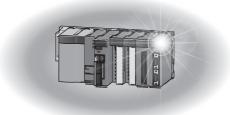


Motion Controller



Q173D(S)CPU/Q172D(S)CPU Motion Controller (SV13/SV22) Programming Manual (REAL MODE)

- -Q172DCPU
- -Q173DCPU
- -Q172DCPU-S1
- -Q173DCPU-S1
- -Q172DSCPU
- -Q173DSCPU





(Please read these instructions before using this equipment.)

Before using this product, please read this manual and the relevant manuals introduced in this manual carefully and pay full attention to safety to handle the product correctly.

These precautions apply only to this product. Refer to the Q173D(S)CPU/Q172D(S)CPU Users manual for a description of the Motion controller safety precautions.

In this manual, the safety instructions are ranked as "DANGER" and "CAUTION".



Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.

Indicates that incorrect handling may cause hazardous conditions, resulting in medium or slight personal injury or physical damage.

In any case, it is important to follow the directions for usage.

Please save this manual to make it accessible when required and always forward it to the end user.

For Safe Operations

1. Prevention of electric shocks

⚠DANGER

- 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 Motion controller and servo amplifier are charged and may lead to electric shocks.
- Completely turn off the externally supplied power used in the system before mounting or removing the module, performing wiring work, or inspections. Failing to do so 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.
- Be sure to ground the Motion controller, servo amplifier and servo motor. (Ground resistance:
 100 Ω or less) 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 Motion controller, servo amplifier and servo motor. 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 Motion controller, servo amplifier or servo motor terminal blocks while the power is ON, as this may lead to electric shocks.
- Do not touch the built-in power supply, built-in grounding or signal wires of the Motion controller and servo amplifier, as this may lead to electric shocks.

2. For fire prevention

∆ CAUTION

- Install the Motion controller, servo amplifier, servo motor and regenerative resistor on incombustible. Installing them directly or close to combustibles will lead to fire.
- If a fault occurs in the Motion controller or servo amplifier, shut the power OFF at the servo amplifier's power source. If a large current continues to flow, fire 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 fire
- 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 fire.
- Do not damage, apply excessive stress, place heavy things on or sandwich the cables, as this may lead to fire.

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.
- Do not touch the heat radiating fins of controller or servo amplifier, regenerative resistor and servo motor, etc., while the power is ON and for a short time after the power is turned OFF. In this timing, these parts become very hot and may lead to burns.
- Always turn the power OFF before touching the servo motor 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

ACAUTION

- Always install a leakage breaker on the Motion controller and servo amplifier power source.
- If installation of an electromagnetic contactor for power shut off during an error, etc., is specified in the instruction manual for the servo amplifier, etc., always install the electromagnetic contactor.
- Install the emergency stop circuit externally so that the operation can be stopped immediately and the power shut off.
- Use the Motion controller, servo amplifier, servo motor and regenerative resistor with the correct combinations listed in the instruction manual. Other combinations may lead to fire or faults.
- Use the Motion controller, base unit and motion module with the correct combinations listed in the instruction manual. Other combinations may lead to faults.
- If safety standards (ex., robot safety rules, etc.,) apply to the system using the Motion controller, servo amplifier and servo motor, make sure that the safety standards are satisfied.
- Construct a safety circuit externally of the Motion controller or servo amplifier if the abnormal operation of the Motion controller or servo amplifier differ from the safety directive operation in the system.
- In systems where coasting of the servo motor will be a problem during the forced stop, emergency stop, servo OFF or power supply 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 the forced stop, emergency stop, servo OFF or power supply OFF, use both dynamic brakes and electromagnetic brakes.

∆ CAUTION

- ◆ The dynamic brakes must be used only on errors that cause the forced stop, emergency stop, or servo OFF. These brakes must not be used for normal braking.
- The brakes (electromagnetic brakes) assembled into the servo motor are for holding applications, and must not be used for normal braking.
- The system must have a mechanical allowance so that the machine itself can stop even if the stroke limits 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.
- Use wires and cables within the length of the range described in the instruction manual.
- The ratings and characteristics of the parts (other than Motion controller, servo amplifier and servo motor) used in a system must be compatible with the Motion controller, servo amplifier and servo motor.
- Install a cover on the shaft so that the rotary parts of the servo motor are not touched during operation.
- There may be some cases where holding by the electromagnetic brakes is not possible due to the life or mechanical structure (when the ball screw and servo motor are connected with a timing belt, etc.). Install a stopping device to ensure safety on the machine side.

(2) Security

^CAUTION

To maintain the security (confidentiality, integrity, and availability) of the programmable controller and the system against unauthorized access, denial-of-service (DoS) attacks, computer viruses, and other cyberattacks from external devices via the network, take appropriate measures such as firewalls, virtual private networks (VPNs), and antivirus solutions.

(3) Parameter settings and programming

⚠ CAUTION

- Set the parameter values to those that are compatible with the Motion controller, servo amplifier, servo motor 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 supply module. 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.

∆CAUTION

- Set the servo motor 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 servo motor 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 intelligent function module's instruction manual for the program corresponding to the intelligent function module.

(4) Transportation and installation

∆CAUTION

- Transport the product with the correct method according to the mass.
- Use the servo motor suspension bolts only for the transportation of the servo motor. Do not transport the servo motor with machine installed on it.
- Do not stack products past the limit.
- When transporting the Motion controller or servo amplifier, never hold the connected wires or cables.
- When transporting the servo motor, never hold the cables, shaft or detector.
- When transporting the Motion controller or servo amplifier, never hold the front case as it may fall off
- When transporting, installing or removing the Motion controller or servo amplifier, never hold the edges.
- Install the unit according to the instruction manual in a place where the mass 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 Motion controller or servo amplifier and control panel inner surface or the Motion controller and servo amplifier, Motion controller or servo amplifier and other devices.

⚠ CAUTION

- Do not install or operate Motion controller, servo amplifiers or servo motors that are damaged or that have missing parts.
- Do not block the intake/outtake ports of the Motion controller, servo amplifier and servo motor with cooling fan.
- Do not allow conductive matter such as screw or cutting chips or combustible matter such as oil
 enter the Motion controller, servo amplifier or servo motor.
- The Motion controller, servo amplifier and servo motor are precision machines, so do not drop or apply strong impacts on them.
- Securely fix the Motion controller, servo amplifier and servo motor to the machine according to the instruction manual. If the fixing is insufficient, these may come off during operation.
- Always install the servo motor with reduction gears in the designated direction. Failing to do so may lead to oil leaks.

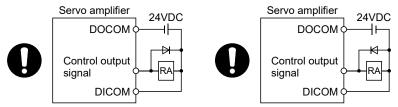
Store and use the unit in the following environmental conditions.

For insurance 4	Conditions	
Environment	Motion controller/Servo amplifier	Servo motor
Ambient temperature	According to each instruction manual.	0°C to +40°C (With no freezing) (32°F to +104°F)
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 (-4°F to +149°F)
Atmosphere	Indoors (where not subject to direct sunlight). No corrosive gases, flammable gases, oil mist or dust must exist	
Altitude	According to each instruction manual	
Vibration	According to each instruction manual	

- When coupling with the synchronous encoder or servo motor 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 synchronous encoder and servo motor shaft. Doing so may lead to shaft breakage.
- When not using the module for a long time, disconnect the power line from the Motion controller or servo amplifier.
- Place the Motion controller and servo amplifier in static electricity preventing vinyl bags and store.
- When storing for a long time, please contact with our sales representative.
 Also, execute a trial operation.
- When fumigants that contain halogen materials such as fluorine, chlorine, bromine, and iodine are used for disinfecting and protecting wooden packaging from insects, they cause malfunction when entering our products.
 - Please take necessary precautions to ensure that remaining materials from fumigant do not enter our products, or treat packaging with methods other than fumigation (heat method). Additionally, disinfect and protect wood from insects before packing products.

⚠ 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 servo motor.
- 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 (terminal U, V, W) and ground. Incorrect connections will lead the servo motor to operate abnormally.
- Do not connect a commercial power supply to the servo motor, 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.



For the sink output interface

For the source output interface

- Do not connect or disconnect the connection cables between each unit, the encoder cable or PLC expansion cable while the power is ON.
- Securely tighten the cable connector fixing screws and fixing mechanisms. Insufficient fixing may lead to the cables coming off during operation.
- Do not bundle the power line or cables.

(6) 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 Motion controller or absolute position motor has been replaced, always perform a home position return.
- Before starting test operation, set the parameter speed limit value to the slowest value, and make sure that operation can be stopped immediately by the forced stop, etc. if a hazardous state occurs.

(7) Usage methods

⚠ CAUTION

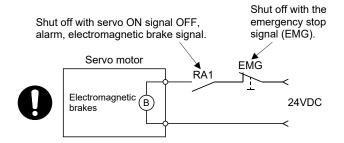
- Immediately turn OFF the power if smoke, abnormal sounds or odors are emitted from the Motion controller, servo amplifier or servo motor.
- Always execute a test operation before starting actual operations after the program or parameters have been changed or after maintenance and inspection.
- Do not attempt to disassemble and repair the units excluding a qualified technician whom our company recognized.
- Do not make any modifications to the unit.
- Keep the effect or electromagnetic obstacles to a minimum by installing a noise filter or by using wire shields, etc. Electromagnetic obstacles may affect the electronic devices used near the Motion controller or servo amplifier.
- When using the CE Mark-compliant equipment, refer to the User's manual for the Motion controllers and refer to the corresponding EMC guideline information for the servo amplifiers, inverters and other equipment.
- Use the units with the following conditions.

Item	Conditions
Input power	According to each instruction manual.
Input frequency	According to each instruction manual.
Tolerable momentary power failure	According to each instruction manual.

(8) Corrective actions for errors

∆CAUTION

- If an error occurs in the self diagnosis of the Motion controller 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 servo motor with electromagnetic brakes or install a brake mechanism externally.
- Use a double circuit construction so that the electromagnetic 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 after alarm release.
- 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.)

⚠ 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 Motion controller 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.
- Do not touch the lead sections such as ICs or the connector contacts.
- Before touching the module, always touch grounded metal, etc. to discharge static electricity from human body. Failure to do so may cause the module to fail or malfunction.
- Do not directly touch the module's conductive parts and electronic components.
 Touching them could cause an operation failure or give damage to the module.
- Do not place the Motion controller 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 Motion controller or servo amplifier, always set the new module settings correctly.
- When the Motion 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 Motion controller using programming software, switch on the power again, then perform a home position return operation.
 - 2) Using the backup function of the programming 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 drop or impact the battery installed to the module.
 Doing so may damage the battery, causing battery liquid to leak in the battery. Do not use the dropped or impacted battery, but dispose of it.
- 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 Motion controller or servo amplifier.
- The electrolytic capacitor and fan will deteriorate. Periodically replace these to prevent secondary damage from faults. Replacements can be made by our sales representative.
- Lock the control panel and prevent access to those who are not certified to handle or install electric equipment.
- Do not burn or break a module and servo amplifier. Doing so may cause a toxic gas.

(10) About processing of waste

When you discard Motion controller, servo amplifier, a battery (primary battery) and other option articles, please follow the law of each country (area).

⚠CAUTION

- This product is not designed or manufactured to be used in equipment or systems in situations that can affect or endanger human life.
- When considering this product for operation in special applications such as machinery or systems used in passenger transportation, medical, aerospace, atomic power, electric power, or submarine repeating applications, please contact your nearest Mitsubishi Electric sales representative.
- Although this product was manufactured under conditions of strict quality control, you are strongly advised to install safety devices to forestall serious accidents when it is used in facilities where a breakdown in the product is likely to cause a serious accident.

(11) General cautions

• 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.

REVISIONS

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

Print Date	* Manual Number	* The manual number is given on the bottom left of the back cover. Revision
Sep., 2007	IB(NA)-0300136-A	
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Nov., 2009	IB(NA)-0300136-B	-
		MR-J3W-□B, MR-J3-□B-RJ080W, MR-J3-□BS
		[Additional correction/partial correction]
		Safety precautions, About Manuals, Restrictions by the software's
		version or serial number, Servo amplifier display servo error code
		(#8008+20), Amplifier-less operation status flag (SM508), SSCNET
		control (Status_SD508), SSCNET control (Command_SD803),
0 0044	ID/NA) 0000400 C	Advanced S-curve acceleration/deceleration, Error code list, Warranty
Sep., 2011	IB(NA)-0300136-C	
		Q173DCPU-S1, Q172DCPU-S1, GX Works2, MR Configurator2
		[Additional function]
		External input signal (DOG) of servo amplifier, Home position return of
		scale home position signal detection method
		[Additional correction/partial correction]
		Safety precautions, About Manuals, Restrictions by the software's
M-= 0040	ID/NA) 0000400 D	version, Error code list
Mar., 2012	IB(NA)-0300136-D	[Additional model]
		Q173DSCPU, Q172DSCPU, MR-J4-□B, MR-J4W-□B
		[Additional function]
		Stroke limit invalid setting, Rapid stop deceleration time setting error
		invalid, Expansion parameters, Speed-torque control
		[Additional correction/partial correction]
		About Manuals, Manual Page Organization, Restrictions by the
		software's version, Programming software version, PI-PID switching
		command (M3217+20n), Parameter error No. (#8009+20n), Servo status1 (#8010+20n), Servo status2 (#8011+20n), Servo status3
		(#8012+20n), Maximum Motion operation cycle (SD524), System
		setting error information (SD550, SD551), Torque limit function, Error
		code list, Processing times of the Motion CPU
Sep., 2012	IB(NA)-0300136-E	[Additional function]
Оер., 2012	ID(IVA)-0300 I30-L	Advanced synchronous control
		[Additional correction/partial correction]
		About Manuals, Restrictions by the software's version, Programming
		software version, Positioning dedicated devices (Internal relays
		(M8192 to M12063), Data registers (D8192 to D19823)), External
		forced stop input ON latch flag (SM506), Operation method (SD560),
		Error code list, Processing times of the Motion CPU
Apr., 2013	IB(NA)-0300136-F	[Additional function]
, 1,51., 2010	.5(14.1) 0000 100-1	Acceleration/deceleration time change function, Home position return
		by the dogless home position signal reference method
		[Additional correction/partial correction]
		About Manuals, Restrictions by the software's version, Error code list,
		Processing times of the Motion CPU
Nov., 2013	IB(NA)-0300136-G	[Additional function]
1.107., 2010	.5() 000010010	Compatible with servo driver VC I series manufactured by CKD Nikki
		Denso Co., Ltd., compatible with inverter FR-A700 series
		[Additional correction/partial correction]
		Safety precautions, Restrictions by the software's version, Error code
		list
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Print Data	* Manual Number	Povision
Print Date Dec., 2015	* Manual Number IB(NA)-0300136-H	Revision [Additional function]
Dec., 2015	IB(NA)-0300 130-F	Compatible with optical hub unit, Driver home position return method home position return, Compatible with servo driver VPH series manufactured by CKD Nikki Denso Co., Ltd., Compatible with AlphaStep/5-phase stepping motor manufactured by ORIENTAL MOTOR Co., Ltd., Compatible with inverter FR-A800 series [Additional correction/partial correction] Restrictions by the software's version, Servo status7 (#8018+20n), Torque limit function, Error codes stored using the Motion CPU, Servo driver VCII series manufactured by CKD Nikki Denso Co., Ltd., Inverter FR-A700 series, Warranty
Mar., 2017	IB(NA)-0300136-J	[Additional function] Compatible with IAI electric actuator controller manufactured by IAI Corporation [Additional correction/partial correction] Safety precautions, Restrictions by the software's version, Error code list, Servo driver VCII series/VPH series manufactured by CKD Nikki Denso Co., Ltd., AlphaStep/5-phase stepping motor driver manufactured by ORIENTAL MOTOR Co., Ltd., Warranty
Dec., 2019	IB(NA)-0300136-K	[Additional correction/partial correction] Servo status1 (#8010+20n), Backlash compensation amount, Upper/lower stroke limit value, S-curve ratio, Control in the control unit "degree", Speed control with fixed position stop, Precautions for the manual pulse generator
Apr., 2022	IB(NA)-0300136-L	[Additional function] MR-J5-□B, MR-J5W-□B [Additional correction/partial correction] Safety precautions, About Manuals, Restrictions by the software's version, Gain changing 2 command (M3206+20n), Servo status5 (#8014+20n), Number of pulses/travel value per rotation, Position follow-up control, Error code list, Warranty
Dec., 2023	IB(NA)-0300136-M	[Additional model] MR-JE-□B [Additional correction/partial correction] About Manuals, Restrictions by the software's version, Speed change accepting flag (M2061 to M2092), Number of pulses/travel value per rotation, Travel value after proximity dog ON, Error code list
Sep., 2024	IB(NA)-0300136-N	[Additional correction/partial correction] Restrictions by the software's version, FR-A800 series detection error

Japanese Manual Number IB(NA)-0300128

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INTRODUCTION

Thank you for choosing the Mitsubishi Electric Motion controller Q173D(S)CPU/Q172D(S)CPU. Before using the equipment, please read this manual carefully to develop full familiarity with the functions and performance of the Motion controller you have purchased, so as to ensure correct use.

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About Manuals

The following manuals are also related to this product.

When necessary, order them by quoting the details in the tables below.

Related Manuals

(1) Motion controller

Manual Name	Manual Number (Model Code)
Q173D(S)CPU/Q172D(S)CPU Motion controller User's Manual This manual explains specifications of the Motion CPU modules, Q172DLX Servo external signal interface module, Q172DEX Synchronous encoder interface module, Q173DPX Manual pulse generator interface module, Power supply modules, Servo amplifiers, SSCNETII cables and Synchronous encoder, and the maintenance/inspection for the system, trouble shooting and others.	IB-0300133 (1XB927)
Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON) This manual explains the Multiple CPU system configuration, performance specifications, common parameters, auxiliary/applied functions, error lists and others.	IB-0300134 (1XB928)
Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (Motion SFC) This manual explains the functions, programming, debugging, error lists for Motion SFC and others.	IB-0300135 (1XB929)
Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE) This manual explains the servo parameters, positioning instructions, device lists, error lists and others.	IB-0300136 (1XB930)
Q173D(S)CPU/Q172D(S)CPU Motion controller (SV22) Programming Manual (VIRTUAL MODE) This manual explains the dedicated instructions to use the synchronous control by virtual main shaft, mechanical system program create mechanical module, servo parameters, positioning instructions, device lists, error lists and others.	IB-0300137 (1XB931)
Q173DSCPU/Q172DSCPU Motion controller (SV22) Programming Manual (Advanced Synchronous Control) This manual explains the dedicated instructions to use the synchronous control by synchronous control parameters, device lists, error lists and others.	IB-0300198 (1XB953)
Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (Safety Observation) This manual explains the details, safety parameters, safety sequence program instructions, device lists and error lists and others for safety observation function by Motion controller.	IB-0300183 (1XB945)
Motion controller Setup Guidance (MT Developer2 Version1) This manual explains the items related to the setup of the Motion controller programming software MT Developer2.	IB-0300142 (—)

(2) PLC

Manual Name	Manual Number (Model Code)
QCPU User's Manual (Hardware Design, Maintenance and Inspection) This manual explains the specifications of the QCPU modules, power supply modules, base units, extension cables, memory card battery, and the maintenance/inspection for the system, trouble shooting, error codes and others.	SH-080483ENG (13JR73)
QnUCPU User's Manual (Function Explanation, Program Fundamentals) This manual explains the functions, programming methods and devices and others to create programs with the QCPU.	SH-080807ENG (13JZ27)
QCPU User's Manual (Multiple CPU System) This manual explains the Multiple CPU system overview, system configuration, I/O modules, communication between CPU modules and communication with the I/O modules or intelligent function modules.	SH-080485ENG (13JR75)
QnUCPU User's Manual (Communication via Built-in Ethernet Port) This manual explains functions for the communication via built-in Ethernet port of the CPU module.	SH-080811ENG (13JZ29)
MELSEC-Q/L Programming Manual (Common Instruction) This manual explains how to use the sequence instructions, basic instructions, application instructions and micro computer program.	SH-080809ENG (13JW10)
MELSEC-Q/L/QnA Programming Manual (PID Control Instructions) This manual explains the dedicated instructions used to exercise PID control.	SH-080040 (13JF59)
MELSEC-Q/L/QnA Programming Manual (SFC) This manual explains the system configuration, performance specifications, functions, programming, debugging, error codes and others of MELSAP3.	SH-080041 (13JF60)
I/O Module Type Building Block User's Manual This manual explains the specifications of the I/O modules, connector, connector/terminal block conversion modules and others.	SH-080042 (13JL99)
MELSEC-L SSCNETII/H Head Module User's Manual This manual explains specifications of the head module, procedures before operation, system configuration, installation, wiring, settings, and troubleshooting.	SH-081152ENG (13JZ78)

(3) Servo amplifier

Manual Name	Manual Number (Model Code)
MR-J5-B/MR-J5W-B User's Manual (Introduction) This manual explains the specifications, functions, start-up procedure and others for AC Servo MR-J5-B/MR-J5W-B Servo amplifier.	IB-0300578ENG (—)
MR-J5 User's Manual (Hardware) This manual explains the installation, wiring, use option and others for AC Servo MR-J5-B/MR-J5W-B Servo amplifier.	SH-030298ENG (—)
MR-J5 User's Manual (Function) This manual explains how to use each function required to operate the AC Servo MR-J5-B/MR-J5W-B Servo amplifier.	SH-030300ENG (—)
MR-J5 User's Manual (Adjustment) This manual explains the operation status adjustment procedure, adjustment method and others for AC Servo MR-J5-B/MR-J5W-B Servo amplifier.	SH-030306ENG (—)
MR-J5 User's Manual (Troubleshooting) This manual explains the causes of alarms, and warnings, etc. for AC Servo MR-J5-B/MR-J5W-B Servo amplifier.	SH-030312ENG (—)
MR-J5-B/MR-J5W-B User's Manual (Parameters) This manual explains the parameters for AC Servo MR-J5-B/MR-J5W-B Servo amplifier.	IB-0300581ENG (—)
SSCNETII/H Interface AC Servo MR-J4B_(-RJ) Servo amplifier Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for AC Servo MR-J4B_(-RJ) Servo amplifier.	SH-030106 (1CW805)
SSCNETII/H Interface Multi-axis AC Servo MR-J4W2B/MR-J4W3B/MR-J4W2-0303B6 Servo amplifier Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for Multi-axis AC Servo MR-J4W2B/MR-J4W3B/MR-J4W2-0303B6 Servo amplifier.	SH-030105 (1CW806)
SSCNETⅢ interface MR-J3-□B Servo amplifier Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for MR-J3-□B Servo amplifier.	SH-030051 (1CW202)
SSCNETⅢ interface 2-axis AC Servo Amplifier MR-J3W-0303BN6/MR-J3W-□B Servo amplifier Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for 2-axis AC Servo Amplifier MR-J3W-0303BN6/MR-J3W-□B Servo amplifier.	SH-030073 (1CW604)
SSCNETII Compatible Linear Servo MR-J3-□B-RJ004U□ Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for Linear Servo MR-J3-□B-RJ004U□ Servo amplifier.	SH-030054 (1CW943)
SSCNETII Compatible Fully Closed Loop Control MR-J3-□B-RJ006 Servo amplifier Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for Fully Closed Loop Control MR-J3-□B-RJ006 Servo amplifier.	SH-030056 (1CW304)
SSCNETⅢ Interface Direct Drive Servo MR-J3-□B-RJ080W Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for Direct Drive Servo MR-J3-□B-RJ080W Servo amplifier.	SH-030079 (1CW601)

Manual Name	Manual Number (Model Code)
SSCNETⅢ interface Drive Safety integrated MR-J3-□B Safety Servo amplifier Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for safety	SH-030084 (1CW205)
integrated MR-J3-□B Safety Servo amplifier.	(121120)
SSCNETII/H interface AC Servo MR-JEB Servo amplifier Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for MR-JE-□B Servo amplifier.	SH-030152ENG (—)
SSCNETII/H interface AC Servo With functional safety MR-JEBF Servo amplifier Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for MR-JEBF Servo amplifier.	SH-030258ENG (—)

Manual Page Organization

The symbols used in this manual are shown below.

Symbol	Description
QDS(Symbol that indicates correspondence to only Q173DSCPU/Q172DSCPU.
QD	Symbol that indicates correspondence to only Q173DCPU(-S1)/Q172DCPU(-S1).

1. OVERVIEW

1.1 Overview

This programming manual describes the positioning control parameters, positioning dedicated devices and positioning method required to execute positioning control in the Motion controller (SV13/22 real mode).

The following positioning control is possible in the Motion controller (SV13/22 real mode).

Applicable CPU	Number of positioning control axes	
Q173DSCPU		
Q173DCPU (-S1)	Up to 32 axes	
Q172DSCPU	Up to 16 axes	
Q172DCPU (-S1)	Up to 8 axes	

In this manual, the following abbreviations are used.

Generic term/Abbreviation	Description		
Q173D(S)CPU/Q172D(S)CPU or	Q173DSCPU/Q172DSCPU/Q173DCPU/Q172DCPU/Q173DCPU-S1/		
Motion CPU (module)	Q172DCPU-S1 Motion CPU module		
	Q172DLX Servo external signals interface module/		
Q172DLX/Q172DEX/Q173DPX/	Q172DEX Synchronous encoder interface module ^(Note-1) /		
Q173DSXY or Motion module	Q173DPX Manual pulse generator interface module/		
	Q173DSXY Safety signal module		
MR-J5(W)-□B	Servo amplifier model MR-J5-□B/MR-J5W-□B		
MR-J4(W)-□B	Servo amplifier model MR-J4-□B/MR-J4W-□B		
MR-J3(W)-□B	Servo amplifier model MR-J3-□B/MR-J3W-□B		
MR-JE-□B	Servo amplifier model MR-JE-□B/MR-JE-□BF		
AMP or Servo amplifier	General name for "Servo amplifier model MR-J5-□B/MR-J5W-□B/MR-J4-□B/MR-J4W-□B/MR-J3-□B/MR-J3W-□B/MR-JE-□B/MR-JE-□BF"		
QCPU, PLC CPU or PLC CPU module	QnUD(E)(H)CPU/QnUDVCPU		
Multiple CPU system or Motion system	Abbreviation for "Multiple PLC system of the Q series"		
	Abbreviation for "CPU No.n (n= 1 to 4) of the CPU module for the Multiple CPU		
CPUn	system"		
Operating system software	General name for "SW7DNC-SV□Q□/SW8DNC-SV□Q□"		
SV13	Operating system software for conveyor assembly use (Motion SFC) :		
	SW8DNC-SV13Q□		
SV22	Operating system software for automatic machinery use (Motion SFC) : SW8DNC-SV22Q□		
Programming software package	General name for MT Developer2/GX Works2/GX Developer/MR Configurator□		
MT Works2	Abbreviation for "Motion controller engineering environment MELSOFT MT Works2"		
MT Developer2 ^(Note-2)	Abbreviation for "Motion controller programming software MT Developer2		
TWIT Developer2	(Version 1.00A or later)"		
GX Works2	Abbreviation for "Programmable controller engineering software		
GA VVOINSZ	MELSOFT GX Works2 (Version 1.15R or later)"		
GX Developer	Abbreviation for "MELSEC PLC programming software package		
GV Developel	GX Developer (Version 8.48A or later)"		
MR Configurator□	General name for "MR Configurator/MR Configurator2"		

1 OVERVIEW

Generic term/Abbreviation	Description
MR Configurator	Abbreviation for "Servo setup software package MR Configurator (Version C0 or later)"
MR Configurator2 ^(Note-2)	Abbreviation for "Servo setup software package MR Configurator2 (Version 1.01B or later)"
Serial absolute synchronous encoder or Q171ENC-W8/Q170ENC	Abbreviation for "Serial absolute synchronous encoder (Q171ENC-W8/Q170ENC)"
SSCNETII/H ^(Note-3) SSCNETII ^(Note-3)	High speed synchronous network between Motion controller and servo amplifier
SSCNETII(/H)	General name for SSCNETⅢ/H, SSCNETⅢ
Absolute position system	General name for "system using the servo motor and servo amplifier for absolute position"
Battery holder unit	Battery holder unit (Q170DBATC)
Intelligent function module	General name for module that has a function other than input or output, such as A/D converter module and D/A converter module.
SSCNETⅢ/H head module	Abbreviation for "MELSEC-L series SSCNETⅢ/H head module (LJ72MS15)"
Optical hub unit or MR-MV200	Abbreviation for "SSCNETII/H compatible optical hub unit (MR-MV200)"

(Note-1): Q172DEX can be used in SV22.

(Note-2): This software is included in Motion controller engineering environment "MELSOFT MT Works2".

(Note-3): SSCNET: \underline{S} ervo \underline{S} ystem \underline{C} ontroller \underline{NET} work

REMARK

For information about each module, design method for program and parameter, refer to the following manuals relevant to each module.

	Item	Reference Manual
Motion CPU module/Motion unit		Q173D(S)CPU/Q172D(S)CPU Motion controller User's Manual
PLC CPU, peripheral devices for sequence program design, I/O modules and intelligent function module		Manual relevant to each module
Operation method	od for MT Developer2	Help of each software
SV13/SV22	Multiple CPU system configuration Performance specification Design method for common parameter Auxiliary and applied functions (common) Design method for Motion SFC program Design method for Motion SFC parameter Motion dedicated PLC instruction Design method for safety observation parameter Design method for user made safety sequence program	Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON) Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (Motion SFC) Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (Safety Observation)
SV22	Design method for mechanical system	Q173D(S)CPU/Q172D(S)CPU Motion controller (SV22)
(Virtual mode)	program	Programming Manual (VIRTUAL MODE)
SV22 (Advanced synchronous control)	Design method for synchronous control parameter	Q173DSCPU/Q172DSCPU Motion controller (SV22) Programming Manual (Advanced Synchronous Control)

△ 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.

1.2 Features

1.2.1 Performance Specifications

(1) Motion control specifications

14 -		047000001	0470000011	047000011/ 04)	047000011/ 04)	
Item		Q173DSCPU	Q172DSCPU	Q173DCPU(-S1)	Q172DCPU(-S1)	
Number of control ax	xes	Up to 32 axes	Up to 16 axes	Up to 32 axes	Up to 8 axes	
Operation cycle (default)	SV13	0.22ms/ 1 to 4 axes 0.44ms/ 5 to 10 axes 0.88ms/ 11 to 24 axes 1.77ms/25 to 32 axes	0.22ms/ 1 to 4 axes 0.44ms/ 5 to 10 axes 0.88ms/ 11 to 16 axes	0.44ms/ 1 to 6 axes 0.88ms/ 7 to 18 axes 1.77ms/19 to 32 axes	0.44ms/ 1 to 6 axes 0.88ms/ 7 to 8 axes	
	SV22	0.44ms/ 1 to 6 axes 0.88ms/ 7 to 16 axes 1.77ms/17 to 32 axes	0.44ms/ 1 to 6 axes 0.88ms/ 7 to 16 axes	0.44ms/ 1 to 4 axes 0.88ms/ 5 to 12 axes 1.77ms/13 to 28 axes 3.55ms/29 to 32 axes	0.44ms/ 1 to 4 axes 0.88ms/ 5 to 8 axes	
Interpolation function	ns	Linear	interpolation (Up to 4 axes Helical interpo	s), Circular interpolation (2 plation (3 axes)	axes),	
Control modes	PTP(Point to Point) control, Speed control, Speed-position switching control, Fixed-pitch feed, Constant speed control, Position follow-up control, Speed control with fixed position stop, Speed switching control Speed switching control		control, Fixed-pitch feed, Position follow-up control, fixed position stop, hing control, cillation control,			
Acceleration/deceleration control		method)) Trapezoidal acceleration/deceleration, S-curve acceleration/deceleration, Advanced S-curve acceleration/deceleration				
Compensation		Backlash compensation, Electronic gear, Phase compensation (SV22)				
Programming langua	age	Motion SFC, Ded Mechanical support la	icated instruction,	ed instruction, Motion SFC, Dedicated instructi		
Servo program capa	acity	16k steps				
Number of positioning	ng points	3200 points (Positioning data can be designated indirectly)				
Peripheral I/F		USB/RS-232/Ether PERIPHERAL I	net (Via PLC CPU) /F (Motion CPU)		net (Via PLC CPU) Motion CPU) ^(Note-2)	
Home position return	n function	Proximity dog m Count metho Data set method (2 type Stopper meth Limit switch cor Scale home position si Dogless home position s	nethod (2 types), od (3 types), es), Dog cradle method, nod (2 types), mbined method, gnal detection method, signal reference method, ion return method	Proximity dog method (2 types), Count method (3 types), Data set method (2 types), Dog cradle r Stopper method (2 types), od, Limit switch combined method, hod, Scale home position signal detection m		
JOG operation funct	ion	Home position return re-try function provided, home position shift function provided		notion provided		
Manual pulse general operation function		Provided Possible to connect 3 modules (Q173DPX use) Possible to connect 1 module (Built-in interface in Motion CPU use) (Note-3)		nodules (Q173DPX use)		
Synchronous encode function (Note-4)	er operation	(Q172DEX + Q173DP		e) in Possible to connect 12 Possible to connect 12 modules (SV22 use) modules (SV		

Motion control specifications (continued)

Ite	em	Q173DSCPU	Q172DSCPU	Q173DCPU(-S1)	Q172DCPU(-S1)			
M-code function			•					
codo idilodon		M-code output function provided, M-code completion wait function provided Number of output points 32 points						
	SV13	Watch data: Motion control data/Word device						
		Virtual mode switching m						
Limit switch outp	out	Number of output poi						
function		Advanced synchronous of	•	Number of output	t points 32 points			
Tarrottorr	SV22	•	nts 64 points × 2 settings	·	introl data/Word device			
		Output timing compe	-	vatori data. Motiori de	into data/vvora device			
		Watch data: Motion contr						
ROM operation	function	Provided						
Multiple CPU sy								
control (Note-5)	no no no do	Prov	vided	No	one			
		O172DLX External input	signals (FLS/RLS/DOG)					
External input si	ignal	-	amplifier,		ernal input signals			
	.gdi		ion CPU (DI), Bit device	(FLS/RLS/DOG)	of servo amplifier			
			vided					
High-speed read	ding function		ce in Motion CPU,		vided			
(Note-7)	ang ranodon	•	module,	(Via input modul	e, Via tracking of			
			72DEX/Q173DPX)	Q172DEX/	Q173DPX)			
			on controller forced stop (E	MI connector System set	ting)			
Forced stop		Wiod	Forced stop termina		g),			
		Total 25	66 points	ar or corre amplinor				
Number of I/O p	oints	(Built-in interface in Motion CPU (Input 4 points) +		Total 25	Total 256 points			
ramber of #0 p	onto	*	ent function module)	(I/O m	odule)			
		i	etection mode,					
	Mark detection		of detection mode,					
	mode setting	·	fer mode	. None				
Mark detection	Mark detection		otion CPU (4 points),					
function	signal	Bit device, DOG/CHANGE signal of Q172DLX		None				
	Mark detection	Bit device, Bee/er ii ti	TOL digital of Q 17 EDEX	1				
	setting	32 settings						
Clock function	, ····· 3		Prov	Provided				
		Prov	vided		vided			
Security function	า		security key or password)		by password)			
All clear function	า	(rided	<u> </u>			
Remote operation				, Remote latch clear				
. torrioto oporatio		Un to 6	data/axis	, . terrioto iatori ologi				
Optional data	SSCNET Ⅲ /H		a: Up to 6 points/axis)	No	one			
monitor		(Serimanioadori date	Up to 3 (lata/axis				
function	SSCNETⅢ		(Communication data					
	1	Motion buffe			ering method			
Digital oscillosco	ope function	Motion buffering method Motion buffering m (Real-time waveform can be displayed) (Real-time waveform can		=				
_19161 000110000		· ·	ord 16CH, Bit 16CH	•	ord 4CH, Bit 8CH			
				•				
Absolute positio	n svstem		Made compatible by setting battery to servo amplifier. (No battery required when a servo motor with a batteryless absolute position encoder is used					
	5,0.0	, , , , , ,	(Possible to select the absolute data method or incremental method for each axis)					
	Communication	(1 0001010 10 30	and abbolate data met	or more mornar mornoc				
SSCNET	type	SSCNET Ⅲ /ŀ	I, SSCNET Ⅲ	SSC	NET II			
communication	Number of	 						
(Note-8)	lines	2 lines (Note-9)	1 line ^(Note-9)	2 lines	1 line			
	111100	<u>l</u>						

Motion control specifications (continued)

_					
Item		Q173DSCPU	Q172DSCPU	Q173DCPU(-S1)	Q172DCPU(-S1)
Driver communication function (Note-10)		Provided		None	
	Q172DLX	4 modules usable	2 modules usable	4 modules usable	1 module usable
Number of	Q172DEX		4 modules usable		
Motion related modules	Q173DPX	4 modules usable ^(Note-11)			3 modules usable (Note-11)
Number of SSCNETII/H head module connection stations		Up to 8 stations usable (Up to 4 stations/line)	Up to 4 stations usable	e Unusable	
Number of optical hub unit connections		Up to 32 units usable (Up to 16 units/line)	Up to 16 units usable	Unus	sable

- (Note-1): SV22 virtual mode only
- (Note-2): Q173DCPU-S1/Q172DCPU-S1 only
- (Note-3): When the manual pulse generator is used via the built-in interface in Motion CPU, the Q173DPX cannot be used.
- (Note-4): Any incremental synchronous encoder connected to the built-in interface in Motion CPU will automatically be assigned an Axis No. one integer greater than the number of encoders connected to any Q172DEX modules and Q173DPX modules.
- (Note-5): SV22 advanced synchronous control only
- (Note-6): Servo amplifier (MR-J5(W)-□B/MR-J4(W)-□B) only.

Refer to "Q173DSCPU/Q172DSCPU Motion controller Programming Manual (Advanced Synchronous Control)" for details on devices that can be used as a synchronous encoder axis.

- (Note-7): This cannot be used in SV22 advanced synchronous control.
- (Note-8): The servo amplifiers for SSCNET cannot be used.
- (Note-9): SSCNETⅢ and SSCNETⅢ/H cannot be combined in the same line.

 For Q173DSCPU, SSCNETⅢ or SSCNETⅢ/H can be set every line.
- (Note-10): Servo amplifier (MR-J5-□B/MR-J4-□B/MR-J3-□B) only.
- (Note-11): When using the incremental synchronous encoder (SV22 use), you can use above number of modules. When connecting the manual pulse generator, you can use only 1 module.

MEMO	

1.3 Restrictions by the Software's Version

There are restrictions in the function that can be used by the version of the operating system software and programming software.

The combination of each version and a function is shown in Table1.1.

Table 1.1 Restrictions by the Software's Version

	<u> </u>		
	Operating system softw		
Function	Q173DSCPU/Q172DSCPU	Q173DCPU(-S1)/Q172DCPU(-S1)	
Checking Motion controller's serial number and operating		00D	
system software version in GX Developer	_	OOD	
Advanced S-curve acceleration/deceleration			
(Except constant-speed control (CPSTART) of servo	_	00H	
program.)			
Direct drive servo		00H	
MR-J3-□B-RJ080W	_	000	
Servo amplifier display servo error code (#8008+20n)	_	00H	
0.44ms fixed-cycle event task	_	00H	
444µs coasting timer (SD720, SD721)	_	00H	
Synchronous encoder current value monitor in real mode	_	00H	
Display of the past ten times history in current value history		00H	
monitor	_	OOH	
Amplifier-less operation	_	00H	
Servo instruction (Home position return (ZERO), high			
speed oscillation (OSC)) and manual pulse generator	_	00H	
operation in mixed function of virtual mode/real mode			
Advanced S-curve acceleration/deceleration in constant-		00K	
speed control (CPSTART) of servo program.		OOK	
External input signal (DOG) of servo amplifier in home			
position return of count method and speed-position	_	00G	
switching control			
Communication via PERIPHERAL I/F		00H	
Motion SFC operation control instruction		00L	
Type conversion (DFLT, SFLT)	_	OOL	
Vision system dedicated function (MVOPEN, MVLOAD,	_	00L	
MVTRG, MVPST, MVIN, MVFIN, MVCLOSE, MVCOM)	_	OOL	
Home position return of scale home position signal	_	00L	
detection method	_	OOL	
Real time display function in digital oscilloscope function	<u> </u>	00N	
Rapid stop deceleration time setting error invalid function		00S	

	Programming software version			
	rks2 (MT Developer2)	MR Configurator2	MR Configurator	Section of reference
Q173DSCPU/Q172DSCPU	Q173DCPU(-S1)/Q172DCPU(-S1)	t Goiga.a.c	····· t deiga.a.a.e.	
_	_	_	1	(Note-2)
1.39R	1.06G	_	I	Section 4.3.3 Section 6.1.7
1.39R	1.06G	1.01B	C2	
_	_	_	_	Section 3.3
1.39R	1.06G	_		(Note-3)
_	_	_		(Note-5)
_	_	_		(Note-4)
1.39R	1.06G	_	_	(Note-5)
_	_	_	_	(Note-5)
1.39R	1.09K			(Note-4)
1.39R	1.09K	_	_	Section 6.17.3 Section 6.17.4
1.39R	1.15R			
1.39R	1.15R	_	_	(Note-5)
1.39R	1.15R	_	_	(Note-3)
1.39R	1.15R	_	_	(Note-3)
1.39R	1.15R	_	_	Section 6.23.13
1.39R	1.17T			
 				Section 4.3.1

—: There is no restriction by the version.

(Note-1): SV13/SV22 is the completely same version.

(Note-2): The operating system software version can be confirmed in the operating system software (CD-ROM), MT Developer2 or GX Works2/GX Developer. (Refer to "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON) Section 1.3, 1.4".)

(Note-3): Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (Motion SFC)

(Note-4): Q173D(S)CPU/Q172D(S)CPU Motion controller (SV22) Programming Manual (VIRTUAL MODE)

(Note-5): Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)

(Note-6): Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (Safety Observation)

(Note-7): Q173DSCPU/Q172DSCPU Motion controller (SV22) Programming Manual (Advanced Synchronous Control)

Table 1.1 Restrictions by the Software's Version (continued)

_	•	•	•	
		Operating system soft	ware version (Note-1), (Note-2)	
Function		Q173DSCPU/Q172DSCPU	Q173DCPU(-S1)/Q172DCPU(-S1)	
Vision system dedicated function (MVOUT)		_	008	
Motion SFC operation control instruction				
Program control (IF - ELSE - IEND, SELE	ECT -CASE - SEND,	_	00R	
FOR -NEXT, BREAK)				
Display format depending on the error se	tting data	_	008	
information of motion error history device	(#8640 to #8735)		000	
Product information list device (#8736 to	#8751)	-	00S	
Safety observation function			00S	
Feed current value update command (M3	3212+20n) valid in	00B	Not support	
speed control (I)		005	Not Support	
External forced stop input ON latch (SM5	06)	00B	00S	
Operation method (SD560)		00B	Not support	
Advanced synchronous control		00B	Not support	
Limit switch output function expansion		00B	Not support	
Driver communication function (SSCNET	Ш)	00C	Not support	
Intelligent function module support	Intelligent function module support		Not support	
SSCNETIII/H head module connection		00C	Not support	
Cam auto-generation (CAMMK) easy stroke ratio cam		00C	Not support	
Acceleration/deceleration time change fu	nction	00C	Not support	
Home position return of dogless home po	sition signal	000	Not august	
reference method		00C	Not support	
Setting range expansion of backlash comp	ensation amount	00C	Not support	
Multiple CPU synchronous control		00C	Not support	
Cam axis length per cycle change during	synchronous control	00C	Not support	
Servo driver VCI series manufactured	SSCNET	_	OOL	
by CKD Nikki Denso Co., Ltd.	SSCNETII/H	00D	Not support	
Inverter FR-A700 series		_	_	
Synchronous encoder via servo amplifier		00D	Not support	
Driver communication function (SSCNETII/H)		00D	Not support	
Optical hub unit connection		00F	Not support	
Home position return of driver home position return method		00H	Not support	
Stepping motor module AlphaStep/5-phase manufactured by ORIENTAL MOTOR Co., Ltd.		00H	Not support	
Servo driver VPH series manufactured by CKD Nikki Denso Co., Ltd.		00Н	Not support	
IAI electric actuator controller manufacture	d by IAI Corporation	00H	Not support	
Inverter FR-A800 series		00J	Not support	

	Programming software version			
	MELSOFT MT Works2 (MT Developer2)		MR Configurator	Section of reference
Q173DSCPU/Q172DSCPU	Q173DCPU(-S1)/Q172DCPU(-S1)			(1) (0)
1.39R	1.39R			(Note-3)
1.39R	1.39R	_	_	(Note-3)
_	_	_	_	(Note-3)
_	_	_	_	Section 3.3
1.39R	1.39R	_	_	(Note-6)
_	Not support	_		Section 6.13
_	_	_		(Note-5)
_	Not support	_	_	(Note-5)
1.47Z	Not support	_		(Note-7)
1.47Z	Not support	_	1	(Note-5)
_	Not support	_	1	(Note-5)
1.56J	Not support	_	1	(Note-5)
1.56J	Not support	_	1	(Note-5)
1.56J	Not support	_	1	(Note-3)
1.56J	Not support	_		Section 7.8
1.56J	Not support	_	_	Section 6.23.14
1.56J	Not support	_	_	Section 7.2
1.56J	Not support	_	_	(Note-7)
1.56J	Not support	_	_	(Note-7)
1.34L	1.15R	_	_	Appendix 6.1
1.56J	Not support	_	_	Appendix 6.1
1.34L	1.15R	_	_	Appendix 6.2
1.68W	Not support	1.23Z	Not support	(Note-7)
1.68W	Not support	1.23Z	Not support	(Note-5)
_	Not support	_	_	Appendix 6.4
1.118Y	Not support	_	_	Section 6.23.15
1.118Y	Not support	_	_	Appendix 6.5
1.118Y	Not support	_		Appendix 6.1
 1.118Y	Not support	_	_	Appendix 6.6
 1.120A	Not support	_	_	Appendix 6.3

—: There is no restriction by the version.

(Note-1): SV13/SV22 is the completely same version.

(Note-2): The operating system software version can be confirmed in the operating system software (CD-ROM), MT Developer2 or GX Works2/GX Developer. (Refer to "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON) Section 1.3, 1.4".)

 $(Note-3): Q173D(S)CPU/Q172D(S)CPU\ Motion\ controller\ (SV13/SV22)\ Programming\ Manual\ (Motion\ SFC)$

(Note-4): Q173D(S)CPU/Q172D(S)CPU Motion controller (SV22) Programming Manual (VIRTUAL MODE)

(Note-5): Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)

 $(Note-6): Q173D(S)CPU/Q172D(S)CPU\ Motion\ controller\ Programming\ Manual\ (Safety\ Observation)$

(Note-7): Q173DSCPU/Q172DSCPU Motion controller (SV22) Programming Manual (Advanced Synchronous Control)

Table 1.1 Restrictions by the Software's Version (continued)

	Operating system software		
Function	Q173DSCPU/Q172DSCPU	Q173DCPU(-S1)/Q172DCPU(-S1)	
Improvement of absolute positioning operation for servo driver VCII/VPH series manufactured by CKD Nikki Denso Co., Ltd., and stepping motor module AlphaStep/5-phase manufactured by ORIENTAL MOTOR Co., Ltd.	00L	Not support	
Servo amplifier MR-J5(W)-□B support	00Y	Not support	
DOG/CHANGE signal input method support	00Y	Not support	
Servo amplifier MR-JE-□B support	0AA	Not support	
Mark detection signal input method support	0AB	Not support	
Fixed cycle system processing time monitor	0AB	Not support	

	Programming software version				
	MELSOFT MT Works2 (MT Developer2)		MDO	MD Configuration	Section of reference
	Q173DSCPU/Q172DSCPU	Q173DCPU(-S1)/Q172DCPU(-S1)	MR Configurator2	MR Configurator	
	_	Not support	_	_	Appendix 6.1 Appendix 6.5
	1.170C	Not support	1.130L	Not support	
	1.170C	Not support	_	_	(Note-5)
	1.187V	Not support	1.145B	Not support	
	1.190Y	Not support	_	_	(Note-5)
·		Not support	_	_	(Note-5)

—: There is no restriction by the version.

(Note-1): SV13/SV22 is the completely same version.

(Note-2): The operating system software version can be confirmed in the operating system software (CD-ROM), MT Developer2 or GX Works2/GX Developer. (Refer to "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON) Section 1.3. 1.4".)

(Note-3): Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (Motion SFC)

(Note-4): Q173D(S)CPU/Q172D(S)CPU Motion controller (SV22) Programming Manual (VIRTUAL MODE)

(Note-5): Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)

(Note-6): Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (Safety Observation)

(Note-7): Q173DSCPU/Q172DSCPU Motion controller (SV22) Programming Manual (Advanced Synchronous Control)

1.4 Programming Software Version

The programming software versions that support Motion CPU are shown below.

M. C. OPU	MELSOFT MT Works2 (MT Developer2)		MD O f	MD 0 5 1	
Motion CPU	SV13/SV22	SV43	MR Configurator2	MR Configurator	
Q173DSCPU	1.39R ^(Note-1)		1.10L	Not support	
Q172DSCPU	1.39R (Note-1)		1.10L	Not support	
Q173DCPU-S1	1.00A (Note-2)	1.03D (Note-3)	1.00A	C0 (Note-4)	
Q172DCPU-S1	1.00A (Note-2)	1.03D (Note-3)	1.00A	C0 (Note-4)	
Q173DCPU	1.00A	1.03D	1.00A	C0 (Note-4)	
Q172DCPU	1.00A	1.03D	1.00A	C0 (Note-4)	

(Note-1): Use version 1.47Z or later to use advanced synchronous control method.

(Note-2): Use version 1.12N or later to communicate via PERIPHERAL I/F.

(Note-3): Use version 1.23Z or later to communicate via PERIPHERAL I/F.

(Note-4): Use version C1 or later to use MR Configurator combination with MT Developer2.

2. POSITIONING CONTROL BY THE MOTION CPU

2.1 Positioning Control by the Motion CPU

The following positioning controls are possible in the Motion CPU.

Q173DSCPU/Q173DCPU(-S1): Up to 32 axes
 Q172DSCPU : Up to 16 axes
 Q172DCPU(-S1) : Up to 8 axes

There are following five functions as controls toward the servo amplifier/servo motor.

(1) Servo operation by the positioning instructions.

There are following two methods for execution of the positioning instruction.

(a) Programming using the motion control step "K" of Motion SFC.

The starting method of Motion SFC program is shown below.

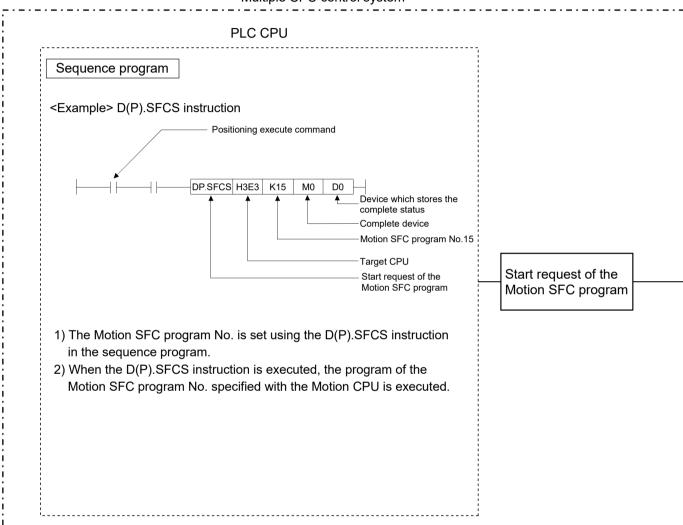
- 1) Motion SFC start request of PLC CPU
- Automatic start setting of Motion SFC program
 (Note): Step "K" of the positioning instruction cannot be programmed to NMI task and event task.
- 3) Start by the Motion SFC program
- (b) Execution of servo program by the servo program start request of PLC CPU.
- (2) JOG operation by each axis command signal of Motion CPU.
- (3) Manual pulse generator operation by the positioning dedicated device of Motion CPU.
- (4) Speed change, torque limit value change, torque limit value individual change and target position change during positioning control by the Motion dedicated PLC instruction and Motion dedicated function of operation control step "F". (Note): Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22)Programming Manual (Motion SFC)" for the Motion dedicated PLC instruction.
- (5) Current value change by the Motion dedicated PLC instruction or servo instructions.

[Execution of the Motion SFC program start (D(P).SFCS instruction)]

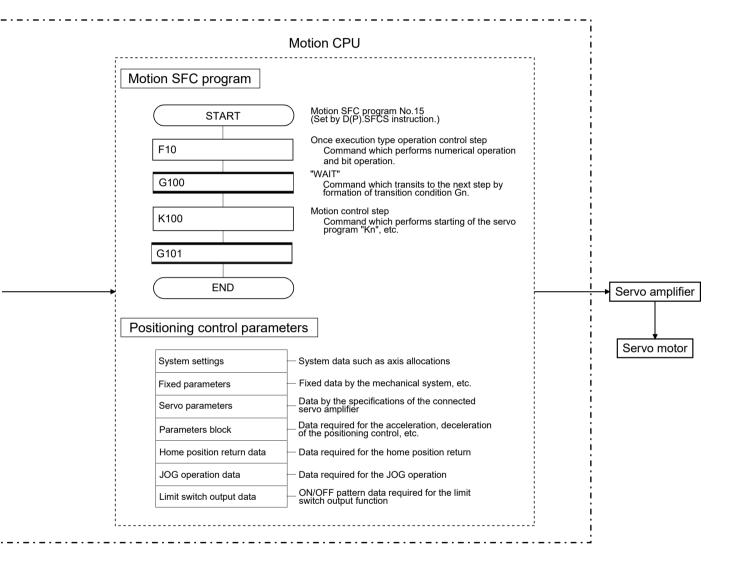
Positioning control is executed by starting the Motion SFC program specified with D(P).SFCS instruction of the PLC CPU in the Motion CPU. (The Motion SFC program can also be started automatically by parameter setting.)

An overview of the starting method using the Motion SFC is shown below.

Multiple CPU control system



- (1) Create/set the sequence programs, Motion SFC programs and positioning control parameters using a programming software package.
- (2) Perform the positioning start using the sequence program (D(P).SFCS instruction) of PLC CPU.
 - (a) Motion SFC program No. is specified with the D(P).SFCS instruction.
 - 1) Motion SFC program No. can be set either directly or indirectly.
- (3) Perform the specified positioning control using the specified with Motion SFC program.

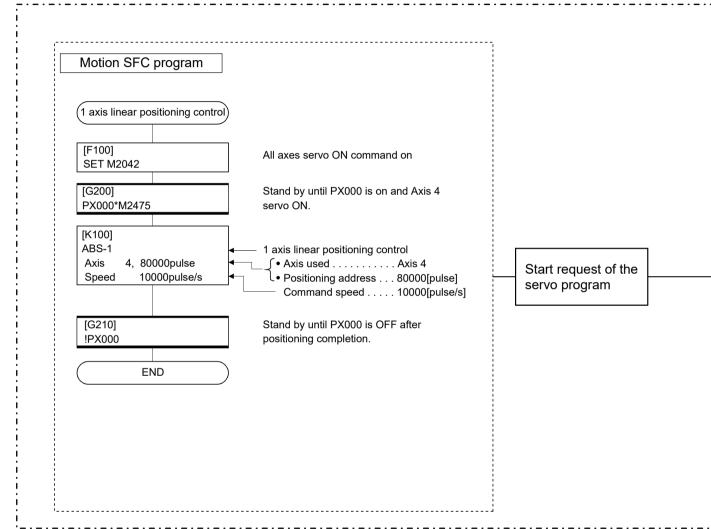


[Execution of the positioning control (Motion SFC program)]

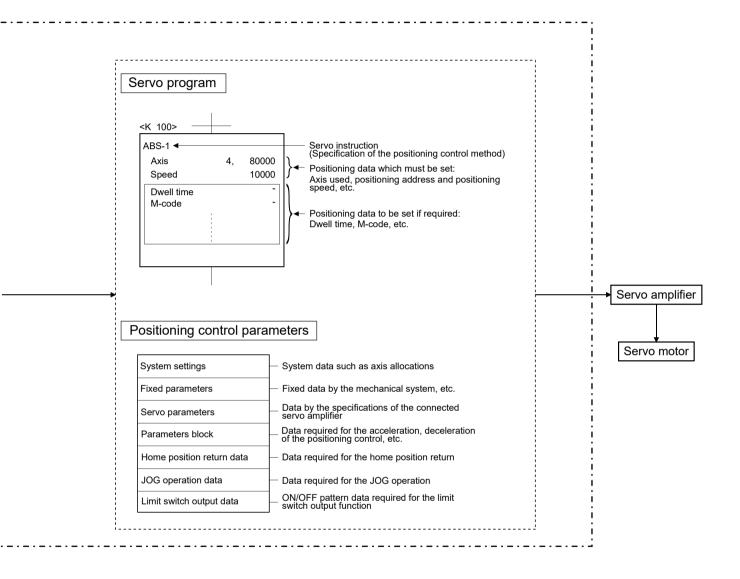
The positioning control is executed using the servo program specified with the Motion SFC program in the Motion CPU system.

An overview of the positioning control is shown below.

Motion CPU control system



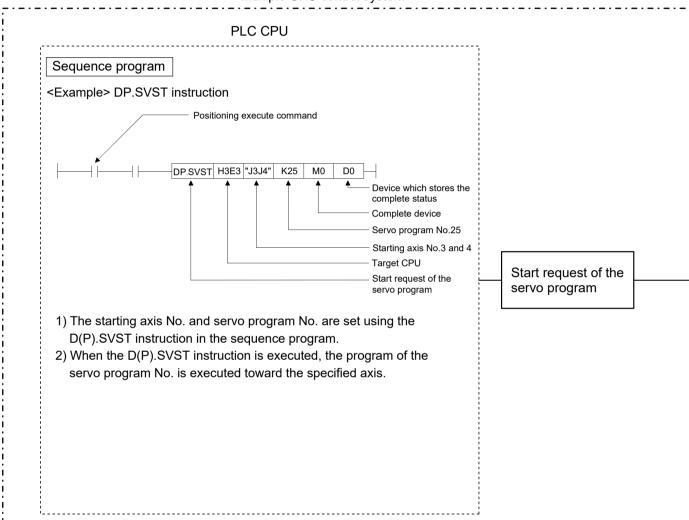
- (1) Create/set the Motion SFC programs, servo programs and positioning control parameters using a programming software package.
- (2) Specify the servo program started by the Motion SFC program.
- (3) Perform the specified positioning control using the specified with servo program.



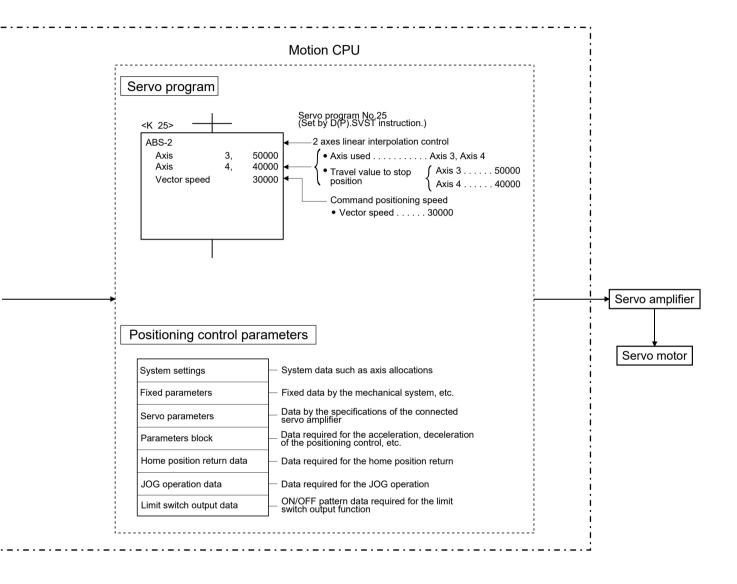
[Execution of the servo program start (D(P).SVST instruction)]

Positioning control is executed by starting the specified servo program toward the axis specified with D(P).SVST instruction of PLC CPU in the Motion CPU. An overview of the starting method using the servo program is shown below.

Multiple CPU control system



- (1) Create/set the sequence programs, servo programs and positioning control parameters using a programming software package.
- (2) Perform the positioning start using the sequence program (D(P).SVST instruction) of PLC CPU.
 - (a) Starting axis No. and servo program No. are specified with the D(P).SVST instruction.
 - 1) Servo program No. can be set either directly or indirectly.
- (3) Perform the positioning control of specified servo program toward the specified axis.

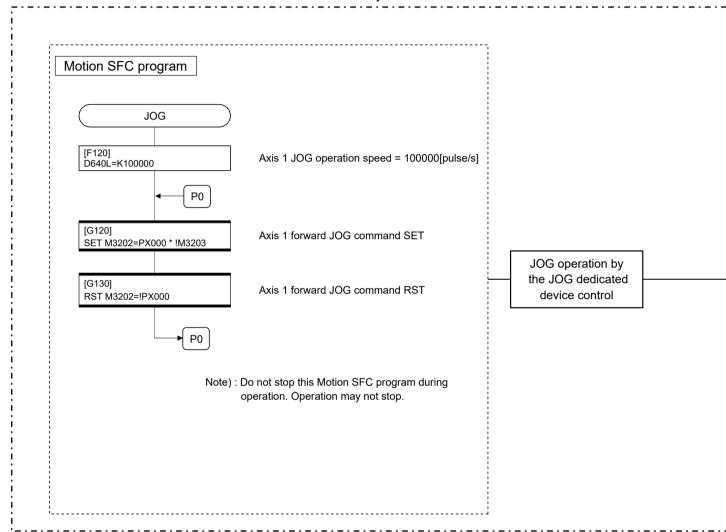


[Execution of the JOG operation]

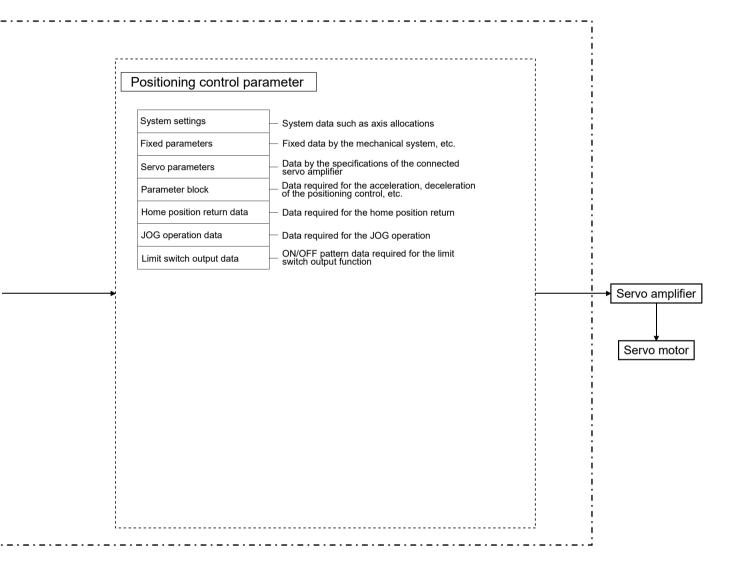
JOG operation of specified axis is executed using the Motion SFC program in the Motion CPU. JOG operation can also be executed by controlling the JOG dedicated device of specified axis.

An overview of JOG operation is shown below.

Motion CPU control system



- (1) Create/set the Motion SFC programs, positioning control parameters using a programming software package.
- (2) Set the JOG speed to the JOG speed setting register for each axis using the Motion SFC program.
- (3) Perform the JOG operation while the JOG start command signal is ON in the Motion SFC program.

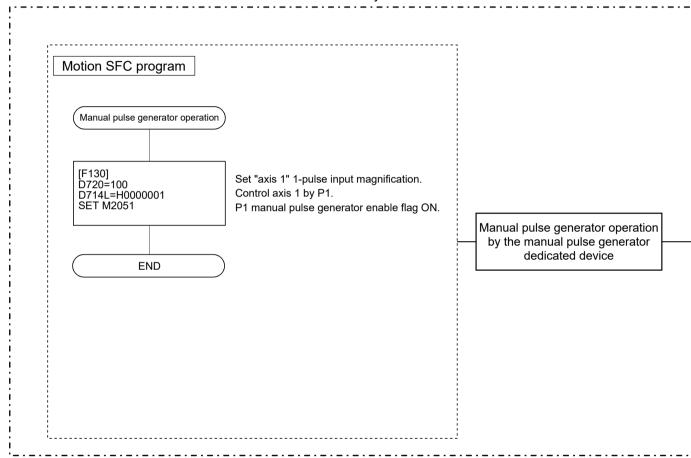


[Executing Manual Pulse Generator Operation]

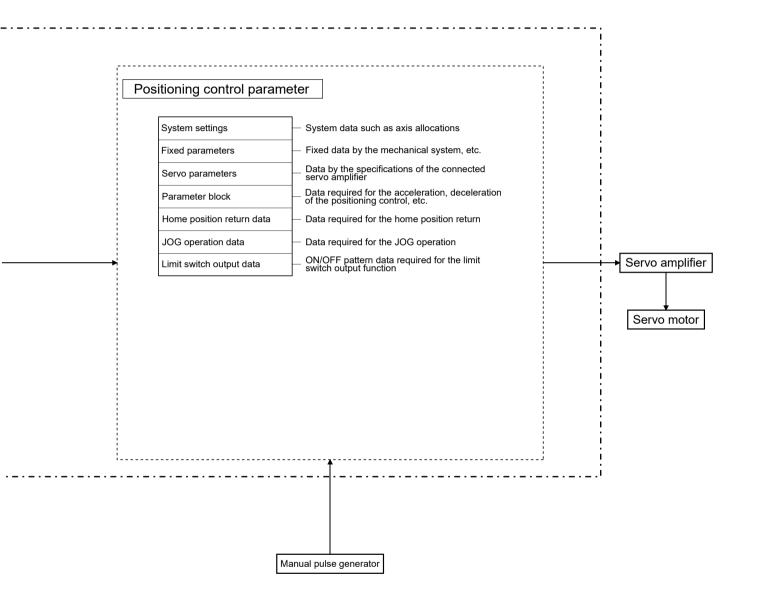
When the positioning control is executed by the manual pulse generator connected to the Q173DPX, manual pulse generator operation must be enabled using the Motion SFC program.

An overview of manual pulse generator operation is shown below.

Motion CPU control system



- (1) Create/set the Motion SFC programs, positioning control parameters using a programming software package.
- (2) Set the used manual pulse generator, operated axis No. and magnification for 1 pulse input using the Motion SFC program.
- (3) Turn the manual pulse generator enable flag on using the Motion SFC program Manual pulse generator operation enabled
- (4) Perform the positioning by operating the manual pulse generator.



(1) Positioning control parameters

There are following seven types as positioning control parameters. Parameter data can be set and corrected using MT Developer2.

	Item	Description	Reference
1	System settings	Multiple system settings, Motion modules and axis No., etc. are set.	Section 4.1
2	Fixed parameters	Data by such as the mechanical system are set for every axis. They are used for calculation of a command position at the positioning control.	Section 4.2
3	Servo parameters	Data by such as the servo amplifier and motor type with connected servo motor are set for every axis. They are set to control the servo motors at the positioning control.	(Note-1)
4	Home position return data	Data such as the direction, method and speed of the home position return used at the positioning control are set for every axis.	Section 6.23.1
5	JOG operation data	Data such as the JOG speed limit value and parameter block No. used at the JOG operation are set for every axis.	Section 6.21.1
6	Parameter block	Data such as the acceleration, deceleration time and speed control value at the positioning control are set up to 64 parameter blocks. They are set with the servo program, JOG operation data and home position return data, and it is used to change easily the acceleration/deceleration processing (acceleration/deceleration time and speed limit value) at the positioning control.	Section 4.3
7	Limit switch output data	Output device, watch data, ON section, output enable/disable bit and forced output bit used for the limit output function for every limit output are set.	(Note-2)

(Note-1): Refer to Section 3.3 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)".

(Note-2): Refer to Section 4.1 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)".

(2) Servo program

The servo program is used for the positioning control in the Motion SFC program. The positioning control by servo program is executed using the Motion SFC program and Motion dedicated PLC instruction (Servo program start request (D(P).SVST)).

It comprises a program No., servo instructions and positioning data. Refer to Chapter 5 for details.

- Program No. It is specified using the Motion SFC program and Motion dedicated PLC instruction.
- Servo instruction It indicates the type of positioning control.
- Positioning data It is required to execute the servo instructions.

The required data is fixed for every servo instruction.

(3) Motion SFC program

Motion SFC program is used to execute the operation sequence or transition control combining "Step", "Transition", or "End" to the servo program.

The positioning control, JOG operation and manual pulse generator operation by the servo program can be executed.

Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (Motion SFC)" for details.

(4) Sequence program

The positioning control by the servo program can be executed using the Motion dedicated PLC instruction of sequence program.

Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (Motion SFC)" for details.

MEMO		
-		
-		

3. POSITIONING DEDICATED SIGNALS

The internal signals of the Motion CPU and the external signals to the Motion CPU are used as positioning signals.

(1) Internal signals

The following five devices of the Motion CPU are used as the internal signals of the Motion CPU.

- Internal relay (M)M2000 to M3839 (1840 points)
- Special relay (SM)SM0 to SM2255 (2256 points)
- Motion register (#)#8000 to #8751 (752 points)
- Special register (SD)SD0 to SD2255 (2256 points)

(2) External signals

The external input signals to the Motion CPU are shown below.

- Upper/lower limit switch input The upper/lower limit of the positioning range is controlled.
- Stop signal This signal makes the starting axis stop.
- Proximity dog signalON/OFF signal from the proximity dog.
- Speed/position switching signal Signal for switching from speed to position.
- Manual pulse generator input Signal from the manual pulse generator.

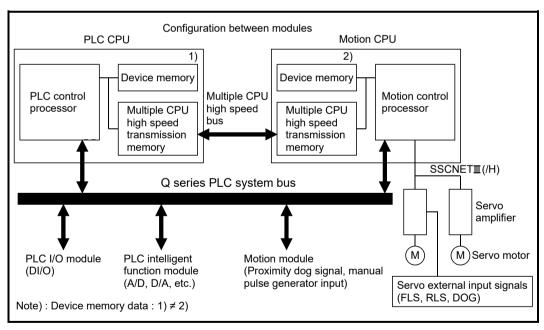


Fig.3.1 Flow of the internal signals/external signals

The positioning dedicated devices are shown below.

It indicates the device refresh cycle of the Motion CPU for status signal with the positioning control, and the device fetch cycle of the Motion CPU for command signal with the positioning control.

The operation cycle of the Motion CPU is shown below.

Item		Q173DSCPU	Q172DSCPU	Q173DCPU(-S1)	Q172DCPU(-S1)
Number of control a	ixes	Up to 32 axes	Up to 16 axes	Up to 32 axes	Up to 8 axes
Operation cycle	SV13	0.22ms/ 1 to 4 axes 0.44ms/ 5 to 10 axes 0.88ms/ 11 to 24 axes 1.77ms/ 25 to 32 axes	0.22ms/ 1 to 4 axes 0.44ms/ 5 to 10 axes 0.88ms/ 11 to 16 axes	0.44ms/ 1 to 6 axes 0.88ms/ 7 to 18 axes 1.77ms/ 19 to 32 axes	0.44ms/ 1 to 6 axes 0.88ms/ 7 to 8 axes
(Default)	SV22	0.44ms/ 1 to 6 axes 0.88ms/ 7 to 16 axes 1.77ms/ 17 to 32 axes	0.44ms/ 1 to 6 axes 0.88ms/ 7 to 16 axes	0.44ms/ 1 to 4 axes 0.88ms/ 5 to 12 axes 1.77ms/ 13 to 28 axes 3.55ms/ 29 to 32 axes	0.44ms/ 1 to 4 axes 0.88ms/ 5 to 8 axes

REMARK

In the positioning dedicated signals, "n" in "M3200+20n", etc. indicates a value corresponding to axis No. such as the following tables.

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 as follows for the device No. corresponding to each axis. (Example) For axis 32

M3200+20n (Stop command)=M3200+20×31=M3820 M3215+20n (Servo OFF command)=M3215+20×31=M3835

- \bullet The range (n=0 to 15) of axis No.1 to 16 is valid in the Q172DSCPU.
- The range (n=0 to 7) of axis No.1 to 8 is valid in the Q172DCPU(-S1).

3.1 Internal Relays

(1) Internal relay list

	SV13		SV	/22	
.		Vi	rtual mode switching method	Advan	ced synchronous control method
Device No.	Purpose	Device No.	Purpose	Device No.	Purpose
M0	User device	M0	User device	M0	User device
to	(2000 points)	to	(2000 points)	to	(2000 points)
M2000	Common device	M2000	Common device	M2000	Common device
to	(320 points)	to	(320 points)	to	(320 points)
M2320	Unusable	M2320	Unusable	M2320	Unusable
to	(80 points)	to	(80 points)	to	(80 points)
M2400 to	Axis status (20 points × 32 axes)	M2400 to	Axis status (20 points × 32 axes) Real mode : Each axis	M2400 to	Axis status (20 points × 32 axes)
M3040 to	Unusable (32 points)	M3040 to	Virtual mode : Output module Unusable (32 points)	M3040 to	Unusable (32 points)
M3072 to	Common device (Command signal) (64 points)	M3072 to	Common device (Command signal) (64 points)	M3072 to	Common device (Command signal) (64 points)
M3136	Unusable	M3136	Unusable	M3136	Unusable
to	(64 points)	to	(64 points)	to	(64 points)
M3200 to	Axis command signal (20 points × 32 axes)	M3200 to	Axis command signal (20 points × 32 axes) Real mode : Each axis Virtual mode : Output module	M3200 to	Axis command signal (20 points \times 32 axes)
M3840	User device (4352 points)	M3840 to M4000 to M4640 to M4688 to M5440 to M5488 to	Unusable (160 points) Virtual servo motor axis status (Note-1) (20 points × 32 axes) Synchronous encoder axis status (4 points × 12 axes) Unusable (Note-1) (112 points) Virtual servo motor axis command signal (Note-1) (20 points × 32 axes) Synchronous encoder axis command signal (4 points × 12 axes) User device (Note-3) (2704 points)	M3840	User device (4352 points)
M8191		M8191	(2104 points)	M8191	

Internal relay list (Continued)

	SV13		S\	/22	
Davidas		Vir	tual mode switching method	Advan	ced synchronous control method
Device No.	Purpose	Device	Durnaga	Device	Durage
INO.		No.	Purpose	No.	Purpose
M8192		M8192		M8192	System area
				to	(1608 points) QDS (Ver.)
				M9800	Command generation axis status
				to	(20 points × 32 axes) QDS(Ver.)
				M10440	Synchronous encoder axis status
				to	(10 points × 12 axes) QDS(Ver.)
				M10560	Output axis status
				to	(10 points × 32 axes) QDS(Ver.)
				M10880	Synchronous control signal
				to	[St.380] (32 points) QDS(Ver)
				M10912	Synchronous analysis complete
				to	signal [St.381]
					(32 points) QDS(Ver.)
				M10944	Unusable
				to	(16 points) QDS(Ver.)
to	System area	to	System area	M10960	Command generation axis
io	(4096 points)	ιο	(4096 points)	to	command signal (20 points × 32 axes)
				M11600	Synchronous encoder axis
				to	command signal (4 points × 12 axes) QDS((Ver)
				M11648	Unusable
				to	(32 points) QDS(Ver.)
				M11680	Output axis command signal
				to	(10 points × 32 axes) QDS(Ver.)
				M12000	Synchronous control start signal
				to	[Rq.380]
				M12020	(32 points) ODS (Ver.)
				M12032	Synchronous analysis request signal [Rq.381]
				to	(32 points) QDS(Ver.)
				M12064	
				to	Unusable (224 points) QDS(Ver)
M12287		M12287		M12287	(224 points)

It can be used as a user device.

(Note-1): It can be used as a user device in the SV22 real mode only.

POINT

• Total number of user device points

• SV13 : 6352 points

: 4704 points (Note) • SV22 virtual mode switching method

• SV22 advanced synchronous control method : 6352 points QDS(Ver.)

(Note): Up to 6096 points can be used when not using it in the virtual mode.

Ver.!): Refer to Section 1.3 for the software version that supports this function.

(2) Axis status list

Axis No.	Device No.				Signal name		
1	M2400 to M2419						_
2	M2420 to M2439						
3	M2440 to M2459			Signal name	Refresh cycle	Fetch cycle	Signal direction
4	M2460 to M2479	0	Positionir	ng start complete			
5	M2480 to M2499	1	Positionir	ng complete		/	
6	M2500 to M2519	2	In-positio	n			
7	M2520 to M2539	3	Comman	d in-position	Operation cycle	/	
8	M2540 to M2559	4	Speed co	ontrolling		/	
9	M2560 to M2579	5	Speed/po	sition switching latch			
10	M2580 to M2599	6	Zero pas	s		/	
11	M2600 to M2619	7	Error dete	ection	Immediate] /	
12	M2620 to M2639	8	Servo err	or detection	Operation cycle] /	Status signal
13	M2640 to M2659	9	Home po	sition return request	Main cycle] /	
14	M2660 to M2679	10	Home po	sition return complete	Operation cycle] /	
15	M2680 to M2699	11		FLS		/	
16	M2700 to M2719	12	External	RLS	Main avala	/	
17	M2720 to M2739	13	signals	STOP	Main cycle		
18	M2740 to M2759	14		DOG/CHANGE			
19	M2760 to M2779	15	Servo rea	ady	Operation cycle	/	
20	M2780 to M2799	16	Torque li	miting	Operation cycle	V	
21	M2800 to M2819	17	Unusable)	-	_	
22	M2820 to M2839		Virtual m	ode continuation	At virtual mode	/	
23	M2840 to M2859	18	operation	disable warning	transition		Status signal
24	M2860 to M2879		(SV22) (N	lote-1)	แสกรแบบ	1	Status Signal
25	M2880 to M2899	19	M-code c	outputting	Operation cycle		
26	M2900 to M2919						
27	M2920 to M2939						
28	M2940 to M2959						
29	M2960 to M2979						
30	M2980 to M2999						
31	M3000 to M3019						
32	M3020 to M3039						

(Note-1): It is unusable in the SV13/SV22 real mode and SV22 advanced synchronous control.

POINT

(1) The following range is valid.

Q172DSCPU : Axis No.1 to 16Q172DCPU(-S1): Axis No.1 to 8

(2) The following device area can be used as a user device.

• Q172DSCPU : 17 axes or more • Q172DCPU(-S1): 9 axes or more

However, when the project of Q172DSCPU/Q172DCPU(-S1) is replaced with Q173DSCPU/Q173DCPU(-S1), this area cannot be used as a user device.

(3) Axis command signal list

Axis No.	Device No.			S	Signal name		
1	M3200 to M3219	_					_
2	M3220 to M3239			0: 1	D ()	5	Signal
3	M3240 to M3259			Signal name	Refresh cycle	Fetch cycle	direction
4	M3260 to M3279		0	Stop command	/	On another social	
5	M3280 to M3299		1	Rapid stop command] /	Operation cycle	
6	M3300 to M3319		2	Forward rotation JOG start command] /		
7	M3320 to M3339		3	Reverse rotation JOG start command] /	Main cycle	
8	M3340 to M3359		4	Complete signal OFF command] /	, , , , , , , , , , , , , , , , , , ,	
9	M3360 to M3379		5	Speed/position switching enable	/	Operation cycle	Command
10	M3380 to M3399	L	J	command] /	Operation cycle	signal
11	M3400 to M3419		6	Gain changing 2 command ^(Note-1)	/	Operation cycle (Note-2)	Signal
12	M3420 to M3439	-	_	QDS(Ver.)	/	,	
13	M3440 to M3459	-	7	Error reset command	/	Main cycle	
14	M3460 to M3479	-	8	Servo error reset command	/		
15	M3480 to M3499		9	External stop input disable at start	/	At start	
16	M3500 to M3519	ŀ		command	<u>/</u>		
17	M3520 to M3539	ŀ	10	Unusable	_	_	_
18	M3540 to M3559	-	11		,		
19	M3560 to M3579	-	12	Feed current value update command	-	At start	
20	M3580 to M3599		13	Address clutch reference setting	/		
21	M3600 to M3619	ŀ		command (SV22 only) (Note-3)		At virtual mode	
22	M3620 to M3639		14	Cam reference position setting command (SV22 only) (Note-3)	/	transition	0
23 24	M3640 to M3659 M3660 to M3679	ŀ	15	Servo OFF command	-	Operation cycle	Command signal
25	M3680 to M3699	ŀ	16	Gain changing command	/		Signal
26	M3700 to M3719	ŀ	17	PI-PID switching command QDS	/	Operation cycle (Note-2)	
27	M3720 to M3739	┟	18	Control loop changing command	1 /		
28	M3740 to M3759	f	19	FIN signal	1/	Operation cycle	
29	M3760 to M3779	L	.5	eiginai	V		
30	M3780 to M3799						
31	M3800 to M3819						
32	M3820 to M3839						

(Note-1): Servo amplifier (MR-J5(W)-□B) only.

(Note-2): Operation cycle 7.1[ms] or more: Every 3.5[ms]

(Note-3): It is unusable in the SV13/SV22 real mode and SV22 advanced synchronous control.

POINT

(1) The following range is valid.

• Q172DSCPU : Axis No.1 to 16 • Q172DCPU(-S1): Axis No.1 to 8

(2) The following device area can be used as a user device.

• Q172DSCPU : 17 axes or more • Q172DCPU(-S1): 9 axes or more

However, when the project of Q172DSCPU/Q172DCPU(-S1) is replaced with Q173DSCPU/Q173DCPU(-S1), this area cannot be used as a user device.

Ver.!: Refer to Section 1.3 for the software version that supports this function.

(4) Common device list

Devises		(1)		Ciamal	Damade	Davida				Cimmal	Damadi
Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction	Remark (Note-7)	Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction	Remark (Note-7)
M2000	PLC ready flag		Main cycle	Command	M3072	M2055					
M2001 M2002 M2003 M2004 M2005	Axis 1 Axis 2 Axis 3 Axis 4 Axis 5			signal		M2056 M2057 M2058 M2059 M2060	Unusable (6 points)	-	-	-	_
M2006 M2007 M2008 M2009 M2010 M2011 M2012 M2013 M2014 M2015 M2016 M2016 M2017 M2018 M2020 M2021 M2022 M2022 M2023 M2024 M2026 M2027 M2028 M2029 M2031 M2031	Axis 6 Axis 7 Axis 8 Axis 9 Axis 10 Axis 11 Axis 12 Axis 13 Axis 14 Axis 15 Axis 16 Axis 17 Axis 18 Axis 19 Axis 20 Axis 20 Axis 21 Axis 22 Axis 23 Axis 24 Axis 25 Axis 26 Axis 27 Axis 28 Axis 29 Axis 29 Axis 30 Axis 31 Axis 31 Axis 31 Axis 32	Operation cycle		Status signal (Note-1), (Note-2), (Note-3), (Note-4)		M2061 M2062 M2063 M2064 M2065 M2066 M2067 M2068 M2070 M2071 M2073 M2074 M2075 M2076 M2076 M2077 M2078 M2080 M2080 M2081	Axis 1 Axis 2 Axis 3 Axis 4 Axis 5 Axis 6 Axis 7 Axis 8 Axis 9 Axis 10 Axis 11 Axis 12 Axis 15 Axis 15 Axis 16 Axis 17 Axis 18 Axis 19 Axis 20 Axis 21 Axis 22 Axis 22 Axis 23 Axis 24 Axis 25 Axis 26 Axis 27	Operation cycle		Status signal (Note-1), (Note-2), (Note-3), (Note-4)	
M2033 M2034	Unusable (2 points)	_	_	_	_	M2088 M2089	Axis 28 Axis 29				
M2035	Motion error history clear request flag		Main cycle	Command signal	M3080	M2090	Axis 30				
M2036	Unusable	_	_	_	_	M2091	Axis 31				
M2037 M2038	(2 points) Motion SFC debugging flag	At debugging mode transition		Status		M2092 M2093	Axis 32		(
M2039	Motion error detection flag	Immediate		signal		M2094					
M2040	Speed switching point specified flag		At start	Command signal	M3073	M2095					
M2041	System setting error flag	Operation cycle		Status signal		M2096					
M2042	All axes servo ON command		Operation cycle		M3074	M2097	Unusable				
M2043	Real mode/virtual mode switching request (SV22) (Note-5)		At virtual mode transition	Command signal	M3075	M2098	(8 points)	_	_	_	_
M2044	Real mode/virtual mode switching status (SV22) (Note-5)					M2099					
M2045	Real mode/virtual mode switching error detection signal (SV22) ^(Note-5)	At virtual mode transition		Status signal		M2100					
M2046	Out-of-sync warning (SV22) (Note-5)					M2101	Axis 1		/		
M2047	Motion slot fault detection flag	Operation cycle	/			M2102	Axis 2		/		
M2048	JOG operation simultaneous start command		Main cycle	Command signal	M3076	M2103	Axis 3		/		
M2049	All axes servo ON accept flag	Operation cycle		Status signal		M2104	Axis 4		/	Stat	
M2050	Unusable	_		Signal —	_	M2105	Synchronous Axis 5 encoder current	Operation cycle	/	Status	
M2051	Manual pulse generator 1 enable flag				M3077	M2106	Axis 6 value changing flag (Note-5), (Note-6)	Operation cycle	/	(Note-2), (Note-4)	
M2052	Manual pulse generator 2 enable flag		Main cycle	Command signal	M3078	M2107			/		
M2053	Manual pulse generator 3 enable flag			əiyildi	M3079	M2108	Axis 8				
M2054	Operation cycle over flag	Operation cycle		Status signal		M2109	Axis 9		/		

Common device list (Continued)

Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction	Remark (Note-7)	Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction	Remark (Note-7)
M2110 M2111 M2112	Axis 11 encoder current value changing flag	Operation cycle		Status signal (Note-2), (Note-4)		M2179 M2180 M2181					
M2113 M2114 M2115 M2116 M2117 M2118 M2119 M2120 M2121 M2123 M2124 M2125 M2126 M2127	Unusable (15 points)	ı	-	-	_	M2182 M2183 M2184 M2185 M2186 M2187 M2188 M2189 M2190 M2191 M2192 M2193 M2194 M2195 M2196					
M2128 M2129 M2130 M2131 M2132 M2133 M2133 M2133 M2133 M2134 M2144 M2147 M2147 M2148 M2149 M2140 M2147 M2141 M2148 M2141 M2148	Axis 2 Axis 3 Axis 4 Axis 5 Axis 6 Axis 7 Axis 8 Axis 9 Axis 10 Axis 11 Axis 12 Axis 13 Axis 14 Axis 15 Axis 16 Axis 17 decelerating flag Axis 12 Axis 20 Axis 21 Axis 22 Axis 22 Axis 23 Axis 24 Axis 25 Axis 26 Axis 27 Axis 28	Operation cycle		Status signal (Note-1), (Note-2), (Note-3), (Note-4)		M2197 M2198 M2199 M2200 M2201 M2203 M2204 M2205 M2206 M2207 M2208 M2209 M2211 M2211 M2212 M2213 M2214 M2215 M2216 M2210 M2211 M2212 M2218 M2210 M2211 M2212 M2213 M2214 M2215 M2214 M2215 M2214 M2215 M2214 M2215 M2214 M2215	Unusable (45 points) (Note-8)	_	_	_	
M2157 M2158 M2159	Axis 30 Axis 31					M2226 M2227 M2228					
M2160 M2161 M2162 M2163 M2164 M2165 M2166 M2167 M2170 M2171 M2172 M2174 M2175 M2176 M2177 M2177 M2177			-	-	_	M2233 M2234 M2235 M2236 M2237 M2238 M2239	Axis 1 Axis 2 Axis 3 Axis 4 Speed change "0" Axis 5 Axis 6 Axis 7	Operation cycle	_	Status signal (Note-1), (Note-3), (Note-4)	_

Common device list (Continued)

D					0'1	Remark	Desta				0'1	Remark
Device No.		Signal name	Refresh cycle	Fetch cycle	Signal direction	(Note-7)	Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction	(Note-7)
	Axis 9				un conorr		M2284	Axis 13		/	unocuon	
_	Axis 10			1			_	Axis 14		l /		
	Axis 11			- /			M2286	Axis 15		/		
	Axis 12			1			_	Axis 16		/		
M2252	Axis 13			1			M2288	Axis 17		/		
M2253	Axis 14			1			M2289	Axis 18		/		
M2254	Axis 15			1			M2290	Axis 19		/		
M2255	Axis 16			1			M2291	Axis 20		/	Status	
M2256	Axis 17			1			M2292	Axis 21		/	signal	
M2257	Axis 18			1			M2293	Axis 22 Control loop monitor		/	(Note-1),	
M2258	Axis 19			/			M2294	Axis 23 status	Operation cycle	/	(Note-2),	
M2259	Axis 20	Speed change "0"		1			M2295	Axis 24		/	(Note-3),	
M2260	Axis 21	accepting flag		1			M2296	Axis 25		/	(Note-4)	
M2261	Axis 22			1			M2297	Axis 26		/		
M2262	Axis 23			1			M2298	Axis 27		/		
M2263	Axis 24			1	Status		M2299	Axis 28		/		
M2264	Axis 25			1	signal		M2300	Axis 29		/		
M2265	Axis 26		0	1	(Note-1),		M2301	Axis 30		/		
M2266	Axis 27		Operation cycle	1	(Note-2),		M2302	Axis 31		/		
M2267	Axis 28			1	(Note-3), (Note-4)		M2303	Axis 32		/		
M2268	Axis 29			1	(Note-4)		M2304					
M2269	Axis 30			1			M2305					
M2270	Axis 31			1			M2306					
M2271	Axis 32			1			M2307					
M2272	Axis 1			1			M2308					
M2273	Axis 2			1			M2309					
M2274	Axis 3			1			M2310					
M2275	Axis 4			1			M2311	Unusable				
M2276	Axis 5]					M2312	(16 points)	_	_	_	-
M2277	Axis 6	Control loop					M2313					
M2278	Axis 7	monitor status					M2314					
M2279	Axis 8]					M2315					
M2280	Axis 9			1			M2316					İ
M2281	Axis 10]		1			M2317					
M2282	Axis 11]		/			M2318					
M2283	Axis 12						M2319					

(Note-1): The range of axis No.1 to 16 is valid in the Q172DSCPU.

(Note-2): The range of axis No.1 to 8 is valid in the Q172DCPU(-S1).

(Note-3): Device area of 17 axes or more is unusable in the Q172DSCPU.

(Note-4): Device area of 9 axes or more is unusable in the Q172DCPU(-S1).

(Note-5): It is unusable in the SV22 advanced synchronous control.

(Note-6): It is unusable in the real mode.

(It can be used in the real mode for the version (Refer to Section 1.3) that supports "synchronous encoder current value monitor in real mode".)

(Note-7): It can also be ordered the device of a remark column.

(Note-8): These devices can be used as the clutch statuses.

The clutch status can also be set as the optional device at the clutch parameter.

Refer to Chapter 7 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV22) Programming Manual (VIRTUAL MODE)" for details.

(5) Common device list (Command signal)

Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction	Remark (Note-1), (Note-2)
M3072	PLC ready flag	/	Main cycle		M2000
M3073	Speed switching point specified flag	/	At start		M2040
M3074	All axes servo ON command	/	Operation cycle		M2042
M3075	Real mode/virtual mode switching request (SV22) ^(Note-3)		At virtual mode transition		M2043
M3076	JOG operation simultaneous start command			Command signal	M2048
M3077	Manual pulse generator 1 enable flag	/			M2051
M3078	Manual pulse generator 2 enable flag	/	Main cycle		M2052
M3079	Manual pulse generator 3 enable flag	/			M2053
M3080	Motion error history clear request flag				M2035
M3081 to M3135	Unusable ^(Note-4) (55 points)	_	_	_	_

- (Note-1): The state of a device is not in agreement when the device of a remark column is turned ON/OFF directly. In addition, when the request from a data register and the request from the above device are performed simultaneously, the request from the above device becomes effective.
- (Note-2): It can also be ordered the device of a remark column.
- (Note-3): It is unusable in the SV22 advanced synchronous control.
- (Note-4): Do not use it as a user device. It can be used as a device that performs automatic refresh because of area for the reserve of command signal.

POINT

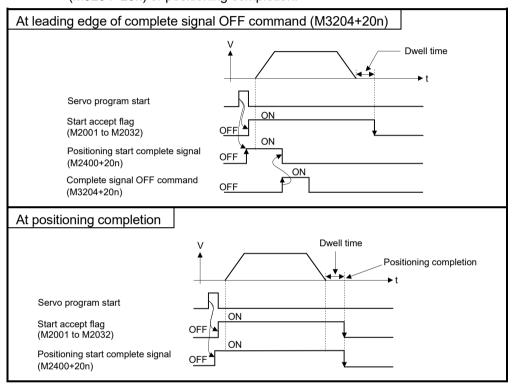
The device of a remark column turns ON by OFF to ON of the above device, and turns OFF by ON to OFF of the above device.

The command signal cannot be turned ON/OFF by the PLC CPU in the automatic refresh because the statuses and commands are mixed together in M2000 to M2053. Use the above devices in the case.

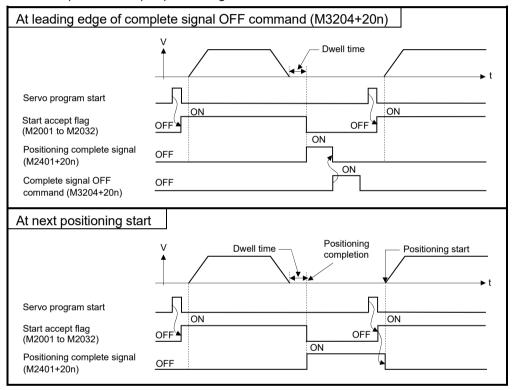
And, it can also be turned ON/OFF by the data register. (Refer to Section 3.2.3.)

3.1.1 Axis statuses

- (1) Positioning start complete signal (M2400+20n)...... Status signal
 - (a) This signal turns on with the start completion for the positioning control of the axis specified with the servo program. It does not turn on at the starting using JOG operation or manual pulse generator operation.
 It can be used to read a M-code at the positioning start.
 (Refer to Section 7.1.)
 - (b) This signal turns off at leading edge of complete signal OFF command (M3204+20n) or positioning completion.



- (2) Positioning complete signal (M2401+20n) Status signal
 - (a) This signal turns on with the completion of the command output to positioning address for the axis specified with the servo program.
 It does not turn on at the start or stop on the way using home position return, JOG operation, manual pulse generator operation or speed control.
 It does not turn on at the stop on the way during positioning.
 It can be used to read a M-code at the positioning completion.
 (Refer to Section 7.1.)
 - (b) This signal turns off at leading edge of complete signal OFF command (M3204+20n) or positioning start.

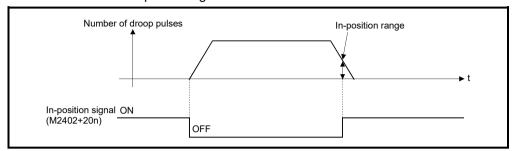


(c) The positioning complete signal turns ON by the execution of servo program even if the travel value of the axis specified with the servo program is set to "0".

∆CAUTION

■ The deviation counter value is not considered, so that the positioning complete signal (M2401+20n) turns on with the completion of the command output to positioning address. Use the positioning complete signal (M2401+20n) together with the in-position signal (M2402+20n) to confirm the positioning completion of servo axis in the final instruction under program.

- (3) In-position signal (M2402+20n) Status signal
 - (a) This signal turns on when the number of droop pulses in the deviation counter becomes below the "in-position range" set in the servo parameters. It turns off at positioning start.



(b) While the control circuit power supply of the servo amplifier is ON, the status of the in-position signal of the servo amplifier (Servo status1 (#8010+20n): b12 (205) is reflected.

However, the state of the signal is always OFF for the following.

- Servo error
- From positioning start until deceleration start (Note-1)
- Current value change
- Home position return (Note-2)

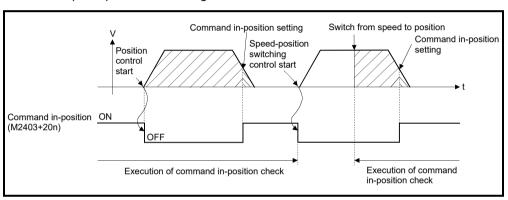
(Note-1): Except during position follow-up control, high-speed oscillation control, manual pulse generator operation, and synchronous control. (The in-position signal is constantly updated during such controls.)

(Note-2): The in-position signal may be updated after a proximity dog is turned ON during home position return.

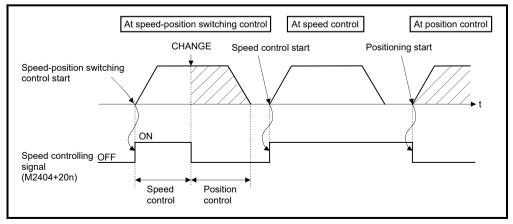
- (4) Command in-position signal (M2403+20n) Status signal
 - (a) This signal turns on when the absolute value of difference between the command position and feed current value becomes below the "command inposition range" set in the fixed parameters.

This signal turns off in the following cases.

- · Positioning control start
- · Home position return
- Speed control
- JOG operation
- · Manual pulse generator operation
- Speed-torque control QDS
- (b) Command in-position check is continually executed during position control. This check is not executed during speed control or speed control in the speed-position switching control.



- (5) Speed controlling signal (M2404+20n) Status signal
 - (a) This signal turns on during speed control, and it is used as judgement of during the speed control or position control.It is turning on while the switching from speed control to position control by the external CHANGE signal at the speed-position switching control.
 - (b) This signal turns off at the power supply on and during position control.



(c) It does not turn on at the speed control mode in speed-torque control.

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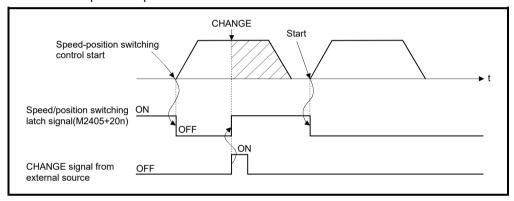
(6) Speed/position switching latch signal (M2405+20n)

.....Status signal

(a) This signal turns on when the 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.

- (b) The signal turns off at the following start.
 - Position control
 - · Speed-position switching control
 - Speed control
 - JOG operation
 - · Manual pulse generator operation



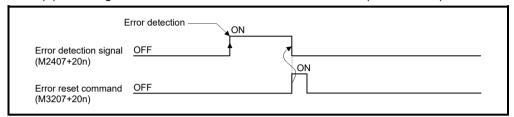
(7) Zero pass signal (M2406+20n) Status signal

This signal turns on when the zero point is passed after the control circuit power supply on of the servo amplifier.

Once the zero point has been passed, it remains on state until the Multiple CPU system has been reset.

However, in the home position return method of proximity dog method, count method, dog cradle method, limit switch combined method, scale home position signal detection method, or dogless home position signal reference method, this signal turns off once at the home position return start and turns on again at the next zero point passage.

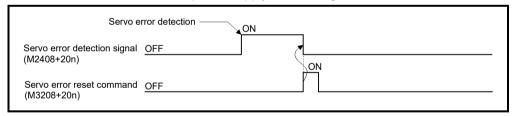
- (8) Error detection signal (M2407+20n) Status signal
 - (a) This signal turns on with detection of a minor error or major error, and can be used to judge if there is an error or not.
 - The applicable error code (Note-1) is stored in the minor error code storage register (D6+20n) with detection of a minor error.
 - The applicable error code (Note-1) is stored in the major error code storage register (D7+20n) with detection of a major error.
 - (b) This signal turns off when the error reset command (M3207+20n) turns on.



REMARK

(Note-1): Refer to APPENDIX 1 for the error codes with detection of major/minor errors.

- (9) Servo error detection signal (M2408+20n) Status signal
 - (a) This signal turns on when an error occurs at the servo amplifier side (except for errors cause of alarms and emergency stops) (Note-1), and can be used to judge is there is a servo error or not.
 - When an error is detected at the servo amplifier side, the applicable error code (Note-1) is stored in the servo error code storage register (D8+20n).
 - (b) This signal turns off when the servo error reset command (M3208+20n) turns on or the servo power supply turns on again.



REMARK

(Note-1): Refer to APPENDIX 1.4 for the error codes on errors detected at the servo amplifier side.

(10) Home position return request signal (M2409+20n)
.....Status signal

This signal turns on when it is necessary to confirm the home position address.

- (a) When not using an absolute position system
 - 1) This signal turns on in the following cases:
 - Multiple CPU system power supply on or reset
 - Servo amplifier power supply on
 - Home position return start
 (Unless a home position return is completed normally, the home position return request signal does not turn off.)
 - 2) This signal turns off by the completion of home position return.
- (b) When using an absolute position system
 - 1) This signal turns on in the following cases:
 - When not executing a home position return once after system start.
 - Home position return start (Unless a home position return is completed normally, the home position return request signal does not turn off.)
 - Erase of an absolute data in Motion CPU according to causes, such as battery error
 - · Servo error [2025] (absolute position erase) occurrence
 - Servo error [2143] (absolute position counter warning) occurrence
 - Servo error [2913] (encoder counter error) occurrence
 - Major error [1201], [1202], [1203], or [1204] occurrence
 - When the "rotation direction selection" of servo parameter is changed.
 - 2) This signal turns off by the completion of the home position return.

∆ CAUTION

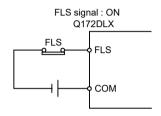
• When using the absolute position system function, on starting up, and when the Motion controller or absolute value motor has been replaced, always perform a home position return. In the case of the absolute position system, use the sequence program to check the home position return request before performing the positioning control.
Failure to observe this could lead to an accident such as a collision.

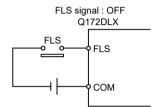
(11) Home position return complete signal (M2410+20n)

Status signal

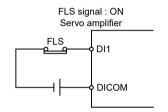
- (a) This signal turns on when the home position return operation using the servo program has been completed normally.
- (b) This signal turns off at the positioning start, JOG operation start and manual pulse generator operation start.
- (c) If the home position return of proximity dog, dog cradle or stopper method using the servo program is executed during this signal on, the a minor error (error code: 115) occurs, and home position return cannot start.

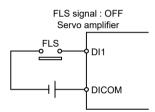
- (12) FLS signal (M2411+20n) (Note-1) Status signal
 - (a) This signal is controlled by the ON/OFF state for the upper stroke limit switch input (FLS) of the Q172DLX/servo amplifier and bit device osk.
 - Upper stroke limit switch input OFF FLS signal: ON
 - Upper stroke limit switch input ON FLS signal: OFF
 - (b) The state for the upper stroke limit switch input (FLS) when the FLS signal is ON/OFF is shown below.
 - 1) Q172DLX use (Note-2)





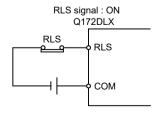
2) Servo amplifier input use (Note-3)

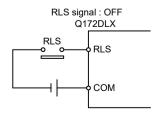




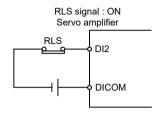
- 3) Bit device use (Note-1) QDS(

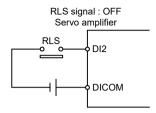
 The set bit device is the FLS signal.
- (Note-1): Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for an external signal and bit device.
- (Note-2): Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller User's Manual" for a pin configuration.
- (Note-3): Refer to the "Servo Amplifier Instruction Manual" for a pin configuration.
- (c) "Normally open contact input" and "Normally closed contact input" of the servo data setting can be selected.
- - (a) This signal is controlled by the ON/OFF state for the lower stroke limit switch input (RLS) of the Q172DLX/servo amplifier and bit device oscillation-new
 - Lower stroke limit switch input OFF RLS signal: ON
 - · Lower stroke limit switch input ON RLS signal: OFF
 - (b) The state of the lower stroke limit switch input (RLS) when the RLS signal is ON/OFF is shown below.
 - 1) Q172DLX use (Note-2)





2) Servo amplifier input use (Note-3)





3) Bit device use (Note-1) QDS(

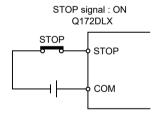
The set bit device is the RLS signal.

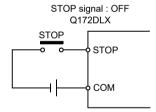
(Note-1): Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for an external signal and bit device.

(Note-2): Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller User's Manual" for a pin configuration.

(Note-3): Refer to the "Servo Amplifier Instruction Manual" for a pin configuration.

- (c) "Normally open contact input" and "Normally closed contact input" of the servo data setting can be selected.
- - (a) This signal is controlled by the ON/OFF state for the stop signal input (STOP) of the Q172DLX and bit device (CDS).
 - Stop signal input of the Q172DLX OFF STOP signal: OFF
 - Stop signal input of the Q172DLX ON STOP signal: ON
 - (b) The state of the stop signal input (STOP) when the STOP signal input is ON/OFF is shown below.
 - 1) Q172DLX use (Note-2)





2) Bit device use (Note-1) (ADS)

The set bit device is the STOP signal.

(Note-1): Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for an external signal and bit device.

(Note-2): Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller User's Manual" for a pin configuration.

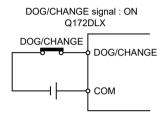
(c) "Normally open contact input" and "Normally closed contact input" of the servo data setting can be selected.

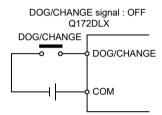
(15) DOG/CHANGE signal (M2414+20n) (Note-1) Status signal

(a) This signal turns on/off by the proximity dog input (DOG) of the Q172DLX/ servo amplifier/input(DI) of built-in interface in Motion CPU (DIX) device (DIX) at the home position return.

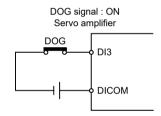
This signal turns on/off by the speed/position switching input (CHANGE) of the Q172DLX/proximity dog input (DOG) of servo amplifier/input (DI) of built-in interface in Motion CPU (bit device (at the speed/position switching control. (Note-2) (There is no CHANGE signal in the servo amplifier.)

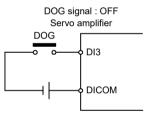
- (b) The state of the speed/position switching input (CHANGE) when the CHANGE signal is ON/OFF is shown below.
 - 1) Q172DLX use (Note-3)



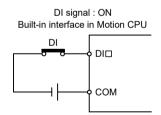


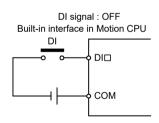
2) Servo amplifier input use (Note-4)





3) Built-in interface in Motion CPU use(Note-3)





4) Bit device use (Note-1) QDS

The set bit device is the DOG/CHANGE signal.

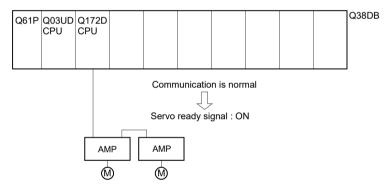
- (Note-1): Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for an external signal and bit device.
- (Note-2): When using the Q173DCPU(-S1)/Q172DCPU(-S1), the external input signal (DOG) of servo amplifier can also be used in the speed-position switching control. (Refer to Section 1.3 for the software version that supports this function.)
- (Note-3): Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller User's Manual" for a pin configuration.
- (Note-4): Refer to the "Servo Amplifier Instruction Manual" for a pin configuration.

(c) When using the Q172DLX/built-in interface in Motion CPU, "Normally open contact input" and "Normally closed contact input" of the system setting can be selected.

When using the proximity dog input (DOG) of servo amplifier/bit device, "Normally open contact input" and "Normally closed contact input" of the servo data setting can be selected.

- (16) Servo ready signal (M2415+20n) Status signal
 - (a) This signal turns on when the servo amplifiers connected to each axis are in the READY state (READY ON and Servo ON).
 - (b) This signal turns off in the following cases.
 - · All axes servo ON command (M2042) is off
 - · Servo amplifier is not mounted
 - · Servo parameter is not set
 - It is received the forced stop input from an external source
 - Servo OFF by the servo OFF command (M3215+20n) ON of each axis
 - · Servo error occurs

Refer to "APPENDIX 1.4 Servo errors" for details.



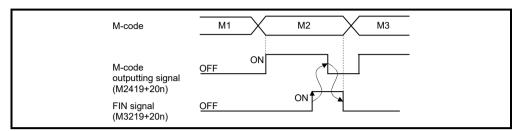
POINT

When the part of multiple servo amplifiers connected to the SSCNET**I**(/H) becomes a servo error, only an applicable axis becomes the servo OFF state.

(17) Torque limiting signal (M2416+20n) Status signal This signal turns on while torque limit is executed.

The signal toward the torque limiting axis turns on

- (18) M-code outputting signal (M2419+20n) Status signal
 - (a) This signal turns during M-code is outputting.
 - (b) This signal turns off when the stop command, cancel signal, skip signal or FIN signal are inputted.

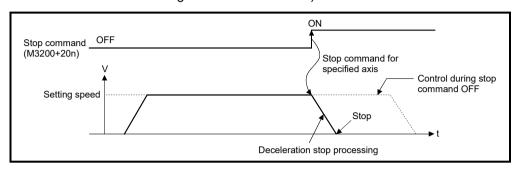


POINTS

- (1) The FIN signal (M3219+20n) and M-code outputting signal (M2419+20n) are both for the FIN signal wait function.
- (2) The FIN signal (M3219+20n) and M-code outputting signal (M2419+20n) are effective only when FIN acceleration/deceleration is designated in the servo program.
 - Otherwise, the FIN signal wait function is disabled, and the M-code outputting signal (M2419+20n) does not turn on.

3.1.2 Axis command signals

- (1) Stop command (M3200+20n) Command signal
 - (a) This command is a signal which stop a starting axis from an external source and becomes effective at leading edge of signal. (An axis for which the stop command is turning on cannot be started.)



(b) The details of stop processing when the stop command turns on are shown below. (Refer to Section 6.13 or 6.14 for details of the speed control.)

Control details	Processing at the turning stop command on	
during execution	During control	During deceleration stop processing
Positioning control	The axis decelerates to a stop in the deceleration time set in the parameter block or servo program.	The deceleration stop processing is continued.
Speed control (I)		
Speed control (I)		
JOG operation		
Speed control with		
fixed position stop		
Manual pulse	An immediate stop is executed without	
generator operation	deceleration processing.	_
Home position return	 (1) The axis decelerates to a stop in the deceleration time set in the parameter block. (2) A "stop error during home position return" occurs and minor error (error code: 202) is stored in the minor error storage register (D6+20n) for each axis. 	
Speed-torque control	The speed commanded to servo amplifier is "0". The mode is switched to position control mode when "Zero speed" turns ON, and the operation stops.	_

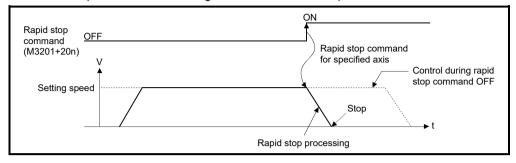
(c) The stop command in a dwell time is invalid. (After a dwell time, the start accept flag (M2001+n) turns OFF, and the positioning complete signal (M2401+20n) turns ON.)

POINT

If it is made to stop by turning on the stop command (M3200+20n) during a home position return, execute the home position return again.

If the stop command is turned on after the proximity dog ON in the proximity dog method, execute the home position return after move to before the proximity dog ON by the JOG operation or positioning.

- (2) Rapid stop command (M3201+20n) Command signal
 - (a) This command stops a starting axis rapidly from an external source and becomes effective at leading edge of signal. (An axis for which the rapid stop command is turning on cannot be started.)



(b) The details of stop processing when the rapid stop command turns on are shown below.

Control details	Processing at the turning	g rapid stop command on		
during execution	During control	During deceleration stop processing		
Position control				
Speed control (I)				
Speed control (I)	The axis decelerates to a rapid stop	Deceleration processing is stopped and		
JOG operation	deceleration time set in the parameter block or servo program.	rapid stop processing is executed.		
Speed control with	block of servo program.			
fixed position stop				
Manual pulse	An immediate stop is executed without			
generator operation	deceleration processing.	_		
Home position return	(1) The axis decelerates to a stop in the raparameter block.(2) A "stop error during home position retucode: 203) is stored in the minor error	·		
Speed-torque control	The speed commanded to servo amplifier is "0". The mode is switched to position control mode when "Zero speed" turns ON, and the operation stops.	_		

(c) The rapid stop command in a dwell time is invalid. (After a dwell time, the start accept flag (M2001+n) turns OFF, and the positioning complete signal (M2401+20n) turns ON.)

POINT

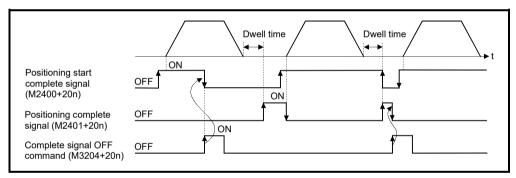
If it is made to stop rapidly by turning on the rapid stop command (M3201+20n) during a home position return, execute the home position return again. If the rapid stop command turned on after the proximity dog ON in the proximity dog method, execute the home position return after move to before the proximity dog ON by the JOG operation or positioning.

- (3) Forward rotation JOG start command (M3202+20n)/Reverse rotation JOG start command (M3203+20n) Command signal
 - (a) JOG operation to the address increase direction is executed while forward rotation JOG start command (M3202+20n) is turning on. When M3202+20n is turned off, a deceleration stop is executed in the deceleration time set in the parameter block.
 - (b) JOG operation to the address decrease direction is executed while reverse rotation JOG start command (M3203+20n) is turning on. When M3203+20n is turned off, a deceleration stop is executed in the deceleration time set in the parameter block.

POINT

Take an interlock so that the forward rotation JOG start command (M3202+20n) and reverse rotation JOG start command (M3203+20n) may not turn on simultaneously.

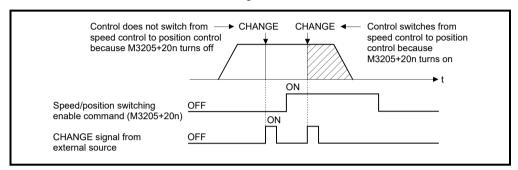
- (4) Complete signal OFF command (M3204+20n)
 - Command signal
 - (a) This command is used to turn off the positioning start complete signal (M2400+20n) and positioning complete signal (M2401+20n).



POINT

Do not turn the complete signal OFF command on with a PLS instruction. If it is turned on with a PLS instruction, it cannot be turned off the positioning start complete signal (M2400+20n) and the positioning complete signal (M2401+20n). Be sure to turn OFF the complete signal OFF, command after confirming the positioning start complete signal (M2400+20n) and positioning complete signal (M2401+20n) are OFF.

- (5) Speed/position switching enable command (M3205+20n)
 - Command signal
 - (a) This command is used to make the CHANGE signal (speed/position switching signal) effective from an external source.
 - ON Control switches from speed control to position control when the CHANGE signal turned on.
 - OFF Control does not switch from speed to position control even if the CHANGE signal turns on.



- (6) Gain changing 2 command (M3206+20n) QDS(Ver.)
 - Command signal

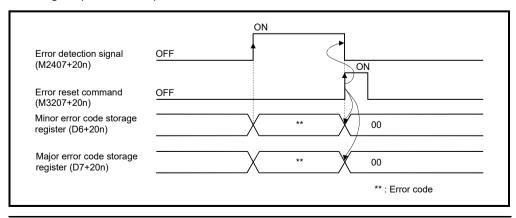
This signal is used to change the gain of servo amplifier (MR-J5(W)-□B) in the Motion controller by the gain changing 2 command ON/OFF.

- ON Gain changing 2 command ON
- OFF Gain changing 2 command OFF

When gain changing command (M3216+20n) and gain changing 2 command (M3206+20n) are both ON, the setting details of gain changing 2 command (M3206+20n) are prioritized.

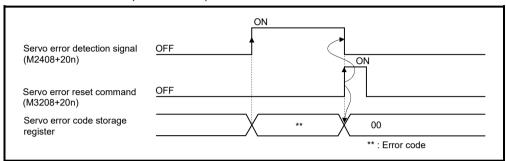
Refer to the "Servo amplifier Instruction Manual" for details of gain changing function.

(7) Error reset command (M3207+20n) Command signal This command is used to clear the minor error code storage register (D6+20n) and major error code storage register (D7+20n) of an axis for which the error detection signal has turn on (M2407+20n: ON), and reset the error detection signal (M2407+20n).



Ver.!: Refer to Section 1.3 for the software version that supports this function.

(8) Servo error reset command (M3208+20n) Command signal This command is used to clear the servo error code storage register (D8+20n) of an axis for which the servo error detection signal has turn on (M2408+20n: ON), and reset the servo error detection signal (M2408+20n). Even when the servo warning is detected (Servo error detection (M2408+20n): OFF), servo error code storage register (D8+20n) can be cleared by servo error reset command (M3208+20n).



REMARK

Refer to APPENDIX 1 for details on the minor error code, major error code and servo error code storage registers.

(9) External stop input disable at start command (M3209+20n) Command signal

This signal is used to set the external stop signal input valid or invalid.

- ON External stop input is set as invalid, and even axes which stop input is turning on can be started.
- OFF External stop input is set as valid, and axes which stop input is turning on cannot be started.

POINT

When it stops an axis with the external stop input after it starts by turning on the external stop input disable at start command (M3209+20n), switch the external stop input from OFF \rightarrow ON (if the external stop input is turning on at the starting, switch it from ON \rightarrow OFF \rightarrow ON).

(10) Feed current value update request command (M3212+20n)	
the starting in speed-position switching control or speed control (I). • ON	nal
ONThe feed current value is not cleared at the starting. The feed current value is updated from the starting. In speed control (I), the software stroke limit is valid. OFFThe feed current value is cleared at the starting.	at
The feed current value is updated from the starting. In speed control (I), the software stroke limit is valid. • OFFThe feed current value is cleared at the starting.	
In speed control (I), the software stroke limit is valid. • OFFThe feed current value is cleared at the starting.	
 OFFThe feed current value is cleared at the starting. 	
 OFFThe feed current value is cleared at the starting. 	
In speed-position switching control, the feed current value is	
updated from the starting.	
In speed control (I), "0" is stored in the feed current value.	
QDS(Ver.)	
 -	

POINT

When it starts by turning on the feed current value update request command (M3212+20n), keep M3212+20n on until completion of the positioning control. If M3212+20n is turned off on the way, the feed current value may not be reliable.

- (11) Servo OFF command (M3215+20n) Command signal This command is used to execute the servo OFF state (free run state) when all axes servo ON command (M2042) is ON.
 - OFF Servo ON
 - ON Servo OFF (free run state)

Execute this command after positioning completion because it becomes invalid during positioning.

⚠ CAUTION

- Turn the power supply of the servo amplifier side off before touching a servo motor, such as machine adjustment.
 - (12) Gain changing command (M3216+20n) Command signal This signal is used to change the gain of servo amplifier in the Motion controller by the gain changing command ON/OFF.
 - ON..... Gain changing command ON
 - OFF Gain changing command OFF

When gain changing command (M3216+20n) and gain changing 2 command (M3206+20n) are both ON, the setting details of gain changing 2 command (M3206+20n) are prioritized. QDS

Refer to the "Servo amplifier Instruction Manual" for details of gain changing function.

Ver.!): Refer to Section 1.3 for the software version that supports this function.

(13) PI-PID switching command (M3217+20n) QDS(

...... Command signal

This signal is used to change the PI-PID switching of servo amplifier in the Motion controller by the PI-PID switching command ON/OFF.

- ON......PI-PID switching command ON(PID control)
- OFF......PI-PID switching command OFF(PI control)

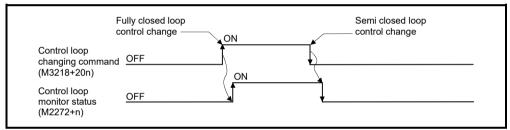
Refer to the "Servo amplifier Instruction Manual" for details of PI-PID switching function.

(14) Control loop changing command (M3218+20n)

...... Command signal

When using the fully closed loop control servo amplifier, this signal is used to change the fully closed loop control/semi closed loop control of servo amplifier in the Motion controller by the control loop changing command ON/OFF.

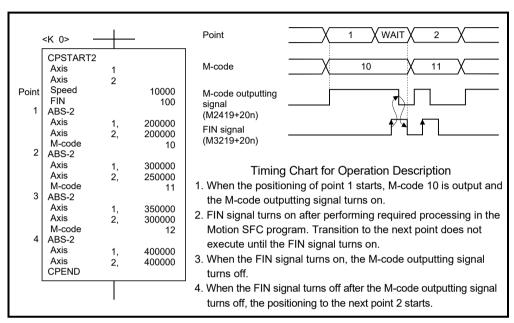
- ON...... During fully closed loop control
- OFF During semi closed loop control



Refer to the "Servo amplifier Instruction Manual" for details of control loop changing function.

POINTS

- (1) When the servo amplifier is not started (LED: "AA", "Ab", "AC", "Ad" or "AE"), if the control loop changing command is turned ON/OFF, the command becomes invalid.
- (2) When the following are operated during the fully closed loop, it returns to the semi closed loop control.
 - (a) Power supply OFF or reset of the Multiple CPU system
 - (b) Wire breakage of the SSCNET**I** cable between the servo amplifier and Motion controller
 - (c) Control circuit power supply OFF of the servo amplifier



POINTS

- (1) The FIN signal (M3219+20n) and M-code outputting signal (M2419+20n) are both signal for the FIN signal wait function.
- (2) The FIN signal (M3219+20n) and M-code outputting signal (M2419+20n) are valid only when FIN acceleration/deceleration is designated in the servo program.

Otherwise, the FIN signal wait function is disabled, and the M-code outputting signal (M2419+20n) does not turn on.

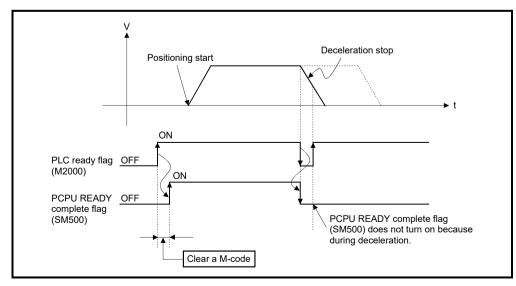
3.1.3 Common devices

POINTS

- (1) Internal relays for positioning control are not latched even within the latch range.
- (2) The range devices allocated as internal relays for positioning control cannot be used by the user even if their applications have not been set.
- (1) PLC ready flag (M2000) Command signal
 - (a) This signal informs the Motion CPU that the PLC CPU is normal.
 - The positioning control, home position return, JOG operation or manual pulse generator operation using the servo program which performs the Motion SFC program when the M2000 is ON.
 - The above 1) control is not performed even if the M2000 is turned on during the test mode [TEST mode ON flag (SM501): ON] using MT Developer2.
 - (b) The setting data such as the fixed parameters, servo parameters and limit switch output data can be changed using MT Developer2 when the M2000 is OFF only.

The above data using MT Developer2 cannot be written when the M2000 is ON.

- (c) The following processing are performed when the M2000 turns OFF to ON.
 - 1) Processing details
 - Clear the M-code storage area of all axes.
 - Turn the PCPU READY complete flag (SM500) on. (Motion SFC program can be executed.)
 - Start to execute the Motion SFC program of the automatic starting from the first.
 - 2) If there is a starting axis, an error occurs, and the processing in above (c) 1) is not executed.
 - 3) The processing in above (c) 1) is not executed during the test mode. It is executed when the test mode is cancelled and M2000 is ON.



- (d) The following processes are performed when the M2000 turns ON to OFF.
 - 1) Processing details
 - Turn the PCPU READY complete flag (SM500) off.
 - Deceleration stop of the starting axis.
 - Stop to execute the Motion SFC program.
 - Turn all points of the real output PY off.
- (e) Operation at STOP to RUN

Set the condition in which the PLC ready flag (M2000) turns ON. Select the following either.

- 1) M2000 turns ON by switching from STOP to RUN. (Default) Condition in which the M2000 turns from OFF to ON.
 - Move the RUN/STOP switch from STOP to RUN.
 - Turn ON the Multiple CPU system's power supply with the RUN/STOP switch set to RUN.

Condition in which the M2000 turns from ON to OFF

- Move the RUN/STOP switch from RUN to STOP.
- 2) M2000 turns ON by switching from STOP to RUN and by setting "1" in the setting register.

Condition in which the M2000 turns from OFF to ON

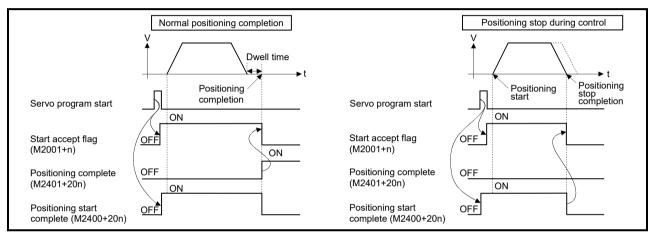
 Set "1" in the setting register (D704) of the PLC ready flag or turn ON the PLC ready flag (M3072) with the RUN/STOP switch set to RUN. (The Motion CPU detects the change from "0" to "1" in the lowest bit of D704.)

