioning control is executed using JOG operation.

For details, see Section 7.19.

- 1) JOG speed limit value
- 2) Parameter block number
- (f) Parameter block

The following data can be set as the parameter block data, for up to 16 blocks if using an A171S/A273UHCPU (8 axis specification), or up to 64 blocks if using an A273UHCPU (32 axis specification). This makes it easy to change settings such as those for acceleration/deceleration processing (acceleration/deceleration time, speed control value) for positioning control.

For details, see Section 4.4.

- 1) Interpolation control unit
- 2) Speed limit value
- 3) Acceleration time
- 4) Deceleration time
- 5) Rapid stop deceleration time
- 6) S curve ratio
- 7) Torque limit value
- 8) Deceleration processing on STOP input
- 9) Allowable error range for circular interpolation
- (g) Limit switch output data

The limit switch output data is set for the used axis when "USE" is set for the limit switch output setting in the fixed parameters. When positioning control of an axis for which limit switch output data has been set is executed, the set ON/OFF pattern is output to an

external destination. For details, see Section 8.1.

1) Limit switch output ON/OFF pattern

2

(2) Servo programs

A servo program is a program for executing positioning control and is run in response to a start request from the sequence program.

It comprises a program number, servo instructions, and positioning data. For details, see Section 6.

- Program numberThis is the number used to designate the servo program from the sequence program.
- Servo instructionsThese indicate the type of positioning control to be executed.
- Positioning dataThis is the data required to execute servo instructions.

The data required is fixed for each servo instruction.

(3) Sequence program

The sequence program serves to enable the execution of positioning control by servo programs, JOG operation, and manual pulse generator operation.

For details, see Section 5.

1.2 Function Upgrades

The functions that have been added or modified since the former version are indicated below.

- (1) Addition of high-speed reading function A function which allows a maximum of 11 types of data out of 16 types - including feed present value and deviation counter value - to be read simultaneously to a specified device with a signal from an input module mounted on a motion base unit as the trigger, has been added.
- (2) Addition of function for canceling/starting program being executed By designating the cancel function in advance in a servo program, a deceleration stop can be caused by inputting a cancel signal (designated bit device) while that program is being executed. Designating the start function too makes it possible to automatically start a designated servo program after the stop.
- (3) Constant speed control instruction function upgrade The following three functions have been added.
 (a) Skip function
 - By setting a skip signal (designated bit device) at each pass point, positioning to that pass point can be canceled by switching on the skip signal, whereupon positioning at the next point will be performed.
 - (b) FIN signal wait function

This is a function whereby, by designating the FIN signal wait function and setting an M code for each pass point, the completion of each pass point can be synchronized with FIN signal ON.

- (c) Circular interpolation function with CPSTART3, CPSTART4 Circular interpolation with two axes is now possible.
- (4) Addition of high-speed oscillation function Control for sine wave oscillation on one axis is now possible.
- (5) Compatibility with MR-J2-B type servo amplifiers
- (6) Present value management when using an absolute encoder has been improved (for details, see Section 1.2.1).

To use the functions (1) to (6) on the previous page, use the OS for positioning and positioning software package indicated below.

[When using A171SCPU]

CPU version

Use an A171SCPU for which "D" or higher is marked as the software version on the front of the module.

("C" and previous versions cannot be used.)



OS for positioning

Model	OS Ver.
SWOSRX-SV13M SWOSRX-SV22L	"U" or higher

Positioning software package

Model	OS Ver.
SW2SRX-GSV13P SW2SRX-GSV22P	"P" or higher

[When using A273UHCPU]

OS for positioning

Model	OS Ver.
SW2SRX-SV13K SW2SRX-SV13V SW2SRX-SV22J SW2SRX-SV22U	"U" or higher

· Positioning software package

Modei	OS Ver.
SW2SRX-GSV13P SW2SRX-GSV22P	"P" or higher

1.2.1 Improved present value managment

By adding the functions described below, present value management when using an absolute encoder has been improved.

- (1) Added functions.
 - (a) An encoder data validity check is now possible during operation.
 - It is checked whether the amount of change at the encoder in 3.5 ms intervals corresponds to rotation within 180° at the motor shaft. (If abnormal, an error is displayed.)
 - Consistency between the encoder data and the feedback position controlled at the servo amplifier is checked. (If abnormal, an error is displayed.)
 - (b) Addition of the present value history monitor has enabled monitoring of the following data at a peripheral device.
 - Encoder present value/servo command value/monitor present value when the power is switched ON.
 - Encoder present value/servo command value/monitor present value when the power is switched OFF.
 - Encoder present value/servo command value/monitor present value when a home position return is performed.
 - (c) By setting the allowable travel while the power is OFF, a change in the encoder data to a value outside the setting range while the power is OFF can now be checked when the servo amplifier power is turned ON. (If abnormal, an error is displayed.)
(2) Restrictions due to the combination of positioning OS and positioning software package.

Positioning OS Version	Positioning Software Package Version	Restrictions
	R or later *1	There are no restrictions. (When a new version positioning OS is installed in place of an old version, it is essential to execute a home position return.)
V or later	Q or earlier *2	 Present value history monitor cannot be used. Since the allowable travel while the power is OFF cannot be set, a minor error (error code: 901 to 9010) occurs when the servo amplifier power is turned on. (When a new version positioning OS is installed in place of an old version, its is essential to execute a home position return.)
U or earlier	R or later *1	None of the function upgrades can be used.
	Q or earlier *2	7

The following restrictions apply, depending on whether an allowable travel while the power is OFF is set or not.

*1: Allowable travel while the power is OFF can be set.

- *2: Allowable travel while the power is OFF cannot be set.
- *3: Since the allowable travel while the power is OFF cannot be set when using an old version positioning software package a minor error is displayed, but this poses no problem to operation.
- (3) Restrictions due to servo amplifier.

The following restrictions apply depending on the combination of servo amplifier and positioning software package used when using positioning OS version V or later.

Servo Amplifier	Positioning Software Package Version	Restrictions
MR-H-B: BCD-B13W000-B2 or later	R or later	There are no restrictions.
MR-J2-B: BCD-B20W200-A1 or later	Q or earlier	Only the function upgrade described in item (a) applies.
MR-H-B: BCD-B13W000-B1 or later MR-J2-B: BCD-B20W200-A0	R or later	Only the function upgrade described in item (c) applies. (However, with respect to item (b), monitoring is possible with the exception of the encoder present value.)
or later MR-J-B: All models ADU: All models	Q or earlier	None of the function upgrades can be used.

(4) Restrictions on the servo system CPU.

[When using A171SCPU]

 CPU version Use an A171SCPU for which the hardware version indicated on the front of the module is "K" and the software version indicated "D" or later.

1

(A171SCPUs whose hardware version is "J" or earlier, or whose software version is "C" or earlier, cannot be used.)



[When using A273UHCPU] • There are no restrictions due to the hardware.

2. PERFORMANCE SPECIFICATIONS

Table 2.1 gives the performance specifications of the PCPU.

Item		PCPII Performance/Specifications				
	A171SCP		A avec (simu	taneous: 2 to 4	aves independent:	
Number of	A273UHC	PUL (8 axis specification)	8 axes (simultaneous: 2 to 4 axes, independent: 9 axes)			
control axes	A273UHC	PU (32 axis specification)	32 aves (sim	ultaneous: 2 to 4	Laves independent	32 9748)
Interpolation functions		Linear Interp	olation (4 axes n	nax.), and circular in	terpolation (2	
Control modes		PTP (point to	point), speed o	ontrol, speed/position	n control, fixed-	
Control units			mm inch d	erree . PUI SE	Autor, position follow	
Languages		Dedicated in	structions (seque	ence ladders + servo	programs).	
		A171S/A273UHCPU (8 axis specification)	13K steps (1	3312 steps)		<u> </u>
Program	Capacity	A273UHCPU (32 axis specification)	14334k steps	3		
	Number o	of points for positioning	Approx. 400 Positioning d	points/axis (dep ata can be indir	ending on the progra	m)
	Setting m	ethod	Setting with a GSV22PE so	an IBM PC, or A ftware.	271 DVP running the	GSV13PE/
Method		PTPSelection of absolute data method or incremental method Speed/positioning control, Incremental method fixed pitch feed Constant speed control Absolute data method and incremen- tal method can be used together				
			Position tollo	w-up control	Adsolute data metri	
			each axis.	s of command u	init indicated below o	an be selected for
Positioning	-		Control Unit	Command Unit	Address Setting Range	Travel Value Setting Range
	Position	ommands	inch	<u>×10⁻¹ μm</u> ×10 ⁻⁵ inch	-2147483648 to 2147483647	
			degree	×10 ⁻⁵ degree	0 to 35999999	0 to ±2147483647
		PULSE	PULSE	-2147483648 to 2147483647		
	Speed co	mmand (command unit)	0.01 to 6000000.00 (mm/min) 0.001 to 600000.000 (inch/min) 0.001 to 600000.000 (degree/min) 1 to 1000000 (PLS/s)			
	High-spe	ed oscillation function	One designa	ted axis can be	made to oscillate on	a sine wave.
Acceleration/	Automatic	c trapezoidal	Acceleration	time1 to 6	5535 (ms)	
deceleration	accelerat	ion/deceleration	Deceleration time			
processing	S curve a	cceleration/deceleration				
Compensation	Backlash compensation		(U to 65535) × position command unit (units converted to pulses: 0 to 65535 pulses)			
Electronic gear		Compensation function for error in actual travel value with respect to command value				
Home position return function		When an absolute position system is not used: Selection of near-zero point dog type or count type. When an absolute position system is used: Selection of data set type, near-zero point dog type or count type.				
JOG operation function		Provided				
Manual pulse	A171SCP	טי	A maximum of one manual pulse generator can be connected. Use a sequence program to set the number of the axis to be controlled.			
operation function	A273UHC (8/32 axis	CPU s specification)	It is possible to set the smoothing magnification. A maximum of three manual pulse generators can be connected. Use a sequence program to set the numbers of the axes to be controlled. It is possible to set the smoothing magnification.			

Table 2.1 PCPU Performance Specifications

item M function		tem	PCPU Performance/Specifications
			M code output function provided
Limit switch output function		on	Up to 8 points per axis, and 10 ON/OFF setting points, can be set.
Absolute position system			Possible with a motor equipped with an absolute position detector. (Possible to select the absolute data method or incremental method for each axis)
High-speed of	Number of	A171SCPU	Max. 9 points (TREN input of A171SENC (1 point) + one PC input module (8 points)
reading of designated	points read	A273UHCPU (8/32 axis specification)	Max. 11 points (TREN input of A273EX (3 points) + one PC input module (8 points)
data	Reading	TREN input	At leading edge of the TREN input signal.
	timing	PC input module input	Within 0.8 ms of the signal leading edge

Table 2.1 PCPU Performance Specifications (Continued)

/

The internal signals of the servo system CPU and the external signals sent to the servo system CPU are used as positioning signals.

(1) Internal signals

Of the devices available in the servo system CPU, the following six types are used for the internal signals of the servo system CPU.

 Outputs (Y) A273UHCPU (8 axis specification) Internal relays (M)A171SCPU A273UHCPU A273UHCPU A273UHCPU A273UHCPU A273UHCPU A273UHCPU A273UHCPU A273UHCPU M2000 to M3839 (32 axis specification) Special relays
 Internal relays (M)A171SCPU M1600 to M2047 (148 points) A273UHCPU M2000 to M2047 (8 axis specification) (48 points) A273UHCPU M2000 to M3839 (32 axis specification) (1840 points) Special relaysM9073 to M9079
A273UHCPU M2000 to M2047 (8 axis specification) (48 points) A273UHCPU M2000 to M3839 (32 axis specification) (1840 points) • Special relays
(8 axis specification) (48 points) A273UHCPU M2000 to M3839 (32 axis specification) (1840 points) • Special relays
A273UHCPU M2000 to M3839 (32 axis specification) (1840 points) • Special relays
(32 axis specification) (1840 points) Special relays
Special relays
(SP.M) (7 points)
Data registers (D)À171SCPU/ D800 to D1023
A273UHCPU (224 points)
(8 axis specification)
A273UHCPU D0 to D799 (800 points)
(32 axis specifications)
Special registersD9180 to D9199
(SP.D) (20 points)

(2) External signals

The external signals input to the servo system CPU are the upper and lower stroke end limit switch input signals, stop signals, near-zero point dog signal, speed/position switching signal, and manual pulse generator input signals.

- Upper and lower stroke end.....ignals that control the upper limit and limit switch input signals lower limit of the positioning range
- Stop signal..... Stop signal for speed control
- Near-zero point dog signal......The ON/OFF signal from the near-zero point dog
- Speed/position switching......Signal that switches control from signal speed to position control
- Manual pulse generator.....Signal from the manual pulse generainput tor



Fig. 3.1 Flow of Positioning Signals

3.1 Axis Input/Output Signals

The servo system CPU has I/O (X, Y) devices and internal relay (M) devices, and the ranges of devices that are used for positioning control are fixed as shown below.

Servo System CPU	I/O / internal Relay	Range for Positioning Control
A171SCPU	M/L0 to M/L2047	M1600 to M1999
A273UHCPU (8 axis specification)	X/Y0 to X/Y1FFF	X/Y0 to X/YFF
A273UHCPU (32 axis specification)	M/L0 to M/L8191	M2400 to M3839

The devices for positioning control are used as axis I/O signals and their applications are fixed as shown in Table 3.1 and Table 3.2.

Signal Name					
		A1718CPU	A273UHCPU (8 axis specification)	A27SUHCPU (32 axis specification)	Signal Direction
Positioning sta	rt completed	M1600+20n	XnO	M2400+20n	
Positioning cor	npleted	M1601+20n	Xn1	M2401+20n	
In-position		M1602+20n	Xn2	M2402+20n	
Command in-p	osition	M1603+20n	Xn3	M2403+20n	
Speed control	in progress	M1604+20n	Xn4	M2404+20n	
Speed/position	switching latch	M1605+20n	Xn5	M2405+20n]
Zero pass		M1606+20n	Xn6	M2406+20n	
Error detection		M1607+20n	Xn7	M2407+20n	
Servo error de	tection	M1608+20n	Xn8	M2408+20n	
Home position return request		M1609+20n	Xn9	M2409+20n	PCPU → SCPU
Home position return completed		M1610+20n	XnA	M2410+20n	
FLS		M1611+20n	XnB	M2411+20n	
External	RLS	M1612+20n	XnC	M2412+20n	
signals	STOP	M1613+20n	XnD	M2413+20n	
, ·	DOG/CHANGE	M1614+20n	_		
	DOG	_	XnE	M2414+20n	
Servo READY		M1615+20n	XnF	M2415+20n	
Torque control in progress		M1616+20n	XD0+n	M2416+20n	
CHANGE signal		-	XD8+n	M2417+20n	
Unusable		M1618+20n	XF0+n	M2418+20n	
"M code output signal	t in progress"	M1619+20n	XC0+n	M2419+20n	

Table 3.1 Axis Input Signals

REMARK

"m" and "n" in Table 3.1 represent the numerical value that corresponds to the axis number.

<A171SCPU>

Axis No.	n	
1	0	
2	2	
3	4	
4	6	

<A273UHCPU (8 axis specification)>

Axis No.	n
1	0
2	1
3	2
4	3
5	4
6	5
7	6
9	7

<A273UHCPU (32 axis specification)>

Axis No.	n	Axis No.	n	Axis No.	n	Axis No.	n
_ 1	0	9	8	17	16	25	24
2	1	10	9	18	17	26	25
3	2	11	10	19	18	27	26
4	3	12	11	20	19	28	27
5	4	13	12	21	20	29	28
6	5	14	13	22	21	30	29
7	6	15	14	23	22	31	30
8	7	16	15	24	23	32	31

 Calculate the device numbers that correspond to each axis when using an A273UHCPU (32 axis specification) as follows.
 Example: 32 axes use

M2400+20n (positioning completed) = M2400+20x31 = M3020

M2417+20n (CHANGE signal) = M2417+20x31 = M3037

		Signal		
Signal Name	A171SCPU	A273UHCPU (8 axis specification)	A273UHCPU (32 axis specification)	Direction
Stop command	M1800+20n	Yn0	M3200+20n	
Rapid stop command	M1801+20n	Yn1	M3201+20n	
Forward JOG start	M1802+20n	Yn2	M3202+20n]
Reverse JOG start	M1803+20n	Yn3	M3203+20n]
End signal OFF command	M1804+20n	Yn4	M3204+20n]
Speed/position switching enabled	M1805+20n	Yn5	M3205+20n	
Limit switch output enable	M1806+20n	Yn6	M3206+20n	
Error reset	M1807+20n	Yn7	M3207+20n	
Servo error reset	M1808+20n	Yn8	M3208+20n	
External STOP input valid/ invalid when starting	M1809+20n	Yn9	M3209+20n	
Unuachia	M1810+20n	YnA	M3210+20n	}
Onusable	M1811+20n	YnB	M3211+20n	
Feed present value update request command	M1812+20n	YnC	M3212+20n	
Unuahla	M1813+20n	YnD	M3213+20n]
	M1814+20n	YnE	M3214+20n]
Servo OFF	M1815+20n	YnF	M3215+20n]
	M1816+20n	—	M3216+20n]
Unusable	M1817+20n	—	M3217+20n	
L	M1818+20n		M3218+20n]
FIN signal	M1819+20n	YC0+n	M3219+20n	

Table 3.2 Axis Output Signal

REMARK

"m" and "n" in Table 3.2 represent the numerical values that correspond to the axis numbers.

<a171scpu></a171scpu>			
Axis No.	n		
1	0		
2	2		
3	4		
4	6		

<A273UHCPU (8 axis specification)>

1

2

3 4

5

6

7

8

Axis n

0

1

3

4

5

6

7

<A273UHCPU (32 axis specification)>

Axis No.	n	Axis No.	n	Axis No.	n	Axis No.	n
1	0	9	8	17	16	25	24
2	1	10	9	18	17	26	25
3	2	11	10	19	18	27	26
4	3	12	11	20	19	28	27
5	4	13	12	21	20	29	28
6	5	14	13	22	21	30	29
7	6	15	14	23	22	31	30
8	7	16	15	24	23	32	31

Calculate the device numbers that correspond to each axis when using an A273UHCPU (32 axis specification) as follows. Example: 32 axes used

M3200+20n (stop command) = M3200+20x31 = M3820 M3215+20n (servo OFF) = M3215+20x31 = M3835

POINTS

- (1) Internal relays for positioning control are not latched even inside the latch range. In this manual, in order to indicate that internal relays for positioning are not latched, the expression used in the text is "M1600 to M1999/M2400 to M3839".
- (2) When the internal relays for positioning control are monitored with a peripheral device, the following happens:
 - (a) With a peripheral device running on the GSV13PE/GSV22PE software package, the internal relays for positioning control which are set in the latch range are displayed as L1600 to L1999/L2400 to L3839.

3.1.1 Positioning start completed signal (M1600+20n/Xn0/M2400+20n)

 This signal comes ON when starting of positioning control of the axis designated by the DSFRP/SVST instruction in the sequence program is completed.
 It does not come ON when positioning control starts due to a home position return, JOG operation or manual pulse generator operation.

It can be used, for example, to read an M code when positioning is started. (See Section 8.2.)

(2) The positioning start completed signal goes OFF at the leading edge (OFF \rightarrow ON) of the end signal OFF command (M1804+20n) or when positioning is completed.





REMARKS

- *1: The 'n' in 'M2001+n is a value corresponding to an axis number, as shown in the table below.
- *2: The "n" in M1600+20n and M1804+20n indicates a numerical value corresponding to the axis number, as indicated in the table below.

<When using A171SCPU>

Axis No.	n
1	0
2	1
3	2
4	3

3.1.2 Positioning completed signal (M1601+20n/Xn1/M2401+20n)

- (1) This signal comes ON when positioning control of the axis designated by the DSFRP/SVST instruction in the sequence program is completed. It does not come ON when positioning control is started, or stopped part way through, due to a home position return, JOG operation, manual pulse generator operation, or speed control. It does not come on when positioning is stopped part way through. It can be used, for example, to read an M code on completion of positioning. (See Section 8.2.)
- (2) The positioning completed signal goes OFF at the leading edge (OFF → ON) of the end signal OFF command, or when a positioning control start is completed.





REMARKS

- *1: The 'n' in 'M2001+n is a value corresponding to an axis number, as shown in the table below.
- *2: The "n" in M1601+20n and M1804+20n indicates a numerical value corresponding to the axis number, as indicated in the table below.
- <When using A171SCPU>

Axis No.	n
1	0
2	1
3	2
4	3

3.1.3 In-position signal (M1602+20n/Xn2/M2402+20n)

(1) The in-position signal comes ON when the number of droop pulses in the deviation counter enters the "in-position range" set in the servo parameters.

It goes off when axis motion starts.



- (2) An in-position check is performed in the following cases.
 - · When the servo power supply is switched on
 - After automatic acceleration/deceleration is started during positioning control
 - After deceleration is started as a result of the JOG start signal going OFF
 - When manual pulse generator operation is in progress
 - . After the near-zero point dog comes ON during a home position return
 - After deceleration is started as a result of a stop command
 - When a speed change to a speed of "0" is executed

3.1.4 Command in-position signal (M1603+20n/Xn3/M2403+20n)

- (1) The command in-position signal comes ON when the absolute value of the difference between the command position and the feed present value enters the "command in-position range" set in the fixed parameters. It goes OFF in the following cases.
 - · When positioning control starts
 - · When a home position return is executed
 - When speed control is executed
 - When JOG operation is performed
 - · When manual pulse generator operation is performed
- (2) Command in-position checks are continually performed during positioning control.

Command in-position checks are not performed during speed control or during speed control in speed/position switching control.



3.1.5 Speed control in progress signal (M1604+20n/Xn4/M2404+20n)

- (1) The speed control in progress signal is ON during speed control and is used to determine whether speed control or position control is currently being executed. In speed/position switching control, it remains ON until the switch from speed control to position control is executed on receipt of the CHANGE signal from an external source.
- (2) The speed control in progress signal is OFF when the power is switched ON and during position control.



3.1.6 Speed/position switching latch signal (M1605+20n/Xn5/M2405+20n)

- The speed/position switching latch signal comes ON when control is switched from speed control to position control. It can be used as an interlock signal to enable or disable changing of the travel value in position control.
- (2) The signal goes OFF when any of the following are started.
 - Position control
 - Speed/position switching control
 - Speed control
 - JOG operation
 - Manual pulse generator operation



3.1.7 Zero pass signal (M1606+20n/Xn6/M2406+20n)

This signal comes ON when the zero point is passed after the power to the servo amplifier has been switched ON.

Once the zero point has been passed, the signal remains ON until the CPU has been reset.

3.1.8 Error detection signal (M1607+20n/Xn7/M2407+20n)

(1) The error detection signal comes ON when a minor error or major error is detected and is used to determine whether or not errors have occurred.

When a minor error is detected, the corresponding error code^{*1} is stored in the minor error code storage area (see Section 3.4.1).

When a major error is detected, the corresponding error code^{*2} is stored in the major error code storage area (see Section 3.4.1).

(2) When the error reset signal (M1807+20n) comes ON, the error detection signal goes OFF.

Minor error or major	error detected ON
Error detection signal	OFF
(M1607+20n)	
Error reset signal	OFF
(M1807+20n)	

REMARKS

*1: For details on the error codes when minor errors occur, see Appendix 2.2.

*2: For details on the error codes when major errors occur, see Appendix 2.3.

3.1.9 Servo error detection signal (M1608+20n/Xn8/M2408+20n)

(1) The servo error detection signal comes ON when an error occurs at the servo amplifier side (excluding errors that cause alarms, and emergency stops)*1, and is used to determine whether or not servo errors have occurred.

When an error is detected at the servo amplifier side, the corresponding error code*1 is stored in the servo error code storage area.

(2) The servo error detection signal goes OFF when the servo error reset signal (M1808+20n) comes ON, or when the servo power supply is switched back on.



REMARK

*1: For details on the error codes of errors detected at the servo amplifier side, see Appendix 2.4.

3.1.10 Home position return request signal (M1609+20n/Xn9/M2409+20n)

This signal comes ON when it is necessary to confirm the home position address when the power is switched on or during positioning control.

- (1) When not using an absolute value system
 - (a) The home position return request signal comes ON in the following cases:
 - 1) When the power is switched on, or the servo system CPU is reset.
 - 2) During a home position return operation.
 - (b) The home position return request signal goes OFF when the home position return operation is completed.
- (2) When using an absolute value system
 - (a) The home position return request signal comes on in the following cases:
 - 1) During a home position return operation.
 - 2) When a backup data (reference value) sum check error occurs (when the power is switched on).
 - (b) The home position return request signal goes OFF when the home position return operation is completed.

3.1.11 Home position return completed signal (M1610+20n/XnA/M2410+20n)

- (1) The home position return completed signal comes ON when the execution of a home position return operation in accordance with a servo program has been completed normally.
- (2) It goes OFF when positioning is started, when JOG operation is started, or when manual pulse generator operation is started.
- (3) If an attempt is made to execute a near-zero-point dog home position return while the home position return completed signal is ON, the "ZERO RETURN START" error occurs, making it impossible to start the home position return.

3.1.12 FLS signal (M1611+20n/XnB/M2411+20n)

- (1) FLS signal is controlled by the ON/OFF status of the upper stroke end limit switch input (FLS) to the A171SENC or A278LX from an external source.
 - Upper stroke end limit switch input OFF......FLS signal: ON
 - Upper stroke end limit switch input ON.....FLS signal: OFF
- (2) The status of the upper stroke end limit switch input (FLS) when the FLS signal is ON/OFF is indicated in the figure below.



3.1.13 RLS signal (M1612+20n/XnC/M2412+20n)

- (1) The RLS signal is controlled by the ON/OFF status of the lower stroke end limit switch input (FLS) to the A171SENC or A278LX from an external source.
 - Lower stroke end limit switch input OFF......RLS signal: ON
 - Lower stroke end limit switch input ON......RLS signal: OFF
- (2) The status of the lower stroke end limit switch input (RLS) when the RLS signal is ON/OFF is indicated in the figure below.



3.1.14 STOP signal (M1613+20n/XnD/M2413+20n)

- (1) The STOP signal is controlled by the ON/OFF status of the stop signal (STOP) sent to the A171SENC or A278LX from an external source.
 - Stop signal OFF.....STOP signal: OFF
 - Stop signal ON.....STOP signal: ON
- (2) The status of the external stop switch (STOP) when the STOP signal is ON/OFF is indicated in the figure below.



3.1.15 DOG/CHANGE signal (M1614+20n): when A171SCPU used

- (1) The DOG/CHANGE signal is controlled by the ON/OFF status of the near-zero-point dog input or the speed/position switching input (DOG/CHANGE) sent to the A171SENC from an external source.
- (2) Regardless of the "normally open contact input" and "normally closed contact input" settings in the system settings, the DOG/CHANGE signal comes on when the near-zero-point dog signal or change signal comes ON.
- (3) When "normally open contact input" is set in the system settings, nearzero-point dog or CHANGE input occurs when the near-zero-point dog or change signal comes ON, and when "normally closed contact input" is set, near-zero-point dog or CHANGE input occurs when the near-zeropoint dog or change signal goes OFF.

3.1.16 DOG signal (XnE/M2414+20n): when A273UHCPU (8/32-exis specification) is used

- (1) The DOG signal is controlled by the ON/OFF status of the near-zero point dog (DOG) notified to the A278LX from an external source.
- (2) Regardless of the "normally open contact input" and "normally closed contact input" settings in the system settings, the near-zero-point dog signal comes ON when the near-zero-point dog comes ON, and goes OFF when the near-zero-point dog goes OFF.
- (3) When "normally open contact input" is set in the system settings, nearzero-point dog input occurs when the near-zero-point dog comes ON, and when "normally closed contact input" is set, near-zero-point dog input occurs when the near-zero-point dog goes OFF.

3.1.17 Servo READY signal (M1615+20n/XnF/M2415+20n)

- (1) The servo READY signal comes ON when the servo amplifiers connected to each axis are in the READY status.
- (2) The signal goes OFF in the following cases.
 - When M2042 is OFF
 - · When no servo amplifier is installed
 - . When the servo parameters have not been set
 - When the power supply module has received an emergency stop input from an external source
 - When the M1815+20n/YnF/M3215+20n signal comes ON and establishes the servo OFF status
 - When a servo error occurs For details, see Appendix 2.4 "Servo Errors"
 - (a) When an A171SCPU is used



POINTS

(1) When an axis driven by an ADU becomes subject to a serve error, the axes that go into the serve OFF status depend on the system settings, as follows. (Applies only when using A273UHCPU (8/32 axis specification))

Setting for processing when ADU servo error occurs	"Servo OFF" axes		
System servo OFF	All axes in the system including the one subject to servo error		
Servo OFF of affected axis only	Only the axis subject to servo error		

(2) When an axis driven by an MR-[]-B becomes subject to a servo error, the affected axis only goes into the servo OFF status.

- (b) When an A273UHCPU is used

3.1.18 Torque control in progress signal (M1616+20n/XDn/M2416+20n)

Signals for axes whose torque is being controlled are ON.

3.1.19 CHANGE signal (XD8+n/M2417+20n): When A273UHCPU (8/32-axis specification) is used

- (1) The CHANGE signal is controlled by the ON/OFF status of the speed/position switching input (CHANGE) to the A278LX from an external source.
 - Speed/position switching input OFF.....CHANGE signal: OFF
 - Speed/position switching input ON.....CHANGE signal: ON
- (2) The status of the speed switching switch (CHANGE) when the CHANGE signal is ON and OFF is indicated in the figure below.



3.1.20 Stop command (M1800+20n/Yn0/M3200+20n)

(1) The stop command is a signal used to stop an axis that is currently being driven and becomes effective at its leading edge (OFF \rightarrow ON). (An axis for which the stop command is ON cannot be started.)



(2) It can also be used as the stop command when speed control is being executed.

(For deta	ils on speed	i control, see	Section 7.12	or Section 7.13.)
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Control Bolon	Processing when the Stop Command Comes ON				
Executed	If Control is Being Executed	If Deceleration Stop Processing is Being Executed			
Position control Speed control (I, II)	The axis decelerates to a stop in the deceleration time set in the parameter block or servo program.	The stop command is ignored and deceleration stop processing continues.			
Manual pulse generator operation	An immediate stop is executed, with no deceleration processing.				
Home position return	 The axis decelerates to a stop in the deceleration time set in the parameter block. A "stop during home position return" error occurs and the error code (202) is stored in the minor error storage area for each axis. 				

POINT

If a stop is executed by turning ON the stop command (M1800+20n/Yn0/ M3200+20n) during a home position return operation, re-execute the home position return operation.

If the stop command came ON after the near-zero point dog came ON in the home position return operation, first retract to a position before the point where the near-zero point dog comes ON using JOG operation or positioning, and then execute the home position return operation again.

3.1.21 Rapid stop command (M1801+20n/Yn1/M3201+20n)

(1) The rapid stop command is a signal used to rapidly stop an axis that is currently being driven and becomes effective at its leading edge (OFF \rightarrow ON). (An axis for which the rapid stop command is ON cannot be started.)



(2) The details of stop processing when the rapid stop command comes ON are presented in the table below.

Control Roing	Processing when the Rapid Stop Command Comes ON				
Executed	If Control is Being Executed	If Deceleration Stop Processing is Being Executed			
Position control	The axis decelerates to a stop in the deceleration time set in the	Deceleration processing is cancelled and rapid stop processing executed instead.			
JOG operation	parameter block or servo program.				
Manual pulse generator operation	An immediate stop is executed, with no deceleration processing.	_			
Home position	 The axis decelerates to a stop in the rapid stop deceleration time set in the parameter block. 				
return	(2) A "stop during home position return" error occurs and the error code (203) is stored in the minor error storage area for each axis.				

POINT

If a stop is executed by turning ON the rapid stop command (M1801+20n/Yn1/M3201+20n) during a home position return operation, re-execute the home position return operation.

If the rapid stop command came ON after the near-zero point dog came ON in the home position return operation, first retract to a position before the point where the near-zero point dog comes ON using JOG operation or positioning, and then execute the home position return operation again.

3.1.22 Forward JOG start command (M1802+20n/Yn2/M3202+20n) / Reverse JOG start command (M1803+20n/Yn3/M3203+20n)

- (1) While the sequence program keeps M1802+20n ON, JOG operation is executed in the direction in which address numbers increase. When M1802+20n is turned OFF, a deceleration stop is executed in the deceleration time set in the parameter block.
- (2) While the sequence program keeps M1803+20n ON, JOG operation is executed in the direction in which address numbers decrease. When M1803+20n is turned OFF, a deceleration stop is executed in the deceleration time set in the parameter block.

POINT

Establish an interlock in the sequence program to make it impossible for the forward JOG start command (M1802+20n/Yn2/M3202+20n) and the reverse JOG start command (M1803+20n/Yn3/M3203+20n) to be ON at the same time.

3.1.23 End signal OFF command (M1804+20n/Yn4/M3204+20n)

(1) The end signal OFF command is used to turn off the positioning start completed signal (M1600+20n) and the positioning completed signal (M1601+20n) by using the sequence program.



POINT

Do not turn the end signal OFF command ON with a PLS command. If it is turned ON with a PLS command, it will not be possible to turn OFF the positioning start completed signal (M1600+20n/Xn0/M2400+20n) or the positioning completed signal (M1601+20n/Xn1/M2401+20n).

3.1.24 Speed/position switching enable command (M1805+20n/Yn5/M3205+20n)

- (1) The speed/position switching enable command is used to make the CHANGE signal (signal for switching from speed to position control) effective from an external source.
 - ON...... Control switches from speed control to position control when the CHANGE signal comes ON.
 - OFF...... Control does not switch from speed to position control even if the CHANGE signal comes ON.

Control does not swit speed control to posi because M1805+20n	tion control is OFF.	Control switches from speed control to position control be- cause M1805+20n is ON.
Speed/position switch- ing enable command (M1805+20n)	OFF	
CHANGE signal from external source	OFF	

3.1.25 Limit switch output enable command (M1806+20n/Yn6/M3206+20n)

The limit switch output enable command is used to enable limit switch output.

- ON...... The limit switch output ON/OFF pattern can be output.
- OFF...... Limit switch output goes OFF.

3.1.26 Error reset command (M1807+20n/Yn7/M3207+20n)

The error reset command is used to clear the minor error code or major error code storage area of an axis for which the error detection signal has come ON (M1607+20n: ON), and reset the error detection signal (M1607+20n).



3.1.27 Servo error reset command (M1808+20n/Yn8/M3208+20n)*

The servo error reset command is used to clear the servo error code storage area of an axis for which the servo error detection signal has come ON ((M1808+20n: ON), and reset the servo error detection signal (M1808+20n).



POINT

*: Do not turn the error reset command (M1807+20n/Yn7/M3207+20n) or servo error reset command (M1808+20n/Yn8/M3208+20n) ON with a PLS command.

If a PLS command is used, it will not be possible to reset the error or servo error.

REMARK

For details on minor error code, major error code, and servo error code storage areas, see Appendix 2.

3.1.28 External STOP input/invalid when starting command (M1809+20n/Yn9/M3209+20n)

This signal is used to make external STOP signal input valid or invalid.

- ON...... External STOP input is set as invalid, and even axes for which STOP input is currently ON can be started.
- OFF...... External STOP input is set as valid, and axes for which STOP input is currently ON cannot be started.

POINT

To stop an axis by external STOP input after it has been started with the M1809+20n/Yn9/M3209+20n command ON, switch the STOP input from OFF to ON (if STOP input is ON when the axis is started, switch it from ON to OFF to ON).

3.1.29 Feed present value update request command (M1812+20n/YnC/M3212+20n)

This signal is used to set whether the feed present value will be cleared or not when motion is started in speed/position switching control.

- ON...... The feed present value is updated, starting from when motion is started.
 - The feed present value is not cleared on starting.
- OFF......The feed present value is updated, starting from when motion is started.

The feed present value is cleared on starting.

POINT

When motion is started with M1812+20n/YnC/M3212+20n, leave M1812+20n ON until positioning control has been completed. If M1812+20n/YnC/M3212+20n is turned OFF part way through, the feed present value may not be reliable.

3.1.30 Servo OFF command (M1815+20n/YnF/M3215+20n)

The servo OFF command is used to establish the servo OFF status (free run status).

- M1815+20n : OFF Servo ON
- M1815+20n : ON.....Servo OFF (free run status)

This command is not effective during positioning and should therefore be executed on completion of positioning.

▲ Turn the power supply at the servo side OFF before turning a servomotor by hand.

3.1.31 FIN signal (M1819+20n/YC0+n/M3219+20n)

- (1) This is a signal to stop the output of an M code.
- (2) It goes OFF when the M code output in progress signal (M1619+20n) goes OFF.

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3.1.32 M code output in progress signal (M1619+20n/XC0+n/M2419+20n)

- (1) This signal indicates that an M code is being output.
- (2) To terminate M code output, turn the FIN signal (M1819+20n) ON.
- (3) This signal goes OFF on input of a stop command, cancel signal, or skip signal.



POINTS

- (1) The FIN signal and M code output in progress signals are used for the purposes of the FIN signal wait function.
- (2) The M code output in progress signal only becomes effective when the FIN signal wait function is designated in a servo program. If this function is not designated, the signal will not come ON even when an M code is being output.

3.2 Internal Relays (M)

An A171SCPU has 2048 internal relay/latch relay points from M/L0 to M/L2047, and an A273UHCPU (8/32 axis specification) has 8192 internal/latch relay points from M/L0 to M/L8191.

Of these, M2000 to M2047 are used for positioning control in the case of the A171SCPU/A273UHCPU (8 axis specification), and M2000 to M2399 are used for positioning control in the case of the A273UHCPU (32 axis specification). The applications of these devices are indicated in the table below.

	Device No.						
Signal Name	A171SCPU		A273L (8 axis spe	A273UHCPU (8 axis specification)		A273UHCPU (32 axis specification)	
	SV13	SV22	SV13	SV22	SV13	SV22	
PC READY			M2	000			SCPU→PCPU
Start reception flag	M2001 (axis 1) to M2004 (axis 4)		M2001 (axis 1) to M2008 (axis 8)		M2001 t M2032	(axis 1) o (axis 32)	PCPU→SCPU
All-axis servo ON reception flag	M2	009	M2	009	M2049		
Manual puise generator enable flag	M2	012	M2012 t	o M2014	M2051 to M2053		SCPU→PCPU
JOG simultaneous start command	M2015		M2015		M2048		SCPU-PCPU
Speed switching point designation flag*	M2016	M2040	M2016 M2040 M204		040		
Start buffer full	M2	020	M2	020	M2	050	
Speed change flags	M2021 (axis 1) to M2024 (axis 4)		M2021 t M2028	M2021 (axis 1) to M2028 (axis 8)		(axis 1) o (axis 32)	PCPU→SCPU
System setting error flag	M2041						
All axis servo start command			M2	042			SCPU→PCPU
Optional slot module error detection flag		M2047					
Automatic deceleration in progress flag	-		-	-	M2128 t M2159	(axis 1) o (axis 32)	PCPU→SCPU
"Accepting speed change [0]"	eed change [0]' —		-	_	M2240 t M2271	(axis 1) o (axis 32)	

Table	3.3	Internal	Relays
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POINTS

(1) Internal relays for positioning control are not latched even inside the latch range.

In this manual, in order to indicate that internal relays for positioning are not latched, the expression used in the text is "M2000 to M2047".

- (2) The range of devices allocated as internal relays for positioning control cannot be used by the user even if their applications have not been set.
- (3) * : When using an A171S/A273UHCPU (8 axis specification), the device number used for the speed switching point designation flag is different for the SV13 and SV22.

- 3.2.1 PC READY flag (M2000) Signal sent from SCPU to PCPU
 - (1) This signal serves to notify the PCPU that the SCPU is normal. It is switched ON and OFF by the sequence program.
 - (a) While M2000 is ON, the positioning control or home position return specified by the servo program, or the JOG operation or manual pulse generator operation specified by the sequence program, can be executed.
 - (b) While M2000 is OFF, and while the test mode for testing from a peripheral device is effective (while the "in-test-mode flag" (M9075) is ON), the control in (a) above will not be executed even if M2000 is turned ON.
 - (2) The fixed parameters, servo parameters, and limit switch output parameters can only be changed using a peripheral device when M2000 is OFF. If an attempt is made to change this data while M2000 is ON, an error will occur.
 - (3) When M2000 is switched from OFF to ON, the following processing occurs.
 - (a) Processing details
 - 1) The servo parameters are transferred to the servo amplifier.
 - 2) The M code storage area for all axes is cleared.
 - 3) The default value of 300% is set in the torque limit value storage area. (See Section 4.4.)
 - 4) The PCPU READY-completed flag (M9074) is turned ON.
 - (b) If there is an axis currently being driven, an error occurs, and the processing in 3 (a) above is not executed.
 - (c) While the test mode is in effect, the processing in 3 (a) above is not executed. When the test mode is cancelled, the processing in 3 (a) will be executed if M2000 is ON.



- (4) When M2000 is switched from ON to OFF, the following processing is executed.
 - (a) Processing details
 - 1) The PCPU READY-completed flag (M9074) is turned OFF.
 - 2) The axis being driven is decelerated to a stop.



3.2.2 Start accept flag (M2001 to M2004/M2001 to M2008/M2001 to M2032) Signal sent from PCPU to SCPU

REMARK

A numerical value corresponding to an axis number is entered for the "n" in "M2001+n".

<A273UHCPU

Axis No.	n
1	0
2	2
3	_4
4	6

<A171SCPU>

(8 axis specification)> ٦

No.	n	
1	0	
2	1	
3	2	
4	3	
5	4	
6	5	
7	6	
8	7	

<a273uhcpu< th=""><th>(32 axis</th><th>s specification)</th><th>)></th></a273uhcpu<>	(32 axis	s specification))>

Axis No.	n	Axis No.	n	Axis No.	n	Axis No.	n
1	0	9	8	17	16	25	24
2	1	10	9	18	17	_26	25
3	2	11	10	19	18	27	26
4	3	12	11	_20	19	28	27
5	_ 4	13	12	21	20	29	28
6	5	14	13	22	21	30	29
7	6	15	14	23	22	31	30
8	7	16	15	24	23	32	31

The start accept flag comes ON when the positioning start (DSFRP/ (1) SVST) instruction is executed in the sequence program: use it as an interlock to enable or disable execution of the DSFRP/SVST instruction.

---------- Example -----When requesting execution of the servo programs for positioning on axis 1 and axis 2, use the start accept flags in the way shown below. DSFRP/SVST instruction execution request enabled/disabled specification M2001 M2003



The start accept flag ON/OFF processing takes the following form. (2)

(a) The start accept flag for the designated axis comes ON in response to a DSFRP/SVST instruction, and goes OFF on completion of positionina.

The start accept flag will also go OFF if positioning is stopped part way through.

(However, if positioning is stopped part way through by a speed change to speed 0, the start accept flag will remain ON.)



- (b) When positioning control is executed by turning ON the JOG operation command (M1802+20n or M1803+20n), the start accept flag goes OFF when positioning is stopped by turning the JOG operation command OFF.
- (c) The start accept flag is ON while the manual pulse generator enable flag (M2012: ON) is ON.
 The start accept flag is OFF while the manual pulse generator enable flag (M2015: OFF) is OFF.
- ▲ The user must not turn start accept flags ON/OFF.
 - If a start accept flag that is ON is switched OFF with the sequence program or a peripheral device, no error will occur but the positioning operation will not be reliable. Depending on the type of machine, it might operate in an unanticipated manner.
 - If a start accept flag that is OFF is switched ON with the sequence program or a peripheral device, no error will occur at that time, but the next time an attempt is made to start the axis an error will occur during a start accept flag being ON and the axis will not start.
 - (d) The start accept flag is ON during a present value change initiated by a DSFLP instruction. It goes OFF on completion of the present value change.



(3) When M2000 is OFF, execution of a DSFRP/SVST instruction causes the start accept flag to come ON; the flag goes OFF when M2000 comes ON.



3.2.3 All axis servo start accept flag (M2009) Signal sent from PCPU to SCPU

The all axis servo start accept flag serves to notify that servo operation is possible.

- ON The servomotor can be driven.
- OFF The servomotor cannot be driven.



3.2.4 Manual pulse generator enable flag (M2012/M2012 to M2014/M2051 to M2053) Signal sent from SCPU to PCPU

The manual pulse generator enable flags set the enabled or disabled status for positioning with the pulse input from the manual pulse generators connected to P1*/P1 to P3* of the A171SENC/A273EX.

- ONPositioning control is executed in accordance with the input from the manual pulse generators.
- OFF Positioning with the manual pulse generators is not possible because the input from the manual pulse generators is ignored.

REMARK

*: For details on the P1 connector of the A171SENC, refer to the A171SCPU Motion Controller User's Manual. For details on the P1 to P3 connectors of the A273EX, refer to the A273UHCPU (8/32 axis specification) Motion Controller User's Manual.

3.2.5 JOG simultaneous start command (M2015/M2015/M2048) Signal sent from SCPU to PCPU

- (1) When M2015 is turned ON, JOG operation is simultaneously started on the axes for which JOG operation is to be executed (of axes 1 to 4) as set in the JOG operation simultaneous start axis setting register (D1015).
- (2) When M2015 is turned OFF, motion on the axis currently executing JOG operation decelerates to a stop.

3.2.6 Speed switching point designation flag (M2016, M2040) Signal sent from SCPU to PCPU

CPU Model	A171SCPU		A273L (8 axis spe	HCPU cification)	A273UHCPU (32 axis specification)	
os	SV13	SV22	SV13	SV22	SV13	SV22
Device No.	M2016	M2040	M2016	M2040	M2040	

The speed switching point designation flag is used when a speed change is designated at the pass point in constant speed control.

(1) By turning M2016 ON before the start of constant speed control (before the servo program is started using the DSFRP/SVST instruction), control can be executed with a speed change at the start of the pass point.



(2) After completion of start accept processing, the speed switching point designation flag can be turned OFF at any time.

3.2.7 Start buffer full (M2020/M2020/M2050) ... Signal sent from PCPU to SCPU

- (1) This signal comes on when 16 or more requests (A171S) or 64 or more requests (A273UH) have been issued simultaneously to the PCPU by means of position start (DSFRP/SVST) instructions and/or control change (DSFLP) instructions in the sequence program.
- (2) Reset M2020 by using the sequence program.

3.2.8 Speed change flags (M2021+n/M2021+n/M2061+n) Signal from PCPU to SCPU

REMARK

A numerical value corresponding to an axis number is entered for the "n" in "M2001+n".

<A273UHCPU

<a171scpu></a171scpu>				
Axis No.	n			
1	0			
2	2			
3	4			
4	6			

<A273UHCPU (32 axis specification)>

Axis No.	n	Axis No.	n	Axis No.	n	Axis No.	n
1	0	9	8	17	16	25	24
2	1	10	9	18	17	26	25
3	2	_ 11	10	19	18	27	26
4	3	12	11	20	19	28	27
5	4	13_	12	21	20	29	28
6	5	14	13	22	21	30	29
7	6	15	14	23	22	31	30
8	7	16	15	24	23	32	31

The speed change flags come ON when a speed change is executed in response to a control change (DSFLP/CHGV) instruction in the sequence program: use them for interlocks in speed change programs.



3.2.9 System setting error flag (M2041) Signal sent from PCPU to SCPU

When the power is switched ON, or when the servo system CPU is reset, the system setting data set with a peripheral device is input, and a check is performed to determine if the set data matches the module mounting status (of the main base unit and extension base units).

- ONError
- OFFNormal
- (1) When using an A273UHCPU (8/32 axis specification), if an error occurs the cause of the error is indicated by the LEDs on the front of the CPU. When using an A171SCPU, if an error occurs the ERROR LED on the front of the CPU lights. It is possible to check the history of errors that have occurred by using a peripheral device (peripheral device running the GSV13PE/GSV22PE software).

(2) When M2041 is ON, positioning cannot be started. You must eliminate the cause of the error and switch the power back ON, or reset the servo system CPU.

REMARK

Even if a module is loaded at a slot set as "NO USE" in the system setting data set with a peripheral device, that slot will be regarded as not used.

3.2.10 All axes servo start command (M2042) Signal from SCPU to PCPU

The all axes servo start command is used to enable servo operation.

- (1) Servo operation enabled M2042 is turned ON while the servo OFF signal (YnF) is OFF and there is no servo error.
- (2) Servo operation disable M2042 is OFF
 - The servo OFF signal (YnF) is ON
 - Servo error



POINT

(1) Once M2042 has been turned ON, it will not go OFF even if the CPU is set in the STOP status.

3.2.11 Optional slot module error detection flag (M2047) Signal from PCPU to SCPU

- (1) When using an A171SCPU This flag is used to determine whether the status of modules mounted to the main base unit and extension base units is "normal" or "abnormal".
 - ONWhen mounted module is abnormal
 - OFF When mounted module is normal

The module information when the power is switched ON and module information after the power has been switched ON are always checked and errors are detected.

- (a) When M2047 comes ON, the ERROR LED of the A171SCPU lights.
- (b) Use the sequence program to execute the appropriate processing (stopping the driven axis, establishing the servo OFF status) when an error occurs.
- (2) When using an A273UHCPU (8/32 axis specification)

This flag is used to determine whether the status of modules mounted to base units or motion extension base units is "normal" or "abnormal".

- ON When the mounted module is abnormal
- OFF When the mounted module is abnormal

The module information when the power is switched ON and module information after the power has been switched ON are continually checked and errors detected.

(a) When M2047 comes ON, the LED indicator on the A273UHCPU displays the following message.

SLOO UNIT ERROR

LI/O slot No. (0 to 7)

-Base unit No. (0: main base 1: motion extension base)

(b) Use the sequence program to execute the appropriate processing (stopping the driven axis, establishing the servo OFF status) when an error occurs.

3.2.12 Automatic deceleration in progress flag (M2128 to M2159): when using an A273UHCPU (32 axis specification) Signal sent from PCPU to SCPU

This signal is ON during automatic deceleration processing in position control or position follow-up control.

- (1) This flag is ON during automatic deceleration to the command address in position follow-up control, but will go OFF if the command address is changed.
- (2) This flag goes OFF on normal start completion, regardless of the control mode used.
- (3) The automatic deceleration flag does not come ON in the following cases.
 - During deceleration caused by turning the JOG signal OFF.
 - During manual pulse generator operation
 - When deceleration is started part way through positioning due to a stop command or stop cause.

• When the travel value is 0



*: The automatic deceleration flags are tabled below.

Axis No.	Device No.						
1	M2128	9	M2136	17	M2144	25	M2152
2	M2129	10	M2137	18	M2145	26	M2153
3	M2130	11	M2138	19	M2146	27	M2154
4	M2131	12	M2139	20	M2147	28	M2155
5	M2132	13	M2140	21	M2148	29	M2156
6	M2133	14	M2141	22	M2149	30	M2157
7	M2134	15	M2142	23	M2150	31	M2158
8	M2135	16	M2143	24	M2151	32	M2159

REMARK

In the SV22 virtual mode, this flag becomes the flag for the virtual servomotor axis.

3.2.13 Speed change "0" accept flag : when A273UHCPU (32 axis specification) is used Signal sent from PCPU to SCPU

The speed change "0" accept flag is ON while a request for a speed change to speed "0" is being accepted.

It comes ON when a request for a speed change to speed "0" is accepted while an axis is being driven. After that, it will go OFF if a request for a speed change to a speed other than "0" is accepted, or on stop completion due to a stop cause.



*: The speed change "0" accept flags are tabled below.

Axis No.	Device No.	Axis No.	Device No.	Axis No.	Device No.	Axis No.	Device No.
1	M2240	9	M2248	17	M2256	25	M2264
2	M2241	10	M2249	18	M2257	26	M2265
3	M2242	11	M2250	19	M2258	27	M2266
4	M2243	12	M2251	20	M2259	28	M2267
5	M2244	13	M2252	21	M2260	29	M2268
6	M2345	14	M2253	22	M2261	30	M2269
7	M2246	15	M2254	23	M2262	31	M2270
8	M2247	16	M2255	24	M2263	32	M2271

REMARKS

- (1) If a start accept flag (M2001 to M2032) is ON even though positioning is stopped, it indicates that a request for a speed change to speed "0" has been accepted. Check this with the speed change "0" accept flag.
- (2) When interpolation is performed, a number of flags corresponding to the number of axes on which interpolation is performed are set.
- (3) In the following cases, a request for a speed change to speed "0" is invalid.
 - After deceleration due to JOG OFF
 - During manual pulse generator operation
 - After the start of automatic deceleration in positioning
 - After deceleration due to a stop cause
- (4) In the SV22 virtual mode, this flag becomes the flag for the virtual servomotor axis.
(1) If a request for a speed change to a speed other than "0" is issued during deceleration to a stop initiated by a speed change to speed "0", this flag goes OFF.



(2) This flag goes OFF when a stop cause occurs after acceptance of a request for a speed change to speed "0".



(3) If the speed change to speed "0" occurs after automatic deceleration has started, the speed change "0" accept flag will not come ON.



(4) During position follow-up control, the speed change "0" accept flag will come ON even if the speed change to speed 0 occurs after automatic deceleration to the command address has started.





(1) During position follow-up control also, if the command address is changed while the speed change to speed "0" is being accepted, the relevant positioning will not be executed.

3.3 Special Relays (SP.M)

The servo system CPU has 256 special relay points from M9000 to M9255. Of these, the 7 points from M9073 to M9079 are used for positioning control, and their applications are indicated in Table 3.4.

Device No.	Signal Name	Signal Direction
M9073	WDT error flag	
M9074	PCPU READY-completed flag	
M9075	In-test-mode flag	DODU - CODU
M9076	External emergency stop input flag	
M9077	Manual pulse generator axis setting error flag]
M9078	Test mode request error flag	
M9079	Servo program setting error flag	

Table 3.4 Special Relays

3.3.1 WDT error flag (M9073) Signal sent from PCPU to SCPU

This flag comes ON when a "watchdog timer error" is detected by the PCPU's self-diagnosis function.

When the PCPU detects a WDT error, it executes an immediate stop without deceleration on the driven axis.

When the WDT error flag has come ON, reset the servo system CPU with the key switch.

If M9073 remains ON after resetting, there is a fault at the PCPU side. The error cause is stored in the PCPU error cause storage area (D9184) (see Section 3.5.2).

3.3.2 PCPU READY-completed flag (M9074) Signal sent from PCPU to SCPU

This flag is used to determine whether the PCPU is normal or abnormal from the sequence program.

- (1) When the PC READY flag (M2000) turns from OFF to ON, the fixed parameters, servo parameters, limit switch output data, etc., are checked, and if no error is detected the PCPU READY-completed flag comes ON. The servo parameters are written to the servo amplifiers and the M codes are cleared.
- (2) When the PC READY flag (M2000) goes off, the PCPU READY-completed flag also goes OFF.



3.3.3 In-test-mode (M9075) Signal from PCPU to SCPU

- (1) This flag is used to determine whether or not a test mode established from a peripheral device is currently effective. Use it, for example, for an interlock effective when starting a servo program with a DSFRP/SVST instruction in the sequence program.
 - ON When the test mode is not in effect
 - OFF When the test mode is in effect
- (2) If a test mode request is issued from a peripheral device but the test mode is not established, the test mode request error flag (M9078) comes ON.

3.3.4 External emergency stop input flag (M9076) Signal from PCPU to SCPU

This flag is used to check the ON or OFF status of external emergency stop signal input at the EMG terminal.

- ON External emergency stop input is ON
- OFF External emergency stop input is OFF

3.3.5 Manual pulse generator axis setting error flag (M9077) Signal sent from PCPU to SCPU

- (1) This flag is used to determine whether the setting in the manual pulse generator axis setting register (D1012) is normal or abnormal.
 - ON When D1012 is normal
 - OFF When D1012 is abnormal
- (2) When M9077 comes ON, the error contents are stored in the manual pulse generator axis setting error register (D9187).

3.3.6 Test mode request error flag (M9078) Signal sent from PCPU to SCPU

- (1) This flag comes ON if the test mode is not established when a test mode request is sent from a peripheral device.
- (2) When M9078 comes ON, the error contents are stored in the test mode request error register (D9188).

POINTS

- (1) When an emergency stop signal (EMG) is input during positioning, the feed present value is advanced within the rapid stop deceleration time set in the parameter block. At the same time, the servo OFF status is established because the all axes servo start command (M2042) goes OFF. When the rapid stop deceleration time has elapsed after input of the emergency stop signal, the feed present value returns to the value at the point when the emergency stop was initiated.
- (2) If the emergency stop is reset before the emergency stop deceleration time has elapsed, a servo error occurs.
- (3) If you do not want to establish the servo ON status immediately after an emergency stop has been reset, include the following section in the sequence program.

All axes servo start command execution signal		110	- 1
MO	[SET	M2042	}

3.3.7 Servo program setting error flag (M9079) Signal from PCPU to SCPU

This flag is used to determine whether the positioning data of the servo program designated by a DSFRP/SVST instruction is normal or abnormal.

- •OFF.....Normal
- ♦ONAbnormal

3.4 Data Registers (D)

An A171SCPU has 1024 data register points from D0 to D1023, and an A273UHCPU (8/32 axis specification) has 8192 data register points from D0 to D8191.

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In the case of an A171SCPU or A273UHCPU (8 axis specification), the 224 points from D800 to D1023, and in the case of an A273UHCPU (32 axis specification) the 800 points from D0 to D799, are used for positioning control, and the applications of these devices are shown in the following table.

<A171SCPU>

Table 3.5 Data Registers

Device No.	Si	gnal Name	Device No.	Signal Name	
D800 to D819	Axis 1 monitoring data	First data register number 0	D1012	Setting register for axis number controlled with manual pulse generator	
D820 to D839	Axis 2 monitoring data	Devisition counter value H Devisition counter value H Minor error code Minor error code Servo error code Servo error code	D1013	Unusable	
D840 to D859	Axis 3 monitoring data	10 zero polski dog la ON H 11 Home position ratura ascond tavat value H 12 Executed program number H 13 H code H 14 Torque Smit value H	D1014	Unusable	
D860 to D879	Axis 4 monitoring data	Travel value change register L H Travel value change register L H For constant value when L STOP is input H For constant speed control	D1015	JOG operation simultaneous start axis setting register	
D880 to D959	Unusable		D1016	1 pulse input magnification setting register of manual pulse generator for axis 1	
D960 to D965	Axis 1 control change data storage area		D1017	1 pulse input magnification setting register of manual pulse generator for axis 2	
D966 to D971	Axis 2 control change data storage area	First data register number O Present velue change I Present velue change H	D1018	1 pulse input magnification setting register of manual pulse generator for axis 3	
D972 to D977	Axis 3 control change data storage area	2 Speed change register L 3 H 4 JOG speed setting register L 5 H	2 Speed change registerH 3H 4JOG speed setting registerH 5H	D1019	1 pulse input magnification setting register of manual pulse generator for axis 4
D978 to D983	Axis 4 control change data storage area		D1020 to D1023	Unusable	
D984 to D1007	Unusable				
D1008 to D1009	Limit switch output d	isable setting			
D1010 to D1011	Unusable				

<A273UHCPU

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(8 axis specification)>

Table 3.6 Data Registers

Device No.	Si	gnal Name	Device No.	Signal Name
D800 to D819	Axis 1 monitoring data		D1012	Setting register for axis number controlled with manual pulse generator 1
D820 to D839	Axis 2 monitoring data		D1013	Setting register for axis number controlled with manual pulse generator 2
D840 to D859	Axis 3 monitoring data	First data register number 0 Feed present value L 1 2 Actual present value L	D1014	Setting register for axis number controlled with manual pulse generator 3
D860 to D879	Axis 4 monitoring data	Constant of the second of	D1015	JOG operation simultaneous start axis setting register
D880 to D899	Axis 5 monitoring data	Berry error code Travel value when the near-L Zero peak dag is CM H Home position man excand gave value Zero peak dag is CM H	D1016	1 pulse input magnification setting register of manual pulse generator for axis 1
D900 to D919	Axis 6 monitoring data	13 M deeds 14 Torque Bink value 16 Travel value change register L 18 H 17 Actual present value change in the L	D1017	1 pulse input magnification setting register of manual pulse generator for axis 2
D920 to D939	Axis 7 monitoring data	18 SIGH is report H	D1018	1 pulse input magnification setting register of manual pulse generator for axis 3
D940 to D959	Axis 8 monitoring data		D1019	1 pulse input magnification setting register of manual pulse generator for axis 4
D960 to D965	Axis 1 control change data storage area		D1020	1 pulse input magnification setting register of manual pulse generator for axis 5
D966 to D971	Axis 2 control change data storage area		D1021	1 pulse input magnification setting register of manual pulse generator for axis 6
D972 to D977	Axis 3 control change data storage area		D1022	1 pulse input magnification setting register of manual pulse generator for axis 7
D978 to D983	Axis 4 control change data storage area	First data register number O Present value change L Register H	D1023	1 pulse input magnification setting register of manual pulse generator for axis 8
D984 to D989	Axis 5 control change data storage area	3 4 5 5 5 5 5 5 5 5 5 5 5 5 5		
D990 to D995	Axis 6 control change data storage area			
D996 to D1001	Axis 7 control change data storage area			
D1002 to D1007	Axis 8 control change data storage area			
D1008 to D1011	Limit switch output di	sable setting		

<A273UHCPU

(32 axis specification)>

Table 3.7 Data Registers

Device No.	Signal Name	Device No.	Signal Name	Data Register Names
D0 to D19	Axis 1 monitoring data	D320 to D339	Axis 17 monitoring data	
D20 to D39	Axis 2 monitoring data	D340 to D359	Axis 18 monitoring data	
D40 to D59	Axis 3 monitoring data	D360 to D379	Axis 19 monitoring data	
D60 to D79	Axis 4 monitoring data	D380 to D399	Axis 20 monitoring data	•
D80 to D99	Axis 5 monitoring data	D400 to D419	Axis 21 monitoring data	
D100 to D119	Axis 6 monitoring data	D420 to D439	Axis 22 monitoring data	
D120 to D139	Axis 7 monitoring data	D440 to D459	Axis 23 monitoring data	First data register number
D140 to D159	Axis 8 monitoring data	D460 to D479	Axis 24 monitoring data	Actual present value
D160 to D179	Axis 9 monitoring data	D480 to D499	Axis 25 monitoring data	A Serve error code A Serve error code P Home position return second travel value Travel value when the near- L zero point dog is O M H
D180 to D199	Axis 10 monitoring data	D500 to D519	Axis 26 monitoring data	12 Executed program number 13 M code 14 Torque limit value 15 For constant speed control 16 Travel value change register 1
D200 to D219	Axis 11 monitoring data	D520 to D539	Axis 27 monitoring data	17 18 Actual present value when L 19 STOP is input H
D220 to D239	Axis 12 monitoring data	D540 to D559	Axis 28 monitoring data	
D240 to D259	Axis 13 monitoring data	D560 to D579	Axis 29 monitoring data	
D260 to D279	Axis 14 monitoring data	D580 to D599	Axis 30 monitoring data	
D280 to D299	Axis 15 monitoring data	D600 to D619	Axis 31 monitoring data	
D300 to D319	Axis 16 monitoring data	D620 to D639	Axis 32 monitoring data	

<A273UHCPU

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(32 axis specification)> Table 3.7 Data Registers (Continued)

Device No.	Signal Name	Device No.	Signal Name	Data Register Names
D640	Axis 1 JOG speed data	D672	Axis 17 JOG speed data	
D641	storage area	D673	storage area	
D642	Axis 2 JOG speed data	D674	Axis 18 JOG speed data	
D643	storage area	D675	storage area	
D644	Axis 3 JOG speed data	D676	Axis 19 JOG speed data	
D645	storage area	D677	storage area	
D646	Axis 4 JOG speed data	D678	Axis 20 JOG speed data	
D647	storage area	D679	storage area	
D648	Axis 5 JOG speed data	D680	Axis 21 JOG speed data	
D649	storage area	D681	storage area	
D650	Axis 6 JOG speed data	D682	Axis 22 JOG speed data	
D651	storage area	D683	storage area	
D652	Axis 7 JOG speed data	D684	Axis 23 JOG speed data	First data register number
D653	storage area	D685	storage area	
D654	Axis 8 JOG speed data	D686	Axis 24 JOG speed data	1 - JOG speed setting register - H
D655	storage area	D687	storage area	
D656	Axis 9 JOG speed data	D688	Axis 25 JOG speed data	
D657	storage area	D689	storage area	
D658	Axis 10 JOG speed data	D690	Axis 26 JOG speed data	
D659	storage area	D691	storage area	
D660	Axis 11 JOG speed data	D692	Axis 27 JOG speed data	
D661	storage area	D693	storage area	
D662	Axis 12 JOG speed data	D694	Axis 28 JOG speed data	
D663	storage area	D695	storage area	
D664	Axis 13 JOG speed data	D696	Axis 29 JOG speed data	
D665	storage area	D697	storage area	
D666	Axis 14 JOG speed data	D698	Axis 30 JOG speed data	
D667	storage area	D699	storage area	
D668	Axis 15 JOG speed data	D700	Axis 31 JOG speed data	
D669	storage area	D701	storage area	
D670	Axis 16 JOG speed data	D702	Axis 32 JOG speed data	
D671	storage area	D703	storage area	

<A273UHCPU

(32 axis specification)> Table 3.7 Data Registers (Continued)

Device No.	Signal Name	Device No.	Signal Name
D704 to D709	Unusable	D737	1 pulse input magnification setting register of manual pulse generator for axis 18
D710 to D713	JOG operation simultaneous start axis setting register	D738	1 pulse input magnification setting register of manual pulse generator for axis 19
D714 D715	Setting register for axis number controlled with manual pulse generator 1	D739	1 pulse input magnification setting register of manual pulse generator for axis 20
D716 D717	Setting register for axis number controlled with manual pulse generator 2	D740	1 pulse input magnification setting register of manual pulse generator for axis 21
D718 D719	Setting register for axis number controlled with manual pulse generator 3	D741	1 pulse input magnification setting register of manual pulse generator for axis 22
D720	1 pulse input magnification setting register of manual pulse generator for axis 1	D742	1 pulse input magnification setting register of manual pulse generator for axis 23
D721	1 pulse input magnification setting register of manual pulse generator for axis 2	D743	1 pulse input magnification setting register of manual pulse generator for axis 24
D722	1 pulse input magnification setting register of manual pulse generator for axis 3	D744	1 pulse input magnification setting register of manual pulse generator for axis 25
D723	1 pulse input magnification setting register of manual pulse generator for axis 4	D745	1 pulse input magnification setting register of manual pulse generator for axis 26
D724	1 pulse input magnification setting register of manual pulse generator for axis 5	D746	1 pulse input magnification setting register of manual pulse generator for axis 27
D725	1 pulse input magnification setting register of manual pulse generator for axis 6	D747	1 pulse input magnification setting register of manual pulse generator for axis 28
D726	1 pulse input magnification setting register of manual pulse generator for axis 7	D748	1 pulse input magnification setting register of manual pulse generator for axis 29
D727	1 pulse input magnification setting register of manual pulse generator for axis 8	D749	1 pulse input magnification setting register of manual pulse generator for axis 30
D728	1 pulse input magnification setting register of manual pulse generator for axis 9	D750	1 pulse input magnification setting register of manual pulse generator for axis 31
D729	1 pulse input magnification setting register of manual pulse generator for axis 10	D751	1 pulse input magnification setting register of manual pulse generator for axis 32
D730	1 pulse input magnification setting register of manual pulse generator for axis 11	D752*	Manual pulse generator 1 (P1) smoothing magnification setting area
D731	1 pulse input magnification setting register of manual pulse generator for axis 12	D753*	Manual pulse generator 2 (P2) smoothing magnification setting area
D732	1 pulse input magnification setting register of manual pulse generator for axis 13	D754*	Manual pulse generator 3 (P3) smoothing magnification setting area
D733	1 pulse input magnification setting register of manual pulse generator for axis 14	D755 to D759	Unusable
D734	1 pulse input magnification setting register of manual pulse generator for axis 15	D760 to D775	Limit switch output disable setting
D735	1 pulse input magnification setting register of manual pulse generator for axis 16	D776* to D791	Limit switch output status storage area
D736	1 pulse input magnification setting register of manual pulse generator for axis 17	D792* to D799	Servo amplifier type

*: Treated as a special register in this manual. For details, see Section 3.5.

3.4.1 Monitoring data area (D800 to D879/D800 to D959/D0 to D639) Data sent from the PCPU to the SCPU

The monitoring data area is used by the PCPU to store data such as the feed present value during positioning control, the actual present value, and the number of droop pulses in the deviation counter.

It can be used to check the positioning control status using the sequence program.

The user cannot write data into the monitoring data area (with the exception of the travel value register).

For details on the delay time between a positioning device (input, internal relay, special relay) going ON or OFF and storage of data in the monitor data area, see APPENDIX 7 "Processing Times".

