MITSUBISHI

MOTION CONTROLLER (SV13/22) (REAL MODE)

Programming Manual

type A171SCPU,A273UCPU

MITSUBISHI ELECTRIC

REVISIONS

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

Print Date	*Manual Number	Revision
Nov., 1995	IB (NA) 67265-A	First edition
Feb., 1997	IB (NA) 67265-D	Correction Precautions for Safety, Chapter 1, Section 1.1, Chapter 2, Sections 3.1, 3.1.11, 3.1.15, 3.1.16, 3.1.17, 3.1.30, 3.2, 3.22, 3.3.1, 3.4, 3.4.1, 3.4.2, 3.4.4, 3.5.1, 3.5.2, 3.5.3, 3.5.4, 3.5.8, 4.1, 4.2, 4.3.1, 4.3.2, 4.3.4, 4.3.7, 4.3.9, 4.3.10, 4.3.11, 4.3.12, 4.3.13, 4.3.14, 4.3.15, 4.3.17, 4.3.19, 4.3.20, 4.3.21, 4.3.22, 4.4.2, 5.2, 5.3.1, 5.3.2, 5.4.2, 6.1.2, 6.2, 6.3, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, 7.8, 7.9, 7.10, 7.11, 7.12, 7.13, 7.14, 7.15, 7.16, 7.17, 7.18, 7.19, 7.20, 7.21.4, 7.21.5, 8.1.2 (2), 8.6, 8.7, 8.8, 8.9, 8.10, 8.12, APPENDICES 2.1, 2.2, 2.3, 2.4, 2.5, 3.2, 5, 6, 6.1, 7, 7 (2) Addition 1.2.1, APPENDICES 2.2 (5) Partial addition 1.2, 3.4.6 (1), 3.4.9, 3.5.9 (1), 7.16.5, 7.20, 8.6 (3), APPENDICES 2.2 (2), 2.3 (3)

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.

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

- 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.
- 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.
- 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.
- 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.
- Always ground the control unit, servo amplifier and servomotor with Class 3 grounding. Do not ground commonly with other devices.
- The wiring work and inspections must be done by a qualified technician.
- Wire the units after installing the control unit, servo amplifier and servomotor. Failing to do so may lead to electric shocks or damage.
- Never operate the switches with wet hands, as this may lead to electric shocks.
- Do not damage, apply excessive stress, place heavy things on or sandwich the cables, as this may lead to electric shocks.
- Do not touch the control unit, servo amplifier or servomotor terminal blocks while the power is ON, as this may lead to electric shocks.
- 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

⚠ CAUTION

- Install the control unit, servo amplifier, servomotor and regenerative resistor on inflammable material. Direct installation on flammable material or near flammable material may lead to fires.
- If a fault occurs in the control unit or servo amplifier, shut the power OFF at the servo amplifier's power source. If a large current continues to flow, fires may occur.
- When using a regenerative resistor, shut the power OFF with an error signal. The regenerative resistor may abnormally overheat due to a fault in the regenerative transistor, etc., and may lead to fires.
- Always take heat measures such as flame proofing for the inside of the control panel where the servo amplifier or regenerative resistor is installed and for the wires used. Failing to do so may lead to fires.

3. For injury prevention

⚠ CAUTION
Do not apply a voltage other than that specified in the instruction manual on any terminal. Doing so may lead to destruction or damage.
Do not mistake the terminal connections, as this may lead to destruction or damage.
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

⚠ CAUTION
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 combinations 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.
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.

⚠ CAUTION
⚠ 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

⚠ CAUTION
⚠ 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. ⚠ 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. ⚠ 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. ⚠ 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. ⚠ 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

⚠ CAUTION

⚠ 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 wires or cables.

⚠ When transporting the servomotor, never hold the cables, shaft or detector.

⚠ When transporting the control unit or servo amplifier, never hold the front case as it may fall off.

⚠ When transporting, installing or removing the control unit or servo amplifier, never hold the edges.

⚠ Install the unit according to the instruction manual in a place where the weight can be 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 panel inner surface or the control unit and servo amplifier, control unit or servo amplifier and other devices.

⚠ Do not install or operate control units, servo amplifiers or servomotors that are damaged or that have missing parts.

⚠ Do not block the intake/outtake ports of the servomotor with cooling fan.

⚠ Do not allow conductive matter such as screw or cutting chips or combustible matter such as oil enter the control unit, servo amplifier or servomotor.

⚠ The control unit, servo amplifier and servomotor are precision machines, so do not drop or apply strong impacts on them.

⚠ Securely fix the control unit and servo amplifier to the machine according to the instruction 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	Conditions	
	Control unit/servo amplifier	Servomotor
Ambient temperature	0°C to +55°C (With no freezing)	0°C to +40°C (With no freezing)
Ambient humidity	According to each instruction manual.	80%RH or less (With no dew condensation)
Storage temperature	According to each instruction manual.	–20°C to +65°C
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.	

⚠ CAUTION

⚠ 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.

⚠ Place the control unit and servo amplifier in static electricity preventing vinyl bags and store.

⚠ When storing for a long time, contact the Service Center or Service Station.

(4) Wiring

⚠ CAUTION

⚠ 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.

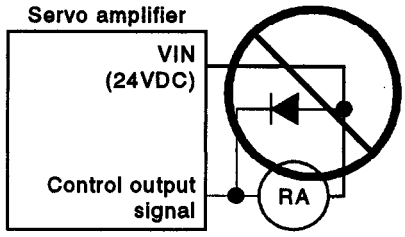
⚠ After wiring, install the protective covers such as the terminal covers to the original positions.

⚠ 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.

⚠ 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.

⚠ Securely tighten the cable connector fixing screws and fixing mechanisms. Insufficient fixing may lead to the cables combing off during operation.

⚠ Do not bundle the power line or cables.

(5) Trial operation and adjustment

⚠ CAUTION

⚠ Confirm and adjust the program and each parameter before operation. Unpredictable movements may occur depending on the machine.

⚠ 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

⚠ CAUTION

⚠ 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.

⚠ The units must be disassembled and repaired by a qualified technician.

⚠ Do not make any modifications 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.

⚠ 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

⚠ CAUTION

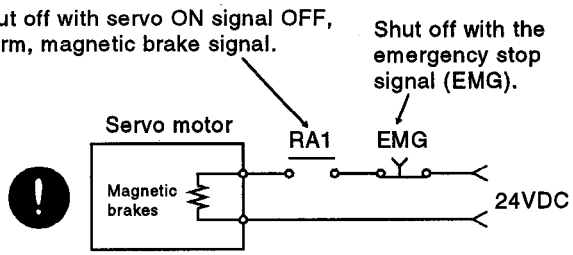
⚠ If an error occurs in the self diagnosis of the control unit or servo amplifier, confirm the check details according to the instruction manual, and restore the operation.

⚠ If a dangerous state is predicted in case of a power failure or product failure, use a servomotor with magnetic brakes or install a brake mechanism externally.

⚠ Use a double circuit construction so that the magnetic brake operation circuit can be operated by emergency stop signals set externally.

⚠ If an error occurs, remove the cause, secure the safety and then resume operation.

⚠ The unit may suddenly resume operation after a power failure is restored, so do not go near the machine. (Design the machine so that personal safety can be ensured even if the machine restarts suddenly.)



(8) Maintenance, inspection and part replacement

⚠ CAUTION

⚠ 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.

⚠ Periodically replace consumable parts such as batteries according to the instruction manual.

⚠ CAUTION

⚠ 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.
⚠ 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.
1) After writing the servo data to the PC using peripheral device software, switch on the power again, then perform a home position return operation.
2) Using the backup function of the peripheral device software, load the data backed up before replacement.
⚠ After maintenance and inspections are completed, confirm that the position detection of the absolute position detector function is correct.
⚠ 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

⚠ CAUTION

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

(10) General cautions

⚠ CAUTION

⚠ All drawings provided in the instruction manual show the state with the covers and safety partitions removed to explain detailed sections. When operating the product, always return the covers and partitions to the designated positions, and operate according to the instruction manual.
⚠ Under no circumstances will Mitsubishi Electric be liable or responsible for any consequential damage that may arise as a result of the installation or use of this equipment.
All examples and diagrams shown in this manual are intended only as an aid to understanding the text, not to guarantee operation. Mitsubishi Electric will accept no responsibility for actual use of the product based on these illustrative examples.
Owing to the very great variety in possible applications of this equipment, you must satisfy yourself as to its suitability for your specific application.

CONTENTS

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"

⚠ CAUTION

⚠ When 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.

⚠ 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 → signal for A273UHCPU (8 axis specification) → 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)
A171SCPU | A273UHCPU (32 axis specification)

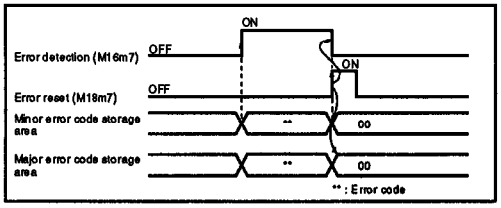
3. POSITIONING SIGNALS

3.1.25 Limit switch output enable command (M18m6/Yn6/M32m6)

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 (M18m7/Yn7/M32m7)*

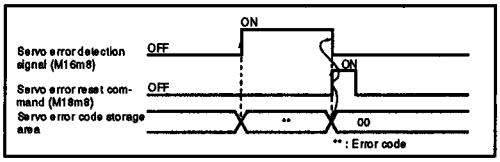
The error reset command is used to clear the minor error code or major error code storage area of an axis for which the error detection signal has come ON (M16m7: ON), and reset the error detection signal (M16m7).



Applies to A171SCPU

3.1.27 Servo error reset command (M18m8/Yn8/M32m8)*

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 ((M16m8: ON), and reset the servo error detection signal (M16m8).



Applies to A171SCPU

POINT

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

REMARK

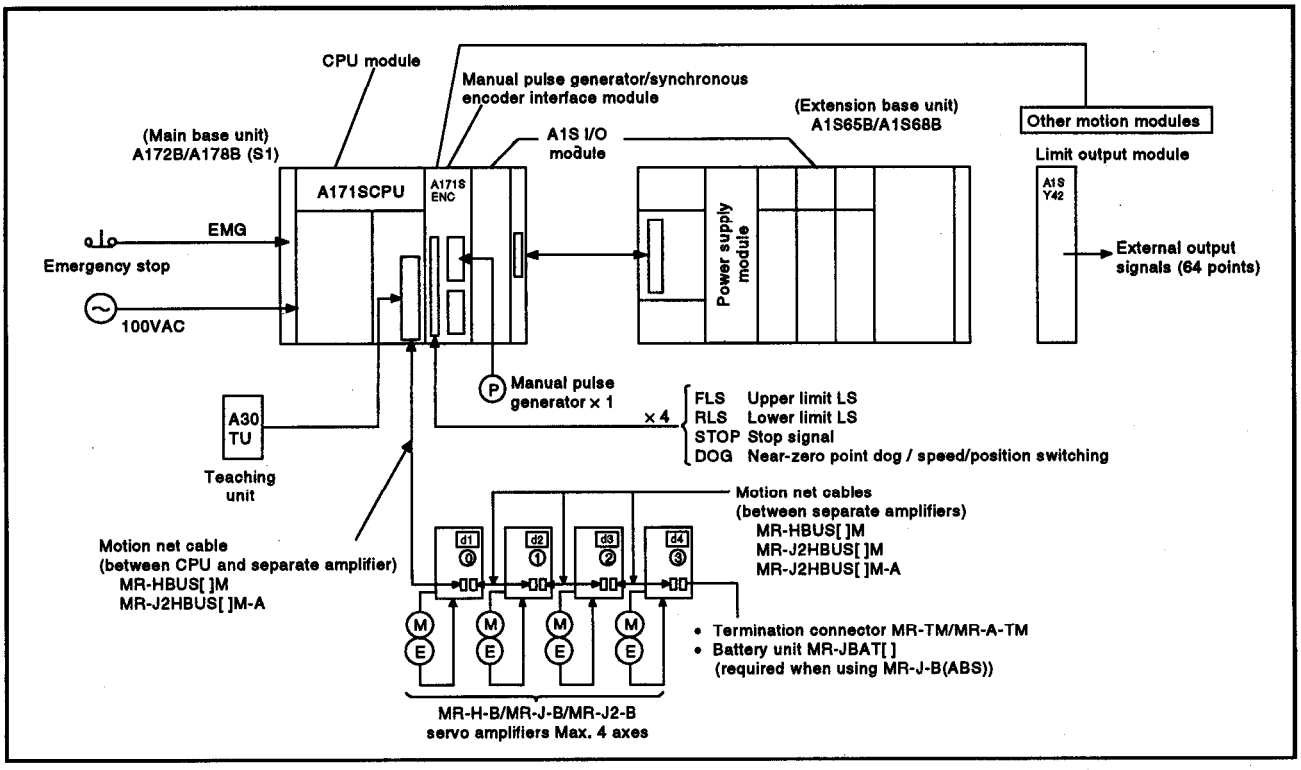
For details on minor error code, major error code, and servo error code storage areas, see Appendix 2.

3-18

1

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)

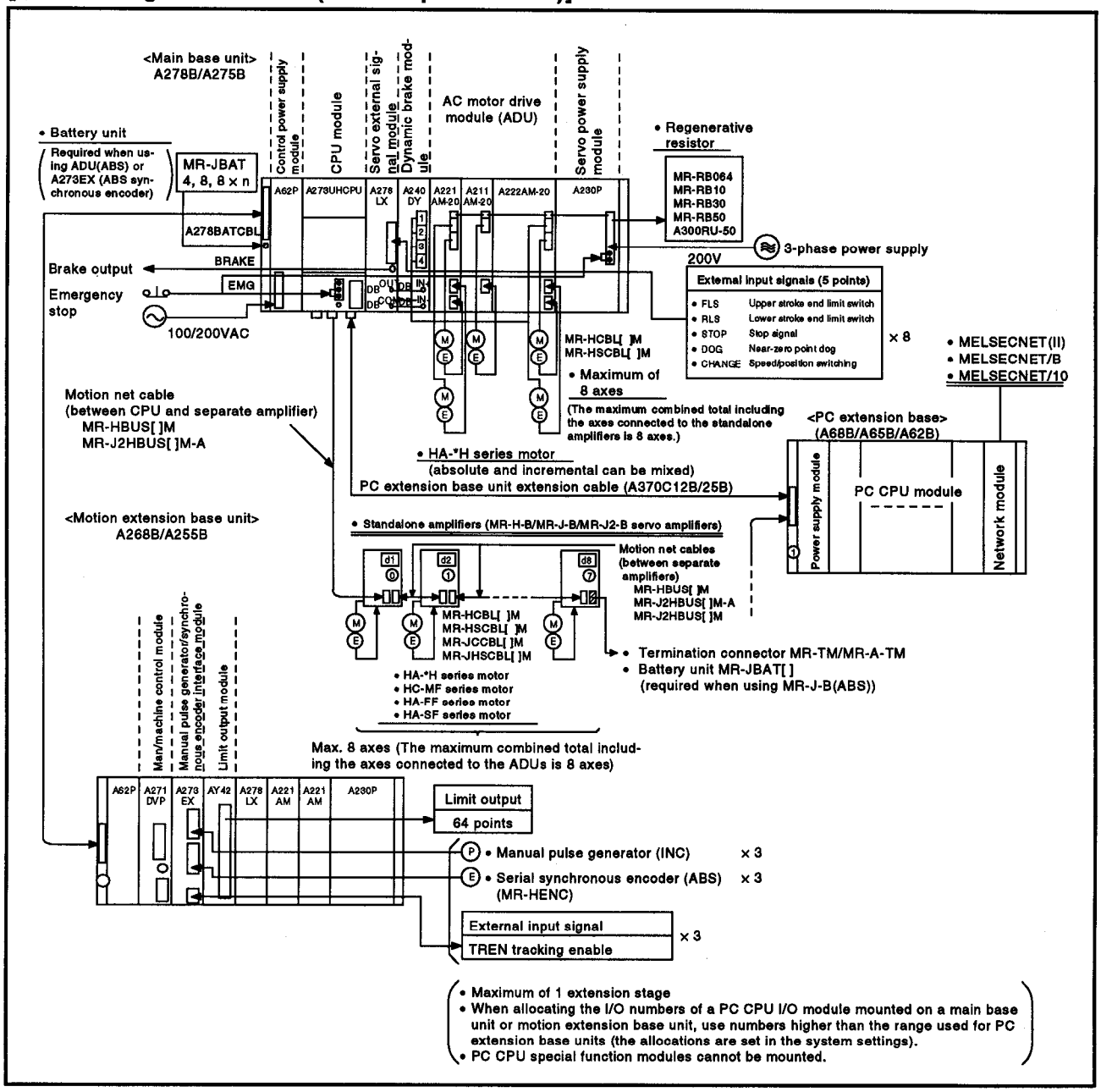
[Note]

(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.

[When Using A273UHCPU (8 Axis Specification)]



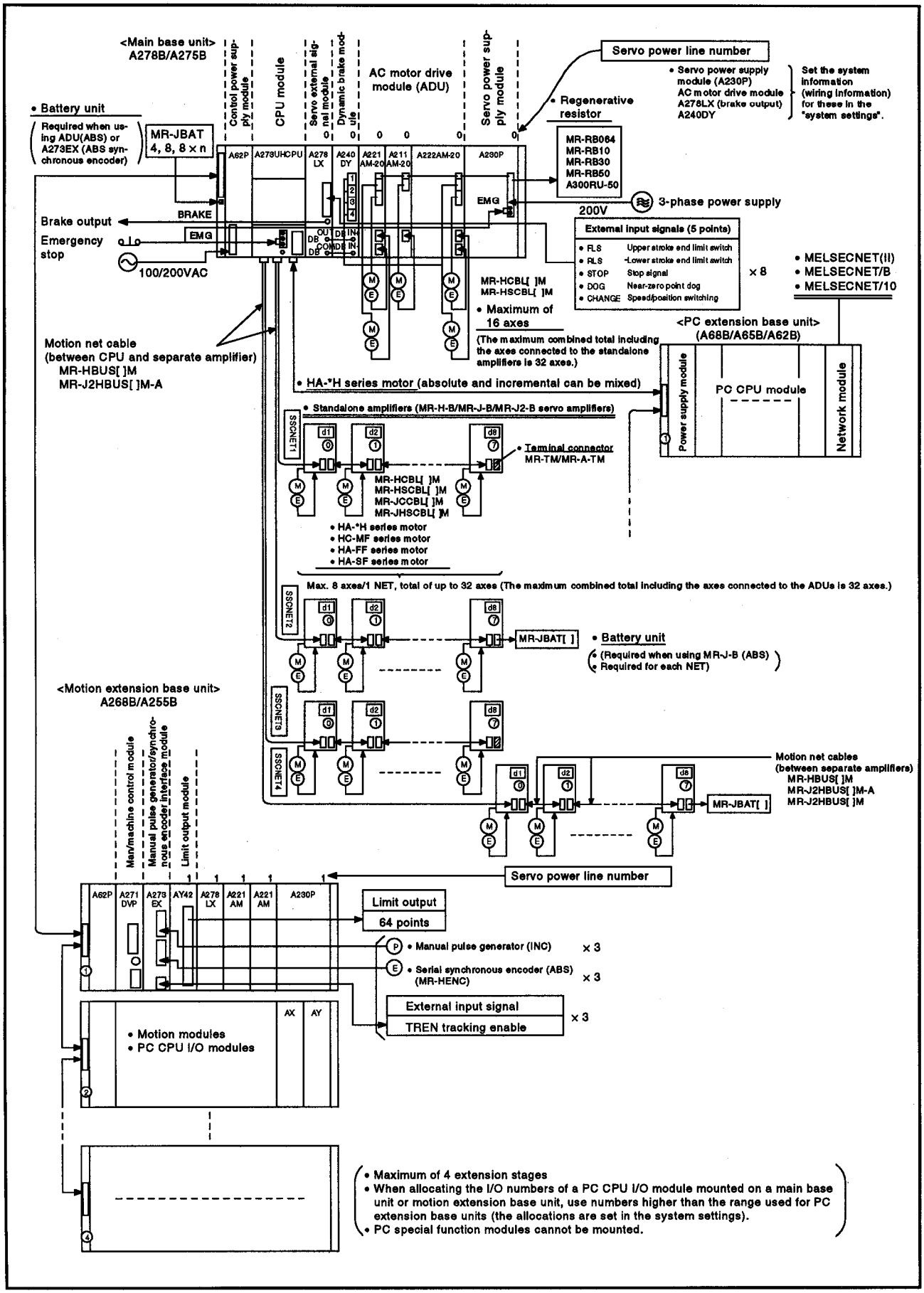
With the servo amplifier configurations indicated below, positioning control of up to 8 axes is possible.

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

(2) AC motor drive modules only
- Main base units only (max. 8 axes)
- Main base unit (max. 8 axes) + motion extension base unit (max. 8 axes) <total of 8 axes>

(3) MR-H-B/MR-J-B/MR-J2-B amplifiers only (max. 8 axes)

[When Using A273UHCPU (32 Axis Specification)]



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

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

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.