Condition in which the M2000 turns from ON to OFF

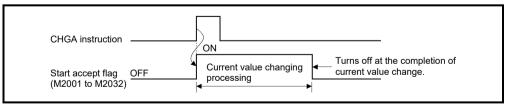
- Set "0" in the setting register (D704) of the PLC ready flag or turn OFF the PLC ready flag (M3072) with the RUN/STOP switch set to RUN. (The Motion CPU detects the change from "1" to "0" in the lowest bit of D704.)
- Move the RUN/STOP switch from RUN to STOP.

- (2) Start accept flag (M2001 to M2032) Status signal
 - (a) This flag turns on when the servo program is started. The start accept flag corresponding to an axis specified with the servo program turns on.
 - (b) The ON/OFF processing of the start accept flag is shown below.
 - When the servo program is started using the Motion SFC program or Motion dedicated PLC instruction (D(P).SVST), the start accept flag corresponding to an axis specified with the servo program turns on and it turns off at the positioning completion. This flag also turns off when it is made to stopping on the way.

(When it is made to stop on the way by the speed change to speed "0", this flag remains on.)



- 2) This flag turns on at the positioning control by turning on the JOG start command (M3202+20n or M3203+20n), and turns off at the positioning stop by turning off the JOG start command.
- This flag turns on during the manual pulse generator enable (M2051 to M2053: ON), and turns off at the manual pulse generator disable (M2051 to M2053: OFF).
- 4) This flag turns on during a current value change by the CHGA instruction of servo program or Motion dedicated PLC instruction (D(P).CHGA), and turns off at the completion of the current value change.



The start accept flag list is shown below.

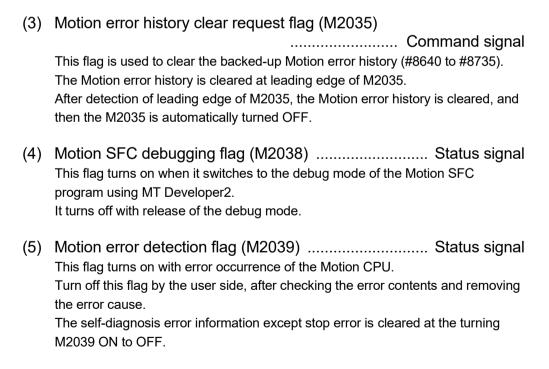
Axis No.	Device No.	Axis No.	Device No.	Axis No.	Device No.	Axis No.	Device No.
1	M2001	9	M2009	17	M2017	25	M2025
2	M2002	10	M2010	18	M2018	26	M2026
3	M2003	11	M2011	19	M2019	27	M2027
4	M2004	12	M2012	20	M2020	28	M2028
5	M2005	13	M2013	21	M2021	29	M2029
6	M2006	14	M2014	22	M2022	30	M2030
7	M2007	15	M2015	23	M2023	31	M2031
8	M2008	16	M2016	24	M2024	32	M2032

(Note): The following range is valid.

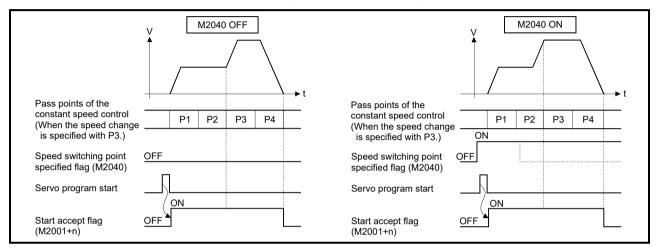
- Q172DSCPU : Axis No.1 to 16
- Q172DCPU(-S1): Axis No.1 to 8

∆ CAUTION

- Do not turn the start accept flags ON/OFF in the user side.
 - If the start accept flag is turned off using the Motion SFC program or MT Developer2 while this flag is on, no error will occur but the positioning operation will not be reliable. Depending on the type of machine, it might operate in an unanticipated operation.
 - If the start accept flag is turned on using the Motion SFC program or MT Developer2 while this flag is off, no error will occur but the "start accept on error" will occur at the next starting and cannot be started.



- (6) Speed switching point specified flag (M2040) Command signal This flag is used when the speed change is specified at the pass point of the constant speed control.
 - (a) By turning M2040 on before the starting of the constant speed control (before the servo program is started), control with the change speed can be executed from the first of pass point.
 - OFF Speed is changed to the specified speed from the pass point of the constant speed control.
 - ON Speed has been changed to the specified speed at the pass point of the constant speed control.



- - ON Error
 - OFF Normal
 - (a) When an error occurs, the 7-segment LED at the front side of Motion CPU shows the system setting error.

The error contents can be confirmed using the monitor of MT Developer2.

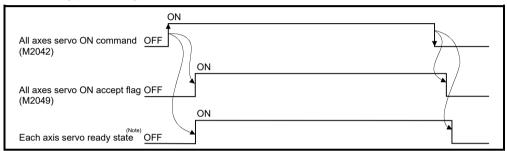
(b) When M2041 is ON, positioning cannot be started. Remove an error factor, and turn the Multiple CPU system's power supply on again or reset.

REMARK

Even if the module which is not set as the system setting of MT Developer2 is installed in the slot, it is not set as the object of an adjustment check. And, the module which is not set as the system setting cannot be used in the Motion CPU.

- (8) All axes servo ON command (M2042) Command signal This command is used to enable servo operation.
 - (a) Servo operation enabled M2042 turns on while the servo OFF command (M3215+20n) is off and there is no servo error.
 - (b) Servo operation disable M2042 is off
 - The servo OFF command (M3215+20n) is on
 - Servo error state
 - Forced stop

Execute this command after positioning completion because it becomes invalid during positioning.



(Note): Refer to servo ready signal (M2415+20n) in Section 3.1.1 for details.

POINT

When M2042 turns ON, it is not turned off even if the Motion CPU is set in the STOP state.

M2042 turns OFF by the forced stop of Motion CPU.

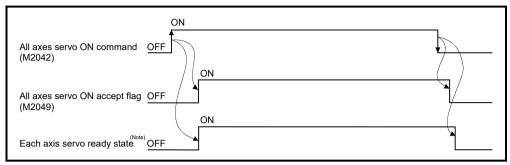
- (9) Motion slot fault detection flag (M2047) Status signal This flag is used as judgement of which modules installed in the slot of Motion management are "normal" or "abnormal".
 - ON Installed module is abnormal
 - OFF Installed module is normal

The module information at the power supply on and after the power supply ON are always checked, and errors are detected.

- (a) When M2047 turns OFF in operation, the operating axis decelerates to a stop.
- (b) When an error occurs, the 7-segment LED at the front side of Motion CPU shows the system setting error.
 - The error contents can be confirmed using the monitor of MT Developer2.
- (c) When M2047 is ON, positioning cannot be started. Remove an error factor, and turn the Multiple CPU system's power supply on again or reset.
- (10) JOG operation simultaneous start command (M2048) Command signal
 - (a) When M2048 turns on, JOG operation simultaneous start based on the JOG operation execution axis set in the JOG operation simultaneous start axis setting register (D710 to D713).
 - (b) When M2048 turns OFF, the operating axis decelerates to a stop.

(11) All axes servo ON accept flag (M2049) Status signal This flag turns on when the Motion CPU accepts the all axes servo ON command (M2042).

Since the servo ready state of each axis is not checked, confirm it in the servo ready signal (M2415+20n).



(Note): Refer to servo ready signal (M2415+20n) in Section 3.1.1 for details.

(12) Manual pulse generator enable flag (M2051 to M2053)

...... Command signal

This flag set the enabled or disabled state for positioning with the pulse input from the manual pulse generators connected to P1 to P3 (Note) of the Q173DPX.

- ON Positioning control is executed by the input from the manual pulse generators.
- OFF Positioning control cannot be executed by the manual pulse generators because of the input from the manual pulse generators is ignored.

Default value is invalid (OFF).

REMARK

(Note): Refer to the "Q173D(S)CPU/Q172D(S)CPU User's Manual" for P1 to P3 connector of the Q173DPX.

(13) Operation cycle over flag (M2054) Status signal

This flag turns on when the time concerning motion operation exceeds the operation cycle of the Motion CPU setting (SD523). Perform the following operation, in making it turn off.

- Turn the power supply of the Multiple CPU system on to off
- Reset the Multiple CPU system
- Reset using the user program

[Operation cycle over measures]

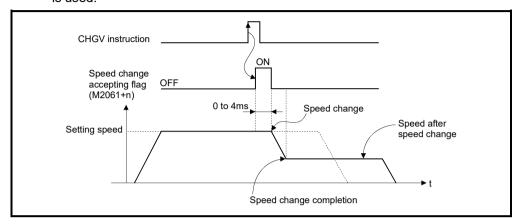
- 1) Change the operation cycle into a large value in the system setting.
- 2) The number of instruction completions of an event task or NMI task in the Motion SFC program.

(14) Speed change accepting flag (M2061 to M2092)

..... Status signal

This flag turns on at start of speed change by the control change (CHGV) instruction of the Motion SFC program.

The flag does not turn on when Motion dedicated PLC instruction (D(P).CHGV) is used.



The speed change accepting flag list is shown below.

Axis No.	Device No.	Axis No.	Device No.	Axis No.	Device No.	Axis No.	Device No.
1	M2061	9	M2069	17	M2077	25	M2085
2	M2062	10	M2070	18	M2078	26	M2086
3	M2063	11	M2071	19	M2079	27	M2087
4	M2064	12	M2072	20	M2080	28	M2088
5	M2065	13	M2073	21	M2081	29	M2089
6	M2066	14	M2074	22	M2082	30	M2090
7	M2067	15	M2075	23	M2083	31	M2091
8	M2068	16	M2076	24	M2084	32	M2092

(Note): The following range is valid.

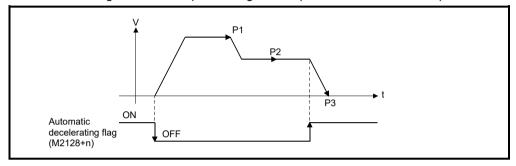
• Q172DSCPU : Axis No.1 to 16

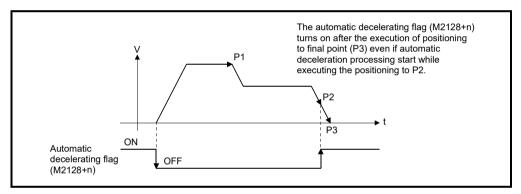
• Q172DCPU(-S1): Axis No.1 to 8

REMARK

In the SV22 virtual mode, the flag is that of the virtual servo motor axis.

- (15) Automatic decelerating flag (M2128 to M2159) Status signal This signal turns on while automatic deceleration processing is performed during the positioning control or position follow-up control.
 - (a) This flag turns on while automatic deceleration to the command address at the position follow-up control, but it turns off if the command address is changed.
 - (b) This signal turns on while automatic deceleration processing is performed during execution of positioning to final point while in constant speed control.



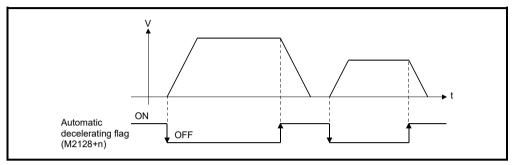


POINT

Set a travel value in which automatic deceleration processing can be started at the final positioning point, therefore the automatic decelerating flag turns on at the start point of automatic deceleration processing after this final point.

- (c) The signal turns off when all normal start complete commands became achieve.
- (d) The automatic decelerating flag (M2128+n) might be turned ON even during acceleration at advanced S-curve acceleration/deceleration.

- (e) In any of the following cases, the automatic decelerating flag (M2128+n) does not turn ON.
 - During deceleration due to JOG signal off
 - During manual pulse generator operation
 - During deceleration due to stop command or stop cause occurrence
 - When travel value is 0



The automatic decelerating flag list is shown 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

(Note): The following range is valid.

• Q172DSCPU : Axis No.1 to 16

• Q172DCPU(-S1): Axis No.1 to 8

REMARK

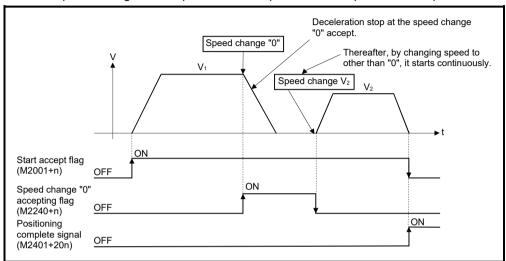
In the SV22 virtual mode, the flag is that of the virtual servo motor axis.

(16) Speed change "0" accepting flag (M2240 to M2271)

..... Status signal

This flag turns on while a speed change request to speed "0" or negative speed change request is being accepted.

It turns on when the speed change request to speed "0" or negative speed change request is accepted during a start. After that, this signal turns off when a speed change is accepted or on completion of a stop due to a stop cause.



The speed change "0" accepting flag list is shown 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	M2245	14	M2253	22	M2261	30	M2269
7	M2246	15	M2254	23	M2262	31	M2270
8	M2247	16	M2255	24	M2263	32	M2271

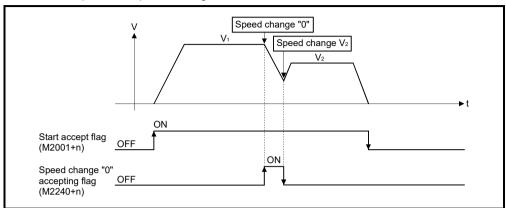
(Note): The following range is valid.

- Q172DSCPU : Axis No.1 to 16
- Q172DCPU(-S1): Axis No.1 to 8

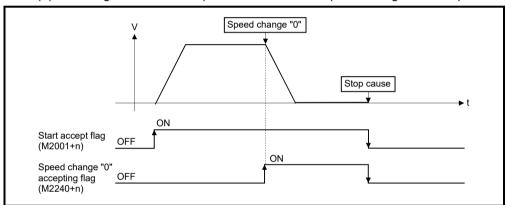
REMARK

- (1) Even if it has stopped, when the start accept flag (M2001+n) is ON state, the state where the request of speed change "0" is accepted is indicated. Confirm by this speed change "0" accepting flag (M2240+n).
- (2) During interpolation, the flags corresponding to the interpolation axes are set.
- (3) In any of the following cases, the speed change "0" request is invalid.
 - · After deceleration by the JOG signal off
 - · During manual pulse generator operation
 - After positioning automatic deceleration start
 - After deceleration due to stop cause
- (4) During the SV22 virtual mode, the flag is that of the virtual servo motor axis.

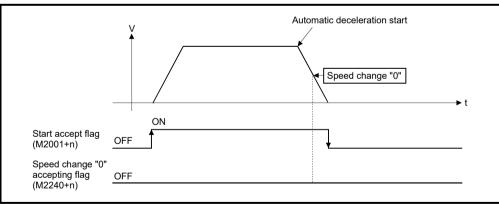
(a) The flag turns off if a speed change request occurs during deceleration to a stop due to speed change "0".

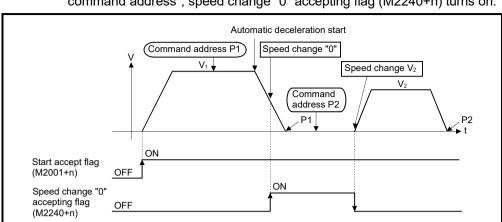


(b) The flag turns off if a stop cause occurs after speed change "0" accept.



(c) The speed change "0" accepting flag (M2240+n) does not turn on if a speed change "0" occurs after an automatic deceleration start.





(d) Even if it is speed change "0" after the automatic deceleration start to the "command address", speed change "0" accepting flag (M2240+n) turns on.

REMARK

It does not start, even if the "command address" is changed during speed change "0" accepting.

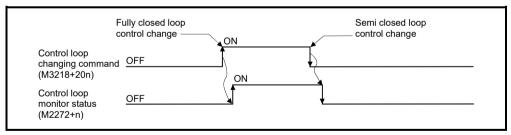
(17) Control loop monitor status (M2272 to M2303)

...... Command signal

When using the fully closed loop control servo amplifier, this signal is used to check the fully closed loop control/semi closed loop control of servo amplifier.

- ON During fully closed loop control
- OFF During semi closed loop control

It can be changed the fully closed loop control/semi closed loop control of servo amplifier in the Motion controller by the control loop changing command ON/OFF.



The Control loop monitor status list is shown below.

Axis No.	Device No.	Axis No.	Device No.	Axis No.	Device No.	Axis No.	Device No.
1	M2272	9	M2280	17	M2288	25	M2296
2	M2273	10	M2281	18	M2289	26	M2297
3	M2274	11	M2282	19	M2290	27	M2298
4	M2275	12	M2283	20	M2291	28	M2299
5	M2276	13	M2284	21	M2292	29	M2300
6	M2277	14	M2285	22	M2293	30	M2301
7	M2278	15	M2286	23	M2294	31	M2302
8	M2279	16	M2287	24	M2295	32	M2303

(Note): The following range is valid.

• Q172DSCPU : Axis No.1 to 16

• Q172DCPU(-S1): Axis No.1 to 8

3.2 Data Registers

(1) Data register list

	SV13	SV22						
		Vii	rtual mode switching method	Advan	ced synchronous control method			
Device No.	Purpose	Device No.	Purpose	Device No.	Purpose			
D0 to	Axis monitor device (20 points × 32 axes)	D0 to	Axis monitor device (20 points × 32 axes) Real mode : Each axis Virtual mode : Output module	D0 to	Axis monitor device (20 points × 32 axes)			
D640 to	Control change register (2 points × 32 axes)	D640 to	Control change register (2 points × 32 axes)	D640 to	Control change register (2 points × 32 axes)			
D704	Common device (Command signal)	D704	Common device (Command signal)	D704	Common device (Command signal)			
to D758	(54 points) Unusable	to D758	(54 points) Unusable	to D758	(54 points) Unusable			
to	(42 points)	to	(42 points)	to	(42 points)			
D800	User device	D800 to D1120 to	Virtual servo motor axis monitor device (Note-1) (10 points × 32 axes) Synchronous encoder axis monitor device (10 points × 12 axes)	D800	User device			
D8191	(7392 points)	D1240 to D1560 to D8191	Cam axis monitor device (Note-1) (10 points × 32 axes) User device (6632 points)	D8191	(7392 points)			
				D8192 to D10240	User device (2048 points) System area			
				to D12280	(2040 points) QDS(Var) Servo input axis monitor device (10 points × 32 axes) QDS(Var)			
				to D12600 to	Command generation axis monitor device (20 points × 32 axes)			
				D13240 to	Synchronous encoder axis monitor device (20 points × 12 axes)			
				D13480 to D13600	Unusable (120 points)			
	,		,	to D14560	(30 points × 32 axes) CDS (Ver) Unusable			
				to D14599	(40 points) QDS(Ver.)			

Ver.!): Refer to Section 1.3 for the software version that supports this function.

Data register list (Continued)

	SV13		SV	′22	
Davida		Vii	rtual mode switching method	Advan	ced synchronous control method
Device No.	Purpose	Purpose Device No.		Device No.	Purpose
				D14600 to	Servo input axis control device (2 points × 32 axes) QDS(Ver
				D14664	Unusable
				to	(16 points) QDS(Ver)
				D14680	Command generation axis control
				to	device (4 points × 32 axes) QDS(Ver)
				D14808	Unusable
				to	(12 points) QDS(Ver.)
				D14820	Synchronous encoder axis control
				to	device (10 points × 12 axes) QDS(Ver)
				D14940	Unusable
				to	(60 points) QDS(Ver.)
/	/	/	/	D15000	Output axis control device
				to	(150 points × 32 axes) QDS(Ver
				D19800	Unusable
				to D19823	(24 points) ODS (Ver)

It can be used as a user device.

(Note-1): It can be used as a user device in the SV22 real mode only.

POINT

• Total number of user device points

• SV13 : 7392 points

: 6632 points (Note) • SV22 virtual mode switching method

• SV22 advanced synchronous control method : 9440 points ODS (Ver.)

(Note): Up to 7272 points can be used when not using it in the virtual mode.

Ver.!: Refer to Section 1.3 for the software version that supports this function.

(2) Axis monitor device list

Axis No.	Device No.			Signal name			
1	D0 to D19						_
2	D20 to D39		0: 1	D ()	-		Signal
3	D40 to D59		Signal name	Refresh cycle	Fetch cycle	Unit	direction
4	D60 to D79	0					
5	D80 to D99	1	Feed current value		/	Command	
6	D100 to D119	2	De el como de celos	Ou and the seconds		unit	
7	D120 to D139	3	Real current value	Operation cycle	/		
8	D140 to D159	4	David Harry County and the				
9	D160 to D179	5	Deviation counter value] /	pulse	
10	D180 to D199	6	Minor error code	Immediate	/		
11	D200 to D219	7	Major error code	Immediate] /	_	
12	D220 to D239	8	Servo error code	Main cycle] /		Monitor
13	D240 to D259		Home position return re-		/	nula a	device
14	D260 to D279	9	travel value	Ou and the manual a		pulse	
15	D280 to D299	10	Travel value after proximity	Operation cycle	/	Command	
16	D300 to D319	11			/	unit	
17	D320 to D339	12	Execute program No.	At start] /		
18	D340 to D359	13	M-code	Operation evals	/		
19	D360 to D379	14	Torque limit value	Operation cycle] /	%	
20	D380 to D399	15	Data set pointer for constant-	At start/during start	/		
21	D400 to D419	18	speed control	At start/during start	V	_	
22	D420 to D439	16	Unusable (Note-1)				
23	D440 to D459	17	, Unusable ,	_		_	_
24	D460 to D479	18	Real current value at stop	Operation cycle		Command	Monitor
25	D480 to D499	19	input	Operation cycle		unit	device
26	D500 to D519						
27	D520 to D539						
28	D540 to D559						
29	D560 to D579						
30	D580 to D599						
31	D600 to D619						
32	D620 to D639						

(Note-1): It can be used as the travel value change register. The travel value change register can be set to the device optionally in the servo program. Refer to Section 6.15 for details.

POINT

(1) The following range is valid.

Q172DSCPU : Axis No.1 to 16Q172DCPU(-S1): Axis No.1 to 8

(2) The following device area can be used as a user device.

• Q172DSCPU : 17 axes or more • Q172DCPU(-S1): 9 axes or more

However, when the project of Q172DSCPU/Q172DCPU(-S1) is replaced with Q173DSCPU/Q173DCPU(-S1), this area cannot be used as a user device.

(3) Control change register list

		(0)	Control onango rog				
Axis No.	Device No.			Signal name			
1	D640, D641						
2	D642, D643		Oi maral managa	Defeath wells	Estab anala	119	Signal
3	D644, D645		Signal name	Refresh cycle	Fetch cycle	Unit	direction
4	D646, D647	0	JOG speed setting		At start	Command	Command
5	D648, D649	1	JOG speed selling		At Start	unit	device
6	D650, D651						
7	D652, D653						
8	D654, D655						
9	D656, D657						
10	D658, D659						
11	D660, D661						
12	D662, D663						
13	D664, D665						
14	D666, D667						
15	D668, D669						
16	D670, D671						
17	D672, D673						
18	D674, D675						
19	D676, D677						
20	D678, D679						
21	D680, D681						
22	D682, D683						
23	D684, D685						
24	D686, D687						
25	D688, D689						
26	D690, D691						
27	D692, D693						
28	D694, D695						
29	D696, D697						
30	D698, D699						
31	D700, D701						
32	D702, D703						

POINT

(1) The following range is valid.

• Q172DSCPU : Axis No.1 to 16 • Q172DCPU(-S1): Axis No.1 to 8

(2) The following device area can be used as a user device.

Q172DSCPU : 17 axes or moreQ172DCPU(-S1): 9 axes or more

However, when the project of Q172DSCPU/Q172DCPU(-S1) is replaced with Q173DSCPU/Q173DCPU(-S1), this area cannot be used as a user device.

(4) Common device list

Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction	Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction
D704	PLC ready flag request				D752	Manual pulse generator 1 smoothing magnification setting register			
D705	Speed switching point specified flag request				D753	Manual pulse generator 2 smoothing magnification setting register		At the manual pulse generator enable flag OFF to ON	
D706	All axes servo ON command request		Main cycle	Command device	D754	Manual pulse generator 3 smoothing magnification setting register			Command device
D707	Real mode/virtual mode switching request (SV22) (Note-1)				D755	Manual pulse generator 1 enable flag request			
D708	JOG operation simultaneous start command request				D756	Manual pulse generator 2 enable flag request	/	Main cycle	
D709	Unusable	_	_	_	D757	Manual pulse generator 3 enable flag request			
D710 D711	JOG operation simultaneous				D758 D759				
D711	start axis setting register	1	At start		D760				
D713		1			D761				
D714	Manual pulse generator axis	1			D762				
D715	1 No. setting register	1			D763				
D716	Manual pulse generator axis	1			D764				
D717 D718	2 No. setting register				D765 D766				
D719	Manual pulse generator axis 3 No. setting register				D767				
D720	Axis 1	1			D768				
D721	Axis 2]			D769				
D722	Axis 3				D770				
D723	Axis 4	1			D771				
D724	Axis 5	1			D772				
D725 D726	Axis 6 Axis 7				D773 D774				
D727	Axis 8				D775				
D728	Axis 9	1			D776				
D729	Axis 10	1			D777				
D730	Axis 11			Command	D778	Unusable			
D731	Axis 12		A4 40	device	D779	(42 points)	_	_	_
D732	Axis 13	1	At the manual pulse generator enable flag		D780				
D733 D734	Axis 14 Axis 15 Manual pulse		OFF to ON		D781 D782				
D734 D735	Axis 16 generators 1 pulse				D782				
D736	Input magnification				D784				
D737	Axis 17 setting register (Note-2), (Note-3)	1			D785				
D738	Axis 19	1 1			D786				
D739	Axis 20				D787				
D740	Axis 21				D788				
D741 D742	Axis 22 Axis 23	1 1			D789 D790				
D742	Axis 24	1 /			D790 D791				
D744	Axis 25				D792				
D745	Axis 26				D793				
D746	Axis 27	1			D794				
D747	Axis 28	1 /			D795				
D748	Axis 29	1			D796				
D749	Axis 30	1			D797				
D750 D751	Axis 31 Axis 32	V			D798 D799				
2,01	. 5 OZ		l .		5,00				

(Note-1): It is unusable in the SV22 advanced synchronous control.

(Note-2): The following range is valid.

• Q172DSCPU : Axis No.1 to 16

• Q172DCPU(-S1) : Axis No.1 to 8

(Note-3): The following device area is unusable.

• Q172DSCPU : 17 axes or more

• Q172DCPU(-S1) : 9 axes or more

3.2.1 Axis monitor devices

The monitoring data area is used by the Motion CPU to store data such as the feed current value during positioning control, the real current value and the deviation counter value.

It can be used to check the positioning control state using the Motion SFC program. The user cannot write data to the monitoring data area.

Refer to "APPENDIX 4 Processing Times of the Motion CPU" for the delay time between a positioning device (input, internal relay and special relay) turning on/off and storage of data in the monitor data area.

stora	ige o	f da	ta in the monitor data area.
(1)	Fee	ed d	current value storage register (D0+20n, D1+20n) Monitor device
	(a)	bas pro 1)	is register stores the target address output to the servo amplifier on the sis of the positioning address/travel value specified with the servo orgam. A part for the amount of the travel value from "0" after starting is stored in the fixed-pitch feed control. The feed current value storage register (D0+20n, D1+20n) during speed-position switching control and speed control is as follows. a) When using Q173DSCPU/Q172DSCPU • In the speed-position switching control and speed control (I), the address at the start depends on the state of feed current value
			update command (M3212+20n) as shown below. • M3212+20n: OFF Resets the feed current value to "0" at the start.

- "0" is stored during speed control (II).
- b) When using Q173DCPU(-S1)/Q172DCPU(-S1)
 - In the speed-position switching control, the address at the start depends on the state of feed current value update command (M3212+20n) as shown below.

• M3212+20n: ON ... Not reset the feed current value at the start.

- M3212+20n: OFF ... Resets the feed current value to "0" at the start.
- M3212+20n: ON ... Not reset the feed current value at the start.
- "0" is stored during speed control (${\bf I}$) and speed control (${\bf I}$).
- (b) The stroke range check is performed on this feed current value data.

(2)	Re	al current value storage register (D2+20n, D3+20n)
		Monitor device
	(a)	This device stores the converted value (in an axis control unit) of the feedback position of the motor encoder (in pulse unit).
	(b)	The "feed current value" is equal to the "real current value" in the stopped state.

- (4) Minor error code storage register (D6+20n) Monitor device
 - (a) This register stores the corresponding error code (Refer to APPENDIX 1.2.) at the minor error occurrence. If another minor error occurs after error code storing, the previous error code is overwritten by the new error code.
 - (b) Minor error codes can be cleared by an error reset command (M3207+20n).
- (5) Major error code storage register (D7+20n) Monitor device
 - (a) This register stores the corresponding error code (Refer to APPENDIX 1.3.) at the major error occurrence. If another major error occurs after error code storing, the previous error code is overwritten by the new error code.
 - (b) Major error codes can be cleared by an error reset command (M3207+20n).
- (6) Servo error code storage register (D8+20n) Monitor device
 - (a) This register stores the corresponding error code (Refer to APPENDIX 1.4.) at the servo error occurrence. If another servo error occurs after error code storing, the previous error code is overwritten by the new error code.
 - (b) Servo error codes can be cleared by an error reset command (M3208+20n).
 - (c) For MR-J5(W)-□B, the register stores error codes (2000 or 2100) (Refer to APPENDIX 1.4.) at the servo error occurrence. Error codes read by the servo amplifier are stored in the servo amplifier display servo error code (#8008+20n).

If the position specified with travel value after proximity dog ON (Refer to Section 6.23.1) using MT Developer2 is used to stop at a position that is not a zero point, the position is made to travel to a zero point by re-travel in the Motion CPU. In this case, the travel value (signed) of making it travel to a zero point by re-travel is stored. (Data does not change with the last value in the data setting type.) The following value is stored according to the number of feedback pulses of the motor connected.

Number of feedback pulses	Stored data
Less than 131072[pulse]	Home position return re-travel value ([pulse] units)
131072[pulse] or more,	1/10 of the home position return re-travel value
262144[pulse] or less	(×10 ⁻¹ [pulse] units) (Note-1)
More than 262144[pulse]	1/10000 of the home position return re-travel value (×10 ⁻⁴ [pulse] units) (Note-1)

(Note-1): Confirm the actual value in home position return re-travel value (#8006+20n, #8007+20n).

- - (a) This register stores the travel value (unsigned) from the proximity dog ON to home position return completion after the home position return start.
 - (b) The travel value (unsigned) of the position control is stored at the time of speed-position switching control.

(9)	Exe	ecute program No. storage register (D12+20n)
` ,		Monitor device
	(a)	This register stores the starting program No. at the servo program starting.
	(b)	generator operation.
		1) JOG operation FFFFh
		2) Manual pulse generator operation FFFEh
		3) Speed control ODS. FFDFh 4) Torque control ODS. FFDEh
		5) Continuous operation to torque control QDS FFDDh
		6) Power supply on FF00h
		7) Current value change execution
		by the Motion dedicated instruction FFE0h
		8) Advanced synchronous control QDS(FFEFh
	(c)	When the following control is being executed using MT Developer2 in the test mode, FFFDh is stored in this register. • Home position return
(10)	М	-code storage register (D13+20n) Monitor device
(10)		This register stores the M-code (Note) set to the executed servo program at
	()	the positioning start.
		If M-code is not set in the servo program, the value "0" is stored.
	(b)	It does not change except positioning start using the servo program.
	(c)	The value "0" is stored at leading edge of PLC ready flag (M2000).
R	EM/	ARK
/NI	-t-\.	Defends the fellowing coefficient for Manadan and reading Manadan
(14	ole).	Refer to the following sections for M-codes and reading M-codes. • M-code Section 7.1
		• Reading M-code APPENDIX 2.1
		Treading W 6646
(11)	To	orque limit value storage register (D14+20n) Monitor device
	(a)	This register stores the positive direction torque limit value to command the
		servo amplifier (unit: [%]).
		The default value "300[%]" is stored at the power supply of servo amplifier
		ON.
	(b)	To monitor the positive/negative direction torque limit value, set "positive
		direction torque limit value monitor device" and "negative direction torque
		limit value monitor device" with the expansion parameter (Refer to Section
		4.4). QDS

(12) Data set pointer for constant-speed control (D15+20n)

..... Monitor device

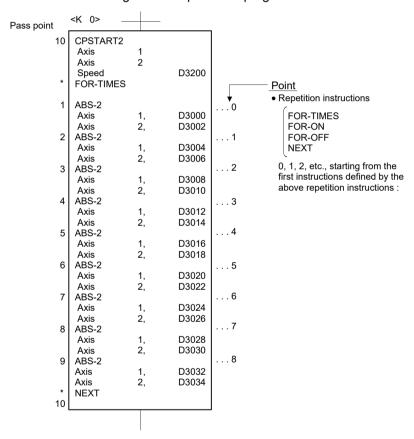
This pointer is used in the constant-speed control when specifying positioning data indirectly and substituting positioning data during operation.

It stores a "point" that indicates which of the values stored in indirect devices has been input to the Motion CPU.

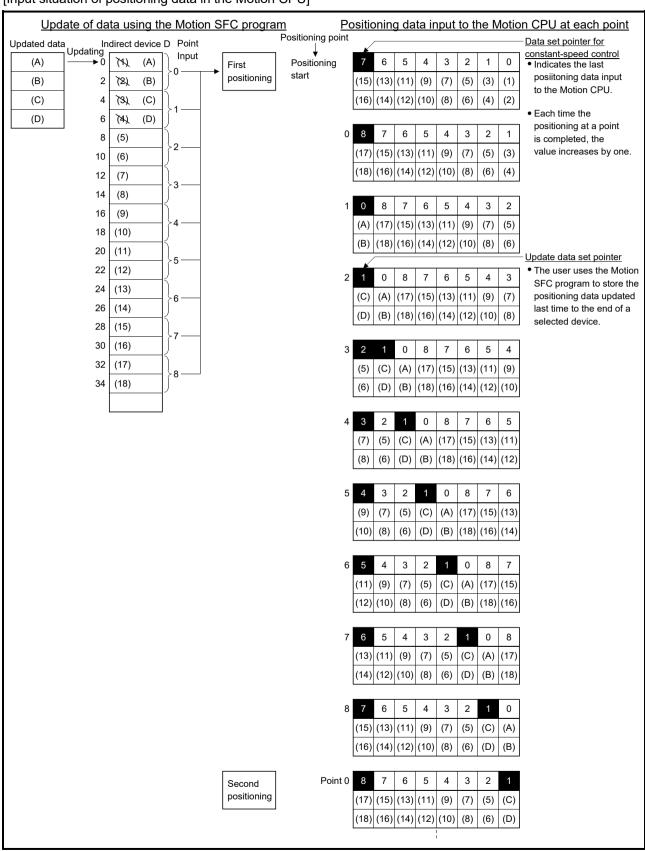
Use this pointer to confirm which positioning data is to be updated using the Motion SFC program.

Also, store the positioning data updated last time to the end of a selected device to use as an updated data set pointer for checking the extent to which the positioning data has been updated.

Data set pointer for constant-speed control and updated data set pointer are described here using the example servo program below.



The input situation of positioning data to the Motion CPU is shown the next page by executing the 2-axes constant-speed control using above the servo program and updating the positioning data in indirect devices D3000 to D3006.



[Input situation of positioning data in the Motion CPU]

The internal processing shown above is described in the next page.

[Internal processing]

- (a) The positioning data ((1) to (16)) of points 0 to 7 is input to the Motion CPU by the constant-speed control starting process (before positioning start). The last point "7" of the input data to be input is stored in the data set pointer for constant-speed control at this time. Because the positioning for point 0 starts immediately after, space opens in the input area for positioning data and the Motion CPU inputs point 8 ((17) to (18)) positioning data. The last point "8" of the input data is stored in the data set pointer for constant-speed control. The "8" stored in the data set pointer for constant-speed control indicates that the second updating of the positioning data stored in points 0 to 8 is possible.
- (b) The positioning data ((1) to (4)) of points 0 to 1 is updated to positioning data ((A) to (D)) using the Motion SFC program.
 The last point "1" of the updated positioning data is stored in the updated data set pointer (the user must create a Motion SFC program) at this time.
 Positioning data of points 2 to 8 (data (5) to (18)) can still be updated.
 However, the positioning data ((A) to (D)) of the updated points 0 to 1 can also be updated because at this point it has still not been input to the Motion CPU.
- (c) On completion of the positioning for point 0, point 1 positioning starts, the Motion CPU discards the positioning data ((3) to (4)) of point 1, and inputs the positioning data ((A) to (B)) of point 0 (second positioning). At this time, the value of the data set pointer for constant-speed control automatically proceeds and changes to "0".
- (d) Hereafter, whenever positioning of each point is completed, the positioning data shifts one place.

The positioning data that can be updated is the data which has not yet been input to the Motion CPU.

Even if the values of the indirect devices D3008 and D3010 are updated by the Motion SFC program after the positioning completion of the point 3, the positioning data of point 2 that is input to the Motion CPU will not be updated and the second positioning will be executed using the unupdated data. The data set pointer for constant-speed control has not yet been input to the Motion CPU, and indicates the positioning data which a user can update using the Motion SFC program.

POINT

Number of points that can be defined by a repeat instruction

- The Motion CPU inputs 8 points in advance, so create a servo program of at least 9 points.
- Even when there are 9 points or more, if pass points with small travel values are included the positioning at each point may complete, and the data input to the Motion CPU, before the data has been updated using the Motion SFC program.
- Create a sufficient number of points to ensure that data will not be input before the Motion CPU has updated the values in the indirect devices.

3.2.2 Control change registers

This area stores the JOG operation speed data.

Table 3.1 Data storage area for control change list

Name	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8
	D641, D640	D643, D642	D645, D644	D647, D646	D649, D648	D651, D650	D653, D652	D655, D654
	Axis 9	Axis 10	Axis 11	Axis 12	Axis 13	Axis 14	Axis 15	Axis 16
JOG speed	D657, D656	D659, D658	D661, D660	D663, D662	D665, D664	D667, D666	D669, D668	D671, D670
setting	Axis 17	Axis 18	Axis 19	Axis 20	Axis 21	Axis 22	Axis 23	Axis 24
register	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

(Note): The following range is valid.

• Q172DSCPU : Axis No. 1 to 16 • Q172DCPU(-S1) : Axis No. 1 to 8

- (1) JOG speed setting registers (D640+2n, D641+2n)
 - Command device
 - (a) This register stores the JOG speed at the JOG operation.
 - (b) Setting range of the JOG speed is shown below.

Unit		mm		inch		degree		pulse	
It	tem	Setting range	Unit	Setting range	Unit	Setting range	Unit (Note-1)	Setting range	Unit
	100	1 to	×10 ⁻²	1 to	×10 ⁻³	1 to	×10 ⁻³	1 to	[m.dee/el
	JOG speed	600000000	[mm/min]	600000000	[inch/min]	2147483647	[degree/min]	2147483647	[pulse/s]

(Note-1): When the "speed control $10 \times$ multiplier setting for degree axis" is set to "valid" in the fixed parameter, the unit is " $\times 10^{-2}$ [degree/min]".

- (c) The JOG speed is the value stored in the JOG speed setting registers (D640+2n, D641+2n) at leading edge of JOG start signal. Even if data is changed during JOG operation, JOG speed cannot be changed.
- (d) Refer to Section 6.21 for details of JOG operation.

3.2.3 Common devices

Because cannot be turn on/off in every bit from the PLC CPU, the bit device is assigned to data register (D), and each bit device turns on with the lowest rank bit 0 to 1 and each bit device becomes off with 1 to 0.

The details of request register are shown below.

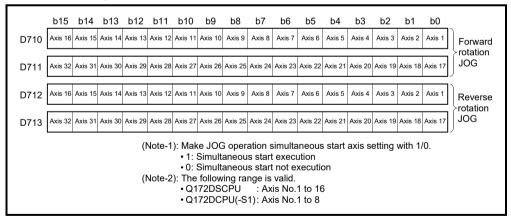
(Refer to Section "3.1.3 Common devices" for the bit device M2000 to M2053.)

Details of the request register

No.	Function	Request register	Bit device	Remark ^(Note-1)
1	PLC ready flag	D704	M2000	M3072
2	Speed switching point specified flag	D705	M2040	M3073
3	All axes servo ON command	D706	M2042	M3074
4	Real mode/virtual mode switching request (SV22) (Note-2)	D707	M2043	M3075
5	JOG operation simultaneous start command	D708	M2048	M3076
6	Manual pulse generator 1 enable flag	D755	M2051	M3077
7	Manual pulse generator 2 enable flag	D756	M2052	M3078
8	Manual pulse generator 3 enable flag	D757	M2053	M3079

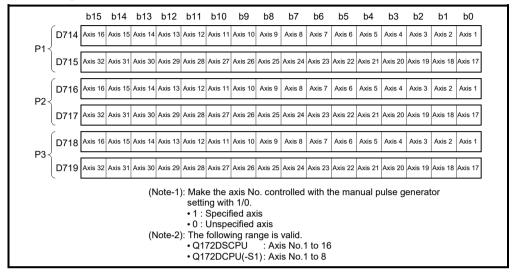
(Note-1): It can also be ordered the device of a remark column. (Note-2):It is unusable in the SV22 advanced synchronous control.

- - (a) These registers set the axis No. and direction which start simultaneously the JOG operation.



(b) Refer to Section 6.21.3 for details of the JOG operation simultaneous start.

- - (a) These registers stores the axis No. controlled with the manual pulse generator.



- (b) Refer to Section 6.22 for details of the manual pulse generator operation.
- (4) Manual pulse generator 1-pulse input magnification setting registers (D720 to D751) Command device
 - (a) These register set the magnification (1 to 10000) per pulse of number of the input pulses from manual pulse generator at the pulse generator operation.

1-pulse input magnification setting register	Axis No.	Setting range	1-pulse input magnification setting register	Axis No.	Setting range
D720	Axis 1		D736	Axis 17	
D721	Axis 2		D737	Axis 18	
D722	Axis 3		D738	Axis 19	
D723	Axis 4		D739	Axis 20	
D724	Axis 5		D740	Axis 21	
D725	Axis 6		D741	Axis 22	
D726	Axis 7		D742	Axis 23	
D727	Axis 8	1 to 10000	D743	Axis 24	1 to 10000
D728	Axis 9	1 10 10000	D744	Axis 25	1 to 10000
D729	Axis 10		D745	Axis 26	
D730	Axis 11		D746	Axis 27	
D731	Axis 12		D747	Axis 28	
D732	Axis 13		D748	Axis 29	
D733	Axis 14		D749	Axis 30	
D734	Axis 15		D750	Axis 31	
D735	Axis 16		D751	Axis 32	

(Note): The following range is valid.

• Q172DSCPU : Axis No. 1 to 16

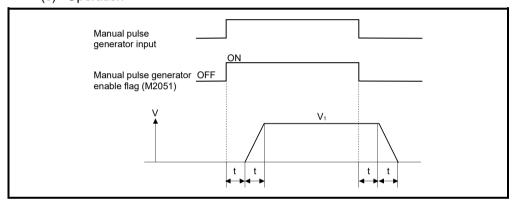
• Q172DCPU(-S1): Axis No. 1 to 8

(b) Refer to Section 6.22 for details of the manual pulse generator operation.

- - (a) These registers set the smoothing time constants of manual pulse generators.

Manual pulse generator smoothing magnification setting register	Setting range
Manual pulse generator 1 (P1): D752	
Manual pulse generator 2 (P1): D753	0 to 59
Manual pulse generator 3 (P1): D754	

- (b) When the smoothing magnification is set, the smoothing time constant is as indicated by the following expression.Smoothing time constant (t) = (smoothing magnification + 1) × 56.8 [ms]
- (c) Operation



Output speed (V_1) [pulse/s] = (Number of input pulses/s) \times (Manual pulse generator 1-pulse input magnification setting)

REMARK

(1) The travel value per pulse of the manual pulse generator is shown below.

Setting unit	Setting range
mm	0.1[µm]
inch	0.00001[inch]
degree	0.00001[degree]
pulse	1[pulse]

(2) The smoothing time constant is 56.8[ms] to 3408[ms].

3.3 Motion Registers (#)

There are motion registers (#0 to #12287) in the Motion CPU. #8000 to #8639 are used as the monitor device, #8640 to #8735 are used as the Motion error history device and #8736 to #8751 are used as the product information list device. Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion Controller (SV13/SV22) Programming Manual (Motion SFC)" for details of the motion registers and Motion error history device.

(1) Monitor devices (#8000 to #8639)

Information for each axis is stored in the monitor devices. The details of the storage data are shown below.

Axis No.	Device No.		Signal name						
1	#8000 to #8019								
2	#8020 to #8039		$\overline{\ }$	Oi-mark manner	Defract, and	Oi ann a lealine a tie an			
3	#8040 to #8059			Signal name	Refresh cycle	Signal direction			
4	#8060 to #8079		0	Servo amplifier type	When the servo amplifier power-on				
5	#8080 to #8099		1	Motor current value					
6	#8100 to #8119		2	Matanana	Operation cycle 1.7[ms] or less : Operation cycle				
7	#8120 to #8139		3	Motor speed	1otor speed Operation cycle 3.5[ms] or more : 3.5[ms]				
8	#8140 to #8159		4	0	On and formation				
9	#8160 to #8179		5	Command speed	Operation cycle				
10	#8180 to #8199		6	Home position return re-	At home position return to trevel	Monitor dovice			
11	#8200 to #8219		7	travel value	At home position return re-travel	Monitor device			
12	#8220 to #8239		0	Servo amplifier display servo					
13	#8240 to #8259		8	error code	Main cycle				
14	#8260 to #8279		9	Parameter error No. QDS					
15	#8280 to #8299		10	Servo status1 QDS(On anation avaled 4.75mal an land On anation avala				
16	#8300 to #8319		11	Servo status2 Operation cycle 1.7[ms] or less : Operation cycle 3.5[ms] or more : 3.5[ms]					
17	#8320 to #8339		12	Servo status3 QDS	Operation cycle 3.5[ms] or more . 3.5[ms]				
18	#8340 to #8359		13	Unusable	_	_			
19	#8360 to #8379		11	Servo status5 QDS(Ver.)	Operation cycle 1.7[ms] or less : Operation cycle	Monitor device			
20	#8380 to #8399		14	Servo statuss	Operation cycle 3.5[ms] or more : 3.5[ms]	Monitor device			
21	#8400 to #8419		15						
22	#8420 to #8439		16	Unusable	_	_			
23	#8440 to #8459		17						
24	#8460 to #8479		18	Servo status7 QDS(Ver.)	Operation cycle 1.7[ms] or less : Operation cycle	Monitor device			
25	#8480 to #8499		10	Servo status/	Operation cycle 3.5[ms] or more : 3.5[ms]	IVIOLIIIOI GEVICE			
26	#8500 to #8519		19	Unusable	_	_			
27	#8520 to #8539								
28	#8540 to #8559								
29	#8560 to #8579								
30	#8580 to #8599								
31	#8600 to #8619								
32	#8620 to #8639								

Ver.!: Refer to Section 1.3 for the software version that supports this function.

(a)	This register	fier type (#8000+20n) stores the servo amplifier type for each axis at th wer supply ON.	
	• 0	• • •	
	• 256		
	250	MR-J3W-□B (For 2-axis type)	
	• 257		
	• 257	MR-J3-□B-RJ006 (For fully closed loop control)	
	. 250	MR-J3-□B Safety (For drive safety servo)	
		MR-J3-□B-RJ004 (For Linear servo motor)	h
		MR-J3-□B-RJ080W (For direct drive motor) Ver	•
	• 4096	MR-J4-DB @DS(
	4050	MR-J4W- B (For 2-axis type, 3-axis type)	
	• 4352	VCII series (Note-1) (CKD Nikki Denso Co., Ltd. m	iake) (25)
	1051	Ver.	
	• 4354	VCI series (For Linear stage) (Note-2)	
	4050	(CKD Nikki Denso Co., Ltd. make) Ver.	
	• 4359	VCI series (For direct drive motor) (Note-2)	
	1000	(CKD Nikki Denso Co., Ltd. make) Ver.	
	• 4608	MR-JE-□B QDS(Ver.)	
	1004	MR-JE- BF QDS (Ver.)	ons/
	• 4864	VPH series (Note-1) (CKD Nikki Denso Co., Ltd. n	nake) (PDS)
	4000	Ver.)	
	• 4866	VPH series (For Linear stage) (Note-2)	
	. 4074	(CKD Nikki Denso Co., Ltd. make) (PSK Ver.)	
	• 48/1	VPH series (For direct drive motor) (Note-2)	
	5040	(CKD Nikki Denso Co., Ltd. make) QDS(Ver.)	
	• 5210	MR-J5- B QDS (Ver.)	
	0400	MR-J5W- B (For 2-axis type, 3-axis type)	ver.ii
		FR-A800-1 (Inverter) QDS (Ver.)	
		FR-A800-2 (Inverter) QDS(Ver.)	
		IAI electric actuator controller	
		(IAI Corporation make) QDS(Ver.)	
	• 8233	5-phase stepping motor driver	
	0004	(ORIENTAL MOTOR Co., Ltd. make) QDS(Ver.)	
	• 8234	Stepping motor driver AlphaStep (AZ series)	
	10010	(ORIENTAL MOTOR Co., Ltd. make) QDS((Ver.)	
	• 16640	FR-A700 series (Inverter) (Ver.)	
		(Note-1): When connecting SSCNETⅢ/H	
		(Note-2): When connecting SSCNETⅢ	0==
	It is not clear	red even if the servo amplifier power supply turns	OFF.
(b)	Motor currer	nt value (#8001+20n)	Monitor device
. ,		stores the motor current value ($ imes 0.1 [\%]$) (signed	

The motor speed ($\times 0.1$ [mm/s]) (signed) is stored at linear servo use.

- (e) Home positions return re-travel value (#8006+20n, #8007+20n)

.....Monitor device

If the position stopped in the position specified with the travel value after proximity dog ON using MT Developer2 is not zero point, it made to travel to zero point by re-travel in the Motion CPU. The travel value (signed ([pulse] units)) of making it travel to zero point by re-travel at this time is stored. (Data does not change with the last value in the data setting type.)

(f) Servo amplifier display servo error code (#8008+20n) Ver.

..... Monitor device

This register stores the servo error code read from the servo amplifier.

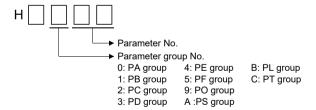
The hexadecimal display is the same as the LED of servo amplifier.

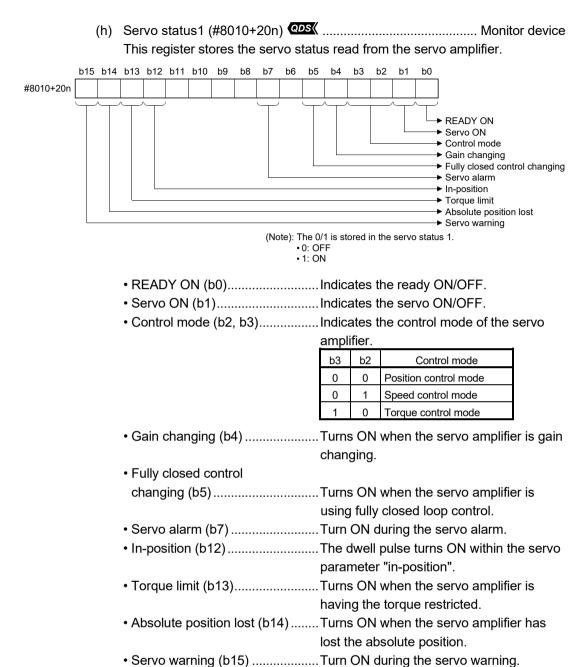
Refer to the "Servo amplifier Instruction Manual" for details of the servo error codes.

Servo amplifier type	Servo amplifier LED display
MR-J5(W)-□B ODS(Ver.)	Displays 4 digits ^(Note-1) on the LED display
MR-J4(W)-□B	Displays 3 digits on the LED display
MR-J3-□B	Displays 2 digits on the LED display
MR-J3W-□B	Displays the first 2 digits on the LED display
MR-JE-□B QDS(Ver.)	Displays 3 digits on the LED display

(Note-1): Alarm No. (3 digits) + Alarm detail No. (1 digit)

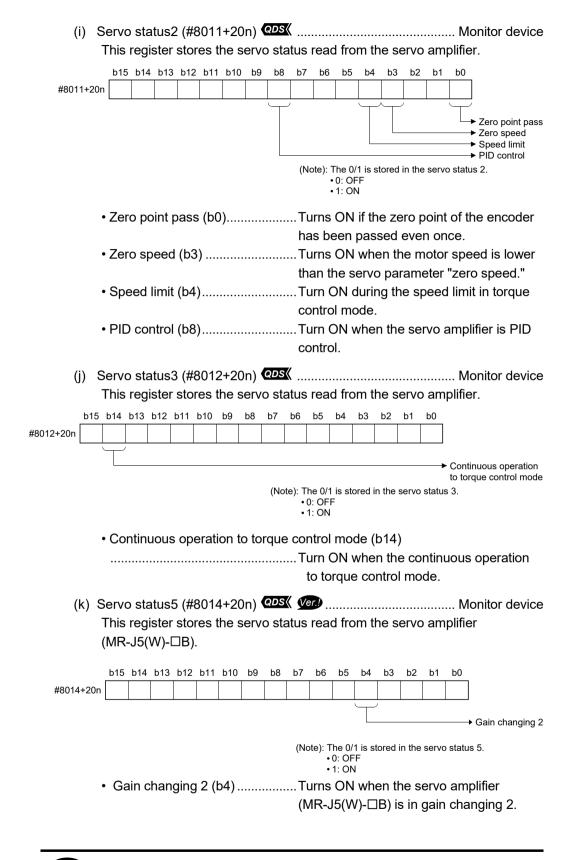
(g) Parameter error No. (#8009+20n) The parameter number of error servo parameter is stored in hexadecimal at the servo error occurrence.

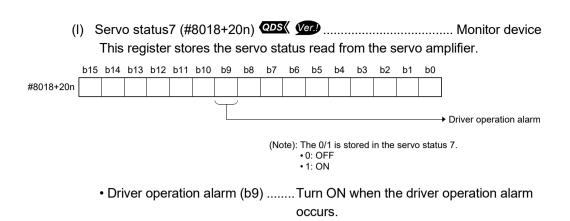




POINT

Servo warning (b15) turns ON during Motion controller forced stop or servo forced stop.





(2) Product information list devices (#8736 to #8751) Ver

The operating system software version and serial number of Motion CPU is stored in ASCII code.

The product information list devices are shown below.

Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction
#8736				
to	Operating system software version			
#8743				
#8744		At power on		Monitor device
to	Motion CPU module serial number			
#8751				

(a) Operating system software version (#8736 to #8743) Monitor device The operating system software version of Motion CPU displayed on the system monitor (product information list) of GX Works2/GX Developer is stored in ASCII code.

(Example) Operating system software version: "SV22j VER300A"

								Devic	e No.							
	#87	736	#87	737	#87	738	#87	739	#87	740	#87	741	#87	742	#87	743
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
ASCII code	20H	53H	56H	32H	32H	6AH	20H	20H	56H	45H	52H	33H	30H	30H	41H	20H
Character	I	S	V	2	2	j			V	Е	R	3	0	0	Α	Γ

□ : Space.

(b) Motion CPU module serial number (#8744 to #8751) Monitor device The serial number of Motion CPU displayed on the system monitor (product information list) of GX Works2/GX Developer is stored in ASCII code. (Example) Serial number: "A7Z123015"

								Devic	e No.							
	#87	744	#87	745	#87	746	#87	747	#87	748	#87	749	#87	750	#87	751
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
ASCII code	41H	37H	5AH	31H	32H	33H	30H	31H	35H	20H	20H	20H	20H	20H	20H	20H
Character	Α	7	Z	1	2	3	0	1	5							Г

□ : Space.

POINT

Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion Controller User's Manual" or "Q173D(S)CPU/Q172D(S)CPU Motion Controller Programming Manual (COMMON)" for checking of the operating system software version and serial number.

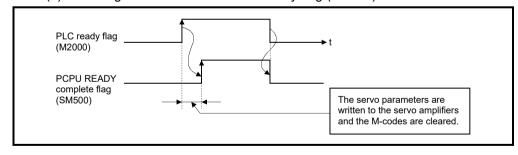
3.4 Special Relays (SM)

There are 2256 special relay points of SM0 to SM2255 in the Motion CPU. Of these, devices in a Table 3.2 are used for the positioning control. The special relay list used for the positioning control is shown below. (Refer to "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for the application of special relays except below.)

Fetch cycle Device No. Refresh cycle Signal type Signal name SM500 PCPU READY complete flag Main cycle SM501 TEST mode ON flag SM502 External forced stop input flag Operation cycle Digital oscilloscope executing flag SM503 Main cycle External forced stop input ON latch flag ver Operation cycle SM506 Status signal SM508 Amplifier-less operation status flag SM510 TEST mode request error flag Motion CPU WDT error flag SM512 Main cycle SM513 Manual pulse generator axis setting error flag SM516 Servo program setting error flag

Table 3.2 Special relay list

- (1) PCPU READY complete flag (SM500) Status signal This flag is used as judgement of the normal or abnormal in the Motion CPU side
 - using the sequence program.
 - (a) The fixed parameters, servo parameters and limit switch output data are checked at leading edge of PLC ready flag (M2000), and if error is not detected, this flag turns on.
 - The servo parameters are written to the servo amplifiers and the M-codes are cleared.
 - (b) This flag turns off when the PLC ready flag (M2000) turns off.



(2)	TEST mode ON flag (SM501)
	(b) If the test mode is not executed in the test mode request from MT Developer2, the TEST mode request error flag (SM510) turns on.
(3)	External forced stop input flag (SM502)
(1)	If the forced stop signal is input during positioning, the operation is as follows. • When using Q173DSCPU/Q172DSCPU The feed current value becomes the same value as the real current value. • When using Q173DCPU(-S1)/Q172DCPU(-S1) The feed current value is advanced within the rapid stop deceleration time set in the parameter block. At the same time, the servo OFF state is established because the all axes servo ON command (M2042) turns off. When the rapid stop deceleration time has elapsed after input of the forced stop signal, the feed current value returns to the value at the point when the emergency stop was initiated. If the forced stop is cancelled while the rapid stop deceleration time isn't progressing, an overspeed error or error excessive error may occur.
(4)	Digital oscilloscope executing flag (SM503) Status signal This flag is used to check the state of execution for the digital oscilloscope. • OFF Digital oscilloscope has stopped. • ON Digital oscilloscope is executing.
(5)	External forced stop input ON latch flag (SM506) Status signal This flag turns on when an external forced stop input is detected. After that, it remains ON even if the external forced stop input is cancelled. Reset the external forced stop input ON latch flag using the Motion SFC program. OFF External forced stop input is not detected. ON External forced stop input is detected.

_

(6)	This	plifier-less operation status flag (SM508) Status signal s flag is used to check the state of amplifier-less operation. FFDuring normal operation NDuring amplifier-less operation
(7)		ST mode request error flag (SM510) Status signal This flag turns on when the test mode is not executed in the test mode request using MT Developer2.
	(b)	When SM510 turns on, the error contents are stored in the test mode request error information (SD510, SD511).
(8)	This Mot Who with If the The	tion CPU WDT error flag (SM512)
(9)	Ма	nual pulse generator axis setting error flag (SM513)Status signal
	(a)	This flag is use as judgement of normal or abnormal setting of the manual pulse generator axis No. setting registers (D714 to D719). • OFFD714 to D719 is normal • OND714 to D719 is abnormal
	(b)	This flag turns ON by turning ON the manual pulse generator enable flag (M2051 to M2053) with the manual pulse generator axis P1 to P3 unused after setting the manual pulse generator interface module (Q173DPX) in the system setting.
	(c)	When SM513 turns on, the error contents are stored in the manual pulse generator axis setting error information (SD513 to SD515).
(10)	Th po	ervo program setting error flag (SM516) Status signal also lis flag is used as judgement of normal or abnormal for the servo program sitioning data. DEF

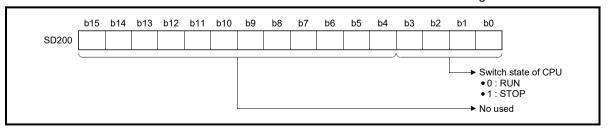
3.5 Special Registers (SD)

There are 2256 special register points of SD0 to SD2255 in the Motion CPU. Of these, devices in a Table 3.3 are used for the positioning control. The special register list used for the positioning control is shown below. (Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for the applications of special registers except below.)

Table 3.3 Special register list

Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction
SD200	State of switch		/	
SD500	Real mode axis information register (SV22)	Main cycle	/	
SD501	(Note-1)			
SD502	Company is a long time information	At power supply on/] /	
SD503	Servo amplifier loading information	operation cycle		
SD504] /	
SD505	Real mode/virtual mode switching error information (SV22) (Note-1)	At virtual mode transition	/	
SD506	Information (SV22) (*******/		/	
SD508	SSCNET control (status)	Main cycle		
SD510	T444	04 44 d	/	
SD511	Test mode request error information	At test mode request] /	
SD512	Motion CPU WDT error cause	At Motion CPU WDT error occurrence		Monitor device
SD513] /	
SD514	Manual pulse generator axis setting error	At the manual pulse generator	/	
SD515	information	enable flag OFF to ON		
SD516	Error program No.	A] /	
SD517	Error item information	At start] /	
SD522	Motion operation cycle	Operation cycle] /	
SD523	Operation cycle of the Motion CPU setting	At power supply on] /	
SD524	Maximum Motion operation cycle QDSK	Operation cycle] /	
SD550	System setting array information (0)	At System setting error	/	
SD551	System setting error information QDS(occurrence]/	
SD560	Operation method QDS(Ver.)	At power supply on	V	
SD803	SSCNET control (command)		Main cycle	Command device

(Note-1): It is unusable in the SV22 advanced synchronous control.



(2) Real mode axis information register (SD500, SD501)

..... Monitor device

This signal is used to store the information used as a real mode axis at the time of switching from real mode to virtual mode.

The real mode axis information does not change at the time of switching from virtual mode to real mode.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	_
SD500	Axis 16	Axis 15	Axis 14	Axis 13	Axis 12	Axis 11	Axis 10	Axis 9	Axis 8	Axis 7	Axis 6	Axis 5	Axis 4	Axis 3	Axis 2	Axis 1	
SD501	Axis 32	Axis 31	Axis 30	Axis 29	Axis 28	Axis 27	Axis 26	Axis 25	Axis 24	Axis 23	Axis 22	Axis 21	Axis 20	Axis 19	Axis 18	Axis 17	
		•Q -2): Re Pro	172DS 172DC fer to / ogramr	SCPU PU(-S APPEN ning M	: Ax 31): Ax NDIX o Ianual	is No. is No. f the "((VIRT)	Q173D	(S)CP ODE)"	for the			otion c		er (SV e axis	22)		Except real mode axis Real mode axis

(3) Servo amplifier loading information (SD502, SD503)

..... Monitor device

The mounting status of the servo amplifier is checked at the power supply on or reset of the Multiple CPU system and its results are stored in this device. If communication with servo amplifier stops, it is reset.

The mounting status of changed axis after the power supply on is stored.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	
SD502	Axis 16	Axis 15	Axis 14	Axis 13	Axis 12	Axis 11	Axis 10	Axis 9	Axis 8	Axis 7	Axis 6	Axis 5	Axis 4	Axis 3	Axis 2	Axis 1	
SD503	Axis 32	Axis 31	Axis 30	Axis 29	Axis 28	Axis 27	Axis 26	Axis 25	Axis 24	Axis 23	Axis 22	Axis 21	Axis 20	Axis 19	Axis 18	Axis 17	
	(Note-	1): The ●Q1				valid. s No.1	to 16										amplifier mounting sta ot mounted ounted

(a) Servo amplifier mounting status

- 1) Mounting status
 - Mounted The servo amplifier is normal. (Communication with the servo amplifier is normal.)
 - Not mounted The servo amplifier is not mounted.
 The servo amplifier control circuit power is off.
 Normal communication with the servo amplifier is not possible due to a connecting cable fault, etc.
- 2) The system settings and servo amplifier mounting status are shown below.

Occations Continue	Servo a	ımplifier
System Settings	Mounted	Not mounted
Used (axis No. setting)	1 is stored	0 is stored
Unused	0 is s	tored

- - 0 Command accept waiting
 - -1 Execute waiting
 - -2 Executing

Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for details of the SSCNET control function.

(5) Test mode request error information (SD510, SD511)

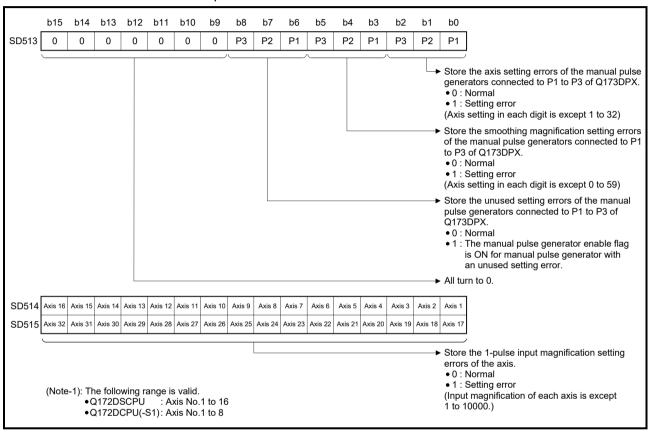
If there are operating axis at a test mode request using MT Developer2, a test mode request error occurs, the test mode request error flag (SM510) turns on, and the during operation/stop data of each axis are stored.

_	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	_
SD510	Axis 16	Axis 15	Axis 14	Axis 13	Axis 12	Axis 11	Axis 10	Axis 9	Axis 8	Axis 7	Axis 6	Axis 5	Axis 4	Axis 3	Axis 2	Axis 1	
SD511	Axis 32	Axis 31	Axis 30	Axis 29	Axis 28	Axis 27	Axis 26	Axis 25	Axis 24	Axis 23	Axis 22	Axis 21	Axis 20	Axis 19	Axis 18	Axis 17	
		-1): Th														data o	s the during operation/sto of each axis During stop

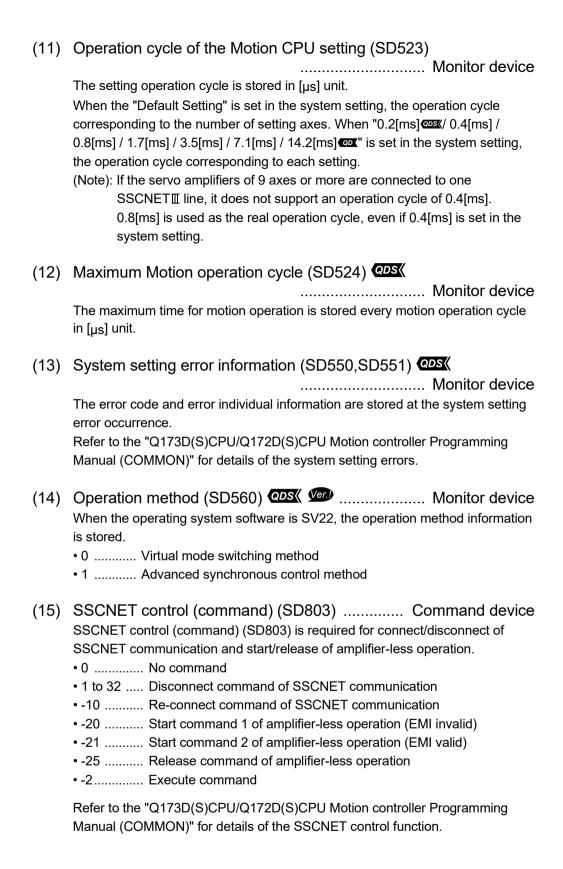
(6) Motion CPU WDT error cause (SD512) Monitor device This register is used as judgement of the error contents in the Motion CPU.

Error code	Error cause	Operation when error occurs	Action to take
1	S/W fault 1		Reset the Multiple CPU system.
2	Operation cycle time over	All axes stop immediately, after which operation cannot be started.	 If the an operation cycle time over reoccurs after resetting, or a main cycle is lengthened (more than 1.0[s]), 1) Change the operation cycle into a large value in the system setting. 2) Reduce the number of command execution of the event task or NMI task in the system setting.
4	WDT error		Reset the Multiple CPU system.
300	S/W fault 3		If the error reoccurs after resetting, explain the error symptom
303	S/W fault 4		and get advice from our sales representative.
304	RIO WDT error		

If there is an unused setting error for the manual pulse generator axis, a correspondence bit of SD513 turns ON.



- (8) Error program No. (SD516) Monitor device
 - (a) When the servo program error occurs at the servo program start, the servo program setting error flag (SM516) turns on and the error servo program No. (0 to 4095).
 - (b) If an error occurs in another servo program when error program No. has been stored, the program No. of the new error is stored.



MEMO		
-		
-		

4. PARAMETERS FOR POSITIONING CONTROL

4.1 System Settings

In the Multiple CPU system, the common system parameters and individual parameters are set for each CPU and written to each CPU.

- (1) The base settings, Multiple CPU settings and Motion slot settings are set in the common system parameter setting.
- (2) The following are set in the individual parameter setting.
 - · System basic setting
 - SSCNET setting QDS
 - CPU name setting
 - · Built-in Ethernet port setting
 - CPU setting
 - Manual pulse generator/synchronous encoder setting QDS
 - Servo amplifier setting
 - · High-speed read setting
 - · Optional data monitor setting
 - Mark detection setting QDS
- (3) The data setting and correction can be performed in MT Developer2. (Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion Controller Programming Manual (COMMON)" for details of the setting contents.)

4.2 Fixed Parameters

- (1) The fixed parameters are set for each axis and their data is fixed based on the mechanical system, etc.
- (2) The fixed parameters are set using MT Developer2.
- (3) The fixed parameters to be set are shown in Table 4.1.

Table 4.1 Fixed parameter list

	1				0.46								
No.	Item			inch	Setting	range		pulse		Initial value	Units	Units Remarks	Section
NO.	item	mm Setting range	Units	Setting range	Linite	degree Setting range Units		Setting range Units		miliai value	Units	Remarks	Section
1	Unit setting	0	_	1	-	2	—	3	-	3	_	Set the command unit for each axis at the positioning control.	_
2	Wumber of pulses per rotation (AP)	1 to 2147483647[pulse]							20000		Set the number of feedback pulses per motor rotation based on the mechanical system.		
3	Travel value per rotation (AL)	0.1 to 214748364.7		0.00001 to 21474.83647		0.00001 to 21474.83647		1 to 2147483647		20000		Set the travel value per motor based on the mechanical system.	4.2.1
4	Backlash compensation amount (Note)	0 to 6553.5		0 to 0.65535		0 to 0.65535		0 to 65535		0	pulse	Set the backlash amount of the machine. Every time of the positioning direction changes at the positioning, compensation by the backlash compensation amount is executed.	7.2
5	Upper stroke limit ^(Note)	-214748364.8 to 214748364.7	μm	-21474.83648 to 21474.83647	inch	0 to 359.99999	degree	-2147483648 to 2147483647	pulse	2147483647		Set the upper limit for the machine travel range.	400
6	Lower stroke limit ^(Note)	-214748364.8 to 214748364.7		-21474.83648 to 21474.83647		0 to 359.99999		-2147483648 to 2147483647		0		Set the lower limit for the machine travel range.	4.2.3
7	Command in- position range (Note)	0.1 to 214748364.7		0.00001 to 21474.83647		0.00001 to 359.99999		1 to 2147483647		100		Set the position at which the command in-position signal (M2403+20n) turns on [(positioning address) - (current value)].	4.2.4
8	Speed control 10×multiplier setting for degree axis	_	_	_	_	Invalid/Valid	_	_	_	Invalid	_	Set whether the positioning control is executed with a value 10×multiplier the speed of a command speed setting, when a control unit is degree axis.	4.2.5

 $(Note): The \ display \ of \ the \ possible \ setting \ range \ changes \ according \ to \ the \ electronic \ gear \ value \ at \ Q173DCPU(-S1)/Q172DCPU(-S1).$

4.2.1 Number of pulses/travel value per rotation

The "Electronic gear function" adjusts the actual machine movement amount and number of pulse output to servo amplifier according to the parameter set in the Motion CPU.

It is defined by the "Number of pulses per rotation" and "Travel value per revolution".

POINTS

- (1) The mechanical system error of the command travel value and real travel value is rectified by adjustment the "electronic gear".
- (2) The value of less than 1 pulse that cannot be execute an output when the machine travels is incremented in the Motion CPU, and a total incremented output is performed when the total incremented value becomes more than 1 pulse.
- (3) The total incremented value of less than 1 pulse that cannot be execute an output is cleared and it is referred to as "0" at the home position return completion, current value change completion, speed-switching control start (except the feed current value update) and fixed-pitch feed control start. (When the total incremented value is cleared, the error occurs to the feed machine value only a part to have been cleared.)
- (4) Set the electronic gear within the following range.

 $0.001 \leq \frac{Number \ of \ pulses \ per \ rotation \ (AP)}{Travel \ value \ per \ rotation \ (AL)} \leq 20000$

(1) Number of pulses/travel value per rotation

Number of pulses (AP)/travel value (AL) per rotation is an item which determines how many rotations (number of pulses per rotation) of the servo motor in order to make it a machine as the travel value ordered by the program.

The position control toward the servo motor is controlled with the number of feedback pulses of the encoder connected to the servo motor in the servo amplifier.

The control content of the Motion CPU is shown below.

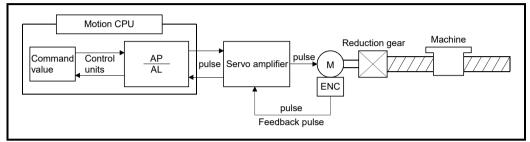


Fig. 4.1 Control content of the Motion CPU

For example, suppose that the servo motor was connected to the ball screw. Because the travel value (\triangle S) of machine per motor rotation is [mm] / [inch] unit, the travel value (positioning address) set in the program is commanded in [mm] / [inch] unit. However, the servo motor is positioning controlled by the servo amplifier in pulse unit.

Therefore, AP/AL is set so that the following expression of relations may be materialized in order to convert the travel value of [mm] / [inch] unit set in the program into a pulse.

Number of pulses per motor rotation = AP
Travel value of machine per motor rotation = AL

Electronic =
$$\frac{AP}{AL}$$
(1)

(There is a range which can be set in the numerical value set as AP/AL, so it is necessary to make the setting range of AP/AL the value calculated from the above expression (reduced) of relations.)

(Note): For MR-J5(W)-□B, the servo amplifier electronic gear is taken into account for the number of pulses per motor rotation (AP).

Number of pulses per motor rotation (AP) = Resolution per servo motor revolution $\times \frac{\text{Electronic gear denominator (PA07)}^{\text{(Note-1)}}}{\text{Electronic gear numerator (PA06)}^{\text{(Note-1)}}}$ (Note-1): Servo amplifier servo parameter

POINTS

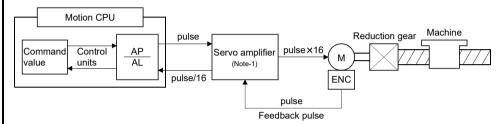
When using a servo motor (such as HK-KT) that has an encoder resolution of 67108864[pulse/rev], set the MR-J5(W)-□B servo parameters to the values below so that the encoder resolution becomes 4194304[pulse/rev].

If the settings are different, a major error (error code: 1340) occurs.

After changing the parameters, turn OFF the servo amplifier power supply before turning ON the power supply again.

- Electronic gear numerator (PA06) : 16
- Electronic gear denominator (PA07): 1

The control content of the Motion CPU is shown below.



(Note-1): Electronic gear numerator(PA06): 16 Electronic gear denominator(PA07): 1

(Note): The following table shows the status of the servo amplifier depending on the operating system software version when a major error (error code: 1340) occurs.

Operating system software version	Servo amplifier status
"0AA" or later	The servo amplifier LED display will show "b (READY OFF) (Note-1)" but corresponding axes will not become servo ON even if the All axes servo ON command (M2042) is turned on. Moreover, for servo amplifiers that are connected after a major error (error code: 1340) occurs in a servo amplifier, turning All axes servo ON command (M2042) on will turn them to servo ON. In addition, the servo amplifier LED display on the SSCNET communication condition monitor in MT Developer2 will show "AH (initializing completion)".
"00Z" or earlier	The servo amplifier LED display alternates between "AC" and "Ad" and servo amplifier cannot be connected. Additionally, the servo amplifiers after cannot connect to the last station.

(Note-1): $\square\square$ = Station No.

Example of the real setting is shown below.

(Note): Refer to this section (2) for the setting at linear servo.

(a) For ball screw

When the ball screw pitch is 20[mm], the servo motor is HF-KP (262144[pulse/rev]) and direct connection (No reduction gear) is set.

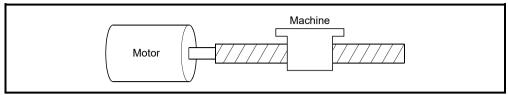


Fig. 4.2 For ball screw

First, find how many millimeters the load (machine) will travel (AL) when the servo motor runs for one rotation (AP).

AP (Number of pulses per motor rotation) = 262144[pulse] (Note-1)

AL (Travel value of machine per rotation)

= Ball screw pitch × Reduction ratio

= 20[mm]

Substitute this for the above expression (1).

$$\frac{AP}{AL} = \frac{262144[pulse]}{20[mm]}$$

Although it becomes above, when a control unit is set to [mm] unit, the minimum unit of the command value in a program is 0.1[µm] and converted from 20[mm] (20.0000[mm]) to 20000.0[µm].

$$\frac{AP}{AL} = \frac{262144[pulse]}{20000.0[\mu m]}$$

The travel value per motor rotation in this example is 0.000076[mm]. For example, when ordering the travel value of 19[mm], it becomes 249036.8[pulse] and the fraction of 0.8[pulse]. At this time, the Motion CPU orders the travel value of 249036[pulse] to the servo motor and the fraction is memorized in the Motion CPU.

Positioning is performed by taking into account the travel value with this fraction at the next positioning.

(Note-1): When controlling a servo motor (HK-KT) (67108864[pulse/rev]) using MR-J5(W)-□B, the AP (Number of pulses per motor rotation) is as follows.

AP (Number of pulses per motor rotation) = 67108864[pulse] × $\frac{1}{16}$ = 4194304[pulse]

Motion CPU Command Control value AP pulse Servo amplifier pulse Feedback pulse Feedback pulse

(2) Number of pulses/travel value at linear servo use

Fig. 4.3 Linear servo use

Calculate the number of pulses (AP) and travel value (AL) for the linear encoder in the following conditions.

Linear encoder

$$Linear encoder resolution = \frac{Number of pulses (AP)}{Travel value (AL)}$$

Linear encoder resolution: 0.05[µm]

$$\frac{\text{Number of pulses (AP) [pulse]}}{\text{Travel value (AL) [µm]}} = \frac{1}{0.05} = \frac{20}{1.0}$$

Set the number of pulses in "Number of pulses per rotation", and the movement amount in "Travel value per rotation" in the actual setting.

(Note): Set the same value as the value set in the fixed parameter to the servo parameter "PS02 (Linear encoder resolution setting Numerator)" and "PS03 (Linear encoder resolution setting Denominator)".

For MR-J5(W)-□B, set servo parameters "Electronic gear numerator (PA06)" and "Electronic gear denominator (PA07)" to "1".

Refer to the "Servo amplifier Instruction Manual" for details.

Servo amplifier type	Instruction manual name						
MR-J5-□B	MD IS DIMD ISM Diller's Manual (Decrease Asse) (ID 0000504ENO)						
MR-J5W-□B	MR-J5-B/MR-J5W-B User's Manual (Parameters) (IB-0300581ENG)						
MR-J4-□B	SSCNETII/H Interface AC Servo MR-J4B_(-RJ) Servo amplifier Instruction Manual (SH-030106)						
MR-J4W-□B	SSCNETII/H Interface Multi-axis AC Servo MR-J4W2B/MR-J4W3B/MR-J4W2-0303B6 Servo amplifier Instruction Manual (SH-030105)						
MR-J3-□B-RJ004	SSCNETⅢ Compatible Linear Servo MR-J3-□B-RJ004U□ Instruction Manual (SH-030054)						

4.2.2 Backlash compensation amount

(1) Backlash compensation amount can be set within the following range.
 (Refer to Section "7.2 Backlash Compensation Function" for details.)
 (Note): The following restriction does not apply to versions compatible with the setting range expansion of backlash compensation amount.

$$0 \le \frac{\text{Backlash compensation amount} \times \text{Number of pulses per rotation (AP)}}{\text{Travel value per rotation (AL)}}$$
 (=A) ≤ 65535 [pulse]

(2) The servo error may occur depending on the type of the servo amplifier (servo motor) or operation cycle even if the backlash compensation amount which fulfill the above condition.

Set the backlash compensation amount within the following range in order for servo error may not occur.

$$A \leq \frac{\text{Motor instantaneous permissible speed [r/min]} \times \text{Encoder resolution [pulse]} \times \text{Operation cycle [ms]}}{60[s] \times 1000[ms]} \text{[pulse]}$$

(Note): The backlash compensation amount is output in one operation cycle.

4.2.3 Upper/lower stroke limit value

The upper/lower limit value for the travel range of mechanical system is set.

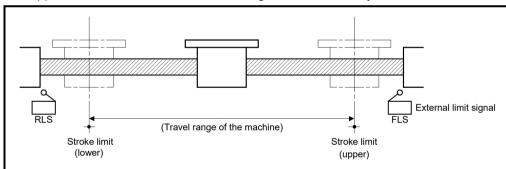


Fig. 4.4 Travel range at the upper/lower stroke limit value setting

(1) Stroke limit range check

The stroke limit range is checked at the following start or during operation.

Operation start	Check	Remarks
 Position follow-up control Constant-speed control Speed switching control Positioning control Fixed-pitch feed control Speed control (I) (Note-1) 	Check	 Checks whether or not the feed current value is within the stroke limit range at the positioning start. If the value is outside the range, a minor error occurs (error code: 106) and positioning is not executed. If the interpolation path exceeds the stroke limit range during circular interpolation start, a minor error occurs (error codes: 207, 208) and deceleration stop is executed. If the current value exceeds the stroke limit range, deceleration stop is executed.
Speed control (I) (Note-2) Speed control (Ⅱ)	Not check	The current value becomes "0", and operation continues until the external limit signal (FLS, RLS, STOP) is received.
 Speed-position switching control (including restart) 		Checks the stroke limit range after the switch to position control, but not while executing speed control.
JOG operation	Check	 When the current value executes a deceleration stop from the current command speed, if the current value exceeds the stroke limit range, a minor error occurs (error code: 207), and deceleration stop is made before reaching the stroke limit. Travel from outside the stroke limit range to the direction that returns the axis into the stroke limit range is possible. For a degree axis, depending on the stroke limit setting, the direction that can return the axis into the stroke limit range is different. 1) When upper stroke limit value > lower stroke limit value When "Feed current value > upper stroke limit value", movement in the negative direction is possible. When "Feed current value < lower stroke limit value", movement in the positive direction is possible. 2) When upper stroke limit value < lower stroke limit value Movement in both the positive and negative direction is possible.
Manual pulse generator operation		 If the current value exceeds the stroke limit range, a minor error occurs (error code: 207), and it stops at stroke limit. In this case, a deceleration stop is not made. Travel from outside the stroke limit range to the direction that returns the axis into the stroke range is possible. For a degree axis, depending on the stroke limit setting, the direction that can return the axis into the stroke limit range is different. 1) When upper stroke limit value > lower stroke limit value When "Feed current value > upper stroke limit value", movement in the negative direction is possible. When "Feed current value < lower stroke limit value", movement in the positive direction is possible. 2) When upper stroke limit value < lower stroke limit value Movement in both the positive and negative direction is possible.
Speed-torque control		If the current feed value exceeds the software stroke limit range, a minor error occurs
(CC)		(error code: 207), and the mode is switched to position control.

(Note-1): When feed current value update command (M3212+20n) is ON. (Note-2): When feed current value update command (M3212+20n) is OFF.

POINTS

- (1) Besides setting the upper/lower stroke limit value in the fixed parameters, the range of mechanical system can also be controlled by using the external limit signals (FLS, RLS).
- (2) When the external limit signal turns off, a deceleration stop is executed. "Deceleration time" and "Rapid stop deceleration time" can be used in the parameter block for deceleration stop time.

(2) Setting range of upper/lower stroke limit value (SV13 only)

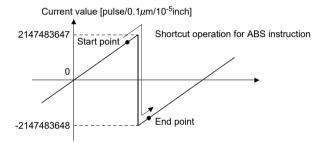
Upper/lower stroke limit value can be set within the following range.

-2147483648 \leq Upper/lower stroke limit value \times $\frac{\text{Number of pulses per rotation (AP)}}{\text{Travel value per rotation (AL)}} \leq$ 2147483647

(3) Stroke limit invalid setting QDS(

The unlimited length feed is possible by setting the stroke limit to invalid even the control unit is "other than degree axis" (mm, inch, pulse). When "(Upper stroke limit) = (Lower stroke limit)" is set as the upper and lower stroke limit is set in the fixed parameter, the stroke limit becomes invalid and the unlimited length feed is possible.

Refer to Section 6.1.5 for details of degree axis.



POINTS

- If the current feed value and real current value exceeds 2147483647 [pulse/0.1μm/10⁻⁵inch], it is controlled with -2147483648[pulse/0.1μm/10⁻⁵inch]. If those values are less than -2147483648[pulse/0.1μm/10⁻⁵inch], it is controlled with 2147483647[pulse/0.1μm/10⁻⁵inch].
- (2) If the absolute position command (ABS instruction) is set when the stroke limit is invalid, it is controlled as shortcut operation.
- (3) The circular interpolation and helical interpolation (other than linear axis) including axis that the stroke limit is set to invalid cannot be executed.
 A minor error (error code: 107 to 109) will occur, and operation does not start.
- (4) If the stroke limit is set to invalid for axis of unit (pulse, mm, inch) in the real mode or real mode axis, the ABS-□ instruction cannot be executed unit (pulse, mm, inch) when the absolute method is set as end point address in the speed-switching control (VSTART).
 - A minor error (error code: 119) will occur, and operation does not start.
- (5) The high-speed oscillation function cannot be used in the axis that set the stroke limit invalid.
- (6) When executing a speed change to negative speed for the axis with stroke limit set to invalid, the operations below occur based on the control mode being executed.

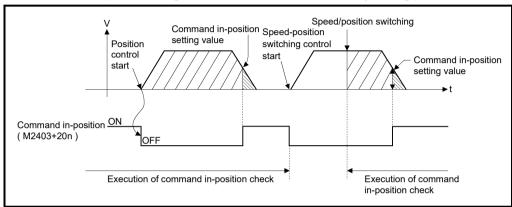
Control mode	Operation
Speed control (I) Speed control (I)	Negative speed-change accept.
Home position return	Minor error (error code: 301) occurs and speed change is ignored.
Speed-position control	
Position follow-up control	Minor owner (owner and a 205) account and arrand
Speed control with fixed position stop	Minor error (error code: 305) occurs and speed
Speed-position switching control	change is ignored.
JOG operation	
Manual pulse generator operation	Consideration in imposed
Speed-torque control	Speed change is ignored.
Others	Minor error (error code: 310) occurs and speed change is ignored.

4.2.4 Command in-position range

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

Once the value for the command in-position has been set, the command in-position signal (M2403+20n) turns on when the difference between the command position and the feed current value enters the set range [(command position - feed current value) \leq (command in-position range)].

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



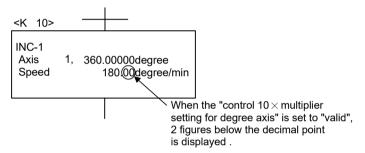
- (1) Command in-position can be set within the following range.
 - (a) Q173DSCPU/Q172DSCPU use
 - 1 ≤ Command in-position range ≤ 2147483647
 - (b) Q173DCPU(-S1)/Q172DCPU(-S1) use

$$1 \le \text{Command in-position range} \times \frac{\text{Number of pulses per rotation (AP)}}{\text{Travel value per rotation (AL)}} \le 32767$$

4.2.5 Speed control 10×multiplier setting for degree axis

The setting range of command speed is 0.001 to 2147483.647[degree/min] normally in the axis of control unit [degree]. However, when the "speed control $10 \times$ multiplier setting for degree axis" is set to "valid" in the fixed parameter the speed setting range increases $10 \times$ multiplier "0.01 to 21474836.47[degree/min]".

- (1) When the "speed control 10 × multiplier setting for degree axis" is set to "valid", the positioning control is executed by the speed increased 10 × multiplier command speed set in the servo program or servo parameter, and speed limit value.
- (2) In the interpolation control for the axis of "control unit [degree] and [except degree]", if the interpolation control unit of parameter block is set as [degree]," the positioning control is executed by the speed increased 10×multiplier command speed and speed limit value.
- (3) When the "speed control 10×multiplier setting for degree axis" is set as "valid", 2 figures below the decimal point of ***.** [degree/min] is displayed on the screen of MT Developer2.



- (4) Speed setting range in the interpolation operation is shown below.
 - (a) Vector speed specification/Long-axis speed specification If the "speed control 10 × multiplier setting for degree axis" is set to "valid" even by one axis among interpolation axes, the speed setting range is "0.01 to 21474836.47[degree/min] ".
 - (b) Reference-axis speed specification If the "speed control 10 × multiplier setting for degree axis" is set to "valid" in the specified reference axis, the speed setting range is "0.01 to 21474836.47[degree/min] ".

Example

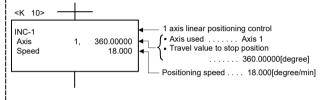
- An example for positioning control is shown below when the "speed control 10 × multiplier setting for degree axis" of fixed parameter and "interpolation control unit" of parameter block are set as follows.
 - Speed control 10 × multiplier setting for degree axis

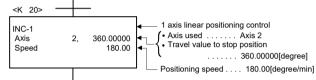
Axis	Speed control 10 × multiplier setting for degree axis
Axis 1	Invalid
Axis 2	Valid

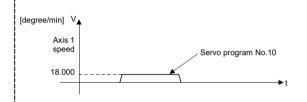
Interpolation control unit of parameter block

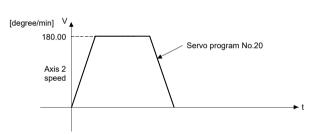
	Block 10
Interpolation control unit	degree

(1) 1 axis linear positioning control program (Axis 1) (2) 1 axis linear positioning control program (Axis 2)



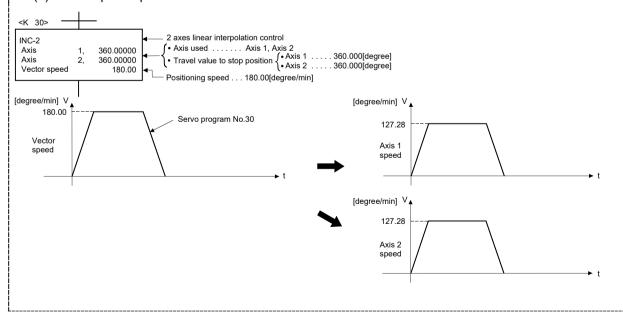


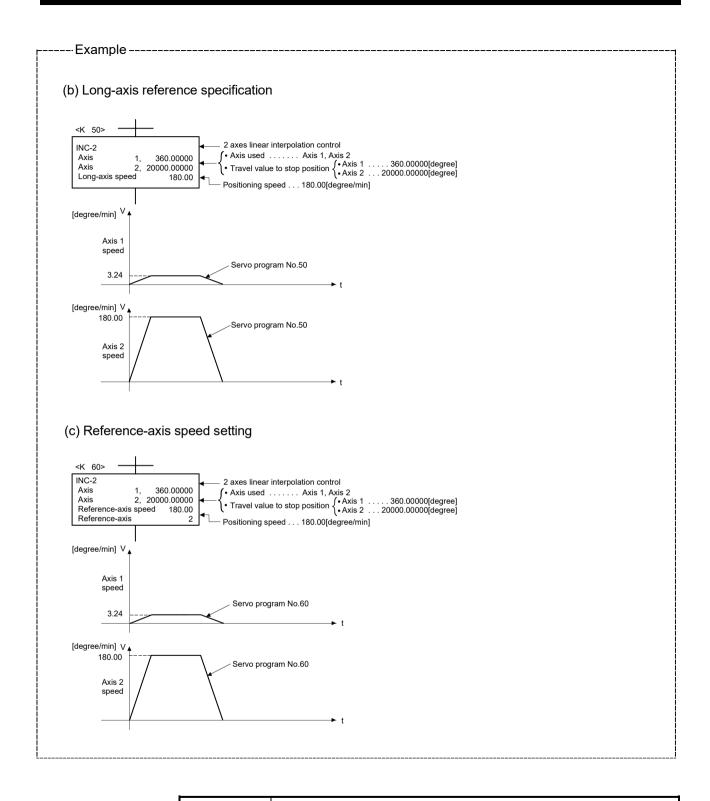




(3) 2 axes linear interpolation control program (Axis 1, Axis 2)

(a) Vector speed specification





POINTS

When a speed change is executed by the Motion dedicated PLC instruction (D(P).CHGV) or Motion SFC program (CHGV instruction) after setting the "speed control $10 \times$ multiplier setting for degree axis is valid", the positioning control is executed by the speed increased $10 \times$ multiplier setting value.

4.3 Parameter Block

- (1) The parameter blocks serve to make setting changes easy by allowing data such as the acceleration/deceleration control to be set for each positioning processing.
- (2) A maximum 64 blocks can be set as parameter blocks.
- (3) Parameter blocks can be set using MT Developer2.
- (4) Parameter block to be set are shown in Table 4.2.

Table 4.2 Parameter Block Setting List

					Settir	ng range							
No.	Item	mm		inch		degre	e	pulse		Initial value	Units	Remarks	Section
		Setting range	Units	Setting range	Units	Setting range	Units	Setting range	Units	value			
1	Interpolation control unit	0		1	l	2	_	3	_	3	l	Set the units for compensation control. It can be also used as the units for the command speed and allowable error range for circular interpolation set in the servo program.	6.1.4
2	Speed limit value	0.01 to 6000000.00	mm/ min	0.001 to 600000.000	inch/ min	0.001 to 2147483.647 (Note-1)	degree/ min	1 to 2147483647	pulse /s	200000	pulse/ s	Set the maximum speed for positioning/home position return. If the positioning speed or home position return speed setting exceeds the speed limit value, control is executed at the speed limit value.	
3	Acceleration time		1 to 65535[ms]						1000	ms	Set the time taken to reach the speed limit value from the positioning start.	4.3.1	
4	Deceleration time		1 to 65535[ms]							1000	ms	Set the time taken to stop from the speed limit value.	
5	Rapid stop deceleration time		1 to 65535[ms]							1000	ms	 Set the time taken to stop from the speed limit value at rapid stop. 	
6	S-curve ratio		0 to 100[%]							0	%	Set the S-curve ratio for S-pattern processing. When the S-curve ratio is 0[%], trapezoidal acceleration/deceleration processing is executed.	4.3.2
	Acceleration/ deceleration system		Trapezoid/S-curve: Trapezoidal acceleration/deceleration/ S-curve acceleration/deceleration						Trapezoid/ S-curve		Set the control method for acceleration/deceleration.		
7	deceleration system Acceleration section 1 ratio Acceleration section 2 ratio Deceleration section 1 ratio Deceleration section 1 ratio Deceleration section 1 ratio Tratio Deceleration section 1 ratio Deceleration section 1 ratio	eleration ition 1 beleration ition 2 celeration ition 2 celeration ition 1 celeration ition 1 celeration ition 2								20.0	%	Set the ratio for advanced S- curve acceleration/ deceleration processing.	4.3.3

Table 4.2 Parameter Block Setting List (Continued)

		Setting range											
No.	Item	mm		inch		degree	9	pulse		Initial	Units	Remarks	Section
		Setting range	Units	Setting range	Units	Setting range	Units	Setting range	Units	value			
8	Torque limit		4 400019/1								%	Set the torque limit value in	
0	value		1 to 1000[%]							300	/0	the servo program.	_
	Deceleration processing on STOP input		Deceleration stop is executed based on the deceleration time. Deceleration stop is executed based on the rapid stop deceleration time.							0		 Set the deceleration processing when external signals (STOP, FLS, RLS) are input. 	_
10	Allowable error range for circular interpolation	0 to 10000.0	μm	0 to 1.00000	inch	0 to 1.00000	degree	0 to 100000	pulse	100	pulse	 Set the permissible range for the locus of the arc and the set end point coordinates. 	4.3.4

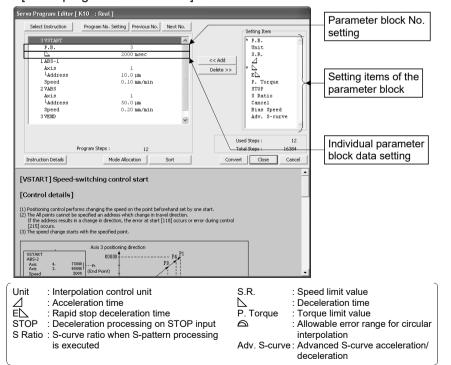
(Note-1): When the "speed control 10×multiplier setting for degree axis" is set to "valid", the setting range is 0.01 to 21474836.47[degree/min]. However, setting range of 0.001 to 2147483.647[degree/min] is displayed in the parameter block setting screen of MT Developer2.

POINTS

- (1) Parameter blocks are specified in the home position return data, JOG operation data or servo program.
- (2) The various parameter block data can be changed using the servo program. (Refer to Section 5.3.)
- (3) The data set in the parameter block is used in the positioning control, home position return and JOG operation.
 - (a) The parameter block No. used in the positioning control is set using MT Developer2 at the creating of the servo program. If it is not set, control is executed with the contents of parameter block No.1.

Also, it is possible to set parameter block data individually in the servo program.

[Servo program editor screen]

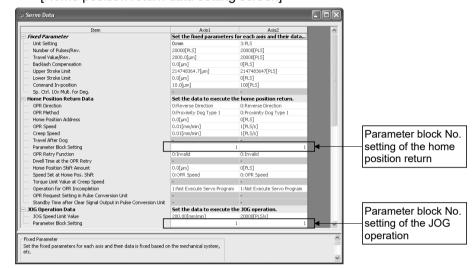


POINTS

(b) The parameter block No. used in the home position return or JOG operation is set at the setting of the "home position return data" or "JOG operation data" using

MT Developer2. Refer to Section "6.23.1 Home position return data" or "6.21.1 JOG operation data" for details.

[Home position return data setting screen]



- (4) The processing method of acceleration/deceleration is set by the acceleration/deceleration method and S-curve ratio set in the parameter block.
 - (a) Set "Trapezoid/S-curve" as acceleration/deceleration method to execute the trapezoidal acceleration/deceleration or S-curve acceleration/deceleration. Set 0[%] as S-curve ratio to execute the trapezoidal acceleration/deceleration, and set 1 to 100[%] to execute the S-curve acceleration/deceleration.
 - (b) Set "Advanced S-curve" to execute the Advanced S-curve acceleration/ deceleration. At this time, the S-curve ratio is invalid.

		Parameter block
	Acceleration/deceleration system	S-curve ratio[%]
Trapezoidal acceleration/deceleration	Trapezoid/S-curve	0
S-curve acceleration/deceleration		1 to 100
Advanced S-curve acceleration/deceleration/	Advanced S-curve	

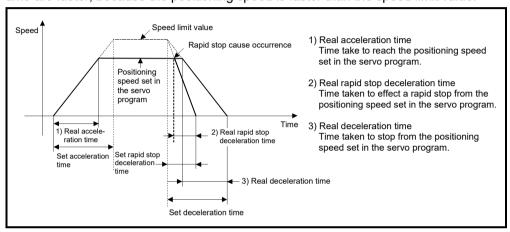
(c) When the FIN acceleration/deceleration (Fixed acceleration/deceleration time method) is set in the constant speed control, the setting for advanced S-curve acceleration/ deceleration is invalid.

4.3.1 Relationships between the speed limit value, acceleration time, deceleration time and rapid stop deceleration time

The speed limit value is the maximum speed at the positioning/home position return. The acceleration time is the time taken to reach the set speed limit value from the start of positioning.

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

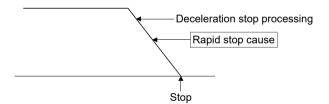
Accordingly, the actual acceleration time, deceleration time, and rapid stop deceleration time are faster, because the positioning speed is faster than the speed limit value.



Refer to Section 4.3.3 for acceleration time, deceleration time and rapid stop deceleration time of the advanced S-curve acceleration/deceleration processing.

Set the rapid stop deceleration time to a time shorter than the deceleration time.

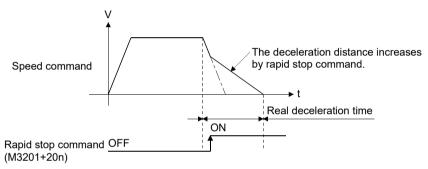
- (1) Deceleration time < Rapid stop deceleration time
 - (a) The servo program setting error (error code: 51) is stored in the error item information (SD517) at start, and the servo program setting error flag (SM516) is turned ON. When the rapid stop cause occurs during deceleration, the axis decelerates to a stop in the deceleration time.



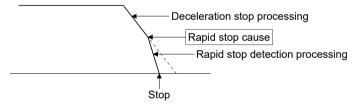
- (b) The rapid stop deceleration time can be set to a value larger than the deceleration time by turning ON the rapid stop deceleration time setting error invalid flag (SM805). Ver.
 - 1) Turn ON the rapid stop deceleration time setting error invalid flag (SM805) before operation to use the rapid stop deceleration time setting error invalid.
 - (The setting value is input at start.)
 - 2) For the advanced S-curve acceleration/deceleration, operation is controlled with either small value of setting value for rapid stop deceleration time and deceleration time even if the rapid stop deceleration time setting error invalid flag (SM805) turns ON.



(1) If the rapid stop deceleration time is longer than the deceleration time, an overrun may occur.



- (2) If a value larger than the deceleration time is set as the rapid stop deceleration time for the parameter block and positioning data of servo program, a warning will occur. However, writing to the Motion CPU is possible.
- (2) Rapid stop deceleration time ≤ Deceleration time When the rapid stop cause occurs during deceleration, the axis decelerates to a stop in the rapid stop time.



4.3.2 S-curve ratio

S-curve ratio can be set as the acceleration/deceleration processing method for S-curve acceleration/deceleration processing.

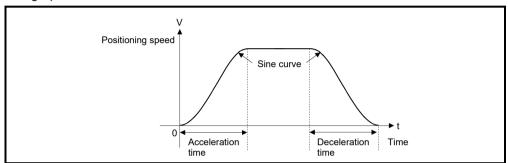
(Refer to Section 6.1.7 for details of S-curve acceleration/deceleration processing.) Setting range of the S-curve ratio is 0 to 100[%].

If it is set outside the range, an error occurs at the start and control is executed with the S-curve ratio set as 0[%] (Trapezoidal acceleration/deceleration).

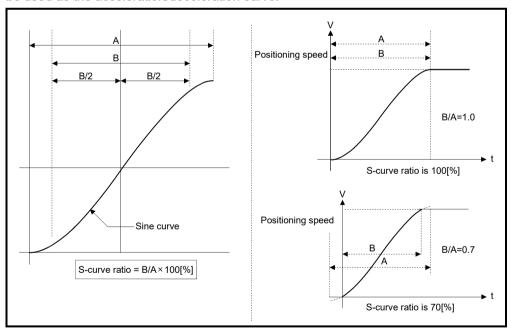
Errors are set in the error item information (SD517).

Setting of the S-curve ratio enables acceleration/deceleration processing to be executed gently.

The graph for S-curve acceleration/deceleration is a sine curve as shown below.



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

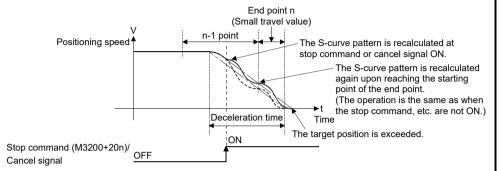


POINTS

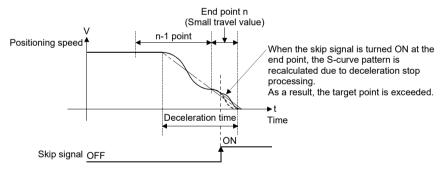
The S-curve pattern is recreated in the cases shown below during S-curve deceleration processing for the S-curve ratio.

In these cases the deceleration pattern may not continue or an overrun may occur.

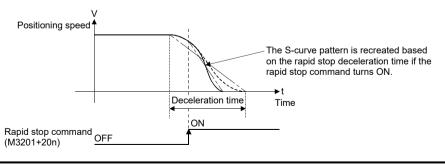
(1) When the same speed control command turns ON the stop command or the skip signal during S-curve deceleration processing for the end point



- (Note-1): The processing described above is also performed at STOP signal input when "Deceleration stop based on the deceleration time" is set in "Deceleration processing on STOP input" for the parameter block or servo program.
- (Note-2): The same processing is also performed when the rapid stop command is set (including when "Deceleration stop based on the rapid stop deceleration time" is set in Deceleration processing on STOP input). However, it is possible to prevent the end point from overrunning by adjusting the setting for the rapid stop deceleration time.
- (2) When the skip signal is turned ON during end point processing for the constantspeed control instruction



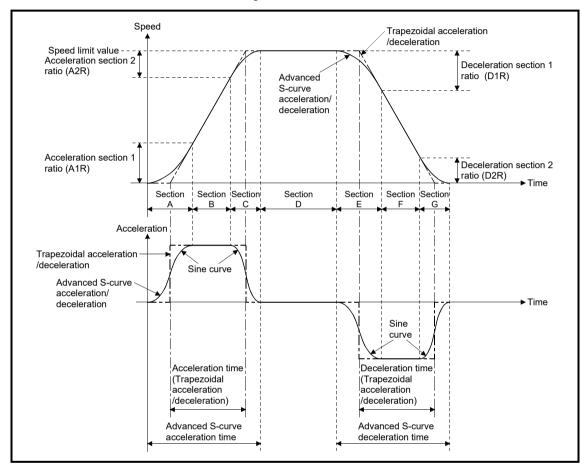
(3) When the rapid stop command is turned ON during S-curve deceleration processing



4.3.3 Advanced S-curve acceleration/deceleration

Processing for smooth acceleration/deceleration can be executed by using the advanced S-curve acceleration/deceleration function. The acceleration section is set as a sine curve as shown in the diagram below.

Each section of acceleration/deceleration is set as a ration using the advanced S-curve acceleration/deceleration setting.



Ver.!: Refer to Section 1.3 for the software version that supports this function.

Processing for advanced S-curve acceleration/deceleration is shown below.

	Section	Processing	Acceleration	Deceleration	Rapid stop		
Α	Acceleration section 1	At the start of acceleration, acceleration continuously changes in a sinusoidal manner until reaching the maximum acceleration for trapezoidal acceleration/deceleration. Set this section in acceleration section 1 ratio (A1R).					
В	Maximum acceleration section The maximum acceleration for trapezoidal acceleration/deceleration						
С	At the end of acceleration, acceleration continuously changes in a sinusoidal manner until reaching Acceleration section 2 Zero acceleration. Set this section in acceleration section 2 ratio (A2R).						
D	Constant-speed section	The specified control positioning speed	ı	ı	_		
E	Deceleration section 1	At the start of acceleration, deceleration continuously changes in a sinusoidal manner until reaching the maximum negative acceleration for trapezoidal acceleration/deceleration. Set this section in deceleration section 1 ratio (D1R).					
F	Maximum negative acceleration section	The same maximum negative acceleration for trapezoidal acceleration/deceleration	_	0	0		
G	Deceleration section 2	At the end of deceleration, deceleration continuously changes in a sinusoidal manner until reaching zero acceleration. Set this section in deceleration section 2 ratio (D2R).					

Set the following parameters in the parameter block.

					0	perati	on
Item	Abbre- viation		Setting range	Processing	Acceleration	Deceleration	Rapid stop
Speed limit value	S.R.	mm inch degree pulse	0.01 to 600000.00[mm/min] 0.001 to 600000.000[inch/min] 0.001 to 2147483.647[degree/min] ^(Note-1) 1 to 2147483647[pulse/s]	Maximum speed at positioning/home position return	0	0	0
Acceleration time	AT			Time to reach the speed limit value (S.R.) after positioning start. (During trapezoidal acceleration)	0	_	
Deceleration time	DT		1 to 65535[ms]	Time to stop from the speed limit value (S.R.). (During trapezoidal deceleration)	_	0	_
Rapid stop deceleration time	ET			Time to stop from the speed limit value (S.R.) at rapid stop. (Trapezoidal deceleration)	_	_	0
Acceleration section 1 ratio	A1R		0.0 to 100.0[%]	Ratio of speed limit value (S.R.) to acceleration peak from zero acceleration.	0	_	_
Acceleration section 2 ratio			$(A1R + A2R \le 100.0[\%])$	Ratio of speed limit value (S.R.) to zero acceleration from acceleration peak.	0	_	_
Deceleration section 1 ratio	D1R		0.0 to 100.0[%]	Ratio of speed limit value (S.R.) to negative acceleration peak from zero acceleration.	_	0	0
Deceleration section 2 ratio	D2R		$(D1R + D2R \le 100.0[\%])$	Ratio of speed limit value (S.R.) to zero acceleration from negative acceleration peak.	_	0	0

(Note-1): When the "speed control 10×multiplier setting for degree axis" is set to "valid", the setting range is 0.01 to 21474836.47[degree/min].

POINTS

The acceleration time to reach the command speed and the travel value during acceleration changes by setting the Acceleration section 1 ratio and acceleration section 2 ratio. The deceleration time to stop from the commanded speed and the travel value during deceleration changes by setting the deceleration section 1 ratio and deceleration section 2 ratio.

(1) There are patterns (below pattern 1 to 4 respectively) that depends on the positioning speed of the acceleration pattern/deceleration pattern of advanced Scurve acceleration/deceleration.

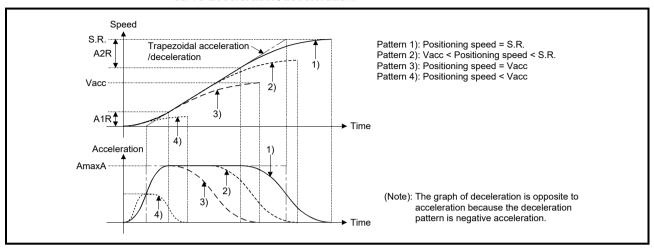
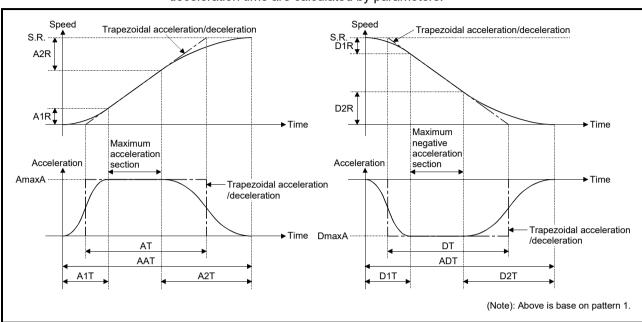


Fig.4.5 Acceleration pattern



The maximum acceleration and advanced S-curve acceleration time/ deceleration time are calculated by parameters.

Fig.4.6 Maximum acceleration, advanced S-curve acceleration time/deceleration time

				0	on	
Item	Abbre- viation	Description	Calculation expression	Acceleration	Deceleration	Rapid stop
Maximum acceleration	AmaxA	Maximum acceleration Same acceleration as trapezoidal acceleration/deceleration	s.r. ÷ at	0	-	_
Maximum negative acceleration	DmaxA	···	s.r. ÷ dt	_	0	_
Maximum negative acceleration at rapid stop	EmaxA	Same negative acceleration as trapezoidal acceleration/ deceleration	s.R. ÷ET	_	-	0
Advanced S-curve acceleration time (Note-1)	AAT	Time to reach the speed limit value (S.R.) after positioning start. (At advanced S-curve acceleration/deceleration) It can be lengthened more than trapezoidal acceleration/deceleration by using A1R or A2R.	AT \times (100.0 + A1R + A2R) \div 100.0	0	1	_
Advanced S-curve deceleration time (Note-1)	ADT	Time to stop from the speed limit value (S.R.) at (rapid stop)	DT × (100.0 + D1R + D2R) ÷ 100.0	_	0	_
Advanced S-curve rapid stop deceleration time (Note-1)	AET	deceleration. (Advanced S-curve acceleration/deceleration) It can be lengthened more than trapezoidal acceleration/ deceleration by using D1R or D2R. ET × (100.0 + D1R + D2R) ÷ 100.0				0
Time of acceleration section 1	A1T	Time to reach acceleration peak from zero acceleration.	AT × (A1R ÷ 100.0) × 2	0	-	_
Time of acceleration section 2	A2T	Time to reach zero acceleration from acceleration peak.	AT \times (A2R \div 100.0) \times 2	0	l	_
Time of deceleration section 1	D1T	Time to reach negative acceleration peak from zero acceleration.	DT × (D1R ÷ 100.0) × 2	_	0	_
Time of deceleration section 2	D2T	Time to reach zero acceleration from negative acceleration peak.	DT \times (D2R \div 100.0) \times 2	_	0	_
Velocity when "AAT=A1T+A2T"	Vacc	The velocity when total acceleration is only "A1T+A2T". (No maximum acceleration section)	S.R. × (A1R + A2R) ÷ 100.0	0		_
Velocity when "ADT=D1T+D2T"	Vdac	The velocity when total acceleration is only "D1T+D2T". (No maximum deceleration section)	S.R. × (D1R + D2R) ÷ 100.0	_	0	_

(Note-1): The actual acceleration time, actual deceleration time and actual rapid stop deceleration time are shortened when the positioning speed is less than the speed limit value.

The actual acceleration/deceleration time for each pattern (Fig.4.5 pattern 1 to 4) based on positioning speed is shown below.

[Actual acceleration time]

	Pattern	Positioning speed	Description	Actual acceleration time	Actual maximum acceleration
Fig	1)	Positioning speed = S.R.	It accelerates with the acceleration section 1, maximum acceleration section and acceleration section 2.	AAT	
1	2)	Vacc < Positioning speed < S.R.	Maximum acceleration section is short than pattern 1.	AAT - (S.R Positioning speed) AmaxA	AmaxA
	3)	Positioning speed = Vacc	No maximum acceleration section It accelerates with only acceleration section 1 and acceleration section 2.	A1T + A2T	
wo	4)	Positioning speed < Vacc	No maximum acceleration section Maximum acceleration and acceleration increase/decrease time of acceleration section 1 and 2 are shortened.	(A1T + A2T) × √(Positioning speed/Vacc)	AmaxA × √(Positioning speed/Vacc)

[Actual deceleration time]

	Pattern	Positioning speed	Description	Actual Deceleration time	Negative actual maximum acceleration	
High	1)	Positioning speed = S.R.	It accelerates with the deceleration section 1, maximum negative acceleration section and deceleration section 2.	ADT		
Ē	2)			ADT - (S.R Positioning speed) DmaxA	DmaxA	
	3)	Positioning speed = Vdac	No maximum negative acceleration section. It decelerates with only deceleration section 1 and deceleration section 2.	D1T + D2T		
→ NoJ	4)	Positioning speed < Vdac	No maximum negative acceleration section. Maximum acceleration of deceleration section 1 and deceleration section 2, and negative acceleration increase/decrease time are shortened.	(D1T + D2T) × √(Positioning speed/Vdac)	DmaxA × √(Positioning speed/Vdac)	

- (2) When the positioning speed is slower than the speed limit value, adjust the acceleration in the following procedure.
 - (a) Shorten time of maximum acceleration section. (Fig.4.5 Pattern 2, 3)
 - (b) Reduce maximum acceleration and acceleration increase/decrease time of acceleration section 1 and 2. (Fig.4.5 Pattern 4)

(3) Advanced S-curve acceleration/deceleration time is calculated as a function of the acceleration/deceleration time set in the parameter block by using the parameter setting of advanced S-curve acceleration/deceleration as shown below.

Advanced S-curve acceleration time

Condition	Advanced S-curve acceleration time
Acceleration section 1 ratio (A1R) = Acceleration section 2 ratio (A2R) = 0.0	Same as acceleration time of the parameter block (Trapezoidal acceleration processing)
Acceleration section 1 ratio (A1R) or Acceleration section 2 ratio (A2R) ≠ 0.0	Longer acceleration time compared with the parameter block.
Acceleration section 1 ratio (A1R) + Acceleration section 2 ratio (A2R) = 100.0	Double the acceleration time of the parameter block.

• Advanced S-curve deceleration time

Condition	Advanced S-curve deceleration time
Deceleration section 1 ratio (D1R) = Deceleration section 2 ratio (D2R) = 0.0	Same as deceleration time of the parameter block (Trapezoidal acceleration processing)
Deceleration section 1 ratio (D1R) or Deceleration section 2 ratio (D2R) ≠ 0.0	Longer deceleration time compared with the parameter block.
Deceleration section 1 ratio (D1R) + Deceleration section 2 ratio (D2R) = 100.0	Double the deceleration time of the parameter block.

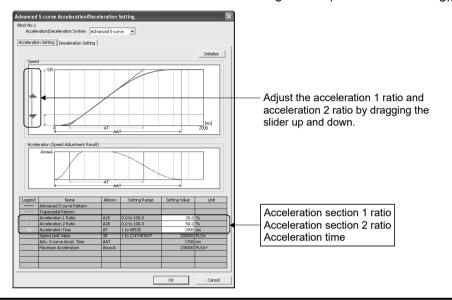
- (4) Deceleration processing is executed by using the deceleration section 1 ratio (D1R) and deceleration section 2 ratio (D2R) at rapid stop deceleration.
- (5) When the FIN acceleration/deceleration (Fixed acceleration/deceleration time method) is set in the constant-speed control, the setting for advanced S-curve acceleration/deceleration is invalid. However, advanced S-curve acceleration/ deceleration can be used regardless whether the speed switching point specified flag (M2040) is ON or OFF.
- (6) Advanced S-curve acceleration/deceleration control is enabled at home position return operation.
 - When executing a home position return using a proximity dog, the movement amount to decelerate to creep speed is different compared to trapezoid acceleration/deceleration and s-curve acceleration/deceleration. This is to ensure smoothness of acceleration/deceleration. For this reason, the stop position (zero point) upon completion of home position return is different to when trapezoid acceleration/deceleration and s-curve acceleration/deceleration is used.

POINTS

Set the advanced S-curve acceleration/deceleration setting using the parameter block on the following screen of MT Developer2. The Advanced S-curve Acceleration time and maximum acceleration are displayed by setting acceleration section 1 ratio, acceleration section 2 ratio and the acceleration time.

The advanced S-curve deceleration time and advanced S-curve rapid stop deceleration time, maximum negative acceleration and maximum negative at rapid stop are displayed by setting deceleration section 1 ratio, deceleration section 2 ratio and deceleration time

[Advanced S-curve acceleration/deceleration setting screen (Acceleration setting)]



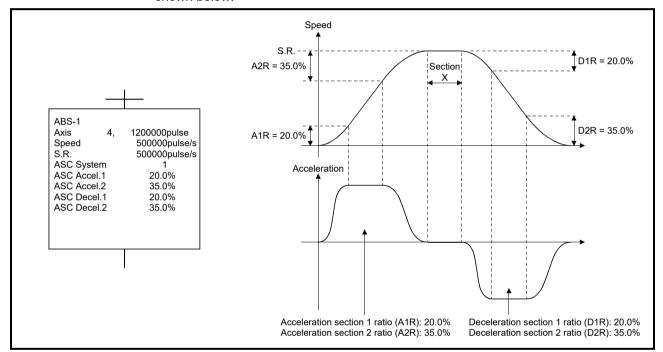
[Error]

In the following cases, the servo program setting error (error code: 45 to 50) will occur, and controls will be executed as trapezoidal acceleration/deceleration (A1R = A2R = D1R = D2R = 0.0).

- Acceleration section 1 ratio is outside the range of 0.0 to 100.0[%].
- Acceleration section 2 ratio is outside the range of 0.0 to 100.0[%].
- Deceleration section 1 ratio is outside the range of 0.0 to 100.0[%].
- Deceleration section 2 ratio is outside the range of 0.0 to 100.0[%].
- "Acceleration section 1 ratio + Acceleration section 2 ratio" > 100.0[%]
- "Deceleration section 1 ratio + Deceleration section 2 ratio" > 100.0[%]

[Program]

A sample servo program using the advanced S-curve acceleration/deceleration is shown below.



POINTS

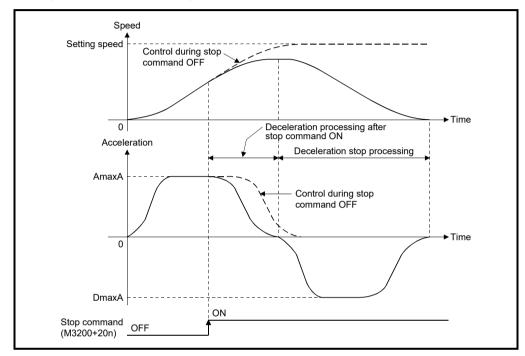
When the advanced S-curve acceleration/deceleration is set, the travel value (section X above) at the commanded speed is different than when using trapezoidal acceleration/deceleration (A1R=A2R=D1R=D2R=0.0).

[Operation]

(1) Stop processing

When the stop command turns ON during acceleration, the acceleration is decreased until it reaches zero according to acceleration section 2 ratio setting. Therefore, the speed will continue to increase for a while before deceleration stop processing is executed.

(Deceleration is smooth.)



POINTS

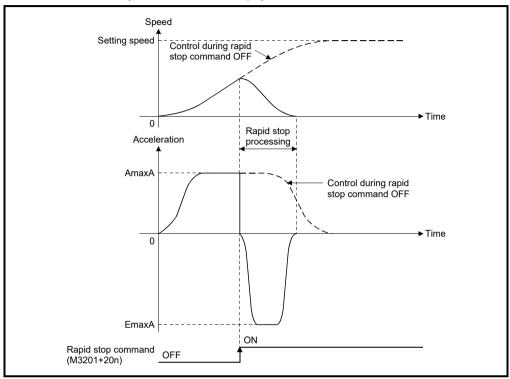
When the stop command turns ON during acceleration processing of advanced S-curve acceleration/deceleration, in order to maintain smoothness of acceleration, the speed will continue to increase until acceleration reaches zero.

Use the rapid stop command if an increase in speed is not desired.

(2) Rapid stop processing

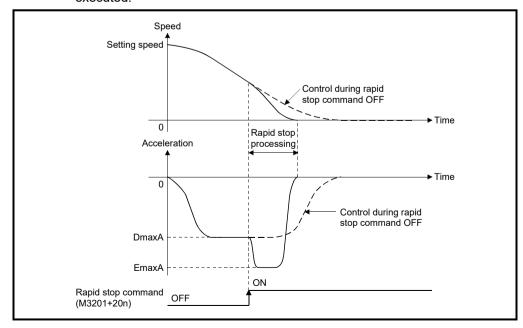
(a) Rapid stop during acceleration

When the rapid stop command turns ON during acceleration, acceleration immediately goes to zero, and rapid stop deceleration processing is executed. (Deceleration is abrupt.)



(b) Rapid stop during deceleration

When the rapid stop command turns ON during deceleration, the negative acceleration is decreased, and the rapid stop deceleration processing is executed.



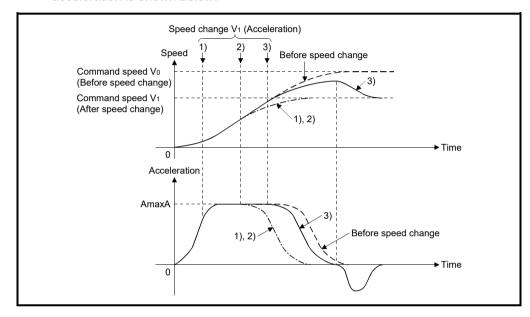
POINTS

When the rapid stop command turns ON during deceleration stop processing of advanced S-curve acceleration/deceleration, timing may be such that a rapid stop will take longer than the advanced S-curve deceleration.

In this case, the advanced S-curve deceleration stop processing will automatically continue instead of using the rapid stop processing.

(3) Speed change processing

Operation in which a speed change is executed during each section of acceleration is shown below.



Pattern	Speed change command	Acceleration/deceleration processing at speed change	Operation
1)	_	Acceleration section 1 (Increasing acceleration section)	Length of maximum acceleration section is adjusted to reach speed V ₁ at acceleration end.
2)		Maximum acceleration section	The acceleration is decreased until the acceleration reaches zero.
3)	Speed change V1 (Acceleration)	Maximum acceleration section (When the speed change occurs in situations where Vo will surpass V1 during the decreasing acceleration section.)	The maximum acceleration section is interrupted, and the acceleration is decreased until the acceleration reaches zero. The deceleration processing is executed to reach speed V1.

(4) Speed control with fixed position stop processing

The "fixed position stop acceleration/deceleration time" set in the servo program is used during acceleration/deceleration processing when a positioning start, speed change request (CHGV) or fixed position stop command ON occurs. It operates in the fixed acceleration/deceleration time method.