Names	Axis 1	Axis 2	Axis 3	Axis 4
Feed present value	D801,D800	D821,D820	D841,D840	D861,D860
Actual present value	D803,D802	D823, D822	D843,D842	D863,D862
Deviation counter value	D805,D804	D825,D824	D845,D844	D865,D864
Minor error code	D806	D826	D846	D866
Major error code	D807	D827	D847	D867
Servo error code	D808	D828	D848	D868
Travel value after near-zero point dog comes ON	D810,D809	D830,D829	D850,D849	D870,D869
Home position return second travel value	D811	D831	D851	D871
Executed program number	D812	D832	D852	D872
M code	D813	D833	D853	D873
Torque limit value	D814	D834	D854	D874
Travel value change register	D816,D815	D836,D835	D856,D855	D876,D875
Actual present value when STOP is input	D818,D817	D838,D837	D858,D857	D878,D877
Constant speed control data set pointer	D819	D839	D859	D879

<A171SCPU> Table 3.8 Monitoring Data Areas

<A273UHCPU (8 axis specification)

8 axis specification)> Table 3.9 Monitoring Data Areas								
Name	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8
Feed present value	D801,D800	D821,D820	D841,D840	D861,D860	D881,D880	D901,D900	D921,D920	D941,D940
Actual present value	D803,D802	D823,D822	D843,D842	D863,D862	D883,D882	D903,D902	D923,D922	D943,D942
Deviation counter value	D805,D804	D825,D824	D845,D844	D865,D864	D885,D884	D905,D904	D925,D924	D945,D944
Minor error code	D806	D826	D846	D866	D886	D906	D926	D946
Major error code	D807	D827	D847	D867	D887	D907	D927	D947
Servo error code	D808	D828	D848	D868	D888	D908	D928	D948
Travel value after near-zero point dog comes ON	D810,D809	D830,D829	D850,D849	D870,D869	D890,D889	D910,D909	D930,D929	D950,D949
Home position return second travel value	D811	D831	D851	D871	D891	D911	D931	D951
Executed program number	D812	D832	D852	D872	D892	D912	D932	D952
M code	D813	D833	D853	D873	D893	D913	D933	D953
Torque limit value	D814	D834	D854	D874	D894	D914	D934	D954
Travel value change register	D816,D815	D836,D835	D856,D855	D876,D875	D896,D895	D916,D915	D936,D935	D956,D955
Actual present value when STOP is input	D818,D817	D838,D837	D858,D857	D878,D877	D898,D897	D918,D917	D938,D937	D958.D959
Constant speed control data set pointer	D819	D839	D859	D879	D899	D919	D939	D959

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<a2730hcpu (32="" axis="" specification)=""></a2730hcpu>						3.10 MOI	nitoring D	ata Areas
Name	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8
Feed present value	D1,D0	D21,D20	D41,D40	D61,D60	D81,D80	D101,D100	D121,D120	D141,D140
Actual present value	D3,D2	D23,D22	D43,D42	D63,D62	D83,D82	D103,D102	D123,D122	D143,D142
Deviation counter value	D5,D4	D25,D24	D45,D44	D65,D64	D85,D84	D105,D104	D125,D124	D145,D144
Minor error code	D6	D26	D46	D66	D86	D106	D126	D146
Major error code	D7	D27	D47	D67	D87	D107	D127	D147
Servo error code	D8	D28	D48	D68	D88	D108	D128	D148
Home position return second travel value	D9	D29	D49	D69	D89	D109	D129	D149
Travel value after near-zero point dog comes ON	D11,D10	D31,D30	D51,D50	D71,D70	D91,D90	D111,D110	D131,D130	D151,D150
Executed program number	D12	D32	D52	D72	D92	D112	D132	D152
M code	D13	D33	D53	D73	D93	D113	D133	D153
Torque limit value	D14	D34	D54	D74	D94	D114	D134	D154
Constant speed control data set pointer	D15	D35	D55	D75	D95	D115	D135	D155
Travel value change register	D17,D16	D37,D36	D57,D56	D77,D76	D97,D96	D117,D116	D137,D136	D157,D156
Actual present value when STOP is input	D19,D18	D39,D38	D59,D58	D79,D78	D99,D98	D119,D118	D139,D138	D159,D158

Name	Axis 17	Axis 18	Axis 19	Axis 20	Axis 21	Axis 22	Axis 23	Axis 24
Feed present value	D321,D320	D341,D340	D361,D360	D381,D380	D401,D400	D421,D420	D441,D440	D461,D460
Actual present value	D323,D322	D343,D342	D363,D362	D383,D382	D403,D402	D423,D422	D443,D442	D463,D462
Deviation counter value	D325,D324	D345,D344	D365,D364	D385,D384	D405,D404	D425,D424	D445,D444	D465,D464
Minor error code	D326	D346	D366	D386	D406	D426	D446	D466
Major error code	D327	D347	D367	D387	D407	D427	D447	D467
Servo error code	D328	D348	D368	D388	D408	D428	D448	D468
Home position return second travel value	D329	D349	D369	D389	D409	D429	D449	D469
Travel value after near-zero point dog comes ON	D331,330	D351,D350	D371,D370	D391,D390	D411,D410	D431,D430	D451,D450	D471,D470
Executed program number	D332	D352	D372	D392	D412	D432	D452	D472
M code	D333	D353	D373	D393	D413	D433	D453	D473
Torque limit value	D334	D354	D374	D394	D414	D434	D454	D474
Constant speed control data set pointer	D335	D355	D375	D395	D415	D435	D455	D475
Travel value change register	D337,D336	D357,D356	D377,D376	D397,D396	D417,D416	D437,D436	D457,D456	D477,D476
Actual present value when STOP is input	D339,D338	D359,D358	D379,D378	D399,D398	D419,D418	D439,D438	D459,D458	D479,D478

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Axis 9	Axis 10	Axis 11	Axis 12	Axis 13	Axis 14	Axis 15	Axis 16
D161,D160	D181,D180	D201,D200	D221,D220	D241,D240	D261,D260	D281,D280	D301,D300
D163,D162	D183,D182	D203,D202	D223,D222	D243,D242	D263,D262	D283,D282	D303,D302
D165,D164	D185,D184	D205,D204	D225,D224	D245,D244	D265,D264	D285,D284	D305,D304
D166	D186	D206	D226	D246	D266	D286	D306
D167	D187	D207	D227	D247	D267	D287	D307
D168	D188	D208	D228	D248	D268	D288	D308
D169	D189	D209	D229	D249	D269	D289	D309
D171,D170	D191,D190	D211,D210	D231,D230	D251,D250	D271,D270	D291,D290	D311,D310
D172	D192	D212	D232	D252	D272	D292	D312
D173	D193	D213	D233	D253	D273	D293	D313
D174	D194	D214	D234	D254	D274	D294	D314
D175	D195	D215	D235	D255	D275	D295	D315
D177,D176	D197,D196	D217,D216	D237,D236	D257,D256	D277,D276	D297,D296	D317,D316
D179,D178	D199,D198	D219,D218	D239,D238	D259,D258	D279,D278	D299,D298	D319,D318

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Axis 25	Axis 26	Axis 27	Axis 28	Axis 29	Axis 30	Axis 31	Axis 32
D481,D480	D501,D500	D521,D520	D541,D540	D561,D560	D581,D580	D601,D600	D621,D620
D483,D482	D503,D502	D523,D522	D543,D542	D563,D562	D583,D582	D603,D602	D623,D622
D485,D484	D505,D504	D525,D524	D545,D544	D565,D564	D585,D584	D605,D604	D625,D624
D486	D506	D526	D546	D566	D586	D606	D626
D487	D507	D527	D547	D567	D587	D607	D627
D488	D508	D528	D548	D568	D588	D608	D628
D489	D509	D529	D549	D569	D589	D609	D629
D491,D490	D511,D510	D531,D530	D551,D550	D571,D570	D591,D590	D611,D610	D631,D630
D492	D512	D532	D552	D572	D592	D612	D632
D493	D513	D533	D553	D573	D593	D613	D633
D494	D514	D534	D554	D574	D594	D614	D634
D495	D515	D535	D555	D575	D595	D615	D635
D497,D496	D517,D516	D537,D536	D557,D556	D577,D576	D597,D596	D617,D616	D637,D636
D499,D498	D519,D518	D539,D538	D559,D558	D579,D578	D599,D598	D619,D618	D639,D638

- (1) Feed present value register Data from the PCPU to the SCPU
 - (a) This register stores the target address output to the servo amplifier on the basis of the positioning address/travel value designated in the servo program.
 - (b) The stroke range check is performed on this feed present value data.
- (2) Actual present value register Data from the PCPU to the SCPU
 - (a) This register stores the present value attained in actual travel (the feed present value minus the droop pulses in the deviation counter).
 1) In fixed-pitch feed control, the travel value counted up from 0 after
 - motion starts is stored.2) In speed/position switching control, the present value counted up from the address when motion starts is stored.
 - 3) During speed control, "0" is stored.
 - (b) In the stopped status, the feed present value is equal to the actual present value.
- (3) Deviation counter value register Data from the PCPU to the SCPU This register stores the difference between the feed present value and the actual present value.
- (4) Minor error code register Data from the PCPU to the SCPU
 - (a) This register stores the relevant error code (see Appendix 2.2) when a minor error occurs.
 If another minor error occurs, the previous error code is overwritten by the new error code.
 - (b) Minor error codes can be cleared by an error reset signal (M1807+20n).
- (5) Major error code register Data from the PCPU to the SCPU
 - (a) This register stores the relevant error code (see Appendix 2.3) when a major error occurs.
 If another major error occurs, the previous error code is overwritten by the new error code.
 - (b) Major error codes can be cleared by an error reset signal (M1807+20n).
- (6) Servo error code register Data from the PCPU to the SCPU
 - (a) This register stores the relevant error code (see Appendix 2.4) when a servo error occurs.
 If another servo error occurs, the previous error code is overwritten by the new error code.
 - (b) Servo error codes can be cleared by a servo error reset signal (M1808+20n).

- (7) Travel value after near-zero point dog comes ON register Data from the PCPU to the SCPU
 - (a) When a home position return operation is performed, the travel value from the point where the near-zero point dog comes ON to the point where the home position return operation is completed is stored in this register (with no sign appended).
 - (b) In speed/position switching control, the travel value during position control is stored in this register (with no sign appended).
- (8) Home position return second travel value register Data from the PCPU to the SCPU If the position at which motion stops in accordance with the travel value setting after the near-zero point dog has been switched ON by a peripheral device (see Section 7.21) is not the zero point, the servo system CPU will initiate a second travel to the zero point. The travel value for travel to the zero point during this second operation is stored in this register (with no sign appended).

Note that in the case of a data set type home position return operation, the data remains unchanged (the previous value stands).

- (9) Executed program number register Data from the PCPU to the SCPU
 - (a) The program number of the program being executed is stored in this register when the DSFRP/SVST instruction is executed.
 - (b) In JOG operation and manual pulse generator operation, the values indicated below are stored in this register.
 - 1) JOG operation.....FFFF
 - 2) Manual pulse generator operation......FFFE
 - 3) When the power is turned on.....FF00
 - (c) When either of the following is being executed by a peripheral device in the test mode, FFFD is stored in this register.
 - 1) A home position retur
 - 2) A position loop gain or position control gain 1 check in servo diagnosis.
- (10) M code register Data from the PCPU to the SCPU
 - (a) The M code* set for the executed servo program is stored in this register when positioning starts. If no M code is set for the servo program, the value stored is "0".
 - (b) If positioning is started by a means other than a servo program, the existing value does not change.
 - (c) The stored value changes to "0" at the leading edge of the PC READY signal (M2000).

REMARK

- *: See the following sections for details on M codes and reading M codes.
 - M code..... Section 8.2
 - M code reading..... Appendix 6.3
- (11) Torque limit value register Data from the PCPU to the SCPU This register stores the value for the torque limit imposed on the servo system. The default value of 300% is stored in this register when the power to the servo system is turned on or at the leading edge of the PC READY signal (M2000).
- (12) Travel value change register Data from the SCPU to the PCPU This is the area used when the position control travel value is changed in speed/position switching control (see Section 7.14).
- (13) Actual present value when STOP is input register Data from the PCPU to the SCPU This register stores the actual present value when a STOP signal is input from an external source.

(14) Constant speed control data set pointer ... Data from the PCPU to the SCPU

This pointer is used in constant speed control when specifying positioning data indirectly and substituting positioning data during operation. It stores a "point" that indicates which of the values stored in indirect

devices has been input to the PCPU when positioning is being repeated by using a repeat instruction (FOR-TIMES, FOR-ON, FOR-OFF).

Use this pointer in conjunction with the PC set pointer (controlled by the user in the sequence program) - which indicates the extent to which the positioning data has been updated by the SCPU - to confirm which positioning data is to be updated.

The use of the data set pointer and PC set pointer for constant speed control is explained here using the example servo program below.

	<k< th=""><th>° +</th><th></th><th></th></k<>	° +		
Pass point	_			
9	CPSTA	RT2		
	Axis	1		
	Axis	2		
	Speed	1	D200	
•	FOR-TI	MES		
			D202	Point
1	ABS-2			• Points are set in the order
	Axis	1,	DO	FOR-TIMES
	Axis	2,	D2	FOR-OFF
2	ABS-2			1 NEXT
	Axis	1,	D4	0, 1, 2, etc., starting from the head of
	Axis	2,	D6	the sequence defined by the following
3	ABS-2			2 repeat instructions:
	Axis	1,	D8	
	Axis	2.	D10	
4	ABS-2			3
	Axis	1.	D12	
	Axis	2.	D14	
5	ABS-2			
	Axis	1,	D16	
	Axis	2.	D18	
6	ABS-2			5
	Axis	1.	D20	
	Axis	2.	D22	
7	ABS-2			6
	Axis	1.	D24	
	Axis	2.	D26	
8	ABS-2			7
	Axis	1,	D28	
	Axis	2,	D30	
•	NEXT	•		
9	CPEND			

The input of positioning data to the PCPU on updating the positioning data in indirect devices D0 to D6 when 2-axis constant speed control is executed using the servo program shown above is described overpage.

[Input of positioning data to the PCPU]



[Internal processing]

- On starting the operation, the positioning data of points 0 to 6 ((1) to (14)) is input to the PCPU.
 At this time, the last point of the data to be input which is point "6" is stored in the data set pointer for constant speed control.
 The "6" stored in the data set pointer for constant speed control indicates that updating of the positioning data stored in points 0 to 6 is possible.
- (2) The positioning data of points 0 and 1 ((A) to (D)) is updated in accordance with the sequence program.
 The last positioning data to be rewritten which is the data of point "1"
 is stored in the PC set pointer (which must be controlled by the user in the sequence program). Updating of positioning data of points 2 to 6 (data (5) to (14)) remains possible.
- (3) On completion of the positioning for point 0, the value in the data set pointer for constant speed control is automatically incremented by one to "7".

At this time, the positioning data of point 0 ((1) to (2)) is discarded and the positioning data for point 7 ((15) to (16)) is input to the PCPU.

(4) Hereafter, each time the positioning for a point is completed, the positioning data shifts one place.
 The positioning data that can be updated is the data after that indicated by the PC set pointer: this is the data which has not yet been input to the PCPU.
 Consequently, after completion of the positioning corresponding to point 3, even if the values stored in indirect devices D8 and D10 are updated

3, even if the values stored in indirect devices D8 and D10 are updated by the sequence program, the point 2 positioning data that is input to the PCPU will not be updated and the second positioning will be executed using the unupdated data.

In other words, the data set pointer for constant speed control is a pointer that indicates data that has not yet been input to the PCPU and can be updated by the sequence program.

POINT

- (1) Number of points that can be defined by a repeat instruction
 - Create a subprogram to create at least eight points.
 - If there are less than eight points and these include pass points with small travel values, the positioning at each point may be completed, and the data input to the PCPU, before the data has been updated by the sequence program.
 - Create a sufficient number of points to ensure that data will not be input to the PCPU before the SCPU has updated the values in the indirect devices.

Data storage area for control change (D960 to D963/D960 to D1007/D640 to D703) Data 3.4.2 from the SCPU to the PCPU

The data storage area for control change is the area for storing present value change data, speed change data, and JOG operating speed data.

<a171scpu></a171scpu>	Table 3.1	je		
Name	Axis 1	Axis 2	Axis 3	Axis 4
Present value change register	D961,D960	D967,D966	D973,D972	D979,D978
Speed change register	D963,D962	D969,D968	D975,D974	D981,D980
JOG speed setting register	D965,D964	D971,D970	D977,D976	D983,D982

<A273UHCPU

(8 axis specification)> Table 3.12 Data Storage Areas for Control Change

Name	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8
Present value change register	D961,D960	D967,D966	D973,D972	D979,D978	D985,D984	D991,D990	D997,D996	D1003, D1002
Speed change register	D963,D962	D969,D968	D975,D974	D981,D980	D987,D986	D993,D992	D999,D998	D1005, D1004
JOG speed setting register	D965,D964	D971,D970	D977,D976	D983,D982	D989,D988	D995,D994	D1001, D1000	D1007, D1006

<A273UHCPU

(32 axis specification)> Table 3.13 Data Storage Areas for Control Change

Name	Axis 1	Axis 2	Axis_3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8
	D641,D640	D643,D642	D645,D644	D647,D646	D649,D648	D651,D650	D653,D652	D655,D654
	Axis 9	Axis 10	Axis 11	Axis 12	Axis 13	Axis 14	Axis 15	Axis 16
JOG speed	D657,D656	D659,D658	D661,D660	D663,D662	D665,D664	D667,D666	D669,D668	D671,D670
setting register	Axis 17	Axis 18	Axis 19	Axis 20	Axis 21	Axis 22	Axis 23	Axis 24
_	D673,D672	D675,D674	D677,D676	D679,D678	D681,D680	D683,D682	D685,D684	D687,D686
	Axis 25	Axis 26	Axis 27	Axis 28	Axis 29	Axis 30	Axis 31	Axis 32
	D689,D688	D691,D690	D693,D692	D695,D694	D697,D696	D699,D698	D701,D700	D703,D702

POINTS

- When using an A171SCPU/A273UHCPU (8 axis specification), either the DSFLP instruction or CHGA/CHGV instruction can be used to execute present value changes/speed changes.
- When using an A273UHCPU (32 axis specification), present value changes/speed changes can be commanded with a CHGA/CHGV instruction and there is therefore no present value change register or speed change register.

- (1) Present value change register (when using A171SCPU/A273UHCPU (8 axis specification) only)
 - (a) This register stores the feed present value after the change when the feed present value of a stopped axis is changed.

Units	mm		Inch		degree		PLUSE			
item	Setting Range	Units	Setting Range	Units	Setting Range	Units	Setting Range	Units	Remarks	
Present value change value	-2147483648 -2147483647	×10 ⁻¹ µm	-2147483648 -2147483647	×10 ⁻⁵ inch	0~35999999	×10 ⁻⁵ degree	-2147483648 ~2147483647	PLS	Even if the set value is outside the stroke range, no error will occur.	

(b) The ranges of values that can be set in the present value change register are indicated below.

- (c) When the positioning control change instruction (DSFLP) is executed, the value stored in the present value change register becomes the feed present value.
- (d) For details on present value changes, see Section 8.8.
- (2) Speed change register (when using A171SCPU/A273UHCPU (8 axis specification) only)
 - (a) This register stores the speed after the change when the speed of an axis in motion is changed.
 - (b) The setting ranges for the speed change register are indicated below.

Linite mm			inch		degree		PLUSE	
Item	Setting Range	Units	Setting Range	Units	Setting Range	Units	Setting Range	Units
Speed change value	0~60000000	×10 ⁻² mm/min	0~600000000	×10 ⁻³ inch/min	0~60000000	×10 ⁻³ degree/min	0-1000000	PLS/sec

- (c) When the positioning control change instruction (DSFLP) is executed, the value stored in the speed change register becomes the positioning speed.
- (d) For details on speed changes, see Section 8.7.
- (3) JOG speed setting register
 - (a) This register stores the JOG speed during JOG operation.
 - (b) The setting ranges for JOG speed are indicated below.

Units		mm		inch		degree		PLUSE	
Item	Item	Setting Range	Units	Setting Range	Units	Setting Range	Units	Setting Range	Units
JOG	speed	1~600000000	×10 ⁻² mm/min	1~600000000	×10 ⁻³ inch/min	1~600000000	×10 ⁻³ degree/min	1~1000000	PLS/sec

(c) At the leading edge (OFF - ON) of the JOG start signal, the value stored in the JOG speed setting register becomes the effective value.

It is only possible to change the data during JOG operation: the JOG speed cannot be changed.

(d) For details on JOG operation, see Section 7.19.

3.4.3 Limit switch output disable setting register (D1008 to D1009/D1008 to D1011/D760 to D775) Data from the SCPU to the PCPU

(1) This is a register for disabling the external output of limit switch output in 1 point units. If a bit is set to "1", the output of the corresponding limit switch is disabled, then the external output goes OFF.





<A273UHCPU (8 axis specification)>



<A273UHCPU (32 axis specification)>

	b15 b14 b13 b12 b11 b10 b9 b8 b7	7 b6 b5 b4 b3 b2 b1 b0						
D760	LYOF LYOE LYOD LYOC LYOB LYOA LYOS LYO	07 LY06 LY05 LY04 LY03 LY02 LY01 LY00						
	For axis 2	For axis 1						
D761	LY1F LY1E LY1D LY1C LY1B LY1A LY19 LY18 LY1	17 LY16 LY15 LY14 LY13 LY12 LY11 LY10						
	For axis 4	For axis 3						
D762	LY2F LY2E LY2D LY2C LY2B LY2A LY29 LY28 LY2	27 LY26 LY25 LY24 LY23 LY22 LY21 LY20						
	For axis 6	For axis 5						
D763	LY3F LY3E LY3D LY3C LY3B LY3A LY39 LY38 LY3	7 LY36 LY35 LY34 LY33 LY32 LY31 LY30						
	For axis 8	For axis 7						
D764	LY4F LY4E LY4D LY4C LY4B LY4A LY49 LY48 LY4	17 LY46 LY45 LY44 LY43 LY42 LY41 LY40						
		For axis 9						
D765	LY5F LY5E LY5D LY5C LY5B LY5A LY59 LY58 LY5	57 LY56 LY55 LY54 LY53 LY52 LY51 LY50						
	For axis 12							
D766	LY6F LY6E LY6D LY6C LY6B LY6A LY69 LY68 LY6	7 LY66 LY65 LY64 LY63 LY62 LY61 LY60						
D767	LY7F LY7E LY7D LY7C LY7B LY7A LY79 LY78 LY7	7 LY76 LY75 LY74 LY73 LY72 LY71 LY70						
		For axis 15						
D768	LY8F LY8E LY8D LY8C LY8B LY8A LY89 LY88 LY8	7 LY86 LY85 LY84 LY83 LY82 LY81 LY80						
D769	LY9F LY9E LY9D LY9C LY9B LY9A LY99 LY98 LY9	7 LY96 LY95 LY94 LY93 LY92 LY91 LY90						
	For axis 20							
D770	LYAFILYAEILYADILYACILYABILYAAILYA9ILYA8ILYA	7 LYA6 LYA5 LYA4 LYA3 LYA2 LYA1 LYA0						
	For axis 22							
D771		7 LYB6 LYB5 LYB4 LYB3 LYB2 LYB1 LYB0						
	For axis 24							
D772		7 LYC6 LYC5 LYC4 LYC3 LYC2 LYC1 LYC0						
		For axis 25						
D773								
0774								
U//4								
D775		TI YEAL YEAL YEAL YEAL YEAL YEAL YEAL YEAL						
0,70	For axis 32	For axis 30						
	1: DisableThe limit switch output status is OFF.							
	0: EnableThe limit switch output comes ON and goes OFF in accordance with the							
	2) LY of LY00 to LYFF shows the limit switch output.							

3.4.4 Registers for setting axis numbers controlled by manual pulse generators (D1012/D1012 to D1014/D714 to D719) Data from the SCPU to the PCPU

(1) These registers store the axis numbers controlled by manual pulse generators.





<A273UHCPU (32 axis specification)>



(2) For details on manual pulse generator operation, see Section 7.20.

3.4.5 JOG operation simultaneous start axis setting register (D1015/D1015/D710 to D713) Data from the SCPU to the PCPU

(1) This register is used to set the axis numbers of axes on which JOG operation is to be executed, and the direction of motion.

<A171SCPU>



<A273UHCPU (8 axis specification)>



<A273UHCPU (32 axis specification)>



(2) For details on simultaneous starting in JOG operation, see Section 7.19.3.

3.4.6 1 pulse input magnification setting registers for manual pulse generators (D1016 to D1019/ D1016 to D1023/D720 to D751) Data from the SCPU to the PCPU

(1) This register is used to set the magnification (from 1 to 100) per pulse for the number of input pulses from a manual pulse generator in manual pulse generator operation.

<a< th=""><th>1</th><th>7</th><th>1</th><th>S</th><th>С</th><th>Ρ</th><th>U</th><th>></th></a<>	1	7	1	S	С	Ρ	U	>
		-				-		_

1-pulse Input Magnifica- tion Setting Register	Corresponding Axis No.	Setting Range
D1016	Axis 1	
D1017	Axis 2	1 to 100
D1018	Axis 3	
D1019	Axis 4	

<A273UHCPU (8-axis)>

1-pulse Input Magnifica- tion Setting Register	Corresponding Axis No.	Setting Range
D1016	Axis 1	
D1017	Axis 2	
D1018	Axis 3	
D1019	Axis 4	1 to 100
D1020	Axis 5	
D1021	Axis 6	
D1022	Axis 7	
D1023	Axis 8	

< <u>273010P0 (32-axis</u>	2	
1-puise Input Magnifica- tion Setting Register	Corresponding Axis No.	Setting Range
D720	Axis 1	
D721	Axis 2	
D722	Axis 3	
D723	Axis 4	
D724	Axis 5	
D725	Axis 6	
D726	Axis 7	
D727	Axis 8	
D728	Axis 9	
D729	Axis 10	
D730	Axis 11	
D731	Axis 12	
D732	Axis 13	
D733	Axis 14	1 to 100
D734	Axis 15	
D735	Axis 16	
D736	Axis 17	
D737	Axis 18	
D738	Axis 19	
D739	Axis 20	
D740	Axis 21	
D741	Axis 22	
D742	Axis 23	
D743	Axis 24	
D744	Axis 25	
D745	Axis 26	
D746	Axis 27	
D747	Axis 28	
D748	Axis 29	
D749	Axis 30	
D750	Axis 31	
D751	Axis 32	

<A273UHCPU (32-axis)>

(2) For details on manual pulse generator operation, see Section 7.20.

3.5 Special Register (SP.D)

A servo system CPU has 256 special register points from D9000 to D9255. Of these, the 20 points from D9180 to D9199 are used for positioning control. In the case of an A273UHCPU (32-axis specification), some of the devices used for positioning control are data registers (D752 to D754, D760 to D799). In this manual, these data registers used for positioning control are treated as special registers.

The special registers used for positioning are shown in the table below (for the applications of special registers other than D9180 to D9199, see Appendix 3.2.)

<a171scpu> Tab</a171scpu>	e 3.14	Special	Registers
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Device Number	Signal Name
D9180	Limit switch output status storage area for axis 1 and axis 2
D9181	Limit switch output status storage area for axis 3 and axis 4
D9182	
D9183	Unusable
D9184	PCPU error cause
D9185	Santa amplifiar tuna
D9186	Servo ampliner type
D9187	Manual pulse generator axis setting error
D9188	Test mode request error
D9189	Error program number
D9190	Error item information
D9191	Servo amplifier loading information
D9192	Area for setting the manual pulse generator smoothing magnification
D9193	
D9194	
D9195	
to	Unusable
D9199	

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<A273UHCPU

(8 axis specificati	on)> Table 3.15 Special Registers
Device Number	Signal Name
D9180	Limit switch output status storage area for axis 1 and axis 2
D9181	Limit switch output status storage area for axis 3 and axis 4
D9182	Limit switch output status storage area for axis 5 and axis 6
D9183	Limit switch output status storage area for axis 7 and axis 8
D9184	PCPU error cause
D9185	Sana amplifiar tuna
D9186	
D9187	Manual pulse generator axis setting error
D9188	Test mode request error
D9189	Error program number
D9190	Error_item information
D9191	Servo amplifier loading information
D9192	Area for setting the manual pulse generator (P1) smoothing magnification
D9193	Area for setting the manual pulse generator (P2) smoothing magnification
D9194	Area for setting the manual pulse generator (P3) smoothing magnification
D9195	
to D9199	Unusable

<A273UHCPU

(32 axis specification)> Table 3.16 Special Registers

Device Number	Signal Name
D752 [*]	Area for setting the manual pulse generator (P1) smoothing magnification
D753 [*]	Area for setting the manual pulse generator (P2) smoothing magnification
D754 [*]	Area for setting the manual pulse generator (P3) smoothing magnification
D776	
to	Limit switch output status storage area
D791	
D792	
to	Servo amplifier type
D799	
D9180	
to	Unusable
D9181	
D9182	
to	Test mode request error
D9183	
D9184	PCPU error cause
D9185	
to	Manual pulse generator setting error
D9187	
D9188	Unusable
D9189	Error program number
D9190	Error item information
D9191	Servo amplifier loading information
D9192	
D9193	
to	Unusable
D9199	

*: Data registers used

1

3.5.1 Limit switch output status storage area (D9180 to D9181/D9180 to D9183/D776 to D791) ... Data from the PCPU to the SCPU

- (1) Stores the output status (ON/OFF) for limit switch output to AY42 set with a peripheral device, as "1" or "0".
 - ON..... 1
 - OFF.....0
- (2) This area can be used for purposes such as outputting limit switch output data to external destinations by using the sequence program.

<A171SCPU>



REMARK

"LY" in LY[][] of D9180 to D9181 indicates a limit switch output.

<A273UHCPU (8 axis specification)>



REMARK

"LY" in LY[][] of D9180 to D9181 indicates a limit switch output.

<A273UHCPU (32 axis specification)>

D776		
0//6		
D 777		For axis 1
0///		
	For axis 4	For axis 3
D778		LY27 LY26 LY25 LY24 LY23 LY22 LY21 L
	For axis 6	For axis 5
D779		LY37 LY36 LY35 LY34 LY33 LY32 LY31 L
	For axis 8	For axis 7
D780		LY47 LY46 LY45 LY44 LY43 LY42 LY41 L
		For axis 9
D781	LY5F LY5E LY5D LY5C LY5B LY5A LY59 LY58	LY57 LY56 LY55 LY54 LY53 LY52 LY51 L
		For axis 11
D782	LY6F LY6E LY6D LY6C LY6B LY6A LY69 LY68	LY67 LY66 LY65 LY64 LY63 LY62 LY61 L
	For axis 14	For axis 13
D783	LY7F LY7E LY7D LY7C LY7B LY7A LY79 LY78	LY77 LY76 LY75 LY74 LY73 LY72 LY71 L
	For axis 16	For axis 15
D784	LY8F LY8E LY8D LY8C LY8B LY8A LY89 LY88	LY87 LY86 LY85 LY84 LY83 LY82 LY81 L
	For axis 18	For axis 17
D785	LY9F LY9E LY9D LY9C LY9B LY9A LY99 LY98	LY97 LY96 LY95 LY94 LY93 LY92 LY91 L
	For axis 20	
D786	LYAF LYAE LYAD LYAC LYAB LYAA LYAS LYA	LYAT LYA6 LYA5 LYA4 LYA3 LYA2 LYA1 L
	For axis 22	For axis 21
D787	LYBE LYBE LYBD LYBC LYBB LYBA LYB9 LYB	LYB7 LYB6 LYB5 LYB4 LYB3 LYB2 LYB1 L
	For axis 24	
D788	LYCF LYCE LYCD LYCC LYCB LYCA LYC9 LYC	LYC7 LYC6 LYC5 LYC4 LYC3 LYC2 LYC1 L
	For axis 26	For axis 25
D789	LYDF LYDE LYDD LYDC LYDB LYDA LYD9 LYDA	LYD7 LYD6 LYD5 LYD4 LYD3 LYD2 LYD1 L
		For axis 27
D790	LYEF LYEE LYED LYEC LYEB LYEA LYE9 LYEE	LYET LYES LYES LYEA LYES LYEE LYET L
	For axis 30	
D791	LYFF LYFE LYFD LYFC LYFB LYFA LYF9 LYF8	LYF7 LYF6 LYF5 LYF4 LYF3 LYF2 LYF1 L
	For axis 32	For axis 31
	* '1' or '0' is set at each bit of D776	to D791.

REMARK

"LY" in LY[][] of D776 to D791 indicates a limit switch output.

•

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3.5.2 PCPU error cause(D9184) ... Data from the PCPU to the SCPU

This register is used to identify the nature of errors occurring in the PCPU part of the servo system.

(1) When using an A171SCPU

Error Code	Error Cause	Operation when Error Occurs	Action to Take
2	PCPU operation synchronization time over	All axes stop immediately,	Reset with the
3	SCPU software fault 2	after which operation cannot be started.	reset key.
300	SCPU software fault 3		

|--|

Error Code	Error Cause	Operation when Error Occurs	Action to Take
1	PCPU software fault 1	All axes stop immediately,	Reset with the
2	PCPU operation synchronization time over	cannot be started.	reset key.
3	PCPU software fault 2		
30	PCPU/SCPU hardware fault		
100 to 107 110 to 117	CPU fault of AC motor drive module 100 Indicates the slot number (0 to 7) where the AC motor drive module with the fault is loaded. Indicates the stage number of the base on which the AC motor drive module with the fault is loaded. 0: Main base 1: Extension base (1st extension stage)	The servo error detected flag (X0n8) for the relevant axis comes ON and the servo OFF status is established. Thereafter, operation follows the setting for action to take in the event of an ADU servo error made in the system settings.	Reset with the reset key. If the error reoccurs after resetting, the ADU is probably faulty: replace it.
200 to 207 210 to 217	Hardware fault of module loaded on motion main base unit or extension base unit. 200 Image: Indicates the slot number (0 to 7) where the module with the fault is loaded. Indicates the stage number of the base on which the module with the fault is loaded. 0: Main base 1: Extension base (1st extension stage)	All axes stop immediately, after which operation cannot be started.	Reset with the reset key. If the error reoccurs after resetting, the relevant module or the relevant slot (base unit) is probably faulty: replace the module/ base unit.
250 to 251	Standalone servo amplifier (MR-[]-B) interface hard ware fault. 2 5 0 Faulty SSCNET No. 0: SSCNET	All axes stop immediately, after which operation cannot be started.	Reset with the reset key. If the error reccurs after resetting, the relevant module or the relevant slot (base unit) is probably faulty: replace the module/base unit.
300	PCPU software fault 3]	Reset with the reset key.

Error Code	Error	Cause	Operation when Error Occurs	Action Take
1	PCPU software fault 1		All axes stop immediately,	Reset with the
2	PCPU operation synchroniz	zation time over	after which operation cannot be started.	reset key.
3	PCPU software fault 2	<u></u>		
30	PCPU/SCPU hardware faul	t	1	
100 to 107 110 to 117 120 to 127 130 to 137 140 to 147	CPU fault of AC motor drive 100 Indicates the slot AC motor drive m loaded. Indicates the stay which the AC mo fault is loaded. 0: Main base 1: Extension b 2: Extension b 3: Extension b	e module t number (0 to 7) where the nodule with the fault is ge number of the base on otor drive module with the base (1st extension stage) base (2nd extension stage) base (3rd extension stage)	The servo error detected flag (M2408+20n) for the relevant axis comes ON and the servo OFF status is established. Thereafter, operation follows the setting for action to take in the event of an ADU servo error mede in the system settings.	Reset with the reset key. If the error reoccurs after resetting, the ADU is probaly faulty: replace it.
	4: Extension b	ase (4th extension stage)		
200 to 207 210 to 217 220 to 227 230 to 237 240 to 247 250 to 253	Hardware fault of module ic base unit or extension base 200 Indicates the slot module with the f Indicates the star which the module 0: Main base 1: Extension b 2: Extension b 3: Extension b 4: Extension b 4: Extension b 5tandalone servo amplifier ware fault. 250 Faulty SSCNET 1 1: SSCNET 2 2: SSCNET 3 3: SSCNET 4	paded on motion main a unit. t number (0 to 7) where the fault is loaded. ge number of the base on with the fault is loaded. ase (1st extension stage) ase (2nd extension stage) ase (3rd extension stage) ase (4th extension stage) (MR-[]-B) interface hard No.	All axes stop immediately, after which operation cannot be started.	Reset with the reset key. If the error reoccurs after resetting, the relevant module or the relevant slot (base unit) is probably faulty: replace the module/base unit.
300	PCPU software fault 3			Reset with the reset key.
301	CPSTART instructions of 8 executed, exceeding the nu can be started simultaneous Version with conventional functions Version with additional functions	or more points have been imber of programs that sly. Number of Programs that can be Started Simultaneously 20 14		Reset with the reset key. Modify so that CPSTART instructions of 8 or more points do not exceed the number of programs that can be started simultaneously.

(3) When using an A273UHCPU (32 axis specification)

3.5.3 Servo amplifier classification (D9185/D9185 to 9186/D792 to D799) ... Data from the PCPU to the SCPU

(1) When an A171SCPU is used On switching on the power to, or resetting, the servo system CPU, the servo amplifier type set in the system settings is set in these devices.



(2) When an A273UHCPU (8/32 axis specification) is used On switching on the control power supply (A6[]P) to the servo system CPU or resetting, the servo amplifier type set in the system settings is set in these devices.

<A273UHCPU (8 axis specification)>



<A273UHCPU (32 axis specification)>

	b15 to b12	b11 to b8	b7 to b4	b3 to 0	
D792	Axis 4	Axis 3	Axis 2	Axis 1	
D793	Axis 8	Axis 7	Axis 6	Axis 5	
D794	Axis 12	Axis 11	Axis 10	Axis 9	
D795	Axis 16	Axis 15	Axis 14	Axis 13	
D796	Axis 20	Axis 19	Axis 18	Axis 17	
D797	Axis 24	Axis 23	Axis 22	Axis 21	
D798	Axis 28	Axis 27	Axis 26	Axis 25	
D799	Axis 32	Axis 31	Axis 30	Axis 29	
	<u> </u>		Serve	amplifier t	ype
			•0		od axis
			• 1	ADU (MB-11	(main pase unit) I-R
			• 5	ADU	(motion extension base unit)

3.5.4 Manual pulse generator axis setting error (D9187/D9187/D9185 to D9187) ... Data from the PCPU to the SCPU

Stores the contents of a manual pulse generator axis setting error when the manual pulse generator axis setting error flag (M9077) comes ON.





<A273UHCPU (8 axis specification)>


<A273UHCPU (32 axis specification)>



3.5.5 Test mode request error (D9188/D9188/D9182 to D9183) ... Data from the PCPU to the SCPU

Stores the data of axes being operated when the test mode request error flag (M9078) comes ON.

<A171SCPU>



3. POSITIONING SIGNALS



<A273UHCPU (8 axis specification)>

<A273UHCPU (32 axis specification)>



3.5.6 Error program No. (D9189) ... Data from the PCPU to the SCPU

- (1) Stores the number of the subprogram (range: 0 to 4095) affected by the error when the subprogram setting error flag (M9079) comes ON.
- (2) If, once an error program number has been stored, an error occurs in another servo program, the program number of the subprogram with the new error is stored.

3.5.7 Error item information (D9190) ... Data from the PCPU to the SCPU

When the servo program setting error flag (M9079) comes ON, the error code that corresponds to the relevant setting item is stored in this device.

Error Code	Error Contents
900	The servo program set for the DSFRP/SVST instruction does not exist.
901	The axis number set for the DSFRP/SVST instruction is different from the axis number set in the servo program.
902	The instruction code cannot be decoded. (A non-existent instruction code has been designated.)
906	An axis designated as unused in the system settings is set in the subprogram set for the DSFRP/SVST instruction.
Error item data	There is an error in the setting items of the servo program set for the DSFRP/SVST instruction. The error item data indicated in Section 6.3 is stored.

3.5.8 Servo amplifier installation information (D9191/D9191/D9191 to D9192) ... Data from the PCPU to the SCPU

(1) When an A171SCPU is used

On switching on the control power supply to the servo system CPU or resetting, the servo amplifier installation status is checked and the result is set in this device.

Lower 4 bits ... Servo amplifier installation status

The "installed" status will be stored for axes for which an amplifier is installed after the power is switched on. However, if the amplifier for an axis is removed, the "installed" status will not change to "not installed".



- (a) Servo amplifier installation status
 - 1) installed/not installed status
 - "Installed" status...... The MR-[]-B is normal (i.e.communication with the servo amplifier is normal)
 - "Not installed" status......No servo amplifier is installed.
 - The servo amplifier power is OFF. Normal communication with the servo amplifier is not possible due, for example, to a connecting cable fault.
 - 2) The system settings and servo amplifier installation statuses are indicated below.

Eveter Cetting	MR-[]-B		
aystem aetung	Installed	Not installed	
Used (axis number setting)	"1" is stored	"0" is stored	
Unused	"0" is stored	"0" is stored	

(2) When an A273UHCPU (8/32 axis specification) is used

On switching on the control power supply (A6[]P) to the servo system CPU or resetting, the servo amplifier and option slot installation status is checked and the result is stored in this device.

Lower 8 bits Servo amplifier installation status (when A273UHCPU (8 axis specification) is used only).

The "installed" status will be stored for axes for which an amplifier is installed after the power is switched on. However, if the amplifier for an axis is removed, the "installed" status will not change to "not installed".

<A273UHCPU (8 axis specification)>



<A273UHCPU (32 axis specification)>



- (a) Servo amplifier installation status
 - 1) Installed/not installed status
 - "Installed" status...... The MR-[]-B is normal (i.e.communication with the servo amplifier is normal)
 - "Not installed" status......No servo amplifier is installed. The servo amplifier power is OFF. Normal communication with the servo amplifier is not possible due, for example, to a connecting cable fault.
 - 2) The system settings and servo amplifier installation statuses are indicated below.

Sustan Batting	A	DU	MR-[]-B		
System Setung	Installed	Not installed	installed	Not Installed	
Used (axis number setting)	"1" is stored	Major error	"1" is stored	'0' is stored	
Unused	"0" is stored	"0" is stored	"0" is stored	"0" is stored	

3.5.9 Area for setting the smoothing magnification for the manual pulse generator (D9192/D9192 to D9194/D752 to D754) ... Data from the SCPU to the PCPU

(1) This device stores the manual pulse generator smoothing time constant.

<a17asc< th=""><th>PU></th></a17asc<>	PU>
--	-----

Manual Puise Generator Smoothing Magnification Setting Register	Setting Range
D9192	0 to 59

<A273UHCPU (8-axis)>

Manual Pulse Generator Smoothing Magnification Setting Register	Setting Range
Manual pulse generator 1 (P1): D9192	
Manual pulse generator 2 (P2): D9193	0 to 59
Manual pulse generator 3 (P3): D9194	

<A273UHCPU (32-axis)>

Manual Pulse Generator Smoothing Magnification Setting Register	Setting Range
Manual pulse generator 1 (P1): D752	
Manual pulse generator 2 (P2): D753	0 to 59
Manual pulse generator 3 (P3): D754]

- (2) The setting range for the smoothing magnification is 0 to 59.
- (3) When the smoothing magnification is set, the smoothing time constant is determined by the formula given below. Smoothing time constant (t) = (smoothing magnification + 1) \times 56.8 [ms]
- (4) Operation



REMARKS

1) The travel value per manual pulse generator pulse is set in one of the following units.

• Setting unit ____ mm : 0.1 µm ____inch : 0.00001 inch ____degree : 0.00001 degree ____ PULSE : 1 pulse

2) The range for the smoothing time constant is 56.8 ms to 3408 ms.

The seven types of parameter used for positioning control are listed below.

- System settings The system settings set the modules used and axis numbers. For details, see Section 4.1.
- (2) Fixed parameters

The fixed parameters set data that is fixed - in accordance with the mechanical system for example - for each axis. These parameter settings are used for applications such as calculating the command position when positioning control is executed.

For details, see Section 4.2.

(3) Servo parameters

The servo parameters set data - such as the servo model name and servo type - that is determined by the connected servomotor, for each axis.

These settings are used for servomotor control when positioning control is executed.

For details, see Section 4.3.

(4) Home position return data The home position return data sets data such as the direction, method, and speed for home position return, for each axis. This data is used when a home position return expertion is executed.

This data is used when a home position return operation is executed. For details, see Section 7.21.1.

(5) JOG operation data

The JOG operation data is the JOG speed limit value and parameter block No. data, and is set for each axis.

This data is used for positioning control executed during JOG operation. For details, see Section 7.19.

(6) Parameter block

The parameter block includes data such as the acceleration/deceleration times and speed limit value: 16 blocks can be set when using an A171S/A273UHCPU (8 axis specification), and 64 blocks can be set when using an A273UHCPU (32 axis specification).

Parameter blocks are designated in servo programs, in the JOG operation data, and in the home position return data, and make it easier to change data such as that for acceleration and deceleration processing (acceleration/deceleration time, speed limit value) for positioning control.

For details, see Section 4.4.

(7) Limit switch output data

The limit switch output data is ON/OFF pattern data that is output when the limit switch output setting in the fixed parameters is set to "USE", and is set for the axes being used. For the axes for which limit switch output data is set, the set ON/OFF pattern is output to external destinations during positioning control. For details, see Section 8.1.

4.1 System Settings

- (1) The settings made for the system settings include the module used (model name), motor type (model name), and axis number (1 to 4 / 1 to 8 / 1 to 32).
- (2) The system setting data is set at a peripheral device.
- (3) The data to be set is indicated below.
 (a) When an A171SCPU is used
 1) Model names of modules that can be set in system settings

Module Name	Model Name	Remarks	Number in Setting Example
	A172B	2 modules can be installed. (Oue motion module)	
Main base unit	A178B	8 modules can be installed. (One motion module)	—
	A178B-S1	8 modules can be installed. (Two motion modules)	
Futoncian base unit	A1S65B	For extension power supply + 5 slots	
Extension base unit	A1S68B	For extension power supply + 8 slots	_
Manual pulse generator/ synchro- nous encoder interface module	A171SENC	Input signals: 32 points Manuai pulse generator: 1 point Synchronous encoder input: 1 point	1)
Limit output module	A1SY42	64 transistor output points, 12/24 VDC, 0.1 A	2)
	MR-RB013	External regenerative resistor 10 W	
	MR-RB032	External regenerative resistor 30 W	
	MR-RB033	External regenerative resistor 30 W	
	MR-RB064	External regenerative resistor 60 W	
	MR-RB064X2	External regenerative resistor 100 W (Two connected in series)	
	MR-RB12	External regenerative resistor 100 W	
	MR-RB30	External regenerative resistor 300 W	
1	MR-RB31	External regenerative resistor 300 W	
	MR-RB32	External regenerative resistor 300 W	
Resistor regenerative option	MR-RB34	External regenerative resistor 300 W	4)
	MR-RB50	External regenerative resistor 500 W	
	MR-RB51	External regenerative resistor 500 W	
	MR-RB54	External regenerative resistor 500 W	
	MR-H11KB Standard	Regenerative power 600 W, resistance value 8 Ω (2 $\Omega \times 4$)	
	accessory	(When cooled by cooling fan: 800 W)	
	MR-H15KB	[Regenerative power 600 W, resistance value 5 Ω	
	accessory	(When cooled by cooling fan: 1300 W)	
1	MB-H22KB	Recenerative power 600 W, resistance value 4 0	
1	Standard	(0.8 Ω x 5)	
	accessory	(When cooled by cooling fan: 1300 W)	
	FR-BU	Brake unit FR-BU15/30/55K	
	FR-RC	Power supply regenerative converter	
Battery unit	MR-JBAT4	Backs up absolute position sensing	3)

Table 4.1 Module Model Names

 2) Motor types/model names, and amplifier model names, that can be set in system settings
 When using MR-H-B/MR-J-B

Table 4.2 Servo Amplifier Model Names When Using an MR-H-B/MR-J-B

Ampl	ifier Model Name	Number in the Setting Example	Ampi	lifier Model Name	Number in the Setting Example
MR-H-B	MR-H10B MR-H20B MR-H40B MR-H60B MR-H200B MR-H200B MR-H350B MR-H350B MR-H700B MR-H700B MR-H15KB MR-H15KB MR-H22KB	5) to 8)	MR-J-B	MR-J10B MR-J20B MR-J40B MR-J60B MR-J100B MR-J200B	5) to 8)

Table 4.3 Motor Types and Model Names When Using an MR-H-B/MR-J-B

Motor Type	Motor Model Name	Number in the Setting Example	Motor Type	Motor Model Name	Number in the Setting Example
НА-МН	HA-MH053 HA-MH13 HA-MH23		HA-RH	HA-RH103 HA-RH153 HA-RH223	
	HA-MH43 HA-MH73	}		HA-LH52 HA-LH102	
HA-FH	HA-FH053 HA-FH13 HA-FH23 HA-FH33 HA-FH43 HA-FH63		HA-LH	HA-LH152 HA-LH202 HA-LH302 HA-LH502 HA-LH502 HA-LH11K2	9) to 12)
HA-SH 1000 rpm	HA-SH81 HA-SH121 HA-SH201	9) to 12)		HA-LH15K2 HA-LH22K2 HA-UH32	
HA-SH 2000 rpm	HA-SH501 HA-SH52 HA-SH102 HA-SH152 HA-SH352 HA-SH352 HA-SH502 HA-SH702		HA-UH	HA-UH102 HA-UH152 HA-UH222 HA-UH352 HA-UH352	
HA-SH 3000 rpm	HA-SH53 HA-SH103 HA-SH153 HA-SH203 HA-SH353				

- Amplifier Model NameNumber in the
Setting ExampleMR-J2-10B
MR-J2-20B
MR-J2-40B
MR-J2-40B
MR-J2-60B
MR-J2-60B
MR-J2-70B
MR-J2-100B5) to 8)
- When using MR-J2-B

Table 4.4 Servo Amplifier Model Names When Using an MR-J2-B

Table 4.5 Motor Types and Model Names When Using an MR-J2-B

Motor Type	Motor Model Name	Number in the Setting Example
HC-MF	HC-MF053 HC-MF13 HC-MF23 HC-MF43 HC-MF73	
HA-FF	HA-FF053 HA-FF13 HA-FF23 HA-FF33 HA-FF43 HA-FF63	9) to 12)
HC-SF	HC-SF52 HC-SF102	

3) System setting examples

The system setting examples are shown in Figures 4.3 and 4.4. (The numbers 1) through 12) in these figures correspond to the numbers in Tables 4.1 through 4.5.)







Fig. 4.2 System Settings (When an Extension Base Unit is Used)

(b) When an A273UHCPU (8/32 axis) is used

1) Model names of modules/units that can be set in system settings

Module/Unit Name Name		Model Name	Remarks			Number in Setting Example
Main base unit A275B		A275B	Allows loading of a total of 5 motion modules and MELSEC A series standard I/O modules			
		A278B	Allows loading of a total of 8 motion modu standard I/O modules	Allows loading of a total of 8 motion modules and MELSEC A series standard I/O modules		
Cor		A61P	Input: 100/200 VAC; output: 5 VDC 8 A			
mo	dule	A62P	Input: 200/200 VAC; output: 5 VDC 5 A, 24 VDC 0.8 A			1)
		A63P	Input: 24VDC; output: 5 VDC 8 A			
	AC motor drive	A221AM-20	Max. drive motor capacity 200 W (When using HA-FH)/100W (When using HA-MH), 2 axes (occupies 1 slot)			
	module	A211AM-20	Max. drive motor capacity 600 W, 1 axis (occupies 1 slot)		4	4) to 6)
		A222AM-20	Max. drive motor capacity 600 W, 2 axes (occupies 2 slots)			
dules	Servo power supply module	A230P	240 to 342 VDC, 30 A output (regenerative resistor not incorporated)	Main base unit)		7)
om no	Dynamic brake module	A240DY	4-axis dynamic brake	Motion extension Ins	nstalled	3)
Motia	Manual pulse generator/syn- chronous encoder interface module	A273EX	Manual pulse generator: 3 points Tracking input: 3 points			32)
	Servo external signal module	A278LX	External output: 5 points x 8 axes; brake/dynamic brake output			2)
	Limit output module	AY42	64 transistor points 12/24 VDC, 0.1 A			31)
	Machine control module	A271DVP	PC/AT			33)
Motion extension base unit		A255B	A combined total of 5 motion modules and MELSEC A series standard I/O modules can be loaded.	Type which does not require a control power supply module	Same as	
		A268B	A combined total of 8 motion modules and MELSEC A series standard I/O modules can be loaded.	Type for which a control power supply module is loaded.	extension base unit	-

Table 4.6 Module/Unit Model Names

Module/Unit Name	Model Name	Remarks	Number in Setting Example						
	MR-RB013	External regenerative resistor 10 W							
	MR-RB032	External regenerative resistor 30 W	1						
	MR-RB033	External regenerative resistor 30 W	1						
		External regenerative resistor 60 W							
	MR-RB064	External regenerative resistor 100 W (Two connected in series) Can only be installed with a servo power supply module							
	MR- RB064X2	External regenerative resistor 100 W (Two connected in series)							
	MR-RB10	External regenerative resistor 100 W Can only be installed with a servo power supply module							
	MR-RB12	External regenerative resistor 100 W							
	MR-RB30	External regenerative resistor 300 W							
	MR-RB31	External regenerative resistor 300 W							
Resistor regenerative	MR-RB32	External regenerative resistor 300 W							
option	MR-RB34	External regenerative resistor 300 W	14)						
	MR-RB50	External regenerative resistor 500 W							
	MR-RB51	External regenerative resistor 500 W							
	MR-RB54	External regenerative resistor 500 W							
	MR-H11KB Standard accessory	Regenerative power 600 W, resistance value 8 Ω (2 Ω x 4) (When cooled by cooling fan: 800 W)							
· · · · · · · · · · · · · · · · · · ·	MR-H15KB Standard accessory	Regenerative power 600 W, resistance value 5 Ω (1 Ω x 5) (When cooled by cooling fan: 1300 W)							
	MR-H22KB Standard accessory	Regenerative power 600 W, resistance value 4 Ω (0.8 Ω x 5) (When cooled by cooling fan: 1300 W)							
	FR-BU	Brake unit FR-BU15/30/55K							
	FR-RC	Power supply regenerative converter							
	A300RU-50	Regenerative resistor 500 W Can only be installed with a servo power supply module							
Bettery unit	MR-JBAT-4	4 axes max. • Battery that serves to back up absolute position sensing	8)						
Dattory unit	MR-JBAT-8	8 axes max. (motor (absolute value)).	0)						

2) Motor types/model names, and amplifier model names, that can be set in system settings

Motor Type	Motor Model Name	Number in the Setting Example	Motor Type	Motor Model Name	Number in the Setting Example
	HA-MH053		HA-SH 2000 rpm	HA-SH52	
на-мн	HA-MH13		HA-SH 3000 rpm	HA-SH53	
	HA-MH23		HA-LH	HA-LH52	9) to 13)
	HA-FH053	9) to 13)	HA-UH	HA-UH32 HA-UH52	
HA-FH	HA-FH13 HA-FH23 HA-FH33 HA-FH43 HA-FH63				

Table 4.7 Motor Types and Model Names When Using an ADU

• When using MR-H-B/MR-J-B

Table 4.8 Servo Amplifier Model Names When Using MR-H-B/MR-J-B

Amplifier Model Name		Number in the Setting Example	Ampi	ifier Model Name	Number in the Setting Example
MR-H-B	MR-H10B MR-H20B MR-H40B MR-H60B MR-H100B MR-H200B MR-H350B MR-H350B MR-H700B MR-H700B MR-H11KB MR-H15KB MR-H22KB	15) to 22)	MR-J-B	MR-J10B MR-J20B MR-J40B MR-J60B MR-J100B MR-J200B	15) to 22)

Table 4.9 MR-H-B/MR-J-B Motor Types and Motor Model Names

Motor Type	Motor Model Name	Number in the Setting Example	Motor Type	Motor Model Name	Number in the Setting Example
на-мн	HA-MH053 HA-MH13 HA-MH23		HA-RH	HA-RH103 HA-RH153 HA-RH223	
	HA-MH43 HA-MH73			HA-LH52 HA-LH102	
HA-FH	HA-FH053 HA-FH13 HA-FH23 HA-FH33 HA-FH43		HA-LH	HA-LH152 HA-LH202 HA-LH302 HA-LH502 HA-LH502 HA-LH702	23) to 30)
	HA-FH63 HA-SH81 HA-SH121	_	HA-LHK	HA-LH11K2 HA-LH15K2 HA-LH22K2	
HA-SH 1000 rpm	HA-SH201 HA-SH301	23) to 30)		HA-UH32 HA-UH52	
HA-SH 2000 rpm	HA-SH52 HA-SH102 HA-SH152 HA-SH202 HA-SH352		НА-UH	HA-UH102 HA-UH152 HA-UH222 HA-UH352 HA-UH352 HA-UH452	
	HA-SH502 HA-SH702				
HA-SH 3000 rpm	HA-SH53 HA-SH103 HA-SH153 HA-SH203 HA-SH353				

•

Ampli	fler Model Name	Number in the Setting Example
MR-J2-B	MR-J2-10B MR-J2-20B MR-J2-40B MR-J2-60B	15) to 22)
	MR-J2-100B	

Table 4.10 Servo Amplifier Model Names When Using an MR-J2-B

• When using MR-J2-B

Table 4.11 Motor Types and Model Names When Using an MR-J2-B

Motor Type	Motor Model Name	Number in the Setting Example
HC-MF	HC-MF053 HC-MF13 HC-MF23 HC-MF43 HC-MF73	
HA-FF	HA-FF053 HA-FF13 HA-FF23 HA-FF33 HA-FF43 HA-FF63	23) to 30)
HC-SF	HC-SF52 HC-SF102	

3) System setting examples

The system setting examples are shown in Figures 4.3 and 4.4. (The numbers 1) through 32) in these figures correspond to the numbers in Tables 4.7 through 4.11.)

<A273UHCPU (8/32 axis specification)>



Fig. 4.3 System Settings (When no Motion Extension Base Unit is Used)

<A273UHCPU (8/32 axis specification)>



Fig. 4.4 System Settings (When a Motion Extension Base Unit is Used)

4.2 Fixed Parameters

- (1) The fixed parameters are set for each axis and their data is fixed in accordance with the mechanical system or other factors.
- (2) The fixed parameters are set with a peripheral device.
- (3) The fixed parameters to be set are shown in Table 4.12.

Γ	Γ			Setting Range					Default			Explane-		
No	ŀ	Item			Inch		degree		PULSE		Initial		Remarks	tory
L			Setting Range	Units	Setting Range	Unite	Setting Range	Unite	Setting Range	Unite	Value			section
1	Ur	nit setting	0	-	1	-	2	-	3	-	3	_	 Set the command unit in positioning control for each axis. 	-
2	pulse (A)	Number of pulses per revolu- tion (Ap)				1 to 6	5535 PLS				20000	PLS	 Set the number of feedback pulses per motor revolution, which is determined by the mechanical system. 	
3	vel value per	Travel value per revolu- tion (AL)	0.1 to 6553.5	μm	0.00001 to 0.65535	inch	0.00001 to 0.65535	degree	1 to 65535	PLS	20000	PLS	 Set the travel value per motor revolution, which is determined by the mechanical system. 	4.2.1
4	Tre	Unit magnifi- cation (AM)	1:	x 1, 1	0: x 10, 100: x 10	00, 10	00: x 1000		-	-	-	-	 Set to change the magnification for the travel value per pulse. 	
5	Ba	oklash npansa- 1 amount*	0 to 655 35.5	μm	0 to 0. 6 5535	inch	0 to 0. 6553 5	degree	0 to 65535	PLS	0	PLS	 Set the amount of backlash in the mechine. Every time the positioning direction changes during positioning, compensation by the backlash compensation amount is executed. The expression below shows the setting range. Os(backlash compensation amount) x AP/AL-AMS8535 	8.3
6	Up stri	per oke limit*	-214 748384.8 to 2147 48364. 7	μm	-21474. 83848 to 21474. 836 47	inch	0 to 359.99999	degree	-2147483648 to 2147483647	PL8	2147483647	PLS	• Set the upper limit for the machine travel value. The expression below shows the setting range. (SV13 only) - 21474836485(upper stroke limit) x AP/AL-AM \$ 2147483647	422
7	Lon	ver oke limit*	-214 748364.8 to 214748384.7	μт	-21474.83848 to 21474.83847	inch	0 to 359.99999	degree	-2147483648 to 2147483647	PLS	0	PLS	 Set the lower limit for the machine travel value. The expression below shows the setting range. (SV13 only) - 21474836485(lower stroke limit) x AP/AL-AM c214748547 	

Table 4.12 Fixed Parameters

Γ				Setting Range						Defau	ft		Explane-
No	. Item	mm		Inch		degree		PULSE		initial	1	Remarks	tory
		Setting Range	Units	Setting Range	Unite	Setting Range	Unite	Setting Range	Links	Value	~		Section
8	Command in-position range*	0.1 to 2147 48384 .7	μm	0.00001 to 21474.83647	inch	0.00001 to 359.99999	degree	1 to 2147483647	PLS	100	PLS	• Set the position at which the command in-position signal (M1603+20n/Xn3/ M2403+20n/Xn3/ M2403+20n/is turned ON [(positioning address) - (present value)]. The expression below shows the setting range. 1≤(command in- position range) x AP/AL-AM≤32767	4.2.3
9	Limit switch output used/not used				0: N 1: U	ot used sed				0	-	 Set whether the limit switch output function is used or not for each axis. 	8.1

Table 4.12 Fixed Parameters (Continued)

•: The display of the possible setting range differs according to the electronic gear value.

4.2.1 Setting the number of pulses per revolution / travel value per revolution / unit magnification

This section explains how to set the number of pulses per revolution, the travel value per revolution, and the unit magnification.

(1) Setting method 1

(a) Finding the smallest position resolution (ΔI).

The smallest position resolution (ΔI) is determined by the travel value per revolution (ΔS) and the number of encoder feedback pulses (Pf).

$$\Delta I = \frac{\Delta S}{P_{f}}$$

(b) Finding the unit magnification (AM) Find the unit magnification on the basis of ΔI determined as described in (a) above. However, make sure that the smallest command unit is not smaller than ΔI .

∆/ found in (a) [mm]	Smallest Command Unit [mm]	Unit Magnification (Au)		
0.00001 < Δ/ ≤ 0.0001	0.0001	1		
0.0001 < ∆/ ≤ 0.001	0.001	10		
0.001 < <u>Δ/</u> ≤ 0.01	0.01	100		
0.01 < ∆/ ≤ 0.1	0.1	1000		

[Example] Assuming that the travel value per revolution (Δ S) is 10 [mm] and the number of encoder feedback pulses (Pf) is 1200 [pulse/rev]:

$$\Delta l = \frac{10 \text{ [mm]}}{12000 \text{ [pulse/rev]}} = 0.00083 \rightarrow 0.0001 < 0.00083 \le 0.001$$

This means that the smallest command unit is 0.001 [mm] and the unit magnification (AM) is 10.

Therefore, 0.001 [mm] units can be specified in commands.

- (c) Finding the travel value per revolution (AL). If the unit magnification (AM) is "1", the travel value per revolution is the value of AL, unchanged. If the unit magnification (AM) is a value other than "1", the travel value per revolution is the product of AL and AM.
- [Example] Assume that the travel value per revolution is 10 [mm] and the unit magnification is 10:

$$AL = \frac{10000.0 \, [\mu m]}{10} = 1000.0 \, [\mu m]$$

Accordingly, 1000.0 $[\mu m]$ is set as the travel value per revolution (AL) in this case.

(d) Number of pulses per revolution (Ap)

Set the number of feedback pulses per revolution of the encoder.

(e) The number of pulses per revolution, travel value per revolution, and unit magnification for the example configuration shown here are calculated below.



$$\Delta S = 10 \times \frac{Z_1}{Z_2} = 10 \times \frac{1}{25}$$

$$\Delta I = \frac{\Delta S}{P_{\rm f}} = \frac{10}{25 \times 12000} = 0.000033... \rightarrow \Delta I = 0.0001$$

- 2) Unit magnification (AM) Since Δ / is 0.0001, the unit magnification (AM) is "1".
- 3) Travel distance per revolution (AL) $AL = \frac{10 \text{ [mm]}}{25} = 0.4 \text{ [mm]} = 400.0 \text{ [}\mu\text{m]}$
- Number of pulses per revolution (AP) AP = 12000 [pulse/rev] ... fixed according to the encoder model.

(2) Setting method 2

If AL cannot be set by using setting method 1, calculate the numerator and denominator of the electronic gear, and set AP as the numerator and AL x AM as the denominator.



Example: With the example configuration shown above, and under the following conditions;

Gear ratio = Z1:Z2 = 1:39 Ball screw pitch = 25.4 [mm] $A_L = \frac{25.4 [mm]}{39} = 0.65128205 [mm]$

and AL cannot be set, calculate as follows

Electronic gear

$$= \frac{P_{f}}{\Delta S} \times \frac{12000 \text{ [pulse]}}{25.4 \text{ [mm]} \times 1000 \times \frac{1}{39}} = \frac{468000}{25400} = \frac{2340}{127} \dots \text{AL} \times \text{AM}$$

(AP = 2340 [pluse]

AL *= 12.7 [µm] ...and set the following values.

- Ам = 1
- *: When actually setting AL, calculate it as indicated in the table below.

Unit	Set Value for A (when Am is "1")
mm	Denominator x 10 ⁻¹ [µm]
inch	Denominator x 10 ⁻⁵ [inches]
degree	Denominator x 10 ⁻⁵ [degrees]
PULSE	Denominator [pulses]

4.2.2 Upper stroke limit value/lower stroke limit value





Fig. 4.5 Travel Range When Setting the Upper Stroke Limit Value and Lower Stroke Limit Value

(1) Stroke limit range check

The stroke limit range check is executed when the operations indicated in the table below are started or while they are in progress.

Operation Started	Check Executed/ Not Executed	Remarks
Positioning control	Executed	 When positioning is started, it is checked whether the feed present value is within the stroke limit range or not. If it outside the range, an error occurs (error code 106) and positioning is not executed. When circular interpolation is in progress, if the interpolation path goes outside the stroke limit range, an error occurs (error codes: 207, 208) and axis motion decelerates to a stop.
Fixed-pitch feed control	Executed	
Speed control (I) Speed control (II)	Not executed	 The present value becomes "0", and motion continues until the external limit signal (FLS, RLS, STOP) is received.
Speed/position switch- ing control (including restart)	Executed	 The check is executed after the switch to position control.
JOG operation	Executed	 If the present value goes outside the stroke limit range, motion stops. Travel in the direction that returns the axes into the stroke range is possible.
Speed switching control	Executed	
Constant speed control	Executed	
Position follow-up con- trol	Executed	 While positioning is in progress, it is checked whether the feed present value is within the stroke limit range. If it outside the range, an error occurs (error code 106) and positioning is not executed.
Manual pulse gener- ator operation	Executed	 If the present value goes outside the stroke limit range, motion stops.

POINTS

- (1) Besides setting the stroke limit upper limit value/lower limit value in the fixed parameters, the stroke limit range can also be set by using the external limit signals (FLS, RLS).
- (2) When the external limit signal goes OFF, a deceleration stop is executed.
 - The time taken to decelerate to a stop can be set by setting the "deceleration time" and "rapid stop deceleration time" in the parameter block.

4.2.3 Command in-position range

The command in-position is the difference between the positioning address (command position) and feed present value.

1

Once the value for the command in-position has been set, the command in-position signal (M1603+20n/Xn3/M2403+20n) will come ON when the difference between the command position and the feed present value enters the set range [(command position – feed present value) \leq (command in-position range)].

The command in-position range check is executed continuously during positioning control.



4.3 Servo Parameters

- (1) The servo parameters are parameters set for each axis: their settings are data fixed by the specifications of the controlled motors and data required to execute servo control.
- (2) The servo parameters are set with a peripheral device.

After setting the servo parameters at a peripheral device, execute a "RELATIVE CHECK" and execute positioning control in the "NO ERROR" status. If there is an error, check the relevant points indicated in this manual and reset it.

4.3.1 ADU servo parameters (applicable only when using A273UHCPU (8/32 axis specification))

The servo parameters to be set are indicated in Tables 4.13 through 4.14.

(1) Basic parameters

				setting A	lange				Defau	n		Explane-
No.	Item	mm	inch		degree		PULSE		Initial	Units	Remarks	tory
		Setting Range Units	Setting Range	Unite Se	tting Range	Unite	Setting Range	Unite	Value			340404
•1	Amplifier setting	2										
2	Regenera- tive resistor											
•3	External dynamic brake	Not displayed on t	he screen									4.1
*4	Motor type	Set automatically i	n accordance with	the systemet	em settings.							
•5	Motor capacity											
6	Motor rpm (R)											
7	Number of feedback pulses (N)											APP. 6
•8	Direction of rotation	0: Forward rotation 1: Reverse rotation	n (CCW) when the n (CW) when the p	positionin	ing address in Ig address de	C78858	B.		0		• Set the direction of rotation as seen from the load side. Forward rotation:	-
9	Automatic tuning	0: Speed only 1: Position/speed 2: Not executed							2	-	 Set the gain (speed/position, speed) for executing automatic setting 	4.3.9
10	Servo responsiven ess	1 to 12							1		Set in order to increase servo responsiveness.	4.3.10

POINT

After changing any of the items marked "*" in the table above, turn the servo power supply on after resetting the servo system CPU with the key switch or turning the PC READY signal (M2000) ON.

(2) Adjustment parameters

					Settin	g Range			Defaul	it		Explana-	
No.	Item	(n)m		Inch		degree		PULSE		Initial	Linite	Remarks	tory
		Setting Range	Units	Setting Range	Units	Setting Range	Unite	Setting Range	Unite	Value			300100
1	Load inertia ratio	0.1 to 20.0								3.0	1	 Set the ratio of moment of load inertia for the motor. 	4.3.8
2	Position control gain 1	Valid range	5 to 50	0 rad/sec Settin	g rang	e 1 to 9999 rad/s	•c			70	rad/ sec	 Set to increase the follow-up with respect to the position command. 	4.3.3
3	Speed control gain 1	Valid range :	20 to 5	000 rad/sec Set	ting ra	nge 1 to 9999 rad	1/sec			1200	rad/ sec	 Set to increase the follow-up with respect to the speed command. 	4.3.4
4	Position control gain 2	Valid range	5 to 10	0 rad/sec Settin	g rang	e 1 to 9999 rad/s	•c			25	rad/ sec	 Set to increase the position response with respect to load disturbance. 	4.3.3
5	Speed control gain 2	Valid range :	20 to 8	000 rad/sec Set	ting ra	nge 1 to 9999 rad	1/sec			600	rad/ sec	 Set when vibration is generated, for example in machines with a large backdash. 	4.3.4
6	Speed integral compensa- tion	Valid range	2 to 24	0 rms Setting ra	nge 2	to 240 ms	-			20	ma	 Set the time constant for integral compensation. 	4.3.5
7	Notch filter			_	-					_	1	Cannot be set	_
8	Feed forward gain	0 to 150% 0: Feed form	ard co	ntrol is not exec	ned.					0	*	 Set the feed forward coefficient used in positioning control. 	4.3.7
	In-position range" (SV13)	0.1 to 214748384.7	μ'n	0.00001 to 2147.83647	inch	0.00001 to 359.99999	degree	1 to 2147 48364 7	PLS			 Sets the quantity of droop pulses in the deviation counter. 	
9	In-position range* (SV22)	0.1 to 3276.7	μm	0.00001 to 0.32767	inch	0.00001 to 0.32767	degree	1 to 32767	PLS	100	PLS	 The in-position signal is ON when the number of droop pulses is within the set range. 	4.3.6
10	Electro- magnetic brake sequence									_	-	• Cannot be set	-

Table 4.14 Servo Parameters (Adjustment Parameters)

4.3.2 MR-[]-B servo parameters

The servo parameters to be set are indicated in Tables 4.15 through 4.17.

(1) Basic parameters

Table 4.15	Servo	Parameters	(Basic	Parameters)
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				Settin	g Range					Defau	lt		Explane-
No.	item	៣៣	Inch		degree			PULSE		Initial	Units	Remarks	tory
		Setting Range Units	Setting Range	Units	Setting Range	Units	Setting	Range	Units	Value			3403608
•1	Amplitier setting											-	
•2	Regenera- tive resistor												
ę	External dynamic brake	Set sutometically i	in eccordance wi	th the :	veten eatlinge								4.1
*	Motor type	Out automationly I			yotenn oetango.								
*5	Motor capacity												
6	Motornpm (R)												
7	Number of feedback pulses (N)												APP. 6
*8	Direction of rotation	0: Forward rotatio 1: Reverse rotatio	n (CCW) when ti n (CW) when the	ne posi positi	tioning address in oning address dec	C70850 F08505	8. •			0	-	• Set the direction of rotation as seen from the load side. Forward rotation:	ł
9	Automatic tuning	0: Speed only 1: Position/speed 2: Not executed								1*1	-	 Set the gain (speed/position, speed) for executing automatic setting 	4.3.9
10	Servo responsive- ness	1 to 12								1	-	• Set in order to increase servo responsiveness.	4.3.10

*1: For MR-J-B, the default is '2'.

1

POINT

After changing any of the items marked "*" in the table above, turn the servo power supply on after resetting the servo system CPU with the key switch or turning the PC READY signal (M2000) ON.