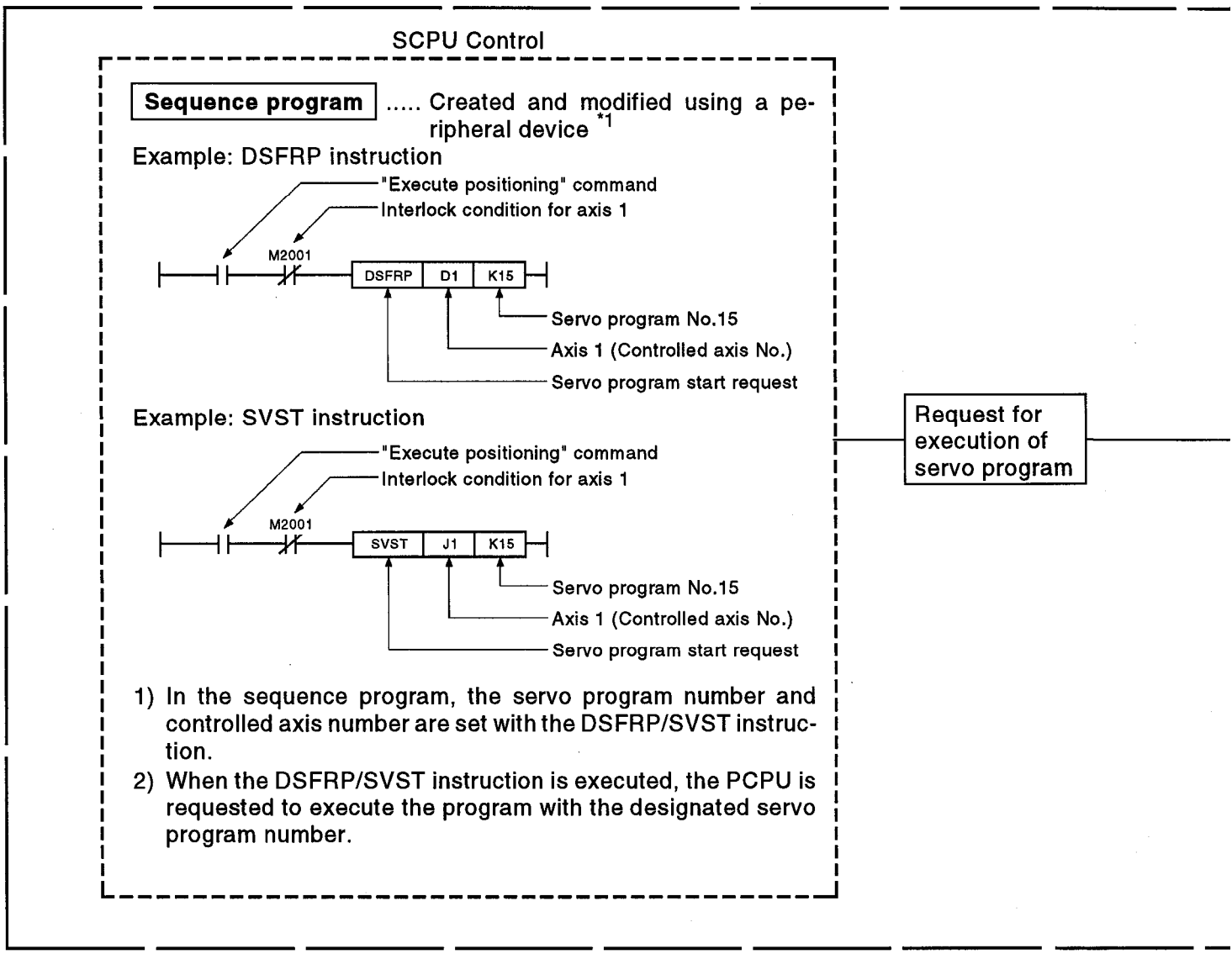
(c) It executes positioning when the manual pulse generator is used.

(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.

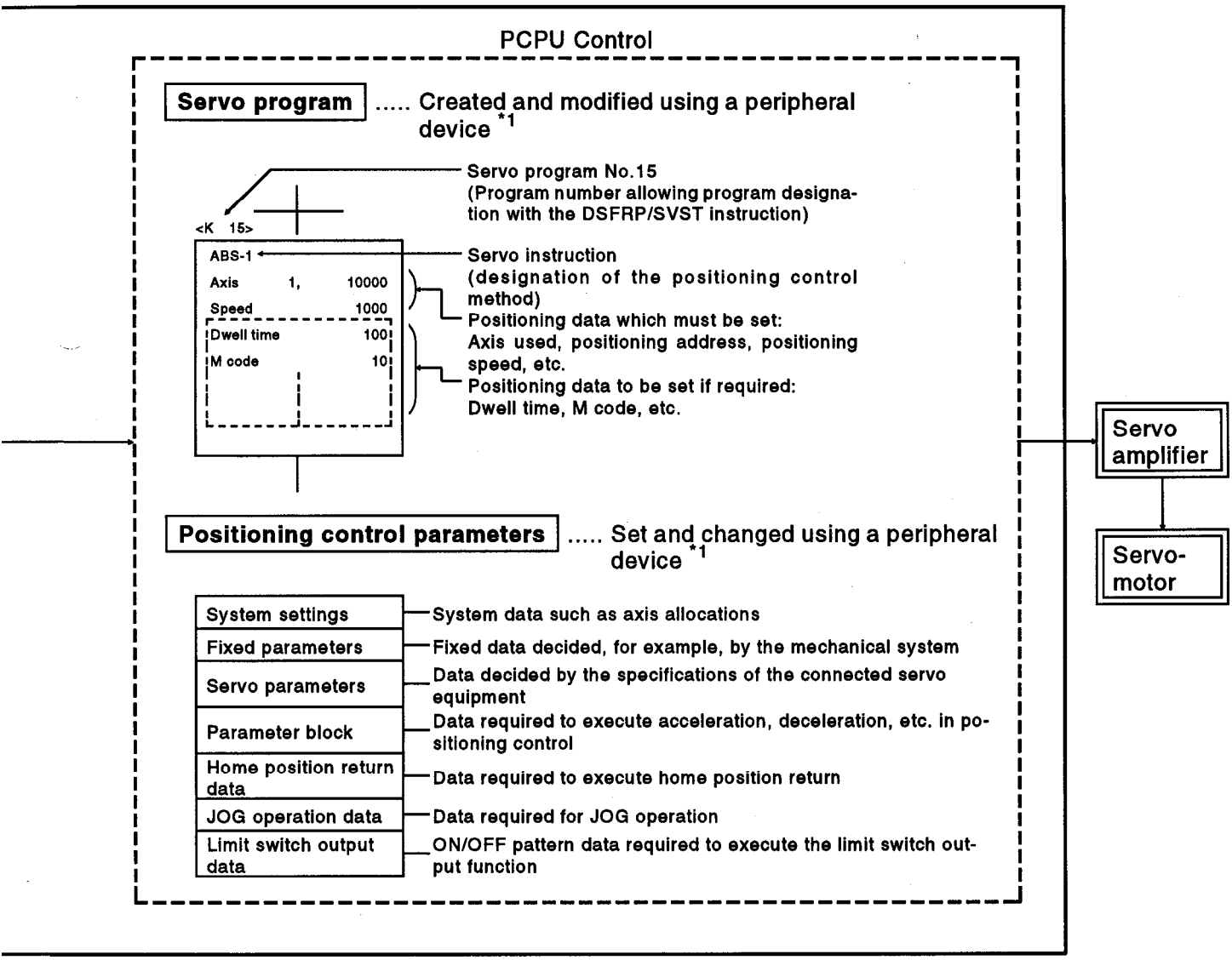
Servo System CPU System



(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.



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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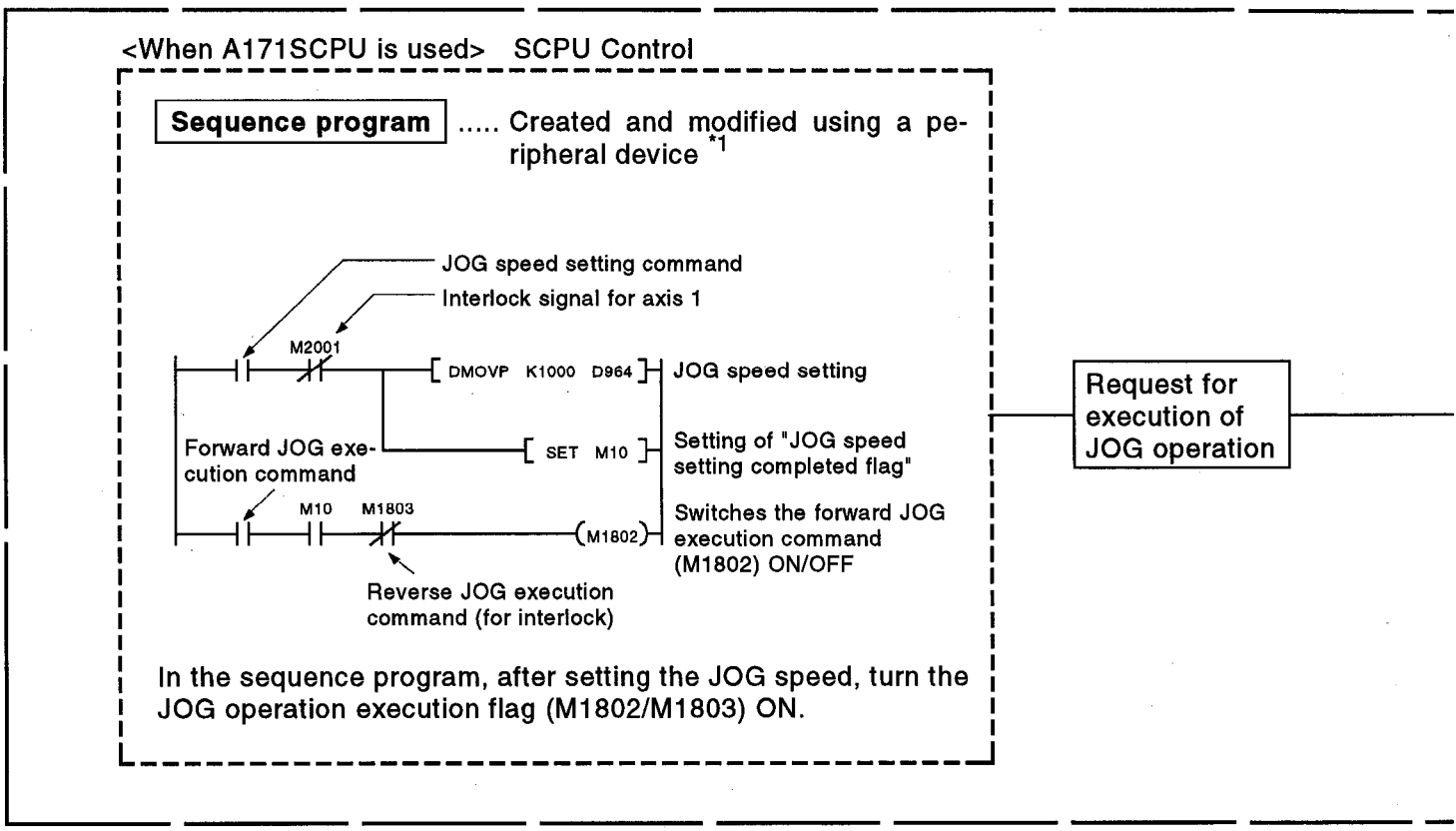
[Executing JOG Operation with a Servo System CPU]

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.

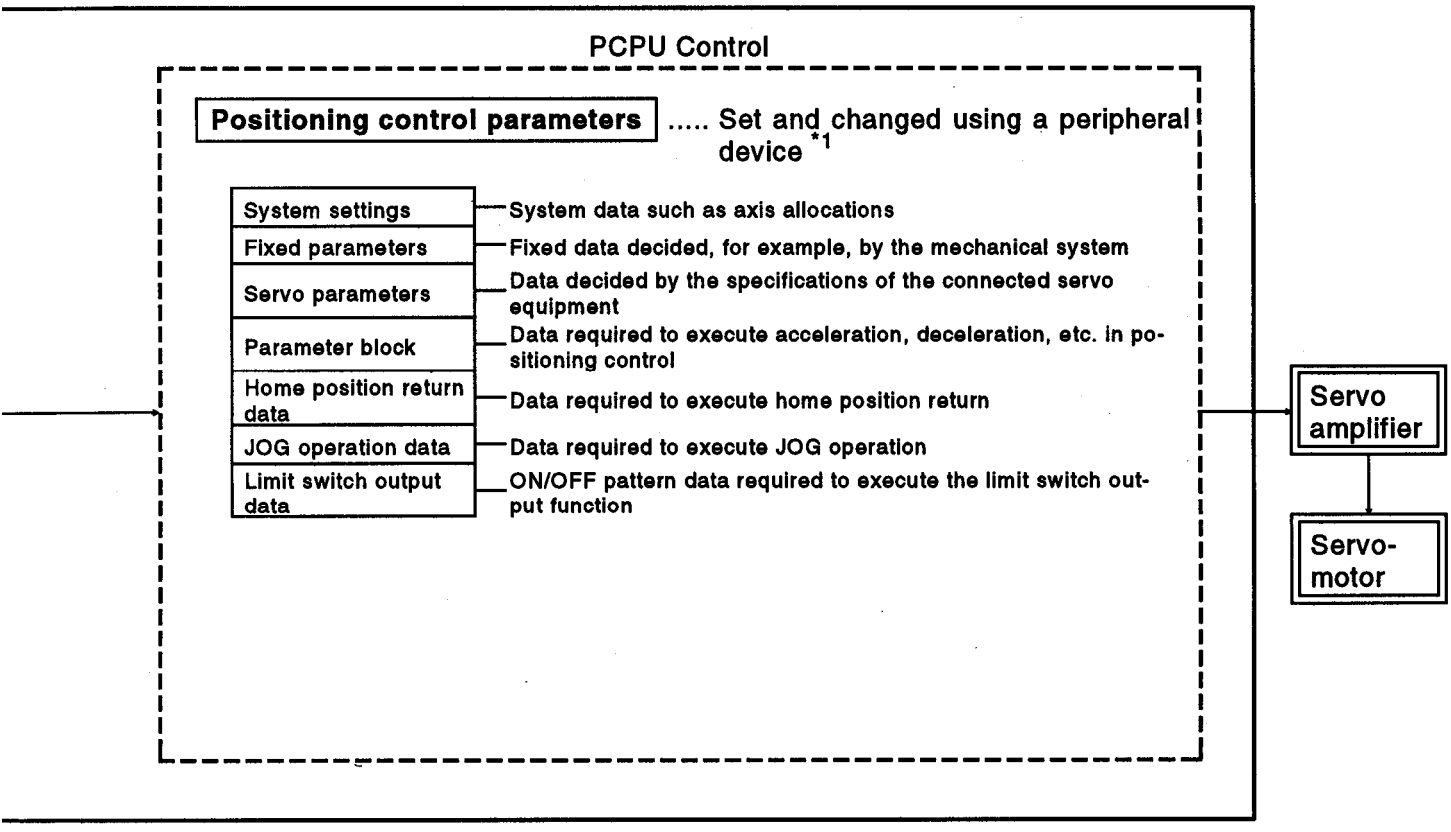
Servo System CPU System



(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



REMARKS

*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

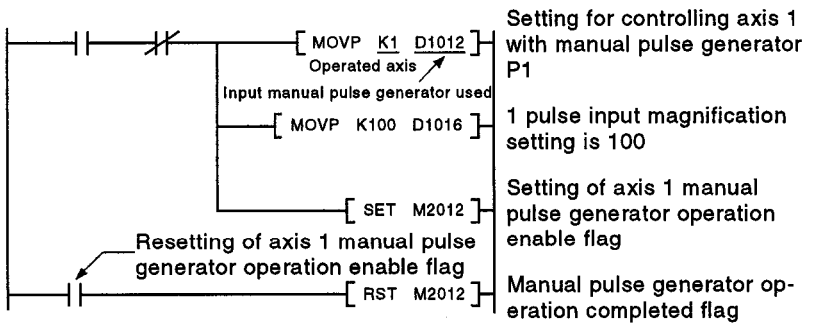
[Executing Manual Pulse Generator Operation with a Servo System CPU]

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

<When A171SCPU is used> SCPU Control

Sequence program



Use the sequence program to turn the manual pulse generator operation enable flag ON after setting the manual pulse generator used, operation number, and magnification for 1 pulse input.

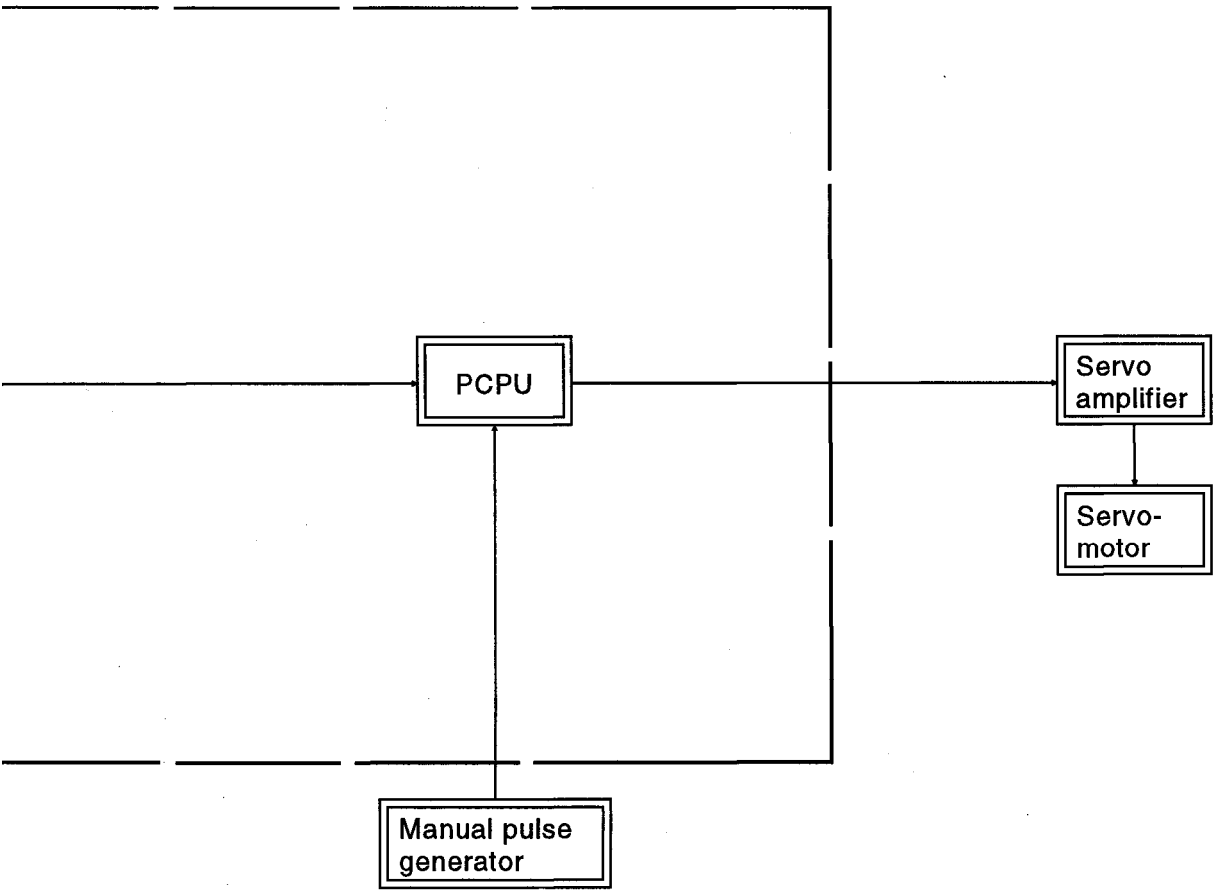
Manual pulse generator used
Operated axis number
1 pulse input magnification
Manual pulse generator enable

(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


PCPU
Servo amplifier
Servo-motor
Manual pulse generator

(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
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) 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 number .....This is the number used to designate the servo program from the sequence program.
- Servo instructions .....These indicate the type of positioning control to be executed.
- Positioning data .....This 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.

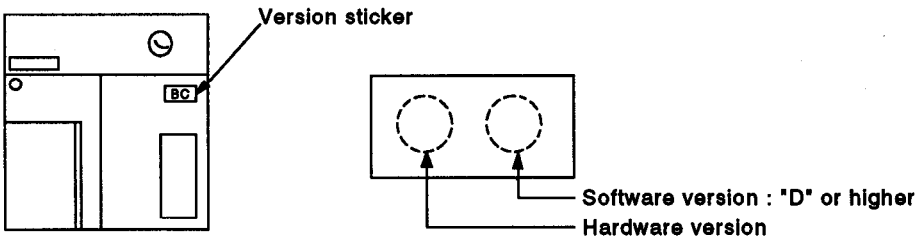
(5) Compatibility with MR-J2-B type servo amplifiers

(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.
SW0SRX-SV13M SW0SRX-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

Model	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.

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

Positioning OS Version	Positioning Software Package Version	Restrictions
V or later	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.)
	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	

*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.

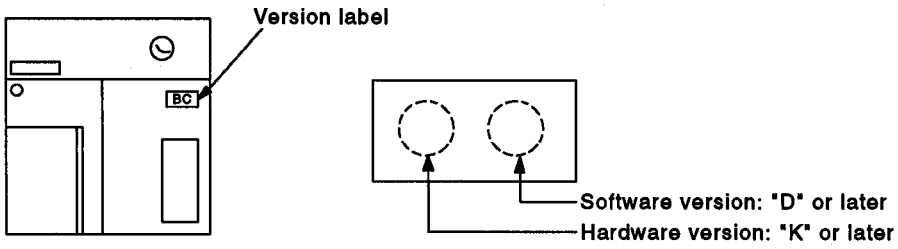
The following restrictions apply depending on the combination of servo amplifier and positioning software package used when using positioning OS version V or later.

Servo Amplifier	Positioning Software Package Version	Restrictions
MR-H-B: BCD-B13W000-B2 or later MR-J2-B: BCD-B20W200-A1 or later	R or later	There are no restrictions.
	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 or later MR-J-B: All models ADU: All models	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.)
	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.
  (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.