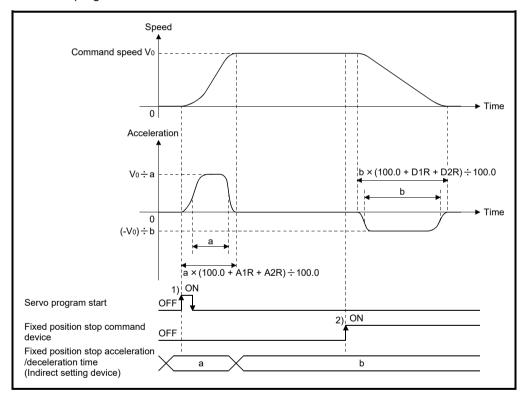
(a) Acceleration/deceleration processing in the fixed acceleration/deceleration time method

Actual acceleration time, deceleration time and maximum acceleration are shown below.

Acceleration time	Specified acceleration time (AT) X (100.0 + A1R + A2R) ÷ 100.0								
Deceleration time	Specified deceleration time (DT) X (100.0 + D1R + D2R) ÷ 100.0								
Maximum acceleration	Speed difference ÷ Specified acceleration/deceleration time								

(b) Acceleration processing from zero speed and deceleration processing to zero speed (fixed time method)

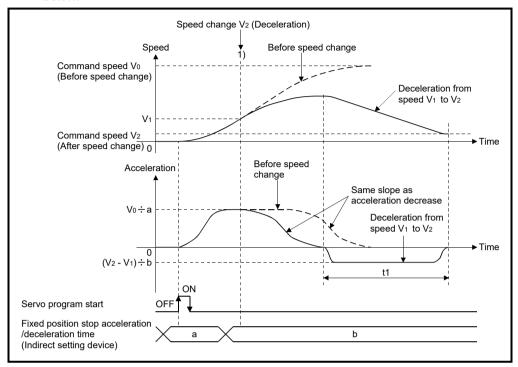
Operation for positioning to fixed position stop command position at servo program start is shown below.



Speed change command	Speed difference	Acceleration/ deceleration time	Maximum acceleration	Operation
1) Servo program start (Acceleration from speed 0 to Vo)	Vo	а	V₀ ÷ a	Actual acceleration time "a × (100.0 + A1R + A2R) ÷ 100.0"
Positioning to fixed position stop command position (Deceleration from speed Vo to 0)	-Vo	b	(-V₀) ÷ b	Actual deceleration time "b × (100.0 + D1R + D2R) ÷ 100.0"

(5) Speed change (fixed time method)

Operation in which a speed change during deceleration is executed is shown below.



Speed change command	Speed difference	Acceleration/ deceleration time	Maximum acceleration	Operation
1) Deceleration from speed Vo to 0	(V2 - V1)	b	(V2 - V1) ÷ b	 (a) The acceleration is decreased until the acceleration becomes from acceleration to"0" at speed change. This inclination of acceleration section 2 (acceleration decrease section) is calculated based on the acceleration/deceleration time before speed change. (b) Deceleration processing is executed. (Note): The acceleration time "t1" is lengthened than "b × (100.0 + D1R + D2R) ÷ 100.0", because the acceleration continues until the acceleration reaches zero after a speed change.

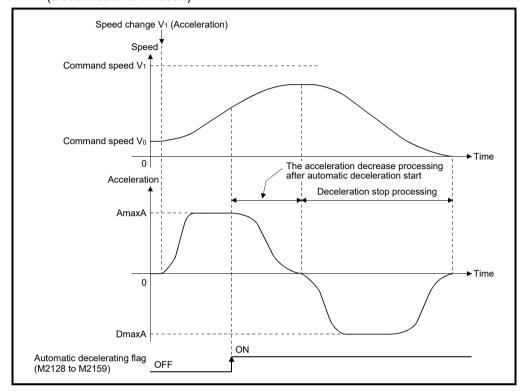
POINTS

When a speed change is executed during decreasing acceleration of advanced S-curve acceleration/deceleration, in order to maintain smoothness of acceleration, the speed will continue to increase until acceleration reaches zero. Therefore, the time for speed change is lengthened.

(6) Automatic decelerating flag (M2128 to M2159)

When the automatic deceleration processing is started during acceleration, the acceleration is decreased according to the acceleration section 2 ratio setting until the acceleration reaches zero. Therefore, the speed increases for a while before deceleration stop processing is executed.

(Deceleration is smooth.)



POINTS

When the automatic deceleration processing is started during acceleration processing of advanced S-curve acceleration/deceleration, in order to maintain smoothness of acceleration, the speed will continue to increase until acceleration reaches zero.

4.3.4 Allowable error range for circular interpolation

The locus of the arc calculated from the start point address and central point address may not coincide with the set end point address for the central-specified control. The allowable error range for circular interpolation sets the allowable range for the error between the locus of the arc determined by calculation and the end point address. If the error is within the allowable range, circular interpolation to the set end point address is executed while also executing error compensation by means of spiral interpolation.

If it exceeds the setting range, an error occurs at the start and positioning does not start. Such an error are set the applicable axis or minor error code area.

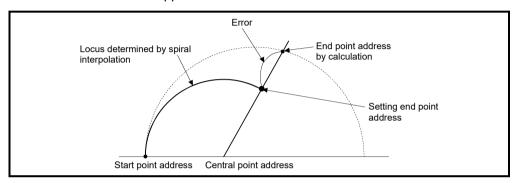


Fig. 4.7 Spiral Interpolation

4.4 Expansion Parameters QDS(

- (1) The expansion parameters are data to execute the following operation by the parameters set in each axis.
 - Monitor individually the positive and negative direction torque limit value.
 - Change the acceleration/deceleration time when changing speed.
- (2) The expansion parameters are set using MT Developer2.
- (3) The expansion parameters to be set are shown in Table 4.3.

Table 4.3 Expansion parameter list

ſ							Setting	range						Indirec	t setting		
	No.	. Item		Setting range	Units	inch Setting range	Units	degr Setting range	ee Units	puls Setting range	e Units	Initial value	Units	Valid/ invalid	Number of words	Remarks	Section
	1	Positive directi limit value mor (Note-1)					_	-				_	_	0	1	Set the device to monitor the positive torque limit value.	
	2	Negative direct limit value mort (Note-1)					_	_				_		0	1	Set the device to monitor the negative torque limit value.	4.4.1
	3		Acceleration/ deceleration time change enable device (Note-1)				_	_				_		0	Bit	Set the device to enable the change of acceleration/ deceleration time at a speed change request.	
	4	time change parameter	New acceleration time value device (Note-1)				-	-				_	1	0	1	Set the device to set the change value of acceleration time.	4.2.2
	5		New deceleration time value device (Note-1)				_	_				_	_	0	1	Set the device to set the change value of deceleration time.	

(Note-1): This setting can be omitted.

Ver.!: Refer to Section 1.3 for the software version that supports this function.

(4) Indirect setting of expansion parameter

(a) Word devices for indirect setting

The word devices for indirect setting are the data registers (D), link registers (W), Motion registers (#) and Multiple CPU area device ($U \square \G$).

Word devices except the above devices cannot be used.

The usable setting range of word devices are shown below.

Word devices	Setting range
D	0 to 8191
W	0 to 1FFF
#	0 to 9215
U□\G	10000 to (10000+p-1) (Note-1) (Note-2)

(Note-1): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

(Note-2): Positive direction torque limit value monitor device and negative direction torque limit value monitor device can use the device of the self CPU only.

(b) Bit devices for indirect setting

The bit devices for indirect setting are the input (X), output (Y), internal relay (M), link relay (B), annunciator (F) and Multiple CPU area device ($U \square \backslash G$). Bit devices except the above devices cannot be used.

The usable setting range of bit devices are shown below.

Bit device	Setting range
Х	0000 to 1FFF ^(Note-1)
Υ	0000 to 1FFF
M	0 to 8191
В	0000 to 1FFF
F	0 to 2047
U□\G	10000.0 to (10000+p-1).F (Note-2)

(Note-1): The range of "PXn+4 to PXn+F" cannot be used (fixed at 0) for the input device (PXn+0 to PXn+F) allocated to the built-in interface in Motion CPU (DI). (n: First input No.)

(Note-2): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

(c) Input of expansion parameter

- The positive direction torque limit value monitor device and negative direction torque limit value monitor device input the monitor value in the specified word device for every operation cycle.
- 2) The acceleration/deceleration time change parameter inputs the data of the specified device at request of speed change.

POINT

Refer to Chapter 2 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for the user setting area points of the Multiple CPU high speed transmission area.

4.4.1 Positive direction torque limit value monitor device/negative direction torque limit value monitor device

The positive direction torque limit value monitor device and negative direction torque limit value monitor device are set for every axis, and the positive and negative direction torque limit value are monitored (0.1 to 1000.0[%]) individually.

- (1) Positive direction torque limit value monitor device Set the device to monitor the positive torque limit value. The positive torque limit value (forward rotation (CCW) driving, reverse rotation (CW) regenerative torque limit value) to command the servo amplifier is stored. The default value "300.0[%]" is stored at the power supply of servo amplifier ON.
- (2) Negative direction torque limit value monitor device
 Set the device to monitor the negative torque limit value.
 The negative torque limit value (reverse rotation (CW) driving, forward rotation (CCW) regenerative torque limit value) to command the servo amplifier is stored.
 The default value "300.0[%]" is stored at the power supply of servo amplifier ON.

POINT

The positive torque limit value is stored in the torque limit value storage register (D14+20n) in 1[%] unit. (The negative torque limit value is not stored.)

4.4.2 Acceleration/deceleration time change parameter (4.4.2 Acceleration/deceleration time change parameter (4.4.2 Acceleration)

The acceleration/deceleration time change parameter arbitrarily changes the acceleration/deceleration time at speed change, when changing speed with the Motion dedicated function (CHGV) of Motion SFC program (and also the Motion dedicated PLC instruction (D(P). CHGV)).

(1) Acceleration/deceleration time change enable device

Set the device to enable the change of acceleration/deceleration time at a speed change request.

The following describes the operation for ON and OFF of the acceleration/ deceleration time change enable device.

- ON Speed change is executed at a speed change request by changing the acceleration/deceleration time values in the new acceleration time value device and new deceleration time value device.
- OFF Does not change acceleration/deceleration time at a speed change request.

(2) New acceleration time value device

Set the device to set the change value when changing the acceleration time at a speed change request.

The following change values are set in the new acceleration time value device.

- 0...... Acceleration time change is disabled, and speed change is maintained at the current acceleration time.
- 1 to 65535[ms] If a speed change request is executed when the acceleration/deceleration time change enable device is ON, speed change is executed by changing the acceleration time to the set value.

(3) New deceleration time value device

Set the device to set the change value when changing the deceleration time at a speed change request.

The following change values are set in the new deceleration time value device.

- 0...... Deceleration time change is disabled, and speed change is maintained at the current deceleration time.
- 1 to 65535[ms]...... If a speed change request is executed when the acceleration/deceleration time change enable device is ON, speed change is executed by changing the deceleration time to the set value.

Ver.!: Refer to Section 1.3 for the software version that supports this function.

POINTS

- (1) When the setting of acceleration/deceleration time change enable device is omitted, change of acceleration/deceleration time at a speed change request is not executed. When changing acceleration/deceleration time at a speed change, set this parameter.
- (2) When the setting of new acceleration time value device and new deceleration time value device is omitted, change of acceleration/deceleration time of the omitted devices is not executed.

5. SERVO PROGRAMS FOR POSITIONING CONTROL

Servo programs specify the type of the positioning data required to execute the positioning control in the Multiple CPU system.

This chapter describes the configuration and setting method of the servo programs. Refer to Chapter "6 POSITIONING CONTROL" for details of the servo program.

5.1 Servo Program Composition Area

This section is described the composition of servo programs and the area in which stores the servo program.

5.1.1 Servo program composition

A servo program is composed a program No., servo instructions and positioning data. When a program No. and the required servo instructions are specified using MT Developer2, the positioning data required to execute the specified servo instructions can be set.

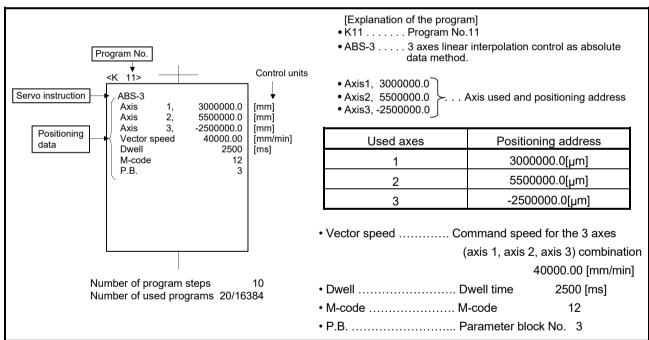


Fig. 5.1 Composition example of servo program

- (1) Program No. This No. is specified using the Motion SFC program. Any No. in the range of 0 to 4095 can be set.
- (2) Servo instruction Type of positioning control is indicated.

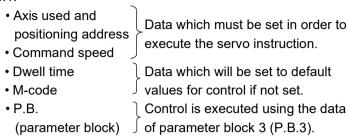
 Refer to Section 5.2 for details.

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

The data required to execute is fixed for each servo instruction.

Refer to Section 5.3 for details.

The follows applies for the servo program shown in Figure 5.1.



5.1.2 Servo program area

(1) Servo program area

This area is an internal memory of the Multiple CPU system which store the servo program created using MT Developer2.

This area is an internal RAM.

(2) Servo program capacity

The servo program area has a capacity of 16384 steps.

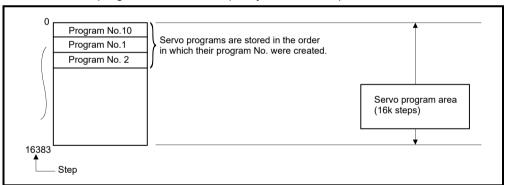


Fig. 5.2 Servo program area

POINT

If the servo program area has insufficient capacity, execute the multiple positioning control operations with one program by indirect setting of the positioning data used in the servo program. (Refer to Section 5.4.2 for details of indirect setting.)

5.2 Servo Instructions

The servo instructions used in the servo programs are shown below.

Refer to Chapter 6 for details of the servo instruction.

Refer to Chapter 7 of the "Q173D(S)CPU/Q172D(S)CPU Motion Controller (SV13/SV22) Programming Manual (Motion SFC)" for details of the current value change control (CHGA, CHGA-E, CHGA-C).

(1) Guide to servo instruction list

Table. 5.1 Guide to Servo Instruction List

			0)		-\	2)	=) 0)
			3) ↑	4) ↑	5) 	6) ↑	7) 8)
						Positioning data	
	struction Processing	Parameter block No. Axis Address/travel	Command speed lowell time Dwell time M-code Torque limit value	Auxiliary point Radius Central point Pitch Pitch Starting angle	Amplitude SS C S C S S S S S S S S S S S S S S S	Pedie ence a said No local process and No local pro	Other Ot
control	Virtual enable	Par		0000-		Reference at Reference at State I Interpolation continue a Special Invitation of the Continue I Invitation of the Continue I Invitation programme at stopic and a special Invitation and I Invita	Pilva accelerat
	Number of step	1 1 1	1 1 1 1	1 1 1 1 1	1 1		
	Number of indired			2 2 2 1 2	2 2	1 1 2 1 1 1 1 2 1 1 1 1 1 2 1 1 1 1 1 1	- 2 1(B) 1(B) 1 1(B) 1 1(B) 1 1(B)
1 axis	ABS-1 Absolute 1-axis position INC-1 Incremental 1-axis posi	<u> </u>					Δ 4 to 17
2 axis	ABS-2 Absolute 2-axes linear	ΔΟΟ	0 0 0		(Δ 5 to 20
roj Z dys	NC 0						
	ľ)					ž)	
Number						Description	
43	Instruction sym	bol Give	s the servo	instruction	s usabl	ole in servo programs.	
1)	Processing	Give	s the proce	essing outlin	nes of th	the servo instructions.	
2)	2) \(\triangle : Iter (b) Allows direct (c) Indirect (c) Serv (c) Number of servo programs	n which must n which is set ct or indirect lesignation designation o program e setting item word data, teps more setting m is created	et be set (Da et when req t designation : Set with n : Set with v execution is n may eithe set the start g items, then	ata which conduired (Data n (except ax numerical va word device. controlled under be 1 or 2 valued to	annot en which wis No.) allue. Lusing the word date and the word date and the mumber and the word date and the word dat	execute the servo instruction unless it sent will be controlled by the default value under the preset word device contents.	ps is displayed when a
3)	Items common	to the serve	instruction	าร			
4)	Items set in cir	cular interpo	lation starti	ing servo pr	ograms	ns	
5)	Items set for hi	gh-speed os	scillation				
6)	Set when chan (The parameter			•	alue wh	hen not set) data set in the servo program	to control.
7)	Setting items of	ther than the	e common,	circular and	d paran	meter block items (Items to be set vary w	ith the servo instruction.)
8)	Indicates the n	umber of ste	eps of each	servo instru	uction.		

(2) Servo instruction list

The servo instructions that can be used in servo programs and the positioning data set in the servo instruction are shown in Table 5.2. Refer to Section 5.3 for details of the positioning data set in the servo instructions.

Table 5.2 Servo instruction list

										P	osition	ing da	ta						
							С	ommo	n				Arc/F	lelical			OSC		
Р	ositioning control	Instruction symbol		Processing	Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M -code	Torque limit value	Auxiliary point	Radius	Central point	Pitch	Starting angle	Amplitude	Frequency	
				Virtual enable	0	0	0	0	0	0	_	0	0	0	0	_	_		
				Number of steps	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
				Number of indirect words	1	_	2	2	1	1	1	2	2	2	1	2	2	2	
	1 axis	ABS-1	Absolute	e 1-axis positioning	Δ	0	0	0	Δ	Δ									
	1 axis	INC-1	Increme	ental 1-axis positioning	Δ	0	0	0	Δ	Δ									
Linear interpolation control	2 axes	ABS-2	Absolute	e 2-axes linear interpolation	Δ	0	0	0	Δ	Δ									
olation		INC-2	Increme	ental 2-sxes linear interpolation	Δ	0	0	0	Δ	Δ									
ır interp	3 axes	ABS-3	Absolut	e 3-axes linear interpolation	Δ	0	0	0	Δ	Δ									
Linea		INC-3	Increme	ental 3-axes linear interpolation	Δ	0	0	0	Δ	Δ									
	4 axes	ABS-4	Absolute	e 4-axes linear interpolation	Δ	0	0	0	Δ	Δ									
		INC-4		ental 4-axes linear interpolation	Δ	0	0	0	Δ	Δ									
	Auxiliary point-	ABS_	circular	e auxiliary point-specified interpolation	Δ	0	0	0	Δ	Δ		0							
	specified	INC 🗸	circular	ental auxiliary point-specified interpolation	Δ	0	0	0	Δ	Δ		0							
ō		ABS◯◀	interpola	e radius-specified circular ation less than CW 180°	Δ	0	0	0	Δ	Δ			0						
Circular interpolation control		ABS	interpola	e radius-specified circular ation CW 180° or more	Δ	0	0	0	Δ	Δ			0						
polatio		ABS⊶	interpola	e radius-specified circular ation less than CCW 180°	Δ	0	0	0	Δ	Δ			0						
ar inter	Radius-	ABS	interpola	e radius-specified circular ation CCW 180° or more	Δ	0	0	0	Δ	Δ			0						
Circul	specified	INC (interpola	ental radius-specified circular ation less than CW 180°	Δ	0	0	0	Δ	Δ			0						
		INC 🕟	interpola	ental radius-specified circular ation CW 180° or more	Δ	0	0	0	Δ	Δ			0						
		INC 🕒	interpola	ental radius-specified circular ation less than CCW 180°	Δ	0	0	0	Δ	Δ			0						
		INC 🕒		ental radius-specified circular ation CCW 180° or more		0	0	0	Δ	Δ			0						

										Р	osition	ing da	ta											
(Note-1)		_	_					er blo			Δdvan	ced S	-CURV						Others					
axis No.	trol unit	it value	on time	on time	on time	it value	n processing at stop input	inge for oolation	S-curve ratio	acc	elerati	on/de	celera	tion	ondition	Program No.	d speed speed	Cancel	Skip	eration	ON/OFF	leration on time	ion stop	
Reference axis No.	Interpolation control unit	Speed limit value	Acceleration time	Deceleration time	Rapid stop deceleration time	Torque limit value	Deceleration processing at stop input	Allowable er circular		Acceleration/deceleration system	Acceleration section 1 ratio	Acceleration section 2 ratio	Deceleration section 1 ratio	Deceleration section 2 ratio	Repe		Command speed (constant speed)			FIN acceleration/deceleration	WAIT-ON/OFF	Fixed position stop acceleration /deceleration time	Fixed position stop	Number of steps
0	_	0	0	0	0	_	_	0	0	0	0	0	0	0	0	0	0	0	0	0	0	_	_	
1	1	2	1	1	1	1	1	2	1	1	1	1	1	1	1 (Note-2) 1/ 1(B)	<u>1</u>	2	2 (Note-2) 1(B)	2 (Note-2) 1(B)	1	2 (Note-2) 1(B)	1	1 (Note-2) 1(B)	
		Δ	Δ	Δ	Δ	Δ	Δ		Δ	Δ	Δ	Δ	Δ	Δ				Δ						
		Δ	Δ	Δ	Δ	Δ	Δ		Δ	Δ	Δ	Δ	Δ	Δ				Δ						4 to 17
0	Δ	Δ	Δ	Δ	Δ	Δ	Δ		Δ	Δ	Δ	Δ	Δ	Δ				Δ						5 to 20
0	Δ	Δ	Δ	Δ	Δ	Δ	Δ		\triangle	Δ	Δ	Δ	Δ	Δ				Δ						
0	Δ .		△		Δ.	Δ .	<u>△</u>				Δ.			Δ.										7 to 21
0	^		^	Δ	^	^	^			^	Δ	^	^	^				^						
0	Δ	Δ		Δ	Δ	Δ	Δ		Δ	Δ	Δ	Δ	Δ	Δ				Δ						8 to 22
)	Δ			Δ				Δ	Δ	Δ	Δ	Δ	Δ	Δ				Δ						
	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ				Δ						7 to 22
	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ				Δ						
	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ				Δ						
	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ				Δ						
	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ				Δ						6 to 21
	^	^	^	Δ	^	<u>^</u>	^	Δ		^	^	^	Δ	^										
	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ				Δ						
	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ				Δ						
																			ot bo		^ · Sc			

 \bigcirc : Must be set. \triangle : Set if required. (Note-1): Only reference axis speed specification. (Note-2): (B) indicates a bit device.

Table 5.2 Servo instruction list (continued)

				Table 3.2 Gerve ii							osition	ina da	ta					ı	
							C	ommo	n	г	osiuoli	iiig da		lelical			OSC		
Р	ositioning control	Instruction symbol		Processing	Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M -code	Torque limit value	Auxiliary point	Radius	Central point	Pitch	Starting angle	Amplitude	Frequency	
				Virtual enable	0	0	0	0	0	0		0	0	0	0			_	
				Number of steps	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
				Number of indirect words	1	-	2	2	1	1	1	2	2	2	1	2	2	2	
tion		ABS ∕.◀		e central point-specified circular ation CW	Δ	0	0	0	Δ	Δ				0					
Circular interpolation	Central point-	ABS∵₄		e central point-specified circular ation CCW	Δ	0	0	0	Δ	Δ				0					
cular in	specified	INC 🖪	l	ental central point-specified interpolation CW	Δ	0	0	0	Δ	Δ				0					
Ωį		INC 🎿	l	ental central point-specified interpolation CCW	Δ	0	0	0	Δ	Δ				0					
	Auxiliary point-	ABH 🕾	helical in	e auxiliary point- specified nterpolation	Δ	0	0	0	Δ	Δ		0			0				
	specified	INH 🗠	helical in	ental auxiliary point- specified nterpolation	Δ	0	0	0	Δ	Δ		0			0				
		ABH◯◀	l	e radius-specified helical ation less than CW 180°	Δ	0	0	0	Δ	Δ			0		0				
		ABH()		e radius-specified helical ation CW 180° or more	Δ	0	0	0	Δ	Δ			0		0				
_		ABH✓		e radius-specified helical ation less than CCW 180°	Δ	0	0	0	Δ	Δ			0		0				
ical interpolation control	Radius-	АВН	l	e radius-specified helical ation CCW 180° or more	Δ	0	0	0	Δ	Δ			0		0				
olation	specified	INH <		ental radius-specified helical ation less than CW 180°	Δ	0	0	0	Δ	Δ			0		0				
l interp		INH 🗪		ental radius-specified helical ation CW 180° or more	Δ	0	0	0	Δ	Δ			0		0				
Helical		INH 🕥	l	ental radius-specified helical ation less than CCW 180°	Δ	0	0	0	Δ	Δ			0		0				
		INH 🕩		ental radius-specified helical ation CCW 180° or more	Δ	0	0	0	Δ	Δ			0		0				
		ABH∕.◀	Absolute	e central point-specified helical ation CW	Δ	0	0	0	Δ	Δ				0	0				
	Central	ABH∵₄		e central point-specified helical ation CCW	Δ	0	0	0	Δ	Δ				0	0				
	point- specified	INH ∕,◀		ental central point-specified nterpolation CW	Δ	0	0	0	Δ	Δ				0	0				
		INH ⊶	Increme	ental central point-specified nterpolation CCW	Δ	0	0	0	Δ	Δ				0	0				

										Po	osition	ing da	ıta											
(Note-1)						Pa	ramet	er blo	ck	ı							1	(Others	3				
is No.	ol unit	value	n time	n time	n time	value	essing input	ge for plation	e ratio			iced S ion/de			dition	m No.	speed (peed)	Cancel	Skip	ration	N/OFF	ration n time	n stop	
Reference axis No.	Interpolation control unit	Speed limit value	Acceleration time	Deceleration time	Rapid stop deceleration time	Torque limit value	Deceleration processing at stop input	,	S-curve ratio	Acœleration/deceleration system	Acceleration se	Acceleration sect	Deceleration sect	Deceleration section 2 ratio	Repeat condition	Program No.	Command speed (constant speed)			FIN acceleration/deceleration	WAIT-ON/OFF	Fixed position stop acceleration /deceleration time	Fixed position stop	Number of steps
0	_	0	0	0	0	_	_	0	0	0	0	0	0	0	0	0	0	0	0	0	0	_	_	
1	1	2	1	1	1	1	1	2	1	1	1	1	1	1	1 (Note-2) 1/	1	2	2 (Note-2) 1(B)	2 (Note-2) 1(B)	1	2 (Note-2) 1(B)	1	1 (Note-2) 1(B)	
	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	1(B)			I(B) △	I(D)		I(D)		1(Б)	
	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ				Δ						
	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ				Δ						7 to 22
	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ				Δ						
	Δ	Δ	Δ	Δ	Δ	Δ	Δ		Δ	Δ	Δ	Δ	Δ	Δ				Δ						
	Δ	Δ	Δ	Δ	Δ	Δ	Δ		Δ	Δ	Δ	Δ	Δ	Δ				Δ						10 to 27
	Δ	Δ	Δ	Δ	Δ	Δ	\triangle		Δ	Δ	Δ	Δ	Δ	Δ				Δ						
	Δ	Δ	Δ	Δ	Δ	Δ	Δ		Δ	Δ	Δ	Δ	Δ	Δ				Δ						
	Δ	Δ	Δ	Δ	Δ	Δ	Δ		Δ	Δ	Δ	Δ	Δ	Δ				Δ						
	Δ	Δ	Δ	Δ	Δ	Δ	Δ		Δ	Δ	Δ	Δ	Δ	Δ				Δ						9 to 26
	Δ .			Δ		Δ.				Δ	Δ	Δ.	Δ.	Δ										
	Δ	Δ	Δ	Δ	Δ	Δ	Δ			Δ	Δ	Δ	Δ	Δ				Δ						
	Δ	^	^	Δ	Δ	^	^		^	Δ	Δ	^	Δ	Δ				^						
	^	^	^	^	^	^	^			^	^	^	^	^				^						
	Δ		Δ	Δ	Δ	Δ	Δ		Δ Δ		Δ	Δ	Δ	Δ				Δ						
	Δ		Δ						Δ	Δ	Δ	Δ	Δ	Δ										10 to 27
	Δ	Δ	Δ	Δ	Δ	Δ	Δ		Δ	Δ	Δ	Δ	Δ	Δ				Δ						
												<u> </u>	<u> </u>									at if roo		

 \bigcirc : Must be set. \triangle : Set if required. (Note-1) : Only reference axis speed specification. (Note-2) : (B) indicates a bit device.

Table 5.2 Servo instruction list (continued)

			Table 3.2 Get								osition	ing da	ta						
							С	ommo	n		osition	ing da		lelical			OSC		
Р	ositioning control	Instruction symbol	Processing		Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M -code	Torque limit value	Auxiliary point	Radius	Central point	Pitch	Starting angle	Amplitude	Frequency	
			Virtual enable		0	0	0	0	0	0	_	0	0	0	0	_	_	_	
			Number of steps		1	1	1	1	1	1	1	1	1	1	1	1	1	1	
			Number of indirect word	ds	1	-	2	2	1	1	1	2	2	2	1	2	2	2	
peed	1 axis	FEED-1	1-axis fixed-pitch feed start		Δ	0	0	0	Δ	Δ									
Fixed-pitch feed	2 axes	FEED-2	2-axes linear interpolation fixed-pitch feed start		Δ	0	0	0	Δ	Δ									
Fixe	3 axes	FEED-3	3-axes linear interpolation fixed-pitch feed start		Δ	0	0	0	Δ	Δ									
Speed control (I)	Forward rotation	VF	Speed control (I) forward rotation start		Δ	0		0		Δ									
Sp	Reverse rotation	VR	Speed control (I) reverse rotation start		Δ	0		0		Δ									
Speed control (II)	Forward rotation	VVF	Speed control (II) forward rotation start		Δ	0		0		Δ	Δ								
Sp	Reverse rotation	VVR	Speed control (II) reverse rotation start		Δ	0		0		Δ	Δ								
ition	Forward rotation	VPF	Speed-position switching control forward rotation start		Δ	0	0	0	Δ	Δ	Δ								
Speed-position switching control	Reverse rotation	VPR	Speed-position switching control reverse rotation start		Δ	0	0	0	Δ	Δ	Δ								
Spe	Restart	VPSTART	Speed-position switching control	restart		0													
		VSTART	Speed-switching control start		Δ														
		VEND	Speed-switching control end																
		ABS-1				0	0	0	Δ	Δ	Δ								
		ABS-2	Speed-switching control end point address			0	0	0	Δ	Δ	Δ								
	ed-switching	ABS-3				0	0	0	Δ	Δ	Δ								
contr	rol	INC-1				0	0	0	Δ	Δ	Δ								
		INC-2	Travel value up to speed-switchin control end point	ng		0	0	0	Δ	Δ	Δ								
		INC-3				0	0	0	Δ	Δ	Δ								
		VABS	Speed-switching point absolute specification				0	0		Δ	Δ								
		VINC	Speed-switching point incremental specification				0	0		Δ	Δ								

										Po	sition	ing da	ta											
(Note-1)		-	_	l _				er blo			Advan	ced S	-CUD/6				_		Others		l			
Reference axis No.	Interpolation control unit	Speed limit value	Acceleration time	Deceleration time	Rapid stop deceleration time	Torque limit value	Deceleration processing at stop input	,	S-curve ratio	Acceleration/deceleration	Acceleration section 1 all ratio	Acceleration section 2 Or Partion 2	Deceleration section 1 all all all all all all all all all a	Deceleration section 2 of ratio		Program No.	Command speed (constant speed)		Skip	FIN acceleration/deceleration	WAIT-ON/OFF	Fixed position stop acceleration /deceleration time	Fixed position stop	Number of steps
1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	2	1	1	
1	1	2	1	1	1	1	1	2	1	1	1	1	1	1	(Note-2) 1/ 1(B)	_	2	(Note-2) 1(B)	(Note-2) 1(B)	1	(Note-2) 1(B)	1	(Note-2) 1(B)	
		Δ	Δ	Δ	Δ	Δ	Δ		Δ	Δ	Δ	Δ	Δ	Δ	1(=)			Δ						4 to 17
	Δ	Δ	Δ	Δ	Δ	Δ	Δ		Δ	Δ	Δ	Δ	Δ	Δ				Δ						5 to 19
	Δ	Δ	Δ	Δ	Δ	Δ	Δ		Δ	Δ	Δ	Δ	Δ	Δ				Δ						7 to 21
		Δ	Δ	Δ	Δ	Δ	Δ		Δ	Δ	Δ	Δ	Δ	Δ				Δ						3 to 15
		Δ	Δ	Δ	Δ	Δ	Δ		Δ	Δ	Δ	Δ	Δ	Δ				Δ						
		Δ	Δ	Δ	Δ	Δ	Δ		Δ	Δ	Δ	Δ	Δ	Δ				Δ						3 to 16
		Δ	Δ	Δ	Δ	Δ	Δ		Δ	Δ	Δ	Δ	Δ	Δ				Δ						
		Δ	Δ	Δ	Δ	Δ	Δ		Δ	Δ	Δ	Δ	Δ	Δ				Δ						4 to 18
		Δ	Δ	Δ	Δ	Δ	Δ		Δ	Δ	Δ	Δ	Δ	Δ				Δ						
	^	^	^	_	^	^	^		^	^	^	^						^						2 to 4
	Δ		Δ	Δ	Δ		Δ			Δ			Δ	Δ				Δ						1 to 13
																		Δ						4 to 9
																		Δ						5 to 10
																		Δ						7 to 12
																		Δ						4 to 9
																		Δ						5 to 10
																		Δ						7 to 12
																								4 to 6
																			iet ho					

○ : Must be set. △ : Set if required. (Note-1) : Only reference axis speed specification. (Note-2) : (B) indicates a bit device.

Table 5.2 Servo instruction list (continued)

	1	,	Table 5.2 Serv	0 111	ว แ เ	JULIC	וו ווע	St (t	JOH									1	
				-						P	osition	ing da		lalic - '		1	000		ı
					. 0	Axis		ommo		g	e	int		lelical ;;	Pitch	gle	OSC e	ıcy	ı
Positioning control	Instruction symbol		Processing		Parameter block No.	Ą	Address/travel value	Command speed	Dwell time	M -code	Torque limit value	Auxiliary point	Radius	Central point	P.	Starting angle	Amplitude	Frequency	
			Virtual enable		0	0	0	0	0	0	_	0	0	0	0	_	_	_	İ
			Number of steps		1	1	1	1	1	1	1	1	1	1	1	1	1	1	i
			Number of indirect words		1	-	2	2	1	1	1	2	2	2	1	2	2	2	ì
Forward rotation	PVF	Speed o	control with fixed position st	op	\triangle	0	0	0	Δ	Δ									1
with fixed rotation stoom of the fixed rotation Reverse rotation rotation	PVR		e specification		Δ	0	0	0	Δ	Δ									l
Position follow-up control	PFSTART	Position	n follow-up control start		Δ	0	0	0		Δ									1
	CPSTART1	1-axis c	constant-speed control start		Δ	0		0											ı
	CPSTART2	2-axes	constant-speed control start	t	Δ	0		0											ı
	CPSTART3	3-axes	constant-speed control start	t	Δ	0		0											ı
	CPSTART4	4-axes	constant-speed control start	t	Δ	0		0											ı
	ABS-1	_		-		0	0			Δ	Δ								ı
	ABS-2	1		-		0	0			Δ	Δ								ı
	ABS-4	_		-		0	0			Δ	Δ								ı
	ABS					0	0			Δ	Δ	0							ı
	ABS◯◀		nt-speed control passing po e specification	oint		0	0			Δ	Δ		0						ı
Constant-speed	ABS()		•			0	0			Δ	Δ		0						ı
control	ABS✓	-				0	0			Δ	Δ		0						ı
	ABS	_		-		0	0			Δ	Δ		0						ı
	ABS ∴			-		0	0			Δ	Δ			0					ı
	ABH_~					0	0			Δ	Δ	0			0				ı
	ABH⊂◀	1		-		0	0			Δ	Δ		0		0				ı
	ABH()			F		0	0			Δ	Δ		0		0				ı
	ABH✓		nt-speed control passing po absolute specification	oint		0	0			Δ	Δ		0		0				ı
	ABH 🕩	_				0	0			Δ	Δ		0		0				ı
	ABH∕,◀			-		0	0			٨	٨			0	0				ı
	ABH∵₄					0	0			Δ	Δ			0	0				

										Po	osition	ing da	ta											
(Note-1)	+	4)	0	0	0		rame				Advan	ced S	-curve	<u> </u>	_	_	T (Others			5 0	0	
Reference axis No.	Interpolation control unit	Speed limit value	Acceleration time	Deceleration time	Rapid stop deceleration time	Torque limit value	Deceleration processing at stop input	Allowable error range for circular interpolation	S-curve ratio		elerati	Acceleration section 2 0 0 0 0 0 0 0 0 0	celera		Repeat condition	Program No.	Command speed (constant speed)	Cancel	Skip	FIN acceleration/deceleration	WAIT-ON/OFF	Fixed position stop acceleration /deceleration time	Fixed position stop	Number of steps
0	_	0	0	0	0	_	_	0	0	0	0	0	0	0	0	0	0	0	0	0	0	_	_	
1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	2	1	1	
1	1	2	1	1	1	1	1	2	1	1	1	1	1	1	(Note-2) 1/ 1(B)	-	2	(Note-2) 1(B)	(Note-2) 1(B)	1	(Note-2) 1(B)	1	(Note-2) 1(B)	
		Δ		Δ	Δ	Δ	Δ		Δ	Δ	Δ	Δ	Δ	Δ	-(=)			Δ				0	0	
		Δ		Δ	Δ	Δ	Δ		Δ	Δ	Δ	Δ	Δ	Δ				Δ				0	0	6 to 19
		Δ	Δ	Δ	Δ	Δ	Δ		Δ	Δ	Δ	Δ	Δ	Δ				Δ						4 to 16
		Δ	Δ	Δ	Δ	Δ	Δ		Δ	Δ	Δ	Δ	Δ	Δ				Δ		Δ				3 to 15
	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ				Δ		Δ				3 to 17
	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ				Δ		Δ				4 to17
	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ				Δ		Δ				
																	Δ		Δ		Δ			2 to 10
																	Δ		Δ		Δ			3 to 11
																	Δ		Δ		Δ			4 to 12
																	Δ		Δ		Δ			5 to 13
																	Δ		Δ		Δ			5 to 14
																	Δ		Δ		٨			
																	Δ		Δ		Δ			4 to 13
																	Δ		Δ		Δ			
																	Δ		Δ		Δ			
																	Δ		Δ		Δ			5 to 14
																	Δ		Δ		Δ			9 to 14
																	Δ		Δ		Δ			0 10 14
																	Δ		Δ		Δ			
																	Δ		Δ		Δ			8 to 13
																	Δ		Δ		Δ			
																	Δ		Δ		Δ			
																	Δ		Δ		Δ			9 to 14

 \bigcirc : Must be set. \triangle : Set if required. (Note-1): Only reference axis speed specification. (Note-2): (B) indicates a bit device.

Table 5.2 Servo instruction list (continued)

											ing da	ta						
						С	ommo	n	ı	1		Arc/F		1		osc		
Positioning control	Instruction symbol		Processing	Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	epoo- M	Torque limit value	Auxiliary point	Radius	Central point	Pitch	Starting angle	Amplitude	Frequency	
			Virtual enable	0	0	0	0	0	0	_	0	0	0	0	_	_	_	
			Number of steps	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
			Number of indirect words	1	_	2	2	1	1	1	2	2	2	1	2	2	2	
	INC-1				0	0			Δ	Δ								
	INC-2				0	0			Δ	Δ								
	INC-3				0	0			Δ	Δ								
	INC-4				0	0			Δ	Δ								
	INC 🗸				0	0			Δ	Δ	0							
	INC <		nt-speed control passing point ental specification		0	0			Δ	Δ		0						
	INC ()				0	0			Δ	Δ		0						
	INC 🕒				0	0			Δ	Δ		0						
	INC 🕒				0	0			Δ	Δ		0						
Constant-speed control	INC 🖪	_			0	0			Δ	Δ			0					
	INC 🛂				0	0			Δ	Δ			0					
	INH 🗸>	_			0	0			Δ	Δ	0			0				
	INH <	_			0	0			Δ	Δ		0		0				
	INH ()	Carat	ot an and control		0	0			Δ	Δ		0		0				
	INH 🕒		nt-speed control passing point ncremental specification		0	0			Δ	Δ		0		0				
	INH 🕩	_			0	0			Δ	Δ		0		0				
	INH ∕,◀	_			0	0			Δ	Δ			0	0				
	INH 🖼				0	0			Δ	Δ			0	0				
	CPEND	Constar	nt-speed control end					\triangle										

	Positioning data																							
(Note-1)						Pa	ramet	er blo	ck	1								(Others	3				
is No.	ol unit	value	n time	n time	n time	value	essing input	ige for olation	e ratio			ced S on/de			dition	m No.	speed speed)	Cancel	Skip	eration	N/OFF	ration n time	n stop	
Reference axis No.	Interpolation control unit	Speed limit value	Acceleration time	Deceleration time	Rapid stop deceleration time	Torque limit value	Deceleration processing at stop input	,		Acceleration/deceleration system	Acceleration section 1 ratio			Deceleration section 2 ratio		Program No.	Command speed (constant speed)			FIN acceleration/deceleration	WAIT-ON/OFF	Fixed position stop acceleration /deceleration time	Fixed position stop	Number of steps
0	_	0	0	0	0	_	_	0	0	0	0	0	0	0	0	0	0	0	0	0	0	_	_	
1	1	2	1	1	1	1	1	2	1	1	1	1	1	1	1 (Note-2) 1/ 1(B)	<u>1</u> _	2	2 (Note-2) 1(B)	2 (Note-2) 1(B)	1	2 (Note-2) 1(B)	1	1 (Note-2) 1(B)	
																	Δ		Δ		Δ			2 to 10
																	Δ		Δ		Δ			3 to 11
																	Δ		Δ		Δ			4 to 12
																	Δ		Δ		Δ			5 to 13
																	Δ		Δ					5 to 14
																	Δ		Δ		Δ			
																	Δ		Δ		Δ			4 to 13
																	Δ		Δ		Δ			
																	Δ		Δ		Δ			- 5 to 14
																	Δ		Δ		Δ			
																	Δ		Δ		Δ			9 to 14
																	Δ		Δ		Δ			8 to 13
																	Δ		Δ		Δ			
																	Δ		Δ		Δ			
																	Δ		Δ		Δ			9 to 14
																	Δ		Δ		Δ			9 to 14
																			est ba					1 to 2

 \bigcirc : Must be set. \triangle : Set if required. (Note-1) : Only reference axis speed specification. (Note-2) : (B) indicates a bit device.

Table 5.2 Servo instruction list (continued)

									Po	osition	ing da	ta						
						С	ommo	n	1			Arc/H	lelical			osc	Kedneuck 2	
Positioning control	Instruction symbol		Processing	Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M -code	Torque limit value	Auxiliary point	Radius	Central point	Pitch	Starting angle	Amplitude	Frequency	
			Virtual enable	0	0	0	0	0	0	_	0	0	0	0	_		_	
			Number of steps	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
			Number of indirect words	1	_	2	2	1	1	1	2	2	2	1	2	2	2	
Repetition of	FOR-TIMES																	
same control (used in speed	FOR-ON	Repeat	range start setting															
switching control, constant-speed	FOR-OFF																	
control)	NEXT	Repeat	range end setting															
Simultaneous start	START	Simulta	neous start															
Home position return	ZERO	Home p	position return start		0													
High speed oscillation	OSC	High-sp	eed oscillation	Δ	0				Δ						0	0	0	
	CHGA		notor/Virtual Servo motor Shaft Value Change		0	0												
Current value change	CHGA-E	Encode	r current value change		0	0												
	CHGA-C	CAM sh	naft current value change		0	0												

										Р	osition	ing da	ta														
(Note-1)						Pa	ramet	ter blo		1	A 1						1		Others		1			4			
is No.	ol unit	value	n time	n time	ı time	value	ssing input	ge for plation	e ratio			iced S ion/de			dition	m No.	speed peed)	Cancel	Skip	ration	J/OFF	ration time	n stop				
Reference axis No.	Interpolation control unit	Speed limit value	Acceleration time	Deceleration time	Rapid stop deceleration time	Torque limit value	Deceleration processing at stop input	Allowable error range for circular interpolation	S-curve ratio	Acceleration/deceleration system	Acceleration section 1 ratio	Acceleration section 2 ratio	Deceleration section 1 ratio	Deceleration section 2 ratio	Repeat condition	Program No.	Command speed (constant speed)	O		FIN acceleration/deceleration	WAIT-ON/OFF	Fixed position stop acceleration /deceleration time	Fixed position stop	Number of steps			
0	_	0	0	0	0	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	_	_				
1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	2	1	1				
1	1	2	1	1	1	1	1	2	1	1	1	1	1	1	(Note-2) 1/ 1(B)	1	2	(Note-2) 1(B)	(Note-2) 1(B)	1	(Note-2) 1(B)	1	(Note-2) 1(B)				
															0												
															0									2			
															0												
																								3			
																0								2 to 3			
																								2			
						Δ												Δ						5 to 10			
																								3			

 \bigcirc : Must be set. \triangle : Set if required. (Note-1): Only reference axis speed specification. (Note-2): (B) indicates a bit device.

5.3 Positioning Data

The positioning data set in the servo programs is shown in Table 5.3.

Table 5.3 Positioning data

						Setting	g value using MT	Developer2			
		Name		Explanation	Default		Setting	g range			
	•			2.40.41.44.51	value	mm	inch	degree	pulse		
	Parar No.	neter block	deceler	ed on which parameter block ation processing at the acceleration/ ation processing and STOP input.	1		1 to	o 64			
	Axis		• It becon	starting axis. nes the interpolation starting axis No. at rpolation.	_		1 to	32			
		Absolute data method	Address	Set the positioning address as an absolute method with an absolute address.		-214748364.8 to 214748364.7 [μm]	-21474.83648 to 21474.83647	0 to 359.99999	-2147483648 to 2147483647		
	alle			Set the positioning address as an		Exc	cept for speed-pos	sition switching cor	ntrol		
	Address/travel value	Incremental data method	Travel	incremental data method with a travel value. Travel direction is indicated by the sign. Only positive settings can be	_	-214748364.7 to 214748364.7 [μm]	-21474.83647 to 21474.83647	-21474.83647 to 21474.83647	-2147483647 to 2147483647		
	dre		value	made at the speed/position control.			Speed-position	switching control	T		
Settings	_			Positive : Forward rotation (address increase direction) Negative: Reverse rotation (address decrease direction)		0 to 214748364.7 [µm]	0 to 21474.83647	0 to 21474.83647	0 to 2147483647		
Common Settings	Com	Command speed		Sets the positioning speed. Units for speed are the "control units" set in the parameter block. It becomes the vector speed/long-axis reference speed/reference axis speed at the interpolation starting. (PTP control only)		0.01 to 6000000.00 [mm/min]	0.001 to 600000.000 [inch/min]	0.001 to 2147483.647 [degree/min] (Note-5)	1 to 2147483647 [pulse/s]		
	Dwell	time	complet	time until outputs the positioning te signal (M2401+20n) after positioning oning address.	0[ms]		0 to 5000[ms]				
	M-code		Set the M-code. Set for each point at the speed-switching control and constant-speed control. Updated it at the start or specified point.		0		0 to 32767				
	Torqu	Updated it at the start or specified point. Set the torque limit value. The torque limit is performed based on the parameter block data at the start. The speed-switching control can be set for each point and the setting torque limit values can be performed with the specified point.		Torque limit setting valued [%] in the parameter block	1 to 1000[%]						

Cotting valu	a using the Metion	CCC program (Indi	root potting)	India	at a atting	Processing at the setting error		
Setting valu	e using the Motion Setting	SFC program (Indi	rect setting)	iriaire	ct setting	Error item information	at the setting error	
mm	inch	degree	pulse	Possible/ not possible	Number of used words	(Stored in SD517) (Note-4)	Control using default value	Not start
	1 to	64		0	1	1	0	
	_	_		×	_	_		
-2147483648 to 2147483647 (×10 ⁻¹ [µm])	147483647 to 214748647 0 to 35999999 -2147483648 147483647 147483647							
Ex	cept for speed-pos	ition switching cont	rol			n03 (Note-1)		
-2147483647 to 2147483647 (×10 ⁻¹ [µm])	-2147483647 to 214748647 (× 10 ⁻⁵ [inch])	-2147483647 to 214748647 (× 10 ⁻⁵ [inch])	-2147483647 to 2147483647	0	2			0
	switching control							
0 to 2147483647 (× 10 ⁻¹ [µm])	0 to 2147483647 (×10 ⁻⁵ [inch])	0 to 2147483647 (×10 ⁻⁵ [degree])	0 to 2147483647			_		
1 to 600000000 (×10-2 [mm/min]) 1 to 600000000 (×10-3 [degree/min]) (Note-5) 1 to 2147483647 1 to 2147483647 [pulse/s]				0	2	4	(Note-2)	○ (Note-3)
	0 to 50	00[ms]		0	1	5	0	
0 to 32767				0	1	6	0	
	1 to 10	000[%]		0	1	7	0	

⁽Note-1): The "n" in n03, n08, n09 and n10, indicates the axis No. (1 to 32).

⁽Note-2): When an error occurs because the speed limit value is exceeded, it is controlled at the speed limit value.

⁽Note-3): Applies when the command speed is "0".

⁽Note-4): If there are multiple errors in the same program, the latest error item information is stored.

⁽Note-5): When the "speed control $10 \times$ multiplier setting for degree axis" is set to "valid", the setting range is 0.01 to 21474836.47 [degree/min].

Table 5.3 Positioning data (Continued)

			T	1						
					Setting	y value using MT	·			
		Name	Explanation	Default		Setting	range			
				value	mm	inch	degree	pulse		
	Auxiliary point	Absolute data method	Set at the auxiliary point-specified circular interpolation.		-214748364.8 to 214748364.7 [µm]	-21474.83648 to 21474.83647	0 to 359.99999	-2147483648 to 2147483647		
	Auxilia	Incremental data method		_	-214748364.7 to 214748364.7 [µm]	-21474.83647 to 21474.83647	-21474.83647 to 21474.83647	-2147483647 to 2147483647		
rpolation	Radius	Absolute data method	Set at the radius-specified circular interpolation. The sitting ranges depending on the		0.1 to 429496729.5 [µm]	0.00001 to 42949.67295	0 to 359.99999	1 to 4294967295		
Circular Interpolation	Rac	Incremental data method	positioning method is shown to the right.	_	0.1 to 214748364.7 [µm]	0.00001 to 21474.83647	0.00001 to 21474.83647	1 to 2147483647		
Ö	Central point	Absolute data method	Set at the central point-specified circular interpolation.	_	-214748364.8 to 214748364.7 [µm]	-21474.83648 to 21474.83647	0 to 359.99999	-2147483648 to 2147483647		
	Centra	Incremental data method			-214748364.7 to 214748364.7 [µm]	-21474.83647 to 21474.83647	-21474.83647 to 21474.83647	-2147483647 to 2147483647		
	Num	ber of pitches	Set at the helical interpolation.	_	., ,	ı	999			
	Inter	oolation ol unit	It can be set only items to be changed of the specified parameter block data.	3	0	1	2	3		
	Speed limit value		Refer to Section 4.3 "Parameter Block" for details of each data.	200000 [pulse/s]	0.01 to 6000000.00 [mm/min]	0.001 to 600000.000 [inch/min]	0.001 to 2147483.647 [degree/min] (Note-5)	1 to 2147483647 [pulse/s]		
	Acce	leration time		1000[ms]		1 to 65	535[ms]	•		
	Dece	leration time		1000[ms]		1 to 65	535[ms]			
		d stop leration time		1000[ms]		1 to 65	535[ms]			
	S-cui	ve ratio		0[%]		0 to 1	00[%]			
block	io	Acceleration/ deceleration system		0	0: Tra S- 1: Ad					
Parameter block	Advanced S-curve	Acceleration section 1 ratio		20.0[%]		1: Advanced S-curve acceleration/deceleration 0.0 to 100.0[%]				
Pa	/anced ration/d	Acceleration section 2 ratio		20.0[%]		0.0 to 1	00.0[%]			
	Advaccele			20.0[%]		0.0 to 1	00.0[%]			
		Deceleration section 2 ratio		20.0[%]		0.0 to 100.0[%]				
		ue limit value		300[%]		1 to 10	000[%]			
	proce	eleration essing on P input		0		stop based on th				
	range	rable error e for circular polation		100[pulse]	0 to 10000.0 [µm]	0 to 1.00000	0 to 1.00000	0 to 100000		

0 1		252 " "	\			Processing at the setting error		
Setting valu	e using the Motion		rect setting)	Indired	ct setting		g at the setting error	
mm	Setting inch	degree	pulse	Possible/ not possible	Number of used words	Error item information (Stored in SD517) (Note-4)	Control using default value	Not start
-2147483648 to 2147483647 (\times 10 ⁻¹ [µm])	-2147483648 to 2147483647 (×10 ⁻⁵ [inch])	0 to 35999999 (×10 ⁻⁵ [degree])	-2147483648 to 2147483647	0	2×2	n08 ^(Note-1)		
-2147483647 to 2147483647 (×10 ⁻¹ [μm])	-2147483647 to 214748647 (×10 ⁻⁵ [inch])	-2147483647 to 214748647 (× 10 ⁻⁵ [inch])	-2147483647 to 2147483647		2^2	1106 \ /		
1 to 4294967295 (× 10 ⁻¹ [μm])	1 to 4294967295 (×10 ⁻⁵ [inch])	0 to 35999999 (× 10 ⁻⁵ [degree])	1 to 4294967295	0	2 n09 (Note-1)			0
1 to 2147483647 (× 10 ⁻¹ [μm])	1 to 2147483647 (×10 ⁻⁵ [inch])	1 to 2147483647 (×10 ⁻⁵ [degree])	1 to 2147483647	0	2	1100		O
-2147483648 to 2147483647 (×10 ⁻¹ [μm])	-2147483648 to 2147483647 (×10 ⁻⁵ [inch])	0 to 35999999 (× 10 ⁻⁵ [degree])	-2147483648 to 2147483647	0	2×2	n10 ^(Note-1)		
-2147483647 to 2147483647 (×10 ⁻¹ [μm])	-2147483647 to 214748647 (× 10 ⁻⁵ [inch])	-2147483647 to 214748647 (× 10 ⁻⁵ [inch])	-2147483647 to 2147483647	0	2^2	nio ()		
	0 to	999		0	1	28		
0	1	2	3	0	1	11		
1 to 600000000 (×10 ⁻² [mm/min])	1 to 600000000 (×10 ⁻³ [inch/min])	1 to 2147483647 (× 10 ⁻³ [degree/min]) (Note-5)	1 to 2147483647 [pulse/s]	0	2	12		
	1 to 655	535[ms]		0	1	13		
	1 to 655	535[ms]		0	1	14		
	1 to 655	535[ms]		0	1	15		
	0 to 1			0	1	21		
S-c	pezoidal acceleration/durve acceleration/duranced S-curve acc	eceleration	ion ^(Note-6)	0	1	_		
	0.0 to 1	00.0[%]		0	1	45, 49	0	
	0.0 to 1	00.0[%]		0	1	46, 49		
	0.0 to 1	00.0[%]		0	1	47, 50		
	0.0 to 1			0	1	48, 50		
	1 to 10			0	1	16		
	o a stop in accorda o a stop in accorda			0	1	_		
1 to 100000 (× 10 ⁻¹ [μm])	1 to 100000 (×10 ⁻⁵ [inch])	1 to 100000 (×10 ⁻⁵ [degree])	1 to 100000 [pulse]	0	2	17		

⁽Note-1): The "n" in n03, n08, n09 and n10, indicates the axis No. (1 to 32).

⁽Note-4): If there are multiple errors in the same program, the latest error item information is stored.

 $⁽Note-5): When the "speed control 10 \times multiplier setting for degree axis" is set to "valid", the setting range is 0.01 to 21474836.47 [degree/min].$

⁽Note-6): Only bit0 is valid. If the value outside the range is set, the state except bit0 is ignored.

Table 5.3 Positioning data (Continued)

				Setting value using MT Developer2				
	Name	Explanation	Default		Setting	g range		
	Name	Explanation	value	mm	inch	degree	pulse	
	Repeat condition (Number of repetitions)	Set the repeat conditions between FOR-TIMES instruction and NEXT instruction.	_		1 to 32767			
	Repeat condition (ON/OFF)	Set the repeat conditions between FOR-ON/OFF instruction and NEXT instruction.	_		X, Y, M, E	B, F, U□\G		
	Program No.	Set the program No. for simultaneous start.	_					
	Command speed (constant-speed)	Set the speed for points on the way in the servo program.	_	0.01 to 6000000.00 [mm/min]	0.001 to 600000.000 [inch/min]	0.001 to 2147483.647 [degree/min] (Note-5)	1 to 2147483647 [pulse/s]	
	Cancel	Set to stop execution of a servo program by deceleration stop by turning on the specified bit device in the servo program.	_	X, Y, M, B, F, U□\G				
Others	Skip	Set to cancel positioning to pass point and execute the positioning to the next point by turning on the specified bit device during positioning at each pass point for constant-speed control instruction.	l	X, Y, M, B, F, U□\G				
	FIN acceleration/ deceleration	Set to execute positioning to each pass point for constant-speed control instruction by turning on the FIN signal.	I		1 to 5000[ms]			
	WAIT-ON/OFF	Set to make state of the waiting for execution by constant-speed control and execute the positioning immediately by turning on/off the command bit device.	_		X, Y, M, B, F, U□\G			
	Fixed position stop acceleration/ deceleration time	Acceleration/deceleration time used in the starting of speed control with fixed position stop, speed change request (CHGV) or fixed position stop command ON.	_	1 to 65535[ms]				
	Fixed position stop	Command bit device of fixed position stop is set.	_		X, Y, M, B, F, U□\G			

Setting valu	e using the Motion	SFC program (Indi	rect setting)	Indire	ct setting	Processing	at the setting error	r
mm	Setting inch	range degree	pulse	Possible/ not possible	Number of used words	Error item information (Stored in SD517) (Note-4)	Control using default value	Not start
	1 to 3	2767		0	1	18	Control by K1	
	-	_		_	_	_		
	0 to -	4095		0	1	19		0
1 to 600000000 (×10 ⁻² [mm/min])	1 to 600000000 (×10 ⁻³ [inch/min])	1 to 2147483647 (× 10 ⁻³ [degree/min]) (Note-5)	1 to 2147483647 [pulse/s]	0	2	4	(Note-2)	○ (Note-3)
_				_	_	_		
	-	_		_	_	_		
	1 to 50	00[ms]		0	1	13	Control by 1000[ms]	
_				_	_	_		
1 to 65535[ms]				0	1	13	Control by 1000[ms]	
	_	_		_	_	_		

⁽Note-2): When an error occurs because the speed limit value is exceeded, it is controlled at the speed limit value.

⁽Note-3): Applies when the command speed is "0".

⁽Note-4): If there are multiple errors in the same program, the latest error item information is stored.

⁽Note-5): When the "speed control 10 × multiplier setting for degree axis is set to "valid", the setting range is 0.01 to 21474836.47 [degree/min].

5.4 Setting Method for Positioning Data

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

- (1) Setting by specifying numerical values ... Refer to Section 5.4.1
- (2) Indirect setting by devices Refer to Section 5.4.2

"Setting by specifying numerical values" and "indirect setting by word devices" can be used together in one servo program.

5.4.1 Setting method by specifying numerical values

In the setting method by specifying numerical values, each positioning data is set by a numerical value, and it becomes fixed data.

Data can be set and corrected using MT Developer2 only.

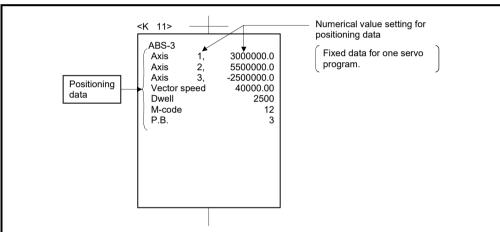


Fig. 5.3 Setting example of positioning data by specifying numerical value

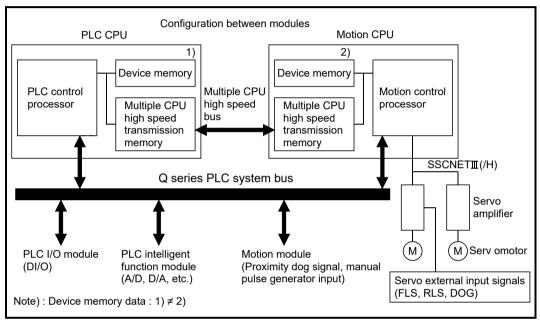
5.4.2 Indirect setting method by devices

In the indirect setting method ^(Note-1) by devices, the device No. is specified to the positioning data specified with the servo program.

By using the contents (data) of specified device using the Motion SFC program (Automatic refresh, etc.), multiple positioning controls can be executed in one servo program.

The device used in the indirect setting is the device of the Motion CPU but the device of the PLC CPU.

The device memory composition of the Motion CPU and PLC CPU is shown below.



(Note-1): Device memory in the Motion CPU.

(1) Word devices for indirect setting

The word devices for indirect setting are the data registers (D), link registers (W), motion registers (#) and Multiple CPU area device ($U \square \backslash G$). Word devices except the above devices cannot be used.

The usable setting range of word devices is shown below.

Word device	Setting range				
D	0 to 8191				
W	0 to 1FFF				
#	0 to 7999				
U□\G	10000 to (10000+p-1) (Note-1)				

(Note-1): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

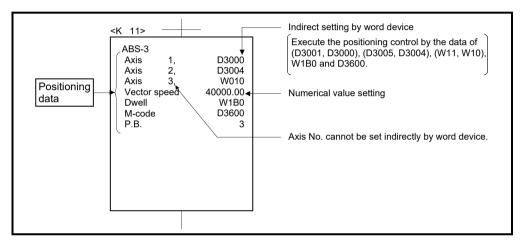


Fig. 5.4 Example of indirect setting by word device for positioning data

(2) Bit devices for indirect setting

The bit devices for indirect setting are the input (X), output (Y), internal relay (M), link relay (B), annunciator (F) and Multiple CPU area device ($U \square \G$). Bit devices except the above devices cannot be used.

The usable setting range of bit devices is shown below.

Bit device	Setting range
X	0000 to 1FFF (Note-1)
Υ	0000 to 1FFF
M	0 to 8191
В	0000 to 1FFF
F	0 to 2047
U□\G	10000.0 to (10000+p-1).F (Note-2)

(Note-1): The range of "PXn+4 to PXn+F" cannot be used (fixed at 0) for the input device (PXn+0 to PXn+F) allocated to the built-in interface in Motion CPU (DI). (n: First input No.)

(Note-2): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

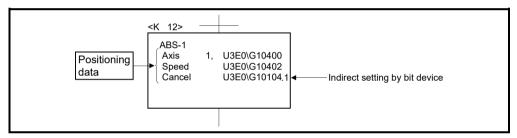


Fig. 5.5 Example of indirect setting by bit device for positioning data

(3) Inputting of positioning data

In indirect setting by word devices, the word device data is inputted when the servo program is executed using the Motion CPU.

It must be executed the start request of the servo program after data is set in the device used for indirect setting at the positioning control.

POINTS

- (1) Indirect setting by word devices of the axis No. cannot be set in the servo program.
- (2) Take an interlock condition by using a start accept flag (M2001 to M2032) not to change the device data for indirect setting until the specified axis has accepted the start command.
 - If the data is changed before the start command is accepted, positioning may not be controlled in a normal value.
- (3) Refer to Chapter 2 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for the user setting area points of the Multiple CPU high speed transmission area.

(4) Program example that uses the Multiple CPU high speed transmission memory

Program example to control by the data transmitted from the PLC CPU to Motion CPU is shown below.

Program that starts the servo program (positioning) by the DP.SVST instruction after the data is written to the Multiple CPU high speed transmission memory (U3E0\G10000 to U3E0\G10003) from the PLC CPU (CPU No.1).

Sequence program (PLC CPU side)

```
MOVP K10000
                                                            U3E0\G10000
                                                              Servo program
K10 position
Instruction
execution
command
                                                               command
                                                             U3E0\G10002
                                           TDMOVP K10000
                                                               Servo program
                                                               K10 speed
                                                               command
               U3E1
               \G516.0
                                     DP.SVST H3E1 "J1" K10 M100 D100
                 ╢
             Start accept
             flag of CPU
             No.2(Axis 1)
                                                                 RST M0
                                                                    Instruction
                                                                    execution
                                                                    command
```

Servo program (Motion CPU side)

```
[ K 10: Real ]

1 INC-1

Axis 1, U3E0\G10000 μm

Speed U3E0\G10002 mm/min
```

6. POSITIONING CONTROL

This section describes the positioning control methods.

6.1 Basics of Positioning Control

This section describes the common items for positioning control, which is described in detail after Section 6.2.

6.1.1 Positioning speed

The positioning speed is set using the servo program.

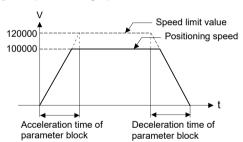
Refer to Chapter 5 for details of the servo programs.

---- Example ---

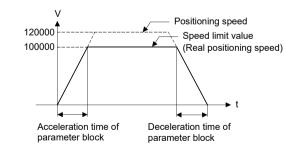
The real positioning speed is set in the positioning speed and speed limit value using the servo program is shown below:

- If the positioning speed setting is less than speed limit value, the positioning is executed with the setting positioning speed.
- If the positioning speed setting is less than speed limit value, the positioning is executed with the positioning speed.

(1) If the speed limit value is 120000[mm/min] and the positioning speed setting is 100000[mm/min], the positioning speed is as follows.



(2) If the speed limit value is 100000[mm/min] and the positioning speed setting is 120000[mm/min], the positioning speed is as follows.



6.1.2 Positioning speed at the interpolation control

The positioning speed of the Motion CPU sets the travel speed of the control system.

(1) 1 axis linear control

Travel speed is the positioning speed of the specified axis at the 1 axis positioning control.

(2) Linear interpolation control

Positioning is controlled with the speed which had the control system specified at the interpolation control.

The positioning speed can be set using one of the following three methods at the 2 to 4 axes linear interpolation control:

- · Vector speed specification
- Long-axis speed specification
- · Reference-axis speed specification

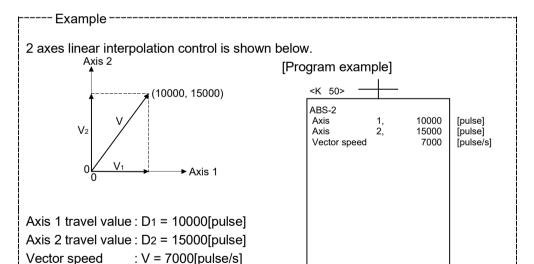
Control method of the Motion CPU control for every specified method is shown below.

(a) Vector speed specification

The Motion CPU calculates the positioning speed of each axis (V1 to V2) using the travel value (D1 to D2) of each axis based on the positioning speed (V) of the setting control system.

Positioning speed of the control system is called the vector speed.

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



The Motion CPU calculates the positioning speed of each axis using the following calculation formulas in the above condition:

Axis 1 positioning speed : $V_1 = V \times D_1 / \sqrt{D_1^2 + D_2^2}$ Axis 2 positioning speed : $V_2 = V \times D_2 / \sqrt{D_1^2 + D_2^2}$ (b) Long-axis speed specification

It is controlled based on the positioning speed (Long-axis speed: V) of the largest travel value axis among address set as each axis.

The Motion CPU calculates the positioning speed of other axes (V1 to V3) using each axis travel value (D1 to D4).

Set the long-axis speed and the travel value of each axis using the servo program.

-- Example -

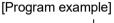
4 axes linear interpolation control is shown below.

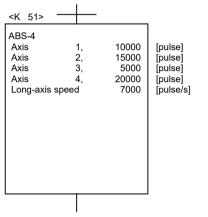
Axis 1 travel value: D1 = 10000[pulse] Axis 2 travel value: D2 = 15000[pulse] Axis 3 travel value: D3 = 5000[pulse] Axis 4 travel value: D4 = 20000[pulse] Long-axis speed : V = 7000[pulse/s]

In this example, since the reference axis is axis 4 of the largest travel value, it is controlled with the positioning speed specified with axis 4.

The Motion CPU calculates the positioning speed of other axes using the following calculation formulas:

Axis 1 positioning speed : $V_1 = D_1 / D_4 \times V$ Axis 2 positioning speed : $V_2 = D_2 / D_4 \times V$ Axis 3 positioning speed : $V_3 = D_3 / D_4 \times V$





The following conversions are performed if the control units of each axis differ.

- 1) Combination of axes set in [mm] and [inch]
 - a) If the interpolation control units are [mm]
 - Travel value: Convert the travel value of axis set in [inch] into [mm] using the formula: inch setting value \times 25.4.
 - Speed : The largest travel value axis is controlled with the longaxis speed and the other axes are controlled with the speed based on the long-axis speed, as the result of conversion.
 - b) If the interpolation control units are [inch]
 - Travel value: Convert the travel value of axis set in [mm] into [inch] using the formula: mm setting value ÷ 25.4.
 - Speed : The largest travel value axis is controlled with the longaxis speed and the other axes are controlled with the speed based on the long-axis speed, as the result of conversion.

- 2) Discrepancy between interpolation control units and control units
 - Travel value: The travel value of each axis is converted into [pulse] unit with the electronic gear of self axis.
 - Speed : The largest travel value axis is controlled with the longaxis speed and the other axes are controlled with the speed based on the long-axis speed, as the result of conversion.

The positioning speed is converted into [pulse/s] unit as the long-axis speed with the electronic gear that the interpolation control units correspond to control units.

POINTS

- (1) Speed limit value and positioning speed
 - The setting speed limit value applies to the long-axis speed.
 - Be careful that the vector speed may exceed the speed limit value at the long-axis speed specification.

INC-2

Axis

Axis

Long-axis speed

[pulse]

[pulse]

[pulse/s]

200

-- Example -

The following settings at the 2 axes linear interpolation, the vector speed exceeds the speed limit value.

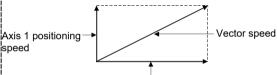
Axis 1 travel value: 100 [pulse]
Axis 2 travel value: 200 [pulse]
Long-axis speed: 50 [pulse/s]
Speed limit value: 55 [pulse/s]

In this example, since the reference-axis is axis 2 of the largest travel value, it is controlled with the speed limit value specified with axis 2.

The positioning speed and vector speed for each axis are as follows:

Axis 1 positioning speed : 100/ 200 \times 50 = 25 [pulse/s]

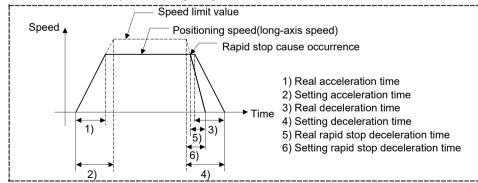
Axis 2 positioning speed : 50 [pulse/s] Vector speed : $\sqrt{25^2 + 50^2} = 55.9$ [pulse/s]



Axis 2 positioning speed

The vector speed exceeds the speed limit value setting of 55.

- (2) Relationship between speed limit value, acceleration time, deceleration time and rapid stop deceleration time.
 - The real acceleration time, deceleration time and rapid stop deceleration time are set by the setting long-axis speed.



(c) Reference-axis speed specification

The Motion CPU calculates the positioning speed of other axes (V1 to V3) based on the positioning speed (reference-axis speed: V) of the setting reference-axis using each axis travel value (D1 to D4).

Set the reference-axis No., reference-axis speed and each axis travel value using the servo program.

Example -

4 axes linear interpolation control is shown below.

Axis 1 travel value : D1 = 10000 [pulse] Axis 2 travel value : D2 = 15000 [pulse] Axis 3 travel value : D3 = 5000 [pulse] Axis 4 travel value : D4 = 20000 [pulse]

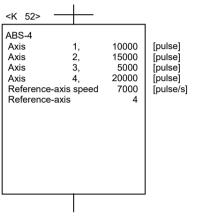
Reference axis speed: V = 7000 [pulse/s] Reference axis : Axis 4

In this example, since the reference-axis is axis 4, it is controlled with the positioning speed specified with axis 4.

The Motion CPU calculates the positioning speed of other axes using the following calculation formulas:

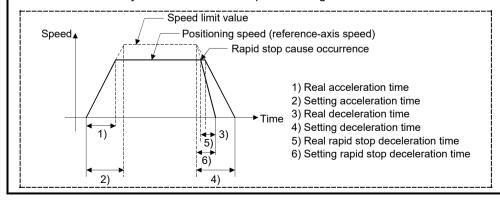
Axis 1 positioning speed : $V_1 = D_1 / D_4 \times V$ Axis 2 positioning speed : $V_2 = D_2 / D_4 \times V$ Axis 3 positioning speed : $V_3 = D_3 / D_4 \times V$

[Program example]



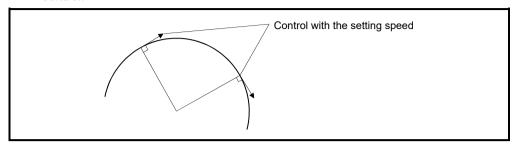
POINTS

- (1) Reference-axis speed and positioning speed of other axes
 - Be careful that the positioning speed of an axis for a larger travel value than the reference-axis may exceed the setting reference-axis speed.
- (2) Indirect specification of the reference-axis
 - The reference-axis can be set indirectly using the word devices. (Refer to Section 5.4.2.)
- (3) Relationship between speed limit value, acceleration time, deceleration time and rapid stop deceleration time.
 - The real acceleration time, deceleration time and rapid stop deceleration time are set by the reference-axis speed setting.



(3) Circular interpolation control

The angular speed is controlled with the setting speed at the circular interpolation control.



6.1.3 Control units for 1 axis positioning control

It is controlled in the control units specified with the fixed parameters at the 1 axis positioning control.

(The control unit specified with the parameter block is ignored.)

6.1.4 Control units for interpolation control

(1) The interpolation control units specified with the parameter block and the control units of the fixed parameter are checked.
If the interpolation control units specified with the parameter block differ from the control units of each axis fixed parameter for the interpolation control, it shown below.

	Interpo	lation control uni	ts in the paramete	er block	Ohandia arang dha d
	mm	inch	degree	pulse	Starting method
	There are axes whose control		There are axes	There are axes	Positioning control starts by the interpolation
	unit set in the fixe	ed parameter is	whose control	whose control	control units of parameter block.
Normal start	[mm] and [inch].		unit set in the	unit set in the	
			fixed parameter	fixed parameter	
			is [degree].	is [pulse].	
Unit mismatch (Minor error (error code: 40))		•	er for all axes diffe		If the control units of axes to be interpolation-controlled are the same, control starts in the preset control unit. If the control units of axes to be interpolation-controlled are different, control starts in the unit of highest priority as indicated below. Priority: pulse > degree > inch > mm
					<example> If axis is set to 1000[pulse] and 10.000[inch], 10.000[inch] setting is considered to be 10000[pulse].</example>

(2) The combinations of each axis control units for interpolation control are shown in the table below.

	mm	inch	degree	pulse
mm	1)	2)	3)	3)
inch	2)	1)	3)	3)
degree	3)	3)	1)	3)
pulse	3)	3)	3)	1)

- 1): Same units
- 2): Combination of [mm] and [inch]
- 3): Unit mismatch

(a) Same units (1))

The position command is calculated with the setting address (travel value), positioning speed or electronic gear, the positioning is executed.

POINT

If control units for one axis are "degree" at the circular interpolation control, use "degree" also for the other axis.

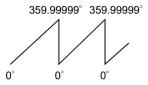
- (b) Combination of [mm] and [inch] (2))
 - If interpolation control units are [mm], positioning is controlled by calculating position commands from the address, travel value, positioning speed and electronic gear, which have been converted to [mm] using the formula: inch
 - setting value \times 25.4 = mm setting value.
 - If interpolation control units are [inch], positioning is controlled by calculating position commands from the address, travel value, positioning speed and electronic gear, which have been converted to [inch] using the formula: mm setting value ÷ 25.4 = inch setting value.
- (c) Discrepancy units (3))
 - The travel value and positioning speed are calculated for each axis.
 - a) The electronic gear converts the travel value for the axis to [pulse].
 - b) For axis where the units match, the electronic gear converts the positioning speed to units of [pulse/s].
 - Positioning is conducted using position commands calculated from travel values converted to [pulse] and speeds and electronic gear converted to [pulse/s].
 - If the interpolation control units match for two or more axes at the 3-axes or more linear interpolation, the positioning speed is calculated with the electronic gear for the axis with the lowest No.

6.1.5 Control in the control unit "degree"

If the control units are "degree", the following items differ from other control units.

(1) Current value address

The current addresses in the control unit "degree" are ring addresses from 0° to 360° .

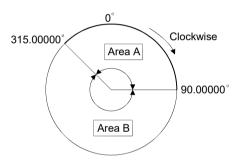


(2) Stroke limit valid/invalid setting

The upper/lower limit value of the stroke limit in the control unit "degree" is within the range of 0° to 359.99999°

(a) Stroke limit is valid

Set the "lower limit value to upper limit value of the stroke limit" in a clockwise direction to validate the stroke limit value.



1) If the travel range in area A or area B is set, the limit values are as follows:

Area	Lower stroke limit value	Upper stroke limit value	Remark
Area A	315.00000°	90.00000°	When the feed current value is outside of the stroke limit range, movement in both the positive and negative direction is possible with JOG operation or manual pulse generator operation.
Area B	90.00000°	315.00000°	When the feed current value is outside of the stroke limit range, movement is possible with JOG operation and manual pulse generator operation in the negative direction if "feed current value > upper stroke limit value", or in the positive direction if "feed current value < lower stroke limit value".

(b) Stroke limit is invalid

Set the "upper stroke limit value" equal to "lower stroke limit value" to invalidate the stroke limit value.

It can be controlled regardless the stroke limit settings.

POINTS

- (1) Circular interpolation including the axis which set the stroke limit as invalid cannot be executed.
- (2) When the upper/lower limit value of the axis which set the stroke limit as valid are changed, perform the home position return after that.
- (3) When the stroke limit is set as valid in the incremental data system, perform the home position return after power supply on.
- (4) Do not use the high-speed oscillation in the axis that invalidates a stroke limit of control unit "degree".
- (5) The unlimited length feed is possible by setting the stroke limit to invalid even the control unit is "other than degree axis" (mm, inch, pulse).

 (Refer to Section 4.2.3.)

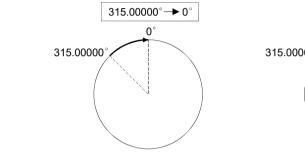
(3) Positioning control

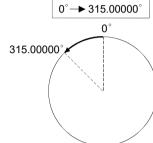
Positioning control method in the control unit "degree" is shown below.

 (a) Absolute data method (ABS□ instructions)
 Positioning in a near direction to the specified address is performed based on the current value.

Example -

- (1) Positioning is executed in a clockwise direction to travel from the current value of 315.00000° to 0°.
- (2) Positioning is executed in a counter clockwise direction to travel from the current value of 0° to 315.00000°.



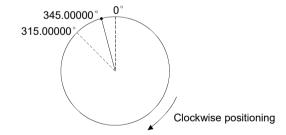


POINTS

(1) The positioning direction of absolute data method is set a clockwise/counter clockwise direction by the setting method of stroke limit range, positioning in the shortest direction may not be possible.

-- Example -

Travel from the current value 0° to 315.00000° must be clockwise positioning if the lower stroke limit value is set to 0° and the upper limit value is set to 345.00000°.



- (2) Set the positioning address within the range of 0° to 360°.

 Use the incremental data method for positioning of one revolution or more.
 - (b) Incremental data method (INC□ instructions)
 Positioning by the specified travel value to the specified direction.

The travel direction is set by the sign of the travel value, as follows:

- 1) Positive travel valueClockwise rotation
- 2) Negative travel value......Counter clockwise rotation

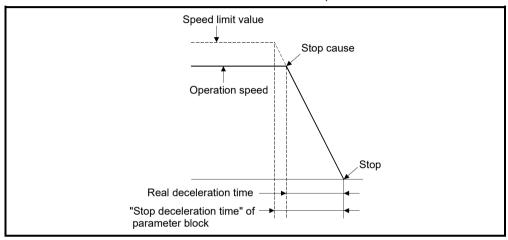
POINT

Positioning of 360° or more can be executed in the incremental data method.

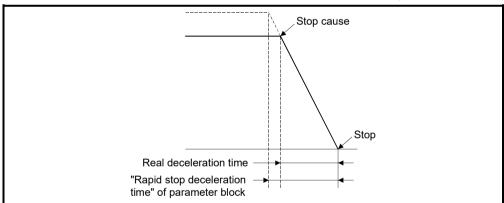
6.1.6 Stop processing and restarting after stop

This section describes the stop processing after a stop cause is input during positioning and restarting after stop.

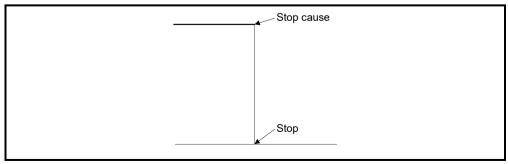
- (1) Stop processing
 - (a) Stop processing methodsStop processing during positioning by stop cause are as follows.
 - 1) Deceleration stop (Process 1)......Deceleration stop by "stop deceleration time" of parameter block.



2) Rapid stop (Process 2)......Deceleration stop by "rapid stop deceleration time" of parameter block.



3) Immediate stop (Process 3)......Stop without deceleration processing.



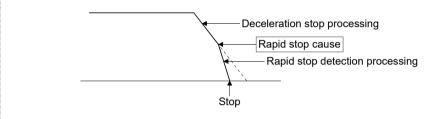
- 4) Stop using the manual pulse generator (Process 4)Deceleration stop by the "deceleration time" of (Smoothing magnification + 1) \times 56.8[ms].
- (b) Priority for stop processing
 Priority for stops when a stop cause is input is as follows:

Process 1 < Process 2 < Process 3

Example -----

A rapid stop is started if a rapid stop cause is input during one of the following types of deceleration stop processing :

- After automatic deceleration start during positioning control;
- · During deceleration after JOG start signal turns off;
- During deceleration stop processing by stop cause (Process 1).



(c) Stop commands and stop causes

Some stop commands and stop causes affect individual axis and others affect all axes.

However, during interpolation control, stop commands and stop causes which affect individual axis also stop the interpolation axis.

For example, both Axis 1 and Axis 2 stop after input of a stop command (stop cause) during the Axis 1 and Axis 2 interpolation control.

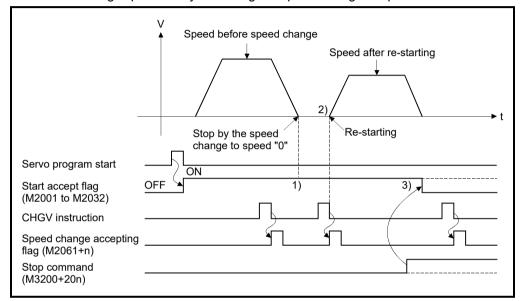
				;	Stop processing	g			
No.	Stop cause	Axis classification	Positioning	Speed	JOG	Home position	Manual pulse	Error processing	
-			control	control	operation	return	generator		
1	STOP signal input (STOP) of the		Process 1 or Pr		ocessing on ST	OP input			
'	Q172DLX ON		 According to deceleration processing on STOP input parameter of parameter block. 						
2	Stop command (M3200+20n) ON		Process 1						
3	Rapid stop command (M3201+20n) ON	Individual	Process 2				Process 4		
4	FLS input signal OFF of Q172DLX/servo amplifier		Process 1 or Process2						
5	RLS input signal OFF of Q172DLX/servo amplifier		_	deceleration pro parameter bloc	•		Refer to "APPENDIX 1 Error Codes Stored Using The		
6	Servo error detection (M2408+20n) ON		Process 2 (The servo motor stops with dynamic brake.)					Motion CPU"	
7	PLC ready flag (M2000) OFF		Process 1						
8	Deceleration stop using MT Developer2 (Note-1)		Process 1				Process 4		
9	Rapid stop of the all axes using MT Developer2 ^(Note-1)		Process 2				F100e55 4		
10	Motion CPU stop		Process 1						
11	Multiple CPU system reset	All axes	Process 3					_	
12	Motion CPU WDT error		Process 3					SM512 (Motion CPU WDT error flag) ON	
13	Other CPU WDT error		Process 1					_	
14	Multiple CPU system power off		Process 3					_	
15	Forced stop		Process 3					Servo amplifier is stopped at the servo OFF.	
16	Servo amplifier control circuit power off	Individual	Process 3				Major error at the start (no servo)		
17	Speed change to speed "0"	Individual (Note-2)	Process 1				_	_	

(Note-1): Test mode

(Note-2): Applies to all axes used in the servo program set in the speed "0".

(2) Re-starting after stop

- (a) If it stopped by the stop command or stop cause (except change speed to speed "0"), re-starting is not possible. However, it stopped by the STOP input of the Q172DLX ON, the stop command (M3200+20n) ON or the rapid stop command (M3201+20n) ON during speed-position switching control, re-starting is possible using VPSTART instruction.
- (b) If it stopped by the speed change to speed "0" using CHGV instruction, restarting is possible by executing the speed change to speed other than "0".

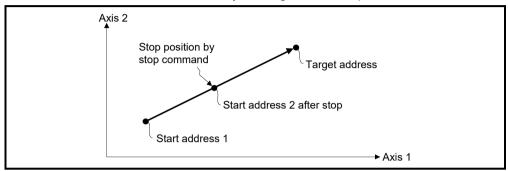


- 1) The start accept flag (M2001 to M2032) remains on after stop by the speed change to "0".
- 2) Re-starting by changing the speed again.
- 3) However, if the start accept flag (M2001 to M2032) turns off by turning on the stop command (M3200+20n), re-starting is not possible even if make a speed change once again.

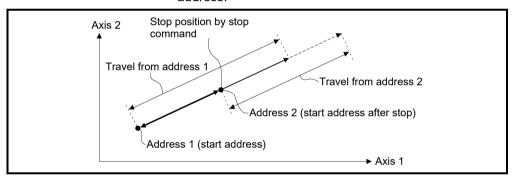
(3) Continuation of positioning control

This section describes the processing which performed servo program No. which was being performed before the stop, after stop by turning on the STOP input of the Q172DLX ON, the stop command (M3200+20n) ON or the rapid stop command (M3201+20n) ON.

- (a) 1 axis linear control/2 or 3 axes linear interpolation control
 - 1) For ABS Positioning control from the stop address to target address by the target address specification.



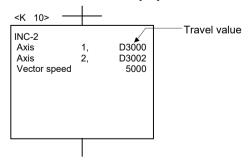
2) For INC□ Positioning control of the travel value from the stop address.



When the address 2 is moved to the same address (address which calculates with start address + specified travel value) using the INC \square , the following processing using the servo program and Motion SFC program is required.

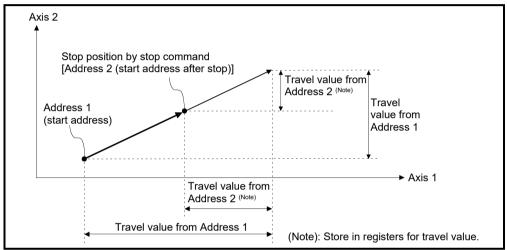
[Servo Program]

The travel value of servo program which executes the positioning from address is set indirectly by the word devices, as follows.



[Processing in the Motion SFC Program]

- 1) Transfer the start address to word devices of the Motion CPU before starting.
- 2) Calculate the target address by applying the travel value to the address before starting.
- 3) Calculate the residual travel value by subtracting the stop address from the target address.
- 4) Store the residual travel value in the servo program for travel value register.
- 5) Perform the servo program.

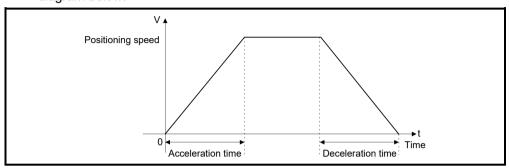


6.1.7 Acceleration/deceleration processing

Acceleration/deceleration are processed by the following three methods.

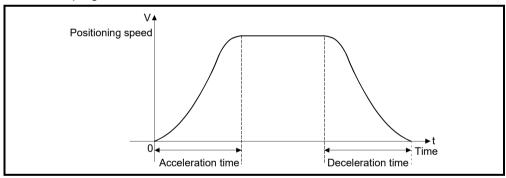
(1) Trapezoidal acceleration/deceleration processing

This is a conventional linear acceleration/deceleration processing. The acceleration/deceleration graph resembles a trapezoid, as shown in the diagram below.

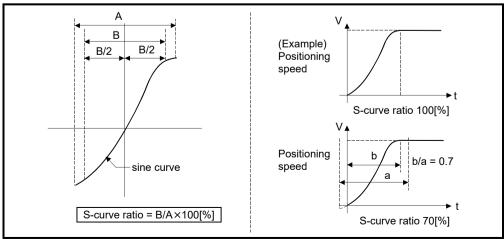


(2) S-curve acceleration/deceleration processing

S-curve ratio is set as a parameter to smoothly provide acceleration/deceleration processing than trapezoidal acceleration/deceleration processing. The acceleration/deceleration graph is a sine curve as shown in the diagram below. Set the S-curve ratio by the parameter block (Refer to Section 4.3.2) or using the servo program.



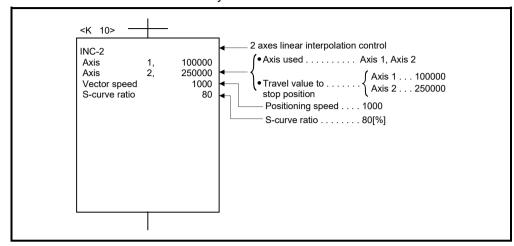
S-curve ratio set the part of the sine curve used to produce the acceleration and deceleration curve as shown in the diagram below.



S-curve ratio can be set by the servo program is following two methods.

(a) Direct specification

S-curve ratio is set directly as a numeric value from 0 to 100.



(b) Indirect specification

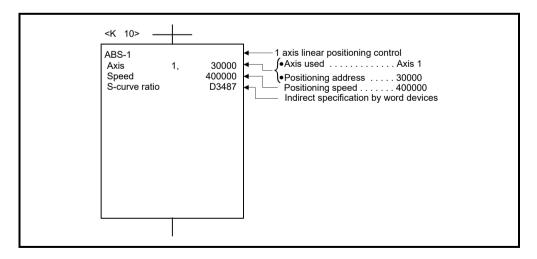
S-curve ratio is set by the contents of data registers.

The usable data registers are shown below.

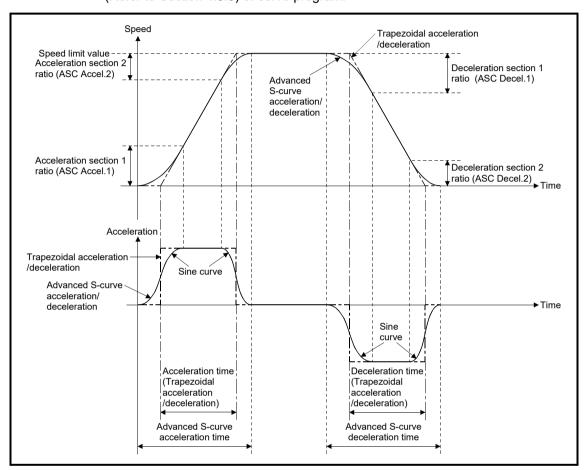
Word devices	Usable devices
D	0 to 8191
W	0 to 1FFF
#	0 to 7999
U□\G	10000 to (10000+p-1) (Note-1)

(Note-1): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

Refer to Chapter 2 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for the user setting area points of the Multiple CPU high speed transmission area.



(3) Advanced S-curve acceleration/deceleration processing ver Processing for smooth acceleration/deceleration can be executed by using the Advanced S-curve acceleration/deceleration function. The acceleration section is set as a sine curve as shown in the diagram below. Set the advanced S-curve acceleration/deceleration by the parameter block (Refer to Section 4.3.3) or servo program.



Ver.!): Refer to Section 1.3 for the software version that supports this function.

6

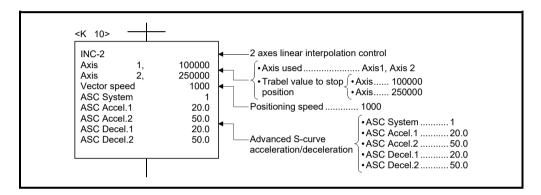
Advanced S-curve acceleration/deceleration can be set by the servo program is following two methods.

(a) Direct specification

Advanced S-curve acceleration/deceleration system and advanced S-curve acceleration/deceleration ratio are set directly as a numeric value.

Setting items	Setting range
ACC Customs	0: Trapezoidal/S-curve acceleration/deceleration
ASC System	1: Advanced S-curve acceleration/deceleration
ASC Accel.1	
ASC Accel.2	0.0 / (Note)
ASC Decel.1	0.0 to 100.0[%] ^(Note)
ASC Decel.2	

(Note): ASC Accel.1 + ASC Accel.2 ≤ 100.0%, ASC Decel.1 + ASC Decel.2 ≤ 100.0%



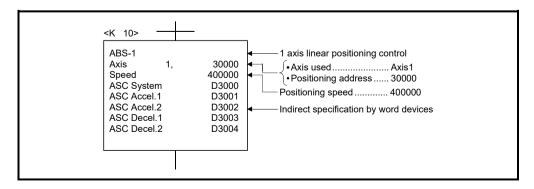
(b) Direct specification

Advanced S-curve acceleration/deceleration system and advanced S-curve acceleration/deceleration ratio is set by the contents of data registers.

Word devices	Usable devices
D	0 to 8191
W	0 to 1FFF
#	0 to 7999
U□\G	10000 to (10000+p-1) (Note-1)

(Note-1): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for the each CPU.

Refer to Chapter 2 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for the user setting area points of the Multiple CPU high speed transmission area.



6.2 1 Axis Linear Positioning Control

Positioning control from the current stop position to the fixed position for specified axis is executed.

Positioning is controlled using ABS-1 (Absolute data method) or INC-1 (Incremental data method) servo instructions.

									Ite	ns s	et us	sing	MT	Dev	elop	er2									
				Common Arc Para											ameter block							ers			
Servo instruction	Positioning method	Number of control axes	Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Interpolation control unit	Speed limit value	Acceleration time	Deceleration time	Rapid Stop deceleration time	Torque limit value	Deceleration processing on stop input	Allowable error range for circular interpolation	S-curve ratio	Advanced S-curve acceleration/deceleration	Cancel	WAIT-ON/OFF	Speed change
ABS-1	Absolute			_	_																				V E I
INC-1	Incremental	1		0	0	0	Δ	Δ						\triangle	Δ	Δ	Δ	Δ	Δ		\triangle	Δ	Δ		Valid

○: Must be set

△: Set if required

[Control details]

Control using ABS-1 (Absolute data method)

- (1) Positioning control from the current stop address (pre-positioning address) based on the home position to the specified address is executed.
- (2) The travel direction is set by the current stop address and the specified address.

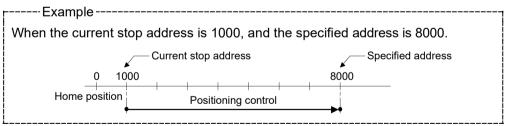


Fig.6.1 Positioning using absolute data method

Control using INC-1 (Incremental data method)

- Positioning control of the specified travel value from the current stop position address is executed.
- (2) The travel direction is set by the sign (+/-) of the travel value, as follows:
 - Positive travel valuePositioning control to forward direction (Address Increase direction)
 - Negative travel value......Positioning control to reverse direction (Address decrease direction)

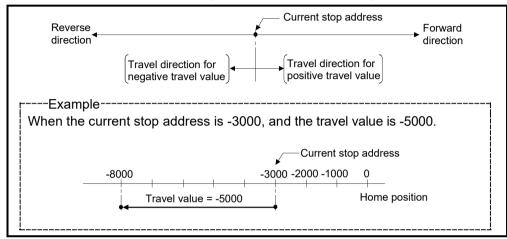


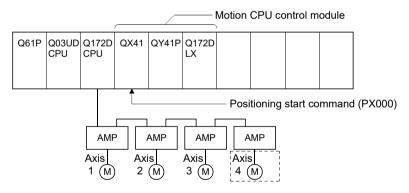
Fig.6.2 Positioning using incremental data method

[Program]

Servo program No. 0 for positioning control is shown as the following conditions.

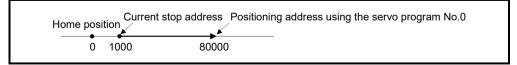
(1) System configuration

1 axis linear positioning control of Axis 4.



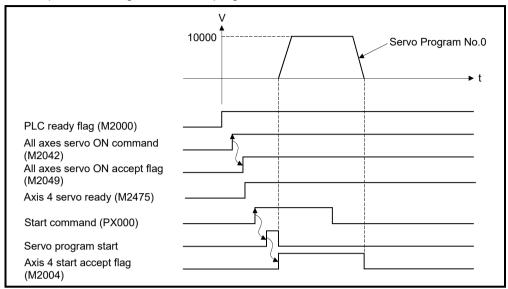
(2) Positioning operation details

Positioning using the servo program No.0 is shown below. In this example, Axis 4 is used in servo program No.0.



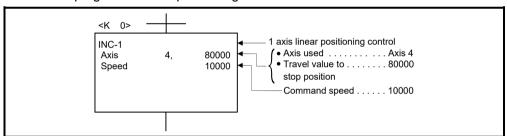
(3) Operation timing

Operation timing for the servo program No.0 is shown below.



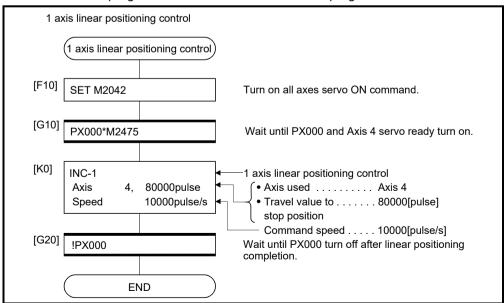
(4) Servo program

Servo program No.0 for positioning control is shown below.



(5) Motion SFC program

Motion SFC program for which executes the servo program is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

6.3 2 Axes Linear Interpolation Control

Linear interpolation control from the current stop position with the specified 2 axes is executed.

ABS-2 (Absolute data method) and INC-2 (Incremental data method) servo instructions are used in the 2 axes linear interpolation control.

								Ite	ns s	et u	sing	МТ	Dev	elop	er2										
	Common								Arc		Parameter block Others											ers			
Servo instruction	Positioning method	Number of control axes	Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Interpolation control unit	Speed limit value	Acceleration time	Deceleration time	Rapid Stop deceleration time	Torque limit value	Deceleration processing on stop input	Allowable error range for circular interpolation	S-curve ratio	Advanced S-curve acceleration/deceleration	Cancel	WAIT-ON/OFF	Speed change
ABS-2	Absolute																								
INC-2	Incremental	2			0	0	Δ									Δ	\triangle	\triangle	Δ		\triangle	Δ	Δ		Valid

): Must be set∆: Set if required

[Control details]

Control using ABS-2 (Absolute data method)

(1) 2 axes linear interpolation from the current stop address (X1 or Y1) based on the home position to the specified address (X2 or Y2) is executed.

(2) The travel direction is set by the stop address (starting address) and positioning address of each axis.

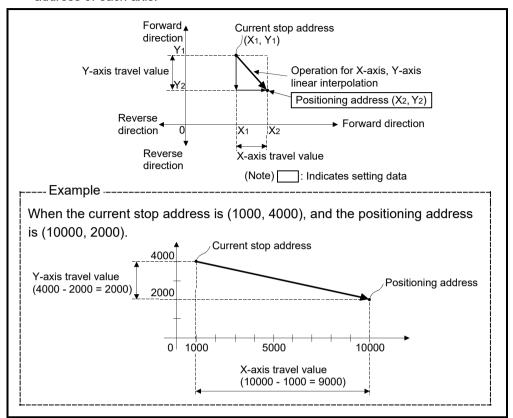


Fig.6.3 Positioning using absolute data method

Control using INC-2 (Incremental data method)

- (1) Positioning control from the current stop address to the position which combined travel direction and travel value specified with each axis is executed.
- (2) The travel direction for each axis is set by the sign (+/-) of the travel value for each axis, as follows:
 - Positive travel valuePositioning control to forward direction (Address increase direction)
 - Negative travel value......Positioning control to reverse direction (Address decrease direction)

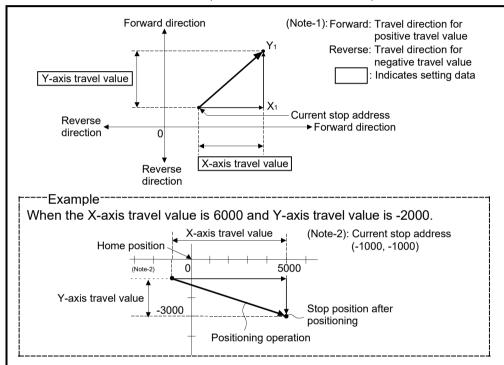


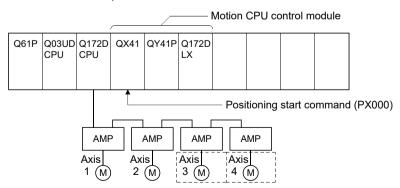
Fig.6.4 Positioning using incremental data method

[Program]

Program for 2 axes linear interpolation control is shown as the following conditions.

(1) System configuration

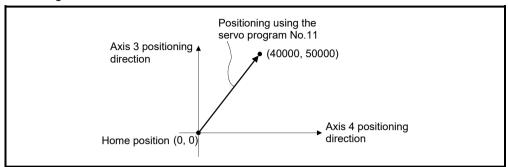
2 axes linear interpolation control of Axis 3 and Axis 4.



(2) Positioning operation details

The positioning is used the Axis 3 and Axis 4 servo motors.

The positioning operation by the Axis 3 and Axis 4 servo motors is shown in the diagram below.



(3) Positioning conditions

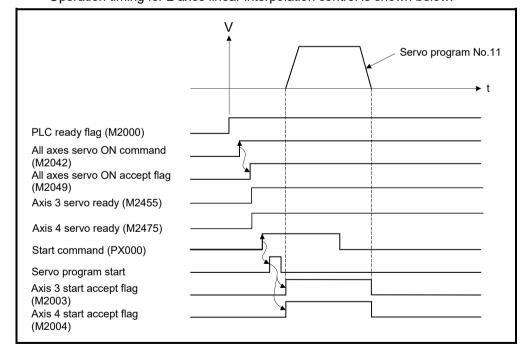
(a) Positioning conditions are shown below.

.,	Servo Program No.
Item	No.11
Positioning speed	30000

(b) Positioning start command PX000 Leading edge (OFF → ON)

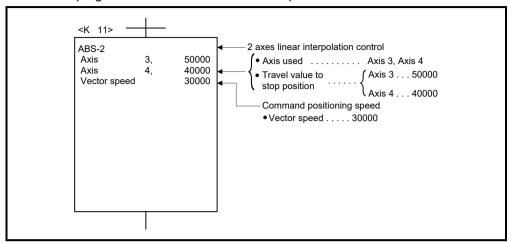
(4) Operation timing

Operation timing for 2 axes linear interpolation control is shown below.



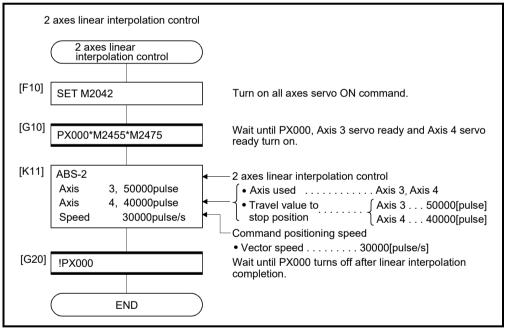
(5) Servo program

Servo program No.11 for 2 axes linear interpolation control is shown below.



(6) Motion SFC program

Motion SFC program for which executes the servo program is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

6.4 3 Axes Linear Interpolation Control

Linear interpolation control from the current stop position with the specified 3 axes is executed.

										Ite	ns s	et us	sing	MT I	Dev	elope	er2								
					Co	mm	on				Arc					Para	amet	er b	lock				Oth	ers	
Servo instruction	Positioning method	Number of control axes	Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Interpolation control unit	Speed limit value	Acceleration time	Deceleration time	Rapid Stop deceleration time	Torque limit value	Deceleration processing on stop input	Allowable error range for circular interpolation	S-curve ratio	Advanced S-curve acceleration/deceleration	Cancel	WAIT-ON/OFF	Speed change
ABS-3	Absolute			_	_																				
INC-3	Incremental	3		0	0	0	Δ	Δ					Δ	Δ	Δ	Δ	\triangle	Δ	Δ		\triangle	Δ	Δ		Valid

○: Must be set

 \triangle : Set if required

[Control details]

Control using ABS-3 (Absolute data method)

- (1) 3 axes linear interpolation from the current stop address (X1, Y1 or Z1) based on the home position to the specified positioning address (X2, Y2, Z2) is executed.
- (2) The travel direction is set by the stop address and specified address of each axis.

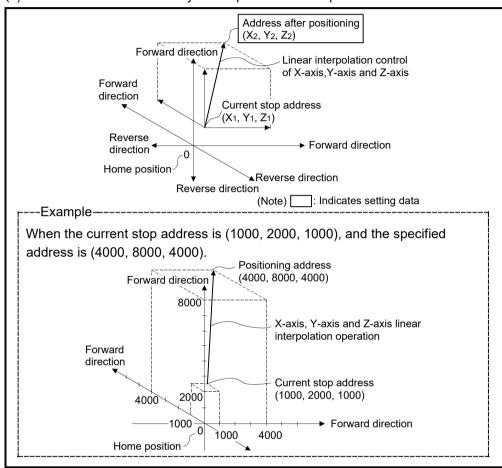


Fig.6.5 Positioning using absolute data method

Control using INC-3 (Incremental data method)

- (1) Positioning control from the current stop address to the position which combined travel direction and travel value specified with each axis is executed.
- (2) The travel direction for each axis is set by the sign (+/-) of the travel value for each axis, as follows:
 - Positive travel valuePositioning control to forward direction (Address increase direction)
 - Negative travel value......Positioning control to reverse direction (Address decrease direction)

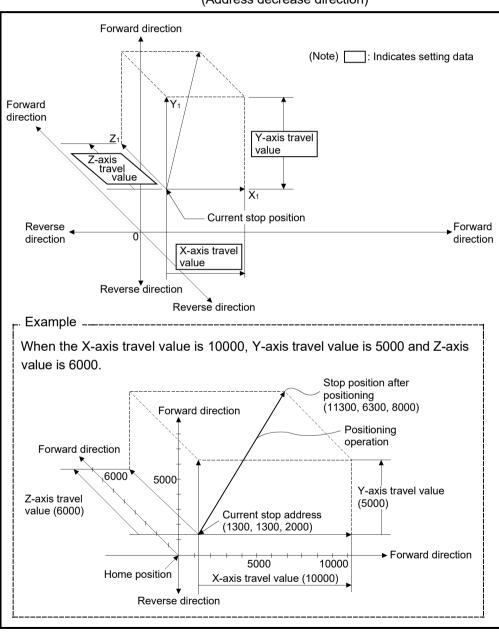


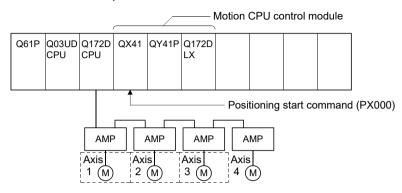
Fig.6.6 Positioning using incremental data method

[Program]

Program for 3 axes linear interpolation control is shown as the following conditions.

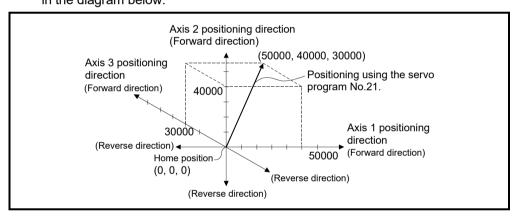
(1) System configuration

3 axes linear interpolation control of Axis 1, Axis 2 and Axis 3.



(2) Positioning operation details

The positioning is used the Axis 1, Axis 2 and Axis 3 servo motors. The positioning operation by the Axis 1, Axis 2 and Axis 3 servo motors is shown in the diagram below.



(3) Positioning conditions

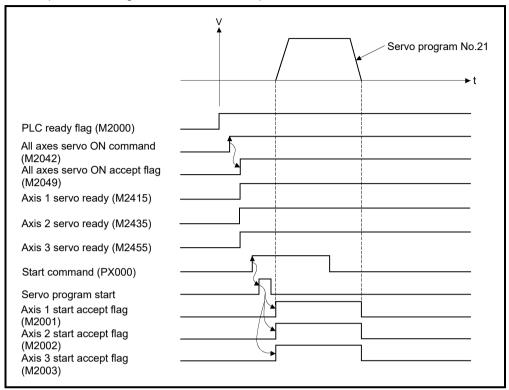
(a) Positioning conditions are shown below.

	Servo Program No.
Item	No.21
Positioning method	Absolute data method
Positioning speed	1000

(b) Positioning start command PX000 Leading edge (OFF → ON)

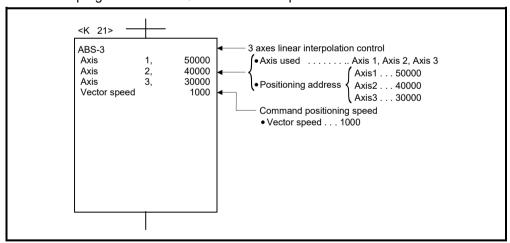
(4) Operation timing

Operation timing for 3 axes linear interpolation control is shown below.



(5) Servo program

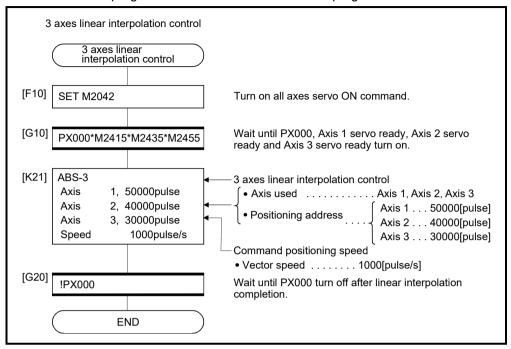
Servo program No.21 for 3 axes linear interpolation control is shown below.



(Note): Example of the Motion SFC program for positioning control is shown next page.

(6) Motion SFC program

Motion SFC program for which executes the servo program is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

6.5 4 Axes Linear Interpolation Control

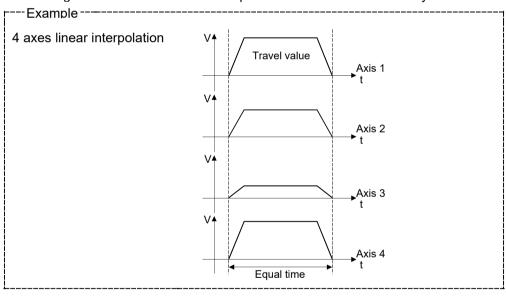
Linear interpolation control from the current stop position with 4 axes specified with the positioning command of the sequence program is executed.

										Ite	ns s	et us	sing	МΤΙ	Dev	elope	er2								
					Co	mm	on				Arc					Para	amet	er b	lock				Oth	ers	
Servo instruction	Positioning method	Number of control axes	Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Interpolation control unit	Speed limit value	Acceleration time	Deceleration time	Rapid Stop deceleration time	Torque limit value	Deceleration processing on stop input	Allowable error range for circular interpolation	S-curve ratio	Advanced S-curve acceleration/deceleration	Cancel	WAIT-ON/OFF	Speed change
ABS-4	Absolute																								
INC-4	Incremental	4		0	0	0	Δ	\triangle					Δ		\triangleleft		Δ				Δ	Δ	Δ		Valid

○: Must be set

[Control details]

Positioning control which starts and completes the 4 axes simultaneously is executed.

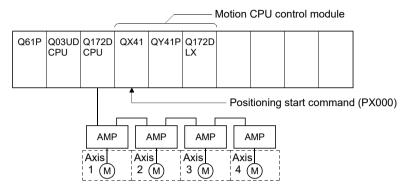


[Program]

Program for 4 axes linear interpolation control is shown as the following conditions.

(1) System configuration

4 axes linear interpolation control of Axis 1, Axis 2, Axis 3 and Axis 4.



(2) Positioning operation details

The positioning is used the Axis 1, Axis 2, Axis 3 and Axis 4 servo motors. The positioning by the Axis 1, Axis 2, Axis 3 and Axis 4 servo motors is shown in the diagram below.

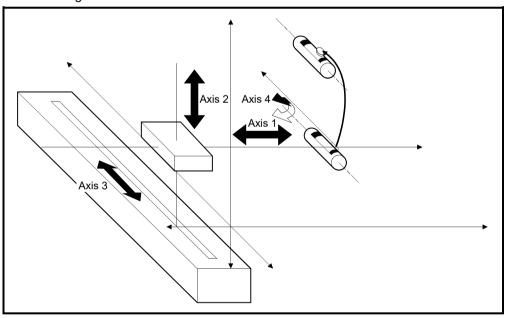


Fig.6.7 Axis configuration

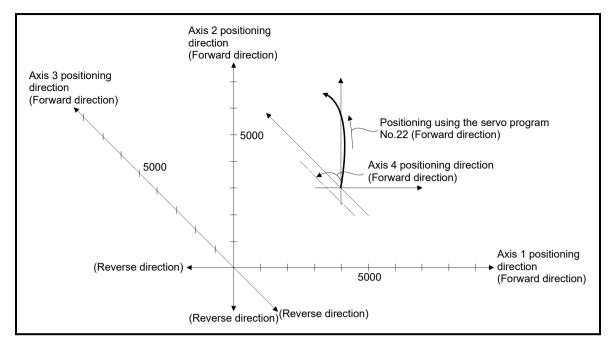


Fig.6.8 Positioning for 4 axes linear interpolation control

(3) Positioning conditions

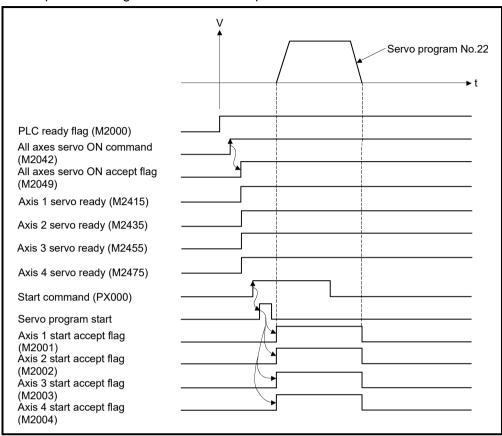
(a) Positioning conditions are shown below.

	Servo Program No.
Item	No.22
Positioning method	Incremental data method
Positioning speed	10000

(b) Positioning start command PX000 Leading edge (OFF \rightarrow ON)

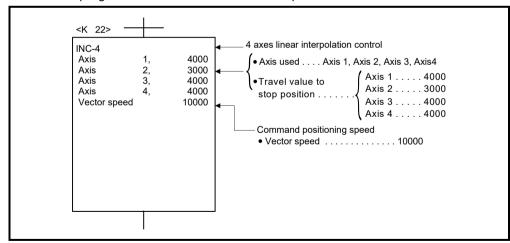
(4) Operation timing

Operation timing for 4 axes linear interpolation control is shown below.



(5) Servo program

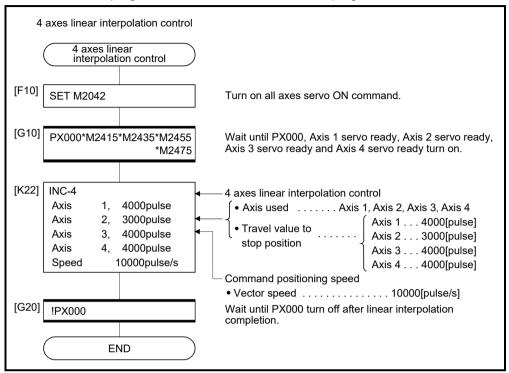
Servo program No.22 for 4 axes linear interpolation control is shown below.



(Note): Example of the Motion SFC program for positioning control is shown next page.

(6) Motion SFC program

Motion SFC program for which executes the servo program is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

6.6 Auxiliary Point-Specified Circular Interpolation Control

Circular interpolation control by specification of the end point address and auxiliary point address (a point on the arc) for circular interpolation is executed.

Auxiliary point-specified circular uses ABS (Absolute data method) and INC (Incremental data method) servo instructions.

										Ite	ns s	et u	sing	МТ	Dev	elop	er2								
					Co	mm	on				Arc					Para	amet	er b	lock				Oth	ers	
Servo instruction	Positioning method	Number of control axes	Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	м-соде	Torque limit value	Auxiliary point	Radius	Central point	Interpolation control unit	Speed limit value	Acceleration time	Deceleration time	Rapid Stop deceleration time	Torque limit value	Deceleration processing on stop input	Allowable error range for circular interpolation	S-curve ratio	Advanced S-curve acceleration/deceleration	Cancel	WAIT-ON/OFF	Speed change
ABS	Absolute																								
INC 🚈	Incremental	2		0	0	0	Δ	Δ		0			\triangle				\triangle	Δ	\triangle	Δ			\triangle		Valid

): Must be set∆: Set if required

[Control details]

Control using ABS (Absolute data method)

- (1) Circular interpolation from the current stop address (address before positioning) based on the home position through the specified auxiliary point address to the end point address is executed.
- (2) The center of the arc is the point of intersection of the perpendicular bisectors of the start point address (current stop address) to the auxiliary point address, and the auxiliary point address to the end point address.

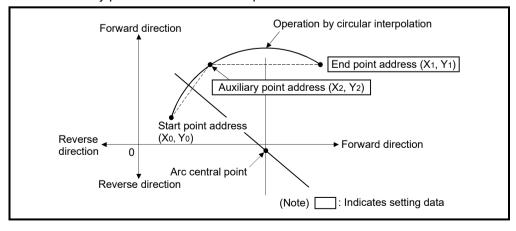


Fig. 6.9 Circular interpolation control using absolute data method

- (3) The setting range of the end point address and auxiliary point address is (-2^{31}) to $(2^{31}-1)$.
- (4) The maximum arc radius is 232-1.

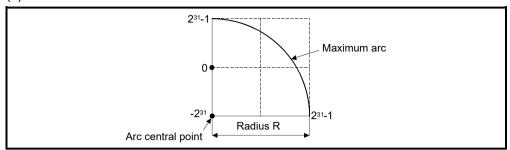


Fig.6.10 Maximum arc

Control using INC (Incremental data method)

- (1) Circular interpolation from the current stop address through the specified auxiliary point address to the end point address is executed.
- (2) The center of the arc is the point of intersection of the perpendicular bisectors of the start point address (current stop address) to the auxiliary point address, and the auxiliary point address to the end point address.

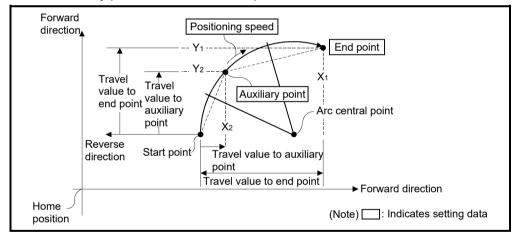


Fig.6.11 Circular interpolation control using incremental data method

(3) The setting range for the travel value to the end point address and auxiliary point address is 0 to \pm (2³¹-1).

(4) The maximum arc radius is 2³¹-1.

If the end point and auxiliary point are set more than a radius of 2³¹-1, an error occurs at the start and minor error (error code: 107) is stored in the data register.

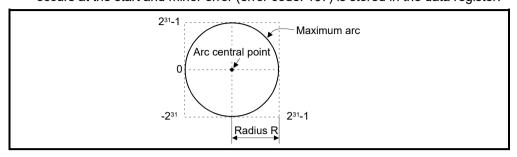


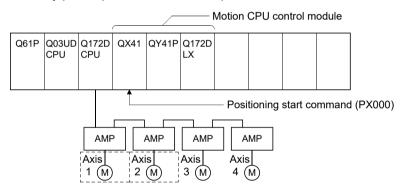
Fig.6.12 Maximum arc

[Program]

Program for auxiliary point-specified circular interpolation control is shown as the following conditions.

(1) System configuration

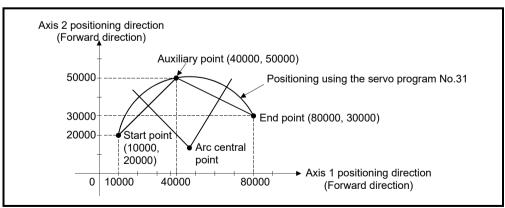
Auxiliary point-specified circular interpolation control of Axis 1 and Axis 2.



(2) Positioning details

The positioning uses the Axis 1 and Axis 2 servo motors.

The positioning by the Axis 1 and Axis 2 servo motors is shown in the diagram below.



(3) Positioning conditions

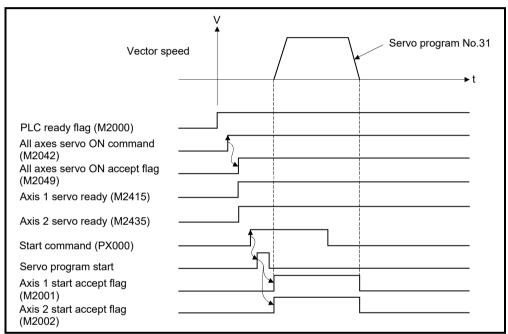
(a) Positioning conditions are shown below.

	Servo program No.
Item	No.31
Positioning method	Absolute data method
Positioning speed	1000

(b) Positioning start command PX000 Leading edge (OFF \rightarrow ON)

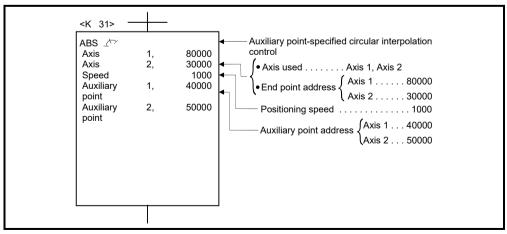
(4) Operation timing

Operation timing for auxiliary point-specified circular interpolation control is shown below.



(5) Servo program

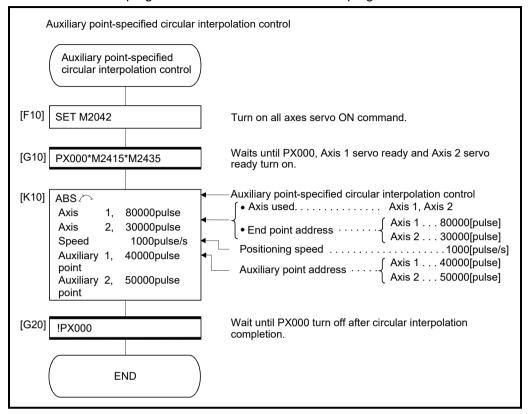
Servo program No.31 for auxiliary point-specified circular interpolation control is shown below.



(Note): Example of the Motion SFC program for positioning control is shown next page.

(6) Motion SFC program

Motion SFC program for which executes the servo program is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

6.7 Radius-Specified Circular Interpolation Control

Circular interpolation control by specification of the end point address and radius for circular interpolation is executed.

Radius-specified circular interpolation control uses ABS , ABS , ABS and ABS (Absolute data method) and INC , INC , INC and INC (Incremental data method) servo instructions.

										Ite	ns s	et u	sing	МТ	Dev	_									
					Co	mm I	on				Arc			1	1	Para	amet	er b	lock				Oth	ers	
Servo instruction	Positioning method	Number of control axes	Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Interpolation control unit	Speed limit value	Acceleration time	Deceleration time	Rapid Stop deceleration time	Torque limit value	Deceleration processing on stop input	Allowable error range for circular interpolation	S-curve ratio	Advanced S-curve acceleration/deceleration	Cancel	WAIT-ON/OFF	Speed change
ABS◯◀																									
ABS()	Absolute																								
ABS✓	Absolute																								
ABS♥		2					_	^			0		_	_	_	^	^	^	Δ	Δ	^	^	^		Valid
INC <		2		0	0	0	Δ	Δ			0		Δ	Δ	Δ	Δ	Δ	Δ		\triangle	Δ	Δ	Δ		valiu
INC ()	Ingramantal																								
INC 🕒	Incremental																								
INC 🕒																									

 \bigcirc : Must be set

 \triangle : Set if required

[Control details]

Details for the servo instructions are shown in the table below.

Instruction	Rotation direction of the servo motors	Maximum controllable angle of arc	Positioning path
ABS ◯◀	Clashovia a		Start Positioning path point θ <180° End point
INC <	Clockwise	00 10 14000	Radius R Central point
ABS⊶	Cauntan ala alguia a	0° < θ < 180°	Radius R
INC 🚄	Counter clockwise		Start θ <180° End point point Positioning path
ABS 🗪	Clockwise		Positioning path 180°≤9<360° Central point
INC 🗪			Radius R End point
ABS 🕩	Counter clockwise	180° ≤ θ < 360°	Start point Radius R End point Central point
INC 🕩			180°≤e<360° Positioning path

Control using ABS ○, ABS ○, ABS ○, ABS ○ (Absolute data method)

- (1) Circular interpolation from the current stop address (address before positioning) based on the home position to the specified end address with the specified radius is executed.
- (2) The center of the arc is the point of intersection of the perpendicular bisectors of the start point address (current stop address) to the end address.