(2) Adjustment parameters

<u> </u>	T						a Bongo	-			Defes			-
No	ttem				hat	LAIN	d the second				In Mal	ř	Remerica	tory .
		Redting Ro			Retting Reage	1 Junites	Cogree		PULSE	1 miles	Value	Units		Section
1	Load inertia ratio	0.0 to 1	0.0	, and a	Setting Hange		eeting sange		eetung runge		*1 3.0		Set the ratio of moment of load inertia for the motor.	4.3.8
2	Position control gain 1	Valid ra	nge 4	to 10	00 rad/sec Setti	ng ran	ge 1 to 9999 rad/	10 C			70	rad/ sec	• Set to increase the follow-up with respect to the position command.	4.3.3
3	Speed control gain 1	Valid ra	nge 20) to 5	000 rad/sec Set	ling ra	nge 1 to 9999 rad	/sec			1200	rad/ sec	 Set to increase the follow-up with respect to the speed command. 	4.3.4
4	Position control gain 2	Valid ra	nge 10) to 5	00 rad/sec Setti	ng ran	ge 1 to 9999 rad/:	800			25	rad) 80	 Set to increase the position response with respect to load disturbance. 	4.3.3
5	Speed control gain 2	Valid ra	nge 20) to 5	000 rad/sec Set	ting ra	nge 1 to 9999 rad	/sec			*2 600	rad/ 800	 Set when vibration is generated, for example in machines with a large becklash. 	4.3.4
6	Speed integral compensa- tion	Valid ra	nge 1	to 10	00 rms Setting r	ange 1	to 9999 rad/sec				20	me	• Set the time constant for integral compensation.	4.3.5
7	Notch filter	0: Not u 1: 1125 2: 750 3: 562 4: 450 5: 375 6: 321 7: 281	bed								0	Hz	• Set the frequency for the notch filter.	4.3.11
8	Feed forward gain	0 to 10 0: Feed	0 to 100% 0: Feed forward control is not executed.									*	 Set the feed forward coefficient used in positioning control. 	4.3.7
9	"3 In-position range	0.1 to 21474836	L.7	μm	0.00001 to 21474 .836 47	inch	0.00001 to 359.99999	degree	1 to 21474 8364 7	PLS	100	PLS	 Sets the quantity of droop pulses in the deviation counter. The in-position signal is ON when the number of droop pulses is within the set range. The expression below shows the setting range. 1≤(in-position range) xAP/AL_AM<2787 	4.3.6
10	*4 Electro- magnetic brake sequence	0 to 10	0 ms			.				•	100	me	 Set the time delay between actuation of the electromagnetic brake and base disconnection. 	4.3.12
11	Monitor output mode (monitor 1)	(MR-H-B/M 0: Spe 1: Toro 2: Spe	R-J-B) Id (±) Ue (±) Id (±)				(MR-J2-B) 0: Speed (± 1: Torque (± 2: Speed (+) =)			0	-		
12	*4 Monitor output mode (monitor 2)	3: Toro 4: Curi 5: Con 6: Droo 7: Droo 8: Droo 9: Droo	2: Operat (Y) 2: Operat (Y) 3: Torque (+) 3: Torque (+) 4: Current command output 4: Current command output 5: Command FAT 5: Command FAT 6: Droop pulse 1/1 6: Droop pulse 1/1 7: Droop pulse 1/4 7: Droop pulse 1/16 8: Droop pulse 1/16 8: Droop pulse 1/16 9: Droop pulse 1/22 9: Droop pulse 1/226								1		 Set the monitor items output as analog outputs in real time. 	4.3.13
13	Optional function 1 (carrier frequency selection)	0: 2.25 3: 9 ki	kHz (i z (low	non k -nois	ow-noise operati e operation)	on)					0	kHz	 Set "low noise" to improve the sound of the frequencies generated from the motor. 	4.3.14
14	*4 Optional function 1 (Encoder type)	0: 2-wi 1: 4-wi	e type e type								o	-	 Set the type of encoder cable. 	4.3.14

Table 4.16 Servo Parameter List (Adjustment Parameters)

*1: For MR-J2-B, the default is *7.0*.

*2: For MR-J-B, the default is *500*.

*3: The display of the possible setting range differs according to the electronic gear value.

*4: Setting not possible for MR-J-B.

			Setti	ng Range		Defau	ft 🛛		Explane-
No.	tem	m	inch	degree	PULSE	Initial	Units	Remerks	tory
	ļ	Setting Range Units	Setting Range Unit	Setting Range Units	Setting Range Units	Value			
15	*5 Optional function 1 (external emergency stop signal)	0 : Used 1 : Not used				0	-	• To invalidate the external emergency stop signal (EMG) set "not used".	4.3.14
16	*6 Optional function 2 (selection of no-motor operation)	0 : I nvali d 1 : Valid				o	_	• To check the status without connecting a motor, set "valid".	4.3.15
17	*6 Optional function 2 (electro- magnetic brake interlock output timing)	0 : Regardless of t following condi • Servo OFF • Occurrence • Emergency s 1 : Output occurs t rota tional spec	the rotational speed of tions. of an alarm stop input OFF (valid) under any of the above ad is zero (expansion p	oonditions provided that	oours under any of the	0	-	• Set the interlock timing for the electromagnetic brake interlock signal.	4.3.15
18	*5 Optional function 2 (selection of microvi- bration suppres- sion function)	0 : Valid 1 : Invalid				0		 Set "valid" to suppress vibration on stopping. 	4.3.15
19	*5 Optional function 2 (motor lock operation)	0 : Valid 1 : Invalid				o	-	 To carry out test operation without rotating the motor, set "valid". 	4.3.15

Table 4.16 Servo Parameter List (Adjustment Parameters) (Continued)

*5 : Cannot be set with MR-H-B/MR-J-B *6 : Cannot be set with MR-J2-B

(3) Expansion parameters

			Settin	g Range	Default				Explane-	
No.	ttem	200	inch	degree	PUL	.SE	Initial	Umba	Remarks	tory
L		Setting Range Units	Setting Range Units	Setting Range Un	te Setting Rai	nge Unlle	Value			Section
1	Motion output 1 offset	(MR-H8/MR-J-8) -9999 to 9999 mv	(MR-J2 -999 to	2-B) 999 mv			0	mv	• Set the offset value for motion output 1.	
2	*1 Motion output 2 offset	(MR-HB/MR-J-B) -9999 to 9999 mv	(MR-J2 -999 to	2-B) 999 mv			*3	mv	• Set the offset value for motion output 2.	4.3.16
3	*1 Pre-alarm data selection (sampling time selection)	0: 1.77 1: 3.55 2: 7.11 3: 14.2 4: 28.4				_	0	ms		
4	*1 Pre-alarm data selection (data selection 1)	0: Speed (±) 1: Torque (±) 2: Speed (+) 3: Torque (+) 4: Current comma	nd output				0	-	 Set the analog data output when an alarm occurs. 	4.3.17
5	*1 Pre-alarm data selection (data selection 2)	5: Command FAT 6: Droop pulse 1/1 7: Droop pulse 1/4 8: Droop pulse 1/1 9: Droop pulse 1/3	6				1	_		
6	Zero speed	0 to 10000 r/min					10000	r/min	 Set the speed at which the motor speed is judged to be "0". 	4.3.18
7	Excessive error alarm level	1 to 1000 kPLS		·			80	KPLS	 Set the value at which an excessive droop pulses alarm is output. 	4.3.19
8	Closed encoder rotation direction	0: CCW 1: CW					o	-	 Set the direction of rotation of the motor and closed encoder. 	٥
9	Home position return reference encoder	0: MOTOR END 1: CLOSED PLG				_	C	-	 Set the encoder to serve as the reference when home position return is excuted. 	D
10	Optional function 5 (PI-PID control switching)	0: invalid 1: Switching in act 2: Speed amplifier	proportional control ve	ring position control v Ilid	alid		0	-	 Set the conditions for PI-PID control switching. 	
11	Optional function 5 (Servo readout characters) *1	0: Japan ese 1: English					0	-	• Set the display format for the parameter unit.	4.3.20
12	*1 PI-PID switching position droop	0 to 50000 PLS					0	PLS	 Set the amount of position droop at the switch to PI-PID control when position control is executed. 	4.3.21
13	*1 *2 Torque control compensa- tion factor	-19 to 9979					0	_	 Set to expand the torque control range up to the speed limit value in torque control. 	4.3.22
14	Speed differential compensa- tion	0 to 10000				-	980	-	 Set the differential compensation value for the actual speed loop. 	4.3.23

Table 4.17 Servo Parameters (Expansion Parameters)

*1 : Cannot be set when using MR-J-B. *2 : Cannot be set when using MR-J2-B. *3 : For MR-J2-B, the default is *1*.

Г			Settin	g Range		Defeu	tt		Explana-
No.	Item	m m	inch	degree	PULSE	Initial		Remarka	tory
		Setting Range Units	Setting Range Units	Setting Range Units	Setting Range Units	Value			Section
15	Number of gear teeth at motor side	0 to 65535				o	-	• Set the ratio between the nunber of gear teeth on the	-
16	Number of gear teeth at machine side	0 to 65535				o	_	notor shall and the number of gear teeth on the encoder shaft.	_
17	Number of closed encoder puises	0 to 65535				o	-	 Set the resolution of the closed encoder within one revolution (ö4 value). 	-

Table 4.17 Servo Parameters (Expansion Parameters) (Continued)

POINT

(1) The "setting range" for position control gain 1 and 2, speed control gain 1 and 2, and speed integral compensation can be set from a peripheral device, but if a setting outside the "valid range" is set, the following servo errors will occur when the power to the servo system CPU is turned ON, when the CPU is reset, and at the leading edge of the PC ready signal (M2000).

Servo Error Code	Error Contents	Processing			
2613	Initial parameter error (position control gain 1)				
2614	Initial parameter error (speed control gain 1)	Correct the setting for the relevant parameter so the			
2615	Initial parameter error (position control gain 2)	it is within the "valid range", turn M2000 from			
2616	Initial parameter error (speed control gain 2)	the reset key.			
2617	Initial parameter error (speed integral compensation)				

4.3.3 Position control gain 1, 2

- (1) Position control gain 1
 - (a) Position control gain 1 is set in order to make the stabilization time shorter.
 - (b) If the position control gain 1 is too high, it could cause overshoot and the value must therefore be adjusted so that it will not cause overshoot or undershoot.



- (2) Position control gain 2
 - (a) Position control gain 2 is set in order to increase position response with respect to load disturbance.
 - (b) Calculate the position control gain 2 value to be set from the load inertia ratio and the speed control gain 2.

Position control gain 2 = $\frac{\text{Speed control gain 2}}{1 + \text{load inertia ratio}} \times \frac{1}{10}$

POINTS

- (1) If the position control gain 1 setting is too low, the number of droop pulses will increase and a servo error (excessive error error) will occur at high speed.
- (2) The position control gain 1 setting can be checked from a peripheral device.

(For the method used to execute this check, refer to the operating manual for the peripheral device used.)

4.3.4 Position control gain 1, 2

- (1) Position control gain 1
 - (a) In the speed control mode Normally, no change is necessary.
 - (b) In the position control mode Set to increase the follow-up with respect to commands.
- (2) Speed control gain 2
 - (a) Speed control gain 2 is set when vibration occurs, for example in low-rigidity machines or machines with a large backlash.
 When the speed control gain 2 setting is increased, responsiveness is improved but vibration (abnormal motor noise) becomes more likely.
 - (b) A guide to setting position gain 2 is presented in Table 4.18 below.

Iddle 4.10 Guide to Speed Control Gam & Sett	Table	4.18	Guide to	Speed	Control	Gain 2	Setting
--	-------	------	----------	-------	---------	--------	---------

Load Inertia Ratio (GDL ² /GDM ²)	1	3	5	10	20	30 or Greater	Remarks
Set value (ms)	800	1000	1500	2000	2000	2000	Setting possible within the range 1 to 9999 (valid range: 20 to 5000)

POINTS

- (1) When the setting for speed control gain 1 is increased, the overshoot becomes greater and vibration (abnormal motor noise) occurs on stopping.
- (2) The speed control gain 1 setting can be checked from a peripheral device.

(For the method used to execute this check, refer to the operating manual for the peripheral device used.)

4.3.5 Speed integral compensation

- (1) This parameter is used to increase frequency response in speed control and improve transient characteristics.
- (2) If the overshoot in acceleration/deceleration cannot be made smaller by adjusting speed loop gain or speed control gain, increasing the setting for the speed integral compensation value will be effective.
- (3) A guide to setting the speed integral compensation is presented in Table 4.19 below.

Load Inertia Ratio (GDL ² /GDM ²)	1	3	5	10	20	30 or Greater	Remarks
Set value (ms)	20	30	40	60	100	200	Setting possible within the range 1 to 9999 (valid range: 1 to 1000)

Table 4.19 Guide to Speed Integral Compensation Setting

4.3.6 In-position range

- (1) The "in-position" refers to the quantity of droop pulses in the deviation counter.
- (2) If an in-position value is set, the in-position signal (M16m2) will come ON when the difference between the position command and position feedback from the servomotor enters the set range.



4.3.7 Feed forward gain

This parameter is used to improve the follow-up of the servo system. The setting range is as follows:

When using an ADU..... 0 to 1500 (\times 0.1%) When using an MR-[]-B 0 to 100 (%)

4.3.8 Load inertia ratio

(1) This parameter sets the ratio of moment of load inertia for the servomotor.

The ratio of moment of load inertia is calculated using the equation below:

1

Ratio of moment of load inertia = <u>Moment of load inertia</u> Motor's moment of inertia

(2) If automatic tuning is used, the result of automatic tuning is automatically set.

4.3.9 Automatic tuning

This is a function whereby the moment of inertia of the load is automatically calculated, and the most suitable gain is automatically set, by sensing the current and speed when motion starts.

POINT

When performing automatic tuning with MB-J-B, set the zero speed in the expansion parameters to at least 50 rpm.

C.

4.3.10 Servo responsiveness setting

(1) This parameter setting is used to increase servo responsiveness. Changing the set value to a higher value in the sequence 1, 2..., 5 improves servo responsiveness. For machines with high friction, use the set values in the range 8 through

Response settings 1: Low-speed response 2: Normal machine -- Standard mode 3. (MR-[]-B usable) 4: 5: High-speed response 8: Low-speed response 9: Machines with high friction _____ High frictional load mode A: (only MR-H-B usable) B: C: High-speed response

- (2) Increase the response setting step by step starting from the low-speed response setting, observing the vibration and stop stabilization of the motor and machine immediately before stopping as you do so. If the machine resonates, decrease the set value. If the load inertia is 5 times the motor inertia, make the set value 1 or greater.
- (3) The figure below shows how the motor's response changes according to the servo responsiveness setting.



(4) Change the servo responsiveness setting while the motor is stopped.

4.3.11 Notch filter

Set Value	Notch Frequency (Hz)
0	Not used
1	1125
2	750
3	562
4	450
5	375
6	321
7	281

This parameter sets the notch frequency for the notch filter.

4.3.12 Electromagnetic brake sequence

This parameter sets the time delay between actuation of the electromagnetic brake and base disconnection. (applies only when using MR-H-B/MR-J2-B.)

4.3.13 Monitor output mode

This parameter is set to output the operation status of the servo amplifier in real time as analog data.

This analog output makes it possible to check the operation status.

Note that the number of monitored items that can be set depends on the servo amplifier used, as indicated below:

When using an MR-H-B/MR-J2-B 2 types When using an MR-J-B 1 type

4.3.14 Optional function 1 (carrier frequency selection)

- (1) Selection of carrier frequency When low noise is set, the amount of electromagnetic noise of audible frequencies emitted from the motor can be reduced.
- (2) Encoder type (applies only when using MR-H-B/MR-J2-B) Set the type of encoder cable used.



(1) Optional function 1 (carrier frequency selection) When low-noise is set, the continuous output capacity of the motor is reduced.
- (3) External emergency stop signal (applies only when using MR-J2-B) The external emergency stop signal (EMG) can be made invalid.
 - 0 : External emergency stop signal is valid.
 - 1 : External emergency stop signal is invalid (automatically turned ON internally).

Since the emergency stop signal at the MR-J2-B cannot be used, do not set "0".

4.3.15 Optional function 2 (no-motor operation selection)

- (1) Selection of no-motor operation (applies when using MR-H-B/MR-J-B only)
 - 0 : Invalid
 - 1 : Valid

If no-motor operation is selected, the output signals that would be output if the motor were actually running can be output, and statuses indicated, without connecting the motor.

This makes it possible to check the sequence program of the PC CPU without connecting a motor.

(2) Electromagnetic brake interlock output timing (applies only when using MR-H-B/MR-J-B)

Select the output timing for the electromagnetic brake interlock signal from among the following.

- 0 : Regardless of the rotational speed of the servo motor, output occurs under any of the following conditions.
 - Servo OFF
 - Occurrence of an alarm
 - Emergency stop input OFF (valid)
- 1 : Output occurs under any of the above conditions provided that the servo motor rotational speed is zero (expansion parameters).
- (3) Selection of microvibration suppression function (applies to MR-J2-B) Set to suppress vibration specific to the servo system on stopping.
 - 0 : Microvibration suppression control is invalidated
 - 1 : Microvibration suppression control is valid
- (4) Motor lock operation (applies only when using MR-J2-B) Allows test operation with the motor connected but without rotating the motor. The operation is the same as no-motor operation with MR-HB/MR-J-B.

0 : Motor lock operation is invalidated

0 : Motor lock operation is valid

When motor lock operation is made valid, operation is possible without connecting the motor. However, since when MR-J2-B is used the connected motor is automatically identified before operation is started, if no motor is connected the connected motor type may be regarded as a default, depending on the type of amplifier. If this default motor type differs from the setting made in the system settings, the controller will detect minor error 900 (motor type in system settings differs from actually mounted motor), but this will not interfere with operation.

4.3.16 Monitor output 1, 2 offset

Set the offset value for the monitored items set when setting monitor outputs 1 and 2.

POINT

(1) Optional function 2 (no-motor operation selection)

No-motor operation differs from operation in which an actual motor is run in that, in response to signals input in no-motor operation, motor operation is simulated and output signals and status display data are created under the condition that the load torque zero and moment of load inertia are the same as the motor's moment of inertia. Accordingly, the acceleration/deceleration time and effective torque, and the peak load display value and the regenerative load ratio is always 0, which is not the case when an actual motor is run.

4.3.17 Pre-alarm data selection

Used to output from the servo amplifier in analog form the data status when an alarm occurs.

(applies only when using MR-H-B/MR-J2-B)

(1) Sampling time selection Set the intervals in which the data status data when an alarm occurs is recorded in the servo amplifier.

(2) Data selection

Set the data output in analog form from the servo amplifier. Two types of data can be set.



4.3.18 Zero speed

This parameter sets the speed at which the motor speed is judged to be zero.

4.3.19 Excessive error alarm level

This parameter sets the range in which the alarm for excessive droop pulses is output.

4.3.20 Optional function 5

- (1) PI-PID control switching (applies only when using MR-H-B/MR-J2-B) This parameter sets the condition under which switching from PI to PID control, or from PID control to PI control, is valid.
- (2) Servo readout characters (applies only when using MR-H-B/MR-J2-B) When the optional parameter unit is connected, set whether the screen display on the parameter unit will be in Japanese or English.

4.3.21 PI-PID switching position droop

This parameter sets the amount of position droop on switching to PI-PID control during position control. (applies only when using MR-H-B/MR-J2-B.) The setting becomes effective when switching in accordance with the droop during position control is made valid by the setting for PI-PID control switching made using optional function 5.

4.3.22 Torque control compensation factor

This parameter is used to expand the torque control range up to the speed control value during torque control. (applies only when using MR-H-B.) If a large value is set, the speed limit value may be exceeded and the motor may rotate.

4.3.23 Speed differential compensation

This parameter sets the differential compensation value for the actual speed loop.

In PI (proportional integration) control, if the value for speed differential compensation is set at 1000, the range for normal P (proportional) control is effective; if it is set to a value less than 1000, the range for P (proportional) control is expanded.

4.4 Parameter Block

- (1) The parameter blocks serve to make setting changes easy by allowing data such as the acceleration/deceleration control to be set for each positioning processing.
- (2) A maximum of 16 blocks in the case of the A171S/A273UHCPU (8 axis specification) or 64 blocks in the case of the A273UHCPU (32 axis specification), can be set as parameter blocks.
- (3) Parameter blocks can be set at a peripheral device.
- (4) The parameter block settings to be made are shown in Table 4.20.

L						Settin	g Range				Defau	n		Explane-
ŀ	No.	item	mm		inch		degree		PULSE		initial	Links	Remarks	tory
L			Setting Range	Unite	Setting Range	Units	Setting Range	Units	Setting Range	Units	Value			Section
ſ													Set the units for compensation control. Can also be used as	
	1	Interpolation control unit	0	-	1	-	2	_	3		3	_	the units for the command speed and allowable error range for circular interpolation set in the servo program.	7.1.4
		Speed limit	0.01 to	mm⁄	0.001 to	200000	PLS/	Set the maximum speed for positioning/home position return. If the positioning speed						
	2	value	6000000.00	min	600000.000	20000	30C	or home position return apeed setting exceeds the speed limit value, control is executed at the speed limit value.						
	3	Acceleration time				1000	ms	 Set the time taken to reach the speed limit value from the start of motion. 	4.4.1					
	4	Deceleration time				1 to 6		1000	ms	 Set the time taken to stop from the speed limit value. 				
	5	Rapid stop deceleration time				1 to 6	5535 ms				1000	ma	 Set the time taken to stop from the speed limit value when a rapid stop is executed. 	
													 Set the S curve ratio for S pattern processing. 	
	6	S curve ratio				0 to	100 %				0	*	 when the S curve ratio is 0%, trapezoidal acceleration/deceleration processing is executed. 	4.4.2
	7	Torque limit value				1 to	500 %				300	*	 Set the torque limit value in the servo program. 	_
	8	Deceleration processing on STOP input	0: Decelera 1: Decelera	tion si tion si	op executed bas op executed bas	ed on	the deceleration the rapid stop d	time. ecelerat	tion time.	_	0	-	 Set the deceleration processing when external signals (STOP, FLS, RLS) are input. 	-
	9	Allowable error range for circular interpolation	0 to 10000.0	μm	0 to 1.00000	inch	0 to 1.00000	degree	0 to 100000	PLS	100	PLS	 Set the permissible range for the locus of the arc and the set end point coordinates. 	4.4.3

Table 4.20 Parameter Block Settings

POINTS

- (1) Parameter blocks are designated in the home position return data, JOG operation data, or servo program.
- (2) The various parameter block data can be changed in the servo program. (See Section 6.3.)

4. PARAMETERS FOR POSITIONING CONTROL

POINT



(b) The parameter block No. used for home position return is set when setting the "home position return data" with a peripheral device.

[Home position return data setting screen] <A171SCPU>

38: DFRED TION 0 OREVENSE 1:FORWARD 38: METHOD 0 0.0DOG 1:COUNT 2:DATA SET 5: ADD RESS 0.0 -214743984.7 (sm) 38: SPEED 0.01 0.01 - 600000.00 (mm/min) 38: MOVEMENT AFTER DOG 1 - 16	AXIS «mm>	SET DATA	SETTING RANGE	
	SE DIRECTION SM METHOD SM ADDRESS SPEED SE CREEP SPEED SM MOVEMENT AFTER DOG SM P.B. NO.	0 0.0 0.01 0.01 	0.8EVERSE 1:FORWARD 0:DOG 1:COUNT 2:DATA SET -214748364.8 - 214748364.7 (µm) 0.01 - 6000000.00 (mm/min) 0.01 - 6000000.00 (mm/min) 1 - 16	
Parameter block No. setting	n a sea an Ar Raine dhalach	o esta da Referencia		Parameter block No. setting

(c) The parameter block No. used for JOG operation is set when setting the "JOG operation data" with a peripheral device.

[JOG operation data setting screen] <A171SCPU>



4.4.1 Relationships among the speed limit value, acceleration time, deceleration time, and rapid stop deceleration time

The speed limit value is the maximum speed during positioning/home position return.

The acceleration time is the time taken to reach the set speed limit value from the start of positioning.

The deceleration time and rapid stop deceleration time are the time taken to effect a stop from the set speed limit value.

Accordingly, the actual acceleration time, deceleration time, and rapid stop deceleration time are faster, because the positioning speed is faster than the speed limit value.



Fig. 4.6 Relationships among the Speed Limit Value, Acceleration Time, Deceleration Time, and Rapid Stop Deceleration Time

4.4.2 S curve ratio

The S curve ratio used when S pattern processing is used as the acceleration and deceleration processing method can be set. (For details on S pattern processing, see Section 7.1.7.)

The setting range for the S curve ratio is 0 to 100 (%).

If a setting that is outside the applicable range is made, an error occurs on starting, and control is executed with the S curve ratio set at 100%.

Errors are set in the servo program setting error area (D9190).

Setting an S curve ratio enables acceleration and deceleration processing to be executed gently.

The graph for S pattern processing is a sine curve, as shown below.





As shown below, the S curve ratio setting serves to select the part of the sine curve to be used as the acceleration and deceleration curve.

4.4.3 Allowable error range for circular interpolation

In control with the center point designated, the locus of the arc calculated from the start point address and center point address may not coincide with the set end point address.

The allowable error range for circular interpolation sets the allowable range for the error between the locus of the arc determined by calculation and the end point address.

If the error is within the allowable range, circular interpolation to the set end point address is executed while also executing error compensation by means of spiral interpolation.

If the setting range is exceeded, an error occurs and positioning does not start.

When such an error occurs, the relevant axis is set in the minor error code area.



Fig. 4.7 Spiral Interpolation

This section explains how to start a servo program using a sequence program or SFC program for positioning control, and gives other information.

5.1 Cautions on Creating a Sequence Program or SFC Program

The following cautions should be observed when creating a sequence program or SFC program.

(1) Positioning control instructions

The servo program start request instruction (DSFRP)/(SVST) (see Section 5.2) and the present value change/speed change instructions (DSFLP)/(CHGA/CHGV) instructions (see Section 5.3) are used as positioning instructions.

(2) Unusable instructions

It is not possible to use the DSFL (word data 1 word shift to left) or DSFR (word data 1 word shift to right) instruction.

If a DSFL instruction of DSFR instruction is executed, an operation error occurs and the following happens:

- (a) Conditions
- (b) 50(OPERATION ERROR) is stored in the self-diagnosis error code register (D9008).
- (c) The step in which the DSFR or DSFL instruction was executed is stored in the error step register (D9010, D9011).
 In order to shift word data, use the BMOV instruction (see Appendix 4).
- (3) Dedicated devices for the PCPU

Of the servo system CPU devices, those shown in Table 5.1 are exclusively for use with the PCPU.

Check the applications of devices before using them in the sequence program (for details, see Section 3).

		Device No.	
Device Name	A171SCPU	A273UHCPU (8 axis specification)	A273UHCPU (32 axis specification)
Inputs		X0 to XFF	_
Outputs		Y0 to YFF	_
Internal relays	M1600 to M2047	M2000 to M2047	M2000 to M3839
Data registers	D800	to D1023	D0 to D799
Special relays		M9073 to M9079	
Special registers		D9180 to D9199	

Table 5.1 Dedicated Devices for the PCPU

Note that internal relays (M1600 to M2047/M2000 to M2047/M2000 to M3839) and data registers (D800 to D1023/D800 to D1023/D0 to D799) will not be latched even if a latch range setting is made for them. (The device symbols for M1600 to M2047/M2000 to M2047/M2000 to M3839 are displayed as M, L, and S by the GPP device in accordance with the M, L, and S settings in the parameters.)

(4) SFC programs

Refer to the manuals below for details on the SFC programming method. MELSAP II Programming Manual (IB-66361) SW2SRX-GSV13PE Operating Manual (IB-67266) SW2SRX-GSV22PE Operating Manual (IB-67264)

5.2 Servo Program Start Request Instruction (DSFRP/SVST)

There are two servo program start request instructions: the DSFRP instruction and the SVST instruction.

When executing positioning control, up to 3 axes can be controlled with the DSFRP instruction and up to 4 axes can be controlled with the SVST instruction.

When using an A273UHCPU (32 axis specification), the DSFRP instruction cannot be used as the start request instruction for a servo program. It can only be used as a word data shift instruction.

5.2.1 Start request instruction for 1 to 3 axes (DSFRP): when using A171SCPU/A273UHCPU (8 axis specification)

										U	sab	ie C)evi	C 8 8								nation	Steps			Carry	FI	ag
$\left \right $			Bit	Dev	ice	B			W	ord	(16	Bit) De	ovic	•\$		Co tai	ns- nts	Po	int- rs	Level	Deelgi	er of 1	t		riag	En	ror
$ \setminus$	x	Y	м	L	s	в	F	т	с	D	w	R	AO	A 1	z	v	к	н	P	1	N	Digit	Numb	Subse	index	M9012	M9010	M9011
(D)										0										_			7		Y		0	
n																	0	0							Û			Ŭ



The following processing is executed at the leading edge (OFF \rightarrow ON) of the DSFRP instruction:

- The start accept flag (M200n) designated in (D) is turned ON (see Section 3.2.2).
- A start request is issued for the servo program designated by "n".

-	ON	
Execution command	OFF	
DSFRP instruction)on	
Start accept flag	OFF	
Designated servo progra	am	

[Data Settings]

(1) Setting the axes to be started The axes to be started are set in (D) in the way shown below.



POINTS

- When two or more axes are started simultaneously, set one of the axes to be started in each servo program. When programming a simultaneous start in which linear interpolation is to be executed with axes 1 and 2, and circular interpolation is to be executed with axes 3 and 4, set axis 1 or axis 2 and axis 3 or axis 4 (example: D13).
- (2) "D" is used as the device symbol for (D), but the present value corresponding to the data register number used in the sequence program is ignored.

[Error Details]

In the following cases, an operation error occurs and the DSFRP instruction is not executed.

- When the setting for (D) comprises 4 or more digits.
- When the axis number given in any digit of (D) is a number other than 1 to 4 (A171SCPU).
- When the axis number given in any digit of (D) is a number other than 1 to 8 (A273UHCPU, 8-axis specification).
- When the same axis number is set twice in (D).
- When n is a value outside the range 0 to 4095 or 30000 to 30799.
- When the settings for (D) or n are made by indirect setting with an index register (Z, V).

POINT

For details on sequence programs that execute start requests for servo programs in accordance with DSFRP instructions, see Section 6.5.

5.2.2 Start request instruction for 1 to 4/1 to 8 axes (SVST)

										U	sabi	le D)evi	ces								nation	Steps			Carry	FI	ag
		1	Bitl	Dev	ice	B			W	ord	(16	Bit) De	ovic	•		Co tai	ns- nts	Po	int- rs	Level	Deelgi	er of	at .		riag	En	
	x	. Y	M	L	s	в	F	т	c	D	w	R	AO	A1	z	v	к	н	P	I	N	Digit	quin	Subse	Index	M9012	M9 010	M9011
(D)																							13		*1		0	0
n										0	0	0					0	0							0			

*1: Possible with indirect setting only



The following processing is executed at the leading edge (OFF - ON) of the SVST instruction:

- The start accept flag (M2001+n) corresponding to the axis designated in (D) is turned ON (see Section 3.2.2).
- A start request is issued for the servo program designated by "n".



[Data Settings]

 Setting the axes to be started The axes to be started are set in (D) in the way shown below.

<A171SCPU>

 Setting for 1 to 4 axes 1 axis to be started
Set J + started axis numbers 1 to 4.
 The number of digits in the axis number indication is fixed at 3, including J (i.e. "J**").

 Upper row Lower row Setting for 1 to 8 axes 1 axis to be started
Example
The axes to be started are designated as follows:
• Axis 1J1
• Axis 1 and axis 2J1.J2. • Axis 1 axis 2 and axis 3J1.J2.J3
• Axis 1, axis 2, axis 3, and axis 4 J1J2J3J4
 2) Servo program No. setting There are two types of servo program number setting: direct and indirect. (a) In direct setting, the servo program number is designated directly as the number itself (0 to 4095).
Example
Servo program No.50 would be set as follows.
♦ When designated with a K deviceK50
(b) In indirect setting, the servo program number is set as a value in a word device

<A273UHCPU (8/32 axis specification)>

1) The word devices that can be used are indicated in the table below.

		CPU	
Word Device	A171S	A273UH (8 Axis Specification)	A273UH (32 Axis Specification)
D	0 to 799	0 to 8191*1	800 to 8191
w	0 to 3FF	0 to 1FFF	0 to 1FFF
R	0 to 4095	0 to 8191	0 to 8191

*1: Excluding 800 to 1023

POINT

- (1) When two or more axes are started simultaneously, set one of the axes to be started in each servo program.
 - (a) When programming a simultaneous start in which linear interpolation is to be executed with axes 1 and 2, and circular interpolation is to be executed with axes 3 and 4, set axis 1 or axis 2 and axis 3 or axis 4 (example: D13).

	Example
	Make the following setting to designate the number of the servo program to be started with the data stored in data register D50:
	Designation with a word device SVST J1J2J3 D50
	 2) An index register (Z, V) or dedicated instruction (IX . IXEND) can be used for index designation of the indirectly set word device. For details on index registers (Z, V), see the ACPU Programming Manual (Fundamentals) (IB-66249). For details on dedicated instruction (IX . IXEND), see the AnACPU/AnUCPU Programming Manual (Dedicated) (IB-66251).
[Error Details]	
	In the following cases, an operation error occurs and the SVST instruction is not executed.
	 When the setting for (D) is for 5 or more axes (A171SCPU).
	• When the setting for (D) is for 8 or more axes (A273UHCPU, 8/32 axis specification).
	• When the axis number given in any digit of (D) is a number other than J1 to J4 (A171SCPU).

- When the axis number given in any digit of (D) is a number other than J1 to J8 (A273UHCPU, 8-axis specification).
- When the axis number given in any digit of (D) is a number other than J1 to J32 (A273UHCPU, 32-axis specification).
- When the same axis number is set twice in (D).
- When the setting for n is outside the applicable range.

[Program example] <A171SCPU>

0	M9039	(м2000)-	PC READY flag turned ON
2	M9074	(M2042)	All axes servo start command turned ON
4	X0100 M9074 M2009 M9076 	s мо]-	When X100 comes ON, the start
11	│ M0 ┌─│ ┝── ────────────────────────────────	ат м1]-	gram No.50 comes ON.
13	M1 M9074 M2001 M2002 M2003 M2004	к 50]-	Execution request for servo pro- gram No.50
с I	Start accept flags	ят м1]-	On completion of the request for execution of servo program No.50, M1 is turned OFF.
1			

5.3 Present Value Change and Speed Change Instructions (DSFLP/CHGA, CHGV)

These instructions are used to change the present value of a stopped axis, and change the speed of an axis during positioning or JOG operation.

5.3.1 DSFLP instruction (when using A171S/A273UHCPU (8-axis specification))

$\left[\right]$										U	sab	le [)evi	ces								nation	Steps			Carry	FI	ag
	Bit Devices								W	ord	(16	Bit) De	evic	8 8		Cons- tants		Point- ers		Levei	Desig	er of	ŗ		гад		
	×	Y	м	L	s	в	F	т	с	D	w	R	AO	A1	z	v	к	н	Ρ	1	N	Digit	Numb	Subse	Index	N9 012	M9010	M9 011
(D)										0													7		v		0	
n																	0	0					<i>'</i>		Ĺ			



- (1) The following processing is executed at the leading edge (OFF ON) of the DSFRP instruction:
 - (a) Present value change
 - When the DSFLP instruction is executed, the present value change is executed in accordance with the following procedure.
 - 1) The start accept flag (M2001 to M2004/M2001 to M2008) corresponding to the axis designated in (D) is turned ON.
 - 2) The present value is changed to the contents of the present value change register for the axis designated in (D).
 - 3) On completion of the present value change, the start accept flag is turned OFF.
 - (b) Speed change

When the DSFLP instruction is executed, the speed is changed in accordance with the following procedure.

- 1) The start accept flag (M2021 to M2024/M2021 to M2028) corresponding to the axis designated in (D) is turned ON.
- A command to change the currently effective positioning speed to the speed stored in the speed change register for the axis designated in (D) is issued.
- 3) The speed change in progress flag is turned OFF.

(2) The numbers of registers used for present value change and speed change operations are indicated in the table below. (For details, see Section 3.4.2.)

<A171SCPU>

Ayle No	Present Value C	hange Registers	Speed Chan	ge Registers
AXIS NO.	Upper	Lower	Upper	Lower
Axis 1	D961	D960	D963	D962
Axis 2	D967	D966	D969	D968
Axis 3	D973	D972	D975	D974
Axis 4	D979	D978	D981	D980

<A273UHCPU (8-Axis Specification)>

Avia No	Present Value C	hange Registers	Speed Chan	ge Registers
ALIS NO.	Upper	Lower	Upper	Lower
Axis 1	D961	D960	D963	D962
Axis 2_	D967	D966	D969	D968
Axis 3	D973	D972	D975	D974
Axis 4	D979	D978	D981	D980
Axis 5	D985	D984	D987	D986
Axis 6	D991	D990	D993	D992
Axis 7	D997	D996	D999	D998
Axis 8	D1003	D1002	D1005	D1004

[Operation Timing]



[Data Settings]

(1) Setting the axis for which the present value change/speed change is to be executed

The axis for which the present value change/speed change set in (D) is executed is set as follows.



- (2) Present value change/speed change The setting for a present value change/speed change is as follows.
 - Present value changeSet K0 or H0.
 - Speed changeSet K1 or H1.



[Error Details]

- (1) In the following cases, an operation error occurs and the DSFLP instruction is not executed.
 - When the setting for (D) is other than 1 to 4 or 1 to 8.
 - When the setting for n is a value other than 1 or 0.
 - When the setting for (D) or n has been indirectly designated using an index register (Z, V).
- (2) In the following cases, a minor error (error on control change) occurs and the present value change/speed change is not executed. When this happens, the error detection flag (M1607+20n/Xn7) is turned ON and the error code is stored in the minor error code area for the relevant axis.
 - When the axis designated in (D) for the present value change is in motion.
 - When the axis designated in (D) is executing a home position return or circular interpolation when the speed change is made.
 - When the axis designated in (D) is decelerating when the speed change is made.
 - When the speed designated by n is outside the range of 0 to the speed limit value when the speed change is made.

[Program Example]

- (1) The program shown below changes the present value for axis 2 to the value designated with an 8-digit digital switch.
 - (a) Conditions
 - 1) Numbers of inputs for the digital switch ... X010 to X02F
 - 2) Present value change commandLeading edge

 $(OFF \rightarrow ON)$ of X000

- 3) Present value change execution flagM0
- 4) Axis 2 start accept flag (used to determine whether axis 2 is stopped or in motion)M2002 (axis 2 start accept flag)

(b) Program example



- (2) The program shown below changes the positioning speed of axis 2 to the value set with an 8-digit digital switch.
 - (a) Conditions
 - 1) Numbers of inputs for the digital switch ... X010 to X02F
 - 2) Speed change commandLeading edge (OFF \rightarrow

ON) of X000

(b) Program example

0	— Speed change in progress flag	[DBIN	K8 X0010 -[DSFL	D2	Desse}} Ki }	The value set with the digital switch is stored in the speed change data registers for axis 2 (D968, D969). Axis 2 speed change execution request
CIRCUIT END						

5.3.2 CHGA/CHGV instructions

$\left \right $			-	-						-	U	sab	ie [)evi	ces								nation	Steps			Carry	FI	ag
$ \rangle$			E	Bit I	Dev	ice	8	_		We	ord	(16	Bit) D(əvic	e s		Co tai	ns- nts	Po e	int- rs	Levei	Desig	er of	Ť		Fiay	E1	
	,	(Y	М	L	s	в	F	Т	с	D	w	R	A 0	A 1	Z	v	к	н	Ρ	I	N	Digit	Numb	Subse	tepuj	M9 012	M9010	M9011
(D)																								7		x		0	0
n											0	0	0					0	0					Ĺ					



- (1) The following processing is executed at the leading edge (OFF ON) of the CHGA/CHGV instruction:
 - (a) Present value change

When the CHGA instruction is executed, the present value change is executed in accordance with the following procedure.

- 1) The start accept flag (M2001 to M2004/M2001 to M2008/M2001 to M2032) corresponding to the axis designated in (D) is turned ON.
- 2) The present value of the axis designated in (D) is changed to the present value designated in n.
- 3) On completion of the present value change, the start accept flag is turned OFF.
- (b) Speed change

When the CHGV instruction is executed, the speed is changed in accordance with the following procedure.

- 1) The start accept flag (M2021 to M2024/M2021 to M2028/M2061 to M2092) corresponding to the axis designated in (D) is turned ON.
- 2) The speed of the axis designated in (D) is changed to the speed designated in n.
- 3) The speed change in progress flag is turned OFF.

[Operation Timing]

Execution command OFF	
Start accept flag/speed	Present value change/speed change completion

[Data Settings]

(1) Setting the axis for which a present value change/speed change is to be executed

The axis with respect to which the present value change/speed change set in (D) is to be executed is set as follows.

	 Started axis No. Set the relevant axis No. in the range 1 to 32 Set the interpolation control time for one of the axes involved in the interpolation. Only J can be used.
r	Example
A	xes to be started are designated as shown below.
•	Axis 1J1
i	
(2)	Setting the present value change/speed change There are two types of setting for present value changes and spe changes: direct setting and indirect setting.
	 (a) In direct setting, the present value or speed to be changed to specified directly as a numerical value. (For the setting range, refer to Section 3.4.2.)
r	Evample
1	
lf •	the present value to be changed to is "10", the setting is as follows. When designated with a K deviceK10
f •	the present value to be changed to is "10", the setting is as follows. When designated with a K deviceK10
If • 	the present value to be changed to is "10", the setting is as follows. When designated with a K deviceK10 (b) The word devices that can be used are indicated in the table belo

below.

		CPU	
Word Device	A171S	A273UH (8 Axis Specification)	A273UH (32 Axis Specification)
D	0 to 799	0 to 8191*1	800 to 8191
w	0 tp 3FF	0 to 1FFF	0 to 1FFF
R	0 to 4095	0 to 8191	0 to 8191

*1: Excluding 800 to 1023

Make the following setting to designate the present value to be changed to with the data stored in data register D50:

Designation with a word device — CHGA J11 D50

- 2) An index register (Z, V) or dedicated instruction (IX . IXEND) can
 - be used for index designation of the indirectly set word device.
 - For details on index registers (Z, V), see the ACPU Programming Manual (Fundamentals) (IB-66249).
 - For details on dedicated instructions (IX, IXEND), refer to the AnACPU/AnUCPU Programming Manual (Dedicated Instructions) (IB-66251).

[Error Details]		
	(1)	In the following cases an operation error occurs and the CHGA/CHGV instruction is not executed.
		 When the setting for (D) is other than J1 to J32.
	(2)	In the following cases, a minor error (error on control change) occurs and the present value change/speed change is not executed. When this happens, the error detection flag (M1607+20n/Xn7/M2407+ 20n) is turned ON and the error code is stored in the minor error code area for the relevant axis.
		• When the axis designated in (D) for the present value change is in motion.
		• When the axis designated in (D) is executing a home position return or circular interpolation when the speed change is made.
		• When the axis designated in (D) is decelerating when the speed change is made.
		• When the speed designated by n is outside the range of 0 to the speed limit value when the speed change is made.
[Program Example]		
	(1)	The program shown below changes the present value for axis 2.
		(a) Conditions
		1) Present value change commandLeading edge (OFF \rightarrow ON) of X000
		2) Present value change execution flagM0
		3) Axis 2 start accept flag (used to
		determine whether axis 2 is stopped
		or in motion)

flag)

(b) Program example

	 -[CHGA J2 [RST	50 M0	Ъ	Axis 2 present value change exe tion request M0 turned OFF	cu-
	 [RST	MO	Ч	1	40 turned OFF

- (2) The program shown below changes the positioning speed for axis 2.
 - (a) Conditions
 - 1) Speed change commandLeading edge (OFF \rightarrow ON) of X000
 - (b) Program example





5.4 SFC Programs

This section explains how to start servo programs using SFC programs.

5.4.1 Starting and stopping SFC programs

SFC programs are started and stopped from the main sequence program. The methods for starting and stopping SFC programs are described below.

- (1) Starting SFC programs
 - (a) An SFC program is started by turning M9101 (SFC program start/stop) ON in the main sequence program.



- (b) There are two types of SFC program start, as indicated below, and the one that is effective is determined by the ON/OFF status of special relay M9102 (SFC program start status selection):
 - 1) SFC program initial start By turning special relay M9101 ON while special relay M9102 is OFF, the SFC program is started from the initial step of block 0.
 - 2) SFC program resumptive start By turning special relay M9101 ON while special relay M9102 is ON, the SFC program is started from the block and step that was being executed immediately before operation was stopped.
- (c) On creation of an SFC program, if no main sequence program has been created (applies only when step 0 is an END instruction), the circuit shown below is automatically created in the main sequence program area by the peripheral device.



- (2) Stopping SFC programs
 - (a) An SFC program is stopped by turning M9101 (SFC program start/stop) OFF in the main sequence program.



(b) When an SFC program is stopped, all the operation outputs in the step being executed are turned OFF.

POINT

Write during run in the SFC mode is not possible with respect to the motion controller.

5.4.2 Servo program start request

A servo program can be started in one of two ways: by using the program start-up symbol intended for this purpose ([SV]), or by inputting a servo program start request instruction in the internal circuit of a normal step (\Box) .

(1) When an [SV] step is created:



POINTS

- (1) When an [SV] step is created, the servo program start request ladder block (|-----[SVST ***]--|) is mandatorily inserted in the sequence program.
- (2) When a DSFRP instruction is used, input it directly into the sequence program at a normal step (_).
- (3) If an SVST instruction is edited and converted, a start accept bit (M2001 to M2004/M2001 to M2008/M2001 to M2032) is automatically inserted into the switching conditions before and after the relevant SFC step to act as an interlock. However, if the order of steps has been changed by addition or insertion, this interlock may not be automatically added/deleted in the switching conditions. Therefore, if a step has been added or inserted, always display the switching conditions using ZOOM display and check the interlock.
 (4) Only the sequence (but of SVST, the base of the set at an ISVI).
- (4) Only the sequence (├──── [SVST ***]→) can be set at an [SV] step. If any additional instructions are to be set, either set them in a normal step (□) or set another sequence instruction section executed in parallel as a normal step (□).
- (5) For details on how to operate peripheral devices used to edit and monitor SFC programs, refer to the SW2SRX-GSV13PE Operating Manual and SW2SRX-GSV22PE Operating Manual.



(2) When a serve program start instruction is input inside a normal step (\Box) .

POINTS

- (1) When a DSFRP or DSFLP instruction is used, input it directly into the internal circuit of a normal step (□).
- (2) If an SVST/DSFRP instruction is edited and converted, a start accept bit (M2001+n) is automatically inserted into the switching conditions before and after the relevant SFC step to act as an interlock.
- (3) If a DSFLP instruction is edited and converted, a speed change in progress flag (M2021 to M2024/M2021 to M2028/M2061 to M2092) is automatically inserted into the switching conditions before and after the relevant SFC step to act as an interlock.
- (4) Set commands such as speed change commands and stop commands, which are executed in an arbitrary timing, in the main sequence program.
- (5) For details on how to operate peripheral devices used to edit and monitor SFC programs, refer to the SW2SRX-GSV13PE Operating Manual and SW2SRX-GSV22PE Operating Manual.

6. SERVO PROGRAMS FOR POSITIONING CONTROL

Servo programs serve to designate the type of the positioning control, and the positioning data, required to execute positioning control with the servo system CPU. This section explains the configuration, and method for designating, servo programs.

For details on the various types of servo program, see the explanation of positioning control in Section 7.

6.1 Servo Program Composition and Area

This section describes the composition of servo programs and the area in which a servo program is stored.

6.1.1 Servo program composition

A servo program comprises a program number, servo instructions, and positioning data.

When a program number and the required servo instructions are designated using a peripheral device, the positioning data required to execute the designated servo instructions can be set.



Fig. 6.1 Example Composition of a Servo Program

- (1) Program No. This is a number used to call the program from the sequence program: any number in the range 0 to 4095 can be set.
- (2) Servo instruction Indicates the type of positioning control. For details, see Section 6.2.

6. SERVO PROGRAMS FOR POSITIONING CONTROL

(3) Positioning data...... This is the data required to execute servo instructions.

The data required for execution is fixed for each servo instruction.

For details, see Section 6.3.

The follows applies for the servo program shown in Figure 6.1:

- Used axes and
- positioning address
- Commanded speed
 Durall time
- Dwell time
- ► M code

 P.B. (parameter block) set in order to execute the servo instruction Data which will be set to default values for control if not set. Control is executed using the data of parameter block 1 (P.B.1).

Data which must be

6.1.2 Servo program area

- (1) Servo program area The servo program area is an internal memory of the the system CPU (not in the memory cassette) which serves to store the servo program created with a peripheral device. The servo program area is an internal RAM.
- (2) Servo program capacity The servo program area has a capacity of 13312 steps in the case of an A171S/A273UHCPU(8 axis specification) or 14334 steps in the case of an A273UHCPU (32 axis specification).

<A171SCPU>



Fig. 6.2 Servo Program Area

POINT

If the servo program area has insufficient capacity, execute multiple positioning control operations with one program by indirect setting of the positioning data used in the servo program. (For details on indirect setting, see Section 6.4.2.)

6.2 Servo Instructions

This section presents the servo instructions used in servo programs.

(1) How to read the servo instruction tables



Fig. 6.1 How to Read Servo Instruction Tables

(2) Servo instruction list

The servo instructions that can be used in servo programs, and the positioning data set for the servo instructions, are indicated in Table 6.2. For details on the positioning data set for servo instructions, see Section 6.3.

Γ		1		-							—	Chr		,		Pe	ito	de c	Det			_		1				_		_	—	Γ
L					г ^а		1			τ_				-	-		-			r Bilo		Т	1	┝	_	۲e			r		1	
Pa	sitior ing ontro	i- instruc- tion i Symbol	Processing Details	Peremeter Block No.	Axle	Address'Travel Value	Commanded Speed	Dwell Time	M Code	Torque Limit Value	Auxiliary Point	Rediue	Enter Point	Number of Pitchee	Control Unit	Speed Limit Yalue	Acceleration Time	Deceleration Time	Repid Step Deceleration Time	Torque Umit Value	Deceleration Processing on STOP Input	Aleverbie Error Range for Circular Interpolation	8 Curve Aatle	Repeat Condition	Program No.	Commanded Speed (Constant Speed	Cancel	Start	Skip	RN Acceleration	Number of Steps	Section for Detailed Explementon
		ABS-1	Absolute 1 axis positioning	▲	0	0	0	▲	▲							▲	▲	▲	۸	۸	▲		4				۵	۵			4	
		INC-1	Incremental 1 axis positioning	⊿	0	0	0	▲	▲							۵	۵	▲	▲	▲	▲	Γ	۵				۵	۵			10 14	7.2
		ABS-2	Absolute 2 axis linear interpolation	▲	0	0	0	▲	۵			Γ			۵	۵	▲	۵	۵	۵	4	Γ	•				۵	۵			5	
fro	2 800	INC-2	Incremental 2 axis linear interpolation	۵	0	0	0	۵	۵			Γ			۵	۸	⊿	▲	▲	4	▲		۵				4	۵			to 16	7.3
		ABS-3	Absolute 3 axis linear interpolation	۸	0	0	0	۵	▲		Γ				۵	۸	4	▲	▲	۵	▲		▲				۵	۸			7	
Ē	3 aud	INC-3	Incremental 3 axis linear interpolation	۸	0	0	0	▲	4		Γ				۵	۵	۸	4	4	۵	۸		۵				Δ	۵			to 18	7.4
		ABS-4	Absolute 4 axis linear interpolation	4	0	0	0	۵	۸		Γ				۵	۵	۵	4	▲	4	۸		۵				۵	۵			8	
	4 axi	INC-4	Incremental 4 axis linear interpolation	4	0	0	0	4	▲						۵	۸	۵	۵	۵	▲	۵		▲				▲	4			to 21	7.5
	Auxi iery	ABS A	Absolute circular interpolation by auxiliary	۵	0	0	0	۵	۵						۵	۸	۵	4	۵	۵	٨		۵				۵	۵			7	
	poin desig natio		Incremental circular interpolation by auxiliary	۵	0	0	0	۸	۵						۵	۵	۵	۵	۵	۵	۵		4				۵	۵			to 19	7.6
		ABS (Absolute circular interpolation by radius designation, within CW180	۵	0	0	0	۵	۵		0				4	۵	۵	۵	۵	4	۵	▲	۵				۵	۵				
control		ABS	Absolute circular interpolation by radius designation, CW180 and greater	۵	0	0	0	۵	۸		0				۵	۵	۵	۵	۵	٨	۵	۵	4				۵	۵				
ir interpolation	Ra- dius	ABS	Absolute circular interpolation by radius designation, within CCW180	۵	0	0	0	۸	4			0			۸	۸	4	▲	۵	▲	۵	▲	٨				۵	۵			6 to	7.7
Circula	natio	ABS	Absolute circular interpolation by radius designation, CCW180 and greater	۵	0	0	0	۵	۸			0			۸	۸	۸	۵	4	4	۵	▲	۵				۵	۵			18	
			Incremental circular interpolation by radius designation, within CW180	۵	0	0	0	۵	۵			0			۵	۵	۵	۵	۵	۵	۵	۵	۵				۵	۵				
		INCA	Incremental circular Interpolation by radius designation, CW180 and greater	۸	0	0	0	۵	۵			0			۵	۵	۸	۵	۵	۵	۵	۵	۸				۵	۵				

Table 6.2 Servo Instruction List

O: Must be set Δ : Set if required

				H							-	-		_	_	Per	150	ing.	Det					1								
				L	<u>~</u>		m 1		-				iri	-			-	-		-	ek .			L		_	0					
Po	sition- ing ontrol	instruc- tion Symbol	Processing Details	Parameter Block No.	Ado	Address/Travel Value	Cemmanded Speed	Dwell Time	M Cede	Terque Limit Velue	Auditary Point	Reduc	Cater Point	Number of Pilohee	Central Unit	Speed Limit Yalve	Acceleration Time	Deceleration Time	Repid Step Deceleration Time	Terque Limit Value	Doodwatton Proceeding on \$70P Input	Afternable Errer Range for Circular Interpolation	S Curve Ratio	Repeat Condition	Program No.	Commanded Speed (Constant Speed)	Cancel	Start	di M	FIN Acceleration	Number of Stepe	Section for Detailed Explanation
	Ra-		Incremental circular interpolation by radius designation, within CCW180	4	0	0	•	۵	۵			0			۵	۸	⊿	۵	۵	۸	۵	۸	۵				۵	۵			6	
control	desig- nation		Incremental circular Interpolation by radius designation, CCW180 and greater	4	•	0	0	۵	۵			0			۵	۵	4	4	۵	•	4	4	۵				۵	۵			to 18	7.7
terpolation		ABS	Absolute cicular Interpolation by center point designation, CW	4	0	0	0	۵	۵				0		۵	۵	۵	4	۵	۸	۸	۵	۸				۵	۵				
Siroular In	Cen- ter point	ABS	Absolute cicular interpolation by center point designation, CCW	4	0	0	٥	۵	۵				0		۵	۵	۸	۵	۵	۸	۵	۵	۵				۵	۵			7 to	7.8
ľ	design ation		Incremental cicular interpolation by center point designation, CW	۵	0	0	0	۵	۵				0		۵	۸	۵	۵	۵	۵	۵	۵	۵				۵	۵			19	
		INC	Incremental cicular interpolation by center point designation, CCW	۵	0	0	0	۵	۵				0		۵	۵	۵	۵	۵	۵	۸	۵	۸				۵	۵				
Pee	1 axis	FEED-1	1 axis fixed-pitch feed start	۵	0	0	0	۵	۵							۵	۸	▲	۸	۵	۵		۵				۵	۵			4 to 15	7.9
pitch	2 exis	FEED-2	2 axis linear interpolation	۵	0	0	0	۵	۵		-					4	▲	▲	▲	۸	▲		۸				۸	۵		\square	5 to	7. 10
Fixed	3 exis	FEED-3	3 axis linear interpolation	▲	0	0	0	۵	۵							۵	4	4	۸	Δ	▲		۵				Δ	۵			7 to	7.
ontrol (I)	For- ward rota- tion	VF	Speed control (I) Forward rotation start	۵	0		0		۵							۵	۵	4	۸	۸	۵		۵				Δ	۵			3	7.
Speed or	Re- verse rota- tion	VR	Speed control (i) Reverse rotation start	۵	0		0		۵							۵	۵	۵	۸	۸	۵		۵				۵	۵			12	12
ontrol (II)	For- ward rota- tion	[VVF]	Speed control (II) Forward rotation start	۸	٥		0		۵	۵						۵	۵	4	۸	۸	۵		۸				۸	4			3	7.
Speeds	Re- verse rota- tion	VVR	Speed control (II) Reverse rotation start	۵	0		0		۵	۵						۵	۵	۸	۵	۵	۵		۵				۵	۵			14	13
aing control	For- ward rota- tion	VPF]	Speed/position switching control Forward rotation start	۵	0	0	0	۵	۵	4						۵	۵	•	۵	۸	۵		۵				۵	۵			4	7.
Nion ewitch	Re- verse rota- tion	VPR	Speed/position switching control Reverse rotation start	۵	0	0	0	۵	۵	۵						۵	۵	۵	۸	۵	۸		۵				۵	۵			15	1
Speed/por	Re- start	VPSTART	Speed/position switching control Restart		٥																						۵	۵			2	7.14 .2
S	peed witch-	VSTART	Speed switching control, start	▲											۵	۵	۵	۵	۵	۵	۵		۵				۵	۵			1 to 10	7.
•	ing ontrol	VEND	Speed switching control, end	Γ																									\square		1	1

Table 6.2 Servo Instruction List (Continued)

O: Must be set ∆ : Set if required

6. SERVO PROGRAMS FOR POSITIONING CONTROL

										_	_	_		_	Pee	itter	deg.	Det		-							·			- 1	
				C.		-	ottin	9.		In	Cire	ole li	on			P	-	e ter	810	ak					_	Othe	re				
Position- ing Control	instruc- tion Symbol	Processing Details	Parameter Block No.	Auto	Addrese/Travel Velue	Commanded Speed	Dwell Time	M Cede	Torque Limit Value	Auxiliary Point	Rediue	Enter Point	Number of Pitchee	Centrol Unit	Speed Limit Value	Acceleration Time	Deceleration Time	Repid Stop Deceleration Time	Torque Limit Value	Deceleration Processing on \$10P Input	Allowable Error Range for Circular Interpolation	S Curve Ratio	Repeat Condition	Program No.	Commended Speed (Constant Speed)	Cancel	Start	Skip	RN Acceleration	Number of Steps	Section for Detailed Explanation
	ABS-1		-	0	0	0	4	4	4																	۵	۵			4 to	
	ABS-2	Speed switching control	F	6	0	0	▲	⊿	▲																	Δ	۵			5 to	
	ABS-3		Γ	0	0	0	⊿	4	▲										1-							۵	۵			7 to	
Speed	INC-1			0	0	0	Δ	▲	⊿																	Δ	۸			4 to	7.
switching control	[INC-2]	Speed switching control		0	0	0	▲	Δ	Δ	Γ						-										۵	۵			5 to	15.
	INC-3			0	0	0	▲	4	⊿																	Δ	۵			7 to 10	
	VABS	Absolute designation of	Γ		0	0		▲	▲										Γ								_			4	
		Incremental designation		\vdash	6	0													F											to 6	
Position		of speed switching point	-	\vdash	ŀ		-	-	-			-			-			-	-			-								4	7
tollow-up control	PESTART	start	4	°	0	٥		^							Δ	Δ	Δ	Δ	Δ	4		Δ	_			Δ	Δ			to 16	17
	CPSTART1	1 axis constant speed control start	Δ	0		٥									۵	۵	▲	۵	▲	۵		۵				۵	۵		۵	3	
	CPSTART2	2 axis constant speed	⊿	0		0								۵	▲	▲	▲	⊿	4	۵	۵	۵				4	۵		۵	14	7.
	CPSTARTS	3 axis constant speed	Δ	0	-	0								۸	Δ	4	⊿	4		⊿		۵				Δ	Δ		۵	4	16
	CPST APT 4	4 axis constant speed			\vdash			<u> </u>	┢										$\frac{1}{1}$						_				•	to 15	
		control start	Ĩ		-	Ť		-	$\frac{1}{2}$			\vdash	-	-	-	- -	-	-	F	-		_			-	-	-		-	2 to	_
	ABS-2		-	0	0	-	\vdash		-	-		-		┝─		-							_		~					6 3 to	
	ABS 3		┝	0	0		-		1 A	-	-		\vdash	\square					┢		-		_		•			-	-	7 4 to	
	ABS-4		\vdash	0	0					-							\vdash		\vdash				_		Δ			-		8 5 to	
	ABS	Absolute designation of		0	0		-			0		\vdash	┢─			-	┢	-	┝╴	ŀ					۵					5 to	
Con-	ABS C	passing point for constant		0	0			Δ			0	\vdash		-		-	┢──			\vdash					۵			⊿			
stant speed	ABS		\vdash	0	0	\uparrow	-	Δ	⊿		0		\vdash				\uparrow		-						۵			⊿		4	
oontroi	ABS C		\vdash	0	0			▲	⊿		0		 	-			<u></u>								۵	-		4		to 8	l
	ABS			0	0	\square	Γ	۵	۵		0									F					۵			⊿			7.
	ABS	1		0	0			۵	Δ			0	Γ				1	Γ							4			۵		5	10
	ABS 👉	1		0	0			⊿	۵			0				Γ									۵			۵		9	
	INC-1			0	0			▲	Δ																۵			۵		2 to 6	
	INC-1]		0	0			۵	Δ																۵			Δ		3 to 7	
	INC-1]		0	٥			⊿	▲																Δ			۵		4 to 8	
	INC-1	of passing point for		0	0			▲	▲																Δ			۵		5 to 9	
	INC 2	constant speed control		0	0			۵	▲	0															Δ			▲		5 to 9	
		1		0	0			۵	▲		0					L		L							۵		ļ	▲		4	
		ļ		0	0	L_		Δ	Δ	Ļ	0							L.,	ļ						Δ	_		▲	-	to 8	ł
1	INC 🗸			0	0			⊿	⊿		0	1													Δ			⊿			

Table 6.2 Servo Instruction List (Continued)

O: Must be set ∆ : Set if required

6. SERVO PROGRAMS FOR POSITIONING CONTROL

		Processing Details		Positioning Deta																											
				Common Sottings						Circular Interpolation			Parameter Block							Others											
Position- ing Control	instruc- tion Symbol			Ade	Addrees/Travel Value	Commanded Speed	Dwell Time	M Code	Terque Limit Velue	Aunthery Peint	Rediue	Enter Point	Number of Pitutioe	Control Unit	Speed Limit Value	Acceleration Time	Deceleration Time	Repid Stop Deceleration Time	Torque Limit Value	Develoration Processing on \$10P input	Allewable Error Range for Circular Interpolation	s Curve Retie	Repeat Condition	Program No.	Commanded Speed (Constant Speed)	Cancel	Start	Ship	An Acceleration	Number of Stepe	Section for Detailed Explanation
Con- stant speed control		Absolute designation of		0	0			▲	4		0														۵			۵		4 to 8	
		passing point for constant		0	0		Γ	▲	Δ			0					Γ	Γ							۵			۵		5	7
		speed control		0	0			Δ	4			0	\square		\square		\square	\vdash	1-	T					٨			۵		to 9	16
		Ends constant speed control					▲											T		1	\vdash									1 to 2	
Repeti-	FOR TIMES	J																					0								
(Used for speed switching control, constant speed control)	FOR-ON													ĺ									0							2	7. 15.
	FOR-OFF	Set the head step for repetition												0								2 7. 16.									
	NEXT																		3	1											
Simulta- neous start	START	Simultaneous start																						0						2 to 3	7. 18
Home position return	ZERO	Starts home position return		0																										2	7. 21
High- speed oscillation	OSC	High-speed oscillation	۵	0	0	0		۵											۵							۸	۵			5 to 11	7. 22

Table 6.2 Servo Instruction List (Continued)

O: Must be set Δ : Set if required

6-7

6.3 Positioning Data

The positioning data set for servo programs is shown in Table 6.3.

Table 6.3 Positioning Data

					Setting Made With Peripheral Device									
Name		Explension				Setting Range								
	nem.			Explanation		Value	mm	Inch	degree	PLUSE	1			
	Parameter block No.		 Sets th that for decele axis. 	e parameter block on the basis acceleration and deceleration ration processing on STOP inpu	1	1 to 16 for 1 to 64	1 to 16 for A171S/A273UHCPU (8 axis specification 1 to 64 for A273UHCPU (32 axis specification)							
			- Set the axis to be started.					1 to 4 for	A171SCPU		<u> </u>			
	Axis		 For interpolation, the numbers of the axes involved in the interpolation are designated. 				1 to 8 for A273UHCPU (8 axis specification) 1 to 32 for A273UHCPU (32 axis specification)							
	9	Absolute data method	Address	Set the positioning address as when using the absolute data r positioning method.	an absolute address method as the	-	-214748364.8 to 214748364.7 (μm)	·214748364.8 to to -2 21474.8364.7 (μm) 21474.83647 359.99999 21 (μm) 21474.83647		-2147483648 to 2147483647	-2147483648 to 2147483647			
	vel val	incremental method		Set the positioning address as using the incremental method a	a travel value when as the positioning		For other than ##speed/position switching control							
	ss/tra		Travel	method. The direction of trave sign. However, only positive s	I is indicated by the ettings can be made		0 to 2147483647							
	Addre		value	Positive : Forward rotation address values	(direction in which increase)	-	F	or speed/positio	n switching cont	rol				
Settings				Negative: Reverse rotation address values	(direction in which decrease)		0 to 214748364.7 (μm)	0 to 21474.83647	0 to 21474.83647	0 to 2147483647				
Common	Con	nmanded ed	 Sets the positioning speed. The units for the speed are the "control units" set in the parameter block. For interpolation, his setting is the resultant speed/long-axis reference speed/reference axis speed. (Applies to PTP control only) 				0.01 to 6000000.00 (mm/min)	0.001 to 600000.000 (inch/min)	0.001 to 600000.000 (degree/min)	1 to 1000000 (PLS/sec)				
	Dwe	ell time	 Set the time from positioning to the positioning address to output of the positioning completion signal (M1601+20n/Xn1/M2401+20n). 			0 (ms)		0 to 5000 (ms)						
	Set the M code For speed switching control and constant speed control, different settings can be made for each point.					o		0 to 255						
			• The se each d	tting is updated each time motic esignated point.	on is started or at									
Torque lim value		que limit Ie	 Set the When is block is value of can be 	torque limit value motion is started, the torque limi s used, but in speed switching o an be set for each point and the made effective at designated po	Torque limit setting (%) in the parameter block	1 to 500 (%)								
	liary point	Absolute data method				-	-214748364.8 to 214748364.7 (μm)	-21474.83648 to 21474.83647	0 to 359.99999	-2147483648 to 2147483647				
Circular Interpolation	Auxi	incremental method				0 to 2147483647								
	lius	Absolute data method	• Set wh radius.	en executing circular interpolati	_	0.1 to 42 9496 729.4 (μm)	0.00001 to 42949.67294	0 to 359.99999	1 to 4294967294					
	He	Incremental method	The se used, a	tting ranges, which depend on t are shown to the right.		0.1 to 214748364.7 (μm)	0.00001 to 21474.83647	0.00001 to 21474.83647	1 to 2147483647					
	ster point	Absolute data method	- Set wh center	en executing circular interpolati point.	_	-214748364.8 to 214748364.7 (μm)	-214748364.8 to 214748364.7 (µm) -21474.83647 to 0 to 359.99999							
	ð	Incremental method	ita)				0 to 2147483847							
	Number of pitches		of • Set when performing helical interpolation					0 to 999						
6. SERVO PROGRAMS FOR POSITIONING CONTROL

	Settin	ettings Made Using the Sequence Program (Indirect Setting)					Indirect Setting		Processing in Event of Setting Error		
	Default Value	nom .	Setting inch	degree	PLUSE	Possible/Not Possible	Number of Words Used	*4 Error item Data (Stored in D9190)	Control Using Default Value	Starting not Possible	
	1	1 to 16 for A171S/A273UHCPU (8 axis specification) 1 to 64 for A273UHCPU (32 axis specification)				o	1	1	o		
	_	_			x	_					
	_	-2147483648 to 2147483647 (×10 ⁻¹ µm)	-2147483648 to 2147483647 (x10 ⁻⁵ inch)	0 to 35999999 (x10 ⁻⁵ degree)	-2147483848 to 2147483847			-03 ^{*1}			
		For oth	er than speed/po	sition switching	control			105		0	
	_		0 to 214	7483647		U	2				
•		For speed/position switching control									
		0 to 21 47483647 (x10 ⁻¹ μm)	0 to 2147483647 (x10 ⁻⁵ inch)	0 to 2147483647 (x10 ⁻⁵ degree)	0 to 21 4748364 7			-			
		1 to 600000000 (×10 ⁻² mm/min)	1 to 600000000 (×10 ⁻³ inch/ min)	1 to 600000000 (x10 ⁻³ degree/ min)	1 to 1000000 (PLS/sec)	o	2	4	0 2	° 3	
	0 (ms)	0 to 5000 (ms)				ο	1	5	0		
	0	0 to 255				0	1	6	o		
	Torque limit setting (%) in the parameter block	1 to 500 (%)			o	1	7	o			
	_	-2147483648 to 2147483647 (×10 ⁻¹ µm)	-2147483648 to 2147483647 (x10 ⁻⁶ inch)	0 to 35 999999 (x10 ⁻⁶ degree)	-2147483648 to 2147483647	o	2 × 2	n08 ^{*1}			
		0 to 2147483647									
		1 to 4294967294 (x10 ⁻¹ µm)	1 to 4294967294 (x10 ⁻⁶ inch)	0 to 3 5999999 (×10 ⁻⁵ degree)	1 to 4294967294	0	3	×09 *1		0	
		1 to 214 748364 7 (×10 ⁻¹ μm)	1 to 2147483647 (x10 ⁻⁵ inch)	1 to 2147483647 (×10 ⁻⁵ degree)	1 to 2147483647	5	2	100		5	
	-	-2147483648 to 2147483647 (×10 ⁻¹ µm)	-2147483648 to 2147483647 (×10 ⁻⁵ inch)	0 to 359999999 (x10 ⁻⁵ degree)	-2147483648 to 2147483647	0	2×2	n10 *1			
			0 to 214	7483647							
	_		0 to	999		0	1	28			

REMARKS

*1: The "n" in n03, n08, n09, n10, indicates the axis number (1 to 4/1 to 8/1 to 32).

*2: When an error occurs because the speed limit value is exceeded, control is executed at the speed limit value.

*3: Applies when the commanded speed is *0*.

*4: If there are multiple errors in the same program, the latest error item data is stored.