Table 2.1 PCPU Performance Specifications

<table>
<tr><th colspan="4">Item</th><th>PCPU Performance/Specifications</th></tr>
<tr><td rowspan="3">Number of control axes</td><td colspan="3">A171SCPU</td><td>4 axes (simultaneous: 2 to 4 axes, independent: 4 axes)</td></tr>
<tr><td colspan="3">A273UHCPU (8 axis specification)</td><td>8 axes (simultaneous: 2 to 4 axes, independent: 8 axes)</td></tr>
<tr><td colspan="3">A273UHCPU (32 axis specification)</td><td>32 axes (simultaneous: 2 to 4 axes, independent: 32 axes)</td></tr>
<tr><td colspan="4">Interpolation functions</td><td>Linear interpolation (4 axes max.), and circular interpolation (2 axes)</td></tr>
<tr><td colspan="4">Control modes</td><td>PTP (point to point), speed control, speed/position control, fixed-pitch feed, constant speed control, position follow-up control</td></tr>
<tr><td colspan="4">Control units</td><td>mm · inch · degree · PULSE</td></tr>
<tr><td rowspan="4">Program</td><td colspan="2">Languages</td><td></td><td>Dedicated instructions (sequence ladders + servo programs).
SFC programming of servo programs also possible.</td></tr>
<tr><td rowspan="2">Capacity</td><td>A171S/A273UHCPU (8 axis specification)</td><td></td><td>13K steps (13312 steps)</td></tr>
<tr><td>A273UHCPU (32 axis specification)</td><td></td><td>14334k steps</td></tr>
<tr><td colspan="2">Number of points for positioning</td><td></td><td>Approx. 400 points/axis (depending on the program)
Positioning data can be indirectly designated.</td></tr>
<tr><td colspan="2">Setting method</td><td></td><td>Setting with an IBM PC, or A271DVP running the GSV13PE/ GSV22PE software.</td></tr>
<tr><td rowspan="5">Positioning</td><td colspan="2">Method</td><td></td><td>PTP..... Selection of absolute data method or incremental method
Speed/positioning control,... Incremental method
fixed pitch feed
Constant speed control..... Absolute data method and incremental method can be used together
Position follow-up control.... Absolute data method</td></tr>
<tr><td colspan="2" rowspan="5">Position commands</td><td colspan="3">The four types of command unit indicated below can be selected for each axis.</td></tr>
<tr><td>Control Unit</td><td>Command Unit</td><td>Address Setting Range</td><td>Travel Value Setting Range</td></tr>
<tr><td>mm</td><td>$\times 10^{-1}$ μm</td><td>-2147483648 to 2147483647</td><td rowspan="4">0 to ±2147483647</td></tr>
<tr><td>inch</td><td>$\times 10^{-5}$ inch</td><td></td></tr>
<tr><td>degree</td><td>$\times 10^{-5}$ degree</td><td>0 to 35999999</td></tr>
<tr><td>PULSE</td><td>PULSE</td><td>-2147483648 to 2147483647</td></tr>
<tr><td colspan="2">Speed command (command unit)</td><td></td><td>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)</td></tr>
<tr><td colspan="2">High-speed oscillation function</td><td></td><td>One designated axis can be made to oscillate on a sine wave.</td></tr>
<tr><td rowspan="2">Acceleration/ deceleration processing</td><td colspan="2">Automatic trapezoidal acceleration/deceleration</td><td></td><td>Acceleration time .....1 to 65535 (ms)
Deceleration time .....1 to 65535 (ms)</td></tr>
<tr><td colspan="2">S curve acceleration/deceleration</td><td></td><td>S curve ratio setting 0 to 100 (%)</td></tr>
<tr><td rowspan="2">Compensation</td><td colspan="2">Backlash compensation</td><td></td><td>(0 to 65535) × position command unit (units converted to pulses: 0 to 65535 pulses)</td></tr>
<tr><td colspan="2">Electronic gear</td><td></td><td>Compensation function for error in actual travel value with respect to command value</td></tr>
<tr><td colspan="4">Home position return function</td><td>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.</td></tr>
<tr><td colspan="4">JOG operation function</td><td>Provided</td></tr>
<tr><td rowspan="2">Manual pulse generator operation function</td><td colspan="3">A171SCPU</td><td>A maximum of one manual pulse generator can be connected.
Use a sequence program to set the number of the axis to be controlled.
It is possible to set the smoothing magnification.</td></tr>
<tr><td colspan="3">A273UHCPU (8/32 axis specification)</td><td>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.</td></tr>
</table>

Table 2.1 PCPU Performance Specifications (Continued)

Item			PCPU Performance/Specifications
M function			M code output function provided
Limit switch output function			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 reading of designated data	Number of points read	A171SCPU	Max. 9 points (TREN input of A171SENC (1 point) + one PC input module (8 points)
		A273UHCPU (8/32 axis specification)	Max. 11 points (TREN input of A273EX (3 points) + one PC input module (8 points)
	Reading timing	TREN input	At leading edge of the TREN input signal.
		PC input module input	Within 0.8 ms of the signal leading edge

3. POSITIONING SIGNALS

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.

• Inputs (X)	A273UHCPU (8 axis specification)	X0 to XFF (256 points)
• Outputs (Y)	A273UHCPU (8 axis specification)	Y0 to YFF (256 points)
• Internal relays (M)	A171SCPU	M1600 to M2047 (148 points)
	A273UHCPU (8 axis specification)	M2000 to M2047 (48 points)
	A273UHCPU (32 axis specification)	M2000 to M3839 (1840 points)
• Special relays (SP.M)	M9073 to M9079 (7 points)	
• Data registers (D)	A171SCPU/ A273UHCPU (8 axis specification)	D800 to D1023 (224 points)
	A273UHCPU (32 axis specifications)	D0 to D799 (800 points)
• Special registers (SP.D)	D9180 to D9199 (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 limit switch input signals	ignals that control the upper limit and 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	Signal that switches control from speed to position control
• Manual pulse generator input	Signal from the manual pulse generator

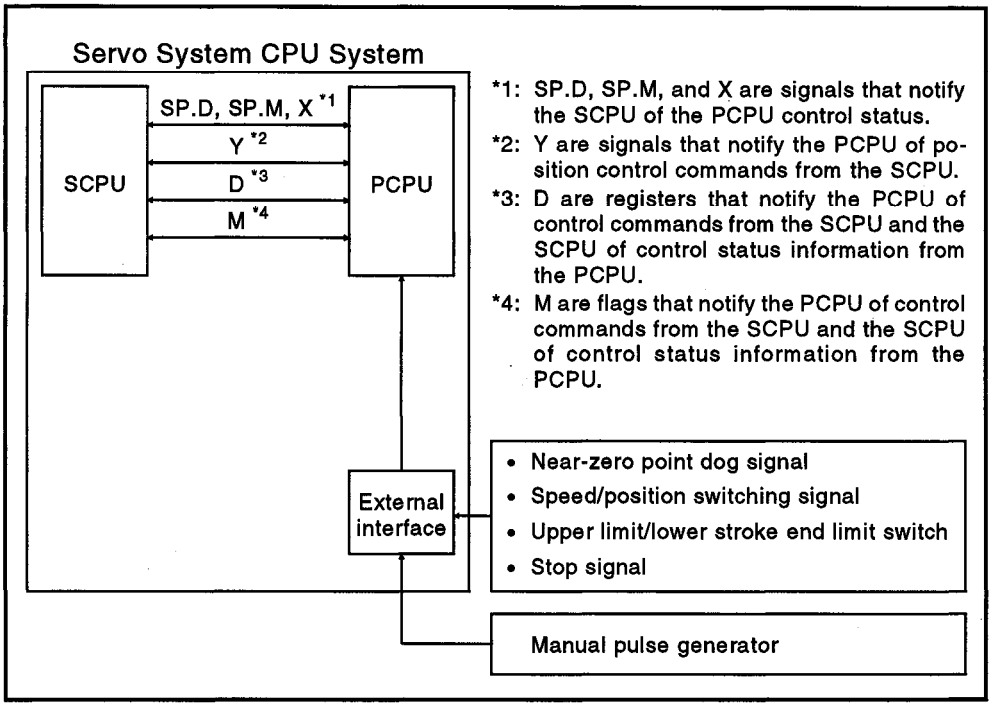


Fig. 3.1 Flow of Positioning Signals

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.

Table 3.1 Axis Input Signals

Signal Name		Device No.			Signal Direction
		A171SCPU	A273UHCPU (8 axis specification)	A273UHCPU (32 axis specification)	
Positioning start completed		M1600+20n	Xn0	M2400+20n	PCPU → SCPU
Positioning completed		M1601+20n	Xn1	M2401+20n	
In-position		M1602+20n	Xn2	M2402+20n	
Command in-position		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 detection		M1608+20n	Xn8	M2408+20n	
Home position return request		M1609+20n	Xn9	M2409+20n	
Home position return completed		M1610+20n	XnA	M2410+20n	
External signals	FLS	M1611+20n	XnB	M2411+20n	
	RLS	M1612+20n	XnC	M2412+20n	
	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 in progress" signal		M1619+20n	XC0+n	M2419+20n	

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
8	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

Table 3.2 Axis Output Signal

Signal Name	Device No.			Signal Direction
	A171SCPU	A273UHCPU (8 axis specification)	A273UHCPU (32 axis specification)	
Stop command	M1800+20n	Yn0	M3200+20n	SCPU → PCPU
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	
Unusable	M1810+20n	YnA	M3210+20n	
	M1811+20n	YnB	M3211+20n	
Feed present value update request command	M1812+20n	YnC	M3212+20n	
Unusable	M1813+20n	YnD	M3213+20n	
	M1814+20n	YnE	M3214+20n	
Servo OFF	M1815+20n	YnF	M3215+20n	
Unusable	M1816+20n	—	M3216+20n	
	M1817+20n	—	M3217+20n	
	M1818+20n	—	M3218+20n	
FIN signal	M1819+20n	YC0+n	M3219+20n	

REMARK

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

<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
8	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)

(1) 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 → ON) of the end signal OFF command (M1804+20n) or when positioning is completed.

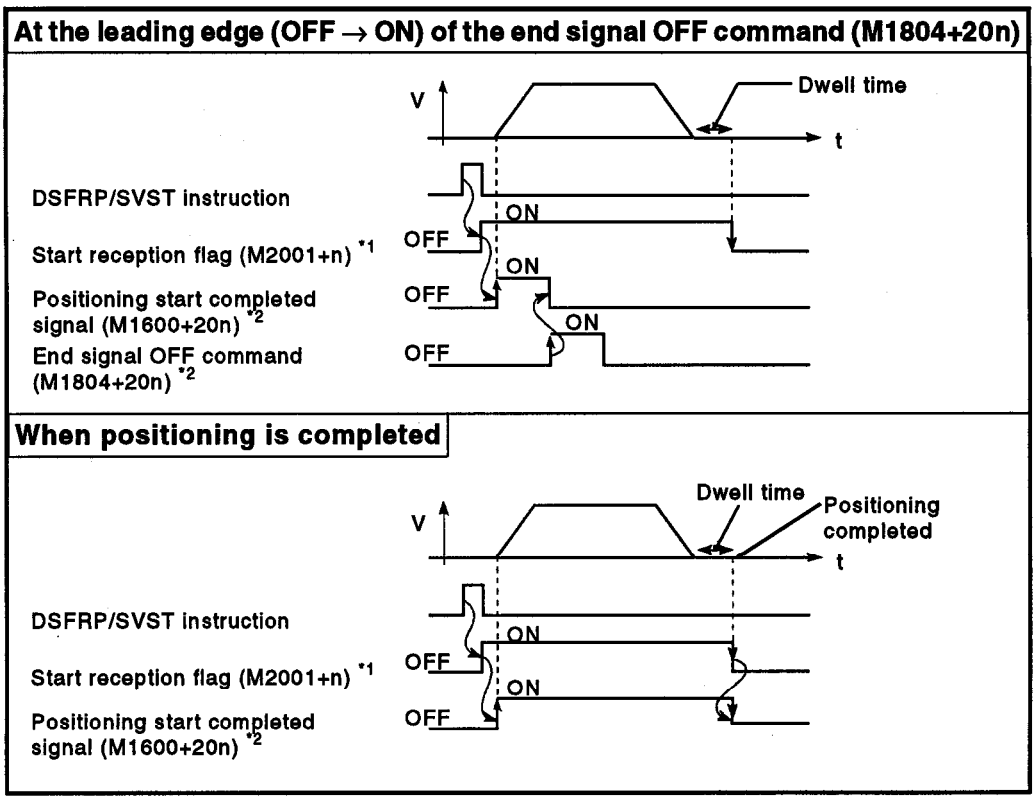


Fig. 3.2 Positioning Start Completed Signal ON/OFF Timing

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.

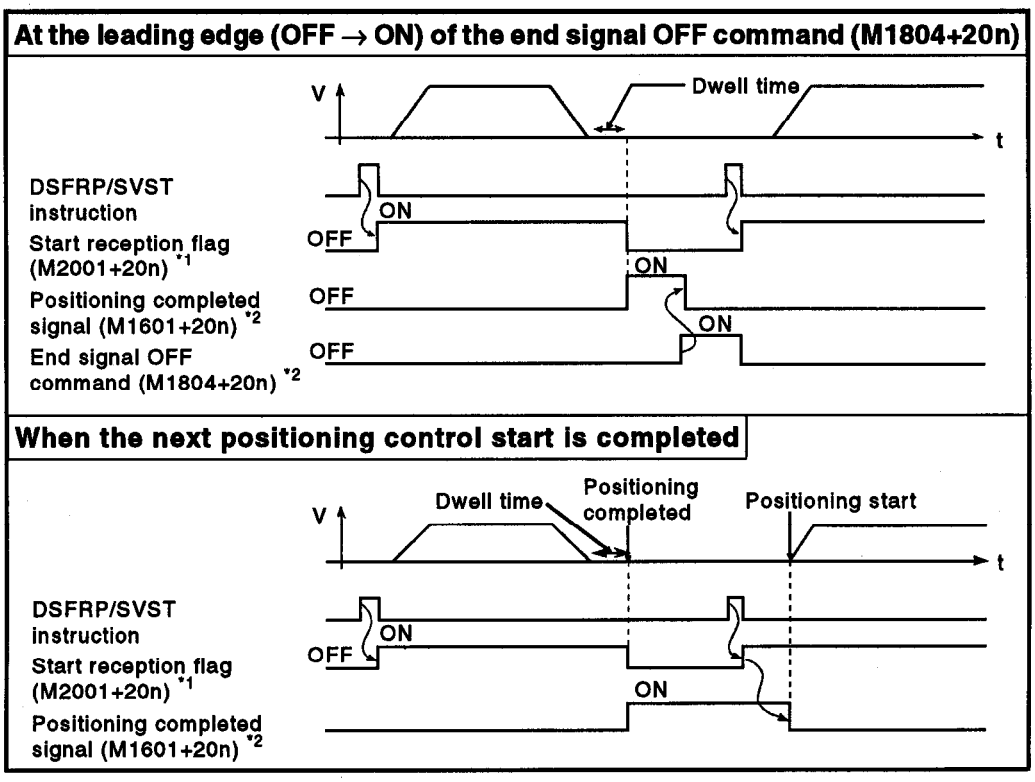


Fig. 3.3 Positioning Completed Signal ON/OFF Timing

REMARKS

*1: The "n" in "M2001+n is a value corresponding to an axis number, as shown in the table below.

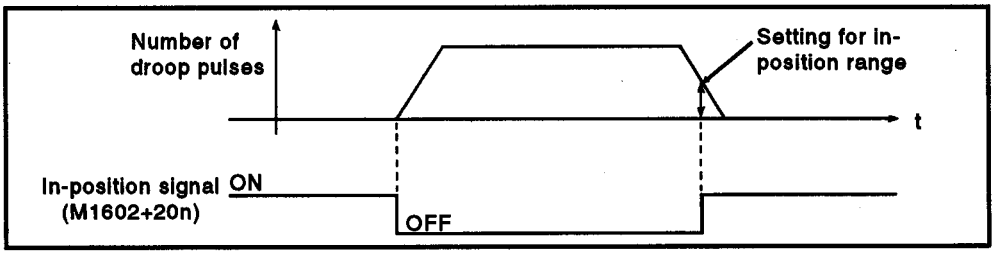
*2: The "n" in M1601+20n and M1804+20n indicates a numerical value corresponding to the axis number, as indicated in the table below.

<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.

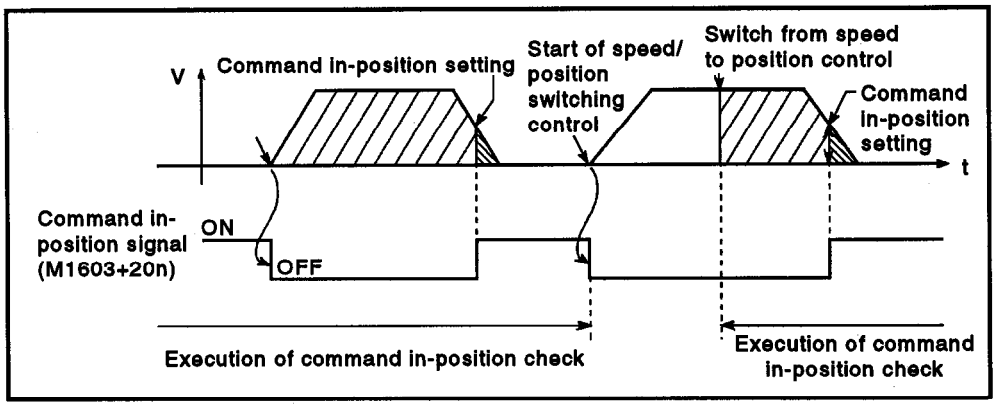


(2) An in-position check is performed in the following cases.
- When the servo power supply is switched on
- After automatic acceleration/deceleration is started during positioning control
- After deceleration is started as a result of the JOG start signal going OFF
- When manual pulse generator operation 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

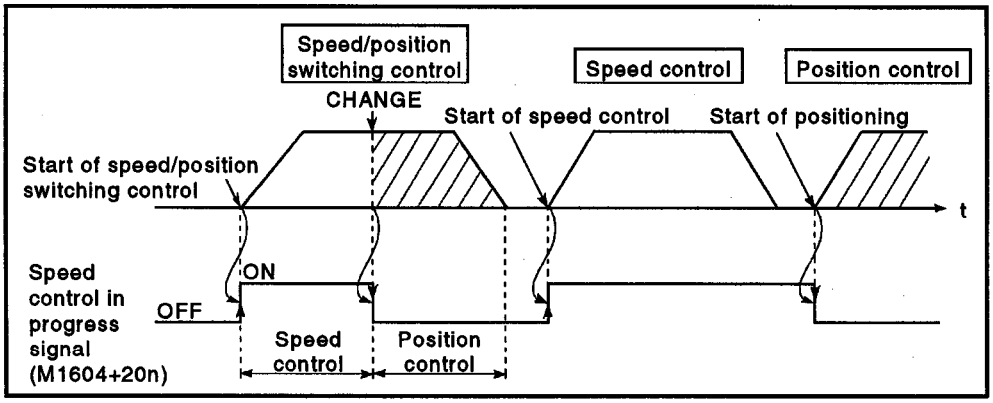
(2) Command in-position checks are continually performed during positioning control.
Command in-position checks are not performed during speed control or during speed control in speed/position switching control.



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.

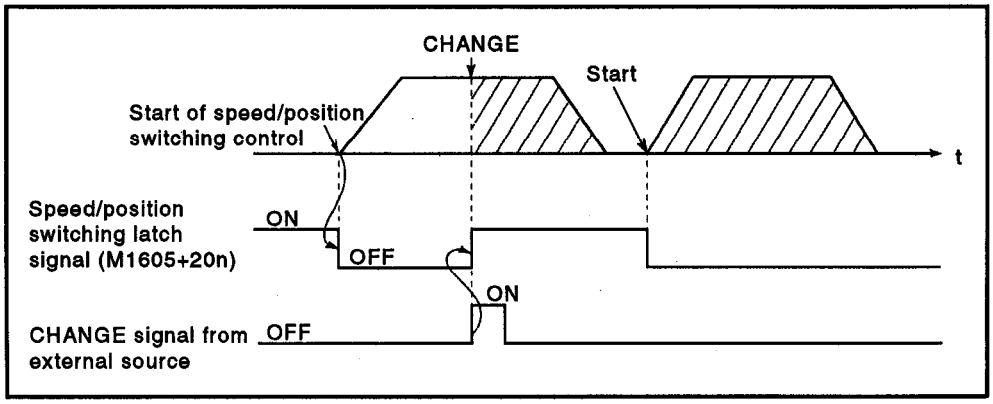
(2) The speed control in progress signal is OFF when the power is switched ON and during position control.



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

(1) 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



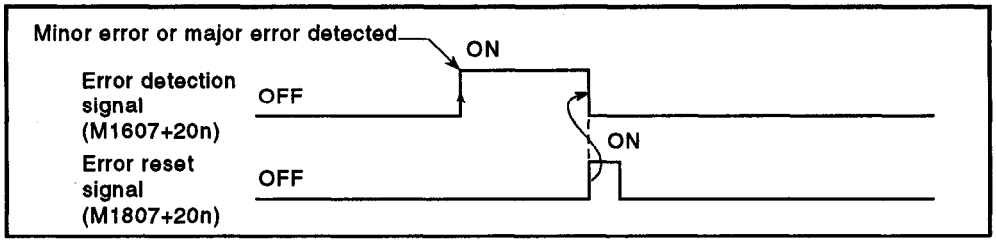
3.1.7 Zero pass signal (M1606+20n/Xn6/M2406+20n)

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.