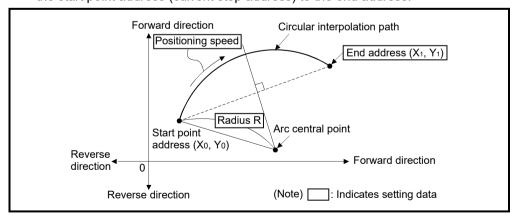


Fig.6.13 Circular interpolation control using absolute data method

(3) The setting range of end point address is (-2^{31}) to $(2^{31}-1)$.

- (4) The setting range for the radius is 1 to $(2^{31}-1)$.
- (5) The maximum arc radius is (232-1).

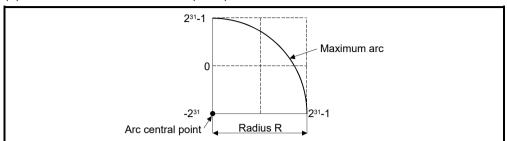


Fig.6.14 Maximum arc

Control using INC , INC , INC , INC (Incremental data method)

- (1) Circular interpolation from the current stop address (0, 0) to the specified end point with specified radius.
- (2) The center of the arc is the point of intersection of the perpendicular bisectors of the start point address (current stop address) to the end address.

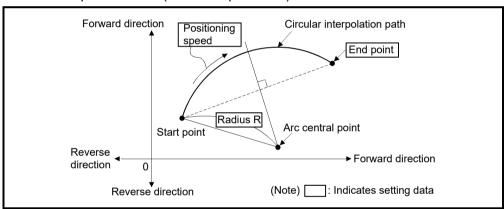


Fig.6.15 Circular interpolation control using incremental data method

- (3) Setting range of end point address is (-2^{31}) to $(2^{31}-1)$.
- (4) Setting range of radius is 1 to (231-1).
- (5) Maximum arc radius is (231-1).

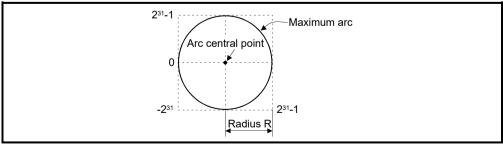


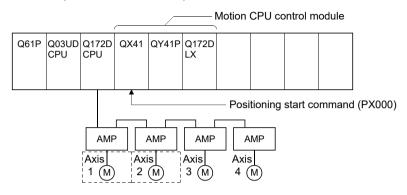
Fig.6.16 Maximum arc

[Program]

Program for radius-specified circular interpolation control is shown as the following conditions.

(1) System configuration

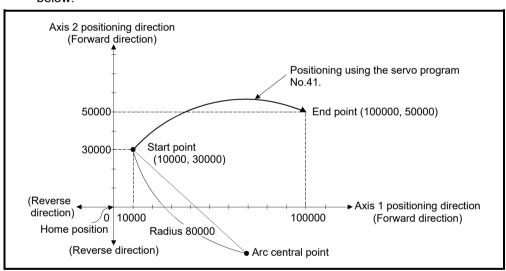
Radius-specified circular interpolation control of Axis 1 and Axis 2.



(2) Positioning operation details

The positioning uses the Axis 1 and Axis 2 servo motors.

The positioning by the Axis 1 and Axis 2 servo motors is shown in the diagram below.



(3) Positioning conditions

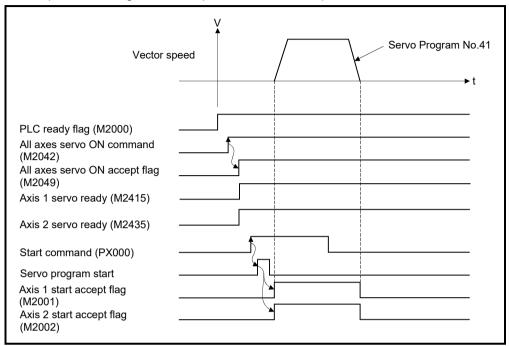
(a) Positioning conditions are shown below.

	Servo Program No.
Item	No.41
Positioning method	Absolute data method
Positioning speed	1000

(b) Positioning start command PX000 Leading edge (OFF \rightarrow ON)

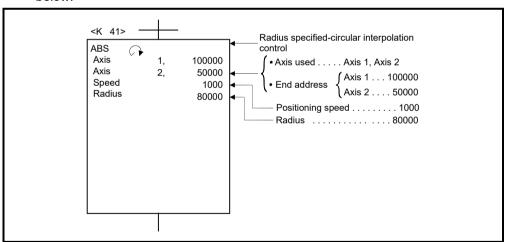
(4) Operation timing

Operation timing for radius-specified circular interpolation control is shown below.



(5) Servo program

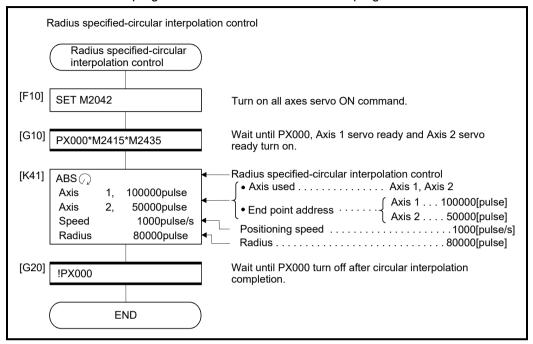
Servo program No.41 for radius-specified circular interpolation control is shown below.



(Note): Example of the Motion SFC program for positioning control is shown next page.

(6) Motion SFC program

Motion SFC program for which executes the servo program is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

6.8 Central Point-Specified Circular Interpolation Control

Circular interpolation control by specification of the end point for circular interpolation and arc central point is executed.

Central point-specified circular interpolation control uses ABS → and ABS → (Absolute data method) and INC → and INC → (Incremental data method) servo instructions.

										Iter	ns s	et us	sing	MT	Dev	elop	er2								
					Co	mm	on				Arc					Para	amet	er b	lock				Oth	ers	
Servo instruction	Positioning method	Number of control axes	Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Interpolation control unit	Speed limit value	Acceleration time	Deceleration time	Rapid Stop deceleration time	Torque limit value	Deceleration processing on stop input	Allowable error range for circular interpolation	S-curve ratio	Advanced S-curve acceleration/deceleration	Cancel	WAIT-ON/OFF	Speed change
ABS ∴ ABS ∴	Absolute																								
INC :	Incremental	2		0	0	0						0	Δ	Δ	Δ	Δ		\triangle	Δ	Δ	Δ	Δ	Δ		Valid

○: Must be set△: Set if required

[Control details]

Details for the servo instructions are shown in the table below.

Instruction	Rotation direction of the servo motors	Maximum controllable angle of arc	Positioning path
ABS ○			Positioning path Start point 0°<0<360° End point
INC 🖪	Clockwise		Central point
ABS❖		0° < θ < 360°	Central point
INC 🍑	Counter clockwise		Start point 0°<0<360° End point Positioning path

Control using ABS →, ABS → (Absolute data method)

(1) Circular interpolation of an arc with a radius equivalent to the distance between the start point and central point, between the current stop address (address before positioning) based on the home position and the specified end point address.

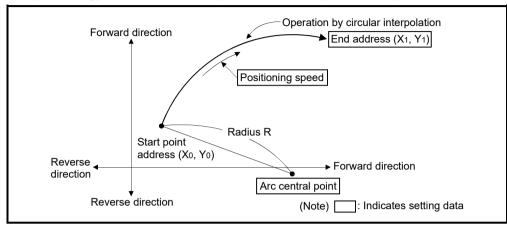


Fig.6.17 Circular interpolation control using absolute date method

(2) Positioning control of a complete round is possible in the central point-specified circular interpolation control.

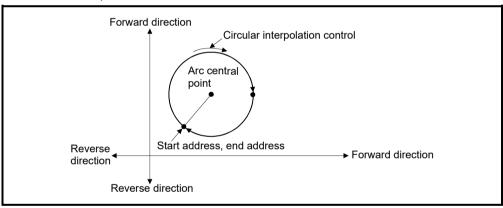


Fig.6.18 Positioning control of a complete round

- (3) Setting range of end point address and arc central point is (-2³¹) to (2³¹-1).
- (4) The maximum arc radius is $(2^{32}-1)$.

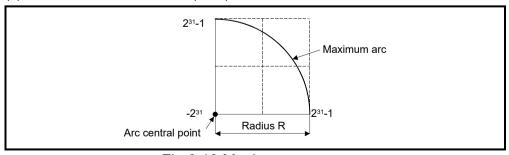


Fig.6.19 Maximum arc

Control using INC , INC (Incremental method)

(1) Circular interpolation from the current stop address (0, 0) with a radius equivalent to the distance between the start point (0, 0) and central point.

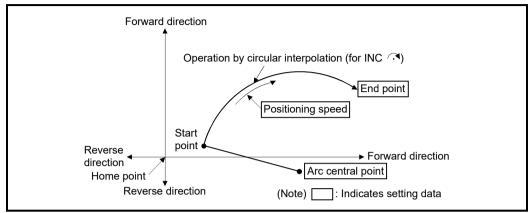


Fig.6.20 Circular interpolation control using incremental data method (INC <)

(2) Positioning control of a complete round is possible in the central point-specified circular interpolation control.

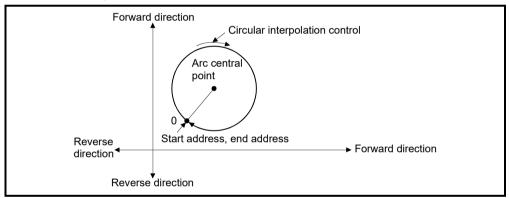


Fig.6.21 Positioning control of a complete round

- (3) Setting range of travel value to end point address and arc central point is 0 to $(2^{31}-1)$.
- (4) The maximum arc radius is (2³¹-1). If the end point and central point are set more than a radius of (2³¹-1), an error occurs at the start and minor error (error code: 109) is stored in the data register.

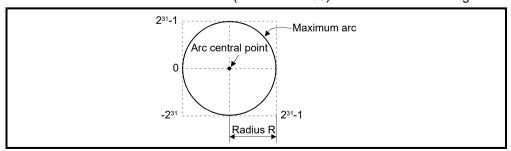


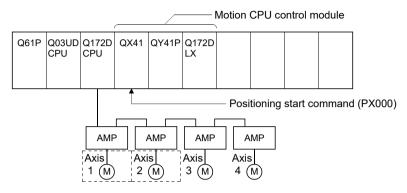
Fig.6.22 Maximum arc radius

[Program]

Program for central point-specified circular interpolation control is shown as the following conditions.

(1) System configuration

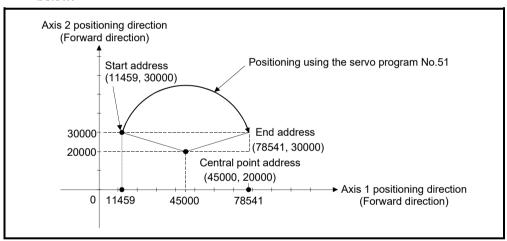
Central point-specified circular interpolation control of Axis 1 and Axis 2.



(2) Positioning operation details

The positioning uses the Axis 1 and Axis 2 servo motors.

The positioning by the Axis 1 and Axis 2 servo motors is shown in the diagram below.



(3) Positioning conditions

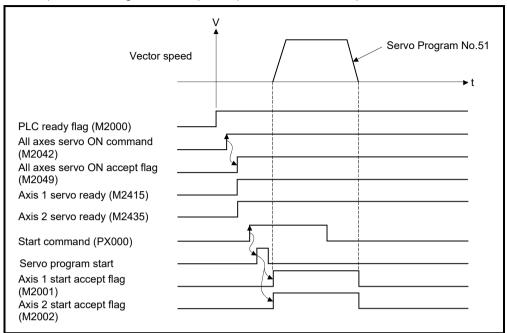
(a) Positioning conditions are shown below.

	Servo Program No.
Item	No.51
Positioning method	Absolute data method
Positioning speed	1000

(b) Positioning start command PX000 Leading edge (OFF \rightarrow ON)

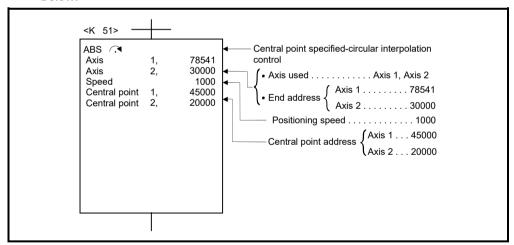
(4) Operation timing

Operation timing for central point-specified circular interpolation is shown below.



(5) Servo program

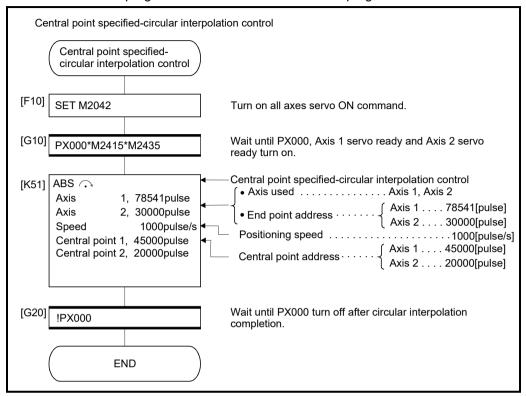
Servo program No.51 for central point-specified circular interpolation is shown below.



(Note): Example of the Motion SFC program for positioning control is shown next page.

(6) Motion SFC program

Motion SFC program for which executes the servo program is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

6.9 Helical Interpolation Control

The linear interpolation control with linear axis is executed simultaneously while the circular interpolation specified with any 2 axes is executed, the specified number of pitches rotates spirally and performs the locus control to command position.

										ľ	tems	s set	usir	ng M	T De	evelo	per2	2									
		Common								Arc/Helical				Parameter block									Others				
Servo instruction	Positioning method	Number of control axes	Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Pitch count	Interpolation control unit	Speed limit value	Acceleration time	Deceleration time	Rapid Stop deceleration time	Torque limit value	Deceleration processing on stop input	Allowable error range for circular interpolation	S-curve ratio	Advanced S-curve acceleration/deceleration	Cancel	WAIT-ON/OFF	Speed change	
ABH⊂◀																											
ABH (→	Absolute			. 0				Δ \ Δ																			
ABH✓																											
ABH ○																											
INH <			Δ		0	0						0		0	Δ	\triangle		Δ					\triangle		Δ		
INH 🗪		ntal 3																									
INH 🗸	Incremental																										
INH 🕩																										Valid	
ABH ∕.◀	Absolute Incremental																		Δ	Δ							
ABH∵₄		_					Δ																				
INH ∕,◀				0	0	0						0	0		Δ	\triangle	Δ	Δ				Δ	\triangle	\triangle			
INH 🌙																											
ABH	Absolute					_							_														
INH 🗸	Incremental		Δ	0	0	0	Δ	Δ		0			0	Δ	Δ	Δ	Δ	Δ	Δ			Δ	Δ	Δ			

○: Must be set

 \triangle : Set if required

6.9.1 Circular interpolation specified method by helical interpolation

The following method of circular interpolation is possible for the helical interpolation. The specified method of circular interpolation connected start point and end point at the seeing on the plane for which performs circular interpolation are as follows.

Servo instruction	Positioning method	Circular interpolation specified method						
ABH <◀	Absolute	Radius-specified method						
INH 🗨	Incremental	less than CW180°						
ABH ✓	Absolute	Radius-specified method						
INH ✓	Incremental	less than CCW180°						
ABH ←	Absolute	Radius-specified method						
INH Դ	Incremental	CW180° or more.						
ABH ♥	Absolute	Radius-specified method						
INH 🖰	Incremental	CCW180° or more.						
ABH ़ ◀	Absolute							
INH 🖪	Incremental	Central point-specified method CW						
авн ⋐	Absolute							
INH 🍑	Incremental	Central point- specified method CCW						
ABH 📉	Absolute	A 11: 17 17 1 11 1						
INH 📉	Incremental	Auxiliary point-specified method						

[Cautions]

- (1) The helical interpolation instruction can be used at the both of real mode/virtual mode.
- (2) When the travel value of linear axis is "0" is set, it can be controlled.

Condition	Operation				
Number of pitches is 0	Same control as normal circular interpolation control.				
rtamber er phenee ie e	(Allowable error range for circular interpolation can be set.)				
	Linear interpolation to linear axis does not executed, circle for the				
Number of pitches is not 0	number of pitches is drawn on the circle plane.				
	(Allowable error range for circular interpolation can be set.)				

- (3) Units for linear axis have not restrictions.
- (4) Circular interpolation axis has the following restrictions.
 - When the unit of one axis is [degree] axis (with stroke range), set another axis also as [degree] axis (without stroke range).
 - The axis of [degree] unit as without stroke range cannot be set.
 - The axis as without stroke range cannot be set in the virtual mode.

- (5) Specified the speed which executes speed change by CHGV instruction during helical interpolation operation with the vector speed of circular interpolation axis 2. If speed change is requested by specifying negative speed by CHGV instruction during helical interpolation operation, deceleration starts from the time and it is possible to return to reverse direction at the deceleration completion.
- (6) If start point = end point, number of pitches = 1 and travel value of linear axis = 0, at the only central point-specified circular interpolation, full circle can be drawn. When the address of "start point = end point" is set at the radius-specified helical interpolation or auxiliary point-specified helical interpolation, a minor error occurs at the start and cannot be start.
 - At auxiliary point-specified helical interpolation : Minor error (error code: 107)
 - At radius-specified helical interpolation : Minor error (error code: 108)
- (7) When the control unit is [degree] and the stroke limit is invalid, if the helical interpolation control is executed using absolute data method, positioning in near direction to specified address based on the current value.
- (8) Allowable error range for circular interpolation can be set.

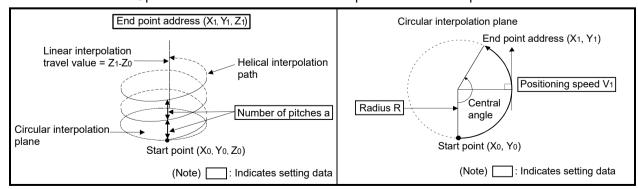
ABH , ABH , ABH , ABH Absolute radius-specified helical interpolation control

[Control details]

The linear interpolation to other linear axis is executed performing 2 axes circular interpolation from current stop position (X₀, Y₀, Z₀) to specified circular end address (X₁, Y₁) or linear axis end point address (Z₁), and the absolute helical interpolation is executed so that it may become a spiral course.

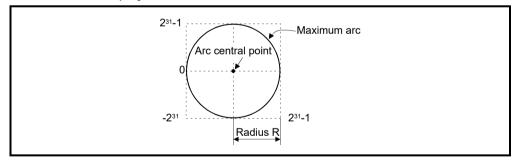
It goes around on the specified circle for the specified number of pitches, the circular interpolation which had remainder specified is executed, and positioning to end address is executed. The radius-specified circle specifies circular interpolation method connected start point and end point at the seeing on the plane for which performs circular interpolation.

Operation details for absolute radius-specified helical interpolation are shown below.



Control details for the servo instructions are shown below.

- (1) The setting range of end point address for the both of circular interpolation axis and linear interpolation axis is (-2³¹) to (2³¹-1).
- (2) The maximum arc radius on the circular interpolation plane is (2^{31} -1). For example, the maximum arc radius for electronic gear 1:1 of unit [mm] is 214748364.7[µm].



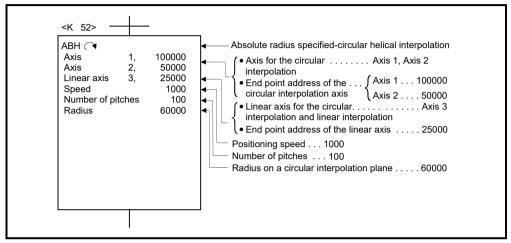
- (3) Set the command speed with the vector speed for 2 axes circular interpolation axis.
- (4) The command speed unit is specified in the parameter block.
- (5) Set the number of pitches within the range of 0 to 999. If it is set outside the setting range, the servo program setting error (error code: 28) occurs, and cannot be started.

(6) All of the circular interpolation axis, linear axis and point address, command speed, radius (2 word data above) and number of pitches (1 word data) are set indirectly by the word devices.

[Program]

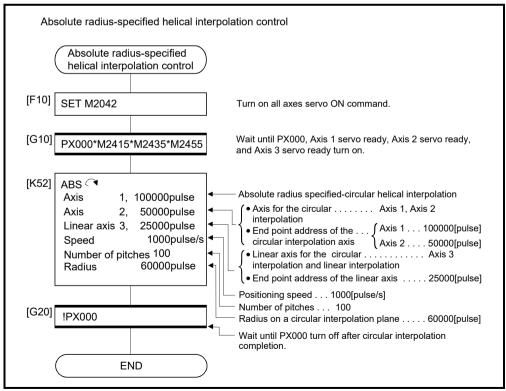
(1) Servo program

Servo program No.52 for absolute radius-specified helical interpolation control is shown below.



(Note): Example of the Motion SFC program for positioning control is shown next page.

(2) Motion SFC program



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

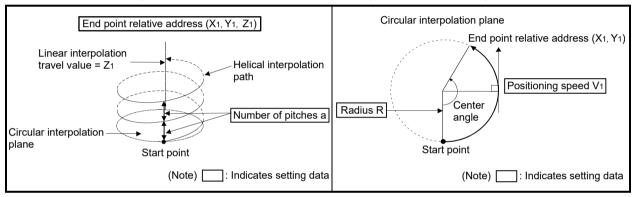
INH \circlearrowleft , INH \hookrightarrow , INH \hookrightarrow Incremental radius-specified helical interpolation control

[Control details]

The linear interpolation to other linear axis is executed performing circular interpolation from current stop position (start point) to specified circular relative end address (X1, Y1) or linear axis end point relative address (Z1), and the incremental helical interpolation control is executed so that it may become a spiral course.

It goes around on the specified circle for the specified number of pitches, the circular interpolation which had remainder specified is executed, and positioning to end address is executed. The radius-specified circle specifies circular interpolation method connected start point and end point at the seeing on the plane for which performs circular interpolation.

Operation details for incremental radius-specified helical interpolation are shown below.



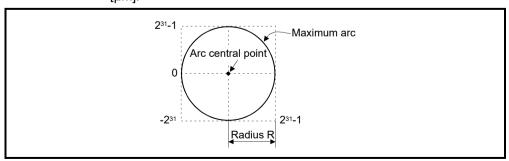
Control	detaile	for the co	rvo instructio	ne ara chaw	n halow
Control	uetalis	ioi ine se	i vo mstructio	ns are snow	n below.

Instruction	Rotation direction of servo motor	Controllable angle of arc	Positioning pass
INH Radius-specified helical interpolation less than CW 180°	Clockwise (CW)		Start Positioning path point End point Radius R Central point
INH Radius-specified helical interpolation less than CCW 180°	Counter clockwise (CCW)	0° < θ < 180°	Radius R Start 0<180° End point point Positioning path
INH Radius-specified helical interpolation CW 180° or more	Clockwise (CW)		Positioning path 180°≤θ≤360° Central point Radius R End point
INH CRADITION Radius-specified helical interpolation CCW 180° or more	Counter clockwise (CCW)	180° ≤ θ ≤ 360°	Start point Radius R End point 180° ≤ θ ≤ 360° Central point Positioning path

(1) The setting range of end point relative address for the both of circular interpolation axis and linear interpolation axis is 0 to \pm (2³¹-1).

The travel direction is set by the sign (+/ -) of the travel value, as follows:

- Positive travel valuePositioning control to forward direction (Address increase direction)
- Negative travel value......Positioning control to reverse direction (Address decrease direction)
- (2) The maximum arc radius on the circular interpolation plane is 2^{31} -1. For example, the maximum arc radius for electronic gear 1:1 of unit [mm] is $214748364.7[\mu m]$.

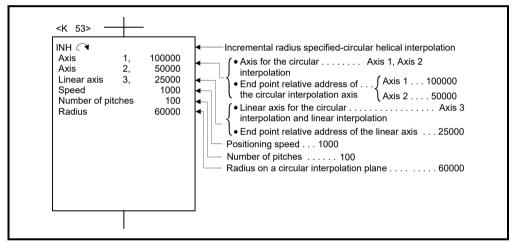


- (3) Set the command speed with the vector speed for 2 axes circular interpolation axis.
- (4) The command speed unit is specified in the parameter block.
- (5) Set the number of pitches within the range of 0 to 999. If it is set outside the setting range, the servo program setting error (error code: 28) occurs and operation does not start.
- (6) All of the circular interpolation axis, linear axis end point relative address, command speed, radius (2 word data above) and number of pitches (1 word data) are set indirectly by the word devices.

[Program]

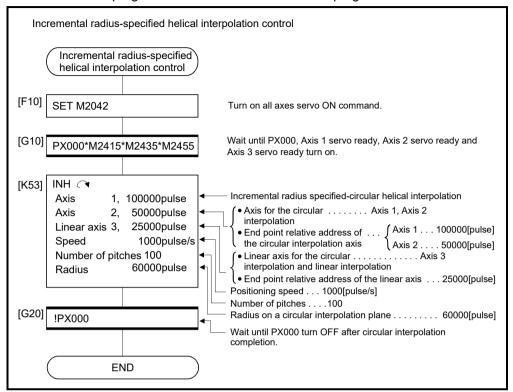
(1) Servo program

Servo program No.53 for incremental radius-specified helical interpolation control is shown below.



(Note): Example of the Motion SFC program for positioning control is shown next page.

(2) Motion SFC program



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

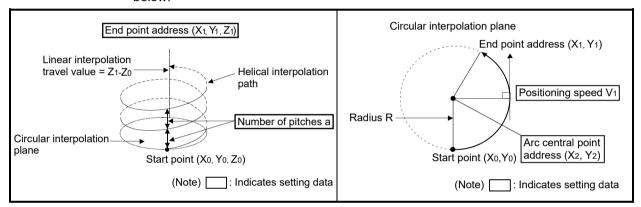
ABH (**, ABH **) Absolute central point-specified helical interpolation control

[Control details]

The linear interpolation to other linear axis is executed performing 2 axes circular interpolation from current stop position (X₀, Y₀, Z₀) to specified circular end address (X₁, Y₁) or linear axis end point address (Z₁), and the absolute helical interpolation is executed so that it may become a spiral course.

It goes around on the specified circle for the specified number of pitches, the circular interpolation which had remainder specified is executed, and positioning to end address is executed. The central point-specified circle specifies circular interpolation method connected start point and end point at the seeing on the plane for which performs circular interpolation.

Operation details for absolute central point-specified helical interpolation are shown below.

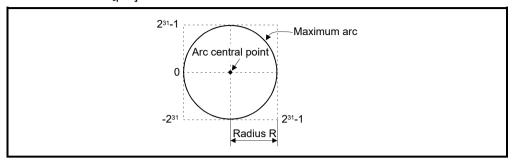


Control details for the servo instructions are shown below.

Instruction	Rotation direction of servo motor	Controllable angle of arc	Positioning pass
ABH C Central point- specified helical interpolation CW	Clockwise (CW)		Start point O°<θ≤360° End point Central point
ABH 🖼 Central point- specified helical interpolation CCW	Counter clockwise (CCW)	0° < θ ≤ 360°	Central point Start point 0°<θ≤360° End point Positioning path

- (1) The setting range of end point address for the both of circular interpolation axis and linear interpolation axis is (-2³¹) to (2³¹-1).
- (2) The setting range of central point address is (-2^{31}) to $(2^{31}-1)$.

(3) The maximum arc radius on the circular interpolation plane is 2^{31} -1. For example, the maximum arc radius for electronic gear 1:1 of unit [mm] is $214748364.7[\mu m]$.

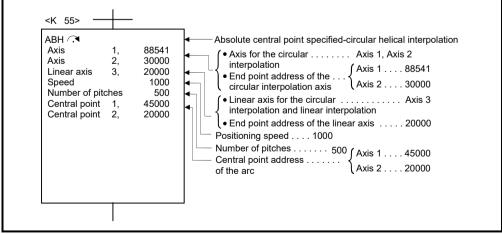


- (4) Set the command speed with the vector speed for 2 axes circular interpolation axis.
- (5) The command speed unit is specified in the parameter block.
- (6) Set the number of pitches within the range of 0 to 999. If it is set outside the setting range, the servo program setting error (error code: 28) occurs and operation does not start.
- (7) All of the circular interpolation axis, linear axis end point address, command speed, radius (2 word data above) and number of pitches (1 word data) are set indirectly by the word devices.
- (8) If start point = end point, number of pitches = 1 and travel value of linear axis = 0, at the only central point-specified circular interpolation, full circle can be drawn.

[Program]

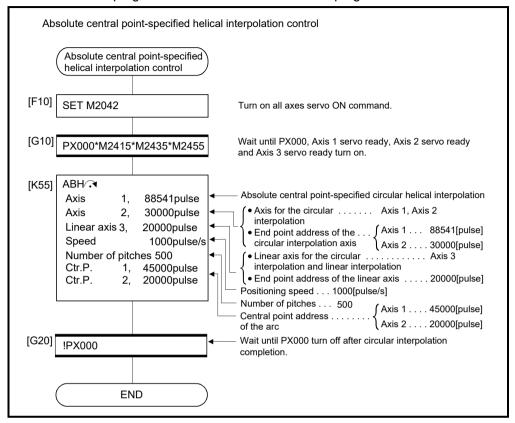
(1) Servo program

Servo program No.55 for absolute central point-specified helical interpolation control is shown below.



(Note): Example of the Motion SFC program for positioning control is shown next page.

(2) Motion SFC program



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

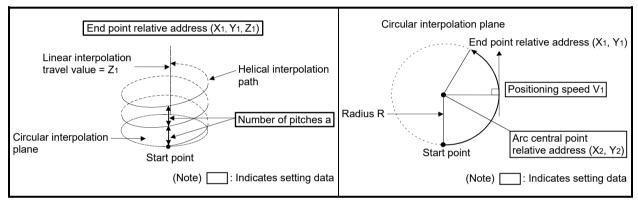
INH , INH Incremental central point-specified helical interpolation control

[Control details]

The linear interpolation to other linear axis is executed performing circular interpolation from current stop position (start point) to specified circular relative end address (X1, Y1) or linear axis end point relative address (Z1), and the incremental helical interpolation control is executed so that it may become a spiral course.

It goes around on the specified circle for the specified number of pitches, the circular interpolation which had remainder specified is executed, and positioning to end address is executed. The central point-specified circle specifies circular interpolation method connected start point and end point at the seeing on the plane for which performs circular interpolation.

Operation details for incremental central point -specified helical interpolation are shown below.

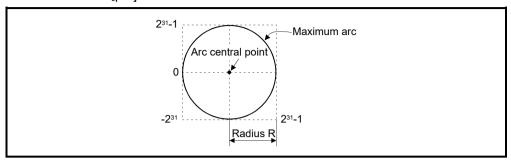


Control details for the servo instructions are shown below.

Instruction	Rotation direction	Controllable angle of	Positioning pass
IIIStruction	of servo motor	arc	Positioning pass
INH ○			Positioning path
Central point-specified	Clockwice (CM)		Start point 0°<θ≤360° End point
helical interpolation	Clockwise (CW)		
CW		00 10 1000	Central point
INH 🍑		0° < θ ≤ 360°	Central point
Central point-specified	Counter		Start point (0°< <i>θ</i> ≤360°) End point
helical interpolation	clockwise (CCW)		
CCW			Positioning path

- (1) The setting range of end point relative address for the both of circular interpolation axis and linear interpolation axis is 0 to \pm (2³¹-1).
- (2) The setting range of central point relative is 0 to \pm (2³¹-1).

(3) The maximum arc radius on the circular interpolation plane is $(2^{31}-1)$. For example, the maximum arc radius for electronic gear 1:1 of unit [mm] is $214748364.7[\mu m]$.

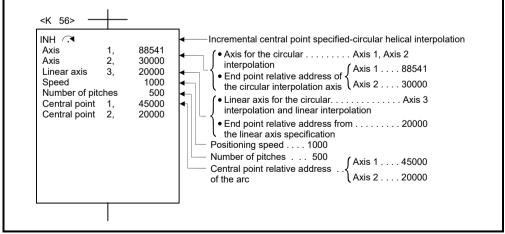


- (4) Set the command speed with the vector speed for 2 axes circular interpolation axis.
- (5) The command speed unit is specified in the parameter block.
- (6) Set the number of pitches within the range of 0 to 999. If it is set outside the setting range, the servo program setting error (error code: 28) occurs and operation does not start.
- (7) All of the circular interpolation axis, linear axis end relative address, command speed, radius (2 word data above) and number of pitches (1 word data) are set indirectly by the word devices.
- (8) If start point = end point, number of pitches = 1 and travel value of linear axis = 0, at the only central point-specified circular interpolation, full circle can be drawn.

[Program]

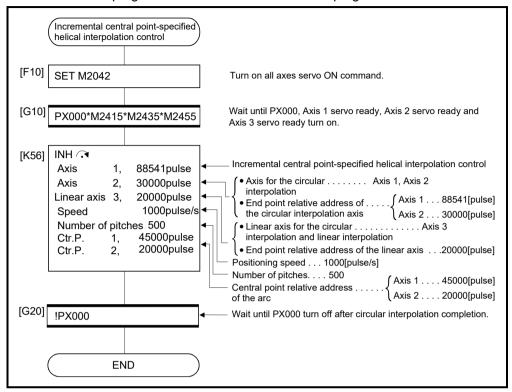
(1) Servo program

Servo program No.56 for incremental central point-specified helical interpolation control is shown below.



(Note): Example of the Motion SFC program for positioning control is shown next page.

(2) Motion SFC program



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

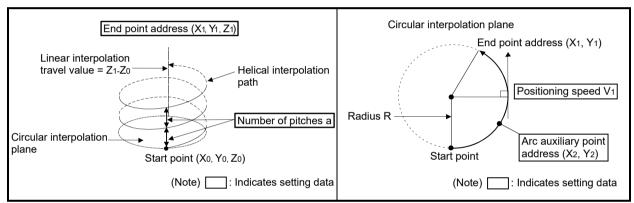
ABH / Absolute auxiliary point-specified helical interpolation control

[Control details]

The linear interpolation to other linear axis is executed performing 2 axes circular interpolation from current stop position (X₀, Y₀, Z₀) to specified circular end address (X₁, Y₁) or linear axis end point address (Z₁), and the absolute helical interpolation is executed so that it may become a spiral course.

It goes around on the specified circle for the specified number of pitches, the circular interpolation which had remainder specified is executed, and positioning to end address is executed. The auxiliary point-specified circle specifies circular interpolation method connected start point and end point at the seeing on the plane for which performs circular interpolation.

Operation details for absolute auxiliary point-specified helical interpolation are shown below.

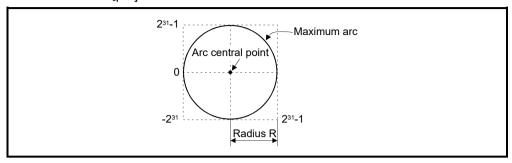


Control details for the servo instructions are shown below.

Instruction	Rotation direction of servo motor	Controllable angle of arc
ABH A Auxiliary point-specified helical interpolation	Clockwise (CW)/ Counter clockwise (CCW)	0° < θ ≤ 360°

- (1) The setting range of end point address for the both of circular interpolation axis and linear interpolation axis is (-2^{31}) to $(2^{31}-1)$.
- (2) The setting range of auxiliary point address is (-2^{31}) to $(2^{31}-1)$.

(3) The maximum arc radius on the circular interpolation plane is 2³¹-1. For example, the maximum arc radius for electronic gear 1:1 of unit [mm] is 214748364.7[µm].

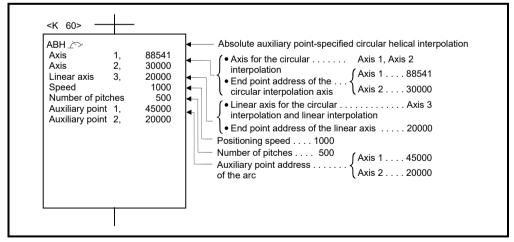


- (4) Set the command speed with the vector speed for 2 axes circular interpolation axis.
- (5) The command speed unit is specified in the parameter block.
- (6) Set the number of pitches within the range of 0 to 999. If it is set outside the setting range, the servo program setting error (error code: 28) occurs and operation does not start.
- (7) All of the circular interpolation axis, linear axis end relative address, command speed, radius (2 word data above) and number of pitches (1 word data) are set indirectly by the word devices.

[Program]

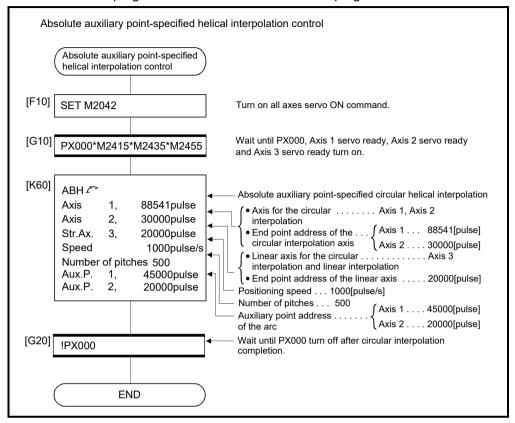
(1) Servo program

Servo program No.60 for absolute auxiliary point-specified helical interpolation control is shown below.



(Note): Example of the Motion SFC program for positioning control is shown next page.

(2) Motion SFC program



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

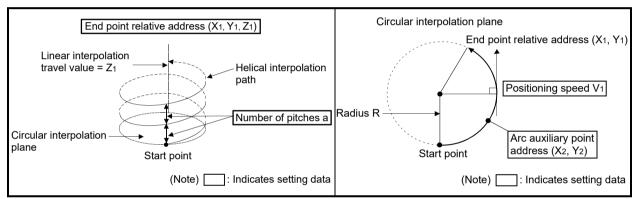
INH / Incremental auxiliary point-specified helical interpolation control

[Control details]

The linear interpolation to other linear axis is executed performing circular interpolation from current stop position (start point) to specified circular relative end address (X1, Y1) or linear axis end point relative address (Z1), and the incremental helical interpolation control is executed so that it may become a spiral course.

It goes around on the specified circle for the specified number of pitches, the circular interpolation which had remainder specified is executed, and positioning to end address is executed. The auxiliary point-specified circle specifies circular interpolation method connected start point and end point at the seeing on the plane for which performs circular interpolation.

Operation details for incremental auxiliary point-specified helical interpolation are shown below.

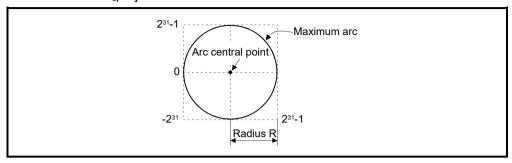


Control details for the servo instructions are shown below.

Instruction	Rotation direction of servo motor	Controllable angle of arc
INH A Auxiliary point- specified helical interpolation	Clockwise (CW)/ Counter clockwise (CCW)	0° < θ ≤ 360°

- (1) The setting range of end point relative address for the both of circular interpolation axis and linear interpolation axis is 0 to \pm (2³¹-1).
- (2) The setting range of auxiliary point relative is 0 to \pm (2³¹-1).

(3) The maximum arc radius on the circular interpolation plane is $(2^{31}-1)$. For example, the maximum arc radius for electronic gear 1:1 of unit [mm] is $214748364.7[\mu m]$.

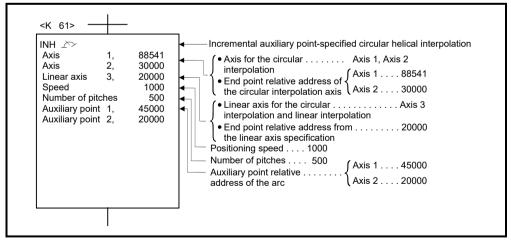


- (4) Set the command speed with the vector speed for 2 axes circular interpolation axis.
- (5) The command speed unit is specified in the parameter block.
- (6) Set the number of pitches within the range of 0 to 999. If it is set outside the setting range, the servo program setting error (error code: 28) occurs and operation does not start.
- (7) All of the circular interpolation axis, linear axis end point address, command speed, radius (2 word data above), and number of pitches (1 word data) are set indirectly by the word devices.

[Program]

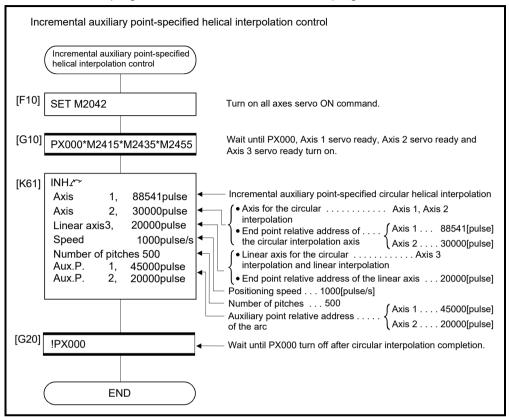
(1) Servo program

Servo program No.61 for incremental auxiliary point-specified helical interpolation control is shown below.



(Note): Example of the Motion SFC program for positioning control is shown next page.

(2) Motion SFC program



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

6.10 1 Axis Fixed-Pitch Feed Control

Positioning control for specified axis of specified travel value from the current stop point.

Fixed-pitch feed control uses the FEED-1servo instruction.

										Iter	ns s	et us	sing	MT I	Deve	elope	er2								
					Co	mm	on				Arc					Para	met	er b	ock				Oth	ers	
Servo instruction	Positioning method	Number of control axes	Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Interpolation control unit	Speed limit value	Acceleration time	Deceleration time	Rapid Stop deceleration time	Torque limit value	Deceleration processing on stop input	Allowable error range for circular interpolation	S-curve ratio	Advanced S-curve acceleration/deceleration	Cancel	WAIT-ON/OFF	Speed change
FEED-1	Incremental	1	Δ	0	0	0	Δ	Δ						Δ	\triangle	Δ	Δ	\triangle	Δ		Δ	Δ	Δ		Valid

): Must be set∆: Set if required

[Control details]

- (1) Positioning control for the specified travel value from the current stop position "0" is executed.
- (2) The travel direction is set by the sign (+/-) of the travel value, as follows:
 - Positive travel valuePositioning control to forward direction (Address increase direction)
 - Negative travel value......Positioning control to reverse direction (Address decrease direction)

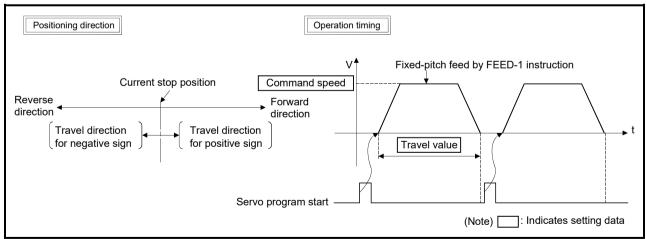


Fig.6.23 1 axis fixed-pitch feed control

POINT

Do not set the travel value to "0" for fixed-pitch feed control.

If the travel value is set to "0", fixed-pitch feed completion without fixed-pitch feed.

[Cautions]

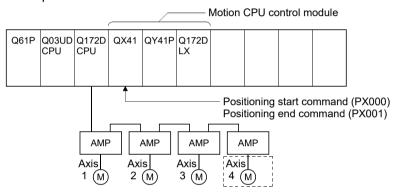
(1) The feed current value is changed to "0" at the start. When fixed-pitch feed control is executed in the absolute position system, the feed current value that is restored when the control circuit power supply of the servo amplifier or the Multiple CPU system power supply is turned ON again, may be different from the feed current value before the power supply was turned ON again.

[Program]

Program for repetition 1 axis fixed-pitch feed control is shown as the following conditions.

(1) System configuration

Fixed-pitch feed control of Axis 4.



(2) Fixed-pitch feed control conditions

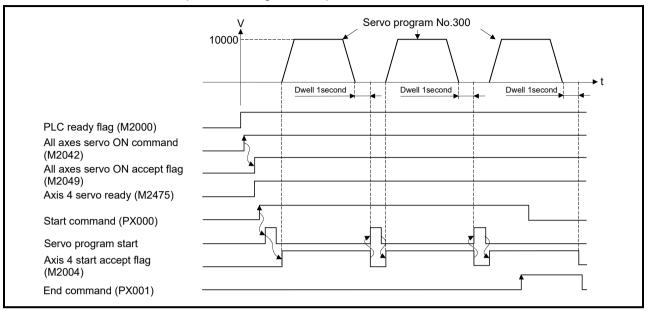
(a) Positioning conditions are shown below.

Item	Setting
Servo program No.	No.300
Control axis	Axis 4
Control speed	10000
Travel value	80000

- (b) Fixed-pitch feed control start command PX000 Leading edge (OFF \rightarrow ON)
- (c) Fixed-pitch feed control end command PX001 Leading edge $(OFF \rightarrow ON)$

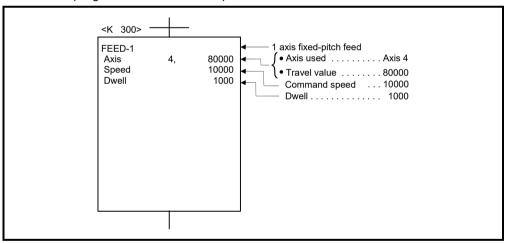
(3) Operation timing

Operation timing for fixed-pitch feed control is shown below.



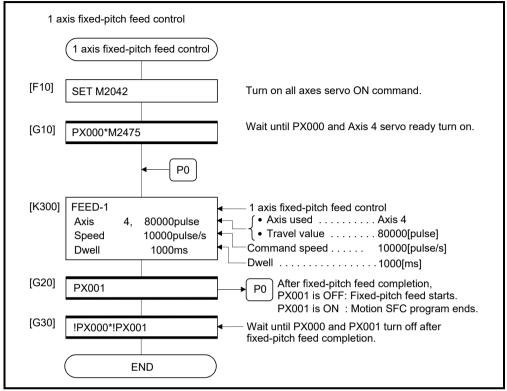
(4) Servo program

Servo program No.300 for fixed-pitch feed control is shown below.



(Note): Example of the Motion SFC program for positioning control is shown next page.

(5) Motion SFC program



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

6.11 Fixed-Pitch Feed Control Using 2 Axes Linear Interpolation

Fixed-pitch feed control using 2 axes linear interpolation from the current stop position with the specified 2 axes.

Fixed-pitch feed control using 2 axes linear interpolation uses the FEED-2 servo instruction.

										Iter	ns s	et us	sing	MT I	Deve	elope	er2								
					Co	mm	on				Arc					Para	amet	er bl	lock				Others		
Servo instruction	Positioning method	Number of control axes	Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Interpolation control unit	Speed limit value	Acceleration time	Deceleration time	Rapid Stop deceleration time	Torque limit value	Deceleration processing on stop input	Allowable error range for circular interpolation	S-curve ratio	Advanced S-curve acceleration/deceleration	Cancel	WAIT-ON/OFF	Speed change
FEED-2	Incremental	2	Δ	0	0	0	\triangle	Δ					\triangle	Δ	Δ	\triangle	Δ	\triangle	\triangle		Δ	Δ	Δ		Valid

○: Must be set

△: Set if required

[Control details]

- (1) Positioning control from the current stop position "0" to the position which combined travel direction and travel value specified with each axis is executed.
- (2) The travel direction for each axis is set by the sign (+/-) of the travel value for each axis, as follows:
 - Positive travel valuePositioning control to forward direction (Address increase direction)
 - Negative travel value......Positioning control to reverse direction (Address decrease direction)

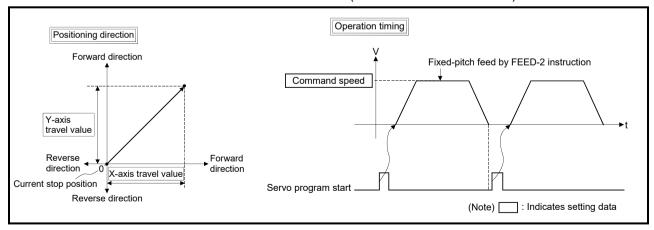


Fig.6.24 Fixed-pitch feed control using 2 axes linear interpolation

POINT

Do not set the travel value to "0" for fixed-pitch feed control.

The following results if the travel value is set to "0":

(1) If the travel value of both is set to "0", fixed-pitch feed completion without fixed-pitch feed.

[Cautions]

(1) The feed current value is changed to "0" at the start.

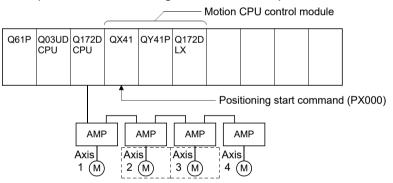
When fixed-pitch feed control is executed in the absolute position system, the feed current value that is restored when the control circuit power supply of the servo amplifier or the Multiple CPU system power supply is turned ON again, may be different from the feed current value before the power supply was turned ON again.

[Program]

Program for fixed-pitch feed control using 2 axes linear interpolation is shown as the following conditions.

(1) System configuration

Fixed-pitch feed control using 2 axes linear interpolation of Axis 2 and Axis 3.



(2) Fixed-pitch feed control

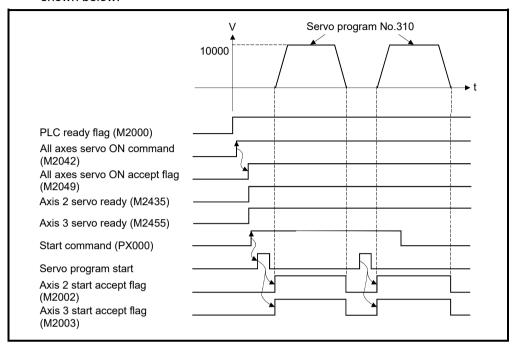
(a) Fixed-pitch feed control conditions are shown below.

Item	Setting								
Servo program No.	No.310								
Positioning speed	100	000							
Control axis	Axis 2	Axis 3							
Travel value	500000	300000							

(b) Fixed-pitch feed control start command PX000 Leading edge $(\mathsf{OFF} \to \mathsf{ON})$

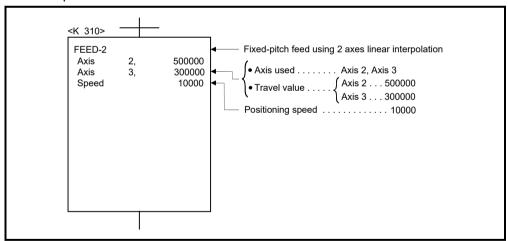
(3) Operation timing

Operation timing for fixed-pitch feed control using 2 axes linear interpolation is shown below.



(4) Servo program

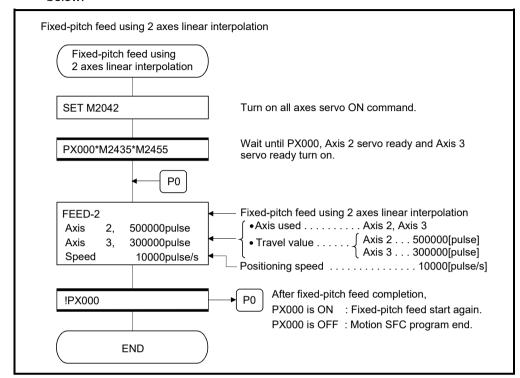
Servo program No.310 for fixed-pitch feed control using 2 axes linear interpolation is shown below.



(Note): Example of the Motion SFC program for positioning control is shown next page.

(5) Motion SFC program

Motion SFC program for which executes the speed-switching control is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

6.12 Fixed-Pitch Feed Control Using 3 Axes Linear Interpolation

Fixed-pitch feed control using 3 axes linear interpolation from the current stop position with the specified 3 axes.

Fixed-pitch feed control using 3 axes linear interpolation uses the FEED-3 servo instruction.

										Iter	ns s	et us	sing	MT I	Dev	elope	er2								
					Co	mm	on				Arc					Para	amet	er b	lock				Oth	ers	
Servo instruction	Positioning method	Number of control axes	Parameter block No.	Axis	Address/travel value	Command speed		M-code	Torque limit value	Auxiliary point	Radius	Central point	Interpolation control unit	Speed limit value	Acceleration time	Deceleration time	Rapid Stop deceleration time	Torque limit value	Deceleration processing on stop input	Allowable error range for circular interpolation	S-curve ratio	Advanced S-curve acceleration/deceleration	Cancel	WAIT-ON/OFF	Speed change
FEED-3	Incremental	2	Δ	0	0	0	Δ	\triangle					Δ	\triangle	Δ	Δ	\triangle	\triangle	Δ		\triangle		Δ		Valid

○: Must be set

[Control details]

- (1) Positioning control from the current stop position "0" to the position which combined travel direction and travel value specified with each axis is executed.
- (2) The travel direction for each axis is set by the sign (+/-) of the travel value for each axis, as follows:
 - Positive travel valuePositioning control to forward direction (Address increase direction)
 - Negative travel value......Positioning control to reverse direction (Address decrease direction)

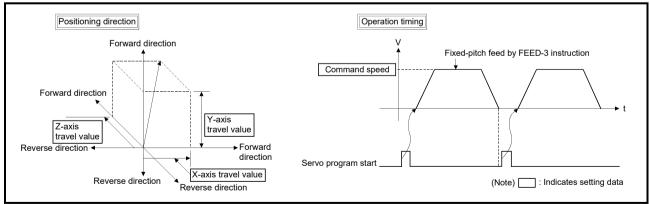


Fig. 6.25 Fixed-pitch feed control using 3 axes linear interpolation

POINT

Do not set the travel value to "0" for fixed-pitch feed control.

The following results if the travel value is set to "0":

(1) If the travel value of all axes are set to "0", fixed-pitch feed completion without fixed-pitch feed.

[Cautions]

(1) The feed current value is changed to "0" at the start.

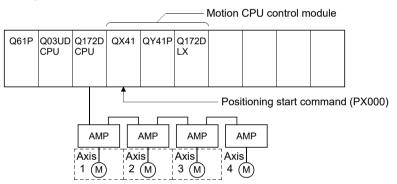
When fixed-pitch feed control is executed in the absolute position system, the feed current value that is restored when the control circuit power supply of the servo amplifier or the Multiple CPU system power supply is turned ON again, may be different from the feed current value before the power supply was turned ON again.

[Program]

Program for fixed-pitch feed control using 3 axes linear interpolation is shown as the following conditions.

(1) System configuration

Fixed-pitch feed control using 3 axes linear interpolation of Axis 1, Axis 2 and Axis 3.



(2) Fixed-pitch feed control

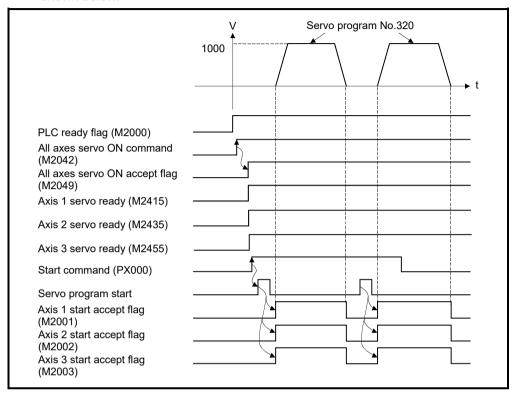
(a) Fixed-pitch feed control conditions are shown below.

Item		Setting	
Servo program No.		No.320	
Positioning speed		1000	
Control axes	Axis 1	Axis 2	Axis 3
Travel value	50000	40000	30000

(b) Fixed-pitch feed control start command PX000 Leading edge $(\mathsf{OFF} \to \mathsf{ON})$

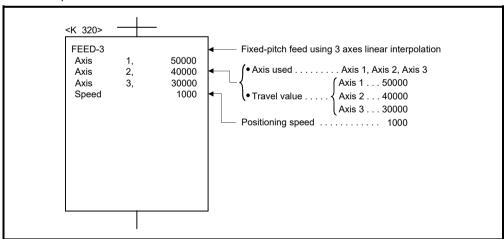
(3) Operation timing

Operation timing for fixed-pitch feed control using 3 axes linear interpolation is shown below.



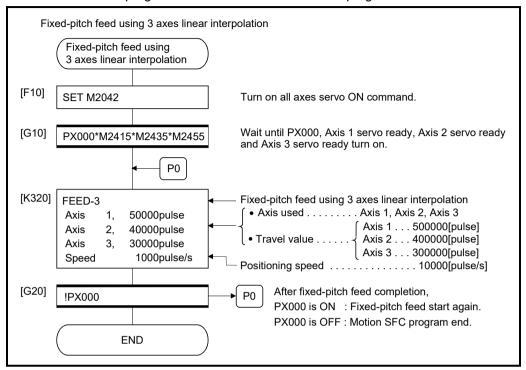
(4) Servo program

Servo program No.320 for fixed-pitch feed control using 3 axes linear interpolation is shown below.



(Note): Example of the Motion SFC program for positioning control is shown next page.

(5) Motion SFC program



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

6.13 Speed Control (I)

- (1) Speed control for the specified axis is executed.
- (2) Control includes positioning loops for control of servo amplifiers.

POINT

Refer to Section 7.7 for performing speed control that does not include positioning loops without using the servo program. QDS

(3) Speed control (I) uses the VF (Forward) and VR (Reverse) servo instructions.

												_					_							1	
							Common						using MT Developer2 Parameter block Others										ers		
Servo instruction	Positioning method	Number of control axes	Parameter block No.	Axis	Address/travel value	Command speed		M-code	Torque limit value	Auxiliary point	Radius Sadius Sa	Central point	Interpolation control unit	Speed limit value	Acceleration time	Deceleration time	Rapid Stop deceleration time	Torque limit value	essing on stop input	Allowable error range for circular interpolation	S-curve ratio	Advanced S-curve acceleration/deceleration		WAIT-ON/OFF	Speed change
VF VR	_	1	Δ	0		0		Δ						Δ	Δ	Δ	Δ	Δ	Δ		Δ	Δ	Δ		Valid

○: Must be set

△: Set if required

[Control details]

- (1) Controls the axis at the specified speed until the input of the stop command after starting of the servo motors.
 - VFForward direction start
 - VRReverse direction start
- (2) The operation of the current value is as follows.
 - (a) Q173DSCPU/Q172DSCPU 🐠

The operation is as follows depending on the status of the feed current value update command (M3212+20n).

- ON The feed current value is updated. The software stroke limit is valid.
- OFF "0" is stored in the feed current value.

(Note): When the operating system software is 00A, the operation is same as (b).

Ver.!): Refer to Section 1.3 for the software version that supports this function.

(b) Q173DCPU(-S1)/Q172DCPU(-S1) Current value does not change at "0".

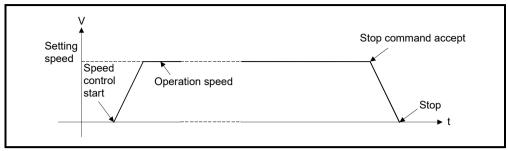


Fig.6.26 Speed control (I)

(3) Stop commands and stop processing

The stop commands and stop processing for speed control are shown in the table.6.1.

Table.6.1 Stop commands and stop processing

Stop command	Stop condition	Stop axis	Stop processing						
STOP signal input of the Q172DLX (STOP)			Deceleration stop based on the parameter block or the "deceleration time on STOP input" specified with the servo instruction.						
Stop command (M3200+20n)	OFF → ON	Specified axis	Deceleration stop based on the parameter block or the "deceleration time" specified with the servo instruction.						
Rapid stop command ^(Note) (M3201+20n)			Deceleration stop based on the parameter block or the "rapid stop deceleration time" specified with the servo instruction.						
Rapid stop of the all axes/ deceleration stop from MT Developer2. (Note) (Test mode)	Click icon	All axes	Deceleration stop based on the parameter block or the "rapid stop deceleration time" specified with the servo instruction.						
Speed change to speed "0"	Speed change request	Specified axis	Deceleration stop based on the parameter block or the "deceleration time" specified with the servo instruction.						

POINT (Note): The rapid stop command and the rapid stop of the all axes from MT Developer2 are also valid during deceleration by the "STOP signal input of the Q172DLX" (STOP) or stop command (M3200+20n), and processing based on the "rapid stop deceleration time" parameter starts at the time the stop condition occurs. Speed limit value "STOP signal input of the Q172DLX" (STOP) or stop command Operation speed Rapid stop command or rapid stop of the all axes from the MT Developer2

[Cautions]

- (1) The operation for feed current value is as follows. When speed control (I) is executed in the absolute position system, the feed current value that is restored when the control circuit power supply of the servo amplifier or the Multiple CPU system power supply is turned ON again, may be different from the feed current value before the power supply was turned ON again.
 - (a) Q173DSCPU/Q172DSCPU When feed current value update command (M3212+20n) is OFF, the feed current value is changed to "0".
 - (b) Q173DCPU(-S1)/Q172DCPU(-S1)

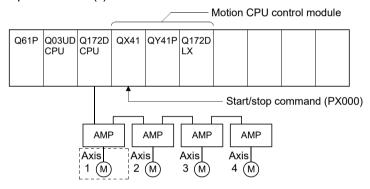
 The feed current value is changed to "0" at the start.
- (2) The dwell time cannot be set.

[Program]

Program for speed control (I) is shown as the following conditions.

(1) System configuration

Speed control (I) of Axis 1.



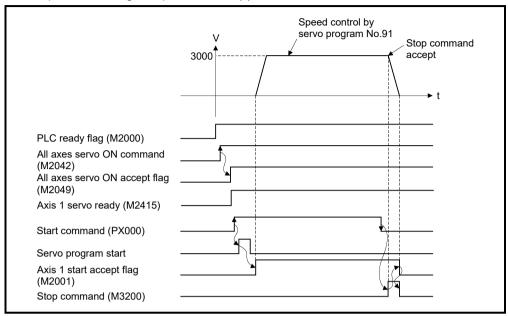
- (2) Speed control (I) conditions
 - (a) Speed control (I) conditions are shown below.

Item	Setting
Servo program No.	No.91
Control axis	Axis 1
Control speed	3000
Rotation direction	Forward

- (b) Speed control (I) start command....... PX000 Leading edge (OFF \rightarrow ON)
- (c) Stop command...... PX000 Trailing edge (ON \rightarrow OFF)

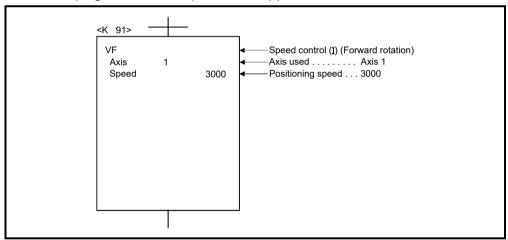
(3) Operation timing

Operation timing for speed control (I) is shown below.

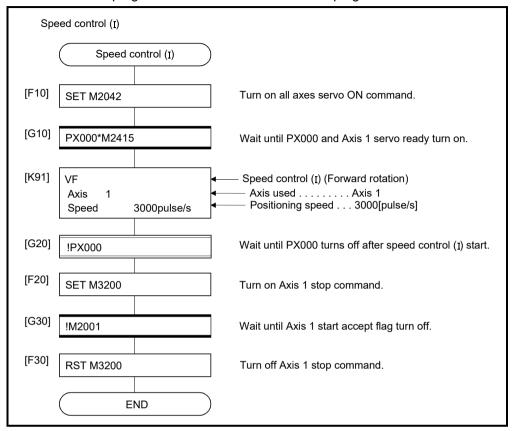


(4) Servo program

Servo program No.91 for speed control (I) is shown below.



(5) Motion SFC program



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

6.14 Speed Control (II)

- (1) Speed control for the specified axis is executed.
- (2) Speed control not includes positioning loops for control of servo amplifiers. It can be used for stopper control, etc. so that it may not become error excessive.

POINT

Refer to Section 7.7 for performing speed control that does not include positioning loops without using the servo program.

(3) Speed control (II) uses the VVF (Forward) and VVR (Reverse) servo instructions.

				Items set using MT Developer2																					
			Common								Arc			Parameter block Others									ers		
Servo instruction	Positioning method	Number of control axes	Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Interpolation control unit	Speed limit value	Acceleration time	Deceleration time	Rapid Stop deceleration time	Torque limit value	Deceleration processing on stop input	Allowable error range for circular interpolation	S-curve ratio	Advanced S-curve acceleration/deceleration	Cancel	WAIT-ON/OFF	Speed change
VVF	_	1	Δ	0		0		Δ	Δ					\triangle	\triangleright	Δ	\triangleright	\triangleright	\triangleright		\triangleright	Δ	Δ		Valid

 \bigcirc : Must be set

[Control details]

- (1) Controls the axis at the specified speed until the input of the stop command after starting of the servo motors.
 - VVF Forward direction start
 - VVR Reverse direction start
- (2) Current value or deviation counter do not change at "0".
- (3) When the setting for "torque" is set in the servo program and an indirect setting made, the torque limit value can be changed during operation by changing the value of the indirect device.
- (4) The stop command and stop processing are the same as for speed control (I).

[Cautions]

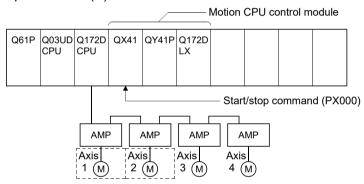
- (1) The feed current value is changed to "0" at the start. When speed control (II) is executed in the absolute position system, the feed current value that is restored when the control circuit power supply of the servo amplifier or the Multiple CPU system power supply is turned ON again, may be different from the feed current value before the power supply was turned ON again.
- (2) The dwell time cannot be set.
- (3) Even if the speed command is set as probe data by the digital oscilloscope function, the value on digital oscilloscope does not change with "0".

[Program]

Program for speed control (II) is shown as the following conditions.

(1) System configuration

Speed control (II) of Axis 3.



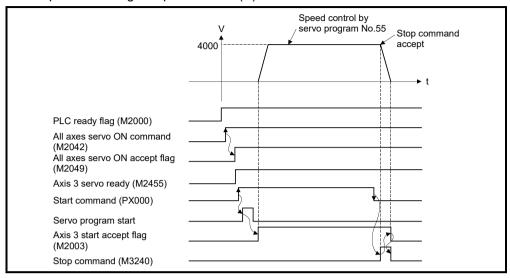
- (2) Speed control (II) conditions
 - (a) Speed control (II) conditions are shown below.

Item	Setting
Servo program No.	No.55
Control axis	Axis 3
Control speed	4000
Rotation direction	Forward

- (b) Speed control (II) start command PX000 Leading edge (OFF \rightarrow ON)
- (c) Stop command PX000 Trailing edge (ON \rightarrow OFF)

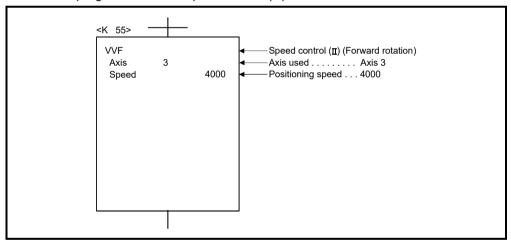
(3) Operation timing

Operation timing for speed control (II) is shown below.



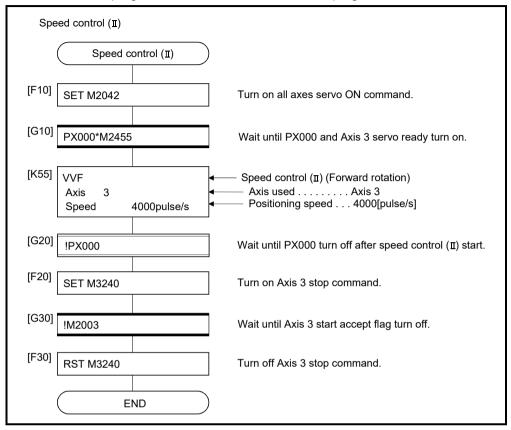
(4) Servo program

Servo program No.55 for speed control (II) is shown below.



(5) Motion SFC program

Motion SFC program for which executes the servo program is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

6.15 Speed-Position Switching Control

6.15.1 Speed-position switching control start

Speed-position switching control for specified axis is executed.

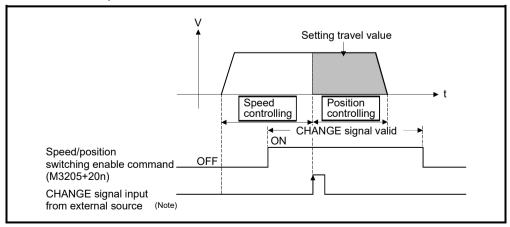
Speed-position switching control uses the VPF (Forward rotation), VPR (Reverse rotation) and VPSTART (Re-start) servo instructions.

										Iter	ns s	et us	sing	MT I	Deve	elope	er2								
					Co	mm	on				Arc					Para	amet	er b	lock				Oth	ers	
Servo instruction	Positioning method	Number of control axes	Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Interpolation control unit	Speed limit value	Acceleration time	Deceleration time	Rapid Stop deceleration time	Torque limit value	Deceleration processing on stop input	Allowable error range for circular interpolation	S-curve ratio	Advanced S-curve acceleration/deceleration	Cancel	WAIT-ON/OFF	Speed change
VPF	Ingramantal	4		0	0	0																			Valid
VPR	Incremental	ı)	0	0	\triangleleft	Δ	Δ					\triangle	Δ	Δ	Δ	Δ	Δ			\triangle	\triangle		Valid

): Must be set△: Set if required

[Control details]

- (1) The speed control (including positioning loops) is executed after the start of the servo motor, and changes from speed control to position control with the CHANGE (Speed/position switching) signal from external source, and then the specified positioning travel value is executed.
 - VPF...... Forward rotation direction (Address increase direction) start
 - · VPR..... Reverse rotation direction (Address decrease direction) start
- (2) The CHANGE signal from external source is effective during speed/position switching enable signal (M3205+20n) is on only. If M3205+20n turns on after the CHANGE signal turned on, it does not change from speed control to position control and speed control is continued.



REMARK

(Note): "The external CHANGE signal input from external source" is inputted to CHANGE of signal type set in speed/position switching signal from external source. When "normally open contact input" is set, CHANGE input occurs at the CHANGE signal on, and when "normally closed contact input" is set, CHANGE input occurs at the CHANGE signal off. (Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller User's Manual".) The signal types that can be used with speed/position switching signal are shown below.

Signal type	Q173DSCPU/ Q172DSCPU	Q173DCPU(-S1)/ Q172DCPU(-S1)
CHANGE signal of Q172DLX	0	0
External input signal (DOG) of servo amplifier (Note-1)	0	○ Ver.
Built-in interface in Motion CPU (DI)	0	×
Bit device	0	×

○: Usable, ×: Unusable

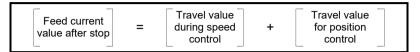
(Note-1): The variation for ON/OFF timing of the external input signal (DOG) of servo amplifier may occur according to the input filter setting value of external signal input setting. Review the input filter setting value compatible with the applications. Use the Q172DLX or built-in interface in Motion CPU (DI) to execute the high-accuracy control.

Ver.!): Refer to Section 1.3 for the software version that supports this function.

(3) Feed current value processing

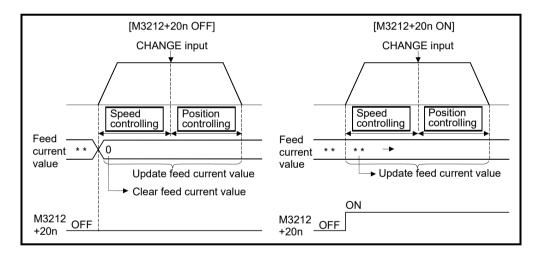
The feed current value is as follows by turning feed current value update command (M3212+20n) on/off at the speed-position switching control start.

- (a) M3212+20n OFF...... The feed current value is cleared to "0" at the start.
 - The feed current value is updated from the start (speed control).
 - The feed current value after stop is as follows:



- (b) M3212+20n ON...... The feed current value is not cleared at the start.
 - The feed current value is updated from the start (speed control).
 - The feed current value after stop is as follows:

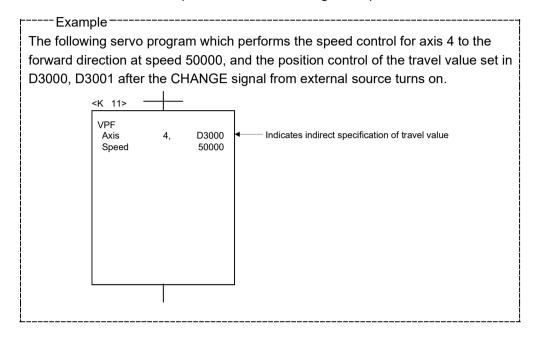




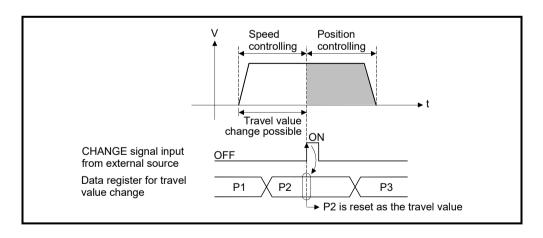
POINT

If it is started with M3212+20n on, leave M3212+20n on until positioning control is completed. If it is turns off during control, the feed current value cannot be guaranteed.

- (4) Change of the travel value during speed control The travel value for position control can be changed during speed control after speed-position switching control start.
 - (a) The travel value is set in indirect specification by optional device (2-word data) in the servo program. When a negative value is set in the travel value, a deceleration stop is made after switching to the position control.



(b) The travel value is stored in the data register for travel value change during speed control in the Motion SFC program. When the CHANGE signal turns on, the contents of the data register for travel value change are set as the travel value.



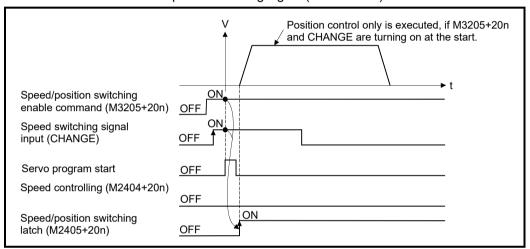
(5) Travel value area after proximity dog ON The travel value since the position mode was selected by the CHANGE signal input from external source is stored in the travel value after proximity dog ON storage register (D10+20n, D11+20n).

[Cautions]

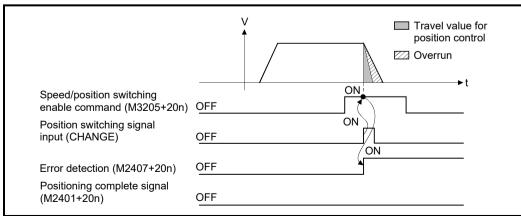
- (1) Item check at the CHANGE signal ON from external source When the external CHANGE signal turns on, speed control switches to position control if the following conditions are met:
 - · Start accept flag (M2001+n) is turning on.
 - · Speed control is executing after starting of the speed-position switching control.
 - · Speed/position switching enable command (M3205+20n) is turning on.

(2) No speed control

Position control only is executed if M3205+20n and CHANGE signal are turning on at the start. The speed controlling signal (M2404+20n) does not turn on.



- (3) "Travel value for position control" is less than "deceleration distance"
 - (a) The deceleration distance from the time when CHANGE is input is calculated based on the controlling speed, the real current value, and the deviation counter. When the travel value for position control is less than this deceleration distance, deceleration processing starts immediately when CHANGE is input.
 - (b) The difference between the deceleration distance and the travel value for position control is the overrun. At this time, the error detection signal (M2407+20n) turns on and minor error (error code: 209) is stored in the data register.
 - (c) The positioning complete signal (M2401+20n) does not turn on.



(4) Stroke limit check

Stroke limit range is not checked during the speed mode. If the travel value exceeds the stroke limit range, a minor error (error code: 210) occurs when position mode is selected, and performs a deceleration stop.

(5) When feed current value update command (M3212+20n) is OFF, the feed current value is changed to "0" at the start.

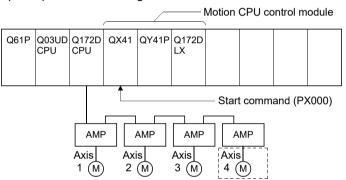
When speed-position switching control is executed in the absolute position system, the feed current value that is restored when the control circuit power supply of the servo amplifier or the Multiple CPU system power supply is turned ON again, may be different from the feed current value before the power supply was turned ON again.

[Program]

Program for speed-position switching control is shown as the following conditions.

(1) System configuration

Speed-position switching control of Axis 4.



(2) Positioning conditions

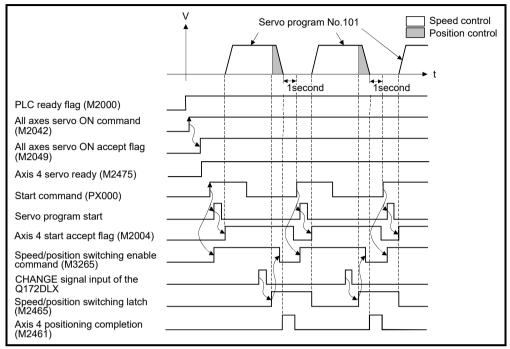
(a) Positioning conditions are shown below.

Item	Positioning conditions
Servo program No.	101
Control axis	Axis 4
Travel value for positioning control	40000
Command speed	1000

- (b) Positioning start command PX000 Leading edge
- (c) Speed/position switching enable command M3265

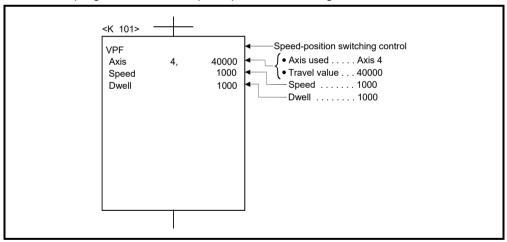
(3) Operation timing

Operation timing for speed-position switching control is shown below.



(4) Servo program

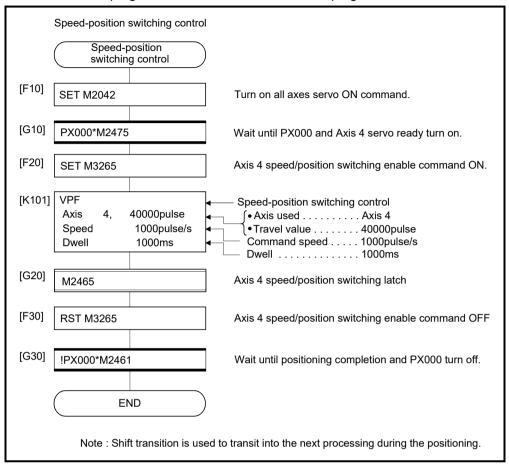
Servo program No.101 for speed-position switching control is shown below.



 $(\mbox{Note}) : \mbox{Example of the Motion SFC program for positioning control is shown next page}.$

(5) Motion SFC program

Motion SFC program for which executes the servo program is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

6.15.2 Re-starting after stop during control

Re-starting (continuing) after stop with stop command during speed-position switching control is executed.

Re-starting uses VPSTART servo instruction.

										Iter	ns s	et us	sing	МΤΙ	Deve	elope	er2									
					Co	omm	on				Arc					Para	amet	er bl	ock				Oth	ers		
Servo instruction	Positioning method	Number of control axes	Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Interpolation control unit	Speed limit value	Acceleration time	Deceleration time	Rapid Stop deceleration time	Torque limit value	Deceleration processing on stop input	Allowable error range for circular interpolation	S-curve ratio	Advanced S-curve acceleration/deceleration	Cancel	WAIT-ON/OFF	Speed change	
VPSTART	Incremental	1		0																			Δ		Valid	

○: Must be set

△: Set if required

[Control details]

- (1) The continuous control after stop during speed control is executed, after speed-position switching control start.
- (2) Re-starting using the VPSTART is effective by stop during speed control or position control.
 - (a) Re-starts with the speed control at the stop during speed control, then switches to position control by turning on the CHANGE signal. The control contents after re-starting are same as the speed-position switching control. Refer to Section 6.15.1.

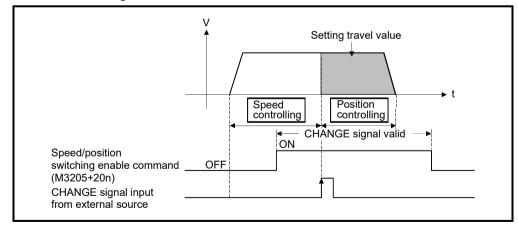
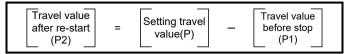


Fig. 6.27 Re-starting during speed control

(b) If the stop occurred during position control, re-start with position, and the positioning control of setting travel value.

The travel value after the re-start is calculated as follows:



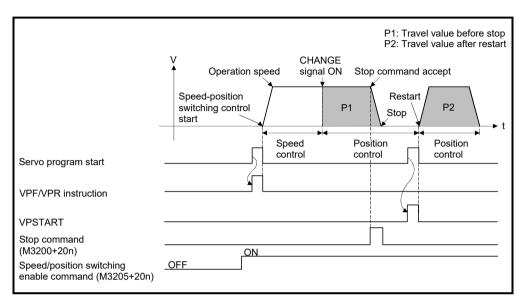


Fig.6.28 Re-starting during speed control

(3) It controls at the speed stored at the VPF/VPR instruction execution in the restarting.

Therefore, even if the speed change before stop during control, it becomes the speed at the VPF/VPR instruction execution.

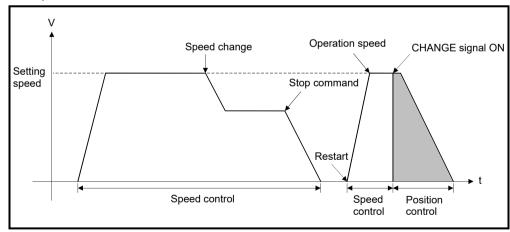


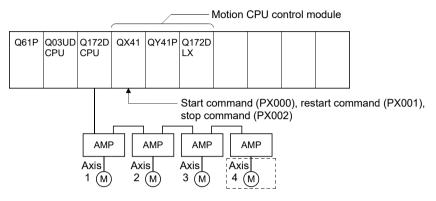
Fig.6.29 Re-starting after speed change

[Program]

Program for restarting after stop during control with the speed-position switching control is shown as the following conditions.

(1) System configuration

Speed-position switching control of Axis 4.



(2) Positioning conditions

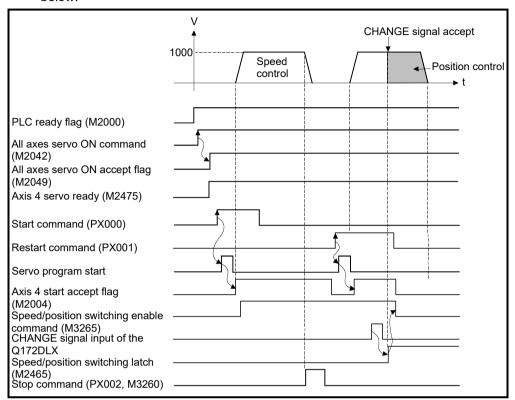
(a) Positioning conditions are shown below.

	Positioning	g conditions
Item	Speed-position switching control	Restart
Servo program No.	101	102
Control axis	Axis 4	Axis 4
Travel value for positioning control	40000	_
Command speed	1000	_

(b)	Positioning start command	PX000 Leading edge (OFF \rightarrow ON)
(c)	Speed/position switching enable command	M3265
(d)	Re-start command	. PX001 Leading edge (OFF → ON)
(e)	Stop command	PX002 Leading edge (OFF → ON)

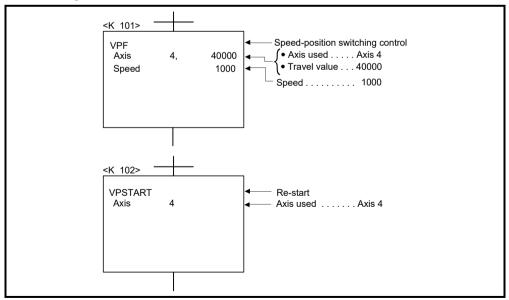
(3) Operation timing

Operation timing for speed-position switching control and re-starting are shown below.



(4) Servo program

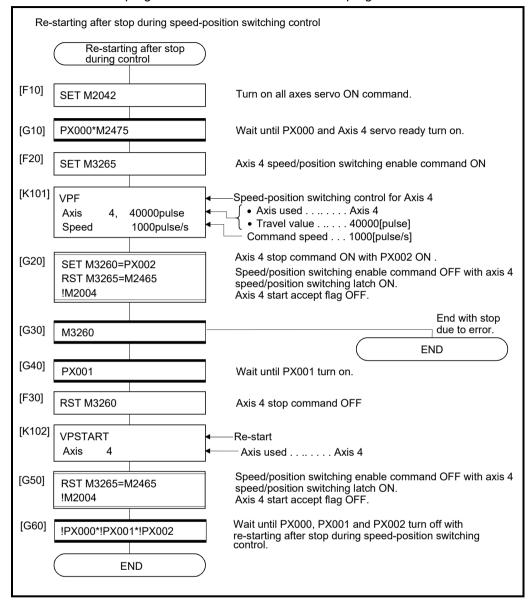
Servo program No.101 and No.2 for speed-position switching control and restarting are shown below.



(Note): Example of the Motion SFC program for positioning control is shown next page.

(5) Motion SFC program

Motion SFC program for which executes the servo program is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

6.16 Speed-Switching Control

- (1) Positioning control performs changing the speed on the point beforehand set by one start.
- (2) The speed-switching points and speed are set using the servo program.
- (3) Repetition control between any speed-switching points can be performed by using repetition instructions.
- (4) M-codes and torque limit values can be changed at each speed-switching point.

6.16.1 Speed-switching control start, speed-switching points and end specification

											Iter	ns s	et us	sing	MT	Deve	elope	er2								
						Co	omm	on				Arc					Para	amet	er b	lock				Oth	ers	
	ervo uction	Positioning method	Number of control axes	Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Interpolation control unit	Speed limit value	Acceleration time	Deceleration time	Rapid Stop deceleration time	Torque limit value	Deceleration processing on stop input	Allowable error range for circular interpolation	S-curve ratio	Advanced S-curve acceleration/deceleration	Cancel	WAIT-ON/OFF	Speed change
Start	VSTART			Δ										Δ	Δ	Δ	Δ	Δ	Δ	Δ		Δ	Δ	Δ		
End	VEND	_	_																							_
	ABS-1		1																							
End point address	ABS-2	Absolute data	2																							
	ABS-3		3				_																			N/ 15 1
Travel	INC-1		1		0	0	0	Δ	Δ	Δ														Δ		Valid
value to	INC-2	Incremental	2																							
end point	INC-3	_	3																							
Speed-	VABS	Absolute data							^	_																
Switching point	VINC	Incremental	_			0	0		Δ	Δ																_

○: Must be set

 \triangle : Set if required

[Control details]

Start and end of the speed-switching control

Speed-switching control is started and ended using the following instructions:

(1) VSTART

Starts the speed-switching control.

(2) VEND

Ends the speed-switching control.

Travel value setting to end address/end point

The travel value to end address/end point with the speed-switching control, positioning control method and positioning speed to the end point are set using the following instructions:

(1) ABS-1/INC-1

Set 1 axis linear positioning control.

The control contents are same as Section 6.2 "1 Axis Linear Positioning Control".

(2) ABS-2/INC-2

Set 2 axes linear interpolation control.

The control contents are same as Section 6.3 "2 Axes Linear Interpolation Control".

(3) ABS-3/INC-3

Set 3 axes linear interpolation control.

The control contents are same as Section 6.4 "3 Axes Linear Interpolation Control".

Speed-switching point setting

The address (travel value) of the speed-switching point and the positioning speed are set using the following instructions:

(1) VABS

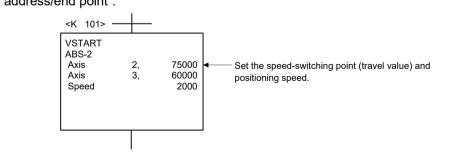
Set the speed-switching point using the absolute data method.

(2) VINC

Set the speed-switching point using the incremental data method.

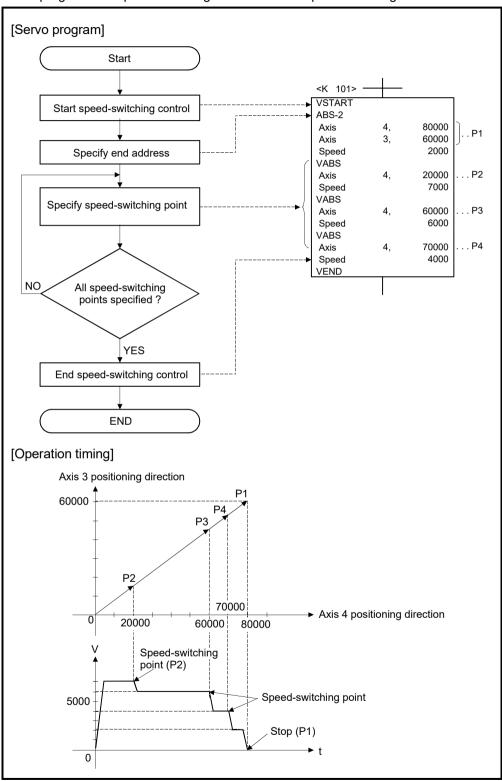
POINT

The axis which set the speed-switching point (travel value) and positioning speed by 2 or 3 axes linear interpolation control is first set in the "travel value to end address/end point".



Procedure of the servo program and operation timing

Servo programs for speed-switching control and the operation timing are shown below.



[Cautions]

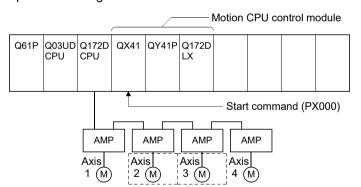
- (1) The number of control axes cannot be changed during control.
- (2) The speed-switching point can be specified the absolute data method (VABS□) and incremental data method (VINC□) by mixed use.
- (3) The speed-switching point cannot be specified an address which change in travel direction. If the travel direction change, the minor error (error code: 215) is stored in the minor error storage register (D6+20n) for each axis and the rapid stop is performed.
- (4) It checks whether to be the end address within the stroke limit range at the start. If it is positioning to outside the stroke limit range, the minor error (error code: 106) is stored in the minor error storage register (D6+20n) for each axis and operation does not start.
- (5) If the travel value between speed-switching points is so short and it shifts to the next speed-switching point during speed-switching control, the speed-switching does not perform.
- (6) The M-code from the previous point is retained in the point with which M-code is not specified.
- (7) Be sure to set the travel value between speed-switching points. (The torque limit value is not correctly set by restricting the internal control processing, and the servo errors might occur or a work might fall.)

[Program]

Program for speed-switching is shown as the following conditions.

(1) System configuration

Speed-switching control of Axis 2 and Axis 3.



(2) Positioning conditions

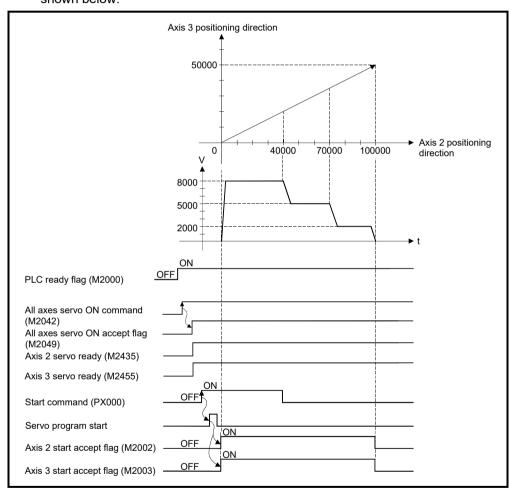
(a) Speed-switching control conditions are shown below.

Item	Set	ting
Servo program No.	50	00
Control axis	Axis 2	Axis 3
End address	100000	50000

(b) Speed-switching control start command PX000 Leading edge $(\mathsf{OFF} \to \mathsf{ON})$

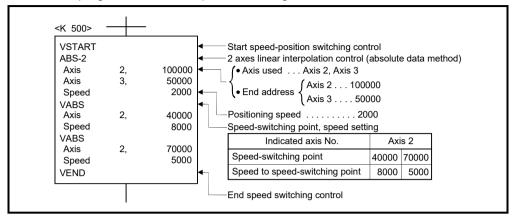
(3) Operation timing and speed-switching positions

Operation timing and speed-switching points for speed-switching control are shown below.



(4) Servo program

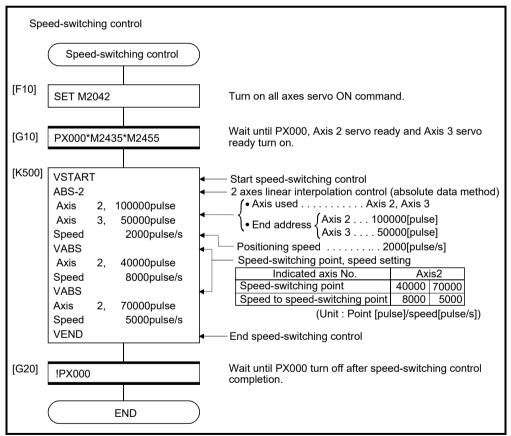
Servo program No.500 for speed-switching control is shown below.



(Note): Example of the Motion SFC program for positioning control is shown next page.

(5) Motion SFC program

Motion SFC program for which executes the speed-switching control is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

6.16.2 Specification of speed-switching points using repetition instructions

Repetition execution between any speed-switching points.

										ľ	tems	set	usir	ng M	T De	velc	per2	2								
					Co	mm	on				Arc						amet		ock				С	ther	s	
Servo instruction	Positioning method	Number of control axes	Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Interpolation control unit	Speed limit value	Acceleration time	Deceleration time	Rapid Stop deceleration time	Torque limit value	Deceleration processing on stop input	Allowable error range for circular interpolation	S-curve ratio	Advanced S-curve acceleration/deceleration	Repeated condition	Cancel	WAIT-ON/OFF	Speed change
FOR-TIMES																										
FOR-ON	_	_																					0			
FOR-OFF																										_
NEXT		_																								

): Must be set∆: Set if required

[Control details]

First repetition range setting

The first repetition range is set using the following instructions:

- (1) FOR-TIMES (number of loops setting)
 - (a) The repetition range set specified number of times is executed repeatedly.
 - (b) The setting range is 1 to 32767.

Outside the range of -32768 to 0 is controlled as a setting of "1".

- (c) The following devices can be used as the repetition number of times:
 - 1) Data register (D)
 - 2) Link register (W)
 - 3) Motion register (#)
 - 4) Multiple CPU area device(U□\G)
 - 5) Decimal constant (K)
 - 6) Hexadecimal constant (H)

≻ For indirect setting

(2) FOR-ON (loop-out trigger condition setting)

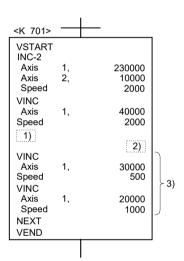
- (a) The repetition range set until the specified bit device turns on is executed repeatedly.
- (b) The following devices are used as the loop-out trigger condition:
 - 1) Input (X/PX)
 - 2) Output (Y/PY)
 - 3) Internal relay (M)
 - 4) Special relay (SM)
 - 5) Link relay (B)
 - 6) Annunciator (F)

(3) FOR-OFF (loop-out trigger condition setting)

- (a) The repetition range set until the specified bit device turns off is executed repeatedly.
- (b) The following devices are used as the loop-out trigger condition:
 - 1) Input (X/PX)
 - 2) Output (Y/PY)
 - 3) Internal relay (M)
 - 4) Special relay (SM)
 - 5) Link relay (B)
 - 6) Annunciator (F)

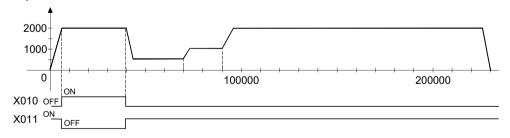
Operation of the repetition control using FOR-TIMES, FOR-ON, and FOR-OFF is shown below.

[Servo program]

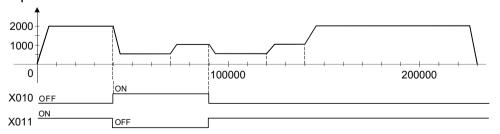


4)		2)	
1)	Condition 1	Condition 2	Condition 3
FOR-TIMES	K1	K2	K3
		$X010 \rightarrow ON$	$X010 \rightarrow ON$
FOR-ON	X010 → ON	during first	during third
FOR-ON	from start	execution of	execution of
		3)	3)
		X011 → OFF	X011 → OFF
FOR-OFF	$X011 \rightarrow OFF$	during first	during third
FUR-UFF	from start	execution of	execution of
		3)	3)

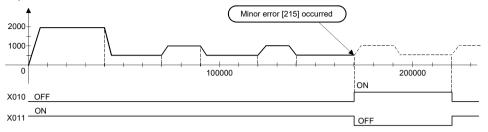
(1) Operation in condition 1



(2) Operation in condition 2



(3) Operation in condition 3



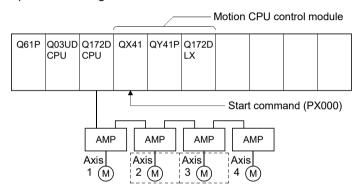
Error occurs because it exceeds the travel value to the stop position.

[Program]

Program for repetition speed-switching control is shown as the following conditions.

(1) System configuration

Speed-switching control of Axis 2 and Axis 3.



(2) Positioning conditions

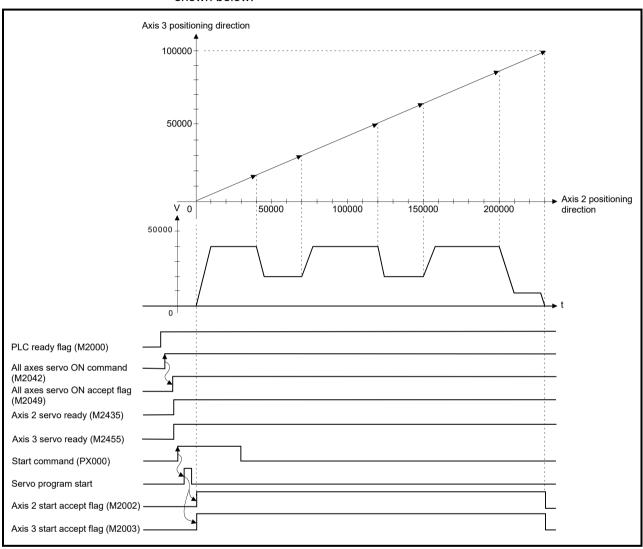
(a) Speed-switching control conditions are shown below.

Item	Set	ting
Servo program No.	50	01
Control axes	Axis 2	Axis 3
End address	230000	100000

(b) Speed-switching control start command PX000 Leading edge $(\mathsf{OFF} \to \mathsf{ON})$

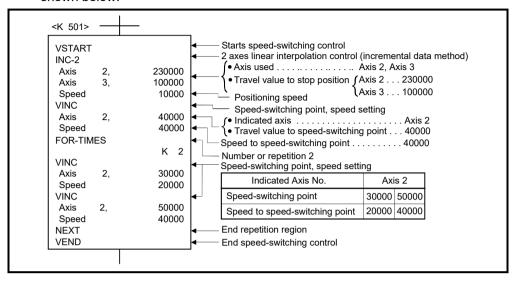
(3) Operation timing and speed-switching positions

Operation timing and speed-switching points for speed-switching control are shown below.



(4) Servo program

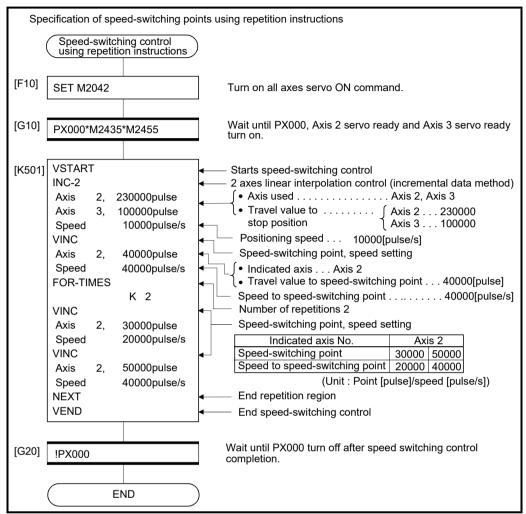
Servo program No. 501 for speed-switching control by the repetition instruction is shown below.



(Note): Example of the Motion SFC program for positioning control is shown next page.

(5) Motion SFC program

Motion SFC program for which executes speed-switching control using repetition instructions is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

6.17 Constant-Speed Control

- (1) Positioning to the pass point beforehand set by one starting is executed with the specified positioning method and positioning speed.
- (2) The positioning method and positioning speed can be changed for each pass point.
- (3) The following parameters is set in the servo program.
 - Pass point
 - Positioning method from any pass point to the next pass point.
 - · Positioning speed from any pass point to the next pass point.
- (4) Repetition control between any pass points can be performed by using repetition instructions.
- (5) M-codes and torque limit values can be changed at each speed-switching point.
- (6) 1 to 4 axes can be controlled.

[Procedure to write servo programs]

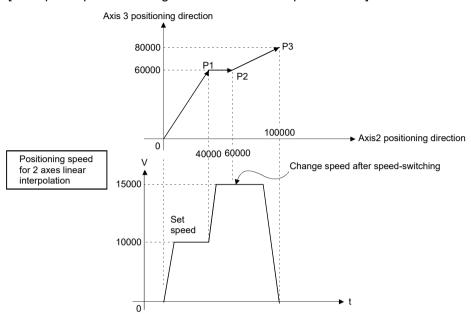
The method to write the servo programs for constant-speed control is shown below.

[Procedure] [Example: Servo program for 2 axes constant-speed control] Start <K Point Set the constant-speed control **CPSTART** Axis Axis Speed 10000 [pulse/s] Set each pass point ABS-2 40000 [pulse] Axis Set the positioning method Axis 60000 [pulse] ABS-2 Set the positioning address Axis 2, 60000 [pulse] (travel value) 60000 [pulse] Axis 3. [pulse/s] 15000 Speed Set the speed-switching ABS-2 Axis 2, 100000 [pulse] [pulse] Axis 80000 3, CPEND NO All pass points are set? YES End constant-speed control End

[Operation timing]

Operation timing for constant-speed control is shown below.

[Example : Operation timing for 2 axes constant-speed control]



[Caution]

- (1) The number of control axes cannot be changed during control.
- (2) The pass point can be specified the absolute data method (ABS□) and incremental method (INC□) by mixed use.
- (3) The pass point can also be specified an address which change in travel direction. The acceleration processing at a pass point is executed for 1 axis constant-speed. However, the acceleration/deceleration processing at a pass point is not executed for 2 to 4 axes constant-speed, so be careful of the servo error occurrence, etc.
- (4) When the FIN acceleration/deceleration is not set in the program with only one pass point, this operation is the same as PTP control.
- (5) Speed change is possible after the start.
 Note the following points at the speed change.
 - (a) The central point-specified circular interpolation is included the constantspeed control.

When the arc path calculated from the start address and central-point address is differ (within the allowable error range for circular interpolation) from the setting end address, if the speed is changed, error compensation (Refer to Section 4.3.4) may not function normally.

When the central point-specified circular interpolation as positioning method is used at the constant-speed control, set the start address, central point address and end address becomes arc correctly.

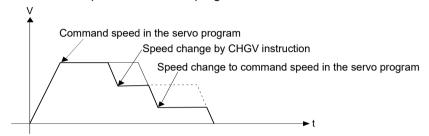
(b) The speed switching and change speed by CHGV instruction are executed toward the same program in the servo program.

The lower of the speed change by CHGV instructions and the command speed in the servo program is selected.

The speed change by CHGV instructions are executed if the speed is lower than the speed set in the servo program; otherwise the CHGV instructions are not executed.

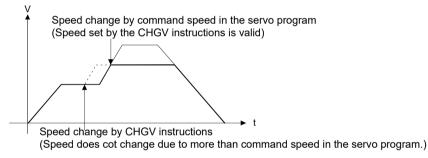
1) Change speed by CHGV instruction > command speed in the servo program

The command speed in the servo program is selected.



2) Change speed by CHGV instruction < command speed in the servo program

The change speed by CHGV instructions is effective.



- (6) An overrun occurs if the distance remaining to the final positioning point when the final positioning point is detected is less than the deceleration distance at the positioning speed after the start (command speed).
 - The minor error (error code: 211) is stored in the minor error storage register (D6+20n) for each axis.
- (7) If positioning to outside the stroke limit range is executed after the start, the minor error (error code: 106) is stored in the minor error storage register (D6+20n) for each axis and a deceleration stop is executed.

(8) The minimum travel value between constant-speed control pass points is shown below:

Command speed per second (control unit/s) × Main cycle [s] < Travel distance [control unit]

Positioning speed drops if the distance between pass points is short the minimum travel value.

Example) Main cycle: 20[ms], Command speed: 600[mm/min]

If the command speed (600[mm/min]) is divided by 60, the command speed per second is 10[mm/s], and the main cycle is 0.02[s].

Therefore, the travel distance is as follow.

 $10[mm/s] \times 0.02[s] = 0.2[mm]$

Set the travel distance to more than 0.2[mm].

6.17.1 Specification of pass points by repetition instructions

This section describes the method of the pass points for which executes between any pass points repeatedly.

										I	tems	set	usir	ng M	T De	evelo	per2	2								
					Co	mm	on				Arc					Para	ame	er b	lock				С	ther	S	
Servo instruction	Positioning method	Number of control axes	Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Interpolation control unit	Speed limit value	Acceleration time	Deceleration time	Rapid Stop deceleration time	Torque limit value	Deceleration processing on stop input	Allowable error range for circular interpolation	S-curve ratio	Advanced S-curve acceleration/deceleration	Repeated condition	Cancel	WAIT-ON/OFF	Speed change
FOR-ON		_																					0			
FOR-OFF)			_
NEXT	_	_																								

): Must be set∆: Set if required

[Control details]

Setting the first of repetition range

The first of repetition range is set by the following instructions:

- (1) FOR-TIMES (number of loops setting)
 - (a) The repetition range set specified number of times is executed repeatedly.
 - (b) The setting range is 1 to 32767.

Outside the range of -32768 to 0 is controlled as a setting of "1".

(c) The following devices can be used as the repetition number of times:

- 1) Data register (D)
 2) Link register (W)
 3) Motion register (#)
 4) Multiple CPU area device (U□\G)
 For indirect setting
- 5) Decimal constant (K)
- 6) Hexadecimal constant (H)

(2) FOR-ON (Loop-out trigger condition setting)

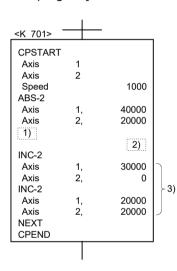
- (a) The repetition range set until the specified bit device turns on is executed repeatedly.
- (b) The following devices are used as the loop-out trigger condition:
 - 1) Input (X/PX)
 - 2) Output (Y/PY)
 - 3) Internal relay (M)
 - 4) Special relay (SM)
 - 5) Link relay (B)
 - 6) Annunciator (F)

(3) FOR-OFF (loop-out trigger condition setting)

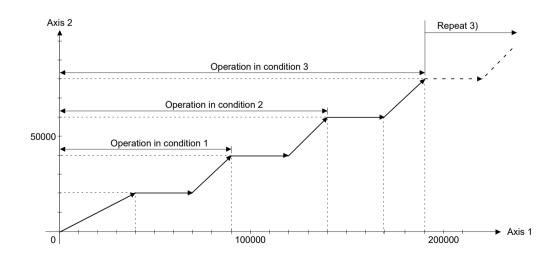
- (a) The repetition range set until the specified bit device turns off is executed repeatedly.
- (b) The following devices are used as the loop-out trigger condition:
 - 1) Input (X/PX)
 - 2) Output (Y/PY)
 - 3) Internal relay (M)
 - 4) Special relay (SM)
 - 5) Link relay (B)
 - 6) Annunciator (F)

The repetition control operation using FOR-TIMES, FOR-ON and FOR-OFF is shown below.

[Servo program]



1)	2)		
	Condition 1	Condition 2	Condition 3
FOR-TIMES	K1	K2	K3
FOR-ON	X010 → ON during first positioning 3)	X010 → ON during second positioning 3)	X010 → ON during third positioning 3)
FOR-OFF	X011 → OFF during first positioning 3)	X011 → OFF during second positioning 3)	X011 → OFF during third positioning 3)



[Caution]

(1) During a FOR-ON loop, or a FOR-OFF loop, if the travel value of the specified pass point is smaller than the travel value of one operation cycle shown below, it will not loop-out even when trigger conditions are satisfied.

To perform a loop-out, make the travel value of the pass point larger than the travel value of one operation cycle, or set a smaller speed command.

The travel value for which positioning is completed in one operation cycle is shown below.

 Command speed: 100.00[mm/min], Operation cycle: 0.44[ms]
$$\frac{100}{6} [mm/s] \times 0.44[ms] = 0.74[\mu m]$$

If the travel value of the pass point exceeds $0.74 [\mu m]$, it will loop-out normally.

(2) During a FOR-ON loop, or a FOR-OFF loop, if the time from satisfaction of trigger conditions until reaching end point of the loop is shorter than the indicated time below, positioning operations are not normal. Set the trigger conditions so that the time from satisfaction of trigger conditions until reaching end point of the loop is longer than the indicated time below.

Time required from satisfaction of trigger conditions until reaching end point of the loop = Main cycle + Time required for deceleration stop

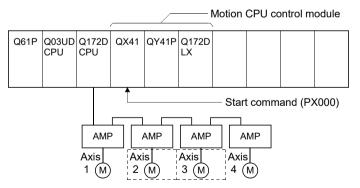
(3) When the last positioning address is detected and the deceleration distance is not enough for the output speed, an overrun, and a minor error (error code:211) occur. However, a minor error does not occur if a movement amount of 0 is the last point.

[Program]

Program for repetition constant-speed control is shown as the following conditions.

(1) System configuration

Constant-speed control for Axis 2 and Axis 3.



(2) Positioning conditions

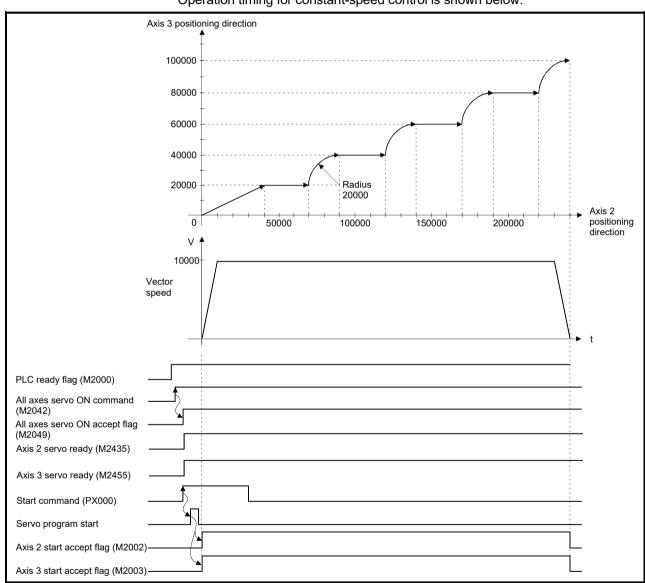
(a) Constant-speed control conditions are shown below.

Item	Setting	
Servo program No.	510	
Control axis	Axis 2, Axis 3	
Positioning speed	10000	

(b) Constant-speed control start command PX000 Leading edge $(\mathsf{OFF} \to \mathsf{ON})$

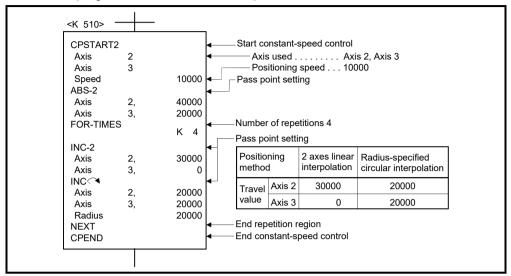
(3) Operation timing

Operation timing for constant-speed control is shown below.



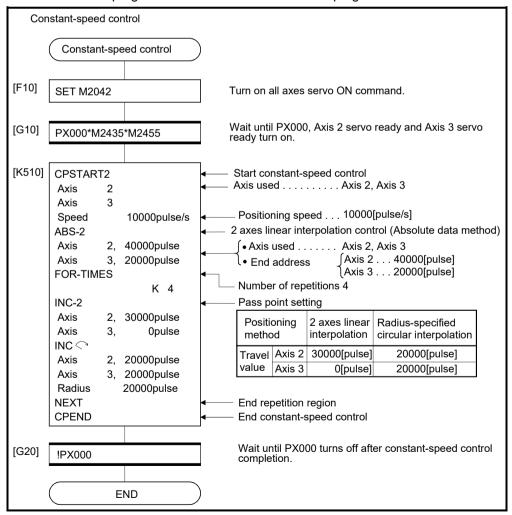
(4) Servo program

Servo program No.510 for constant-speed control is shown below.



(5) Motion SFC program

Motion SFC program for which executes the servo program is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

6.17.2 Speed-switching by instruction execution

The speed can be specified for each pass point during the constant-speed control instruction.

The speed change from a point can be specified directly or indirectly in the servo program.

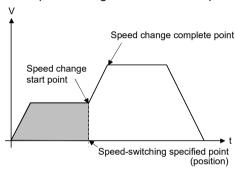
[Cautions]

- (1) The speed switching during servo instruction is possible at the constant-speed control for 1 to 4 axes.
- (2) The speed command can be set for point.
- (3) By turning on the speed-switching point specified flag (M2040) before the start, the point which completes speed change can be specified.

The speed change timing at the flag ON/OFF.

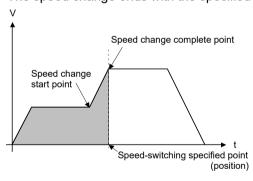
(a) M2040 is OFF

The speed change starts with the specified speed-switching point.



(b) M2040 is ON

The speed change ends with the specified speed-switching point.

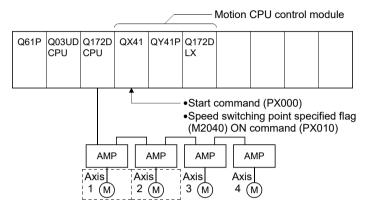


[Program]

Program for which executes the speed-switching control by turning on M2040 during constant-speed instruction is shown as the following conditions.

(1) System configuration

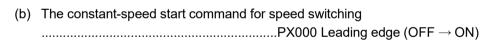
Switches speed for Axis 1 and Axis 2.



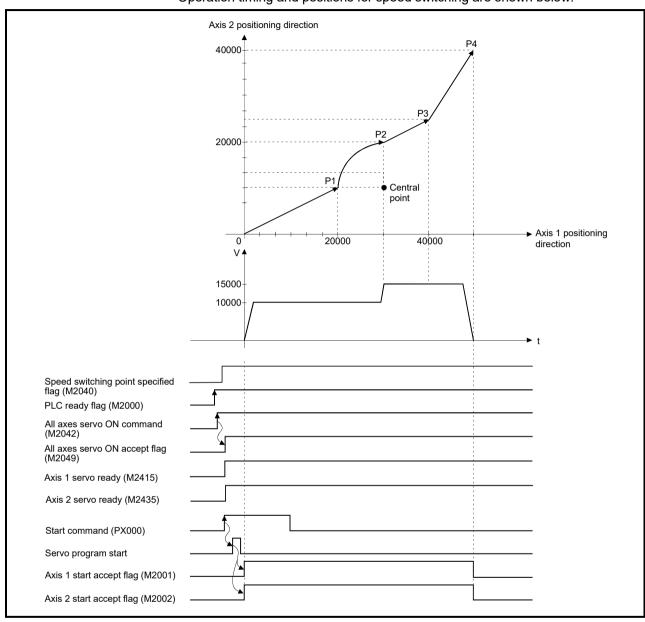
(2) Positioning conditions

(a) Speed switching conditions are shown below.

Item			Setti	ng	
Servo program	n No.		310)	
Positioning spe	eed	100	000	150	000
Positioning me	ethod	2 axes linear interpolation	Central point- specified circular interpolation	2 axes linear interpolation	2 axes linear interpolation
D : 1	Axis 1	20000	30000	40000	50000
Pass point	Axis 2	10000	20000	25000	40000

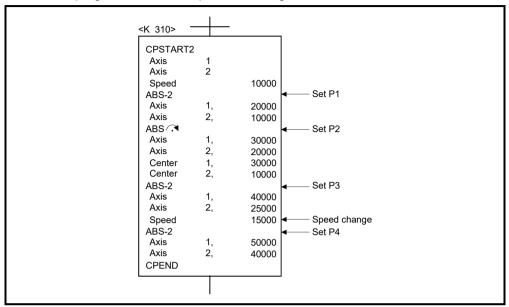


(3) Operation timing and speed-switching positions Operation timing and positions for speed switching are shown below.



(4) Servo program

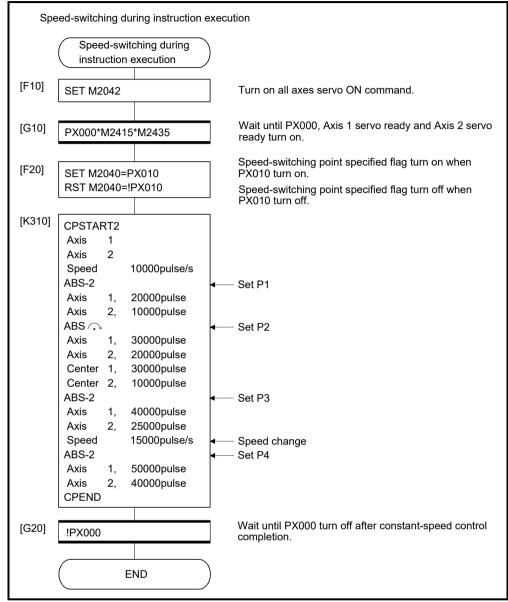
Servo program No.310 for speed-switching is shown below.



(Note): Example of the Motion SFC program for positioning control is shown next page.

(5) Motion SFC program

Motion SFC program for which executes the servo program is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

6.17.3 1 axis constant-speed control

Constant-speed control for 1 axis.

												ľ	tems	set	usin	g M	T De	evelo	per:	2									
					1	Co	mm	on	1	1		Arc	1				Para	ame	er b	lock	1				0	ther	s		
	Servo struction	Positioning method	Number of control axes	Parameter block No.	Axis	Address/travel value	Command speed		M-code	Torque limit value	Auxiliary point	Radius	Central point	Interpolation control unit	Speed limit value	Acceleration time	Deceleration time	Rapid Stop deceleration time	Torque limit value	Deceleration processing on stop input	Allowable error range for circular interpolation	S-curve ratio	Advanced S-curve acceleration/deceleration	Commanded speed (Constant)	Cancel	Skip	FIN acceleration/deceleration	WAIT-ON/OFF	Speed change
Start	CPSTART1	_	1	Δ	0		0								\triangle	\triangle	Δ	Δ	Δ	Δ		Δ	Δ		\triangle		Δ		
End	CPEND	_	_					Δ																					.,
Pass	ABS-1	Absolute data	1		0	0			Δ	Δ														Δ		Δ		Δ	Valid
point	INC-1	Incremental	1		0	0			Δ	Δ														Δ		Δ		Δ	

: Must be set

[Control details]

Start and end for 1 axis constant-speed control

1 axis constant-speed control is started and ended by the following instructions:

(1) CPSTART1 Ver.

Starts the 1 axis constant-speed control. Sets the axis No. and command speed.

(2) CPEND

Ends the 1 axis constant-speed control for CPSTART1.

Positioning control method to the pass point

The positioning control to change control is specified with the following instructions:

(1) ABS-1/INC-1

Sets the 1 axis linear positioning control.

Refer to Section 6.2 "1 Axis Linear Positioning Control" for details.

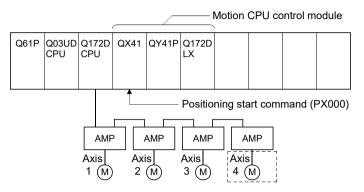
Ver.!: Refer to Section 1.3 for the software version that supports the advanced S-curve acceleration/deceleration in constant-speed (CPSTART).

[Program]

Program for repetition 1 axis constant-speed control is shown as the following conditions.

(1) System configuration

Axis 4 constant-speed control.



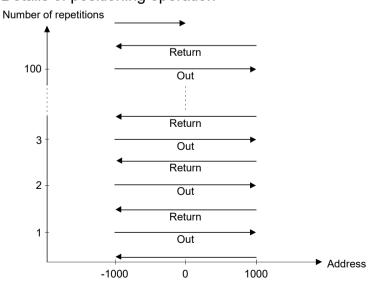
(2) Positioning conditions

(a) Constant-speed control conditions are shown below.

Item		Setting
Servo program No		500
Control axis		Axis 4
Positioning speed		10000
Number of repetition	ons	100
	P1	-1000
Pass point	P2	2000
travel value	P3	-2000
	P4	1000

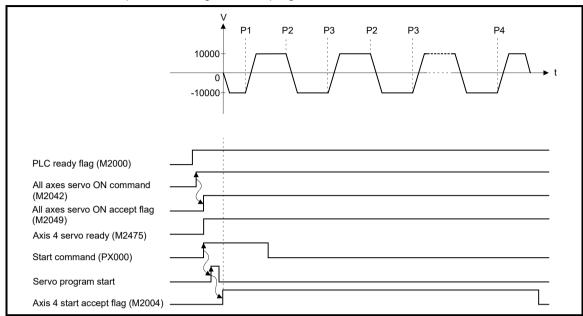
(b) Constant-speed control start command PX000 Leading edge $(\mathsf{OFF} \to \mathsf{ON})$

(3) Details of positioning operation



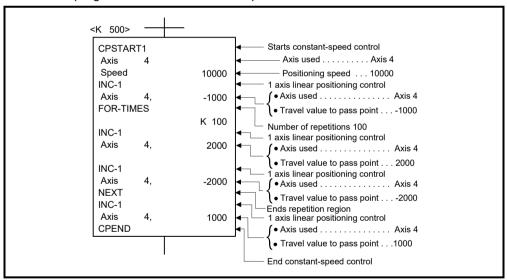
(4) Operation timing

Operation timing for servo program No.500 is shown below.



(5) Servo program

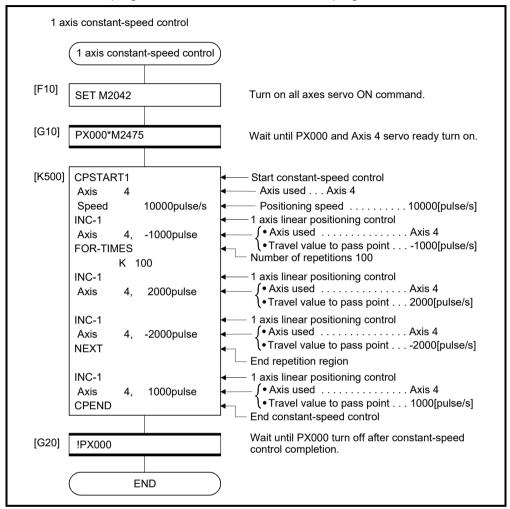
Servo program No.500 for constant-speed control is shown below.



(Note): Example of the Motion SFC program for positioning control is shown next page.

(6) Motion SFC program

Motion SFC program for which executes the servo program is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

6.17.4 2 to 4 axes constant-speed control

Constant-speed control for 2 to 4 axes.

			Constant	Ĺ											usir	ng M	T De	evelo	oper.	2									
					1	Co	mm	on		ı		Arc								lock	1	ı		1	С	ther	s		
	Servo struction	Positioning method	Number of control axes	Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Interpolation control unit	Speed limit value	Acceleration time	Deceleration time	Rapid Stop deceleration time	Torque limit value	Deceleration processing on stop input	Allowable error range for circular interpolation	S-curve ratio	Advanced S-curve acceleration/deceleration	Commanded speed (Constant)	Cancel	Skip	FIN acceleration/deceleration	WAIT-ON/OFF	Speed change
	CPSTART2		2	Δ	0		0							Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ		Δ		Δ		
Start	CPSTART3	_	3	Δ	0		0							Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ		Δ		Δ		
	CPSTART4		4	Δ	0		0							Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ		Δ		Δ		
End	CPEND							Δ																					
	ABS-2		2		0	0			Δ	Δ														Δ		Δ		\triangle	
	ABS-3		3		0	0			Δ	Δ														Δ		Δ		Δ	
	ABS-4		4		0	0			Δ	Δ														Δ		Δ		Δ	
	ABS 🗠				0	0			Δ	Δ	0													Δ		Δ		\triangle	
	ABS ABS ABS	Absolute data	2		0	0			Δ	Δ		0												\triangle		Δ		Δ	Valid
Pass	ABS ∵₄				0	0			Δ	Δ			0											Δ		Δ		Δ	vana
point	INC-2		2		0	0			\triangleleft	Δ														Δ		Δ		Δ	
	INC-3		3		0	0			\triangle	\triangle														Δ		Δ		\triangle	
	INC-4		4		0	0			Δ	Δ														Δ		Δ		Δ	
	INC 🕾				0	0			Δ	Δ	0													Δ		Δ		Δ	
	INC INC INC	Incremental data	2		0	0			Δ	Δ		0												Δ		Δ		Δ	
	INC :				0	0			Δ	Δ			0											Δ		Δ		Δ	

○: Must be set

 \triangle : Set if required

[Control details]

Start and end for 2 to 4 axes constant-speed control

2 to 4 axes constant-speed control is started and ended using the following instructions:

(1) CPSTART2 Ver.