Table 6.3 Positioning Data (Continued)

			Setting Made With Peripheral Device					
Name		Explanation	Detent	Setting Range				
			Value	mm	inch	degree	PLUSE	
Γ	Control unit	It is possible to set only those items in the set parameter block data that you want to change.	3	o	1	2	3	
	Speed limit value	 For details on each data item, see Section 4.4 "Parameter Block". 	200.000 (PLS/sec)	0.01 to 6000000.00 (mm/min)	0.001 to 600000.000 (inch/min)	0.001 to 600000.000 (degree/min)	1 to 1000000 (PLS/sec)	
	Acceleration time		1000 (ms)		1 to 65	535 (ms)		
block	Deceleration time	,		1 to 65535 (ms)				
meter	Repid stop deceleration time S curve ratio		1000 (ms)	1 to 65535 (ms)				
l e			0 (%)	1 to 100 (%)				
	Torque limit value		300 (%)	1 to 500 (%)				
	Deceleration processing on STOP input		o	0: Deceleration to a stop in accordance with the deceleration time 1: Deceleration to a stop in accordance with the rapid stop deceleration time				
	Allowable error range for circular interpolation		100 (PLS)	0 to 100000	0 to 100000	0 to 100000	0 to 100000	
	##Repeat condition	Set the repeat condition for repetition between the FOR- TIMES instruction and the NEXT instruction.	-	1 to 32767				
	Program No.	Set the program numbers for simultaneous starts.	—	0 to 4095				
ł	Commanded speed (constant speed)	Set the speed for points part way through positioning in the servo program.	-	0.01 to 6000000.00 (mm/min)	0.001 to 600000.000 (inch/min)	0.001 to 600000.000 (degree/min)	1 to 1000000 (PLS/sec)	
	Cancel	Set to end execution of a serve program by deceleration to a stop by turning ON a designated bit device in that program.		Х, Ү, М, ТС, ТТ, СС, СТ, В, F				
ð	Start	 Set to automatically start a designated program after execution of "cancel" above. Can only be set when "cancel" has been set. 	-	K0 to K4095				
	Skip	Set in order to cancel positioning at a pass point and carry out positioning at the next pass point by turning ON a designated bit device during execution of positioning at each of the pass points associated with a constant speed control instruction.	-	Х, Ү, М, ТС, ТТ, СС, СТ, В, F				
	FIN acceleration/ deceleration	Set in order to execute positioning at each pass point associated with a constant speed control instruction by		00 (ms)				

6. SERVO PROGRAMS FOR POSITIONING CONTROL

Settings Made Using the Sequence Program (indirect Setting)					Indirect Setting Processing in Event of Setting Er			ting Error	
Default		Setting	Range		Possible/Not	Number of	*4 Error Item	Control Lieing	Starting not
 Value	mm	inch	degree	PLUSE	Possible	Words Used	Data (Stored In D9190)	Default Value	Possible
3	0	1	2	3	0	1	11		
200.000 (PLS/sec)	1 to 600000000 (×10 ⁻² mm/min)	1 to 600000000 (x10 ⁻³ inch/ min)	1 to 600000000 (×10 ⁻³ degree/ min)	1 to 1000000 (PLS/sec)	o	2	12		
1000 (ms)		1 to 655	535 (ms)		o	1	13		
1000 (ms)	1 to 65535 (ms)				o	1	14		
1000 (sm)		1 to 655	335 (ms)		o	1	15	0	
0 (%)		1 to 1	00 (%)		0	2	21		
300 (%)		1 to 5	00 (%)		o	1	16		
 O	0: Deceleration to a stop in accordance with the deceleration time 1: Deceleration to a stop in accordance with the rapid stop deceleration time				o	1	-		
100 (PLS)	0 to 100000				o	2	17		
-	1 to 32767				0	_	18	Controlled by K1	
_	0 to 4095			0	_	19		0	
_	1 to 600000000 (×10 ⁻² mm/min)	1 to 600000000 (×10 ⁻³ inch/ min)	1 to 600000000 (x10 ⁻³ degree/ min)	1 to 1000000 (PLS/sec)	o	2	4	0 2	0 ⁵
_	-				-	-	_		
-	0 to 4095				0	1	_		
-	_				_	—	-		
 _		1 to 50	60(ms)		0	1	13	o	

REMARKS

*2: When an error occurs because the speed limit value is exceeded, control is executed at the speed limit value.

*3: Applies when the commanded speed is *0*.

*4: If there are multiple errors in the same program, the latest error item data is stored.

6.4 Method for Setting Positioning Data

This section explains how to set the positioning data used in a servo program. There are two ways to set positioning data, as follows:

- (1) Designating numerical values.....see Section 6.4.1
- (2) Indirect designation using word devices......see Section 6.4.2

It is possible to combine data setting by designating numerical values and indirect designation using word devices in the same servo program.

6.4.1 Setting by designating numerical values

The method of setting by designating numerical values is a method whereby each positioning data item is set as a numerical value and becomes fixed data.

Data can only be set and corrected at a peripheral device.



Fig.6.3 Example of Setting Positioning Data by Numerical Value Setting

6.4.2 Setting by using word devices (D, W)

The method of setting by using word devices is a method whereby a word device (D, W) number is designated in the positioning data designated for the servo program.

By changing the contents (data) of the designated word device with the sequence program, it is possible to use the same servo program to execute more than one positioning control.

(1) Devices for setting indirect data

The devices that can be used for setting indirect data are data registers (D) and link registers (W). (Word devices other than data registers and link registers cannot be used.)

The data registers which can be used are indicated in the table below.

	CPU						
Word Device	A171S	A273UH (8 Axis Specification)	A273UH (32 Axis Specification)				
D	0 to 799	0 to 8191 *	800 to 8191				
w	0 to 3FF	0 to 1FFF	0 to 1FFF				

*1: Excluding 800 to 1023



Fig.6.3 Example of Setting Positioning Data by Numerical Value Setting

(2) Input of Positioning Data In indirect setting with word devices, the word device data is input when the PCPU executes the servo program. Accordingly, when positioning control is executed, after data is set in the

device used for indirect setting, the servo program start request signal must be issued.

POIN	TS
(1)	It is not possible to indirectly set axis numbers using word devices with a servo program.
(2)	Establish an interlock by using a start accept signal (M2001 to M2004/M2001 to M2008/M2001 to M2032) to ensure that the device data designated for indirect setting is not changed until the designated axis has accepted the start command. If the data is changed before the start command is accepted, positioning control in accordance

6.5 Creating Sequence Programs to Start Servo Programs

This section describes sequence programs that execute positioning control by using servo programs.

6.5.1 Case where the servo program is executed once only

The general concept for a program that executes a designated servo program once only in response to the start request is shown in Figure 6.5.

A, L, S, B, F) 4): Axis No. designated in the servo program 5): Started servo program No. (K0 to K4095) I A sequence program that issues a start request for servo program No.10 - which exe- cutes circular interpolation with axis 3 and axis 4 - when X000 comes ON, is shown below. (1) Condition The flags that can be used with sequence programs are indicated below. Flag for recording the start request M10 Start accept flag X000 ← Start request PLS M10 M10 M10 M10 M10 M11 M2003 M2004 RST M11	 The applications of 1) to 5) 1): Start request leading B, F) 2): Start accept flag (set designated in the sen 3): DSERP/SVST instruct 	PLS 1) SET 3) DSFRP 4) 5) (SVST) RST 3)) are indicated below. edge detection flag (device a number of flags correspondence) vo program) tion execution request flag	 When the start request comes ON, if the desig- nated axis is not in motion, a request to execute a DS- FRP/SVST instruction is is- sued. Servo program start re- quest issued in response to DSFRP/SVST instruction. On completion of execution of the DSFRP/SVST in- struction, the device desig- nated at 1) is reset. es that can be used: Y, M, L, S, onding to the number of axes (devices that can be used: Y
5): Started servo program No. (K0 to K4095) - Example	M, L, S, B, F) 4): Axis No. designated i	n the servo program	(devices that can be used. T,
- Example A sequence program that issues a start request for servo program No.10 - which exe- cutes circular interpolation with axis 3 and axis 4 - when X000 comes ON, is shown below. (1) Condition The flags that can be used with sequence programs are indicated below. Flag Name Device No. Flag for recording the start request M10 DSFRP/SVST instruction execution request flag M11 Start accept flag Axis 3 M2003 Axis 4 M2004 (2) Sequence program example X000 ← Start request PLS M10 M11 M2003 M204 M10 M10 Start accept Start accept SET M11 M2003 M204 M10	5): Started servo program	n No. (K0 to K4095)	
A sequence program that issues a start request for servo program No.10 - which exe- cutes circular interpolation with axis 3 and axis 4 - when X000 comes ON, is shown below. (1) Condition The flags that can be used with sequence programs are indicated below. Flag for recording the start request M10 DSFRP/SVST instruction execution request flag M11 Start accept flag Axis 3 M2004 (2) Sequence program example X000 ← Start request M10 H1 M2003 M204 (2) Sequence program example X000 ← Start request PLS M10 H1 M2003 M204			
Flag Name Device No. Flag for recording the start request M10 DSFRP/SVST instruction execution request flag M11 Start accept flag Axis 3 M2003 Axis 4 (2) Sequence program example X000 - Start request PLS M10 M10 Image: Start accept M11 M2003 M10 Image: Start accept M11 M2004	cutes circular interpolation wit below. (1) Condition	th axis 3 and axis 4 - when	X000 comes ON, is shown
Flag for recording the start request M10 DSFRP/SVST instruction execution request flag M11 Start accept flag Axis 3 M2003 (2) Sequence program example X000 - Start request PLS M10 M10 M10 Image: Main and the start request M10 Image: Main and the start request M10 Image: Main and the start request Image: Main and the start reques	The flags that can be used	d with sequence programs	are indicated below.
X000 Start request M10 (2) Sequence program example X000 Start request PLS M10 M10 M10 M10 Start request M10 Start accept Start accept SET M11 M2003 M2004 M10 M10 Start request M11 M2003 M2004 SET	The flags that can be used	d with sequence programs	are indicated below.
Start accept flag Axis 3 $M2003Axis 4$ $M2004(2) Sequence program exampleX000 \leftarrow Start request PLS M10M10M10M11 M2003 M2004C = Start accept$ SET M11 M11 M2003 M2004 C = SVST J3J4 K10 (-SVST J3J4 K10 RST M11	The flags that can be use Flag	d with sequence programs Name	are indicated below.
Start accept flag (2) Sequence program example $X000 \leftarrow Start request$ M10 M10 M11 M2003 M2004 Start accept SET M11 M2003 M2004 SET M11 M10 (-SVST J3J4 K10 RST M11	The flags that can be use Flag Flag for recording the sta DSERP/SVST instruction	d with sequence programs Name art request execution request flag	are indicated below.
(2) Sequence program example X000 \leftarrow Start request M10 M10 M11 M2003 M2004 (-SVST J3J4 K10 +) RST M11	The flags that can be use Flag Flag for recording the sta DSFRP/SVST instruction	d with sequence programs Name art request execution request flag Axis 3	are indicated below. Device No. M10 M11 M2003
1 1	The flags that can be use Flag Flag for recording the sta DSFRP/SVST instruction Start accept flag	d with sequence programs Name art request execution request flag Axis 3 Axis 4	are indicated below. Device No. M10 M11 M2003 M2004



6.5.2 Case where different servo programs are executed consecutively

The general concept for a program that, on completion of positioning in accordance with a servo program executed in response to a start request, executes the next servo program, is shown in Figure 6.6. below.



Fig. 6.6 Sequence Program for Starting Servo Programs

6.5.3 Case where the same servo program is executed repeatedly

The general concept for a program that executes repeated positioning control in accordance with the same servo program is indicated in Figure 6.7.





7. POSITIONING CONTROL

This section describes the positioning control methods.

7.1 Basics of Positioning Control

This section describes the common items for positioning control, which is described in detail from Section 7.2.

7.1.1 Positioning speed

The positioning speed is set using a servo program.

See Section 6 for details about servo programs.

The actual positioning speed is determined by the positioning speed setting in the servo program and the speed limit value, according to the following relationship:

- if positioning speed setting < speed limit value positioning occurs at set positioning speed;
- if positioning speed setting > speed limit value positioning occurs at speed limit value.

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7.1.2 Positioning speed under interpolation control

The positioning speed of the servo system CPU determines the travel speed of the controlled system.

- One-axis linear control Under 1-axis control, the travel speed is the positioning speed of the designated axis.
- (2) Linear interpolation control

Under linear interpolation control, the controlled system is controlled at the set speed.

The positioning speed can be set for 2- to 4-axis control using one of the following three methods:

- resultant speed designation
- long-axis speed designation
- reference-axis speed designation

Details of the servo system CPU control for each of these three methods are described below.

(a) Resultant speed designation

The servo system CPU uses the travel value of each axis (D1 to D4) to calculate the positioning speed of each axis (V1 to V4) from the set positioning speed (V) of the controlled system.

The positioning speed of the controlled system is called the resultant speed.

Set the resultant speed and the travel value of each axis in the servo program.



ĺ



The control of each axis is based on the positioning speed (long-axis speed: V) set for the axis whose positioning address is the greatest distance from the current position.

The servo system CPU uses the travel value of each of the other axes (D1 to D4) to calculate the positioning speed of each axis (V1 to V4). Set the long-axis speed and the travel value of each axis in the servo program.



conversion.

- 2) Discrepancy between interpolation control units and control units
 - Travel value: The electronic gear converts the travel value for the axis to pulses.
 - Speed
 Speed control of each axis is based on the long-axis speed, which is the positioning speed of the axis with the greatest travel value after conversion.
 For axes where interpolation control units and control units match, the electronic gear converts the positioning speed to units of pulse/ sec. and this speed is used as the long-axis speed.

POINTS	
 (1) Speed limit value and positioning speed The set speed limit value applies to the long-axis spe Note that the resultant speed may exceed the spe designation is used. 	eed. eed limit value if long-axis speed
During 2-axis linear interpolation with the following settings speed limit value. Axis 1 travel value: 100 pulses	s, the resultant speed exceeds the [Program Example]
Axis 2 travel value: 200 pulses Long-axis speed: 50 pulse/sec. Speed limit value: 55 pulse/sec.	INC-2 Axis 1, 100 (PLS) Axis 2, 200 (PLS) Long-axis speed 50 (PLS/sec)
greatest travel value; therefore the set speed limit value applies to Axis 2. In this case, the positioning speed of each axis and the resultant speed are as follows:	
Axis 1 positioning speed: $(100/200) \times 50 = 25$ pulse/sec. Axis 2 positioning speed: 50 pulse/sec. Resultant speed: $\sqrt{25^2 + 50^2} = 55.9$ pulse/sec.	
Axis 1 positioning speed Axis 2 positioning speed	
The resultant speed exceeds the speed limit value setting	of 55.

7. POSITIONING CONTROL

- (2) Relationship between speed limit value, acceleration time, deceleration time, and rapid stop deceleration time
 - The actual acceleration time, deceleration time, and rapid stop deceleration time are determined by the long-axis speed setting.



(c) Reference-axis speed designation
 The servo system CPU uses the travel value of each axis (D1 to D4)
 to calculate the positioning speed of each axis (V1 to V4) from the set

positioning speed of the reference axis (reference axis speed: V). Set the reference axis number, reference axis speed, and the travel value of each axis in the servo program.

4-axis linear interpolation control [Program Example] Axis 1 travel value: [Program Example] D1 = 10,000 pulses <k 52=""> Axis 2 travel value: ABS-4 D2 = 15,000 pulses Axis 1, 10000 (PLS) Axis 3 travel value: Axis 2, 15000 (PLS) D3 = 5,000 pulses Axis 4, 20000 (PLS)</k>								
Axis 1 travel value: [Program Example] D1 = 10,000 pulses <k 52=""> Axis 2 travel value: ABS-4 D2 = 15,000 pulses Axis 1, 10000 (PLS) Axis 3 travel value: Axis 2, 15000 (PLS) D3 = 5,000 pulses Axis 4, 20000 (PLS)</k>								
D1 = 10,000 pulses Axis 2 travel value: Axis 2 travel value: ABS-4 D2 = 15,000 pulses Axis 1, 10000 (PLS) Axis 3 travel value: Axis 2, 15000 (PLS) D3 = 5,000 pulses Axis 4, 20000 (PLS)								
$D_2 = 15,000 \text{ pulses}$ Axis 1, 10000 (PLS) Axis 3 travel value: Axis 2, 15000 (PLS) $D_3 = 5,000 \text{ pulses}$ Axis 4, 20000 (PLS)								
Axis 3 travel value: Axis 2, 15000 (PLS) D3 = 5,000 pulses Axis 4 20000 (PLS)								
D3 = 5,000 pulses $A_{xis} = 4$ 20000 (PLS)								
AXIS 4 Travel value: D4 = 20,000 pulses Reference axis speed 7000 (PLS/sec) Reference axis number 4								
Reference axis speed:								
V = 7,000 pulse/sec.								
Reference axis number: Axis 4								
In this example, Axis 4 is set as the								
on the positioning speed of Axis 4								
The servo system CPU calculates the								
positioning speed of each of the other								
axes using the following calculation formulas:								
Axis 1 positioning speed: $V_1 = D_1/D_4 \times V$								
Axis 2 positioning speed: $V_2 = D_2/D_4 \times V$								
Axis 3 positioning speed: V3 = D3/D4 × V								

7. POSITIONING CONTROL

POINTS

- (1) Reference axis speed and positioning speed of other axes
 - Note that the positioning speed of an axis with a greater travel value than the reference axis will exceed the set reference axis speed.
- (2) Indirect designation of reference axis
 - The reference axis can be indirectly designated using word devices D and W. See Section 6.4.2.
- (3) Relationship between speed limit value, acceleration time, deceleration time, and rapid stop deceleration time
 - The actual acceleration time, deceleration time, and rapid stop deceleration time are determined by the reference axis speed setting.



(3) Circular interpolation control Under circular interpolation control, the angular speed is controlled to the set speed.



7.1.3 Control units for one-axis positioning control

Positioning control of one axis is conducted in the control units designated in the fixed parameters.

(The control unit designation in the parameter block is ignored.)

7.1.4 Control units for interpolation control

(1) The interpolation control units designated in the parameter block are checked against the control units designated in the fixed parameters. For interpolation control, the result of the interpolation control units designated in the parameter block differing from the control units designated in the fixed parameters are listed in the following table.

	Interpolation Control Units in Parameter Block				Start Method
	mm	inch	degree	PULSE	Start Method
Normal start conditions	Fixed parameters and inch control u	designate mm units for axes.	Fixed parame- ters designate degree control units for axes.	Fixed parame- ters designate pulse control units for axes.	Control started using interpolation control units designated in the parameter block.
Unit discrepancy error (Error code 40)	Discrepancy betw parameter block i	veen fixed parame interpolation contr	eter control units a rol units for all axe	nd the s.	 Control started using set control units when control units match for axes under interpolation control. Control started using the control units with the highest order of priority (see below) when control units differ for axes under interpolation control. Order or priority Pulse > degree > inch > mm <example> If axes are set to 1000 pulses and 10.000 inch, the 10.000 inch setting is considered to be 10.000 pulses </example>

(2) The possible combinations of control units for interpolation control for the axes are shown in the table below.

/	mm	inch	degree	PULSE
mm	1)	2)	3)	3)
inch	2)	1)	3)	3)
degree	3)	3)	1)	3)
PULSE	3)	3)	3)	1)

Remarks

Same units
 Combination of mm and inches

3): Discrepancy

(a) Same units (1))

Positioning is conducted using position commands calculated from the address, travel value, positioning speed, and electronic gear.

POINT

- (1) Circular interpolation control
 - If control units for one axis are degrees, use degrees also for the other axis.

- (b) Combination of millimeters and inches (2))
 - If interpolation control units are millimeters, positioning is conducted using position commands calculated from the address, travel value, positioning speed, and electronic gear, which have been converted to millimeters using the formula: inch set value × 25.4 = mm set value.
 - If interpolation control units are inches, positioning is conducted using position commands calculated from the address, travel value, positioning speed, and electronic gear, which have been converted to inches using the formula: millimeter set value ÷ 25.4 = inch set value.
- (c) Discrepancy (3))
 - If a discrepancy exists between interpolation control units and the control units, the travel value and positioning speed are calculated for each axis.
 - a) The electronic gear converts the travel value for the axis to pulses.
 - b) For axes where the units match, the electronic gear converts the positioning speed to units of pulse/sec.
 Positioning is conducted using position commands calculated from travel values converted to pulses and speeds and electronic gear converted to pulses per second.
 - If the interpolation control units match for two or more axes during linear interpolation with three axes or more, the positioning speed is calculated using the electronic gear for the axis with the lowest number.

7.1.5 Control using degrees as control units

If the control units are degrees, the following items differ from when other control units are set.

(1) Present address

When degrees are set, the present addresses become ring addresses between 0° and 360°.



- (2) Stroke limit valid/invalid setting For degree settings, the upper limit value and lower limit value lie in the range between 0° and 359.99999°.
 - (a) If the stroke limit is valid
 - If the stroke limit is valid, set the stroke limit upper limit value and lower limit value in a clockwise direction.



- 1) For travel in area A, set the limit values as follows:
 - a) Stroke limit lower limit value : 315.00000°
 - b) Stroke limit upper limit value: 90.00000°
- 2) For travel in area B, set the limit values as follows:
 - a) Stroke limit lower limit value : 90.00000°
 - b) Stroke limit upper limit value: 315.00000°
- (b) If the stroke limit is invalid
 - If the stroke limit is invalid, set the stroke limit upper limit value equal to the lower limit value.

The stroke limit settings are ignored during control.

POINT

Circular interpolation is not possible for axes set with the stroke limit invalid.

- (3) Positioning control
 - Positioning control using degrees as control units is described below. (a) Absolute data method (ABS [] instructions)
 - The absolute data method uses the present value as reference to position the axis in the shortest distance to the designated address.
- Examples ----- Examples ---- Positioning occurs clockwise to travel from the present value of 315.00000° to 0°.
- (2) Positioning occurs counterclockwise to travel from the present value 0° to 315.00000°.



POINTS

 In some cases the stroke limit settings determine clockwise or counterclockwise rotation and absolute data method positioning in the shortest distance may not be possible.

---- Example -----

lution.

Travel from the present value 0° to 315.00000° must be clockwise if the stroke limit lower limit value is set to 0° and the upper limit value is set to 345.00000°.



- (b) Incremental method (INC instructions) The incremental method positions the axis by a designated travel value in the designated direction. The travel direction is designated by the sign of the travel value, as follows:
 - 1) Positive travel valueclockwise rotation
 - 2) Negative travel valuecounterclockwise rotation

POINT

The incremental method permits positioning in excess of 360°.

7.1.6 Stop processing and restarting after a stop

This section describes the stop processing after a stop cause is input during positioning, and restarting after a stop.

- (1) Stop processing
 - (a) Stop processing methods Stop processing during positioning depends on the type of stop cause which was input.
 - 1) Deceleration stop...... Decelerates and stops according to the (Process 1) stop deceleration time parameter in the parameter block.



2) Rapid stop......Decelerates and stops according to the (Process 2) rapid stop deceleration time parameter in the parameter block.



- _____Stop cause
- 3) Immediate stop......Stops without deceleration processing. (Process 3)

- (b) Order of priority for stops
 - The order of priority for stops when a stop cause is input is as follows:

Process 1 < Process 2 < Process 3



(c) Stop commands and stop causes

Some stop commands and stop causes affect individual axes and others affect all axes.

However, during interpolation control, stop commands and stop causes which affect individual axes also stop the interpolation axes. For example, both Axis 1 and Axis 2 stop after input of a stop command or stop cause during interpolation control of Axis 1 and Axis 2.

		1	Stop						
No.	Stop Cause	Individual/ All Axes	Positioning Control	Speed Control	Jog Operation	Home Position Return	Manuai Puise Generator	Error Processing	
1	External STOP input ON		Process 1 or According to STOP input	Process 2 decelera paramete	2 ation process r in parame				
2	Stop command M1800+20n/Yn0/ M3200+20n ON		Process 1						
3	Rapid stop command M1800+20n/Yn1/ M3201+20n ON	Individual	Process 2				Serious error		
4	External FLS input OFF		Process 1 or Process 2 (According to deceleration processing on STOP input parameter in parameter block.) Process 3					during home position return only	
5	External RLS input OFF						Process 3		
6	Servo error detect M1608+20n/Xn8/ M2408+20n ON								
7_	PC ready M2000 OFF		Process 1						
8	Emergency stop from exterior ^{*2} , BREAK key pressed		Process 2	Process 2					
9	Servo system CPU stop	All	Process 1						
10	Servo system reset		Process 3 ^{*1}	Process 3 ^{*1}				1	
11	PCPU WDT error		Process 3 ^{*1}					M9073 (WDT error) ON	
12	SCPU WDT error		Process 1]			
13	Servo system CPU power off		Process 3 ^{*1}				-		
14	Servo amplifier power off	Individual	Process 3 ^{*1}				Serious error at start-up (no servo)		
15	Speed changed to zero	Individual ^{*3}	Process 1					-	

*1: Emergency stop due to H/W

*2: Test mode

*3: Applies to all axes set to speed = 0 in servo program.

- (2) Restarting after a Stop
 - (a) Control cannot be restarted after a stop command or stop cause (except changing speed to zero).
 However, restarting is possible using the VSTART instruction after a stop due to the external STOP input, the stop command (M1800+20n) turning ON, or the rapid stop command (M1801+20n) turning ON during speed/position switching control.
 - (b) When the stop is caused by a speed change to speed "0" When a speed change to speed "0" is executed in the DSFLP instruction, operation can be restarted by executing another speed change to a speed other than "0".



- 1) The start accept flag M2001+n remains ON after a stop due to changing the speed to zero.
- 2) Restart after changing the speed again.
- 3) However, control cannot be restarted after the speed is changed if the start accept flag M2001+n is turned OFF due to the stop command (M1800+20n) turning ON.
- (3) Continuing positioning control

This section describes the method to continue control from the servo program number where the stop was applied by turning ON the external STOP input, the stop command (M1800+20n), or the rapid stop command (M1801+20n).

- (a) One-axis linear control/2- or 3-axis linear interpolation control
 - 1) Absolute data method...As a target address is designated, positioning control is possible from the stop address to the target address.





2) Incremental method......Positioning control of the travel value from the stop address.

To use the incremental method to travel to the original address (calculated from start address + designated travel value) from address 2, requires the following processing in the servo program and sequence program.

[Servo Program]

Use word devices for indirect designation of the travel value in the positioning control servo program.



[Processing in the Sequence Program]

- 1. Before starting, transfer the start address to the servo system CPU word devices.
- 2. Add the travel value to the start address to calculate the target address.
- 3. Subtract the stop address from the target address to calculate the residual travel value.
- 4. Store the residual travel value in the servo program travel value register.
- 5. Run the servo program from the sequence program.



7.1.7 Acceleration and deceleration processing

Acceleration and deceleration are processed by the two methods described below.

- (1) Trapezoidal acceleration and deceleration processing
 - The conventional linear acceleration and deceleration processing. The acceleration and deceleration graph resembles a trapezoid, as shown in the diagram below.

The acceleration and deceleration times are set automatically.



(2) S-curve acceleration and deceleration processing

The S-curve ratio is set as a parameter to provide gentler acceleration and deceleration than trapezoidal processing. The acceleration and deceleration graph is sinusoidal, as shown in the diagram below. Set the S-curve ratio in the parameter block (see Section 4.4.2) or in a servo program.



As shown in the diagram below, the S-curve ratio sets the part of the sine curve used to produce the acceleration and deceleration curve.



The S-curve ratio can be set by a servo program using one of two methods.

(a) Direct designation

The S-curve ratio is designated directly as a numeric value from 0 to 100.



(b) Indirect designation

The S-curve ratio is set by the contents of the data registers. The available data registers are shown below.

	CPU						
Word Device	A171S	A273UH (8-Axis Specification)	A273UH (32-Axis Specification)				
D	0 to 799	0 to 8191 ^{*1}	800 to 8191				
w	0 to 3FF	0 to 1FFF	0 to 1FFF				



*1: Excluding 800 to 1023

7.2 One-Axis Linear Positioning Control

Positioning control of the designated axis from the present stop position to a fixed position.

Positioning control uses ABS-1 (absolute data method) and INC-1 (incremental method) servo instructions.

				tems Set by Peripherals																				
			L		<u> </u>	omm	<u>on</u>				Arc		I		!	aran	eter	Bloc	K			Oth	-	
Servo Instruction	Positioning Method	Number of Controllable Axes	Parameter Block No.	Axte	Address/Travel Value	Commanded Speed	Dwell Time	M Code	Torque Limit Value	Auxiliary Point	Radius	Center Point	Control Units	Speed Limit Value	Acceleration Time	Deceleration Time	Repid Stop Deceleration Time	Torque Limit Value	Deceleration Processing on Stop input	Allowable Error Range for Circular Interpolation	S-Curve Ratio	Cancel	Start	Speed Change
ABS-1	Absolute data	1																					,	or
INC-1	Incremental	-		0	0	0	^	^						4	Δ	4	Δ	^	^		^	Δ	Δ	UK

O : Must be set

 Δ : Set if required

[Control Details]

Control with ABS-1 (absolute data method).

- (1) Positioning control from the present stop address (pre-positioning address) to the designated address, using the home position as the reference.
- (2) The travel direction is determined from the present stop address and the designated address.



Figure 7.1 Positioning by Absolute Data Method

7. POSITIONING CONTROL

Control with INC-1 (incremental method)

- (1) Positioning control of a designated travel value from the present stop position.
- (2) The travel direction is designated by the sign of the travel value, as follows:
 - Positive travel value......forward direction (increased address)
 - Negative travel value......reverse direction (decreased address)



Figure 7.2 Positioning by Incremental Method

[Program Example]

This program conducts positioning control using servo program No. 0 under the conditions below.

- (1) System configuration
 - One-axis linear positioning control of Axis 4.



(2) Positioning details

The positioning by servo program No. 0 is shown in the diagram below. In this example, Axis 4 is used in servo program No. 0.



(3) Operation timing

The operation timing for servo program No. 0 is shown below.



(4) Servo program example

The servo program No. 0 for positioning control is shown below.



(5) Sequence program example The sequence program which runs the servo program is shown below.



7.3 Two-Axis Linear Interpolation Control

Linear interpolation control from the present stop position with the two axes designated in the sequence program positioning commands.

Two-axis linear interpolation control uses ABS-2 (absolute data method) and INC-2 (incremental method) servo instructions.

										Item	s Set	by P	eriph	erals										
		Common							Arc			r	Parameter Block							Others				
Servo Instruction	Positioning Method	Number of Controllable Axee	Peremeter Block No.	Axis	Address/Travel Value	Commanded Speed	Dwell Time	M Code	Torque Limit Value	Auxillery Point	Radiue	Center Point	Control Unite	Speed Limit Value	Acceleration Time	Deceleration Time	Rapid Stop Deceleration Time	Torque Limit Veiue	Deceleration Processing on Stop input	Allowable Error Range for Circular Interpolation	8-Curve Ratio	Canoel	Slart	Speed Change
ABS-2	Absolute data																							
INC-2	Incremental	2	^	0	0	0	^	Δ						^	Δ :	Δ	Δ	Δ	Δ		4	Δ	Δ	OK

O: Must be set

 $\boldsymbol{\Delta}$: Set if required

[Control Details]

Control with ABS-2 (absolute data method)

- (1) Linear interpolation with two axes from the present stop address (X1, Y1) to the designated address (X2, Y2), using the home position as the reference.
- (2) The travel direction is determined from the stop addresses and designated addresses for the respective axes.



Figure 7.3 Positioning by Absolute Data Method

Control with INC-2 (incremental method)

- (1) Positioning control from the present stop position to the position which is the resultant of the designated travel directions and travel values of the respective axes.
- (2) The travel direction of each axis is designated by the sign of the travel value, as follows:
 - Positive travel value......forward direction (increased address)
 - Negative travel value.....reverse direction (decreased address)



Figure 7.4 Positioning by Incremental Method

[Program Example]

This program conducts 2-axis linear interpolation control under the conditions below.

- (1) System configuration
 - Two-axis linear interpolation control of Axis 3 and Axis 4.



(2) Positioning details The positioning by the Axis 3 and Axis 4 servomotors is shown in the diagram below.



(3) Positioning conditions

(a) The positioning conditions are shown below.

ltem	Servo Program Number
10010	No. 11
Positioning speed	30000

(b) Positioning start.... leading edge of X000 (OFF \rightarrow ON)

7. POSITIONING CONTROL

- (4) Operation timing
 - The operation timing for 2-axis linear interpolation control is shown below.

	V A Servo program No. 11
PC ready (M2000)	
All axes servo start command (M2042) All-axis servo start accept flag (M2009)	
Positioning start command (X000)	
SVST instruction	
Axis 3 start accept flag (M2003)	
Axis 4 start accept flag (M2004)	

(5) Servo program

The servo program No. 11 for 2-axis linear interpolation control is shown below.



(6) Sequence program The sequence program which runs the servo program is shown below.

	Manag		ł	
0		-(M2000	୬	Turns ON PC ready.
2	M9074	-(м204;	2	Turns ON all axes servo start command.
4	X000 M9074 M2009 M9076 	MO	Ч	Turns ON servo program No. 11 start command flag
11		M 1	거	J (M1) when X000 turns OFF → ON.
13	M1 M9074 M2003 M2004 HI	к 11	Н	Servo program No. 11 execu- tion request.
CIR		M1	Н	Tums OFF M1 on comple- tion of servo program No. 11 execution request.
7.4 Three-Axis Linear Interpolation Control

											Item	s Set	by P	eriph	erais									
			L		¢	o mim	on				Arc				F	'eren	neter.	Bloc	ĸ			Oth	ers	
Servo Instruction	Positioning Method	Number of Controllable Axes	Parameter Blook No.	Axis	Address/Travel Value	Commanded Speed	Dwell Time	M Code	Torque Limit Value	Auxiliary Point	Rediue	Center Point	Control Unite	Speed Limit Value	Acceleration Time	Deceleration Time	Rapid Stop Deceleration Time	Torque Limit Value	Deceleration Processing on Stop Input	Allowable Error Range for Circular Interpolation	8-Curve Ratio	Cancel	Start	Speed Change
ABS-3	Absolute data			•																				~
INC-3	Incremental	3	^	0	0	0	Δ	Δ					Δ	Δ	۵	Δ	Δ	Δ	Δ		Δ	Δ	Δ	

Linear interpolation control from the present stop position with the three axes designated in the sequence program positioning commands.

O: Must be set

∆ : Set if required

[Control Details]

Control with ABS-3 (absolute data method)

- Linear interpolation with three axes from the present stop address (X1, Y1, Z1) to the designated address (X2, Y2, Z2), using the home position as the reference.
- (2) The travel direction is determined from the stop addresses and designated addresses for the respective axes.

7. POSITIONING CONTROL



Figure 7.5 Positioning by Absolute Data Method

7. POSITIONING CONTROL

Control with INC-3 (incremental method)

- (1) Positioning control from the present stop position to the position which is the resultant of the designated travel directions and travel values of the respective axes.
- (2) The travel direction of each axis is designated by the sign of the travel value, as follows:
 - Positive travel value.....forward direction (increased address)
 - Negative travel value.....reverse direction (decreased address)



Figure 7.6 Positioning by Incremental Method

This program conducts 3-axis linear interpolation control under the conditions below.

(1) System configuration

Three-axis linear interpolation control of Axis 1, Axis 2, and Axis 3.



(2) Positioning details

The positioning by the Axis 1, Axis 2, and Axis 3 servomotors is shown in the diagram below.



(3) Positioning conditions

(a) The positioning conditions are shown below.

Item	Servo Program Number
	No. 21
Positioning method	Absolute data
Positioning speed	1000

(b) Positioning start.... leading edge of X000 (OFF \rightarrow ON)

(4) Operation timing

The operation timing for 3-axis linear interpolation control is shown below.



(5) Servo program

The servo program No. 21 for 3-axis linear interpolation control is shown below.



(6) Sequence program The sequence program which runs the servo program is shown below.

	M9039		
0		(M2000)-	Turns ON PC ready.
2	M9074	(M2042)-	Turns ON all axes servo start command.
4	x000 M9074 M2009 M9076 → → → → → → → → → → → → → → → → → → →	M21 3	Turns ON servo program No. 21 start command flag
11	M2 /	M23]	$\int (M23)$ when X000 turns OFF \rightarrow ON.
13		21]	Servo program No. 21 execu- tion request.
CIF	- [RST	M23 }	Tums OFF M23 on comple- tion of servo program No. 21 execution request.

7.5 Four-Axis Linear Interpolation Control

											Item	s Set	by P	eriph	erais									
	1				C	omm	on				Arc]	Paran	neter	Bloc	ĸ			Oth		
Servo Instruction	Positioning Method	Number of Controllable Axes	Parameter Block No.	Axis	Address/Travel Value	Commanded Speed	Dwelt Time	M Code	Torque Limit Value	Auxiliary Point	Redius	Center Point	Control Units	Speed Limit Velue	Acceleration Time	Deceleration Time	Rapid Stop Deceleration Time	Torque Limit Value	Deceleration Processing on Stop Input	Allowable Error Range for Circular Interpolation	8-Curve Ratio	Cencel	Start	Speed Change
ABS-4	Absolute data	4	Δ	0	0	0	Δ	Δ					۵	۵	۵	۵	۵	Δ	۵		Δ	۵	۵	ок
INC-4	Incremental																							

Linear interpolation control from the present stop position with the four axes designated in the sequence program positioning commands.

O: Must be set

∆ : Set if required

[Control Details]

Positioning control which starts and completes positioning of the four axes simultaneously.



This program conducts 4-axis linear interpolation control under the conditions below.

- (1) System configuration
 - Four-axis linear interpolation control of Axis 1, Axis 2, Axis 3, and Axis 4.



(2) Positioning details The positioning by the Axis 1, Axis 2, Axis 3, and Axis 4 servomotors is shown in the diagram below.



Figure 7.7 Axis Configuration

7. POSITIONING CONTROL





- (3) Positioning conditions
 - (a) The positioning conditions are shown below.

ltem	Servo Program Number
item.	No. 22
Positioning method	Incremental
Positioning speed	1000

- (b) Positioning start.... leading edge of X000 (OFF \rightarrow ON)
- (4) Operation timing

The operation timing for 4-axis linear interpolation control is shown below.



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(5) Servo program

The servo program No. 22 for 4-axis linear interpolation control is shown below.



(6) Sequence program The sequence program which runs the servo program is shown below.



7.6 Circular Interpolation Using Auxiliary Point Designation

Circular interpolation control by designating the end point address and auxiliary point address (a point on the arc).

Circular interpolation control using auxiliary point designation uses ABS \nearrow (absolute data method) and INC \checkmark (incremental method) servo instructions.

			_						_		Item	s 8et	by P	eriph	erale	_								<u> </u>
			L		<u> </u>	omm	on				Arc				1	Peran	neter	Bloc	K			Oth	1878]
Servo Instruction	Positioning Method	Number of Controllable Axes	Parameter Block No.	Axle	Address/Travel Value	Commanded Speed	Dwell Time	M Code	Torque Limit Value	Auxillary Point	Rediue	Center Point	Control Unite	Speed Limit Value	Acceleration Time	Deceleration Time	Rapid Stop Deceleration Time	Torque Limit Value	Deceleration Processing on Stop input	Allowable Error Range for Circular Interpolation	8-Curve Ratio	Canoel	Start	Speed Change
ABS	Absolute data	2																						NO
	Incremental	2	Δ			Ű		4					Δ	Δ	^	Δ	Δ	Δ	4	Δ	4	Δ	4	NG

O: Must be set

∆ : Set if required

[Control Details]

Control with ABS Ar (absolute data method).

- (1) Circular interpolation from the present stop address (pre-positioning address) through the designated auxiliary point address to the end point address, using the home position as the reference.
- (2) The center of the arc is the point of intersection of the perpendicular bisectors of the start point address (present stop address) to the auxiliary point address, and the auxiliary point address to the end point address.



Figure 7.9 Circular Interpolation Control by Absolute Data Method

- (3) The setting range for the end point address and auxiliary point address is -2^{31} to $+2^{31}-1$.
- (4) The maximum arc radius is $2^{31}-1$.



Figure 7.10 Maximum Arc



- (1) Circular interpolation from the present stop address (pre-positioning address) through the designated auxiliary point address to the end point address.
- (2) The center of the arc is the point of intersection of the perpendicular bisectors of the start point address (present stop address) to the auxiliary point address, and the auxiliary point address to the end point address.



Figure 7.11 Circular Interpolation Control by Incremental Method

- (3) The setting range for the travel value to the end point address and auxiliary point address is 0 to $\pm (2^{31}-1)$.
- (4) The maximum arc radius is $2^{31}-1$. If the designated end point and auxiliary point result in a radius greater than $2^{31}-1$, an error occurs at the start and error code 107 is stored in the data register.



This program conducts circular interpolation control using auxiliary point designation under the conditions below.

- (1) System configuration
 - Circular interpolation control of Axis 1 and Axis 2 using auxiliary point designation.



(2) Positioning details The positioning by the Axis 1 and Axis 2 servomotors is shown in the diagram below.



- (3) Positioning conditions
 - (a) The positioning conditions are shown below.

ltem	Servo Program Number
item.	No. 31
Positioning method	Absolute data
Positioning speed	1000

(b) Positioning start.... leading edge of X000 (OFF \rightarrow ON)

(4) Operation timing

The operation timing for circular interpolation control using auxiliary point designation is shown below.



(5) Servo program

The servo program No. 31 for circular interpolation control using auxiliary point designation is shown below.



(6) Sequence program

The sequence program which runs the servo program is shown below.



7.7 Circular Interpolation Using Radius Designation

Circular interpolation control by designating the end point and arc radius. Circular interpolation control using radius designation uses ABS \curvearrowright , ABS \bigcirc , ABS \bigcirc , and ABS \bigcirc (absolute data method) and INC \curvearrowright , INC \bigcirc , INC \bigcirc , and INC \bigcirc (incremental method) servo instructions.

											Item	s Set	by P	eriph	erais									
			<u> </u>			omm	on				Arc	r	 		!	Paran	seter	Bloc	k			Oth	ers	
Servo instruction	Positioning Method	Number of Controllable Axee	Parameter Block No.	Axte	Address/Travel Value	Commanded Speed	Dwell Time	M Code	Torque Limit Value	Auxiliary Point	Radius	Center Point	control Unite	Speed Limit Value	Acceleration Time	Deceleration Time	Rapid Stop Deceleration Time	Torque Limit Value	Deceleration Processing on Stop input	Allowable Error Range for Circular Interpolation	s-Curve Ratio	Cancel	Start	Speed Change
ABS (Absolute data																							
ABS J		2		0	0	0		Δ			0													NG
	Incrementai		-	-	-								-	-	-	~	-	-	-	-	-	-	-	
INC V																								
INC J																							l,	

O: Must be set

 Δ : Set if required

[Control Details]

Details of control with the servo instructions are shown in the table below.

Instruction	Servomotor Direction of Rotation	Max. Controllable Angle of Arc	Positioning Path
ABS 🦳	Clockwise		Start Positioning path point $\theta < 180^\circ$ End point
	CIUCKWISE	0° < 8 < 180°	Radius R Center point
ABS 🏒	Counterclockwise		Radius R Center point Start
	Counterclockwise		point to e 180° End point Positioning path
abs 介	Clockwise		θ Positioning path
INC 介	Clockwige	180° ≤ θ < 360°	Radius End point Start point
abs 🕁	Counterploopwine		Start point Radius, ~ End point
	CounterciockWISe	•	180° Center point < 0 < 360° Positioning path

- (1) Circular interpolation of an arc of the designated radius from the present stop address (pre-positioning address) to the designated end point address, using the home position as the reference.
- (2) The center of the arc lies at the point of intersection of the designated radius and the perpendicular bisector of the start point address (present stop address) to the end point address.





- (3) The setting range for the end point address is -2^{31} to $+2^{31}-1$.
- (4) The maximum arc radius is $2^{32}-1$.



Figure 7.13 Maximum Arc

Control with INCA, INCA, INCA, and INC

- (1) Circular interpolation of an arc of the designated radius from the present stop address (0, 0) to the designated end point address.
- (2) The center of the arc lies at the point of intersection of the designated radius and the perpendicular bisector of the start point address (present stop address) to the end point address.





- (3) The setting range for the end point address is -2^{31} to $+2^{31}-1$.
- (4) The maximum arc radius is $2^{32}-1$.



Figure 7.15 Maximum Arc

This program conducts circular interpolation control using radius designation under the conditions below.

(1) System configuration

Circular interpolation control of Axis 1 and Axis 2 using radius designation.



(2) Positioning details The positioning by the Axis 1 and Axis 2 servomotors is shown in the diagram below.



- (3) Positioning conditions
 - (a) The positioning conditions are shown below.

ltom	Servo Program Number
Item	No. 41
Positioning method	Absolute data
Positioning speed	1000

(b) Positioning start.... leading edge of X000 (OFF \rightarrow ON)

(4) Operation timing

The operation timing for circular interpolation control using radius designation is shown below.



(5) Servo program

The servo program No. 41 for circular interpolation control using radius designation is shown below.



(6) Sequence program
The sequence program which runs the servo program is shown below.



7.8 Circular Interpolation Using Center Point Designation

Circular interpolation control by designating the end point and arc center point.

Circular interpolation control using center point designation uses ABS and ABS (absolute data method) and INC and INC (incremental method) servo instructions.

	_										Item	s Set	by P	eriph	erale									
					<u> </u>	omm	on				Arc		L			Paran	neter	Bloc	K			Oth	-	
Serva instruction	Positioning Method	Number of Controllable Axes	Parameter Block No.	Axis	Address/Travet Value	Commanded Speed	Dwell Time	M Code	Torque Limit Value	Auxiliary Point	Radius	Center Point	Control Units	Speed Limit Value	Acceleration Time	Deceleration Time	Rapid Stop Deceleration Time	Torque Limit Value	Deceleration Processing on Stop input	Allowable Error Range for Circular Interpolation	8-Curve Ratio	Cancel	Start	Speed Change
ABS (* ABS (*	Absolute data	2	•	0	0	0						0								•	•			NG
	Incrementai	_	-					-					-	-	-	3	-	~	-	-	-	3	4	

O : Must be set ∆ : Set if required

[Control Details]

Details of control with the servo instructions are shown in the table below.

Instruction	Servomotor Direction of Rotation	Max. Controllable Angle of Arc	Positioning Path
ABS 🔨	Clockwise		Start
	CICCRWISE	0° < 8 < 360°	Center point
ABS 😋	Counterplactoriae		Center point Start
	Counterclockwise		Point $0^{\circ} < \theta \le 180^{\circ}$ and point Positioning path

Control with ABS and ABS (absolute data method)

(1) Circular interpolation of an arc with a radius equivalent to the distance between the start point and center point, between the present stop address (pre-positioning address used as the start point address) and the designated end point address, using the home position as the reference.





(2) To conduct positioning control of a full circle, divide the circular interpolation control into two operations.





- (3) The setting range for the end point address and arc center point is -2^{31} to $+2^{31}-1$.
- (4) The maximum arc radius is $2^{31}-1$.



Figure 7.18 Maximum Arc

7. POSITIONING CONTROL

Control with INC and INC (incremental method)

(1) Circular interpolation of an arc from the present stop address (start point address, 0, 0) with a radius equivalent to the distance between the start point (0, 0) and center point.





(2) To conduct positioning control of a full circle, divide the circular interpolation control into two operations.



Figure 7.20 Positioning Control of a Full Circle

- (3) The setting range for the center point and travel value to the end point is 0 to $\pm (2^{31}-1)$.
- (4) The maximum arc radius is 2³¹-1. If the designated end point and center point result in a radius greater than 2³¹-1, an error occurs at the start and error code 107 is stored in the data register.



Figure 7.21 Maximum Arc Radius

This program conducts circular interpolation control using center point designation under the conditions below.

- (1) System configuration
 - Circular interpolation control of Axis 1 and Axis 2 using center point designation.



(2) Positioning details

The positioning by the Axis 1 and Axis 2 servomotors is shown in the diagram below.



(3) Positioning conditions

(a) The positioning conditions are shown below.

ltem	Servo Program Number
	No. 51
Positioning method	Absolute data
Positioning speed	1000

(b) Positioning start.... leading edge of X000 (OFF \rightarrow ON)

(4) Operation timing

The operation timing for circular interpolation control using center point designation is shown below.



(5) Servo program

The servo program No. 51 for circular interpolation control using center point designation is shown below.



(6) Sequence program The sequence program which runs the servo program is shown below.

	140000		1
٥	MUU39	-(M2000)	Turns ON PC ready.
2	M9074	-(M2042)	Turns ON all axes servo start command.
4	x000 M9074 M2009 M9076 	M51]	Turns ON servo program
11	₩51 →	м53]	$\downarrow \int$ (M53) when X000 turns OFF \rightarrow ON.
13	M9074 M53 M2001 M2002	K 51]	Servo program No. 51 execu- tion request.
CiF		M53]	Turns OFF M53 on comple- tion of servo program No. 51 execution request.

7.9 One-Axis Fixed-Pitch Feed Control

Positioning control to move the axis designated with the sequence program positioning commands by the designated travel value from the present stop position.

Fixed-pitch feed control uses the FEED-1 servo instruction.

											Item	a Bet	by P	eriph	erale									
				.	<u> </u>	omm T	<u>on</u>	·			Arc		L	r		Paran	leter	Bioc	<u>K</u>			Oth	ers	
Servo Instruction	Posklioning Method	Number of Controlisble Axes	Parameter Block No.	Axia	Address/Travel Value	Commanded Speed	Dwell Time	M Code	Torque Limit Veiue	Auxiliary Point	Radius	Center Point	Control Unit	Speed Limit Value	Acceleration Time	Deceleration Time	Rapid Stop Deceleration Time	Torque Limit Veiue	Deceleration Processing on Stop Input	Allowable Error Range for Circular Interpolation	8 Curve Ratto	Cancel	Glart	speed Change
FEED-1	Incremental	1	Δ.	0	0	0	۵	Δ						۸	۵	۵	۵	▲	Δ		۵	۸	۵	ок

O: Must be set

∆ : Set if required

[Control Details]

- (1) Positioning control through the designated travel value from the present stop position (0).
- (2) The travel direction is designated by the sign of the travel value, as follows:
 - Positive travel value forward direction (increased address)
 - Negative travel value ... reverse direction (decreased address)



Figure 7.22 One-Axis Fixed-Pitch Feed Control

POINT

Do not set the travel value to zero for fixed-pitch feed control. If the travel value is set to zero, fixed-pitch feed ends with no feed taking place.

This program conducts repeated 1-axis fixed-pitch feed control under the conditions below.

- (1) System configuration
 - Fixed-pitch feed control of Axis 4.



(2) Fixed-pitch feed control conditions

(a) The positioning conditions are shown below.

Setting	
No. 300	
Axis 4	
10000	_
100000	
	Setting No. 300 Axis 4 10000 100000

- (b) Fixed-pitch feed control start commandleading edge of X000 (OFF \rightarrow ON)
- (c) Fixed-pitch feed control end commandleading edge of X001 (OFF \rightarrow ON)
- (3) Operation timing
 - The operation timing for fixed-pitch feed control is shown below.



(4) Servo program

The servo program No. 300 for fixed-pitch feed control is shown below.



(5) Sequence program example The sequence program which runs the servo program is shown below.



7.10 Fixed-Pitch Feed Control Using Two-Axis Linear Interpolation

Fixed-pitch feed control using 2-axis linear interpolation from the present stop position with the two axes designated in the sequence program positioning commands.

Fixed-pitch feed control using two-axis linear interpolation uses the FEED-2 servo instruction.

											Item	s Set	by P	eriph	erais									
					C	omm	0.0				Arc		L			aran	ieter	Bloc	<u>k</u>			Oth	ers	
Servo Instruction	Positioning Nethod	Number of Controllable Axes	Parameter Block No.	Axts	Address/Travel Value	Commanded Speed	Dwell Time	M Code	Torque Limit Value	Auxiliary Point	Radiue	Center Point	Control Unit	Speed Limit Value	Acceleration Time	Deceleration Time	Rapid Stop Deceleration Time	Torque Limit Value	Deceleration Processing on Stop input	Allowable Error Range for Circular Interpolation	8 Curve Ratio	Cancel	Blart	Speed Change
FEED-2	Incremental	2	Δ	0	0	0	⊿	Δ					▲	▲	Δ	Δ	Δ	Δ	Δ		Δ	▲	⊿	ок

O: Must be set

 Δ : Set if required

[Control Details]

- (1) Positioning control from the present stop position (0) to the position which is the resultant of the designated travel directions and travel values of the respective axes.
- (2) The travel direction is designated by the sign of the travel value, as follows:
 - Positive travel value forward direction (increased address)
 - Negative travel value ... reverse direction (decreased address)



Figure 7.23 Fixed-Pitch Feed Control Using Two-Axis Linear Interpolation

POINT

- (1) Do not set the travel value to zero for fixed-pitch feed control. The following results if the travel value is set to zero:
 - (a) If both axes are set to zero, the fixed-pitch feed ends with no feed taking place.
 - (b) If the travel value is set to zero for one axis only, fixed-pitch feed control will not occur at the normal positioning speed for the axis set to a non-zero travel value.

[Program Example]

This program conducts fixed-pitch feed control using 2-axis linear interpolation under the conditions below.

(1) System configuration

Fixed-pitch feed control using 2-axis linear interpolation of Axis 2 and Axis 3.



(2) Positioning conditions

The fixed-pitch feed control conditions are shown below.

ltem	Setting								
Servo program number	No.	310							
Positioning speed	10	000							
Controlled axis	Axis 2	Axis 3							
Travel value	500000	300000							

(a) Fixed-pitch feed control start commandleading edge of X000 (OFF \rightarrow ON)

(3) Operation timing

The operation timing for fixed-pitch feed control using two-axis linear interpolation is shown below.



(4) Servo program

The servo program No. 310 for fixed-pitch feed control using two-axis linear interpolation is shown below.



 (5) Sequence program The sequence program which runs the servo program is shown below.



7.11 Fixed-Pitch Feed Control Using Three-Axis Linear Interpolation

Fixed-pitch feed control using 3-axis linear interpolation from the present stop position with the three axes designated in the sequence program positioning commands.

Fixed-pitch feed control using three-axis linear interpolation uses the FEED-3 servo instruction.

											ttem	s Set	by P	eriph	erais									
			L		<u> </u>		pn_		r		Arc		 	<u>.</u>		Paran	eter.	Bloc	K			Oth	ers	
Servo Instruction	Positioning Method	Number of Controllable Axes	Parameter Block No.	Axte	Address/Travel Value	Commanded Speed	Dwell Time	M Code	Torque Limit Value	Auxiliary Point	Radius	Center Point	Control Unit	Speed Limit Value	Acceleration Time	Deceleration Time	Rapid Stop Deceleration Time	Torque Limit Value	Deceleration Processing on Stop input	Allowable Error Range for Ciroular Interpolation	8 Curve Ratio	Cancel	Start	Speed Change
FEED-3	Incremental	3	▲	0	0	0	۵	Δ					۵	▲	۵	Δ	۵	۵	Δ		۸	Δ	۵	ок

O: Must be set

∆ : Set if required

[Control Details]

- (1) Positioning control from the present stop position (0) to the position which is the resultant of the designated travel directions and travel values of the respective axes.
- (2) The travel direction is designated by the sign of the travel value, as follows:
 - Positive travel value forward direction (increased address)
 - Negative travel value ... reverse direction (decreased address)



Figure 7.24 Fixed-Pitch Feed Control Using Three-Axis Linear Interpolation

POINT

- (1) Do not set the travel value to zero for fixed-pitch feed control. The following results if the travel value is set to zero:
 - (a) If all three axes are set to zero, the fixed-pitch feed ends with no feed taking place.
 - (b) If the travel value is set to zero for any of the three axes, fixed-pitch feed control will not occur at the normal positioning speed for the axis or axes set to a non-zero travel value.

[Program Example]

This program conducts fixed-pitch feed control using 3-axis linear interpolation under the conditions below.

- (1) System configuration
 - Fixed-pitch feed control using 3-axis linear interpolation of Axis, 1, Axis 2, and Axis 3.



(2) System configuration

(a) The positioning conditions are shown below.

ltem		Setting	
Servo program number		No. 320)
Positioning speed		1000	
Controlled axes	Axis 1	Axis 2	Axis 3
Travel value	50000	40000	30000

(b) Fixed-pitch feed control start commandleading edge of X000 $(OFF \rightarrow ON)$

(3) Operation timing

The operation timing for fixed-pitch feed control using three-axis linear interpolation is shown below.



(4) Servo program

The servo program No. 320 for fixed-pitch feed control using three-axis linear interpolation is shown below.



(5) Sequence program The sequence program which runs the servo program is shown below.

o	M9039	-(M2000)-	Tums ON PC ready.
2		-(M2042)-	Tums ON all axes servo start command.
4		мз20 Ӈ	Turns ON servo program No. 320 start command flag
11	SET	м321 Ъ. к) (M321) when X000 turns OFF → ON.
13	-1[svst J1J2J3	320]-	Servo program No. 320 exe- cution request.
CIR		M321]-	Turns OFF M321 on comple- tion of servo program No. 320 execution request.

7.12 Speed Control (I)

- (1) Speed control of the axes designated in the sequence program positioning commands.
- (2) Control includes positioning loops for control of servo amplifiers.
- (3) Speed control (I) uses the VF (forward) and VR (reverse) servo instructions.

											Item	s Set	by Pe	eriph	erals									
1					C	ommo	חכ				Arc				F	eran	eter	Bloc	۲.			Oth	878	
Servc Instruction	Positioning Method	Number of Controllable Axes	Parameter Block No.	Axte	Address/Fravel Value	Commanded Speed	Dwell Time	M Code	Torque Limit Value	Auxiliary Point	Radius	Center Point	Control Unit	Speed Limit Value	Acceleration Time	Deceleration Time	Rapid Stop Deceleration Time	Torque Limit Value	Deceleration Processing on Stop input	Allowable Error Range for Circular Interpolation	s curve Ratio	Cancel	Start	Speed Change
VF	-	1	۸	0		0		Δ						۵	۵	۵	۵	۵	Δ		۵	۵	۵	ок

O: Must be set

 $\boldsymbol{\Delta}$: Set if required

[Control Details]

- (1) Controls the axis at the designated speed between the start of servomotor operation and the input of the stop command.
 - VF movement in forward direction
 - VR movement in reverse direction
- (2) The present value does not change at zero.



Figure 7.25 Speed Control (I)

(3) Stop commands and stop processing

The stop commands and stop processing for speed control are listed in Figure 7.1.

Stop Command	Stop Condition	Stopped Axis	Stop Processing							
External STOP signal			Deceleration stop according to the deceleration time on STOP input designated in the parameter block or by a servo instruction.							
Stop command (M1800+20n/Yn0/ M3200+20n)	OFF → ON	Designa- ted axis	Deceleration stop according to the deceleration time designated in the parameter block or by a servo instruction							
Rapid stop command* (M1801+20n/Yn1/ M3201+20n)			Deceleration stop according to the rapid stop deceleration time designated in the parameter block or by a servo instruction.							
Emergency stop from peripheral device* (test mode)	Key input	All axes	Deceleration stop according to the rapid stop deceleration time designated in the parameter block or by a servo instruction.							
Speed changed to 0	Value stored in speed change register	Designa- ted axis	Deceleration stop according to the deceleration time designated in the parameter block or by a servo instruction.							

Figure 7.1 Stop Commands and Stop Processing

POINT

*: The rapid stop command and emergency stop from a peripheral device are valid during deceleration due to input of an external STOP signal or the stop command (M1800+20n/Yn0/M3200+20n), and processing according to the rapid stop deceleration time parameter starts at the time the stop condition occurs.



[Cautions]

- (1) After running speed control using the absolute data system, the feed present value cannot be set to zero by the following operations:
 - Reset with the RUN key
 - Turning on the servo power supply (OFF \rightarrow ON)
- (2) The dwell time cannot be set.

- This program conducts speed control (I) under the conditions below.
- (1) System configuration
 - Speed control (I) of Axis 1.



- (2) Speed control (I) conditions
 - (a) The speed control (I) conditions are shown below.

Item	Setting
Servo program number	No. 91
Controlled axis	Axis 1
Control speed	3000
Rotation direction	Forward

- (b) Speed control (I) start command ...leading edge of X000 (OFF \rightarrow ON)
- (c) Speed control (I) stop command ...trailing edge of X000 (ON \rightarrow OFF)

(3) Operation timing

The operation timing for speed control (I) is shown below.


(4) Servo program

The servo program No. 91 for speed control (I) is shown below.



(5) Sequence program

The sequence program which runs the servo program is shown below.



7.13 Speed Control (II)

- (1) Speed control of the axes designated in the sequence program positioning commands.
- (2) Control does not include positioning loops for control of servo amplifiers. Use stopper control to prevent errors becoming excessive.
- (3) Speed control (II) uses the VVF (forward) and VVR (reverse) servo instructions.

											Item	s Set	by P	eriph	erals									
ļ			<u> </u>		<u> </u>	omm	on			<u> </u>	Arc				_	aran	neter	Bloc	ĸ			Oth	-	
Servo Instruction	Positioning Method	Number of Controllable Axes	Parameter Block No.	Axts	Address/Travei Value	Commanded Speed	Dwell Time	M Code	Torque Limit Value	Auxiliary Point	Radius	Center Point	Control Unit	Speed Limit Value	Acceleration Time	Deceleration Time	Rapid Stop Deceleration Time	Torque Limit Value	Deceleration Processing on Stop input	Allowable Error Range for Circular Interpolation	8 Curve Ratio	Cancel	Start	Speed Change
VVF VVR		1	۵	0		0		▲	۵					۵	۵	۵	۵	•	▲		۵	۵	▲	ок



∆ : Set if required

[Control Details]

- (1) Controls the axis at the designated speed between the start of servomotor operation and the input of the stop command.
 - VVF movement in forward direction
 - VVR movement in reverse direction
- (2) The present value or deviation counter do not change at zero.
- (3) When the setting for "torque" is set in a servo program and an indirect designation is made, the torque limit value can be changed during operation by changing the value of the indirect device.
- (4) The stop command and stop processing are the same as for speed control(I).

[Cautions]

- (1) After running speed control using the absolute data system, the feed present value cannot be set to zero by resetting with the RUN key.
- (2) The dwell time cannot be set.
- (3) Cannot be used with respect to MR-J-B axes.

[Program Example]

This program conducts speed control (II) under the conditions below.

(1) System configuration Speed control (II) of Axis 3.



- (2) Speed control (II) conditions
 - (a) The speed control (II) conditions are shown below.

item	Setting
Servo program number	No. 55
Controlled axis	Axis 3
Control speed	4000_
Rotation direction	Forward

- (b) Speed control (II) start command ...leading edge of X000 $(OFF \rightarrow ON)$
- (c) Speed control (II) stop command ...trailing edge of X000 (ON \rightarrow OFF)
- (3) Operation timing
 - The operation timing for speed control (II) is shown below.



(4) Servo program

The servo program No. 55 for speed control (II) is shown below.



(5) Sequence program The sequence program which runs the servo program is shown below.

٥	<u>м</u> өрээ	(M2000)	Turns ON PC ready.
2	M9074	(M2042)	Turns ON all axes servo start command.
4	X000 M9074 M2009 M9076	м55]-	Detects leading edge of X000 (OFF → ON)
	[PLF	M58 }-	Detects trailing edge of X000 (ON → OFF)
14	M55 ☐	M57]-	Turns ON servo program No. 55 start command flag (M57) when X000 turns
16	M9074 M57 M2003	к 55 }-	OFF → ON. Servo program No. 55 execution re- quest.
	[RST	M57]-	Turns OFF M57 on completion of servo program No. 55 execution request.
27	M58 	M1840]-	Turns ON stop command flag (M1840) at trailing edge of X000.
29	M2003 M1840	M1840]	Turns OFF stop command flag (M1840) when Axis 3 stops.
CIF	CUITEND		1

7.14 Speed/Position Switching Control

7.14.1 Starting speed/position switching control

Speed/position switching control of the axes designated in the sequence program positioning commands.

Speed/position switching control uses the VPF (forward), VPR (reverse), and VPSTART (restart) servo instructions.

									_		item	s Set	by Pe	riph	orais									
					<u> </u>		n				Arc					Parar	nter	Block	<u> </u>			Oth	ers	
Servo Instruction	Positioning Method	Number of Controllable Axes	Parameter Block No.	Axis	Address/Travel Value	Commanded Speed	Dwell Time	M Code	Torque Limit Value	Auxillary Point	Rediue	Center Point	Control Unit	Speed Limit Value	Acceleration Time	Deceleration Time	Rapid Stop Deceleration Time	Torque Limit Value	Deceleration Processing on 8top Input	Allowable Error Range for Circular Interpolation	8 Curve Ratio	Cancel	Start	Speed Change
VPF VPR	Incremental	1	۵	0	0	0	۵	۵	Δ					۵	۵	۵	۵	۵	۵		Δ	۵	۵	ок



Δ : Set if required

[Control Details]

- (1) The servomotor starts under speed control, but on input of the external CHANGE signal the control changes from speed control to position control and the axis is positioned by the designated travel value.
 - VPF ... movement in forward direction (direction in which addresses increase)
 - VPR ... movement in reverse direction (direction in which addresses decrease)
- (2) The external CHANGE signal is only valid when M1805+20n (Speed/ position switching enable signal) is ON. If M1805+20n turns ON after the CHANGE signal turns ON, no speed/position switching occurs and speed control is continued.



REMARKS

- *: 1) When using A171SCPU, the external CHANGE signal is an external input to the A171SENC DOG/CHENGE terminal. When "normally open contact input" is set in the system settings, CHANGE input occurs when the DOG/CHANGE signal comes ON, and when "normally closed contact input" is set, CHANGE input occurs when the DOG/CHANGE signal goes OFF. (See the A171SCPU Motion Controller User's Manual (IB-67276) for details.)
 - 2) When using A273UHCPU (8/32-axis specification), the external CHANGE signal is an external input to the A278LX CHANGE terminal. (See the A273UHCPU (8/32-axis specification) Motion Controller User's Manual (IB-67262) for details.)
- (3) Feed present value processing

The feed present value is determined in one of the following two ways according to the ON/OFF status of M1812+20n (feed present value update request command) when speed/position switching control is started.

- (a) M1812+20n..... The feed present value is cleared to zero at the start of speed/position switching control.
 - The feed present value is updated from the start of control (speed control).
 - The feed present value after control is stopped is as follows:



- (b) M1812+20n..... The feed present value is not cleared at start of speed/position switching control.
 - The feed present value is updated from the start of control (speed control).
 - The axis makes a deceleration stop if the feed present value exceeds the stroke limit.
 - The feed present value after control is stopped is as follows:





POINT

If control is started by turning M1812+20n/YnC/M3212+20n ON, leave M1812+20n/YnC/M3212+20n ON until positioning control is completed. The feed present value cannot be guaranteed if M1812+20n /YnC/ M3212+20n is turned OFF during control.

- (4) Changing travel value during speed control After speed/position switching control is started, the travel value for position control can be changed while speed control is in progress. Follow the procedure described below to change the travel value.
 - (a) Indirectly designate the travel value in the servo program using the 2-word data registers shown in the table below.

<A171SCPU>

	Data Register	Data Registers to Ch	ange Travel Value
Axis No.	Number for Indirect Designation	Most-Significant Data	Least-Significant Data
1	D815	D816	D815
2	D835	D836	D835
3	D855	D856	D855
4	D875	D876	D875

 See Sections 3.4 for the data register numbers used in indirect designation of travel values with A273UHCPU (8/32-axis specification).

Example The following servo program moves Axis 4 in the forward direction at speed 50000 under speed control and after the external CHANGE signal turns ON, it executes position control for the travel value designated in registers D875 and D876.



(b) The sequence program sets the travel value in the travel value change data register while speed control is in progress. When the external CHANGE signal turns ON, the contents of the travel value change data register are set as the travel value.



(5) Travel value area after near-zero point dog turns ON The travel value since the position mode was selected by the external CHANGE signal is stored in the travel value area (see section 3.4.1) when the near-zero point dog turns ON.

[Cautions]

- (1) Items checked when the external CHANGE signal turns ON Speed control switches to position control when the External CHANGE signal turns ON if the following conditions are met:
 - The start accept flag (M2001+1) is ON.
 - Speed control is in progress after start of speed/position switching control.
 - Speed/position switching enable signal (M1805+20n) is ON.
- (2) To omit speed control

Position control only is executed if M1805+20n and the CHANGE signal are ON when control starts. The speed control signal (M1604+20n) does not turn ON.



- (3) If travel value under position control is less than deceleration distance
 - (a) If the position control travel value is less than the deceleration distance at the controlled speed, deceleration processing starts immediately when CHANGE is input.
 - (b) The difference between travel value for the deceleration stop and position control is the overrun. If an overrun occurs, the error detection signal (M1607+20n) turns ON and error code 209 is stored in the data register.
 - (c) The positioning completed signal (M1601+20n) does not turn ON.



(4) Stoke limit check

No stroke limit range check is made during the speed mode. If the travel value exceeds the stroke limit range, a minor error (error code: 210) occurs when position mode is selected, and a deceleration stop occurs.

(5) Switching time from speed control to position control Switching from speed control to position control takes 1 ms after the external CHANGE signal turns ON.

[Program Example]

This program executes speed/position switching control under the conditions below.

(1) System configuration Speed/position switching control of Axis 4.



- (2) Positioning conditions
 - (a) The positioning conditions are shown below.

Item	Setting
Servo program number	No. 101
Controlled axis	Axis 4
Positioning control travel value	40000
Commanded speed	1000

- (b) Positioning start commandleading edge of X000 (OFF \rightarrow ON)
- (c) Speed/position switching enable flagM1865

(3) Operation timing

The operation timing for speed/position switching control is shown below.



(4) Servo program

The servo program No. 101 for speed/position switching control is shown below.



(5) Sequence program

The sequence program which runs the servo program is shown below.



7.14.2 Restarting speed/position switching control

Restarting (continuing) speed/position switching control after a stop due to a stop command. Control is restarted using the VPSTART servo instruction.

									_		Item	s Set	by P	eriph	erais									
					c	omm	on				Arc		_			Parar	nter I	Block				Oth	878	
Servo Instruction	Positioning Method	Number of Controliable Axes	Parameter Blook No.	Axis	Address/Travel Value	Commanded Speed	Dweil Time	M Code	Torque Limit Value	Auxiliary Point	Redius	Center Point	Control Unit	Speed Limit Value	Acceleration Time	Deceleration Time	Rapid Stop Deceleration Time	Torque Limit Value	Deceleration Processing on Stop input	Allowable Error Range for Ciroutar Interpolation	8 Curve Ratio	Cancel	Start	Speed Change
VPSTART				0																		Δ	۵	

O: Must be set

 Δ : Set if required

[Control Details]

- (1) Speed/position switching control is continued after it was stopped due to a stop command.
- (2) Restarting using VPSTART is valid whether the stop occurred during speed control or position control.
 - (a) If the stop occurred during speed control, then speed control continues and switches to position control when the CHANGE signal turns ON.

The control conditions after restarting are the same as the previous speed/position switching control conditions. See 7.14.1 "Starting Speed/Position Switcing Control".



Figure 7.26 Restarting During Speed Control

7. POSITIONING CONTROL

(b) If the stop occurred during position control, then position control continues until the positioning reaches the set travel value. The travel value after the restart is calculated as follows:





Figure 7.27 Restarting During Speed Control

(3) The speed at restart is the speed stored when the VPF/VPR instruction occurred.

Therefore, even if a speed change occurred before the stop, control restarts at the speed set at the time of VPF/VPR instruction execution.



Figure 7.28 Restarting After Speed Change

[Program Example]

This program restarts speed/position switching control after a stop, under the conditions below.