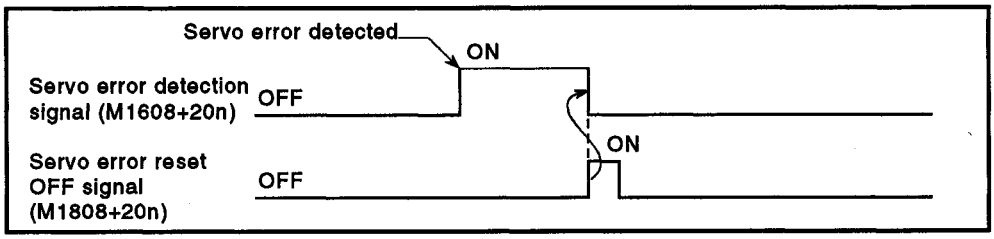
REMARKS

*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)

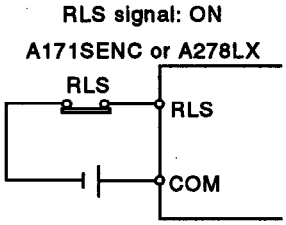
(1) FLS signal is controlled by the ON/OFF status of the upper stroke end limit switch input (FLS) to the A171SENC or A278LX from an external source.
- Upper stroke end limit switch input OFF.....FLS signal: ON
- Upper stroke end limit switch input ON.....FLS signal: OFF

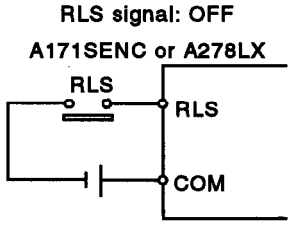
(2) The status of the upper stroke end limit switch input (FLS) when the FLS signal is ON/OFF is indicated in the figure below.

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.

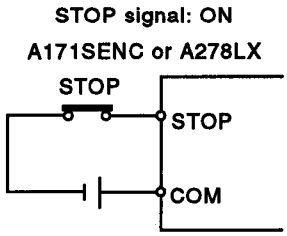


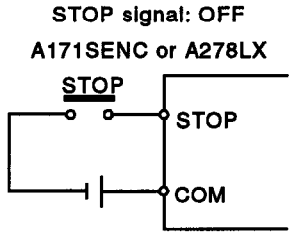


3.1.14 STOP signal (M1613+20n/XnD/M2413+20n)

(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, near-zero-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-zero-point dog or change signal goes OFF.

3.1.16 DOG signal (XnE/M2414+20n): when A273UHCPU (8/32-axis 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.

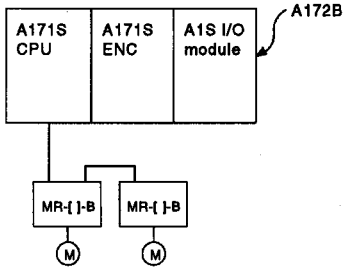
(3) When "normally open contact input" is set in the system settings, near-zero-point dog input occurs when the near-zero-point dog comes ON, and when "normally closed contact input" is set, near-zero-point dog input occurs when the near-zero-point dog goes OFF.

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



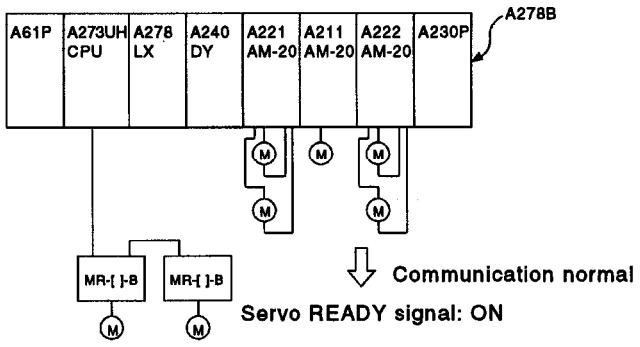
POINTS

(1) When an axis driven by an ADU becomes subject to a servo error, the axes that go into the servo 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)

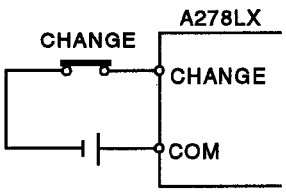
Signals for axes whose torque is being controlled are ON.

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

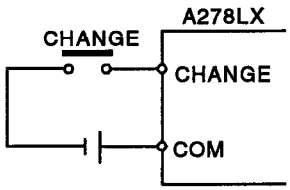
(1) The CHANGE signal is controlled by the ON/OFF status of the speed/position switching input (CHANGE) to the A278LX from an external source.
- Speed/position switching input OFF.....CHANGE signal: OFF
- Speed/position switching input ON.....CHANGE signal: ON

(2) The status of the speed switching switch (CHANGE) when the CHANGE signal is ON and OFF is indicated in the figure below.

CHANGE signal: ON

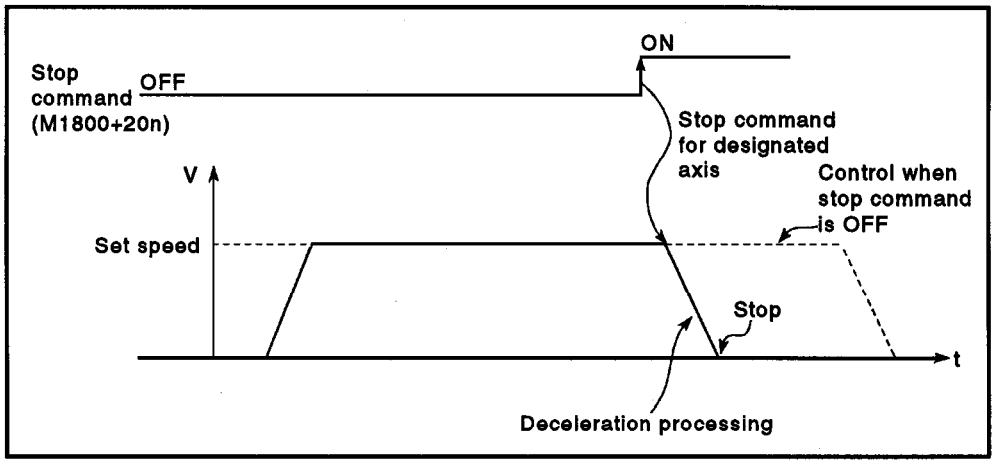


CHANGE signal: OFF



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 → 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 details on speed control, see Section 7.12 or Section 7.13.)

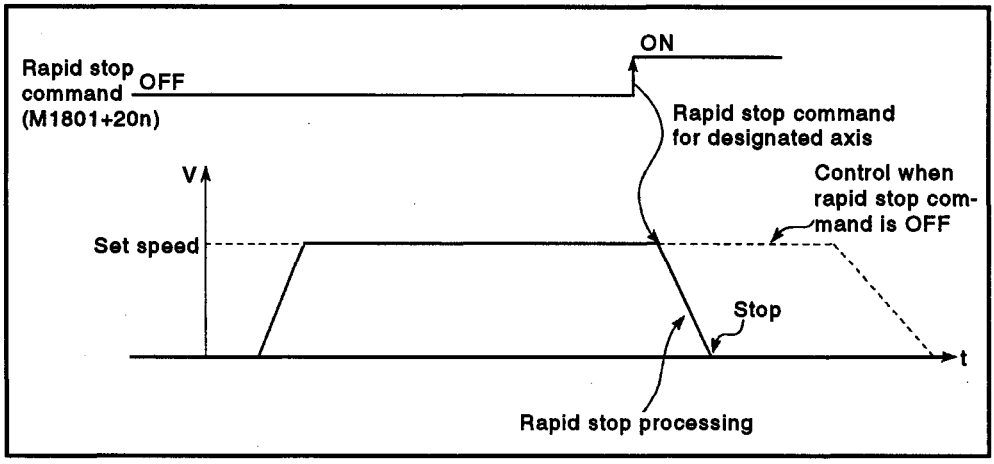
Control Being Executed	Processing when the Stop Command Comes ON	
	If Control Is Being Executed	If Deceleration Stop Processing is Being Executed
Position control Speed control (I, II) JOG operation	The axis decelerates to a stop in the deceleration time set in the parameter block or servo program.	The 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	(1) The axis decelerates to a stop in the deceleration time set in the parameter block. (2) 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 → 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 Being Executed	Processing when the Rapid Stop Command Comes ON	
	If Control is Being Executed	If Deceleration Stop Processing is Being Executed
Position control Speed control (I, II) JOG operation	The axis decelerates to a stop in the deceleration time set in the parameter block or servo program.	Deceleration processing is cancelled and rapid stop processing executed instead.
Manual pulse generator operation	An immediate stop is executed, with no deceleration processing.	—
Home position return	(1) The axis decelerates to a stop in the rapid stop deceleration time set in the parameter block. (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.

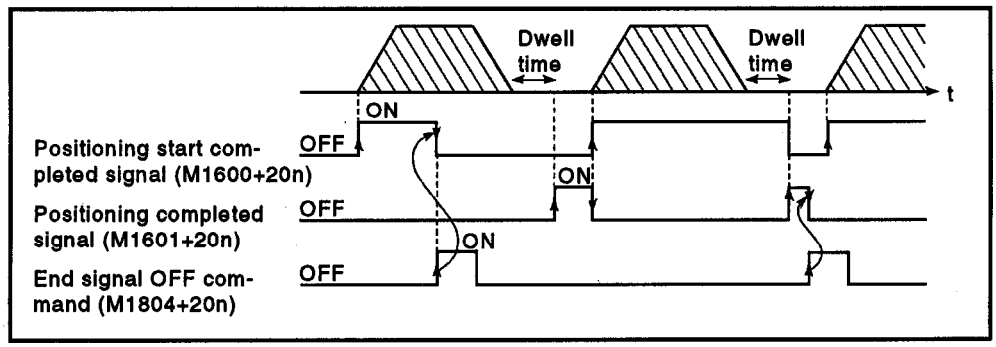
(2) While the sequence program keeps M1803+20n ON, JOG operation is executed in the direction in which address numbers decrease. When M1803+20n is turned OFF, a deceleration stop is executed in the deceleration time set in the parameter block.

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.



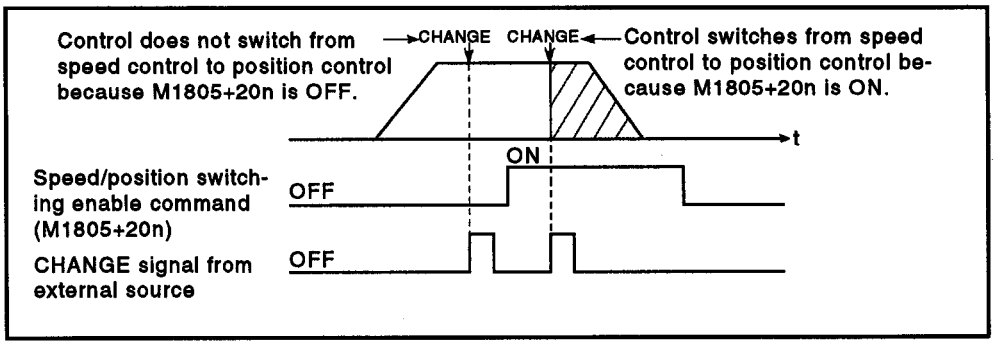
POINT

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.



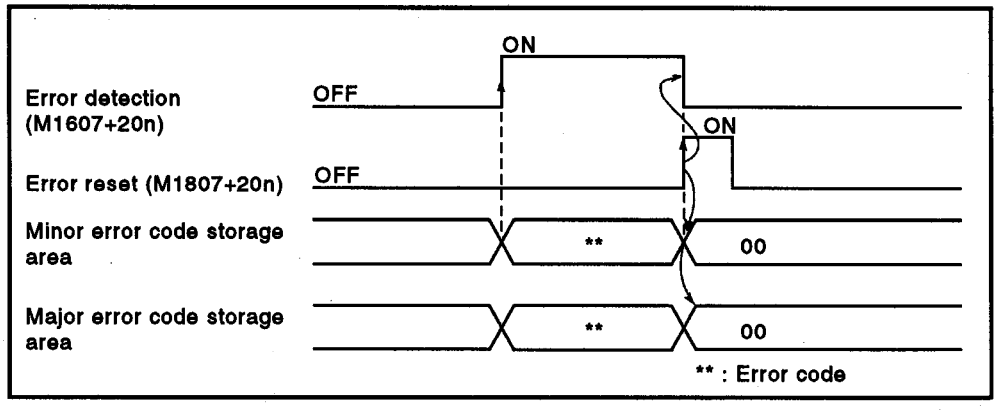
3.1.25 Limit switch output enable command (M1806+20n/Yn6/M3206+20n)

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.

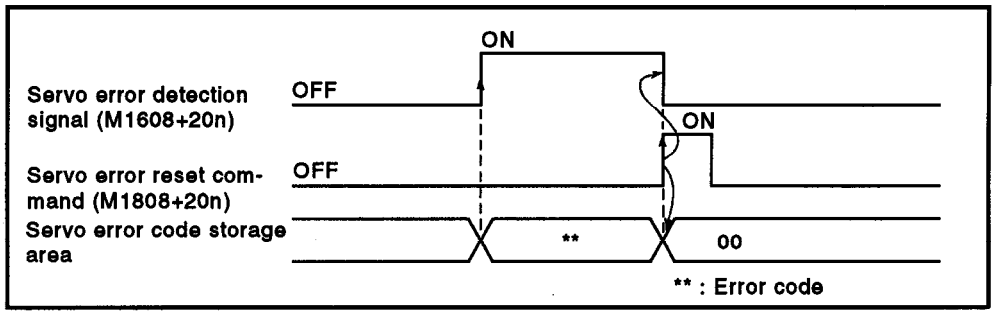
3.1.26 Error reset command (M1807+20n/Yn7/M3207+20n)*

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.

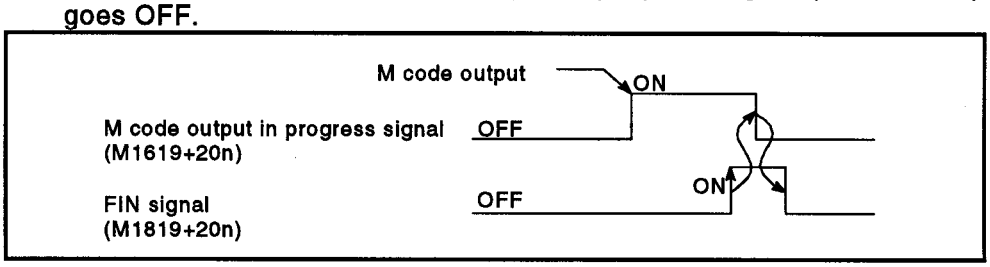
⚠ CAUTION

⚠ 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.

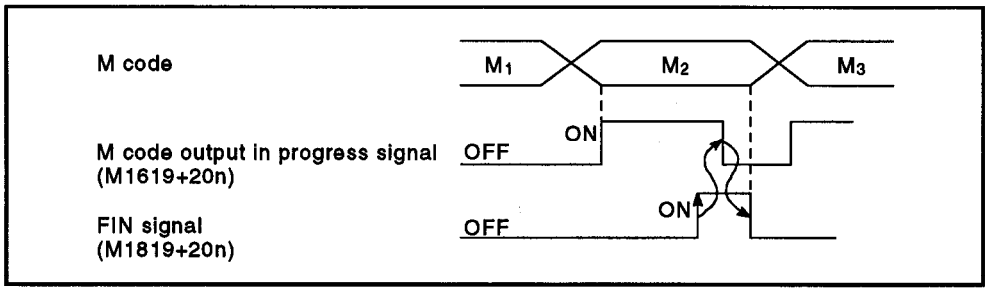


3.1.32 M code output in progress signal (M1619+20n/XC0+n/M2419+20n)

(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.

Table 3.3 Internal Relays

Signal Name	Device No.						Signal Direction
	A171SCPU		A273UHCPU (8 axis specification)		A273UHCPU (32 axis specification)		
	SV13	SV22	SV13	SV22	SV13	SV22	
PC READY	M2000						SCPU→PCPU
Start reception flag	M2001 (axis 1) to M2004 (axis 4)		M2001 (axis 1) to M2008 (axis 8)		M2001 (axis 1) to M2032 (axis 32)		PCPU→SCPU
All-axis servo ON reception flag	M2009		M2009		M2049		
Manual pulse generator enable flag	M2012		M2012 to M2014		M2051 to M2053		SCPU→PCPU
JOG simultaneous start command	M2015		M2015		M2048		SCPU→PCPU
Speed switching point designation flag*	M2016	M2040	M2016	M2040	M2040		
Start buffer full	M2020		M2020		M2050		PCPU→SCPU
Speed change flags	M2021 (axis 1) to M2024 (axis 4)		M2021 (axis 1) to M2028 (axis 8)		M2061 (axis 1) to M2092 (axis 32)		
System setting error flag	M2041						
All axis servo start command	M2042						SCPU→PCPU
Optional slot module error detection flag	M2047						PCPU→SCPU
Automatic deceleration in progress flag	—		—		M2128 (axis 1) to M2159 (axis 32)		
"Accepting speed change [0]"	—		—		M2240 (axis 1) to M2271 (axis 32)		

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.

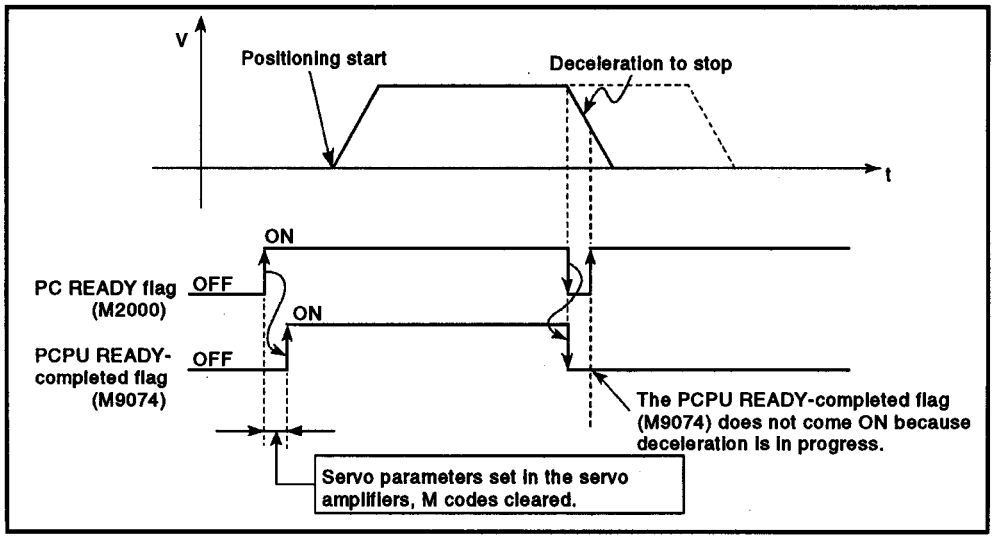
(3) When M2000 is switched from OFF to ON, the following processing occurs.

(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.

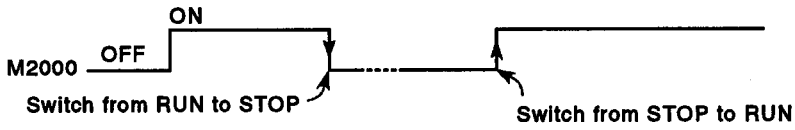
(c) While the test mode is in effect, the processing in 3 (a) above is not executed. When the test mode is cancelled, the processing in 3 (a) will be executed if M2000 is ON.



(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.

POINT

The PC READY flag (M2000) goes OFF when the servo system CPU is in the STOP status.
When the RUN status is re-established, the status is the same as before the STOP was executed.



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".

<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
8	7

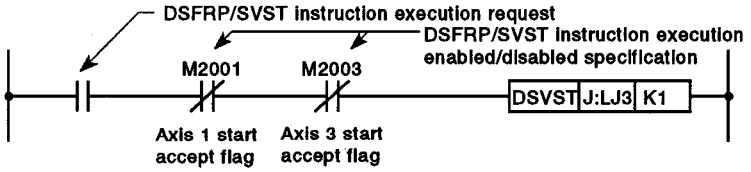
<A273UHCPU (32 axis specification)>

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

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

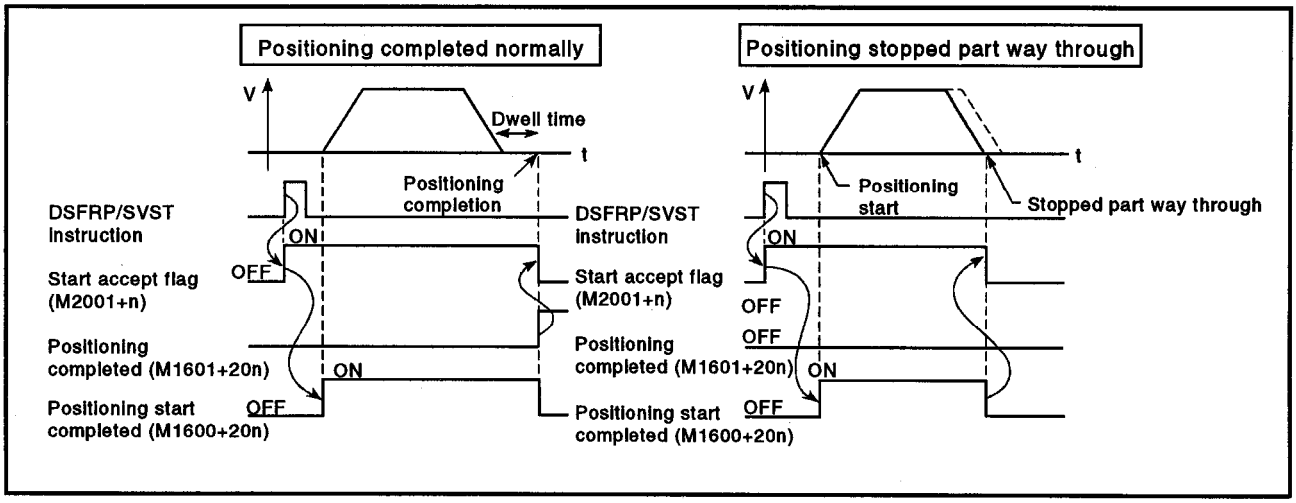
Example

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.