Starts the 2 axes constant-speed control. Sets the axis No. and command speed.

(2) CPSTART3 Ver.

Starts the 3 axes constant-speed control. Sets the axis No. and command speed.

(3) CPSTART4 Ver.

Starts the 4 axes constant-speed control. Sets the axis No. and command speed.

(4) CPEND

Ends the 2, 3, or 4 axes constant-speed control for CPSTART2, CPSTART3, or CPSTART4.

Positioning control method to the pass point

Positioning control to change control is specified using the following instructions:

(1) ABS-2/INC-2

Sets 2 axes linear interpolation control.

Refer to Section 6.3 "2 Axes Linear Interpolation Control" for details.

(2) ABS-3/INC-3

Sets 3 axes linear interpolation control.

Refer to Section 6.4 "3 Axes Linear Interpolation Control" for details.

(3) ABS-4/INC-4

Sets 4 axes linear interpolation control.

Refer to Section 6.5 "4 Axes Linear Interpolation Control" for details.

(4) ABS/INC A

Sets circular interpolation control using auxiliary point specification.

Refer to Section 6.6 "Auxiliary Point-Specified Circular Interpolation Control" for details.

(5) ABS/INC →, ABS/INC →, ABS/INC →

Sets circular interpolation control using radius specification.

Refer to Section 6.7 "Radius-Specified Circular Interpolation Control" for details.

Ver.!): Refer to Section 1.3 for the software version that supports the advanced S-curve acceleration/deceleration in constant-speed (CPSTART).

(6) ABS/INC →, ABS/INC →

Sets circular interpolation control using center point specification.

Refer to Section 6.8 "Central Point-Specified Circular Interpolation Control" for details.

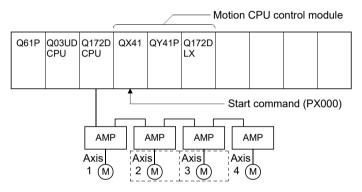
[Cautions]

(1) For circular interpolation control at the pass points for constant-speed control of 2 to 4 axes, specify any 2 axes among the controlled axes. When axes other than the axes specified for circular interpolation control are detected, an error occurs, resulting in a deceleration stop.

[Program]

- (1) Program for 2 axes constant-speed control is shown as the following conditions.
 - (a) System configuration

Constant-speed control for Axis 2 and Axis 3.



(b) Positioning operation details

Axis 2 and axis 3 servo motors are used for positioning operation. Positioning details for Axis 2 and Axis 3 servo motors are shown below.

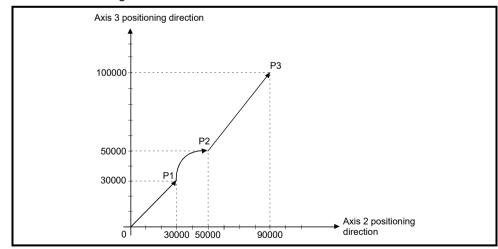


Fig.6.30 Positioning for Axis 2 and Axis 3

(c) Positioning conditions

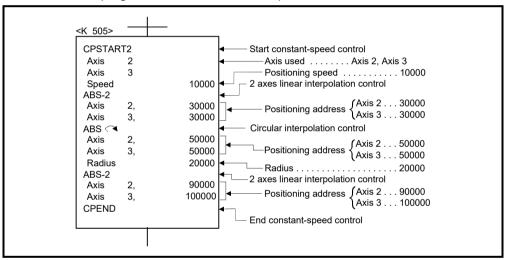
1) Constant-speed control conditions are shown below.

Iter	n		Setting									
Servo program	n No.		505									
Positioning sp	eed		10000									
Positioning me	ethod	2 axes linear interpolation	Radius-specified circular interpolation	2 axes linear interpolation								
D : 1	Axis 2	30000	50000	90000								
Pass point	Axis 3	30000	50000	100000								

2) Constant-speed control start command ... PX000 Leading edge $(\mathsf{OFF} \to \mathsf{ON})$

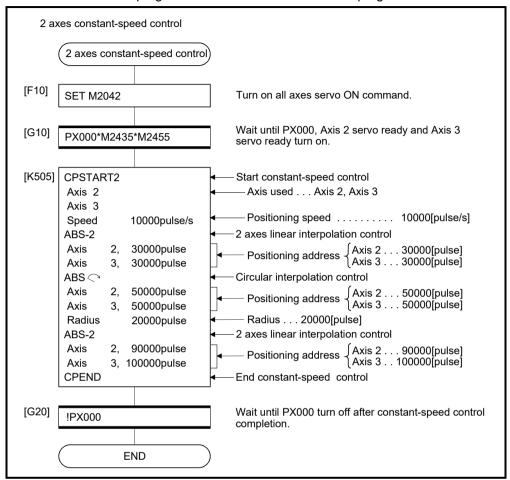
(d) Servo program

Servo program No.505 for constant-speed control is shown below.



(Note): Example of the Motion SFC program for positioning control is shown next page.

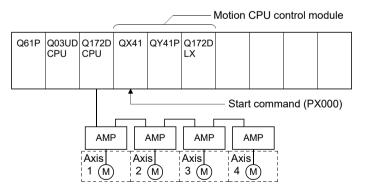
(e) Motion SFC program Motion SFC program for which executes the servo program is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

- (2) Program for 4 axes constant-speed control is shown as the following conditions.
 - (a) System configuration

Constant-speed control for Axis 1, Axis 2, Axis 3, and Axis 4.



(b) Positioning conditions

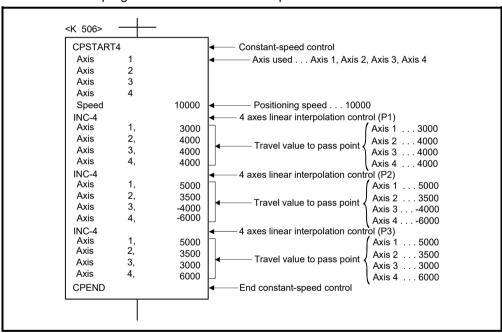
1) Constant-speed control conditions are shown below.

Iter	n		Setting	
Servo program	n No.		506	
Positioning spe	eed		10000	
De sitie min er me	. 4 la d	4 axes linear	4 axes linear	4 axes linear
Positioning me	etnoa	interpolation	interpolation	interpolation
	Axis 1	3000	5000	5000
	Axis 2	4000	3500	3500
Pass point	Axis 3	4000	-4000	3000
	Axis 4	4000	-6000	6000

2) Constant-speed control start command... PX000 Leading edge $(\mathsf{OFF} \to \mathsf{ON})$

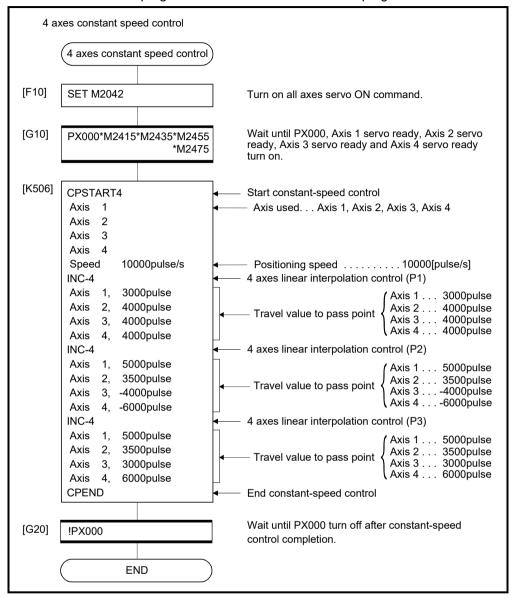
(c) Servo program

Servo program No.506 for constant-speed control is shown below.



(Note): Example of the Motion SFC program for positioning control is shown next page.

(d) Motion SFC programMotion SFC program for which executes the servo program is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

6.17.5 Constant speed control for helical interpolation

The helical interpolation can be specified as the positioning control method to pass point for 3 or 4 axes constant-speed control.

Starting or ending instruction for constant-speed control uses the same CPSTART3, CPSTART4 or CPEND as 3 or 4 axes constant-speed control instruction.

												tems										- C						
				(Com	mor	1		Α	rc/H	lelica	al				Para	amet	er b	ock					С	ther	s		
Servo instruction	Positioning method	Number of control axes	Parameter block No.	Axis	Address/travel value	Command speed	M-code	Torque limit value	Auxiliary point	Radius	Central point	Pitch	Interpolation control unit	Speed limit value	Acceleration time	Deceleration time	Rapid Stop deceleration time	Torque limit value	Deceleration processing on stop input	Allowable error range for circular interpolation	S-curve ratio	Advanced S-curve acceleration/deceleration	Commanded speed (Constant)	Cancel	Skip	FIN acceleration/deceleration	WAIT-ON/OFF	Speed change
ABH∠~				0	0		Δ	Δ	0			0											Δ		Δ		Δ	
ABH⊂◀																												
ABH()																												
ABH✓	Absolute			0	0		Δ	Δ		0		0											Δ		Δ		Δ	
ABH 🕩																												
ABH ∕.◀																												
ABH❖				0	0		Δ	Δ			0	0											Δ		\triangle		Δ	
INH 🗸		2		0	0		\triangle	\triangle	0			0											Δ		\triangle		\triangle	Valid
INH <																												
INH 🗪				(0					(
INH 🕒	Incremental			0	0		Δ	Δ		0		0											Δ		Δ		Δ	
INH 🕩																												
INH ∕.◀							_	_															^				_	
INH ☑				0	0		Δ	Δ			0	0											Δ		\triangle		Δ	

○: Must be set

 \triangle : Set if required

Servo instruction	Positioning method	Circular interpolation specified method
ABH ◯◀	Absolute	Radius-specified method
INH <	Incremental	less than CW180°
ABH✓	Absolute	Radius-specified method
INH 🗹	Incremental	less than CCW180°
ABH →	Absolute	Radius-specified method
INH 🗪	Incremental	CW180° or more.
АВН ♥	Absolute	Radius-specified method
INH 🕒	Incremental	CCW180° or more.
ABH ़ ◀	Absolute	
INH ○	Incremental	Central point-specified method CW
АВН 🥌	Absolute	
INH 🍑	Incremental	Central point-specified method CCW
ABH ♪	Absolute	
INH 📉	Incremental	Auxiliary point-specified method

[Cautions]

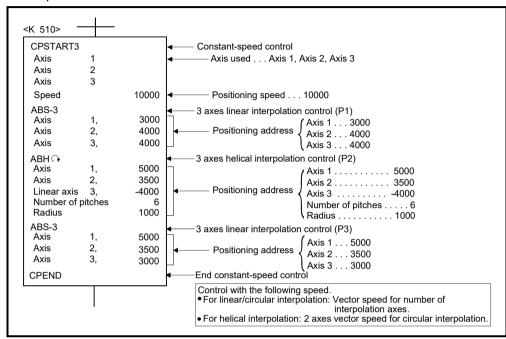
- (1) The helical interpolation specification at pass point for constant-speed control can be used in the both of real mode/virtual mode. When axes other than the axes specified for helical interpolation control are detected, an error occurs, resulting in a deceleration stop.
- (2) Specify any 3 axes among 4 controlled axes in the helical interpolation control at the pass point for 4 axes constant-speed control (CPSTART4).
- (3) Command speed at the helical interpolation specified point is controlled with the speed of circumference. Control is the same as before at the point except for the helical interpolation specification. (Both of the linear interpolation-specified point and circular interpolation-specified point are the vector speed for number of interpolation axes.)
- (4) Skip function toward the helical interpolation-specified each point for constantspeed control is possible. If the absolute-specified helical interpolation is specified to point since the skip signal specified point, set the absolute linear interpolation between them. If it does not set, it may occur an error and stop.
- (5) FIN signal wait function toward the helical interpolation specified each pass point for constant-speed control is possible. M-code outputting signal is outputted to all circular interpolation axes and linear axes. Fin signal can be operated with the both of circular interpolation axes and linear axes.
- (6) If negative speed change toward the helical interpolation-specified each pass point for constant-speed control is executed, it can be returned before 1 point during positioning control.

(7) Speed-switching point-specified flag is effective toward the helical interpolationspecified each pass point for constant-speed control.

[Program1]

(1) Servo program

Servo program for which helical interpolation specified pass point for constantspeed control is shown below.

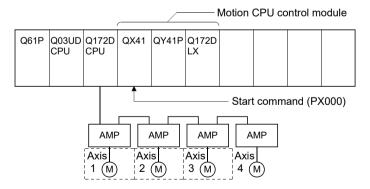


[Program2]

Program for direction of the nozzle of controlling the normal for circular arc curve is shown as the following conditions.

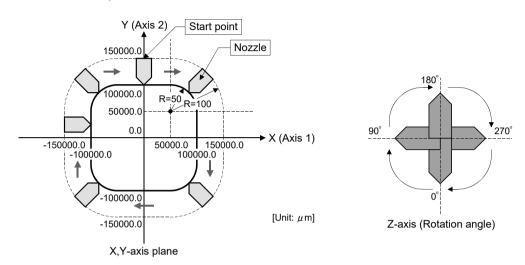
(1) System configuration

Helical interpolation with constant-speed control of Axis 1, Axis 2 and Axis 3



(2) Positioning operation details

The operation to start as the following figure from start point and which keeps a nozzle at right angles toward the contour of line and that it goes around the contour and which is returned to start point. It is the following program when a helical interpolation function is used.



(3) Positioning conditions

(a) Helical interpolation conditions for constant-speed control are shown below.

		-		-				
ı	tem			Setting				
Servo pr	ogram No.			61, 62				
Positioni	ng speed			1000.00 [mm/min]			
		Р	ositioning addres	ss	Centra	al point		
Control a	axis	Axis 1 [µm]	Axis 2 [µm]	Axis 3 [degree]	Axis 1 [µm]	Axis 2 [µm]		
	Start point	0.0	150000.0	0.00000	_			
	P1	50000.0	150000.0	0.00000	_			
	P2	150000.0	50000.0	90.00000	50000.0	50000.0		
_	P3	150000.0	-50000.0	90.00000	_			
Pass	P4	50000.0	-150000.0	180.00000	50000.0	-50000.0		
point	P5	-50000.0	-150000.0	180.00000	_			
	P6	-150000.0	-50000.0	270.00000	-50000.0	-50000.0		
	P7	-150000.0	50000.0	270.00000	_	_		
	P8	-50000.0	150000.0	0.00000	-50000.0	50000.0		

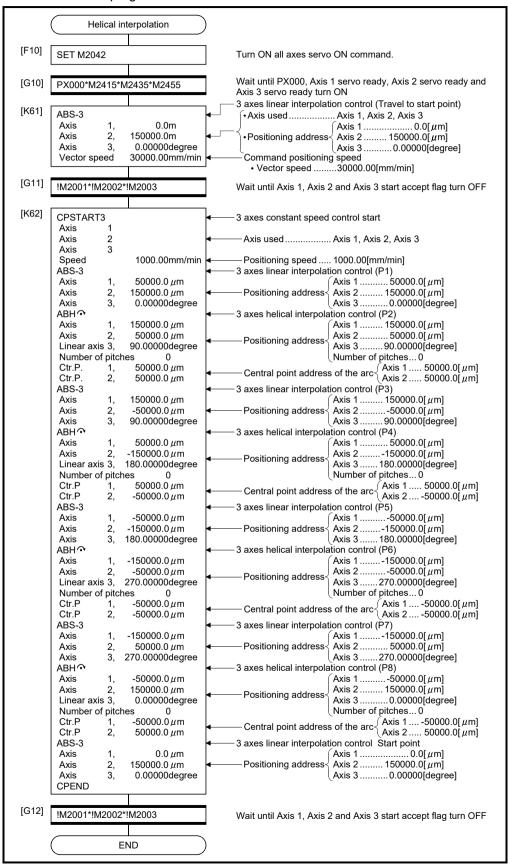
Vibration may cause the machine at the pass point depend on the speed change. In this case, reduce the speed change (acceleration) in the FIN acceleration/deceleration.

However, a locus will change depend on the setting time of the FIN acceleration/deceleration.

(b) Constant-speed control start command PX000 Leading edge $(\mathsf{OFF} \to \mathsf{ON})$

(4) Motion SFC program

Motion SFC program for is shown below.



6.17.6 Pass point skip function

This function stops positioning to the executing point and executes positioning to the next point by setting a skip signal for each pass point for constant-speed control.

[Data setting]

(1) Skip signal devices

The following devices can be specified as skip signal devices.

X, Y, M, B, F, U□\G

[Cautions]

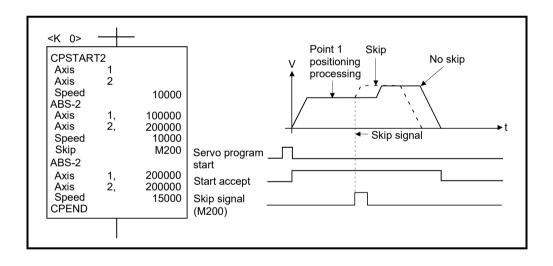
(1) When absolute circular interpolation or absolute helical interpolation is specified to a point after the skip signal specified point, set the absolute linear interpolation between them.

If not set, an error may occur that causes a stop.

(2) If a skip signal is inputted at the end point, a deceleration stop occurs at that point and the program is ended.

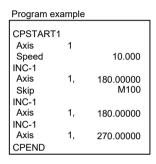
When setting the S-curve ratio, the S-curve pattern is recalculated upon input of the skip signal. Refer to Section 4.3.2 for details of the operation.

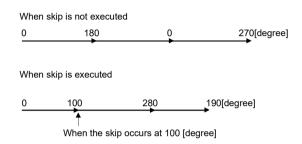
[Program]



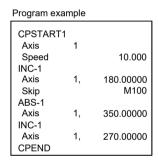
∆ CAUTION

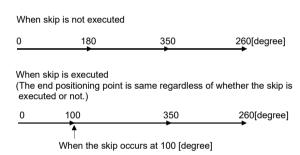
- When a skip is specified during constant-speed control and the axis which has no stroke range [degree] is included, the operation at the execution of skip is described.
 - (Note-1): If there is an ABS instruction after the skip in these conditions, the end positioning point and the travel distance in the program as a whole will be the same regardless of whether the skip is executed or not.
 - (1) All instructions after the skip are INC instructions:



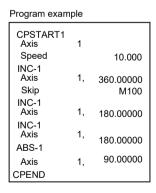


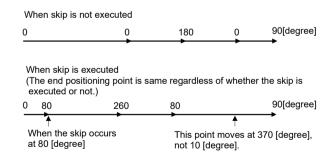
(2) Instruction immediately after the skip is ABS instruction:





(3) Instruction immediately after the skip is INC instruction and there is ABS instruction after that:





6.17.7 FIN signal wait function

By selecting the FIN signal wait function and setting a M-code at each executing point, a process end of each executing point is synchronized with the FIN signal, the FIN signal turns ON to OFF and then the next positioning is executed.

Turn the FIN signal on/off using the Motion SFC program or sequence program.

[Data setting]

(1) When the FIN signal wait function is selected, the fixed acceleration/deceleration time method is used. Set the acceleration/deceleration time within the range of 1 to 5000 [ms] by "FIN acceleration/deceleration" (selecting item) in the servo program.

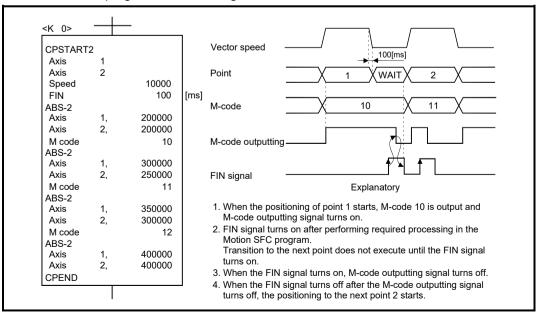
Indirect setting is also possible by the word devices (1 word).

[Cautions]

- (1) If the acceleration/deceleration time is specified outside the setting range, the servo program setting error (error code: 13) will occur at the start and it is controlled with the acceleration/deceleration time of 1000[ms].
- (2) M-code outputting signal is output to all interpolation axes at the interpolation control. In this case, turn on the FIN signal for one of the interpolation axes.
- (3) When M-code is set at the end point, positioning ends after the FIN signal has turn OFF to ON to OFF.
- (4) When the FIN acceleration/deceleration (Fixed acceleration/deceleration time method) is set in the constant speed control, the setting for advanced S-curve acceleration/deceleration is invalid.

[Operation]

Servo program K0 for FIN signal wait function is shown below.

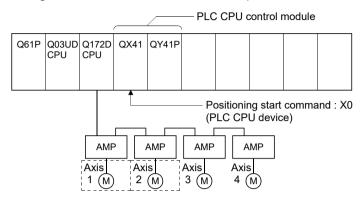


[Program example]

(1) FIN signal wait function by the PLC program

(a) System configuration

FIN signal wait function toward constant-speed control for Axis 1 and Axis 2.



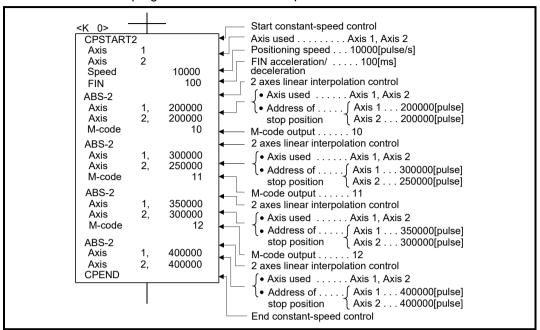
(b) Positioning conditions

1) Constant-speed control conditions are shown below.

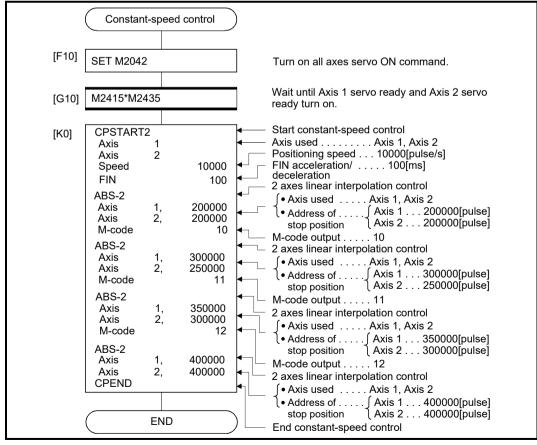
Ite	em		Set	ting					
Servo program	ı No.		()					
Positioning spe	eed		100	000					
FIN acceleration/de	eceleration time		100	[ms]					
Positioning me	thod	2 a	axes linear inte	erpolation con	trol				
Dit	Axis 1	200000	300000	350000	400000				
Pass point	Axis 2	200000	250000	300000	400000				
M-code		10 11 12 -							

2) Constant-speed control start comma	nd
	X0 Leading edge (OFF \rightarrow ON)
	(PLC CPU device)

(c) Servo program Servo program No.0 for constant-speed control is shown below.



(d) Motion SFC programMotion SFC program for constant-speed control is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

(e) Sequence program Sequence program for FIN signal wait function is shown below.

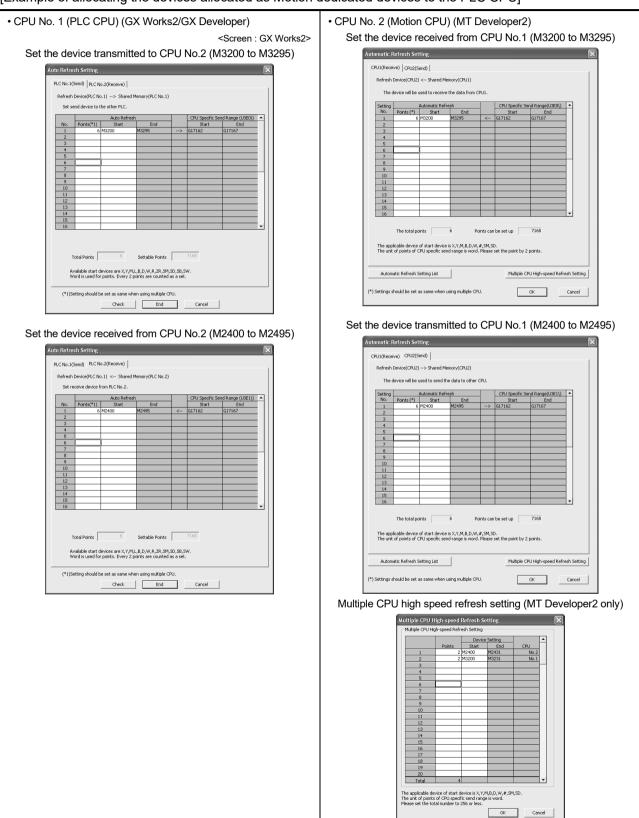
```
Sequence program
                                                                                                  —[ DP.SFCS H3E1 K110 M0
                                                                                                  D51 3 Substitutes 1 for D51 after program start.
                                                                                -{ MOVP K1
                                                                                                         Reads data of D13 for Multiple CPU
system No.2 by turning M2419 on,
and stores in the data area D1 of
self CPU
    M2419
14
                                                                        D50
                                                                                  D13
                                                                                           D1
                                                                                                M3219 M3219 is set
                                                                                       -[SET
    M2419
26
                                                                                       -[RST
                                                                                                M3219 Resets M3219 by turning M2419 off.
28
                                                                                             (Note): Details of D1 is used as control.
```

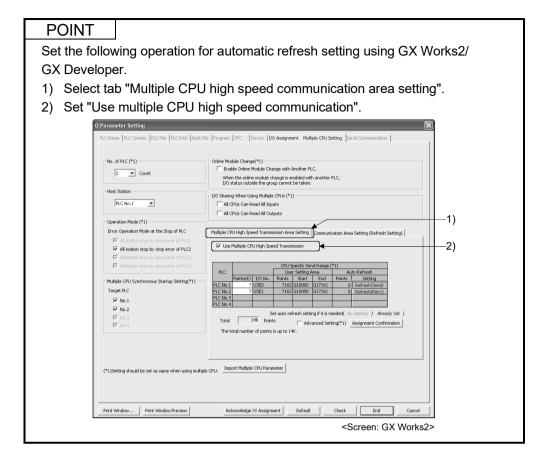
(Note): The automatic refresh setting example for FIN signal wait function is shown next page.

(f) Parameter setting

The automatic refresh setting example for FIN signal wait function is shown below.

[Example of allocating the devices allocated as Motion dedicated devices to the PLC CPU]

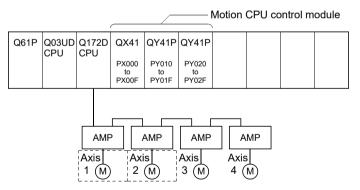




(2) FIN signal wait function using the Motion SFC program

(a) System configuration

FIN signal wait function toward constant-speed control for Axis 1 and Axis 2.



(b) Positioning conditions

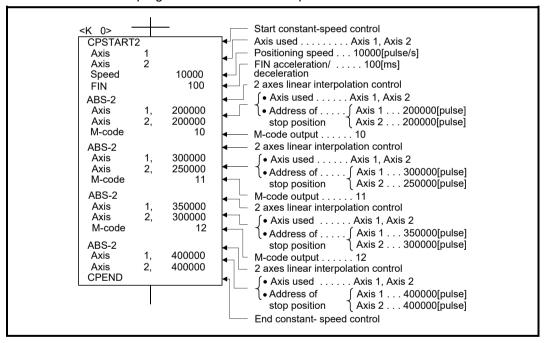
1) Constant-speed control conditions are shown below.

Ito	em		Set	ting				
Servo program	n No.		()				
Positioning spe	eed		100	000				
FIN acceleration/de	eceleration time		100	[ms]				
Positioning me	ethod	2 8	axes linear inte	erpolation con	trol			
D : 1	Axis 1	200000	200000 300000 350000					
Pass point	Axis 2	200000	250000	300000	400000			
M-code		10	11	12	_			

2) Constant-speed control start command ... PX000 Leading edge $(\mathsf{OFF} \to \mathsf{ON})$

(c) Servo program

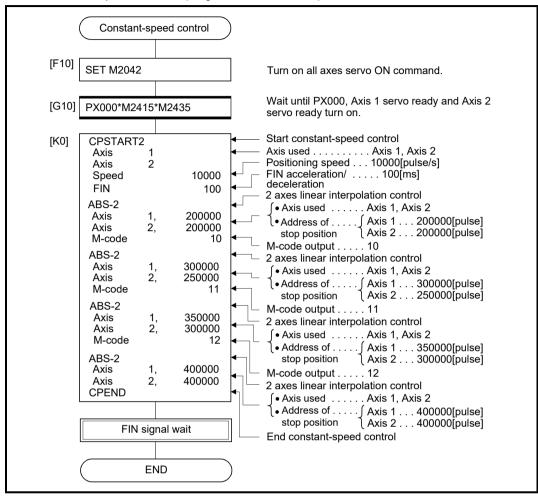
Servo program No.0 for constant speed control is shown below.



(Note): Example of the Motion SFC program for positioning control is shown next page.

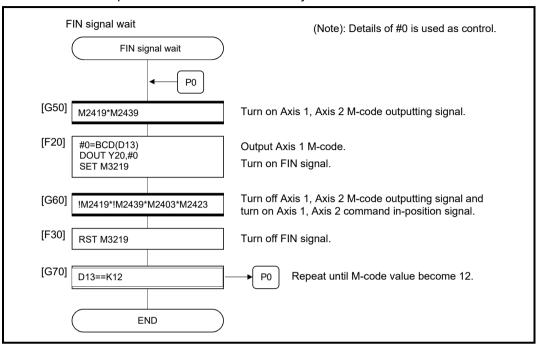
(d) Motion SFC program

1) Motion SFC program for constant-speed control is shown below.



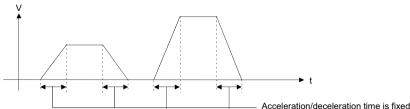
(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

2) Motion SFC program which outputs M-code of each point for constantspeed control to PY20 to PY2F by BCD code is shown below.

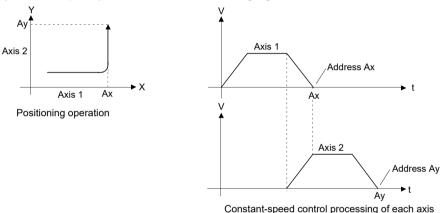


POINTS

(1) The fixed acceleration/deceleration time method is acceleration/deceleration processing that the time which acceleration/deceleration takes is fixed, even if the command speed differs.

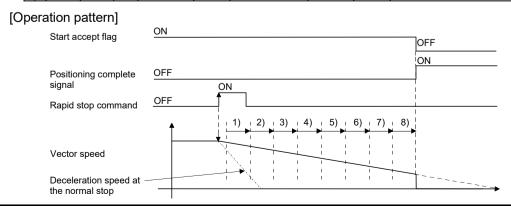


- (a) The following processing and parameters are invalid in the fixed acceleration/deceleration time method.
 - Rapid stop deceleration time in parameter block
 - Completion point specification method for speed change point
 - S-curve acceleration/deceleration
- (b) The speed processing for each axis is as shown below in positioning operation (constant-speed) as shown in the following figure.



(2) When the rapid stop command is executed by the setting "deceleration time < rapid stop deceleration time" during constant-speed control, the point data currently executed in the middle of deceleration, and the positioning may be completed suddenly as a speed "0". In the case of, "deceleration time ≥ rapid stop deceleration time", the above operation is not executed. For the following condition, note that the speed may become 0 in the middle of deceleration.</p>

Travel value by the point data currently executed at the rapid stop command (Up to 9 points) < speed at rapid stop command input \times rapid stop deceleration time/2



6.18 Position Follow-Up Control

Positioning to the address set in the word device of the Motion CPU specified with the servo program at one start is executed.

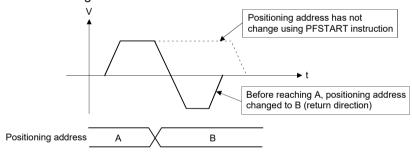
Position follow-up control is started using the PFSTART servo program instruction.

			Items set using MT Developer2								1															
		<u> </u>		Common Arc Parameter block								Others														
Servo instruction	Positioning method	Number of control axes	Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Interpolation control unit	Speed limit value	Acceleration time	Deceleration time	Rapid Stop deceleration time	Torque limit value	Deceleration processing on stop input	Allowable error range for circular interpolation		Advanced S-curve acceleration/deceleration	Cancel	WAIT-ON/OFF	Speed change	
PFSTART	Absolute	1	Δ	0	0	0		Δ						Δ	Δ	Δ	Δ	Δ	Δ		Δ	Δ	Δ		Valid	

○: Must be set

[Control details]

- (1) Positioning to the address set in the word device of the Motion CPU specified with the servo program is executed.
- (2) Position follow-up control is executed until the stop instruction is input. If the word device value changes during operation, positioning is executed to the changed address.



[Cautions]

- (1) Number of control axes is 1 axis.
- (2) Only the absolute data method (ABS□) is used for positioning control to the pass points.
- (3) The speed can be changed during the start.

 The changed speed is effective until the stop command is input.
- (4) Set the positioning address in the servo program using indirect setting with the word devices.
- (5) Use only even-numbered devices for indirect setting of positioning address in the servo program.

If odd-numbered devices are used, a minor error (error code: 141) occurs at the start and control does not start.

(6) Positioning speeds can be set in the servo program using indirect setting with the word devices.

However, this data is effective only at the position follow-up control start (servo program start) and the speed does not change if the indirect setting are changed during the start.

(7) Change the value of the positioning address so that it is within the range below.

-2147483648 ≤ (Change in positioning address ÷ Travel value per rotation × Number of pulses per rotation) ≤ 2147483647

(a) The following is an example of a calculation of the positioning address values with the conditions below.

Item	Value						
Number of pulses per servo motor revolution	4194304[pulse]						
Ball screw pitch	1[mm]						
External gear ratio	1/100						

When the electronic gear setting is:

• Number of pulses per servo motor revolution : 4194304[pulse]

• Travel distance per servo motor revolution : 100.0[µm]

Actual change in positioning address[µm] = $\frac{\text{Maximum value of change in positioning address[pulse]}}{\text{Number of pulses per servo motor revolution}} \times \frac{\text{Travel distance per servo motor revolution}}{\text{servo motor revolution}}$

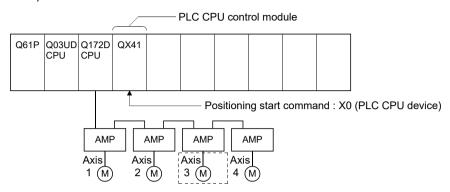
 $= \frac{2147483647[pulse] \times 100}{4194304} = 51200.0[\mu m]$

However, the actual change in positioning address needs to be less than " $\pm 51200.0 [\mu m]$ ".

[Program]

(1) System configuration

Axis 3 position follow-up control for PLC CPU (CPU No.1) to Motion CPU (CPU No.2).



(2) Positioning conditions

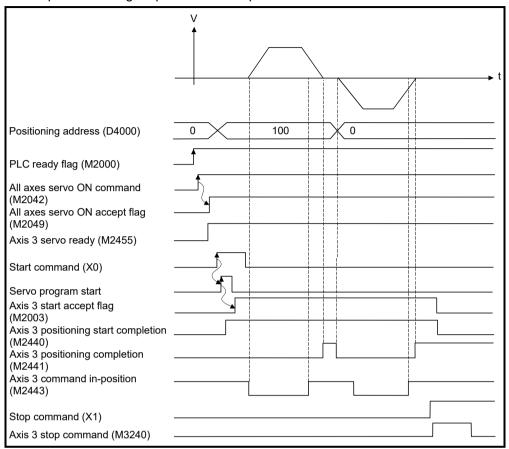
(a) Position follow-up conditions are shown below.

Item	Setting					
Servo program No.	100					
Control axis	Axis 3					
Positioning address	D4000					
Positioning speed	20000					

(b) Position follow-up control start command

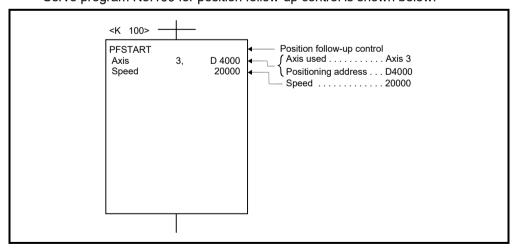
(3) Operation timing

Operation timing for position follow-up control is shown below.



(4) Servo program

Servo program No.100 for position follow-up control is shown below.



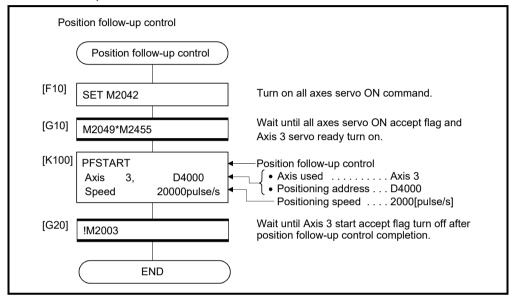
(Note): Example of the Motion SFC program for positioning control is shown next page.

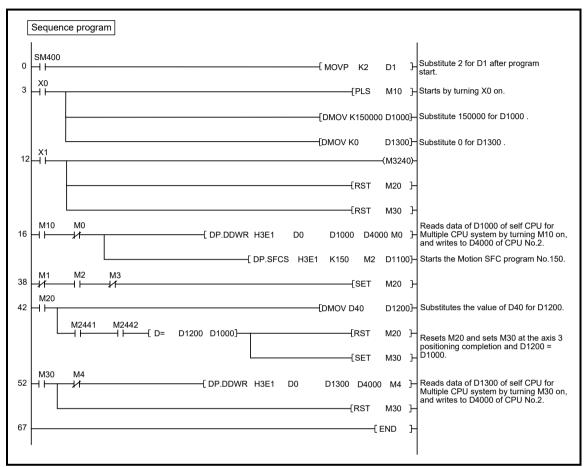
(5) Motion SFC program

Motion SFC program, sequence program and parameter setting for position follow-up control is shown below.

(a) Motion SFC program

Motion SFC program example for position follow-up control is shown below. This program is started using D(P).SFCS instruction from PLC CPU (CPU No.1).



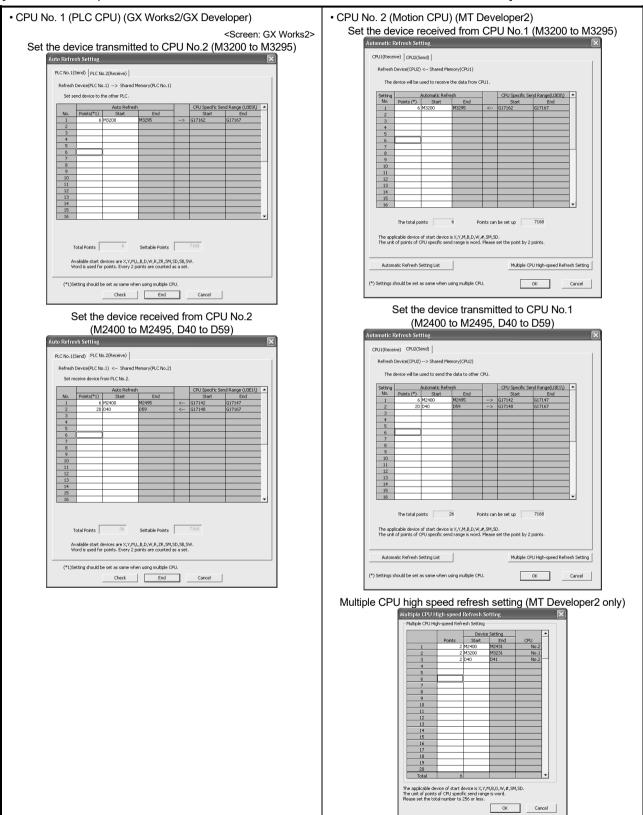


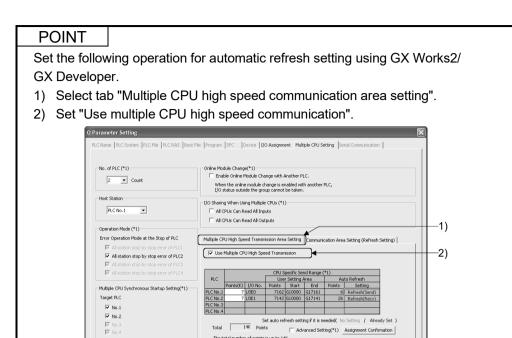
(Note): The automatic refresh setting example for position follow-up control is shown next page.

(c) Parameter setting

The automatic refresh setting example for position follow-up control is shown below.

[Allocation example of devices allocated in the Motion dedicated device to the PLC CPU]





(*1)Setting should be set as same when using multiple CPU. Import Multiple CPU Parameter

Total 14K Points Advanced Setting(*1) Assignment Confirmation
The total number of points is up to 14K.

Acknowledge XY Assignment Default Check End

<Screen: GX Works2>

6.19 Speed Control with Fixed Position Stop

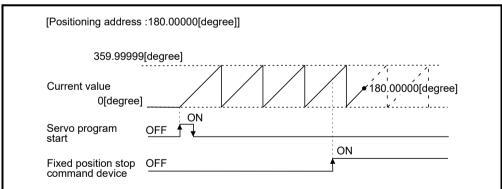
Speed control with fixed position stop of the specified axis is executed. Speed control with fixed position stop is started using the PVF (forward rotation) or PVR (reverse rotation) of servo program instruction.

											Ite	ms s	et us	sing	MT I	Deve	elope	er2									
			Common Arc/Helical								Parameter block Oth						ers										
Servo instruction	Positioning method	Number of control axes	Parameter block No.	Axis	Address/travel value	Command speed		M-code	Torque limit value	Auxiliary point	Radius	Central point	Interpolation control unit	Speed limit value	Acceleration time	Deceleration time	Rapid Stop deceleration time	Torque limit value	Deceleration processing on stop input	Allowable error range for circular interpolation	S-curve ratio	Advanced S-curve acceleration/deceleration	Cancel	WAIT-ON/OFF	Fixed position stop accel./decel.time	Fixed position stop	Speed change
PVF	A I I 4 -)																						\/_I;_I
PVR	Absolute	1		0	0	0	\triangle	\triangle								Δ		Δ			Δ	Δ			0	O	Valid

): Must be set△: Set if required

[Control details]

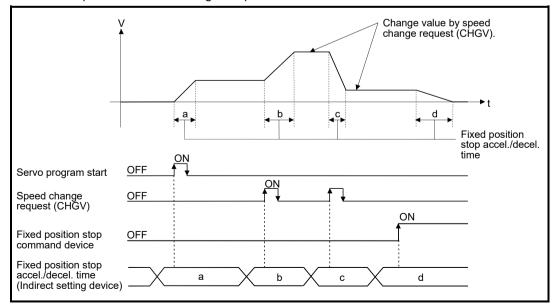
- (1) After starting of servo motor, control at the specified speed is executed until the fixed position stop command turns on.
 - PVF..... Forward rotation direction (Address increase direction) start
 - PVR...... Reverse rotation direction (Address decrease direction) start
- (2) When the fixed position stop command turns on, a positioning control to the specified address is executed.



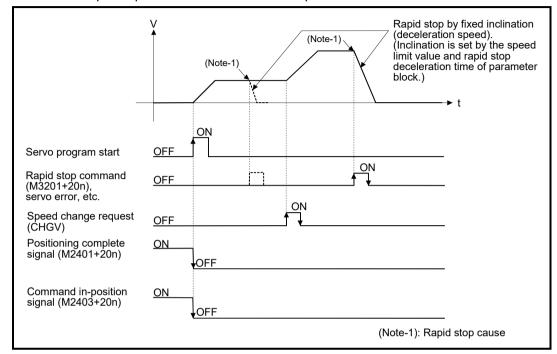
(3) It can be controlled in the real mode only for axis which "control unit is [degree] and stroke limit is invalid ("upper stroke limit value" equal to "lower stroke limit value")". If it is started for axis which "control unit is except [degree] or stroke limit is not invalid", a minor error (error code: 130) occurs and it does not start. And, if it is started for the virtual servo motor axis in the virtual mode, a servo program setting error (error code: 905) occurs and it does not start. (It can be started for real mode axis.)

- (4) Address setting range is 0 to 35999999 (0 to 359.99999[degree]) in the indirect setting of positioning address. If it is set outside the setting range, a servo program setting error (error code: n03) occurs and it does not start. Positioning address is input at the program start.
- (5) It is controlled in the fixed position stop acceleration/deceleration time set in the servo program at positioning start, speed change request (CHGV) and fixed position stop command ON. The fixed acceleration/deceleration time method is used as an acceleration/deceleration processing in this case.
- (6) The setting range of fixed position stop acceleration/deceleration time is 1 to 65535[ms].
- (7) In the case of indirect setting, the fixed position stop acceleration/deceleration time is input in the following timing.
 - Positioning start
 - Speed change request (CHGV)
 - Fixed position stop command ON
- (8) When the positioning to specified address completes, the positioning complete signal (M2401+20n) turns on. It does not turn on at the time of stop by the stop command (M3200+20n)/rapid stop command (M3201+20n). The positioning complete signal (M2401+20n) turns off at leading edge of complete signal OFF command (M3204+20n) or positioning start.
- (9) Prior to turning ON the fixed position stop command device, speed change can be executed any number of times by the speed change request (CHGV) instruction during operation.

The speed change request (CHGV) instruction is disabled after the fixed position stop command device turns ON. If the fixed position stop command device turns ON while changing the speed by the speed change request (CHGV) instruction, the acceleration/deceleration is stopped and positioning is performed for the specified address using the speed at that time.



(10) Deceleration speed by the stop command (M3200+20n)/rapid stop command (M3201+20n) is controlled with fixed inclination (deceleration speed). Deceleration processing is executed using the speed limit value or deceleration/ rapid stop deceleration time set in the parameter block.



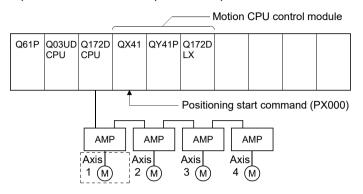
- (11) When the fixed position stop command turns on, the command in-position check starts. When the absolute value of difference between the setting address and feed current value below the "command in-position range" set in the fixed parameter, the command in-position signal (M2403+20n) turns on. The command in-position signal (M2403+20n) turns on by a positioning start.
- (12) In any of the following cases, positioning is executed at the speed that was specified by the speed limit value.
 - Speed control with fixed position stop is started with the fixed position stop command turned ON.
 - The fixed position stop command is turned ON after a speed change to "0".

[Program]

Program for speed control with fixed position stop is shown as the following conditions.

(1) System configuration

Speed control with fixed position stop for "Axis 1".



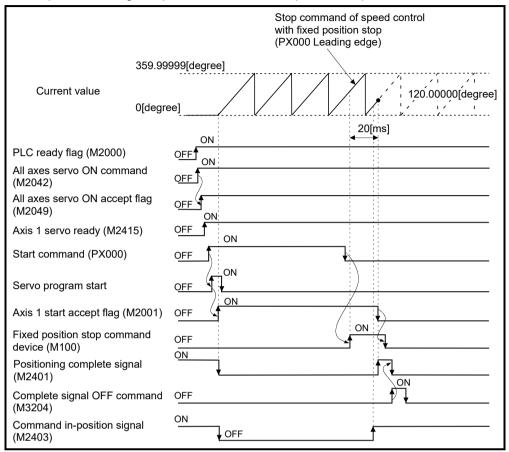
(2) Positioning conditions

(a) Speed control with fixed position stop conditions are shown below.

ltem	Setting
Servo program No.	55
Start direction	Forward
Control axis	Axis 1
Positioning address	120.00000[degree]
Control speed	30000[degree/min]
Acceleration/deceleration time	20ms
Fixed position stop command device	M100

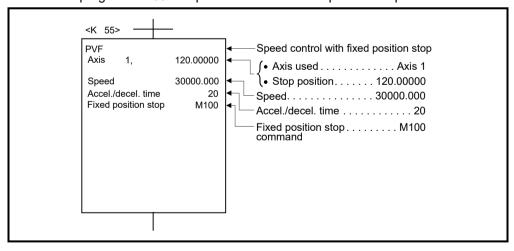
(3) Operation timing

Operation timing for speed control with fixed position stop is shown below.



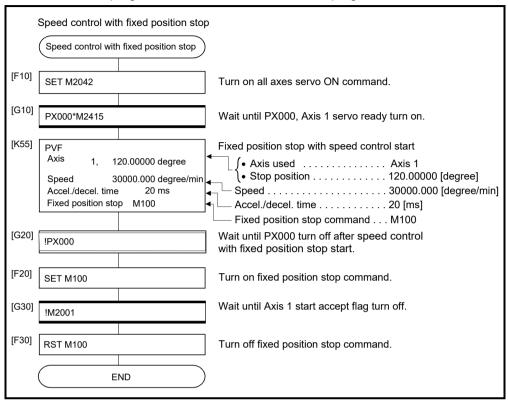
(4) Servo program

Servo program No.55 for speed control with fixed position stop is shown below.



(5) Motion SFC program

Motion SFC program for which executes the servo program is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

6.20 Simultaneous Start

Simultaneous start of the specified servo program at one start is executed. Simultaneous start is started using the START servo program instruction.

										Iter	ns s	et us	sing	MT I	Deve	elope	er2								
					Co	mm	on				Arc					Para	amet	er bl	ock				Oth	ers	
Servo instruction	Positioning method	Number of control axes	Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Interpolation control unit	Speed limit value	Acceleration time	Deceleration time	Rapid Stop deceleration time	Torque limit value	Deceleration processing on stop input	Allowable error range for circular interpolation	S-curve ratio	Advanced S-curve acceleration/deceleration	Others	Program No.	Speed change
START	*	*																						0	*

^{○:} Must be set

[Control details]

Control using START instruction

- (1) Simultaneous start of the specified servo programs is executed.
- (2) The servo program except for the simultaneous start (START instruction) can be specified.
- (3) Up to 3 servo programs can be specified.
- (4) Each axis is controlled using the specified servo program after the simultaneous start.

[Cautions]

(1) A check is made at the start. An error occurs and operation does not start in the following cases.

F	-	Stored codes							
Error	Error processing	SD516	SD517						
Specified servo program does not exist. START instruction is set as the specified servo program. The specified servo program	Servo program setting error flag (SM516): ON	Erroneous program No. of simultaneous start.	19						
start axis is already used. A servo program cannot start by an error.	Start accept flag (M2001+n): OFF	Erroneous program No. of program specified with simultaneous start.	Error Item data (Refer to Section 3.5)						

(2) The servo program No. specified using START instruction cannot be set indirectly.

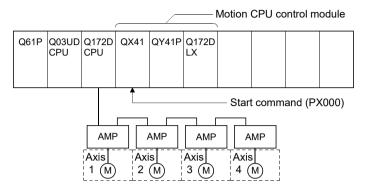
^{*:} It changes by the servo program for simultaneous start.

[Program]

Program for simultaneous start is shown as the following conditions.

(1) System configuration

Simultaneous start for "Axis 1 and Axis 2", Axis 3 and Axis 4.



(2) Number of specified servo programs and program No.

- (a) Number of specified servo programs: 3
- (b) Specified servo program No. are shown below.

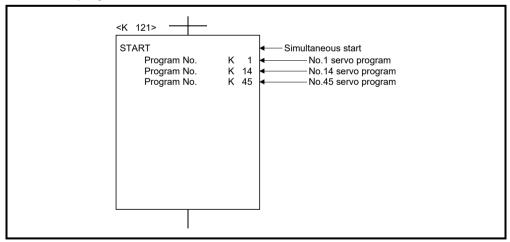
Servo Program No.	Used axis	Control Details
No.1	Axis 1, Axis 2	Circular interpolation control
No.14	Axis 3	Speed control
No.45	Axis 4	Home position return control

(3) Start conditions

- (a) Simultaneous start servo program No. No.121
- (b) Simultaneous start execute command PX000 Leading edge $(\mathsf{OFF} \to \mathsf{ON})$

(4) Servo program

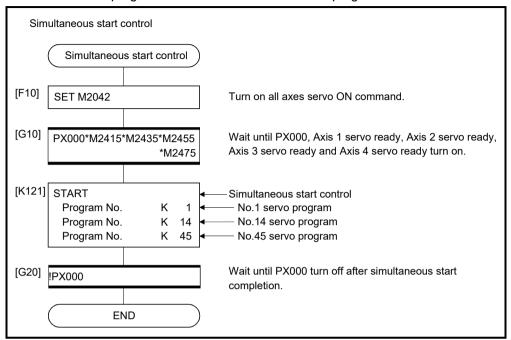
Servo program No.121 for simultaneous start is shown below.



(Note): Example of the Motion SFC program for positioning control is shown next page.

(5) Motion SFC program

Motion SFC program for which executes the servo program is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

6.21 JOG Operation

The setting JOG operation is executed.

Individual start or simultaneous start can be used in the JOG operation.

JOG operation can be executed using the Motion SFC program or test mode of MT Developer2. (Refer to the help of MT Developer2 for JOG operation method in the test mode of MT Developer2.)

JOG operation data must be set for each axis for JOG operation. (Refer to Section 6.21.1.)

6.21.1 JOG operation data

JOG operation data is the data required to execute JOG operation. Set the JOG operation data using MT Developer2.

Table 6.2 JOG operation data list

						Settir	ng range								
N	اما	Item	mm		inch		degree)	pulse		Initial	Units	Remarks	Explanatory	
IN	10.	item	Setting range	Units	Setting range	Units	Setting range Units		Setting range	Units	value	Units	Remarks	section	
	1	JOG speed limit value	0.01 to 6000000.00	mm /min	0.001 to 600000.000	inch /min	0.001 to 2147483.647 (Note-1)	degree /min	1 to 2147483647	pulse /s	20000	pulse /s	Sets the maximum speed at the JOG operation. If JOG speed setting exceeds the JOG speed limit value, it is controlled with JOG speed limit value.		
:	2	Parameter block setting		1 to 64								_	Sets the parameter block No. to be used at the JOG operation.	4.3	

 $(Note-1): When the "speed control 10 \times multiplier speed setting for degree axis" is set to "valid", the setting range is 0.01 to 21474836.47 [degree/min].$

(1) JOG operation data check

A relative check of the JOG operation data is executed at the following timing:

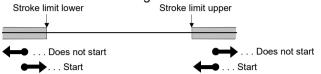
- · JOG operation Individual start
- · JOG operation simultaneous start
- JOG operation request

(2) Data error processing

- · Only data for which detected errors is controlled as default value.
- The error code corresponding to each data for erroneous axis is stored in the data register.

POINT

Start to outside the range of stroke limit of fixed parameter cannot be executed. However, JOG operation is possible in the direction from outside the stroke limit range to back inside the stroke limit range.



For a degree axis, depending on the stroke limit setting, the direction that can return the axis into the stroke limit range is different.

- When upper stroke limit value > lower stroke limit value
 When "Feed current value > upper stroke limit value", movement in the negative direction is possible.
 - When "Feed current value < lower stroke limit value", movement in the positive direction is possible.
- When upper stroke limit value < lower stroke limit value
 Movement in both the positive and negative direction is possible.

6.21.2 Individual start

JOG operation for the specified axes is started.

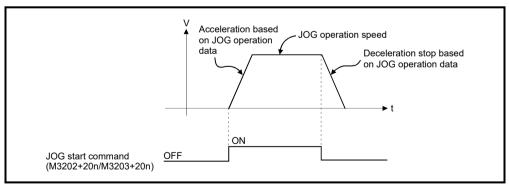
JOG operation is executed by the following JOG start commands:

- Forward JOG start command (M3202+20n)
- Reverse JOG start command (M3203+20n)

[Control details]

JOG operation continues at the JOG speed setting register (D640+2n, D641+2n) value while the JOG start command turns on, and a deceleration stop is made by the JOG start command OFF.

Control of acceleration/deceleration is based on the data set in JOG operation data.



JOG operation for axis for which JOG start command is turning on is executed.

(2) The setting range for JOG speed setting registers (D640+2n, D641+2n) are shown below.

	100		100	JOG speed setting register				Settin	g range			
Axis No.	JOG op	peration	JOG speed s	etting register	mm		inch		degre	е	pulse	1
(Note-2)	Forward JOG	Reverse JOG	Most significant	Least significant	Setting range	Units	Setting range	Units	Setting range	Units	Setting range	Units
1	M3202	M3203	D641	D640								
2	M3222	M3223	D643	D642								
3	M3242	M3243	D645	D644								
4	M3262	M3263	D647	D646								
5	M3282	M3283	D649	D648								
6	M3302	M3303	D651	D650								
7	M3322	M3323	D653	D652								
8	M3342	M3343	D655	D654								
9	M3362	M3363	D657	D656								
10	M3382	M3383	D659	D658								
11	M3402	M3403	D661	D660								
12	M3422	M3423	D663	D662								
13	M3442	M3443	D665	D664								
14	M3462	M3463	D667	D666								
15	M3482	M3483	D669	D668		× 10 ⁻²		× 10 ⁻³		× 10 ⁻³		
16	M3502	M3503	D671	D670	1 to		1 to		1 to	degree	1 to	pulse/
17	M3522	M3523	D673	D672	600000000	mm /min	600000000	inch	2147483647	/min	2147483647	s
18	M3542	M3543	D675	D674		///////		/min		(Note-1)		
19	M3562	M3563	D677	D676								
20	M3582	M3583	D679	D678								
21	M3602	M3603	D681	D680								
22	M3622	M3623	D683	D682								
23	M3642	M3643	D685	D684								
24	M3662	M3663	D687	D686								
25	M3682	M3683	D689	D688								
26	M3702	M3703	D691	D690								
27	M3722	M3723	D693	D692								
28	M3742	M3743	D695	D694								
29	M3762	M3763	D697	D696								
30	M3782	M3783	D699	D698								
31	M3802	M3803	D701	D700								
32	M3822	M3823	D703	D702								

(Note-1): When the "speed control $10 \times \text{multiplier}$ setting for degree axis" is set to "valid" in the fixed parameter, the unit is " $\times 10^{-2}$ [degree/min]". (Note-2): The following is valid.

• Q172DSCPU : Axis No. to 16

• Q172DCPU(-S1): Axis No. to 8

POINT

When the JOG operation speed is set in the Motion SFC program, stores a value which is 100 times the real speed in units of [mm] or 1000 times the speed in units of [inch] or [degree] in the JOG speed setting register (D640+2n, D641+2n).

-----Example -----

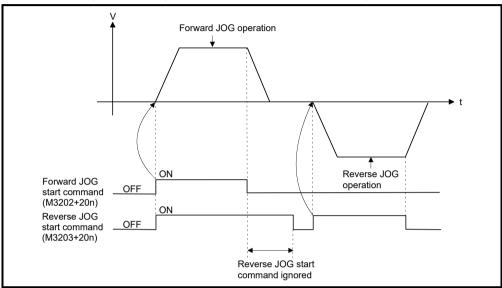
If JOG operation speed of 6000.00[mm/min] is set, stores the value "600000" in the JOG speed setting register (D640+2n, D641+2n).

(Note): Store a value which is 100 times the real speed in the JOG speed setting register (D640+2n, D641+2n) for the "degree axis control 10× multiplier speed setting valid".

[Cautions]

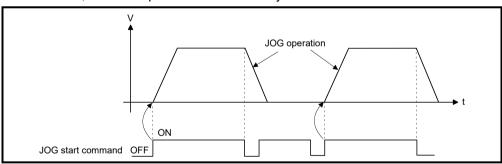
(1) If the forward JOG start command (M3202+20n) and reverse JOG start command (M3203+20n) turn on simultaneously for a single axis, the forward JOG operation is executed.

When a deceleration stop is made by the forward JOG start command (M3202+20n) OFF the reverse JOG operation is not executed even if the reverse JOG start command (M3203+20n) is ON. After that, when the reverse JOG start command (M3203+20n) turns off to on, the reverse JOG operation is executed.

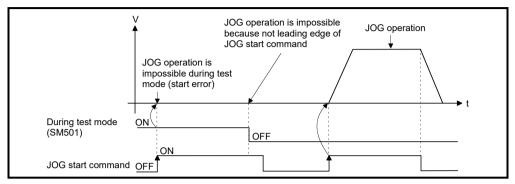


(2) If the JOG start command (M3202+20n/M3203+20n) turns on during deceleration by the JOG start command OFF, after deceleration stop, JOG operation is not executed.

After that, the JOG operation is executed by the JOG start command OFF to ON.



(3) JOG operation by the JOG start command (M3202+20n/M3203+20n) is not executed during the test mode using MT Developer2. After release of test mode, the JOG operation is executed by turning the JOG start command off to on.

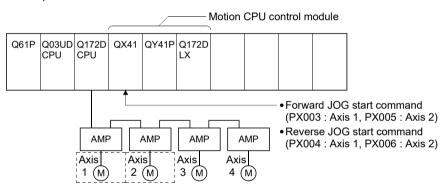


[Program]

Program for JOG operation is shown as the following conditions.

(1) System configuration

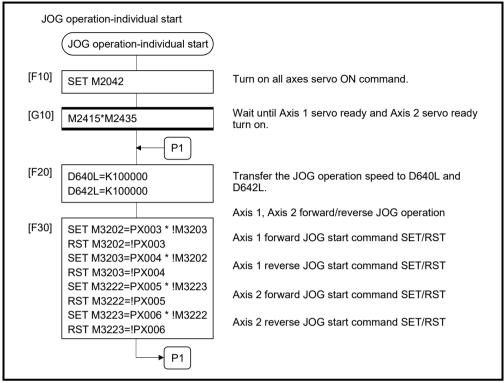
JOG operation for Axis 1 and Axis 2.



- (2) JOG operation conditions
 - (a) Axis No. Axis 1, Axis 2
 - (b) JOG start speed 100000 (1000.00[mm/min])
 - (c) JOG start commands
 - 1) Forward JOG start Axis 1: PX003 ON, Axis 2: PX005 ON
 - 2) Reverse JOG start Axis 1: PX004 ON, Axis 2: PX006 ON

(3) Motion SFC program

Motion SFC program for which executes JOG operation is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

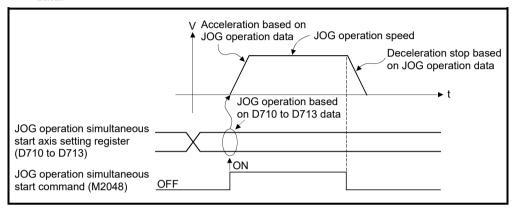
6.21.3 Simultaneous start

Simultaneous start JOG operation for specified multiple axes.

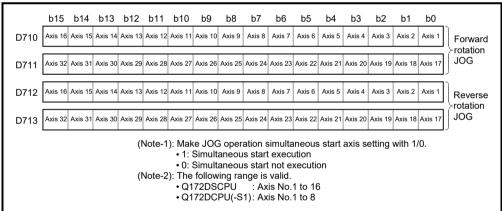
[Control details]

(1) JOG operation continues at the JOG speed setting register value for each axis while the JOG operation simultaneous start command (M2048) turns on, and a deceleration stop is made by the M2048 OFF.

Control of acceleration/deceleration is based on the data set in the JOG operation data.



(2) JOG operation axis is set in the JOG operation simultaneous start axis setting register (D710 to D713).



(3) The setting range for JOG speed setting registers (D640+2n, D641+2n) are shown below.

A:-	100 as	peration	IOC anada	atting register				Settin	g range			
Axis No.	JOG 0	Derauon	JOG speed s	etting register	mm		inch		degree	е	pulse	:
(Note-2)	Forward JOG	Reverse JOG	Most significant	Least significant	Setting range	Units	Setting range	Units	Setting range	Units	Setting range	Units
1	M3202	M3203	D641	D640								
2	M3222	M3223	D643	D642								
3	M3242	M3243	D645	D644								
4	M3262	M3263	D647	D646								
5	M3282	M3283	D649	D648								
6	M3302	M3303	D651	D650								
7	M3322	M3323	D653	D652								
8	M3342	M3343	D655	D654								
9	M3362	M3363	D657	D656								
10	M3382	M3383	D659	D658								
11	M3402	M3403	D661	D660								
12	M3422	M3423	D663	D662								
13	M3442	M3443	D665	D664								
14	M3462	M3463	D667	D666								
15	M3482	M3483	D669	D668		× 10 ⁻²		× 10 ⁻³		× 10 ⁻³		
16	M3502	M3503	D671	D670	1 to		1 to		1 to	degree	1 to	pulse
17	M3522	M3523	D673	D672	600000000	mm /min	600000000	inch /min	2147483647	/min	2147483647	/s
18	M3542	M3543	D675	D674		///////		///////		(Note-1)		
19	M3562	M3563	D677	D676								
20	M3582	M3583	D679	D678								
21	M3602	M3603	D681	D680								
22	M3622	M3623	D683	D682								
23	M3642	M3643	D685	D684								
24	M3662	M3663	D687	D686								
25	M3682	M3683	D689	D688								
26	M3702	M3703	D691	D690								
27	M3722	M3723	D693	D692								
28	M3742	M3743	D695	D694								
29	M3762	M3763	D697	D696								
30	M3782	M3783	D699	D698								
31	M3802	M3803	D701	D700								
32	M3822	M3823	D703	D702								

(Note-1): When the "speed control 10 \times multiplier setting for degree axis" is set to "valid" in the fixed parameter, the unit is " \times 10 $^{-2}$ [degree/min]". (Note-2): The following is valid.

• Q172DSCPU : Axis No.1 to 16

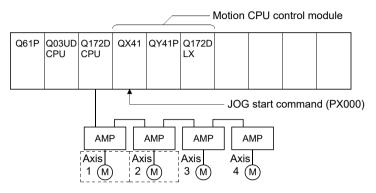
• Q172DCPU(-S1): Axis No.1 to 8

[Program]

Program for simultaneous start of JOG operations are shown as the following conditions.

(1) System configuration

JOG operation for Axis 1 and Axis 2.



(2) JOG operation conditions

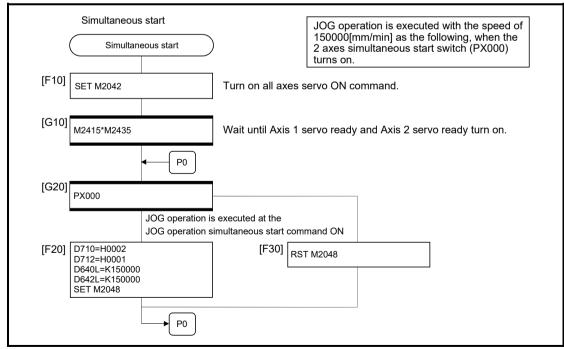
(a) JOG operation conditions are shown below.

Item	JOG operation	on conditions
Axis No.	Axis 1	Axis 2
JOG operation speed	150000	150000

(b) JOG start command During PX000 ON

(3) Motion SFC program

Motion SFC program for which executes the simultaneous start of JOG operation is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

6.22 Manual Pulse Generator Operation

Positioning control based on the number of pulses inputted from the manual pulse generator is executed.

Simultaneous operation for 1 to 3 axes is possible with one manual pulse generator, the number of connectable modules are shown below.

Number of connectable to the manual pulse generator
3

POINT

• When two or more Q173DPXs are installed, connect the manual pulse generator to first (It counts from 0 slot of the main base) Q173DPX.

(When the manual pulse generator is used, only first Q173DPX is valid.)

[Control details]

(1) Positioning of the axis set in the manual pulse generator axis setting register based on the pulse input from the manual pulse generator. Manual pulse generator operation is only valid while the manual pulse generator enable flag turn ON.

Manual pulse generator	Manual pulse generator	Manual pulse generator
connecting position	axis No. setting register	enable flag
P1	D714, D715	M2051
P2	D716, D717	M2052
P3	D718, D719	M2053

- (2) The travel value and output speed for positioning control based on the pulse input from manual pulse generator are shown below.
 - (a) Travel value

The travel value based on the pulse input from a manual pulse generator is calculated using the following formula.

[Travel value] = [Travel value per pulse] \times [Number of input pulses] \times [Manual pulse generator 1- pulse input magnification setting]

The travel value per pulse for manual pulse generator operation is shown below.

Unit	Travel value
mm	0.1 [µm]
inch	0.00001 [inch]
degree	0.00001 [degree]
pulse	1 [pulse]

If units is [mm], the command travel value for input of one pulse is: (0.1[μ m]) \times (1[μ m]) \times (Manual pulse generator 1- pulse input magnification setting)

(b) Output speed

The output speed is the positioning speed corresponding to the number of pulses input from a manual pulse generator in unit time.

[Output speed] = [Number of input pulses per 1[ms]] × [Manual pulse generator 1- pulse input magnification setting]

(3) Setting of the axis operated by the manual pulse generator The axis operated by the manual pulse generator is set in the manual pulse generator axis setting register (D714 to D719). The bit corresponding to the axis controlled (1 to 32) is set.

(4) Manual pulse generator 1- pulse input magnification setting Make magnification setting for 1- pulse input from the manual pulse generator for each axis.

1- pulse input magnification setting register	Applicable axis No. (Note-1)	Setting range
D720	Axis 1	
D721	Axis 2	
D722	Axis 3	
D723	Axis 4	
D724	Axis 5	
D725	Axis 6	
D726	Axis 7	
D727	Axis 8	
D728	Axis 9	
D729	Axis 10	
D730	Axis 11	
D731	Axis 12	
D732	Axis 13	
D733	Axis 14	
D734	Axis 15	
D735	Axis 16	4 +- 40000
D736	Axis 17	1 to 10000
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	

(Note-1): The following range is valid.

• Q172DSCPU : Axis No.1 to 16

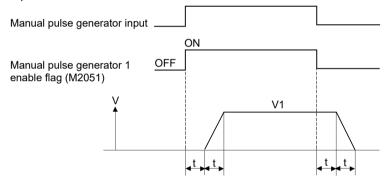
• Q172DCPU(-S1) : Axis No.1 to 8

(Note): The manual pulse generator does not have a speed limit value, so set the magnification setting within the rated speed of the servo motor.

- (5) The setting manual pulse generator 1- pulse input magnification checks the "1-pulse input magnification setting registers of the manual pulse generator" of the applicable axis at leading edge of manual pulse generator enable flag. If the value is outside of range, the manual pulse generator axis setting error register (SD513 to SD515) and manual pulse generator axis setting error flag (SM513) are set and a value of "1" is used for the magnification.
- (6) Manual pulse generator smoothing magnification setting A magnification to smooth leading edge/trailing edge of manual pulse generator operation is set.

Manual pulse generator smoothing magnification setting register	Setting range
Manual pulse generator 1 (P1): D752	
Manual pulse generator 2 (P2): D753	0 to 59
Manual pulse generator 3 (P3): D754	

(a) Operation



Output speed (V1) = [Number of input pulses/ms] \times [Manual pulse generator 1- pulse input magnification setting]

Travel value (L) = [Travel value per pulse] \times [Number of input pulses] \times [Manual pulse generator 1-pulse input magnification setting]

(b) When the smoothing magnification is set, the smoothing time constant is as following formula.

Smoothing time constant (t) = (Smoothing magnification + 1) \times 56.8 [ms]

REMARK

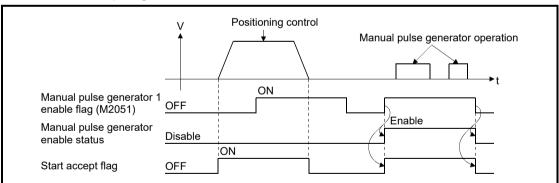
The smoothing time constant is within the range of 56.8 to 3408 [ms].

(7) Errors details at the data setting for manual pulse generator operation are shown below.

Error details	Error processing
Axis setting is 4 axes or more	Manual pulse generator operation is executed according to valid for 3 axes from the lowest manual pulse generator axis setting register.
All of bit is "0" for the effective axis No. of manual pulse generator axis No. setting register.	Manual pulse generator operation is not executed.

[Cautions]

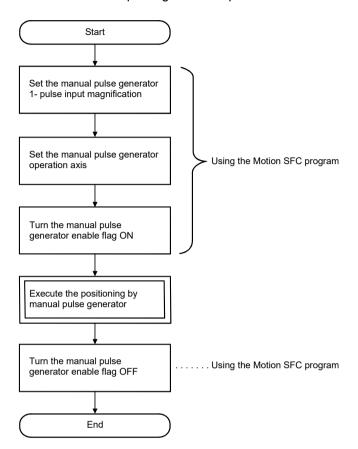
- (1) The start accept flag turns on for axis during manual pulse generator operation. Positioning control or home position return cannot be started using the Motion CPU or MT Developer2.
 - Turn off the manual pulse generator enable flag after the manual pulse generator operation end.
- (2) When the torque limit value is not specified with D(P).CHGT (torque limit value change request instruction form the PLC CPU to the Motion CPU), D(P).CHGT2 (torque limit value individual change request instruction form the PLC CPU to the Motion CPU) (CHGT) (torque limit value change request) or CHGT2 (torque limit value individual change request) (CHGT).
 - The torque limit value is fixed at 300[%] during manual pulse generator operation.
- (3) If the manual pulse generator enable flag turns on for the axis for which the start accept flag is ON, a minor error (error code: 214) is set to the applicable axis and manual pulse generator input is not enabled. When enabling the manual pulse generator input, turn the manual pulse generator flag ON again while the start accept flag is OFF.



- (4) If another axis is set and the same manual pulse generator enable flag turns on again during smoothing deceleration after manual pulse generator enable flag turns off, the manual pulse generator input is not enabled.
 - At this time, the manual pulse generator axis setting error bit of the manual pulse generator axis setting error storage register (SD513 to SD515) turns on, and the manual pulse generator axis setting error flag (SM513) turns on.
 - Include the start accept flag OFF for specified axis as an interlock condition for turning on the manual pulse generator enable flag.

[Procedure for manual pulse generator operation]

Procedure for manual pulse generator operation is shown below.

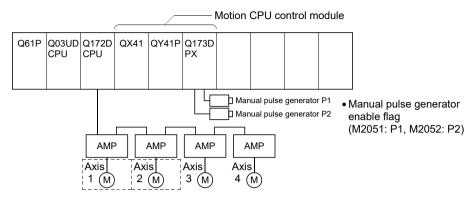


[Program]

Program executes manual pulse generator operation is shown as the following conditions.

(1) System configuration

Manual pulse generator operation of Axis 1 and Axis 2.

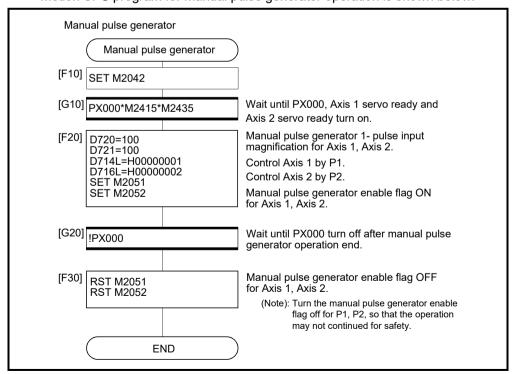


(2) Manual pulse generator operation conditions

- (a) Manual pulse generator operation axis......Axis 1, Axis 2
- (b) Manual pulse generator 1- pulse input magnification........... 100
- (c) Manual pulse generator operation enableM2051 (Axis 1)/ M2052 (Axis 2) ON
- (d) Manual pulse generator operation endM2051 (Axis 1)/
 M2052 (Axis 2) OFF

(3) Motion SFC program

Motion SFC program for manual pulse generator operation is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

MEMO			
_			

6.23 Home Position Return

- (1) Use the home position return at the power supply ON and other times where decision of axis is at the machine home position is required.
- (2) The home position return data must be set for each axis to execute the home position return.
- (3) The home position return methods that are available are proximity dog method, count method, data set method, dog cradle method, stopper method, limit switch combined method, scale home position signal detection method, dogless home position signal reference method, and driver home position return method. Select the optimal home position return method for the system configuration and applications with reference to the following.

	sition return thods	Reference position	External signal	Applications
Proximity dog method	Proximity dog method 1 Proximity dog method 2	Motor zero point		 It is used in the system which can surely pass a zero point from the home position return start to proximity dog ON → OFF. When the proximity dog is ON, it cannot be started. This method is valid when the stroke range is short and "proximity dog method 1" cannot be used. When the proximity dog is ON, it cannot be started.
Count	Count method 1 Count Command	It is used in the system which can surely pass a zero point from the home position return start to point of travel distance set as "travel value after proximity dog ON".		
method		• This method is used when the proximity dog is near the stroke end and the stroke range is narrow.		
	Count method 3	Motor zero point		This method is valid when the stroke range is short and "count method "cannot be used."
Data set method	Data set method 1	Command position	_	 It is used in a system where external input signals such as dog signal are not set in the absolute position system. This method is valid for the data set independent of a deviation counter value.
	Data set method 2	Motor actual position		It is used in a system where external input signals such as dog signal are not set in the absolute position system.
Dog cradle	method	Motor zero point	DOG (FLS/RLS)	 Home position is zero point of servo motor immediately after the proximity dog signal ON. It is easy to set the position of proximity dog, because the proximity dog is set near the position made to the home position.
Stopper	Stopper method 1	Motor actual	DOG	This method is valid to improve home position accuracy in order to make the home position for the position which stopped the machine by
method	nethod Stopper position		_	the stopper.

Home position return methods	Reference position	External signal	Applications
Limit switch combined method		FLS (for forward home position return direction)/RLS (for reverse home position return direction)	It is used in a system where the proximity dog signal cannot be used and only external limit switch can be used.
Scale home position signal detection method	Motor zero point	DOG	 The travel direction is reversed at the proximity dog ON, and home position is encoder zero point after reversal. This method is valid to make the home position for the load side at the linear motors or direct drive motors use.
Dogless home position signal reference method		(FLS/RLS)	 It is used in a system where proximity dog signal cannot be used and stops at the zero point of servo motor. Home position return operation differs by servo amplifier.
Driver home position return method Gera	Position in driver settings	_	The driver performs home position return operation autonomously according to the settings on the driver-side.

Ver.!: Refer to Section 1.3 for the software version that supports this function.

6.23.1 Home position return data

This data is used to execute the home position return. Set this data using MT Developer2.

Table 6.3 Home position return data list

					0-4:							
		Setting range mm inch degree pulse						Initial				
No.	Item							value	Units			
		Setting range	Units	Setting range	Units	Setting range	Units	Setting range	Units			
1	Home position return direction				•	decrease direction	•			0	_	
2	Home position return method	4: Proximity dog 1: Count metho 5: Count metho 6: Count metho	0: Proximity dog method 1 4: Proximity dog method 2 8: Stopper method 1 1: Count method 1 9: Stopper method 2 5: Count method 2 10: Limit switch combined method 6: Count method 3 11: Scale home position signal detection method 2: Data set method 1 12: Dogless home position signal reference method 3: Data set method 2 13: Driver home position return method					0	_			
3	Home position address	-214748364.8 to 214748364.7	μm	-21474.83648 to 21474.83647	inch	0 to 359.99999	degree	-2147483648 to 2147483647	pulse	0	pulse	
4	Home position return speed	0.01 to 6000000.00	mm/min	0.001 to 600000.000	inch/min	0.001 to 2147483.647 (Note-1)	degree/ min	1 to 2147483647	pulse/s	1	pulse/	
5	Creep speed	0.01 to 6000000.00	mm/min	0.001 to 600000.000	inch/min	0.001 to 2147483.647 (Note-1)	degree/ min	1 to 2147483647	pulse/s	1	pulse/	
6	Travel value after proximity dog ON	0.0 to 214748364.7	μm	0.00000 to 21474.83647	inch	0.00000 to 21474.83647	degree	0 to 2147483647	pulse	0	pulse	
7	Parameter block setting	1 to 64							1	_		
8	Home position return retry function		O: Invalid (Do not execute the home position return retry by limit switch.) 1: Valid (Execute the home position return retry by limit switch.)							0	_	
9	Dwell time at the home position return retry		0 to 5000 [ms]							0	ms	
10	Home position shift amount	-214748364.8 to 214748364.7	μm	-21474.83648 to 21474.83647	inch	-21474.83648 to 21474.83647	degree	-2147483648 to 2147483647	pulse	0	pulse	
11	Speed set at the home position shift	0: Home position return speed 1: Creep speed						0	_			
12	Torque limit value at the creep speed	1 to 1000 [%]							300	%		
13	Operation setting for incompletion of home position return	0: Execute a servo program 1: Not execute a servo program					1	_				

Indirect setting		Downston	Explanatory
Valid/invalid	Number of words	Remarks	section
_	_	The home position return direction is set.	_
-	_	The home position return method is set. The proximity dog method or count method are recommended for the servo amplifier which does not support absolute value.	
0	2	The current value of home position after the home position return is set.	
0	2	The home position return speed is set.	_
0	2	The creep speed (low speed immediately before stopping after deceleration from home position return speed) after the proximity dog ON is set.	_
0	2	The travel value after the proximity dog ON for the count method is set. More than the deceleration distance at the home position return speed is set.	
_	_	The parameter block (Refer to Section 4.3) No. to use for home position return is set.	_
_	_	/alid/invalid of home position return retry is set.	
0	1	The stop time at the deceleration stop during the home position return retry is set.	6.23.1 (2)
0	2	The shift amount at the home position shift is set.	6.23.1 (3)
_	_	The operation speed which set the home position shift amount except "0" is set.	
0	1	The torque limit value with creep speed at the stopper method home position return is set.	
-	_	When the home position return request signal is ON, it set whether a servo program is executed or not.	

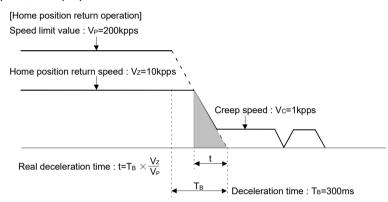
(Note-1): When the "speed control $10 \times \text{multiplier}$ setting for degree axis" is set to "valid" in the fixed parameter, the setting range is "0.01 to 21474836.47[degree/min]".

(1) Travel value after proximity dog ON

- (a) The travel value after proximity dog ON is set to execute the count method home position return.
- (b) After the proximity dog ON, the home position is the first zero-point after travel by the setting travel value.
- (c) Set the travel value after proximity dog ON more than the deceleration distance from the home position return speed.

Example

The deceleration distance is calculated from the speed limit value, home position return speed, creep speed and deceleration time as shown below.



[Deceleration distance (shaded area under graph)]

$$= \frac{1}{2} \times \frac{V_z}{1000} \times t$$

$$= \frac{V_z}{2000} \times \frac{T_B \times V_z}{V_P}$$

$$= \frac{10 \times 10^3}{2000} \times \frac{300 \times 10 \times 10^3}{200 \times 10^3}$$

$$= 75 \dots \text{ Set 75 or more}$$

POINT

(1) A home position return must be made after the servo motor has been rotated more than one revolution to pass the axis through the Z-phase (motor reference position signal).

For a proximity dog method or count method home position return, the distance between the point where the home position return program is started and the deceleration stop point before re-travel must be such that the servo motor is rotated more than one revolution to pass the axis through the Z-phase.

When a data set method home position return is made in an ABS (absolute position) system, the servo motor must also have been rotated more than one revolution by JOG operation or the like to pass the axis through the Z-phase.

- (Note): When "1: No servo motor Z-phase pass after power ON" is selected in the "function selection C-4 (PC17)" of servo parameter (expansion setting parameter), even if it does not pass zero point, the home position return can be executed and restrictions are lost.
- (2) Calculate the movement amount using the same procedure in the example above, regardless of the unit setting.

- (2) Home position return retry function/dwell time at the home position
 - (a) Valid/invalid of home position return retry is set.

return retry

- (b) When the valid of home position return retry function is set, the time to stop at return of travel direction is set with dwell time at the home position return retry.
- (c) Operation for the proximity dog method home position return by setting "valid" for home position return retry function is shown below.

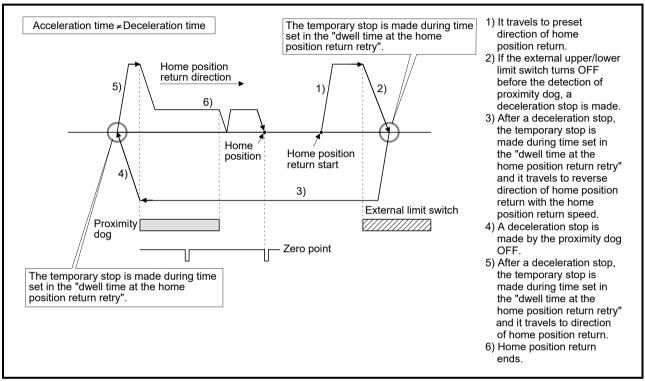


Fig. 6.31 Operation for home position return retry function

(d) Valid/invalid of home position return retry function by the home position return method is shown below.

Home position re	eturn methods	Valid/invalid of home position return retry function
Proximity dog meth	od	0
Count method		0
Data set method		×
Dog cradle method		0
Stopper method		×
Limit switch combin	ned method	×
Scale home positio detection method	n signal	×
Dogless home	Operation A	0
position signal	Operation B	×
reference method	Operation C	×
Driver home position	n return method	×

○: Valid, ×: Invalid

- (3) Home position shift amount/speed set at the home position shift
 - (a) The shift (travel) amount from position stopped by home position return is set.
 - (b) If the home position shift amount is positive value, it shifts from detected zero point signal to address increase direction. If it is negative value, it shifts from detected zero point signal to address decrease direction.
 - (c) Operation speed which set the home position shift amount except "0" is set in the speed set at the home position shift. Select one of the "home position return speed" or "creep speed".

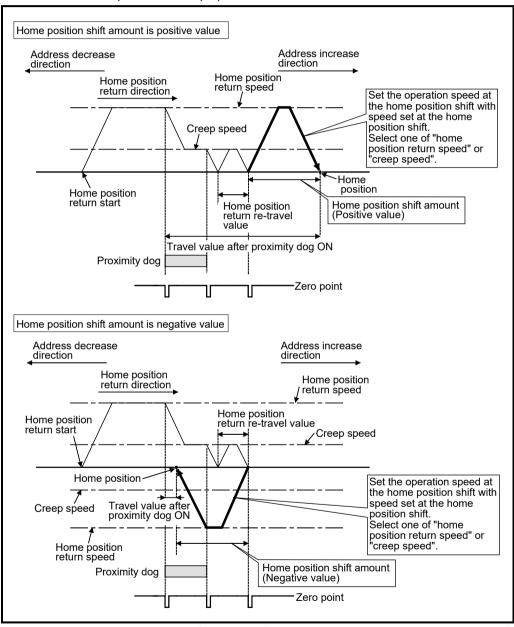


Fig. 6.32 Home position shift amount/speed set at the home position shift

(d) Valid/invalid of the setting value for home position shift amount by the home position return method is shown below.

Home position return methods	Valid/invalid of home position shift amount
Proximity dog method	0
Count method	0
Data set method	×
Dog cradle method	0
Stopper method	×
Limit switch combined method	0
Scale home position signal detection method	0
Dogless home position signal reference method	0
Driver home position return method	×

○: Valid, ×: Invalid

POINT

- (1) Home position shift function is used to rectify a home position stopped by the home position return. When there are physical restrictions in the home position by the relation of a proximity dog setting position, the home position is rectified to the optimal position. In addition, by using the home position shift function it is not necessary to consider the zero point when mounting the servo motor.
- (2) After proximity dog ON, if the travel value including home position shift amount exceeds the range of "-2147483648 to 2147483647" [$\times\,10^{\text{-}1}\mu\text{m},\,\times\,10^{\text{-}5}\text{inch},\,\times\,10^{\text{-}5}\text{degree},\,\text{pulse}$], "travel value after proximity dog ON" of monitor register is not set correctly.
- (4) Torque limit value at the creep speed
 - (a) Torque limit value at the creep speed (on press) is set in the case of using the pressed position as the home position by the home position return of stopper method 1, 2.
 - (b) Valid/invalid of the torque limit value at the creep speed by the home position return method is shown below.

Home position return methods	Valid/invalid of torque limit value at the creep speed
Proximity dog method	×
Count method	×
Data set method	×
Dog cradle method	×
Stopper method	0
Limit switch combined method	×
Scale home position signal detection method	×
Dogless home position signal reference method	×
Driver home position return method	×

○: Valid, ×: Invalid

- (a) Operation in selecting "1: Not execute servo program"
 - Servo program cannot be executed if the home position return request signal (M2409+20n) is ON. However, the servo program can be executed even if the home position return request signal (M2409+20n) is ON in the case of only servo program of home position return instruction (ZERO).
 - 2) At the time of servo program start, when "1: Not execute servo program" is selected in the operation setting for incompletion of home position return and the axis which the home position return request signal (M2409+20n) is ON exists also with one axis, a minor error (error code: 121) occurs and the servo program does not start.
 - JOG operation and manual pulse generator operation can be executed regardless of the home position return request signal (M2409+20n) ON/OFF.
 - 4) Same operation is executed regardless of absolute position system or not. When "1: Not execute servo program" is selected in the case of not absolute position system, the home position return request signal (M2409+20n) turns ON at power supply ON or reset of Multiple CPU system and power supply ON of servo amplifier. Therefore, it must be executed home position return before a servo program start.
 - 5) Same operation is executed in also TEST mode.
 - 6) This setting is valid in the real mode only. Servo program can be executed for a virtual axis connected to the output axis which the home position return request signal (M2409+20n) is ON.
- (b) Operation in selecting "0: Execute servo program"
 - 1) Servo program can be executed even if the home position return request signal (M2409+20n) is ON.

⚠ CAUTION

 Do not execute the positioning control in home position return request signal (M2409+20n) ON for the axis which uses in the positioning control.

Failure to observe this could lead to an accident such as a collision.

(6) Indirect setting of home position return data

A part of home position return data can be executed the indirect setting by the word devices of Motion CPU.

(a) Word devices for indirect setting

The word devices for indirect setting are the data registers (D), link registers (W), Motion registers (#) and Multiple CPU area device (U□\G).

Word devices except the above devices cannot be used.

The usable setting range of word devices are shown below. (For data that uses2 words, set as an even number.)

Word devices	Setting range
D	0 to 8191
W	0 to 1FFF
#	0 to 7999
U□\G	10000 to (10000+p-1) (Note-1)

(Note-1): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

(b) Input of home position return

In the indirect setting by the word devices, the specified word device data are read at servo program execution by Motion CPU.

Set data to devices for indirect setting and then execute the start request of servo program at home position return.

- (1) Indirect setting of axis cannot be executed using word devices in the servo program.
- (2) Take an interlock with start accept flag (M2001 to M2032) not to change until the device data specified for indirect setting.
 - If the device data is changed before starting accept, it may not execute the home position return at the normal value.
- (3) Refer to the Chapter 2 of "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for the user setting area points of the Multiple CPU high speed transmission area.

(7) Setting items for home position return data

		(7) Cetting items for			•							n mo	thoda	,				
Items							HOITIE	e pos	Sidori	retur	n me			Dogless home position signal reference method		e on I ce	um method	
		Proximity dog method 1	Proximity dog method 2	Count method 1	Count method 2	Count method 3	Data set method 1	Data set method 2	Dog cradle method	Stopper method 1	Stopper method 2	Limit switch combined method	Scale home position signal detection method	Operation A	Operation B	Operation C	Driver home position return method	
	Home position r		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Home position a		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Home position r	return speed	0	0	0	0	0	_	_	0	0	_	0	0	0	0	0	_
	Creep speed		0	0	0	0	0	_	_	0	0	0	0	0	0	0	0	
l		er proximity dog ON	_	_	0 (0	0	_	_	_	_	_	_			_	_	_
Home	- v		0	0	0	0	0	_	_	0	0	0	0	0	0	0	0	_
position		return retry function	0	0	0	0	0	_	_	0	_	_	_	_	0	_	_	
return data	- · · · · · · · · · · · · · · · · · · ·		0	0	0	0	0	_	_	0	_	_	<u> </u>	<u> </u>	0	<u> </u>	-	_
	Home position shift amount Speed set at the home position shift		0	0	0 (0	0	_	_	0		_	0	0	0	0	0	-
	Speed set at the home position shift		0	0	0	0	0	_	_	0	-	<u> </u>	0	0		0	0	_
	Torque limit value at the creep speed		_	_	_	_	_	_	_	_	0	0	_	_	_	_	_	
	position return	ng for incompletion of home	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Interpolation co	ntrol unit	_	_	_	_	_	_	_	_	_	_	_	_	_	_	—	—
	Speed limit valu	ie	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_
	Acceleration tim	ne	0	0	0	0	0	_	_	0	0	0	0	0	0	0	0	_
	Deceleration tim	ne	0	0	0	0	0	_	_	0	0	0	0	0	0	0	0	—
	Rapid stop dece	eleration time	0	0	0	0	0	_	_	0	0	0	0	0	0	0	0	_
	S-curve ratio		0	0	0	0	0	_	_	0	0	0	0	0	0	0	0	_
Parameter Advanced		Acceleration/deceleration system	0	0	0	0	0			0	0	0	0	0	0	0	0	_
blocks	S-curve	Acceleration section 1 ratio	0	0	0	0	0	_	_	0	0	0	0	0	0	0	0	_
	acceleration/	Acceleration section 2 ratio	0	0	0	0	0	_	_	0	0	0	0	0	0	0	0	
	deceleration	Deceleration section 1 ratio	0	0	0	0	0	_	_	0	0	0	0	0	0	0	0	_
		Deceleration section 2 ratio	0	0	0	0	0	_	_	0	0	0	0	0	0	0	0	_
	Torque limit valu	ue	0	0	0	0	0	_	_	0	0	0	0	0	0	0	0	_
	Deceleration processing at the stop time		0	0	0	0	0	_	_	0	0	0	0	0	0	0	0	_
	Allowable error	range for circular interpolation	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_

^{○:} Must be set (Indirect setting)

^{○:} Must be set

^{—:} Must be not set

6.23.2 Home position return by the proximity dog method 1

(1) Proximity dog method 1

Zero point position after proximity dog ON to OFF is home position in this method. When it does not pass (zero pass signal: M2406+20n OFF) the zero point from home position return start to deceleration stop by proximity dog ON to OFF, an error will occur and home position return is not executed. However, when "1: Not need to pass motor Z phase after the power supply is switched on" is selected in the "function selection C-4 (PC17)" of servo parameter (expansion setting parameter), if it does not pass zero point from home position return start to deceleration stop by proximity dog ON to OFF, the home position return can be executed.

(2) Home position return by the proximity dog method 1 Operation of home position return by proximity dog method 1 for passing (zero pass signal: M2406+20n ON) the zero point from home position return start to

pass signal: M2406+20n ON) the zero point from home position return start to deceleration stop by proximity dog ON to OFF is shown below.

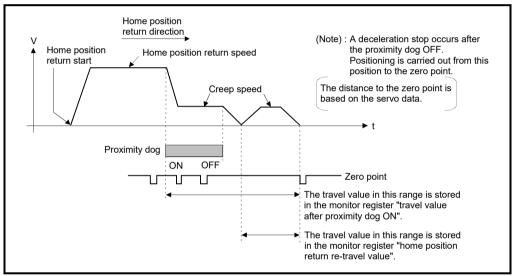


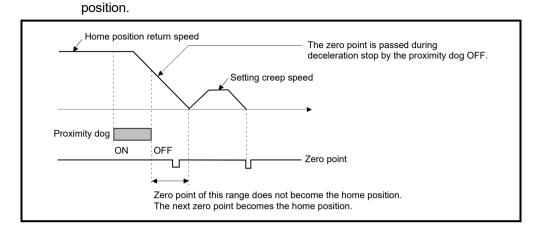
Fig. 6.33 Home position return operation by the proximity dog method 1

(3) Home position return execution

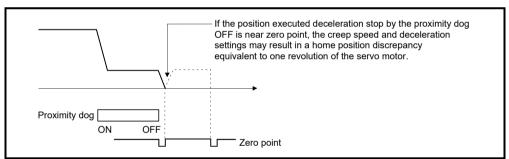
Home position return by the proximity dog method 1 is executed using the servo program in Section 6.23.19.

(4) Cautions

(a) Keep the proximity dog ON during deceleration from the home position return speed to the creep speed.If the proximity dog turns OFF before deceleration to the creep speed, a deceleration stop is made and the next zero point is set as the home



(b) The position executed deceleration stop by the proximity dog OFF is near zero point, a home position discrepancy equivalent to one revolution of the servo motor may occur. Adjust the position of proximity dog OFF, such that the home position return re-travel value becomes half the travel value for one revolution of the servo motor.



POINT

When the home position return retry function is not set in the following cases, execute the home position return, after return the axis once to position before the proximity dog ON by the JOG operation, etc.

Home position return cannot be executed without returning to position before the proximity dog ON.

- (1) Home position return with a position after the proximity dog ON to OFF.
- (2) When the power supply turned OFF to ON after home position return end.

- (c) When it does not pass (zero pass signal: M2406+20n ON) the zero point from home position return start to deceleration stop by proximity dog ON to OFF, a minor error (error code: 120) will occur, a deceleration stop is made and home position return does not end normally. When a distance between home position return start position and home position is near and a zero point is not passed, select the proximity dog method 2.
- (d) If home position return is executed in the proximity dog ON, a major error (error code: 1003) will occur, the home position return is not executed. Use the proximity dog method 2 in this case.
- (e) When home position return retry function is not set, if home position return is executed again after home position return end, a minor error (error code: 115) will occur, the home position return is not executed.
- (f) If in-position signal (M2402+20n) does not turn ON, home position return is not ended.

6.23.3 Home position return by the proximity dog method 2

(1) Proximity dog method 2

Zero point position after proximity dog ON to OFF is home position in this method. When it passed (zero pass signal: M2406+20n ON) the zero point from home position return start to deceleration stop by proximity dog ON to OFF, operation for "proximity dog method 2" is the same as "proximity dog method 1". (Refer to Section 6.23.2)

When it does not pass (zero pass signal: M2406+20n OFF) the zero point from home position return start to deceleration stop by proximity dog ON to OFF, it moves to home position return direction after the servo motor is rotated one revolution to reverse direction and it passed the zero point, and the first zero point position is set as home position after proximity dog ON to OFF.

(2) Home position return by the proximity dog method 2 Operation of home position return by proximity dog method 2 for not passing the zero point from home position return start to deceleration stop by proximity dog ON to OFF is shown below.

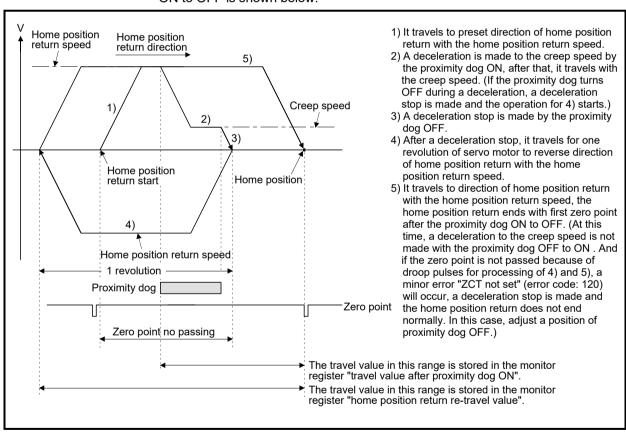


Fig. 6.34 Home position return operation by the proximity dog method 2 (zero point no passing)

(3) Home position return execution

Home position return by the proximity dog method 2 is executed using the servo program in Section 6.23.19.

- (a) A system in which the servo motor can rotate one time or more is required.
- (b) When a servo motor stops with the specified condition enabled and rotates to reverse direction one time after proximity dog ON, make a system which does not turn OFF the external upper/lower stroke limit.
- (c) Keep the proximity dog ON during deceleration from the home position return speed to the creep speed.If the proximity dog turns OFF before deceleration to the creep speed, a deceleration stop is made and the next zero point is set as the home position.
- (d) If home position return is executed in the proximity dog ON, it starts with the creep speed.
- (e) When home position return retry function is not set, if home position return is executed again after home position return completion, a minor error (error code: 115) will occur, the home position return is not executed.
- (f) When "1 : Not need to pass motor Z phase after the power supply is switched on" is selected in the "function selection C-4 (PC17)" of servo parameter (expansion setting parameter), even if it does not pass zero point at the servo amplifier power ON, the zero pass signal (M2406+20n) turns ON. This operation is the same as proximity dog method 1.
- (g) If in-position signal (M2402+20n) does not turn ON, home position return is not ended.

6.23.4 Home position return by the count method 1

(1) Count method 1

After the proximity dog ON, the zero point after the specified distance (travel value after proximity dog ON) is home position in this method. When the zero point is not passed (zero pass signal: M2406+20n OFF) until it travels the distance set in the "travel value after proximity dog ON" from home position return start, an error will occur and home position return is not executed. However, when "1: Not need to pass motor Z phase after the power supply is switched on" is selected in the "function selection C-4 (PC17)" of servo parameter (expansion setting parameter), if the zero point is not passed until it travels the distance set in the "travel value after proximity dog ON" from home position return start, the home position return can be executed. The travel value after proximity dog ON is set in the home position return data

(Refer to Section 6.23.1).

(2) Home position return by the count method 1

Operation of home position return by count method 1 for passing the zero point during travel of specified distance set in the "travel value after proximity dog ON" from the home position return start is shown below.

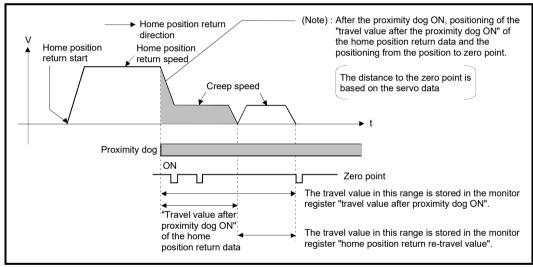


Fig. 6.35 Home position return operation by the count method 1

(3) Home position return execution

Home position return by the count method 1 is executed using the servo program in Section 6.23.19.

(4) Cautions

- (a) Home position return and continuously start of home position return are also possible in the proximity dog ON in the count method 1. When the home position return or continuously start of home position return are executed in the proximity dog ON, the home position return is executed after return the axis once to position of the proximity dog OFF.
- (b) When the zero point is not passed (zero pass signal: M2406+20n ON) until it travels the distance set in the "travel value after proximity dog ON" from home position return start, a minor error (error code: 120) will occur, a deceleration stop is made and home position return does not end normally. When a distance between home position return start position and home position is near and a zero point is not passed, select the count method 3.
- (c) When the "travel value after proximity dog ON" is less than the deceleration distance from "home position return speed" to "creep speed", a minor error (error code: 209) will occur and deceleration stop is made.
- (d) If in-position signal (M2402+20n) does not turn ON, home position return is not ended.

REMARK

The signal types that can be used with home position return by the count method 1 are shown below.

Signal type	Q173DSCPU/ Q172DSCPU	Q173DCPU(-S1)/ Q172DCPU(-S1)
DOG signal of Q172DLX	0	0
External input signal (DOG) of servo amplifier (DOG)	0	⊖ (Ver.)
Built-in interface in Motion CPU (DI)	0	×
Bit device	0	×

○: Usable, ×: Unusable

Ver.!): Refer to Section 1.3 for the software version that supports this function.

6.23.5 Home position return by the count method 2

(1) Count method 2

After the proximity dog ON, the position which traveled the specified distance (travel value after proximity dog ON) is home position in this method. It is not related for zero point pass or not pass.

A count method 2 is effective method when a zero point signal cannot be taken. (However, dispersions will occur to the stop position at the home position return compared with the count method 1.)

The travel value after proximity dog ON is set in the home position return data (Refer to Section 6.23.1).

(2) Home position return by the count method 2

Operation of home position return by count method 2 is shown below.

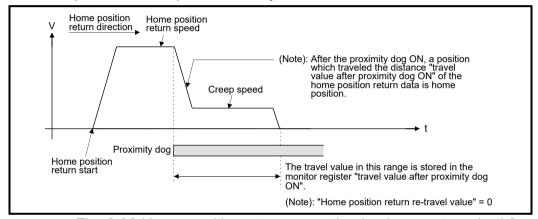


Fig. 6.36 Home position return operation by the count method 2

(3) Home position return execution

Home position return by the count method 2 is executed using the servo program in Section 6.23.19.

- (a) Home position return and continuously start of home position return are also possible in the proximity dog ON in the count method 2. When the home position return and continuously start of home position return are executed in the proximity dog ON, the home position return is executed after return the axis once to position of the proximity dog OFF.
- (b) When the "travel value after proximity dog ON" is less than the deceleration distance from "home position return speed" to "creep speed", a minor error (error code: 209) will occur and deceleration stop is made.
- (c) Command position is the home position.
- (d) If in-position signal (M2402+20n) does not turn ON, home position return is not ended.

REMARK

The signal types that can be used with home position return by the count method 2 are shown below.

Signal type	Q173DSCPU/ Q172DSCPU	Q173DCPU(-S1)/ Q172DCPU(-S1)
DOG signal of Q172DLX	0	0
External input signal (DOG) of servo amplifier (DOG) (Note-1)	0	○ (Ver.)
Built-in interface in Motion CPU (DI)	0	×
Bit device	0	×

○: Usable, ×: Unusable

(Note-1): The variation for ON/OFF timing of the external input signal (DOG) of servo amplifier may occur according to the input filter setting value of external signal input setting.

Review the input filter setting value compatible with the applications.

Use the Q172DLX or built-in interface in Motion CPU (DI) to execute the high-accuracy control.



Ver.!: Refer to Section 1.3 for the software version that supports this function.

6.23.6 Home position return by the count method 3

(1) Count method 3

After the proximity dog ON, the zero point after the specified distance (travel value after proximity dog ON) is home position in this method.

When the zero point is passed (zero pass signal: M2406+20n ON) during travel of specified distance set in the "travel value after proximity dog ON" from the home position return start, home position return operation is the same as "count method 1". (Refer to Section 6.23.4)

When a zero point is not passed (zero pass signal: M2406+20n OFF) during travel of specified distance set in the "travel value after proximity dog ON" from the home position return start, it rotates one time to reverse direction and passes the zero point, re-travels to home position return direction, and then the first zero point after the specified distance (travel value after proximity dog ON) after proximity dog ON is set as home position.

The travel value after proximity dog ON is set in the home position return data (Refer to Section 6.23.1).

(2) Home position return by the count method 3

Operation of home position return by count method 3 for not passing the zero point during travel of specified distance set in the "travel value after proximity dog ON" from the home position return start is shown below.

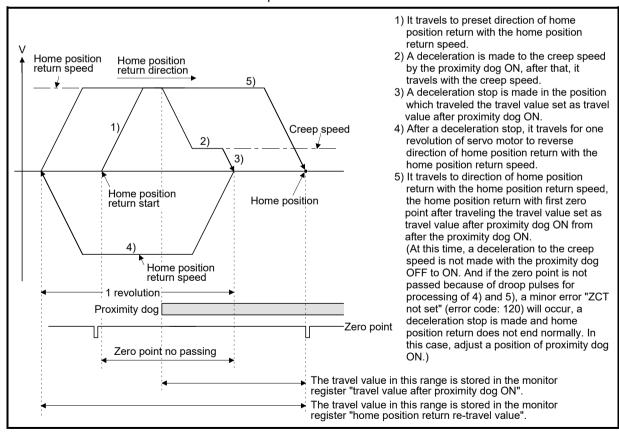


Fig. 6.37 Home position return operation by the count method 3 (zero point no passing)

(3) Home position return execution

Home position return by the count method 3 is executed using the servo program in Section 6.23.19.

(4) Cautions

- (a) A system in which the servo motor can rotate one time or more is required.
- (b) After the proximity dog ON, when a servo motor rotates one time to reverse direction after stop with travel value set in the "travel value after proximity dog ON", make a system which does not turn OFF the external upper/lower stroke limit.
- (c) Home position return and continuously start of home position return are also possible in the proximity dog ON in the count method 3. When the home position return and continuously start of home position return are executed in the proximity dog ON, the home position return is executed after return the axis once to position of the proximity dog OFF.
- (d) When the "travel value after proximity dog ON" is less than the deceleration distance from "home position return speed" to "creep speed", a minor error (error code: 209) will occur and deceleration stop is made.
- (e) When "1: Not need to pass motor Z phase after the power supply is switched on" is selected in the "function selection C-4 (PC17)" of servo parameter (expansion setting parameter), even if it does not pass zero point at the servo amplifier power ON, the zero pass signal (M2406+20n) turns ON. This operation is the same as count method 1.
- (f) If in-position signal (M2402+20n) does not turn ON, home position return is not ended.

REMARK

The signal types that can be used with home position return by the count method 3 are shown below.

Signal type	Q173DSCPU/ Q172DSCPU	Q173DCPU(-S1)/ Q172DCPU(-S1)
DOG signal of Q172DLX	0	0
External input signal (DOG) of servo amplifier (DOG)	0	○ Ver.
Built-in interface in Motion CPU (DI)	0	×
Bit device	0	×

○: Usable, ×: Unusable

Ver.!): Refer to Section 1.3 for the software version that supports this function.

6.23.7 Home position return by the data set method 1

(1) Data set method 1

The proximity dog is not used in this method.

(2) Home position return by the data set method 1

Home position is the command position at the home position return operation.

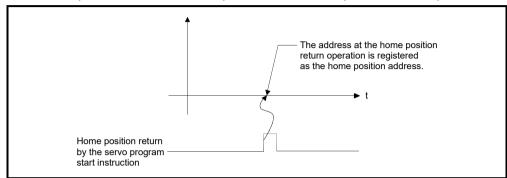


Fig. 6.38 Home position return operation by the data set method 1

(3) Home position return execution

Home position return by the data set method 1 is executed using the servo program in Section 6.23.19.

- (a) A zero point must be passed (zero pass signal: M2406+20n ON) between turning ON the power supply and executing home position return. If home position return is executed without passing a zero point once, "no zero point passed error" occurs. If "no zero point passed error" occurred, perform the home position return again after resetting the error and turn the servo motor at least one revolution by the JOG operation. The zero point passing can be confirmed with the zero pass signal (M2406+20n). However, when "1: Not need to pass motor Z phase after the power supply is switched on" is selected in the "function selection C-4 (PC17)" of servo parameter (expansion setting parameter), even if it does not pass zero point at the servo amplifier power ON, the home position return is possible because the zero pass signal (M2406+20n) turns ON.
- (b) Home position return is started by the data set method 1 when the absolute position system does not support, it becomes same function as the current value change command.
- (c) The home position return data required for the data set method 1 are the home position return direction and home position address.
- (d) If in-position signal (M2402+20n) does not turn ON, home position return is not ended.

6.23.8 Home position return by the data set method 2

(1) Data set method 2

The proximity dog is not used in this method.

(2) Home position return by the data set method 2

Home position is the real position of the servo motor at the home position return operation.

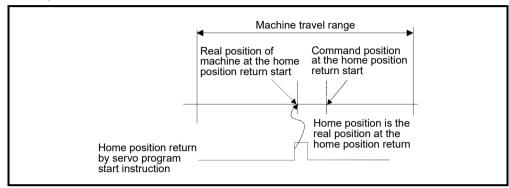


Fig. 6.39 Home position return operation by the data set method 2

(3) Home position return execution

Home position return by the data set method 2 is executed using the servo program in Section 6.23.19.

- (a) A zero point must be passed (zero pass signal: M2406+20n ON) between turning on the power supply and executing home position return. If home position return is executed without passing a zero point once, "no zero point passed error" occurs. If "no zero point passed error" occurred, perform the home position return again after resetting the error and turn the servo motor at least one revolution by the JOG operation. The zero point passing can be confirmed with the zero pass signal (M2406+20n). However, when "1: Not need to pass motor Z phase after the power supply is switched on" is selected in the "function selection C-4 (PC17)" of servo parameter (expansion setting parameter), even if it does not pass zero point at the servo amplifier power ON, the home position return is possible because the zero pass signal (M2406+20n) turns ON.
- (b) The home position return data required for the data set method 2 are the home position return direction and home position address.

6.23.9 Home position return by the dog cradle method

(1) Dog cradle method

After deceleration stop by the proximity dog ON, if the zero point is passed (zero pass signal: M2406+20n ON) after traveling to reverse direction and turning the proximity dog OFF, the deceleration stop is made. And it moves to direction of home position return again with creep speed and the first zero point after proximity dog ON is home position in this method.

(2) Home position return by the dog cradle method

Operation of home position return by the dog cradle method for setting the
proximity dog in the home position return direction is shown below.

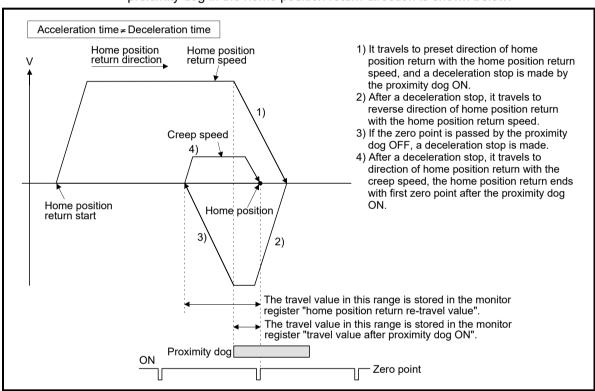


Fig. 6.40 Home position return operation by the dog cradle method

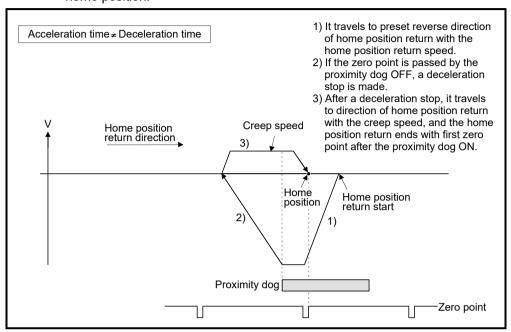
(3) Home position return execution

Home position return by the dog cradle method is executed using the servo program in Section 6.23.19.

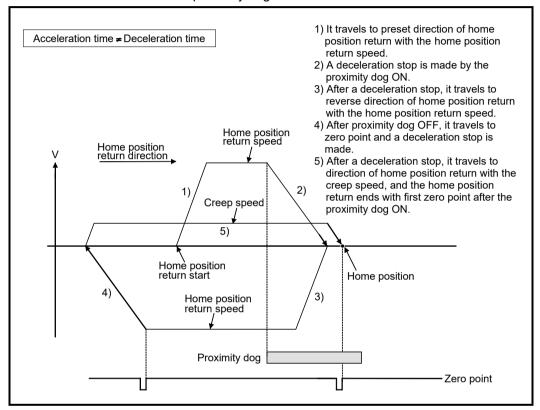
(4) Cautions

(a) When home position return retry function is not set, if home position return is executed again after home position return end, a minor error (error code: 115) will occur, the home position return is not executed.

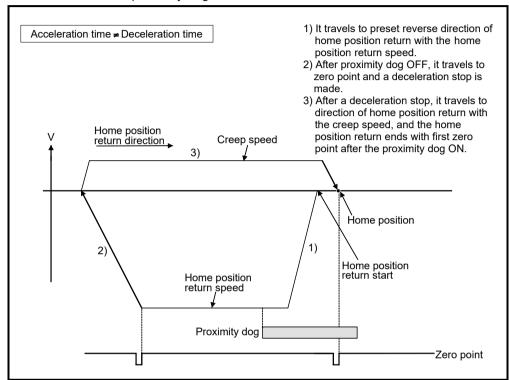
(b) If the home position return is executed in the proximity dog, it travels to reverse direction of home position return. If proximity dog turns OFF, a deceleration stop is made, it travels to direction of home position return again with the creep speed and the first zero point after proximity dog ON is home position.



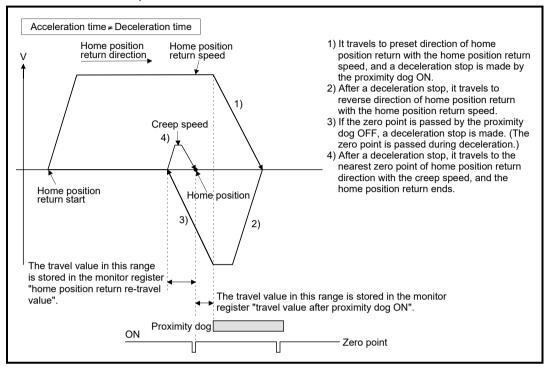
(c) When the proximity dog is set in the home position return direction, the proximity dog is turned OFF during travel to reverse direction of home position return, and the zero point is not passed (zero pass signal: M2406+20n OFF), it continues to travel in the reverse direction of home position return with home position return speed until the zero point is passed. The zero point is passed again during deceleration by zero point pass, the home position becomes this side compared with the case to pass zero point at the time of the proximity dog OFF.



(d) When it starts in the proximity dog, the zero point is not passed (zero pass signal: M2406+20n OFF) at the time of the proximity dog is turned OFF during travel to reverse direction of home position return, it continues to travel with home position return speed until the zero point is passed. The zero point is passed again during deceleration by zero point pass, the home position becomes this side compared with the case to pass zero point at the time of the proximity dog OFF.



(e) If the zero point is passed during deceleration, the nearest zero point from deceleration stop position to home position return direction is set as the home position.



6.23.10 Home position return by the stopper method 1

(1) Stopper method 1

Position of stopper is home position in this method.

It travels to the direction set in the "home position return direction" with the "home position return speed", after a deceleration starts by proximity dog OFF to ON and it presses against the stopper and makes to stop with the torque limit value set in the "torque limit value at the creep speed" and "creep speed" of home position return data. The actual position of the servo motor at the time that the torque limiting signal OFF to ON is detected is the home position.

Torque limit value after reaching creep speed is set in the "torque limit value at the creep speed" of home position return data.

(2) Home position return by the stopper method 1

Operation of home position return by the stopper method 1 is shown below.

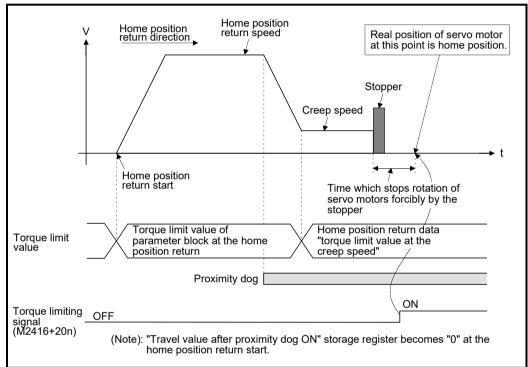


Fig. 6.41 Home position return operation by the stopper method 1

(3) Home position return execution

Home position return by the stopper method 1 is executed using the servo program in Section 6.23.19.

- (a) A zero point does not must be passed (zero pass signal: M2406+20n ON) between turning on the power supply and executing home position return.
- (b) Home position return retry function cannot be used in the stopper method 1.
- (c) Set the torque limit value after reaching the creep speed for system. When the torque limit value is too large, servo motors or machines may be damaged after pressing the stopper. Also, when the torque limit value is too small, it becomes the torque limiting before pressing the stopper and ends the home position return.
- (d) If the home position return is executed again after home position return completion, a minor error (error code: 115) will occur, the home position return is not executed.
- (e) Home position return is started during the proximity dog ON, it is started from the "creep speed".

6.23.11 Home position return by the stopper method 2

(1) Stopper method 2

Position of stopper is home position in this method.

It travels the direction set in the "home position return direction" with the "creep speed", and it presses against the stopper and makes to stop with the "creep speed". (The torque limit value is valid set in the "torque limit value at the creep speed" of the home position return data from the home position return start.) The actual position of the servo motor at the time that the torque limiting signal OFF to ON is detected is the home position.

Torque limit value after reaching creep speed is set in the "torque limit value at the creep speed" of home position return data.

(2) Home position return by the stopper method 2 Operation of home position return by the stopper method 2 is shown below.

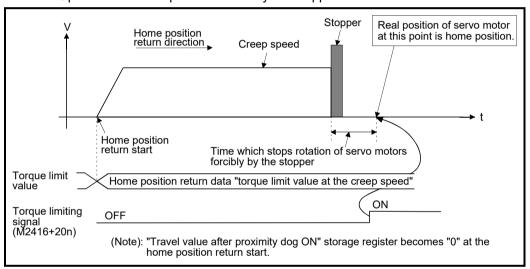


Fig. 6.42 Home position return operation by the stopper method 2

(3) Home position return execution

Home position return by the stopper method 2 is executed using the servo program in Section 6.23.19.

- (a) A zero point does not must be passed (zero pass signal: M2406+20n ON) between turning on the power supply and executing home position return.
- (b) Home position return retry function cannot be used in the stopper method 2.
- (c) Set the torque limit value at the reaching creep speed for system. When the torque limit value is too large, servo motors or machines may be damaged after pressing the stopper. Also, when the torque limit value is too small, it becomes the torque limiting before pressing the stopper and ends the home position return.
- (d) If the home position return is executed again after home position return completion, a minor error (error code: 115) will occur, the home position return is not executed.

6.23.12 Home position return by the limit switch combined method

(1) Limit switch combined method

The proximity dog is not used in this method. Home position return can be executed by using the external upper/lower limit switch.

When the home position return is started, it travels to direction of home position return with "home position return speed". Deceleration is made by turning the limit switch of home position return direction ON to OFF, it travels to reverse direction of home position return with creep speed, and the zero point just before limit switch is home position.

(2) Home position return by the limit switch combined method Operation of home position return by limit switch combined method for setting the limit switch in the home position return direction is shown below.

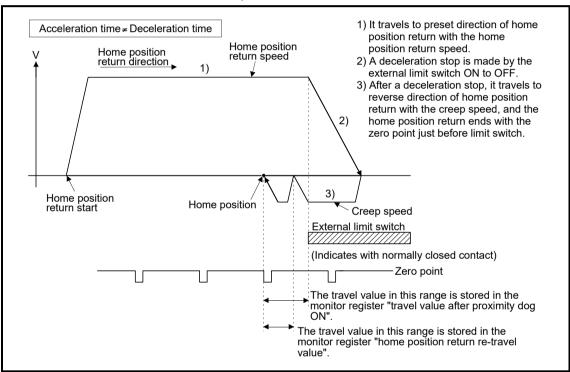


Fig. 6.43 Home position return operation by the limit switch combined method

(3) Home position return execution

Home position return by the limit switch combined method is executed using the servo program in Section 6.23.19.

- (a) For the axis which executes the home position return by the limit switch combined method, if the external input signal has not set in the system settings, a minor error (error code: 142) will occur and home position return is not executed.
- (b) When the limit switch reverse to home position return direction is turned ON to OFF, deceleration stop is made, home position return is not completed and a major error (error code: 1101, 1102) will occur.
- (c) Home position return retry function cannot be used in the limit switch combined method.
- (d) If the home position return is executed with the limit switch OFF, it is started to reverse direction of home position return with creep speed.
- (e) When it does not pass (zero pass signal: M2406+20n ON) the zero point from home position return start to deceleration stop by limit switch OFF, a minor error (error code: 120) will occur, a deceleration stop is made and home position return does not end normally. However, when "1: Not need to pass motor Z phase after the power supply is switched on" is selected in the "function selection C-4 (PC17)" of servo parameter (expansion setting parameter), if the zero point is not passed until from home position return start to deceleration stop by limit switch OFF, the home position return can be executed.
- (f) Deceleration stop is executed after the limit switch OFF. Set the limit switch in expectation of deceleration distance.
- (g) If the in-position signal (M2402+20n) is turned ON, home position return is not ended.
- (h) When the width is in a zero point, the home position differs from the home position return by the proximity dog method 1, proximity dog method 2, count method 1, count method 3, dog cradle method and scale home position signal detection method.

6.23.13 Home position return by the scale home position signal detection method ver



(1) Scale home position signal detection method

Home position return is executed using home position signal (zero point). After detecting the proximity dog, it makes to travel to reverse direction of home position return. And the detecting position of home position signal (zero point) is home position in this method.

(2) Home position return by the scale home position signal detection method

Operation of home position return by the scale home position signal detection method for setting the proximity dog in the home position return direction is shown below.

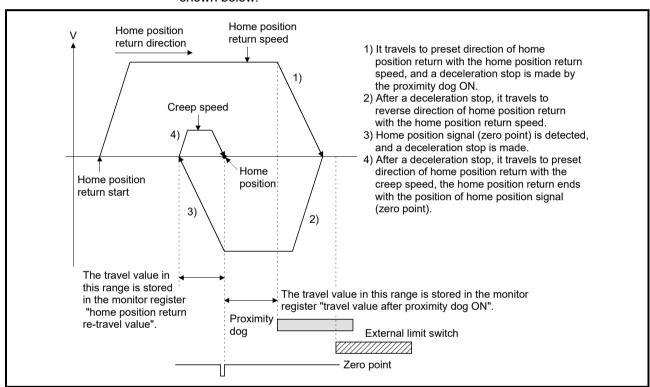


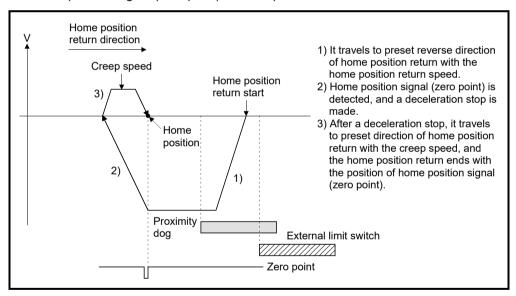
Fig. 6.44 Home position return operation by the scale home position signal detection method

(3) Home position return execution

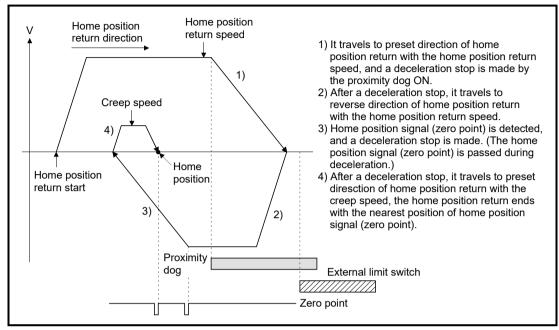
Home position return by the scale home position signal detection method is executed using the servo program in Section 6.23.19.