(1) System configuration Speed/position switching control of Axis 4.



- (2) Positioning conditions
 - (a) The positioning conditions are shown below.

	Settin	g
ltem	Speed/Position Switching Control	Restart
Servo program number	No. 101	No. 102
Controlled axis	Axis 4	Axis 4
Positioning control travel value	40000	_
Commanded speed	1000	-

- (b) Positioning start commandleading edge of X000 (OFF \rightarrow ON)
- (c) Speed/position switching enable flagM1865
- (d) Restart commandleading edge of X001 (OFF \rightarrow ON)
- (e) Stop commandleading edge of X002 (OFF \rightarrow ON)

7. POSITIONING CONTROL

(3) Operation timing

The operation timing for speed/position switching control and restarting is shown below.



(4) Servo program

The servo program No. 101 for speed/position switching control and No. 102 for restarting are shown below.



7. POSITIONING CONTROL

(5) Sequence program

The sequence program which runs the servo programs is shown below.

0	M9039 -	(M2000)-	Turns ON PC ready.
2		(M2042)-	Turns ON all axes servo start command.
4		M101]-	Detects leading edge of X000 (OFF \rightarrow ON)
		M1888]-	Turns ON speed/position switching en- able flag (M1865).
12		M102]-	Turns ON servo program No. 101 start command flag (M102) at X000 leading edge.
14	M9074 M102 M2004	к 101 Ъ	Servo program No. 101 execution re- quest.
	[RST	M102 J	Turns OFF M102 on completion of servo program No. 101 execution re- quest.
25		м103 Ӈ	
29	M103	м1888]-	able flag (M1865) on speed/position switching signal (CHANGE) input.
31	X0001 -	M104]-	Detects leading edge of X001 (OFF \rightarrow ON)
35	M104	M105]-	Turns ON servo program No. 102 start command flag (M105) at X001 leading
37	M9074 M105 M2004	к 102 Э	euge. Servo program No. 102 execution re- quest.
	L RST	M105 7-	Turns OFF M105 on completion of servo program No. 102 execution request.
48		M1880)-	Stops Axis 4 when the external stop com- mand is input.
CIR			

7.15 Speed-Switching Control

- (1) After a single control start, the speed is switched for positioning control to the preset speed-switching points.
- (2) The speed-switching points and speed are set by the servo program.
- (3) Repeated instructions permit repeated control between any speedswitching points.
- (4) M codes and torque limit values can be changed at each speed-switching point.

7.15.1 Starting speed-switching control, speed-switching points, end designation

					_						It	eine	Set	by P	eripi	ersi	\$	_							
						Co	mm	on			_	Arc		_		P	ram	eter	Bio	k			Oth	ers	
Se Instri	rve Jetion	Positioning Method	Number of Controliable Axes	Parameter Block No.	Axis	Address/Travel Value	Commanded Speed	Dwell Time	M Code	Torque Limit Value	Auxillary Point	Radiue	Center Point	Control Unit	Speed Limit Value	Acceleration Time	Deceleration Time	Rapid Stop Deceleration Time	Torque Limit Value	Deceleration Processing on Stop input	Allowable Error Range for Circular Interpolation	8 Curve Ratio	Canoel	Start	Speed Change
Start	VSTART			۸										Δ	Δ	Δ	⊿	Δ	Δ	Δ		۵	Δ	۵	
End	VEND	-	_																						-
	ABS-1		1																						
End point address	ABS-2	Absolute data	2																						
	ABS-3		3		0	0	0																		ок
_	INC-1		1					_	_	_															
to end point	INC-2	Incremental	2]]																					
	INC-3		3																						
Speed-	VABS	Absolute data																							
point	VABC	Incremental	_			0	0		Δ	Δ															~

O: Must be set

 Δ : Set if required

[Control Details]

Starting and ending speed-switching control

Speed-switching control is started and ended using the following instructions:

- (1) VSTART
 - Starts speed-switching control.
- (2) VEND

Ends speed-switching control.

End address and travel value to end point

The speed-switching control end address and travel value to the end point, positioning method, and positioning speed to the end point are set using the following instructions:

(1) ABS-1/INC-1

Designate one-axis linear positioning control. The control details are described in Section 7.2 "One-axis Linear Positioning Control".

(2) ABS-2/INC-2

Designate two-axis linear interpolation control.

The control details are described in Section 7.3 "Two-axis Linear Interpolation Control".

(3) ABS-3/INC-3

Designate three-axis linear interpolation control.

The control details are described in Section 7.4 "Three-axis Linear Interpolation Control".

Speed-switching point setting

The address (travel value) to the speed-switching point and the positioning speed are set using the following instructions:

- (1) VABS Designates the speed-switching point using the absolute data method.
- (2) VINC Designates the speed-switching point using the incremental method.



Operation timing and the procedure to write servo programs

The method to write servo programs for speed-switching control and the operation timing are shown in Figure 7.29.



Figure 7.29 Servo Program for Speed/Position Switching Control And Operation Timing

7. POSITIONING CONTROL

[Cautions]

- (1) The number of controllable axes cannot be changed while control is in progress.
- (2) Designation of position switching points can use a combination of the absolute data method (ABSD) and the incremental method (INCD).
- (3) A speed-switching point cannot be designated as an address which results in a change in travel direction. If the address results in a change in direction, the error code 215 is stored in the minor error register for the axis and a deceleration stop occurs.
- (4) A maximum of 768 steps (approximately 100 points) can be designated in a speed-switching control program.
- (5) When control is started a check is made to ensure that the end address lies in the stroke range. If the check determines that positioning would result in an axis moving out of the stroke limit range, the error code 106 is stored in the minor error register for the axis and operation does not start.
- (6) Speed switching is not carried out if the travel value between speedswitching points is so short that the next speed-switching point is reached while speed switching is still in progress.
- (7) If no M code is designated for a speed-switching point, the M code from the previous point is retained.

[Program Example]

- This program executes speed-switching control under the conditions below.
- (1) System configuration Speed-switching control of Axis 2 and Axis 3.



- (2) Positioning conditions
 - (a) The speed-switching control conditions are shown below.

ltem	Sett	ing
Servo program number	No.	500
Controlied axes	Axis 2	Axis 3
End address	100000	50000

- (b) Speed-switching control start commandleading edge of X000 (OFF \rightarrow ON)
- (3) Operation timing and speed-switching positions The operation timing for speed-switching control and the speed-switching points are shown below.



7. POSITIONING CONTROL

			\triangle	CAUTI	ON			
The oper ontrol, v ange is ollowing vhole wil resente 1) When	ration t when a include the sk II be th d below a all the	hat takes plac in axis for whic ed, is describe kip, the final po le same regarc w. e instructions a	e on execut ch "degree" d here. If, u ositioning po dless of whe after the ski	ion of a is desig under th int and ther the p are IN	skip designa nated as the ese condition the travel dis skip is exec IC instruction	ted during co unit and whi ns, there is a stance in the uted or not. s:	onstan ch has n ABS progra Exam	t speed no stroke instruction am as a oles are
Progr	am ex	ample	Motic	n wher	skin is not e	vecuted		
CPSTART	1		-			^		270 [degree]
Axis	1		0		80	0 		
Speed		10.000						
INC-1			Motio	on when	skip is exec	uted		
Axis	1,	180.00000	(whe	n the sl	in occurs at	100 (degree)	۱	
Skip		X100	(1110		ap occurs at		,	
INC-1			0	100	280		190 [d	legree]
Axis	1,	180.00000	-		·			
INC-1		370 00000						
AXIS	1,	270.00000						
CPSTART Axis	1	10 000	Motic o	n when 180	skip is not e 350	xecuted	2	270 [degree]
CPSTART Axis Speed INC-1 Axis Skip INC-1 Axis	1 1	10.000 180.00000 X100	Motic o Motic (when o	n when 180 n when n the sk	skip is not e 350 skip is execu ip occurs at	xecuted Ited 100 [degree])	2	270 [degree]
CPSTART Axis Speed INC-1 Axis Skip INC-1 Axis INC-1	1 1 1, 1,	10.000 180.00000 X100 350.00000	Motic o Motic (when o	n when 180 n when n the sk	skip is not e 350 skip is exect ip occurs at 350	xecuted uted 100 [degree])	2	270 [degree]
CPSTART Axis Speed INC-1 Axis Skip INC-1 Axis INC-1 Axis	1 1 1, 1, 1,	10.000 180.00000 X100 350.00000 270.00000	Motic o Motic (when o	n when 180 n when n the sk	skip is not e 350 skip is exect ip occurs at 350	xecuted uted 100 [degree])	2	270 [degree]
CPSTART Axis Speed INC-1 Axis Skip INC-1 Axis INC-1 Axis CPEND	1 1, 1, 1,	10.000 180.00000 X100 350.00000 270.00000	Motic o Motic (when o 	n when 180 n when 100 her or n	skip is not e 350 skip is exect ip occurs at 350 ot the skip of	xecuted uted 100 [degree]) ccurs, the fin	al posi	270 [degree]
CPSTART Axis Speed INC-1 Axis Skip INC-1 Axis INC-1 Axis CPEND	1 1, 1, 1, 1, 1,	10.000 180.00000 X100 350.00000 270.00000	Motic o Motic (when o 	n when 180 n when n the sk 100 her or n will be	skip is not e 350 skip is exect ip occurs at 350 ot the skip of the same.	xecuted Ited IOO [degree]) ccurs, the fin	al posi	270 [degree] 270 [degree] tioning
CPSTART Axis Speed INC-1 Axis Skip INC-1 Axis INC-1 Axis CPEND 3) When ABS i Progr	1 1, 1, 1, 1, 1, instruc ram ex	10.000 180.00000 X100 350.00000 270.00000 estruction imme tion after that ample	Motic o Motic (when o 	n when 180 n when her or n will be owing th	skip is not ei 350 skip is exect ip occurs at 350 not the skip of the same. ne skip is an l skip is not ei	xecuted I 00 [degree]) ccurs, the fin NC instructio	al posi	270 [degree] 270 [degree] itioning there is an
CPSTART Axis Speed INC-1 Axis Skip INC-1 Axis INC-1 Axis CPEND 3) When ABS i Progr	1 1, 1, 1, 1, instruc ram ex	10.000 180.00000 X100 350.00000 270.00000 estruction imme tion after that ample	Motic o Motic (when o 	n when 180 n when h the sk 100 her or n will be owing th n when	skip is not ei 350 skip is exect ip occurs at 350 not the skip of the same. ne skip is an l skip is not ei 0	xecuted uted 100 [degree]) ccurs, the fin NC instruction (Accuted 180	al posi on and	270 [degree] 270 [degree] itioning there is an 90 [degree]
CPSTART Axis Speed INC-1 Axis Skip INC-1 Axis INC-1 Axis CPEND 3) When ABS i Progr CPSTART Axis Speed INC-1	1 1, 1, 1, 1, instruc am ex	10.000 180.00000 x100 350.00000 270.00000 estruction imme tion after that ample 10.000	Motic o Motic (when o 	her or n will be	skip is not ei 350 skip is exect ip occurs at 350 not the skip of the same. ne skip is an l skip is not en 0	xecuted uted 100 [degree]) ccurs, the fin NC instruction (NC instruction (NC instruction (NC instruction)	al position and	270 [degree] 270 [degree] itioning there is an 90 [degree]
CPSTART Axis Speed INC-1 Axis Skip INC-1 Axis INC-1 Axis CPEND 3) When ABS i Progr CPSTART Axis Speed INC-1 Axis	1 1, 1, 1, 1, instruc 2am ex.	10.000 180.00000 x100 350.00000 270.00000 270.00000 istruction imme tion after that ample 10.000 360.00000	Motic o Motic (when o 	n when 180 n when h the sk 100 her or n will be owing th n when	skip is not ei 350 skip is exect ip occurs at 350 not the skip of the same. ae skip is an l skip is not ei 0	xecuted uted 100 [degree]) ccurs, the fin NC instruction (NC instruction (NC instruction)	al posi on and	270 [degree] 270 [degree] itioning there is an 90 [degree]
CPSTART Axis Speed INC-1 Axis Skip INC-1 Axis CPEND 3) When ABS i Progr CPSTART Axis Speed INC-1 Axis Speed	1 1, 1, 1, 1, instruc ram ex 1 1,	10.000 180.00000 x100 350.00000 270.00000 270.00000 10.000 360.00000 x100	Motic o Motic (when o 	n when 180 n when n the sk 100 her or n will be pwing th n when n when	skip is not ei 350 skip is exect ip occurs at 350 not the skip of the same. ne skip is an l skip is not en 0 skip is exect	xecuted Ited IOO [degree]) ccurs, the fin INC instruction (NC instruction (NC instruction) (NC instruction)	al position and	270 [degree] 270 [degree] itioning there is an 90 [degree]
CPSTART Axis Speed INC-1 Axis Skip INC-1 Axis INC-1 Axis CPEND 3) When ABS i Progr CPSTART Axis Speed INC-1 Axis Speed INC-1	1 1, 1, 1, 1, instruc ram ex 1 1,	10.000 180.00000 X100 350.00000 270.00000 270.00000 10.000 360.00000 X100	Motic o Motic (when o Whet point ediately follo o Motio (when	n when 180 n when n the sk 100 her or n will be pwing th n when n when her ski	skip is not ei 350 skip is execu ip occurs at 350 not the skip of the same. ne skip is an l skip is not ei 0 skip is execu p occurs at 8	xecuted I ted I 00 [degree]) ccurs, the fin INC instruction (NC instruction (NC instruction (NC instruction (NC instruction) (NC	al position and	270 [degree] 270 [degree] itioning there is an 90 [degree]
CPSTART Axis Speed INC-1 Axis Skip INC-1 Axis INC-1 Axis CPEND 3) When ABS i Progr CPSTART Axis Speed INC-1 Axis Speed INC-1 Axis	1 1, 1, 1, 1, 1, 1 1, 1, 1, 1,	10.000 180.00000 X100 350.00000 270.00000 270.00000 10.000 360.00000 X100 180.00000	Motic o Motic (when o Whet point ediately follo 0 Motio 0 Motio (wher o 80	n when 180 n when her or n will be owing th n when n when her ski	skip is not ei 350 skip is execu ip occurs at 350 oot the skip oo the same. ne skip is an l skip is not ei 0 skip is execu p occurs at 8	xecuted uted 100 [degree]) ccurs, the fin NC instruction (NC instruction (NC instruction (NC instruction (NC instruction (NC instruction) (NC inst	al posi on and	270 [degree] 270 [degree] itioning there is an 90 [degree] 90 [degree]
CPSTART Axis Speed INC-1 Axis Skip INC-1 Axis INC-1 Axis CPEND 3) When ABS i Progr CPSTART Axis Speed INC-1 Axis Speed INC-1 Axis Speed	1 1, 1, 1, 1, 1, 1 1, 1, 1, 1,	10.000 180.00000 X100 350.00000 270.00000 270.00000 10.000 360.00000 X100 180.00000	Motic o Motic (when o Whet point ediately follo o Motio o Motio (when o so	n when 180 n when n the sk 100 her or n will be owing th n when n when her ski	skip is not ei 350 skip is execu ip occurs at 350 not the skip of the same. ne skip is an l skip is not ei 0 skip is execu p occurs at 8 260	xecuted uted 100 [degree]) ccurs, the fin NC instruction (NC instruction (NC instruction (NC instruction (NC instruction (NC instruction) (NC inst	al posi on and	270 [degree] 270 [degree] itioning there is an 90 [degree] 90 [degree]
CPSTART Axis Speed INC-1 Axis Skip INC-1 Axis INC-1 Axis CPEND 3) When ABS i Progr CPSTART Axis Speed INC-1 Axis Speed INC-1 Axis Skip INC-1 Axis Speed	1 1, 1, 1, 1, 1, 1 1, 1, 1, 1,	10.000 180.00000 X100 350.00000 270.00000 270.00000 10.000 360.00000 X100 180.00000 180.00000	Motic o Motic (when o Whet point ediately follo o Motio o Motio (when o so	n when 180 n when n the sk 100 her or n will be pwing th n when n when n the ski	skip is not ei 350 skip is execu ip occurs at 350 not the skip of the same. ne skip is an l skip is not ei 0 skip is execu p occurs at 8 260	xecuted uted 100 [degree]) ccurs, the fin NC instruction (NC instruct	al posi on and	270 [degree] 270 [degree] itioning there is an 90 [degree] 90 [degree]
CPSTART Axis Speed INC-1 Axis Skip INC-1 Axis INC-1 Axis CPEND 3) When ABS i Progr CPSTART Axis Speed INC-1 Axis Speed INC-1 Axis Speed INC-1 Axis Speed INC-1 AXIS Speed	1 1, 1, 1, 1, 1, 1 1, 1, 1, 1,	10.000 180.00000 X100 350.00000 270.00000 270.00000 10.000 360.00000 X100 180.00000 180.00000	Motic o Motic (when o Whet point ediately follo o Motio o Motio (when o so	n when 180 n when n the sk 100 her or n will be owing th n when n when n the ski At this po	skip is not exact skip is exect ip occurs at 350 not the skip of the same. ne skip is an l skip is not execu- o skip is execu- p occurs at 8 260 int there is a model skip is a model skip is execu- p occurs at 8	xecuted uted 100 [degree]) ccurs, the fin NC instruction (NC instruct	al posi on and 0	270 [degree] 270 [degree] itioning there is an 90 [degree] 90 [degree] 00 [degree]
CPSTART Axis Speed INC-1 Axis Skip INC-1 Axis CPEND 3) When ABS i Progr CPSTART Axis Speed INC-1 Axis Speed INC-1 Axis Skip INC-1 Axis Speed INC-1 Axis Speed INC-1 Axis Speed INC-1 AXIS Speed INC-1 AXIS Speed INC-1 AXIS Speed INC-1 AXIS Speed INC-1 AXIS Speed ABS I AXIS Speed ABS I AXIS Speed INC-1 AXIS Speed INC-1 AXIS Speed INC-1 AXIS Speed INC-1 AXIS Speed INC-1 AXIS Speed ABS I ABS I AXIS Speed ABS I AXIS ABS I AXIS Speed ABS I AXIS ABS I AXIS Speed ABS I AXIS AXIS AXIS AXIS AXIS AXIS AXIS AXI	1 1, 1, 1, 1, 1, 1, 1, 1, 1, 1	10.000 180.00000 X100 350.00000 270.00000 270.00000 10.000 360.00000 X100 180.00000 180.00000 90.00000	Motic o Motic (when o Whet point ediately follo o Motio (when o so	n when 180 n when her or n will be owing th n when n when her ski At this po	skip is not exact skip is exect ip occurs at 350 not the skip of the same. ne skip is an l skip is not execu o skip is execu p occurs at 8 260 int there is a mo	xecuted uted 100 [degree]) ccurs, the fin NC instruction (NC instruct	al posi on and 0	270 [degree] 270 [degree] itioning there is an 90 [degree] 90 [degree] 10 degrees.
CPSTART Axis Speed INC-1 Axis Skip INC-1 Axis CPEND 3) When ABS i Progr CPSTART Axis Speed INC-1 Axis Speed INC-1 Axis Skip INC-1 Axis Speed INC-1 Axis CPEND	1 1, 1, 1, 1, 1, 1, 1, 1, 1, 1	10.000 180.00000 X100 350.00000 270.00000 270.00000 10.000 360.00000 X100 180.00000 180.00000 90.00000	Motic o Motic (when o Whet point ediately follo 0 Motio 0 Motio (when o so	n when 180 n when her or n will be owing th n when n when her ski At this po	skip is not exact skip is exect ip occurs at 350 not the skip of the same. ne skip is an l skip is not execu o skip is execu p occurs at 8 260 int there is a mo	xecuted uted 100 [degree]) ccurs, the fin NC instruction (NC instruct	al posi on and o	270 [degree] 270 [degree] itioning there is an 90 [degree] 90 [degree] 10 degrees.

(4) Servo program

The servo program No. 500 for speed-switching control is shown below.



(5) Sequence program The sequence program which runs the servo program is shown below.



7.15.2 Setting speed-switching points using repeat instructions

											Ite	me S	et by	Peri	pher	als									
					<u> </u>	mm	on				Arc				P	aran	eter	Bloc	k			0	ther	8	
Servo Instruction	Positioning Method	Number of Controllable Axee	Parameter Block No.	Axte	Address/Travel Value	Commanded Speed	Dweil Time	M Code	Torque Limit Value	Auxiliary Point	Radiue	Center Point	Control Unit	Speed Limit Value	Acceleration Time	Deceleration Time	Rapid Stop Deceleration Time	Torque Limit Veiue	Deceleration Processing on Stop input	Allowable Error Range for Ciroular Interpolation	8 Curve Ratio	Repeated Condition	Cancel	Start	Speed Change
FOR-TIMES		_																				0	۵	۵	
NEXT		_																							

Repeated execution between any speed-switching points.

O: Must be set

∆ : Set if required

[Control Details]

Setting the Start of the Repeated Range

The start of the repeated range is designated using the following instructions:

- (1) FOR-TIMES (number of loops setting)
 - (a) The designated repeated range is executed the set number of times.
 - (b) The setting range is (1 to 32767). An out-of-range setting between -32768 and 0 is controlled as a setting of 1.
 - (c) The following devices are available to set the number of repeats:
 - 1) Data register (D) ~
 - 2) Link register (W) > Indirect designation
 - 3) Decimal constant (K)
 - 4) Hexadecimal constant (H)
- (2) FOR-ON (loop-out trigger condition setting)
 - (a) The set repeated range is executed while the designated bit device is ON.
 - (b) The following devices are available to set the loop-out trigger condition:
 - 1) Input (X)
 - 2) Output (Y)
 - 3) Internal relay (M)/Special relay (SP.M)
 - 4) Latch relay (L)
 - 5) Link relay (B)
 - 6) Annunciator (F)

- (3) FOR-OFF (loop-out trigger condition setting)
 - (a) The set repeated range is executed while the designated bit device is OFF.
 - (b) The following devices are available to set the loop-out trigger condition:
 - 1) Input (X)
 - 2) Output (Y)
 - 3) Internal relay (M)/Special relay (SP.M)
 - 4) Latch relay (L)
 - 5) Link relay (B)
 - 6) Annunciator (F)

Repeated operation using FOR-TIMES, FOR-ON, and FOR-OFF is shown below.

[Servo Program]



(1) Operation under condition 1



(2) Operation under condition 2



(3) Operation under condition 3



Error generated because the distance to the stop position exceeds the travel value.

[Program Example]

This program executes repeated speed-switching control under the conditions below.

(1) System configuration Speed-switching control of Axis 2 and Axis 3.



- (2) Positioning conditions
 - (a) The speed-switching control conditions are shown below.

Item	Setting					
Servo program number	No.	501				
Controlled axes	Axis 2	Axis 3				
End address	230000	100000				

(b) Speed-switching control start commandleading edge of X000 (OFF \rightarrow ON)

(3) Operation timing and speed-switching positions The operation timing for speed-switching control and the speedswitching points are shown below.



(4) Servo program

The servo program No. 501 for speed-switching control is shown below.

VSTART INC-2 Axis Axis Speed	2, 3,	230000 100000 10000		P-axis linear interpolation control (incre Axis usedAxis 2, Axis 3 End address (Axis 2 230000 Axis 3 100000 Positioning speed10000	mental me	ethod)
VINC Axis Speed FOR-TIMES VINC	2,	40000 40000 K 2		- Speed-switching point, speed setting (• Indicated axisAxis 2 (• Travel value to speed-switching point - Number of repeats 2 - Speed-switching point and speed setting	nt 400 g	00
Axis	2,	30000		Indicated axis number	Axis 2	
Speed		20000		Travel value to speed-switching point	30000	50000
Axis	2,	50000		Speed to speed-switching point	20000	40000
NEXT		40000	•	- End speed-switching range - End speed-switching control		

(5) Sequence program

The sequence program which runs the servo program is shown below.



7.16 Constant-Speed Control

- (1) After a single control start, positioning control is executed using the designated positioning method and positioning speed to the preset pass point.
- (2) The positioning method and positioning speed can be changed for each pass point.
- (3) Set the following parameters with the servo program.
 - pass point
 - positioning method from one pass point to the next pass point.
 - positioning speed from one pass point to the next pass point.
- (4) Repeat instructions permit repeated control between any pass points.
- (5) M code and torque limit value can be changed at each pass point.
- (6) From one to four axes can be controlled.

[Procedure to Write Servo Programs]

The method to write servo programs for constant-speed control is shown below.



[Operation Timing]

The operation timing for constant-speed control is shown below. [Example: Operation timing for 2-axis constant-speed control]



[Caution]

- (1) The number of controllable axes cannot be changed while control is in progress.
- (2) Positioning control to the pass points can use a combination of the absolute data method (ABSC) and the incremental method (INCC).
- (3) A pass point can be designated as an address which results in a change in travel direction.
 However, a servo error or some other error may occur if acceleration processing occurs at a page point for 1-axis constant apaged control but

processing occurs at a pass point for 1-axis constant-speed control but no acceleration or deceleration processing occurs at the pass point for 2- to 4-axis constant-speed control.

(4) Speed change is possible after start

Note the following points when changing the speed.

(a) If constant-speed control includes circular interpolation using center point designation

Error compensation (see Section 4.4.3) may not function normally if the speed is changed when a discrepancy (within the allowable error range for circular interpolation) exists between the designated endpoint address and the arc path calculated from the start address and center-point address.

Therefore, if the circular interpolation using center point designation positioning method is used under constant-speed control, ensure that the set start address, center-point address, and end address lie correctly on the arc.

(b) If both a servo program and the DSFLP/CHGV instructions are used for the speed change in the same program

The lower of the speed changed by the DSFLP/CHGV instructions and the speed set by the servo program is selected.

The DSFLP/CHGV instructions are executed if the changed speed is lower than the speed set in the servo program; otherwise the DSFLP/CHGV instructions are not executed.

1) If DSFLP/CHGV changed speed>servo program set speed The speed set in the servo program is selected.



2) If DSFLP/CHGV changed speed<servo program set speed The speed changed by the DSFLP/CHGV instructions is valid.





- (5) An overrun occurs if the distance remaining to the final positioning point when the final positioning point is detected is less than the deceleration distance at the positioning speed (commanded speed). If an overrun occurs, the error code 211 (overrun error) is stored in the minor error register for the axis.
- (6) A maximum of 768 steps (approximately 100 points) can be designated in a constant-speed control program.
- (7) If positioning moves outside the stroke limit range after control is started, the error code 106 is stored in the minor error register for the axis and a deceleration stop occurs.
- (8) The minimum travel value between constant-speed control pass points is determined as follows:

Commanded speed x 0.02 < Travel distance (pulses)

Positioning speed drops if the distance between pass points is extremely short.

Example	1
comes 280 pps, regardless of the commanded speed setting.	
	-

7.16.1 Setting Pass points using Repeated instructions

								_	_		iter	me 8	et by	Pert	pher	ale .									
					<u> </u>	o munu	DR.		-	L	Arc				P	aran	eter	Bloc	ĸ				ther	-	
Servo Instruction	Positioning Method	Number of Controllable Axes	Parameter Blook No.	Axie	Addrese/Travel Value	Commanded Speed	Dwell Time	M Code	Torque Limit Value	Auxiliary Point	Radiue	Center Point	Control Unite	Speed Limit Value	Acceleration Time	Deceleration Time	Rapid Stop Deceleration Time	Torque Limit Value	Deceleration Processing on Stop input	Allowable Error Range for Circular Interpolation	8-Curve Retio	Repeated Condition	Cancel	Blart	Speed Change
FOR-TIMES	-	-																				0	۵	۵	_
NEXT	-	-																							

This section describes the method of designating the pass points used for repeated execution between pass points.

O: Must be set Δ : Set if required

[Control Details]

Setting the start of the repeated range

The start of the repeated range is designated using the following instructions:

- (1) FOR-TIMES (number of loops setting)
 - (a) The designated repeated range is executed the set number of times.
 - (b) The setting range is (1 to 32767). If an out-of-range setting between -32768 and 0 is designated, control is executed with a setting of "1".
 - (c) The following devices are available to set the number of repetitions:
 - 1) Data register (D) Indirect designation
 - 2) Link register (W) -
 - 3) Decimal constant (K)
 - 4) Hexadecimal constant (H)
- (2) FOR-ON (loop-out trigger condition setting)
 - (a) The set repeated range is executed while the designated bit device is ON.
 - (b) The following devices are available to set the loop-out trigger condition:
 - 1) Input (X)
 - 2) Output (Y)
 - 3) Internal relay (M)/Special relay (SP.M)
 - 4) Latch relay (L)
 - 5) Link relay (B)
 - 6) Annunciator (F)

- (3) FOR-OFF (loop-out trigger condition setting)
 - (a) The set repeated range is executed while the designated bit device is OFF.
 - (b) The following devices are available to set the loop-out trigger condition:
 - 1) Input (X)
 - 2) Output (Y)
 - 3) Internal relay (M)/Special relay (SP.M)
 - 4) Latch relay (L)
 - 5) Link relay (B)
 - 6) Annunciator (F)

Repeated operation using FOR-TIMES, FOR-ON, and FOR-OFF is shown below.

[Servo Program]





[Program Example]

This program executes repeated constant-speed control under the conditions below.

- (1) System configuration
 - Constant-speed control of Axis 2 and Axis 3.



- (2) Positioning conditions
 - (a) The constant-speed control conditions are shown below.

Item	Setting						
Servo program number No.	510						
Controlled axes	Axis 2, Axis 3						
Positioning speed	10000						

(b) Constant-speed control start command leading edge of X000 (OFF \rightarrow ON)

7. POSITIONING CONTROL



(3) Operation timing

The operation timing for constant-speed control is shown below.
(4) Servo program

The servo program No. 510 for constant-speed control is shown below.



(5) Sequence program

The sequence program which runs the servo program is shown below.



7.16.2 Speed switching during instruction execution

The speed can be designated for each pass point during a constant-speed control instruction.

The speed change from a point can be designated directly or indirectly in the servo program.

[Cautions]

- (1) The speed can be changed during servo instruction execution for 1- to 4-axis constant-speed control.
- (2) The speed command can be set for each point.
- (3) The speed-switching point designation flag M2016 (see Section 3.2.6) can be turned ON before control is started to set the designated speed-switching point as the end point for the speed change. The speed change timing is shown below for the cases where the speed-switching point designation flag M2016 is ON and OFF.
 - (a) M2016 is OFF
 - The speed change starts at the designated speed-switching point.



Designated speed-switching point

(b) M2016 is ON

The speed change ends at the designated speed-switching point.



[Program Example]

This program turns ON M2016 during constant-speed control instruction execution and changes the speed, under the conditions below.

- (1) System configuration
 - Switches speed for Axis 1 and Axis 2.



- (2) Positioning conditions
 - (a) The speed switching conditions are shown below.

ltem			Setting		
Servo progi number	ram		310		
Positioning	speed		10000		
Positioning method		2-axis linear interpolation	Circular interpolation using center point designation	2-axis linear interpolation	2-axis linear interpolation
Bass point	Axis 1	20000	30000	40000	50000
rass point	Axis 2	10000	20000	25000	40000

(b) Constant-speed control with speed switching start command leading edge of X000 (OFF \rightarrow ON)

7. POSITIONING CONTROL



(3) Operation timing and speed-switching positions The operation timing and positions for speed switching are shown below.

(4) Servo program

The servo program No. 310 for speed switching is shown below.



(5) Sequence program

The sequence program which runs the servo program is shown below.



7.16.3 One-axis constant-speed control

		<u> </u>			<u> </u>			_	-				Iten	18 8	et by	Per	iohe	rais	i		_				_			
					Common					Arc Parameter						Block Oth						ther	hers					
in	Servo struction	Positioning Method -	Number of Controllable Axes	Parameter Block No.	Axis	Address/Travel Value	Commanded Speed	Dwell Time	M Code	Torque Limit Value	Auxiliary Point	Radius	Center Point	Control Unite	Speed Limit Value	Acceleration Time	Deceleration Time	Rapid Stop Deceleration Time	Torque Limit Velue	Deceleration Processing on Stop input	Allowable Error Range for Circular Interpolation	8-Curve Ratio	Commanded speed (constant-speed)	Cancel	Start	Skip	FiN acceleration	Speed Change
Start	CPSTART1	-	1	Δ	0		0								۵	Δ	Δ	Δ	۵	۵		۵		Δ	۵		۸	
End	CPEND	-	-					۵																				ок
Pass	ABS-1	Absolute data	1		0	0			۵	۵													۵			Δ		
point	INC-1	Incremental	1		0	0			Δ	۵													Δ			Δ		

Constant-speed control for the one axis designated with the sequence program positioning commands.

O : Must be set

 $\Delta: \textbf{Set if required}$

[Control Details]

Starting and ending one-axis constant-speed control

One-axis constant-speed control is started and ended using the following instructions:

- (1) CPSTART1
 - Starts one-axis constant-speed control. Sets the axis number used and the commanded speed.
- (2) CPEND

Ends the one-axis constant-speed control which was started using CPSTART1.

Positioning control method to the pass point

The positioning control to the point where control is changed is designated using the following instructions:

(1) ABS-1/INC-1

Designates one-axis linear positioning control. See Section 7.2 "One-axis Linear Positioning Control" for details.

[Program Example]

This program executes repeated one-axis constant-speed control under the conditions below.

- (1) System configuration
 - Constant-speed control for Axis 4.



- (2) Positioning conditions
 - (a) The constant-speed control conditions are shown below.

ltem		Setting
Servo program number		500
Controlled axis	\$	Axis 4
Positioning sp	bee	10000
Number of rep	etitions	100
	P1	-1000
Pass point	P2	2000
travel value	P3	-2000
	P4	1000

- (b) Constant-speed control start command leading edge of X000 (OFF \rightarrow ON)
- (3) Details of positioning operation



7. POSITIONING CONTROL

(4) Operation timing

The operation timing for servo program No. 500 is shown below.



(5) Servo program

The servo program No. 500 for constant-speed control is shown below.



(6) Sequence program

The sequence program which runs the servo program is shown below.



7.16.4 Two- to four-axis constant-speed control

				ttems Set by Peripherals																								
					<u></u>	<u></u>	omn I	on		·		Arc				_ P:	erem I	eter	Bio	ck_					ther			
in	Serv o struction	Positioning Method	Number of Controllable Axes	Parametar Block No.	Axis	Address/Travel Value	Commanded Speed	Dwell Time	M Code	Torque Limit Value	Auxiliary Point	Radius	Center Point	Control Units	Speed Limit Value	Acceleration Time	Deceleration Time	Rapid Stop Deceleration Time	Torque Limit Value	Deceleration Processing on Stop input	Allowable Error Range for Circutar Interpolation	8-Curve Ratio	Commanded speed (constant-speed)	Cancel	Start	Skip	Fin Acceleration	Speed Change
	CPSTART2		2	Δ	0		0								۵	۵	۵	۵	Δ	۵	Δ	۵		Δ	۵		Δ	
Start	CPSTART3	-	3	▲	0		0								Δ	۵	۵	▲	Δ	Δ		۵		Δ	Δ		Δ	
	CPSTART4		4	▲	0	ļ	0								Δ	Δ	▲	Δ	۵	Δ		۸		Δ	Δ		۵	
End	CPEND		-					Δ				<u> </u>					L											
	ABS-2		2		0	0			Δ	Δ		<u> </u>									_		Δ			Δ		
	ABS-3		3		0	•			Δ	Δ													۵			Δ		
	ABS-4		4		0	0			Δ	Δ													۵			Δ		
	ABS 🔊				0	0	Í		Δ	Δ	0															۵		
	ABS (Absolute data	2		o	0			۵	۵		0											۵			۵		oĸ
Pass point	ABS 🕋				0	o			۸	۵			0										۵			۵		
	INC-2		2		0	0			۵	۵													Δ			Δ		
	INC-3		3		0	0			۵	۵													۸			۵		
	INC-4		4		0	0			۵	۵													۵			۵		
					0	0			۵	۵	0												۵			4		
		Incremental	2		Ō	0			۵	۵		o											۵			۵		
					0	o			۵	۵			0										۵			۵		

Constant-speed control for the two, three, or four axes designated with the sequence program positioning commands.

O : Must be set

 $\Delta: \textbf{Set if required}$

[Control Details]

Starting and Ending Two- to Four-Axis Constant-Speed Control

Two-, three-, or four-axis constant-speed control is started and ended using one of the following instructions:

- (1) CPSTART2 Starts two-axis constant-speed control. Sets the axis numbers used and the commanded speed.
- (2) CPSTART3 Starts three-axis constant-speed control. Sets the axis numbers used and the commanded speed.
- (3) CPSTART4 Starts four-axis constant-speed control. Sets the axis numbers used and the commanded speed.
- (4) CPEND Ends the two-, three-, or four-axis constant-speed control which was started using CPSTART2, CPSTART3, or CPSTART4.

Positioning Control Method to the Pass Point

The positioning control to the point where control is changed is designated using the following instructions:

- ABS-2/INC-2 Designates two-axis linear interpolation control. See Section 7.3 "Two-axis Linear Interpolation Control" for details.
- (2) ABS-3/INC-3

Designates three-axis linear interpolation control. See Section 7.4 "Three-axis Linear Interpolation Control" for details.

- (3) ABS-4/INC-4
 Designates four-axis linear interpolation control.
 See Section 7.5 "Four-axis Linear Interpolation Control" for details.
- (4) ABS/INC
 Designates circular interpolation control using auxiliary point designation.
 See Section 7.6 "Circular Interpolation Using Auxiliary Point Designation" for details.
- (5) ABS/INC , ABS/INC , ABS/INC , ABS/INC Designates circular interpolation control using radius designation. See Section 7.7 "Circular Interpolation Using Radius Designation" for details.
- (6) ABS/INC , ABS/INC
 Designates circular interpolation control using center point designation.
 See Section 7.8 "Circular Interpolation Using Center Point Designation" for details.

[Program Example]

- (1) This program executes two-axis constant-speed control under the conditions below.
 - (a) System configuration Constant-speed control for Axis 2 and Axis 3.



- (b) Positioning conditions
 - 1) The constant-speed control conditions are shown below.

ltem			Setting	
Servo prog number	ram		505	
Positioning	speed		10000	
Positioning method		2-axis linear interpolation	Circular Interpolation Using Radius Designation	2-axis linear interpolation
Page point	Axis 2	30000	50000	90000
r ass point	Axis 3	30000	50000	100000

2) Constant-speed control start command leading edge of X000 (OFF \rightarrow ON)

- <K 505> CPSTART2 Start constant-speed control Axis 2 Axis used..... Axis 2, Axis 3 Axis 3 Positioning speed......10000 Speed 10000 Two-axis linear interpolation control ABS-2 Axis 2....30000 Axis 30000 2, Positioning address Axis 3....30000 Axis 3. 30000 ABS C Circular interpolation control Axis 2, 50000 Axis 2....50000 Positioning address 50000 Axis 3, Axis 3....50000 Radius 20000 Radius..... 20000 ABS-2 Axis - Two-axis linear interpolation control 2, 90000 Axis З, 100000 Axis 2....90000 Positioning address CPEND Axis 3....100000 End constant-speed control
- (c) Servo program

Servo program No. 505 for constant-speed control is shown below.

(d) Sequence program

The sequence program which runs the servo program is shown below.

o	M9039	(M2000)-	Turns ON PC ready.
2	M9074	(M2042)-	Turns ON all axes servo start command.
4	X0000 M9074 M2009 M9076	M550]-	Turns ON servo program No. 505 start command flag
11	M550	M551]-	\int (M551) when X000 turns OFF \rightarrow ON.
13	M9074 M551 M2002 M2003	^к 505 Ъ	Servo program No. 505 exe- cution request.
CIF		M551]}	Turns OFF M551 on comple- tion of servo program No. 505 execution request.

[Program Example]

- (2) This program executes four-axis constant-speed control under the conditions below.
 - (a) System configuration Constant-speed control for Axis 1, Axis 2, Axis 3, and Axis 4.



(b) Positioning details The positioning by the Axis 1, Axis 2, Axis 3, and Axis 4 servomotors is shown in the diagram below.



Figure 7.30 Axis Configuration

7. POSITIONING CONTROL



Figure 7.31 Positioning by Four-Axis Constant-Speed Control

(c) Positioning conditions

1) The constant-speed control conditions are shown below.

item			Setting	
Servo progi number	am		506	
Positioning	speed		10000	
Positioning method		4-Axis Linear Interpolation	4-Axis Linear Interpolation	4-Axis Linear Interpolation
	Axis 1	3000	5000	5000
Pass point	Axis 2	4000	3500	3500
	Axis 3	4000	-4000	3000
	Axis 4	4000	-6000	6000

2) Constant-speed control start command leading edge of X000 (OFF \rightarrow ON)

(d) Servo program

The servo program No. 506 for constant-speed control is shown below.



(e) Sequence program

The sequence program which runs the servo program is shown below.

	l		1	
0	M9039		(M2000)-	Turns ON PC ready.
2	M9074		(M2042)-	Turns ON all axes servo start command.
4		-[PLS	м550 Э	Turns ON servo program No. 506 start command flag
11		-[SET	M551]-	(M551) when X000 turns OFF $\rightarrow ON$
13	M9074 M551 M2001 M2002 M2003 M2004	J1J2J3J4	к 506]-	Servo program No. 506 exe- cution request.
CIF		-{RST	M551]-	Turns OFF M551 on comple- tion of servo program No. 506 execution request.

7.16.5 Pass point skip function

This is a function whereby, by setting a skip signal for each pass point associated with a constant speed control instruction, positioning at the current point can be canceled and positioning carried out at the next point.

[Data setting]

 (1) Skip signal device The following devices can be designated as skip signal devices.
 X, Y, M, TC, TT, CC, CT, B, F

[Notes]

- (1) If absolute circular interpolation is designated at or beyond the point where the skip signal was designated, set absolute linear interpolation up to that point. Otherwise, an error occurs and operation stops.
- (2) When a skip signal is input at the final point, deceleration to a stop occurs at that point and the program is ended.

[Program example]



7.16.6 FIN signal wait function

This is a function whereby, when the FIN wait function is selected and an M code is set for each point on the way, the end of processing of each point on the way is synchronized with the FIN signal, and positioning at the subsequent point is carried out when the FIN signal comes ON.

[Data setting]

 When the FIN signal wait function is selected, the fixed acceleration/deceleration time method is used. Set the acceleration/deceleration time within the range 1 ms to 5000 ms in the servo program by using the "FIN acceleration/deceleration" option. Indirect setting is also possible by using D and W devices (1 word).

[Notes]

- (1) If the acceleration/deceleration time designation is outside the permissible range, the servo program setting error "13" will occur on starting and control will be performed with an acceleration/deceleration time of 1000 ms.
- (2) When interpolation is performed, the M code output in progress signal is output for all interpolation axes. In this case, turn ON the signal for one of the interpolating axes.
- (3) When an M code is set at the final point, positioning is completed after the FIN signal has gone from OFF to ON to OFF.

[Program example]

1	<k 0=""> CPSTART Axis Axis Speed FIN acce decelera ABS-2 Axis Axis M code ABS-2 Axis Axis M code Axis M code</k>	2 1 2 eleratic tion 1, 2, 1, 2,	10000 pn/ 100 200000 200000 10 300000 250000 11	Currently executed point M code P→S M code output in progress FIN signal S→P Explanatory 1. When the positioning at point 1 starts, an M code is output and the M code output in progress signal comes ON. 2. On receiving this signal, the relevant processing is performed at the PC, and then the FIN signal is
3	ABS-2 Axis Axis M code	1, 2,	350000 300000 12	switched ON. Operation does not proceed to the next point until the FIN signal comes ON. 3. When the FIN signal is turned ON from the programmable controller, the M code output in
4	ABS-2 Axis Axis CPEND	1, 2,	400000 400000	 progress signal goes OFF. 4. After the M code output in progress signal has gone OFF, the FIN signal is turned OFF from the programmable controller. After that, positioning at the next point, point 2, starts.

POINT





7.17 Position Follow-Up Control

After a single control start, positioning occurs to the address set with the word device of the servo system CPU designated in the servo program. Position follow-up control is started using the PFSTART servo program instruction.

											Item	s Set	by P	eriph	erals							_		
					c	omm	on				Arc				<u> </u>	eran	neter	Bloc	k			Others		
Servo Instruction	Positioning Method	Number of Controliable Axes	Parameter Blook No.	Axto	Address/Travel Value	Commanded Speed	Dwell Time	M Code	Torque Limit Vatue	Auxiliary Point	Radius	Center Point	Control Unit	Speed Limit Value	Acceleration Time	Deceleration Time	Rapid Stop Deceleration Time	Torque Limit Value	Deceleration Processing on Stop input	Allowable Error Range for Circular Interpotation	S Curve Ratio	Cancel	start	Speed Change
PESTART	Absolute	1	Δ	0	0	0		Δ						۸	٨	۸	۵	۵	Δ		Δ	Δ	Δ	ок

O: Must be set

 Δ : Set if required

[Control Details]

Control Using PFSTART Instruction

- (1) Positioning to the address set with the word device of the servo system CPU designated in the servo program.
- (2) Position follow-up control is executed until the stop instruction is input. If the word device value changes while control is progress, positioning is executed to the changed address.



7. POSITIONING CONTROL

[Cautions]

- (1) The number of controllable axes is limited to one.
- (2) Only the absolute data method (ABSD) is used for positioning control to the pass points.
- (3) The speed can be changed after control is started. The changed speed remains valid until the stop command is input.
- (4) Set the positioning address in the servo program using indirect designation with the word devices D and W.
- (5) Use only even-numbered devices for indirect designation of positioning addresses in a servo program. If odd-numbered devices are used, when an attempt is made to start the control error 141 occurs and control does not start.
- (6) Positioning speeds can be set in the servo program using indirect designation with the word devices D and W. However, this set speed is valid only at the start of position follow-up control (on execution of SVST, DSFRP instructions) and the speed does not change if the indirect designations are changed while control is in progress.

[Program Example]

(1) System configuration Position follow-up control of Axis 3.



- (2) Positioning conditions
 - (a) The position follow-up conditions are shown below.

item	Setting
Servo program number	100
Controlled axis	Axis 3
Positioning address	D50
Positioning speed	20000

(b) Position follow-up control start command leading edge of X000 (OFF \rightarrow ON)

7. POSITIONING CONTROL

(3) Operation timing

The operation timing for position follow-up control is shown below.



(4) Servo program

The servo program No. 100 for position follow-up control is shown below.



(5) Sequence program

The sequence program which runs the servo program is shown below.



7.18 Simultaneous Start

After a single control start, the designated servo programs start simultaneously.

items Set by Peripherals Common Parameter Block Others Allowable Error Range for Circular Interpolation Deceleration Processing on Stop input Number of Positioning Servo Time Controllable Instruction Method Ares Rapid Stop Deceleration **Condition of repetitions** Address/Travel Value Parameter Block No. Commanded Speed **Forque Limit Value Forque Limit Value Bpeed Limit Value** Acceleration Time **Deceieration Time** Program number **Auxiliary Point** Speed Change **8 Curve Ratio Center Point** ontrol Unit Dwell Time M Code Radiue Axis START o . . .

Use the START instruction to simultaneously start servo programs.

O: Must be set

Differs according to serve program started.

[Control Details]

Control Using START Instruction

- (1) Simultaneously start the designated servo programs.
- (2) Any servo program can be designated, except the simultaneous start (START instruction) servo program.
- (3) Up to three servo programs can be designated.
- (4) After the simultaneous start, each axis is controlled by the designated servo program.

[Cautions]

(1) A check is made at the simultaneous start. An error occurs and operation does not start in the cases shown in the table below.

Error	Error Processing	Stored Codes						
EITO	Error Processing	D9189	D9190					
Designated servo program does not exist	Servo program setting error flag	Program number causing error	10					
START instruction designated as servo program	(M9079): ON Start accept flag	on simultaneous start	19					
A servo program cannot start due to an error	(M2001+n): OFF	Program number for which error occurred on simultaneous start	Error Item Data (see Section 6.3)					

- (2) The servo programs cannot be designated for the START instruction using indirect designation.
- (3) If the servo programs designated for the START instruction include fixed-pitch feed control or speed/position switching control, start may be delayed a maximum of one second compared to other speed control or position control.

[Program Example]

- This program executes simultaneous start under the conditions below. (1) System configuration
 - Simultaneous start of Axis 1, Axis 2, Axis 3, and Axis 4.



- (2) Quantity and numbers of servo programs designated(a) Designated servo programs: 3
 - (b) Designated servo program numbers

Servo Program No.	Axis	Control Details
1	1, 2	Circular interpolation control
14	3	Speed control
45	4	Home position return control

(3) Start conditions

- (a) Simultaneous start servo program number......No. 121
- (b) Simultaneous start run command...... leading edge of X100 (OFF \rightarrow ON)

(4) Servo program

The simultaneous start servo program No. 121 is shown below.



7. POSITIONING CONTROL

- M9039 (M2000)-Turns ON PC ready. 0 -11-M9074 Turns ON all axes servo start 2 (M2042) -11 command. X0000 M9074 M2009 M9076 Turns ON servo program No. -[PLS м121 Ӈ) 4 H. 121 start command flag M121 (M122) when X000 turns OFF м122 Ъ∫∫ 11 -[SET -→ ON. M9074 M122 M2001 M2002 M2003 M2004 κ Servo program No. 121 exe-13 -[SVST J1J3J4 121 Э 11 -14 -14 ٩٢ -11 -Jł cution request. Turns OFF M122 on comple--[RST M122] tion of servo program No. 121 execution request. CIRCUIT END
- (5) Sequence program

The sequence program which runs the servo program is shown below.

7.19 JOG Operation

Runs the set JOG operation.

Individual start or simultaneous start can be used for JOG operation. JOG operation can be run from a sequence program or in a peripheral device test mode.

(For information on running JOG operation in a peripheral device test mode, refer to the operation manual for the appropriate peripheral device.) To carry out JOG operation, the JOG operation must be set for each axis.

7.19.1 JOG operation data

The JOG operation data is the data required to carry out JOG operation. Set the JOG operation data from a peripheral device.

						Setting Range				Defaul	t		Explane-
No	. Item	mm		inch degree		degree		PULSE	PULSE		13-34-	Remarks	tory
		Setting Range	Units	Setting Range	Units	Setting Range	Units	Setting Range	Units	Value			Section
Γ												 Sets the max. speed during JOG operation. 	
t	JOG speed limit value	0.01 to 6000000.00	mm/ min	0.001 to 600000.000	inch/ min	0.001 to 600000.000	degree / min	1 to 1000000	PLS/ sec	20000	PLS/	 The JOG speed limit value becomes the JOG operation speed if the JOG operation speed is set greater than JOG speed limit value. 	<u> </u>
2	Parameter block setting		1 to 16 (A171/A273UHCPU (8-axis specification)) 1 to 64 (A273UHCPU (32-axis specification))							1	-	 Sets the parameter block number used for JOG operation. 	4.4

Table 7.2 Table of JOG Operation Data

(1) JOG operation data check

A relative check of the JOG operation data is executed at the following times:

- Power on
- On PC ready (M2000) leading edge (OFF→ ON)
- When test mode is selected.
- (2) Data error processing
 - Only data for which errors were detected during the relative check is changed to its default value for JOG operation control.
 - The error code corresponding to the data for axes where an error was detected is stored in the data register.



7.19.2 Individual start

Starts JOG operation for the designated axes.

JOG operation is controlled by the following JOG operation signals:

- Forward JOG operation M1802+20n
- Reverse JOG operationM1803+20n

[Control Details]

(1) JOG operation continues at the speed value stored in the JOG operation speed setting register while the JOG operation signal remains ON and a deceleration stop occurs when the JOG operation signal turns OFF. Control of acceleration and deceleration is based on the JOG operation data settings.



JOG operation carried out for axes for which the JOG operation signal is ON.

(2) The JOG operation signal, JOG operation setting register, and setting range for each axis are shown in the table below.

<a1 100f02<="" th=""><th><a></th><th>17</th><th>71</th><th>S</th><th>C</th><th>P</th><th>U</th><th>></th><th></th></a1>	<a>	17	71	S	C	P	U	>	
--	---------	----	----	---	---	---	---	---	--

			JOG Operation Setting					Setting	Range									
No.	100.01	Peration	Reg	ister	m	m	In	ch	deg	1.66	PU	.8E						
	Forward JOG	Reverse	Most Significant	Least Significant	Setting Range	Units	Setting Range	Unite	Setting Range	Ualte	Setting Range	Units						
1	M1802	M1803	D965	D964								-2		-5		-3		
2	M1822	M1823	D971	D970	1 to	× 10	1 to	× 10	1 to	× 10	1 to	PLS/sec						
3	M1842	M1843_	D977	D976	60000000	mmminin	60000000	manarinan	60000000	manyimin	1000000							
4	M1862	M1863	D983	D982														

See Section 3.4.2 for the JOG operation signal and JOG operation setting register used for each axis with the A273UHCPU (8-/32-axis specification) However, the setting ranges are the same as those shown in the table above.

OINT
To set the JOG operation speed using a sequence program, store a value in the JOG operation speed setting register which is 100 times the actual speed in units of millimeters or 1000 times the speed in units of inches or degrees.
To set a JOG operation speed of 6000.00 mm/min., store the value 600000 in the JOG operation speed setting register.

[Cautions]

(1) Forward JOG operation occurs if the forward JOG signal (M1802+20n) and reverse JOG signal (M1803+20n) turn ON simultaneously for a single axis.

After the forward JOG signal turns OFF and deceleration stop is complete, reverse JOG operation starts if the reverse JOG operation signal remains ON.



(2) If the JOG operation signal turns back ON during deceleration after the JOG operation signal previously turned OFF, deceleration continues until the speed reaches zero before JOG operation is restarted.



(3) JOG operation cannot be started by the JOG operation signals (M1802+20n/M1803+20n) in a peripheral device test mode. JOG operation starts on the leading edge (OFF \rightarrow ON) of the JOG operation signal after the test mode is reset.



[Program Example]

.

- This program executes JOG operation under the conditions below.
 - (1) System configuration JOG operation of Axis 4.



(2) JOG operation conditions

- (a) Axis number Axis 4
- (b) JOG operation speed1000
- (c) JOG operation commands
 - 1) Forward JOG operationX000 ON
 - 2) Reverse JOG operationX001 ON

(3) Sequence program

0	M9039 	(M2000)-	Turns ON PC ready.
2		(M2042)-	Turns ON all axes servo start command.
4		D982]	Stores JOG operation speed (1000) in D982, D983 when
		M140 3	X000 or X001 is ON.
	X140 X0000 M1863	(),,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Turns ON M140 when storage of JOG operation speed is com-
10	X140 X0001 M1862	(1002)	plete.
22		(M1863)-	Forward JOG operation.
26	x0000 x0001 	M140]	Reverse JOG operation.
CIRC		1	Turns OFF M140 when X000 and X001 turn OFF.

7.19.3 Simultaneous start

Simultaneously starts JOG operation designated for multiple axes.

[Control Details]

(1) JOG operation continues at the speed value stored in the JOG operation speed setting register for each axis while the JOG simultaneous start command (M2015) remains ON, and a deceleration stop occurs when M2015 turns OFF.

Control of acceleration and deceleration is based on the JOG operation data settings.



(2) JOG operation is carried out on the axes set in the JOG simultaneous start axis setting area (D1015).



(3) The JOG operation speed setting registers are described below.

<A171SCPU>

	JOG OF	peration	Speed Change Value							
Axis	is Register		mm		inch		degree		PULSE	
No.	Most Signifi- cant	Leest Signifi- cant	Set Range	Units	Set Range	Units	Set Range	Units	Set Range	Units
1	D965	D964				•				
2	D971	D970	1 to	× 10	1 to	× 10	1 to	× 10	1 to	PLS/sec
3	D977	D976	600000000	mm/min	600000000	mm/min	600000000	mm/min	1000000	
4	D983	D982]							

 See Section 3.4.2 for the JOG operation speed setting register used for each axis with the A273UHCPU (8-/32-axis specification) However, the speed change values are the same as those shown in the table above.

[Program Example]

This program executes simultaneous start of JOG operations under the conditions below.

- (1) System configuration
 - JOG operation of Axis 1, Axis 2, and Axis 4.



- (2) JOG operation conditions
 - (a) The JOG operation conditions are tabled below.

Item		JOG					
Axis number	Axis 1	Axis 2	Axis 4				
JOG operation speed	1000	500	1000				
JOG operation direction	Forward	Forward	Reverse				

(b) JOG operation command X000 ON

(3) Sequence program

0 →	(M2000)- Turns ON PC ready.
2	M2042) command. D1015] Stores in D1015 JOG operation axes while X000 is ON.
- [DMOV 1000	Desa]- Desa]- Desa]- Propriate JOG operation speed
[DMOV 1000	D982 ⊣ Turns ON M141 when setting is M141 → complete for simultaneous start
x0000 M141 38 -	Axes and JOG operation speeds.
CIRCUIT END	Turns OFF M141 when X000 turns OFF.

7.20 Manual Pulse Generator Operation

Positioning control according to the number of pulses input from the manual pulse generator.

Simultaneous operation of 1 to 3 axes is possible with one manual pulse generator; the number of modules that can be connected is as shown below.

	Number Connectable to the Manual Pulse Generator
A171SCPU	1
A273UHCPU (8-/32-axis specifcation)	3

IMPORTANT

When two or more A273EX are installed, connect the manual pulse generator to the first A273EX (counting from slot 0 of the main base unit).

(Only one manual pulse generator can be used.)

[Control Details]

 Positioning of the axes set in the manual pulse generator axis setting register according to the pulses input from the manual pulse generator. Manual pulse generator operation is only valid while the manual pulse generator enable flag is ON.

<A171SCPU>

Manual Pulse Generator Axis Setting Register	Manual Pulse Generator Enable Flag				
D1012	D2012				

<A273UHCPU (8-axis specification)>

Manual Puise Generator Connected Position	Manual Puise Generator Axis Setting Register	Manual Pulse Generator Enable Flag
P1	D1012	M2012
P2	D1013	M2013
P3	D1014	M2014

<A273UHCPU (32-axis specification)>

Manual Pulse Generator Connected Position	Manual Pulse Generator Axis Setting Register	Manual Pulse Generator Enable Flag
P1	D714, D715	M2051
P2	D716, D717	M2052
P3	D718, D719	M2053

- (2) The travel value and output speed are shown below for positioning control due to manual pulse generator output.
 - (a) Travel value

The travel value due to the input of pulses from a manual pulse generator is calculated using the following formula.

[travel value] = [travel value per pulse] × [number of input pulses] × [manual pulse generator input multiplication factor setting] The travel value per pulse during manual pulse generator operation is shown in the following table.

Units	Travel Value	
mm	0.1 μm	
inch	0.00001 inch	
degree	0.00001 degree	
PLUSE	1 PULSE	

For units of millimeters, the commanded travel value for input of one pulse is: $(0.1 \ \mu m) \times (1 \ pulse) \times (manual \ pulse \ generator \ input \ magnification \ setting)$

(b) Output speed

The output speed is the positioning speed corresponding to the number of pulses input from a manual pulse generator in unit time.

[output speed] = [input pulses per 1 ms] × [manual pulse generator input multiplication factor setting]

- B) Setting the axes controlled by the manual pulse generator
 - (a) The axes controlled by the manual pulse generator are set in the manual pulse generator axis setting register (D1012/D1012 to D1014/D714 to D719).
 - <A171SCPU/A273UHCPU (8-axis specification)> The value is set as a maximum of three decimal digits, with each digit representing an axis from Axis 1 to Axis 4/Axis 1 to Axis 8. (The number of digits represents the number of simultaneously controlled axes.)



<A273UHCPU (32-axis specification)>

Set bits corresponding to the controlled axes (1 to 32).

To control axis 1 and axis 22 and axis 30 with manual pulse	
generator 1, make the following settings.	

 b15
 b14
 b13
 b12
 b11
 b10
 b9
 b8
 b7
 b6
 b5
 b4
 b3
 b2
 b1
 b0

 D714
 Axis 16
 b12
 b11
 b10
 b9
 b8
 b7
 b6
 b5
 b4
 b3
 b2
 b1
 b0

 D714
 Axis 16
 b14
 b13
 b12
 b11
 b10
 b2
 b14
 b13
 b2
 b1
 b0

 D714
 Axis 16
 b14
 b13
 b12
 b11
 b10
 b2
 b14
 b13
 b2
 b1
 b0

D715 Axie 32 Axie 31 Axie 30 Axie 26 Axie 28 Axie 27 Axie 28 Axie 28 Axie 28 Axie 28 Axie 28 Axie 21 Axie 20 Axie 19 Axie 18 Axie 17

D714

(1) When set in hexadecimal (H)..... DMOV H2020001

When	set in	decimal	(K)	·····	┨┝───	DMOV	K538968065	D714
		a tan baran	Marchine .			1997 - 19		

(3)

1

1

I

1 (2)

Evampla

REMARK

The connected position of the manual pulse generator used with the A273UHCPU (8-/32-axis specification) indicates the A273EX connector pin (P1, P2, P3) to which the manual pulse generator is connected.

See the A273UHCPU (8/32-axis specification) Motion Controller User's Manual (IB-67262 for details about A273EX.)

- (4) Manual pulse generator 1-pulse input magnification
 - (a) The magnification setting for a 1 pulse input from the manual pulse generator is set for each axis.

<A171SCPU>

1-puise input Magnification Setting Register	Corresponding Axis No.	Setting Range
D1016	Axis 1	
D1017	Axis 2	1-100
D1018	Axis 3	
D1019	Axis 4	

<A273UHCPU (8-axis)>

1-puise Input Magnification Setting Register	Corresponding Axis No.	Setting Range
D1016	Axis 1	
D1017	Axis 2	
D1018	Axis 3	
D1019	Axis 4	1-100
D1020	Axis 5	
D1021	Axis 6	
D1022	Axis 7	
D1023	Axis 8	

<A273UHCPU (32-axis)>

1-pulse input Magnification Setting Register	Corresponding Axis No.	Setting Range
D720	Axis 1	
D721	Axis 2	
D722	Axis 3	
D723	Axis 4	
D724	Axis 5	
D725	Axis 6	
D726	Axis 7	
D727	Axis 8	
D728	Axis 9	
D739	Axis 10	
D730	Axis 11	
D731	Axis 12	
D732	Axis 13	1-100
D733	Axis 14	
D734	Axis 15	
D735	Axis 16	
D736	Axis 17	
D737	Axis 18	
D738	Axis 19	
D739	Axis 20	
D740	Axis 21	
D741	Axis 22	
D742	Axis 23	
D743	Axis 24	
D744	Axis 25	
D745	Axis 26	
D746	Axis 27	
D747	Axis 28	
D748	Axis 29	
D749	Axis 30	
D750	Axis 31	
D751	Axis 32	

(5) At the leading edge of the manual pulse generator enable flag, a check is made in the manual pulse generator 1-pulse input magnification setting registers of the manual pulse generator input magnifications set for the appropriate axes.

If an out-of-range value is detected, the manual pulse generator axis setting error register (D9187) and manual pulse generator axis setting error flag (M9077) are set and a value of 1 is used for the magnification.

(6) Manual pulse generator smoothing magnification setting Set a magnification to smooth the leading edge and trailing edge of manual pulse generator operation.

<a1 150pu=""></a1>		<a273uhcpu (32-axis)=""></a273uhcpu>
Manual Pulse Generator Smoothing Magnification Setting Register	Setting Range	Manual Pulse Generator Smoothing Setting Magnification Setting Register Range
D9192	0 to59	Manual pulse generator 1 (P1) : D752
<a273uhcpu (8-axis)=""></a273uhcpu>		Manual pulse generator 2 (P2) : D753 0 to59
Manual Pulse Generator Smoothing Magnification Setting Register	Setting Range	Manual pulse generator 5 (FS) . Dros
Manuai puise generator 1 (P1) : D9192 Manual puise generator 2 (P2) : D9193 Manual puise generator 3 (P3) : D9194	0 to59	
(a) Op	eration	·
Man	ual puise gene	rator input
Man enal	ual puise gene ble flag (M2012	rator OFF
Output speed (V1)	= (number (pulses/m	of input $) \times ($ manual pulse generator 1 pulse $)$ as
Travel value (L) =	(travel value) per pulse	e) x $\begin{pmatrix} number \\ of input \\ pulses \end{pmatrix}$ x $\begin{pmatrix} manual pulse generator 1 \\ pulse input magnification \\ setting \end{pmatrix}$
(1) The travel • Setting u) value per manu ınit — r	al pulse generator pulse is as follows. mm : 0.1 μm

PULSE : 1 pulse(2) The smoothing time constant is a value in the range 56.8 ms to 3408 ms.

- degree : 0.00001 degree
(7) Details of errors occurring during the setting of data for manual pulse generator operation are shown in the table below.

Error Details	Error Processing		
A digit was set outside the ranges 1-4, 1-8, or 1-32.	 Digit ignored where error occurred. Manual pulse generator of valid axes with settings in rang es 1-4, 1-8, or 1-32. 		
The designated axis is set for manual pulse generator operation.	 Duplicated designated axis ignored. Executes the manual pulse generator operation set first. 		
More than 4 digits set	All set axes ignored		

[Cautions]

 The start accept flag turns ON for axes during manual pulse generator operation.
 Consequently, positioning control or home position return cannot be started by the servo system CPU or a peripheral device.

Turn OFF the manual pulse generator enable flag when manual pulse generator operation is complete.

- (2) The torque limit value is fixed at 300% during manual pulse generator operation.
- (3) When the manual pulse generator enable flag comes ON for a driven axis, for example one performing positioning control or JOG operation, error 214 is set for the relevant axis and manual pulse generator input is not enabled. After the axis has been stopped, the rise of the manual pulse generator enable flag is validated, the manual pulse generator input enabled status is established, the start accept flag comes ON, and input from the manual pulse generator is accepted.
- (4) If the manual pulse generator enable flag for another manual pulse generator No. is turned ON for an axis currently performing manual pulse generator operation, error 214 is set for the relevant axis and the input of that manual pulse generator is not enabled.
- (5) If, after the manual pulse generator enable flag has been turned OFF, it is turned ON again for an axis that is performing smoothing deceleration, error 214 is set and manual pulse generator input is not enabled. Turn the manual pulse generator enable flag ON after smoothing deceleration to a stop (after the start accept flag has gone OFF).
- (6) If, after the manual pulse generator enable flag has been turned OFF, another axis is set during smoothing deceleration and the same manual pulse generator enable flag is turned ON again, manual pulse generator input will not be enabled. In this case, the manual pulse generator axis setting error bit of the manual pulse generator axis setting error storage register (D9187) comes ON, and the manual pulse generator axis setting error flag (M9077) comes ON. Establish an interlock such that the start accept flag of the designated axis going OFF is a condition for the manual pulse generator enable flag coming ON.

[Procedure for Manual Pulse Generator Operation]

The procedure for manual pulse generator operation is shown below.



[Program Example]

This program executes manual pulse generator operation under the conditions below.

(1) System configuration

Manual pulse generator operation of Axis 1.



- (2) Manual pulse generator operation conditions(a) Manual pulse generator operation axis......Axis 1
 - (b) Manual pulse generator 1-pulse input100 magnification
 - (c) Manual pulse generator operation enable......leading edge of X000 (OFF \rightarrow ON)
 - (d) Manual pulse generator operation complete....leading edge of X001 (OFF \rightarrow ON)
- (3) Sequence program

A sequence program for manual pulse generator operation is shown below.

0	M9039	(M2000)- Turns ON PC ready. Turns ON all axes servo
4	X0000 M9074 M2009 M9076 Image: State Sta	$\begin{array}{rl} \text{start command.} \\ \text{S} & \text{M140} \end{bmatrix} & \text{Detects leading edge of} \\ & \text{X000} (\text{OFF} \rightarrow \text{ON}) \\ & \text{D1012]} & \text{Sets axis (Axis 1) for manual pulse generator opera-} \end{array}$
	- [MOV 100	D1016] tion. Axis 1 manual pulse gener- ator 1-pulse input magnifi- cation Cation
25 29 CIRC		M141 generator enable flag. Turns OFF manual pulse generator enable flag when X001 turns ON.

7.21 Home Position Return

- (1) Use home position return at power on and other times where confirmation that axes are at the machine home position is required.
- (2) The following three methods of home position return are available:
 - Near-zero point dog method Used when not using an absolute
 - Count method _____ position system
 - Data set method......(Recommended for an absolute-position system)
- (3) To carry out home position return, the home position return data must be set for each axis.

7.21.1 Home position return data

The home position return data is the data required to carry out home position return.

Set the home position return data from a peripheral device.

Table 7.3 Table of Home Position Return Data

Г		Setting Range								Default		Explane-
No	. Item	mm		Inch	· · · · · · · ·	degree	<i>p</i>	PULSE		Initial	Remarks	tory
∟		Setting Range	Units	Setting Range	Units	Setting Range	Units	Setting Range	Units	Value		Section
1	Home position return direction	0: reverse d 1: forward d	irection irection	(decreased addre (increased addre	122) 53)					o	 Sets the direction for home position return. Axis travels in designated direction after home posi- tion return is started. 	-
2	Home position return method	0: near-zero 1: count me 2: data set r	point d thod nethod	og method						o	 Sets the home position re- turn method. The near-zero point dog method or count method is recommended for a servo amplifier which does not support abso- lute data, and the data set method is recom- mended for a servo am- plifier which supports absolute data. 	_
з	Home position address	-2147483648 to 2147483647	×10 ⁻¹ µm	-2147483648 to 2147483647	×10 ⁻⁵ inch	0 to 3599 9999	×10 ⁻⁵ degree	-2147483648 to 2147483647	PLS	0	 Sets the present value of the home position after home position return. It is recommended that the home position ad- dress is set at the stroke limit upper limit or lower limit. 	-
4	Home position return speed	0.01 to 6000000.00	rnm∕ min	0.001 to 600000.000	inch/ min	0.001 to 600000.000	degree/ min	1 to 1000000	PLS/ sec	1	a Sets the speed for home position return.	-
5	Creep speed	0.01 to 6000000.00	rnm/ min	0.001 to 600000.000	inch/ min	0.001 to 600060.000	degree/ min	1 to 1000000	PLS/ sec	1	s Sets the creep speed (low speed immediately before stopping after de- celeration from home position return speed) after the near-zero point dog.	_
6	Travel value after near- zero point dog	0 to 214748364.7	μm	0 to 21474.83647	inch	0 to 21474.83647	degræe	0 to 2147 4836 47	PLS	_	 Sets the travel value after the near-zero point dog for the count method. Set greater than the de- celeration distance at the home position return speed. 	7.21.1 (1)
7	Parameter block setting			1 to 16 (A171S/A 1 to 64 (A273	273UHC UHCPU	PU (8-axis speci (32-axis specific	fication)) ation)))		1	Sets the parameter block to use for home position return (see Section 4.4).	-

7. POSITIONING CONTROL

- (1) Setting the travel value after near-zero point dog
 - (a) This parameter sets the travel value after the near-zero point dog turns ON for home position return using the count method.
 - (b) After the near-zero point dog turns ON, the home position is the first zero point after travel by the set travel value is complete.
 - (c) Set the travel value after the near-zero point dog turns ON greater than the deceleration distance at the home position return speed.



7.21.2 Home position return by the near-zero point dog method

- (1) Near-zero point dog method Using the near-zero point dog method, the home position is the first zero point after the near- zero point dog turns OFF.
- (2) Home position return by the near-zero point dog method The home position return operation using the near-zero point dog method is shown in Fig. 7.32.