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

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

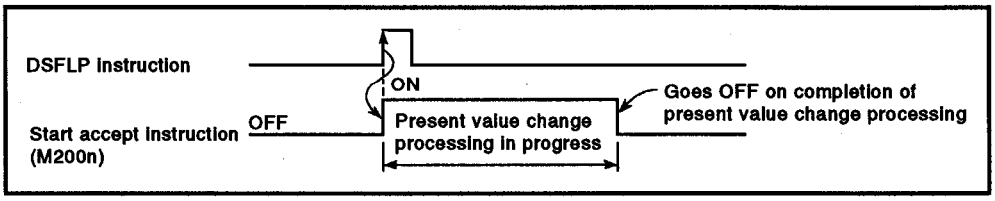
(c) The start accept flag is ON while the manual pulse generator enable flag (M2012: ON) is ON.
The start accept flag is OFF while the manual pulse generator enable flag (M2015: OFF) is OFF.

⚠ CAUTION

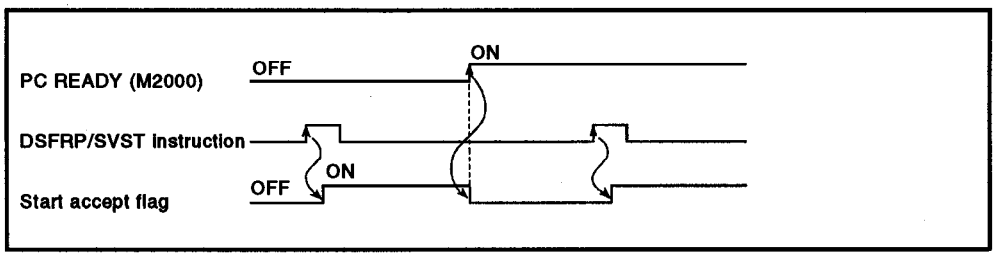
⚠ The user must not turn start accept flags ON/OFF.

- 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.



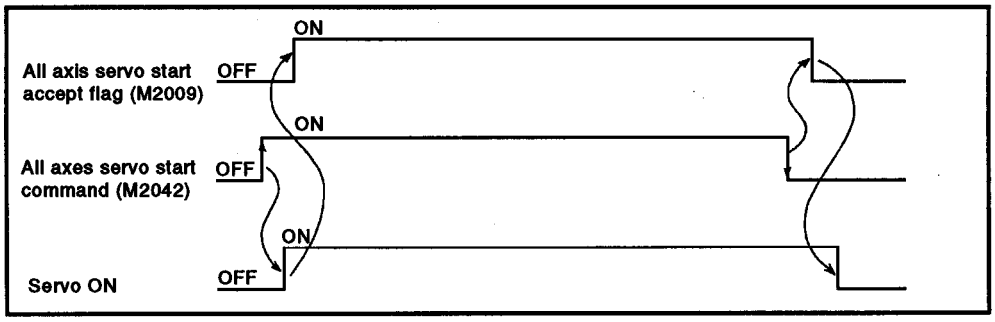
(3) When M2000 is OFF, execution of a DSFRP/SVST instruction causes the start accept flag to come ON; the flag goes OFF when M2000 comes ON.



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.

- ON .....Positioning 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).

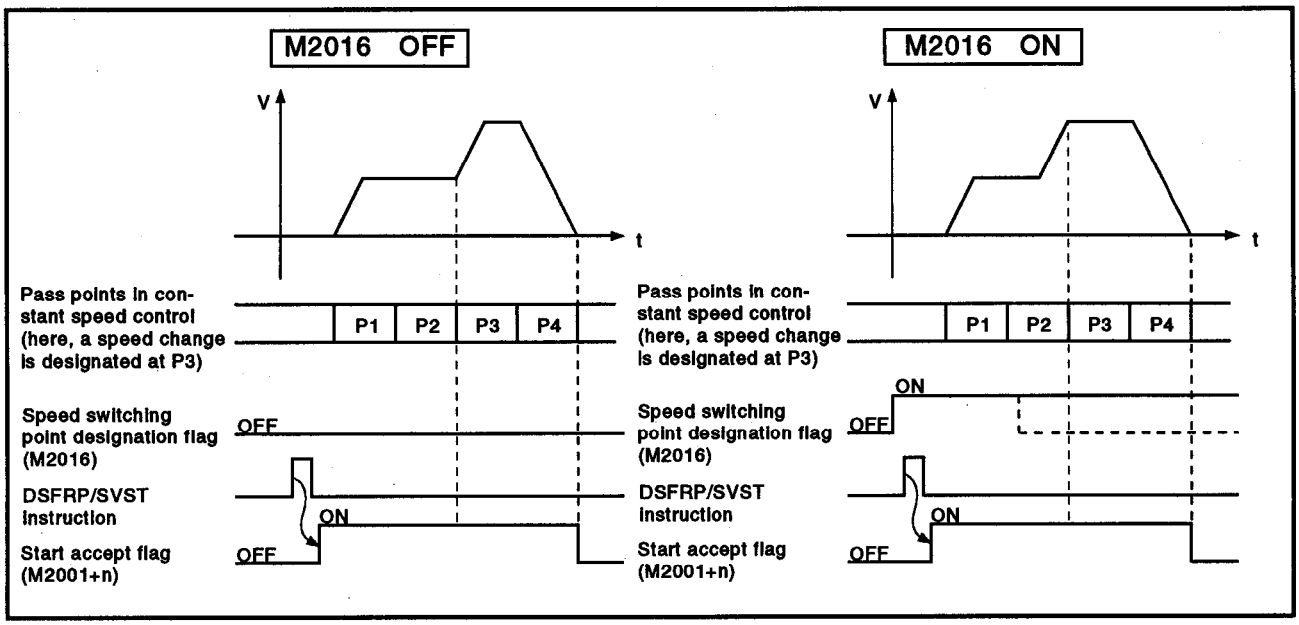
(2) When M2015 is turned OFF, motion on the axis currently executing JOG operation decelerates to a stop.

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

CPU Model	A171SCPU		A273UHCPU (8 axis specification)		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".

<A171SCPU>

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

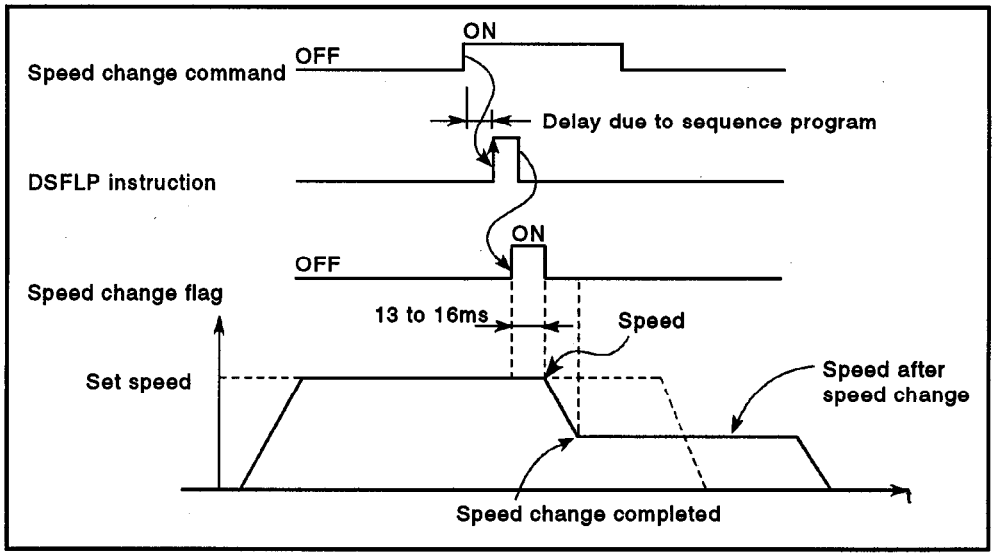
<A273UHCPU (8 axis specification)>

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

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).

- ON .....Error
- OFF .....Normal

(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

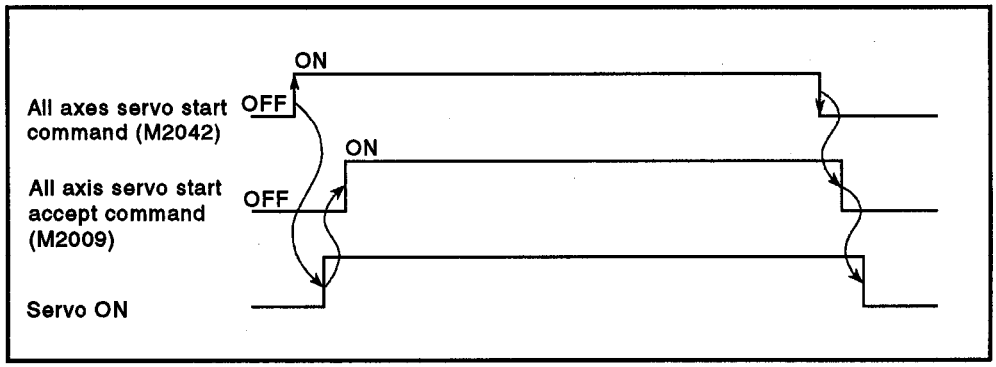
Even if a module is loaded at a slot set as "NO USE" in the system setting data set with a peripheral device, that slot will be regarded as not used.

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".

- ON .....When 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.

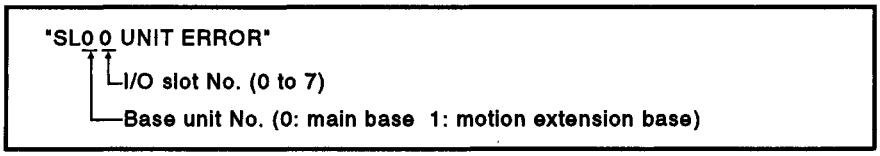
(2) When using an A273UHCPU (8/32 axis specification)

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.



(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

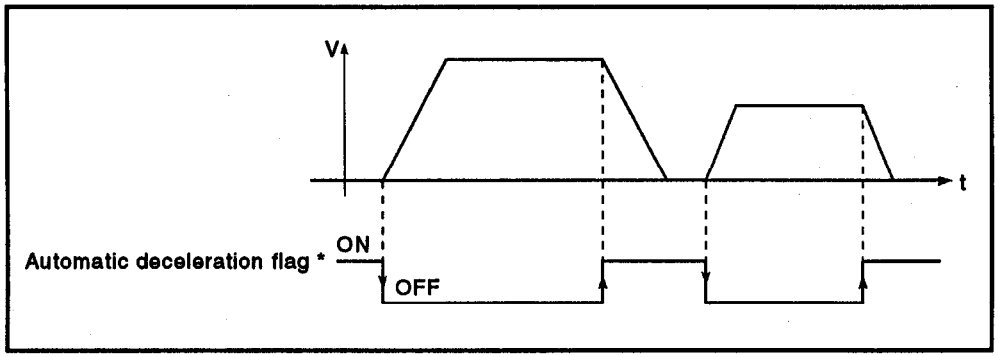
This signal is ON during automatic deceleration processing in position control or position follow-up control.

(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.

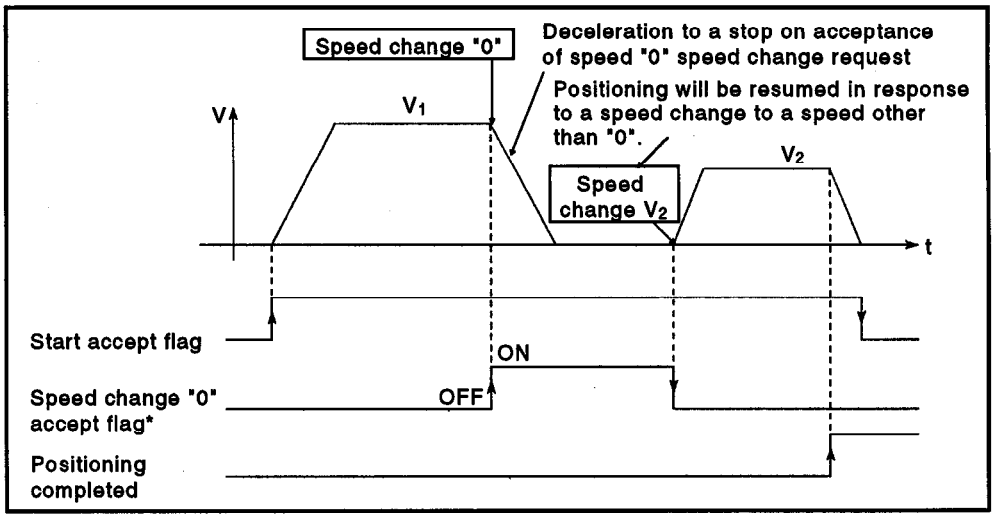
Axis No.	Device No.	Axis No.	Device No.	Axis No.	Device No.	Axis No.	Device No.
1	M2128	9	M2136	17	M2144	25	M2152
2	M2129	10	M2137	18	M2145	26	M2153
3	M2130	11	M2138	19	M2146	27	M2154
4	M2131	12	M2139	20	M2147	28	M2155
5	M2132	13	M2140	21	M2148	29	M2156
6	M2133	14	M2141	22	M2149	30	M2157
7	M2134	15	M2142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

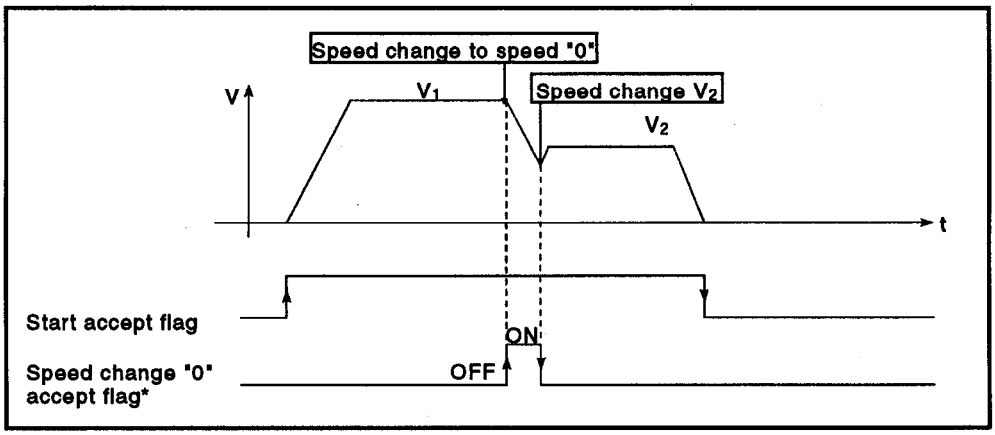
Axis No.	Device No.	Axis No.	Device No.	Axis No.	Device No.	Axis No.	Device No.
1	M2240	9	M2248	17	M2256	25	M2264
2	M2241	10	M2249	18	M2257	26	M2265
3	M2242	11	M2250	19	M2258	27	M2266
4	M2243	12	M2251	20	M2259	28	M2267
5	M2244	13	M2252	21	M2260	29	M2268
6	M2345	14	M2253	22	M2261	30	M2269
7	M2246	15	M2254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

REMARKS

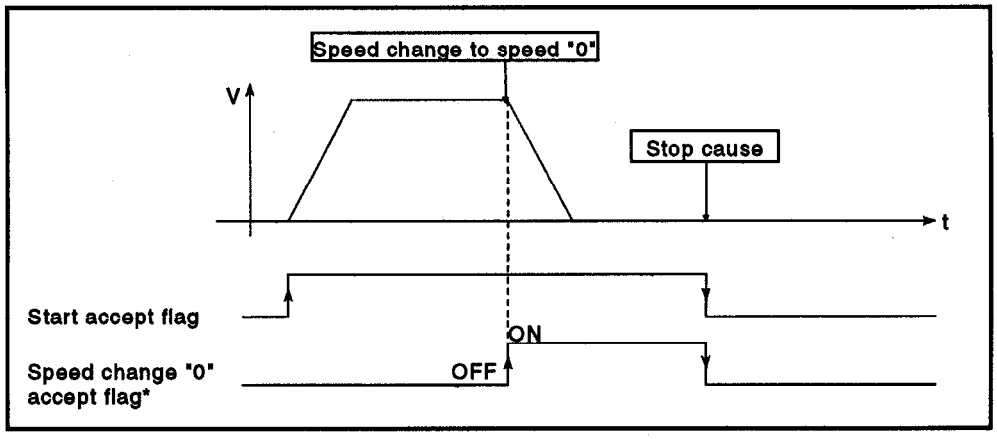
(1) If a start accept flag (M2001 to M2032) is ON even though positioning is stopped, it indicates that a request for a speed change to speed "0" has been accepted. Check this with the speed change "0" accept flag.
(2) When interpolation is performed, a number of flags corresponding to the number of 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.

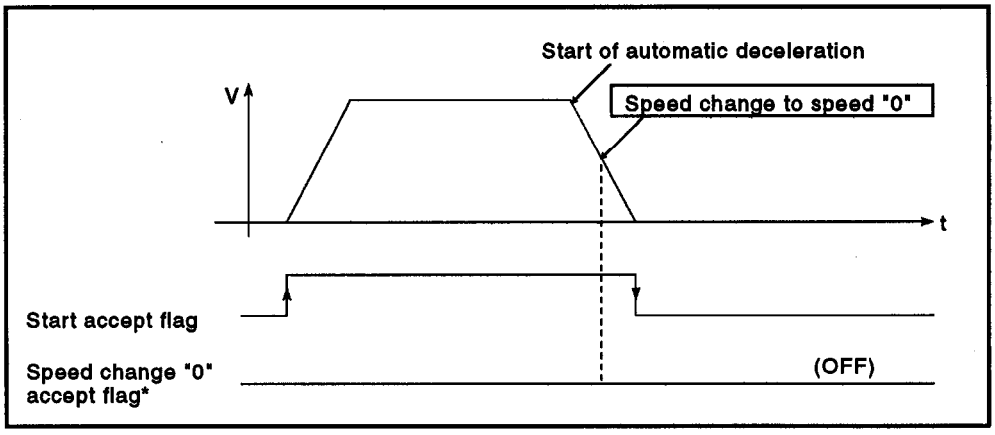
(1) If a request for a speed change to a speed other than "0" is issued during deceleration to a stop initiated by a speed change to speed "0", this flag goes OFF.



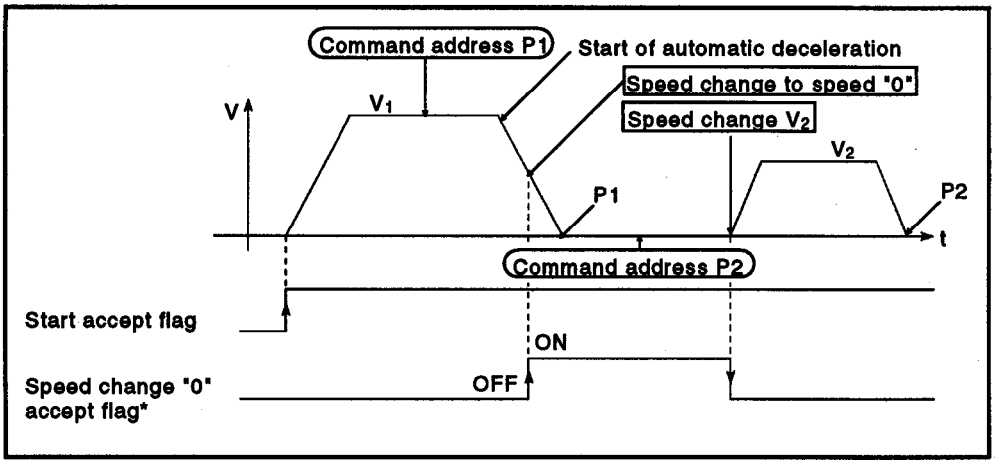
(2) This flag goes OFF when a stop cause occurs after acceptance of a request for a speed change to speed "0".



(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.



REMARK

(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.

Table 3.4 Special Relays

Device No.	Signal Name	Signal Direction
M9073	WDT error flag	PCPU → SCPU
M9074	PCPU READY-completed flag	
M9075	In-test-mode flag	
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	

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

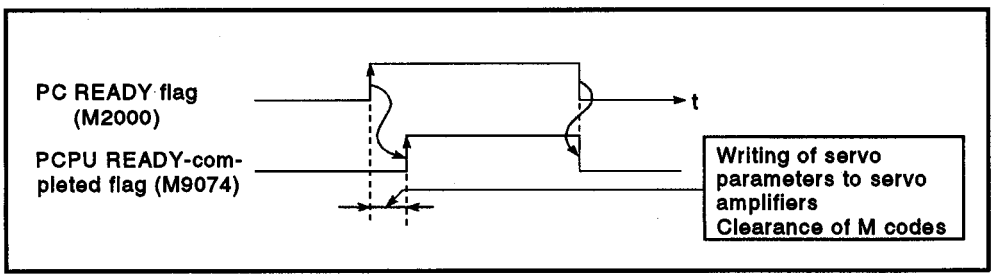
This flag comes ON when a "watchdog timer error" is detected by the PCPU's self-diagnosis function.
When the PCPU detects a WDT error, it executes an immediate stop without deceleration on the driven axis.
When the WDT error flag has come ON, reset the servo system CPU with the key switch.
If M9073 remains 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.

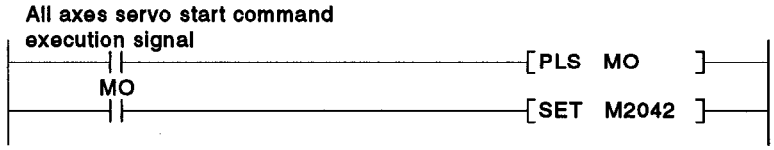
(2) When M9078 comes ON, the error contents are stored in the test mode request error register (D9188).

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.



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
- ON .....Abnormal

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.
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.