Ver.!): Refer to Section 1.3 for the software version that supports this function.

- (a) When home position is in the proximity dog, if home position return is executed again after home position return end, a minor error (error code: 123) will occur, the home position return is not executed.
- (b) Set "0: Need to pass motor Z phase after the power supply is switched on" in the "function selection C-4 (PC17)" of servo parameter (expansion setting parameter). When "1: Not need to pass motor Z phase after the power supply is switched on" is set, a minor error (error code: 124) will occur at home position return by the scale home position signal detection method starting, the home position return is not executed.
- (c) When zero pass signal (M2406+20n) turns on by passing zero point at home position return start, this signal turns off once at the reverse direction of home position return start and turns on again at the next zero point passage.
- (d) Home position return is executed in the proximity dog, it travels to reverse direction of home position return. If home position signal (zero point) is detected, a deceleration stop is made, it travels to direction of home position return again with the creep speed and the detecting position of home position signal (zero point) is home position.



(e) If the zero point is passed during deceleration, the nearest position of home position signal (zero point) of home position return direction from deceleration stop position is set as the home position.



- (f) Home position return retry function cannot be used in the scale home position signal detection method.
- (g) An error always occurs without the proximity dog in home position return direction from home position return starting position, so that the proximity dog is set before limit switch of home position return direction for making the proximity dog overlap in limit switch like Fig. 6.44. And, when home position return is executed in the proximity dog, an error will occur if zero point is not in reverse direction of home position return from home position return starting position.
- (h) When there is only one zero point in the motor like linear motor, home position return may not be ended if zero point is in the proximity dog. Set zero point before the proximity dog.
- (i) If the in-position signal (M2402+20n) is not turned ON, home position return is not ended.



(1) Dogless home position signal reference method

Home position return is executed using home position signal (zero point). This is a home position return method that does not use proximity dogs.

Home position, home position return operation, home position return data (home position return retry function, dwell time at the home position return retry) differ by the servo amplifier connected as shown below.

Also, set the servo parameter "Function selection C-4 (PC17) (Selection of home position setting condition)" as follows.

Servo amplifier model		Linear encoder type	Home position	Home position return operation (Note-1)	Home position return retry function	Dwell time at the home position return retry	servo parameter "Function selection C-4 (PC17) (Selection of home position setting condition)"	
Standard		_	Home position signal	Operation B	In	valid	Not need to pass motor Z phase after the power supply is switched on.	
	Direct drive motor	_	(zero point)	Operation A	Valid		Need to pass motor Z phase after the power supply is switched on.	
MR-J5-□B MR-J5W-□B MR-J5-□B-RJ	Linear servo	Absolute position type	Position where address of absolute linear encoder becomes 0.	Operation C	ln	valid	Both	
MR-J4-□B MR-J4W-□B MR-J4-□B-RJ		Incremental type	Reference mark	Operation A	٧	′alid	Need to pass motor Z phase after the power supply is switched on.	
Fully closed loop control		Absolute position type	Position where address of absolute linear encoder becomes 0.	Operation C	Invalid		Both	
	(Note-2)	Incremental type	Reference mark	Operation A	٧	′alid	Need to pass motor Z phase after the power supply is switched on.	
MR-J3-□B MR-J3-□B Safety MR-J3W-□B		_	Home position signal (zero point)	Operation B			Not need to pass motor Z phase after the power supply is switched on.	
MR-J3-□B-RJ004		Absolute position type	Position where address of absolute linear encoder becomes 0.	Operation C	In	valid	Both	
MR-J3-□B Safety	мк-J3-Шв Sallety		Reference mark	Operation A	V	/alid	Need to pass motor Z phase after the power supply is switched on.	
MR-J3-□B-RJ006 ^(Note-2) MR-J3-□B Safety		Absolute position type	Position where address of absolute linear encoder becomes 0.	Operation C	Invalid		Both	
· ·		Incremental type	Reference mark				0: Need to pass motor Z	
MR-J3-□B-RJ080W		_	Home position signal (zero point)	Operation A	Valid		phase after the power supply is switched on.	
MR-JE-□B MR-JE-□BF		_	Home position signal (zero point)	Operation B	In	valid	Not need to pass motor Z phase after the power supply is switched on.	

(Note-1): Refer to (2) to (4) of this section for home position return operation.

(Note-2): During semi closed loop control is equivalent to MR-J5-□B (standard), MR-J4-□B (standard), and MR-J3-□B.

Ver.!: Refer to Section 1.3 for the software version that supports this function.

- (2) Home position return by the dogless home position signal reference method (Operation A)
 - "Operation A" of a home position return by the dogless home position signal reference type is shown in Fig. 6.45 and Fig. 6.46.
 - (a) When the zero point is in the home position return direction.

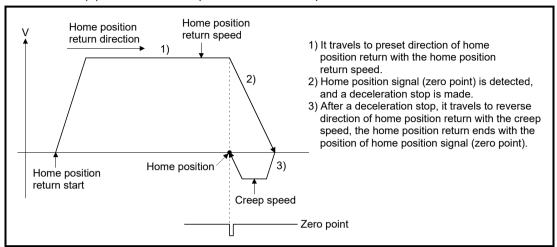


Fig. 6.45 Home position return by the dogless home position signal reference method (Operation A)

- (1) If an external limit switch is detected during a deceleration stop after zero point detection, an error occurs and stops. Ensure there is enough distance between the zero point signal and external limit switch, or set the deceleration time so the decelerating distance is shortened.
- (2) If multiple home position signals (zero points) are passed during deceleration after zero point detection, by the connected servo amplifier, the following operation occurs.

Servo	amplifier model	Operation				
MR-J5-□B	Direct drive motor	Home position return ends at the position of the				
MR-J5W-□B	Direct drive motor	last home position signal (zero point) passed.				
MR-J5-□B-RJ	Linear servo					
MR-J4-□B						
MR-J4W-□B	Fully closed loop control	Home position return ends at the position of th first home position signal (zero point) passed.				
MR-J4-□B-RJ						
MR-J3-□B-RJ0	04					
MR-J3-□B-RJ0	06					
MR-J3-□B-RJ0	80W	Home position return ends at the position of the last home position signal (zero point) passed.				

Home position Home position 1) It travels to preset direction of home Home position return speed return speed position return with the home position return direction return speed. 2) External limit switch is detected, and a deceleration stop is made. 6) 2) 3) After a deceleration stop, it travels to reverse direction of home position return with the home position return speed. Home 5) 4) Home position signal (zero point) is detected, position and a deceleration stop is made. 5) After a deceleration stop, it travels to home position return with the home position return Home position 6) Home position signal (zero point) is detected, return start and a deceleration stop is made. Creep speed 3) 7) After a deceleration stop, it travels to reverse Home position direction of home position return with the creep return start speed, the home position return ends with the position of home position signal (zero point). External limit switch Zero point

(b) When the zero point is not in the home position return direction.

Fig. 6.46 Home position return by the dogless home position signal reference method (Operation A)

POINT

Set home position return retry function to "valid". When set as "invalid" at the detection of the external limit switch, an error occurs and stops.

(3) Home position return by the dogless home position signal reference method (Operation B)

"Operation B" of a home position return by the dogless home position signal reference method is shown below.

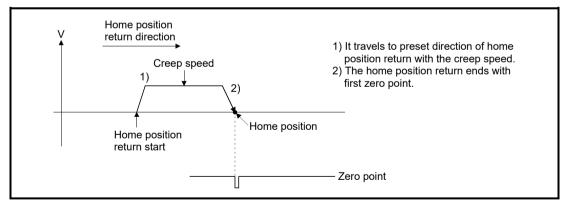


Fig. 6.47 Home position return by the dogless home position signal reference method (Operation B)

- (1) If an external limit switch is detected during home position return operation, an error occurs and stops.
- Home position return retry function cannot be used.

- (4) Home position return by the dogless home position signal reference method (Operation C)
 - "Operation C" of a home position return by the dogless home position signal reference method is shown in Fig. 6.48 and Fig. 6.49.
 - (a) When the position where address of absolute linear encoder becomes 0 is in the home position return direction.

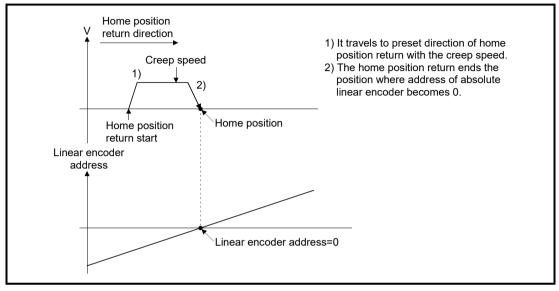


Fig. 6.48 Home position return by the dogless home position signal reference method (Operation C)

- (1) If an external limit switch is detected during home position return operation, an error occurs and stops.
- (2) Home position return retry function cannot be used.

(b) When the position where address of absolute linear encoder becomes 0 is not in the home position return direction.

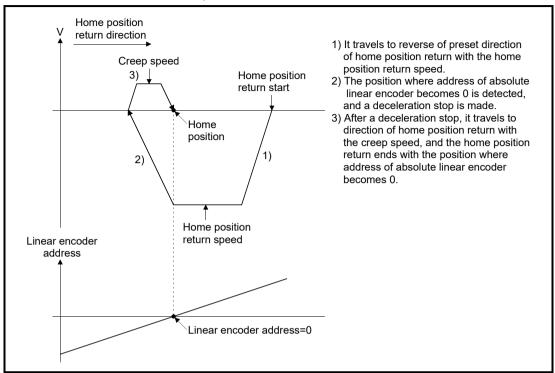


Fig. 6.49 Home position return by the dogless home position signal reference method (Operation C)

POINT

- (1) If an external limit switch is detected during home position return operation, an error occurs and stops.
- Home position return retry function cannot be used.

(5) Home position return execution

Home position return by dogless home position signal reference method is executed using the servo program in Section 6.23.19.

(6) Cautions

- (a) If a home position return is started for an axis connected with servo amplifiers other than MR-J5(W)-□B, MR-J4(W)-□B, MR-J3(W)-□B, and MR-JE-□B, a minor error (error code: 192) will occur and the home position return is not executed.
- (b) If home position return is executed again after home position return end, a minor error (error code: 115) will occur, the home position return is not executed.
- (c) If connecting a rotational motor on the load side with a fully closed loop control servo amplifier (MR-J5-□B, MR-J4-□B, and MR-J3-□B-RJ006), execute home position return in a semi closed loop control state. (The home position return operation becomes that of "Operation B".)

POINT

If a home position return is performed in a fully closed loop control state, the home position return is at the position of encoder current value of multiple revolution position =0, and single revolution position =0 (The home position return operation becomes that of "Operation C"), and the motor might revolve more than necessary. When connecting a rotational motor on the load side, execute home position return in a semi closed loop control state.

- (d) If executing home position return with a fully closed loop control servo amplifier (MR-J5-□B, MR-J4-□B, and MR-J3-□B-RJ006), do not change fully closed loop control/semi closed loop control during home position return operation. When fully closed loop control/semi closed loop control is changed during home position return operation, the home position return might not be completed normally
- (e) If performing home position return from zero point, depending on the actual motor position at the start, and it's relative position to zero point, the home position return might be completed at the next zero point. It is recommended to move the start of the home position return from the zero point to a position in the in the reverse direction of home position return direction.
- (f) If home position return is executed during operation of amplifier-less operation function:
 - MR-J5(W)-□B/MR-J4(W)-□B/MR-JE-□B
 Home position return is executed by the home position return operation stated in amplifier operation mode that is set in amplifier setting of system setting.
 - MR-J3(W)-□B
 Regardless of the servo amplifier model, home position return is executed by the home position return operation of "Operation B".

- (g) Home position return by dogless home position signal reference method (Operation A)
 - 1) Set the servo parameter (expansion parameter) "Function selection C-4 (PC17)" to "0: Need to pass motor Z phase after the power supply is switched on". If set to "1: Not need to pass motor Z phase after the power supply is switched on", when home position return by dogless home position signal reference method (operation A) is started, a minor error (error code: 124) will occur and the home position return is not executed.
 - 2) If the zero pass signal (M2046+20n) was on at home position return start, this signal turns off once at the home position return start and turns on again at the next zero point passage.
 - 3) If an external limit switch is detected during a deceleration stop after zero point detection, an error occurs and stops. Ensure there is enough distance between the zero point signal and external limit switch, or set the deceleration time so the decelerating distance is shortened.
 - 4) With home position return retry function valid, if zero point is detected during a deceleration stop after external limit switch is detected, an error occurs and stops. Set the external limit switch in a position that puts the zero signal inside the external limit switch.
- (h) Home position return by dogless home position signal reference method (Operation B)
 - 1) Set the servo parameter (expansion parameter) "Function selection C-4 (PC17)" to "1: Not need to pass motor Z phase after the power supply is switched on". If set to "0: Need to pass motor Z phase after the power supply is switched on", when home position return by dogless home position signal reference method (operation B) is started, a minor error (error code: 193) will occur and the home position return is not executed.
 - 2) Home position return retry function cannot be used.
- (i) Home position return by dogless home position signal reference method (Operation C)
 - 1) If an external limit switch is detected during home position return operation, an error occurs and stops.
 - 2) Home position return retry function cannot be used.

6.23.15 Home position return by the driver home position return method ^{ver}

(1) Driver home position return method

The stepping driver performs home position return autonomously based on the positioning patterns set on the stepping driver side. Home position return data is set with the parameters on the stepping driver side.

Driver home position return method cannot be used on anything other than a stepping driver. Refer to the instruction manual of the stepping driver being used for home position return operations and parameters.

(2) Home position return by driver home position return method The operation for home position return by driver home position return method is shown below.

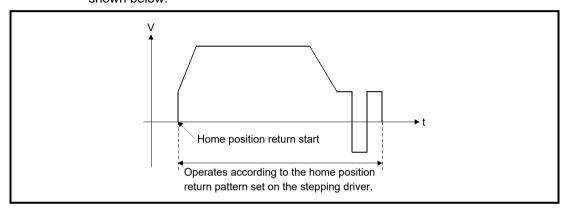


Fig. 6.50 Home position return by driver home position return method

(3) Home position return execution

Home position return by driver home position return method is executed using the servo program in Section 6.23.19.

(4) Cautions

- (a) If a home position return is started for an axis that is not connected to a stepping driver, a minor error (error code: 194) will occur and the home position return is not executed.
- (b) When a stop cause is detected during driver home position return, home position return operation is stopped.
 - The stopping operation for when a stop cause is detected depends on the stepping driver.
 - Refer to the instruction manual of the stepping driver being used for details.
- (c) During driver home position return, the home position return is performed based on the home position return direction of the parameters on the stepping driver side. Make sure the home position return direction is the same as home position return direction of the parameters on the stepping driver side.

Ver.!): Refer to Section 1.3 for the software version that supports this function.

6.23.16 Home position return retry function

When a current value has been exceeded home position during positioning control, etc., even if it executes the home position return, depending on the position of current value, a current value may not travel to home position direction. In this case, a current value is normally travelled before the proximity dog by the JOG operation, etc, and the home position return is started again. However, by using the home position return retry function, the home position return can be executed regardless of current value position. Refer to Section 6.23.1(7) for home position return method by using the home position return retry function.

[Data Setting]

When the "home position return retry function" is used, set the following "home position return data" using MT Developer2.

Set the "dwell time at the home position return retry" as required.

Set the parameters for every axis.

Items	Setting details	Setting	Initial value	
Romo	County dotaile	value	iritiai valac	
Home position return retry function	Invalid (Do not execute the home position return retry by limit switch.) Valid (Execute the home position return retry by limit switch.)	0, 1	0	
Dwell time at the home position return retry	The stop time at the deceleration stop during the home position return retry is set.	0 to 5000 [ms]	0	

Table 6.4 Home position return data

[Control details]

Operation for the home position return retry function is shown below.

(1) Home position return retry operation setting a current value within the range of external limit switch

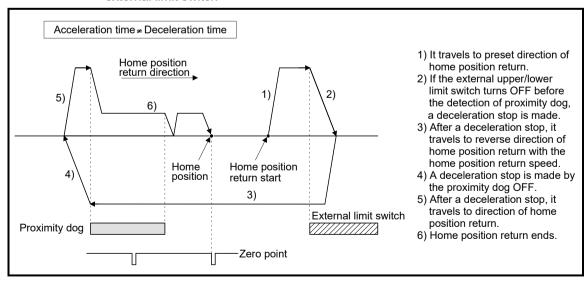
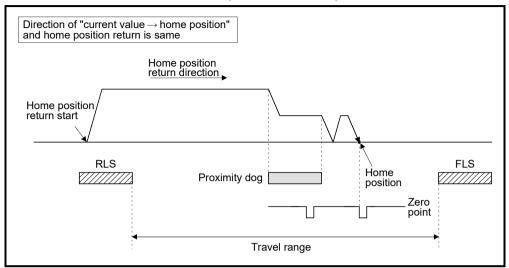
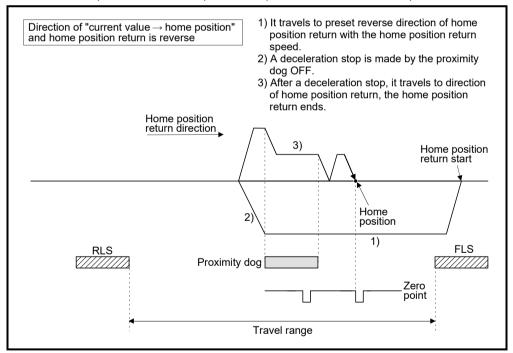


Fig. 6.51 Operation for home position return retry (proximity dog method)

- (2) Home position return retry operation setting a current value outside the range of external limit switch
 - (a) When the direction of "current value → home position" and home position return is same, normal home position return is operated.



(b) When the direction of "current value → home position" and home position return is reverse, deceleration stop is made with the proximity dog OFF and home position return is operated to preset direction of home position return.



(3) Dwell time setting at the home position return retry
Reverse operation by detection of the external upper/lower limit switch and dwell
time function at the home position return start after stop by proximity dog OFF are
possible with the dwell time at the home position return retry in the home position
return retry function.

Dwell time at the home position return retry becomes valid at the time of deceleration stop of the following 2) and 4). (Dwell time operates with the same value.)

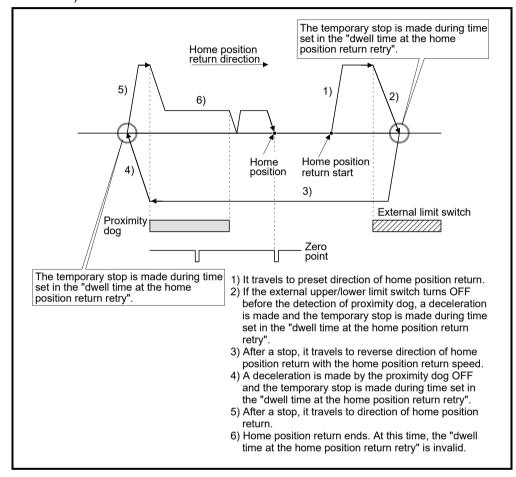


Fig. 6.52 Dwell time setting at the home position return retry

[Cautions]

(1) Valid/invalid of home position return retry function by the home position return method is shown below.

Home position re	turn methods	Valid/invalid of home position return retry function
Proximity dog meth	iod	0
Count method		0
Data set method		×
Dog cradle method		0
Stopper method		×
Limit switch combin	ned method	×
Scale home positio detection method	n signal	×
Dogless home	Operation A	0
position signal	Operation B	×
reference method	Operation C	×
Driver home position	n return method	×

○: Valid, ×: Invalid

- (2) Make a system for which does not execute the servo amplifier power off or servo OFF by the external upper/lower limit switch. Home position return retry cannot be executed only in the state of servo ON.
- (3) Deceleration is made by detection of the external limit switch and travel to reverse direction of home position return is started. In this case, a major error (error codes: 1001, 1002, 1101, 1102) will not occur.

∆CAUTION

■ Be sure to set the external limit switch (FLS, RLS) in the upper/lower position of machines. If the home position return retry function is used without external limit switch, servo motors continue rotating.

6.23.17 Home position shift function

Normally, when the machine home position return is executed, a position of home position is set by using the proximity dog or zero point signal. However, by using the home position shift function, the position to which only the specified travel value was travelled from the position which detected the zero point signal can be regarded as home position.

[Data Setting]

Set the following "home position return data" using MT Developer2 to use the home position shift function.

Refer to Section 6.23.1(7) for home position return method by using the home position shift function.

Set the parameters for every axis.

Table 6.5 Home position return data

Items	Setting details	Setting value	Initial value
Home position shift amount	The shift amount at the home position shift is set.	-2147483648 to 2147483647 $[\times10^{\text{-1}}\mu\text{m},\times10^{\text{-5}}\text{inch},10^{\text{-5}}\text{degree},\text{pulse}]$	0
Speed set at the home position shift	The speed at the home position shift is set.	0 : Home position return speed 1: Creep speed	0

[Control details]

Home position shift operation
 Operation for the home position shift function is shown below.

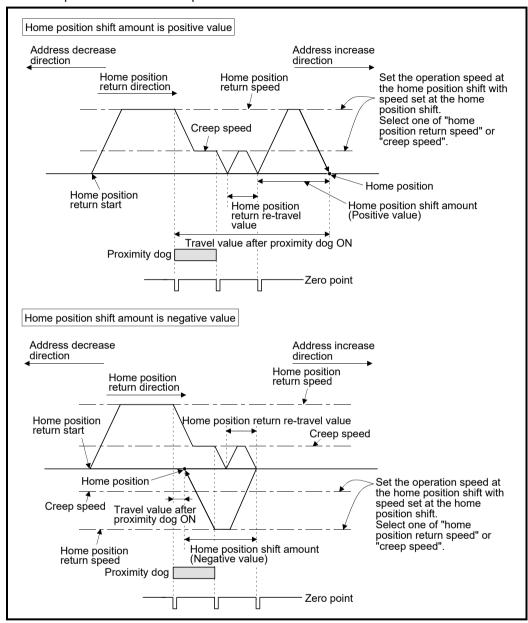


Fig. 6.53 Operation for home position shift

(2) Setting range of home position shift amount Set the home position shift amount within the range of from the detected zero signal to external upper/lower limit switch (FLS/RLS). If the range of external upper/lower limit switch is exceeded, a major error (error code: 1102, 1103) will occur at that time and the home position return is not ended.

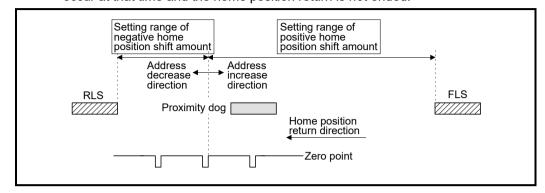


Fig. 6.54 Setting range of home position shift amount

(3) Travel speed at the home position shift

When the home position shift function is used, set the travel speed at the home position shift as the speed set at the home position shift. Either the home position return speed or creep speed is selected as the travel speed at the home position shift.

The travel speed at the home position shift for the home position return by proximity dog method is shown below.

(a) Home position shift operation with the "home position return speed"

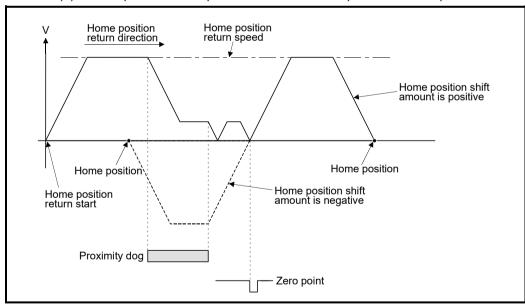
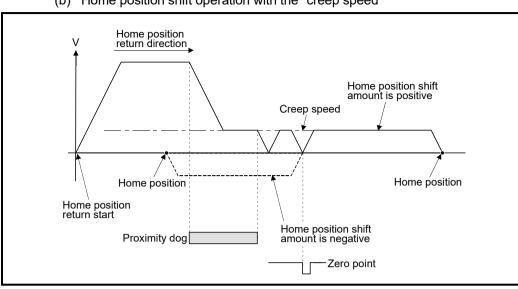


Fig. 6.55 Operation for home position shift with the home position return speed



(b) Home position shift operation with the "creep speed"

Fig. 6.56 Operation for home position shift with the creep speed

[Cautions]

(1) Valid/invalid of home position shift amount setting value by the home position return method.

Home position return methods	Valid/invalid of home position return retry function
Proximity dog method	0
Count method	0
Data set method	×
Dog cradle method	0
Stopper method	×
Limit switch combined method	0
Scale home position signal detection method	0
Dogless home position signal reference method	0
Driver home position return method	×

○: Valid, ×: Invalid

- (2) Axis monitor devices and axis statuses are set after completion of home position shift.
- (3) When the home position return by proximity dog method set the travel value after proximity dog ON and home position shift amount within the range of "-2147483648 to 2147483647" [\times 10⁻¹ µm, \times 10⁻⁵ inch, 10⁻⁵ degree, pulse].

6.23.18 Home position set condition selection

A home position return must be made after the servo motor has been rotated more than one revolution to pass the axis through the Z-phase (motor reference position signal) and the zero pass signal (M2406+20n) has been turned ON.

When "1: Not need to pass motor Z phase after the power supply is switched on" is selected in "Function selection C-4 (PC17), Selection of home position setting condition" in the servo parameter (expansion setting parameter), the zero pass signal (M2406+20n) can be turned ON even if the servo motor does not pass zero point with the motor rotation after turning the servo amplifier power ON.

[Data Setting]

Set the following "Servo parameter" using MT Developer2 to select "Function selection C-4 (PC17)".

Set the servo parameters for every axis.

Table 6.6 Servo parameter (expansion setting parameter)

Items	Setting details	Setting value	Initial value
Function selection C-4 (PC17) (Selection of home position setting condition)	condition for the absolute	O: Need to pass motor Z phase after the power supply is switched on 1: Not need to pass motor Z phase after the power supply is switched on	0

[Cautions]

- (1) When "1 : Not need to pass motor Z phase after the power supply is switched on" is set as the above servo parameter, a restrictions such as "make the home position return after the servo motor is rotated more than one revolution to pass the axis through the Z-phase (motor reference position signal) " is lost.
- (2) When "1 : Not need to pass motor Z phase after the power supply is switched on" is selected in the "function selection C-4 (PC17)" of servo parameter (expansion setting parameter), if it does not pass zero point at the servo amplifier power ON, the zero pass signal (M2406+20n) turns ON.
- (3) When the above parameter is changed, turn the servo amplifier control circuit power OFF to ON after resetting or turning power OFF to ON of Multiple CPU system.

POINT

- (1) Set "0: Need to pass motor Z phase after the power supply is switched on" in the "function selection C-4 (PC17)" of servo parameter (expansion setting parameter) for the home position return by the scale home position signal detection method.
 - If "1: Not need to pass motor Z phase after the power supply is switched on" is set, a minor error (error code: 124) will occur at the home position return start and the home position return is not executed.
- (2) When executing home position return by dogless home position signal reference method, set the servo parameter (expansion parameter) "Function selection C-4 (PC17)" by the servo amplifier connected. (Refer to Section 6.23.14)

6.23.19 Servo program for home position return

The home position return executed using the ZERO servo instruction.

										Iter	ns s	et u	sing	МΤΙ	Deve	elope	er2								
					Co	omm	on				Arc					Para	amet	er bl	lock				Oth	ers	
Servo instruction	Positioning method	Number of control axes	Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Interpolation control unit	Speed limit value	Acceleration time	Deceleration time	Rapid Stop deceleration time	Torque limit value	Deceleration processing on stop input	Allowable error range for circular interpolation	S-curve ratio	Advanced S-curve acceleration/deceleration	Others	Program No.	Speed change
ZERO	_	1		0																					_

○: Must be set

[Control details]

(1) Home position return is executed by the home position return method specified with the home position return data (Refer to Section 6.23.1).

Refer to the following sections for details of the home position return methods :

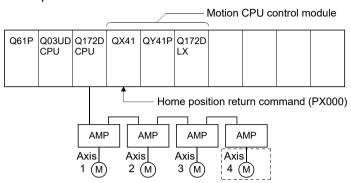
<u> </u>	•
Proximity dog method 1	Section 6.23.2
Proximity dog method 2	Section 6.23.3
Count method 1	Section 6.23.4
Count method 2	Section 6.23.5
Count method 3	Section 6.23.6
Data set method 1	Section 6.23.7
Data set method 2	Section 6.23.8
Dog cradle method	Section 6.23.9
Stopper method 1	Section 6.23.10
Stopper method 2	Section 6.23.11
Limit switch combined method	Section 6.23.12
• Scale home position signal detection method	Section 6.23.13
• Dogless home position signal reference method	Section 6.23.14
Driver home position return method	Section 6.23.15

[Program]

Servo program No. 0 for home position return is shown as the following conditions.

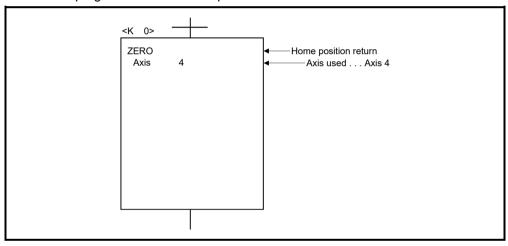
(1) System configuration

Home position return of Axis 4.



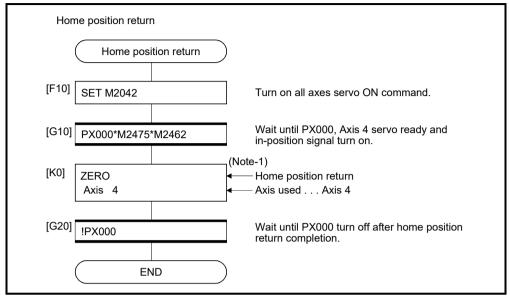
(2) Servo program example

Servo program No. 0 for home position return is shown below.



(3) Motion SFC program

Motion SFC program for which executes the servo program is shown below.



(Note-1): It is necessary to turn on the zero pass signal before execution of the home position return instruction for data set method home position return.

(Note-2): Example of the above Motion SFC program is started using the automatic start or sequence program.

[Cautions]

If the home position is not within the in-position range of servo parameter, it does not mean having reached the home position and the home position return does not end in the proximity dog method, count method, data set method 1, dog cradle method, limit switch combined method, scale home position signal detection method, dogless home position signal reference method, or driver home position return method home position return. In this case, adjusts the in-position range of servo parameter or position control gain.

6.24 High-Speed Oscillation

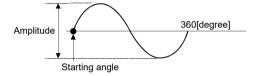
Positioning of a specified axis is caused to oscillate on a sine wave.

										Iter	ns s	et us	sina	МΤΙ	Deve	elope	er2								
					Сс	mm	on				osc							er bl	lock				Oth	ers	
Servo instruction	Positioning method	Number of control axes	Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Starting angle	Amplitude	Frequency	Interpolation control unit	Speed limit value	Acceleration time	Deceleration time	Rapid Stop deceleration time	Torque limit value	Deceleration processing on stop input	Allowable error range for circular interpolation	S-curve ratio	Advanced S-curve acceleration/deceleration	Cancel	WAIT-ON/OFF	Speed change
osc	_	1	\triangleright	0				\triangle		0	0	0						Δ					\triangleright		Invalid

○: Must be set

[Control details]

The designated axis caused to oscillate on a specified sine wave. Acceleration/deceleration processing is not performed.



(1) Amplitude

Set the amplitude of the oscillation in the setting units.

The amplitude can be set within the range of 1 to 2147483647.

(2) Starting angle

Set the angle on the sine curve at which oscillation is to start. The setting range is 0 to 359.9 [degree]

(3) Frequency

Set how many sine curve cycles occur in one minute. The setting range is 1 to 5000 [CPM].

POINT

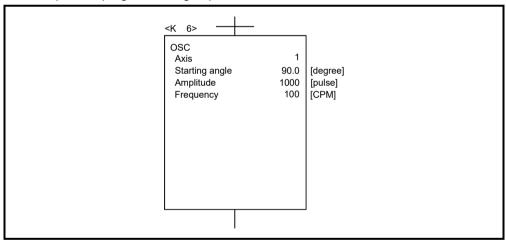
Since acceleration/deceleration processing is not performed, you should set the starting angle to 90 or 270 [degree] in order to avoid an abrupt start.

[Cautions]

- (1) If the amplitude setting is outside the range, the servo program setting error (error code: 25) occurs and operation does not start.
- (2) If the starting angle setting is outside the range, the servo program setting error (error code: 26) occurs and operation does not start.
- (3) If the frequency setting is outside the range, the servo program setting error (error code:27) occurs and operation does not start.
- (4) Operation is continually repeated until a stop signal is input after the start.
- (5) Speed changes during operation are not possible. Attempted speed changes will cause minor error (error code:310).
- (6) Do not use the high-speed oscillation in the axis that invalidates a stroke limit of control unit "degree".

[Program]

An example of a program for high-speed oscillation is shown below.



MEMO			

7. AUXILIARY AND APPLIED FUNCTIONS

This section describes the auxiliary and applied functions for positioning control in the Multiple CPU system.

7.1 M-code Output Function

M-code is a code No. between 0 and 32767 which can be set for every positioning control. During positioning control, these M-codes are read using the Motion SFC program to check the servo program during operation and to command auxiliary operations, such as clamping, drill rotation and tool replacement.

(1) Setting of M-codes

M-code can be set using MT Developer2 at the creation and correction of the servo program.

(2) Storage of M-code and read timing

- (a) M-codes are stored in the M-code storage register of the axis specified with the positioning start completion and specified points (at the speed switching control or constant-speed control).
 - During interpolation control, the M-codes are stored in all axes which perform interpolation control.
- (b) When the M-code is read at the positioning start completion, use the positioning start complete signal (M2400+20n) as the reading command.

At the position control or speed control Dwell time ON OFF PLC ready flag (M2000) Servo program start ON OFF Start accept flag (M2001+n) ON Positioning start complete OFF signal (M2400+20n) ON Positioning complete signal (M2401+20n) OFF M-code Storage of setting M-code No. At the speed switching control P1 (Speed-switching point) P2 (Speed-switching point) P3 (Stop) ON OFF PLC ready flag (M2000) Servo program start ON Start accept flag (M2001+n) OFF ON Positioning start complete signal (M2400+20n) OFF ON Positioning complete signal (M2401+20n) OFF M-code Storage of setting M-code No.

(c) When the M-code is read at positioning completion, use the positioning complete signal (M2401+20n) as the read command.

(3) Resetting of M-codes

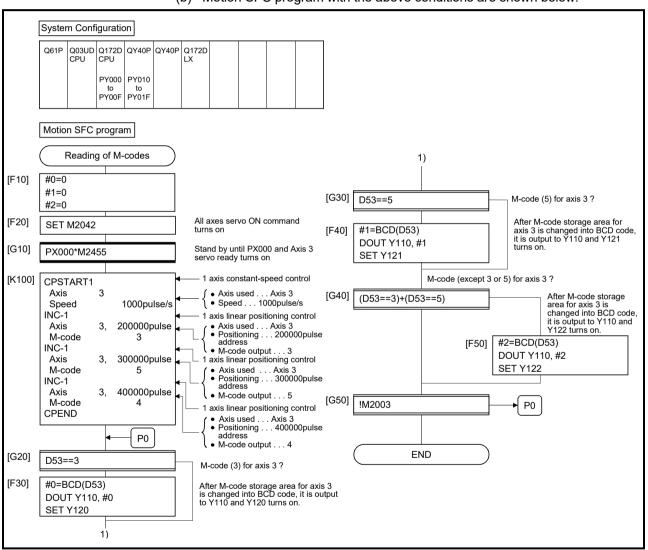
M-codes can be reset by setting of the M-code output devices to zero.

Use this method during positioning control to perform operations unrelated to the servo program, such as when it has been difficult to output the M-code during the previous positioning control.

However, M-code is set during the speed switching control or constant-speed control, the M-code output of the servo program takes priority.

(4) Program example

- (a) The Motion SFC program to read M-codes is shown as the following conditions.
 - 1) Axis used No......Axis 3
 - 2) Processing at the positioning start by M-code M-code No. is output as BCD code to Y110 to Y11F
 - 3) Processing at the positioning completion by M-code
 - a) M-code = 3......Y120 turns on
 - b) M-code = 5......Y121 turns on
 - c) M-code is except for (3 or 5)Y122 turns on
- (b) Motion SFC program with the above conditions are shown below.



7.2 Backlash Compensation Function

This function compensates for the backlash amount in the machine system. When the backlash compensation amount is set, extra feed pulses equivalent to the backlash compensation amount set up whenever the travel direction is generated at the positioning control, JOG operation or manual pulse generator operation.

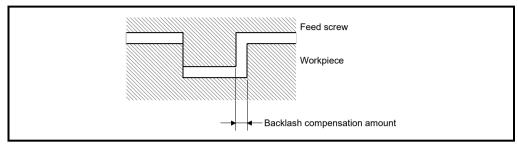


Fig.7.1 Backlash compensation amount

(1) Setting of the backlash compensation amount

The backlash compensation amount is one of the fixed parameters, and is set for each axis using MT Developer2.

The setting range differs according to whether [mm], [inch], [degree] or [pulse] units are used as shown below.

- (a) [mm] units
 - 0 to 6553.5
 - $0 \le \frac{\text{(Backlash compensation amount)}}{\text{(Travel value per pulse)}} \le 65535 \text{[pulse]}$

(Decimal fraction rounded down)

- (b) [inch] or [degree] units
 - 0 to 0.65535
 - 0 ≤ (Backlash compensation amount) (Note-1) (Travel value per pulse)

(Decimal fraction rounded down)

- (c) [pulse] units
 - 0 to 65535
 - 0 ≤ (Backlash compensation amount) (pulse per rotation) (Travel value per rotation) \leq 65535[pulse] ^(Note-1)

(Decimal fraction rounded down)

(Note-1): The following restriction does not apply to versions compatible with the setting range expansion of backlash compensation amount. Ver.

Ver.!): Refer to Section 1.3 for the software version that supports this function.

(2) Backlash compensation processing

Details of backlash compensation processing are shown below.

Table 7.1 Details of backlash compensation processing

Condition	Processing
First start after power on	 If travel direction is equal to home position return direction, the backlash compensation is not executed. If travel direction is not equal to home position return direction, the backlash compensation is executed.
JOG operation start	If travel direction is changed at the JOG operation start, the backlash compensation is executed.
Positioning start	If travel direction is changed, the backlash compensation is executed.
Manual pulse generator operation	If travel direction is changed, the backlash compensation is executed.
Home position return completion	The backlash compensation is executed after home position return completion.
Absolute position system	Status stored at power off and applied to absolute position system.

POINTS

- (1) When backlash compensation amount has been set, feed pulses of the backlash compensation amount are added to the position command value but are not added to feed current value.
- (2) When the backlash compensation amount is changed, the home position return is required.
 - When the home position return is not executed, the original backlash compensation amount is not changed.

7.3 Torque Limit Function

This function restricts the generating torque of the servo motor within the setting range. If the torque required for control exceeds the torque limit value during positioning control, it restricts with the setting torque limit value.

(1) Default of the torque limit value

The default 300[%] is set as torque limit value at the servo amplifier's power supply or Multiple CPU system's power supply ON.

POINTS

Even while the Multiple CPU system power supply is ON, the torque limit value is returned to the default value of 300[%] when the control circuit power supply of the servo amplifier is turned ON again, or when the SSCNET communication is disconnected or connected again. Set the torque control value again as required using the Motion SFC program or the Motion dedicated PLC instruction.

(2) Setting method of torque limit value

Set the torque limit value by the following method.

The positive direction of torque limit value restricts the forward rotation (CCW) driving and reverse rotation (CW) regenerative torque of servo motor, and the negative direction of torque limit value restricts the reverse rotation (CW) driving and forward rotation (CCW) regenerative torque.

Se	tting method	Setting details	Setting range	Setting units	Reference
Parameter bl	ock	Set the torque limit value in the parameter block. By setting the parameter block No. used in the servo program, the torque limit value of specified axis is changed to same value for both of positive direction and negative direction for every positioning control. Set the torque limit value in the parameter block. By setting the parameter block in the home position return data and JOG operation data for every axis, the torque limit value at home position return and JOG operation is changed to same value for both of positive direction and negative direction.	1 to 1000	[%]	Section 4.3
Servo progra	m	By setting the torque limit value in the servo program, the torque limit value of specified axis at servo program execution is changed to same value for both of positive direction and negative direction.		[70]	Section 5.3
Motion SFC	Torque limit value change request (CHGT)	By executing the torque limit value change request (CHGT) in the operating control step of Motion SFC program, the torque limit value of specified axis is changed to same value for both of positive direction and negative direction.			(Note 1)
program	Torque limit value individual change request (CHGT2)	By executing the torque limit value individual change request (CHGT2) in the operating control step of Motion SFC program, the torque limit value of specified axis is changed to different value for positive direction and negative direction.	1 to 10000	[0.1%]	(Note-1)

Se	etting method	Setting details	Setting range	Setting units	Reference
Motion dedicated	Torque limit value change request instruction (D(P).CHGT)	By executing the torque limit value change request instruction (D(P).CHGT) in the PLC CPU, the torque limit value of specified axis is changed to same value for both of positive direction and negative direction.	1 to 1000	[%]	
PLC instruction	Torque limit value individual change request instruction (D(P).CHGT2)	By executing the torque limit value individual change request instruction (D(P).CHGT2) in the PLC CPU, the torque limit value of specified axis is changed to different value for positive direction and negative direction.	1 to 10000	[0.1%]	(Note-1)

(Note-1): Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (Motion SFC)

(3) Priority of torque limit value setting

When the multiple torque limit values are set on the same axis, the latest torque limit value is valid. However, the setting of torque limit value set in the parameter block or servo program is valid only if lower than the torque limit value set in the Motion SFC program, Motion dedicated PLC instruction, and speed-torque control. Also, the setting of torque limit value in speed-torque control is valid only if lower than the current torque limit value.

POINTS

When the torque limit value is set individually for positive direction and negative direction in the Motion SFC program or Motion dedicated PLC instruction, only either one of the positive direction or negative direction may become valid depending on the setting value of servo program.

(4) Monitoring of torque limit status

(a) When using Q173DSCPU/Q172DSCPU

The torque limit value of each axis can be monitored with torque limit value (D14+20n), and the positive/negative direction torque limit value can be monitored by setting "Positive Direction Torque Limit Value Monitor Device" and "Negative Direction Torque Limit Value Monitor Device" in the expansion parameter.

The torque limit status of each axis can be also monitored with torque limiting (M2416+20n).

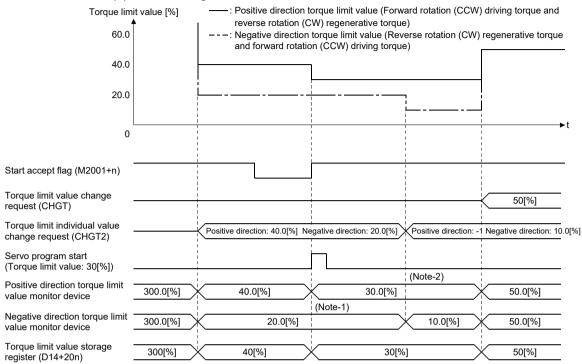
(b) When using Q173DCPU(-S1)/Q172DCPU(-S1)

The positive direction torque limit value of each axis can be monitored with the torque limit value (D14+20n).

The torque limit status of each axis can be also monitored with torque limiting (M2416+20n).

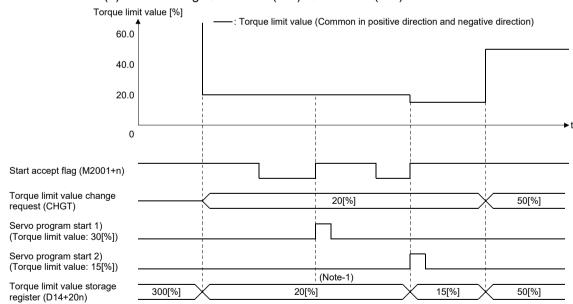
(5) Operation description

(a) When using Q173DSCPU/Q172DSCPU



(Note-1): The torque limit value specified with servo program is cramped with the negative direction torque limit value changed by CHGT2. (Note-2): The torque limit value is not changed so that "-1" is set as the positive direction torque limit value of CHGT2.

(b) When using Q173DCPU(-S1)/Q172DCPU(-S1)



(Note-1): The torque limit value specified with servo program is cramped with the torque limit value changed by CHGT.

(6) Maintaining of torque limit value

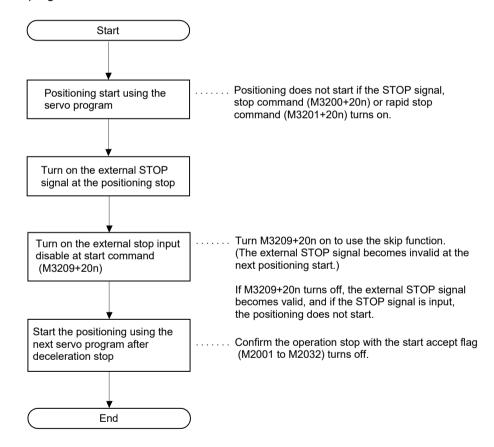
The setting of torque limit value is held during servo amplifier's power supply ON and Multiple CPU system's power supply ON. When the default of torque limit value becomes 300[%] by turning ON again the servo amplifier's power supply or Multiple CPU system's power supply.

7.4 Skip Function in which Disregards Stop Command

When the current positioning is stopped by input from external source and the next positioning control is performed, it enables starting of the next positioning control even if the input from external source is on (continuation).

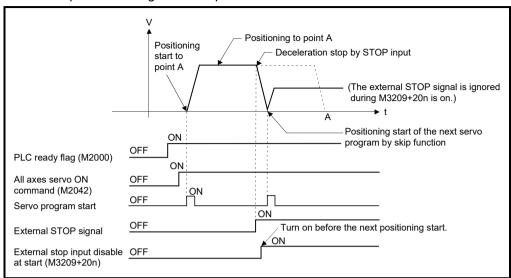
There are following tow functions in the function called "Skip".

- Skip during constant-speed control (CPSTART command) (Refer to Section 6.17.6.)
- Skip in which disregards stop command
 Usually, although an error [***] occurs with the servo program start during the
 STOP signal on, if external stop input disable at start command (M3209+20n) turns
 on and the servo program starts, the next servo program starts even if during the
 STOP signal on.
- (1) The procedure for the skip function by the external STOP signal and Motion SFC program is shown below.



(2) Operation timing

The operation timing for the skip function is shown below.



7.5 Cancel of the Servo Program

This function performs a deceleration stop of executing servo program during execution by turning on the cancel signal.

[Control details]

(1) When the cancel signal is turned on during execution of a program for which the cancel has been specified, the positioning processing is suspended, and a deceleration stop is executed.

[Data setting]

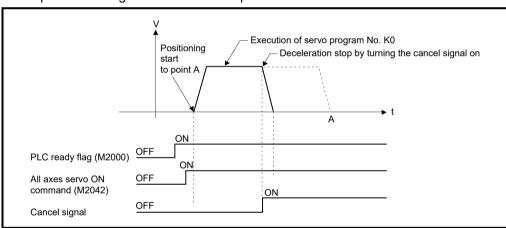
Cancel signal device
 The usable cancel signal devices are shown below.
 X, Y, M, B, F, U□\G

[Note]

- This function cannot be used in the home position return instruction (ZERO) or simultaneous start instruction (START).
 Refer to the servo instruction list (5.2(2)) for setting of other instructions.
- (2) Refer to Section 4.3.2 for details of operation when S-curve ratio is set.

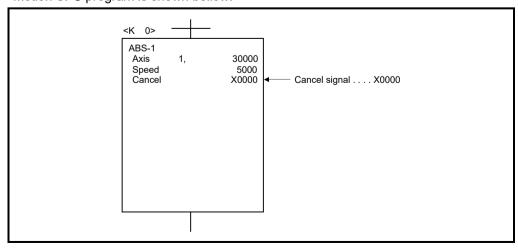
[Operation timing]

The operation timing for deceleration stop is shown below.



[Program example]

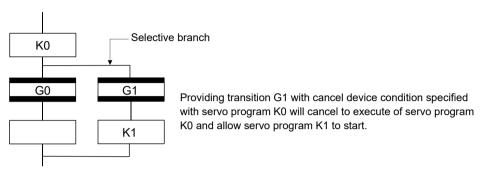
Motion SFC program is shown bellow.



7.5.1 Cancel/start

When a cancel/start has been set in the setting items of the servo program which was started at the motion control step of the Motion SFC program, the cancel of the running servo program is valid but the servo program specified to start after a cancel is ignored, without being started.

Example of the Motion SFC program which executed control equivalent to a cancel start is shown below.



7.6 Synchronous Encoder Ver.

The synchronous encoder can be used in real mode by setting the synchronous encoder used in the system setting.

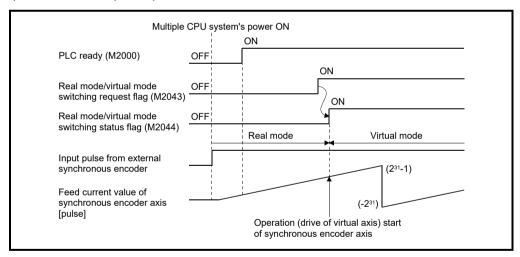
The synchronous encoder set in the system setting can be used the following functions in both of the real mode and virtual mode regardless of whether or not the synchronous encoder is set in the mechanical program.

Functions	Description		
Current value storage register (D1120+10n, D1121+10n)	A current value of synchronous encoder is updated for operation cycle.		
Synchronous encoder current value change • Servo instruction of Motion SFC (CHGA-E) • Motion dedicated PLC instruction (D(P).CHGA)	A current value change of synchronous encoder axis is executed.		
Error reset command (M5440+4n)	An error reset of synchronous encoder axis is executed.		

[Control details]

The input pulse from external synchronous encoder is always input after Multiple CPU system's power supply ON. The input pulse is always input in real mode regardless of the state for the clutch of mechanical system program or external signal.

Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (VIRTUAL MODE)" for operation in virtual mode.



Ver.!: Refer to Section 1.3 for the software version that supports this function.

7.7 Speed-Torque Control QDSK

This function is used to execute the speed control or torque control that does not include the position loop for the command to servo amplifier.

The "continuous operation to torque control mode" switches the control mode to torque control mode without stopping the servo motor during positioning operation when tightening a bottle cap or a screw.

Switch the control mode from "position control mode" to "speed control mode", "torque control mode" or "continuous operation to torque control mode" to execute the "Speed-torque control".

Control mode	Control	Remark		
Position control mode	Positioning control ^(Note-1) , home position return control, JOG operation, and manual pulse generator operation	Control that include the position loop for the command to servo amplifier		
Speed control mode		Control that does not include the position loop for the command to		
Continuous operation to torque control mode	Speed-torque control	servo amplifier Control that does not include the position loop for the command to servo amplifier Control mode can be switched during positioning control or speed control.		

(Note-1): Excluding speed control (II).

Use the servo amplifiers whose software versions are compatible with each control mode to execute the "Speed-torque control".

Servo amplifier software versions that are compatible with each control mode are shown below.

	Software version					
Servo amplifier model	Speed control	Torque control (Note-1)	Continuous operation			
		Torque control .	to torque control			
MR-J5-□B		_	_			
MR-J5W-□B		_	_			
MR-J4-□B		_	_			
MR-J4W-□B		_	_			
MR-J3-□B		B3 or later	C7 or later			
MR-J3W-□B		_	Not compatible			
MR-J3-□B Safety		_	C7 or later			
MR-JE-□B	_	_	_			
MR-JE-□BF		_	_			

—: There is no restriction by the version.

(Note-1): In the servo amplifier that supports continuous operation to torque control, the torque generation direction of servo motor can be switched by setting "Function selection C-B (PC29) (POL reflection selection at torque control)". (Refer to Section 7.7.1 (7).)

In the servo amplifier that does not support continuous operation to torque control, the operation is the same as when "0: Valid" is set in "Function selection C-B (PC29) (POL reflection selection at torque control)".

∆CAUTION

• If operation that generates torque more than 100% of the rating is performed with an abnormally high frequency in a servo motor stop status (servo lock status) or in a 30r/min or less low-speed operation status, the servo amplifier may malfunction regardless of the electronic thermal relay protection.

7.7.1 Speed-torque control data

Speed-torque control data are for executing "speed-torque control". Set the data using servo data setting of MT Developer2.

Table 7.2 Speed-torque control data list

			Setting ned		Setting value using MT Developer2						
			Jenny nec	Continuous			Setting value using intribeveloper2 Setting range				
No.	Setting item	Speed control	Torque control	operation to torque control	Initial value	Units	mm	inch	degree	pulse	
1	Control mode switching request device	0	0	0	_	_	_				
2	Control mode setting device	0	0	0	_	_		_			
3	Speed limit value at speed-torque control	0	0	0	200000	Selected unit	0.01 to 6000000.00 [mm/min]	0.001 to 600000.000 [mm/min]	0.001 to 2147483.647 [degree/min] (Note-1)	1 to 2147483647 [pulse/s]	
4	Torque limit value at speed-torque control	0	0	0	300.0	%	0.1 to 1000.0 [%]				
5	Speed command device	0	0	0	_	J	_				
6	Command speed acceleration time	0	_	0	1000	ms	0 to 65535 [ms]				
7	Command speed deceleration time	0	_	0	1000	ms	0 to 65535 [ms]				
8	Torque command device	_	0	0	_	_	_				
9	Command torque time constant (positive direction)	_	0	0	1000	ms	0 to 65535 [ms]				
10	Command torque time constant (negative direction)	_	0	0	1000	ms	0 to 65535 [ms]				
11	Speed initial value selection at control mode switching	0	_	0	0	_	0: Command speed 1: Feedback speed 2: Automatic selection				
12	Torque initial value selection at control mode switching	_	0	0	0	_	0: Command torque 1: Feedback torque				
13	Invalid selection during zero speed at control mode switching	0	0	0	0	_	Condition at control mode switching: valid Condition during zero speed at control mode switching: invalid				

Settino	y value using the Motion	SEC program (Indirect s	Indirect	setting		
Octung	Setting		maneo			
mm	inch	degree	pulse	Valid/ invalid	Number of words	Remarks
	-	_	0	Bit		
1	O: Position control mode 10: Speed control mode 20: Torque control mode 30: Continuous operation	0	1			
1 to 600000000 (×10 ⁻² [mm/min])	1 to 600000000 (×10 ⁻³ [inch/min])	1 to 2147483647 (×10 ⁻³ [degree/min]) (Note-2)	1 to 2147483647 [pulse/s]	0	2	
	1 to 10000	(×0.1 [%])		0	1	
-600000000 to 600000000 (×10 ⁻² [mm/min])	-600000000 to 600000000 (×10 ⁻³ [inch/min])	-2147483648 to 2147483647 (×10 ⁻³ [degree/min]) (Note-3)	-2147483648 to 2147483647 [pulse/s]	0	2	
	0 to 655	35 [ms]		0	1	
	0 to 655	0	1			
	-10000 to 100	000 (×0.1 [%])		0	1	
	0 to 655	35 [ms]	0	1		
	0 to 655	35 [ms]	0	1		
	-	_	_			
			_	_		
	_	_	_	_		

(Note-1): When the "speed control 10×multiplier setting for degree axis" is set to "valid", the setting range is 0.01 to 21474836.47[degree/min]. (Note-2): When the "speed control 10×multiplier setting for degree axis" is set to "valid", the setting range is 1 to 2147483647[×10⁻²degree/min]. (Note-3): When the "speed control 10×multiplier setting for degree axis" is set to "valid", the setting range is -2147483648 to 2147483647[×10⁻²degree/min].

A part of speed-torque control data can be executed the indirect setting by the word devices of Motion CPU

· Word devices for indirect setting

The word devices for indirect setting are the data registers (D), link registers (W), motion registers (#) and Multiple CPU area device ($U\square \G$). Word devices except the above devices cannot be used.

The usable setting range of word devices is shown below.

Word device	Setting range
D	0 to 8191
W	0 to 1FFF
#	0 to 7999
U□\G	10000 to (10000+p-1) (Note-1)

(Note-1): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

(Note-2): Refer to Chapter 2 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for the user setting area points of the Multiple CPU high speed transmission area.

· Bit devices for indirect setting

The bit devices for indirect setting are the input (X), output (Y), internal relay (M), link relay (B), annunciator (F) and Multiple CPU area device $(U \square \backslash G)$.

Bit devices except the above devices cannot be used.

The usable setting range of bit devices is shown below.

Bit device	Setting range
Х	0000 to 1FFF ^(Note-1)
Υ	0000 to 1FFF
M	0 to 8191
В	0000 to 1FFF
F	0 to 2047
U□\G	10000.0 to (10000+p-1).F (Note-2)

(Note-1): The range of "PXn+4 to PXn+F" cannot be used (fixed at 0) for the input device (PXn+0 to PXn+F) allocated to the built-in interface in Motion CPU (DI). (n: First input No.)

(Note-2): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

(Note-3): Refer to Chapter 2 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for the user setting area points of the Multiple CPU high speed transmission area.

• Input of speed-torque control data

Input timing of each setting device is shown below.

Setting item	Input timing of device	
Control mode switching request device	Operation cycle	
Control mode setting device		
Speed limit value at speed-torque control	Control mode switching	
Torque limit value at speed-torque control		
Speed command device	Operation cycle	
Command speed acceleration time	0 1 1 1 11	
Command speed deceleration time	Control mode switching	
Torque command device	Operation cycle	
Command torque time constant (positive direction)	0 1 1 1 11	
Command torque time constant (negative direction)	Control mode switching	

(1) Control mode switching request device

Set the device to request switching of the control mode.

When the control mode switching request device is turned OFF to ON, the mode is switched to the control mode set in the control mode setting device.

(2) Control mode setting device

Set the device to set the control mode after switching.

When the control mode switching request device is turned OFF to ON, the following mode is applied based on the value set in the control mode setting device.

Control mode setting device value	Control mode
0	Position control mode
10	Speed control mode
20	Torque control mode
30	Continuous operation to toque control mode

If the value of control mode setting device is outside the range at control mode switching request, a minor error (error code: 155) will occur, and the control mode is not switched.

(3) Speed limit value at speed-torque control

Set the speed limit value (absolute value) at speed control, torque control or continuous operation to torque control. If the command speed exceeds the speed limit value at speed-torque control, a minor error (error code: 315) will occur, and the control is executed with the speed limit value at speed-torque control.

(4) Torque limit value at speed-torque control

Set the torque limit value (absolute value) in speed control, torque control or continuous operation to torque control. If the command torque exceeds the torque limit value at speed-torque control, a minor error (error code: 316) will occur, and the control is executed with the torque limit value at speed-torque control.

(5) Speed command device

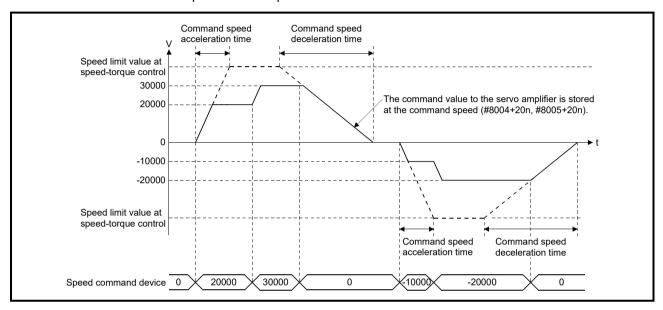
Set the command speed at speed control and the speed limit command value to servo amplifier at torque control or continuous operation to torque control. The value of speed command device can be changed at any time.

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The actual motor speed may not reach the speed limit value depending on the machine load situation during torque control or continuous operation to torque control.

(6) Command speed acceleration time, Command speed deceleration time

Set the acceleration time for the speed to increase from "0" to reach the speed limit value at speed-torque control and deceleration time taken to stop from the speed limit value at speed-torque control during speed control or continuous operation to torque control.



When the rotation direction is changed due to the command speed change during speed control, the operation is as follows.

• A deceleration is made to 0 [r/min] according to the setting value of command speed deceleration time. After that, an acceleration is made to the command speed according to the setting value of command speed acceleration time.

(7) Torque command device

Set the command torque at torque control and continuous operation to torque control. Command torque can be changed at any time.

(a) Torque control

The relation between setting of command torque and torque generation direction of servo motor differs from the setting of servo parameter "Rotation direction selection (PA14)" and "Function selection C-B (PC29) (POL reflection selection at torque control)".

Table 7.3 Relation between setting of command torque and torque generation direction of servo motor (Torque control)

Function selection C-B (PC29) (POL reflection selection at torque control)"	Rotation direction selection (PA14)	Torque command device	Torque generat	ion direction of servo motor
	0: Forward rotation (CCW)	Positive value (Forward direction)	CCW direction	
0.14 %	with the increase of the positioning address	Negative value (Reverse direction)	CW direction	
0: Valid	1: Reverse rotation (CW)	Positive value (Forward direction)	CW direction	
	with the increase of the positioning address	Negative value (Reverse direction)	CCW direction	
	0: Forward rotation (CCW)	Positive value (Forward direction)	CCW direction	CCW CW
	with the increase of the positioning address	Negative value (Reverse direction)	CW direction	direction GVV direction
1: Invalid	1: Reverse rotation (CW)	Positive value (Forward direction)	CCW direction	
	with the increase of the positioning address	Negative value (Reverse direction)	CW direction	

(b) Continuous operation to torque control

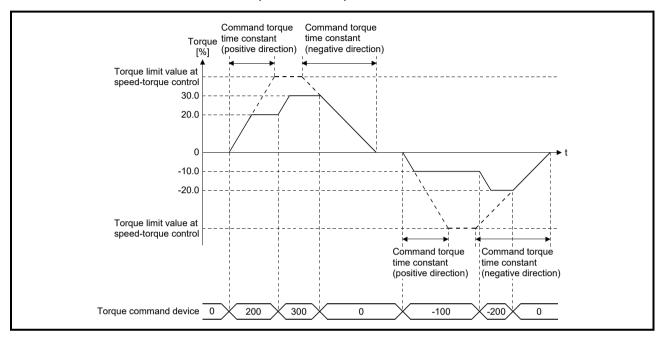
The relation between setting of command torque and torque generation direction of servo motor is fixed regardless of the setting of servo parameter "Rotation direction selection (PA14)" and "Function selection C-B (PC29) (POL reflection selection at torque control)".

Table 7.4 Relation between setting of command torque and torque generation direction of servo motor (Continuous operation to torque control)

Function selection C-B (PC29) (POL reflection selection at torque control)"	Rotation direction selection (PA14)	Torque command device	Torque generat	ion direction of servo motor
	0: Forward rotation (CCW)	Positive value (Forward direction)	CCW direction	
0. Valid	with the increase of the positioning address	Negative value (Reverse direction)	CW direction	
0: Valid	1: Reverse rotation (CW)	Positive value (Forward direction)	CCW direction	
	with the increase of the positioning address	Negative value (Reverse direction)	CW direction	
	0: Forward rotation (CCW)	Positive value (Forward direction)	CCW direction	CCW CW
As loss of field	with the increase of the positioning address	Negative value (Reverse direction)	CW direction	direction CVV direction
1: Invalid	1: Reverse rotation (CW)	Positive value (Forward direction)	CCW direction	
	with the increase of the positioning address	Negative value (Reverse direction)	CW direction	

(8) Command torque time constant (positive direction), Command torque time constant (negative direction)

Set the time (positive direction) for torque to increase from "0" to reach the torque limit value at speed-torque control and the time (negative direction) to decrease to "0" from the torque limit value at speed-torque control during torque control or continuous operation to torque control.



When the torque generation direction of servo motor is changed due to the command torque change during torque control or continuous operation to torque control, the operation is as follows.

• The torque output value is 0 [%] according to the setting value of command torque time constant (negative direction). After that, the value becomes command torque according to the setting value of command torque time constant (positive direction).

- (9) Speed initial value selection at control mode switching Set the speed initial value at the following control mode switching.
 - Position control to speed control
 - · Position control to continuous operation to torque control
 - · Speed control to continuous operation to torque control

Speed initial value selection at control mode switching	Command speed to servo amplifier immediately after control mode switching
0: Command speed	The speed to servo amplifier immediately after switching is the speed during command.
1: Feedback speed	Motor speed received from servo amplifier at switching.
2: Automatic selection	The speed to servo amplifier immediately after switching is the lower speed between "0: Command speed" and "1: Feedback speed".

POINT

When the mode is switched to continuous operation to torque control mode in cases where command speed and actual speed are different such as during acceleration/deceleration or when the speed does not reach command speed due to torque limit, set "1: Feedback speed".

(10) Torque initial value selection at control mode switching Set the torque initial value at switching to torque control mode or continuous operation to torque control mode.

Torque initial value selection at control mode switching	Command torque to servo amplifier immediately after control mode switching
0: Command speed	Immediately after switching the control mode, the value of torque command device is the torque to servo amplifier regardless of the command torque time constant.
1: Feedback speed	Motor current value received from servo amplifier at switching is the command torque to servo amplifier.

(11) Invalid selection during zero speed at control mode switching Set to switch the control mode without waiting for stop of servo motor.

L	Invalid selection during zero speed at control mode switching
Ī	0: Condition at control mode switching: valid
	1: Condition during zero speed at control mode switching: invalid

POINT

Normally, set "0". Set "1" to switch to the control mode without waiting for stop of servo motor immediately after completion of the command to servo motor. At switching to continuous operation to torque control, switching of control mode is possible without stop regardless of the setting value.

7.7.2 Operation of speed-torque control

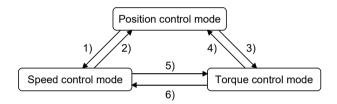
(1) Switching of control mode (Speed control/Torque control)

(a) Switching method of control mode

Turn OFF to ON the control mode switching request device after setting the control mode (10: Speed control mode, 20: Torque control mode) in the control mode setting device to switch to the speed control or torque control. When the mode is switched to the speed control mode or torque control mode, the control data used in each control mode must be set before turning ON the control mode switching request device.

When the switching condition is satisfied at control mode switching request, the control mode is switched, and the start accept flag (M2001+n) turns ON. A minor error (error code: 101, 156) will occur if the switching condition is not satisfied, and the control mode is not switched.

The following shows the switching condition of each control mode.



	Switching operation	Switching condition
1) I Decition control mode → Chood control mode		Not during positioning ^(Note-1) and during motor stop _(Note-2)
2)	Seed control mode → Position control mode	During motor stop (Note-2)
3)	Position control mode → Torque control mode	Not during positioning ^(Note-1) and during motor stop _(Note-2)
4)	Torque control mode → Position control mode	During motor stop (Note-2)
5)	Speed control mode → Torque control mode	Name
6) Torque control mode → Speed control mode		None

(Note-1): The start accept flag (M2001+n) is OFF.

(Note-2): ZERO speed (b3) of Servo status2 (#8011+20n) is ON.

The control mode can be changed without checking the switching condition of "during motor stop" in Motion CPU by setting "1: Condition during zero speed at control mode switching: invalid" in "Invalid selection during zero speed at control mode switching". Set "1: Condition during zero speed at control mode switching: invalid" to switch the control mode without waiting for stop of servo motor.

Confirm the control mode with "control mode (b2, b3)" of servo status1 (#8010+20n).

1) Control mode (b2, b3) of servo status1 (#8010+20n)

b3	b2	Control mode
0	0	Position control mode
0	1	Speed control mode
1	0	Torque control mode

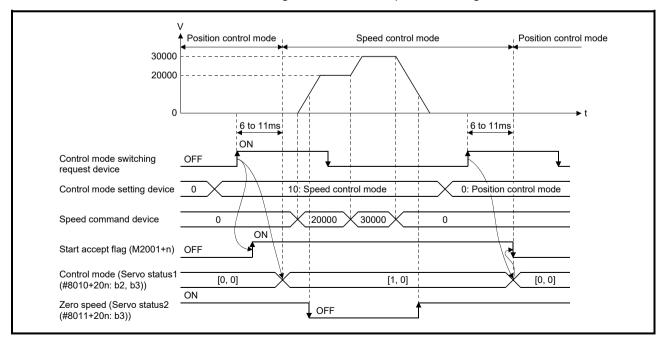
- (b) Precautions at control mode switching
 - 1) The positioning start complete signal (M2400+20n) and positioning complete signal (M2401+20n) do not turn ON at control mode switching.
 - 2) During speed control or torque control, the start accept flag (M2001+n) turns ON.
 - 3) The motor speed might change momentarily at switching from the speed control mode to torque control mode. Therefore, it recommended to switch from the speed control mode to torque control mode after the servo motors are stopped.
 - 4) Cannot use press with limited torque during speed control mode.
 - 5) In speed controlling signal (M2404+20n) does not turn ON during speed control mode in the speed-torque control.
- (c) Operation for "Position control mode

 Speed control mode switching"

 When the mode is switched from position control mode to speed control mode, the command speed immediately after switching is the speed set in "speed initial value selection at control mode switching".

Speed initial value selection at	Command speed to servo amplifier immediately after switching
control mode switching	from position control mode to speed control mode
0: Command speed	The speed to servo amplifier immediately after switching is "0".
1: Feedback speed	Motor speed received from servo amplifier at switching.
2: Automatic selection	At control mode switching, operation is the same as "0: Command speed".

When the mode is switched from speed control mode to position control mode, the command position immediately after switching is the current feed value at switching.



(d) Operation for "Position control mode

Speed control mode switching"

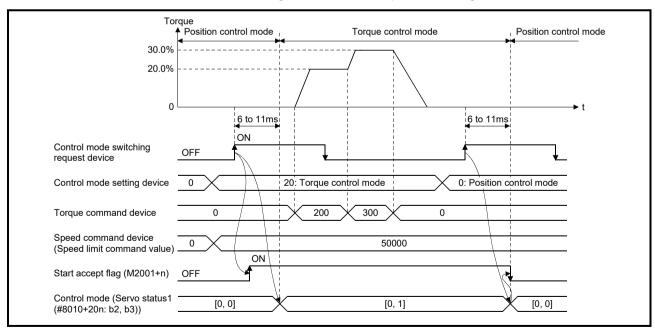
When the mode is switched from position control mode to torque control mode, the command torque immediately after switching is the torque set in "torque initial value selection at control mode switching".

Torque initial value selection at control mode switching	Command torque to servo amplifier immediately after switching from position control mode to torque control mode
0: Command torque	Immediately after switching the control mode, the value of torque command device is the torque to servo amplifier regardless of the command torque time constant.
1: Feedback torque	Motor current value received from servo amplifier at switching is the torque to servo amplifier.

POINT

When the servo parameter "POL reflection selection at torque control (PC29)" is set to "0: Valid" and "Torque initial value selection at control mode switching" is set to "1: Feedback torque", a minor error (error code: 154) will occur at control mode switching, and the command value immediately after switching is the same as the case of selecting "0: Command torque". If the feedback torque is selected, set "1: Invalid" in the servo parameter "POL reflection selection at torque control (PC29)".

When the mode is switched from torque control mode to position control mode, the command position immediately after switching is the current feed value at switching.



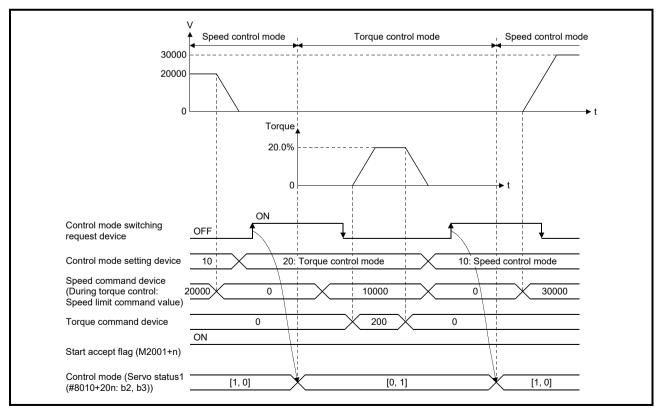
(e) Operation for "Speed control mode ↔ Torque control mode switching" When the mode is switched from speed control mode to torque control mode, the command torque immediately after switching is the torque set in "Torque initial value selection at control mode switching".

Torque initial value selection at control mode switching	Command torque to servo amplifier immediately after switching from speed control mode to torque control mode
0: Command torque	Immediately after switching the control mode, the value of torque command device is the torque to servo amplifier regardless of the command torque time constant.
1: Feedback torque	Motor current value received from servo amplifier at switching is the torque to servo amplifier.

POINT

When the servo parameter "POL reflection selection at torque control (PC29)" is set to "0: Valid" and "Torque initial value selection at control mode switching" is set to "1: Feedback torque", a minor error (error code: 154) will occur at control mode switching, and the command value immediately after switching is the same as the case of selecting "0: Command torque". If the feedback torque is selected, set "1: Invalid" in the servo parameter "POL reflection selection at torque control (PC29)".

When the mode is switched from torque control mode to speed control mode, the command speed immediately after switching is the motor speed at switching.



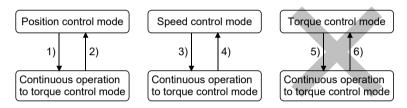
(2) Switching of control mode (Continuous operation to torque control)

(a) Switching method of control mode

Turn OFF to ON the control mode switching request device after setting the control mode in the control mode setting device (30: Continuous operation to torque control mode) to switch from position control mode or speed control mode to continuous operation to torque control.

When the mode is switched to continuous operation to torque control mode, the control data used in continuous operation to torque control mode must be set before turning on the control mode switching request device.

When the switching condition is satisfied at control mode switching request, the control mode is switched, and the start accept flag (M2001+n) turns ON. The following shows the switching condition of continuous operation to torque control mode.



Switching operation		Switching condition	
1)	Position control mode → Continuous operation to torque control mode	Not during positioning (Note-1) or during following positioning mode * ABS-1 : 1-axis linear control (ABS) * INC-1 : 1-axis linear control (INC) * FEED-1 : 1-axis fixed-feed control * VF : Speed control (I) (Forward) * VR : Speed control (I) (Reverse) * VPF : Speed-position switching control (Forward) * VPR : Speed-position switching control (Reverse) * PFSTART : Position follow-up control * CPSTART : 1-axis constant-speed control * PVF : Speed control with fixed position stop (Forward) * PVR : Speed control with fixed position stop (Reverse) (Note): JOG operation, Speed control (II) (VVF, VVR), Speed switching control (VSTART), High-speed oscillation control (OSC) are not supported.	
2)	Continuous operation to torque control mode \rightarrow Position control mode	During motor stop (Note-2)	
3)	Speed control mode \rightarrow Continuous operation to torque control mode	None	
4)	Continuous operation to torque control mode \rightarrow Speed control mode	None	
5)	Torque control mode \rightarrow Continuous operation to torque control mode	Switching not possible	
6)	Continuous operation to torque control mode $\ensuremath{\rightarrow}$ Torque control mode	Switching not possible	

(Note-1): The start accept flag (M2001+n) is OFF.

(Note-2): ZERO speed (b3) of Servo status2 (#8011+20n) is ON.

The control mode can be changed without checking the switching condition of "during motor stop" in Motion CPU by setting "1: Condition during zero speed at control mode switching: invalid" in "Invalid selection during zero speed at control mode switching". Set "1: Condition during zero speed at control mode switching: invalid" to switch the control mode without waiting for stop of servo motor.

Confirm the status of continuous operation to torque control mode with "Continuous operation to torque control (b14)" of servo status3 (#8012+20n). When the mode is switched to continuous operation to torque control mode, the value in "control mode (b2, b3)" of servo status1 (#8010+20n) will stay the same before control mode switching.

1) Continuous operation to torque control mode (b14) of servo status3 (#8012+20n)

b14	Continuous operation to torque control mode
0	Not continuous operation to torque control mode
1	Continuous operation to torque control mode

POINTS

- (1) When the mode is switched from position control mode to continuous operation to torque control mode, only the switching from continuous operation to torque control mode to position control mode is possible. If the mode is switched to other control modes, a minor error (error code: 155) will occur, and the control mode is not switched.
- (2) When the mode is switched from speed control mode to continuous operation to torque control mode, only the switching from continuous operation to torque control mode to speed control mode is possible. If the mode is switched to other control modes, a minor error (error code: 155) will occur, and the control mode is not switched.
 - (b) Precautions at control mode switching
 - 1) The positioning start complete signal (M2400+20n) and positioning complete signal (M2401+20n) do not turn ON at control mode switching.
 - 2) During continuous operation to torque control, the start accept flag (M2001+n) turns ON.
 - 3) When using continuous operation to torque control mode, use the servo amplifiers that are compatible with continuous operation to torque control. If servo amplifiers that are not compatible with continuous operation to torque control are used, a minor error (error code: 318) will occur at request of switching to continuous operation to torque control mode. (A deceleration stop is made during the positioning control. The mode is switched to position control during the speed control, and the operation immediately stops.)

(c) Operation for "Position control mode \leftrightarrow Continuous operation to torque control mode switching

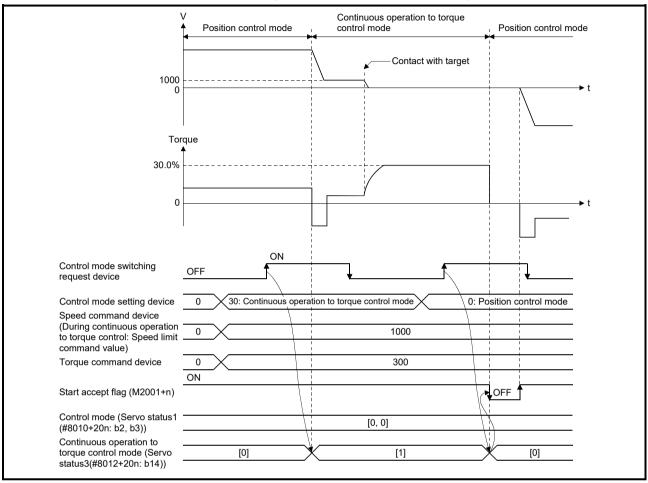
When the mode is switched from position control mode to continuous operation to torque control mode, the command torque and command speed immediately after switching are the values set in "Torque initial value selection at control mode switching" and "Speed initial value selection at control mode switching".

Torque initial value selection at control mode switching	Command torque to servo amplifier immediately after switching from position control mode to continuous operation to torque control mode
0: Command torque	Immediately after switching the control mode, the value of torque command device is the torque to servo amplifier regardless of the command torque time constant.
1: Feedback torque	Motor current value received from servo amplifier at switching is the torque to servo amplifier.

Speed initial value selection at control mode switching	Command speed to servo amplifier immediately after switching from position control mode to continuous operation to torque control mode	
0: Command speed	The speed to servo amplifier immediately after switching is the speed during command.	
1: Feedback speed	Motor speed received from servo amplifier at switching.	
2: Automatic selection	The speed commanded to servo amplifier immediately after switching is the lower speed between "0: Command speed" and "1: Feedback speed".	

POINT

When the mode is switched to continuous operation to torque control mode in cases where command speed and actual speed are different such as during acceleration/deceleration or when the speed does not reach command speed due to torque limit, set "1: Feedback speed" in "Speed initial value selection at control mode switching".

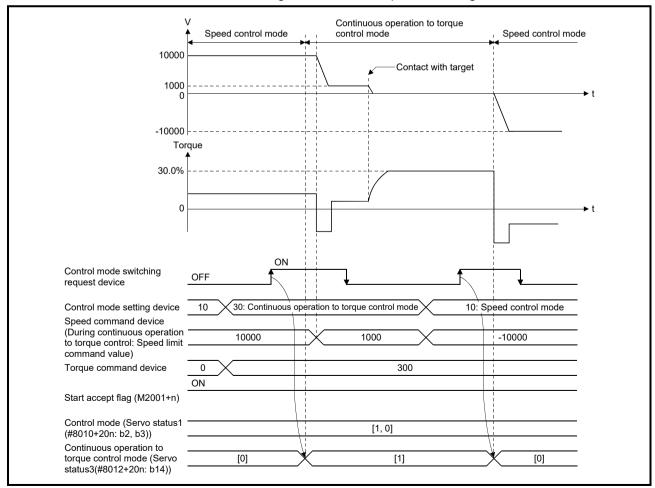


(d) Operation for "Speed control mode ↔ Continuous operation to torque control mode switching"

When the mode is switched from speed control mode to continuous operation to torque control mode, the command torque and command speed immediately after switching are the values set in "Torque initial value selection at control mode switching" and "Speed initial value selection at control mode switching".

Torque initial value selection at control mode switching	Command torque to servo amplifier immediately after switching from speed control mode to continuous operation to torque control mode
0: Command torque	Immediately after switching the control mode, the value of torque command device is the torque to servo amplifier regardless of the command torque time constant.
1: Feedback torque	Motor current value received from servo amplifier at switching is the torque to servo amplifier.

Speed initial value selection	Command speed to servo amplifier immediately after switching from
at control mode switching	speed control mode to continuous operation to torque control mode
0: Command speed	The speed to servo amplifier immediately after switching is the speed during command.
1: Feedback speed Motor speed received from servo amplifier at switching.	
2: Automatic selection	The speed to servo amplifier immediately after switching is the lower speed between "0: Command speed" and "1: Feedback speed".



POINT

When the mode is switched from continuous operation to torque control mode to speed control mode, the torque command during continuous operation to torque control is invalid. As shown in the figure above, when the target is pressed in continuous operation to torque control direction, if the mode is switched to speed control, torque is output to the torque limit value.

Execute the following either if such operation will be a problem.

- Set the speed command which is in opposite direction of continuous operation to torque control direction in the speed command device before switching to the speed control mode.
- Change the torque limit value to the lower value by torque limit value change request (CHGT) before switching to the speed control mode.

(3) Speed control mode

(a) Operation for speed control mode

The speed control is executed at speed set in "Speed command device" in the speed control mode.

Set a positive value for forward rotation and a negative value for reverse rotation. "Speed command device" can be changed any time during speed control mode.

Acceleration/deceleration is a trapezoidal acceleration/deceleration processing. Set acceleration/deceleration time toward "Speed limit value at speed-torque control" in "Command speed acceleration time" and "Command speed deceleration time". The value when the control mode switching request device turns OFF to ON is valid.

The command speed during speed control mode is limited with "Speed limit value at speed-torque control". If the speed exceeds speed limit value is set, a minor error (error code: 315) will occur, and the operation is controlled with speed limit value.

Confirm the command speed to servo amplifier the command speed (#8004+20n, #8005+20n).

Speed change request (CHGV, D(P).CHGV) is invalid (no operation). Torque limit value can be changed within the range of "Torque limit value at speed-torque control" by torque limit value change request (CHGT, D(P).CHGT) or torque limit value individual change request (CHGT2, D(P).CHGT2). If the change outside the range of "Torque limit value at speed-torque control" is requested by torque limit value change request or torque limit value individual change request, a minor error (error code: 319) will occur, and the torque limit value is not changed.

(b) Current feed value during speed control mode Feed current value (D0+20n, D1+20n) and real current value (D2+20n, D3+20n) are updated even during speed control mode. If the current feed value exceeds the software stroke limit, a minor error (error code: 207) will occur and the operation is switched to position control mode. Invalidate the software stroke limit to execute one-way feed.

(c) Stop cause during speed control mode The operation for stop cause during speed control mode is shown below.

Item	Operation during speed control mode	
The stop command (M3200+20n) turned ON.	The motor decelerates to speed "0" by setting value of	
The rapid stop command (M3201+20n)	"command speed deceleration time". The mode is switched	
turned ON.	to position control mode when "Zero speed (b3)" of servo	
The external stop input turned ON.	status2 (#8011+20) turns ON, and the operation stops.	
The all axes servo ON (M2042) turned OFF.	The servo OFF is not executed during speed control mode.	
The servo OFF command (M3215+20n)	The command status at that time becomes valid when the	
turned ON.	mode is switched to position control mode.	
The current value reached to software stroke	A minor error (error code: 200, 207) and major error (error	
limit.	code: 1101, 1102) will occur, and the motor decelerates to	
The position of motor reached to hardware	speed "0" by setting value of "Command speed deceleration	
stroke limit	time". The mode is switched to position control when "Zero	
The DLC woods flow (M2000) toward OFF	speed (b3)" of servo status2 (#8011+20n) turns ON, and	
The PLC ready flag (M2000) turned OFF.	the operation stops.	
The forced stop input to Motion CPU.	The mode is switched to position control mode when the	
The forced stop input to servo amplifier.	servo OFF (The servo ready signal (M2415+20n) turns	
	OFF) is executed. (While the servo amplifier is servo OFF,	
The servo error occurred.	even if the mode is switched to position control mode, the	
The servo endroccurred.	servo motor occurs to the free run. (The operation stops	
	with dynamic brake.))	
	The motor occurs to the free run. (The operation stops with	
The servo amplifier's power supply turned	dynamic brake.)	
OFF.	(The mode is to position control mode at the servo	
	amplifier's power supply ON again.)	

(4) Torque control mode

(a) Operation for torque control mode

The torque control is executed at command torque set in "Torque command device" in the torque control mode. Command torque can be changed any time during torque control mode.

Set time that reaches "Torque limit value at speed-torque control" from 0[%] in "Command torque time constant (Positive direction)" and time that decreases 0[%] from "Torque limit value at speed-torque control" in "Command torque time constant (Negative direction)". The value when the control mode switching request turns OFF to ON is valid for command torque time constant (Positive direction) and command torque time constant (Negative direction).

The command torque during torque control mode is limited with "Torque limit value at speed-torque control". If the torque exceeds torque limit value is set, a minor error (error code: 316) will occur, the operation is controlled with torque limit value at speed-torque control.

Speed change request (CHGV, D(P).CHGV) is invalid (no operation). Torque limit value to servo amplifier can be changed within the range of "Torque limit value at speed-torque control" by torque limit value change request (CHGT, D(P).CHGT) or torque limit value individual change request (CHGT2, D(P).CHGT2), but the value is valid when the mode is switched to position control mode. Command torque time constant is calculated based on the "Torque limit value at speed-torque control" at torque control mode switching after the torque limit value is changed. If the change outside the range of "Torque limit value at speed-torque control" is requested by torque limit value change request torque limit value individual change request, a minor error (error code: 319) will occur, and the torque limit value is not changed.

(b) Speed during torque control mode

The speed during torque control mode is controlled with the absolute value of value set in "Speed command device" as speed limit command value. When the speed reaches the absolute value of "Speed command device", "Speed limit (b4)" of servo status2 (#8011+20n)" turns ON.

And, the value of "Speed command device" (speed limit command value for torque control) is limited with "Speed limit value at speed-torque control". If the speed limit command value exceeds speed limit value at speed-torque control is set, a minor error (error code: 315) will occur, and the operation is controlled with speed limit value at speed-torque control.

The acceleration/deceleration processing is invalid for the value of "Speed command device".

POINTS

The actual motor speed may not reach the speed limit command value depending on the machine load situation during torque control.

- (c) Current feed value during torque control mode
 Feed current value (D0+20n, D1+20n) and real current value (D2+20n, D3+20n) are updated even in torque control. If the current feed value exceeds the software stroke limit, a minor error (error code: 207) will occur and the operation is switched to position control mode. Invalidate the software stroke limit to execute one-way feed.
- (d) Stop cause during speed control mode

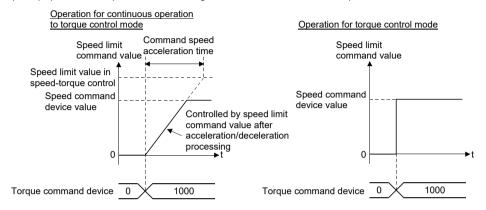
 The operation for stop cause during torque control mode is shown below.

Item	Operation during torque control mode	
The stop command (M3200+20n) turned ON.	The speed limit command value commanded to servo	
The rapid stop command (M3201+20n)	amplifier is "0" regardless of the setting value of "Speed	
turned ON.	command device". The mode is switched to position control	
The external stop input turned ON.	mode when "Zero speed (b3)" of servo status2 (#8011+20n) turns ON, and the operation stops immediately. (Deceleration processing is not executed.) The value of command torque is not changed. It might take time to reach at the speed "0" depending on the current torque command value.	
The all axes servo ON command (M2042) turned OFF.	The servo OFF is not executed during torque control mode. The command status at that time becomes valid when the	
The servo OFF command (M3215+20n) turned ON.	mode is switched to position control mode.	
The current value reached to software stroke	The minor error (error code: 200, 207) and major error	
limit.	(error code: 1101, 1102) will occur. The mode is switched to	
The position of motor reached to hardware	position control mode at current position, and the operation	
stroke limit	immediately stops. (Deceleration processing is not	
The PLC ready flag (M2000) turned OFF.	executed.)	
The forced stop input to Motion CPU.	The mode is switched to position control mode when the	
The forced stop input to servo amplifier.	servo OFF (The servo ready signal (M2415+20n) turns	
The servo error occurred.	OFF) is executed. (While the servo amplifier is servo OFF, even if the mode is switched to position control mode, the servo motor occurs to the free run. (The operation stops with dynamic brake.))	
The servo amplifier's power supply turned OFF.	The motor occurs to the free run. (The operation stops with dynamic brake.) (The mode is to position control mode at the servo amplifier's power supply ON again.)	

(5) Continuous operation to torque control mode

(a) Operation for continuous operation to torque control mode In continuous operation to torque control, the torque control can be executed by the speed limit command value after acceleration/deceleration processing without stopping the operation during the positioning in position control mode or speed command in speed control mode.

(Example) When the torque command is changed from 0.0% to 100% with the torque command device.



During continuous operation to torque control mode, the torque control is executed at command torque set in "Torque command device".

Command torque can be changed any time during continuous operation to torque control mode.

Speed change request (CHGV, D(P).CHGV) is invalid (no operation). Torque limit value to servo amplifier can be changed within the range of "Torque limit value at speed-torque control" by torque limit value change request (CHGT, D(P).CHGT) or torque limit value individual change request (CHGT2, D(P).CHGT2), but the value is valid when the mode is switched to position control mode. Command torque time constant is calculated based on the "Torque limit value at speed-torque control" at torque control mode switching after the torque limit value is changed. If the change outside the range of "Torque limit value at speed-torque control" is requested by torque limit value change request or torque limit value individual change request, a minor error (error code: 319) will occur, and the torque limit value is not changed.

POINTS

When oscillations such as vibrations occur during continuous operation to torque control, check if lowering the value of the "Torque feedback loop gain (PB03)" servo parameter reduces the oscillations.

(b) Torque command setting method

During continuous operation to torque control mode, set time for the command torque to increase from 0[%] to torque limit value at speed-torque control" in "Command torque time constant (Positive direction)", and the command torque to decrease from "Torque limit value at speed-torque control" to 0[%] in "Command torque time constant (Negative direction)". The value when the control mode switching request turns OFF to ON is valid for "Command torque time constant (Positive direction) and command torque time constant (Negative direction). The command torque during continuous operation to torque control mode is limited with "Torque limit value at speed-torque control".

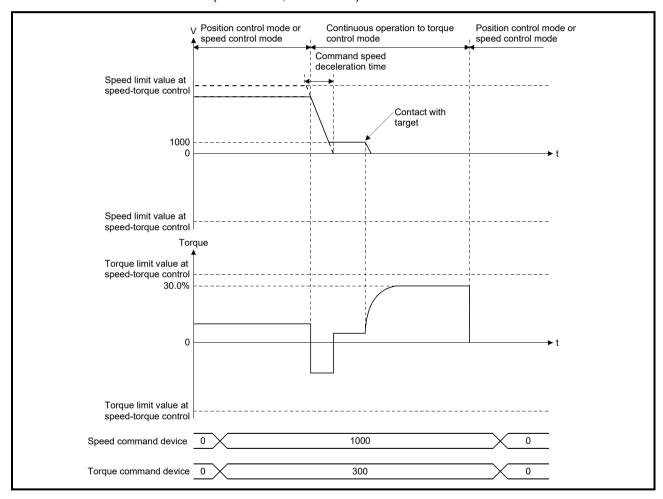
If torque exceeds torque limit value is commanded, a minor error (error code: 316) will occur, and the operation is controlled with torque limit value at speed-torque control.

(c) Acceleration/deceleration processing at continuous operation to torque control mode

Acceleration/deceleration is a trapezoidal acceleration/deceleration processing. Set acceleration/deceleration time toward "Speed limit value at speed-torque control" in "Command speed acceleration time" and "Command speed deceleration time". The value when the control mode switching request device turns OFF to ON is valid.

Command speed during continuous operation to torque control mode is limited with "Speed limit value at speed-torque control". If the speed exceeds speed limit value is commanded, a minor error (error code: 315) will occur, and the operation is controlled with speed limit value.

Confirm the command speed to servo amplifier with command speed (#8004+20n, #8005+20n).



- (d) Precautions at continuous operation to torque control mode The following servo amplifier functions cannot be used during continuous operation to torque mode.
 - · Base cut delay time function
 - · Forced stop deceleration function
 - · Vertical axis freefall prevention function

(e) Speed during continuous operation to torque control mode The speed during continuous operation to torque control mode is limited with the absolute value of speed limit command value after acceleration/ deceleration processing with signed value set in "Speed command device". Speed direction depends on the torque command. When the speed reaches the absolute value of speed limit command value, "Speed limit (b4)" of servo status2 (#8011+20n) turns ON".

And, the value of "Speed command device" (speed limit command value for continuous operation to torque control) is limited with "Speed limit value at speed-torque control". If the speed limit command value exceeds speed limit value at speed-torque control is set, a minor error (error code: 315) will occur, and the operation is controlled with speed limit value at speed-torque control.

POINTS

- (1) The actual motor speed may not reach the speed limit command value depending on the machine load situation during continuous operation to torque control mode.
- (2) It is recommended to match the direction of torque command and speed command. When the direction of torque command and speed command is different, the speed may decelerate to 0.
 - (f) Current feed value during continuous operation to torque control mode Feed current value (D0+20n, D1+20n) and real current value (D2+20n, D3+20n) are updated even in continuous operation to torque control mode. If the current feed value exceeds the software stroke limit, a minor error (error code: 207) will occur and the operation is switched to position control mode. Invalidate the software stroke limit to execute one-way feed.

(g) Stop cause during continuous operation to torque control mode

The operation for stop cause during continuous operation to torque control mode is shown below.

Item	Operation during torque control mode	
The stop command (M3200+20n) turned ON. The rapid stop command (M3201+20n) turned ON.	The speed limit command value commanded to servo amplifier is "0" regardless of the setting value of "Speed command device". The mode is switched to position control	
The external stop input turned ON.	mode when "Zero speed (b3)" of servo status2 (#8011+20n) turns ON, and the operation stops immediately. (Deceleration processing is not executed.) The value of command torque is not changed. It might take time to reach at the speed "0" depending on the current torque command value.	
The all axes servo ON command (M2042) turned OFF.	The servo OFF is not executed during torque control mode. The command status at that time becomes valid when the	
Servo OFF command (M3215+20n) turned ON.	mode is switched to position control mode.	
The current value reached to software stroke limit.	The minor error (error code: 200, 207) and major error (error code: 1101, 1102) will occur. The mode is switched to	
The position of motor reached to hardware stroke limit	position control mode at current position, and the operation immediately stops. (Deceleration processing is not executed.) When the operation immediately stops, the motor will start hunting depending on the motor speed. Therefore, be sure not to reach to limit in high speed or do not turn OFF the PLC READY.	
The PLC ready flag (M2000) turned OFF.		
The forced stop input to Motion CPU.	The mode is switched to position control mode when the	
The forced stop input to servo amplifier.	servo OFF (The servo ready signal (M2415+20n) turns	
The servo error occurred.	OFF) is executed. (While the servo amplifier is servo OFF, even if the mode is switched to position control mode, the servo motor occurs to the free run. (The operation stops with dynamic brake.))	
The servo amplifier's power supply turned OFF.	The motor occurs to the free run. (The operation stops with dynamic brake.) (The mode is to position control mode at the servo amplifier's power supply ON again.)	

7.8 Acceleration/Deceleration Time Change Function QDS(Ver.)

This function arbitrarily changes the acceleration/deceleration time at speed change, when changing speed with Motion dedicated functions (CHGV, CHGVS) of Motion SFC program (and also the Motion dedicated PLC instruction D(P).CHGV, D(P).CHGVS).

Normally (speed change without changing the acceleration/deceleration time), the acceleration/deceleration time is controlled by the positioning data of the servo program or the parameter block at the start. However, if a speed change is executed after setting the acceleration/deceleration time change parameter, speed changes at the set acceleration/deceleration time.

POINTS

"Acceleration/deceleration time after change" is the acceleration/deceleration time of positioning control being executed. "Acceleration/deceleration time after change" is valid until the switching of the next positioning point. (Automatic decelerating processing at positioning completion is also controlled by "Acceleration/deceleration time after change".)

(1) Speed change instructions for acceleration/deceleration time change

Classification	Instruction	Description	Remarks
Motion SFC program (Motion dedicated function)	CHGV	Speed change request	The acceleration/deceleration time change function toward the virtual servo axis is invalid.
	CHGVS	Command generation axis speed change request	
Motion dedicated PLC instruction	D(P).CHGV	Speed change request of the specified axis	The acceleration/deceleration time change function toward the virtual servo axis is invalid.
	D(P).CHGVS	Speed change request of the specified command generation axis	

(2) Control details

After setting the acceleration/deceleration time change parameter, if speed change command is executed, the acceleration/deceleration time changes. The acceleration/deceleration time change parameter is set for every axis in the servo data settings of MT Developer2.

Refer to Section 4.4 for details of acceleration/deceleration time change parameter.

Refer to the "Q173DSCPU/Q172DSCPU Motion controller (SV22) Programming Manual (Advanced Synchronous Control)" for details of command generation axis parameter.

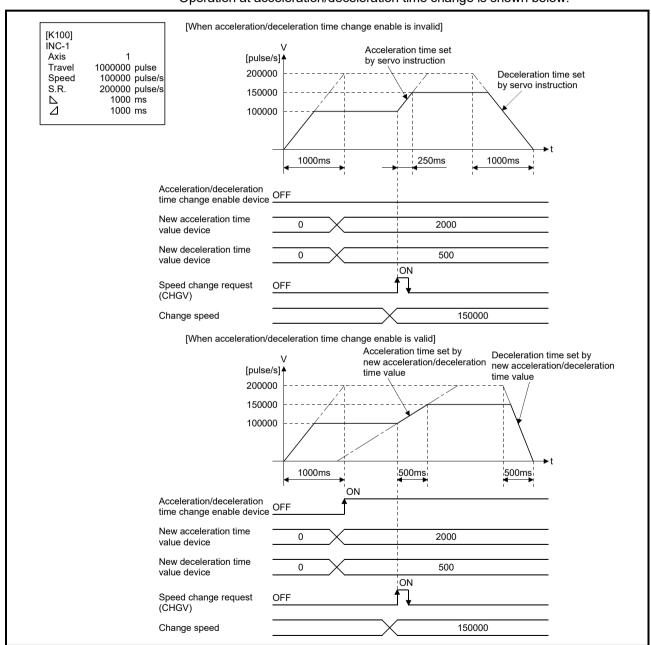
Ver.): Refer to Section 1.3 for the software version that supports this function.

(a) Set the change value of acceleration/deceleration time in the device set by acceleration time change value device/deceleration time change value device.

Name	Setting range
New acceleration time value device	0: Time change invalid
New deceleration time value device	1 to 65535[ms]

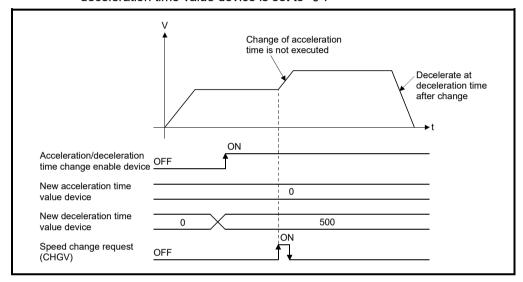
(b) Device set by the acceleration/deceleration time change enable device turns ON (valid).

Operation at acceleration/deceleration time change is shown below.



(3) Cautions

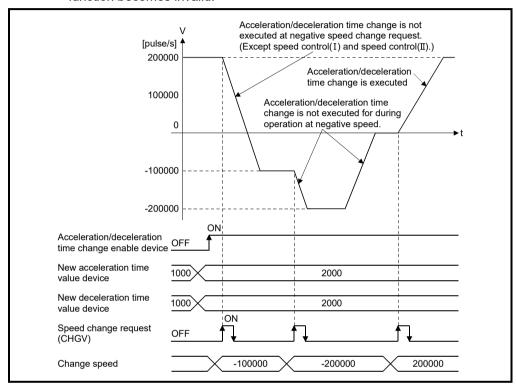
- (a) In the following cases acceleration time or deceleration time does not change when a speed change is executed. The acceleration time or deceleration time at the time of speed change accept is maintained.
 - When setting of the acceleration/deceleration time change enable device was omitted.
 - When setting of new acceleration time value device or new deceleration time value device was omitted.
 - When the device set by new acceleration time value device or new deceleration time value device is set to "0".



- (b) During interpolation control, change of acceleration/deceleration time is executed by the acceleration/deceleration time change parameter of the axis No. specified with the speed change command.
- (c) Acceleration/deceleration time change function becomes invalid for axes executing the following servo instructions:
 - Circular interpolation control (including point during CPSTART)
 - Helical interpolation control (including point during CPSTART)
 - · Speed control with fixed position stop
- (d) Acceleration/deceleration time change function becomes invalid for axes executing the following acceleration/deceleration methods:
 - FIN acceleration/deceleration
 - Advanced S-curve acceleration/deceleration control

(e) If a negative speed change request is executed acceleration/deceleration time change function is only valid for axes executing speed control (I), or speed control (I).

If a negative speed change request is executed for axes executing other instructions, acceleration/deceleration time change function becomes invalid. Also, if an acceleration/deceleration time change is performed for axes operating at a negative speed, acceleration/deceleration time change function becomes invalid.

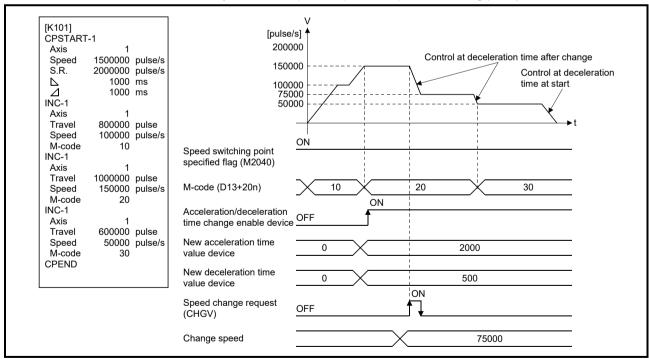


- (f) After changing deceleration time, operations for a stop or rapid stop are shown below:
 - Stop Deceleration stop by the deceleration speed after change.
 - Rapid stop Rapid stop by parameter setting values at start.

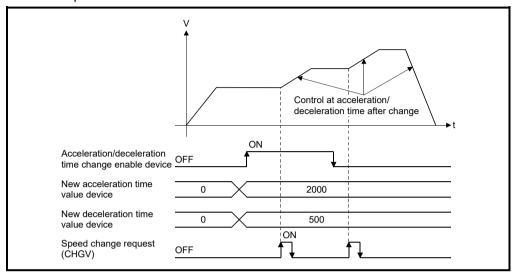
If changing deceleration time by the acceleration/deceleration time change function, regardless of whether the rapid stop deceleration time setting error invalid flag (SM805) is ON or OFF, deceleration time can be changed. Therefore, if the setting values of the rapid stop deceleration time are larger than the deceleration time change value after change, an overrun may occur. Refer to Section 4.3.1 for details of operation.

(g) When the current value is to execute a deceleration stop from current command speed, if the current value exceeds the stroke limit range, a minor error (error code: 207) occurs, and deceleration stop is made before a stroke limit. However, if the deceleration distance after the deceleration time change is longer than the distance until the stroke limit, deceleration stop exceeds the stroke limit. Execute a speed change at a position where enough movement amount until the stroke limit is ensured.

- (h) During a positioning operation where acceleration/deceleration time is changed, and the deceleration distance to the final positioning address for the output speed is not enough, a minor error (error code: 211) occurs and the operation immediately stops at the final positioning address. Execute a speed change at a position where enough movement amount until the stop position is ensured.
- (i) If acceleration/deceleration time is changed during speed control in speed-position switching (VPF/VPR), control continues at the acceleration/deceleration times changed during speed control even after switching from speed to position control. To control with the acceleration/deceleration time of the start after switching to position control, execute speed change again.
- (j) If acceleration/deceleration time is changed during speed switching control (VSTART), constant-speed control (CPSTART), control at the "acceleration/deceleration time after change" occurs only between the points where change was executed. From the next point onward, control at the "acceleration/deceleration time at start" set beforehand occurs. If the speed switching point specified flag (M2040) is ON in constant-speed control (CPSTART), speed change is executed up to the speed switching point at the "acceleration/deceleration time after change". (If the acceleration/deceleration time is changed to a large value, speed change may not be completed up to the speed switching point).



(k) For control with changed acceleration/deceleration time, even if acceleration/deceleration time change enable device is turned OFF (invalid), control at acceleration/deceleration time after change continues until the operation ends.



(I) When position follow-up control (PFSTART) is performed in an axis where trapezoidal acceleration/deceleration is set, and deceleration time is changed to a value smaller than the operation cycle by the acceleration/deceleration time change function during automatic deceleration, positioning to the set address is completed instantly. This can cause vibrations or collisions, and depending on the remaining movement amount, servo errors can occur. Add automatic decelerating flag (M2128+n) to an interlock condition to so that acceleration/deceleration time change is not performed during automatic deceleration, or change the acceleration/deceleration time at a deceleration time where deceleration stop can be performed without fail.

MEMO		

APPENDICES

APPENDIX 1 Error Codes Stored Using the Motion CPU

The servo program setting errors and positioning errors are detected in the Motion CPU side.

(1) Servo program setting errors

These are positioning data errors set in the servo program, and it checks at the start of each servo program.

They are errors that occur when the positioning data is specified indirectly.

The operations at the error occurrence are shown below.

- The servo program setting error flag (SM516) turns on.
- The erroneous servo program is stored in the error program No. storage register (SD516).
- The error code is stored in the error item information register (SD517).

(2) Positioning error

- (a) Positioning errors occurs at the positioning start or during positioning control. There are minor errors, major errors and servo errors.
 - Minor errors...... These errors occur in the Motion SFC program or servo program, and the error codes 1 to 999 are used.
 Check the error code, and remove the error cause by correcting the Motion SFC program or servo program.
 - 2) Major errors...... These errors occur in the external input signals or control commands from the Motion SFC program, and the error codes 1000 to 1999 are used. Check the error code, and remove the error cause of the external input signal state or Motion SFC program.
 - 3) Servo errors These errors detected in the servo amplifier, and the error codes 2000 to 2999 are used. Check the error code, and remove the error cause of the servo amplifier side.

APP.

(b) The error detection signal of the erroneous axis turns on at the error occurrence, and the error codes are stored in the minor error code, major error code or servo error code storage register.

Table 1.1 Error code storage registers, error detection signals

Device		Error code storage register								Error							
	Axis	Axis	Axis	Axis	Axis	Axis	Axis	Axis	Axis	Axis	Axis	Axis	Axis	Axis	Axis	Axis	detection
Error class	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	signal
Minor error	D6	D26	D46	D66	D86	D106	D126	D146	D166	D186	D206	D226	D246	D266	D286	D306	M0407.00
Major error	D7	D27	D47	D67	D87	D107	D127	D147	D167	D187	D207	D227	D247	D267	D287		M2407+20n
Servo error	D8	D28	D48	D68	D88	D108	D128	D148	D168	D188	D208	D228	D248	D268	D288	D308	M2408+20n

Device		Error code storage register									Error						
	Axis	Axis	Axis	Axis	Axis	Axis	Axis	Axis	Axis	Axis	Axis	Axis	Axis	Axis	Axis	Axis	detection
Error class	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	signal
Minor error	D326	D346	D366	D386	D406	D426	D446	D466	D486	D506	D526	D546	D566	D586	D606	D626	NAC 407 - 00
Major error	D327	D347	D367	D387	D407	D427	D447	D467	D487	D507	D527	D547	D567	D587	D607	D627	M2407+20n
Servo error	D328	D348	D368	D388	D408	D428	D448	D468	D488	D508	D528	D548	D568	D588	D608	D628	M2408+20n

(Note): The following range is valid.

• Q172DSCPU : Axis No.1 to 16 • Q172DCPU(-S1) : Axis No.1 to 8

- (c) If another error occurs after an error code has been stored, the existing error code is overwritten, deleting it.
- However, the error history can be checked using MT Developer2.
- (d) Error detection signals and error codes are held until the error reset command (M3207+20n) or servo error reset command (M3208+20n) turns on.

POINTS

- (1) Even if the servo error reset (M3208+20n) turns on at the servo error occurrence, the same error code might be stored again.
- (2) Reset the servo error after removing the error cause of the servo amplifier side at the servo error occurrence.

APPENDIX 1.1 Servo program setting errors (Stored in SD517)

The error codes, error contents and corrective actions for servo program setting errors are shown in Table 1.2.

In the error codes marked with "Note" indicates the axis No. (1 to 32).

Table 1.2 Servo program setting error list

Error code stored in SD517	Error name	Error contents	Error processing	Corrective action		
1	Parameter block No. setting error	The parameter block No. is outside the range of 1 to 64.	Execute the servo program with the default value "1" of parameter block.	Set the parameter block No. within the range of 1 to 64.		
n03 ^(Note)	Address (travel value) setting error (Except the speed control and speed/position control.) (Setting error for linear axis at the helical-interpolation.)	(1) The address is outside the setting range at the positioning start for absolute data method. Unit Address setting range degree 0 to × 10 ⁻⁵ (degree) (2) The travel value is set to -2147483648 (H80000000) at the positioning start for incremental data method.	(1) Positioning control does not start. (All interpolation control at the interpolation control.) (2) If the error is detected during the speedswitching control or constant-speed control, a deceleration stop is made. (3) If an error occurs in one servo program, all servo programs do not execute during the simultaneous start.	 (1) If the control unit is [degree], set the address within the range of 0 to 35999999. (2) Set the travel value within the range of "0 to ± (2³¹-1)". 		
4	Command speed error	(1) The command speed is outside the range of 1 to the speed limit value. (2) The command speed is outside the setting range. Unit Speed setting range 1 to ×10 ⁻² 600000000 [mm/min] inch 1 to ×10 ⁻³ 600000000 [inch/min] 4 to 10 ⁻³ 600000000 [inch/min] 600000000 [inch/min] 7 to 2147483647 /min] (Note-1) pulse 1 to [pulse/s]	 (1) Positioning control does not start if the command speed is "0" or less. (2) If the command speed exceeds the speed limit value, control with the speed limit value. 	Set the command speed within the range of 1 to the speed limit value.		
5	Dwell time setting error	The dwell time is outside the range of 0 to 5000.	Control with the default value "0".	Set the dwell time within the range of 0 to 5000.		
6	M-code setting error	The M-code is outside the range of 0 to 32767.		Set the M-code within the range of 0 to 32767.		
7	Torque limit value setting error	The torque limit value is outside the range of 1 to 1000.	orque limit value is outside Control with the torque limit			

(Note-1): When the "speed control $10 \times$ multiplier setting for degree axis" is set to "valid", the setting range is 0.01 to 21474836.47 [degree/min].

Table 1.2 Servo program setting error list (Continued)

Error code	Error name	Error contents	Error processing	Corrective action
stored in SD517			Error processing	
n08 ^(Note)	Auxiliary point setting error (At the auxiliary point-specified circular interpolation.) (At the auxiliary point-specified	(1) The auxiliary point address is outside the setting range at the positioning start for absolute data method. Unit Address setting range 0 to ×10 ⁻⁵ 35999999 [degree]	Positioning control does not start.	(1) If the control unit is [degree], set the auxiliary point address within the range of 0 to 35999999.
	helical interpolation.)	(2) The auxiliary point address is set to -2147483648 (H80000000) at the positioning start for incremental data method.		(2) Set the auxiliary point address within the range of 0 to ± (2 ³¹ -1).
n09 ^(Note)	Radius setting error (At the radius- specified circular interpolation.) (At the radius- specified helical interpolation.)	(1) The radius is outside the setting range at the positioning control for absolute data method. Unit Address setting range 0 to × 10 ⁻⁵ 35999999 [degree]		(1) If the control unit is [degree], set the radius within the range of 0 to 35999999.
		(2) The radius is set to "0" or negative setting at the positioning start for incremental data method.		(2) Set the radius within the range of 1 to (2 ³¹ -1).
n10 ^(Note)	Central point setting error (At the central point-specified circular interpolation.) (At the central point-specified helical interpolation.)	(1) The central point address is outside the setting range at the positioning start for absolute data method. Unit Address setting range 0 to × 10 ⁻⁵ degree 35999999 [degree]		(1) If the control unit is [degree], set the central point address within the range of 0 to 35999999.
		(2) The central point is set to -2147483648 (H80000000) at the positioning start for incremental data method.		(2) Set the central point address within the range of 0 to ± (2 ³¹ -1).
11	Interpolation control unit setting error	The interpolation control unit is set outside the range of 0 to 3.	"3".	unit within the range of 0 to 3.
12	Speed limit value setting error	The speed limit value is set outside the setting range.	Control with the default value 200000[pulse/s].	Set the speed limit value within the setting range. [For pulse] 1 to 2147483647[pulse/s]
13	Acceleration time setting error FIN acceleration/ deceleration setting error Fixed position stop acceleration/ deceleration time setting error	The acceleration time is set to "0". The FIN acceleration/deceleration time is set except 1 to 5000. The fixed position stop acceleration/deceleration time is set to "0".	Control with the default value "1000".	Set the acceleration time within the range of 1 to 65535. The FIN acceleration/ deceleration time within the range of 1 to 5000. Set the fixed position stop acceleration/deceleration time within the range of 1 to 65535.
14	Deceleration time setting error	The deceleration time is set to "0".		Set the deceleration time within the range of 1 to 65535.

Table 1.2 Servo program setting error list (Continued)

Error code	_			
stored in SD517	Error name	Error contents	Error processing	Corrective action
15	Rapid stop deceleration time setting error	The rapid stop deceleration time is set to "0".	Control with the default value "1000".	Set the rapid stop deceleration time within the range of 1 to 65535.
16	Torque limit value setting error	The torque limit value is outside the range of 1 to 1000.	Control with the default value "300[%]".	Set the torque limit value within the range of 1 to 1000.
17	Allowable error range for circular interpolation setting error	The allowable error range for circular interpolation is outside the setting range. Unit Address setting range mm × 10 ⁻¹ [µm] × 10 ⁻⁵ [inch] × 10 ⁻⁵ [degree] pulse [pulse]	Control with the default value "100[pulse]".	Set the allowable error range for circular interpolation within the setting range.
18	Repeat count error	The repeat count is outside the range of 1 to 32767.	Control the repeat count with "1".	Set the repeat count within the range of 1 to 32767.
19	START instruction setting error	 (1) The servo program specified with the START instruction does not exist. (2) There is a START instruction in the specified servo program. (3) The starting axis of the specified servo program overlap. (4) The real mode program and virtual mode program are mixed. (5) The real axis program and command generation axis program are mixed. 	Positioning control does not start.	 (1) Create the servo program specified with the START instruction. (2) Delete the servo program specified with the START instruction. (3) Do not overlap the starting axis. (4) Do not allow mixture of the real mode program and virtual mode program. (5) Do not allow mixture of the real axis program and command generation axis program.
20	Point setting error	Point is not specified in the instruction at the constant-speed control.		Set a point between CPSTART and CPEND.
21	Reference axis speed setting error	The axis except interpolation axis is set as the reference axis at the linear interpolation of the reference axis speed-specified method.		Set one of the interpolation axes as the reference axis.
22	S-curve ratio setting error	S-curve ratio is set outside the range of 0 to 100[%] at the S-curve acceleration/deceleration.	Control the S-curve ratio with 0[%] (Trapezoidal acceleration/deceleration).	Set the S-curve ratio within the range of 0 to 100[%].
23	VSTART setting error	Not even one speed-switching point has been set between a VSTART and VEND instruction, or between FOR and NEXT instruction.	Positioning control does not start.	Set the speed switching point between the VSTART and VEND instructions or the FOR and NEXT instructions.
24	Cancel function start program No. error	The start program No. for the cancel function is set outside the range 0 to 4095.		Start after set the start program No. within the range of 0 to 4095.

Table 1.2 Servo program setting error list (Continued)

Error code stored in D517	Error name	Error contents	Error processing	Corrective action
25	High-Speed oscillation command amplitude error	Operation cannot be started because the amplitude specified with the high-speed oscillation function is outside the range 1 to 2147483647.	Positioning control does not start.	Start after set the command amplitude within the range of 1 to 214783647.
26	High-Speed oscillation command starting angle error	Operation cannot be started because the starting angle specified with the high-speed oscillation function is outside the range of 0 to 3599 (×0.1[degree]).		Start after set the starting angle within the range of 0 to 3599 (× 0.1 [degree]).
27	High-Speed oscillation command frequency error	Operation cannot be started because the frequency specified with the high-speed oscillation function is outside the range of 1 to 5000[CPM].		Start after set the frequency within the range of 1 to 5000[CPM].
28	Number of helical interpolation pitches error	The specified number of pitches of helical interpolation is outside the range of 0 to 999.		Set the specified number of pitches within the range of 0 to 999.
41	Device error of the home position return data for indirect setting	Any unauthorized devices are set in the home position return data for indirect setting.	Positioning control does not start.	Review the devices of home position return data for indirect setting.
45	Advanced S-curve acceleration/ deceleration setting	The acceleration section 1 ratio is outside the range of 0.0 to 100.0[%].	Control with acceleration section 1 ratio = 0.0	Set the each ratio within the range of 0.0 to 100.0[%].
46	error	The acceleration section 2 ratio is outside the range of 0.0 to 100.0[%].	acceleration section 2 ratio = 0.0 deceleration section 1 ratio =	
47		The deceleration section 1 ratio is outside the range of 0.0 to 100.0[%].	0.0 deceleration section 2 ratio = 0.0	
48		The deceleration section 2 ratio is outside the range of 0.0 to 100.0[%].		
49		(Acceleration section 1 + Acceleration section 2) > 100.0[%]		
50		(Deceleration section 1 + Deceleration section 2) > 100.0[%]		
51	Rapid stop deceleration time setting error	The rapid stop deceleration time is bigger than the setting value of deceleration time.	Control the rapid stop deceleration time with the setting value of deceleration time.	Set the rapid stop deceleration time within the range of 1 to deceleration time setting value.
900	START instruction setting error	The servo program specified with the servo program start does not exist.	Positioning control does not start.	Set the correct servo program No.
901	START instruction setting error	The axis No. set in the servo program start is different from the axis No. set in the servo program.		Set the correct axis No.
902	Servo program instruction code error	The instruction code cannot be decoded. (A non-existent instruction code has been specified.)		Set the correct instruction code.

Table 1.2 Servo program setting error list (Continued)

		· ·	<u> </u>	•
Error code stored in SD517	Error name	Error contents	Error processing	Corrective action
903	Start error	A virtual mode program was started in the real mode.	Positioning control does not start.	Check the program mode allocation.
905	Start error	 (1) Operation disable instructions (VPF, VPR, VPSTART, PVF, PVR, ZERO, VVF, VVR, OSC) was started in virtual mode. (2) Operation disable instructions (ZERO, OSC, CHGA-C) was started in real mode axis. (3) Operation disable instructions (VPF, VPR, VPSTART, VSTART, ZERO, VVF, VVR, OSC) was started in command 		Correct the servo program.
		generation axis. (4) Operation disable instructions (CHGA-C, CHGA-E) from the D(P).SVST instruction of Motion dedicated instruction was started.		Use the D(P).CHGA instruction of Motion dedicated instruction.
906	Axis No. setting error	 (1) Unused axis of the system setting is set in the servo program start. (2) It was started by setting the real mode axis in the virtual servo program. (3) It was started in the condition that the real mode axis had been mixed with virtual axis in the interpolation axis. (4) It was started by setting the virtual axis in the real mode program in virtual mode. 		Set the axis No. set in the system setting or mechanical system program.
907	Start error	It was started during processing for switching from real mode to virtual mode.		Use M2043 (real mode/virtual mode switching request), M2044 (real mode/virtual
908	Start error	It was stated during processing for switching from virtual mode to real mode.		mode switching status) as interlocks for start.

APPENDIX 1.2 Minor errors

These errors are detected in the sequence program or servo program, and the error codes of 1 to 999 are used.

Minor errors include the setting data errors, starting errors, positioning control errors and current value/speed/target position change errors and system errors.

(1) Setting data errors (1 to 99)

These errors occur when the data set in the parameters for positioning control is not correct.

The error codes, causes, processing, and corrective actions are shown in Table 1.3.

Table 1.3 Setting data error (1 to 99) list

Error code	Erroneous data	Check timing	Error cause	Error processing	Corrective action
21		Home position return start of the proximity dog method, count method, data set method, dog cradle method, stopper method, limit switch combined method, scale home position signal detection method, and dogless home position signal reference method.	The home position address is outside the range of 0 to 35999999 (× 10 ⁻⁵ [degree]) with degree axis.		Set the home position address within the setting range using MT Developer2.
22		Home position return start of the proximity dog method, count method, data	The home position return speed is outside the range of 1 to speed limit value.		Set the home position return speed or less to the speed limit value using MT Developer2.
23	Home position return data	set method, dog cradle method, stopper method, limit switch combined method, scale home position signal detection method, and dogless home position signal reference method.	The creep speed is outside the range of 1 to home position return speed.	Home position return is not started.	Set the creep speed below to the home position return speed or less using MT Developer2.
24		Home position return start of the count method.	The travel value after the proximity dog ON is outside the range of 0 to $(2^{31}-1)$ (\times unit).		Set the travel value after the proximity dog ON within the setting range using MT Developer2.
25		Home position return start of the count method, proximity dog method, dog cradle method, stopper method, limit switch combined method, scale home position signal detection method, and dogless home position signal reference method.	The parameter block No. is outside the range of 1 to 64.		Set the parameter block No. within the setting range using MT Developer2.
26		Home position return start of the stopper method.	Torque limit value at the creep speed is outside the range of 1 to 1000[%].		Set the torque limit value at the creep speed within the setting range using MT Developer2.

Table 1.3 Setting data error (1 to 99) list (Continued)

Error code	Erroneous data	Check timing	Error cause	Error processing	Corrective action
27	Inneition	Home position return start of the usable retry function.	return is outside the range of 0	return is not	Set the dwell time at the home position return retry within the setting range using MT Developer2.
40	Parameter block	Interpolation control start	The interpolation control unit of the parameter block is different from the control unit of the fixed parameters.		Set the same control unit of the fixed parameters and servo parameters.

POINT

When the interpolation control unit of parameter block is different from the control unit of fixed parameters, an error code may not be stored with the combination of units.

Refer to Section 6.1.4 for details.

(2) Positioning control start errors (100 to 199)

These errors are detected at the positioning control start.

The error codes, causes, processing, and corrective actions are shown in Table 1.4.

Table 1.4 Positioning control start error (100 to 199) list

					(Cont	rol n	node	9							
Error	Positioning	Fixed-pitch feed	Speed	Speed-position switching	Speed switching	Constant-speed	OOC	Manual pulse generator	Home position return	Position follow-up control	osc	Speed control with fixed position stop	Speed-torque control	Error cause	Error processing	Corrective action
100	0	0	0	0	0	0	0	0	0	0	0	0	0	• The PLC ready flag (M2000) or PCPU READY complete flag (SM500) is OFF.		Set the Motion CPU to RUN. Turn the PLC ready flag (M2000) on.
101	0	0	0	0	0	0	0	0	0	0	0	0	0	The start accept flag (M2001 to M2032) for applicable axis is ON.		Take an interlock in the program not to start the starting axis. (Use the start accept flag OFF of the applicable axis as the starting condition).
103	0	0	0	0	0	0	0	0	0	0	0	0	0	• The stop command (M3200+20n) for applicable axis is ON.		Turn the stop command (M3200+20n) off and start.
104	0	0	0	0	0	0	0	0	0	0	0	0	0	• The rapid stop command (M3201+20n) for applicable axis is ON.		Turn the rapid stop command (M3201+20n) off and start.
105 (Note)	0				0	0				0				The feed current value is outside the range of stroke limit at the start.	Positioning control does not start.	 Set within the stroke limit range by the JOG operation. Set within the stroke limit range by the home position return or current value change.
106 (Note)	0	0			0	0				0	0			Positioning is outside the range of stroke limit. When absolute position system is enabled for stepping driver, and software stroke limit is valid with control units as degree, the following instructions were started. Absolute system instructions in constant-speed control Position follow-up control Absolute system instructions in speed-switching control		Perform the positioning within the range of stroke limit. When absolute position system is enabled for stepping driver, if software stroke limit is valid and control units are degree, do not use the following instructions. (1) Absolute system instructions in constant-speed control (2) Position follow-up control (3) Absolute system instructions in speed-switching control

(Note): These errors are stored the error codes of the all applicable interpolation axes at the interpolation operation.