Fig. 7.32 Operation of Home Position Return by the Near-Zero Point Dog Method

- (3) Running home position return To run home position return, use the servo program described in Section 7.21.5.
- (4) Cautions

Take note of the following points during home position return by the near-zero point dog method.

(a) Keep the near-zero point dog ON during deceleration from the home position return speed to the creep speed.

A deceleration stop occurs if the near-zero point dog turns OFF before deceleration to the creep speed, and the next zero point becomes the home position.



(b) Adjust the position where the near-zero point dog turns OFF, such that the home position return second travel value becomes half the travel value for one revolution of the motor.

A home position discrepancy equivalent to one revolution of the motor may occur if the home position return travel value is less than half the travel value for one revolution of the motor.



IMPORTANT

- (1) In the following cases, before starting the home position return, use JOG operation or some other method to return the axis to a position before where the near-zero point dog turned ON. Home position return will not start unless the axis is returned to a position before the near-zero point dog position.
 - (a) Home position return from a position after the near-zero point dog turned OFF.
 - (b) When the power is turned ON after home position return was completed.

7.21.3 Home position return by the count method

(1) Count method

Using the count method, the home position is the first zero point after a designated distance (travel value after near-zero point dog turns ON) after the near-zero point dog turns ON.

The travel value after the near-zero point dog turns ON is set in the table of home position return data shown in section 7.21.1.

- (2) Home position return by the count method
 - The home position return operation using the count method is shown in Fig. 7.33.



Fig. 7.33 Operation of Home Position Return by the Count Method

- (3) Running home position return To run home position return, use the servo program described in Section 7.21.5.
- (4) Cautions
 - (a) Maintain sufficient distance between the position where the nearzero point dog turns OFF and the home position.
 - (b) Using the count method, home position return or resumptive start of home position return is possible when the near-zero point dog turns ON. To carry out home position return or resumptive start of home position return when the near-zero point dog turns ON, return the axis to a position where the near-zero point dog is OFF before starting the home position return.

7.21.4 Home position return by the data set method

(1) Data set method

The data set method is a home position return method which does not use the near-zero point dogs. This method can be used with the absolute position system.

(2) Home position return by the data set method The address present value becomes the home position address when the home position return operation is run with the DSFRP instruction.





- (3) Executing home position return To execute home position return, use the servo program described in Section 7.21.5.
- (4) Cautions
 - (a) A zero point must be passed between turning on the power and executing home position return.

A no zero point passed error occurs if home position return is executed before a zero point is passed.

After a no zero point passed error occurs, reset the error and turn the servomotor at least one revolution using JOG operation before running the home position return operation again.

Use the zero point passed signal (M16m6) to check that a zero point is passed.

- (b) Starting home position return with the data set method when not using the absolute position system has the same function as the present value change command.
- (c) The home position return data required for the data set method are the home position return method and home position address.

7.21.5 Home position return servo program

											Item	s Set	by P	eriph	orals							 	T
	1				¢	omm	on				Arc			_			Parar	neter	Bloc	×		 _]
Servo Instruction	Positioning Method	Number of Controllable Axee	Parameter Block No.	Axto	Address/Travel Value	Commanded Speed	Dwell Time	M Code	Torque Limit Value	Auxiliary Point	Radius	Center Point	Control Unit	Speed Limit Value	Acceleration Time	Deceleration Time	Rapid Stop Deceleration Time	Torque Limit Value	Deceleration Processing on Stop Input	Allowable Error Range for Circular Interpolation	8 Curve Ratio		Speed Change
ZERO	l —	1		0																			

Home position return uses the ZERO servo instruction.

O: Must be set

[Control Details]

- (1) Home position return is carried out using the method designated in the home position return data (see Section 7.21.1). Refer to the following sections for details about the home position return methods:
 - Near-zero point dog method Section 7.21.2
 - Count method..... Section 7.21.3
 - Data set method..... Section 7.21.4

[Caution]

 If the following circuit conducts home position return using the near-zero point dog method after the PC ready flag (M2000) turns ON but before the PCPU ready flag (M9074) turns ON, another home position return request is issued after home position return is complete. Therefore, apply interlock conditions to M9074 and X1602+20n (in-position signal) when carrying out a home position return. (See program example.)



[Program Example]

This program carries out home position return using servo program No. 0, under the conditions below.

(1) System configuration Home position return of Axis 4.



(2) Servo program example Servo program No. 0 for home position return is shown below.



(3) Sequence program example The sequence program which runs the servo program is shown below.

0	M9039	-(M2000)-	Turns ON PC ready.
2	M9074 	-(M2042)-	Turns ON all axes servo start command.
4	X0000 M9074 M2009 M9076	м 0]−	Turns ON servo program No. 0
11		м1]- к	X000 turns ON.
13		°Э	Servo program No. 0 execution request.
CIRC		м1 Э	Turns OFF M1 on completion of servo program No. 0 execution request.

7.22 High-Speed Oscillation



Positioning of a designated axis is performed on an oscillating sine wave.

O: Must be set

∆ :Set if required

[Control details]

The designated axis is caused to oscillate on a designated sine wave. Acceleration/deceleration processing is not performed.



Starting angle

(1) Amplitude

Designate the amplitude of the oscillation in the setting units. The amplitude can be set in the range 1 to 2147483647.

- (2) Starting angle Set the angle on the sine curve at which oscillation is to start. The setting range is 0 to 359.9 (degrees).
- (3) Frequency Set how many sine curve cycles occur in one minute. The setting range is 1 to 5000 (CPM).

POINT

Since acceleration/deceleration processing is not performed, you should set the starting angle to 90 degrees or 270 degrees in order to avoid an abrupt start.

7. POSITIONING CONTROL

[Notes]

- (1) If the amplitude setting is outside the permissible range, the servo program setting error "25" occurs and operation does not start.
- (2) If the starting angle setting is outside the permissible range, the servo program setting error "26" occurs and operation does not start.
- (3) If the frequency setting is outside the permissible range, the servo program setting error "27" occurs and operation does not start.
- (4) After starting, operation is continually repeated until a stop signal is input.
- (5) Speed changes during operation are not possible. Attempted speed changes will cause minor error "310".

[Example program]

An example of a program for high-speed oscillation is shown below.

OSC Axis Start angle Amplitude Frequency	1 90.0 1000 100	[degree] [PLS] [CPM]

This section describes the auxiliary and applied functions available for positioning control by the servo system CPU.

(1)	Limit switch output function Section 8.1
(2)	M code output function Section 8.2
(3)	Backlash compensation function Section 8.3
(4)	Torque limit function
(5)	Electronic gear function Section 8.5
(6)	Absolute positioning system Section 8.6
(7)	Speed change Section 8.7
(8)	Present value change Section 8.8
(9)	Skip function Section 8.9
(10)	Teaching function Section 8.10
(11)	High-speed reading of designated data Section 8.11
(12)	Servo program cancel/start function Section 8.12

8.1 Limit Switch Output Function

The limit switch output function allows the A1SY42 output module or AY42 output module to output ON/OFF signals corresponding to the positioning address set for each axis.

8.1.1 Limit switch output data

item	Setti	ngs	Initial Value	Comments
ON/OFF point setting	 -2147483648 to 2147483647 (x 10⁻¹ μm, x 10⁻⁵ inch, PLS) 0 to 35999999 (x 10⁻⁵ degree) 	Units	0	• Up to 10 points can be set for each axis.

8.1.2 Limit switch output function

[Control Details]

(1) The limit switch function outputs the ON/OFF pattern from the A1SY42/ AY42 at the set addresses.

Before running the limit switch output function, the ON/OFF point addresses and the ON/OFF pattern must be set from a peripheral device. (Settings cannot be made by the sequence program.)

The number of limit switch outputs per axis and the ON/OFF points are as follows:

(a) Number of limit switch output points:.....8 points/axis,

total 64 points



(2) Limit Switch Enable/Disable Setting The following devices can be used to enable or disable the limit switch output from each axis or each point.

Set Data/Device	Setting Unit	Processing	Set Data Valid Timing		
Limit switch output used/not used set-	Axis	Used Set ON/OFF pattern can be output for the appropriate axis.	(1) Leading edge of PC ready (M2000)		
ting in the fixed pa- rameters.		Not Used All outputs OFF for the appropriate axis.	(2) When test mode is started		
Limit switch output enable signal (M1806+20n)	Axis	ON ON/OFF pattern is output for the appropriate axis based on the set ON/OFF pattern and the limit switch output disable setting registers (D1008 and D1009). UNOFF pattern is output for the used/not used setting in the fixed parameters is set			
		All outputs OFF for the appropriate axis.			
Limit switch output		Disable bit (1) Outputs corresponding to disable bits set to "1" are OFF.			
disable setting registers (D1008 and D1009)	Point	Enable bit (0) Outputs corresponding to enable bits set to "0" output an ON/OFF pattern based on the set ON/OFF pattern.	ON.		

Table 8.1 Limit Switch Enable/Disable Settings

REMARKS

The data in Table 8.1 is also valid during the test mode set by a peripheral device.

- (3) Cautions
 - (a) The limit switch output is based on the "feed present value" for each axis after PC ready (M2000) turns ON and the PCPU ready flag (M9074) is ON.
 All paints turn OEE when the BCPU ready flag (M9074) turns OEE

All points turn OFF when the PCPU ready flag (M9074) turns OFF.

(b) While the PCPU ready flag (M9074) is ON and the feed present value is outside the set stroke limits, the limit switch output is based on M1806+20n.

Consequently, the user should apply an interlock to ensure that the sequence program turns M1806+20n ON inside the stroke limit range only.

8.2 M Code Output Function

An M code is a code number between 0 and 255 which can be set for each positioning control. During positioning control execution, these M codes are read by the sequence program to check the current servo program and to command auxiliary operations, such as clamping, drill rotation, and tool changing.

(1) Setting M codes

The M code can be set when a servo program is written or modified using a peripheral device. One M code can be set for each servo program.

- (2) M code storage and read timing
 - (a) M codes are stored in the M code register for the designated axis on positioning start completion and at designated points (speed switching control, constant speed control).
 During interpolation control, the M code is stored for all axes under interpolation control.
 - (b) To read an M code on positioning start completion, use the positioning start completion signal (M16m0) as the read command.
 - (c) To read an M code on positioning completion, use the positioning completion signal (M16m1) as the read command.



Figure 8.1 M Code Storage and Read Timing

- (3) Resetting M codes The M codes can be reset by clearing the M code output devices to zero. Use this method during positioning control to carry out operations unrelated to the servo program, such as when it has been difficult to output the M code during the previous positioning control. However, an M code output from the servo program takes priority over an M code set for an intermediate point under speed switching control or constant-speed control.
- (4) Program example
 - (a) A sequence program to read M codes is shown below, using the following conditions.
 - 1) Axis used..... Axis 3
 - 2) Processing on positioning...... M code number output as BCD start due to M code code from Y110 to Y118
 - 3) Processing on positioning completion due to M code
 - a) if M code = 3 turn ON Y120
 - b) if M code = 5 turn ON Y121
 - c) if M code is not 3 or 5turn ON Y122
 - (b) The sequence program based on the above conditions is shown below.

$0 \qquad \qquad$	Out BC SCD D853 Y0010]- (Y0020)- (Y0021)- (Y0022)- (Y0022)- (Y0022)- (Y0022)-	tputs M code number as D code from Y110 to 18 when the Positioning rt completion signal 16m0) turns ON. ns ON Y120, Y121, Y122 positioning complete.
I CIRCUIT END	1	

8.3 Backlash Compensation Function

The backlash compensation function compensates for the backlash amount in the mechanical system. When the backlash compensation amount is set, extra pulses equivalent to the backlash compensation amount are output after a change in travel direction resulting from positioning control, JOG operation, or manual pulse generator operation.



Figure 8.2 Backlash Compensation Amount

(1) Setting the backlash compensation amount The backlash compensation amount is one of the fixed parameters, and is set for each axis using a peripheral device. The setting range differs according to whether mm, inch, degree, or pulse units are used, as shown below. (a) Millimeter units • 0 to 6553.5 $0 \leq \frac{(Backlash compensation amount)}{5} \leq 65535 (PLS)$ (Travel value per pulse) (Decimal fraction rounded down.) (b) Inch or Degree Units • 0 to 0.65535 $0 < \frac{(Backlash compensation amount)}{(Backlash compensation amount)} \le 65535 (PLS)$ (Travel value per pulse) (Decimal fraction rounded down.) (c) Pulse Units o to 65535 🖌 🖌 • 0 < (Backlash compensation amount) × (Pulses per rotation) (Travel value per rotation) ≤ 65535 (PLS) (Decimal fraction rounded down.)

(2) Backlash compensation processing The details of backlash compensation processing are shown in the table below.

Condition	Processing
First motion after power on	 No backlash compensation if travel direction = home position return direction. Backlash compensation if travel direction ≠ home position return direction.
JOG operation start	 Minimum backlash amount on first JOG operation after travel direction change.
Positioning start	 Backlash compensation if travel direction changed.
Manual pulse generator operation	 If travel direction changed.
Home position return start	 Backlash compensation amount is valid after home position return is started.
Absolute position system	 Status stored at power off and applied to absolute position system.

Table 8.2 Details of Backlash Compensation Processing

POINTS

- (1) The feed pulses equivalent to the backlash compensation amount are not added to the feed present value.
- (2) Home position return is required after the backlash compensation amount is changed.

The original backlash compensation amount is retained until home position return is carried out.

8.4 Torque Limit Function

The torque limit function controls the torque generated by the servomotor within the set range.

The torque is controlled to the set torque limit value if the torque required during positioning control exceeds the set limit value.

- (1) Torque limit value set range Set the torque limit value between 1% and 500% of the rated torque.
- (2) How to set the torque limit value
 - Set the torque limit value using a peripheral device, as described below.
 - (a) Setting in the Parameter Block (See Section 4.4)
 - Set the Torque limit value parameter in the parameter block. Using the servo program to designate which parameter block number is used allows the servomotor torque to be controlled to a torque limit value for any positioning control.
 - (b) Setting with a Servo Program Designating the torque limit value with the servo program allows restriction of the servomotor torque to the designated torque limit value during execution of the servo program.



(1) Servo program



(2) Parameter block



(3) General description of operation



8.5 Electronic Gear Function

The electronic gear function changes the travel value per pulse. The electronic gear is set by setting the travel value per pulse (see Section 4.2.1).

Using the electronic gear function allows positioning control without the need to select the encoder to match the mechanical system.





Pulses per motor revolution 10000 [PLS] Travel value per motor revolution ... 10 mm [mm]

(1) Electronic gear 1:1 (electronic gear setting = 1)

Travel value per pulse = <u>Travel value per motor revolution</u> = <u>10 [mm]</u> Pulses per motor revolution = <u>10 [mm]</u> = 0.001 [mm/PLS]

Positioning control is executed at the commanded speed.

(2) Electronic gear 2:1 (electronic gear setting = 0.5)

Travel value per pulse =

 $\frac{\text{Travel value per motor revolution}}{\text{Pulses per motor revolution}} = \frac{5 \text{ [mm]}}{10000 \text{ [PLS]}} = 0.0005 \text{ [mm/PLS]}$

Positioning control is executed faster than the commanded speed.

(3) Electronic gear 1: 2 (electronic gear setting = 2)

Travel value per pulse = <u>Travel value per motor revolution</u> = <u>20 [mm]</u> Pulses per motor revolution = <u>10000 [PLS]</u> = 0.002 [mm/PLS]

Positioning control is executed slower than the commanded speed.

The relationship between the commanded speed (positioning speed set in the servo program) and actual speed (actual positioning speed) is shown below for different electronic gear settings.

- if electronic gear setting = 1, commanded speed = actual speed
- if electronic gear setting < 1, commanded speed < actual speed
- if electronic gear setting > 1, commanded speed > actual speed



Figure 8.3 Relationship Between Commanded Speed and Actual Speed

8.6 Absolute Positioning System

The absolute positioning system can be used for positioning control when using an absolute- position-compatible servomotor (A273UHCPU (8-/32-axis specification using ADU) and MR-[]-B.

Home position return is not necessary using the absolute positioning system because after the machine position is initially established at system startup, the absolute position is sensed each time the power is turned on.

The machine position is established using a home position return initiated from the sequence program or a peripheral device.

(1) Absolute position system startup procedure

The system startup procedure is shown below.



 (2) In the absolute positioning system, the absolute position may be lost under the following conditions: Re-establish the absolute position using home position return or by

Re-establish the absolute position using home position return or by aligning the machine position and using present value change.

- (a) After removing or replacing the battery unit.
- (b) On occurrence of a servo battery error (detected at servo amplifier power on).
- (c) After the mechanical system is disturbed by a shock.
- (3) Power of Allowed Traveling Points can be monitored in the system setting mode of a peripheral device, and the present value history can be monitored in the monitor mode.

(For details on monitoring Power of Allowed Traveling Points and the present value history, refer to the operating manual for the peripheral device being used.)

- (a) Present value history monitor
 - 1) Month/day/hour/minute

The time when a home position return is completed or the servo amplifier power is turned ON or OFF is indicated.

In order to display the time correctly, it is necessary to first set the clock data at the programmable controller side, then switch ON M9028 (clock data read request) from the sequence program.

2) Encoder present value

When using MR-H-B (version BCD-B13W000-B2 or later) or MR-J2-B (version BCD-B20W200-A1 or later), the multiple revolution data and within-one-revolution data read from the encoder is displayed.

Note:For the encoder present value in the home position data area, the encoder present value when the motor is within the in-position range after completion of a home position return is displayed (not the encoder value at the home position).

- 3) Servo command value
- The command value issued to the servo amplifier is displayed.
- 4) Monitor present value

The present value controlled within the servo system CPU is displayed.

Note:A value close to the feed present value is displayed, but, since the monitor present value and feed present value are different data, the display of different values does not indicate an error.

5) Alarms

When an error involving resetting of the present value occurs while the servo amplifier power is ON, an error code is displayed. For details of the error, refer to the error contents area (related error list) at the bottom of the screen.

- After removing or replacing the battery unit, correctly install the new unit and establish the absolute position.
- After a servo battery error occurs, eliminate the cause of the error and ensure operation is safe before establishing the absolute position.
- After the mechanical system is disturbed by a shock, make the necessary checks and repairs, and ensure operation is safe before establishing the absolute position.

POINTS

- (1) The address setting range for absolute position systems is -2147483648 to 2147483647.
 - It is not possible to restore position commands that exceed this limit, or present values, after a power interruption. When performing an infinite feed operation, solve this problem by
 - setting the units to degrees or by setting a rotary table (when using SV22).
- (2) Even when the present value address is changed by a present value change instruction, the restored data for the present value after a power interruption is the value based on the status prior to execution of the present value change instruction.
- (3) When home position return has not been completed, restoration of the present value after a power interruption is not possible.

8.7 Speed Change

Changes the speed for positioning control and JOG operation. Speed change is possible with the sequence program DSFLP instruction (for A171SCPU/A273UHCPU (8-axis specification), the CHGV instruction, and in the test mode with a peripheral device.

(See the peripheral device operation manual for the method of changing the speed in the test mode with a peripheral device.)

[Control Details]

- (1) Forcibly changes the speed of an axis during operation to the speed designated in the speed change register.
- (2) Speed change is possible with the DSFLP instruction (for A171SCPU/ A273UHCPU (8-axis specification) and the CHGV instruction. See Section 5.3 for details about the DSFLP instruction and the CHGV instruction.

[Data Settings]

 (1) The speed change registers for each axis when using the DSFLP instruction are listed in the table below.
 <A171SCPU>

Avie No	Speed Change Register						
AXIS NO.	Most Significant	Least Significant					
1	D963	D962					
2	D969	D968					
3	D975	D974					
4	D981	D980					

<A273UHCPU (8-axis specification)>

Avie No	Speed Chan	Speed Change Register					
AXIS NO.	Most Significant	Least Significant					
1	D963	D962					
2	D969	D968					
3	D975	D974					
4	D981	D980					
5	D987	D986					
6	D993	D992					
7	D999	D998					
8	D1005	D1004					

(2) The setting ranges for the speed change registers are shown below.

Unit	m	m	in	ch	degree Set Range Units		PULSE		
Item	Set Range	Units	Set Range	Units			Set Range	Unite	
Speed change value	0 to 600000000	× 10 ⁻² mm/min	0 to 600000000	× 10 ⁻³ inch/min	0 to 600000000	× 10 ⁻³ degree/min	0 to 1000000	PLS/sec	

POINT

To set the speed using a sequence program, store a value in the speed change register which is 100 times the actual speed in units of millimeters or 1000 times the speed in units of inches or degrees.

[Cautions]

- (1) To change the speed during 2- to 4-axis linear interpolation control, change the speed of one of the axes under interpolation control.
- (2) The speed units are the control units set in the parameter block.
- (3) The values in the speed change registers are ignored during test mode with a peripheral device.
- (4) The speed does not change if any of the following errors occurs during the check on DSFLP/CHGV instruction execution.

	Error Details	Error Processing	Error Code
	An axis number was set outside the range 1-4 or 1-8.		
	Axis number set by indirect designation using index qualification.	• Error step saved in D9010, D9011.	
	Present value change data not set to 0 or 1.	• M9010, M9011 turn ON.	
Data set- ting error	Present value change data set by indirect designation using index qualification.	for (A273UHCPU (8-/32- axis specification.)	
	Speed not set in range between 0	• Error detection flag (M1607+20n/Yn7/M2407+ 20n) turns ON.	205
	and speed limit value.	 Error code listed at right is stored in the minor error register for each axis. 	305
	Home position return in progress for designated axis.		301
Error at speed	Circular interpolation in progress for designated axis.	• Error detection flag (M16+20n07/Yn7/M2407+ 20n) turns ON.	302
cnange	Automatic deceleration in progress under positioning control.	• Error code listed at right is	303
	Deceleration in progress after JOG operation signal turned OFF.	register for each axis.	304

- (5) The speed set by the speed change is ignored in the following cases, but no error occurs:
 - (a) During deceleration due to a stop command;
 - (b) When stopped;
 - (c) During manual pulse generator operation.

[Operation Timing]

The operation timing for speed change is shown in Figure 8.4.



Figure 8.4 Operation Timing for Speed Change

[Program Example]

A program to change the speed is shown below, using the following conditions.

- (1) Speed change conditions
 - (a) Axis for speed change Axis 4
 - (b) Speed after change 5000
 - (c) Speed change command...... X000
- (2) Sequence program

	······································	[PLS	M151]	Senses X000 leading edge (OFF \rightarrow ON
M151		{ SET	M152]	Turns ON speed change command (M152) at X000 leading edge.
M152 M9074 M2024 		K 5000	D980]-	5000 stored in Axis 4 speed change re ters (D980, D981).
-		DSFL D4	к 1 Э	Speed change request for Axis 4.
		{ RST	M152 }	Turns OFF M152 on completion of Axis speed change.

8.8 Present Value Change

Feed present value of a stopped axis can be changed with the sequence program DSFLP instruction (for A171SCPU/A273UHCPU (8-axis specification), the CHGA instruction, and in the test mode with a peripheral device. (See the peripheral device operation manual for the method of changing the present value in the test mode with a peripheral device.)

[Control Details]

- Changes the present value to the value designated in the present value change register. The actual present value is also changed when the feed present value is changed.
- (2) Present value change is possible with the DSFLP instruction (for A171SCPU/A273UHCPU (8-axis specification) and the CHGA instruction. See Section 5.3 for details about the DSFLP instruction and the CHGA instruction.
- (3) When a present value change is executed in an absolute position system, the machine position address is changed.

[Data Settings]

 The present value change registers for each axis when using the DSFLP instruction are listed in the table below.
 <A171SCPU>

Avie No	Present Value (Value Change Register				
AAIS NU.	Most Significant	Least Significant				
1	D961	D960				
2	D967	D966				
3	D973	D972				
4	D979	D978				

<A273UHCPU (8-axis specification)>

Avia Na	Present Value (Change Register
AAIB NU.	Most Significant	Least Significant
1	D961	D960
2	D967	D966
3	D973	D972
4	D979	D978
5	D985	D984
6	D991	D990
7	D997	D996
8	D1003	D1002

Unit	mn	۱	incl	h	degre	•	pulse		Commente
rtem	Set Range	Units	Set Range	Units	Set Range	Unite	Set Range	Unite	Conunents
Present value change value	-2147483648 to 2147483647	×10 ⁻¹ µm	-2147483648 to 2147483647	×10 ⁻⁵ inch	-2147483648 to 2147483647	×10 ⁻⁵ degree	-2147 48364 8 to 2147 48364 7	PLS	No error occurs if the set value is outside the stroke range.

(2) The setting ranges for the present value change registers are shown below.

POINT

To set the present value using a sequence program, store a value in the present value change register which is 10 times the actual present value in units of millimeters or 100000 times the present value in units of inches or degrees.

To set a present value of 100000.00 mm/min., store the value 1000000 in the present value change register.

[Cautions]

- (1) The present value cannot be changed for an axis when it is being operated.
 If an attempt is made to change the present value for an axis which is being operated, a minor error occurs and the error detection flag (M16m7) turns ON.
 The error code 300 is stored in the minor error register for the appropriate axis.
- (2) The values in the present value change registers are ignored during test mode with a peripheral device.
- (3) In the absolute position system, use present value change on system startup to establish the reference position at the machine position address.
- (4) The present value does not change if any of the following errors occurs during the check on DSFLP/CHGA instruction execution.

	Error Details	Error Processing
	An axis number was set outside the range 1-4 or 1-8.	
Data setting error	Axis number set by indirect designation using index qualification.	• Error step saved in D9010, D9011.
	Present value change data not set to 0 or 1.	• M9010, M9011 turn ON. (M9010 does not turn ON for (A273UHCPU (8-/32- axis specification)
	Present value change data set by indirect designation using index qualification.	
Error at present value change	Axis designated for present value change is in operation.	Error detection flag (M1607+20n/Yn7/M2407+20n) turns
	Servo not commissioned for axis.	 ON. Error code 300 is stored in the minor error register for each axis.

- (5) The start accept flag remains ON during present value change.
- (6) Present value change is executed whether PC ready (M2000) is ON or OFF.

[Operation Timing]

The operation timing for present value change is shown in Figure 8.5.



Figure 8.5 Operation Timing for Signals during Present Value Change

[Program Example]

A program to change the present value is shown below, using the following conditions.

- (1) Present value change conditions
 - (a) Axis for present value change Axis 4
 - (b) Present value change command X000
 - (c) Present value after change 0
- (2) Sequence program

0 X0000 M161		[PLS	M161]-	Detects X000 leading edge (OFF \rightarrow ON).
4	Ермоу	[SET К 0	M162 }-	Turns ON present value change command flag (M162) at X000 leading edge. 0 stored in Axis 4 present value change
			К 0)- м162]-	regarters (<i>Ders, Ders</i>). Present value change request for Axis 4. Turns OFF M162 on completion of Axis 4
I CIRCUT END				present value change.

8.9 Skip Function

Based on an external input, the skip function halts the current positioning and executes the next positioning control.

The servo system CPU can run the skip function according to the external STOP signal and the sequence program.

(1) The procedure for using the skip function based on the external STOP signal and the sequence program is shown below.



(2) Operation timing The operation timing of the skip function is shown in the diagram below.



8.10 Teaching Function

The teaching function allows the operator to teach the servo system CPU when the target position (address) is unknown or to align with an object.

(1) Teaching methods

Two teaching methods are available: "address teaching" and "program teaching."

(a) Address teaching

Writes the present value to the designated program address. The program must be created before the address teaching method can be used.

- (b) Program teaching Writes the present value to addresses while the program is being created.
- (2) For details about teaching, see the A30TU Teaching Unit Operating Manual (IB-67277).
8.11 High-Speed Reading of Designated Data

This function stores the designated positioning data in the designated device (D, W) with the signal from an input module mounted on the motion base as the trigger.

It can be set in the system setting of a peripheral device software package.

- (1) Positioning data that can be set
 - 1. Feed present value
 - 2. Present value
 - 3. Deviation counter value
 - 4. M codes
 - 5. Torque limit value
 - 6. Motor current
 - 7. Motor rpm
 - 8. Virtual servo motor feed present value
 - 9. Synchronous encoder present value
 - 10. Virtual servo M code
 - 11. Present value after differential gear of main shaft
 - 12. Present value in one rotation of main virtual axis
 - 13. Present value in one rotation of auxiliary input axis
 - 14. Present value in one rotation of cam axis
 - 15. Executed cam No.
 - 16. Executed stroke amount
- (2) Modules and signals used

Only valid in SV22 virtual mode

CPU	input Module	Signal	Reading Timing	Number of Points Settable
When using	A171SENC	TREN		1
A171SCPU	PC input module	X device		8
When using	A273EX	TREN	0.8 ms	3
A273UHCPU (8/32-axis specification)	PC input module	X device		8

Note: Only one PC input module can be used.

8.12 Servo Program Cancel/Start Function

	This a d con nate	s is a function for stopping a servo program being executed by means of eceleration stop caused turning the cancel signal ON. When used in abination with "start" (selectable item), this function also allows a desig- ed servo program to be automatically started after a deceleration start.
[Control details]	(1)	When the cancel signal is turned ON during execution of a program for which the cancel function has been designated, the positioning processing being executed is suspended, and a deceleration stop is executed.
	(2)	If "start" has been designated in conjunction with "cancel", after the stop has been executed as described above, the designated servo pro- gram is started.
[Data setting]	(1)	Cancel signal device The devices that can be used as cancel signal devices are indicated below. X, Y, M, TC, TT, CC, CT, B, F
	(2)	Start (selectable item) setting method Set by indirect designation (1 word) by using a constant (K) or D, W devices.
[Notes]	(1)	Cannot be used with the home position return instruction (ZERO) or si- multaneous start instruction (START). For details on whether other instructions can be used or not, refer to the servo instruction list (6.2(2)).
	(2)	If the axes used with a servo program designated by "start" are al- ready in operation and the program cannot be executed, the axes de- celerate to a stop and minor error "101" occurs.
[Operation timing]		



[Uperation timing]

8. AUXILIARY AND APPLIED FUNCTIONS

The operation timing is shown below.

[Program example]

A program example is shown below.



APPENDICES

APPENDIX 1 SCPU ERROR CODE LIST

If an error occurs when the PC is switched to the RUN status or is in the RUN status, the error indication and error code (including the step number) are stored in a special register by the self-diagnosis function. When an error occurs, refer to Table 1.1 for its cause and the corrective action to take. Eliminate the cause of the error by taking the appropriate corrective action. Error codes can be read at a peripheral device; for details on the relevant operation, see the Operating Manual for the peripheral device.

Mhen an error occurs, check the points stated in this manual and reset the error.

1.1 SCPU Error Code List

The list presented below gives the error numbers, and the error contents, causes, and corrective actions for each error message.

Error Message (When an A273UHCPU (8/32 Axis Specification) is Used)	Contents of Special Register D9008 (BIN Value)	CPU Status	Error Contents and Cause	Corrective Action
INSTRCT.CODE ERR (When an instruction is executed.)	10	Stopped	 An instruction code that cannot be decoded has been included in the program. (1) A ROM which includes undecodable instruction codes has been installed. (2) The memory contents have changed for some reason and now include an undecodable instruction code. 	 Read the error step with a peripheral device, and correct the program at that step. If the ROM is the problem, either rewrite its contents or replace it with a ROM into which the correct contents have been written.
PARAMETER ERROR On switching on the power or resetting. On switching from STOP PAUSE to {RUN STEP RUN}	11	Stopped	The parameter data in the CPU's memory has been changed due to noise or incorrect installation of the memory.	 Check the installation of the memory and install it correctly. Read the parameter data of the CPU memory at a peripheral device, check the data, correct it, and write the corrected data back into the memory.
MISSING END INS. (When M9056 or M9057 is ON.) On switching from STOP {STOP PAUSE} to {RUN STEP RUN}	12	Stopped	 There is no END (FEND) instruction in the program. When a subprogram is set in the parameters, there is no END instruction in the subprogram. 	 Write an END instruction at the end of the program.
CAN'T EXECUTE (P) (When a CJ/SCJ/JMP/CALL(P)/ FOR-NEXT instruction is executed. On switching from {STOP {PAUSE} to {RUN STEP RUN}	13	Stopped	 The jump destination designated with a CJ/SCJ/ CALL/CALLP/JMP instruction does not exist, or more than one exists. There is a CHG instruction but no subprogram is set. Athough there is no CALL instruction, there is a RET instruction in the program and is has been executed. A CS/SCJ/CALL/CALLP/JMP instruction whose jump destination is at or beyond the END instruction has been executed. The number of FOR instructions. A JMP instruction has been included between a FOR and NEXT command, exiting the FOR - NEXT sequence. The subroutine has been exited by execution of a JMP instruction before execution of a RET instruction. Execution of a JMP instruction has caused a jump into a step in a FOR - NEXT range, or into a subroutine. 	(1) Read the error step with a peripheral device, and correct the program at that step. (Correct, for example, by insert- ing a jump destination, or making sure there is only one jump destination.)

Table 1.1 Error Code List

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Error Message (When an A273UHCPU (8/32 Axis Specification) is Used)	of Special Register D9008 (BIN Value)	CPU Status	Error Contents and Cause	Corrective Action
CHK FORMAT ERR."	14	Stopped	 An instruction other than an LDX, LDIX, ANDX, or ANIX instruction (including NOP) has been included in the same ladder block as a CHK instruction. More than one CHK instruction exists. The number of contacts in a CHK instruction ladder block exceeds 150. The device number of an X device in a CHK instruction ladder block exceeds X7FE when using an A373CPU or X1FFE when using an A373U/A273U. The following ladder block the following ladder block the following ladder block. The D1 device (number) of a CHK D1 D2 instruction is not the same as the device (number) of the contact before the CJ[] instruction. The pointer P254 is not appended at the head of a CHK instruction ladder block. 	 Check if any of items (1) to (6) in the column to the left apply to the program with the CHK instruction ladder block, correct any problem in the program with a peripheral device, then restart program operation. This error code is only valid when the I/O control method used is the direct method.
CAN'T EXECUTE (I) (When an interruption occurs. On switching from {STOP {PAUSE} to {RUN {STEP RUN}}	15	Stopped	 An interrupt module is used but there is no number for the corresponding interrupt pointer I in the program. Or, more than one exists. There is no IRET instruction in the interrupt program. There is an IRET instruction other than in the interrupt program. 	 Check the whether or not an interrupt program correspond- ing to the interrupt module exists and either create an interrupt program or eliminate the duplicated I number. Check if there is an IRET inst- ruction in the interrupt program: if there is not, insert one. Check if there is an IRET inst- ruction other than in the inter- rupt program: if there is, delete if
CASSETTE ERROR	16	Stopped	No memory cassette is installed.	Install a memory cassette and reset.
RAM ERROR (On switching on the power or resetting.) When M9084 is turned ON (in the STOP status.	20	Stopped	(1) On checking if data can be read from and written to the CPU data memory area normally, it is determined that one or both are not possi- ble.	There is a hardware fault. Contact your nearest Mitsubishi service center, agent, or office, and ex- plain the problem.
OPE.CIRCUIT ERR.	21	Stopped	(1) The operation circuit that executes sequence processing in the CPU does not operate nor- mally.	
"WDT ERROR"	22	Stopped	 The scan time has exceeded the watchdog error monitor time. (1) The user program scan time has been exceeded due to the conditions. (2) A momentary power interruption has occurred during scanning, extending the scan time. 	 Calculate and check the scan time for the user program and shorten the scan time, e.g. by using a CJ instruction. Monitor the contents of special register D9005 with a peripheral device. If the contents are other than "0" the power supply vol- tage is unstable: in this case check the power supply and regime uplace direction.
'END NOT EXECUTE'	24	Stopped	 When the END instruction is executed it is read as another instruction code, e.g. due to noise. The END instruction has been changed to another instruction code somehow. 	(1) Reset and establish the RUN status again. If the same error is displayed again, the cause is a CPU hardware error. Contact your nearest Mitsubishi service center, agent, or office, and explain the problem.
"WDT ERROR"	25	Stopped	A loop has been established for execution of the sequence program, due for example to a CJ instruc- tion, and the END instruction cannot be executed	Check if any program will be run in an endless loop: if there is such a program modify the program
(When an END instruction is executed. (When M9084 or M9094 is ON.	31	Stopped (RUN)	 The I/O information does not match a loaded module when the power is switched ON. (1) An I/O module (this includes special function modules) is loose, or has become detached, during operation. Or, a completely different module has been loaded. 	 The bit in special registers D9116 to D9123 that corresponds to the module for which the verification error occurred will be set to "1": check for the module whose bit is set to "1" by monitoring these registers with a peripheral device and replace that module. (2) If the current arrangement of loaded modules is acceptable, reset with the reset set to the

Table 1.1 Error Code List (Continued)

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Error Message (When an A273UHCPU (8/32 Axis Specification) is Used)	Contents of Special Register D9005 (BIN Value)	CPU Status	Error Contents and Cause	Corrective Action
"FUSE BREAK OFF" (When an END instruction is executed. (However, no check is performed (when M9084 or M9094 is ON.)	32	RUN (Stopped)	There is an output module with a blown fuse.	 Check the blown fuse indicator LEDs of the output modules and replace the fuse of the module whose indicator LED is int. Modules with blown fuses can also be detected by using a peripheral device. The bit in special registers D9100 to D9107 that corres- ponds a module whose fuse has blown will be set to "1": monitor these registers to check.
CONTROL-BUS ERR. (When FROM, TO instructions are executed. On switching on the power or resetting. On switching from {STOP {STOP} {PAUSE} to {RUN {STEP RUN}	40	Stopped	FROM, TO instructions cannot be executed. (1) Fault in the control bus to the special function module.	(1) There is a hardware fault of the special function module, CPU module, or base unit: replace each module/unit to find the defective one. Contact your nearest Mitsubish service center, agent, or office, and explain the problem with the defective module/unit.
SP.UNIT DOWN (When FROM, TO instructions are executed.) On switching on the power or resetting. On switching from {STOP {STOP} PAUSE} to {RUN {STEP RUN}	41	Stopped	On execution of a FROM, TO instruction, a special function module was accessed but no response was received. (1) The accessed special function module is faulty.	There is a hardware fault in the ac- cessed special function module: contact your nearest Mitsubishi service center, agent, or office, and explain the problem.
LINK UNIT ERROR (On switching on the power or resetting.) On switching from STOP {PAUSE} to {RUN PAUSE} to {STEP RUN}	42	Stopped	(1) A data link module for use with MELSECNET has been loaded at the master station.	(1) Remove the data link module for MELSECNET from the master station. After making this correction, reset and start operation from the initial status.
I/O INT.ERROR (When an interruption occurs.)	43	Stopped	An interruption has occurred although there is no interrupt module.	(1) There is a hardware fault in one of the modules: replace each module in turn to determine which one is defective. Contact your nearest Mitsubishi service center, agent, or office, and explain the problem with the defective module.
"SP.UNIT LAY.ERR." (On switching on the power or resetting. (On switching from (STOP) (FUN) (PAUSE) to (STEP RUN) (STEP RUN)	44	Stopped	 Three or more computer link modules have been installed for one CPU module. Two or more data link modules for MELSECNET have been installed. Two or more interrupt modules have been installed. In the parameter settings made at a peripheral device, an allocation for a special function module has been made where there is in fact an I/O module, or vice versa. 	 Do not install more than two computer link modules. Do not install more than one data link module for MELSEC- NET. Install only one interrupt module (4) Re-set the I/O allocations in the parameter settings made at the peripheral device so that they agree with the loaded modules.
"SP.UNIT ERROR" (When a FROM, TO instruction is executed)	46	Stopped (RUN)	(1) A location where there is no special function module has been accessed (when the FROM, TO instruction was executed).	(1) Read the error step using a pe-ripheral device, check the contents of the FROM, TO instruction at that step, and correct it using the peripheral device.
LINK PARALERROR On switching on the power or resetting. On switching from STOP PAUSE to {RUN STEP RUN}	47	RUN	 The data written to the link parameter area when link range settings are made by para- meter setting at a peripheral device differ for some reason from the parameter data read by the CPU. The setting for the total number of slave sta- tions is "0". 	 Write the parameters again and check. If the error is displayed again, there is a hardware fault. Contact your nearest Mitsubishi service center, agent, or office, and explain the problem.
OPERATION ERROR	50	RUN (Stopped)	 The result of BCD conversion is outside the stipulated range (max. 9999 or 99999999). A setting exceeding the stipulated device range has been made and operation is therefore impossible. A file register has been used in the program without having made a file register capacity setting. 	 Read the error step with a peripheral device, and correct the program at that step. (Check the device setting range, BCD conversion value, etc.)
BATTERY ERROR (At any time (However, no check is performed (when M9084 is ON.	70	RUN	 The battery voltage has failen below the stipulated value. The battery's lead connecter has not been installed. 	 Replace the battery. If the battery is used to back up the RAM memory or to retain memory contents during momentary power interruptions, install a lead connector.

Table 1.1 Error Code List (Continued)

APPENDIX 2 ERROR CODES STORED BY THE PCPU

The errors that are detected at the PCPU are servo program setting errors and positioning errors.

(1) Servo program setting errors

Servo program setting errors are errors in the positioning data set in the servo program and are checked for when a servo program is started. They are errors that occur when the positioning data is designated indirectly.

When a servo program setting error occurs, the following happens:

- The servo program setting error flag (M9079) comes ON.
- The program number of the program in which the error occurred is stored in the error program No. register (D9189).
- The error code is stored in the error item information register (D9190).

(2) Positioning error

- (a) Positioning errors are errors that occur when positioning starts or during positioning: they are classified into minor errors, major errors, and servo errors.
 - 1) Minor errors..... These are errors generated by sequence programs or servo programs; they are assigned error codes 1 to 999.

The cause of minor errors can be eliminated by checking the error code and correcting the sequence program or servo program.

- 2) Major error...... These are errors generated by external input signals or control commands from the SCPU; they are assigned error codes 1000 to 1999. When a major error occurs, check the error code and eliminate the error cause in the external input signal status or sequence program.
- 3) Servo error..... These are errors detected by the servo amplifier; they are assigned error codes 2000 to 2999.

When a servo error occurs, check the error code and eliminate the error cause at the servo side.

(b) When an error occurs, the error detection signal for the relevant axis comes ON, and the error code is stored in the minor error code, major error code, or servo error code register.

	Table 2.1	Error Code	e Registers,	
<a171scpu></a171scpu>	Error	Detection	Flags	
	and a second			1

Device		Error Detec-			
Error Class	Axis 1	Axis 2	Axis 3	Axis 4	tion Signal
Minor error	D806	D826	D846	D866	M1607+200
Major error	D807	D827	D847	D867	M 1607 +2011
Servo error	D808	D828	D848	D868	M1608+20n

<A273UHCPU

(8 axis specification)>

Table 2.2Error CodeRegisters, Error Flags

Device		Error Code Register									
Error Class	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8	Signal		
Minor error	D806	D826	D846	D866	D886	D906	D926	D946	¥.7		
Major error	D807	D827	D847	D867	D887	D907	D927	D947	Xn/		
Servo error	D808	D828	D848	D868	D888	D908	D928	D948	Xn8		

<A273UHCPU (32 axis specification)>

Table 2.3 Error Code Registers,Error Flags

Device	Error Code Register										Error						
Error Class	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8	Axis 9	Axis 10	Axis 11	Axis 12	Axis 13	Axis 14	Axis 15	Axia 16	Detection Signal
Minor error	D6	D26	D46	D66	D86	D106	D126	D146	D166	D186	D206	D226	D246	D266	D286	D306	1007.00-
Major error	D7	D27	D47	D67	D87	D107	D127	D147	D167	D187	D207	D227	D247	D267	D287	D307	M2407+200
Servo error	D8	D28	D48	D68	D88	D108	D128	D148	D168	D188	D208	D228	D248	D268	D288	D308	M2408+20n

Device	Error Code Register										Error						
Error Class	Axis 17	Axis 18	Axis 19	Axis 20	Axis 21	Axis 22	Axis 23	Axis 24	Axis 25	Axis 26	Axis 27	Axis 28	Axis 29	Axis 30	Axis 31	Axis 32	Detection Signal
Minor error	D326	D346	D366	D386	D406	D426	D446	D466	D486	D506	D526	D546	D566	D586	D606	D626	N0407-00-
Major error	D327	D347	D367	D387	D407	D427	D447	D467	D487	D507	D527	D547	D567	D587	D607	D627	M2407+201
Servo error	D328	D348	D368	D388	D408	D428	D448	D468	D488	D508	D528	D548	D568	D588	D608	D628	M2408+20n

- (c) If another error occurs after an error code has been stored, the existing error code is overwritten, deleting it.
 However, it is possible to check the history of error occurrence by
 - using a peripheral device started up with the GSV13PE/GSV22PE software.
- (d) Error detection flags and error codes are latched until the error code reset signal (M1807+20n/Yn7/M3207+20n) or servo error reset signal (M1808+20n/Yn8/M3208+20n) comes ON.

POINTS

- When some servo errors occur, the same error code will be stored again even if the servo error reset signal (M1806+20n/Xn8/M3208+ 20n: ON) is issued.
- (2) When a servo error occurs, reset the servo error after first eliminating the error cause at the servo side.

2.1 Servo Program Setting Errors

The error codes, error contents, and corrective actions for servo program setting errors are shown in Table 2.4. The *** in error codes marked with an asterisk indicates the axis number (1 to 4/1 to 8/1 to 32).

Error Code Stored In D9190	Error Name	Error Contents	Error Processing	Corrective Action	
1	Parameter Block number Setting error	The designated parameter block number is outside the range 1 to 16 (A273UH 32-axis specification : 1 to 64).	The serve program is executed with the parameter block number set to the default value of "1".	Designate the parameter block number in the range 1 to 16 (1 to 64).	
n03"	Address/travel value setting error (Excluding speed control and speed/ position switching	(1) An address outside the designated range is set when executing absolute positioning control. Units Address Setting Range degree 0 to 35000900 × 10 ⁻¹ degree	 (1) Axis motion does not start. (When executing interpolation control, none of the interpolation control axes start.) (2) If the error is detected during speed switching control or constant speed control, a deceleration stop is executed. (3) When multiple serve programs are to be 	(1) If the control unit is degrees, set the address in the range 0 to 35999999.	
	control)	(2) The travel value is set to -2147483648 (H80000000) when executing incremen- tal positioning control.	executed simultaneously, if an error oc- curs in one servo program none of the programs are executed.	(2) Set the travel value in the range 0 to ±(2 ³¹ -1).	
		(1) The commanded speed is set outside the range of 1 to the speed limit value.	 The axis does not start if the commanded speed is set at "0" or less. If the set commanded speed exceeds 	(1) Set the commanded speed in the range from 1 to the speed limit value.	
4	Commanded speed error	Units Address Setting Range mm 1 to 60000000 mm 1 to 600000000 x10 ⁻¹ mm/min inch 1 to 600000000 x10 ⁻¹ mch/min degree 1 to 60000000 x10 ⁻¹ degree/n in PULSE 1 to 1000000	the speed limit value, control is exe- cuted at the speed limit value.		
5	Dwell time setting error	The dwell time is set outside the range 0 to 5000.	Control is executed using the default value of "0".	Set the dwell time in the range from 0 to 5000.	
6	M code setting error	The M code is set outside the range 0 to 255.	Control is executed using the default value of "0".	Set the M code in the range from 0 to 255.	
7	Torque limit value setting error	The torque limit value is set outside the range 1 to 500.	Control is executed using the torque limit value set in the designated parameter block.	Set the torque limit value in the range from 1 to 500.	
	Auxiliary point setting error (when executing circular interpolation by designating an auxiliary point).	(1) An address outside the designated range is set when executing absolute positioning control. Units Address Setting Range degree 0 to 3500000 × 10 ⁻⁴ degree	Positioning control does not start.	(1) If the control unit is degrees, set the address in the range 0 to 35999999.	
n08*		(2) The travel value is set to -2147483648 (H8000000) when executing incremental positioning control.		(2) Set the travel value in the range 0 to ±2147483647.	
		(3) The start point is also the auxiliary point, or the auxiliary point is also the end point.		(3) Set the start, auxiliary, and end points so that they are not equal to one another.	
		(4) The auxiliary point is located on a straight line between the start and end points.		(4) Set the auxiliary point at a location not on the straight line between the start and end points.	
		(1) An address outside the applicable range is set when executing absolute positioning control. Units Address Setting Range degree 0 to 35999990 x 10 ^{-d} egree	Positioning control does not start.	(1) If the control unit is degrees, set the address in the range 0 to 35999999.	
	Radius setting error (when executing	(2) The travel value is set to -2147483648 (H8000000) when executing incremental positioning control.		(2) Set the travel value in the range 0 to ±2147483647.	
n09*	circular interpolation by designating a radius)	(3) The start point is also the end point.		(3) Set the start and end points so that they are not equal to each another.	
		(4) The distance between the start and end points is greater than the radius.		(4)Change the relationship between the start-to-end point distance (L) and the radius (R) so that it conforms with the following equation: ≤ 1	

Table 2.4 Servo Program Setting Error List

Error Code Stored in D9190	Error Name	Error Co	ntents	Error Processing	Corrective Actien		
n10*	Center point setting error (when executing circular interpolation	(1) An address outside range is set when e positioning control. Units Address degree 0 to \$5000000	the applicable secuting absolute Setting Range	Positioning control does not start.	(1) If the control unit is degrees, set the address in the range 0 to 35999999.		
	by designating a center point)	(2) The travel value is a (H80000000) when incremental position	et to -2147483648 executing ing control.		(2) Set the travel value in the range 0 to ±2147483647.		
11	Interpolation control unit setting error	The interpolation contro the range 0 to 3.	el unit is set outside	Control is executed at the default value of "3".	Set the interpolation control unit in the range 0 to 3.		
12	Speed limit value setting error	The speed limit value is applicable range.	set outside the	Control is executed at the default value of 200000 PLS/sec.	Set the speed limit value in the specified range.		
13	Acceleration time setting error	The acceleration time is	set to "0".	Control is executed at the default value of 1000.	Set the acceleration time in the range 1 to 65535.		
14	Deceleration time setting error	The deceleration time is	s set to *0*.		Set the deceleration time in the range 1 to 65535.		
15	Rapid stop deceleration time setting error	The rapid stop decelera "0".	tion time is set to		Set the rapid stop deceleration time in the range 1 to 65535.		
16	Torque limit value setting error	The torque limit value is range 1 to 500.	set outside the	Control is executed at the default value of 300%.	Set the torque limit value in the range 1 to 500.		
		The allowable error ran interpolation is set outs range.	ge for circular ide the applicable	Control is executed at the default value (100PLS).	Set the allowable error range for circular interpolation in the applicable range.		
17	Allowable error range for circular	Units Address	Sotting Range				
	interpolation setting error	inch 1 to 100000	x 10 ⁻¹ inch				
		degree	× 10 ⁻¹ degree				
	·						
18	Repeat count error	to 32767.	outside the range 1	set to "1".	Set the repeat count in the range 1 to 32767.		
		(1) The servo program of START instruction d	lesignated by the oes not exist.	Positioning control does not start.	(1) Create a servo program designated by the START instruction.		
19	START instruction setting error	(2) There is a START in designated servo pr	struction in the ogram.		(2) Delete the servo program containing the START instruction.		
		(3) More than one axis ed for the started se	has been designat- rvo program.		(3) Do not designate more than one axis.		
20	Point setting error	No point has been designstruction for constant	nated in the speed control.	Positioning control does not start.	Designate a point between CPSTART and CPEND.		
21	Reference axis speed setting error	In linear interpolation us axis speed designation involved in the interpole designated as the refer	sing the reference method, an axis not tion has been ence axis.	Positioning control does not start.	Set one of the axes involved in the interpolation as the reference axis.		
22	S-curve ratio setting error	The S-curve ratio when S-curve acceleration/de outside the range 0 to 1	designating celeration is 00%.	Control is executed with an S-curve ratio of 100%.	Set the S-curve ratio within the range 0 to 100%.		
23	VSTART setting error	Not even one speed sw been set between a VS instruction, or between instruction. (Applies wi (8/32 axis specification)	tching point has TART and VEND a FOR and NEXT th A273UHCPU only.)	Positioning control does not start.	Set a speed switching point between the VSTART and VEND instructions or the FOR and NEXT instructions.		
24	Cancel function start program No. error	The start program No. f function has been set o 0 to 4095.	or the cancel utside the range	Positioning control does not start.	Set the start program No. within the range 0 to 4095 and then start.		
25	High-speed oscillation command amplitude error	Operation cannot be sta amplitude commanded oscillation function is of 2147483647.	arled because the for the high-speed utside the range 1 to	Positioning control does not start.	Set the commanded amplitude within the range 1 to 2147483647 and then start.		
26	High-speed oscillation starting angle error	Operation cannot be sta commanded starting an speed oscillation function range 0 to 3599 (x 0.1 c	inted because the gle for the high- bn is outside the legrees).	Positioning control does not start.	Set the starting angle within the range 0 to 3599 (x 0.1 degrees) and then start.		
27	High-speed oscillation frequency error	Operation cannot be sta commanded frequency oscillation function is or 5000 (CPM).	inted because the for the high-speed itside the range 1 to	Positioning control does not start.	Set the frequency within the range 1 to 5000 (CPM) and then start.		

Table 2.4 Servo Program Setting Error List (Continued)

Error Code Stored in D9190	Error Name	Error Contents	Error Processing	Corrective Action
900	START instruction setting error	The servo program designated by the DSFRP/SVST program does not exist.	Positioning control does not start.	Set the correct servo program number.
901	START instruction	(1) The axis number set for the DSFRP/SVST instruction is different from the axis number set for the servo program.	Positioning control does not start.	(1) Set the correct axis number.
	setting erre.	(2) A DSFRP instruction has been used when executing 4-axis linear interpolation.		(2) Use the SVST instruction for 4-axis linear interpolation.
902	Servo program instruction code error	The instruction code cannot be decoded (a non-existent instruction code has been designated).	Positioning control does not start.	Set the correct instruction code.
903	Start error	A virtual mode program was started in the real mode.	Positioning control does not start.	Check the mode allocation for the program.
904	Start error	A real mode program was started in the virtual mode.	Positioning control does not start.	Check the mode allocation for the program.
905	Start error	An instruction that cannot be used in the virtual mode (VPF, VPR, VPSTART, ZERO, VVF, VVR, OSC) was issued.	Positioning control does not start.	Correct the serve program.
906	Axis No. setting error	An axis not used in the system settings has been set for the servo program set in a DSFRP/SVST instruction.	Positioning control does not start.	Set an axis number that is setted in the system settings.
907	Start error	Start attempted during processing for switching from real mode to virtual mode.	Positioning control does not start.	Use M2034 (real/virtual mode switching request), M2044
908	Start error	Start attempted during processing for switching from virtual mode to real mode.		(real/virtual mode status) as interlocks for starting.

Table 2.4 Servo Program Setting Error List (Continued)

2.2 Minor Errors

Minor errors are those that occur in the sequence program or servo program. The error codes for these errors are from 1 to 999.

Minor errors include set data errors, positioning control start-up errors, positioning control errors, and control change errors.

(1) Set data errors (1 to 99, 900)

These errors occur when the data set in the parameters for positioning control is not correct.

The error codes, causes, processing, and corrective actions are shown in Table 2.5 below.

Error Code	Data Where Error Occurred	Check Timing	Error Cause	Error Processing	Corrective Action
21		When count type, near-zero-point dog type, or data set type home position return is started.	The home position address of a degree axis is outside the range 0 to 359999999 (x 10 ⁻⁵ degrees).		Set the home position address within the permissible range with a peripheral device.
22		When a count type or near-zero-point	The home position return speed is set outside the range of 1 to the speed limit value.		Set the home position return speed at or below the speed limit value by using a peripheral device.
23	Home position return data	position return is started.	The creep speed is set outside the range of 1 to the home position return speed.	Home position return is not started.	Set the creep speed at or below the home position return speed by using a peripheral device.
24		When a count type home position return is started.	The travel value after the near-zero-point dog comes ON is outside the range ON2 ³¹ -1 (x unit).	s	Set the travel value after the near-zero-point dog to within the permissible range with a peripheral device.
25		When a count type or near-zero-point dog type home position return is started.	The parameter block No. is outside the range of 1 to the maximum No.*		Set the parameter block No. within the permissible range with a peripheral device.
40	Parameter block	When interpola- tion control is started	The unit for interpolation control designated in the parameter block is different from the control unit designated in the fixed parameters.	Control is executed using the control unit designated in the fixed parameters.	Designate the same control unit in the fixed parameters and servo parameters.

Table 2.5 Set Data Error List (1 to 99, 900)

POINT

Sometimes, if the interpolation control unit designated in the parameter block and the control unit designated in the fixed parameters are different, no error code is stored; this depends on the combination of units designated.

For details, see Section 7.1.4.

(2) Positioning control start-up errors (100 to 199)

The errors shown in this section are those detected when positioning control is started.

Error codes, causes, processing, and corrective actions are shown in Table 2.6 below.

*: When interpolation control is being executed, the error codes are stored in the error code storage areas of all the axes involved in the interpolation.

		Control Mode						Control Mode						
Error Code	Positioning	Fixed-Pitch Feed	Bpeed	Speed/Position Switching	Speed Bwitching	Constant 8peed	DOG	Manual Puise Generator	Home Poeition Return	Position Follow-Up Control	080	Error Cause	Error Proc ess ing	Corrective Action
100	0	0	0	0	0	0	0	0	0	0	0	The PC ready flag (M2000) or PCPU ready flag (M9074) is OFF.		Set the servo system CPU to RUN.
101	0	0	0	0	0	0	0	0	0	0	0	•The start accept flag (M2001 to M2004/M2001 to M2008/M2001 to M2032) of the relevant axis has been turned ON.		Furn the PC ready hag (M2000) CN. Provide an interlock in the program to prevent the axis from being started while in motion (use the turning OFF of the start accept signal for the axis as the interlock condition).
103	0	0	0	0	0	0	0	0	0	0	0	The stop command (M1800+20n/YnQ/M3200+20n) of the relevant axis has been turned ON.		Turn the stop command (M1800+20n/Yn0/M3200+20n) OFF and start positioning.
104	0	0	0	0	0	0	0	0	0	0	0	•The rapid stop command (M1801+20n/Yn1/M3201+20n) of the relevant axis has been turned ON.		•Turn the rapid stop command (M1801+20n/Yn1/M3201+20n) OFF and start positioning.
105	0				0	0				0		On starting, the feed present value is outside the stroke limit range.		Move back inside the stroke range using JOG operation. Enter inside the stroke range by execut- ing a home position return or present value change.
106*	0	0			0	0				0	0	 Positioning outside the stroke limit has been designated. 		Positioning end point must be within the specified stroke limit.
107	٥					0						•An address that does not generate an arc was designated in circular interpolation for which an auxiliary point is designated. (Error in relationship between the start) point, auxiliary point, and end point	Positioning control does not start.	Designate correct addresses in the servo program.
108*	0					0						•An address that does not make an arc was designated in circular interpolation for which a radius is designated. (Error in relationship between the start point, auxiliary point, and end point		
109	0					0						•An address that does not generate an arc was designated in circular interpolation for which a center point is designated. (Error in relationship between the start) point, auxiliary point, and end point		
110*	0					0						 In circular interpolation, the difference between the end point address and the ideal end point exceeded the allowable error range for circular interpolation. 		
111				0								•An attempt was been made to restart speed/position switching control although it had not stopped.		•Do not attempt restart when speed/position switching control has not stopped.
115									0			•The home position return completed signal (M1610+20n/XnA/M2410+20n) has been turned ON during a near-zero point dog type home position return operation.		 Resumptive starts are not possible for home position return operations. Use JOG operation or positioning operation to return the axis to a point before the near-zero point dog signal was output, then retry the home position return operation.

Table 2.6	Positioning	Control S	tart-Up E	rror List (1	00 to 19	9) (Continued)	
							-

					Co	ntro	l Ma	de						
Error Code	Positioning	Fixed-Pitch Feed	Bpeed	Speed/Position Switching	Speed Switching	Constant Speed	JOG	Manual Puise Generator	Home Position Return	Position Follow-Up Control	080	Error Cause	Error Proc essing	Corrective Action
												• The set JOG speed is 0.	Positioning control does not start.	• Set a correct speed (within the specified range).
116							0					 The set JOG speed exceeds the JOG speed limit value. 	Control is executed at the JOG speed limit value.	
117								0				 Both forward and reverse motion were designated when simultaneously starting JOG operation programs. 	Only the axis set to move in the forward direction starts.	• Set correct data.
												• The speed change point is beyond the final address.	Positioning control	 Set a speed change point that is before the final address.
110					Ŭ							• An address that causes positioning in the reverse direction is set.	does not start.	• Set an address for positioning in the forward direction.
120					-					0		ZCT not set During second travel in dog type or count type home position return, or when data set type home position return is started, the zero pass signal (M1606+20n/Xn6/M2406+20n) is OFF.	Home position return is not completed correctly.	 Carry out the home position return after the home position has been passed.
136			0									• A VVF/VVR instruction has been used for an MR-[]-B axis.		• MR-J-B axes cannot be started with VVF/VVR instructions: use VF/VR instructions instead.
140	0											 In linear interpolation for which a reference axis is designated, the travel value of the reference axis is set at "0". 	Positioning control	• Do not set an axis whose travel value is 0 as the reference axis.
141											0	 An odd number has been set for the position command device for position follow-up control. 	does not start.	• Set an even number for the position command device for position follow-up control.
142				0						0		 An external input signal has come ON although external input signal setting has not been performed for that signal in the system settings. 		 Perform external input signal setting in system setting.

(3) Positioning control errors (200 to 299)

The errors shown in this section are those detected during positioning control.

Error codes, causes and corrective actions are shown in Table 2.7.

Table 2.7 Positioning Control Error List (200 to 299)

		Control Mode												
Error Code	Positioning	Fixed-Pitch Feed	Speed	Speed/Position Switching	Speed Switching	Constant Speed	JOG	Manual Pulse Generator	Home Position Return	Position Follow-Up Control	080	Error Cause	Error Processing	Corrective Action
200	0	0	0	0	0	0	0	0		0	0	 The PC ready flag (M2000) was turned OFF while positioning was being started in response to a start request issued by a sequence program. 	Avia motion	Turn the PC ready flag (M2000) ON after all axes have stopped.
201									0			 The PC ready flag (M2000) was turned OFF during a home position return operation. 	decelerates to a stop.	After turning the PC ready flag (M2000) ON or turning the stop command (M1800+20n/Yn0/M3200+20n) or rapid
202									0			• The stop command (M1800+20n/Yn0/ M3200+20n) has been turned ON during a home position return operation.		stop command (M1801+20n/Yn1/M3201 +20n) OFF, re-attempt home position return. In the case of a near-zero point doo
203									0			 The rapid stop command (M1801+20n/Yn1/M3201+20n) has been turned ON during a home position return operation. 	Axis motion stops immediately.	type home position return, use JOG operation or positioning operation to return the axis to the point before the near-zero point dog signal was output, and re-attempt home position return.
204	0	0	0	0	0	0	0	0	0	0	0	 The PC ready flag (M2000) was turned back ON during deceleration initiated by turning OFF the PC ready flag (M2000). 	No processing	• Turn the PC ready flag (M2000) ON after all axes have stopped. (Turing ON of the PC ready flag (M2000) during deceleration is ignored)
206									o			 While a home position return operation was in progress, an emergency stop was executed in the test mode at a peripheral device by pressing the [Back Space] key. 	Axis motion stops immediately.	 In the case of a near-zero point dog type home position return, use JOG operation or positioning operation to return the axis to the point before the near-zero point dog signal was output, and re-attempt home position return. If the near-zero point dog signal is turned OFF when executing a count type home position return, use JOG operation or positioning operation to return the axis to the point before the near-zero point dog signal was output, and re-attempt home position return. If the near-zero point dog signal is turned ON when executing count type home position return, re-attempt the home position return.
207	0				o	o	0			o		• The feed present value exceeded the stroke limit during positioning. In the case of circular interpolation, an error code is stored only for axes whose feed present value exceeded the stroke limit. In the case of linear interpolation, error codes are stored for all axes involved in the interpolation.		 Correct the stroke limit or travel value setting so that positioning is executed within the stroke limit.
208	0				0	0		0				 During circular interpolation or during simultaneous operation of multiple manual pulse generators, the feed present value of another axis exceeded the stroke limit value. (For detection of other axis errors). 	Axis motion decelerates to a stop.	
209				0					0			• An overrun has occurred because the set travel value exceeds the deceleration distance when a speed/position change (CHANGE) signal is input during speed/position switching control, or when the near-zero-point dog signal is input during count type home position return.		Correct the speed setting so that overrun does not occur. Set a travel value which will not cause an overrun.
210				0								 During speed/position switching control, the set travel value exceeds the stroke limit when a speed/position switching (CHANGE) signal is input. 		 Correct the stroke limit or travel value setting so that positioning is executed within the stroke limit.

					Co	ntro	Mc	de						
Error Code	Positioning	Fixed-Pitch Feed	Speed	Speed/Position Switching	Speed Switching	Constant Speed	JOG	Manual Puise Generator	Home Position Return	Position Follow-Up Control	080	Error Cause	Error Processing	Corrective Action
211						0						 During positioning, an overrun occurs because the deceleration distance for the output speed is not attained at the point where the final positioning address is detected. 	Axis motion decelerates to a stop.	 Set a speed at which overrun does not occur. Set a travel value which will not cause an overrun.
214								0				 An attempt was made to control an axis already being moved by the manual pulse generator by setting the manual pulse generator operation enable flag for that axis. 	The manual pulse generator input is ignored until the axis stops.	 Perform the manual puise generator operation after the axis has stopped.
												• The speed switching point address is greater than the end point address.		• Set the speed switching point within the range from the previous speed
215					0							 An address to control positioning in the opposite direction was set during speed switching control. 	A rapid stop is executed.	switching point address to the end point address.
												• The same servo program was been executed a second time.		• Modify the sequence program.
220						1				0		 In position follow-up control, when the control unit is "degrees", a command address outside the 0 to 35999999 has been set. 	Axis motion decelerates to a stop.	 When the control unit is "degrees", set a command address within the range 0 to 35999999.
												The command address has exceeded the stroke limit range in position follow-up control.	(M2001+20n OFF)	 Set an address within the stroke limit range.
225										0		 In constant speed control, the speed at the pass point exceeds the speed limit value. 	The speed is kept at the speed limit value.	• Set a speed command value between 1 and the velocity limit value.

 Table 2.7 Positioning Control Error List (200 to 299) (Continued)

(4) Errors occurring at present value changes and speed changes (300 to 399)

The errors shown in this section are those that occur on execution of present value changes and speed changes.

Error codes, causes, processing, and corrective actions are shown in table 2.8.

Table 2.8 List of Errors that Occur at Present Value/Speed Changes

					Co	ntre	i Me	de						
Error Code	Positioning	Fixed-Pitch Feed	Speed	Speed/Position Switching	Speed Switching	Constant Speed	DOL	Manual Pulse Generator	Home Position Return	Position Follow-Up Control	080	Error Cause Processi		Corrective Action
												 An attempt was made to change the present value data of an axis in motion. 		 Use the following states of the following devices as interlocks to ensure that the present value of an axis in motion cannot be changed.
300	0	0	0	0	0	0	0	0	0	0	0	 An attempt was made to change the present value data of an axis that had not been started up. 	value data is not changed.	(1) OFF state of the start accept flag (M2001 to M2004/M2001 to M2008/M2001 to M2032) for the relevant axis
												 An attempt was made to change the present value data of an axis whose status was "servo OFF". 		(2) ON state of the servo READY flag XnF
301									0			 An attempt was made to change the speed of an axis executing a home position return. 		 The speed of an axis executing a home position return cannot be changed.
302	0					0						 An attempt was made to change the speed of an axis executing circular interpolation. 	D	• The speed of an axis executing circular interpolation cannot be changed.
303	0	0		0	0	0				0		 An attempt was made to change the speed of an axis after automatic deceleration had started in positioning. 	is not changed.	 The speed of an axis cannot be changed after automatic deceleration has started.
304							0					 An attempt was made to change the speed of an axis during deceleration initiated by turning OFF the JOG operation start signal (M1802+20n, M1803+20nYn2, Yn3/M3202+20n, M3203+20n). 		• Do not attempt a speed change during deceleration initiated by turning OFF the JOG operation start signal (M1802+20n, M1803+20n/Yn2, Yn3/M3202+20n, M3203+20n).
305	0	0	0	0	0	0	o			0		 The speed to be changed to in a speed change was set outside the range of 0 to the speed limit value. 	The speed is kept at the speed limit value.	 Set the speed within the range from 0 to the speed limit value.
309												• A present value change command outside the range of 0 to 35999999 (x 10 ⁻⁵ degrees) has been issued for an axis whose control units are degrees.	The present value data is not changed.	• Make a setting in the range of 0 to 35999999 (× 10 ⁻⁶ degrees).
310												• A speed change was attempted during high-speed oscillation.	The speed	 Do not perform speed changes during high-speed oscillation.
310											Ŭ	• A speed change to "0" request was issued during high-speed oscillation.	changed.	

(5)	System	errors	(900 ⁻ to	999)
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Table 2.9	System	Error List	(900 to	999)
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					Co	ntro	I Me	de						
Error Code	Positioning	Fixed-Pitch Feed	Speed	Speed/Position Switching	Speed Switching	Constant Speed	JOG	Manual Pulse Generator	Home Position Return	Position Follow-Up Control	08C	Error Cause	Error Processing	Corrective Action
900												 When the serve amplifier power is switched ON, the motor type set in the "system settings" differs from the motor type actually installed. (Checked only when using MR-J2-B) 	Further	 Correct the motor type setting in the system settings.
901												 When the serve amplifier power is switched ON, the motor travel value while the power was OFF is found to have exceeded the "Power of Allowed Travel- ing Points" setting made in the system settings. 	operation is impossible.	• Check the position. Check the encoder battery.

2.3 Major Errors

Major errors are caused by external input signals or by control commands from the SCPU. The error codes for major errors are 1000 to 1999.

Major errors consist of control start-up errors, positioning errors, absolute system errors, and system errors.

- (1) Positioning control start-up errors (1000 to 1099)
 - The errors shown in this section are those detected when positioning control is started.

Error codes, error causes, error processing and corrective actions are shown in Table 2.10.