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Table 3.5 Data Registers

Device No.	Signal Name		Device No.	Signal Name
D800 to D819	Axis 1 monitoring data	First data register number 0,1 Feed present value (L/H) 2,3 Actual present value (L/H) 4,5 Deviation counter value (L/H) 6 Minor error code 7 Major error code 8 Servo error code 9,10 Travel value when the near-zero point dog is ON (L/H) 11 Home position return second travel value 12 Executed program number 13 M code 14 Torque limit value 15,16 Travel value change register (L/H) 17,18 Actual present value when STOP is input (L/H) 19 For constant speed control	D1012	Setting register for axis number controlled with manual pulse generator
D820 to D839	Axis 2 monitoring data		D1013	Unusable
D840 to D859	Axis 3 monitoring data		D1014	Unusable
D860 to D879	Axis 4 monitoring data		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	First data register number 0,1 Present value change register (L/H) 2,3 Speed change register (L/H) 4,5 JOG speed setting register (L/H)	D1017	1 pulse input magnification setting register of manual pulse generator for axis 2
D966 to D971	Axis 2 control change data storage area		D1018	1 pulse input magnification setting register of manual pulse generator for axis 3
D972 to D977	Axis 3 control change data storage area		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 disable setting			
D1010 to D1011	Unusable			

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(8 axis specification)>

Table 3.6 Data Registers

Device No.	Signal 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	D1014	Setting register for axis number controlled with manual pulse generator 3
D860 to D879	Axis 4 monitoring data	D1015	JOG operation simultaneous start axis setting register
D880 to D899	Axis 5 monitoring data	D1016	1 pulse input magnification setting register of manual pulse generator for axis 1
D900 to D919	Axis 6 monitoring data	D1017	1 pulse input magnification setting register of manual pulse generator for axis 2
D920 to D939	Axis 7 monitoring data	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	D1023	1 pulse input magnification setting register of manual pulse generator for axis 8
D984 to D989	Axis 5 control change data storage area		
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 disable setting		

First data register number

0	Feed present value	L
1		H
2	Actual present value	L
3		H
4	Deviation counter value	L
5		H
6	Minor error code	
7	Major error code	
8	Servo error code	
9	Travel value when the near-zero point dog is ON	L
10		H
11	Home position return second travel value	
12	Executed program number	
13	M code	
14	Torque limit value	
15	Travel value change register	L
16		H
17	Actual present value when STOP is input	L
18		H
19	For constant speed control	

First data register number

0	Present value change register	L
1		H
2	Speed change register	L
3		H
4	JOG speed setting register	L
5		H

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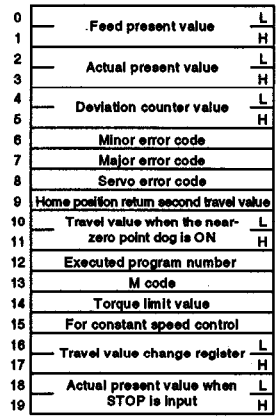
(32 axis specification)>

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	
D140 to D159	Axis 8 monitoring data	D460 to D479	Axis 24 monitoring data	
D160 to D179	Axis 9 monitoring data	D480 to D499	Axis 25 monitoring data	
D180 to D199	Axis 10 monitoring data	D500 to D519	Axis 26 monitoring data	
D200 to D219	Axis 11 monitoring data	D520 to D539	Axis 27 monitoring data	
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	

First data register number



<A273UHCPU
(32 axis specification)>

Table 3.7 Data Registers (Continued)

Device No.	Signal Name	Device No.	Signal Name	Data Register Names
D640 D641	Axis 1 JOG speed data storage area	D672 D673	Axis 17 JOG speed data storage area	First data register number 0 1 — JOG speed setting register L H
D642 D643	Axis 2 JOG speed data storage area	D674 D675	Axis 18 JOG speed data storage area	
D644 D645	Axis 3 JOG speed data storage area	D676 D677	Axis 19 JOG speed data storage area	
D646 D647	Axis 4 JOG speed data storage area	D678 D679	Axis 20 JOG speed data storage area	
D648 D649	Axis 5 JOG speed data storage area	D680 D681	Axis 21 JOG speed data storage area	
D650 D651	Axis 6 JOG speed data storage area	D682 D683	Axis 22 JOG speed data storage area	
D652 D653	Axis 7 JOG speed data storage area	D684 D685	Axis 23 JOG speed data storage area	
D654 D655	Axis 8 JOG speed data storage area	D686 D687	Axis 24 JOG speed data storage area	
D656 D657	Axis 9 JOG speed data storage area	D688 D689	Axis 25 JOG speed data storage area	
D658 D659	Axis 10 JOG speed data storage area	D690 D691	Axis 26 JOG speed data storage area	
D660 D661	Axis 11 JOG speed data storage area	D692 D693	Axis 27 JOG speed data storage area	
D662 D663	Axis 12 JOG speed data storage area	D694 D695	Axis 28 JOG speed data storage area	
D664 D665	Axis 13 JOG speed data storage area	D696 D697	Axis 29 JOG speed data storage area	
D666 D667	Axis 14 JOG speed data storage area	D698 D699	Axis 30 JOG speed data storage area	
D668 D669	Axis 15 JOG speed data storage area	D700 D701	Axis 31 JOG speed data storage area	
D670 D671	Axis 16 JOG speed data storage area	D702 D703	Axis 32 JOG speed data 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".

<A171SCPU> **Table 3.8 Monitoring Data Areas**

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

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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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Table 3.10 Monitoring Data 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

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

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.

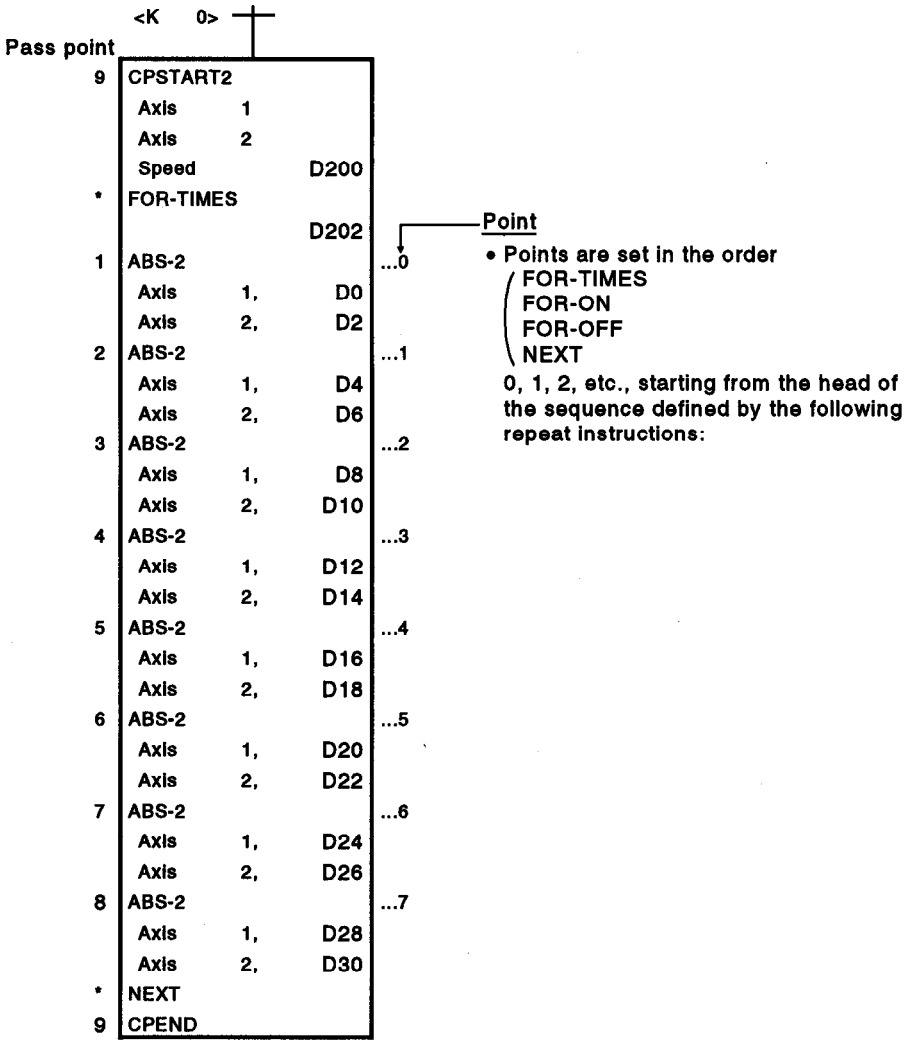
(14) Constant speed control data set pointer ... Data from the PCPU to the SCPU

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).

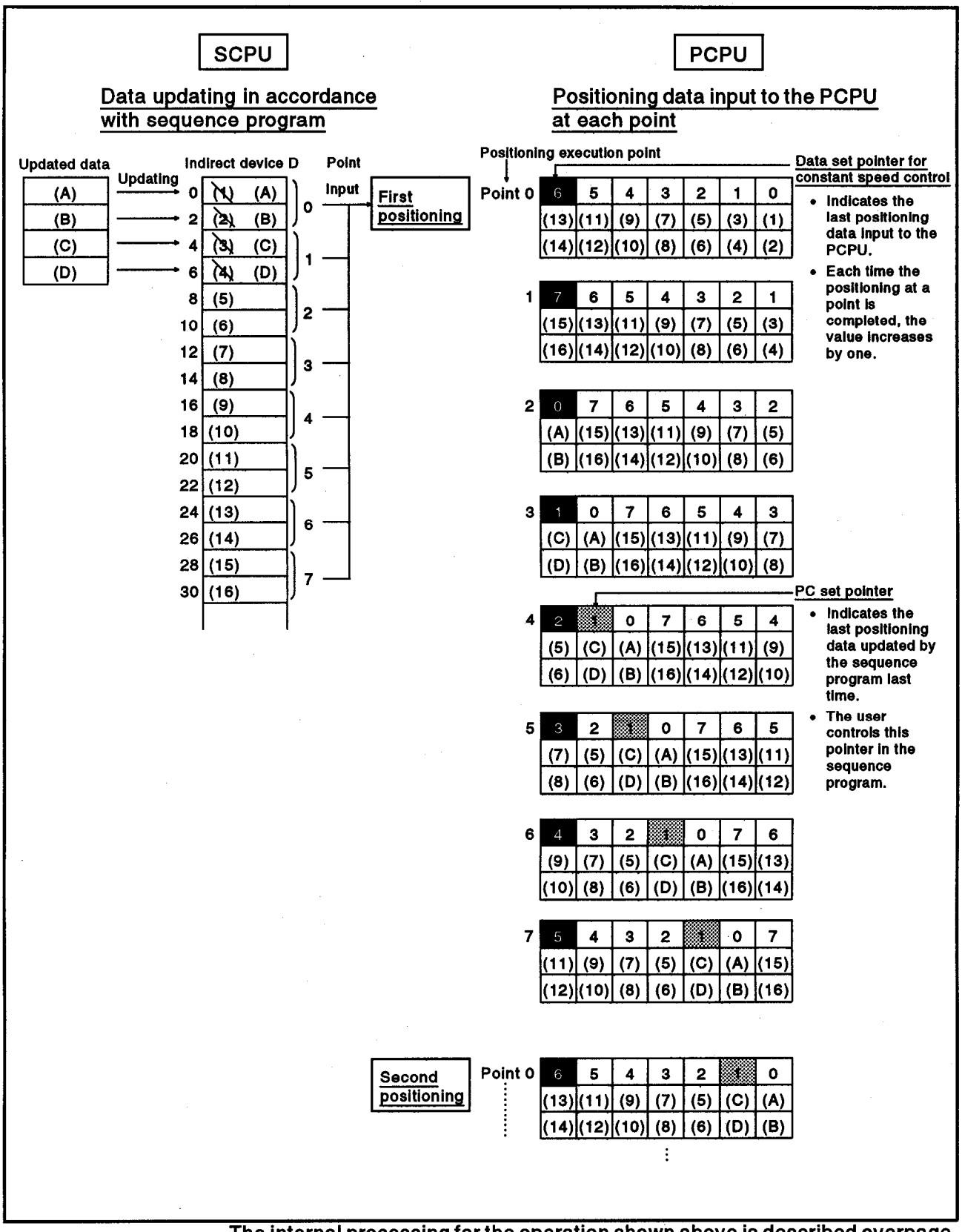
Use this pointer in conjunction with the PC set pointer (controlled by the user in the sequence program) - which indicates the extent to which the positioning data has been updated by the SCPU - to confirm which positioning data is to be updated.

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



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]



The internal processing for the operation shown above is described overpage.

[Internal processing]

(1) 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 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.

3.4.2 Data storage area for control change (D960 to D983/D960 to D1007/D640 to D703) ..... Data 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> **Table 3.11 Data Storage Areas for Control Change**

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
JOG speed setting register	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
	D657,D656	D659,D658	D661,D660	D663,D662	D665,D664	D667,D666	D669,D668	D671,D670
	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.

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

Item \ Units	mm		inch		degree		PLUSE		Remarks
	Setting Range	Units	Setting Range	Units	Setting Range	Units	Setting Range	Units	
Present value change value	-2147483648 ~2147483647	$\times10^{-1}$ μm	-2147483648 ~2147483647	$\times10^{-5}$ inch	0~35999999	$\times10^{-5}$ degree	-2147483648 ~2147483647	PLS	Even if the set value is outside the stroke range, no error will occur.

(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.

Item \ Units	mm		inch		degree		PLUSE	
	Setting Range	Units	Setting Range	Units	Setting Range	Units	Setting Range	Units
Speed change value	0~600000000	$\times10^{-2}$ mm/min	0~600000000	$\times10^{-3}$ inch/min	0~600000000	$\times10^{-3}$ 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.

Item \ Units	mm		inch		degree		PLUSE	
	Setting Range	Units	Setting Range	Units	Setting Range	Units	Setting Range	Units
JOG speed	1~600000000	$\times10^{-2}$ mm/min	1~600000000	$\times10^{-3}$ inch/min	1~600000000	$\times10^{-3}$ 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.

<A171SCPU>

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
D1008	LY0F	LY0E	LY0D	LY0C	LY0B	LY0A	LY09	LY08	LY07	LY06	LY05	LY04	LY03	LY02	LY01	LY00
	For axis 2								For axis 1							
D1009	LY1F	LY1E	LY1D	LY1C	LY1B	LY1A	LY19	LY18	LY17	LY16	LY15	LY14	LY13	LY12	LY11	LY10
	For axis 4								For axis 3							

1) "1" or "0" is stored for each bit.
   1: Disable .....The limit switch output status is OFF.
   0: Enable .....The limit switch output comes ON and goes OFF in accordance with the set data.
2) LY of LY00 to LY1F shows the limit switch output.

<A273UHCPU (8 axis specification)>

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
D1008	LY0F	LY0E	LY0D	LY0C	LY0B	LY0A	LY09	LY08	LY07	LY06	LY05	LY04	LY03	LY02	LY01	LY00
	For axis 2								For axis 1							
D1009	LY1F	LY1E	LY1D	LY1C	LY1B	LY1A	LY19	LY18	LY17	LY16	LY15	LY14	LY13	LY12	LY11	LY10
	For axis 4								For axis 3							
D1010	LY2F	LY2E	LY2D	LY2C	LY2B	LY2A	LY29	LY28	LY27	LY26	LY25	LY24	LY23	LY22	LY21	LY20
	For axis 6								For axis 5							
D1011	LY3F	LY3E	LY3D	LY3C	LY3B	LY3A	LY39	LY38	LY37	LY36	LY35	LY34	LY33	LY32	LY31	LY30
	For axis 8								For axis 7							

1) "1" or "0" is stored for each bit.
   1: Disable .....The limit switch output status is OFF.
   0: Enable .....The limit switch output comes ON and goes OFF in accordance with the set data.
2) LY of LY00 to LY3F shows the limit switch output.

<A273UHCPU (32 axis specification)>

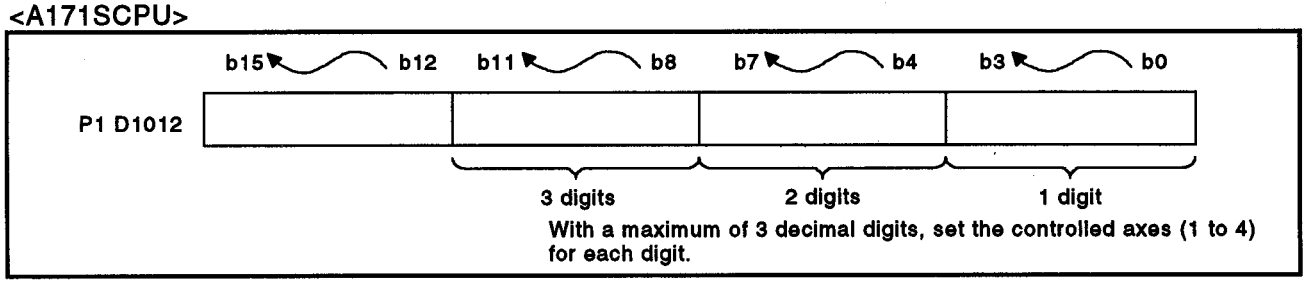
	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
D760	LY0F	LY0E	LY0D	LY0C	LY0B	LY0A	LY09	LY08	LY07	LY06	LY05	LY04	LY03	LY02	LY01	LY00
	For axis 2								For axis 1							
D761	LY1F	LY1E	LY1D	LY1C	LY1B	LY1A	LY19	LY18	LY17	LY16	LY15	LY14	LY13	LY12	LY11	LY10
	For axis 4								For axis 3							
D762	LY2F	LY2E	LY2D	LY2C	LY2B	LY2A	LY29	LY28	LY27	LY26	LY25	LY24	LY23	LY22	LY21	LY20
	For axis 6								For axis 5							
D763	LY3F	LY3E	LY3D	LY3C	LY3B	LY3A	LY39	LY38	LY37	LY36	LY35	LY34	LY33	LY32	LY31	LY30
	For axis 8								For axis 7							
D764	LY4F	LY4E	LY4D	LY4C	LY4B	LY4A	LY49	LY48	LY47	LY46	LY45	LY44	LY43	LY42	LY41	LY40
	For axis 10								For axis 9							
D765	LY5F	LY5E	LY5D	LY5C	LY5B	LY5A	LY59	LY58	LY57	LY56	LY55	LY54	LY53	LY52	LY51	LY50
	For axis 12								For axis 11							
D766	LY6F	LY6E	LY6D	LY6C	LY6B	LY6A	LY69	LY68	LY67	LY66	LY65	LY64	LY63	LY62	LY61	LY60
	For axis 14								For axis 13							
D767	LY7F	LY7E	LY7D	LY7C	LY7B	LY7A	LY79	LY78	LY77	LY76	LY75	LY74	LY73	LY72	LY71	LY70
	For axis 16								For axis 15							
D768	LY8F	LY8E	LY8D	LY8C	LY8B	LY8A	LY89	LY88	LY87	LY86	LY85	LY84	LY83	LY82	LY81	LY80
	For axis 18								For axis 17							
D769	LY9F	LY9E	LY9D	LY9C	LY9B	LY9A	LY99	LY98	LY97	LY96	LY95	LY94	LY93	LY92	LY91	LY90
	For axis 20								For axis 19							
D770	LYAF	LYAE	LYAD	LYAC	LYAB	LYAA	LYA9	LYA8	LYA7	LYA6	LYA5	LYA4	LYA3	LYA2	LYA1	LYA0
	For axis 22								For axis 21							
D771	LYBF	LYBE	LYBD	LYBC	LYBB	LYBA	LYB9	LYB8	LYB7	LYB6	LYB5	LYB4	LYB3	LYB2	LYB1	LYB0
	For axis 24								For axis 23							
D772	LYCF	LYCE	LYCD	LYCC	LYCB	LYCA	LYC9	LYC8	LYC7	LYC6	LYC5	LYC4	LYC3	LYC2	LYC1	LYC0
	For axis 26								For axis 25							
D773	LYDF	LYDE	LYDD	LYDC	LYDB	LYDA	LYD9	LYD8	LYD7	LYD6	LYD5	LYD4	LYD3	LYD2	LYD1	LYD0
	For axis 28								For axis 27							
D774	LYEF	LYEE	LYED	LYEC	LYEB	LYEA	LYE9	LYE8	LYE7	LYE6	LYE5	LYE4	LYE3	LYE2	LYE1	LYE0
	For axis 30								For axis 29							
D775	LYFF	LYFE	LYFD	LYFC	LYFB	LYFA	LYF9	LYF8	LYF7	LYF6	LYF5	LYF4	LYF3	LYF2	LYF1	LYF0
	For axis 32								For axis 30							

1) "1" or "0" is stored for each bit.
   1: Disable .....The limit switch output status is OFF.
   0: Enable .....The limit switch output comes ON and goes OFF in accordance with the set data.
2) LY of LY00 to LYFF shows the limit switch output.