Table 1.4 Positioning control start error (100 to 199) list (Continued)

					(Cont	rol n	node	;		_					·
Error code	Positioning	Fixed-pitch feed	Speed	Speed-position switching	Speed switching		JOG	Manual pulse generator	Home position return	Position follow-up control	osc	Speed control with fixed position stop	Speed-torque control	Error cause	Error processing	Corrective action
107 (Note)	0					0								The address that does not generate an arc is set at auxiliary point-specified circular interpolation or auxiliary point-specified helical interpolation. Relationship between the start point, auxiliary point and end point. The auxiliary point-specified circular interpolation or auxiliary point-specified helical interpolation was started in the control unit degree axis which is "stroke limit invalid".		Correct the addresses of the servo program. Make the stroke limit valid for the control unit degree axis starts the auxiliary point-specified circular interpolation or auxiliary point-specified helical interpolation. Make the stroke limit valid for
														circular interpolation or auxiliary point-specified helical interpolation was started in the axis which is "stroke limit invalid".	Positioning control does	the axis starts the auxiliary point-specified circular interpolation or auxiliary point-specified helical interpolation.
														The address that does not generate an arc is set at R (radius) specified circular interpolation or R (radius) specified helical interpolation. Relationship between the start point, radius and end point.	not start.	Correct the addresses of the servo program.
108 (Note)	0					0								The radius-specified circular interpolation or radius-specified helical interpolation was started in the control unit degree axis which is "stroke limit invalid". The radius-specified circular interpolation or radius-specified helical interpolation was started in the axis which is "stroke limit invalid".		 Make the stroke limit valid for the control unit degree axis starts the radius-specified circular interpolation or radius- specified helical interpolation. Make the stroke limit valid for the axis starts the radius- specified circular interpolation or radius-specified helical interpolation.

(Note): These errors are stored the error codes of the all applicable interpolation axes at the interpolation operation.

Table 1.4 Positioning control start error (100 to 199) list (Continued)

						Cont					_				, ,	,
Error code	Positioning	Fixed-pitch feed	Speed	Speed-position switching	Speed switching	Constant-speed	JOG	Manual pulse generator	Home position return	Position follow-up control	osc	Speed control with fixed position stop	Speed-torque control	Error cause	Error processing	Corrective action
109 (Note)	0					0								The address that does not generate an arc is set at central point-specified circular interpolation or central point-specified helical interpolation. Relationship between the start point, central point and end point. The central point-specified circular interpolation or central point-specified helical interpolation was started in the control unit degree axis which is "stroke limit invalid". The central point-specified circular interpolation or central point-specified circular interpolation or central point-specified helical interpolation was started in the axis which is "stroke limit invalid".	Positioning control does not start.	Correct the addresses of the servo program. Make the stroke limit valid for the control unit degree axis starts the central point-specified circular interpolation or central point-specified helical interpolation. Make the stroke limit valid for the axis starts the central point-specified circular interpolation or central point-specified helical interpolation.
110 (Note)	0					0								The difference between the end point address and ideal end point is outside the allowable error range for circular interpolation at the circular interpolation.		Correct the addresses of the servo program.
111				0										 The speed/position control restarting was performed, although it was not after stop during operation of the speed-position switching control. 		Do not re-start except the stop during speed-position switching control.

(Note): These errors are stored the error codes of the all applicable interpolation axes at the interpolation operation.

Table 1.4 Positioning control start error (100 to 199) list (Continued)

						Cont					9 `		0	i start error (100 to 1		
Error code	Positioning	Fixed-pitch feed	Speed	Speed-position switching	Speed switching	Constant-speed	906	Manual pulse generator	Home position return	Position follow-up control	osc	Speed control with fixed position stop	Speed-torque control	Error cause	Error processing	Corrective action
115									0					The home position return complete signal (M2410+20n) turned on at the home position return of proximity dog method, dog cradle method, stopper method, and dogless home position signal reference method. The setting JOG speed is	Positioning control does not start.	Do not start continuously for the home position return. (1) At the home position return of proximity dog method, dog cradle method or stopper method: Return to a point before the proximity dog signal ON by JOG operation or positioning operation, etc., and perform the home position return. (2) At the home position return of dogless home position signal reference method: Return to a point before the home position by JOG operation or positioning operation, etc., and perform the home position return. Set the correct speed (within)
116							0							"0". • The setting JOG speed exceeded the JOG speed limit value. • The setting JOG speed limit value exceeded the setting	Control with the JOG speed limit value. Control with the	 the setting range). Set the correct JOG speed limit value (within the setting range).
														range.	maximum setting range of each control unit.	
117							0							 Both of forward and reverse rotation were set at the simultaneous start for the JOG operation. 	Only the applicable axis set to the forward direction starts.	Set a correct data.
119					0									• In the real mode or at the real mode axis, the instruction to specify the end point address by absolute data method in speed switching control was executed for the axis with unit [pulse/mm/inch] where the stroke limit is disabled.	Positioning control does not start.	When specifying the end point address by absolute data method in speed switching control, make the stroke limit valid.

Table 1.4 Positioning control start error (100 to 199) list (Continued)

								node						start crior (100 to 1	, ,	,
Error code	Positioning	Fixed-pitch feed	Speed	Speed-position switching	Speed switching	Constant-speed	Joe	Manual pulse generator	Home position retum	Position follow-up control	osc	Speed control with fixed position stop	Speed-torque control	Error cause	Error processing	Corrective action
120									0					• ZCT not set The zero pass signal (M2406+20n) turned off at the re-travel at the home position return for proximity dog, count and limit switch combined method or start in the home position return for data set method.	Home position return is not completed correctly.	Execute the home position return after the zero point passed.
121	0	0	0	0	0	0				0	0	0	0	When "Not execute servo program" is selected in the operation setting for incompletion of home position return, the home position return request signal (M2409+20n) turns on.	Positioning control does not start.	Execute servo program after home position return. In the system which enables execution of servo program even if the home position return request signal (M2409+20n) turns on, set "Execute servo program" as "operation setting for incompletion of home position return".
122									0					 Home position return is started on the direct drive motor when the absolute position data of the encoder has not been established. 		Turn the power supplies of the system or servo amplifier from OFF to ON after passing the zero point of the motor by the JOG operation, etc.
123									0					When the home position is on the proximity dog, the scale home position signal detection method home position return was started up again, at the home position return complete signal ON, after completion of the home position return.	Home	 When the home position is on the proximity dog, continuous home position returns of scale home position signal detection method are not supported. Execute JOG operation or positioning to return before the proximity dog ON, and execute home position return.
124									0					When using the scale home position signal detection method home position return or the dogless home position signal reference method home position return (operation A), the servo parameter PC17 is other than "Need to pass motor Z phase after the power supply is switched on".		Set "Need to pass motor Z phase after the power supply is switched on" to the servo parameter PC17. When you change the servo parameter PC17, please once turn off the power supply of servo amplifier and turn it on again.

Table 1.4 Positioning control start error (100 to 199) list (Continued)

				ıaı							9 (ıuc	start error (100 to 1	33) iist (C	
		ı			(Cont	rol n	node	9							
Error code	Positioning	Fixed-pitch feed	Speed	Speed-position switching	Speed switching	Constant-speed	906	Manual pulse generator	Home position retum	Position follow-up control	osc	Speed control with fixed position stop	Speed-torque control	Error cause	Error processing	Corrective action
130												0		 Speed control with fixed position stop with was started for the axis set in except unit [degree]. Speed control with fixed position stop was started in the axis which is not "stroke limit invalid". 	Positioning control does not start.	Set the unit [degree] in the axis which starts speed control with fixed position stop. Set the stroke limit invalid "(Upper stroke limit value) equal to (lower stroke limit value)" in the axis which starts speed control with fixed position stop.
133									0					 A data set method 2 and stopper method 1/2 home position return were started when using VCI (CKD Nikki Denso) and VPH (CKD Nikki Denso). 	Home position return does not start.	VCII (CKD Nikki Denso) and VPH (CKD Nikki Denso) does not support data set method 2 and stopper method 1/2 home position return. Change to the usable home position return system.
136			0											 An unusable instruction (VVF/VVR) was started in an axis that does not support VVF/VVR instruction. 		Cannot start VVF/VVR instruction in an axis that does not support VVF/VVR instruction.
140	0													 The travel value of the reference axis is set at "0" in the linear interpolation for reference axis specification. 		Do not set axis of travel value "0" as the reference axis.
141										0				 The position command device of position follow-up control is set the odd number. 	Positioning control does	Set the even number for the position command device of position follow-up control.
142				0					0					 The positioning control which use the external input signal was executed for the axis which has not set the external input signal in the system settings. 	not start.	Set the external input signal in the system setting.
145				0					0					Unusable instructions were started in the external input signal setting via servo amplifier.		Do not start the speed-position switching control and count method home position return in the external input signal setting via servo amplifier.
151	0	0	0		0	0	0	0		0				 Not allowed axis started in the virtual mode. (It cannot be started with error at real mode/virtual mode switching.) 	Positioning control does	Start in the virtual mode again after correct the error cause in the real mode.
152	0	0	0		0	0	0	0		0				 It started at the virtual mode and during deceleration by all axes servo OFF (M2042 OFF). 	not start.	

Table 1.4 Positioning control start error (100 to 199) list (Continued)

								node			3			or start error (100 to 1		
Error code	Positioning	Fixed-pitch feed	Speed	Speed-position switching	Speed switching	Constant-speed	90f	Manual pulse generator	Home position retum	Position follow-up control	oso	Speed control with fixed position stop	Speed-torque control	Error cause	Error processing	Corrective action
153	0	0	0		0	0	0	0		0				 It started at the virtual mode and during deceleration by occurrence of the output module servo error. 	Positioning control does not start.	Start in the virtual mode again after correct the error cause in the real mode.
														 One of the devices set in the speed-torque control operation data is outside the range. 	The control mode is not switched.	Correct the speed-torque control operation data device.
154													0	control (PC29)" is set to "0: Valid" in the axis where the	Control with the initial value selection of torque at control mode switching as command torque.	Use the servo amplifier compatible with the reflection selection at torque control and set the POL reflection selection at torque control to "1: Invalid". Set the command torque to the torque initial value selection at control mode switching.
155													0	 The control mode switching was executed with an invalid value specified in the control mode setting device. 	The control	 Correct the value of the control mode setting device. When switching the mode from the continuous operation to torque control mode to another, return the mode to the previous one.
156													0	 The control mode switching request was executed during the zero speed was OFF. 	mode is not switched.	 Switch the control mode while the axis is stopped and the zero speed is turned on. Make "Invalid selection during zero speed at control mode switching" valid when not waiting for the stop of the servo motor.
157													0	At the control mode switching, a value set to the speed limit value at speed- torque control is outside the range.	Control with the maximum setting range of each axis unit.	Set the correct speed limit value (within the setting range).
158													0	 At the control mode switching, a value set to the torque limit value at speed- torque control is outside the range. 	Control with the default value "300[%]".	• Set the torque limit value to 0.1[%] to 1000.0[%].
159													0	axis that connects to the	The control mode is not switched.	Do not switch the control mode switching request of speed/torque control for the axis that connects to the stepping driver which does not support the control mode switching.

Table 1.4 Positioning control start error (100 to 199) list (Continued)

							node			_				, ,	,
Error code	Positioning	Fixed-pitch feed	Speed	Speed-position switching	Speed switching	906	Manual pulse generator	Home position return	Position follow-up control	OSC	Speed control with fixed position stop	Speed-torque control	Error cause	Error processing	Corrective action
192								0					The dogless home position signal reference method home position return was started for the axis which is connected with an amplifier other than MR-J3(W)-B series, MR-J4(W)-B series, MR-J5(W)-B series, and MR-JE-B series.		Start the dogless home position signal reference method home position return for the axis which is connected with either of MR-J3(W)-B series, MR-J4(W)-B series, MR-J5(W)-B series, or MR-JE-B series.
193								0					When using the dogless home position signal reference method home position return (operation B), the servo parameter PC17 is other than "Not need to pass motor Z phase after the power supply is switched on".	Home position return does	Set the servo parameter PC17 to "Not need to pass motor Z phase after the power supply is switched on". When you change the servo parameter PC17, please once turn off the power supply of servo amplifier and turn it on again.
194								0					 A home position return instruction that cannot be executed on stepping driver was executed. The driver home position return method home position return was started for the axis which is not connected with a stepping driver. 	not start.	Home position return methods other than the following cannot be used for stepping driver. Change to a home position return method that can be used. (1) Count method 2 (2) Data set method 1 (3) Driver home position return method Start the driver home position return method home position return for the axis which is connected with a stepping driver.

(3) Positioning control errors (200 to 299)

These are errors detected during the positioning control.

The error codes, causes, processing and corrective actions are shown in Table 1.5.

Table 1.5 Positioning control error (200 to 299) list

					(Cont	rol n	node)							
Error code	Positioning	Fixed-pitch feed	Speed	Speed-position switching	Speed switching	Constant-speed	906	Manual pulse generator	Home position return	Position follow-up control	osc	Speed control with fixed position stop	Speed-torque control	Error cause	Error processing	Corrective action
200	0	0	0	0	0	0	0	0		0	0	0	0	The PLC ready flag (M2000) turned off during the control by the servo program.	Deceleration stop (Immediate stop during torque control and continuous operation to torque control)	Turn the PLC ready flag (M2000) on after all axes have stopped.
201									0					The PLC ready flag (M2000) turned off during the home position return.		Perform the home position return again after turning the PLC ready flag (M2000) on or
202									0					The stop command (M3200+20n) turned on during the home position return.	Deceleration stop	turning the stop command (M3200+20n) or rapid stop command (M3201+20n) off. Return to a point before the
203									0					The rapid stop command (M3201+20n) turned on during the home position return.	Rapid stop	proximity dog signal ON using JOG operation or positioning operation, and perform the home position return again in the proximity dog method.
204	0	0	0	0	0	0	0	0	0	0	0	0		 The PLC ready flag (M2000) turned off to on again during deceleration by turning off the PLC ready flag (M2000). 	No operation	Turn the PLC ready flag (M2000) off to on after all axes have stopped. Turn the PLC ready flag (M2000) off to on during deceleration is "no operation".

Table 1.5 Positioning control error (200 to 299) list (Continued)

								node						(200 to 299	, (,
Error	Positioning	Fixed-pitch feed	Speed	Speed-position switching	Speed switching	Constant-speed	JOG	Manual pulse generator	Home position return	Position follow-up control	osc	Speed control with fixed position stop	Speed-torque control	Error cause	Error processing	Corrective action
206									0					All axes rapid stop is executed using the test mode of MT Developer2 during the home position return.	Rapid stop	Return to a point before the proximity dog signal ON using JOG operation or positioning operation, and perform the home position return again in the proximity dog method. Return to a point before the proximity dog signal ON using JOG operation or positioning operation, and perform the home position return again, when the proximity dog signal turns off in the count method. Perform the home position return operation again, when the proximity dog signal turns on in the count method.
207	0				0	0	0			0			0	The feed current value exceeded the stroke limit range during positioning control. Only the axis exceed the stroke limit range is stored at the circular/helical interpolation. All interpolation axes are stored in the linear interpolation.	Deceleration stop (Immediate stop during torque control and continuous operation to torque control)	Correct the stroke limit range or travel value setting so that positioning control is within the range of the stroke limit.
208	0				0	0		0						The feed current value of another axis exceeded the stroke limit value during the circular/helical interpolation control or simultaneous manual pulse generator operation. (For detection of other axis errors).		
209				0					0					An overrun occurred because the setting travel value is less than the deceleration distance at the speed/position switching (CHANGE) signal input during speed-position switching control, or at the proximity dog signal input during home position return of count method.	Deceleration stop	 Set the speed setting so that overrun does not occur. Set the travel value so that overrun does not occur.

Table 1.5 Positioning control error (200 to 299) list (Continued)

								node						(200 to 299	, \	,
Error code	Positioning	Fixed-pitch feed	Speed	Speed-position switching	Speed switching	Constant-speed	906	Manual pulse generator	Home position return	Position follow-up control	oso	Speed control with fixed position stop	Speed-torque control	Error cause	Error processing	Corrective action
210				0										The setting travel value exceeded the stroke limit range at the speed/position switching (CHANGE) signal input during the speed-position switching control.		Correct the stroke limit range or setting travel value so that positioning control is within the range of stroke limit.
						0								During positioning control, an overrun occurred because the deceleration distance for the output speed is not attained at the point where the final positioning address was detected.	Deceleration stop	Set the speed setting so that overrun does not occur. Set the travel value so that overrun does not occur.
211	0	0			0					0				During control with acceleration/deceleration time change, an overrun occurred because the deceleration distance to the final positioning address for the output speed was not attained.	Immediate stop after reaching the final positioning address	 Set the speed setting so that overrun does not occur. Set the travel value so that overrun does not occur. Change the deceleration time so that overrun does not occur.
214								0							Manual pulse generator input is ignored until the axis stops.	Execute the manual pulse generator operation after the applicable axis stopped.
215					0									 The speed switching point address exceed the end point address. The positioning address in the reverse direction was set during the speed switching control. 		Set the speed-switching point between the previous speed switching point address and the end point address.
220										0				 The same servo program was executed again. When the control unit is "degree" during the position follow-up control, the command address exceeded the range of 0 to 35999999. The command address for the position follow-up control exceeded the stroke limit 	Deceleration stop	Correct the Motion SFC program. When the control unit is "degree", set the command address within the range of 0 to 35999999. Set the address within the stroke limit range.

Table 1.5 Positioning control error (200 to 299) list (Continued)

								node				_		(200 to 233	, ,	,
Error code	Positioning	Fixed-pitch feed	Speed	Speed-position switching	Speed switching	Constant-speed	900	Manual pulse generator	Home position return	Position follow-up control	OSC	Speed control with fixed position stop	Speed-torque control	Error cause	Error processing	Corrective action
221												0		During the speed control with fixed position stop, the setting address exceeded the range of 0 to 35999999 at the fixed position stop command device ON.	Deceleration stop	Set the command address within the range of 0 to 35999999.
222												0		During the speed control with fixed position stop, the fixed position acceleration/ deceleration time is "0" at the fixed position acceleration/ deceleration/ deceleration time input.	Control with the default value "1000".	Set the acceleration/ deceleration time within the range of 1 to 65535.
225						0								control.	Control with the speed limit value. Control with the speed of last pass point	Set the speed command value within the range of 1 to speed limit value.
230						0								When the skip is executed in the constant-speed control, the next interpolation instruction is an absolute circular interpolation or absolute helical interpolation. After the skip is executed in the constant-speed control, an absolute circular interpolation or absolute helical interpolation is executed while passing through only the positioning point for incremental method.	Immediate stop	If absolute circular interpolation or absolute helical interpolation is designated at a point after the skip designation point, set an absolute linear interpolation in the interval.
260	0	0				0								method. • The target position change request (CHGP) specifying the address where the target position is outside the range of 0 to 35999999 is executed to the axis whose unit is [degree].	stop	When executing the target position change request specifying the address to the axis whose unit is [degree], set the target position within the range of 0 to 35999999.

Table 1.5 Positioning control error (200 to 299) list (Continued)

							rol n							200 to 299	, (,
Error code	Positioning	Fixed-pitch feed	Speed	Speed-position switching	Speed switching	Constant-speed	oor	Manual pulse generator	Home position return	Position follow-up control	osc	Speed control with fixed position stop	Speed-torque control	Error cause	Error processing	Corrective action
261	0	0				0								 At the target position change request (CHGP), since the travel to the target position after the change was shorter than the deceleration distance, an overrun occurred. 		Set the speed so that an overrun will not occur. Set the target position so that an overrun will not occur.
262	0	0				0								 At the target position change request (CHGP), the target position after the change exceeds the range of the stroke limit. 		 Set the stroke limit range or the target position after the change so that the positioning control is performed within the stroke limit range.
263	0	0				0								The target position change request (CHGP) is executed to the program where the following acceleration/deceleration system is set. FIN acceleration/deceleration/deceleration Advanced S-curve acceleration/deceleration/	Deceleration stop	Do not execute the target position change to the program where the FIN acceleration/deceleration or the advanced S-curve acceleration/deceleration is set. Set the acceleration/ deceleration system of the parameter block or the servo program to the trapezoid/ S-curve acceleration/ deceleration.
264	0													• In reference axis-specified linear interpolation or the long axis-specified linear interpolation, the travel of the reference axis or the long axis after the target position change request (CHGP) is 0.		Set a target position so that the travel of the reference axis or the long axis after the target position change is not 0.
270									0					 An operation alarm occurred in the stepping driver when a driver home position return method home position return was performed. 		Check the operation alarm details and perform a home position return again.
271									0					• During home position return,	lmama a eli e t e	Perform a home position return
272									0					data could not be obtained	Immediate stop	again. When the same error is
273									0					from the stepping driver correctly.	,	displayed, the possible cause is a hardware failure of the Motion CPU or stepping driver. Explain the error symptom and get advice from our sales representative.

(4) Current value/speed/target position change errors (300 to 399)

These are errors detected at current value change, speed change or target position change.

The error codes, causes, processing and corrective actions are shown in Table 1.6.

Table 1.6 Current value/speed/target position change error (300 to 399) list

					(Cont	rol n	node	9							
Error code	Positioning	Fixed-pitch feed	Speed	Speed-position switching	Speed switching	Constant-speed	90f	Manual pulse generator	Home position return	Position follow-up control	oso	Speed control with fixed position stop	Speed-torque control	Error cause	Error processing	Corrective action
300	0	0	0	0	0	0	0	0	0	0	0	0	0	The current value was changed during positioning control of the applicable axis. The current value was changed for the axis that had not been started. The current value was changed for the servo OFF axis.	Current value is not changed.	Use the following devices as interlocks not to change the current value for the applicable axis. (1) The start accept flag (M2001 to M2032) OFF for applicable axis. (2) The servo READY signal (M2415+20n) ON.
301									0					The speed was changed for the axis during home position return.	Speed is not changed.	Do not change speed during home position return.
305				0	0		0			0		0		The speed after speed change is set outside the range of 0 to speed limit value.	Control with	Set the speed after speed change within the range of 0 to speed limit value.
305	0	0	0			0								The absolute value of speed after speed change is set outside the range of 0 to speed limit value.	the speed limit value.	Set the absolute value of speed after speed change within the range of 0 to speed limit value.
309														• The current value was changed outside the range of 0 to 35999999 (×10-5 [degree]) for the degree axis.	Current value is not changed.	• Set the current value within the range of 0 to 35999999 (×10-5[degree]).
310											0			The speed was changed during high-speed oscillation. The speed change to "0" was requested during high-speed oscillation.	Speed is not changed.	Do not change speed during high-speed oscillation.
	0	0				0								Change speed to negative speed in the invalid axis of stroke limit.		Do not change speed to negative speed in the invalid axis of stroke limit.

Table 1.6 Current value/speed/target position change error (300 to 399) list(Continued)

							rol n		÷					position change cire	`	, , ,
Error code	Positioning	Fixed-pitch feed	Speed	Speed-position switching	Speed switching	Constant-speed		Manual pulse generator	Home position return	Position follow-up control	osc	Speed control with fixed position stop	Speed-torque control	Error cause	Error processing	Corrective action
311														 The value outside the range of 1 to 1000[%] was set in the torque limit value change request (D(P).CHGT, CHGT). The positive direction torque limit value or the negative direction torque limit value outside the range of 0.1 to 1000.0[%] was set in the torque limit value individual change request (D(P).CHGT2, CHGT2). 	Torque limit value is not changed.	Set the change request within the range of 1 to 1000[%] in the torque limit value change request (CHGT). Set the change request within the range of 0.1 to 1000.0[%] for the positive direction torque limit value or the negative direction torque limit value in the torque limit value individual change request (CHGT2).
312														The torque limit value change request (D(P).CHGT,CHGT) was made for the axis that had not been started. The torque limit value individual change request (D(P).CHGT2, CHGT2) was made for the axis that had not been started.	S	Request the torque limit change or the torque limit value individual change for the starting axis.
315													0	During speed-torque control, the absolute value of the	Control with the speed limit value at speed-torque control.	Set the speed after speed change within the range of 0 to speed limit value at speed- torque control.
316													0	value of the command torque is outside the range	Control with the torque limit value at speed-torque control.	Set the torque after torque change within the range of 0 to the torque limit value at speed- torque control.
317	0	0	0		0		0	0	0		0		0	 At the switching request to the continuous operation to torque control, a control mode which cannot be switched is used. 	The control mode is not switched.	Request switching during the control which can be switched to the continuous operation to torque control.

Table 1.6 Current value/speed/target position change error (300 to 399) list(Continued)

					(Cont	rol n	node)					-		
Error code	Positioning	Fixed-pitch feed	Speed	Speed-position switching	Speed switching	Constant-speed	JOG	Manual pulse generator	Home position return	Position follow-up control	osc	Speed control with fixed position stop	Speed-torque control	Error cause	Error processing	Corrective action
318	0	0	0		0		0	0	0		0		0	Switching to the stopper control was requested to the servo amplifier which is not compatible with the continuous operation to torque control.	Position control: Deceleration stop Speed control: The mode is switched to position control mode, and the operation stops immediately.	Use the servo amplifier where the continuous operation to torque control is available.
319													0	 During the speed-torque control, the change value by the torque limit value change request (D(P).CHGT, CHGT) or torque limit value individual change request (D(P).CHGT2, CHGT2) exceeds the torque limit value at speed-torque control. 	Torque limit value is not changed.	Request changing within the range of torque limit value at speed-torque control.
330			0	0	0		0	0	0		0	0	0	The target position change request (CHGP) was executed for the axis which was executing a servo instruction which was not compatible with target position change.	Target position is not changed.	Change the target position for the axes operated by the following servo instructions. (1) Linear interpolation control (2) Fixed-pitch feed operation (3) Constant-speed control

(5) System errors (900 to 999)

These are errors detected at the power-on.

The error codes, causes, processing and corrective actions are shown in Table 1.7.

Table 1.7 System error (900 to 999) list

					(Cont	rol n	node							
Error	Positioning	Fixed-pitch feed	Speed	Speed-position switching	Speed switching	Constant-speed	JOG	Manual pulse generator	Home position return	Position follow-up control	osc	Speed control with fixed position stop	Error cause	Error processing	Corrective action
901													allowable travel value during	Further operation is possible.	Check the position. Check the battery of encoder.
902													power-on, ABS/INC setting in "System Setting" differs from the installed servo driver setting. (Check when	Further operation is possible according to servo driver setting.	Correct ABS/INC setting in "System Setting".

APPENDIX 1.3 Major errors

These errors occur by control command from the external input signal or Motion SFC program, and the error codes 1000 to 1999 are used.

Major errors include the positioning control start errors, positioning control errors, absolute position system errors and system errors.

(1) Positioning control start errors (1000 to 1099)

These errors are detected at the positioning control start.

The error codes, causes, processing and corrective actions are shown in Table 1.8.

Table 1.8 Positioning control start error (1000 to 1099) list

														Control Start Chor (10		,
Error	Positioning	Fixed-pitch feed	Speed	Speed-position switching	Speed switching	Constant-speed	roi r 90f	Manual pulse generator	Home position return	Position follow-up control	oso	Speed control with fixed position stop	Speed-torque control	Error cause	Error processing	Corrective action
1000	0	0	0	0	0	0	0	0	0	0	0	0	0	The external STOP signal of the applicable axis turned on.		Turn the STOP signal off.
1001	0	0	0	0	0		0	0	0	0	0	0		The external signal FLS (upper limit LS) turned off at the forward direction (address increase direction) start.		Move in the reverse direction by the JOG operation, etc. and set within the external limit range.
1002	0	0	0	0	0		0	0	0	0	0	0		The external signal RLS (lower limit LS) turned off at the reverse direction (address decrease direction) start.		Move in the forward direction by the JOG operation, etc. and set within the external limit range.
1003									0					The external DOG (proximity dog) signal turned on at the home position return start of the proximity dog method.		Perform the home position return after move to the proximity dog ON by the JOG operation, etc. at the home position return of the proximity dog method.
1004	0	0	0	0	0	0	0	0	0	0	0	0	0	 The applicable axis is not servo READY state. (M2415+20n: OFF). (1) The power supply of the servo amplifier is OFF. (2) During initial processing after turning on the servo amplifier. (3) The servo amplifier is not mounted. (4) A servo error is occurred. (5) Cable fault. (6) Servo OFF command (M3215+20n) is ON. 	Positioning control does not start.	Wait until the servo READY state (M2415+20n: ON).
1005	0	0	0	0	0	0	0	0	0	0	0	0	0	The servo error detection signal of the applicable axis (M2408+20n) turned on.		• Eliminate the servo error, reset the servo error detection signal (M2408+20n) by the servo error reset command (M3208+20n), then start operation.

(2) Positioning control errors (1100 to 1199)

These errors are detected at the positioning control.

The error codes, causes, processing and corrective actions are shown in Table 1.9.

Table 1.9 Positioning control error (1100 to 1199) list

					(Cont	rol n	node	9							
Error	Positioning	Fixed-pitch feed	Speed	Speed-position switching	Speed switching	Constant-speed	90r	Manual pulse generator	Home position return	Position follow-up control	oso	Speed control with fixed position stop	Speed-torque control	Error cause	Error processing	Corrective action
1101	0	0	0	0	0	0	0	0	0	0	0	0	0	The external signal FLS (upper limit LS) turned off during the forward direction (address increase direction).	Deceleration stop by "Stop processing on STOP input"	Travel in the reverse direction by the JOG operation, etc. and set within the external limit range.
1102	0	0	0	0	0	0	0	0	0	0	0	0	0	The external signal RLS (lower limit LS) turned off during the reverse direction (address decrease direction).	of the parameter block. (Deceleration stop during speed control, immediate stop during continuous operation to torque control mode)	Travel in the forward direction by the JOG operation, etc. and set within the external limit range.
1103									0					The external stop signal (stop signal) turned on during home position return.	Deceleration stop by "Stop processing on STOP input" of the parameter block.	Execute the home position return so that the external stop signal (stop signal) may not turn on.
1104	0	0	0	0	0	0	0	0	0	0	0	0	0	The servo error detection signal turned on during	Immediate stop without	Start after disposal at the servo error.
1105	0	0	0	0	0	0	0	0	0	0	0	0	0	positioning control. The power supply of the servo amplifier turned off during positioning control. (Servo not mounted status detection, cable fault, etc.) Home position return did not complete normally without stop within the in-position range of home position at the home position return.	Turn the servo READY (M2415+ 20n) off.	 Turn on the power supply of the servo amplifier. Check the connecting cable to the servo amplifier. Make the gain adjustment.

Table 1.9 Positioning control error (1100 to 1199) list (Continued)

														·		
					(Cont	rol n	node	!							
Error	Positioning	Fixed-pitch feed	Speed	Speed-position switching	Speed switching	Constant-speed	906	Manual pulse generator	Home position return	Position follow-up control	OSC	Speed control with fixed position stop	Speed-torque control	Error cause	Error processing	Corrective action
														 Q172DEX or encoder hardware error. Disconnected encoder cable. 	Immediate input stop	 Check (replace) the Q172DEX or encoder. Check the encoder cable.
1151														in the system setting differs	Input from synchronous encoder does not accept.	Set a synchronous encoder actually connected in the system setting.
														No battery or disconnected battery at Q172DEX.	Immediate input stop	 Replace the battery and turn ON the Multiple CPU system power supply a few minutes later.
1152														Low voltage at Q172DEX.		Replace the battery.
1150														 No battery or disconnected battery at Q172DEX. 	Operation continues.	Replace the battery or check (replace) the Q172DEX.
1153														 Capacitor degradation of the synchronous encoder. 	oonandos.	Replace the synchronous encoder.

(3) Absolute position system errors (1200 to 1299)

These errors are detected at the absolute position system.

The error codes, causes, processing and corrective actions are shown in Table 1.10.

Table 1.10 Absolute position system error (1200 to 1299) list

					(Cont	rol n	node)							
Error	Positioning	Fixed-pitch feed	Speed	Speed-position switching	Speed switching	Constant-speed	JOG	Manual pulse generator	Home position return	Position follow-up control	osc	Speed control with fixed position stop	Speed-torque control	Error cause	Error processing	Corrective action
1201														The error causes why the home position return is required in the absolute position system are as follows: The home position return has never been executed after the system start. The home position return is started, but not completed correctly. Absolute data in the Motion CPU is erased due to causes such as a battery error. Servo error [2025], [2143], or [2913] occurred. Major error [1202], [1203] or [1204] occurred. Rotation direction selection" of the servo parameter is changed.	Home position return request ON	Execute the home position return after checking the batteries of the Motion CPU module and servo amplifier.
1202														and encoder occurred at the turning on servo amplifier power supply.	Depending on the version of operating system software and servo amplifier, home position return request ON, servo error [2016] set. (Fully closed loop control servo amplifier use: Servo error [2070] is set.)	Check the motor and encoder cables. If the home position return request signal is turning ON, execute a home position return.

Table 1.10 Absolute position system error (1200 to 1299) list (Continued)

					(Cont	rol n	node								
Error code	Positioning	Fixed-pitch feed	Speed	Speed-position switching	Speed switching	Constant-speed	JOG	Manual pulse generator	Home position return	Position follow-up control	osc	Speed control with fixed position stop	Speed-torque control	Error cause	Error processing	Corrective action
1203														The amount of change in encoder current value is excessive during operation. A continual check is performed (both of servo ON and OFF states) after the servo amplifier power has been turned ON. (Q17□DCPU(-S1) use)		Check the motor and encoder cables.
1204														• The following expression holds: "Encoder current value [pulse] ≠ feedback current value [pulse] (encoder effective bit number)" during operation. A continual check is performed (both of servo ON and OFF states) after the servo amplifier power has been turned on. (Q17□DCPU(-S1) use)	Home position return request ON	
1205														• The following expression holds: "Encoder current value [pulse] ≠ feedback current value [pulse] (encoder effective bit	Operation continues. (Home position return signal does not turn ON.)	

(4) System errors (1300 to 1399)

These errors are detected at the power-on.

The error codes, causes, processing and corrective actions are shown in Table 1.11.

Table 1.11 System error (1300 to 1399) list

					(Cont	rol n	node	;							
Error code	Positioning	Fixed-pitch feed	Speed	Speed-position switching	Speed switching	Constant-speed	JOG	Manual pulse generator	Home position return	Position follow-up control	OSC	Speed control with fixed position stop	Speed-torque control	Error cause	Error processing	Corrective action
1310														 Initial communication with the Multiple CPU system did not complete normally. Motion CPU fault. 		Replace the Motion CPU.
1340														When using a rotary servo motor with an encoder resolution of 67108864[pulse/rev] with a MR-J5(W)-B series servo amplifier, the values set to "Electronic gear numerator (PA06)" and "Electronic gear denominator (PA07)" servo parameters are not a compatible combination.	Positioning control does not start.	Set the values below to the "Electronic gear numerator (PA06)" and the "Electronic gear denominator (PA07)" servo parameters of the corresponding axis. After changing the parameters, turn OFF the servo amplifier power supply before turning ON the power supply again. (1) Electronic gear numerator (PA06) : 16 (2) Electronic gear denominator (PA07): 1
1350														An operation cycle that the servo amplifier does not support has been set.		Set an operation cycle that is supported.
1360														 Number of axes set for the master axis in servo parameter "Driver communication setting (PD15)" exceed the setting range. 		Set the number of master axis to 4 axes or less for SSCNETⅢ lines, and 8 axes or less for SSCNETⅢ/H lines in servo parameter "PD15".
1361														Servo parameters "Driver communication setting Master axis No. selection 1 for slave (PD20)" or "PD21 to PD23" are set the self axis.	System setting error	Review the servo parameters "PD20" or "PD21 to PD23" of applicable slave axis.
1362														 There is no master axis setting corresponding to the slave axis. 		
1363														Setting the driver communication to servo amplifier which does not support the driver communication.		Confirm the driver communication and the actually connected servo amplifier.

Table 1.11 System error (1300 to 1399) list (Continued)

					(Cont	rol n	node							
Error	Positioning	Fixed-pitch feed	Speed	Speed-position switching	Speed switching	Constant-speed	906	Manual pulse generator	Home position return	Position follow-up control	osc	Speed control with fixed position stop	Error cause	Error processing	Corrective action
1365													Setting the driver communication in the operation cycle setting of 0.2ms.		• For SSCNETII, set the operation cycle setting to 0.4ms or more.
1366													The servo amplifier type of the master axis that corresponds with the slave axis is different.	System setting error	For MR-J4-□B slaves axes, set the master axis to MR-J4-□B. For MR-J5-□B slaves axes, set the master axis to MR-J5-□B.

APPENDIX 1.4 Servo errors

(1) Servo errors (2000 to 2999)

These errors are detected by the servo amplifier, and the error codes are [2000] to [2999].

The servo error detection signal (M2408+20n) turns on at the servo error occurrence. Eliminate the error cause, reset the servo amplifier error by turning on the servo error reset command (M3208+20n) and perform re-start. (The servo error detection signal does not turn on because the codes [2100] to [2599] are for warnings.)

(Note-1): As for the regenerative alarm (error code [2030]) or overload 1 or 2 (error codes [2050], [2051]), the state at the operation is held also for after the protection circuit operation in the servo amplifier. The memory contents are cleared with the external power supply off, but are not cleared by the reset signal.

(Note-2): If resetting by turning off the external power supply is repeated at the occurrence of error code [2030], [2050] or [2051], it may cause devices to be destroyed by overheating. Re-start operation after eliminating the cause of the error certainly.

The hexadecimal display of servo amplifier display servo error code (#8008+20n) is the same as the LED of servo amplifier. Ver.

∆ CAUTION

• If a controller, servo amplifier self-diagnosis error occurs, check the points stated in this manual and clear the error.

> List of servo errors are shown in next page or later. Refer to the "Servo amplifier Instruction Manual" for details.

Servo amplifier type	Instruction manual name
MR-J5-□B	MD IF Heads Married (Travibles heading) (CH 030340FNC)
MR-J5W-□B	MR-J5 User's Manual (Troubleshooting) (SH-030312ENG)
MR-J4-□B	SSCNETII/H Interface AC Servo MR-J4B_(-RJ) Servo amplifier Instruction Manual (SH-030106)
MR-J4W-□B	SSCNETII/H Interface Multi-axis AC Servo MR-J4W2B/MR-J4W3B/MR-J4W2-0303B6 Servo amplifier Instruction Manual (SH-030105)
MR-J3-□B	SSCNETⅢ interface MR-J3-□B Servo amplifier Instruction Manual (SH-030051)
MR-J3W-□B	SSCNETⅢ interface 2-axis AC Servo Amplifier MR-J3W-0303BN6/MR-J3W-□B Servo amplifier Instruction Manual (SH-030073)
MR-J3-□B-RJ004	SSCNETⅢ Compatible Linear Servo MR-J3-□B-RJ004U□ Instruction Manual (SH-030054)
MR-J3-□B-RJ006	SSCNETⅢ Compatible Fully Closed Loop Control MR-J3-□B-RJ006 Servo amplifier Instruction Manual (SH-030056)
MR-J3-□B-RJ080	SSCNETⅢ Interface Direct Drive Servo MR-J3-□B-RJ080W Instruction Manual (SH-030079)
MR-J3-□B Safety	SSCNETⅢ interface Drive Safety integrated MR-J3-□B Safety Servo amplifier Instruction Manual (SH-030084)
MR-JE-□B	MELSERVO-JE Servo amplifier Instruction Manual (Trouble Shooting) (SH-030166ENG)
MR-JE-□BF	SSCNETII/H interface AC Servo With functional safety MR-JEBF Servo amplifier Instruction Manual (SH-030258ENG)

Ver.!): Refer to Section 1.3 for the software version that supports this function.

(a) MR-J5(W)-□B

The servo errors below are all displayed with the same error codes (2000 or 2100).

Check servo amplifier display servo error code (#8008+20n) for the details of servo errors read by the servo amplifier.

Table 1.12 Servo error (2000 and 2100) list (MR-J5(W)-□B)

Error code	Servo amplifier LED display	Name	Details name	Remarks
	010.1	I la deminite no	Voltage drop in the control circuit power	
	010.2	Undervoltage	Voltage drop in the main circuit power	
	011.1	Switch setting error	Rotary switch setting error	
	011.2	Switch setting error	Disabled axis setting error	
	012.1		RAM error 1	
	012.2		RAM error 2	
	012.4		RAM error 4	
	012.5	Mamany array 1 (DAM)	RAM error 5	
	012.6	Memory error 1 (RAM)	RAM error 6	
	012.7		RAM error 7	
	012.8		RAM error 8	
	012.9		RAM error 9	
	013.1		CPU error 1	
	013.2	0011	CPU error 2	
	013.4	CPU error	CPU error 4	
	013.5		CPU error 5	
	014.1		Control process error 1	
	014.2		Control process error 2	
	014.3		Control process error 3	
2000	014.4	0	Control process error 4	
	014.5	Control process error	Control process error 5	
	014.8		Control process error 8	
	014.9		Control process error 9	
	014.C		Control process error 12	
	016.1		Encoder initial communication – Receive data error 1	
	016.2		Encoder initial communication – Receive data error 2	
	016.3		Encoder initial communication – Receive data error 3	
	016.5		Encoder initial communication – Transmission data error 1	
	016.6		Encoder initial communication – Transmission data error 2	
		Encoder initial	Encoder initial communication – Transmission data	
	016.7	communication error 1	error 3	
	016.A		Encoder initial communication – Process error 1	
	016.B		Encoder initial communication – Process error 2	
	016.C		Encoder initial communication – Process error 3	
	016.D		Encoder initial communication – Process error 4	
	016.E		Encoder initial communication – Process error 5	
	016.F		Encoder initial communication – Process error 6	

Table 1.12 Servo error (2000 and 2100) list (MR-J5(W)-□B) (Continued)

Error code	Servo amplifier LED display	Name	Details name	Remarks
	017.1		Board error 1	
	017.3		Board error 2	
	017.4		Board error 3	
	017.5	Board error	Board error 4	
	017.6		Board error 5	
	017.7		Board error 7	
	017.9		Board error 8	
	019.1		Flash-ROM error 1	
	019.2	Mamaam / amman 2	Flash-ROM error 2	
	019.3	Memory error 3	Flash-ROM error 3	
	019.6		Flash-ROM error 6	
	01A.1		Servo motor combination error 1	
	01A.2		Servo motor control mode combination error	
	01A.3	Servo motor	Control mode/load-side encoder combination error	
	01A.4	combination error	Servo motor combination error 2	
	01A.5		Servo motor combination error 3	
	01A.6	1	Servo motor combination error 4	
	01E.1	Encoder initial	Encoder malfunction	
	01E.2	communication error 2	Load-side encoder malfunction	
	01F.1	Encoder initial	Incompatible encoder	
	01F.2	communication error 3	Incompatible load-side encoder	
	020.1		Encoder normal communication – Receive data error 1	
	020.2		Encoder normal communication – Receive data error 2	
	020.3		Encoder normal communication – Receive data error 3	
2000	020.5	1	Encoder normal communication – Transmission data	
	020.5	Encoder normal	error 1	
		communication error 1	Encoder normal communication – Transmission data	
	020.6		error 2	
		1	Encoder normal communication – Transmission data	
	020.7		error 3	
	021.1		Encoder data error 1	
	021.2		Encoder data update error	
	021.3	Encoder normal	Encoder data waveform error	
	021.4	communication error 2	No encoder signal	
	021.5	1	Encoder hardware error 1	
	021.6	1	Encoder hardware error 2	
	024.1		Ground fault detected via hardware detection circuit	
	024.2	Main circuit error	Ground fault detected via software detection processing	
	025.1		Servo motor encoder absolute position erased	
		Absolute position	Scale measurement encoder – Absolute position	
	025.2	erased	erased	
	027.1		Initial magnetic pole detection – Abnormal termination	
	027.2	1	Initial magnetic pole detection – Time out error	
	027.3	1	Initial magnetic pole detection – Limit switch error	
	027.4	Initial magnetic pole	Initial magnetic pole detection – Estimation error	
	027.5	detection error	Initial magnetic pole detection – Speed deviation error	
	027.6	1	Initial magnetic pole detection – Speed deviation error	
	027.7	1	Initial magnetic pole detection – Position deviation en or	

Table 1.12 Servo error (2000 and 2100) list (MR-J5(W)-□B) (Continued)

Error code	Servo amplifier LED display	Name	Details name	Remarks
	028.1	Lincon an and day amon O	Linear encoder environmental error	
	028.2	Linear encoder error 2	Load-side linear encoder environmental error	
	02A.1		Linear encoder error 1-1	
	02A.2		Linear encoder error 1-2	
	02A.3		Linear encoder error 1-3	
	02A.4]	Linear encoder error 1-4	
	02A.5	Linear encoder error 1	Linear encoder error 1-5	
	02A.6		Linear encoder error 1-6	
	02A.7		Linear encoder error 1-7	
	02A.8	1	Linear encoder error 1-8	
	02B.1		Encoder counter error 1	
	02B.2	Encoder counter error	Encoder counter error 2	
	030.1		Regenerative heat error	
	030.2	Regenerative error	Regenerative signal error	
	030.3	1 togetherative error	Regenerative feedback signal error	
	031.1	Overspeed	Servo motor speed error	
	001.1	Overspeed	Overcurrent detected via hardware detection circuit	
	032.1		(during operation)	
		1	Overcurrent detected via software detection processing	
	032.2		(during operation)	
		Overcurrent	Overcurrent detected via hardware detection circuit	
	032.3		(during a stop)	
2000		1	Overcurrent detected via software detection processing	
	032.4		(during a stop)	
	033.1	Overvoltage	Main circuit voltage error	
	034.1	Overvoitage	SSCNET receive data error	
	034.1	-	SSCNET receive data error SSCNET connector connection error	
		SSCNET receive error		
	034.3	1	SSCNET communication data error	
	034.4	-	Hardware error signal detection	
	034.7		SSCNET communication data error 2	
	035.1	Command frequency error	Command frequency error	
	036.1	SSCNET receive error 2	Intermittent communication data error	
	037.1		Parameter setting range error	
	037.2	Parameter error (Note-1)	Parameter combination error	
	037.6	1, 3, 3, 1,	Parameter mismatch error	
	03A.1	Inrush current suppression circuit error	Inrush current suppression circuit error	
	03D.1		Slave-side driver communication parameter combination error	
	03D.2	Driver communication parameter setting error	Master-side driver communication parameter	
			combination error	
	03E.9	Operation mode error	Connection mode error 1	

(Note-1): Refer to the parameter No. stored in parameter error No. (#8009+20n) for details of the parameter for which the error occurred.

Table 1.12 Servo error (2000 and 2100) list (MR-J5(W)-□B) (Continued)

Error code	Servo amplifier LED display	Name	Details name	Remarks
	042.1		Servo control error based on position deviation	
	042.2		Servo control error based on speed deviation	
	042.3		Servo control error based on torque/thrust deviation	
	040.0	Camera acontrol amon	Fully closed loop control error based on position	
	042.8	Servo control error	deviation	
	042.9		Fully closed loop control error based on speed deviation	
	042.4		Fully closed loop control error based on position	
	042.A		deviation during command stop	
	045.1	Main circuit device	Main circuit device overheat error 1	
	045.2	overheat	Main circuit device overheat error 2	
	046.1		Servo motor temperature error 1	
	046.2		Servo motor temperature error 2	
	046.3		Thermistor disconnected error	
	046.4	Servo motor overheat	Thermistor circuit error	
	046.5		Servo motor temperature error 3	
	046.6		Servo motor temperature error 4	
	046.7		Servo motor temperature error 5	
	047.1	0 11 6	Cooling fan stop error	
	047.2	Cooling fan error	Decreased cooling fan speed error	
2000	050.1		Thermal overload error 1 during operation	
	050.2		Thermal overload error 2 during operation	
	050.3]	Thermal overload error 4 during operation	
	050.4	Overload 1	Thermal overload error 1 during a stop	
	050.5		Thermal overload error 2 during a stop	
	050.6		Thermal overload error 4 during a stop	
	051.1		Thermal overload error 3 during operation	
	051.2	Overload 2	Thermal overload error 3 during a stop	
	052.1		Excessive droop pulse 1	
	052.3		Excessive droop pulse 2	
	052.4	Excessive error	Excessive error during 0 torque limit	
	052.5		Excessive droop pulse 3	
	052.6		Excessive droop pulse at servo-off	
	054.1	Oscillation detection	Oscillation detection error	
	056.2		Speed exceeded during forced stop	
	056.3	Forced stop error	Estimated distance exceeded during forced stop	
	056.5]	Travel distance exceeded during forced stop 2	
	063.1		STO1 off	
	063.2	STO timing error	STO2 off	
	068.1	STO diagnosis error	STO signal mismatch error	

Table 1.12 Servo error (2000 and 2100) list (MR-J5(W)-□B) (Continued)

Error code	Servo amplifier LED display	Name	Details name	Remarks
	070.1		Load-side encoder initial communication – Receive	
		-	data error 1	
	070.2		Load-side encoder initial communication – Receive	
		-	data error 2	
	070.3		Load-side encoder initial communication – Receive data error 3	
		1	Load-side encoder initial communication –	
	070.5		Transmission data error 1	
		1	Load-side encoder initial communication –	
	070.6		Transmission data error 2	
	070.7		Load-side encoder initial communication –	
	070.7	Load-side encoder	Transmission data error 3	
	070.A	initial communication error 1	Load-side encoder initial communication – Process	
	070.A	enori	error 1	
	070.B		Load-side encoder initial communication – Process	
	070.5	_	error 2	
	070.C		Load-side encoder initial communication – Process	
		_	error 3	
	070.D		Load-side encoder initial communication – Process	
		_	error 4	
	070.E		Load-side encoder initial communication – Process	
		-	error 5	
	070.F		Load-side encoder initial communication – Process error 6	
2000			Load-side encoder normal communication – Receive	
	071.1		data error 1	
		=	Load-side encoder normal communication – Receive	
	071.2		data error 2	
			Load-side encoder normal communication – Receive	
	071.3	Load-side encoder	data error 3	
	074.5	normal communication	Load-side encoder normal communication –	
	071.5	error 1	Transmission data error 1	
	074.6		Load-side encoder normal communication –	
	071.6		Transmission data error 2	
	071.7		Load-side encoder normal communication –	
	07 1.7		Transmission data error 3	
	072.1	_	Load-side encoder data error 1	
	072.2	Load-side encoder	Load-side encoder data update error	
	072.3	normal communication	Load-side encoder data waveform error	
	072.4	error 2	No load-side encoder signal	
	072.5	1	Load-side encoder hardware error 1	
	072.6		Load-side encoder hardware error 2	
	082.1	Master-slave operation error 1	Master-slave operation error 1	
	088.1		Watchdog 1-1	
	088.2	Watchdog	Watchdog 1-2	<u> </u>
	088.4	vvaluidog	Watchdog 1-4	
	088.8		Watchdog 1-8	

Table 1.12 Servo error (2000 and 2100) list (MR-J5(W)-□B) (Continued)

Error code	Servo amplifier LED display	Name	Details name	Remarks
	08E.1		Serial communication receive error	
	08E.2	1	Serial communication checksum error	
	08E.3	Serial communication	Serial communication character error	
	08E.4	error	Serial communication command error	
	08E.5		Serial communication data number error	
	118.1	Encoder diagnosis	Encoder communication circuit diagnosis in progress	
	119.1	· ·	Memory error 4-1	
	119.2		Memory error 4-2	
	119.3	1	Memory error 4-3	
	119.4	1	Memory error 4-4	
	119.5	Memory error 4	Memory error 4-5	
	119.6	1	Memory error 4-6	
	119.7		Memory free space error 4-1	
	119.8	1	Memory free space error 4-2	
	11A.1		Servo motor constant file error	
2000	11A.2	Servo motor constant	Servo motor constant file extension error	
	11A.3	error	Servo motor constant file amount error	
	130.1	Regenerative error 2	Regenerative heat error	
	139.1	1 togonorativo orior 2	Input open-phase error	
	139.2	Open-phase error	Output open-phase error	
	139.3	Opon phase oner	Motor wiring error	
	17A.1		Load-side linear encoder error 1-1	
	17A.2	-	Load-side linear encoder error 1-2	
	17A.3	-	Load-side linear encoder error 1-3	
	17A.4	Load-side linear	Load-side linear encoder error 1-4	
	17A.5	encoder error 1	Load-side linear encoder error 1-5	
	17A.6	onocuer ener 1	Load-side linear encoder error 1-6	
	17A.7	-	Load-side linear encoder error 1-7	
	17A.8	-	Load-side linear encoder error 1-8	
	188.1	Watchdog 2	Watchdog 2-1	
	091.1	Servo amplifier overheat warning	Main circuit device overheat warning	
	092.1		Encoder battery cable disconnection warning	
	092.2	Battery cable	Load-side encoder battery cable disconnection warning	
	092.3	disconnection warning	Battery degradation	
	095.1		STO1 off detection	
	095.2	STO warning	STO2 off detection	
	096.1	Home position setting	In-position warning at homing	
2100	096.2	warning	Command input warning at homing	
	09B.1		Excessive droop pulse 1 warning	
	09B.3	Excessive error	Excessive droop pulse 2 warning	
	09B.4	warning	Excessive error warning during 0 torque limit	
	09F.1		Low battery	
	09F.2	Battery warning	Battery degradation warning	
	0E0.1	Excessive regeneration warning	Excessive regeneration warning	

Table 1.12 Servo error (2000 and 2100) list (MR-J5(W)-□B) (Continued)

Error code	Servo amplifier LED display	Name	Details name	Remarks
	0E1.1		Thermal overload warning 1 during operation	
	0E1.2		Thermal overload warning 2 during operation	
	0E1.3		Thermal overload warning 3 during operation	
	0E1.4		Thermal overload warning 4 during operation	
	0E1.5	Overload warning 1	Thermal overload warning 1 during a stop	
	0E1.6		Thermal overload warning 2 during a stop	
	0E1.7		Thermal overload warning 3 during a stop	
	0E1.8		Thermal overload warning 4 during a stop	
	0E1.0	Servo motor overheat	Servo motor temperature warning	
	0E2.1	warning	Servo motor temperature warning 2	
	0E3.2	warning	·	
		Albandusta manitiam	Absolute position counter warning	
	0E3.5	Absolute position	Encoder absolute position counter warning	
	0E3.6	counter warning	Scale measurement encoder absolute position counter warning	
	0E4.1	Parameter warning (Note-1)	Parameter setting range error warning	
	0E6.1	Servo forced stop warning	Forced stop warning	
	0E7.1	Controller forced stop warning	Controller forced stop input warning	
	0E8.1	Decreased cooling fan	Decreased cooling fan speed	
	0E8.2	speed warning	Cooling fan stop	
	0E9.1		Servo-on signal on during main circuit off	
2100	0E9.2	Main circuit off	Bus voltage drop during low speed operation	
	0E9.3	warning	Ready-on signal on during main circuit off	
	0EB.1	The other axis error warning	The other axis error warning	
	0EC.1	Overload warning 2	Overload warning 2	
	0ED.1	Output watt excess warning	Output watt excess warning	
	0F0.1		Instantaneous power failure tough drive warning	
	0F0.3	Tough drive warning	Vibration tough drive warning	
	0F2.1		Drive recorder warning 1	
	0F2.2	1	Drive recorder warning 2	
	0F2.3	1	Drive recorder warning 3	
	0F2.3	Drive recorder warning	Drive recorder warning 3 Drive recorder warning 4	
		†		
	0F2.5	+	Drive recorder warning 5	
	0F2.6 0F3.1	Oscillation detection	Drive recorder warning 6 Oscillation detection warning	
	0F7.1	warning	Vibration failure prediction warning	
		-		
	0F7.2 0F7.3	Machine diagnosis	Friction failure prediction warning Failure prediction warning based on servo motor total	
		warning	travel distance	
	0F7.4	4	Gear failure prediction warning	
	0F7.5	_	Static friction failure prediction warning	
	0F7.6		Belt failure prediction warning	

(Note-1): Refer to the parameter No. stored in parameter error No. (#8009+20n) for details of the parameter for which the error occurred.

Table 1.12 Servo error (2000 and 2100) list (MR-J5(W)-□B) (Continued)

Error code	Servo amplifier LED display	Name	Details name	Remarks
	19E.4	Network warning 2	SSCNET communication error warning	
0400	1E9.1	Open-phase warning	Input open-phase warning	
2100	1F8.1		Memory writing frequency warning	
	1F8.2	Memory warning 1	Memory free space warning	

(b) MR-J4(W)-□B

Table 1.13 Servo error (2000 to 2999) list (MR-J4(W)-□B)

Error code	Servo amplifier LED display	Name	Details name	Remarks
0040	10.1		Voltage drop in the control power	
2010	10.2	Undervoltage	Voltage drop in the main circuit power	
0044	11.1	0	Axis number setting error/Station number setting error	
2011	11.2	Switch setting error	Disabling control axis setting error	
	12.1		RAM error 1	
	12.2		RAM error 2	
2042	12.3	Manager ((DAM)	RAM error 3	
2012	12.4	Memory error 1 (RAM)	RAM error 4	
	12.5		RAM error 5	
	12.6		RAM error 6	
2042	13.1	Clask sman	Clock error 1	
2013	13.2	Clock error	Clock error 2	
	14.1		Control process error 1	
	14.2		Control process error 2	
	14.3		Control process error 3	
	14.4	Control process error	Control process error 4	
	14.5		Control process error 5	
2014	14.6		Control process error 6	
	14.7		Control process error 7	
	14.8		Control process error 8	
	14.9		Control process error 9	
	14.A		Control process error 10	
	14.B		Control process error 11	
	15.1	M 0	EEP-ROM error at power on	
2015	15.2	Memory error 2	EEP-ROM error during operation	
	15.4	(EEP-ROM)	Home position information read error	
	16.1		Encoder initial communication - Receive data error 1	
	16.2		Encoder initial communication - Receive data error 2	
	16.3		Encoder initial communication - Receive data error 3	
	16.4		Encoder initial communication - Encoder malfunction	
	16.5		Encoder initial communication - Transmission data error	
	16.6		Encoder initial communication - Transmission data error 2	
2016	16.7	Encoder initial communication error 1	Encoder initial communication - Transmission data error 3	
	16.8		Encoder initial communication - Incompatible encoder	
	16.A		Encoder initial communication - Process error 1	
	16.B		Encoder initial communication - Process error 2	
	16.C	1	Encoder initial communication - Process error 3	
	16.D		Encoder initial communication - Process error 4	
	16.E		Encoder initial communication - Process error 5	
	16.F	1	Encoder initial communication - Process error 6	

Table 1.13 Servo error (2000 to 2999) list (MR-J4(W)-□B) (Continued)

Error code	Servo amplifier LED display	Name	Details name	Remarks
	17.1		Board error 1	
	17.3		Board error 2	
	17.4		Board error 3	
	17.5		Board error 4	
2017	17.6	Board error	Board error 5	
	17.7	1	Board error 7	
	17.8	1	Board error 6	
	17.9	1	Board error 8	
	19.1		Flash-ROM error 1	
2019	19.2	Memory error 3	Flash-ROM error 2	
2010	19.3	(Flash-ROM)	Flash-ROM error 3	
	20.1			
	20.1	-	Encoder normal communication - Receive data error 1	
	-	-	Encoder normal communication - Receive data error 2	
	20.3	1	Encoder normal communication - Receive data error 3	
	20.5		Encoder normal communication - Transmission data	
0000		Encoder normal	error 1	
2020	20.6	communication error 1	Encoder normal communication - Transmission data	
			error 2	
	20.7		Encoder normal communication - Transmission data	
		=	error 3	
	20.9		Encoder normal communication - Receive data error 4	
	20.A		Encoder normal communication - Receive data error 5	
	21.1	-	Encoder error 1	
	21.2	-	Encoder data update error	
	21.3	Encoder normal	Encoder data waveform error	
2021	21.4	communication error 2	Encoder non-signal error	
	21.5	- Communication on E	Encoder hardware error 1	
	21.6		Encoder hardware error 2	
	21.9		Encoder error 2	
2024	24.1	Main aireuit arrar	Ground fault detected at hardware detection circuit	
2024	24.2	Main circuit error	Ground fault detected at software detection function	
2025	25.1	Absolute position	Servo motor encoder - Absolute position erased	
2025	25.2	erased	Scale measurement encoder - Absolute position erased	
	27.1		Initial magnetic pole detection - Abnormal termination	
	27.2		Initial magnetic pole detection - Time out error	
	27.3]	Initial magnetic pole detection - Limit switch error	
2027	27.4	Initial magnetic pole	Initial magnetic pole detection - Estimated error	
	27.5	detection error	Initial magnetic pole detection - Speed deviation error	
	27.6	1	Initial magnetic pole detection - Position deviation error	
	27.7	1	Initial magnetic pole detection - Current error	
2028	28.1	Linear encoder error 2	Linear encoder - Environment error	
2020	30.1	Enfour chooder chorz	Regeneration heat error	
2030	30.2	Regenerative error	Regeneration signal error	
2030	JU.Z	1 regenerative entiti	rtogonoration signal GHU	
2000	30.3		Regeneration feedback signal error	

Table 1.13 Servo error (2000 to 2999) list (MR-J4(W)-□B) (Continued)

Error code	Servo amplifier LED display	Name	Details name	Remarks
	32.1		Overcurrent detected at hardware detection circuit	
			(during operation)	
	32.2		Overcurrent detected at software detection function	
2032	V=	Overcurrent	(during operation)	
2002	32.3	0.101.011.	Overcurrent detected at hardware detection circuit	
		_	(during a stop)	
	32.4		Overcurrent detected at software detection function	
		0 "	(during a stop)	
2033	33.1	Overvoltage	Main circuit voltage error	
	34.1	_	SSCNET receive data error	
	34.2	_	SSCNET connector connection error	
	34.3	_	SSCNET communication data error	
2034	34.4	SSCNET receive error	Hardware error signal detection	
	34.5	1	SSCNET receive data error (safety observation	
	01.0	_	function)	
	34.6		SSCNET communication data error (safety observation	
	04.0		function)	
2035	35.1	Command frequency error	Command frequency error	
	36.1	OCCUPATION :	Continuous communication data error	
2036 36.2	SSCNET receive error	Continuous communication data error (safety		
	36.2	2	observation function)	
	37.1		Parameter setting range error	
2037 (Note-1)	37.2	Parameter error	Parameter combination error	
	37.3		Point table setting error	
	42.1		Servo control error by position deviation	
	42.2	Servo control error	Servo control error by speed deviation	
	42.3	1	Servo control error by torque/thrust deviation	
2042	42.8		Fully closed loop control error by position deviation	
	42.9	Fully closed loop	Fully closed loop control error by speed deviation	
		control error	Fully closed loop control error by position deviation	
	42.A		(during command stop)	
	45.1	Main circuit device	Main circuit device overheat error 1	
2045	45.2	overheat	Main circuit device overheat error 2	
	46.1		Abnormal temperature of servo motor 1	
	46.2	1	Abnormal temperature of servo motor 2	
	46.3	1	Thermistor disconnected error	
2046	46.4	Servo motor overheat	Thermistor discornicated error	
	46.5	1	Abnormal temperature of servo motor 3	
			·	
	46.6		Abnormal temperature of servo motor 4	
2047	47.1	Cooling fan error	Cooling fan stop error	
	47.2		Cooling fan speed reduction error Thermal everledd error 1 during energtion	
	50.1	1	Thermal overload error 1 during operation	
	50.2	1	Thermal overload error 2 during operation	
2050	50.3	Overload 1	Thermal overload error 4 during operation	
	50.4	-	Thermal overload error 1 during a stop	
	50.5	4	Thermal overload error 2 during a stop	
	50.6		Thermal overload error 4 during a stop	

(Note-1): Refer to the parameter No. stored in parameter error No. (#8009+20n) for details of the parameter for which the error occurred.

Table 1.13 Servo error (2000 to 2999) list (MR-J4(W)-□B) (Continued)

Error code	Servo amplifier LED display	Name	Details name	Remarks
2051	51.1	Overload 2	Thermal overload error 3 during operation	
2031	51.2	Overload 2	Thermal overload error 3 during a stop	
	52.1		Excess droop pulse 1	
	52.3		Excess droop pulse 2	
2052	52.4	Error excessive	Error excessive during 0 torque limit	
	52.5		Excess droop pulse 3	
	52.6		Excessive droop pulse at servo-off	
2054	54.1	Oscillation detection	Oscillation detection error	
	56.2		Over speed during forced stop	
2056	56.3	Forced stop error	Estimated distance over during forced stop	
	1A.1		Servo motor combination error	
2060		Servo motor		
2000	1A.2	combination error	Servo motor control mode combination error	
	1A.4		Servo motor combination error 2	
	2A.1		Linear encoder error 1-1	
	2A.2		Linear encoder error 1-2	
	2A.3		Linear encoder error 1-3	
2061	2A.4	Linear encoder error 1	Linear encoder error 1-4	
2001	2A.5	Linear encoder enor 1	Linear encoder error 1-5	
	2A.6		Linear encoder error 1-6	
	2A.7		Linear encoder error 1-7	
	2A.8		Linear encoder error 1-8	
	63.1		STO1 off	
	63.2	STO timing error	STO2 off	
2063	63.5		STO by functional safety unit	
2000	1E.1	Encoder initial	Encoder malfunction	
	1E.2	communication error 2	Load-side encoder malfunction	
	64.1	Communication chor 2		
		Functional safety unit	STO input error	
0004	64.2	setting error	Compatibility mode setting error	
2064	64.3		Operation mode setting error	
	1F.1	Encoder initial	Incompatible encoder	
	1F.2	communication error 3	Incompatible load-side encoder	
	65.1		Functional safety unit communication error 1	
	65.2		Functional safety unit communication error 2	
	65.3		Functional safety unit communication error 3	
	65.4	Functional asfate	Functional safety unit communication error 4	
2065	65.5	Functional safety unit	Functional safety unit communication error 5	
	65.6	connection error	Functional safety unit communication error 6	
	65.7	1	Functional safety unit communication error 7	
	65.8	1	Functional safety unit shut-off signal error 1	
	65.9	1	Functional safety unit shut-off signal error 2	
	55.5		Encoder initial communication - Receive data error 1	
	66.1		(safety observation function)	
		-	Encoder initial communication - Receive data error 2	
	66.2	Encoder in:		
		Encoder initial	(safety observation function)	
2066	66.3	communication error	Encoder initial communication - Receive data error 3	
		(safety observation	(safety observation function)	
	66.7	function)	Encoder initial communication - Transmission data error	
	<u> </u>	-	1 (safety observation function)	
	66.9		Encoder initial communication - Process error 1 (safety	
	55.5		observation function)	

Table 1.13 Servo error (2000 to 2999) list (MR-J4(W)-□B) (Continued)

Error code	Servo amplifier LED display	Name	Details name	Remarks
	67.1	Encoder normal	Encoder normal communication - Receive data error 1 (safety observation function)	
	67.2	communication error 1 (safety observation	Encoder normal communication - Receive data error 2 (safety observation function)	
2067	67.3	function)	Encoder normal communication - Receive data error 3 (safety observation function)	
	67.4	Encoder normal communication error 1	Encoder normal communication - Receive data error 4 (safety observation function)	
	67.7	(safety observation function)	Encoder normal communication - Transmission data error 1 (safety observation function)	
2068	68.1	STO diagnosis error	Mismatched STO signal error	
	70.1		Load-side encoder initial communication - Receive data error 1	
	70.2		Load-side encoder initial communication - Receive data error 2	
	70.3		Load-side encoder initial communication - Receive data error 3	
	70.4		Load-side encoder initial communication - Encoder malfunction	
	70.5		Load-side encoder initial communication - Transmission data error 1	
	70.6		Load-side encoder initial communication - Transmission data error 2	
0070	70.7	Load-side encoder	Load-side encoder initial communication - Transmission data error 3	
2070	70.8	initial communication error 1	Load-side encoder initial communication - Incompatible encoder	
	70.A		Load-side encoder initial communication - Process error 1	
	70.B		Load-side encoder initial communication - Process error 2	
	70.C		Load-side encoder initial communication - Process error 3	
	70.D		Load-side encoder initial communication - Process error 4	
	70.E		Load-side encoder initial communication - Process error 5	
	70.F		Load-side encoder initial communication - Process error 6	

Table 1.13 Servo error (2000 to 2999) list (MR-J4(W)-□B) (Continued)

Error code	Servo amplifier LED display	Name	Details name	Remarks
	71.1		Load-side encoder communication - Receive data error	
	71.2		Load-side encoder communication - Receive data error 2	
	71.3		Load-side encoder communication - Receive data error 3	
0074	71.5	Load-side encoder	Load-side encoder communication - Transmission data error 1	
2071	71.6	normal communication error 1	Load-side encoder communication - Transmission data error 2	
	71.7		Load-side encoder communication - Transmission data error 3	
	71.9		Load-side encoder communication - Transmission data error 4	
	71.A		Load-side encoder communication - Transmission data error 5	
	72.1		Load-side encoder data error 1	
	72.2		Load-side encoder data update error	
	72.3	Load-side encoder	Load-side encoder data waveform error	
2072	72.4	normal communication	Load-side encoder non-signal error	
	72.5	error 2	Load-side encoder hardware error 1	
	72.6		Load-side encoder hardware error 2	
	72.9		Load-side encoder data error 2	
	79.1		Functional safety unit power voltage error	
	79.2	Functional safety unit diagnosis error	Functional safety unit internal error	
	79.3		Abnormal temperature of functional safety unit	
0070	79.4		Servo amplifier error	
2079	79.5		Input device error	
	79.6		Output device error	
	79.7		Mismatched input signal error	
	79.8		Position feedback fixing error	
2082	82.1	Master-slave operation error 1	Master-slave operation error 1	
2088	888	Watchdog	Watchdog	
2091	91.1	Servo amplifier overheat warning	Main circuit device overheat warning	
	95.1		STO1 off detection	
	95.2		STO2 off detection	
2095	95.3	STO warning	STO warning 1 (safety observation function)	
	95.4		STO warning 2 (safety observation function)	
	95.5		STO warning 3 (safety observation function)	
2402	92.1	Battery cable	Encoder battery cable disconnection warning	
2102	92.3	disconnection warning	Battery degradation	
	96.1		In-position warning at home positioning	
	96.2	Hama nasiti	Command input warning at home positioning	
2106	96.3	Home position setting	Servo off warning at home positioning	
	96.4	warning	Home positioning warning during magnetic pole detection	
0	9F.1		Low battery	
2116	9F.2	Battery warning	Battery degradation warning	

Table 1.13 Servo error (2000 to 2999) list (MR-J4(W)-□B) (Continued)

Error code	Servo amplifier LED display	Name	Details name	Remarks
2140	E0.1	Excessive regeneration warning	Excessive regeneration warning	
	E1.1		Thermal overload warning 1 during operation	
	E1.2		Thermal overload warning 2 during operation	
	E1.3		Thermal overload warning 3 during operation	
	E1.4		Thermal overload warning 4 during operation	
2141	E1.5	Overload warning 1	Thermal overload error 1 during a stop	
	E1.6		Thermal overload error 2 during a stop	
	E1.7	1	Thermal overload error 3 during a stop	
	E1.8	-	Thermal overload error 4 during a stop	
2142	E2.1	Servo motor overheat warning	Servo motor temperature warning	
	E3.1	Warring	Multi-revolution counter travel distance excess warning	
	E3.2	1	Absolute position counter warning	
2143	20.2	Absolute position	Absolute positioning counter EEP-ROM writing	
2140	E3.4	counter warning	frequency warning	
	E3.5	-	Encoder absolute positioning counter warning	
2144 ^(Note-1)	E4.1	Parameter warning	Parameter setting range error warning	
2144	E6.1	Farameter warning	Forced stop warning	
2146	E6.2	Servo forced stop		
2140		warning	SS1 forced stop warning 1 (safety observation function)	
	E6.3	O and the Hamiltonia and a dame	SS1 forced stop warning 2 (safety observation function)	
2147	E7.1	Controller forced stop warning	Controller forced stop warning	
2148	E8.1	Cooling fan speed	Decreased cooling fan speed warning	
2140	E8.2	reduction warning	Cooling fan stop	
	E9.1	_	Servo-on signal on during main circuit off	
2149	E9.2	Main circuit off	Bus voltage drop during low speed operation	
2149	E9.3	warning	Ready-on signal on during main circuit off	
	E9.4		Converter unit forced stop	
2151	EB.1	The other axis error warning	The other axis error warning	
2152	EC.1	Overload warning 2	Overload warning 2	
2153	ED.1	Output watt excess warning	Output watt excess warning	
	F0.1	Ü	Instantaneous power failure tough drive warning	
2160	F0.3	Tough drive warning	Vibration tough drive warning	
	F2.1	Drive recorder -	Drive recorder - Area writing time-out warning	
2162	F2.2	Miswriting warning	Drive recorder - Data miswriting warning	
2163	F3.1	Oscillation detection warning	Oscillation detection warning	
	F7.1		Vibration failure prediction warning	
2167	F7.2	Machine diagnosis	Friction failure prediction warning	
•	F7.3	warning	Total travel distance failure prediction warning	
2907	1B.1	Converter error	Converter unit error	
	, D. 1	5511761161 61161		
	2B.1		Encoder counter error 1	

(Note-1): Refer to the parameter No. stored in parameter error No. (#8009+20n) for details of the parameter for which the error occurred.

Table 1.13 Servo error (2000 to 2999) list (MR-J4(W)-□B) (Continued)

Error code	Servo amplifier LED display	Name	Details name	Remarks
2918	3A.1	Inrush current suppression circuit error error		
0004	3D.1	Parameter setting	Parameter combination error for driver communication on slave	
2921	3D.2	error for driver communication	Parameter combination error for driver communication on master	
	3E.1		Operation mode error	
2922	3E.6	Operation mode error	Operation mode switch error	
	7A.1		Parameter verification error (safety observation function)	
20.42	7A.2	Parameter setting	Parameter setting range error (safety observation function)	
2942	7A.3	error (safety observation function)	Parameter combination error (safety observation function)	
	7A.4		Functional safety unit combination error (safety observation function)	
	7B.1	Formal Control	Encoder diagnosis error 1 (safety observation function)	
2042	7B.2	Encoder diagnosis	Encoder diagnosis error 2 (safety observation function)	
2943	7B.3	error (safety observation function)	Encoder diagnosis error 3 (safety observation function)	
	7B.4	observation function)	Encoder diagnosis error 4 (safety observation function)	
	7C.1	Functional safety unit communication	Functional safety unit communication cycle error (safety observation function)	
2944	7C.2	diagnosis error (safety observation function)	Functional safety unit communication data error (safety observation function)	
	7D.1	Safety observation	Stop observation error	
2945	7D.2	error	Speed observation error	
	8A.1	USB communication time-out error/serial	USB communication time-out error/serial communication time-out error	
2948	8A.2	communication time- out error/Modbus-RTU communication time- out error	Modbus-RTU communication time-out error	
	8E.1		USB communication receive error/serial communication receive error	
	8E.2		USB communication checksum error/serial communication checksum error	
	8E.3	USB communication error/serial	USB communication character error/serial communication character error	
2952	8E.4	communication error/Modbus-RTU	USB communication command error/serial communication command error	
	8E.5	communication error	USB communication data number error/serial communication data number error	
	8E.6		Modbus-RTU communication receive error	
	8E.7		Modbus-RTU communication message frame error	
	8E.8		Modbus-RTU communication CRC error	
	9B.1		Excess droop pulse 1 warning	
2955	9B.3	Error excessive	Excess droop pulse 2 warning	
	9B.4	warning	Error excessive warning during 0 torque limit	
2956	9C.1	Converter error	Converter unit error	

(c) MR-J3-□B

Table 1.14 Servo error (2000 to 2999) list (MR-J3-□B)

Error code	Servo amplifier LED display ^(Note-1)	Name	Remarks
2010	10	Undervoltage	
2012	12	Memory error 1 (RAM)	
2013	13	Clock error	
2015	15	Memory error 2 (EEP-ROM)	
2016	16	Encoder error 1 (At power on)	
2017	17	Board error	
2019	19	Memory error 3 (Flash ROM)	
2020	20	Encoder error 2 (During runtime)	
2021	21	Encoder error 3 (During runtime)	
2024	24	Main circuit error	
2025	25	Absolute position erase	
2030	30	Regenerative error	
2031	31	Overspeed	
2032	32	Overcurrent	
2033	33	Overvoltage	
2034	34	Receive error 1	
2035	35	Command frequency error	
2036	36	Receive error 2	
2045	45	Main circuit device overheat	
2046	46	Servo motor overheat	
2047	47	Cooling fan error	
2050	50	Overload 1	
2051	51	Overload 2	
2052	52	Error excessive	
2060	1A	Motor combination error	
2082	82	Master/slave operation error 1	
2088	888	Watchdog	
2102	92	Battery cable disconnection warning	
2106	96	Home position setting warning	
2116	9F	Battery warning	
2140	E0	Excessive regeneration warning	
2141	E1	Overload warning 1	
2143	E3	Absolute position counter warning	
2146	E6	Servo forced stop warning	
2147	E7	Controller forced stop warning	
2148	E8	Cooling fan speed reduction warning	
2149	E9	Main circuit off warning	
2152	EC	Overload warning 2	
2153	ED	Output watt excess warning	
2301 to 2599	E4	Parameter warning (Refer to the table 1.15)	
2601 to 2899	37	Parameter error (Refer to the table 1.15)	

(Note-1): The LED display is different when using the servo amplifiers with a large capacity. Refer to the "Servo amplifier Instruction Manual" for details.

Table 1.14 Servo error (2000 to 2999) list (MR-J3-□B) (Continued)

Error code	Servo amplifier LED display ^(Note-1)	Name Remarks	
2907 ^(Note-2)	1B	Converter alarm	
2921 ^(Note-2)	3D	Driver communication parameter setting error	
2948 ^(Note-2)	8A	USB communication time-out error	
2952 ^(Note-2)	8E	USB communication error	
2956 ^(Note-2)	9C	Converter warning	

(Note-1): The LED display is different when using the servo amplifiers with a large capacity. Refer to the "Servo amplifier Instruction Manual" for details.

(Note-2): Error codes will differ depending on the operating system software version.

Error code Operating system software version		Servo amplifier	Name
"00F" or earlier	"00G" or later	LED display	
2021	2907	1B	Converter alarm
2043	2921	3D	Driver communication parameter setting error
2090	2948	8A	USB communication time-out error
2094	2952	8E	USB communication error
2102	2956	9C	Converter warning

Table 1.15 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail

	Table 1.		rarameter warning (2501 to 259s
Error code		Parameter No.	Name
2301	2601	PA01	Control mode
2302	2602	PA02	Regenerative option
2303	2603	PA03	Absolute position detection system
2304	2604	PA04	Function selection A-1
2305	2605	PA05	For many factures acting
2306	2606	PA06	For manufacturer setting
2307	2607	PA07	
2308	2608	PA08	Auto tuning mode
2309	2609	PA09	Auto tuning response
2310	2610	PA10	In-position range
2311	2611	PA11	
2312	2612	PA12	For manufacturer setting
2313	2613	PA13	For manufacturer setting
2314	2614	PA14	Rotation direction selection
2315	2615	PA15	Encoder output pulse
2316	2616	PA16	
2317	2617	PA17	For manufacturer setting
2318	2618	PA18	
2319	2619	PA19	Parameter write inhibit
2320	2620	PB01	Adaptive tuning mode (adaptive filter II)
2321	2621	PB02	Vibration suppression control tuning mode (advanced vibration suppression control)
2322	2622	PB03	For manufacturer setting
2323	2623	PB04	Feed forward gain
2324	2624	PB05	For manufacturer setting
2325	2625	PB06	Ratio of load inertia moment to servo motor inertia moment
2326	2626	PB07	Model loop gain
2327	2627	PB08	Position loop gain
2328	2628	PB09	Speed loop gain
2329	2629	PB10	Speed integral compensation
2330	2630	PB11	Speed differential compensation
2331	2631	PB12	Overshoot amount compensation
2332	2632	PB13	Machine resonance suppression filter 1
2333	2633	PB14	Notch shape selection 1
2334	2634	PB15	Machine resonance suppression filter 2
2335	2635	PB16	Notch shape selection 2
2336	2636	PB17	Automatic setting parameter
2337	2637	PB18	Low-pass filter setting
2338	2638	PB19	Vibration suppression control vibration frequency setting

Error	code	Parameter No.	Name
2339	2639	PB20	Vibration suppression control resonance frequency setting
2340	2640	PB21	
2341	2641	PB22	For manufacturer setting
2342	2642	PB23	Low-pass filter selection
2343	2643	PB24	Slight vibration suppression control selection
2344	2644	PB25	For manufacturer setting
2345	2645	PB26	Gain changing selection
2346	2646	PB27	Gain changing condition
2347	2647	PB28	Gain changing time constant
2348	2648	PB29	Gain changing ratio of load inertia moment to servo motor inertia moment
2349	2649	PB30	Gain changing position loop gain
2350	2650	PB31	Gain changing speed loop gain
			Gain changing speed integral
2351	2651	PB32	compensation
			Gain changing vibration suppression
2352	2652	PB33	control vibration frequency setting
			Gain changing vibration suppression
2353	2653	PB34	control resonance frequency setting
2354	2654	PB35	
2355	2655	PB36	
2356	2656	PB37	
2357	2657	PB38	
2358	2658	PB39	
2359	2659	PB40	For manufacturer setting
2360	2660	PB41	
2361	2661	PB42	
2362	2662	PB43	
2363	2663	PB44	
2364	2664	PB45	Vibration suppression control filter 2
2365	2665	PC01	Error excessive alarm level
2366	2666	PC02	Electromagnetic brake sequence output
2367	2667	PC03	Encoder output pulse selection
2368	2668	PC04	Function selection C-1
2369	2669	PC05	Function selection C-2
2370	2670	PC06	Function selection C-3
2371	2671	PC07	Zero speed
2372	2672	PC08	For manufacturer setting
2373	2673	PC09	Analog monitor 1 output
2374	2674	PC10	Analog monitor 2 output
2375	2675	PC11	Analog monitor 1 offset
2376	2676	PC12	Analog monitor 2 offset

(Note): The details are different when using the servo amplifiers with a large capacity. Refer to the "Servo amplifier Instruction Manual" for details.

Table 1.15 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail (Continued)

	Parame		rameter			Parameter	
Error	code	No.	Name	Erro	code	No.	Name
2377	2677	PC13	Analog monitor feedback position output	2416	2716	PD20	Driver communication setting
			standard data Low	-	<u> </u>		Master axis No. selection1 for slave
2378	2678	PC14	Analog monitor feedback position output standard data High	2417	2717	PD21	
2379	2679	PC15	For manufacturer setting	2418	2718	PD22	
2380		PC16	Function selection C-3A	2419	2719	PD23	
2381	2681	PC17	Function selection C-4	2420	2720	PD24	For manufacturer setting
2382		PC18	For manufacturer setting	2421	2721	PD25	i oi manarastaror sotting
2383		PC19	•		2722	PD26	
2384		PC20	Function selection C-7		2723	PD27	
2385		PC21	Alarm history clear		2724	PD28	
2386	2686	PC22		2425	2725	PD29	
2387	2687	PC23		2426	2726	PD30	Master-slave operation - Torque command coefficient on slave
2388	2688	PC24		2427	2727	PD31	Master-slave operation - Speed limit coefficient on slave
2389	2689	PC25		2428	2728	PD32	Master-slave operation - Speed limit adjustment value on slave
2390	2690	PC26		2429	2729	PE01	
2391	2691	PC27		2430	2730	PE02	
2392	2692	PC28		2431	2731	PE03	
2393	2693	PC29	For manufacturer setting	2432	2732	PE04	
2394	2694	PC30		2433	2733	PE05	
2395	2695	PC31		2434	2734	PE06	
2396	2696	PC32			2735	PE07	
2397	2697	PD01			2736	PE08	
2398	2698	PD02		2437	2737	PE09	
2399	2699	PD03		2438	2738	PE10	
2400	2700	PD04		2439	2739	PE11	
2401	2701	PD05		2440	2740	PE12	
2402	2702	PD06		2441	2741	PE13	
2403	2703	PD07	Output signal device selection 1 (CN3-13)	2442	2742	PE14	For manufacturer setting
2404	2704	PD08	Output signal device selection 2 (CN3-9)	2443	2743	PE15	
2405	2705	PD09	Output signal device selection 3 (CN3-15)	2444	2744	PE16	
2406	2706	PD10	For manufacturer setting	2445	2745	PE17	
2407	2707	PD11	Input filter setting	2446	2746	PE18	
2408	2708	PD12	For manufacturar acting	2447	2747	PE19	
2409	2709	PD13	For manufacturer setting	2448	2748	PE20	
2410	2710	PD14	Function selection D-3	2449	2749	PE21	
2411	2711	PD15	Driver communication setting	2450	2750	PE22	
2412	2712	PD16	Driver communication setting Master transmit data selection1	2451	2751	PE23	
2413	2713	PD17	Driver communication setting Master transmit data selection2	2452	2752	PE24	
2414	2714	PD18		2453	2753	PE25	
2415		PD19	For manufacturer setting		2754	PE26	Filter coefficient 2-1

(Note): The details are different when using the servo amplifiers with a large capacity. Refer to the "Servo amplifier Instruction Manual" for details.

Table 1.15 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail (Continued)

			J ()
Error code		Parameter No.	Name
2455	2755	PE27	Filter coefficient 2-2
2456	2756	PE28	Filter coefficient 2-3
2457	2757	PE29	Filter coefficient 2-4
2458	2758	PE30	Filter coefficient 2-5
2459	2759	PE31	Filter coefficient 2-6
2460	2760	PE32	Filter coefficient 2-7
2461	2761	PE33	Filter coefficient 2-8

Error	code	Parameter No.	Name
2462	2762	PE34	
2463	2763	PE35	
2464	2764	PE36	
2465	2765	PE37	For manufacturer setting
2466	2766	PE38	
2467	2767	PE39	
2468	2768	PE40	

(Note): The details are different when using the servo amplifiers with a large capacity. Refer to the "Servo amplifier Instruction Manual" for details.

(d) MR-J3W-□B

Table 1.16 Servo error (2000 to 2999) list (MR-J3W-□B)

Error code	Servo amplifier LED display	Name	Details name	Remarks	
2010	10.1	Lindonioltogo	Voltage drop in the control circuit power supply		
2010	10.2	Undervoltage	Voltage drop in the main circuit power		
	11.1		Rotary switch setting error		
0044	11.2	0	DIP switch setting error		
2011	11.3	Switch setting error	Servo motor selection switch setting error		
	11.4		Servo motor selection switch setting error 2		
	12.1		CPU built-in RAM error		
2012	12.2	Memory error 1 (RAM)	CPU data RAM error		
	12.3		Custom IC RAM error		
2013	13.1	Clock error	Clock error		
	15.1	Memory error 2 (EEP-	EEP-ROM error at power on		
2015	15.2	ROM)	EEP-ROM error during operation		
	16.1	,	Encoder receive data error 1		
	16.2	1	Encoder receive data error 2		
	16.3	Encoder initial	Encoder receive data error 3		
2016	16.5	communication error 1	Encoder transmission data error 1		
	16.6		Encoder transmission data error 2		
	16.7	<u>-</u>	Encoder transmission data error 3		
	17.1		AD converter error		
	17.2		Current feedback data error		
	17.3		Custom IC error		
2017	17.4	Board error	Amplifier detection signal error		
	17.5	1	Rotary switch error		
	17.6	1	DIP switch error		
	19.1	Memory error 3 (Flash	Flash-ROM error 1		
2019	19.2	ROM)	Flash-ROM error 2		
	20.1	T(OW)	Encoder receive data error 1		
	20.1	_	Encoder receive data error 2		
2020	20.3	Encoder normal	Encoder receive data error 3		
	20.5	communication error 1	Encoder transmission data error 1		
	20.6	1	Encoder transmission data error 2		
	20.7		Encoder transmission data error 3		
0004	21.1	Encoder normal	Encoder data error		
2021	21.2	communication error 2	Encoder data update error		
	21.3		Encoder waveform error	Direct drive motor use	
2024	24.1	Main circuit error	Ground fault detected at hardware detection circuit		
	24.2		Ground fault detected at software detection function		
2025	25.1	Absolute position erase	Absolute position data erase		
	27.1	_	Magnetic pole detection abnormal termination		
	27.2	_	Magnetic pole detection time out error	Linear servo motor/	
	27.3	Initial magnetic rela	Magnetic pole detection limit switch error		
2027	27.4	Initial magnetic pole	Magnetic pole detection estimated error		
	27.5	detection error	Magnetic pole detection position deviation error	direct drive motor use	
	27.6		Magnetic pole detection speed deviation error		
	27.7		Magnetic pole detection current error		
2028	28.1	Linear encoder error 2	Linear encoder environment error	Linear servo motor use	

Table 1.16 Servo error (2000 to 2999) list (MR-J3W-□B) (Continued)

Error code	Servo amplifier LED display	Name	Details name	Remarks
	30.1		Regeneration heat error	
2030	30.2	Regenerative error	Regenerative transistor error	
	30.3		Regenerative transistor feedback data error	
2031	31.1	Overspeed	Abnormal motor speed (Note-1), (Note-2)	
	32.1		Overcurrent detected at hardware detection circuit (during operation).	
	32.2		Overcurrent detected at software detection function (during operation).	
2032	32.3	Overcurrent	Overcurrent detected at hardware detection circuit (during a stop).	
	32.4		Overcurrent detected at software detection function (during a stop).	
2033	33.1	Overvoltage	Main circuit voltage error	
2000	34.1		SSCNET receive data error	
2034	34.2	SSCNET receive error	SSCNET communication connector connection error	
2004	34.3	1	Communication data error	
	34.4		Hardware error signal detection	
2035	35.1	Command frequency error	Command frequency error	
2036	36.1	SSCNET receive error	Continuous communication data error	
	42.1	Linear servo control error	Linear servo control error on the positioning detection	Linear servo motor use
		Servo control error	Servo control error due to position deviation	Direct drive motor use
2042	42.2	Linear servo control error	Linear servo control error on the speed detection	Linear servo motor use
		Servo control error	Servo control error due to speed deviation	Direct drive motor use
	42.3	Linear servo control error	Linear servo control error on the thrust detection	Linear servo motor use
		Servo control error	Servo control error due to torque detection	Direct drive motor use
2045	45.1	Main circuit device	Main circuit abnormal temperature	
2045	45.2	overheat	Board temperature error	
	46.1		Abnormal temperature of servo motor	
	46.2	Servo motor overheat	Linear servo motor thermal sensor error	Linear servo motor use
2046	40.2	(Note-2)	Direct drive motor thermal sensor error	Direct drive motor use
	46.3		Thermistor wires are not connected error	Linear servo motor/direct drive motor use
2047	47.1	Cooling fan error	Cooling fan stop error	
2041	47.2	Cooming tall 61101	Decreased cooling fan speed error	
	50.1	1	Thermal overload error 1 during operation	
	50.2	1	Thermal overload error 2 during operation	
2050	50.3	Overload 1	Thermal overload error 4 during operation	
2000	50.4	- Overioad i	Thermal overload error 1 during a stop	
	50.5	_	Thermal overload error 2 during a stop	
	50.6		Thermal overload error 4 during a stop	

(Note-1): The name is different when using the linear servo motors. Refer to the "Servo amplifier Instruction Manual" for details. (Note-2): The name is different when using the direct drive motors. Refer to the "Servo amplifier Instruction Manual" for details.

Table 1.16 Servo error (2000 to 2999) list (MR-J3W-□B) (Continued)

Error code	Servo amplifier LED display	Name	Details name	Remarks
2051	51.1	Overload 2	Thermal overload error 3 during operation	
2031	51.2	Overload 2	Thermal overload error 3 during a stop	
2052	52.3		Excess droop pulse (Note-1), (Note-2)	
2052	52.4	Error excessive	Maximum deviation at 0 torque limit (Note-1), (Note-2)	
2060	1A.1	Motor combination error	Motor combination error	
	2A.1		Linear encoder side error 1	
	2A.2		Linear encoder side error 2	1
	2A.3		Linear encoder side error 3	
0004	2A.4]	Linear encoder side error 4	Ī
2061	2A.5	Linear encoder error 1	Linear encoder side error 5	Linear servo motor use
	2A.6		Linear encoder side error 6	
	2A.7		Linear encoder side error 7	
	2A.8		Linear encoder side error 8	1
2063 ^(Note-3)	1E.1	Encoder initial communication error 2	Encoder failure	
2064 ^(Note-3)	1F.1	Encoder initial communication error 3	Incompatible encoder	
2088	888	Watchdog	_	
2101 ^(Note-3)	91.1	Main circuit device	Main circuit device overheat warning	
2101 (100 0)	91.2	overheat warning	Board temperature warning	
2102	92.1	Battery cable disconnection warning	Encoder battery disconnection warning signal detection	
0.100	96.1	Home position setting	In-position error at home positioning	
2106	96.2	warning	Command input error at home positioning	
2116	9F.1	Battery warning	Low battery	
2140	E0.1	Excessive regeneration warning	Excessive regeneration warning	
	E1.1		Thermal overload warning 1 during operation	
	E1.2		Thermal overload warning 2 during operation	
	E1.3	1	Thermal overload warning 3 during operation	
	E1.4	1	Thermal overload warning 4 during operation	
2141	E1.5	Overload warning 1	Thermal overload warning 1 during a stop	
	E1.6	1	Thermal overload warning 2 during a stop	
	E1.7	1	Thermal overload warning 3 during a stop	
	E1.8	1	Thermal overload warning 4 during a stop	
0440		Linear servo motor overheat warning	Linear servo motor overheat warning	Linear servo motor use
2142	E2.1	Direct drive motor overheat warning	Direct drive motor overheat warning	Direct drive motor use

(Note-1): The name is different when using the linear servo motors. Refer to the "Servo amplifier Instruction Manual" for details. (Note-2): The name is different when using the direct drive motors. Refer to the "Servo amplifier Instruction Manual" for details. (Note-3): Error codes will differ depending on the operating system software version.

	code n software version	Servo amplifier	Name	
"00F" or earlier "00G" or later		LED display		
2024	2063	1E	Encoder initial communication error 2	
2025	2064	1F	Encoder initial communication error 3	
2091	2101	91	Main circuit device overheat warning	

Table 1.16 Servo error (2000 to 2999) list (MR-J3W-□B) (Continued)

Error code	Servo amplifier LED display	Name	Details name	Remarks
2143	E3.1	Absolute position	The multi-revolution counter travel distance excess warning	
	E3.2	counter warning	Absolute positioning counter error	
2146	E6.1	Servo forced stop warning	Servo forced stop warning	
2147	E7.1	Controller forced stop warning	Controller forced stop warning	
2148	E8.1	Cooling fan speed reduction warning	Decreased cooling fan speed warning	
	E9.1		Ready-on signal on at main circuit off	
2149	E9.2	Main circuit off warning	Bus voltage drop during low speed operation (Note-1)	
	E9.3		Servo-on signal on at main circuit off	
2151	EB.1	The other axis fault warning	The other axis fault warning	
2152	EC.1	Overload warning 2	Overload warning 2	
2153	ED.1	Output watt excess warning	Output watt excess	
2301 to 2599	E4.1	Parameter warning (Refer to the table 1.17)	Parameter setting range error warning	
	37.1	Parameter error	Parameter setting range error	
2601 to 2899	37.2	(Refer to the table 1.17)	Parameter combination error	
2913 ^(Note-3)	2B.1	Chander counter arrer	Encoder counter error 1	Direct drive meter use
2810 . /	2B.2	Encoder counter error	Encoder counter error 2	Direct drive motor use
2948 ^(Note-3)	8A.1	USB communication time-out error	USB communication time-out error	
	8E.1		USB communication receive error	
	8E.2	LIOD	USB communication checksum error	
2952 (Note-3)	8E.3	USB communication	USB communication character error	
	8E.4	error	USB communication command error	
	8E.5		USB communication data No. error	

(Note-1): The name is different when using the linear servo motors. Refer to the "Servo amplifier Instruction Manual" for details. (Note-2): The name is different when using the direct drive motors. Refer to the "Servo amplifier Instruction Manual" for details. (Note-3): Error codes will differ depending on the operating system software version.

Error	code	Comus amplifiar		
Operating system	software version	Servo amplifier	Name	
"00F" or earlier "00G" or later		LED display		
2031	2913	2B	Encoder counter error	
2090	2948	8A	USB communication time-out error	
2094	2958	8E	USB communication error	

Table 1.17 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail

		Parameter	17 Parameter warning (2501 to 258
Error	code	No.	Name
2301	2601	PA01	Control mode
2302	2602	PA02	Regenerative option
2303	2603	PA03	Absolute position detection system
2304	2604	PA04	Function selection A-1
2305	2605	PA05	
2306	2606	PA06	For manufacturer setting
2307	2607	PA07	_
2308	2608	PA08	Auto tuning mode
2309	2609	PA09	Auto tuning response
2310	2610	PA10	In-position range
2311	2611	PA11	
2312	2612	PA12	For manufacturer setting
2313	2613	PA13	
2314	2614	PA14	Rotation direction selection
2315	2615	PA15	Encoder output pulse
2316	2616	PA16	Encoder output pulse 2
2317	2617	PA17	
2318	2618	PA18	For manufacturer setting
2319	2619	PA19	Parameter write inhibit
2320	2620	PB01	Adaptive tuning mode (adaptive filter II)
2321	2621	PB02	Vibration suppression control tuning mode (advanced vibration suppression control)
2322	2622	PB03	For manufacturer setting
2323	2623	PB04	Feed forward gain
2324	2624	PB05	For manufacturer setting
	2625	PB06	Ratio of load inertia moment to servo motor inertia moment
2326	2626	PB07	Model loop gain
2327	2627	PB08	Position loop gain
2328	2628	PB09	Speed loop gain
2329	2629	PB10	Speed integral compensation
2330	2630	PB11	Speed differential compensation
2331	2631	PB12	For manufacturer setting
2332	2632	PB13	Machine resonance suppression filter 1
2333	2633	PB14	Notch shape selection 1
2334	2634	PB15	Machine resonance suppression filter 2
2335	2635	PB16	Notch shape selection 2
2336	2636	PB17	Automatic setting parameter
2337	2637	PB18	Low-pass filter setting
2338	2638	PB19	Vibration suppression control vibration
		. 5.0	frequency setting
2339	2639	PB20	Vibration suppression control resonance frequency setting

Error	code	Parameter No.	Name				
2340	2640	PB21					
2341	2641	PB22	For manufacturer setting				
2342	2642	PB23	Low-pass filter selection				
			Slight vibration suppression control				
2343	2643	PB24	selection				
2344	2644	PB25	For manufacturer setting				
2345	2645	PB26	Gain changing selection				
2346	2646	PB27	Gain changing condition				
2347	2647	PB28	Gain changing time constant				
00.40	0040	DDOO	Gain changing ratio of load inertia moment				
2348	2648	PB29	to servo motor inertia moment				
2349	2649	PB30	Gain changing position loop gain				
2350	2650	PB31	Gain changing speed loop gain				
00=1	00=1	DECC	Gain changing speed integral				
2351	2651	PB32	compensation				
			Gain changing vibration suppression				
2352	2652	PB33	control vibration frequency setting				
						_	Gain changing vibration suppression
2353	2653	PB34	control resonance frequency setting				
2354	2654	PB35					
2355	2655	PB36					
2356	2656	PB37					
2357	2657	PB38					
2358	2658	PB39					
		PB40					
2359	2659	PD40	For manufacturer setting				
2360	2660	PB41	To manuacturer setting				
2361	2661	PB42					
2362	2662	PB43					
2363	2663	PB44					
2364	2664	PB45					
2365	2665	PC01	Error excessive alarm level				
2366	2666	PC02	Electromagnetic brake sequence output				
2367	2667	PC02	Encoder output pulse selection				
2368	2668	PC04	Function selection C-1				
2369		PC04 PC05					
	2669		Function selection C-2				
2370	2670	PC06	Function selection C-3				
2371	2671	PC07	Zero speed				
2372	2672	PC08	For manufacturer setting				
2373	2673	PC09	Analog monitor 1 output				
2374	2674	PC10	Analog monitor 2 output				
2375	2675	PC11	Analog monitor 1 offset				
2376	2676	PC12	Analog monitor 2 offset				
2377	2677	PC13	For manufacturer setting				
2378	2678	PC14	To manuacturer setting				

Table 1.17 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail (Continued)

Error	code	Parameter No.	Name
2379	2679	PC15	Station number selection
2380	2680	PC16	For manufacturer setting
2381	2681	PC17	Function selection C-4
2382	2682	PC18	
2383	2683	PC19	For manufacturer setting
2384	2684	PC20	
2385	2685	PC21	Alarm history clear
2386	2686	PC22	
2387	2687	PC23	
2388	2688	PC24	
2389	2689	PC25	
2390	2690	PC26	
2391	2691	PC27	
2392	2692	PC28	
2393	2693	PC29	
2394	2694	PC30	
2395	2695	PC31	For manufacturer setting
2396	2696	PC32	
2397	2697	PD01	
2398	2698	PD02	
2399	2699	PD03	
2400	2700	PD04	
2401	2701	PD05	
2402	2702	PD06	
2403	2703	PD07	Output signal device selection 1 (CN3-12 for A-axis and CN3-25 for B-axis)
2404	2704	PD08	For manufacturer setting
2405	2705	PD09	Output signal device selection 3 (CN3-11 for A-axis and CN3-24 for B-axis)
2406	2706	PD10	For manufacturer setting
2407	2707	PD11	Input filter setting
2408	2708	PD12	-
2409	2709	PD13	For manufacturer setting
2410	2710	PD14	Function selection D-3
2411	2711	PD15	For manufacturer setting

		Parameter	, , , ,
Error	code	No.	Name
2412	2712	PD16	
2413	2713	PD17	
2414	2714	PD18	
2415	2715	PD19	
2416	2716	PD20	
2417	2717	PD21	
2418	2718	PD22	
2419	2719	PD23	
2420	2720	PD24	For manufacturer setting
2421	2721	PD25	
2422	2722	PD26	
2423	2723	PD27	
2424	2724	PD28	
2425	2725	PD29	
2426	2726	PD30	
2427	2727	PD31	
2428	2728	PD32	
2485	2785	Po01	Function selection O-1
2486	2786	36 Po02	Axis selection for graphing analog data
2400	2700	1 002	(MR Configurator)
2487	2787	Po03	Axis selection for graphing digital data
	2.01	1 000	(MR Configurator)
	2788	Po04	Function selection O-2
2489	2789	Po05	
2490	2790	Po06	
2491	2791	Po07	
2492	2792	Po08	
2493	2793	Po09	
2494	2794	Po10	For manufacturer setting
2495	2795	Po11	
2496	2796	Po12	
2497	2797	Po13	
2498	2798	Po14	
	2799	Po15	
2500	2800	Po16	

(e) MR-J3-□B-RJ004 (For linear servo)

Table 1.18 Servo error (2000 to 2999) list (MR-J3-□B-RJ004)

Error code	Servo amplifier LED display	Name	Remarks
2010	10	Undervoltage	
2012	12	Memory error 1 (RAM)	
2013	13	Clock error	
2015	15	Memory error 2 (EEP-ROM)	
2016	16	Encoder error 1 (At power on)	
2017	17	Board error	
2019	19	Memory error 3 (Flash ROM)	
2020	20	Encoder error 2	
2021	21	Encoder error 3	
2024	24	Main circuit error	
2027	27	Initial magnetic pole detection error	
2028	28	Linear encoder error 2	
2030	30	Regenerative error	
2031	31	Overspeed	
2032	32	Overcurrent	
2033	33	Overvoltage	
2034	34	Receive error 1	
2035	35	Command frequency alarm	
2036	36	Receive error 2	
2042	42	Linear servo control error	
2045	45	Main circuit device overheat	
2046	46	Linear servo motor overheat	
2047	47	Cooling fan alarm	
2050	50	Overload 1	
2051	51	Overload 2	
2052	52	Error excessive	
2061	2A	Linear encoder error 1	
2088	888	Watchdog	
2106	96	Home position setting error	
2140	E0	Excessive regeneration warning	
2141	E1	Overload warning 1	
2142	E2	Linear servo motor overheat warning	
2146	E6	Servo forced stop warning	
2147	E7	Controller emergency stop warning	
2148	E8	Cooling fan speed reduction warning	
2149	E9	Main circuit off warning	
2152	EC	Overload warning 2	
2153	ED	Output watt excess warning	
2301 to 2599	E4	Parameter warning (Refer to the table 1.19)	
2601 to 2899	37	Parameter error (Refer to the table 1.19)	

Table 1.18 Servo error (2000 to 2999) list (MR-J3-□B-RJ004) (Continued)

Error code	Servo amplifier LED display	Name	Remarks
2948 ^(Note-1)	8A	USB communication time-out error	
2952 ^(Note-1)	8E	USB communication error	

(Note-1): Error codes will differ depending on the operating system software version.

	Error code Operating system software version "00F" or earlier "00G" or later		Name
2090	2948	8A	USB communication time-out error
2094	2952	8E	USB communication error

Table 1.19 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail

2321 2621 PB02 (advanced vibration suppression control) 2322 2622 PB03 For manufacturer setting 2323 2623 PB04 Feed forward gain 2324 2624 PB05 For manufacturer setting 2325 2625 PB06 Load mass ratio to the linear servo motor primary side (coil) 2326 2626 PB07 Model loop gain 2327 2627 PB08 Position loop gain 2328 2628 PB09 Speed loop gain 2329 2629 PB10 Speed differential compensation 2330 2630 PB11 Speed differential compensation 2331 2631 PB12 For manufacturer setting 2332 2632 PB13 Machine resonance suppression filter 1 2333 2633 PB14 Notch form selection 1 2334 2634 PB15 Machine resonance suppression filter 2 2335 2635 PB16 Notch form selection 2 2336 2636 PB17	Error	code	Parameter No.	Name
2303 2603 PA03 Absolute position detection system 2304 2604 PA04 Function selection A-1 2305 2605 PA06 PA06 2307 2607 PA07 PA07 2308 2608 PA08 Auto tuning mode 2309 2609 PA09 Auto tuning response 2310 2610 PA10 In-position range 2311 2611 PA11 PA12 2312 2612 PA12 For manufacturer setting 2313 2613 PA13 PA14 2314 2614 PA14 Moving direction selection 2315 2615 PA15 Encoder output pulse 2316 2616 PA16 Encoder output pulse 2 2317 2617 PA17 For manufacturer setting 2318 2618 PA18 For manufacturer setting 2321 2621 PB02 Vibration suppression control tuning mode (advanced vibration suppression control) 2322 2622 </td <td>2301</td> <td>2601</td> <td>PA01</td> <td>For manufacturer setting</td>	2301	2601	PA01	For manufacturer setting
2004 2604 PA04 Function selection A-1	2302	2602	PA02	Regenerative option
2305 2605 PA05 2306 2606 PA06 For manufacturer setting 2307 2607 PA07 For manufacturer setting 2308 2608 PA08 Auto tuning mode 2309 2609 PA09 Auto tuning response 2310 2610 PA10 In-position range 2311 2611 PA11 PA11 2312 2612 PA12 For manufacturer setting 2313 2613 PA13 PA13 2314 2614 PA14 Moving direction selection 2315 2615 PA15 Encoder output pulse 2316 2616 PA16 Encoder output pulse 2 2317 2617 PA17 For manufacturer setting 2320 2620 PB01 Adaptive tuning mode (adaptive filter II) 2321 2621 PB02 Vibration suppression control tuning mode (advanced vibration suppression control) 2322 2622 PB03 For manufacturer setting 2323 <td< td=""><td>2303</td><td>2603</td><td>PA03</td><td>Absolute position detection system</td></td<>	2303	2603	PA03	Absolute position detection system
2306 2606 PA06 For manufacturer setting 2307 2607 PA07 PA07 2308 2608 PA08 Auto tuning mode 2309 2609 PA09 Auto tuning response 2310 2610 PA10 In-position range 2311 2611 PA11 For manufacturer setting 2312 2612 PA12 For manufacturer setting 2313 2613 PA13 PA13 2314 2614 PA14 Moving direction selection 2315 2615 PA15 Encoder output pulse 2316 2616 PA16 Encoder output pulse 2 2317 2617 PA17 For manufacturer setting 2318 2618 PA18 Parameter write inhibit 2320 2620 PB01 Adaptive tuning mode (adaptive filter II) 2321 2621 PB02 Vibration suppression control tuning mode (advanced vibration suppression control) 2322 2622 PB03 For manufacturer setting	2304	2604	PA04	Function selection A-1
2307 2607 PA07 2308 2608 PA08 Auto tuning mode 2309 2609 PA09 Auto tuning response 2310 2610 PA10 In-position range 2311 2611 PA11 For manufacturer setting 2312 2612 PA12 For manufacturer setting 2313 2613 PA13 PA15 Encoder output pulse 2315 2616 PA16 Encoder output pulse PA17 2318 2618 PA18 PA18 PA18 2319 2619 PA19 Parameter write inhibit 2320 2620 PB01 Adaptive tuning mode (adaptive filter II) 2321 2621 PB02 Vibration suppression control tuning mode (advanced vibration suppression control) 2322 2622 PB03 For manufacturer setting 2323 2623 PB04 Feed forward gain 2324 2624 PB05 For manufacturer setting 2325 2625 PB06 For manu	2305	2605	PA05	
2308 2608 PA08 Auto tuning mode 2309 2609 PA09 Auto tuning response 2310 2610 PA10 In-position range 2311 2611 PA11 PA11 2312 2612 PA12 For manufacturer setting 2313 2613 PA13 PA14 2314 2614 PA14 Moving direction selection 2315 2615 PA15 Encoder output pulse 2316 2616 PA16 Encoder output pulse 2317 2617 PA17 PA17 2318 2618 PA18 Parameter write inhibit 2320 2620 PB01 Adaptive tuning mode (adaptive filter II) 2321 2621 PB02 Vibration suppression control tuning mode (advanced vibration suppression control) 2322 2622 PB03 For manufacturer setting 2323 2623 PB04 Feed forward gain 2324 2624 PB05 For manufacturer setting 2325	2306	2606	PA06	For manufacturer setting
2309 2609 PA09 Auto tuning response 2310 2610 PA10 In-position range 2311 2611 PA11 PA11 2312 2612 PA12 For manufacturer setting 2313 2613 PA13 PA13 2314 2614 PA14 Moving direction selection 2315 2615 PA15 Encoder output pulse 2316 2616 PA16 Encoder output pulse 2 2317 2617 PA17 2318 2618 PA18 2319 2619 PA19 Parameter write inhibit Adaptive tuning mode (adaptive filter II) 2321 2621 PB02 Vibration suppression control tuning mode (advanced vibration suppression control) (advanced vibration suppression control) 2322 2621 PB03 For manufacturer setting 2322 2622 PB03 For manufacturer setting 2323 2623 PB04 Feed forward gain 2325 2625 PB06 <td>2307</td> <td>2607</td> <td>PA07</td> <td></td>	2307	2607	PA07	
2310 2610 PA10 In-position range 2311 2611 PA11 PA11 2312 2612 PA12 For manufacturer setting 2313 2613 PA13 PA14 2314 2614 PA14 Moving direction selection 2315 2615 PA15 Encoder output pulse 2316 2616 PA16 Encoder output pulse 2 2317 2617 PA17 PA17 2318 2618 PA18 Parameter write inhibit 2320 2620 PB01 Adaptive tuning mode (adaptive filter II) 2321 2621 PB02 Vibration suppression control tuning mode (advanced vibration suppression control) 2322 2621 PB03 For manufacturer setting 2323 2623 PB04 Feed forward gain 2324 2624 PB05 For manufacturer setting 2325 2625 PB06 PB07 Model loop gain 2326 2626 PB07 Model loop gain	2308	2608	PA08	Auto tuning mode
2311 2611 PA11 2312 2612 PA12 For manufacturer setting 2313 2613 PA13 PA13 2314 2614 PA14 Moving direction selection 2315 2615 PA15 Encoder output pulse 2316 2616 PA16 Encoder output pulse 2 2317 2617 PA17 2318 2618 PA18 2319 2619 PA19 Parameter write inhibit Parameter write inhibit 2320 2620 PB01 Adaptive tuning mode (adaptive filter II) 2321 2621 PB02 Vibration suppression control tuning mode (advanced vibration suppression control) 2322 2621 PB03 For manufacturer setting 2323 2623 PB04 Feed forward gain 2324 2624 PB05 For manufacturer setting 2325 2625 PB06 PB07 Model loop gain 2326 2627 PB08 Position loop gain 2329 <td>2309</td> <td>2609</td> <td>PA09</td> <td>Auto tuning response</td>	2309	2609	PA09	Auto tuning response
2312 2612 PA12 For manufacturer setting 2313 2613 PA13 2314 2614 PA14 Moving direction selection 2315 2615 PA15 Encoder output pulse 2316 2616 PA16 Encoder output pulse 2317 2617 PA17 2318 2618 PA18 For manufacturer setting 2319 2619 PA19 Parameter write inhibit 2320 2620 PB01 Adaptive tuning mode (adaptive filter II) 2321 2621 PB02 Vibration suppression control tuning mode (advanced vibration suppression control) 2322 2622 PB03 For manufacturer setting 2323 2623 PB04 Feed forward gain 2324 2624 PB05 For manufacturer setting 2325 2625 PB06 Load mass ratio to the linear servo motor primary side (coil) 2327 2627 PB08 Position loop gain 2328 2629 PB10 Speed loop gain	2310	2610	PA10	In-position range
2313 2613 PA13 2314 2614 PA14 Moving direction selection 2315 2615 PA15 Encoder output pulse 2316 2616 PA16 Encoder output pulse 2 2317 2617 PA17 2318 2618 PA18 For manufacturer setting 2319 2619 PA19 Parameter write inhibit 2320 2620 PB01 Adaptive tuning mode (adaptive filter II) 2321 2621 PB02 Vibration suppression control tuning mode (advanced vibration suppression control) 2322 2622 PB03 For manufacturer setting 2323 2623 PB04 Feed forward gain 2324 2624 PB05 For manufacturer setting 2325 2625 PB06 Load mass ratio to the linear servo motor primary side (coil) 2326 2626 PB07 Model loop gain 2327 2627 PB08 Position loop gain 2328 2628 PB09 Speed loop gain <td< td=""><td>2311</td><td>2611</td><td>PA11</td><td></td></td<>	2311	2611	PA11	
2314 2614 PA14 Moving direction selection 2315 2615 PA15 Encoder output pulse 2316 2616 PA16 Encoder output pulse 2 2317 2617 PA17 2318 2618 PA18 2319 2619 PA19 Parameter write inhibit 2320 2620 PB01 Adaptive tuning mode (adaptive filter II) 2321 2621 PB02 Vibration suppression control tuning mode (advanced vibration suppression control) 2322 2622 PB03 For manufacturer setting 2323 2623 PB04 Feed forward gain 2324 2624 PB05 For manufacturer setting 2325 2625 PB06 Load mass ratio to the linear servo motor primary side (coil) 2326 2626 PB07 Model loop gain 2327 2627 PB08 Position loop gain 2328 2628 PB09 Speed loop gain 2330 2630 PB11 Speed differential compensation	2312	2612	PA12	For manufacturer setting
2315 2615 PA15 Encoder output pulse 2316 2616 PA16 Encoder output pulse 2 2317 2617 PA17 2318 2618 PA18 For manufacturer setting 2319 2619 PA19 Parameter write inhibit 2320 2620 PB01 Adaptive tuning mode (adaptive filter II) 2321 2621 PB02 Vibration suppression control tuning mode (advanced vibration suppression control) 2322 2622 PB03 For manufacturer setting 2323 2623 PB04 Feed forward gain 2324 2624 PB05 For manufacturer setting 2325 2625 PB06 Load mass ratio to the linear servo motor primary side (coil) 2326 2626 PB07 Model loop gain 2327 2627 PB08 Position loop gain 2328 2629 PB10 Speed loop gain 2330 2630 PB11 Speed differential compensation 2331 2631 PB12 For manufactu	2313	2613	PA13	
2316 2616 PA16 Encoder output pulse 2 2317 2617 PA17 2318 2618 PA18 2319 2619 PA19 Parameter write inhibit 2320 2620 PB01 Adaptive tuning mode (adaptive filter II) 2321 2621 PB02 Vibration suppression control tuning mode (advanced vibration suppression control) 2322 2622 PB03 For manufacturer setting 2323 2623 PB04 Feed forward gain 2324 2624 PB05 For manufacturer setting 2325 2625 PB06 For manufacturer setting 2326 2626 PB07 Model loop gain 2327 2627 PB08 Position loop gain 2328 2628 PB09 Speed loop gain 2329 2629 PB10 Speed differential compensation 2331 2631 PB12 For manufacturer setting 2332 2632 PB13 Machine resonance suppression filter 1 2333	2314	2614	PA14	Moving direction selection
2317 2617 PA18 For manufacturer setting 2318 2618 PA18 For manufacturer setting 2319 2619 PA19 Parameter write inhibit 2320 2620 PB01 Adaptive tuning mode (adaptive filter II) 2321 2621 PB02 Vibration suppression control tuning mode (advanced vibration suppression control) 2322 2622 PB03 For manufacturer setting 2323 2623 PB04 Feed forward gain 2324 2624 PB05 For manufacturer setting 2325 2625 PB06 Load mass ratio to the linear servo motor primary side (coil) 2326 2626 PB07 Model loop gain 2327 2627 PB08 Position loop gain 2328 2628 PB09 Speed loop gain 2329 2629 PB10 Speed differential compensation 2331 2631 PB12 For manufacturer setting 2332 2632 PB13 Machine resonance suppression filter 1 2334	2315	2615	PA15	Encoder output pulse
2318 2618 PA18 PA19 Parameter write inhibit	2316	2616	PA16	Encoder output pulse 2
2318 2618 PA18 2319 2619 PA19 Parameter write inhibit 2320 2620 PB01 Adaptive tuning mode (adaptive filter II) 2321 2621 PB02 Vibration suppression control tuning mode (advanced vibration suppression control) 2322 2622 PB03 For manufacturer setting 2323 2623 PB04 Feed forward gain 2324 2624 PB05 For manufacturer setting 2325 2625 PB06 Load mass ratio to the linear servo motor primary side (coil) 2326 2626 PB07 Model loop gain 2327 2627 PB08 Position loop gain 2328 2628 PB09 Speed loop gain 2329 2629 PB10 Speed integral compensation 2330 2630 PB11 Speed differential compensation 2331 2631 PB12 For manufacturer setting 2332 2632 PB13 Machine resonance suppression filter 1 2334 2634 PB15	2317	2617	PA17	For manufacturar sotting
2320 2620 PB01 Adaptive tuning mode (adaptive filter II) 2321 2621 PB02 Vibration suppression control tuning mode (advanced vibration suppression control) 2322 2622 PB03 For manufacturer setting 2323 2623 PB04 Feed forward gain 2324 2624 PB05 For manufacturer setting 2325 2625 PB06 Load mass ratio to the linear servo motor primary side (coil) 2326 2626 PB07 Model loop gain 2327 2627 PB08 Position loop gain 2328 2628 PB09 Speed loop gain 2329 2629 PB10 Speed integral compensation 2330 2630 PB11 Speed differential compensation 2331 2631 PB12 For manufacturer setting 2332 2632 PB13 Machine resonance suppression filter 1 2333 2633 PB14 Notch form selection 1 2334 2634 PB15 Machine resonance suppression filter 2 2	2318	2618	PA18	For manufacturer setting
Vibration suppression control tuning mode (advanced vibration suppression control) 2322 2622	2319	2619	PA19	Parameter write inhibit
2321 2621 PB02 (advanced vibration suppression control) 2322 2622 PB03 For manufacturer setting 2323 2623 PB04 Feed forward gain 2324 2624 PB05 For manufacturer setting 2325 2625 PB06 Load mass ratio to the linear servo motor primary side (coil) 2326 2626 PB07 Model loop gain 2327 2627 PB08 Position loop gain 2328 2628 PB09 Speed loop gain 2329 2629 PB10 Speed differential compensation 2330 2630 PB11 Speed differential compensation 2331 2631 PB12 For manufacturer setting 2332 2632 PB13 Machine resonance suppression filter 1 2333 2633 PB14 Notch form selection 1 2334 2634 PB15 Machine resonance suppression filter 2 2335 2635 PB16 Notch form selection 2 2336 2636 PB17	2320	2620	PB01	Adaptive tuning mode (adaptive filter II)
2323 2623 PB04 Feed forward gain 2324 2624 PB05 For manufacturer setting 2325 2625 PB06 Load mass ratio to the linear servo motor primary side (coil) 2326 2626 PB07 Model loop gain 2327 2627 PB08 Position loop gain 2328 2628 PB09 Speed loop gain 2329 2629 PB10 Speed integral compensation 2330 2630 PB11 Speed differential compensation 2331 2631 PB12 For manufacturer setting 2332 2632 PB13 Machine resonance suppression filter 1 2333 2633 PB14 Notch form selection 1 2334 2634 PB15 Machine resonance suppression filter 2 2335 2635 PB16 Notch form selection 2 2336 2636 PB17 Automatic setting parameter 2337 2637 PB18 Low-pass filter setting Vibration suppression control vibration frequency setting <td>2321</td> <td>2621</td> <td>PB02</td> <td>Vibration suppression control tuning mode (advanced vibration suppression control)</td>	2321	2621	PB02	Vibration suppression control tuning mode (advanced vibration suppression control)
2324 2624 PB05 For manufacturer setting 2325 2625 PB06 Load mass ratio to the linear servo motor primary side (coil) 2326 2626 PB07 Model loop gain 2327 2627 PB08 Position loop gain 2328 2628 PB09 Speed loop gain 2329 2629 PB10 Speed integral compensation 2330 2630 PB11 Speed differential compensation 2331 2631 PB12 For manufacturer setting 2332 2632 PB13 Machine resonance suppression filter 1 2333 2633 PB14 Notch form selection 1 2334 2634 PB15 Machine resonance suppression filter 2 2335 2635 PB16 Notch form selection 2 2336 2636 PB17 Automatic setting parameter 2337 2637 PB18 Low-pass filter setting Vibration suppression control vibration frequency setting Vibration suppression control resonance	2322	2622	PB03	For manufacturer setting
2325 2625 PB06 Load mass ratio to the linear servo motor primary side (coil) 2326 2626 PB07 Model loop gain 2327 2627 PB08 Position loop gain 2328 2628 PB09 Speed loop gain 2329 2629 PB10 Speed integral compensation 2330 2630 PB11 Speed differential compensation 2331 2631 PB12 For manufacturer setting 2332 2632 PB13 Machine resonance suppression filter 1 2333 2633 PB14 Notch form selection 1 2334 2634 PB15 Machine resonance suppression filter 2 2335 2635 PB16 Notch form selection 2 2336 2636 PB17 Automatic setting parameter 2337 2637 PB18 Low-pass filter setting Vibration suppression control vibration frequency setting Vibration suppression control vibration frequency setting	2323	2623	PB04	Feed forward gain
2325 2625 PB06 primary side (coil) 2326 2626 PB07 Model loop gain 2327 2627 PB08 Position loop gain 2328 2628 PB09 Speed loop gain 2330 2630 PB10 Speed integral compensation 2331 2631 PB12 For manufacturer setting 2332 2632 PB13 Machine resonance suppression filter 1 2333 2633 PB14 Notch form selection 1 2334 2634 PB15 Machine resonance suppression filter 2 2335 2635 PB16 Notch form selection 2 2336 2636 PB17 Automatic setting parameter 2337 2637 PB18 Low-pass filter setting Vibration suppression control vibration frequency setting Vibration suppression control vibration frequency setting	2324	2624	PB05	For manufacturer setting
2327 2627 PB08 Position loop gain 2328 2628 PB09 Speed loop gain 2329 2629 PB10 Speed integral compensation 2330 2630 PB11 Speed differential compensation 2331 2631 PB12 For manufacturer setting 2332 2632 PB13 Machine resonance suppression filter 1 2333 2633 PB14 Notch form selection 1 2334 2634 PB15 Machine resonance suppression filter 2 2335 2635 PB16 Notch form selection 2 2336 2636 PB17 Automatic setting parameter 2337 2637 PB18 Low-pass filter setting Vibration suppression control vibration frequency setting Vibration suppression control vibration frequency setting	2325	2625	PB06	
2328 2628 PB09 Speed loop gain 2329 2629 PB10 Speed integral compensation 2330 2630 PB11 Speed differential compensation 2331 2631 PB12 For manufacturer setting 2332 2632 PB13 Machine resonance suppression filter 1 2333 2633 PB14 Notch form selection 1 2334 2634 PB15 Machine resonance suppression filter 2 2335 2635 PB16 Notch form selection 2 2336 2636 PB17 Automatic setting parameter 2337 2637 PB18 Low-pass filter setting 2338 2638 PB19 Vibration suppression control vibration frequency setting	2326	2626	PB07	Model loop gain
2329 2629 PB10 Speed integral compensation 2330 2630 PB11 Speed differential compensation 2331 2631 PB12 For manufacturer setting 2332 2632 PB13 Machine resonance suppression filter 1 2333 2633 PB14 Notch form selection 1 2334 2634 PB15 Machine resonance suppression filter 2 2335 2635 PB16 Notch form selection 2 2336 2636 PB17 Automatic setting parameter 2337 2637 PB18 Low-pass filter setting 2338 2638 PB19 Vibration suppression control vibration frequency setting	2327	2627	PB08	Position loop gain
2330 2630 PB11 Speed differential compensation 2331 2631 PB12 For manufacturer setting 2332 2632 PB13 Machine resonance suppression filter 1 2333 2633 PB14 Notch form selection 1 2334 2634 PB15 Machine resonance suppression filter 2 2335 2635 PB16 Notch form selection 2 2336 2636 PB17 Automatic setting parameter 2337 2637 PB18 Low-pass filter setting Vibration suppression control vibration frequency setting Vibration suppression control vibration control vibration frequency setting	2328	2628	PB09	Speed loop gain
2331 2631 PB12 For manufacturer setting 2332 2632 PB13 Machine resonance suppression filter 1 2333 2633 PB14 Notch form selection 1 2334 2634 PB15 Machine resonance suppression filter 2 2335 2635 PB16 Notch form selection 2 2336 2636 PB17 Automatic setting parameter 2337 2637 PB18 Low-pass filter setting 2338 2638 PB19 Vibration suppression control vibration frequency setting Vibration suppression control resonance Vibration suppression control resonance	2329	2629	PB10	Speed integral compensation
2332 2632 PB13 Machine resonance suppression filter 1 2333 2633 PB14 Notch form selection 1 2334 2634 PB15 Machine resonance suppression filter 2 2335 2635 PB16 Notch form selection 2 2336 2636 PB17 Automatic setting parameter 2337 2637 PB18 Low-pass filter setting 2338 2638 PB19 Vibration suppression control vibration frequency setting Vibration suppression control resonance	2330	2630	PB11	Speed differential compensation
2333 2633 PB14 Notch form selection 1 2334 2634 PB15 Machine resonance suppression filter 2 2335 2635 PB16 Notch form selection 2 2336 2636 PB17 Automatic setting parameter 2337 2637 PB18 Low-pass filter setting 2338 2638 PB19 Vibration suppression control vibration frequency setting Vibration suppression control resonance	2331	2631	PB12	For manufacturer setting
2334 2634 PB15 Machine resonance suppression filter 2 2335 2635 PB16 Notch form selection 2 2336 2636 PB17 Automatic setting parameter 2337 2637 PB18 Low-pass filter setting 2338 2638 PB19 Vibration suppression control vibration frequency setting	2332	2632	PB13	Machine resonance suppression filter 1
2335 2635 PB16 Notch form selection 2 2336 2636 PB17 Automatic setting parameter 2337 2637 PB18 Low-pass filter setting 2338 2638 PB19 Vibration suppression control vibration frequency setting 2338 Vibration suppression control resonance	2333	2633	PB14	Notch form selection 1
2336 2636 PB17 Automatic setting parameter 2337 2637 PB18 Low-pass filter setting 2338 2638 PB19 Vibration suppression control vibration frequency setting Vibration suppression control resonance	2334	2634	PB15	Machine resonance suppression filter 2
2337 2637 PB18 Low-pass filter setting 2338 2638 PB19 Vibration suppression control vibration frequency setting Vibration suppression control resonance	2335	2635	PB16	Notch form selection 2
2338 2638 PB19 Vibration suppression control vibration frequency setting Vibration suppression control resonance	2336	2636	PB17	Automatic setting parameter
2338 2638 PB19 frequency setting Vibration suppression control resonance	2337	2637	PB18	Low-pass filter setting
Vibration suppression control resonance	2338	2638	PB19	
2339 2639 PB20 frequency setting	2339	2639	PB20	
2340 2640 PB21 For manufacturer setting	2340	2640	PB21	

Error	code	Parameter No.	Name
2341	2641	PB22	For manufacturer setting
2342	2642	PB23	Low-pass filter selection
2343	2643	PB24	Slight vibration suppression control selection
2344	2644	PB25	For manufacturer setting
2345	2645	PB26	Gain changing selection
2346	2646	PB27	Gain changing condition
2347	2647	PB28	Gain changing time constant
2348	2648	PB29	Gain load mass ratio to the linear servo motor primary side (coil)
2349	2649	PB30	Gain changing position loop gain
2350	2650	PB31	Gain changing speed loop gain
			Gain changing speed integral
2351	2651	PB32	compensation
00=5	00=0	DD	Gain changing vibration suppression
2352	2652	PB33	control vibration frequency setting
00=0	0050	550	Gain changing vibration suppression
2353	2653	PB34	control resonance frequency setting
2354	2654	PB35	
2355	2655	PB36	
2356	2656	PB37	
2357	2657	PB38	
2358	2658	PB39	
2359	2659	PB40	For manufacturer setting
2360	2660	PB41	3
2361	2661	PB42	
2362	2662	PB43	
2363	2663	PB44	
2364	2664	PB45	Vibration suppression control filter 2
2365	2665	PC01	Error excessive alarm level
2366	2666	PC02	Electromagnetic brake sequence output
2367	2667	PC03	Encoder output pulse selection
2368	2668	PC04	
2369	2669	PC05	For manufacturer setting
	2670	PC06	To mandadare setting
2371	2671	PC07	Zero speed
2372	2672	PC08	For manufacturer setting
2373	2673	PC09	Analog monitor 1 output
2374	2674	PC10	Analog monitor 2 output
2375	2675	PC10 PC11	Analog monitor 1 offset
2376	2676	PC12	Analog monitor 2 offset
2377	2677	PC12 PC13	r tidlog Monitor 2 0036t
2378	2678	PC13	
2379	2679	PC15	For manufacturer setting
2380	2680	PC16	

Table 1.19 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail (Continued)

Error	code	Parameter No.	Name
2381	2681	PC17	Function selection C-4
2382	2682	PC18	
2383	2683	PC19	For manufacturer setting
2384	2684	PC20	
2385	2685	PC21	Alarm history clear
2386	2686	PC22	
2387	2687	PC23	F
2388	2688	PC24	For manufacturer setting
2389	2689	PC25	
2390	2690	PC26	Function selection C-8
2391	2691	PC27	Function selection C-9
2392	2692	PC28	
2393	2693	PC29	
2394	2694	PC30	E
2395	2695	PC31	For manufacturer setting
2396	2696	PC32	
2397		PD01	
2398	2698	PD02	Input signal automatic ON selection
2399	2699	PD03	
2400	2700	PD04	
2401	2701	PD05	For manufacturer setting
2402	2702	PD06	
2403	2703	PD07	Output signal device selection 1 (CN3-13)
2404	2704	PD08	Output signal device selection 2 (CN3-9)
2405	2705	PD09	Output signal device selection 3 (CN3-15)
2406	2706	PD10	For manufacturer setting
2407	2707	PD11	Input filter setting
2408	2708	PD12	
2409	2709	PD13	For manufacturer setting
2410	2710	PD14	Function selection D-3
2411	2711	PD15	
2412	2712	PD16	
	2713	PD17	
		PD18	
2415	2715	PD19	
2416	2716	PD20	
2417	2717	PD21	
2418	2718	PD22	
2419	2719	PD23	For manufacturar action
2420	2720	PD24	For manufacturer setting
2421	2721	PD25	
2422	2722	PD26	
2423	2723	PD27	
2424	2724	PD28	
2425	2725	PD29	
2426	2726	PD30	

		Parameter	2899) error detail (Continued)	
Error	code	No.	Name	
2427	2727	PD31		
2428	2728	PD32		
2429	2729	PE01		
2430	2730	PE02		
2431	2731	PE03		
2432	2732	PE04		
2433	2733	PE05		
2434	2734	PE06		
2435	2735	PE07		
2436	2736	PE08		
2437	2737	PE09		
2438	2738	PE10		
2439	2739	PE11		
2440	2740	PE12	For manufacturer setting	
2441	2741	PE13		
2442	2742	PE14		
2443	2743	PE15		
2444	2744	PE16		
2445	2745	PE17		
2446	2746	PE18		
2447	2747	PE19		
2448	2748	PE20		
2449	2749	PE21		
2450	2750	PE22		
2451	2751	PE23		
2452	2752	PE24		
2453	2753	PE25		
2454	2754	PE26	Filter coefficient 2-1	
2455	2755	PE27	Filter coefficient 2-2	
2456	2756	PE28	Filter coefficient 2-3	
2457	2757	PE29	Filter coefficient 2-4	
2458	2758	PE30	Filter coefficient 2-5	
2459	2759	PE31	Filter coefficient 2-6	
2460	2760	PE32	Filter coefficient 2-7	
2461	2761	PE33	Filter coefficient 2-8	
2462	2762	PE34		
2463	2763	PE35		
2464	2764	PE36		
2465	2765	PE37	For manufacturer setting	
2466	2766	PE38		
2467	2767	PE39		
2468	2768	PE40		
2501	2801	PS01	Linear function selection 1	
2502	2802	PS02	Linear encoder resolution setting	
	2002	2002	· - 	Numerator
2503	2803	2803	PS03	Linear encoder resolution setting
0504	0004	D00.1	Denominator	
2504	2804	PS04	Linear function selection 2	

Table 1.19 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail (Continued)

Error	code	Parameter No.	Name
2505	2805	PS05	Linear servo motor control position deviation error detection level
2506	2806	PS06	Linear servo motor control speed deviation error detection level
2507	2807	PS07	Linear servo motor control thrust deviation error detection level
2508	2808	PS08	Linear function selection 3
2509	2809	PS09	Magnetic pole detection voltage level
2510	2810	PS10	At magnetic pole detection current detection method Identification signal frequency
2511	2811	PS11	At magnetic pole detection current detection method Identification signal amplitude
2512	2812	PS12	
2513	2813	PS13	
2514	2814	PS14	
2515	2815	PS15	For manufacturer setting
2516	2816	PS16	
2517	2817	PS17	
2518	2818	PS18	

Error	code	Parameter No.	Name
2519	2819	PS19	
2520	2820	PS20	
2521	2821	PS21	
2522	2822	PS22	
2523	2823	PS23	
2524	2824	PS24	For manufacturer setting
2525	2825	PS25	
2526	2826	PS26	
2527	2827	PS27	
2528	2828	PS28	
2529	2829	PS29	
2530	2830	PS30	
2531	2831	PS31	
2532	2832	PS32	

(f) MR-J3-□B-RJ006 (For fully closed control)

Table 1.20 Servo error (2000 to 2999) list (MR-J3-□B-RJ006)

Error code	Servo amplifier LED display	Name	Remarks
2010	10	Undervoltage	
2012	12	Memory error 1 (RAM)	
2013	13	Clock error	
2015	15	Memory error 2 (EEP-ROM)	
2016	16	Encoder error 1 (At power on)	
2017	17	Board error	
2019	19	Memory error 3 (Flash ROM)	
2020	20	Encoder error 2 (During runtime)	
2021	21	Encoder error 3 (During runtime)	
2024	24	Main circuit error	
2028	28	Linear encoder error 2	
2030	30	Regenerative error	
2031	31	Overspeed	
2032	32	Overcurrent	
2033	33	Overvoltage	
2034	34	Receive error 1	
2035	35	Command frequency alarm	
2036	36	Receive error 2	
2042	42	Fully closed control error detection	
2045	45	Main circuit device overheat	
2046	46	Servo motor overheat	
2047	47	Cooling fan alarm	
2050	50	Overload 1	
2051	51	Overload 2	
2052	52	Error excessive	
2060	1A	Motor combination error	
2061	2A	Linear encoder error 1	
2070	70	Load side encoder error 1	
2071	71	Load side encoder error 2	
2088	888	Watchdog	
2106	96	Home position setting error	
2140	E0	Excessive regeneration warning	
2141	E1	Overload warning 1	
2146	E6	Servo forced stop warning	
2147	E7	Controller emergency stop warning	
2148	E8	Cooling fan speed reduction warning	
2149	E9	Main circuit off warning	
2152	EC	Overload warning 2	
2153	ED	Output watt excess warning	
2301 to 2599	E4	Parameter warning (Refer to the table 1.21)	
2601 to 2899	37	Parameter error (Refer to the table 1.21)	

Table 1.20 Servo error (2000 to 2999) list (MR-J3-□B-RJ006) (Continued)

Error code	Servo amplifier LED display	Name	Remarks
2948 ^(Note-1)	8A	USB communication time-out error	
2952 ^(Note-1)	8E	USB communication error	

(Note-1): Error codes will differ depending on the operating system software version.