Table 2.10 Positioning Control Start-Up Error List (1000 to 1099)

			_		Co	ntro	i Me	de				••••			
Error Code	Positioning	Fixed-Pitch Feed	Speed	Bpeed/Position Switching	Speed Switching	Constant Speed	JOG	Manual Pulse Generator	Home Position Return	Position Follow-Up Control	080		Error Cause	Error Proc ess ing	Corrective Action
1000	0	0	0	0	0	0	0	0	0	0	0		• The external stop signal of the corresponding axis was turned ON.		• Turn OFF the STOP signal.
1001	0	0	0	0	0	0	0	0	0	0	o		• When positioning was started in the forward direction (addresses increasing), the external FLS (upper limit LS) signal was turned OFF.		 Move the axis in the reverse direction in the JOG mode until it enters the external limit range.
1002	0	0	0	0	0	o	0	0	0	0	0		• When positioning was started in the reverse direction (addresses decreasing), the external RLS (lower limit LS) signal was turned OFF.		 Move the axis in the forward direction in the JOG mode until it enters the external limit range.
1003									0				 When near-zero point type home position return was started, the external DOG (near-zero point dog) signal was turned ON. 	Positioning	 Move the axis to a point before the near-zero point dog in the JOG mode and then execute a home position return.
1004	0	0	0	o	0	0	0	0	0	0	0		 The servo state of the corresponding axis is not servo READY. (M1615+20n/XnF/M2415+20n : OFF). (1) The power supply to the servo amplifier is OFF. (2) Initial processing is in progress after turning on the servo amplifier. (3) The servo amplifier has not been in- stalled. (4) A servo error has occurred. (5) Cable fault. 	control does not start.	• Wait until the servo status is READY (M1615+20n/XnF/M2415+20n : OFF).
1005	0	0	0	0	0	0	0	0	0	0	0		• The serve error detection signal of the corresponding axis (M1608+20n/XnB/M2408+20n) was turned ON.		• Eliminate the error at the servo side, reset the servo error detection signal (M1608+20n/Xn8/M2408+20n) by using the servo error reset command (M1808+20n/Xn8/M3208+20n), then start operation.

(2) Positioning control errors (1100 to 1199) The errors shown in this section are those detected during positioning. Error codes, error causes, error processing, and corrective actions are shown in Table 2.11.

	Control Mode						ode							
Error Code	Positioning	Fixed-Pitch Feed	8peed	Speed/Position Switching	Speed Switching	Constant Speed	DOG	Manual Pulse Generator	Home Poekion Return	Position Follow-Up Control	080	Error Cause	Error Processing	Corrective Action
1101	0	0	0	0	0	0	0	0	0	0	0	 When positioning was started in the forward direction (addresses increasing), the external FLS (upper limit LS) signal was turned OFF. 	Axis motion decelerates to a stop in accordance	 Move axis in the reverse direction in the JOG mode until it enters the external limit range.
1102	0	0	0	0	0	0	0	٥	0	0	0	 When positioning was started in the reverse direction (addresses decreasing), the external RLS (lower limit LS) signal was turned OFF. 	with the "deceleration processing on STOP	 Move the axis in the forward direction in the JOG mode until it enters the external limit range.
1103									0			 The external STOP signal (stop signal) was turned ON while the axis was moving. 	setting in the parameter block.	 When executing a near-zero point dog type home position return, move the axis to a point before the near-zero point dog in the JOG mode and then execute a home position return.
1104	0	0	0	0	0	0	0	0	0	0	0	 The serve error detection signal (Xn8) was turned ON while an axis was in motion. 	The axis stops immediately without decelerating.	 After taking the appropriate corrective action for the servo error, the axis can be restarted.
1105	0	0	٥	0	0	0	0	0	0	0	0	 The power supply to the serve amplifier was turned OFF while an axis was in motion. (Serve not installed status detected, cable fault, etc.) 	M1615+20n/ XnF/M2415 +20n turned OFF.	 Turn ON the power supply to the servo amplifier. Check the cable to servo amplifier connecting cable.

(3) Absolute System Errors (1200 to 1299)

The errors shown in this section are those detected in an absolute system.

Error codes, error causes, error processing, and corrective actions are shown in Table 2.12.

Table 2.12 Absolute Sysyem Error List (1200 to 1299)

			·		Co	ntro	i Me	ode _						
Error Code	Poettioning	Fixed-Pitch Feed	Speed	Speed/Position Switching	Bpeed Switching	Constant Speed	JOG	Manual Pulse Generator	Home Position Return	Position Follow-Up Control	080	Error Cause	Error Pro cess ing	Corrective Action
1201												• When the serve amplifier power was switched ON, a sum check error occurred with the backup data in the controller. Home position return has not been performed. CPU module battery error.	Home position return request (X0n9) ON	 Check the battery of the CPU module and execute a home position return.
1202*												 When the servo amplifier power is turned ON, a communication error in communication between the servo amplifier and encoder occurs. 	Home position return request (X0n9) ON, servo error 2016 set.	 Check the motor and encoder cables and perform home position return again.
1203*												• During operation, the amount of change in the encoder present value complies with the following expression : "Amount of change in encoder present value/3.5 ms 180° of motor revolution" After the servo amplifier power has been turned ON, a continual check is performed (in both servo ON and OFF states).	No	• Check the motor and encoder cables.
1204*												 During operation, the following expression holds: "Encoder present value (PLS) e feedback present value (PLS) (encoder effective bit number)". After the servo amplifier power has been turned ON, a continual check is performed (in both servo ON and OFF states). 	- คา <i>ดงส</i> รษณ์มี	

• : These errors occur only when using MR-H-B and MR-J2-B servo amplifiers.

 (4) System error (1300 to 1399, 1500 to 1599) This is an error that is detected when the power is turned on. Error codes, error causes, error processing, and corrective actions are shown in Table 2.13.

					Co	ntro	I Mo	de							
Error Code	Positioning	Fixed-Pitch Feed	speed	Speed/Position Switching	Speed Switching	Constant Bpeed	DOG	Manual Pulse Generator	Home Position Return	Position Follow-Up Control	OCR	Error Cause	Error Pro cess ing	Corrective Action	
1300												 System setting differs from actual ADU installation status. 		• Review the parameter settings.	
									1			ADU defective.		Replace the ADU.	
1310												 Initial communication with servo system CPU not completed correctly. 	Positioning	• Replace the servo system CPU or ADU.	
1010												 Servo system CPU defective, or ADU defective. 	does not		
1500												• The servo power supply (A230P) is not on, or the all axes servo ON command		 Issue the all axes serve ON command after turning on the serve power supply. 	
1300												(M2042 ON) was given during a fault status.		 Replace the serve power supply module. 	
1501												• When use of A278LX brake output is set, 24 VDC is not supplied correctly.]_	• Supply a 24 VDC power supply to the A278LX.	

Table 2.13 Main Base Unit Error List (1300 to 1399, 1500 to 1599)

2.4 Servo Errors

Servo errors include servo amplifier errors and servo power supply module errors (only when using an A273UHCPU (8/32 axis specification)). [When using A273UHCPU (32-axis specification)]

When using A273UHCPU (32-axis specification), the processing when a servo error is detected can be set separately for each system.

(However, this applies only to serve errors detected at the ADU.)

The processing and systems are set in the system settings at a peripheral device.

	Setting	Control Details
1	System servo OFF (default)	 If even one ADU axis is subject to a servo error, servo OFF is established for all the axes in that system. (Same control as when all axes servo OFF is performed.)
2	Servo OFF of affected axis only	 Only the ADU axis subject to the serve error goes into the serve OFF status and other axes are unaffected. However: Where there are two axes per module, if one of the axes is subject to a serve error then both axes go into the serve OFF status. When the following serve errors occur, serve OFF for individual systems becomes effective. Overcurrent (2032) Insufficient voltage (2810)
		Excessive regeneration (2830) Overvoltage (2833) Amplifier power supply overheated (2847)

(1) Servo amplifier errors (2000 to 2799)

The servo amplifier errors are errors detected by the servo amplifier and are assigned error codes 2000 to 2799.

Servo errors include errors at an ADU (only when using an A273UHCPU (8/32 axis specification)) and errors at an MR-[]-B.

In the following tables, the types of servo amplifier are indicated by symbols: (A) for "ADU", and (M) for MR-[]-B.

The servo error detection signal (M1608+20n/Xn8/M2408+20n) comes ON when a servo error occurs. Eliminate the cause of the error, reset the error by turning ON the servo error reset signal (M1808+20n/Yn8/

M3208+20n), and reset operation. (Note that the servo error detection signal will not come ON in response to error codes in the range 2100 to 2499 because these codes are for warnings.)

- Note: 1. When an excessive regeneration error (code 2030), or overload 1 or 2 error (codes 2050, 2051) occurs, the state that applied when the error occurred is stored in the servo amplifier even after the protection circuit has operated. The memory contents are cleared if the external power supply is turned OFF, but are not cleared by the reset signal.
 - 2. Repeated resetting by turning OFF the external power supply after occurrence of error code 2030, 2050, or 2051, may cause devices to be destroyed by overheating. Only restart operation after eliminating the cause of the error.

Details of servo errors are given in Table 2.14.

▲ If a controller or servo amplifier self-diagnosis error occurs, check the points stated in this manual and clear the error.

						/
Error Code	Ampilifier Type	Name	Error Cause Description	When Error Checked	Error Processing	Corrective Action
	(A)	P-N not connected.	P-N of the ADU are not connected to P-N of the servo power supply module.			• Review the wiring.
2010			The power supply voltage is less than 160 VAC. A momentary power interruption of	At any time during operation.		Measure the input voltage (R, S, T) with a voltmeter. Monitor with an oscilloscope to
	(M)	Low voltage	The power supply voltage dropped, for example when motion control			 check whether a momentary power interruption has occurred. Review the power capacity.
		Internal	started, due to insufficient power capacity.	a When the serve amplifier		a Replace the ADU
	(A)	memory error		power is turned ON.		
2012	(M)	Memory error 1	 Servo ampiriter SFAM is tautty. Servo ampiriter EPROM check sum error. 	When the serve amplifier power is turned ON At the leading edge of the PC READY flag (M2000) When a serve error is reset When the power to the serve system CPU is turned ON		• Replace the servo amplifier.
2013	(M)	Clock error	Servo amplifier clock fault.			Replace the serve amplifier.
2014	(A)	Watchdog	Fault in servo control system ADU faikure	At any time during operation		Reset the serve system CPU and check again. Replace the ADU.
	(M)		Servo amplifier hardware fault Servo system CPU hardware fault			Replace the serve amplifier. Benince the serve system CPU.
	(A)	2-port memory error	Faulty 2-port memory in ADU	• When the servo amplifier power is turned ON • When a servo error is reset		Rest the serve system CPU and check again. Replace the ADU.
2015	(M)	Memory error 2	• Servo amplitier EEPROM fault	When the servo amplifier power is turned ON At the leading edge of the PC READY flag (M2000) When a servo error is reset When the power to the servo system CPU is turned ON	Immediata stop.	 Replace the servo amplifier.
	(Å)		 Communication with the encoder is not normal at initialization. The encoder type sat in the system settings (ABS/NO) does not match the encoder actually connected. 	When the servo amplifier power is turned ON When a servo error is reset		 Reset the servo system CPU and oheck again. Replace the servomotor (encoder). Review the system settings.
2016	(M)	Position sensor error 1	 Fault in communication with the encoder 	When the serve amplifier power is turned ON At the leading edge of the PC READY flag (M2000) When a serve error is reset When the power to the serve system CPU is turned ON		Check if the connector of the encoder cable is loose. Replace the servomotor. Replace the encoder cable.
	(A)		• ADU A/D onverter faulty	When the serve amplifier power is turned ON When a serve error is reset		 Reset the serve system CPU and check again, Replace the ADU.
2017	(M)	PCB error	 Faulty device in the serve amplifier PCB. 	When the serve amplifier power is turned ON At the leading edge of the PC READY flag (M2000) When a serve error is reset When the power to the serve system CPU is turned ON		• Replace the servo amplifier.
2019	(M)	Memory error 3	 Servo amplifier flash ROM check sum error 	When the serve amplifier power is turned ON At the leading edge of the PC READY flag (M2000) When a serve error is reset When the power to the serve system CPU is turned ON		• Replace the servo amplifier.

Table 2.14 Servo Amplifier Error List (2000 to 2799)

Error	Amplifier		Enter Cause	When Error Checked	Error	Corrective Action	
Code	Туре	Name	Description		Processing		
	(A)	Position	 Communication with the encoder was not performed normally during operation. 			Check the connection between the encoder and ADU. Replace the servomotor (encoder).	
2020	(M)	sensor error 2	 Fault in communication with the encoder 	At any time during operation		Check if the connector of the encoder cable is loose. Replace the servomotor. Replace the encoder cable.	
2024	(M)	Output ground fault	• U, V, or W of the servo amplifier output grounded tput ground It		 Use a multimeter to check between the U, V, and W terminals and the case. Use a multimeter and megger tocheck between the U, V, and W terminals of the motor and the core. 		
	(A)	Absolute position lost	 The voltage of the supercapacitor inside the absolute encoder has dropped below 2.5 ±0.2 V. The absolute encoder rotated at greater than 500 rpm during a momentary power interruption. 	When the servo amplifier power is turned ON When a servo error is reset	Immediate stop	Replace the battery (MR-JBAT-{)). Check the connection between the encoder and ADU.	
2025	(M)	Battery alarm	The voltage of the supercapacitor inside the absolute position sensor has dropped. The battery voltage is low. Failure of battery cable or battery.	When the servo amplifier power is turned ON At the leading edge of the PC READY flag (M2000) When a servo error is resat When the power to the servo system CPU is turned ON		Turn the power ON for 2 to 3 minutes to charge the supercapacitor, switch the power OFF then ON again, and execute a home position return. Turn the servo amplifier power OFF, then measure the battery voltage. Replace the servo amplifier	
2026	(A)	Unit mismatch	 (Home position return must be re- executed after clearing the error.) There is a discrepancy between the servo parameters (system settings) and the actually installed servo amplifuer. 	When the servo amplifier power is turned ON When a servo error is react		Review the system settings.	
			 The frequency of ON/OFF switching of the power transistor for regeneration is too high. (Caution is required since the regenerative resistor could overheat.) 			Reduce the frequency of acceleration and deceleration or feed speed while checking the servo monitor regeneration level (%). Reduce the load. Increase the servomotor capacity.	
2030	(M)	Excessive regeneration	Servo parameter (system settings) setting error Incorrect wiring of regenerative resistor	At any time during operation		Check the serve parameters (regenerative resistor and motor type settings in the system settings). Connect the regenerative resistor correctly.	
			Failure of regenerative resistor Ower transistor for regeneration damaged by short circuit	-		Replace the regenerative resistor. Replace the servo amplifier.	
2031	(A)	Overspeed	The commanded speed is too high. An overshoot occurred during acceleration.			Review the commanded speed. Review the servo parameters.	

Table 2.14 Servo Amplifier Error List (2000 to 2799) (Continued)

Ettor	Amplifier	[Frmr Cause		Error	
Code	Туре	Name	Description	When Error Checked	Processing	Corrective Action
2031	(M)	Overapeed	 The motor rpm has exceeded 115% of the rated rpm. An overshoot has occurred because the acceleration time constant is too small. An overshoot has occurred because the servo system is unstable. Position sensor fault. 	At any time during operation		 Check the motor rpm in the servo parameters. Check if the number of pulses per revolution and travel value per revolution in the fixed parameters match the machine specifications. If an overshoot occurs during acceleration, check the acceleration time and deceleration time in the fixed parameters. If overshoot occurs, increase the speed integral compensation by adjusting the position loop gain / position control gain 1, 2 in the servo parameters. Check if the encoder cable is disconnected.
2032	(A) (M)	Overcurrent	 A servemeter that does not match the setting has been connected. The U, V, W phases in the ADU outputs have shorted with each other or to ground. Incorrect wiring of U, V, W phases in the ADU outputs The transistor module of the ADU is damaged. ADU failure— Failure of coupling between the servemeter and encoder The servemeter coolinated. U, V, W in the serve amplifier outputs have short circuited with each other. U, V, W in the serve amplifier outputs have short do ground. Incorrect wiring of U, V, W phases in the serve amplifier outputs. The serve amplifier outputs. The serve amplifier ransistor is damaged. Failure of coupling between servemeter and encoder Encoder cable failure A servemeter that does not match the setting has been connected. The servemeter coolidated. 	When the servo amplifier power is turned ON When a servo error is reset	Immediate stop	 Review the system settings. Check the servomotor cable. Correct the servomotor cable. Replace the ADU. Replace the ADU. Replace the servomotor. Review the servo parameters. Check if there is a short circuit between U, V, W of the servo amplifier outputs have been grounded to the ground terminal. Check if U, V, W of the servomotor are grounded to the core. If grounding is found, replace the servo amplifier and/or motor. Replace the servo amplifier and/or motor. Replace the servo amplifier. Check the connected motor set in the system settings. Check and adjust the gain value set in the servo parameters.
2033	(M)	Overvoltage	detection circuit. • The converter bus voltage has reached 400 V or more. • The frequency of acceleration and deceleration was too high for the regenerative resistor has been connected incorrectly. • The regenerative resistor in the servo amplifier is destroyed. • The power transistor for regeneration is damaged. • The power supply voltage is too high.			operating in the vicinity. • Increase the acceleration time and deceleration time in the fixed parameters. • Check the connection between C and P of the terminal block for the terminal block for regenerative resistance. • Measure between C and P of the terminal block for regenerative resistance with a multimeter; if abnormal, replace the servo amplifier. (Measure about 3 minutes after the charge lamp has gone out.) • Replace the servo amplifier. • Measure the input voltage (R, S, T) with a voltmeter.

Table 2.14 Servo Amplifier Error List (2000 to 2799) (Continued)

Error	Ampilitier		Error Cause		Error	
Code	Туре	Name	Description	When Error Checked	Processing	Corrective Action
2034	(M)	Communica- tions error	 Error in data received from the servo system CPU 			 Check the connection of the motion bus cable. Check if there is a disconnection in the motion us cable. Check if the motion bus cable is clement oversetty.
	(A)		The commanded speed is too high. Servo system CPU failure			Review the commanded speed. Replace the servo system CPU.
2035	(M)	Data error	 There is excessive variation in the position commands from the servo system CPU; commanded speed is too high. Noise has entered the commands from the servo system CPU. 			Check the commanded speed, and the number of pulses per revolution and travel value per revolution in the fixed parameters. Check the connection of the motion bus cable connector. Check if the motion bus cable is clamped correctly. Check if the motion bus cable is clamped correctly. Check if any relays or valves are operating in the vicinity.
	(A)		Servo system CPU failure			• Replace the servo system CPU.
2036	(M)	Transmission error	 Fault in communication with the servo system CPU 			Check the connection of the motion bus cable connector. Check if there is a disconnection in the motion bus cable. Check if the motion bus cable is clamped correctly.
2042	(M)	Feedback error	Encoder signal fault	At any time during operation	Immediate	Replace the servomotor.
	(A)	Amplifier fin overheating	The fan of the ADU has stopped. The continuous output current rating of the ADU was exceeded. Failure of ADU thermal sensor		stop	Replace the fan of the ADU. Reduce the load. Replace the ADU
2045	(M)	Fin overheating	The heat sink in the servo amplifier is overheated. Amplifier error (rated output exceeded) Power repeatedly switched ON/OFF during overload. Cooling fault			 If the effective torque of the servomotor is high, reduce the load. Reduce the frequency of acceleration and deceleration. Check if the amplifier's fan has stopped. (MR-H150B or higher) Check if the passage of cooling ar is obstructed. Check if the temperature inside the panel is too high (range: 0 to +55°C). Check if the electromagnetic brake was actuated from an external device during operation. Replace the servo amplifier.
	(A)		The thermal protector incorporated in the servomotor operated. The continuous output rating of the motor has been exceeded.			Replace the servomotor. Reduce the load.
2046	(M)	Motor overheating	The servomotor is overloaded. The servomotor and regenerative option are overheated. The thermal protector incorporated in the encoder is faulty.			 If the effective torque of the servomotor is high, reduce the load. Check the ambient temperature of the servomotor (range: 0 to +40°C). Replace the servomotor.

Table 2.14 Servo Amplifier Error List (2000 to 2799) (Continued)

Error	Amplifier		Error Cause		Error	
Code	Туре	Name	Description	When Error Checked	Processing	Corrective Action
	(A)	Overload	The rated current of the motor has been exceeded. The load inertia or friction is too great. Hunting occurred due to parameter			 Reduce the load. Review the servo parameters.
2050	(M)	Overioad 1	 An overload current of about 200% has been continuously supplied to the servo amplifier and servomotor. 			 Check if there has been a collision at the machine. If the load inertia is very large, either increase the time constant for acceleration and deceleration or reduce the load. If hunting occurs, adjust the position loop gain in the ervo parameters. Check the connection of U, V, W of the servo amplifier and servomotor. Check for disconnection of the encoder cable. Replace the servomotor.
2051	(M)	Overloed 2	 The servo amplifier and servomotor were overloaded at a torque close to the maximum torque (95% or more of the current control value). 	At any time during operation	Immediate stop	 Check if there has been a collision at the machine. If the load inertia is very large, either increase the time constant for acceleration and deceleration or reduce the load. If huming occurs, adjust the position loop gain / position control gain 1, 2, speed loop gain/ speed control gain 1, 2 in the servo parameters. Check the connection of U, V, W of the servo amplifier and servomotor. Check for disconnection of the encoder cable. Replace the servomotor. If the voltage of the bus in the servo amplifier has dropped (charge lamp has gone out), replace the servo amplifier.
	(A)		The deviation counter value has exceeded the stipulated value. Adequate acceleration is not possible because the inertia is too great. Encoder or cable failure.			 Review the servo parameters. Replace the encoder, cable.
2052	(M)	Excessive error	The difference between the servo amplifier command pulses and feedback pulses has exceeded 80000 pulses.			 Check if there has been a collision at the machine. Increase the time constant for acceleration and deceleration. Increase the position loop gain / position control gain 1, 2, in the servo parameters. Check for disconnection of the encoder cable. Replace the servomotor. If the voltage of the bus in the servo amplifier has gone out), replace the servo amplifier.
2057	(A)	Hardware fault	Hardware fault in an ADU		·	Replace the ADU
2086	(M)	RS232 communication error	Parameter unit communication error			Check for disconnection of the parameter unit cable. Replace the parameter unit.
2102	(A)	Battery warning	The voltage of the backup battery for the absolute encoder has become low. The voltage of the battery installed		Operation	Heplace the battery (MR-JBAT-[]). Replace the battery.
2103	(M) (M)	Battery disconnection warning	in the serve amplifier has become low. • The power supply voltage to the absolute position sensor has become low.			Replace the battery. Check for disconnection of the encoder cable. Replace the servomotor. Replace the servo amplifier.

Table 2.14 Servo Amplifier Error List (2000 to 2799) (Continued)

Error	Amplifier	1.	Error Cause		Error	
Code	Type	Name	Description	When Error Checked	Processing	Corrective Action
2140	(M)	Excessive regeneration warning	 An excessive regeneration error (2030) is likely to occur (regeneration of 85% of the maximum load capacity for the regenerative resistor has been detected). 			 Refer to the details on the excessive regeneration error (2030).
2141	(A)	Overload	• A load of 80% of the level that will cause an overload error (2050) has been detected.		Operation	Refer to the details on the overload error (2050).
2141	(M)	warning	An overload error (2050, 2051) is likely to occur (85% of overload level detected).		continues	Refer to the details on the overload errors (2050, 2051).
2143	(A)	Absolute position counter warning	• Encoder failure			Replace the encoder.
2146	(M)	Servo emergency stop	 The connection between 1A and 1B (emergency stop input) of CN6 of the servo amplifier encoder has been broken. 			 Establish a short circuit between 1A and 1B of CN6 of the servo amplifier encoder.
	(A)	Emergency	An emergency stop has been executed.		Immediate	• Release the emergency stop.
2147	(M)	stop	 An emergency stop (EMG) signal has been input from the servo system CPU. 		stop	
2149	(M)	Main circuit OFF warning	The servo ON (SON) signal was turned ON while the contactor was OFF. The main circuit bus voltage fell to 215 V or lower at 50 rpm or lower.			Turn the main circuit contactor or circuit power supply ON.
2196	(M)	Home position setting error warning	 After a home position set command, the droop pulses did not come within the in-position range. 			Re-attempt home position return.
2201 to 2224	(A)	Parameter warning	 An Incorrect parameter setting has been made. 2201 Amplifier setting 2202 Motor type 2203 Motor capacity 2204 Number of feedback pulese 2205 In-position range 2006 Position control gain 2 (Actual position gain) 2207 Speed control gain 2 (Actual speed gain) 2208 Speed integral compensation 2209 Torque limit (forward) 2210 Torque limit (reverse) 2211 Emergency stop time delay 2212 Position control gain 1 (Model position gain) 2213 Speed control gain 1 (Model speed gain) 2214 Load inertia ratio 2215 Excessive error alarm level 2216 Td dead band compensation 2219 Feed toward gain 2210 Torque imbalance compensation 2211 Dither control 2222 Gain operation time 	At any time during operation	Operation continues	• neview the system settings and servo parameters.
			2223 Servo responsibility 2224			

Table 2.14 Servo Amplifier Error List (2000 to 2799) (Continued)

Error	Amplifier	Error Cause Name Description			Error		
Code	Туре			Description	When Error Checked	Processing	Corrective Action
			 Out-of been param the va retain 	I-range parameter setting has designated. Incorrect neter values are ignored and Jues before setting are ed.			 Check the serve parameter setting range.
			2301	Amplifier setting			
			2302	Regenerative resistance			
			2303	Motor type			
			2304	Motor capacity			
			2305	Motor rpm			
			2306	Number of feedback pulses			
			2307	Rotating direction setting		8	
			2308	Automatic tuning setting	4		
			2309	Servo responsibility			
			2310	Torque limit (forward)			
			2311	Torque limit (reverse)			
			2312	Load inertia ratio			
			2313	Position control gain 1			
			2314	Speed control gain 1			
	(M)	Parameter error	2315	Position control gain 2	At any time during operation	Operation continues	
			2316	Speed control gain 2			
			2317	Speed integral compensation			
2301			2318	Notch filter			
to 2 336			2319	Feed forward coefficient			
			2320	In-position range			
			2321	Electromagnetic brake sequence output			
			2322	Monitor output mode selection			
			2323	Optional function 1			
			2324	Optional function 2			
			2325	Optional function 3			
			2326	Optional function 4			
			2327	Monitor output 1 offset			
			2328	Monitor output 2 onset			
			2329	Pre-slarm data selection			
			2330	Eversive error starm level			
			2332	Ontional function 5			
			2333	Optional function 6			
			2334	PI-PID switching position			
			2335	droop Torque limit compensation factor			
			2336	Speed integral compensation (actual speed differential compensation)			

Table 2.14 Servo Amplifier Error List (2000 to 2799) (Continued)

Error	Amplitier	Error Cause			When Error Checked	Error	Corrective Action
Code	Туре	Name		Description	when Error Checked	Processing	Corrective Action
			 Out-of-range parameter setting has been designated. Incorrect parameter values are ignored and the values before setting are retained. 				 Check the serve parameter setting range.
			2301	Amplifier setting			
			2302	Motor type	At any time during operation		
			2303	Motor capacity			
	{		2304	Number of feedback pulese			
			2305	in-position range			
	(A)		2306	Position control gain 2 (Actual position gain)		Operation continues	
		Parameter error	2307	Speed control gain 2 (Actual speed gain)			
			2308	Speed integral compensation			
			2309	Torque limit (forward)			
2201			2310	Torque limit (reverse)			
2301 to			2311	Emergency stop time delay			
2324			2312	Position control gain 1 (Model position gain)			
			2313	Speed control gain 1 (Model speed gain)			
			2314	Load inertia ratio			
			2315	Excessive error alarm level			
			2316	Special compensation processing			
			2317	Special servo processing			
	Į		2318	Td dead band compensation			
			2319	Feed forward gain			
			2320	Torque imbalance compensation			
			2321	Dither control			
			2322	Gain operation time			
			2323	Servo responsibility			
			2324	-			
2500	(A)	Parameter error	The fol were so Ampli resist Motor	lowing servo parameters et incorrectly. itier/external regenerative lance setting r type	 When the serve amplifier power is turned ON When a serve error is reset 		 Review the system settings and the servo parameters.
			Motor	capacity			

Table 2.14 Servo Amplifier Error List (2000 to 2799) (Continued)

Error	Amplifier		Error Cause		When Error Checked	Error	Corrective Action	
Code	Type	Name		Description	WHEN EITOR CHECKED	Processing	Corrective Action	
			Incorrect parameter settings have been made. Source is a setting been made. Source is a setting PC READ PC READ	ect parameter settings have nade.	• When the serve amplifier power is turned ON		 Review the system settings and the servo parameters. 	
				PC READY flag (M2000)				
			2502	Motor type	When a serve error is			
			2503	Motor capacity				
			2504	Number of feedback pulse				
			2505	In-position range				
	(A)	Parameter error	2506	Position control gain 2 (Actual position gain)				
			2507	Speed control gain 2 (Actual speed gain)				
			2508	Speed integral compensation				
			2509	Torque limit (forward)				
			2510	Torque limit (reverse)	Operation continues			
0504			2511	Emergency stop time delay				
to 2524			2512	Position control gain 1 (Model position gain)		Operation continues		
2024			2513	Speed control gain 1 (Model speed gain)				
			2514	Load inertia ratio				
			2515	Excessive error alarm level				
			2516	Special compensation processing				
			2517	Special servo processing				
			2518	Td dead band compensation				
			2519	Feed forward gain				
			2520	Torque imbalance compensation				
			2521	Dither control				
			2522	Gain operation time				
			2523	Servo responsibility				
			2524					
		l					I	

Table 2.14 Servo Amplifier Error List (2000 to 2799) (Continued)

Error	Amplifier		Error Cause Name Description		When Error Chested	Error	Corrective Action	
Code	Туре	Name			When Strot Checked	Processing	Corrective Action	
			 The set parameter values are incorrect. The parameter data has been destroyed. 		 When the serve amplifier power supply is turned ON At the leading edge of the PC READY flag (M2000) 		• Check and change the set parameter values, then switch the power to the servo system CPU OFF then ON again, press	
			2601	Amplifier setting	 When a serve error is reset 		the reset key, or turn the PC READY flac (M2000) OFF then	
l I			2602 Regenerative resistance . When the power to the	• When the power to the		ON again.		
1			2603	Motor type	servo system CPU is turned ON			
			2604	Motor capacity				
1			2605	Motor rpm				
			2606	Number of feedback pulses				
			2607	Rotating direction setting				
			2608	Automatic tuning setting				
			2609	Servo responsibility				
ł			2610	Torque limit (forward)				
			2611	Torque limit (reverse)				
[Initial parameter error	2612	Load inertia ratio	Immediate			
ľ	(M)		2613	Position control gain 1				
			2614	Speed control gain 1				
			2615	Position control gain 2				
			2616	Speed control gain 2		1		
			2617	Speed integral compensation				
2601			2618	Notch filter		1		
to			2619	Feed forward coefficient		Immediate		
2636			2620	In-position range				
			2621	Electromagnetic brake sequence output				
			2622	Monitor output mode selection				
1			2623	Optional function 1				
ł			2624	Optional function 2				
[2625	Optional function 3				
]			2626	Optional function 4		Į		
]		5	2627	Monitor output 1 offset		1		
]			2628	Monitor output 2 offset				
1			2629 Pre-alarm data selection					
			2630	Zero speed				
			2631	Excessive error alarm level				
1			2632	Optional function 5				
			2634	PI-PID switching position				
			2635	Torque limit compensation				
ł	Į			Speed internal				
1			2636	compensation				
				(actual speed differential compensation)				
L					L	L		

Table 2.14 Servo Amplifier Error List (2000 to 2799) (Continued)

(2) Servo power supply module errors (2800 to 2999: only applicable when using 273UHCPU (8/32 axis specification))

Servo power supply module errors are detected by the servo amplifier, and their codes are 2800 to 2999.

The servo error detection signal (M1608+20n/Xn8/M2408+20n) comes ON when a servo error occurs. Eliminate the cause of the error, reset the error by turning ON the servo error reset signal (M1808+20n/Yn8/ M3208+20n), and reset operation. (Note that the servo error detection signal will not come ON in response to error codes in the range 2900 to 2999 because these codes are for warnings.)

- Note: 1. Regarding the excessive regeneration error (error code 2830), the state at the time the error occurred remains stored in the servo amplifier even after the protection circuit has operated. The memory contents are cleared when the external power supply is turned OFF, but are not cleared by the RESET signal.
 - 2. If error code 2830 is repeatedly reset by turning OFF the external power supply, devices may be destroyed due to overheating: only restart operation after the cause of the error has been completely eliminated.

The servo power supply module errors are shown in Table 2.15.

Error		Error Cause	When Error	Error	Corrective Action	
Code	Name	Description	Checked	Processing		
2810	Low voltage	 The voltage to the power supply module fell below 170 VAC. A momentary power interruption occurred. The load is too great. 			 Review the power supply equipment. Review the power capacity. 	
2830	Excessive regeneration	 The maximum load capacity of the regenerative resistor has been exceeded due to frequent operation or continuous regenerative operation. The power transistor for regeneration has been damaged. The regenerative resistor setting in the system settings is incorrect. The regenerative resistor is wired incorrectly 	At any time during	Immediate stop	 Review the operation pattern, either by reducing the frequency of acceleration and deceleration or reducing the speed. Replace the servo power supply module. Review the system settings. Connect the wiring correctly. 	
2833	Overvoltage	 The regenerative resistor is connected incorrectly. The power transistor for regeneration has been damaged. The regenerative resistor is destroyed. The power supply voltage is too high. 	operation		 Correct the wiring. Replace the servo power supply module. Replace the regenerative resistor. Review the power supply equipment. 	
2847	Amplifier power supply overheating	 The servo power supply module fan is stopped. The continuous output current of the power supply module has been exceeded. Thermal sensor fault. 			 Replace the fan. Reduce the load. Replace the servo power supply module. 	
2940	Excessive regeneration warning	 80% of the level that would cause an excessive regeneration error (2830) was detected. 		Operation continues.	 Refer to the details on the excessive regeneration error (2830). 	

Table 2.15 Servo Power Supply Module Error List (2800 to 2999)

2.5 LED Indications when Errors Occur at the PCPU

When the errors listed below occur, they are indicated by the "ERROR" LED on the front panel of the A171SCPU, and the LED on the front panel of the A273UHCPU. The error message can be read on the error list monitor screen of the peripheral device.

For details on the operating procedure, refer to the operating manual for the peripheral device.

A171SCPU "ERROR" LED •: Ltt •: Not lit	LED Display on Front Panel of A273UHCPU	Error Cause	Error Check Timing	Operation when Error Occurs	Error Set Device	Corrective Action
•	(<u>L.A.Y., E.R.R.O.R. (S.L.B.B.)</u>) (*1) Base No. + slot No.	• The slot set in the "system settings" has nothing mounted in it, or has a different module mounted in it.				• Set the "system settings" correctly in accordance with the
•	[A,X,I,S, ,H,O, ,M,U,L,T,I,O,E,F]	Axis number settings are duplicated in the "system settings".				modules actually mounted, then
•	[A.M.P. N.O. S.E.T.T	•Not even one axis No. has been set in the "system settings".				RESET key switch.
-	[P.WN.OS.E.T.T.I.N.C	• When an ADU axis has been set in the system settings, no servo power supply module (A230P) has been set.				
•	(<u>5, y, s, s, e, y, d, a, t, a, e, e</u> , e)	No system setting data has been written. The system setting data has been written without performing a relative check. Or it has been written although an error occurred in the relative check. There is no battery in the memory cassette.	When power switched ON On resetting with the RESET key switch	• Start is disabled.	• System setting error flag (M2041) ON	
•	(A. X. I. Ş N. O E. R. R. O. R]	• An axis No. that exceeds the "number of controlled axes" setting in the "system settings" has been set.				
•	1.7.0 P.O.I.N.T.S. O.Y.E.R.	• The total number of VO points of the PC I/O modules set in motion slots in the "system settings" exceeds 256.				
•	(A. 9, P, Y. P.E. E.R.R.O.R. 10) Axis No. (01 to 32)	•The amplifier type set in the "system settings" (MR-H- B/MR-J-B/MR-J2-B) disagrees with the amplifier type actually installed.	When the servo amplifier power is turned ON	• Servo operation does not start for the relevant axis only. Starting of this axis is disabled.		

Table 2.16 LED Indications When Errors Occur at PCPU

Note : '---' in the A171SCPU 'ERROR' LED area indicates errors that do not occur with A171SCPU.
A171SCPU "ERROR" LED •: Lit O: Not lit	LED Display on Front Panel of A273UHCPU	Error Cause	Error Check Timing	Operation when Error Occurs	Error Set Device	Corrective Action
•	(*1) Base No. + slot No.	•ADU hardware error	When the power is switched ON (or on resetting with the RESET key switch)	The servo ON status cannot be established for the relevant ADU axis.		• Try replacing the ADU.
For servo error	Serve error code Axis No. (01to 32)	• Occurrence of a servo error or servo warning		• in the case of MR-H-B, MR-J- B, and MR-J2-	• Servo error	•Eliminate the error cause and perform a
For warning O	• *(**)* if applicable to all axes.	•When using A171SCPU, the LED does not light for a warning. (SV13, SV22, Ver.U or later)		B axes, only the relevant axis enters the servo OFF status. • In the case of ADU axes, the operation follows the ADU servo error processing.	detection flag (M 1608+20n/ Xn8/M2408+ 20n) ON Servo error code device (D808+20n/ D808+20n/D08 +20n) set	servo error reset. After servo error reset, if the servo status is normal at all axes, the LED display is cleared.
_	(S.V. É.R.R.O.R.M.J.M.(PM.)) Servo error le indicates 'n' for code the 'nth' servo power supply	•Occurrence of servo error detected at a servo power supply module (A230P)				
	System error Indicates code (major "n" for error) detected the "nth" at a servo servo power supply power supply module. When using A273UHCPU (32-axis specification), indicates a system error that is unconnected with the servo power supply module system.	Occurrence of a system error (major error) detected at a servo power supply module.	At all times	• All axes in the affected system assume the servo OFF status.	• Major error detection flag (M1607+20N/Xn 7/M2407+20N) ON. • Major error code device (D807+20n/ D807+20n/D07 +20n) set.	• Eliminate the error cause and issue the all axes servo ON command. If all axes enter the servo ON status normally, the LED display is cleared.
•	(*1) Bese No. + slot No.	Detection of motion slot module abnormality (module comes out, or is loose, during operation)			• Motion slot module error detection flag (M2047) ON	• Switch off the power and mount the module correctly.
•	PCPU WDT error code	•Occurrence of a PCPU WDT error		Immediate stop of all axes	PCPU WDT error flag (M9073) ON PCPU WDT error cause (D9184) set	• See Section 3.5.2.

Table 2.16 LED Indications When Errors Occur at PCPU (Continued)

(*1) Indicates the base No., slot No., and the slot information where the error occurred. (SL III)

0 : 1/O slot 0

7 : I/O slot 7

----- Extension stage of the base unit where the error occurred

- 0 : Main base unit
- 1 : First motion extension base unit
- 2 : Second motion extension base unit
- 3 : Third motion extension base unit
- 4 : Fourth motion extension base unit

REMARK

Numerical values corresponding to axis numbers are entered for "m" and "n" in Table 2.16 (error set device).

<A171SCPU>

Axis No.	n
1	0
2	1
3	2
4	3

(8-axis specification)>					
Axis No.	n				
1	0				
2	1				
3	2				
4	3				
5	4				
6	5				
7	6				
8	7				

<A273UHCPU

<A273UHCPU (32 axis specification)>

Axis No.	n	Axis No.	n	Axis No.	n	Axis No.	n
1	0	9	8	17	16	25	24
2	1	10	9	18	17	26	25
3	2	11	10	19	18	27	26
4	3	12	11	20	19	28	27
5	4	13	12	21	20	29	28
6	5	14	13	22	21	30	29
7	6	15	14	23	22	31	30
8	7	16	15	24	23	32	31

 Calculate "n" when using A273UHCPU (8-axis specification), and the device No. corresponding to each axis when using A273UHCPU (32-axis specification), as shown below.

Example : For 32 axes...

M2408+20n (servo error detection flag) = M2408+20 \times 31 = M3028 D07+20n (major error code device) = D07+20 \times 31 = D627

APPENDIX 3 SPECIAL RELAYS AND SPECIAL REGISTERS

3.1 Special Relays (SP, M)

The special relays are internal relays with fixed applications in the programmable controller. Accordingly, they must not be turned ON and OFF in sequence programs (those marked *1 and *2 in the table are exceptions).

Number	Name	Stored Data		Explanation	Applicability A273UH A171S		
M9000 ^{*1}	Fuse blown	OFF ON	Normal There is a module with a blown fuse.	 Comes ON even if there is only one output module with a blown fuse, and remains ON even after return to normal. 	•	•	
M9002*1	I/O unit verify error	OFF ON	Normal Error	 Comes ON if there is a discrepancy between the actual I/O modules and the registered information when the power is turned on. 	•	•	
M9004 ^{*1}	MINI link error	OFF ON	Normal Error	 Come ON when a module detects an error at the master station of the MINI link. Remains ON even after return to normal. 	•	•	
M9005 ^{*1}	AC DOWN detection	OFF ON	AC DOWN detected AC DOWN not detected	 Comes ON when there is a momentary power interruption not exceeding 20 ms; reset by turning the power OFF then ON again. 	•	•	
M9006	Battery low	OFF ON	Normai Low battery voltage	 Comes ON when the battery voltage fails below the stipulated value; goes OFF when normal battery voltage is re-established. 	٠	•	
M9007 ^{*1}	Battery low latch	OFF ON	Normal Low battery voltage	 Comes ON when the battery voltage falls below the stipulated value; remains ON even after normal battery voltage is re-established. 	•	•	
M9008 ^{*1}	Self-diagnostic error	OFF ON	No error Error	 Comes ON when an error occurs as a result of self-diagnosis. 	•	•	
M9009	Annunciator detection	OFF ON	No F number detected F number detected	 Comes ON when OUT F, SET F instructions are executed. Goes OFF when 0 is stored in D9124. 	•	•	
M9010	Operation error flag	OFF ON	No error Error	 Comes on when an operation error occurs during execution of an application instruction; goes OFF when the error is cleared. Cannot be used with A273UHCPU (8/32 axis specification). 		•	
M9011 ^{*1}	Operation error flag	OFF ON	No error Error	 Comes on when an operation error occurs during execution of an application instruction; remains ON even after the error is cleared. 	•	•	
M9012	Carry flag	OFF ON	Carry OFF Carry ON	Carry flag used in an application instruction.	•	•	
M9016 ^{*2}	Data memory clear flag	OFF ON	No processing Output cleared	• When M9016 is ON, all data memory contents, including those in the latch range but with the exception of special relays/registers, are cleared on reception of remote RUN from a computer or other device.	•	•	
M9017'2	Data memory clear flag	OFF ON	No processing Output cleared	• When M9017 is ON, all data memory contents that are not latched, with the exception of special relays/registers, are cleared on reception of remote RUN from a computer or other device.	•	•	

Table 3.1 Special Relay List

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Number	Name	Stored Data	Explanation	Applicability	
M9020	User timing clock No.0		 Relay repeats ON/OFF switching at fixed scan intervals. 		
M9021	User timing clock No.1	n2 n2	• Starts from the OFF status when the power is turned ON or on resetting		
M9022	User timing clock No.2		• The ON/OFF intervals are set with the DUTY instruction.	•	•
M9023	User timing clock No.3	nt scan			
M9024	User timing clock No.4				
M9025 ^{*2}	Clock data set request	OFF No processing ON Data set request	 Writes the clock data stored in D9025 to D9028 to the clock devices after execution of the END instruction in the scan in which M9025 is switched ON. 	•	•
M9026	Clock data error	OFF No error ON Error	 Comes ON when there is an error in the clock data (D9025 to D9028) values. OFF when there is no error. 	٠	•
M9027	Clock data display	OFF No processing ON Display	 Displays the clock data (D9025 to D9028) on the LED display on the front panel of the CPU module, as the month, day, hour, minute, and second. 	•	·
M9028 ¹²	Clock data read request	OFF No processing ON Read request	• When M9028 is ON, the clock data is read to D9025 to D9028 as BCD data.	٠	•
M9029 ^{*2}	Data communication request batch processing	OFF Batch processing not performed ON Batch processing performed	 By turning M9029 ON in the sequence program, all of the data communication requests received during one scan are processed at the END processing of that scan. Data communication request processing can be switched between ON and OFF during the RUN status. The default is OFF (one request at a time is processed at END processing, in the order in which the data communication requests were received). 	•	
M9030	0.1 second clock	0.05 0.05 sec. sec.			
M9031	0.2 second clock	0.1 0.1 sec. sec.	 These relays generate the 0.1 second, 0.2 second, 1 second, 2 second, and 1 minute clocks 		
M9032	1 second clock	0.5 0.5 sec. sec.	• These relays do not go ON/OFF with each scan but when their respective fixed inter- vals have element even during a scan	•	•
M9033	2 second clock	1 sec. 1 sec.	• These relays start from the OFF status when the power is turned on or resetting.		
M9034	1 minute clock	30 sec. 30 sec.			
M9036	Always ON	ON	 Relay used for initialization during a se- quence program or as a dummy contact for an application instruction. 	•	•
M9037	Always OFF	ON OFF	 M9036 and M9037 retain their ON or OFF status regardless of the settings of the key switch on the front of the CPU, but M9038 	•	٠
M9038	ON for 1 scan only after RUN	ON 1 scan	and M9039 change in accordance with the key switch status. They go OFF when the key switch is set to the STOP position.	•	٠
M9039	RUN flag (OFF for 1 scan only after RUN)	ON I scan	when the Key switch is at a position other than STOP, M9038 comes ON for one scan only, and M9039 goes OFF for one scan only.	٠	•

Table 3.1 Special Relay List (Continued)

Number	Name	Stored Data	Explanation	Applica	bility
M9040	PAUSE enable coil	OFF PAUSE disable ON PAUSE enabled	When the RUN/STOP key switch is set to PAUSE or the remote PAUSE contact is	AZ73UH	A1715
M9041	PAUSE status contact	OFF PAUSE not in effect ON PAUSE in effect	turned on, provided M9040 is ON, the PAUSE status is established and M9041 comes ON.	•	•
M9042	STOP status contact	OFF STOP not in effect ON STOP in effect	• ON when the RUN/STOP key switch is set to STOP.	•	٠
M9043	Sampling trace completed	OFF Sampling trace in progress ON Sampling trace completed	• Comes ON on completion of the number of sampling traces set in the parameters are completed after execution of the STRA instruction. After that, it is reset by execution of the STRAR instruction.	•	•
M9044	Sampling trace	0→1 Same as executing [STRA] 1→0 Same as executing [STRAR]	 By switching M9044 ON/OFF the [STRA]/ [STRAR] instruction can be executed. (M9044 is turned ON/OFF by executing forced ON/OFF at a peripheral device.) M9044 OFF → ON : [STRA] instruction M9044 ON → OFF : [STRAR] instruction 	•	
M9045	Watchdog timer (WDT) reset	OFF WDT is not reset ON WDT is reset	 By turning M9045 ON, WDT can be reset when a ZCOM instruction is executed or when data communication request batch processing is executed. (Used when the scan time exceeds 200 ms.) 	•	
M9046	Sampling trace	OFF Trace not in progress ON Trace in progress	• ON during execution of a sampling trace	•	٠
M9047	Sampling trace preparation	OFF Sampling trace stop ON Sampling trace start	 A sampling trace cannot be executed unless M9047 has been turned ON. When M9047 is turned OFF, the sampling trace is stopped. 	•	•
M9049	Number of out- put characters selection	OFF Output until NULL cod ON 16 characters output	When M9049 is OFF, output continues until the NULL (00H) code. When M9049 is ON, ASCII code for 16 characters is output.	•	•
M9051	CHG instruction execution disable	OFF Enabled ON Disabled	 Turned ON to disable execution of the CHG instruction. Turn ON when issuing a program transfer request; automatically turned OFF on completion of transfer. 	•	-
M9052 ^{*2}	SEG instruction switch	OFF 7-segment display ON I/O part refresh	 When M9052 is ON it is executed as the I/O partial refresh instruction. When M9052 is ON, it is executed as the 7- segment display instruction. 	•	•
M9053 ^{*2}	EI/DI instruction switch	OFF Sequence interrupt control ON Link interrupt control	• Turn ON when a link refresh enable/disable (EI, DI) instruction is executed.	-	•
M9054	STEP RUN flag	OFF STEP RUN not in effect	 ON when the RUN/STOP key switch is set to the RUN position. 	•	•
M9055	Status latch completion flag	OFF Not completed ON Completed	 Comes ON when status latch is completed. Goes OFF on execution of a reset instruction. 	٠	•
M9056	Main side P, I set request	ON P, I set being requeste OFF Other than when P, I set being requested	 These relays switch ON the P, I set request on completion of program transfer while another program is being run (for example a 	•	
M9057	Sub side P, I set request	ON P, I set being requeste OFF Other than when P, I set being requested	d subprogram during execution of a main program). Automatically turned OFF on completion of P, I setting.	•	

Table 3.1 Special Relay List (Continued)

Number	Name	Stored Data	Explanation		ability
M9058	Main program	Momentarily ON on	e Comes ON momentarily on completion of P	●	-
M9059	Subprogram P, i set complete	Momentarily ON on completion of P, I setting	I setting, then goes OFF immediately.	•	_
M9065	Partial processing execution detection	OFF Partial processing not in progress ON Partial processing in progress	 ON during partial processing of an instruction given with respect to AD57(S1) or AD58; goes OFF on completion of this execution (when partial processing is not being performed). 	•	
M9066 ^{*2}	Partial processing request flag	OFF Batch processing ON Partial processing	• When an instruction with a long processing time is executed with respect to AD57(S1) or AD58 and the scan time is lengthened, this instruction can be dealt with by partial processing by turning M9066 ON.	•	_
M9070 ^{*2}	A8UPU/A8PUJ search time	OFF No reduction of reading time ON Reading time reduced	• By turning this relay ON, the time required for a search at an A8UPU/A8PUJ can be shortened. (In this case the scan time is increased by 10%.)	•	_
M9081	Communication request entry areas busy signal	OFF Communication request entry areas available ON Communication request entry areas not available	• 32 entry areas are provided for FROM/TO instructions waiting for execution at MNET/MINI(-S3); this relay comes ON when there are no more empty areas.	•	-
M9084 ^{*2}	Error check	OFF Error check executed ON No error check	 Set whether or not the error check shown below is executed on END instruction processing. (Used to shorten END instruction processing time.) (1) Blown fuse check (2) I/O module verification check (3) Battery check 	•	•
M9091 ^{*1}	Instruction error flag	OFF No error ON Error	Comes ON when an instruction related error occurs. Remains ON even after return to normal.	•	-
M9094 ^{*2 *3}	I/O change flag	OFF No replacement ON Replacement	 When M9094 is turned ON after the head I/O number of the I/O module to be replaced has been set in it, it is possible to replace the I/O module in the online status. (It is only possible to replace one I/O module per setting.) To replace an I/O module in the RUN mode, use the program or a peripheral device to turn this relay ON; to replace an I/O module in the STOP mode, use the test mode of a peripheral device to turn this relay ON. Do not switch between RUN and STOP modes until I/O module replacement is peripheral. 	•	_
M9100	Existence of SFC program	OFF No SFC program ON SFC program exists	 ON when an SFC program is registered and a work area for SFC has been secured. OFF when no SFC program is registered, or the work area for SFC could not be secured. 	•	
M9101 ^{*2}	SFC program start/stop	OFF SFC program stop ON SFC program start	• Turned ON by the user in order to start an SFC program. When turned OFF, the operation output of the step being executed is turned OFF and the SFC program is stopped.	•	-

Number	ber Name Stored Data		Stored Data	Explanation		Applicability	
					A273UH	A1715	
M9102*2	SFC program start status	OFF	Initial start Continued start	 Selects the start step when an SFC program is restarted using M9101. When OFF All execution statuses that applied when the SFC program was stopped are cle- ared and the program is started from the initial step of block 0. When ON The SFC program is started from the block and step that were being executed when it was stopped. Once this relay has been turned ON, it is latched (memory back up) by the system. 	•	-	
M9103 ^{*2}	Continuous transition setting	OFF	Continuous transition ineffective Continuous transition effective	 Selects whether or not to execute all the steps whose transition conditions have been satisfied in one scan in cases where all the transition conditions of consecutive steps have been satisfied. When ON Steps are executed continuously (continuous transition effective). When OFF 	•		
M9104	Continuous transition prevention flag	OFF ON	At completion of transition Before transition	• When continuous transition is effective, ON when continuous transition is not being performed and goes OFF when the transition of one step is completed. By writing M9104 with an AND condition as the transition condition, continuous transition of the relevant step can be prevented.	•	-	
M9108 ^{*2}	Step transition monitor timer start (corresponds to D9108)						
M9109 ^{*2}	Step transition monitor timer start (corresponds to D9109)						
M9110 ^{*2}	Step transition monitor timer start (corresponds to D9110)			• Turned ON to start timing by the step transition monitor timer. When turned OFF, the monitor timer is reset.			
M9111 ^{*2}	Step transition monitor timer start (corresponds to D9111)	OFF ON	Monitor timer reset Monitor timer reset start		•		
M9112 ^{*2}	Step transition monitor timer start (corresponds to D9112)						
M9113 ^{*2}	Step transition monitor timer start (corresponds to D9113)						
M9114 ^{*2}	Step transition monitor timer start (corresponds to D9114)						
M9180	Active step sampling trace completed flag	OFF ON	Trace start Trace complete	 Comes ON on completion of sampling trace for all designated blocks, and goes OFF at the start of sampling trace. 	•	-	
M9181	Active step sampling trace execution flag	OFF ON	Trace not executed yet Trace being executed	• ON during sampling trace execution, goes OFF on completion or suspension of sampling trace.	•	-	

Table 3.1 Special Relay List (Continued)

APPENDICES

Number	Name	Stored Data		Explanation			
			ļ			A273UH	A1715
M9182 ^{*2}	Active step sampling trace enabled	OFF Trace disabled/ OFF suspended ON Trace enabled	Selects samplin When C : Exe When C : Exe When C : Exe susp	whether g trace. N cution o FF cution o on this re cution of conded.	r to enable or disable f sampling trace is enabled. f sampling trace is disabled. elay is turned OFF during f sampling trace, the trace is	•	_
M9196 ^{*2}	Operation output at block stop	OFF Coil output OFF ON Coil output ON	Selects stop is a When O The ope bein stop When O All c (Op is re state	the ope executed N coil ON ration ou g execu ped is r FF coil outp eration o tained r us of MS	ration output when a block 1. /OFF status used for the utput of the step that was ted when the block was etained. uts are turned OFF. putput by a SET instruction egardless of the ON/OFF 196.)	•	
		The display is selected by	M9197	M9198	Display Range		
{			OFF	OFF	Statuses X/Y0 to 7F0		
			ON	OFF	Statuses X/Y800 to FF0		
ļ			OFF	ON	Statuses X/Y1000 to 17F0		
M9197	Fuse blown /	the combination of the	ON	ON	Statuses X/Y1800 to 1FF0	•	
M9198	display switching	M9197 ON/OFF and M9198 ON/OFF statuses.	 Selects the I/O module numbers for fuse blown module display (D9100 to D9107) and I/O module verify error display (D9116 to D9123). The display selection is executed at END processing. 				
M9199	Online sampling trace status latch data restore	OFF Data not restored ON Data restored	Restore enables samplin execute For re-e (It is not periphered)	s the se restarting trace/s d. execution t necess ral device	t data stored in the CPU and ng of operation after status latch has been n, turn M9199 ON. ary to write the data from a e again.)	•	

Table 3.1 Special Relay List (Continued)

POINTS

- (1) All special relays, M, are turned OFF by turning the power OFF, performing latch clear, or resetting with the RESET key switch. When the RUN key switch is set to "STOP", the special relay settings are retained.
- (2) The special relays marked "*1" in the table above remain "ON" even after a return to normal. They must therefore be turned OFF by using one of the following methods.
 - (a) Method using the user program Insert the ladder block at right into the program and turn the reset execution command contact ON to clear the special relay. Reset execution



Perform a forced reset using the test function of the peripheral device.

For details on this operation, refer to the manual for the peripheral device.

- (c) Turn the special relay OFF by setting the RESET key switch on the front panel of the CPU module to "RESET".
- (3) The ON/OFF status of special relays marked "*2" in the table above is controlled by the sequence program.
- (4) The ON/OFF status of special relays marked "*3" in the table above is controlled in the test mode of a peripheral device.
- (5) The status of special relays marked "*4" in the table above is only reset on switching the power ON.

3.2 Special Registers (SP.D)

The special registers are data registers used for specific purposes in the programmable controller. Therefore, do not write data to the special registers in the program (with the exception of those whose numbers are marked *2 in the table).

Of the special relays, those from D9180 to D9199 are used for positioning control.

Table 3.2 Special Register List

Number	Name	Stored Data	Explanation		Applicability		
Number	Hallit			A273UH	A1715		
D9000	Fuse blown	se blown Number of module with blown fuse	 When modules with blown fuses are detected, the lowest module number among the detected modules is stored in hexadecimal. (Example: when the fuses of output modules Y50 to 6F have blown, *50* is stored in hexadecimal.) When monitoring with a peripheral device, use a hexadecimal display monitoring operation. (Cleared when all contents of D9100 to D9107 are reset to zero.) 	the ave			
			 When modules with a blown fuse are detected, the lowest I/O number of the detected modules is stored in hexadecimal in this special relay. (Exampl:: Blown fuse at the output module Y50 to 6F *50* is stored in hexadecimal) For monitoring at a peripheral device, use hexadecimal display monitor operations. (Cleared when the contents of D9100 are all *0*.) 	_	•		
D9002	I/O unit verify error	I/O module verification error module number	 If I/O modules that do not match the registered data are detected when the power is turned on, the first I/O number of the lowest module number among the detected modules is stored in hexadecimal (the storage method is the same as for D9000). When monitoring with a peripheral device, use a hexadecimal display monitoring operation. (Cleared when all contents of D9116 to D9123 are reset to zero.) 	•	•		
D9004 ^{*1}	MINI link error	Indicates the status for the number of master modules set in the parameters (1 to 8)	Stores the MINI(S3) link error detected status for the master modules installed. <u>b15</u> <u>b8</u> <u>b7</u> <u>b0</u> <u>b15</u> <u>b1</u>	•			
D9005 ^{*1}	AC DOWN counter	AC DOWN occurrence count	 1 is added to the stored value each time the input voltage becomes 80% or less of the rating while the CPU module is performing an operation, and the value is stored in BIN code. 				
D9008 ^{*1}	Self-diagnostic error	Self-diagnostic error number	 1 is added to the stored value when an error is found as a result of self-diagnosis, the error number, and the value is stored in BIN code. 				

Number	Name	Name Stored Data Explanation		Stored Data Explanation		Applica	bility
				A273UH	A1715		
			 When one of F0 to F255 is turned on by <u>QUT F</u> or <u>SET F</u>, the F number detected earliest among the F numbers which have been turned on is stored in BIN code. D9009 can be cleared by executing a <u>RST F</u> or <u>LEDR</u> instruction. If another F number has been 	_	•		
	Annunciator	F number at which	detected, the clearing of D9009 causes the next number to be stored in D9009.				
D9009	detection	external failure has occurred	• When one of F0 to F255 is turned on by <u>QUT F</u> or <u>SET F</u> , the F number detected earliest among the F numbers which have been turned on is stored in BIN code.				
			 D9009 can be cleared by executing a <u>RST</u> or <u>LEDR</u> instruction, or by setting the INDICATOR RESET switch on the front of the CPU to ON. If another F number has been detected, the clearing of D9009 causes the next number to be stored in D9009. 	•	-		
			• When it has not been possible to access a module for which a special function module setting has been made at STOP \rightarrow RUN, the module No. of the special function module is stored in this special register.	•			
D9010	Error step	Step number at which operation error has occurred	 When an operation error occurs during execution of an application instruction, the step No. where the error occurred is stored in BIN code, and thereafter every time an operation error occurs the contents of D9010 are updataed. 				
			 When an operation error occurs during execution of an application instruction, the step No. where the error occurred is stored in BIN code, and thereafter every time an operation error occurs the contents of D9010 are updated. 	-	•		
D9011	Error step	Step number at which operation error has occurred.	• When an operation error occurs during execution of an application instruction, the step number at which the error occurs is stored in this register in BIN code. Since storage is executed when M9011 changes from OFF to ON, the contents of D9011 cannot be updated unless it is cleared by the user program.	—	•		
D9014		I/O control mode	 The set I/O control method is represented as follows: 3: Refresh method for both input and output 	•	-		
D9014	I/O control mode	/O control mode number	• The set control mode is represented as follows: 0: I/O in direct mode 3: I/O in refresh mode	-	•		

Number	Name	Stored Data	Explanation	Applica A273UH	bility
D9015	CPU operating	Operating states of	The operating states of the CPU are stored in D9015 as shown below. B15B12B11B8 B7B4 B3B0 CPU RUN/STOP Remains unchanged in key switch remote run/stop mode 0 RUN 1 STOP 2 PAUSE* 3 STEP RUN Remote RUN/STOP by parameter setting 0 RUN 1 STOP 2 PAUSE* Status in program 0 Other than below 1 STOP 2 PAUSE* *: When the CPU is in the RUN mode and M9040 is off, the RUN mode remains in effect even if an attempt is made to change to the PAUSE mode.	▲ 273UH	<u>A1715</u>
			The CPU operating states indicated in the figure below are stored in D9015. B15B12B11B8 B7B4 B3B0 CPU key Remains unchanged in switch remote run/stop mode. 0 RUN 1 STOP 2 PAUSE* Status in program 0 Other than below 1 STOP 2 PAUSE* Status in program 0 Other than below 1 STOP 2 PAUSE* *: When the CPU is in the RUN status and M9040 is OFF, the CPU remains in RUN mode even if set to PAUSE.		•

Table 3.2 Special Register List (Continued)

Number	Name	Stored Data	Explanation	Applical	bility
D9016	Program No.	The type of sequence program being executed is stored as a BIN value.	 The type of sequence program currently being executed is stored under one of the following code numbers. 0: ROM main 4: RAM sub 3 8: EEP-ROM main 1: RAM main 5: ROM sub 1 9: EEP-ROM sub 1 2: RAM sub 1 6: ROM sub 2 A: EEP-ROM sub 2 3: RAM sub 2 7: ROM sub 3 B: EEP-ROM sub 3 	•	-
	ROM/RAM setting	0 : ROM 1 : RAM 2 : E ² ROM	 Indicates the setting for the memory selection chip; one of the values 0 to 2 is set in BIN code. 	-	•
D9017	Scan time	Minimum scan time (10 ms units)	 At each END instruction, if the scan time is shorter than the contents of D9017, the new value is stored in this register. In other words, the minimum value for scan time is stored in D9017, in BIN code. 	•	•
D9018	Scan time	Scan time (10 ms units)	• The scan time is stored in BIN code at each END instruction and is always rewritten.	•	•
D9019	Scan time	Maximum scan time (10 ms units)	• At each END instruction, if the scan time is longer than the contents of D9019, the new value is stored in this register. In other words, the maximum value for scan time is stored in D9019, in BIN code.	•	•
		Constant scan time	When a user program is executed at fixed intervals, set the interval in 10 ms units. 0 : Constant scan function not used 1 to 20 : Constant scan function used Execution at (set value)×10 ms inter vals	-	•
D9020*2	Constant scan	(user-specified in 10 ms units)	When user programs are executed at fixed intervals, used to set the execution intervals, in 10 ms units. 0 : Constant scan function not used 1 to 200 : Constant scan function used; program executed at intervals of (set value)×10 ms.	•	_
D9021	Scan time	Scan time (1 ms units) • The scan time is stored in BIN code at each processing overwriting the existing value		•	—
D9022	Time	Time	 Counts up +1 for each second. 	•	
D9025 ^{*2}	Clock data	Clock data (year, month)	• The year (last two digits) and month are stored in BCD code in D9025 as shown below. B15B12 B11B3 B7B4 B3B0 Example : July 1993 H9307	•	•
D9026 ^{*2}	Clock data	Clock data (day, hour)	The day and hour are stored in BCD code in D9026 as shown below. B15B12 B11B3 B7B4 B3B0 Example : 31st, 10th hour Hair	•	•
D9027 ^{*2}	Clock data	Clock data (minute, second)	• The minute and second are stored in BCD code in D9027 as shown below. B15B12 B11B4 B3B0 Example : 35 ms, 48 s H3548	•	•

Table 3.2 Special Register List (Continued)

Number	Name	Stored Data	Explanation	Applica	bility
D9038 ^{*2} D9039 ^{*2}		Priorities 1 to 4 Priorities 5 to 7	 The element numbers for display priorities 1 to 4 (D9038) and 5 to 7 (D9039) of the LED display of the CPU module are set and changed. Dis. Biz Billing Bill	•	<u>-</u>
	LED display priority		 The element numbers for priorities 1 to 4 (D9038) and 5 to 7 (D9039) for the lighting (or flashing) of the ERROR LED when an error occurs, are set and changed. BIS_BIZ_BIL		•
D9044	For sampling trace	Step or time for sampling trace	• The value that D9044 contains is used as a sampling trace condition when the sampling trace instruction [STRA], [STRAR] is executed by switching ON/OFF M9044 from the peripheral device. For scan — Set '0'. For scan — Set '0'. For time — Set the time in 10 ms units.	•	-
D9049	SFC work area	Extension file register block number	 The extension file register block number used as the SFC work area is stored. Higher 8 bits Block number is stored. Lower 8 bits Step number is stored. 	•	-
D9050	SFC program error code	Error code generated during SFC program execution	 Error codes generated during SFC program execution are stored in BIN code. 0 : No error 80 : SFC program parameter error 81 : Number of simultaneous execution steps exceeded 82 : Block start error 83 : SFC program operation error 	•	

Number	Name	Stored Data	Explanation	Applicability	
	Namo			A273UH	A171S
D9051	Error block	Block numbers at which errors occurred during Block number in which an error occurred In the case of error code 82, the start block step number is stored.		•	-
D9052	Error step	Step number at which an error occurred	• The step number at which error 83 occurred during SFC program execution is stored in BIN code. In the case of error code 80 or 81, *0* is stored. In the case of error code 82, the block start step number is stored.	•	
D9053	Error transition	Transition condition number at which an error occurred	• The transition condition number at which error 83 occurred during SFC program execution is stored in BIN code. In the case of error code 80, 81, or 82, "0" is stored.	•	
D9054	Error sequence step	Sequence step number at which an error occurred	• The sequence step number of the transition condition and operation output when error 83 occurred during SFC program execution is stored in BIN code.	•	_
D9055	Status latch	Status latch step	 The step number executed when the status is latched is stored in BIN code. 	•	
D9072	PC communication check	Computer link data check	 Used at self-loopback check 	•	-
D9081	Empty communication request entry areas	Empty communication request entry areas	 The number of empty communication request entry areas in which communication requests to MNET/MINI(S3) can be entered is stored (Max. 32). 	•	_
D9085	Time check value setting register	Default value 10 s	 The time check value at execution of a MELSECNET/10 link instruction (ZNRD, ZNWR) is stored. Setting range : 1 to 65535 sec Setting unit : 1 sec If the set value is "0", the default of "10 sec" is used for operation. 	•	
D9090 ⁻¹	Excessive special function modules	Too many special function modules	 When the number of special function modules mounted is excessive, the value '(head I/O number of the last special function module entered) / 16' is stored as a BIN value. 	•	_
D9091 ^{*1}	Detailed error numbers	Self-diagnostic detailed error numbers	 The detailed error number when a self-diagnostic error occurs is stored. 	•	_
D9094 ^{*2}	Replacement I/O first I/O number	Replacement I/O first I/O number	 Stores the upper two digits of the first I/O number of an I/O module that is removed/replaced in the online status. Example: Input module X2F0 → H2F 	•	

Number	Name	Stored Data	Explanation Applicabilit	ty
D9100 to D9107	Fuse blown module	Bit pattern in units of 16 points, indicating the modules whose fuses have blown	 The numbers of output modules whose fuses have blown are input as a bit pattern (in units of 16 points). (If the module numbers are set by parameter, the parameter-set numbers are stored.) The blown fuse statuses of the output modules of remote stations are also detected. 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 Deloo 0 0 1 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0	-
D9100 ^{*1} D9101 ^{*1}			• Output module numbers of the (in units of 16 points) of output modules whose fuses have blown or whose external power supply has been switched OFF are entered in a bit pattern. (Preset output number when parameter setting has been performed.) 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 De100 0 0 0 $\frac{1}{10}$ 0 0 0 $\frac{1}{10}$ 0 0 0 0 0 0 0 0 0 0 0 De101 $\frac{1}{101}$ 0 0 0 $\frac{1}{101}$ 0 0 0 0 0 0 0 0 0 0 0 0 0 0 indicates a blown fuse (Since the error is not cleared even after returning to normal, it must be cleared with a program.)	-

Number	Name	Stored Data	Explanation	Applica	bility
D9116 to D9123	Input/Output module verification error	Bit pattern, in units of 16 points, indicating the modules with verification errors.	 When the power is turned on, the module numbers of the I/O modules whose information differs from the registered I/O module information are set in this register (in units of 16 points). (If the I/O numbers are set by parameter, the parameter-set numbers are stored.) The I/O module information of remote stations can be detected. 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 De116 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	<u>A273UH</u>	<u></u>
D91 16 ^{*1} D91 17 ^{*1}			When an I/O modules whose data is different from that entered are detected, the I/O module numbers (in units of 16 points) are entered in a bit pattern. (Preset I/O module numbers when parameter setting has been performed.) 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 De116 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		•
D9124	Annunciator detection quantity	Number of detected annunciators	• When one of F0 to 2047 is turned ON by OUT F or SET F, 1 is added to the contents of D9124. When an RST F or LED R instruction is executed, 1 is subtracted from the contents of D9124. (This can also be achieved with the INDICATOR RESET switch on the front panel of the CPU module.) The maximum number of annunciators switched ON by OUT F or SET F that can be stored in D9124 is 8.	•	
			• When one of F0 to 255 is turned on by an <u>OUT F</u> or <u>SET F</u> , 1 is added to the contents of D9124. When the <u>RST F</u> or <u>LED R</u> instruction is executed, 1 is subtracted from the contents of D9124. The number of annunciators that has been turned on by <u>OUT F</u> or <u>SET F</u> is stored in D9124: the maximum stored value is 8		•

Number	Name	Stored Data	Explanation	Applicability
D9125	Annunciator	Annunciator detection number	When one of F0 to 2047 is turned ON by OUT or SET F, the F number which has been turned ON is entered in D9125 to D9132, in due order, BIN code. An F number which has been turned OFF by RST F is erased from D9125 to D9132 and the contents of data registers succeeding the data register from which the F number was erased at shifted to the preceding data registers. By executing the LED R instruction, the contents of D9125 to D9132 are shifted upward by one. (Th can also be done with the INDICATOR RESET switch on the front of the CPU module.) When there are 8 annunciator detections, a 9th will no be stored in D9125 to D9132 even if detected. SET SET SET SET SET SET SET SET SET F50 P25 F19 F25 F15 F70 F85 F30 F10 P15 F210 LEDR OCCO CO CO CO CO CO CO SET SET SET SET SET SET SET SET SET F30 P25 F19 F25 F15 F70 F85 F30 F10 P15 F210 LEDR OCCO CO CO CO CO CO SET SET SET SET SET SET SET SET SET F30 P25 F19 P25 F15 F70 F85 F30 F10 P15 F210 LEDR OCCO CO CO CO CO CO SET SET SET SET SET SET SET SET SET F30 P25 F19 P25 F15 F70 F85 F30 F10 P15 F210 LEDR OCCO CO CO CO CO CO SET SET SET SET SET SET SET SET SET F30 P25 F19 P25 F15 F70 F85 F30 F10 P15 F210 LEDR OCCO CO CO CO CO CO CO CO SET SET SET SET SET SET SET SET SET SET F30 P25 F19 P25 F15 F70 F85 F30 F10 P15 F210 LEDR OCCO CO CO CO CO CO CO CO CO CO CO SET SET SET SET SET SET SET SET SET SET	A273UH A1715
DA135	THE INDER		When F numbers in the range F0 to 255 are turned on by OUT F or SET F, they are enter in D9125 to D9132 in ascending order of register numbers. An F number which is turned off by $\boxed{\texttt{RSTF}}$ is erased from D9125 to D9132, and the contents the data registers following the one where the erased F number was stored are each shifted to the preceding data register. When the $\boxed{\texttt{LEDH}}$ instruction is executed, the contents of D9125 to D9132 are shifted upward by one. When there are 8 annunciator detections, a 9th one is not stored in D9125 to D9132 even if detected. Stored in D9125 to D9132 even if detected. Stored in D9125 to D9132 even if $\underbrace{\texttt{STSTF}}_{\text{F0}} = \underbrace{\texttt{ST}}_{\text{F2}} = \underbrace{\texttt{ST}}_{\text{F10}} = \underbrace{\texttt{ST}}_{\text{F2}} = \underbrace{\texttt{ST}}_{F$	Id r bf 9 8 99 5 70 55 10 51 10

POINTS

- All special register data is cleared by the power-off, latch clear, and reset operations. The data is retained when the RUN/STOP key switch is set to STOP.
 The contents of the special relays marked *1 in the table above are not cleared even after the normal status is restored. To clear the contents, use one of the following methods:

 (a) Using a user program Insert the ladder block shown at right into the program and turn on the clear execution command contact to clear the contents
- (b) Using a peripheral device Using the test function of a peripheral device, set the register to "0" by using present value change or forced reset. For details on the operation involved, refer to the manual for the relevant peripheral device.
 (c) Set the special register to "0" by setting the RESET key switch on the front of the CPU to the RESET position.
 (3) For special registers marked **2", data is written in the sequence program.
- (4) For special registers marked "*3", data is written in the test mode of a peripheral device.
- (5) For special registers marked "*4", data is cleared only when the power is turned ON.