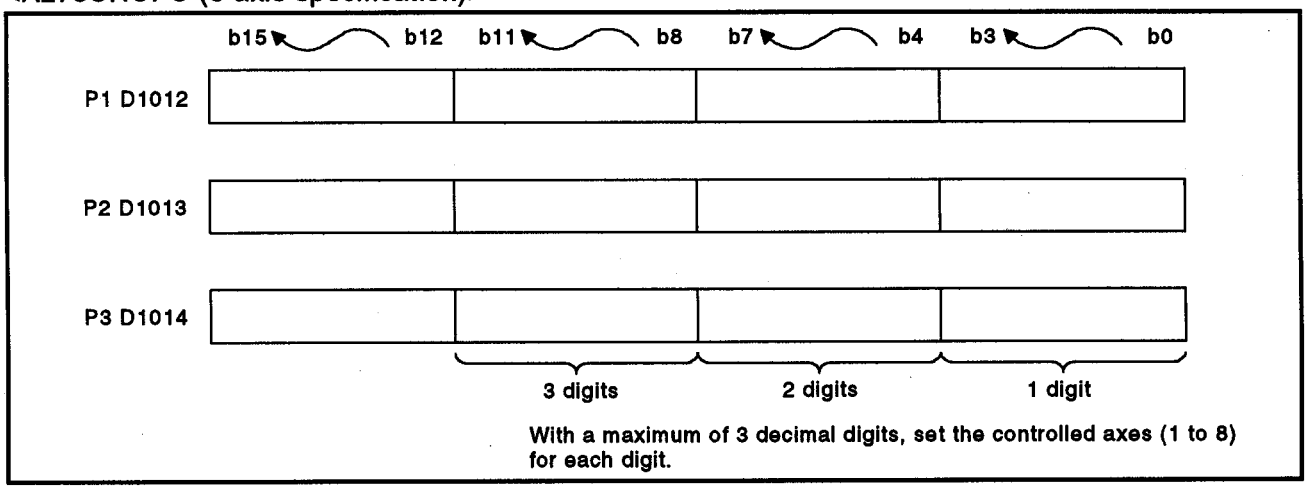
3.4.4 Registers for setting axis numbers controlled by manual pulse generators (D1012/D1012 to D1014/D714 to D719) ..... Data from the SCPU to the PCPU

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

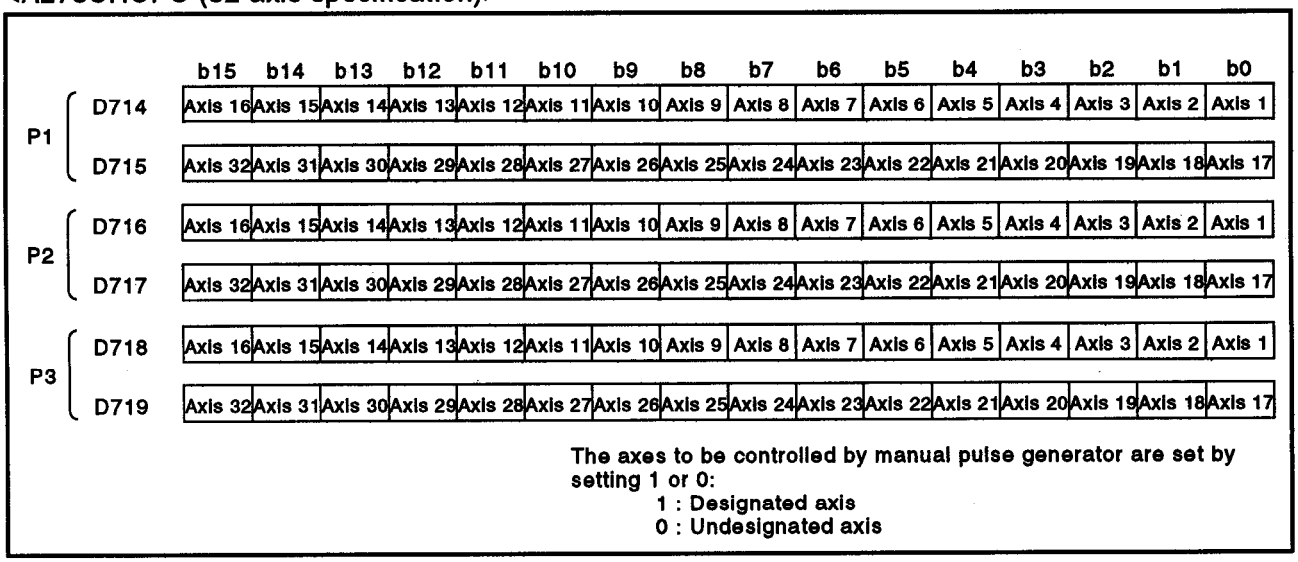
<A171SCPU>



<A273UHCPU (8 axis specification)>



<A273UHCPU (32 axis specification)>

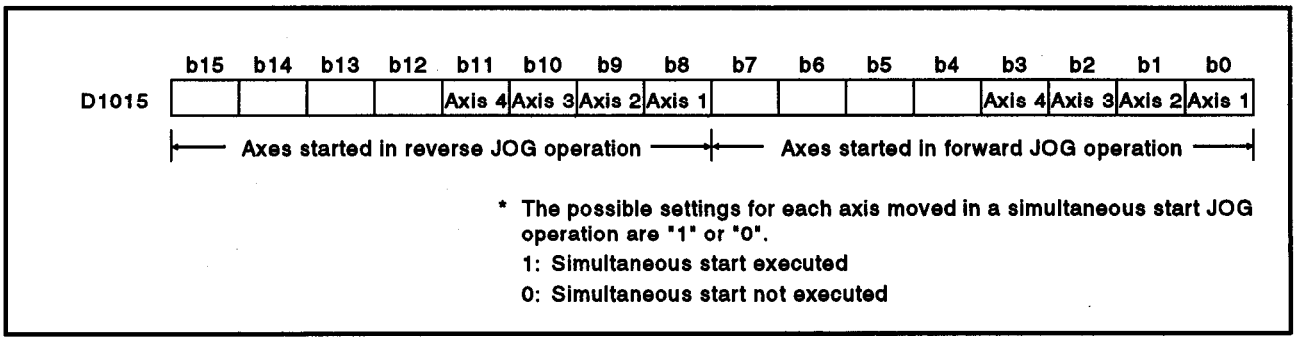


(2) For details on manual pulse generator operation, see Section 7.20.

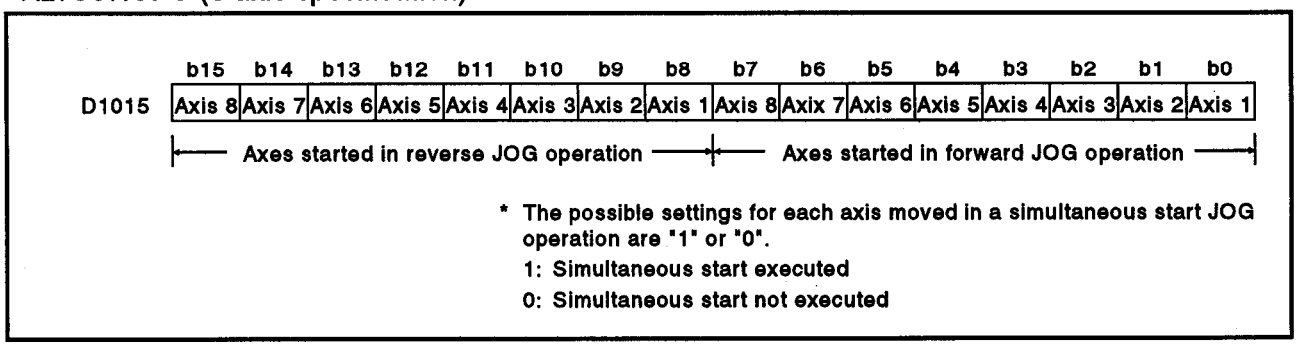
3.4.5 JOG operation simultaneous start axis setting register (D1015/D1015/D710 to D713) ..... Data from the SCPU to the PCPU

(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.

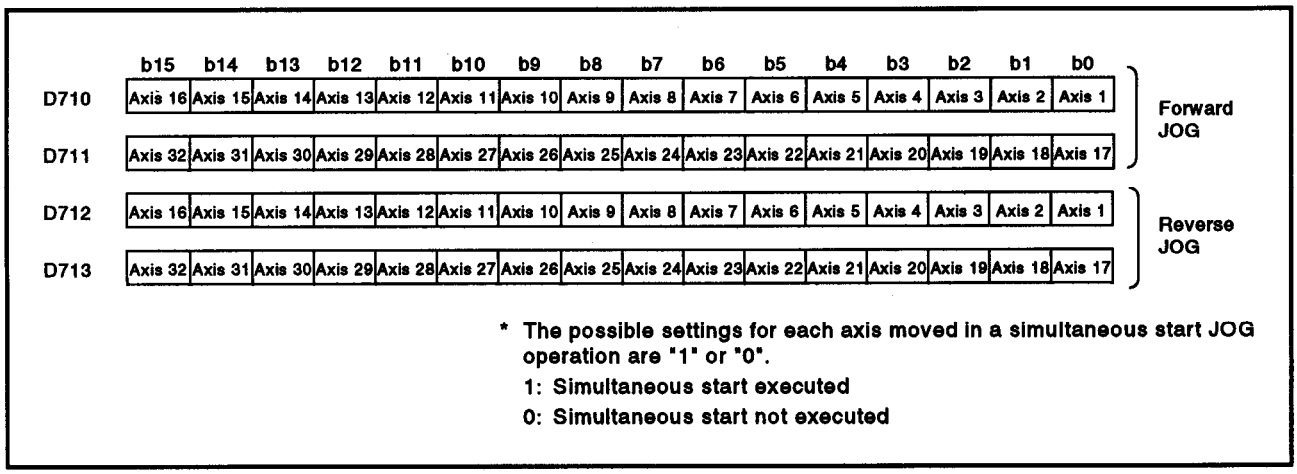
<A171SCPU>



<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.

<A171SCPU>

1-pulse input Magnification Setting Register	Corresponding Axis No.	Setting Range
D1016	Axis 1	1 to 100
D1017	Axis 2	
D1018	Axis 3	
D1019	Axis 4	

<A273UHCPU (8-axis)>

1-pulse input Magnification Setting Register	Corresponding Axis No.	Setting Range
D1016	Axis 1	1 to 100
D1017	Axis 2	
D1018	Axis 3	
D1019	Axis 4	
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	1 to 100
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	
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	

(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> **Table 3.14 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	Unusable
D9183	
D9184	PCPU error cause
D9185	Servo 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 smoothing magnification
D9193	Unusable
D9194	
D9195 to D9199	Unusable

<A273UHCPU
(8 axis specification)>

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	Servo 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 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 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	Servo amplifier loading information
D9192	
D9193 to D9199	Unusable

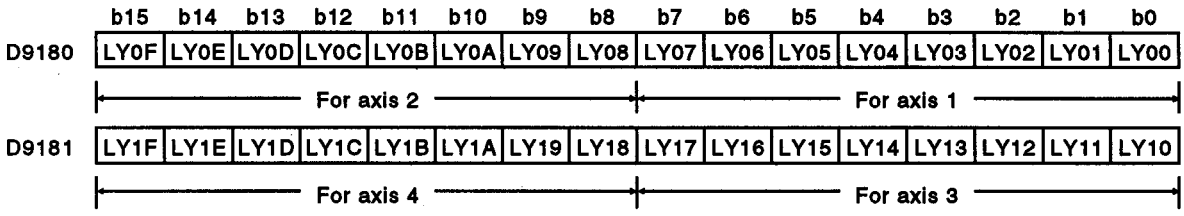
*: Data registers used

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>

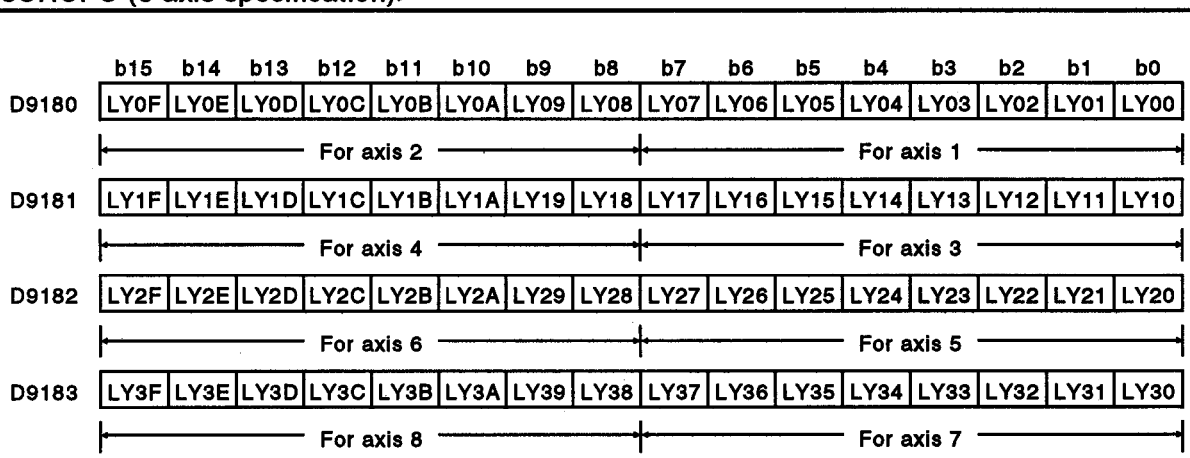


* "1" or "0" is set at each bit of D9180 to D9181.
- ON.....1
- OFF.....0

REMARK

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

<A273UHCPU (8 axis specification)>



* "1" or "0" is set at each bit of D9180 to D9183.
- ON.....1
- OFF.....0

REMARK

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

<A273UHCPU (32 axis specification)>

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
D776	LY0F	LY0E	LY0D	LY0C	LY0B	LY0A	LY09	LY08	LY07	LY06	LY05	LY04	LY03	LY02	LY01	LY00
	For axis 2								For axis 1							
D777	LY1F	LY1E	LY1D	LY1C	LY1B	LY1A	LY19	LY18	LY17	LY16	LY15	LY14	LY13	LY12	LY11	LY10
	For axis 4								For axis 3							
D778	LY2F	LY2E	LY2D	LY2C	LY2B	LY2A	LY29	LY28	LY27	LY26	LY25	LY24	LY23	LY22	LY21	LY20
	For axis 6								For axis 5							
D779	LY3F	LY3E	LY3D	LY3C	LY3B	LY3A	LY39	LY38	LY37	LY36	LY35	LY34	LY33	LY32	LY31	LY30
	For axis 8								For axis 7							
D780	LY4F	LY4E	LY4D	LY4C	LY4B	LY4A	LY49	LY48	LY47	LY46	LY45	LY44	LY43	LY42	LY41	LY40
	For axis 10								For axis 9							
D781	LY5F	LY5E	LY5D	LY5C	LY5B	LY5A	LY59	LY58	LY57	LY56	LY55	LY54	LY53	LY52	LY51	LY50
	For axis 12								For axis 11							
D782	LY6F	LY6E	LY6D	LY6C	LY6B	LY6A	LY69	LY68	LY67	LY66	LY65	LY64	LY63	LY62	LY61	LY60
	For axis 14								For axis 13							
D783	LY7F	LY7E	LY7D	LY7C	LY7B	LY7A	LY79	LY78	LY77	LY76	LY75	LY74	LY73	LY72	LY71	LY70
	For axis 16								For axis 15							
D784	LY8F	LY8E	LY8D	LY8C	LY8B	LY8A	LY89	LY88	LY87	LY86	LY85	LY84	LY83	LY82	LY81	LY80
	For axis 18								For axis 17							
D785	LY9F	LY9E	LY9D	LY9C	LY9B	LY9A	LY99	LY98	LY97	LY96	LY95	LY94	LY93	LY92	LY91	LY90
	For axis 20								For axis 19							
D786	LYAF	LYAE	LYAD	LYAC	LYAB	LYAA	LYA9	LYA8	LYA7	LYA6	LYA5	LYA4	LYA3	LYA2	LYA1	LYA0
	For axis 22								For axis 21							
D787	LYBF	LYBE	LYBD	LYBC	LYBB	LYBA	LYB9	LYB8	LYB7	LYB6	LYB5	LYB4	LYB3	LYB2	LYB1	LYB0
	For axis 24								For axis 23							
D788	LYCF	LYCE	LYCD	LYCC	LYCB	LYCA	LYC9	LYC8	LYC7	LYC6	LYC5	LYC4	LYC3	LYC2	LYC1	LYC0
	For axis 26								For axis 25							
D789	LYDF	LYDE	LYDD	LYDC	LYDB	LYDA	LYD9	LYD8	LYD7	LYD6	LYD5	LYD4	LYD3	LYD2	LYD1	LYD0
	For axis 28								For axis 27							
D790	LYEF	LYEE	LYED	LYEC	LYEB	LYEA	LYE9	LYE8	LYE7	LYE6	LYE5	LYE4	LYE3	LYE2	LYE1	LYE0
	For axis 30								For axis 29							
D791	LYFF	LYFE	LYFD	LYFC	LYFB	LYFA	LYF9	LYF8	LYF7	LYF6	LYF5	LYF4	LYF3	LYF2	LYF1	LYF0
	For axis 32								For axis 31							

* "1" or "0" is set at each bit of D776 to D791.
• ON.....1 • OFF.....0

REMARK

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

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, after which operation cannot be started.	Reset with the reset key.
3	SCPU software fault 2		
300	SCPU software fault 3		

(2) When using an A273UHCPU (8 axis specification)

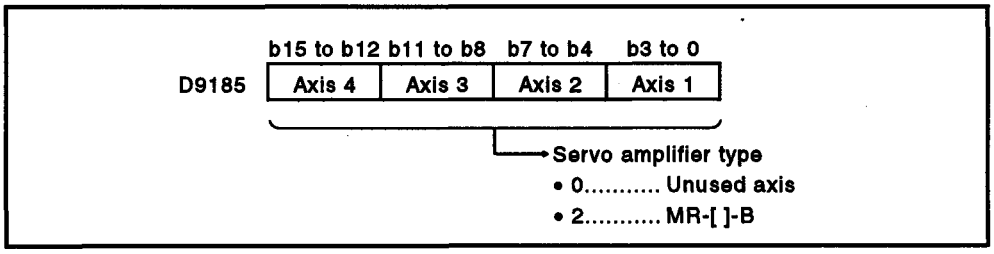
Error Code	Error Cause	Operation when Error Occurs	Action to Take
1	PCPU software fault 1	All axes stop immediately, after which operation cannot be started.	Reset with the reset key.
2	PCPU operation synchronization time over		
3	PCPU software fault 2		
30	PCPU/SCPU hardware fault		
100 to 107 110 to 117	CPU fault of AC motor drive module 1 0 0 └ 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. 2 0 0 └ 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 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.

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

<table>
<tr><th>Error Code</th><th>Error Cause</th><th>Operation when Error Occurs</th><th>Action Take</th></tr>
<tr><td>1</td><td>PCPU software fault 1</td><td rowspan="4">All axes stop immediately, after which operation cannot be started.</td><td rowspan="4">Reset with the reset key.</td></tr>
<tr><td>2</td><td>PCPU operation synchronization time over</td></tr>
<tr><td>3</td><td>PCPU software fault 2</td></tr>
<tr><td>30</td><td>PCPU/SCPU hardware fault</td></tr>
<tr><td>100 to 107
110 to 117
120 to 127
130 to 137
140 to 147</td><td>CPU fault of AC motor drive module
1 0 0
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)
2: Extension base (2nd extension stage)
3: Extension base (3rd extension stage)
4: Extension base (4th extension stage)</td><td>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.</td><td>Reset with the reset key.
If the error reoccurs after resetting, the ADU is probaly faulty: replace it.</td></tr>
<tr><td>200 to 207
210 to 217
220 to 227
230 to 237
240 to 247</td><td>Hardware fault of module loaded on motion main base unit or extension base unit.
2 0 0
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)
2: Extension base (2nd extension stage)
3: Extension base (3rd extension stage)
4: Extension base (4th extension stage)</td><td rowspan="4">All axes stop immediately, after which operation cannot be started.</td><td rowspan="3">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.</td></tr>
<tr><td>250 to 253</td><td>Standalone servo amplifier (MR-[ ]-B) interface hard ware fault.
2 5 0
Faulty SSCNET No.
0: SSCNET 1
1: SSCNET 2
2: SSCNET 3
3: SSCNET 4</td></tr>
<tr><td>300</td><td>PCPU software fault 3</td></tr>
<tr><td>301</td><td>CPSTART instructions of 8 or more points have been executed, exceeding the number of programs that can be started simultaneously.
<table>
<tr><th></th><th>Number of Programs that can be Started Simultaneously</th></tr>
<tr><td>Version with conventional functions</td><td>20</td></tr>
<tr><td>Version with additional functions</td><td>14</td></tr>
</table></td><td>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.</td></tr>
</table>

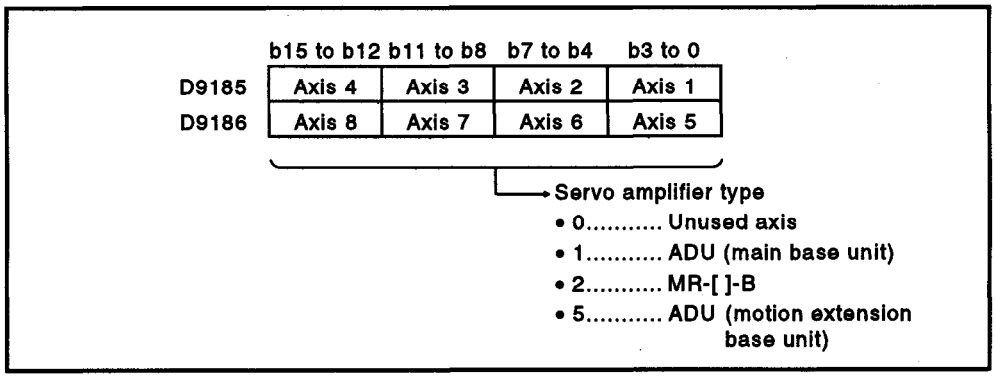
3.5.3 Servo amplifier classification (D9185/D9185 to 9186/D792 to D799) ... Data from the PCPU to the SCPU

(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.

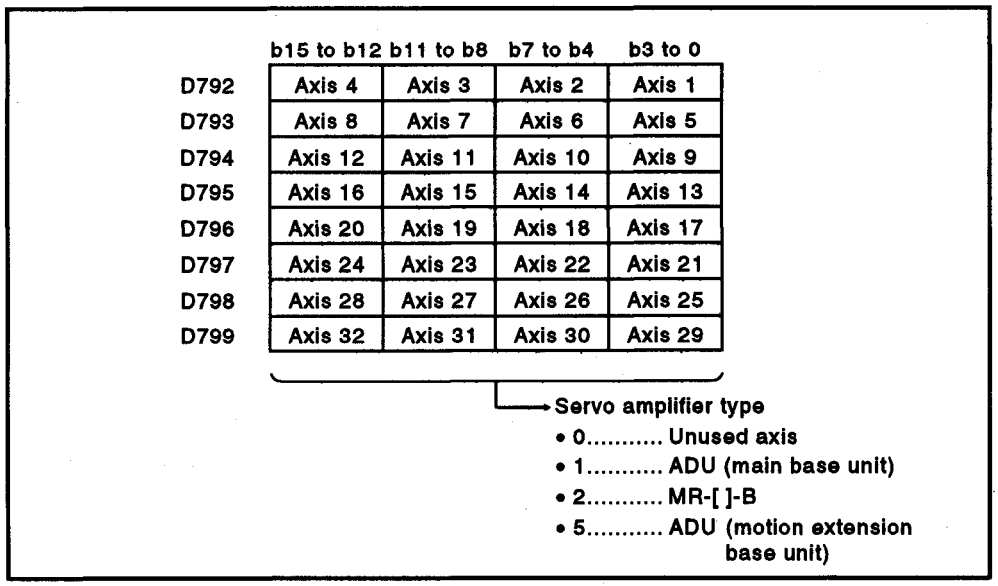


(2) When an A273UHCPU (8/32 axis specification) is used
On switching on the control power supply (A6[ ]P) to the servo system CPU or resetting, the servo amplifier type set in the system settings is set in these devices.