Number	Name	Stored Data	Explanation
D9180 to D9183	Limit switch output storage area	Limit switch output storage area 1: ON 0: OFF	 The status of output (ON/OFF) to limit switch output AY42 set with a peripheral device is stored as "1" or "0". ON OFF These registers can be used to output limit switch output data to an external device using the sequence program. A171SCPU bis bid bi3 bi2 bi1 bi0 be be b7 be b5 bd b3 b2 b1 b0 bete tweetweetweetweetweetweetweetweetwee

(1) A171SCPU/A273UHCPU (8-axis specifications)

Table 3.3 Special Register List

				Explanation										
			• The PCPU Wi (1) When usin	DT errors tabled below are stored in D9184. ng an A171SCPU										
			Error Code	Error Cause										
			2	PCPU excessive operation frequency										
			3	SCPU software fault 2										
			300	SCPU software fault 3										
			(2) When usin	g an A273UHCPU (8-axis specification)										
			Error Code	Error Cause										
			11	PCPU software fault 1										
Ì			2	PCPU excessive operation frequency										
			3	PCPU software fault 2										
			30	Hardware fault between PCPU and SCPU										
D9184	Cause of PCPU error	PCPU error number	100 to 107 110 to 117 200 to 207 210 to 217	AC motor drive module CPU error 1 0 0 1 0 1										
														250 to 251
1			300 P	PCPU software fault 3										
		301	CPSTART instructions for 8 or more points simultaneously started for 21 or more programs. CPSTART instructions for 8 or more points can only be started simultaneously for up to 20 programs.											

Number	Nema	Stored Date	Evnlanation				
		STALAN NELS	On switching the power ON or resetting, the serve amplifier type				
D9185	Sanyo amplifiar type	Servo amplifier tupe	set in the system settings is set in these devices. (1) When an A171SCPU is used b15 w b12 b11 w b5 b7 w b4 b3 w b0 D9185 Axis 4 Axis 3 Axis 2 Axis 1 Servo amplifiler type • 0 Unused axis • 2 MR-[]-B (2) When an A273UHCPU (8 axis specification) is used				
D9186	Servo ampimer type	Servo ampiner type	b15 to b12 b11 to b8 b7 to b4 b3 to b0 D9185 Axis 4 Axis 3 Axis 2 Axis 1 D9186 Axis 8 Axis 7 Axis 6 Axis 5 Servo amplifiler type • 0 Unused axis • 1 ADU (main base) • 2 MR-[]-B • 5 ADU (extension base) • 2 ADU (extension base)				
D9187	Manual pulse gener- ator axis setting error	Manual puise gener- ator axis setting error	 Stores the contents of the manual pulse generator axis setting flag (M9077) comes ON. (1) When an A171SCPU is used bits bit bits bits bits bits bits bits b				

Number	Name	Stored Data	Explanation			
D9188	Test mode request error	Test mode request error	 Stores the data of axes being operated when the test mode request error flag (M9078) comes ON. (1) When an A171SCPU is used 			
			D9188 0 0	113 b12 b11 b10 b9 b8 b7 b8 b5 b4 b3 b2 b1 b0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 Axis 4 Axis 3 Axis 2 Axis 1 		
				All set to "0" Stores the operating/stopped status of each axis: • 0 : Stopped • 1 : Operating		
			(2) When A27	3UHCPU (8 axis specification) is used		
			D9188 0 0	13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0 0 0 0 0 0 0 0 Avie 8 Avie 8 Avie 6 Avie 6 Avie 4 Avie 3 Avie 2 Avie 1		
				Stores the operating/stopped status of each axis: • 0 : Stopped • 1 : Operating All set to "0"		
D0180	Error program No.	Error program number	 Stores the subprogram number (range: 0 to 4095) affected by the error when the subprogram setting error flag (M9079) comes ON. 			
			 If, once an err occurs in anot program with 	or program number has been stored, an error ther servo program, the program number of the the new error is stored.		
			 When the servo program setting error flag (M9079) comes ON, the error code that corresponds to the relevant setting item is stored in this device. 			
			Error Code	Error Contents		
	Error item information	Servo program setting error number	900	The servo program set for the DSFRP/SVST instruction does not exist.		
D9190			901	The axis number set for the DSFRP/SVST in- struction is different from the axis number set in the servo program.		
			902	The instruction code cannot be decoded (there is a questionable instruction code).		
			906	An axis designated as unused in the system settings is set in the subprogram set for the DSFRP/SVST instruction.		
			Error item data	There is an error in the settings of the servo program set for the DSFRP/SVST instruction. The error item in 6.3 is stored.		

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Number	Name	Stored Data	Explanation				
D9191	Servo amplifier in- stallation information	Servo amplifier in- stallation information	 When the power is turned ON, or on resetting, the serve amplifier and option slot installation statuses are checked and the results stored in this device. (1) When an A171SCPU is used D15 to b12 b11 to b8 b7 to b4 b3 b2 b1 b0 D19191				
D9192	Area for setting the smoothing magnifi- cation for manual pulse generator 1 (P1)		 Stores the manual pulse generator smoothing time constant. The smoothing time constant is calculated using the following formula: Smoothing time = (Smoothing) × 56.8[ms] 				
D9193	Area for setting the smoothing magnifi- cation for manual pulse generator 2 (P2) (A273UH only)	Areas for setting manual puise gener- ator smoothing mag- nifications	The setting range for smoothing magnification is 0 to 59.				
D9194	Area for setting the smoothing magnifi- cation for manual pulse generator 3 (P3) (A273UH only)						

(2) A273UHCPU (32 specification)

ladie 3.4 Special Register	List
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Number	Name	Stored Data	Explanation			
D752	Area for setting the smoothing magnifi- cation for manual pulse generator 1 (P1)		 Stores the manual pulse generator smoothing time constant. The smoothing time constant is calculated using the following formula: Smoothing time = (Smoothing +) × 56.8[ms] 			
D753	Area for setting the smoothing magnifi- cation for manual pulse generator 2 (P2)	Areas for setting manual puise gener- ator smoothing mag- nifications	The setting range for smoothing magnification is 0 to 59.			
D754	Area for setting the smoothing magnifi- cation for manual pulse generator 3 (P3)					
D776 to - D791	Storage area for axis 1 to axis 32 limit switch output statuses	Limit switch output storage area 1: ON 0: OFF	• The status of output (ON/OFF) to limit switch output AY42 set with a peripheral device is stored as "1" or "0". 1: ON 0: OFF • These registers can be used to output limit switch output data to an external device using the sequence program. bis bid bis biz bil bil bil bie bis bit bis			
D792 to D799	Servo amplifier type	Servo amplifier type	• On switching the power ON or resetting, the servo amplifier type set in the system settings is set in these devices. b15 b b12 b11 b b8 b7 b b4 b3 b b0 D792 Axis 4 Axis 3 Axis 2 Axis 1 Axis 4 Axis 3 Axis 2 Axis 1 Axis 12 Axis 11 Axis 10 Axis 9 D794 Axis 12 Axis 11 Axis 10 Axis 9 D795 Axis 20 Axis 15 Axis 13 Axis 13 D796 Axis 20 Axis 19 Axis 18 Axis 17 D797 Axis 22 Axis 21 Axis 22 Axis 22 D798 Axis 32 Axis 23 Axis 22 Axis 25 D799 Axis 32 Axis 31 Axis 30 Axis 29 Servo amplifier type 1) e 0Unused axis e 1ADU (main base) e 2MR-[]-B e 5ADU (extension base)			

*: Data registers are used (see Section 3.5).

Number	Name	Stored Data	Explanation			
D9182 to • D9183	Test mode request error	Test mode request error	Stores the data of axes being operated when the test mode request error flag (M9078) comes ON. b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0 D9182 where televise			
			• The PCPU WDT errors tabled below are stored in D9184.			
			Error Code	Error Cause		
			1	PCPU software fault 1		
			2	PCPU excessive operation frequency		
			3	PCPU software fault 2		
			30	Hardware fault between PCPU and SCPU		
			100 to 107	AC motor drive module CPU error		
			110 to 117	Indicates the slot No. (0 to 7) where the AC motor drive module with the		
			130 to 137	error is loaded. Indicates the stage number of the base on which the		
			140 to 147	(0: main base, 1: extension base, 2: extension base, 3: extension base, 4: extension base)		
D9184	Cause of PCPU error	PCPU WDT error number	200 to 207 210 to 217 220 to 227 230 to 237 240 to 247	Hardware fault of module loaded in main base unit or motion extension base unit. 200 • Indicates the slot No. (0 to 7) where the module with the error is loaded. • Indicates the stage number of the base on which the module with the error is loaded. (0: main base, 1: extension base, 2: extension base, 3: extension base, 4: extension base)		
			250 to 253	Separate servo amplifier (MR-[]-B) interface hardware fault 2 5 0		
			300	PCPU software fault 3		
			301	CPSTART instructions for 8 or more points simultaneously started for 21 or more programs. CPSTART instructions for 8 or more points can only be started simultaneously for up to 20 programs		
				can only be started simultaneously for up to 20 programs.		

Table 3.4 Special Register List (Continued)

Number	Name	Stored Data	Explanation				
			• Stores the contents of the manual pulse generator axis sett error when the manual pulse generator axis setting fi (M9077) comes ON. <u>b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1</u>				
D9185	Manual pulse gener-	Manual pulse gener-		0 1 5 0 1 5 0 1 5 0 1 5 0 1 5 0 1 5 0 1 5 0 1 5 0 1 5 0 1 5 0			
to D9187	ator axis setting error	ator axis setting error	O : Normal				
D9180 to D9183	Limit switch output storage area						
				 Stores setting errors for the 1 pulse input magnification setting for each axis. 0 : Normal 1 : Setting error (When the input magnification for any axis is outside the range 1 to 100) 			
D9189	Fror program No	Error program number	 Stores the subprogram number (range: 0 to 4095) affected by the error when the subprogram setting error flag (M9079) comes ON. 				
			 If, once an error program number has been stored, an error occurs in another servo program, the program number of the program with the new error is stored. 				
			 When the ser the error code stored in this 	vo program setting error flag (M9079) comes ON, e that corresponds to the relevant setting item is device.			
	Error item information	Servo program setting error number	Error Code	Error Contents			
			900	The servo program set for the DSFRP/SVST instruction does not exist.			
D9190			901	The axis number set for the DSFRP/SVST instruction is different from the axis number set in the servo program.			
			902	The instruction code cannot be decoded (there is a questionable instruction code).			
			906	An axis designated as unused in the system settings is set in the subprogram set for the DSFRP/SVST instruction.			
			Error item data	There is an error in the settings of the servo program set for the DSFRP/SVST instruction. The error item in 6.3 is stored.			

Number	Name	Stored Data	Explanation			
			 When the power is turned ON, or on resetting, the servo ampli- fier and option slot installation statuses are checked and the results stored in this device. 			
		2018년 홍수 2023년 201 1일, 2023년 2018년 2019년 1919년 - 1919년 2019년 2019	b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0 D9191 tote 15 hote 16 hote 16 hote 13 hote 13 hote 12 hote 11 hote 10 hote 9 hote 9 hote 3 hote 7 hote 6 hote 5 hote 4 hote 3 hote 2 hote 1 D9192 tote 32 hote 31 hote 30 hote 28 hote 28 hote 28 hote 25 hote 24 hote 24 hote 24 hote 21 hote 20 hote 16 hote 17			
D9191 to D9192	Servo amplifier in- stallation information	Servo amplifier in- stallation information	Servo amplifier installation status			
			0 Not installed, or ADU fault, MR-[]-B power OFF, or connecting cable fault 1			
			 1 Installed *1: In the case of an ADU, if the module is not installed although an axis number has been set in the system settings, a major error is displayed. 			

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Table 3.4 Special Register List (Continued)

*: Data registers are used (see Section 3.5).

APPENDIX 4 EXAMPLE PROGRAMS

4.1 Word Data 1 Word Shift to Left

(1) A program for shifting to the left a range of devices that comprises n points and starts with a designated word device is shown here.



(2) Word data can be shifted one word to the left by using the BMOV (P) instruction and RST instruction.

The format for a program for shifting data one word to the left by using the BMOV (P) instruction and RST instruction is shown in Figure 4.1.



Fig. 4.1 Format for Left Shift Using BMOV(P) Instruction and RST Instruction



(3) Execution condition The execution condition when the BMOV instruction and BMOVP instruction are used is as follows.



4.2 Word Data 1 Word Shift to Right

(1) A program for shifting to the right a range of devices that comprises n points and starts with a designated word device is shown here.



(2) Word data can be shifted one word to the right by using the BMOV (P) instruction and RST instruction.

The format for a program for shifting data one word to the right by using the BMOV (P) instruction and RST instruction is shown in Figure 4.2.



Fig. 4.2 Format for Right Shift Using BMOV(P) Instruction and RST Instruction



(3) Execution condition The execution condition when the BMOV instruction and BMOVP instruction are used is as follows.



4.3 Reading M Codes

An example of a program for reading an M code on completion of positioning start or on completion of positioning is shown here.

The distinction between positioning start completion and positioning completion is made with the following signals.

- Positioning start completed ... M1600+20n (positioning start completed signal)
- Positioning completedM1601+20n (positioning completed signal)

[Program Example]

(1) A program that outputs the M code for axis 1 from Y000 to Y00F to an external destination on completion of positioning start and after conversion to BCD code, is shown here.



(2) A program that outputs the M code for axis 1 from Y000 to Y00F to an external destination on completion of positioning and after conversion to BCD code, is shown here.



4.4 Error Code Reading

A program that reads the error code when an error occurs is shown here. The following signals are used to determine whether or not an error has occurred:

- Minor errors, major errorsError detection signal (M1607+20n)
- Servo errorsServo error detection signal (M1608+

20n)

POINT

- (1) The following delay occurs between the leading edge (OFF \rightarrow ON) of M1607+20n/M1608+20n and storage of the error code.
 - (a) If the sequence program scan time is less than 80 ms, there will be a delay of up to 80 ms.
 - (b) If the sequence program scan time is longer than 80 ms, there will be a delay of up to one scan time.
 Program so that error code reading is executed after sufficient time has elapsed for error codes to be written in the various error code storage areas after M1607+20n/M1608+20n comes ON.

[Program Example]

(1) A program that converts the error code to BCD and outputs it to Y000 to Y00F when an axis 1 error occurs (minor error, major error) is shown here.



APPENDIX 5 RATED MOTOR SPEED AND NUMBER OF FEEDBACK PULSES FOR EACH SER-VOMOTOR TYPE

The rated motor speed and number of feedback pulses for each servomotor type is shown in Table 5.1.

Motor Model Name	Rated Motor Speed [rpm]	Number of Feedback Pulses (PLS)	Motor Model Name	Rated Motor Speed [rpm]	Number of Feedback Pulses (PLS)
HA-MH053			HA-LH502	1	
HA-MH13		8192	HA-LH102]	
HA-MH23			HA-LH152	2000	
HA-MH43			HA-LH202		
HA-MH73	3000		HA-LH302]	
HA-FH053]		HA-LH502		
HA-FH13]		HA-LH702		
HA-FH23]		HA-LH11K2		16384
HA-FH33		ļ	HA-LH15K2	2000	
HA-FH43			HA-LH22K2		8192
HA-FH63			HA-UH32		
HA-SH81			HA-UH52		
HA-SH121	1000	16384	HA-UH102	2000	
HA-SH201			HA-UH152		
HA-SH301			HA-UH222		
HA-SH52	2000		HA-UH352		
HA-SH102			HA-UH452		
HA-SH152			HA-FF053	3000	
HA-SH202			HA-FF13		
HA-SH352]		HA-FF23		
HA-SH502			HA-FF33		
HA-SH702]		HA-FF43		
HA-SH53			HA-FF63		
HA-SH103			HC-MF053		
HA-SH153			HC-MF13		
HA-SH203	3000		HC-MF23		
HA-SH353			HC-MF43		
HA-RH103			HC-MF73		
HA-RH153			HC-SF52		
HA-RH223			HC-SF102	2000	10364
HA-LH52					
HA-LH102]				
HA-LH152	2000				
HA-LH202	1				
HA-LH302					

Table 5.1 Rated Motor Speed and Number of Feedback Pulses for Each Servomotor Type
APPENDIX 6 SIGNALS FOR POSITIONING

6.1 Internal Relays

<a171scpu></a171scpu>	Table 6.	1 Axis	I/O Sigr	al List		
Signa	l Nama		Devid	e No.		Signal
oigita		Axis 1	Axis 2	Axis 3	Axis 4	Direction
Positioning start of	ompleted	M1600	M1620	M1640	M1660	
Positioning compl	eted	M1601	M1621	M1641	M1661	
In-position		M1602	M1622	M1642	M1662	
Command in-posi	tion	M1603	M1623	M1643	M1663	
Speed control in p	orogress	M1604	M1624	M1644	M1664	
Speed/position sw	ritching latch	M1605	M1625	M1645	M1665	
Zero pass		M1606	M1626	M1646	M1666	
Error detection		M1607	M1627	M1647	M1667	PCPU
Servo error detec	tion	M1608	M1628	M1648	M1668	_→
Home position ret	urn request	M1609	M1629	M1649	M1669	SCPU
Home position ret	urn completed	M1610	M1630	M1650	M1670	
	FLS	M1611	M1631	M1651	M1671	
External signals	RLS	M1612	M1632	M1652	M1672	
-	STOP	M1613	M1633	M1653	M1673	
	DOG/CHANGE	M1614	M1634	M1654	M1674	
Servo READY		M1615	M1635	M1655	M1675	
Torque control in	progress	M1616	M1636	M1656	M1676	
Unusable		M1617	M1637	M1657	M1677	
		M1618	M1638	M1658	M1678	
M code output in	progress signal	M1619	M1639	M1659	M1679	
Stop command		M1800	M1820	M1840	M1860	
Rapid stop commi	and	M1801	M1821	M1841	M1861	
Forward JOG star	t	M1802	M1822	M1842	M1862	
Reverse JOG star	t	M1803	M1823	M1843	M1863	
End signal OFF co	ommand	M1804	M1824	M1844	M1864	
Speed/position sw	itching enabled	M1805	M1825	M1845	M1865	
Limit switch outpu	t enable	M1806	M1826	M1846	M1866	
Error reset		M1807	M1827	M1847	M1867	
Servo error reset		M1808	M1828	M1848	M1868	SCPU
External STOP in when starting	out valid/invalid	M1809	M1829	M1849	M1869	→ PCPU
linusahia		M1810	M1830	M1850	M1870	
		M1811	M1831	M1851	M1871	1
Feed present valu command	e update request	M1812	M1832	M1852	M1872	
Unusable		M1813	M1833	M1853	M1873	1
Serve OFF		M1815	M1825	M1854	M1975	
Gervo Orr	<u></u>	MIRIE	M1936	M1055	M1976	1
Unusable		M1817	M1837	M1857	M1977	
		M1212	M1939	M1852	M1270	
EIN signal		Misio	M1830	M1850	M1870	
Li ili signal		I MILOIS	N11033	M1033	MIGIS	

<A273UHCPU (8 axis specification)> Table 6.2 Axis I/O Signal List

Г		T			Devic	e No.				Signal
i Signal	Name	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8	Direction
Positioning start c	ompleted	X00	X10	X20	X30	X40	X50	X60	X70	
Positioning comple	eted	X01	X11	X21	X31	X41	X51	X61	X71	
In-position		X02	X12	X22	X32	X42	X52	X62	X72	
Command in-posit	tion	X03	X13	X23	X33	X43	X53	X63	X73	
Speed control in p	rogress	X04	X14	X24	X34	X44	X54	X64	X74	:
Speed/position sw	vitching latch	X05	X15	X25	X35	X45	X55	X65	X75	
Zero pass		X06	X16	X26	X36	X46	X56	X66	X76	
Error detection		X07	X17	X27	X37	X47	X57	X67	X77	PCPU
Servo error detect	ion	X08	X18	X28	X38	X48	X58	X68	X78	- → SCPU
Home position ret	urn request	X09	X19	X29	X39	X49	X59	X69	X79	00.0
Home position ret	urn completed	XOA	X1A	X2A	ХЗА	X4A	X5A	X6A	X7A	
	FLS	XOB	X1B	X28	ХЗВ	X4B	X5B	X6B	X7B	
External signals	RLS	XOC	X1C	X2C	ХЗС	X4C	X5C	X6C	X7C	
	STOP	XOD	X1D	X2D	X3D	X4D	X5D	X6D	X7D	
	DOG	XOE	X1E	X2E	ХЗЕ	X4E	X5E	X6E	X7E	
Servo READY		XOF	X1F	X2F	ХЗF	X4F	X5F	X6F	X7F	
M code output in progress signal		XCO	XC1	XC2	XC3	XC4	XC5	XC6	XC7	
Torque control in	progress	XD0	XD1	XD1	ХDЗ	XD4	XD5	XD6	XD7	
CHANGE signal		XD8	XD9	XDA	XDB	XDC	XDD	XDE	XDF	
Stop command		Y00	Y10	Y20	Y30	Y40	Y50	Y60	Y70	
Rapid stop comma	and	Y01	Y11	Y21	Y31	Y41	Y51	Y61	Y71	
Forward JOG star	t	Y02	Y12	Y22	Y32	Y42	Y52	Y62	Y72	
Reverse JOG star	t	Y03	Y13	Y23	Y33	Y43	Y53	Y63	Y73	
End signal OFF co	mmand	Y04	Y14	Y24	Y34	Y44	Y54	Y64	Y74	
Speed/position sw	itching enabled	Y05	Y15	Y25	Y35	Y45	Y55	Y65	Y75	
Limit switch output	t enable	Y06	Y16	Y26	Y36	Y46	Y56	Y66	Y76	00011
Error reset		Y07	Y17	Y27	Y37	Y47	Y57	Y67	Y77	SCPU
Servo error reset		Y08	Y18	Y28	Y38	Y48	Y58	Y68	Y78	PCPU
External STOP inp when starting	out valid/invalid	Y09	Y19	Y29	Y39	Y 4 9	Y59	Y69	Y79	
Unuarhla		YOA	Y1A	Y2A	Y3A	Y4A	Y5A	Y6A	Y7A	
Onusable		YOB	Y1B	Y2B	Y3B	Y4B	Y5B	Y6B	Y7B	
Feed present valu command	e update request	YOC	Y1C	Y2C	Y3C	Y4C	Y5C	Y6C	Y7C	
Unweekle		YOD	Y1D	Y2D	Y3D	Y4D	Y5D	Y6D	Y7D	
Unusable		YOE	Y1E	Y2E	Y3E	Y4E	Y5E	Y6E	Y7E	
Servo OFF		YOF	Y1F	Y2F	Y3F	Y4F	Y5F	Y6F	Y7F	
FIN signal		YCO	YC1	YC2	YC3	YC4	YC5	YC6	YC7	

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<A273UHCPU (32 axis specification)>

Table 6.3 Axis I/O Signal List

Signe	l Neme							Device No.	
Signa		Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Γ.
Positioning start of	ompleted	M2400	M2420	M2440	M2460	M2480	M2500	M2520	
Positioning completed		M2401	M2421	M2441	M2461	M2481	M2501	M2521	
In-position	In-position		M2422	M2442	M2462	M2482	M2502	M2522	
Command in-posi	tion	M2403	M2423	M2443	M2463	M2483	M2503	M2523	
Speed control in p	progress	M2404	M2424	M2444	M2464	M2484	M2504	M2524	
Speed/position sw	vitching latch	M2405	M2425	M2445	M2465	M2485	M2505	M2525	
Zero pass		M2406	M2426	M2446	M2466	M2486	M2506	M2526	
Error detection		M2407	M2427	M2447	M2467	M2487	M2507	M2527	
Servo error detec	tion	M2408	M2428	M2448	M2468	M2488	M2508	M2528	
Home position ret	urn reguest	M2409	M2429	M2449	M2469	M2489	M2509	M2529	
Home position ret	urn completed	M2410	M2430	M2450	M2470	M2490	M2510	M2530	
	FLS	M2411	M2431	M2451	M2471	M2491	M2511	M2531	
External signals	RLS	M2412	M2432	M2452	M2472	M2492	M2512	M2532	
	STOP	M2413	M2433	M2453	M2473	M2493	M2513	M2533	
	DOG	M2414	M2434	M2454	M2474	M2494	M2514	M2534	
Servo READY		M2415	M2435	M2455	M2475	M2495	M2515	M2535	
Torque control in	progress	M2416	M2436	M2456	M2476	M2496	M2516	M2536	
CHANGE signal		M2417	M2437	M2457	M2477	M2497	M2517	M2537	
Unusable		M2418	M2438	M2458	M2478	M2498	M2518	M2538	
M code output in progress signal		M2419	M2439	M2459	M2479	M2499	M2519	M2539	
Stop command		M3200	M3220	M3240	M3260	M3280	M3300	M3320	
Rapid stop comm	and	M3201	M3221	M3241	M3261	M3281	M3301	M3321	
Forward JOG star	t	M3202	M3222	M3242	M3262	M3282	M3302	M3322	
Reverse JOG star	t	M3203	M3223	M3243	M3263	M3283	M3303	M3323	
End signal OFF co	ommand	M3204	M3224	M3244	M3264	M3284	M3304	M3324	
Speed/position sw	ritching enabled	M3205	M3225	M3245	M3265	M3285	M3305	M3325	
Limit switch output	t enable	M3206	M3226	M3246	M3266	M3286	M3306	M3326	
Error reset		M3207	M3227	M3247	M3267	M3287	M3307	M3327	
Servo error reset		M3208	M3228	M3248	M3268	M3288	M3308	M3328	
External STOP in when starting	out valid/invalid	M3209	M3229	M3249	M3269	M3289	M3309	M3329	
		M3210	M3230	M3250	M3270	M3290	M3310	M3330	
Unusable		M3211	M3231	M3251	M3271	M3291	M3311	M3331	
Feed present valu command	e update request	M3212	M3232	M3252	M3272	M3292	M3312	M3332	
		M3213	M3233	M3253	M3273	M3293	M3313	M3333	
Unusadie		M3214	M3234	M3254	M3274	M3294	M3314	M3334	
Servo OFF		M3215	M3235	M3255	M3275	M3295	M3315	M3335	
		M3216	M3236	M3256	M3276	M3296	M3316	M3336	· · · ·
Unusable		M3217	M3237	M3257	M3277	M3297	M3317	M3337	
		M3218	M3238	M3258	M3278	M3298	M3318	M3338	
FIN signal		M3219	M3239	M3259	M3279	M3299	M3319	M3339	

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	Axis 8	Axis 9	Axis 10	Axis 11	Axis 12	Axis 13	Axis 14	Axis 15	Axis 16	Direction
	M2540	M2560	M2580	M2600	M2620	M2640	M2660	M2680	M2700	
	M2541	M2561	M2581	M2601	M2621	M2641	M2661	M2681	M2701	
	M2542	M2562	M2582	M2602	M2622	M2642	M2662	M2682	M2702	
	M2543	M2563	M2583	M2603	M2623	M2643	M2663	M2683	M2703	
	M2544	M2564	M2584	M2604	M2624	M2644	M2664	M2684	M2704	
	M2545	M2565	M2585	M2605	M2625	M2645	M2665	M2685	M2705	
	M2546	M2566	M2586	M2606	M2626	M2646	M2666	M2686	M2706	
	M2547	M2567	M2587	M2607	M2627	M2647	M2667	M2687	M2707	PCPU
	M2548	M2568	M2588	M2608	M2628	M2648	M2668	M2688	M2708	\rightarrow
	M2549	M2569	M2589	M2609	M2629	M2649	M2669	M2689	M2709	SCPU
	M2550	M2570	M2590	M2610	M2630	M2650	M2670	M2690	M2710	
	M2551	M2571	M2591	M2611	M2631	M2651	M2671	M2691	M2711	
	M2552	M2572	M2592	M2612	M2632	M2652	M2672	M2692	M2712	
	M2553	M2573	M2593	M2613	M2633	M2653	M2673	M2693	M2713	
	M2554	M2574	M2594	M2614	M2634	M2654	M2674	M2694	M2714	
_ ·	M2555	M2575	M2595	M2615	M2635	M2655	M2675	M2695	M2715	
<u> </u>	M2556	M2576	M2596	M2616	M2636	M2656	M2676	M2696	M2716	
	M2557	M2577	M2597	M2617	M2637	M2657	M2677	M2697	M2717	
	M2558	M2578	M2598	M2618	M2638	M2658	M2678	M2698	M2718	
	M2559	M2579	M2599	M2619	M2639	M2659	M2679	M2699	M2719	
	M3340	M3360	M3380	M3400	M3420	M3440	M3460	M3480	M3500	
	M3341	M3361	M3381	M3401	M3421	M3441	M3461	M3481	M3501	
	M3342	M3362	M3382	M3402	M3422	M3442	M3462	M3482	M3502	
	M3343	M3363	M3383	M3403	M3423	M3443	M3463	M3483	M3503	
	M3344	M3364	M3384	<u>M3404</u>	M3424	M3444	M3464	M3484	M3504	
	M3345	M3365	M3385	M3405	M3425	M3445	M3465	M3485	M3505	
	M3346	M3366	M3386	<u>M3406</u>	M3426	M3446	M3466	M3486	M3508	
	M3347	M3367	M3387	M3407	M3427	M3447	M3467	M3487	M3507	
	M3348	M3368	M3388	M3408	M3428	M3448	M3468	M3488	M3508	SCPU
	M3349	M3369	M3389	M3409	M3429	M3449	M3469	M3489	M3509	→ PCPU
	M3350	M3370	M3390	M3410	M3430	M3450	M3470	M3490	M3510	
	M3351	M3371	M3391	M3411	M3431	M3451	M3471	M3491	M3511	·
	M3352	M3372	M3392	M3412	M3432	M3452	M3472	M3492	M3512	
	M3353	M3373	M3393	M3413	M3433	M3453	M3473	M3493	M3513	
	M3354	M3374	M3394	M3414	M3434	M3454	M3474	M3494	M3514	
	M3355	M3375	M3395	M3415	M3435	M3455	M3475	M3495	M3515	
	M3356	M3376	M3396	M3416	M3436	M3456	M3476	M3496	M3516	
	M3357	M3377	M3397	M3417	M3437	M3457	M3477	M3497	M3517	
	M3358	M3378	M3398	M3418	M3438	M3458	M3478	M3498	M3518	·
	M3359	M3379	M3399	M3419	M3439	M3459	M3479	M3499	M3519	

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Signa	i Name							Device No.	
		Axis 17	Axis 18	Axis 19	Axis 20	Axis 21	Axis 22	Axis 23	
Positioning start completed		M2720	M2740	M2760	M2780	M2800	M2820	M2840	
Positioning completed		M2721	M2741	M2761	M2781	M2801	M2821	M2841	
In-position		M2722	M2742	M2762	M2782	M2802	M2822	M2842	L
Command in-posi	tion	M2723	M2743	M2763	M2783	M2803	M2823	M2843	
Speed control in	progress	M2724	M2744	M2764	M2784	M2804	M2824	M2844	
Speed/position sv	vitching latch	M2725	M2745	M2765	M2785	M2805	M2825	M2845	
Zero pass		M2726	M2746	M2766	M2786	M2806	M2826	M2846	
Error detection		M2727	M2747	M2767	M2787	M2807	M2827	M2847	
Servo error detec	tion	M2728	M2748	M2768	M2788	M2808	M2828	M2848	
Home position ret	urn request	M2729	M2749	M2769	M2789	M2809	M2829	M2849	
Home position ret	urn completed	M2730	M2750	M2770	M2790	M2810	M2830	M2850	
	FLS	M2731	M2751	M2771	M2791	M2811	M2831	M2851	
External signals	RLS	M2732	M2752	M2772	M2792	M2812	M2832	M2852	
, i i i i i i i i i i i i i i i i i i i	STOP	M2733	M2753	M2773	M2793	M2813	M2833	M2853	
	DOG	M2734	M2754	M2774	M2794	M2814	M2834	M2854	
Servo READY		M2735	M2755	M2775	M2795	M2815	M2835	M2855	
Torque control in	progress	M2736	M2756	M2776	M2796	M2816	M2836	M2856	
CHANGE signal		M2737	M2757	M2777	M2797	M2817	M2837	M2857	
Unusable		M2738	M2758	M2778	M2798	M2818	M2838	M2858	
M code output in progress signal		M2739	M2759	M2779	M2799	M2819	M2839	M2859	
Stop command		M3520	M3540	M3560	M3580	M3600	M3620	M3640	
Rapid stop comma	and	M3521	M3541	M3561	M3581	M3601	M3621	M3641	
Forward JOG star	t	M3522	M3542	M3562	M3582	M3602	M3622	M3642	
Reverse JOG star	t	M3523	M3543	M3563	M3583	M3603	M3623	M3643	
End signal OFF co	ommand	M3524	M3544	M3564	M3584	M3604	M3624	M3644	
Speed/position sw	ritching enabled	M3525	M3545	M3565	M3585	M3605	M3625	M3645	
Limit switch output	t enable	M3526	M3546	M3566	M3586	M3606	M3626	M3646	
Error reset		M3527	M3547	M3567	M3587	M3607	M3627	M3647	
Servo error reset		M3528	M3548	M3568	M3588	M3608	M3628	M3648	
External STOP inp when starting	out valid/invalid	M3529	M3549	M3569	M3589	M3609	M3629	M3649	
		M3530	M3550	M3570	M3590	M3610	M3630	M3650	
Unusable		M3531	M3551	M3571	M3591	M3611	M3631	M3651	
Feed present valu command	e update request	M3532	M3552	M3572	M3592	M3612	M3632	M3652	
Unucable		M3533	M3553	M3573	M3593	M3613	M3633	M3653	
Unusable		M3534	M3554	M3574	M3594	M3614	M3634	M3654	
Servo OFF		M3535	M3555	M3575	M3595	M3615	M3635	M3655	
		M3536	M3556	M3576	M3596	M3616	M3636	M3656	
Unusable		M3537	M3557	M3577	M3597	M3617	M3637	M3657	
		M3538	M3558	M3578	M3598	M3618	M3638	M3658	
FIN signal		M3539	M3559	M3579	M3599	M3619	M3639	M3659	

Table 6.3 Axis I/O Signal List (Continued)

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									Signal
 Axis 24	Axis 25	Axis 26	Axis 27	Axis 28	Axis 29	Axis 30	Axis 31	Axis 32	Direction
 M2860	M2880	M2900	M2920	M2940	M2960	M2980	M3000	M3020	
 M2861	M2881	M2901	M2921	M2941	M2961	M2981	M3001	M3021	
 M2862	M2882	M2902	M2922	M2942	M2962	M2982	M3002	M3022	
M2863	M2883	M2903	M2923	M2943	M2963	M2983	M3003	M3023	
 M2864	M2884	M2904	M2924	M2944	M2964	M2984	M3004	M3024	
 M2865	M2885	M2905	M2925	M2945	M2965	M2985	M3005	M3025	
M2866	M2886	M2906	M2926	M2946	M2966	M2986	M3006	M3026	
M2867	M2887	M2907	M2927	M2947	M2967	M2987	M3007	M3027	PCPU
 M2868	M2888	M2908	M2928	M2948	M2968	M2988	M3008	M3028	→
M2869	M2889	M2909	M2929	M2949	M2969	M2989	M3009	M3029	SCPU
M2870	M2890	M2910	M2930	M2950	M2970	M2990	M3010	M3030	
M2871	M2891	M2911	M2931	M2951	M2971	M2991	M3011	M3031	
M2872	M2892	M2912	M2932	M2952	M2972	M2992	M3012	M3032	
 M2873	M2893	M2913	M2933	M2953	M2973	M2993	M3013	M3033	
M2874	M2894	M2914	M2934	M2954	M2974	M2994	M3014	M3034	
 M2875	M2895	M2915	M2935	M2955	M2975	M2995	M3015	M3035	
M2876	M2896	M2916	M2936	M2956	M2976	M2996	M3016	M3036	
M2877	M2897	M2917	M2937	M2957	M2977	M2997	M3017	M3037	
M2878	M2898	M2918	M2938	M2958	M2978	M2998	M3018	M3038	
M2879	M2899	M2919	M2939	M2959	M2979	M2999	M3019	M3039	
M3660	M3680	M3700	M3720	M3740	M3760	M3780	M3800	M3820	
 M3661	M3681	M3701	M3721	M3741	M3761	M3781	M3801	M3821	
 M3662	M3682	M3702	M3722	M3742	M3762	M3782	M3802	M3822	
 M3663	M3683	M3703	M3723	M3743	M3763	M3783	M3803	M3823	
 M3664	M3684	M3704	M3724	M3744	M3764	M3784	M3804	M3824	
 M3665	M3685	M3705	M3725	M3745	M3765	M3785	M3805	M3825	
 M3666	M3686	M3706	M3726	M3746	M3766	M3786	M3806	M3826	
 M3667	M3687	M3707	M3727	M3747	M3767	M3787	M3807	M3827	
 M3668	M3688	M3708	M3728	M3748	M3768	M3788	M3808	M3828	SCPU
M3669	M3689	M3709	M3729	M3749	M3769	M3789	M3809	M3829	→ PCPU
M3670	M3690	M3710	M3730	M3750	M3770	M3790	M3810	M3830	
M3671	M3691	M3711	M3731	M3751	M3771	M3791	M3811	M3831	
M3672	M3692	M3712	M3732	M3752	M3772	M3792	M3812	M3832	
 M3673	M3693	M3713	M3733	M3753	M3773	M3793	M3813	M3833	
M3674	M3694	M3714	M3734	M3754	M3774	M3794	M3814	M3834	
 M3675	M3695	M3715	M3735	M3755	M3775	M3795	M3815	M3835	
M3676	M3696	M3716	M3736	M3756	M3776	M3796	M3816	M3836	
M3677	M3697	M3717	M3737	M3757	M3777	M3797	M3817	M3837	
M3678	M3698	M3718	M3738	M3758	M3778	M3798	M3818	M3838	
M3679	M3699	M3719	M3739	M3759	M3779	M3799	M3819	M3839	

						
Device Number	Signal Name	Signal Direction				
M2000	PC READY flag	SCPU → PCPU				
M2001	Axis 1 start accept flag					
M2002	Axis 2 start accept flag	PCPU → SCPU				
M2003	Axis 3 start accept flag					
M2004	Axis 4 start accept flag					
M2005						
to Manna	Unusable	-				
M2009	All-axis serve start accent flag					
M2010						
to	Unusable	_				
M2011						
M2012	Manual pulse generator enable flag	SCPU → PCPU				
M2013	l Unusable					
M2014						
M2015	JOG simultaneous start command					
M2016	When using SV13: Speed switching point designation flag					
	When using SV22: Unusable					
M2017 to M2019	Unusable					
M2020	Start buffer fuli					
M2021	Axis 1 speed change flag					
M2022	Axis 2 speed change flag	PCPU → SCPU				
M2023	Axis 3 speed change flag					
M2024	Axis 4 speed change flag					
M2025						
to M2039	Unusable	_				
M2040	When using SV13: Unusable					
	When using SV22: Speed switching point designation flag	SCPU → PCPU				
M2041	System setting error flag	PCPU → SCPU				
M2042	All axes servo start command	SCPU → PCPU				
M2043 to M2046	Unusable	-				
M2047	Optional slot module error detection flag	PCPU → SCPU				

447400DU Table 6.4 Inte

Device Number	Signal Name	Signal Direction		
M2000	PC READY flag	SCPU → PCPU		
M2001	Axis 1 start accept flag			
M2002	Axis 2 start accept flag			
M2003	Axis 3 start accept flag			
M2004	Axis 4 start accept flag	PCPU → SCPU		
M2005	Axis 5 start accept flag			
M2006	Axis 6 start accept flag			
M2007	Axis 7 start accept flag			
M2008	Axis 8 start accept flag]		
M2009	All-axis servo start accept flag			
M2010				
to M2011	Unusable	-		
M2012	Manual pulse generator 1 enable flag			
M2013	Manual pulse generator 2 enable flag	1		
M2014	Manual pulse generator 3 enable flag	- SCPU → PCPU		
M2015	JOG simultaneous start command			
	When using SV13: Speed switching point designation flag	1		
M2016	When using SV22: Unusable			
M2017 to M2019	Unusable	-		
M2020	Start buffer full			
M2021	Axis 1 speed change flag			
M2022	Axis 2 speed change flag			
M2023	Axis 3 speed change flag			
M2024	Axis 4 speed change flag			
M2025	Axis 5 speed change flag			
M2026	Axis 6 speed change flag			
M2027	Axis 7 speed change flag			
M2028	Axis 8 speed change flag			
M2029 to M2039	Unusable	_		
M2040	When using SV13: Unusable			
₩2040	When using SV22: Speed switching point designation flag	SCPU → PCPU		
M2041	System setting error flag	PCPU → SCPU		
M2042	All axes servo start command	SCPU → PCPU		
M2043 to M2046	Unusable			
M2047	Motion slot module error detection flag	PCPU → SCPU		

<A273UHCPU (8-axis specification)> Table 6.5 Internal Relay List

<A273UHCPU

(32-axis specification)>

Table 6.6 Internal Relay List

Device	Signal Name	Signal Direction	Device	Signal Name	Signal Direction
M2000	PC READY flag		M2061	Axis 1 speed change flag	Diroonon
M2001	Axis 1 start accept flag]	M2062	Axis 2 speed change flag	
M2002	Axis 2 start accept flag]	M2063	Axis 3 speed change flag	
M2003	Axis 3 start accept flag]	M2064	Axis 4 speed change flag	
M2004	Axis 4 start accept flag]	M2065	Axis 5 speed change flag	
M2005	Axis 5 start accept flag]	M2066	Axis 6 speed change flag	
M2006	Axis 6 start accept flag		M2067	Axis 7 speed change flag	
M2007	Axis 7 start accept flag		M2068	Axis 8 speed change flag	
M2008	Axis 8 start accept flag		M2069	Axis 9 speed change flag	
M2009	Axis 9 start accept flag	1	M2070	Axis 10 speed change flag	
M2010	Axis 10 start accept flag		M2071	Axis 11 speed change flag	
M2011	Axis 11 start accept flag	1	M2072	Axis 12 speed change flag	
M2012	Axis 12 start accept flag		M2073	Axis 13 speed change flag	
M2013	Axis 13 start accept flag		M2074	Axis 14 speed change flag	PCPU -> SCPU
M2014	Axis 14 start accept flag	PCPU → SCPU	M2075	Axis 15 speed change flag	
M2015	Axis 15 start accept flag		M2076	Axis 16 speed change flag	
M2016	Axis 16 start accept flag		M2077	Axis 17 speed change flag	
M2017	Axis 17 start accept flag		M2078	Axis 18 speed change flag	
M2018	Axis 18 start accept flag		M2079	Axis 19 speed change flag	
M2019	Axis 19 start accept flag		M2080	Axis 20 speed change flag	
M2020	Axis 20 start accept flag		M2081	Axis 21 speed change flag	
M2021	Axis 21 start accept flag		M2082	Axis 22 speed change flag	
M2022	Axis 22 start accept flag		M2083	Axis 23 speed change flag	
M2023	Axis 23 start accept flag]	M2084	Axis 24 speed change flag	
M2024	Axis 24 start accept flag		M2085	Axis 25 speed change flag	
M2025	Axis 25 start accept flag		M2086	Axis 26 speed change flag	
M2026	Axis 26 start accept flag		M2087	Axis 27 speed change flag	
M2027	Axis 27 start accept flag	1	M2088	Axis 28 speed change flag	
M2028	Axis 28 start accept flag		M2089	Axis 29 speed change flag	
M2029	Axis 29 start accept flag		M2090	Axis 30 speed change flag	
M2030	Axis 30 start accept flag		M2091	Axis 31 speed change flag	
M2031	Axis 31 start accept flag		M2092	Axis 32 speed change flag	
M2032	Axis 32 start accept flag		M2093		
M2033			to	Unusable	-
to	Unusable	<u> </u>	M2127		
M2039			M2128	Axis 1 automatic deceleration flag	
	Speed switching point designation		M2129	Axis 2 automatic deceleration flag	
M2040	flag	SCPU → PCPU	M2130	Axis 3 automatic deceleration flag	
M2041	System setting error flag	PCPU → SCPU	M2131	Axis 4 automatic deceleration flag	
M2042	All axes serve start flag	SCPU → PCPU	M2132	Axis 5 automatic deceleration flag	
M2043			M2133	Axis 6 automatic deceleration flag	
to	Unusable	_	M2134	Axis 7 automatic deceleration flag	
M2046			M2135	Axis 8 automatic deceleration flag	
	Motion slot module error detection		M2136	Axis 9 automatic deceleration flag	
M2047	flag	PCPU → SCPU	M2137	Axis 10 automatic deceleration flag	PCPU → SCPU
M2048	JOG simultaneous start command	SCPU → PCPU	M2138	Axis 11 automatic deceleration flag	
M2049	All axis servo start accept flag		M2139	Axis 12 automatic deceleration flag	
M2050	Start buffer full		M2140	Axis 13 automatic deceleration flag	
M2051	Manual pulse generator 1 enable		M2141	Axis 14 automatic deceleration flag	
	Manual pulse generator 2 enable		M2142	Axis 16 automatic deceleration flag	
M2052	flag		M2144	Axis 17 automatic deceleration flag	
HOOSO	Manual pulse generator 3 enable		M2145	Axis 18 automatic deceleration flag	
M2053	fiag		M2146	Axis 19 automatic deceleration flag	
M2054			M2147	Axis 20 automatic deceleration flag	
to	Unusable		M2148	Axis 21 automatic deceleration flag	
M2060			M2149	Axis 22 automatic deceleration flag	

Table 6.6	Internal	Relay	List	(Continued)
	meenda	Tionay	FIAL	(commund)

Device No.	Signal Name	Signal Direction	Device No.	Signal Name	Signai Direction
M2150 M2151	Axis 23 automatic deceleration flag Axis 24 automatic deceleration flag		M2254	Axis 15 speed change "0" accept flag	
M2152	Axis 25 automatic deceleration flag		M2255	Axis 16 speed change "0" accept flag	
M2154	Axis 27 automatic deceleration flag	PCPU → SCPU	M2256	Axis 17 speed change "0" accept	
M2155 M2156	Axis 29 automatic deceleration flag		M2257	Axis 18 speed change "0" accept	-
M2157 M2158	Axis 30 automatic deceleration flag		M2258	Axis 19 speed change "0" accept	
M2159 M2160		_	M2259	Axis 20 speed change "0" accept flag	4
M2239			M2260	Axis 21 speed change "0" accept	
M2240	flag		M2261	Axis 22 speed change "0" accept	
M2241	flag		M2262	Axis 23 speed change "0" accept flag	
M2242	flag		M2263	Axis 24 speed change "0" accept	
M2243	flag		M2264	Axis 25 speed change "0" accept	
M2244	Axis 5 speed change "0" accept flag		M2265	Axis 26 speed change "0" accept	
M2245	Axis 6 speed change "0" accept flag		M2266	Axis 27 speed change '0' accept	
M2246	Axis 7 speed change "0" accept flag		M2267	Axis 28 speed change "0" accept	-
M2247	Axis 8 speed change "0" accept flag		M2268	Axis 29 speed change "0" accept	
M2248	Axis 9 speed change "0" accept flag		M2269	Axis 30 speed change "0" accept	
M2249	Axis 10 speed change "0" accept flag		M2270	Axis 31 speed change "0" accept	-
M2250	Axis 11 speed change "0" accept flag		M2271	flag Axis 32 speed change *0* accept	
M2251	Axis 12 speed change '0' accept flag		M2272	flag	
M2252	Axis 13 speed change "0" accept flag		to M2319	Unusable	-
M2253	Axis 14 speed change "0" accept flag				

<A171SCPU/A273UHCPU

(8/32-axis specification)> Table 6.7 Special Relay List

Device No.	Signal Name	Signal Direction
M9073	WDT error flag	
M9074	PCPU READY-completed flag	
M9075	in-test-mode flag	
M9076	External emergency stop input flag	PCPU → SCPU
M9077	Manual pulse generator axis setting error flag	
M9078	Test mode request error flag	
M9079	Servo program setting error flag	

6.2 Data Registers (D)

Table 6.8 Data Register List <A171SCPU> Device Device Signal Name Signal Name No. No. First data register number D800 Axis 1 monitorina Setting register for axis number controlled with ٥ 되는 Feed present value D1012 to data 1 manual pulse generator D819 ÷ 2 Actual present value 3 느 4 Deviation counter value D1013 D820 5 Axis 2 monitorina Minor error code 6 Unusable to to data 7 Major error code D1014 D839 8 Servo error code Travel value when the near-zero point dog is ON J. 9 H 10 D840 Axis 3 monitoring 11 Home position return second travel value JOG operation simultaneous start axis setting D1015 to 12 Executed program number data register D859 13 M cod 14 Torque limit value 15 Travel value change register D860 16 н 1 pulse input magnification setting register of Axis 4 monitoring Actual present value when STOP is input 17 Ľ D1016 to manual pulse generator for axis 1 data 18 н D879 19 For constant speed control D880 1 pulse input magnification setting register of D1017 Unusable to manual pulse generator for axis 2 D959 D960 Axis 1 control 1 pulse input magnification setting register of D1018 change data to manual pulse generator for axis 3 D965 storage area D966 Axis 2 control 1 pulse input magnification setting register of D1019 to change data First data register number manual pulse generator for axis 4 D971 storage area Present value change register ٥Γ H 1 2 L Speed change register D1020 D972 Axis 3 control 3 н change data Unusable to 4 to L JOG speed setting register ł D1023 D977 storage area D978 Axis 4 control change data to D983 storage area D984 Unusable to D1007 D1008 Limit switch output disable setting to D1009 D1010 Unusable to D1011

<A273UHCPU (8-axis specification)>

Table 6.9 Data Register List

Device No.	Si	gnal Name	Device No.	Signal Name
D800 to D819	Axis 1 monitoring data		D1012	Setting register for axis number controlled with manual pulse generator 1
D820 to D839	Axis 2 monitoring data		D1013	Setting register for axis number controlled with manual pulse generator 2
D840 to D859	Axis 3 monitoring data	First data register number	D1014	Setting register for axis number controlled with manual pulse generator 3
D860 to D879	Axis 4 monitoring data	Beviation counter value L B Minor error code Major error code	D1015	JOG operation simultaneous start axis setting register
D880 to D899	Axis 5 monitoring data	serve error code	D1016	1 pulse input magnification setting register of manual pulse generator for axis 1
D900 to D919	Axis 6 monitoring data	13 M code 14 Torque ilmit value 15	D1017	1 pulse input magnification setting register of manual pulse generator for axis 2
D920 to D939	Axis 7 monitoring data	18 SIGHT 18 Impart H 19 For constant speed control	D1018	1 pulse input magnification setting register of manual pulse generator for axis 3
D940 to D959	Axis 8 monitoring data		D1019	1 pulse input magnification setting register of manual pulse generator for axis 4
D960 to D965	Axis 1 control change data storage area		D1020	1 pulse input magnification setting register of manual pulse generator for axis 5
D966 to D971	Axis 2 control change data storage area		D1021	1 pulse input magnification setting register of manual pulse generator for axis 6
D972 to D977	Axis 3 control change data storage area		D1022	1 pulse input magnification setting register of manual pulse generator for axis 7
D978 to D983	Axis 4 control change data storage area	First data register number O Present value change L T register H	D1023	1 pulse input magnification setting register of manual pulse generator for axis 8
D984 to D989	Axis 5 control change data storage area	Speed change register H JOG speed setting register H H		
D990 to D995	Axis 6 control change data storage area			
D996 to D1001	Axis 7 control change data storage area			
D1002 to D1007	Axis 8 control change data storage area			
D1008 to D1011	Limit switch output di	sable setting		

<A273UHCPU (32-axis specification)> Table 6.10 Data Register List Device Device Signal Name Signal Name **Data Register Names** No. No. DO D320 to Axis 1 monitoring data to Axis 17 monitoring data D19 D339 D20 D340 to Axis 2 monitoring data to Axis 18 monitoring data D39 D359 D40 D360 to Axis 3 monitoring data to Axis 19 monitoring data D59 D379 D60 D380 to Axis 4 monitoring data to Axis 20 monitoring data D79 D399 D80 D400 Axis 5 monitoring data to to Axis 21 monitoring data D99 D419 D100 D420 to Axis 6 monitoring data to Axis 22 monitoring data D119 D439 First data register number D120 D440 Axis 7 monitoring data to to Axis 23 monitoring data 0 L H Feed present value D139 D459 L â Actual present value 3 н D140 D460 4 L Deviation counter value to Axis 8 monitoring data to Axis 24 monitoring data 5 н D159 D479 Minor error code E 7 Major error code D160 D480 Servo error code ş e position return second travel 200 Axis 9 monitoring data to to Axis 25 monitoring data 10 zero point dog is ON L D179 D499 11 н 12 Executed program number D180 D500 13 M code 14 Torque limit value to Axis 10 monitoring data to Axis 26 monitoring data 15 For constant speed control D199 D519 16 el value change regist L Tra 17 н L H D200 D520 18 Actual present value w STOP is input 19 Axis 11 monitoring data Axis 27 monitoring data to to D219 D539 D220 D540 Axis 12 monitoring data to to Axis 28 monitoring data D239 D559 D240 D560 to Axis 13 monitoring data to Axis 29 monitoring data D259 D579 D260 D580 to Axis 14 monitoring data to Axis 30 monitoring data D279 D599 D280 D600 to Axis 15 monitoring data to Axis 31 monitoring data D299 D619 D300 D620 Axis 16 monitoring data

to

D639

Axis 32 monitoring data

to

D319

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<A273UHCPU

(32-axis specification)> Table 6.10 Data Register List (Continued)

Device No.	Signal Name	Device No.	Signal Name	Data Register Names
D640	Axis 1 JOG speed data	D672	Axis 17 JOG speed	
D641	storage area	D673	data storage area	
D642	Axis 2 JOG speed data	D674	Axis 18 JOG speed	
D643	storage area	D675	data storage area	
D644	Axis 3 JOG speed data	D676	Axis 19 JOG speed	
D645	storage area	D677	data storage area	
D646	Axis 4 JOG speed data	D678	Axis 20 JOG speed	
D647	storage area	D679	data storage area	
D648	Axis 5 JOG speed data	D680	Axis 21 JOG speed	
D649	storage area	D681	data storage area	
D650	Axis 6 JOG speed data	D682	Axis 22 JOG speed	
D651	storage area	D683	data storage area	
D652	Axis 7 JOG speed data	D684	Axis 23 JOG speed	First data register number
D653	storage area	D685	data storage area	
D654	Axis 8 JOG speed data	D686	Axis 24 JOG speed	1 H
D655	storage area	D687	data storage area	
D656	Axis 9 JOG speed data	D688	Axis 25 JOG speed	
D657	storage area	D689	data storage area	
D658	Axis 10 JOG speed	D690	Axis 26 JOG speed	
D659	data storage area	D691	data storage area	
D660	Axis 11 JOG speed	D692	Axis 27 JOG speed	
D661	data storage area	D693	data storage area	
D662	Axis 12 JOG speed	D694	Axis 28 JOG speed	
D663	data storage area	D695	data storage area	
D664	Axis 13 JOG speed	D696	Axis 29 JOG speed	
D665	data storage area	D697	data storage area	
D666	Axis 14 JOG speed	D698	Axis 30 JOG speed	
D667	data storage area	D699	data storage area	
D668	Axis 15 JOG speed	D700	Axis 31 JOG speed	
D669	data storage area	D701	data storage area	
D670	Axis 16 JOG speed	D702	Axis 32 JOG speed	
D671	data storage area	D703	data storage area	

<A273UHCPU

(32-axis specification)> Table 6.10 Data Register List (Continued)

Device No.	Signal Name	Device No.	Signal Name
D704 to D709	Unusable	D737	1 pulse input magnification setting register of manual pulse generator for axis 18
D710 to D713	JOG operation simultaneous start axis setting register	D738	1 pulse input magnification setting register of manual pulse generator for axis 19
D714 D715	Setting register for axis number controlled with manual pulse generator 1	D739	1 pulse input magnification setting register of manual pulse generator for axis 20
D716 D717	Setting register for axis number controlled with manual pulse generator 2	D740	1 pulse input magnification setting register of manual pulse generator for axis 21
D718 D719	Setting register for axis number controlled with manual pulse generator 3	D741	1 pulse input magnification setting register of manual pulse generator for axis 22
D720	1 pulse input magnification setting register of manual pulse generator for axis 1	D742	1 pulse input magnification setting register of manual pulse generator for axis 23
D721	1 pulse input magnification setting register of manual pulse generator for axis 2	D743	1 pulse input magnification setting register of manual pulse generator for axis 24
D722	1 pulse input magnification setting register of manual pulse generator for axis 3	D744	1 pulse input magnification setting register of manual pulse generator for axis 25
D723	1 pulse input magnification setting register of manual pulse generator for axis 4	D745	1 pulse input magnification setting register of manual pulse generator for axis 26
D724	1 pulse input magnification setting register of manual pulse generator for axis 5	D746	1 pulse input magnification setting register of manual pulse generator for axis 27
D725	1 pulse input magnification setting register of manual pulse generator for axis 6	D747	1 pulse input magnification setting register of manual pulse generator for axis 28
D726	1 pulse input magnification setting register of manual pulse generator for axis 7	D748	1 pulse input magnification setting register of manual pulse generator for axis 29
D727	1 pulse input magnification setting register of manual pulse generator for axis 8	D749	1 pulse input magnification setting register of manual pulse generator for axis 30
D728	1 pulse input magnification setting register of manual pulse generator for axis 9	D750	1 pulse input magnification setting register of manual pulse generator for axis 31
D729	1 pulse input magnification setting register of manual pulse generator for axis 10	D751	1 pulse input magnification setting register of manual pulse generator for axis 32
D730	1 pulse input magnification setting register of manual pulse generator for axis 11	D752*	Manual pulse generator 1 (P1) smoothing magnification setting area
D731	1 pulse input magnification setting register of manual pulse generator for axis 12	D753*	Manual pulse generator 2 (P2) smoothing magnification setting area
D732	1 pulse input magnification setting register of manual pulse generator for axis 13	D754*	Manual pulse generator 3 (P3) smoothing magnification setting area
D733	1 pulse input magnification setting register of manual pulse generator for axis 14	D756 to D759	Unusable
D734	1 pulse input magnification setting register of manual pulse generator for axis 15	D760 to D775	Limit switch output disable setting
D735	1 pulse input magnification setting register of manual pulse generator for axis 16	D776 to D791	Limit switch output status storage area
D736	1 pulse input magnification setting register of manual pulse generator for axis 17	D792 to D799	Servo amplifier type

*: Treated as a special register. For details, see Section 3.5.

Device Number	Signal Name
D9180	Limit switch output status storage area for axis 1 and axis 2
D9181	Limit switch output status storage area for axis 3 and axis 4
D9182	
D9183	
D9184	PCPU error cause
D9185	Serve emplifier type
D9186	Serve ampliner type
D9187	Manual pulse generator axis setting error
D9188	Test mode request error
D9189	Error program number
D9190	Error item information
D9191	Servo amplifier loading information
D9192	Area for setting the manual pulse generator smoothing magnification
D9193	
D9194	
D9195 to D9199	Unusable

<A171SCPU> Table 6.11 Special Register List

<A273UHCPU

(8-axis specification)> Table 6.12 Special Register List

Device Number	Signal Name
D9180	Limit switch output status storage area for axis 1 and axis 2
D9181	Limit switch output status storage area for axis 3 and axis 4
D9182	Limit switch output status storage area for axis 5 and axis 6
D9183	Limit switch output status storage area for axis 7 and axis 8
D9184	PCPU error cause
D9185	Serve amplifier type
D9186	
D9187	Manual pulse generator axis setting error
D9188	Test mode request error
D9189	Error program number
D9190	Error item information
D9191	Servo amplifier loading information
D9192	Area for setting the manual pulse generator (P1) smoothing magnification
D9193	Area for setting the manual pulse generator (P2) smoothing magnification
D9194	Area for setting the manual pulse generator (P3) smoothing magnification
D9195 to D9199	Unusable

<A273UHCPU

(32-axis specification)> Table 6.13 Special Register List

Device Number	Signal Name
D752*	Area for setting the manual pulse generator (P1) smoothing magnification
D753*	Area for setting the manual pulse generator (P2) smoothing magnification
D754*	Area for setting the manual pulse generator (P3) smoothing magnification
D776 to • D791	Limit switch output status storage area
D792 to • D799	Servo amplifier type
D9180 to D9181	Unusable
D9182 to D9183	Test mode request error
D9184	PCPU error cause
D9185 to D9187	Manual pulse generator setting error
D9188	Unusable
D9189	Error program number
D9190	Error item information
D9191 to D9192	Servo amplifier loading information
D9193 to D9199	Unusable

*: Data registers used (See Section 3.5)

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APPENDIX 7 PROCESSING TIMES

The processing times for each signal and each instruction when performing positioning control with a servo system CPU are indicated here.

(1) Operation cycle for each servo system CPU

The processing times for performing positioning control operation with each servo system CPU are indicated below.

	A17	1SCPU	A273UHCPU			
Set num of axes	ber 1 to 3	4	1 to 12	13 to 24	25 to 32	
Operation cycle	3.5 ms	7.1 ms	3.5 ms	7.1 ms	14.2 ms	

(2) PCPU processing cycle

The processing time at the PCPU after detection of the start request signal and PC ready (M2000) signal ON is indicated below.

	A171SCPU		A273U (8-axis spe	HCPU cification)	A273UHCPU				
	Number of axes used	4 axes	4 axes	8 axes	4 axes	8 axes	16 axes	32 axes	
Servo program processing time		7 to 14 ms*1	4 to 11 ms		4 to 11 ms		10 to 18 ms	14 to 21 ms	
Speed change response time		7 to 14 ms	0 to 4 ms		0 to 4 ms		0 to 8 ms	0 to 14 ms	
PC ready (M2000) ON→ PCPU ready completed flag (M9074) ON		100 to 300 ms	80 to 100 ms		8 to 100 ms		90 to 400 ms	100 to 800 ms	
Simultaneous start processing time		7 to 17 ms*2	7 to 17 ms		7 to 17 ms		10 to 24 ms	14 to 28 ms	

*1 : For FEED, VPF, and VPR, this differs greatly according to the conditions. If the other axes are stopped it is 14 to 28 ms.

*2 : The range of 7 to 17 ms should be regarded as a guide only.

(3) Common devices

The processing times for the common devices for each axis in positioning control are indicated below. For each signal whose direction of transmission is "PCPU \rightarrow SCPU", the cycle for notification from the PCPU to the SCPU is indicated. For signals whose direction of transmission is "SCPU \rightarrow PCPU", the cycle for notification from the SCPU to the PCPU, or the cycle for detection at the PCPU, is indicated.

Signal Name								A273	JHCPU	
		Device No.		Signal Direction	A171	SCPU	8-axis Specification	32-	exis Specifica	tion
	A171SCPU	A273UHCPU (8-axis	A27SUHCPU (32-exis		Set Numb	er of Axes	Set Number of Axes	S•	Set Number of Axes	
		specification)	specification)		1 to 3	4	1 to 8	1 to 12	13 to 24	25 to 32
Axis start accept flage	M2001 to M2004	M2001 to M2008	M2001 to M2032		10 ms					
All-axie servo start scoopt flag	M2009	M2009	M2049		10 ms	10 ms	10 ms	END 7	END 1	END "
Axis speed change flage	M2021 to M2024	M2021 to M2028	M2061to M2092		END "1	END 7	END *1	END 7	END "	END '1
System setting error flag	M2041	M2041	M2041	PCPU→	END "	END *1	END "	END "	END "	END "
Optional slot module error detection flag	M2047	M2047	M2047	SCPU	END 1	END *1	END "	END "	END "	END "1
Automatic deceleration flags	-	1	M2128 to M2159		_	-	-	3.5 ms	7.1 ms	14.2 ms
Speed change *0* accept flage	_	-	M2240 to M2271			-	—	3.5 ms	7.1 ms	14.2 ms
Limit switch output status storage areas	D9180 to D9181	D9180 to D9183	D776 to D791		3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
Areas for setting the manual pulse generator smoothing magnifications	D9192	D9192 to D9194	D752 to D754		At leading edge of manual pulse generator enable signal	At leading edge of manual pulse generator enable signal	At leading edge of menual pulse generator enable signal	At leading edge of manual puise generator enable signal	At leading edge of manual pulse generator enable signal	At leading edge of manual pulse generator enable signal
Limit switch output enable/ disable satting	D1008 to D1009	D1008 to D1011	D760 to D775		3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
Manusi puise generator axia aetting	D1012	D1012 to D1014	D714 to D719		At leading edge of manual puise generator enable signal	At leading edge of manual pulse generator enable signal	At leading edge of menual pulse generator enable signal	At leading edge of manual pulse generator enable signal	At leading edge of manual pulse generator enable signal	At leading edge of manual pulse generator enable signal
JOG operation simultaneous start axis setting	D1015	D1015	D710 to D713	SCPU→ PCPU	At start					
Manual puise generator 1 puise input magnification	D1016 to D1019	D1016 to D1023	D720 to D751		At leading edge of manual pulse generator enable signal					
Present value change register			-		When DSFLP instruction is executed	When DSFLP instruction is executed	When DSFLP instruction is executed	-	-	-
Speed change register	D960 to D1007	D960 to D1007	-		When DSFLP Instruction is executed	When DSFLP instruction is executed	When DSFLP instruction is executed	-	-	-
JOG speed setting register			D640 to D703		At start					

END *1 : With A171SCPU : *80 ms* or *PC program scan time*, whichever is longer With A273UHCPU : *50 ms* or PC program scan time, whichever is longer

- (4) Devices specific to each axis
 - The processing times for the devices for each axis in positioning control are indicated below. For each signal whose direction of transmission is "PCPU \rightarrow SCPU", the cycle for notification from the PCPU to the SCPU is indicated. For signals whose direction of transmission is "SCPU \rightarrow PCPU", the cycle for notification from the SCPU to the PCPU, or the cycle for detection at the PCPU, is indicated.

							A273L	HCPU		
Signal Name		Device No.		Signal	A171	SCPU	8-exis Specification	32-	axis Specifica	tion
	A171SCPU	A273UHCPU	A273UHCPU (32-exis		Set Numb	er of Axes	Set Number of Axes	8 #	Set Number of Axes	
		specification)	specification)		1 to 3	4	1 to 8	1 to 12	13 to 24	25 to 32
Positioning start completed					3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
Poellioning completed					3.5 ms	7.1 ms	3.5 ms	3.5 me	7.1 ms	14.2 ms
in-position					3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
Command in-position					3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
Speed control in progress					3,5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
Speed position switching latch	M1600 to	X000 to	M2400 10	PCPU→ SCPU	3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
Zero pase	M1759	XOFF	M3039		3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
Error detection					3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
Servo error detection					3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
Home position return request					3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
Home position return completed					3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
Servo ON/OFF statue					3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
Torque control in progress					3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
Stop command		Y000 to Y070	M3200 to M3839	SCPU→ PCPU	3,5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
Rapid stop command					3,5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
Speed/position switching enabled					3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
Limit ewitch output enable	M1400 to M1559				3.5 ma	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
External STOP input/invalid at start					At start	At start	At start	At start	At start	At start
Feed present value update request command					At start	At start	At start	At start	At start	At start
Servo OFF					3,5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
Feed present value					END'1	END	3.5 ms	3.5 ms	7.1 ms	14.2 ms
Actual present value					END ¹	END	3.5 ms	3.5 ms	7.1 ms	14.2 ms
Deviation counter value					END ¹¹	END	3.5 ms	3.5 ms	7.1 ms	14.2 ms
Home position return second travel value	Deaa	Deco			3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
Travel value after near-zero-point dog ON	to D959	to D959	to D639	PCPU→ SCPU	END"	END"	END'1	END	END ¹¹	END ¹¹
Executed program No.					At start	At start	At start	At start	At start	At start
M code					3.5 ms	7.1 ms	3.5 ma	3.5 ms	7.1 ms	14.2 ms
Torque limit value					3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
Travel value change register					3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
Actual present value when STOP is input					END'1	END	END ^{*1}	END	END"	END"

END *1 : With A171SCPU : '80 ms' or 'PC program scan time', whichever is longer With A273UHCPU : '50 ms' or PC program scan time, whichever is longer (5) Processing time for DSFRP/SVST instructions, DSFLP instruction, END instruction

The processing times for each instruction used in sequence programs used for e.g. positioning control start are indicated below. For the processing times of sequence program instructions other than the ones indicated below, refer to the ACPU Programming Manual (Common Instructions) IB-66250.

	بركرة كالشريب برغازة الأتاب									
			A171SCPU	20 A273UHCPU (8-axis specification)		A273UHCPU (32-axis specification)				
		Number of axes used	4 axes	4 axes	8 axes	4 axes	8 axes	16 axes	32 axes	
	1-axis start		180 µs	25	μs					
DSFRP	2-axis. 3-axis start		200 µs	25 μs		—				
	Error occurrence		850 µs	120	μs	—				
	Present value	When normal	120 µs	10 µs		-				
DSFLP	change	Error	770 µs	25	μs		-	-		
0012	Smood control	When normal	80 µs	15	15 μs		—			
	Speed control	Error	700 µs	30	30 µs		_			
	1-axis start		190 µs	35	35 µs 35 µs					
SVST	2 to 4 axis star	t	700 μs	70 µs		70 µs				
	Error		900 µs	150 µs		150 μs				
END		7600 µs		500	0 µs	5000 μs				



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