<A273UHCPU (8 axis specification)>



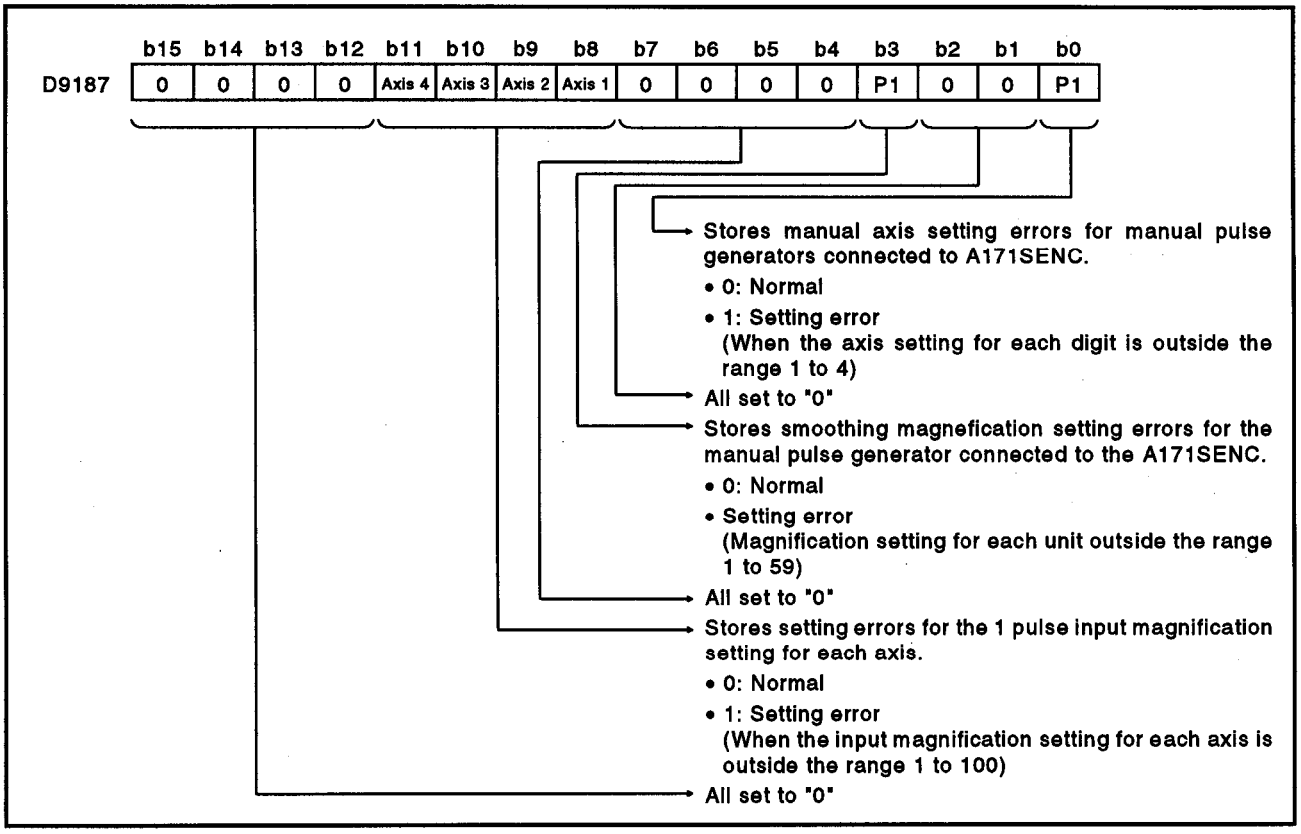
<A273UHCPU (32 axis specification)>



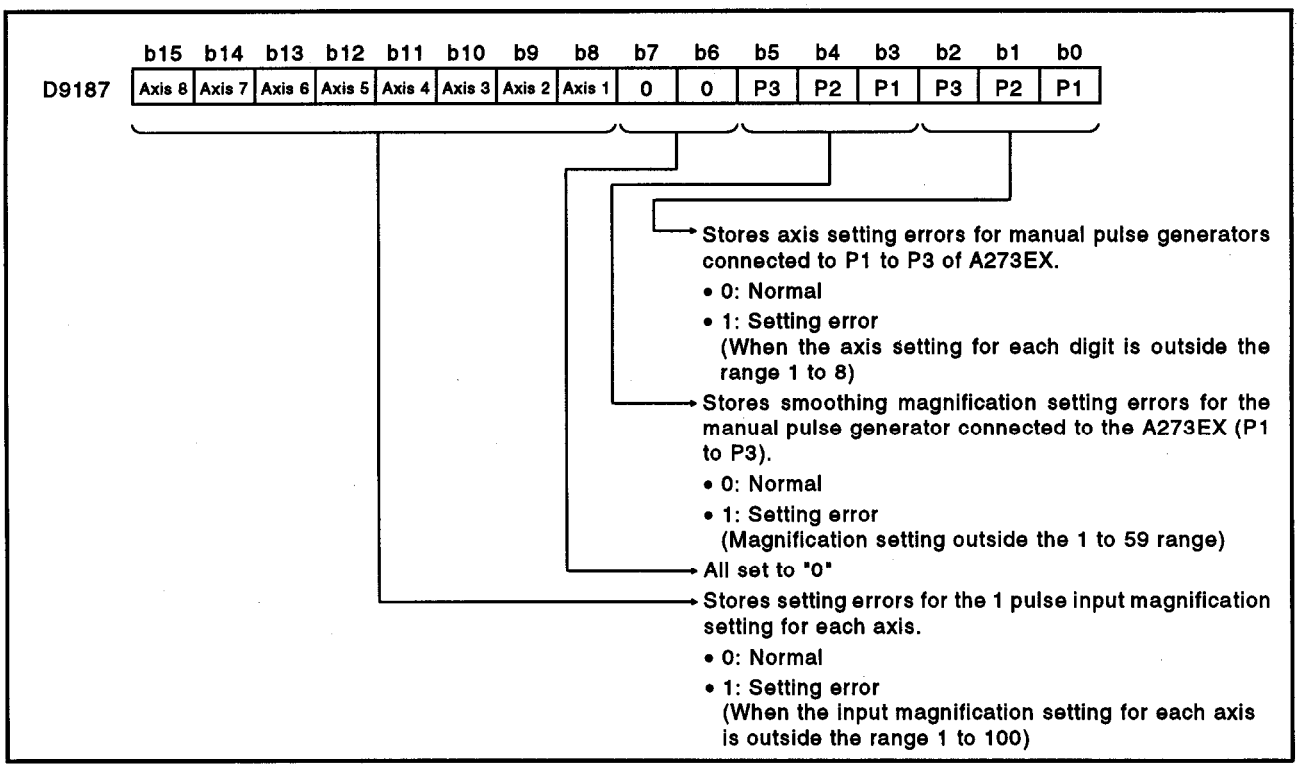
3.5.4 Manual pulse generator axis setting error (D9187/D9187/D9185 to D9187) ... Data from the PCPU to the SCPU

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

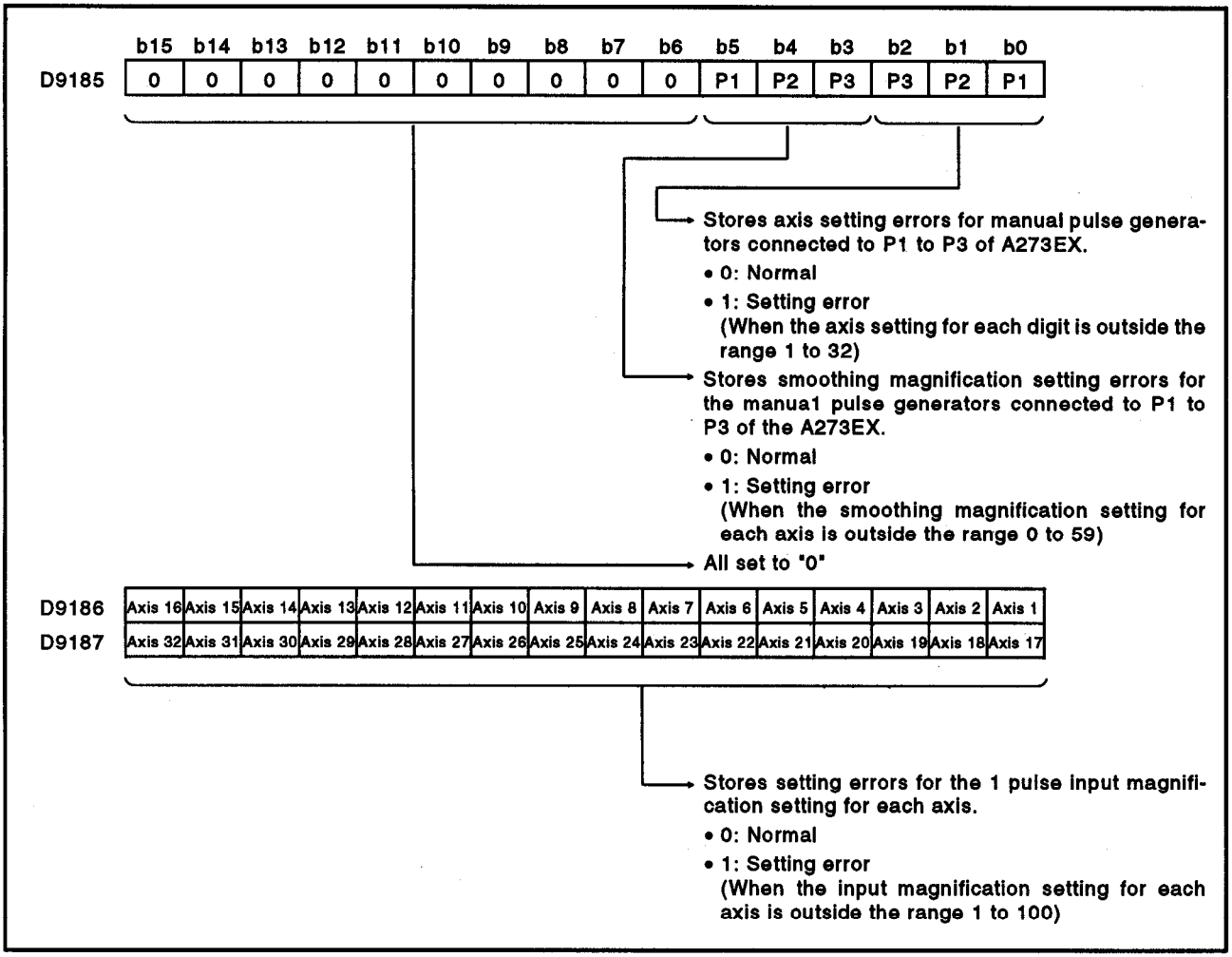
<A171SCPU>



<A273UHCPU (8 axis specification)>



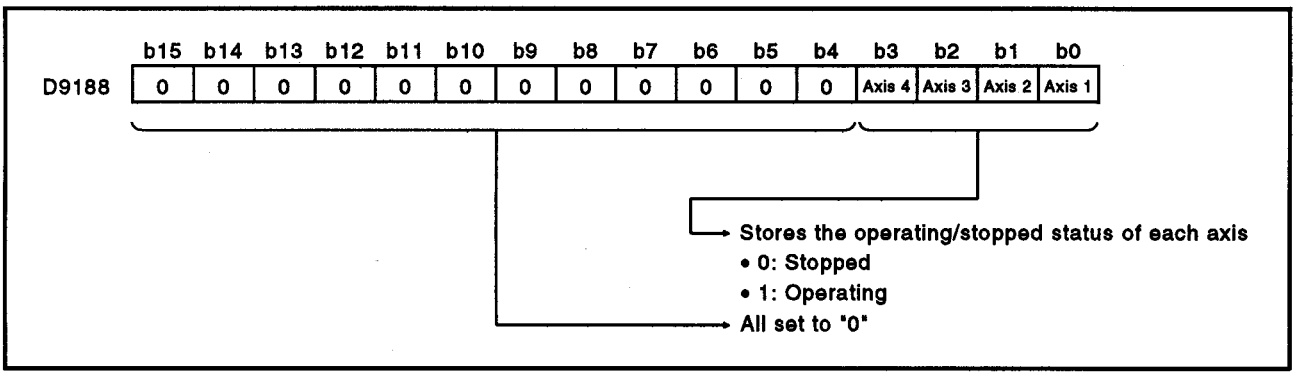
<A273UHCPU (32 axis specification)>



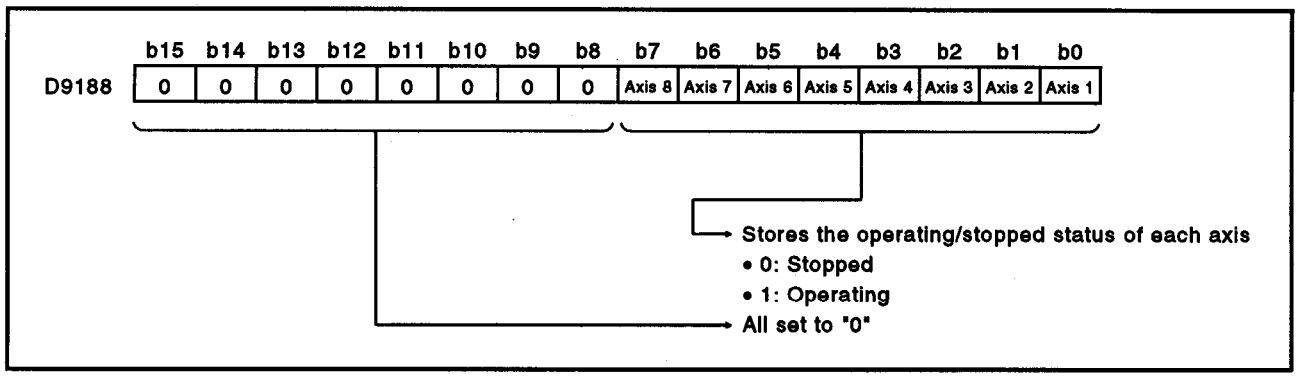
3.5.5 Test mode request error (D9188/D9188/D9182 to D9183) ... Data from the PCPU to the SCPU

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

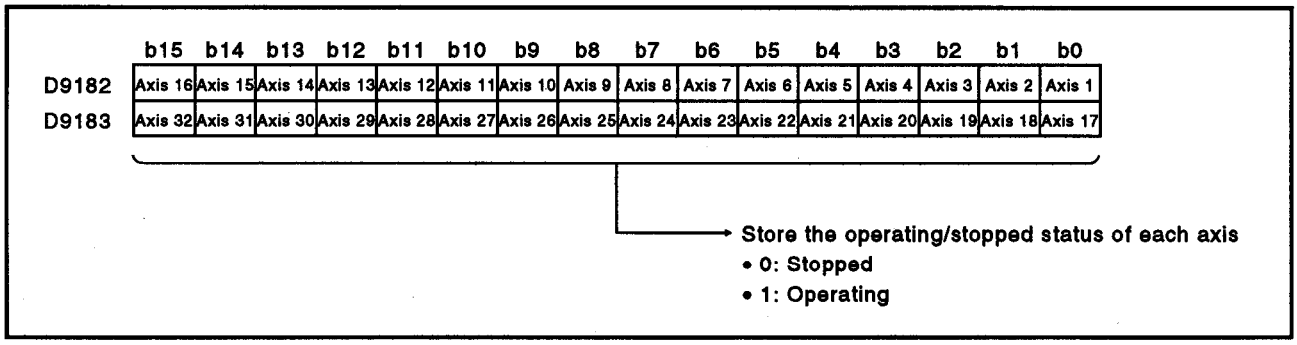
<A171SCPU>



<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

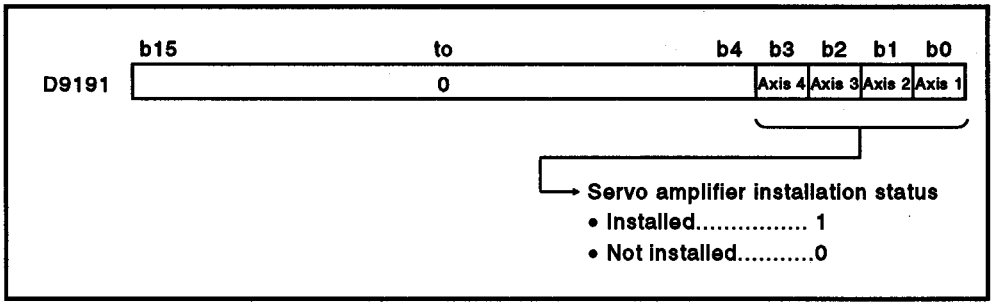
When the servo program setting error flag (M9079) comes ON, the error code that corresponds to the relevant setting item is stored in this device.

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.

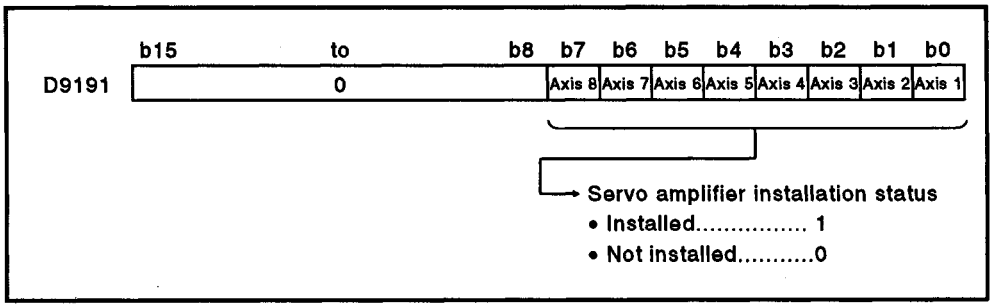
2) The system settings and servo amplifier installation statuses are indicated below.

System Setting	MR-[ ]-B	
	Installed	Not Installed
Used (axis number setting)	"1" is stored	"0" is stored
Unused	"0" is stored	"0" is stored

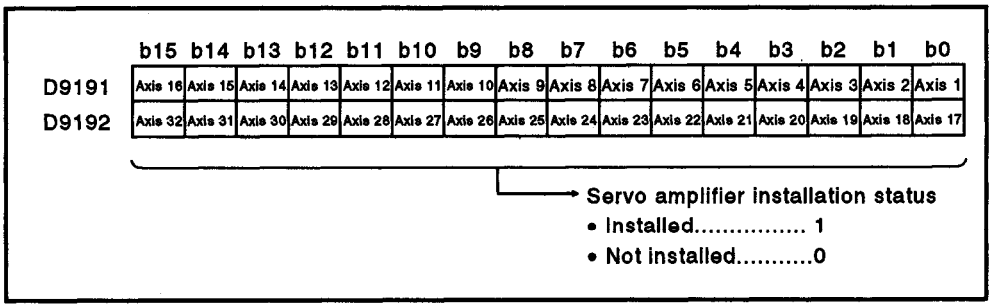
(2) When an A273UHCPU (8/32 axis specification) is used
On switching on the control power supply (A6[ ]P) to the servo system CPU or resetting, the servo amplifier and option slot installation status is checked and the result is stored in this device.
Lower 8 bits .... Servo amplifier installation status (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.

System Setting	ADU		MR-[ ]-B	
	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.

<A17ASCPU>

Manual Pulse 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	0 to 59
Manual pulse generator 2 (P2): D9193	
Manual pulse generator 3 (P3): D9194	

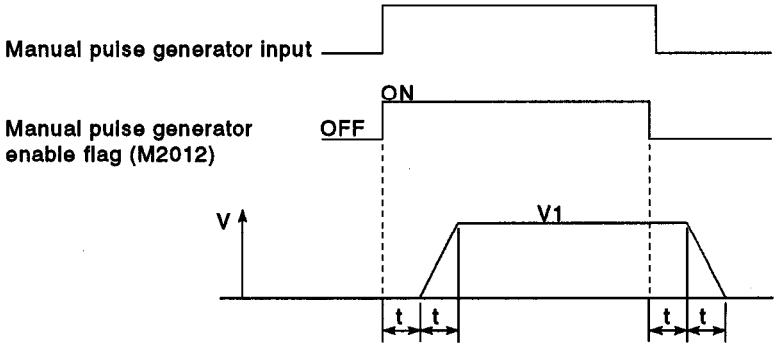
<A273UHCPU (32-axis)>

Manual Pulse Generator Smoothing Magnification Setting Register	Setting Range
Manual pulse generator 1 (P1): D752	0 to 59
Manual pulse generator 2 (P2): D753	
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) × 56.8 [ms]

(4) Operation



$$\text{Output speed (V1)} = \begin{pmatrix}\text{number of input}\\ \text{pulses / ms}\end{pmatrix} \times \begin{pmatrix}\text{1 manual pulse generator pulse}\\ \text{input magnification setting}\end{pmatrix}$$

$$\text{Travel value (L)} = \begin{pmatrix}\text{travel value}\\ \text{per pulse}\end{pmatrix} \times \text{number of input pulses} \times \begin{pmatrix}\text{1 manual pulse generator pulse}\\ \text{input magnification setting}\end{pmatrix}$$

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.