Error code Operating system software version "00F" or earlier "00G" or later		Servo amplifier LED display	Name
2090	2948	8A	USB communication time-out error
2094	2952	8E	USB communication error

Table 1.21 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail

Error code		Parameter No.	Name	
2301	2601	PA01	Control mode	
2302	2602	PA02	Regenerative option	
2303	2603	PA03	Absolute position detection system	
2304	2604	PA04	Function selection A-1	
2305	2605	PA05		
2306	2606	PA06	For manufacturer setting	
2307	2607	PA07		
2308	2608	PA08	Auto tuning mode	
2309	2609	PA09	Auto tuning response	
2310	2610	PA10	In-position range	
2311	2611	PA11		
2312	2612	PA12	For manufacturer setting	
2313	2613	PA13		
2314	2614	PA14	Rotation direction selection	
2315	2615	PA15	Encoder output pulse	
2316	2616	PA16	Encoder output pulse 2	
2317	2617	PA17		
2318	2618	PA18	For manufacturer setting	
2319	2619	PA19	Parameter write inhibit	
2320	2620	PB01	Adaptive tuning mode (adaptive filter II)	
2321	2621	PB02	Vibration suppression control tuning mode (advanced vibration suppression control)	
2322	2622	PB03	For manufacturer setting	
2323	2623	PB04	Feed forward gain	
2324	2624	PB05	For manufacturer setting	
2325	2625	PB06	Ratio of load inertia moment to servo motor inertia moment	
2326	2626	PB07	Model loop gain	
2327	2627	PB08	Position loop gain	
2328	2628	PB09	Speed loop gain	
2329	2629	PB10	Speed integral compensation	
2330	2630	PB11	Speed differential compensation	
2331	2631	PB12	Overshoot amount compensation	
2332	2632	PB13	Machine resonance suppression filter 1	
2333	2633	PB14	Notch shape selection 1	
2334	2634	PB15	Machine resonance suppression filter 2	
2335	2635	PB16	Notch shape selection 2	
2336	2636	PB17	Automatic setting parameter	
2337	2637	PB18	Low-pass filter setting	
2338	2638	PB19	Vibration suppression control vibration frequency setting	
2339	2639	PB20	Vibration suppression control resonance frequency setting	
2340	2640	PB21	For manufacturer setting	

Error	code	Parameter No.	Name		
2341	2641	PB22	For manufacturer setting		
2342	2642	PB23	Low-pass filter selection		
2343	2643	PB24	Slight vibration suppression control selection		
2344	2644	PB25	For manufacturer setting		
2345	2645	PB26	Gain changing selection		
2346	2646	PB27	Gain changing condition		
2347	2647	PB28	Gain changing time constant		
2348	2648	PB29	Gain changing ratio of load inertia moment to servo motor inertia moment		
2349	2649	PB30	Gain changing position loop gain		
2350	2650	PB31	Gain changing speed loop gain		
2351	2651	PB32	Gain changing speed integral compensation		
2352	2652	PB33	Gain changing vibration suppression control vibration frequency setting		
2353	2653	PB34	Gain changing vibration suppression control resonance frequency setting		
2354	2654	PB35	. , ,		
2355	2655	PB36			
2356	2656	PB37			
2357	2657	PB38			
2358	2658	PB39			
2359	2659	PB40	For manufacturer setting		
2360	2660	PB41	• • • • • • • • • • • • • • • • • • •		
2361	2661	PB42			
2362	2662	PB43			
2363	2663	PB44			
2364	2664	PB45	Vibration suppression control filter 2		
2365	2665	PC01	Error excessive alarm level		
2366	2666	PC02	Electromagnetic brake sequence output		
2367	2667	PC03	Encoder output pulse selection		
2368	2668	PC04	Function selection C-1		
2369	2669	PC05	Function selection C-2		
2370	2670	PC06	Function selection C-3		
2371	2671	PC07	Zero speed		
2372	2672	PC08	For manufacturer setting		
2373	2673	PC09	Analog monitor 1 output		
2374	2674	PC10	Analog monitor 2 output		
2375	2675	PC11	Analog monitor 1 offset		
2376	2676	PC12	Analog monitor 2 offset		
2377	2677	PC13			
2378	2678	PC14	For manufacturer setting		
2379	2679	PC15	,		
2380	2680	PC16	Function selection C-3A		

Table 1.21 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail (Continued)

			<u> </u>		
Error	code	Parameter No.	Name	Error	coc
2381	2681	PC17	Function selection C-4	2425	27
2382	2682	PC18		2426	27
2383	2683	PC19	For manufacturer setting	2427	27
2384	2684	PC20	Function selection C-7	2428	27
2385	2685	PC21	Alarm history clear	2429	27
2386	2686	PC22		2430	27
2387	2687	PC23		2431	27
2388	2688	PC24	For manufacturer setting	2432	27
2389	2689	PC25		2433	27
2390	2690	PC26	Function selection C-8	2434	27
2391	2691	PC27	Function selection C-9	2435	27
2392	2692	PC28		2436	27
2393	2693	PC29		2437	27
2394	2694	PC30		2438	27
2395	2695	PC31		2439	27
2396	2696	PC32		2440	27
2397	2697	PD01	For manufacturer setting	2441	27
2398	2698	PD02		2442	27
2399	2699	PD03		2443	27
2400	2700	PD04		2444	27
2401	2701	PD05		2445	27
2402	2702	PD06		2446	27
2403	2703	PD07	Output signal device selection 1 (CN3-13)	2447	27
2404	2704	PD08	Output signal device selection 2 (CN3-9)	2448	27
2405	2705	PD09	Output signal device selection 3 (CN3-15)	2449	27
2406	2706	PD10	For manufacturer setting	2450	27
2407	2707	PD11	Input filter setting	2451	27
2408	2708	PD12		2452	27
2409	2709	PD13	For manufacturer setting	2453	27
2410	2710	PD14	Function selection D-3	2454	27
2411	2711	PD15		2455	27
2412	2712	PD16		2456	27
2413	2713	PD17		2457	27
2414	2714	PD18		2458	27
2415	2715	PD19		2459	27
2416	2716	PD20		2460	27
2417	2717	PD21		2461	27
2418	2718	PD22	For manufacturer setting	2462	27
2419	2719	PD23		2463	27
2420	2720	PD24		2464	27
2421	2721	PD25		2465	27
2422	2722	PD26		2466	27
2423	2723	PD27		2467	27
2424	2724	PD28		2468	27

Error	code	Parameter No.	Name
2425	2725	PD29	
2426	2726	PD30	
2427	2727	PD31	For manufacturer setting
	2728	PD32	
	2729	PE01	Fully closed loop selection 1
2430	2730	PE02	For manufacturer setting
2431	2731	PE03	Fully closed loop selection 2
			Fully closed loop feedback pulse
2432	2732	PE04	electronic 1 gear numerator
0.400	.=	5505	Fully closed loop feedback pulse
2433	2733	PE05	electronic gear 1 denominator
0404	0704	DEOC	Fully closed loop control speed deviation
2434	2734	PE06	error detection level
2435	2735	PE07	Fully closed loop control position deviation
2435	2735	PEU/	error detection level
2436	2736	PE08	Fully closed loop dual feedback filter
2437	2737	PE09	For manufacturer setting
2438	2738	PE10	Fully closed loop selection 3
2439	2739	PE11	
2440	2740	PE12	
2441	2741	PE13	
2442	2742	PE14	
2443	2743	PE15	
2444	2744	PE16	
2445	2745	PE17	
2446	2746	PE18	For manufacturer setting
2447	2747	PE19	
2448	2748	PE20	
2449	2749	PE21	
2450	2750	PE22	
2451	2751	PE23	
2452	2752	PE24	
2453	2753	PE25	
2454	2754	PE26	Filter coefficient 2-1
2455	2755	PE27	Filter coefficient 2-2
2456	2756	PE28	Filter coefficient 2-3
2457	2757	PE29	Filter coefficient 2-4
2458	2758	PE30	Filter coefficient 2-5
2459	2759	PE31	Filter coefficient 2-6
2460	2760	PE32	Filter coefficient 2-7
2461	2761	PE33	Filter coefficient 2-8
2462	2762	DE24	Fully closed loop feedback pulse
2402	2462 2762	2762 PE34	electronic gear 2 numerator
2463	2463 2763	PE35	Fully closed loop feedback pulse
2403	2103	1 E33	electronic gear 2 denominator
2464	2764	PE36	
2465	2765	PE37	
2466	2766	PE38	For manufacturer setting
2467	2767	PE39	
2468	2768	PE40	

(g) MR-J3-DB-RJ080W (For direct drive motor)

Table 1.22 Servo error (2000 to 2999) list (MR-J3-□B-RJ080W)

Error code	Servo amplifier LED display	Name	Remarks	
2010	10	Undervoltage		
2012	12	Memory error 1 (RAM)		
2012	13	Clock error		
2015	15	Memory error 2 (EEP-ROM)		
2016	16	Encoder error 1		
2017	17	Board error		
2019	19	Memory error 3 (Flash ROM)		
2020	20	Encoder error 2		
2021	21	Encoder error 3		
2024	24	Main circuit error		
2025	25	Absolute position erase		
2027	27	Initial magnetic pole detection error		
2030	30	Regenerative error		
2031	31	Overspeed		
2032	32	Overcurrent		
2033	33	Overvoltage		
2034	34	Receive error 1		
2035	35	Command frequency alarm		
2036	36	Receive error 2		
2042	42	Servo control error		
2045	45	Main circuit device overheat		
2046	46	Direct drive motor overheat		
2047	47	Cooling fan alarm		
2050	50	Overload 1		
2051	51	Overload 2		
2052	52	Error excessive		
2060	1A	Motor combination error		
2064 ^(Note-1)	1F	Encoder combination error		
2088	888	Watchdog		
2102	92	Battery cable disconnection warning		
2106	96	Home position setting error		
2116	9F	Battery warning		
2140	E0	Excessive regeneration warning		
2141	E1	Overload warning 1		
2142	E2	Direct drive motor overheat warning		
2143	E3	Absolute position counter warning		
2146	E6	Servo forced stop warning		
2147	E7	Controller emergency stop warning		
2148	E8	Cooling fan speed reduction warning		
2149	E9	Main circuit off warning		
2152	EC	Overload warning 2		
2153	ED	Output watt excess warning		

(Note-1): Error codes will differ depending on the operating system software version.

		0 ,		
Error	code	0 1:5		
Operating system	software version	Servo amplifier LED display	Name	
"00F" or earlier	"00F" or earlier "00G" or later			
2025	2064	1F	Encoder combination error	

Table 1.22 Servo error (2000 to 2999) list (MR-J3-□B-RJ080W) (Continued)

Error code	Servo amplifier LED display	Name	Remarks
2301 to 2599	E4	Parameter warning (Refer to the table 1.23)	
2601 to 2899	37	Parameter error (Refer to the table 1.23)	
2913 ^(Note-1)	2B	Encoder counter error	
2948 ^(Note-1)	8A	USB communication time-out error	
2952 ^(Note-1)	8E	USB communication error	

(Note-1): Error codes will differ depending on the operating system software version.

	code n software version	Servo amplifier	Name	
"00F" or earlier "00G" or later		LED display		
2031	2913	2B	Encoder counter error	
2090	2948	8A	USB communication time-out error	
2094	2952	8E	USB communication error	

Table 1.23 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail

Error	code	Parameter No.	Name
2301	2601	PA01	For manufacturer setting
2302	2602	PA02	Regenerative option
2303	2603	PA03	Absolute position detection system
2304	2604	PA04	Function selection A-1
2305	2605	PA05	
2306	2606	PA06	For manufacturer setting
2307	2607	PA07	
2308	2608	PA08	Auto tuning mode
2309	2609	PA09	Auto tuning response
2310	2610	PA10	In-position range
2311	2611	PA11	· · · · · · · · · · · · · · · · · · ·
2312	2612	PA12	For manufacturer setting
2313	2613	PA13	Ů
2314	2614	PA14	Rotation direction selection
2315	2615	PA15	Encoder output pulse
2316	2616	PA16	
2317	2617	PA17	For manufacturer setting
2318	2618	PA18	
2319	2619	PA19	Parameter write inhibit
2320	2620	PB01	Adaptive tuning mode (adaptive filter II)
2321	2621	PB02	Vibration suppression control tuning mode (advanced vibration suppression control)
2322	2622	PB03	For manufacturer setting
2323	2623	PB04	Feed forward gain
2324	2624	PB05	For manufacturer setting
2325	2625	PB06	Ratio of load inertia moment to direct drive motor inertia moment
2326	2626	PB07	Model loop gain
2327	2627	PB08	Position loop gain
2328	2628	PB09	Speed loop gain
2329	2629	PB10	Speed integral compensation
2330	2630	PB11	Speed differential compensation
2331	2631	PB12	For manufacturer setting
2332	2632	PB13	Machine resonance suppression filter 1
2333	2633	PB14	Notch shape selection 1
2334	2634	PB15	Machine resonance suppression filter 2
2335	2635	PB16	Notch shape selection 2
2336	2636	PB17	Automatic setting parameter
2337	2637	PB18	Low-pass filter setting
2338	2638	PB19	Vibration suppression control vibration frequency setting
2339	2639	PB20	Vibration suppression control resonance frequency setting

Error code		Parameter No.	Name		
2340	2640	PB21	For manufacturer setting		
2341	2641	PB22			
2342	2642	PB23	Low-pass filter selection		
2343	2643	PB24	Slight vibration suppression control selection		
2344	2644	PB25	For manufacturer setting		
2345	2645	PB26	Gain changing selection		
2346	2646	PB27	Gain changing condition		
2347	2647	PB28	Gain changing time constant		
00.40	0040	DDOO	Gain changing ratio of load inertia moment		
2348	2648	PB29	to direct drive motor inertia moment		
2349	2649	PB30	Gain changing position loop gain		
2350	2650	PB31	Gain changing speed loop gain		
			Gain changing speed integral		
2351	2651	PB32	compensation		
			Gain changing vibration suppression		
2352	2652	PB33	control vibration frequency setting		
			Gain changing vibration suppression		
2353	2653	PB34	control resonance frequency setting		
2354	2654	PB35	. , ,		
2355	2655	PB36			
2356		PB37			
2357	2657	PB38			
2358	2658	PB39			
2359	2659	PB40	For manufacturer setting		
2360	2660	PB41	r of managed octains		
2361	2661	PB42			
2362	2662	PB43			
2363	2663	PB44			
2303	2003	F D44			
2364	2664	PB45	Vibration suppression control filter 2		
2365	2665	PC01	Error excessive alarm level		
2366	2666	PC02	Electromagnetic brake sequence output		
2367	2667	PC03	Encoder output pulse selection		
2368	2668	PC04	Function selection C-1		
2369	2669	PC05	For manufacturer setting		
2370	2670	PC06	Function selection C-3		
2371	2671	PC07	Zero speed		
2372	2672	PC08	For manufacturer setting		
2373	2673	PC09	Analog monitor 1 output		
2374	2674	PC10	Analog monitor 2 output		
2375	2675	PC11	Analog monitor 1 offset		
2376	2676	PC12	Analog monitor 2 offset		
2377	2677	PC13	Analog monitor feedback position output standard data Low		
2378	2678	PC14	Analog monitor feedback position output standard data High		

Table 1.23 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail (Continued)

Error	codo	Parameter	Name	Error	code	Parameter	Name	
EHOI	Joue	No.	INAIIIC	EHOI	Joue	No.	IVAIIIC	
2379	2679	PC15		2426	2726	PD30		
2380	2680	PC16		2427	2727	PD31		
2381	2681	PC17	For manufacturer setting	2428	2728	PD32		
2382	2682	PC18		2429	2729	PE01		
2383		PC19			2730	PE02		
2384		PC20	Function selection C-7	2431	2731	PE03		
2385		PC21	Alarm history clear		2732	PE04		
2386		PC22			2733	PE05		
2387		PC23	_		2734	PE06		
2388		PC24			2735	PE07		
2389		PC25			2736	PE08		
2390		PC26			2737	PE09		
2391		PC27			2738	PE10		
2392		PC28			2739	PE11	For manufacturer setting	
2393		PC29			2740	PE12	Ü	
2394			For manufacturer setting		2741	PE13		
2395		PC31			2742	PE14		
2396		PC32			2743	PE15		
2397		PD01			2744	PE16		
2398		PD02			2745	PE17		
2399		PD03			2746	PE18		
2400		PD04	Output signal device colection 1 (CN2 12)		2747	PE19		
2401		PD05			2748	PE20		
2402		PD06			2749	PE21		
2403 2404		PD07 PD08	Output signal device selection 1 (CN3-13) Output signal device selection 2 (CN3-9)	2450	2750 2751	PE22 PE23		
2404		PD09	Output signal device selection 2 (CN3-9) Output signal device selection 3 (CN3-15)		2752	PE23		
2406			For manufacturer setting		2753	PE25		
2407			Input filter setting		2754	PE26	Filter coefficient 2-1	
2408		PD12	Input litter setting		2755	PE27	Filter coefficient 2-2	
2409		PD13	For manufacturer setting		2756	PE28	Filter coefficient 2-3	
2410		PD14	Function selection D-3		2757	PE29	Filter coefficient 2-4	
2411		PD15			2758	PE30	Filter coefficient 2-5	
2412		PD16		2459		PE31	Filter coefficient 2-6	
	2713	PD17			2760	PE32	Filter coefficient 2-7	
2414		PD18			2761	PE33	Filter coefficient 2-8	
	2715	PD19			2762	PE34		
2416		PD20			2763	PE35		
2417		PD21			2764	PE36		
2418			For manufacturer setting		2765	PE37	For manufacturer setting	
	2719	PD23			2766	PE38		
2420		PD24			2767	PE39		
2421		PD25			2768	PE40		
2422		PD26		2501		PS01	Special function selection 1	
	2723	PD27			2802	PS02		
2424		PD28			2803	PS03	For manufacturer setting	
2425	2725	PD29		2504	2804	PS04	Special function selection 2	

Table 1.23 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail (Continued)

Error	code	Parameter No.	Name	
2505	2805	PS05	Servo control position deviation error detection level	
2506	2806	PS06	Servo control speed deviation error detection level	
2507	2807	PS07	Servo control torque deviation error detection level	
2508	2808	PS08	Special function selection 3	
2509	2809	PS09	Magnetic pole detection voltage level	
2510	2810	PS10		
2511	2811	PS11		
2512	2812	PS12		
2513	2813	PS13	For manufacturer setting	
2514	2814	PS14		
2515	2815	PS15		
2516	2816	PS16		
2517	2817	PS17	Minimal position detection method function selection	
2518	2818	PS18	Minimal position detection method identification signal amplitude	

Error code		Parameter No.	Name
2519	2819	PS19	
2520	2820	PS20	
2521	2821	PS21	
2522	2822	PS22	
2523	2823	PS23	
2524	2824	PS24	
2525	2825	PS25	For manufacturer setting
2526	2826	PS26	
2527	2827	PS27	
2528	2828	PS28	
2529	2829	PS29	
2530	2830	PS30	
2531	2831	PS31	
2532	2832	PS32	

(h) MR-J3-□B Safety (For safety servo)

Table 1.24 Servo error (2000 to 2999) list (MR-J3-□B Safety)

Error code	Servo amplifier LED display	Name	Remarks
2010	10	Undervoltage	
2012	12	Memory error 1 (RAM)	
2013	13	Clock error	
2015	15	Memory error 2 (EEP-ROM)	
2016	16	Encoder error 1 (At power on)	
2017	17	Board error	
2019	19	Memory error 3 (Flash ROM)	
2020	20	Encoder error 2 (during runtime)	
2021	21	Encoder error 3 (during runtime)	
2024	24	Main circuit error	
2025	25	Absolute position erase	
2028	28	Linear encoder error 2	
2030	30	Regenerative error	
2031	31	Overspeed	
2032	32	Overcurrent	
2033	33	Overvoltage	
2034	34	Receive error 1	
2035	35	Command frequency error	
2036	36	Receive error 2	
2042	42	Fully closed control error detection	
2045	45	Main circuit device overheat	
2046	46	Servo motor overheat	
2047	47	Cooling fan error	
2050	50	Overload 1	
2051	51	Overload 2	
2052	52	Error excessive	
2056	56	Forced stop error	
2070	70	Load side encoder error 1	
2071	71	Load side encoder error 2	
2060	1A	Motor combination error	
2061	2A	Linear encoder error 1	
2063	63	STO timing error	
2088	888	Watchdog	
2095	95	STO warning	
2102	92	Battery cable disconnection warning	
2106	96	Home position setting warning	
2116	9F	Battery warning	
2140	E0	Excessive regeneration warning	
2141	E1	Overload warning 1	
2143	E3	Absolute position counter warning	
2146	E6	Servo forced stop warning	
2147	E7	Controller forced stop warning	
2148	E8	Cooling fan speed reduction warning	
2149	E9	Main circuit off warning	
2152	EC	Overload warning 2	
2153	ED	Output watt excess warning	

Table 1.24 Servo error (2000 to 2999) list (MR-J3-□B Safety) (Continued)

Error code	Servo amplifier LED display	Name	Remarks
2301 to 2599 E4 Parameter warning (Refer to the table 1.3		Parameter warning (Refer to the table 1.25)	
2601 to 2899 37		Parameter error (Refer to the table 1.25)	
2948 ^(Note-1) 8A US		USB communication time-out error	
2952 ^(Note-1) 8E USB communication e		USB communication error	

(Note-1): Error codes will differ depending on the operating system software version.

	Error code Operating system software version "00F" or earlier "00G" or later		Name
2090	2948	8A	USB communication time-out error
2094	2952	8E	USB communication error

Table 1.25 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail

Error code		Parameter No.	Name	
2301	2601	PA01	Control mode	
2302	2602	PA02	Regenerative option	
2303	2603	PA03	Absolute position detection system	
2304	2604	PA04	Function selection A-1	
2305	2605	PA05		
2306	2606	PA06	For manufacturer setting	
2307	2607	PA07	, and the second	
2308	2608	PA08	Auto tuning mode	
2309	2609	PA09	Auto tuning response	
2310	2610	PA10	In-position range	
2311	2611	PA11		
2312	2612	PA12	For manufacturer setting	
2313	2613	PA13	Ů	
2314	2614	PA14	Rotation direction selection	
2315	2615	PA15	Encoder output pulse	
2316	2616	PA16	Encoder output pulse 2	
2317	2617	PA17		
2318	2618	PA18	For manufacturer setting	
2319	2619	PA19	Parameter write inhibit	
2320	2620	PB01	Adaptive tuning mode (adaptive filter II)	
2321	2621	PB02	Vibration suppression control tuning mode (advanced vibration suppression control)	
2322	2622	PB03	For manufacturer setting	
2323	2623	PB04	Feed forward gain	
2324	2624	PB05	For manufacturer setting	
2325	2625	PB06	Ratio of load inertia moment to servo	
2326	2626	PB07	Model loop gain	
2327	2627	PB08	Position loop gain	
2328	2628	PB09	Speed loop gain	
	2629	PB10	Speed integral compensation	
2330	2630	PB11	Speed differential compensation	
2331	2631	PB12	Overshoot amount compensation	
2332	2632	PB13	Machine resonance suppression filter 1	
2333	2633	PB14	Notch shape selection 1	
2334	2634	PB15	Machine resonance suppression filter 2	
2335	2635	PB16	Notch shape selection 2	
2336	2636	PB17	Automatic setting parameter	
2337	2637	PB18	Low-pass filter setting	
2338	2638	PB19	Vibration suppression control vibration frequency setting	
2339	2639	PB20	Vibration suppression control resonance frequency setting	

Error	code	Parameter No.	Name	
2340	2640	PB21		
2341	2641	PB22	For manufacturer setting	
2342	2642	PB23	Low-pass filter selection	
20.42	00.10	5504	Slight vibration suppression control	
2343	2643	PB24	selection	
2344	2644	PB25	For manufacturer setting	
2345	2645	PB26	Gain changing selection	
2346	2646	PB27	Gain changing condition	
2347	2647	PB28	Gain changing time constant	
2348	2648	PB29	Gain changing ratio of load inertia mome	
2340	2040	FD29	to servo motor inertia moment	
2349	2649	PB30	Gain changing position loop gain	
2350	2650	PB31	Gain changing speed loop gain	
2351	2651	PB32	Gain changing speed integral	
2001	2001	1 002	compensation	
2352	2652	PB33	Gain changing vibration suppression	
	2002	. 200	control vibration frequency setting	
2353	2653	PB34	Gain changing vibration suppression	
			control resonance frequency setting	
2354	2654	PB35		
2355	2655	PB36		
2356	2656	PB37		
2357	2657	PB38		
2358	2658	PB39		
2359	2659	PB40	For manufacturer setting	
2360	2660	PB41		
2361	2661	PB42		
2362	2662	PB43		
2363	2663	PB44		
2364	2664	PB45	Vibration suppression control filter 2	
2365	2665	PC01	Error excessive alarm level	
2366	2666	PC02	Electromagnetic brake sequence output	
2367	2667	PC03	Encoder output pulse selection	
2368	2668	PC04	Function selection C-1	
2369	2669	PC05	Function selection C-2	
2370	2670	PC06	Function selection C-3	
2371	2671	PC07	Zero speed	
2372	2672	PC08	For manufacturer setting	
2373	2673	PC09	Analog monitor 1 output	
2374	2674	PC10	Analog monitor 2 output	
2375	2675	PC11	Analog monitor 1 offset	
2376	2676	PC12	Analog monitor 2 offset	
2377	2677	PC13	Analog monitor feedback position output standard data Low	
2378	2678	PC14	Analog monitor feedback position output standard data High	

Table 1.25 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail (Continued)

Error	code	Parameter No.	Name			
2379	2679	PC15	For manufacturer setting			
2380	2680	PC16	Function selection C-3A			
2381	2681	PC17	Function selection C-4			
2382	2682	PC18				
2383	2683	PC19	For manufacturer setting			
2384	2684	PC20	Function selection C-7			
2385	2685	PC21	Alarm history clear			
2386	2686	PC22	For manufacturar cotting			
2387	2687	PC23	For manufacturer setting			
2388	2688	PC24	Forced stop deceleration time constant			
2389	2689	PC25	For manufacturer setting			
2390	2690	PC26	Function selection C-8			
2391	2691	PC27	Function selection C-9			
2392	2692	PC28				
2393	2693	PC29	For manufacturer setting			
2394	2694	PC30				
2395	2695	PC31	Vertical axis freefall prevention compensation amount			
2396	2696	PC32				
2397	2697	PD01				
2398	2698	PD02				
2399	2699	PD03	For manufacturer setting			
2400	2700	PD04	For manufacturer setting			
2401	2701	PD05				
2402	2702	PD06				
2403	2703	PD07	Output signal device selection 1 (CN3-13)			
2404	2704	PD08	Output signal device selection 2 (CN3-9)			
2405	2705	PD09	Output signal device selection 3 (CN3-15)			
2406	2706	PD10	For manufacturer setting			
2407	2707	PD11	Input filter setting			
2408	2708	PD12	For manufacturer setting			
2409	2709	PD13	i or manufacturer setting			
2410	2710	PD14	Function selection D-3			
2411	2711	PD15				
2412	2712	PD16				
2413	2713	PD17				
2414	2714	PD18				
2415	2715	PD19				
2416	2716	PD20	For manufacturer setting			
2417	2717	PD21				
2418	2718	PD22				
2419	2719	PD23				
2420	2720	PD24				

Error	code	Parameter No.	Name				
2421	2721	PD25					
2422	2722	PD26					
2423	2723	PD27					
2424	2724	PD28	For manufacturer setting Fully closed loop selection 1				
2425	2725	PD29					
2426	2726	PD30					
2427	2727	PD31					
2428	2728	PD32					
2429	2729	PE01	Fully closed loop selection 1				
2430	2730	PE02	For manufacturer setting				
2431	2731	PE03	Fully closed loop selection 2				
2422	2722	DE04	Fully closed loop feedback pulse				
2432	2732	PE04	electronic gear 1 numerator				
2433	2733	PE05	Fully closed loop feedback pulse				
2433	2133	PEUS	electronic gear 1 denominator				
2434	2734	PE06	Fully closed loop speed deviation error				
2404	2134	1 200	detection level				
2435	2735	PE07	Fully closed loop position deviation error				
2400	2100	1 207	detection level				
2436	2736	PE08	Fully closed loop dual feedback filter				
2437	2737	PE09	For manufacturer setting				
2438	2738	PE10	Fully closed loop selection 3				
2439	2739	PE11					
2440	2740	PE12					
2441	2741	PE13					
2442	2742	PE14					
2443	2743	PE15					
2444	2744	PE16					
2445	2745	PE17					
2446	2746	PE18	For manufacturer setting				
2447	2747	PE19					
2448	2748	PE20					
2449	2749	PE21					
2450	2750	PE22					
2451	2751	PE23					
2452	2752	PE24					
2453	2753	PE25					
2454	2754	PE26	Filter coefficient 2-1				
2455	2755	PE27	Filter coefficient 2-2				
2456	2756	PE28	Filter coefficient 2-3				
2457	2757	PE29	Filter coefficient 2-4				
2458	2758	PE30	Filter coefficient 2-5				
2459	2759	PE31	Filter coefficient 2-6				
2460	2760	PE32	Filter coefficient 2-7				
2461	2761	PE33	Filter coefficient 2-8				
			Fully closed loop feedback pulse				
2462	2762	PE34	electronic gear 2 numerator				

Table 1.25 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail (Continued)

Error code		Parameter No.	Name	
2463	2763	PE35	Fully closed loop feedback pulse electronic gear 2 denominator	
2464	2764	PE36		
2465	2765	PE37	For manufacturer setting	

Error code		Parameter No.	Name		
2466	2766	PE38			
2467	2767	PE39	For manufacturer setting		
2468					

(i) MR-JE-□B(F)

Table 1.26 Servo error (2000 to 2999) list (MR-JE-□B(F))

Error code	Servo amplifier LED display	Name	Details name	Remarks
2010	10.1	Lindonioltogo	Voltage drop in the power	
2010	10.2	Undervoltage	Bus voltage drop	
	12.1		RAM error 1	
	12.2		RAM error 2	
2012	12.3	M (DAM)	RAM error 3	
	12.4	Memory error 1 (RAM)	RAM error 4	
	12.5		RAM error 5	
	12.6		RAM error 6	
	13.1		Clock error 1	
2013	13.2	Clock error	Clock error 2	
	13.3		Clock error 3	
	14.1		Control process error 1	
	14.2]	Control process error 2	
	14.3		Control process error 3	
	14.4		Control process error 4	
	14.5	1	Control process error 5	
	14.6	1	Control process error 6	
2014	14.7	Control process error	Control process error 7	
	14.8		Control process error 8	
	14.9		Control process error 9	
	14.A		Control process error 10	
	14.C		Control process error 12	
	14.D	1	Control process error 13	
	15.1		EEP-ROM error at power on	
2015	15.2	Memory error 2	EEP-ROM error during operation	
2013	15.4	(EEP-ROM)	<u> </u>	
	16.1		Home position information read error Encoder initial communication - Receive data error 1	
	16.2		Encoder initial communication - Receive data error 2	
	16.3		Encoder initial communication - Receive data error 3	
	16.5		Encoder initial communication - Transmission data error 1	
	16.6		Encoder initial communication - Transmission data error 2	
2016	16.7	Encoder initial communication error 1	Encoder initial communication - Transmission data error 3	
	16.A	1	Encoder initial communication - Process error 1	
	16.B	1	Encoder initial communication - Process error 2	
	16.C		Encoder initial communication - Process error 3	
	16.D	1	Encoder initial communication - Process error 4	
	16.E	1	Encoder initial communication - Process error 5	
	16.F	1	Encoder initial communication - Process error 6	
	17.1		Board error 1	
	17.3	1	Board error 2	
	17.4	1	Board error 3	
2017		Board error		
	17.5 17.6	-	Board error 4	
	17.0	1	Board error 5 Board error 7	

Table 1.26 Servo error (2000 to 2999) list (MR-JE-□B(F)) (Continued)

Error code	Servo amplifier LED display	Name	Details name	Remarks
	19.1		Flash-ROM error 1	
0040	19.2	Memory error 3	Flash-ROM error 2	
2019	19.4	(Flash-ROM)	Flash-ROM error 4	
	19.5		Flash-ROM error 5	
	20.1		Encoder normal communication - Receive data error 1	
	20.2		Encoder normal communication - Receive data error 2	
	20.3		Encoder normal communication - Receive data error 3	
	00.5		Encoder normal communication - Transmission data	
	20.5		error 1	
2020	20.6	Encoder normal communication error 1	Encoder normal communication - Transmission data error 2	
	20.7		Encoder normal communication - Transmission data error 3	
	20.9		Encoder normal communication - Receive data error 4	
	20.A	1	Encoder normal communication - Receive data error 5	
	21.1		Encoder data error 1	
	21.2		Encoder data update error	
	21.3	Encoder normal	Encoder data waveform error	
2021	21.5	communication error 2	Encoder hardware error 1	
	21.6		Encoder hardware error 2	
	21.9		Encoder data error 2	
	24.1		Ground fault detected at hardware detection circuit	
2024	24.2	Main circuit error	Ground fault detected at software detection function	
2025	25.1	Absolute position erased	Servo motor encoder - Absolute position erased	
	30.1		Regeneration heat error	
2030	30.2	Regenerative error	Regeneration signal error	
	30.3	1	Regeneration feedback signal error	
2031	31.1	Overspeed	Abnormal motor speed	
			Overcurrent detected at hardware detection circuit	
	32.1		(during operation)	
			Overcurrent detected at software detection function	
	32.2		(during operation)	
2032		Overcurrent	Overcurrent detected at hardware detection circuit	
	32.3		(during a stop)	
			Overcurrent detected at software detection function	
	32.4		(during a stop)	
2033	33.1	Overvoltage	Main circuit voltage error	
	34.1		SSCNET receive data error	
	34.2	SSCNET receive error	SSCNET connector connection error	
2034	34.3	1	SSCNET communication data error	
	34.4	1	Hardware error signal detection	
2035	35.1	Command frequency error	Command frequency error	
2036	36.1	SSCNET receive error 2	Continuous communication data error	
	37.1		Parameter setting range error	
2037 ^(Note-1)	37.2	Parameter error	Parameter combination error	
	37.3		Point table setting error	

(Note-1): Refer to the parameter No. stored in parameter error No. (#8009+20n) for details of the parameter for which the error occurred.

Table 1.26 Servo error (2000 to 2999) list (MR-JE-□B(F)) (Continued)

Error code	Servo amplifier LED display	Name	Details name	Remarks
	39.1		Program error	
2039	39.2	Program error	Instruction argument external error	
2039	39.3	Program enoi	Register No. error	
	39.4		Non-correspondence command error	
2045	45.1	Main circuit device overheat	Main circuit device overheat error 1	
	46.1		Abnormal temperature of servo motor 1	
2046	46.5	Servo motor overheat	Abnormal temperature of servo motor 3	
	46.6		Abnormal temperature of servo motor 4	
2047	47.2	Cooling fan error	Cooling fan speed reduction error	
	50.1	Ţ.	Thermal overload error 1 during operation	
	50.2		Thermal overload error 2 during operation	
	50.3	1	Thermal overload error 4 during operation	
2050	50.4	Overload 1	Thermal overload error 1 during a stop	
	50.5	1	Thermal overload error 2 during a stop	
	50.6	1	Thermal overload error 4 during a stop	
	51.1		Thermal overload error 3 during operation	
2051	51.2	Overload 2	Thermal overload error 3 during a stop	
	52.1		Excess droop pulse 1	
	52.3	=	Excess droop pulse 2	
2052	52.4	Error excessive	Error excessive during 0 torque limit	
	52.5	1	Excess droop pulse 3	
2054	54.1	Oscillation detection	Oscillation detection error	
2004	56.2	Oscillation detection	Over speed during forced stop	
2056	56.3	Forced stop error	Estimated distance over during forced stop	
	1A.1	Servo motor	Servo motor combination error 1	
2060	1A.4	combination error	Servo motor combination error 2	
2061	61.1			
2001		Operation error	Point table setting range error	
	63.1	CTO timing orrer	STO1 off	
2063	63.2	STO timing error	STO2 off	
2003	63.5 1E.1	Encoder initial	STO by functional safety unit Encoder malfunction	
2064	1F.1	Encoder initial	Incompatible encoder	
	69.1	communication error 3	Forward rotation-side software limit detection -	
	69.2	-	Command excess error Reverse rotation-side software limit detection -	
2069	69.3	Command error	Command excess error Forward rotation stroke end detection - Command	
	69.4	1	Reverse rotation stroke end detection - Command excess error	
	86.1		Network communication error 1	
2086	86.4	Network	Network communication error 4	
2000	86.5	communication error	Network communication error 5	
2088	888	Watchdog	Watchdog	
۷00	90.1	vvatoriuOg	Home position return incomplete	
2000		Home position return	•	
2090	90.2	incomplete warning	Home position return abnormal termination	

Table 1.26 Servo error (2000 to 2999) list (MR-JE-□B(F)) (Continued)

Error code	Servo amplifier LED display	Name	Details name	Remarks
2005	95.1	CTO	STO1 off detection	
2095	95.2	STO warning	STO2 off detection	
2097	97.1	Positioning specification warning	Program operation disabled warning	
2000	98.1	0 - # 1!:#	Forward rotation-side software stroke limit reached	
2098	98.2	Software limit warning	Reverse rotation-side software stroke limit reached	
	99.1		Forward rotation stroke end off	
2099	99.2	Stroke limit warning	Reverse rotation stroke end off	
2101	91.1	Servo amplifier overheat warning	Main circuit device overheat warning	
0400	92.1	Battery cable	Encoder battery cable disconnection warning	
2102	92.3	disconnection warning	Battery degradation	
	96.1		In-position warning at home positioning	
2106	96.2	Home position setting	Command input warning at home positioning	
	96.3	warning	Servo off warning at home positioning	
2116	9F.1	Battery warning	Low battery	
2140	E0.1	Excessive regeneration warning	Excessive regeneration warning	
	E1.1		Thermal overload warning 1 during operation	
	E1.2		Thermal overload warning 2 during operation	
	E1.3		Thermal overload warning 3 during operation	
	E1.4	<u> </u>	Thermal overload warning 4 during operation	
2141	E1.5	Overload warning 1	Thermal overload warning 1 during a stop	
	E1.6		Thermal overload warning 2 during a stop	
	E1.7		Thermal overload warning 3 during a stop	
	E1.8		Thermal overload warning 4 during a stop	
	E3.1		Multi-revolution counter travel distance excess warning	
	E3.2		Absolute position counter warning	
2143	E3.4	Absolute position counter warning	Absolute positioning counter EEPROM writing frequency warning	
	E3.5		Encoder absolute positioning counter warning	
2144 ^(Note-1)	E4.1	Parameter warning	Parameter setting range error warning	
2146	E6.1	Servo forced stop warning	Forced stop warning	
2147	E7.1	Controller forced stop warning	Controller forced stop input warning	
2148	E8.1	Cooling fan speed reduction warning	Decreased cooling fan speed warning	
	E9.1	Main circuit off	Servo-on signal on during main circuit off	
2149	E9.2	warning	Bus voltage drop during low speed operation	
	E9.3	waiting	Ready-on signal on during main circuit off	
2152	EC.1	Overload warning 2	Overload warning 2	
2153	ED.1	Output watt excess warning	Output watt excess warning	
2160	F0.1	Tough drive warning	Instantaneous power failure tough drive warning	
2160	F0.3	Tough drive warning	Vibration tough drive warning	
2400	F2.1	Drive recorder -	Drive recorder - Area writing timeout warning	
2162	F2.2	Miswriting warning	Drive recorder - Data miswriting warning	

(Note-1): Refer to the parameter No. stored in parameter error No. (#8009+20n) for details of the parameter for which the error occurred.

Table 1.26 Servo error (2000 to 2999) list (MR-JE-□B(F)) (Continued)

Error code	Servo amplifier LED display	Name	Details name	Remarks
2163	F3.1	Oscillation detection warning	Oscillation detection warning	
	F4.4		Target position setting range error warning	
2464	F4.6	Desitionina a commina	Acceleration time constant setting range error warning	
2164	F4.7	Positioning warning	Deceleration time constant setting range error warning	
	F4.8		Control command input error warning	
	F5.1	Simple cam function	Cam data - Area writing time-out warning	
2165	F5.2	Cam data miswriting	Cam data - Area miswriting warning	
	F5.3	warning	Cam data checksum error	
	F6.1		Cam axis one cycle current value restoration failed	
	F6.2		Cam axis feed current value restoration failed	
0400	F6.3	Simple cam function -	Cam unregistered error	
2166	F6.4	Cam control warning	Cam control data setting range error	
	F6.5		Cam No. external error	
	F6.6		Cam control inactive	
2918	3A.1	Inrush current suppression circuit error	Inrush current suppression circuit error	
	3E.1		Operation mode error	
2922	3E.6	Operation mode error	Operation mode switch error	
	8A.1	USB communication time-out error/serial	USB communication time-out error/serial communication timeout error	
2948	8A.2	communication timeout error/Modbus RTU communication timeout error	Modbus RTU communication timeout error	
	8C.1		Network module communication error 1	
	8C.2		Network module communication error 2	
	8C.3	Network module communication error	Network module communication error 3	
2950	8C.4		Network module communication error 4	
	8C.5		Network module communication error 5	
	8C.6		Network module communication error 6	
	8C.7		Network module communication error 7	
			USB communication receive error/serial communication	
	8E.1		receive error	
	25.0		USB communication checksum error/serial	
	8E.2		communication checksum error	
	05.0	USB communication	USB communication character error/serial	
	8E.3	error/serial	communication character error	
2952	05.4	communication	USB communication command error/serial	
	8E.4	error/Modbus RTU	communication command error	
	8E.5	communication error	USB communication data number error/serial communication data number error	
	8E.6		Modbus RTU communication receive error	
	8E.7		Modbus RTU communication message frame error	
	8E.8	1	Modbus RTU communication CRC error	
	9B.1		Excess droop pulse 1 warning	
2955	9B.3	Error excessive	Excess droop pulse 1 warning Excess droop pulse 2 warning	
2000	9B.4	warning	Error excessive warning during 0 torque limit	

APPENDIX 2 Example Programs

APPENDIX 2.1 Reading M-code

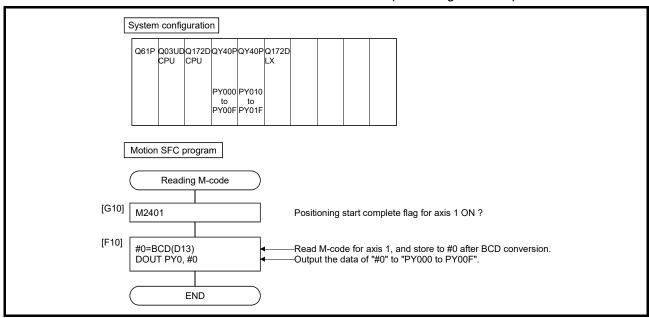
The program example for reading M-code at the completion of positioning start or positioning is shown below.

The judgement of the positioning start completion and positioning completion is made with the following signals.

- Positioning start completionM2400+20n (positioning start complete signal)
- Positioning completionM2401+20n (positioning complete signal)

[Program Example]

(1) A program that outputs the M-code from PY000 to PY00F to external destination after conversion into BCD code at the positioning start completion is shown below.



APPENDIX 2.2 Reading error code

The program example for reading error code at the error occurrence is shown below. The following signals are used to determine whether or not an error has occurred:

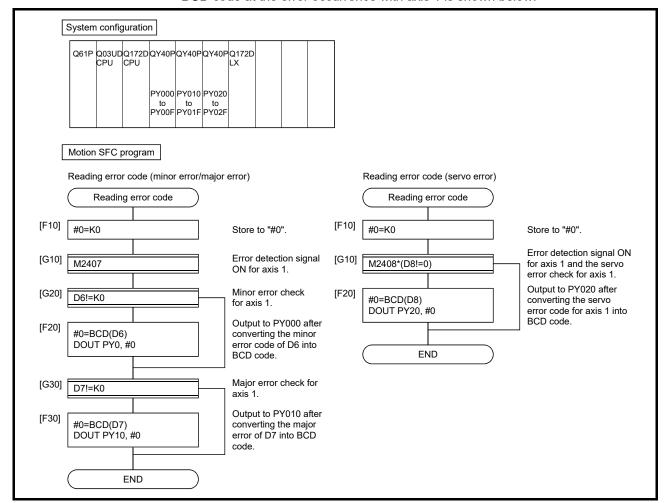
- Minor errors, major errors Error detection signal (M2407+20n)
- Servo errors Servo error detection signal (M2408+20n)

POINT

- (1) The following delay occurs for leading edge of M2407+20n/M2408+20n and storage of the error code.
 - (a) If the sequence program scan time is 80[ms] or less, there will be a delay of up to 80[ms].
 - (b) If the sequence program scan time is 80[ms] or more, there will be a delay of up to one scan time.
 - The error code is stored to each error code storage area after turning on M2407+20n/M2408+20n, and then read the error code.

[Program Example]

(1) A program that outputs each error code to PY000 to PY00F (minor error), PY010 to PY01F (major error) and PY020 to PY02F (servo error) after conversion into BCD code at the error occurrence with axis 1 is shown below.



APPENDIX 3 Setting Range for Indirect Setting Devices

Positioning address, command speed or M-code, etc. (excluding the axis No.) set in the servo program can be set indirectly by the word.

(1) Device range

The number of device words and device range at indirect setting are shown below.

		Item	Number of device words		Device setting range	Remarks
	Parameter bloo	ck No.	1			
_	Address (travel value)		2			
Common	Command speed		2	Device	Range	
l o	Dwell time		1	D	0 to 8191 ^(Note-1)	
	M-code		1	W	0000 to 1FFF	
	Torque limit va	lue	1	#	0 to 7999	
	Auxiliary point	Torque limit value Auxiliary point		U□\G	10000 to (10000+p-1) (Note-2)	
Arc	Radius		2			
⋖	Central point					
	Pitch		1			
	Control unit		1			
	Speed limit val	ue	2			
	Acceleration tir	ne	1			
	Deceleration til	me	1			
	Rapid stop dec	eleration time	1			
SS	S-curve ratio		1			
Parameter block	Advanced	Acceleration/deceleration system	1			
an.	S-curve acceleration/ deceleration	Acceleration section 1 ratio	1			
Par		Acceleration section 2 ratio	1			
		Deceleration section 1 ratio	1			
		Deceleration section 2 ratio	1			
	Torque limit va	lue	1			
	Deceleration p	rocessing on STOP input	1			
	Allowable error	range for circular interpolation	2			
	Command spee	ed (Constant speed)	2			
	FIN acceleration		1			
	Fixed position s time	stop acceleration/deceleration	1			
	Repetition cond	dition (Number of repetitions)	1			
	Repetition cond	dition (ON/OFF)				
<u>S</u>	Cancel			Device	Range	
Others	Skip			Х	0000 to 1FFF ^(Note-3)	
	WAIT ON/OFF	•		Υ	0000 to 1FFF	
	Fixed position		Bit	М	0 to 8191 ^(Note-1)	
	•	·		В	0000 to 1FFF	
				F	0 to 2047	
				U□\G	10000.0 to (10000+p-1).F (Note-2)	

(Note-1): Synchronous encoder axis area cannot be set.

(Note-2): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

(Note-3): The range of "PXn+4 to PXn+F" cannot be used (fixed at 0) for the input device (PXn+0 to PXn+F) allocated to the built-in interface in Motion CPU (DI). (n: First input No.)

POINT

- (1) Be sure to set even-numbered devices of the items set as 2-word.

 Be sure to set as 32-bit integer type when the data is set in these devices using the Motion SFC programs. (Example : #0L, D0L)
- (2) Refer to Chapter 2 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for the user setting area points of the Multiple CPU high speed transmission area.

(2) Inputting device data

Indirect setting device data is inputted by the Motion CPU at the servo program start.

Do not change the applicable device before setting to device and start completion.

The procedures by start method for setting data to devices and cautions are shown below.

Start method	Setting method	Notes
Start by the servo program	Set data in indirect setting devices. ↓ Start the servo program.	Do not change the indirect setting device before the "positioning start complete signal" of the starting axis turns on.
Set the loop (FOR - NEXT) point data for CPSTART instruction indirectly	Set initial command data in the indirect setting device. ↓ Start using the servo program (or turn the cancel command device on). ↓ Read the value of "data set pointer for constant-speed control" of the start axis, and update the data input by Motion CPU.	Refer to the positioning signal data register "Monitoring data area" for details.

APPENDIX 4 Processing Times of the Motion CPU

The processing time of each signal and each instruction for positioning control in the Multiple CPU system is shown below.

(1) Motion operation cycle [ms] (Default)

(a) Q173DSCPU/Q172DSCPU

		Q173E	SCPU	Q172DSCPU			
Number of setting axes (SV22)	_	1 to 6	7 to 16	17 to 32		1 to 6	7 to 16
Number of setting axes (SV13)	1 to 4	5 to 10	11 to 24	25 to 32	1 to 4	5 to 10	11 to 16
Operation cycle [ms]	0.22	0.44	0.88	1.77	0.22	0.44	0.88

(b) Q173DCPU(-S1)/Q172DCPU(-S1)

		Q173DC	Q172DCPU(-S1)			
Number of setting axes (SV22)	1 to 4	5 to 12	13 to 28	29 to 32	1 to 4	5 to 8
Number of setting axes (SV13)	1 to 6	7 to 18	19 to 32		1 to 6	7 to 8
Operation cycle [ms]	0.44	0.88	1.77	3.55	0.44	0.88

(2) CPU processing time [ms]

The instruction processing time means the time until the content is reflected to servo amplifier side after each instruction is executed.

(Including the transmission time between Motion controller and servo amplifier.)

(a) Q173DSCPU/Q172DSCPU

				Q173DSCPU	Q172DSCPU		
Ор	eration cycle [ms]	0.22	0.44	0.88	1.77	3.55	7.11
Servo program	"WAIT ON/OFF" + Motion control step	0.44	0.88	1.77	2.66	4.44	7.99
start processing	Only Motion control step	0.6 to 0.9	1.0 to 1.4	1.9 to 2.8	2.8 to 4.6	4.6 to 8.2	8.1 to 15.2
time ^(Note-1)	Dedicated instruction (D(P).SVST) from the PLC CPU	1.4 to 2.3	2.2 to 3.1	3.5 to 4.4	5.3 to 6.2	8.8 to 9.7	16.0 to 16.9
Speed change	Instruction (CHGV) from the Motion SFC	0.4 to 0.9	0.8 to 1.3	1.7 to 2.6	2.6 to 4.4	4.4 to 8.0	8.0 to 15.1
response time	Dedicated instruction (D(P).CHGV) from the PLC CPU	1.4 to 2.3	1.7 to 2.6	2.6 to 3.5	3.5 to 4.4	5.3 to 6.2	8.9 to 9.8
Command generation axis	Instruction (CHGVS) from the Motion SFC	0.4 to 0.9	0.8 to 1.3	1.7 to 2.6	2.6 to 4.4	4.4 to 8.0	8.0 to 15.1
speed change response time	Dedicated instruction (D(P).CHGVS) from the PLC CPU	1.4 to 2.3	1.7 to 2.6	2.6 to 3.5	3.5 to 4.4	5.3 to 6.2	8.9 to 9.8
Torque limit value	Instruction (CHGT) from the Motion SFC	0.4 to 0.9	0.8 to 1.3	1.7 to 2.6	2.6 to 4.4	4.4 to 8.0	4.4 to 11.5
change response time	Dedicated instruction (D(P).CHGT) from the PLC CPU	1.4 to 2.3	1.7 to 2.6	2.6 to 3.5	3.5 to 4.4	5.3 to 6.2	5.3 to 9.7
Torque limit value	Instruction (CHGT2) from the Motion SFC	0.4 to 0.9	0.8 to 1.3	1.7 to 2.6	2.6 to 4.4	4.4 to 8.0	4.4 to 11.5
individual change response time	Dedicated instruction (D(P).CHGT2) from the PLC CPU	1.4 to 2.3	1.7 to 2.6	2.6 to 3.5	3.5 to 4.4	5.3 to 6.2	5.3 to 9.7
Target position change response time	hange response Motion SFC		0.8 to 1.3	1.7 to 2.6	2.6 to 4.4	4.4 to 8.0	8.0 to 15.1
	dy flag (M2000) ON to plete flag (SM500) ON			44 to	o 60		

(Note-1): FEED instruction varies greatly depending on the condition (whether other axes are operating).

(b) Q173DCPU(-S1)/Q172DCPU(-S1)

			Q1	73DCPU(-S1).	/Q172DCPU(-	S1)	
Ор	eration cycle [ms]	0.44	0.88	1.77	3.55	7.11	14.2
Servo program	"WAIT ON/OFF"		1.77	2.66	4.44	7.99	15.11
start processing	Only Motion control step	1.0 to 1.4	1.9 to 2.8	2.8 to 4.6	4.6 to 8.2	8.1 to 15.2	15.2 to 29.4
time ^(Note-1)	Dedicated instruction (D(P).SVST) from the PLC CPU	2.2 to 3.1	3.5 to 4.4	5.3 to 6.2	8.8 to 9.7	16.0 to 16.9	30.2 to 31.1
Speed change	Instruction (CHGV) from the Motion SFC	0.8 to 1.3	1.7 to 2.6	2.6 to 4.4	4.4 to 8.0	8.0 to 15.1	15.1 to 29.3
response time	Dedicated instruction (D(P).CHGV) from the PLC CPU	1.7 to 2.6	2.6 to 3.5	3.5 to 4.4	5.3 to 6.2	8.9 to 9.8	16.0 to 16.9
Torque limit value	Instruction (CHGT) from the Motion SFC	0.8 to 1.3	1.7 to 2.6	2.6 to 4.4	4.4 to 8.0	4.4 to 11.5	4.4 to 18.6
time	hange response Dedicated instruction (D(P).CHGT) from the PLC CPU		2.6 to 3.5	3.5 to 4.4	5.3 to 6.2	5.3 to 9.7	5.3 to 16.0
	dy flag (M2000) ON to plete flag (SM500) ON			22 t	o 28		

(Note-1): FEED instruction varies greatly depending on the condition (whether other axes are operating).

APPENDIX 5 Device List

(1) Axis status list

Axis No.	Device No.				Signal name		
1	M2400 to M2419				<u> </u>		
2	M2420 to M2439						
3	M2440 to M2459			Signal name	Refresh cycle	Fetch cycle	Signal direction
4	M2460 to M2479	(Positionii	ng start complete		/	
5	M2480 to M2499	1		ng complete		/	
6	M2500 to M2519	2	! In-position	n			
7	M2520 to M2539	3	Commar	d in-position	Operation cycle		
8	M2540 to M2559	4	Speed co	ontrolling			
9	M2560 to M2579	5	Speed/po	osition switching latch			
10	M2580 to M2599	6	Zero pas	s		/	
11	M2600 to M2619	7	' Error det	ection	Immediate	/	
12	M2620 to M2639	8	Servo er	ror detection	Operation cycle	/	Status signal
13	M2640 to M2659	9	Home po	sition return request	Main cycle	/	
14	M2660 to M2679	1) Home po	sition return complete	Operation cycle	/	
15	M2680 to M2699	1	1	FLS		/	
16	M2700 to M2719	1:	2 External	RLS	Main cycle	/	
17	M2720 to M2739	1	3 signals	STOP	Main Cycle	/	
18	M2740 to M2759	1	4	DOG/CHANGE		」 /	
19	M2760 to M2779	1	5 Servo rea	ady	Operation cycle	/	
20	M2780 to M2799	1	6 Torque li	miting	Орегацоп сусте	<u>/</u>	
21	M2800 to M2819	1	7 Unusable	e	_		
22	M2820 to M2839			ode continuation	At virtual mode		
23	M2840 to M2859	1	8 operation	n disable warning	transition		Status signal
24	M2860 to M2879		(SV22) (f			/	ziaido oigilai
25	M2880 to M2899	1	9 M-code o	outputting	Operation cycle	\vee	
26	M2900 to M2919						
27	M2920 to M2939						
28	M2940 to M2959						
29	M2960 to M2979						
30	M2980 to M2999						
31	M3000 to M3019						
32	M3020 to M3039						

(Note-1): It is unusable in the SV13/SV22 real mode and SV22 advanced synchronous control.

POINT

(1) The following range is valid.

Q172DSCPU : Axis No.1 to 16Q172DCPU(-S1): Axis No.1 to 8

(2) The following device area can be used as a user device.

• Q172DSCPU : 17 axes or more • Q172DCPU(-S1): 9 axes or more

However, when the project of Q172DSCPU/Q172DCPU(-S1) is replaced with Q173DSCPU/Q173DCPU(-S1), this area cannot be used as a user device.

(2) Axis command signal list

Axis No.	Device No.		S	Signal name		
1	M3200 to M3219					
2	M3220 to M3239		a	56.		Signal
3	M3240 to M3259		Signal name	Refresh cycle	Fetch cycle	direction
4	M3260 to M3279	0	Stop command	/		
5	M3280 to M3299	1	Rapid stop command	1 /	Operation cycle	
6	M3300 to M3319	2	Forward rotation JOG start command] /		
7	M3320 to M3339	3	Reverse rotation JOG start command] /	Main cycle	
8	M3340 to M3359	4	Complete signal OFF command] /		
9	M3360 to M3379	5	Speed/position switching enable	/	On anation avala	0
10	M3380 to M3399	ס	command] /	Operation cycle	Command
11	M3400 to M3419	6	Gain changing 2 command ^(Note-1)	/	Operation cycle (Note-2)	signal
12	M3420 to M3439	0	QDS(Ver.)] /	Operation cycle ,	
13	M3440 to M3459	7	Error reset command] /	Main cycle	
14	M3460 to M3479	8	Servo error reset command] /	Iviaiii Cycle	
15	M3480 to M3499	9	External stop input disable at start	/	At start	
16	M3500 to M3519		command	/	Atstart	
17	M3520 to M3539	10	Unusable	_	_	_
18	M3540 to M3559	11	Ondouble	ļ ,		
19	M3560 to M3579	12	Feed current value update command	. /	At start	
20	M3580 to M3599	13	Address clutch reference setting	/		
21	M3600 to M3619		command (SV22 only) (Note-3)	/	At virtual mode	
22	M3620 to M3639	14	Cam reference position setting	/	transition	
23	M3640 to M3659		command (SV22 only) (Note-3)	. /		Command
24	M3660 to M3679	15	Servo OFF command	/	Operation cycle	signal
25	M3680 to M3699	16	Gain changing command	/	Operation cycle (Note-2)	
26	M3700 to M3719	17	PI-PID switching command QDS	/	,	
27	M3720 to M3739	18	Control loop changing command	1/	Operation cycle	
28	M3740 to M3759	19	FIN signal	V	, , , , , ,	
29	M3760 to M3779					
30	M3780 to M3799					
31	M3800 to M3819					
32	M3820 to M3839					

(Note-1): Servo amplifier (MR-J5(W)-□B) only.

(Note-2): Operation cycle 7.1[ms] or more: Every 3.5[ms]

(Note-3): It is unusable in the SV13/SV22 real mode and SV22 advanced synchronous control.

POINT

(1) The following range is valid.

• Q172DSCPU : Axis No.1 to 16 • Q172DCPU(-S1): Axis No.1 to 8

(2) The following device area can be used as a user device.

• Q172DSCPU : 17 axes or more • Q172DCPU(-S1): 9 axes or more

However, when the project of Q172DSCPU/Q172DCPU(-S1) is replaced with Q173DSCPU/Q173DCPU(-S1), this area cannot be used as a user device.

Ver.!): Refer to Section 1.3 for the software version that supports this function.

(3) Common device list

Device		(0)		Signal	Remark	Device					Signal	Remark
No.	Signal name	Refresh cycle	Fetch cycle	direction	(Note-7)	No.		Signal name	Refresh cycle	Fetch cycle	direction	(Note-7)
M2000	PLC ready flag		Main cycle	Command signal	M3072	M2055						
M2001 M2002 M2003 M2004 M2005	Axis 1 Axis 2 Axis 3 Axis 4 Axis 5			3		M2056 M2057 M2058 M2059 M2060	Unusabl (6 points		-	_	-	_
M2006 M2007 M2008 M2009 M2010 M2011 M2011 M2012 M2013 M2016 M2016 M2017 M2018 M2019 M2020 M2021 M2022 M2023 M2024 M2025 M2026 M2027 M2028 M2029 M2030 M2031 M2031 M2031	Axis 6 Axis 7 Axis 8 Axis 9 Axis 10 Axis 11 Axis 12 Axis 13 Axis 15 Axis 16 Axis 17 Axis 18 Axis 19 Axis 20 Axis 20 Axis 21 Axis 22 Axis 23 Axis 24 Axis 25 Axis 26 Axis 27 Axis 28 Axis 29 Axis 20 Axis 31 Axis 21 Axis 21 Axis 22 Axis 23 Axis 24 Axis 25 Axis 26 Axis 27 Axis 28 Axis 29 Axis 30 Axis 31 Axis 31 Axis 31	Operation cycle		Status signal (Note-1), (Note-2), (Note-3), (Note-4)		M2061 M2062 M2063 M2064 M2066 M2066 M2066 M2067 M2070 M2071 M2072 M2073 M2074 M2076 M2076 M2077 M2078 M2079 M2079 M2079 M2079 M2079 M2079 M2079 M2079 M2079 M2078 M2078 M2080 M2080 M2081	Axis 1 Axis 2 Axis 3 Axis 4 Axis 5 Axis 6 Axis 6 Axis 7 Axis 8 Axis 7 Axis 8 Axis 10 Axis 11 Axis 12 Axis 13 Axis 14 Axis 15 Axis 16 Axis 17 Axis 18 Axis 19 Axis 22 Axis 24 Axis 23 Axis 24 Axis 24 Axis 24 Axis 26 Axis 27	Speed change accepting flag	Operation cycle		Status signal (Note-1), (Note-2), (Note-3), (Note-4)	
M2033 M2034	Unusable (2 points) Motion error history clear		—	— Command		M2088 M2089	Axis 28 Axis 29					
M2035 M2036 M2037	request flag Unusable (2 points)	_	Main cycle —	signal —	M3080	M2090 M2091 M2092	Axis 30 Axis 31 Axis 32					
M2038 M2039	Motion SFC debugging flag Motion error detection flag	At debugging mode transition		Status signal		M2093 M2094						
M2040	Speed switching point specified flag		At start	Command signal	M3073	M2095						
M2041	System setting error flag	Operation cycle		Status signal		M2096						
M2042 M2043	All axes servo ON command Real mode/virtual mode switching request (SV22) (Note-5)		Operation cycle At virtual mode transition	Command signal	M3074 M3075	M2097 M2098	Unusabl (8 points		-	-	-	-
M2044	Real mode/virtual mode switching status (SV22) (Note-5)					M2099						
M2045	Real mode/virtual mode switching error detection signal (SV22) (Note-5)	At virtual mode transition		Status signal		M2100				,		
M2046	Out-of-sync warning (SV22) (Note-5)					M2101	Axis 1			/		
M2047	Motion slot fault detection flag	Operation cycle	/			M2102	Axis 2			/		
M2048	JOG operation simultaneous start command		Main cycle	Command signal	M3076	M2103	Axis 3			/		
M2049	All axes servo ON accept flag	Operation cycle		Status signal		M2104	Axis 4	Synchronous		/	Status	
M2050	Unusable			Signal —	_	M2105	Axis 5	Synchronous encoder current	Operation cycle	/	signal	
M2051	Manual pulse generator 1 enable flag				M3077	M2106	Axis 6	value changing flag (Note-5), (Note-6)	operation by ord	/	(Note-2), (Note-4)	
M2052	Manual pulse generator 2 enable flag		Main cycle	Command signal	M3078	M2107	Axis 7			/		
M2053	Manual pulse generator 3 enable flag			Signal	M3079	M2108	Axis 8			/		
M2054	Operation cycle over flag	Operation cycle		Status signal		M2109	Axis 9					

Common device list (Continued)

Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction	Remark (Note-7)	Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction	Remark (Note-7)
M2110	Axis 10 Synchronous			Status		M2179					
M2111	Axis 11 encoder curre	nt Operation cycle		signal		M2180					
M2112	Axis 12 value changing (Note-5), (Note-	g flag		(Note-2), (Note-4)		M2181					
<u> </u>	(14010-0), (14010-	,		(14010-1)							
M2113 M2114						M2182 M2183					
M2115						M2184					
M2116						M2185					
M2117						M2186					
M2118						M2187					
M2119	Unusable					M2188					
M2120	(15 points)	_	_	_	_	M2189					
M2121	,					M2190					
M2122						M2191					
M2123 M2124						M2192 M2193					
M2125						M2194					
M2126						M2195					
M2127						M2196					
M2128	Axis 1					M2197					
M2129	Axis 2		1			M2198					
	Axis 3		1			M2199	Unusable				
M2131	Axis 4		1 /			M2200	Unusable (45 points)	_	_	_	_
M2132	Axis 5		1 /			M2201	(Note-8)				
M2133 M2134	Axis 6 Axis 7		1 /			M2202 M2203					
M2135	Axis 8		1			M2204					
	Axis 9		1			M2205					
M2137	Axis 10		1			M2206					
M2138	Axis 11		1 /			M2207					
M2139	Axis 12		1 /			M2208					
M2140	Axis 13		1 /			M2209					
M2141	Axis 14		1 /	Status		M2210					
M2142 M2143	Axis 15		1 /	signal		M2211					
M2144	Axis 16 Automatic Axis 17 decelerating flag	Operation cycle	1 /	(Note-1), (Note-2),		M2212 M2213					
	Axis 18	-9	1 /	(Note-3),		M2214					
	Axis 19		1 /	(Note-4)		M2215					
M2147	Axis 20		1 /			M2216					
M2148	Axis 21		1 /			M2217					
	Axis 22		1 /			M2218					
M2150	Axis 23		1 /			M2219					
M2151	Axis 24		1 /			M2220 M2221					
M2152 M2153	Axis 25 Axis 26		1 /			M2222					
M2154	Axis 27		1 /			M2223					
M2155	Axis 28		1/			M2224					
M2156	Axis 29		1/			M2225					
M2157			1/			M2226					
M2158			V			M2227					
M2159 M2160	Axis 32		Y	1		M2228 M2229					
M2161						M2230					
M2162						M2231					
M2163							Unusable (16 points)	_	_	_	_
M2164						M2233	(10 points)				
M2165						M2234					
M2166						M2235					
M2167						M2236					
	Unusable					M2237					
	(19 points)	_	_	_	_	M2238					
M2170	(Note-8)					M2239					
M2171							Axis 1		/		
M2172						M2241	Axis 2		/		
M2173							Axis 3		/	Status signal	
M2174						M2243	Axis 4 Speed change "0"		/	(Note-1),	
M2175						M2244	Axis 5 accepting flag	Operation cycle	/	(Note-2),	
M2176						M2245	Axis 6		/	(Note-3),	
M2177						M2246	Axis 7		/	(Note-4)	
M2178				<u></u>		M2247			<u>/</u>		
_							•				

Common device list (Continued)

Device No.	Signal name	Refresh cycle	Fetch cycle	Signal	Remark (Note-7)	Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction	Remark (Note-7)
M2248 Axis 9 M2249 Axis 10 M2250 Axis 11 M2251 Axis 12 M2252 Axis 13 M2253 Axis 14 M2255 Axis 16 M2255 Axis 16 M2255 Axis 16 M2256 Axis 17 M2257 Axis 18 M2258 Axis 19 M2259 Axis 20 M2260 Axis 21 M2261 Axis 22 M2262 Axis 23 M2263 Axis 24 M2264 Axis 26 M2266 Axis 27 M2265 Axis 26 M2266 Axis 27 M2267 Axis 28 M2268 Axis 28 M2268 Axis 28 M2268 Axis 28 M2268 Axis 28 M2268 Axis 28 M2268 Axis 28	Speed change "0" accepting flag	Operation cycle		Status signal (Note-1), (Note-2), (Note-3), (Note-4)		M2286 A: M2287 A: M2288 A: M2289 A: M2290 A: M2291 A: M2292 A: M2293 A: M2294 A: M2295 A: M2296 A: M2297 A: M2298 A: M2290 A: M2297 A: M2298 A: M2298 A: M2298 A: M2298 A: M2299 A: M2299 A: M2299 A: M2290 A: M2290 A: M2291 A: M2292 A: M2293 A: M2293 A: M2294 A: M2295 A: M2296 A: M2297 A: M2298 A: M2298 A: M2299 A: M22	xis 13 xis 14 xis 15 xis 15 xis 15 xis 17 xis 18 xis 19 xis 20 xis 21 xis 22 Control loop monitor xis 23 xis 24 xis 25 xis 26 xis 27 xis 28 xis 29 xis 31 xis 31 xis 32	Operation cycle		Status signal (Note-1), (Note-2), (Note-3), (Note-4)	
M2270 Axis 31 M2271 Axis 32 M2272 Axis 1 M2273 Axis 2 M2273 Axis 2 M2275 Axis 4 M2276 Axis 5 M2277 Axis 6 M2278 Axis 7 M2279 Axis 8 M2280 Axis 9 M2281 Axis 10 M2282 Axis 11 M2283 Axis 12	Control loop monitor status					M2306 M2307 M2308 M2309 M2310 M2311 U M2312 (1 M2313 M2314 M2315 M2316 M2317 M2318 M2319	inusable 16 points)	-	-	_	_

(Note-1): The range of axis No.1 to 16 is valid in the Q172DSCPU.

(Note-2): The range of axis No.1 to 8 is valid in the Q172DCPU(-S1).

(Note-3): Device area of 17 axes or more is unusable in the Q172DSCPU.

(Note-4): Device area of 9 axes or more is unusable in the Q172DCPU(-S1).

(Note-5): It is unusable in the SV22 advanced synchronous control.

(Note-6): It is unusable in the real mode.

(It can be used in the real mode for the version (Refer to Section 1.3) that supports "synchronous encoder current value monitor in real mode".)

(Note-7): It can also be ordered the device of a remark column.

(Note-8): These devices can be used as the clutch statuses.

The clutch status can also be set as the optional device at the clutch parameter.

Refer to Chapter 7 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV22) Programming Manual (VIRTUAL MODE)" for details.

(4) Common device list (Command signal)

Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction	Remark (Note-1), (Note-2)
M3072	PLC ready flag	/	Main cycle		M2000
M3073	Speed switching point specified flag	/	At start		M2040
M3074	All axes servo ON command		Operation cycle		M2042
140075	Real mode/virtual mode switching request	/	At virtual mode		140040
M3075	(SV22) (Note-3)		transition		M2043
M3076	JOG operation simultaneous start command			Command signal	M2048
M3077	Manual pulse generator 1 enable flag	/			M2051
M3078	Manual pulse generator 2 enable flag	/	Main cycle		M2052
M3079	Manual pulse generator 3 enable flag	/			M2053
M3080	Motion error history clear request flag	V			M2035
M3081	(Note-4)				
to	Unusable (Note-4)	_	_	_	_
M3135	(55 points)				

- (Note-1): The state of a device is not in agreement when the device of a remark column is turned ON/OFF directly. In addition, when the request from a data register and the request from the above device are performed simultaneously, the request from the above device becomes effective.
- (Note-2): It can also be ordered the device of a remark column.
- (Note-3): It is unusable in the SV22 advanced synchronous control.
- (Note-4): Do not use it as a user device. It can be used as a device that performs automatic refresh because of area for the reserve of command signal.

POINT

The device of a remark column turns ON by OFF to ON of the above device, and turns OFF by ON to OFF of the above device.

The command signal cannot be turned ON/OFF by the PLC CPU in the automatic refresh because the statuses and commands are mixed together in M2000 to M2053. Use the above devices in the case.

And, it can also be turned ON/OFF by the data register. (Refer to Section 3.2.3)

(5) Axis monitor device list

Axis No.	Device No.			Signal name			
1	D0 to D19						
2	D20 to D39		0		-		Signal
3	D40 to D59		Signal name	Refresh cycle	Fetch cycle	Unit	direction
4	D60 to D79	0					
5	D80 to D99	1	Feed current value		/	Command	
6	D100 to D119	2	D		/	unit	
7	D120 to D139	3	Real current value	Operation cycle	/		
8	D140 to D159	4					
9	D160 to D179	5	Deviation counter value			pulse	
10	D180 to D199	6	Minor error code	lua una adi aka			
11	D200 to D219	7	Major error code	Immediate] /	_	
12	D220 to D239	8	Servo error code	Main cycle] /		Monitor
13	D240 to D259		Home position return re-] /		device
14	D260 to D279	9	travel value	Out and the second of	/	pulse	
15	D280 to D299	10	Travel value after proximity	Operation cycle	/	Command	
16	D300 to D319	11	dog ON] /	unit	
17	D320 to D339	12	Execute program No.	At start] /		
18	D340 to D359	13	M-code	On anation avala	/	_	
19	D360 to D379	14	Torque limit value	Operation cycle] /	%	
20	D380 to D399	45	Data set pointer for constant-	A to a to a to a to a to a to a to a to	/		
21	D400 to D419	15	speed control	At start/during start	/	_	
22	D420 to D439	16	Unusable (Note-1)				
23	D440 to D459	17	Ullusable .	_		_	
24	D460 to D479	18	Real current value at stop	Operation cycle		Command	Monitor
25	D480 to D499	19	input	Operation cycle		unit	device
26	D500 to D519						
27	D520 to D539						
28	D540 to D559						
29	D560 to D579						
30	D580 to D599						
31	D600 to D619						
32	D620 to D639						

(Note-1): It can be used as the travel value change register. The travel value change register can be set to the device optionally in the servo program. Refer to Section 6.15 for details.

POINT

(1) The following range is valid.

Q172DSCPU : Axis No.1 to 16Q172DCPU(-S1): Axis No.1 to 8

(2) The following device area can be used as a user device.

Q172DSCPU : 17 axes or moreQ172DCPU(-S1): 9 axes or more

However, when the project of Q172DSCPU/Q172DCPU(-S1) is replaced with Q173DSCPU/Q173DCPU(-S1), this area cannot be used as a user device.

(6) Control change register list

Axis		(0)	gonia or origing	-			
No.	Device No.			Signal name			
1	D640, D641						
2	D642, D643						Signal
3	D644, D645		Signal name	Refresh cycle	Fetch cycle	Unit	direction
4	D646, D647	0	100			Command	Command
5	D648, D649	1	JOG speed setting		At start	unit	device
6	D650, D651	<u>-</u>					
7	D652, D653						
8	D654, D655						
9	D656, D657						
10	D658, D659						
11	D660, D661						
12	D662, D663						
13	D664, D665						
14	D666, D667						
15	D668, D669						
16	D670, D671						
17	D672, D673						
18	D674, D675						
19	D676, D677						
20	D678, D679						
21	D680, D681						
22	D682, D683						
23	D684, D685						
24	D686, D687						
25	D688, D689						
26	D690, D691						
27	D692, D693						
28	D694, D695						
29	D696, D697						
30	D698, D699						
31	D700, D701						
32	D702, D703						

POINT

(1) The following range is valid.

• Q172DSCPU : Axis No.1 to 16 • Q172DCPU(-S1): Axis No.1 to 8

(2) The following device area can be used as a user device.

Q172DSCPU : 17 axes or moreQ172DCPU(-S1): 9 axes or more

However, when the project of Q172DSCPU/Q172DCPU(-S1) is replaced with Q173DSCPU/Q173DCPU(-S1), this area cannot be used as a user device.

(7) Common device list

Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction	Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction
D704	PLC ready flag request				D752	Manual pulse generator 1 smoothing magnification setting register	/		
D705	Speed switching point specified flag request				D753	Manual pulse generator 2 smoothing magnification setting register		At the manual pulse generator enable flag OFF to ON	
D706	All axes servo ON command request		Main cycle	Command device	D754	Manual pulse generator 3 smoothing magnification setting register			Command device
D707	Real mode/virtual mode switching request (SV22) (Note-1)				D755	Manual pulse generator 1 enable flag request			
D708	JOG operation simultaneous start command request				D756	Manual pulse generator 2 enable flag request	/	Main cycle	
D709	Unusable	_	_	_	D757	Manual pulse generator 3 enable flag request	/		
D710 D711	JOG operation simultaneous				D758 D759				
D712	start axis setting register		At start		D760				
D713		[D761				
D714	Manual pulse generator axis 1 No. setting register	/			D762				
D715 D716	Manual pulse generator axis				D763 D764				
D717	2 No. setting register	/			D765				
D718	Manual pulse generator axis	/			D766				
D719	3 No. setting register	/			D767				
D720 D721	Axis 1 Axis 2	/			D768 D769				
D721	Axis 3	1			D770				
D723	Axis 4	/			D771				
D724	Axis 5				D772				
D725	Axis 6	/			D773				
D726 D727	Axis 7 Axis 8	/			D774 D775				
D728	Axis 9	/			D776				
D729	Axis 10	1			D777				
D730	Axis 11			Command	D778	Unusable	_	_	_
D731	Axis 12		At the manual pulse	device	D779	(42 points)			
D732	Axis 13		generator enable flag		D780				
D733 D734	Axis 14 Axis 15 Manual pulse		OFF to ON		D781 D782				
D735	Axis 16 generators 1 pulse				D783				
D736	Axis 17 input magnification setting register				D784				
D737	Axis 18 (Note-2), (Note-3)				D785				
D738	Axis 19				D786				
D739 D740	Axis 20 Axis 21				D787 D788				
D740	Axis 22				D789				
D742	Axis 23				D790				
D743	Axis 24				D791				
D744	Axis 25				D792				
D745	Axis 26				D793				
D746 D747	Axis 27 Axis 28				D794 D795				
D747	Axis 29				D796				
D749	Axis 30				D797				
D750	Axis 31	/			D798				
D751	Axis 32	V			D799				

(Note-1): It is unusable in the SV22 advanced synchronous control.

(Note-2): The following range is valid.

• Q172DSCPU : Axis No.1 to 16

• Q172DCPU(-S1): Axis No.1 to 8

(Note-3): The following device area is unusable.
• Q172DSCPU : 17 axes or more

• Q172DCPU(-S1): 9 axes or more

(8) Motion register list (#)

Axis	Device No.		<u> </u>	Circul name	
No.	Device No.			Signal name	
1	#8000 to #8019				
2	#8020 to #8039		0: 1	5.4	0: 1.1: 1:
3	#8040 to #8059		Signal name	Refresh cycle	Signal direction
4	#8060 to #8079	0	Servo amplifier type	When the servo amplifier power-on	
5	#8080 to #8099	1	Motor current value		
6	#8100 to #8119	2		Operation cycle 1.7[ms] or less : Operation cycle	
7	#8120 to #8139	3	Motor speed	Operation cycle 3.5[ms] or more : 3.5[ms]	
8	#8140 to #8159	4	0	On the state of th	
9	#8160 to #8179	5	Command speed	Operation cycle	
10	#8180 to #8199	6	Home position return re-	At home position return re-travel	Monitor device
11	#8200 to #8219	7	travel value	At home position return re-travel	Monitor device
12	#8220 to #8239	8	Servo amplifier display servo		
13	#8240 to #8259	0	error code	Main cycle	
14	#8260 to #8279	9	Parameter error No. QDS		
15	#8280 to #8299	10	Servo status1 QDS	Operation evals 1.7[ma] or less Operation evals	
16	#8300 to #8319	11	Servo status2 QDS	Operation cycle 1.7[ms] or less : Operation cycle Operation cycle 3.5[ms] or more : 3.5[ms]	
17	#8320 to #8339	12	Servo status3 QDS	Operation cycle 3.5[ms] or more : 3.5[ms]	
18	#8340 to #8359	13	Unusable	<u> </u>	_
19	#8360 to #8379	14	Servo status5 QDS Ver.!	Operation cycle 1.7[ms] or less : Operation cycle	Monitor device
20	#8380 to #8399	14	Servo statuss Cara	Operation cycle 3.5[ms] or more : 3.5[ms]	Worldon device
21	#8400 to #8419	15			
22	#8420 to #8439	16	Unusable	_	_
23	#8440 to #8459	17			
24	#8460 to #8479	18	Servo status7 QDS(Ver.)	Operation cycle 1.7[ms] or less : Operation cycle	Monitor device
25	#8480 to #8499	10	Convo Status/	Operation cycle 3.5[ms] or more : 3.5[ms]	WOINTOI GEVICE
26	#8500 to #8519	19	Unusable	_	_
27	#8520 to #8539				
28	#8540 to #8559				
29	#8560 to #8579				
30	#8580 to #8599				
31	#8600 to #8619				
32	#8620 to #8639				

(9) Product information list devices (9)

Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction
#8736				
to	Operating system software version			
#8743		At power supply		NA
#8744		ON		Monitor device
to	Motion CPU module serial number			
#8751				

Ver.!: Refer to Section 1.3 for the software version that supports this function.

(10) Special relay list

Device No.	Signal name	Refresh cycle	Fetch cycle	Signal type
SM500	PCPU READY complete flag	NA sim social s	/	
SM501	TEST mode ON flag	Main cycle	/	
SM502	External forced stop input flag	Operation cycle	/	
SM503	Digital oscilloscope executing flag	Main cycle		
SM506	External forced stop input ON latch flag	Operation cycle		0
SM508	Amplifier-less operation status flag			Status signal
SM510	TEST mode request error flag		/	
SM512	Motion CPU WDT error flag	Main cycle	/	
SM513	Manual pulse generator axis setting error flag		/	
SM516	Servo program setting error flag		/	

(11) Special register list

Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction
SD200	State of switch		/	
SD500	Real mode axis information register (SV22)	Main cycle	/	
SD501	(Note-1)			
SD502	Composition localing information	At power supply on/	/	
SD503	Servo amplifier loading information	operation cycle		
SD504	Book words to the class of a contraction		/	
SD505	Real mode/virtual mode switching error information (SV22) (Note-1)	At virtual mode transition	/	
SD506	iniomation (3v22)			
SD508	SSCNET control (status)	Main cycle		
SD510		04 4 4	/	Monitor device
SD511	Test mode request error information	At test mode request	/ /	
SD512	Motion CPU WDT error cause	At Motion CPU WDT error occurrence		
SD513			1 /	
SD514	Manual pulse generator axis setting error	At the manual pulse generator	/	
SD515	information	enable flag 🖣	/	
SD516	Error program No.] /	
SD517	Error item information	At start		
SD522	Motion operation cycle	Operation cycle] /	
SD523	Operation cycle of the Motion CPU setting	At power supply on] /	
SD524	Maximum Motion operation cycle QDS	Operation cycle] /	
SD550	Contains author and information (005/	At System setting error	/	
SD551	System setting error information QDS	occurrence]/	
SD560	Operation method QDS(Ver.)	At power supply on	V	
SD803	SSCNET control (command)		Main cycle	Command device

(Note-1): It is unusable in the SV22 advanced synchronous control.

Ver.!: Refer to Section 1.3 for the software version that supports this function.

APPENDIX 6 Compatible Devices with SSCNETⅢ(/H)

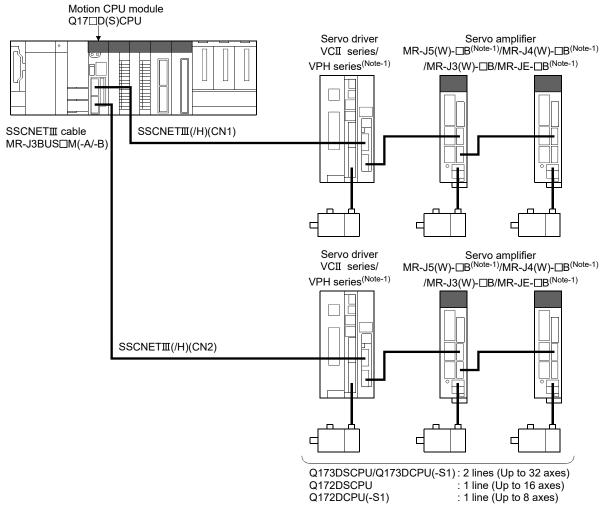
APPENDIX 6.1 Servo driver VCII series/VPH series manufactured by CKD Nikki Denso Co., I td QDS (Ver.)

The direct drive τDISC/τiD roll/τServo compass/τLinear stage, etc. manufactured by CKD Nikki Denso Co., Ltd. can be controlled by connecting with the servo driver VCII series/VPH series manufactured by the same company using the Motion CPU and

Contact the CKD Nikki Denso overseas sales office for details of VCII series/VPH series.

(1) System configuration

The system configuration using VCII series/VPH series is shown below.



(Note-1): MR-J5(W)-□B, MR-J4(W)-□B, MR-JE-□B, and the VPH series can only be used with Q173DSCPU/Q172DSCPU

Ver.!): Refer to Section 1.3 for the software version that supports this function.

(2) Parameter setting

- (a) To connect VCII series, set the following in the system setting of MT Developer2.
 - 1) When using Q173DSCPU/Q172DSCPU
 - Set the following for communication type in SSCNET setting.
 - When connecting SSCNETII/H: "SSCNETII/H"
 - When connecting SSCNETⅢ : "SSCNETⅢ"
 - Set the amplifier model in amplifier setting to "VCII (CKD Nikki Denso)".
 - Set the ABS/INC setting in amplifier setting to "INC", or "ABS".
 - 2) When using Q173DCPU(-S1)/ Q172DCPU(-S1)
 - Set the amplifier model in amplifier setting to "VCII (CKD Nikki Denso)".
 - Set the ABS/INC setting in amplifier setting to "INC", or "ABS".

POINT

Match the ABS/INC setting with the setting of VCII series. Otherwise, it does not operate correctly.

- (b) To connect VPH series, set the following in the system setting of MT Developer2.
 - Set the following for communication type in SSCNET setting.
 - When connecting SSCNET II/H: "SSCNET II/H"

 - Set the amplifier model in amplifier setting to "VPH (CKD Nikki Denso)".

(3) Control of VCII series/VPH series parameters

Parameters set in VCII series/VPH series are not controlled by the Motion CPU. They are set directly using VCII/VPH data editing software. For details on setting items for VCII series/VPH series, refer to the instruction manual of VCII series/VPH series.

(4) Comparisons of specifications with MR-J5(W)- \square B/MR-J4(W)- \square B/MR-JE- \square B

Item	VCI series (Note-1)	VPH series (Note-1) QDS	MR-J5(W)-□B	MR-J4(W)-□B	MR-J3(W)-□B	MR-JE-□B Q DS 《
Amplifier type	VCII (CKD Nikki Denso)	VPH (CKD Nikki Denso)	MR-J5(W)-B(-RJ)	MR-J4(W)-B(-RJ)	MR-J3(W)-B, MR-J3-□B(S) (For fully closed loop control), MR-J3(W)-B (Linear servo), MR-J3(W)-B (Direct drive motor)	MR-JE-B(F)
Control of servo amplifier parameters External input	Controlled by VCI series (Note-2)	Controlled by VPH series			by Motion CPU	
signal	Bit devices a	are available	External inpu	t signals of servo ar	nplifier, and bit device	
Optional data monitor (Data type)	• Effective load ratio • Regenerative load ratio • Peak load ratio • Position F/B • Encoder position within 1 revolution • Encoder Multirevolution counter • Position loop gain 1 • Cumulative current value • Position loop	Effective load ratio Regenerative load ratio Peak load ratio Position F/B Encoder position within 1 revolution Encoder Multirevolution counter Position loop gain 1 Bus voltage Cumulative current value	Effective load ratio Regenerative load Peak load ratio Position F/B Encoder position v Encoder Multi-rev Load inertia mome Model loop gain Bus voltage Cumulative currer Servo motor spee Selected droop pu Unit power consul Unit total power color Load side encode Load side encode Load side encode Z-phase counter Servo motor them Torque equivalent Overload alarm m Excessive error al Settling time Overshoot amoun Servo motor/Load deviation Internal temperatu	within 1 revolution olution counter ent ratio at value d sulse emption onsumption que r information1 r information2 mistor temperature to disturbance argin arm margin t side position	Effective load ratio Regenerative load ratio Peak load ratio Position F/B Encoder position within 1 revolution Encoder Multirevolution counter COSK Load inertia moment ratio Model loop gain 1 Bus voltage Cumulative current value COSK Selected droop pulse COSK Load side encoder information1 COSK Load side encoder information2 COSK Servo motor thermistor temperature	Position F/B Encoder position within 1 revolution Encoder Multi- revolution counter Load inertia moment ratio Model loop gain Bus voltage Cumulative current value Servo motor speed Selected droop pulse Unit power consumption Unit total power consumption Instantaneous torque Torque equivalent to disturbance Overload alarm margin Excessive error alarm margin Settling time Overshoot amount Internal temperature of
Absolute position detection system	Usable	(Note-3)		U	sable	encoder

Item	VCI series (Note-1)	VPH series (Note-1)	MR-J5(W)-□B	MR-J4(W)-□B	MR-J3(W)-□B	MR-JE-□B @ DS 《	
Home position return method	Proximity dog Count meth Data set in Dog cradl Limit switch cor Scale home position meth Dogless home reference m	nethod (1), e method, nbined method, on signal detection nod, position signal	Proximity dog method (1, 2), Count method (1 to 3), Data set method (1, 2), Dog cradle method, Stopper method (1, 2), Limit switch combined method, Scale home position signal detection method, Dogless home position signal reference method				
Speed-torque control QDS	Position co Speed cor Torque co	trol mode,		•	control mode, Torque n to torque control m		
Torque limit value change	Usa (Separate setting: F		Usable				
Gain changing command	Va		Valid				
PI-PID switching command	Valid	Invalid	Valid				
Control loop changing command	Invalid	Valid	Va	ilid	Valid when using servo amplifier for fully closed loop control (MR-J3- □B-RJ006)	Invalid	
Amplifier-less operation (Note-5)	Usa	ble		U	sable		
Servo parameter read/change	Usa	ble		U	sable		
Driver communication	Unusable		Usable ^(Note-6) Unusable			Unusable	
Servo error (Motion error history)	Error codes detected by VCII series are stored	Error codes detected by VPH series are stored	·				
Programming tool	MR Configurator: Use VCII data e		MR Configurator2 is available.				

- (Note-1): Confirm the specifications of VCII series/VPH series for details.
- (Note-2): Match the absolute position detection system setting in each setting of VCII series and Motion CPU.
- (Note-3): The direct drive τDISC series manufactured by CKD Nikki Denso Co., Ltd. can restore the absolute position in the range from -2147483648 to 2147483647. Confirm the specifications of VCII series/VPH series for restrictions by the version of VCII series/VPH series.
- (Note-4): The specification of torque limit direction differs by the version of VCII series/VPH series. Confirm the specifications of VCII series/VPH series for details.
- (Note-5): During amplifier-less operation function, the following are spuriously connected.

		Q173DCPU(-S1)/				
		SSCN	000157	Q172DCPU(-S1)		
	VCI / VPH series	MR-J4(W)-□B	MR-J5(W)-□B	MR-JE-□B	SSCNETⅢ	
Servo amplifier	MR-J4-10B		MR-J5-10B	MR-JE-10B	MR-J3-10B	MR-J3-10B
Servo motor	HG-K	R053	HK-KT053	HG-KN053	HF-KP053	HF-KP053

(Note-6): Refer to the "Servo Amplifier Instruction Manual" for the servo amplifiers that can be used.

(5) Precautions during control

(a) Absolute position system (ABS)/Incremental system (INC).Match the ABS/INC setting in each setting of VCII series and Motion CPU.

Otherwise, a minor error (error code: 902) occurs, and it is controlled by the setting of VCII series side.

ABS/INC setting for the VPH series is set on the VPH series side.

1) Absolute position system (ABS)

When control units are degree axis and the stroke limit is valid, operation may not be normal when the following positioning controls are started. Do not use the following controls.

Operating system software version	Positioning control
"00L" or later	Absolute specification instructions in speed-switching control (VSTART instruction)
"00K" or later	Instructions for pass point absolute specifications in constant-speed control (CPSTART instruction) (linear interpolation, circular interpolation, helical interpolation) Position follow-up control (PFSTART instruction) Absolute specification instructions in speed-switching control (VSTART instruction)

Incremental system (INC)
 There are no restrictions.

(b) Home position return

1) Home position return operation types

The home position return methods that can be used in VCII series/VPH series are shown below.

Home position	on return method	Possible/Not possible
Danish da a a a da d	Proximity dog method 1	0
Proximity dog method	Proximity dog method 2	0
	Count method 1	0
Count method	Count method 2	0
	Count method 3	0
Data and worth and	Data set method 1	0
Data set method	Data set method 2	× (Note-1)
Dog cradle method		0
	Stopper method 1	× (Note-1)
Stopper method	Stopper method 2	× (Note-1)
Limit switch combined r	method	0
Scale home position sig	gnal detection method	0
Dogless home position	signal reference method	0
Driver home position re	turn method	× (Note-2)

 \bigcirc : Possible, \times : Not possible

(Note-1): Minor error (error code: 133) occurs, and home position return is not performed. (Note-2): Minor error (error code: 194) occurs, and home position return is not performed.

2) Dogless home position signal reference method When performing "dogless home position signal reference method" in VCII series, the home position, home position return operation, and home position return data (home position return retry function, dwell time at the home position return retry) is the following. Also, set the VCII series parameter "Function select of SSCNETIII communication mode (P612) (Condition selection of home position set)" as follows.

Servo amplifier type		Linear encoder type	Home position	Home position return operation (Note-1)	Home position Home position return retry function	on return data Dwell time at the home position return retry	Parameter "Function select of SSCNET ommunication mode (P612) (Condition selection of home position set)"
	Linear stage		Position where address of absolute linear encoder becomes 0	Operation C	lnv	alid	-
VCII series/ VPH series		Incremental type	Reference mark	Operation A	Va	alid	0
	Direct drive position type Home position sign (zero point) Incremental type	Home position signal	Operation A/ Operation B	Valid/	Invalid	0/1	
			(zero point)	Operation A	Valid		0

(Note-1): Refer to Section 6.23.14 for home position return operation.

- 3) Home position return without passing motor Z phase
 - When "1" is set in the first digit of the parameter of VCII series "Function select of SSCNETIII communication mode (P612)", it is possible to carry out the home position return without passing the zero point. (Return to home position after power is supplied will be executed when passing of motor Z phase is not necessary.) When "0" is set, a minor error (error code: 120) occurs because the home position is executed without passing the motor Z phase (motor reference position signal).
 - When the parameter of VPH series "Marker (zero point/Z-phase) transit selection in communication mode (P800)" is set to "Zero return operation allowed", it is possible to carry out the home position return without passing the zero point. (Return to home position after power is supplied will be executed when passing of motor Z phase is not necessary.) When "Zero return operation allowed after the marker is passed" is set, a minor error (error code: 120) occurs because the home position is executed without passing the motor Z phase (motor reference position signal).

(c) Control mode QDS

Control modes that can be used are shown below.

- Position control mode (position control, and speed control including position loop)
- Speed control mode (speed control not including position loop)
- Torque control mode (torque control)

However, it is not available to switch to continuous operation to torque control mode of "Speed-torque control". If the mode is switched to continuous operation to torque control mode, a minor error (error code: 318) occurs and the operation stops.

"1: Feedback torque" cannot be set in "Torque initial value selection at control mode switching". If it is set, a minor error (error code: 154) occurs and the command value immediately after switching is the same as the case of selecting "0: Command torque".

(d) Servo parameter

- Control of servo parameters
 Parameters of VCII series/VPH series are not controlled by Motion CPU.
 Therefore, even though the parameter of VCII series/VPH series is changed during the communication between Motion CPU and VCII series/VPH series, it does not process, and is not reflected to the parameter.
- 2) Servo parameter change function QDS(
 - a) Change function of servo parameter can be executed.
 The following is the operation for the servo parameter change function.

	Operation for the servo parameter change function
Servo parameter write request	The servo parameter of VCII series/VPH series is controlled in a unit of 2 words, so that it is necessary to set "3: 2 words write request" in servo parameter write/read request (SD804) for executing the parameter write. If "1: 1 word write request" is executed to VCII series/VPH series, the parameter write fails, and "-1" is stored in servo parameter write/read request (SD804).
Servo parameter read request	The servo parameter of VCII series/VPH series is controlled in a unit of 2 words, so that it is necessary to set "4: 2 words read request" in servo parameter write/read request (SD804) for executing the parameter read. If "2: 1 word read request" is executed to VCII series/VPH series, the parameter read fails, and "-1" is stored in servo parameter write/read request (SD804).

b) When the servo parameter of VCII series/VPH series is changed by the servo parameter change function, the parameter value after changing the servo parameter cannot be confirmed using VCII/VPH data editing software. When confirming the parameter value, execute the servo parameter read request. Also, when the power of VCII series/VPH series is turned OFF, the parameter changed by the servo parameter change function becomes invalid, and the value written by VCII/VPH data editing software becomes valid.

 c) "Servo parameter write/read" device
 Store the value in the following special registers to change or display the servo parameter.

No.	Name	Meaning	Details	Set by
SD552		Servo parameter read value	The read value (low 1 word) of servo parameter which executed "4: 2 word read request" in SD804 is stored. The read value (high 1 word) of servo parameter	System (At read request)
SD553			which executed "4: 2 word read request" in SD804 is stored.	
SD804 (Note-1)		Servo parameter write/read request flag	The "write/read request" is executed after setting of the axis No. and servo parameter No. 2 word write request 2 word read request "0" is automatically set by Motion CPU after completion of servo parameter write/read request. "-1" is stored by Motion CPU at write/read error.)	User/ System
SD805	Servo parameter write/read request	Axis No.	The axis No. to write/read servo parameter is stored. Q173DSCPU: 1 to 32 Q172DSCPU: 1 to 16	
SD806		Servo parameter No.	The servo parameter No. to be written/read is stored in hexadecimal. H Parameter No. Parameter group No. 0: Group 0	User
SD808		Servo parameter	• The setting value of servo parameter to be written is	
SD809		setting value (2 word)	stored when "3: 2 word write request" is set in SD804.	

(Note-1): Do not execute the automatic refresh.

(e) Optional data monitor setting

The following table shows data types that can be set.

Set the total number of communication data points per 1 axis so there are no more than 6 points on a SSCNETII/H line, and no more than 3 points on a SSCNETII line.

	Unit	Number of words	Number of communication data points	Data types that can be set		
Data tuna				VCII series		
Data type				Q173DSCPU/ Q172DSCPU	Q173DCPU(-S1)/ Q172DCPU(-S1)	VPH series QDS(
Effective load ratio	[%]	1	1	0	0	0
Regenerative load ratio	[%]	1	1	0	0	0
Peak load ratio	[%]	1	1	0	0	0
Position F/B	[pulse]	2	0	0	0	0
Encoder position within 1 revolution	[pulse]	2	0	0	0	0
Encoder Multi-revolution counter	[rev]	1	0	0	×	0
Position loop gain 1	[rad/s]	1	1	0	0	0
Bus voltage	[V]	1	1	×	×	0
Cumulative current value	[Position command] (Note-1)	2	0	0	×	0

○: Settable ×: Unsettable

(Note-1): The position command is the command unit set in the fixed parameter.

- (f) Gain changing command, PI-PID switching command, control loop changing command.
 - VCI series
 Gain changing command and PI-PID switching command are available.
 Control loop changing command becomes invalid.
- (g) Driver communication The driver communication is not supported. If the driver communication is set in a servo parameter, a major error (error code: 1363) will occur when the power of Multiple CPU system is turned ON.

(h) Monitor devices (#8000 to #8639)

1) Servo amplifier type (#8000 + 20n)

This register stores the servo amplifier types below when using VCII series/VPH series.

VCT Selles/VLI13	selles.
• 4352	VCII series (Note-1) (CKD Nikki Denso Co., Ltd. make)
	QDS(
• 4354	VCII series (For Linear stage) ^(Note-2)
	(CKD Nikki Denso Co., Ltd. make)
• 4359	VCII series (For direct drive motor) (Note-2)
	(CKD Nikki Denso Co., Ltd. make)
• 4864	VPH series ^(Note-1) (CKD Nikki Denso Co., Ltd.
	make) QDS
• 4866	VPH series (For Linear stage) ^(Note-2)
	(CKD Nikki Denso Co., Ltd. make) QDS
• 4871	VPH series (For direct drive motor) (Note-2)
	(CKD Nikki Denso Co., Ltd. make)

(Note-1): When connecting SSCNET**I**/H (Note-2): When connecting SSCNET**I**

(i) Operation cycle QDS

If "SSCNETII" is set as the SSCNET settings communication type, the operation cycle of 0.22[ms] cannot be used.

Furthermore, even if the operation cycle is set to 0.22[ms] in the setting for axes 1 to 4 for 1 line, if the servo amplifier is mixed with the VCII series, the servo amplifier operates with an operation cycle of 0.44[ms].

If "SSCNET**I**/H" is set as the SSCNET settings communication type, there are no restrictions.

(6) VCII series/VPH series detection error

When an error occurs on VCII series/VPH series, the servo error detection signal (M2408 + 20n) turns ON. Eliminate the error cause, reset the servo amplifier error by turning ON servo error reset command (M3208+20n) and perform restart.

However, "0" is always stored in parameter error No. (#8009+20n).

Refer to the instruction manual of VCII series/VPH series for details of the errors.

APPENDIX 6.2 Inverter FR-A700 series Ver.



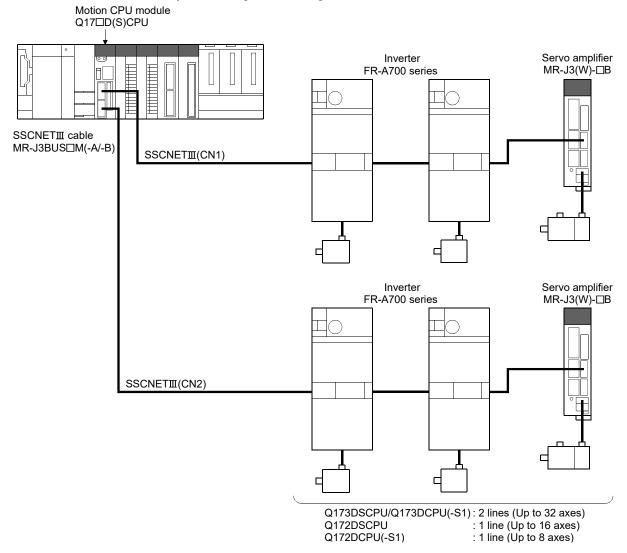
FR-A700 series can be connected via SSCNET by using built-in option FR-A7AP and FR-A7NS.

POINT

FR-A700 series cannot be used on a line where the communication type in SSCNET setting of MT Developer2 is set to "SSCNETII/H".

(1) System configuration

The system configuration using FR-A700 series is shown below.



Ver.!): Refer to Section 1.3 for the software version that supports this function.

(2) Parameter setting

To connect FR-A700 series, set the following in the system setting of MT Developer2.

- (a) When using Q173DSCPU/Q172DSCPU
 - Set " SSCNET III" for communication type in SSCNET setting.
 - Set the amplifier model in amplifier setting to "FR-A700".
- (b) When using Q173DCPU(-S1)/ Q172DCPU(-S1)
 - Set the amplifier model in amplifier setting to "FR-A700".

(3) Control of FR-A700 series parameters

Parameters set in FR-A700 series are not controlled by Motion CPU. Set the parameters by connecting FR-A700 series directly with the operation panel on the front of inverter (FR-DU07/FR-PU07) or FR Configurator that is inverter setup software. For details on setting items for FR-A700 series, refer to the instruction manual of the FR-A700 series.

POINT

In the state of connecting between FR-A700 series and Motion CPU, only a part of parameters can be set if the parameter of the inverter " Pr.77 Parameter write selection" is in the initial state. Set "2: Write parameters during operation" to rewrite the parameters of FR-A700 series.

(4) Reset selection/disconnected PU detection/PU stop selection When PU stop is executed in FR-A700 series, position error excessive, etc. occur because a command from Motion CPU does not stop. Set "0 to 3" in the parameter of the inverter " Pr.75 Reset selection/disconnected PU detection/PU stop selection". To stop FR-A700 series, use the stop signal and the forced stop of Motion CPU, or use the output stop (MRS) of FR-A700 series.

Setting item	Default value	Setting value	Details		
		0	Reset input is always enabled. If the PU is disconnected, operation will be continued. PU stop is disabled at SSCNETⅢ connection.		
		1	 A reset can be input only when the protective function is activated. If the PU is disconnected, operation will be continued. PU stop is disabled at SSCNETII connection. 		
		2	 Reset input is always enabled. When the PU is disconnected, the inverter trips. PU stop is disabled at SSCNETII connection. 		
Reset selection/ disconnected PU		3	 A reset can be input only when the protective function is activated. When the PU is disconnected, the inverter trips. PU stop is disabled at SSCNETII connection. 		
detection/ PU stop selection (Pr. 75)	14		 Reset input is always enabled. If the PU is disconnected, operation will be continued. Deceleration stop by PU stop in any operation mode. 		
		15	 A reset can be input only when the protective function is activated. If the PU is disconnected, operation will be continued. Deceleration stop by PU stop in any operation mode. 		
	16			16	 Reset input is always enabled. When the PU is disconnected, the inverter trips. Deceleration stop by PU stop in any operation mode.
			 A reset can be input only when the protective function is activated. When the PU is disconnected, the inverter trips. Deceleration stop by PU stop in any operation mode. 		

(Note): Note that the default value is set to "14". (Change the value to "0 to 3")

(5) In-position range

Set the in-position range in the parameter of the inverter "In-position width (Pr. 426)".

When the position of the cam axis is restored in advanced synchronous control, a check is performed by the servo parameter "In-position range" (PA10). However, because the servo parameter settings are not performed in FR-A700 series, the "In-position range" is checked as 100[pulse] (fixed value).

(6) Optional data monitor setting

The following table shows data types that can be set.

Set the data so that the total number of communication points per axis is no more than 3 points.

		Number of words	Number of	Data types that can be set	
Data type	Unit		communication data points	Q173DSCPU/ Q172DSCPU	Q173DCPU(-S1)/ Q172DCPU(-S1)
Motor load ratio	[%]	1	1	0	0
Position F/B	[pulse]	2	0	0	0
Encoder position within 1 revolution	[pulse]	2	0	0	0
Load inertia moment ratio	[× 0.1 times]	1	1	0	0
Position loop gain	[rad/s]	1	1	0	0
Converter output voltage	[V]	1	1	0	0
Cumulative current value	[Position command] (Note-1)	2	0	0	×

○: Settable ×: Unsettable

(Note-1): The position command is the command unit set in the fixed parameter.

POINT

When FR-A700 series is used, each data is delayed for "update delay time + communication cycle" because of the update cycle of the inverter. The update delay time for each data is shown in the table below.

=	
Data type	Update delay time of FR-A700 series
Motor load ratio	12.5ms
Position F/B	222µs
Encoder position within 1 revolution	222µs
Load inertia moment ratio	56ms or more (up to 2500ms)
Position loop gain	56ms or more (up to 2500ms)
Converter output voltage	9.888ms

(7) External input signal

Set as the following to fetch the external input signal (FLS/RLS/DOG) via FR-A700 series.

- (a) Set the following items with MT Developer2
 - When using Q173DSCPU/Q172DSCPU
 Set "Amplifier input" for every axis with signal type in the servo external signal parameter of servo data setting.
 - When using Q173DCPU(-S1)/ Q172DCPU(-S1)
 Set "Amplifier input valid" as the external signal input setting in the "Amplifier setting" of system setting.
- (b) Set the parameters of the inverter as below. (Otherwise, each signal remains OFF.)

Setting item	Default value	Setting value	Details
STF terminal function selection (Pr. 178)	60	60	
STR terminal function selection (Pr. 179)	61	61	Use with the default value
JOG terminal function selection (Pr. 185)	5	76	Set 76 (Proximity dog)
SSCNETIII input filter selection (Pr. 449)	4	0: None 1: 0.88ms 2: 1.77ms 3: 2.66ms 4: 3.55ms	Set the input filter setting value at reading an external signal.

(8) Comparisons of specifications with MR-J3(W)-□B

Item	FR-A700 series (Note-1)	MR-J3(W)-□B
Amplifier type	FR-A700	MR-J3(W)-B, MR-J3-□B(S) (For fully closed loop control), MR-J3(W)-B (Linear servo), MR-J3(W)-B (Direct drive motor)
Control of servo amplifier parameters	Set directly by inverter. (Not controlled by Motion CPU.)	Controlled by Motion CPU.
External input signal	External input signals of FR-A700 series, and bit devices are available.	External input signals of servo amplifier, and bit devices are available.
Optional data monitor (Data type)	• Motor load ratio • Position F/B • Encoder position within 1 revolution • Load inertia moment ratio • Position loop gain • Converter output voltage • Cumulative current value	Effective load ratio Regenerative load ratio Peak load ratio Position F/B Encoder position within 1 revolution Encoder multi-revolution counter Load inertia moment ratio Model loop gain Bus voltage Cumulative current value Servo motor speed Selected droop pulse Load side encoder information1 Load side encoder information2 Servo motor thermistor temperature

Item	FR-A700 series (Note-1)	MR-J3(W)-□B
Absolute position detection system	Unusable	Usable
Home position return method	Proximity dog method (1, 2), Count method (1 to 3), Data set method (1), Dog cradle method, Limit switch combined method, Scale home position signal detection method	Proximity dog method (1, 2), Count method (1 to 3), Data set method (1, 2), Dog cradle method, Stopper method (1, 2), Limit switch combined method, Scale home position signal detection method, Dogless home position signal reference method
Speed-torque control @DSK	Position control mode, Speed control mode, Torque control mode	Position control mode, Speed control mode, Torque control mode, Continuous operation to torque control mode
Gain changing command	Valid	Valid
PI-PID switching command	Valid	Valid
Control loop changing command	Invalid	Valid when using servo amplifier for fully closed loop control (MR-J3-□B-RJ006)
Servo parameter read/write	Unusable	Usable
Amplifier-less operation function (Note-2)	Usable ^(Note-3)	Usable
Driver communication QDS	Unusable	Usable (Note-4)
Monitoring of servo parameter error No.	Unusable	Usable

(Note-1): For details of FR-A700 series, refer to FR-A700 series instruction manual.

(Note-2): During amplifier-less operation function, the following are spuriously connected.

Servo amplifier : MR-J3-10BServo motor : HF-KP053

(Note-3): Parameters set in FR-A700 series are not controlled by Motion CPU. Therefore, the operation is the same as when the servo parameter "Rotation direction selection/travel direction selection (PA14)" is set as below during amplifier-less operation mode.

Setting item	Setting value	Details
Rotation direction selection/travel		Positioning address increase: CCW or positive direction
direction selection (PA14)	0	Positioning address decrease: CW of negative direction

(Note-4): Refer to the "Servo Amplifier Instruction Manual" for the servo amplifiers that can be used.

(9) Precautions during control

(a) Absolute position system (ABS)/Incremental system (INC) When using FR-A700 series, absolute position system (ABS) cannot be used.

(b) Control mode QDS

Control modes that can be used are shown below.

- Position control mode (position control, and speed control including position loop)
- Speed control mode (speed control not including position loop)
- Torque control mode (torque control)

However, it is not available to switch to continuous operation to torque control mode of "Speed-torque control". If the mode is switched to continuous operation to torque control mode, a minor error (error code: 318) occurs and the operation stops.

"1: Feedback torque" cannot be set in "Torque initial value selection at control mode switching". If it is set, a minor error (error code: 154) occurs and the command value immediately after switching is the same as the case of selecting "0: Command torque".

(c) Control mode switching of speed-torque control The axis connected with FR-A700 series takes more time to switch the control mode than the axis connected with the servo amplifier.

Switching operation	Switching time at the servo amplifier use	Switching time at FR-A700 series use	
Position control mode → Speed control mode	•		
Speed control mode → Position control mode		19 to 24ms	
Position control mode → Torque control mode	6 to 11ms		
Torque control mode → Position control mode			
Speed control mode \rightarrow Torque control mode			
Torque control mode \rightarrow Speed control mode			

(d) Driver communication QDS

The driver communication is not supported. If the driver communication is set in a servo parameter, a major error (error code: 1363) will occur when the power supply of the Multiple CPU system is turned ON.

- (e) Monitor devices (#8000 to #8639)
 - Servo amplifier type (#8000+20n)
 This register stores the servo amplifier types below when using FR-A700 series.
 - 16640 FR-A700 series (Inverter)

(f) Operation cycle QDS

The operation cycle of 0.22[ms] cannot be used.

Furthermore, even if the operation cycle is set to 0.22[ms] in the setting for axes 1 to 4 for 1 line, if the servo amplifier is mixed with the FR-A700 series, the servo amplifier operates with an operation cycle of 0.44[ms].

(10) FR-A700 series detection error

When an error occurs on FR-A700 series, the servo error detection signal (M2408+20n) turns ON. Eliminate the error cause, reset the servo amplifier error by turning ON servo error reset command (M3208+20n) and perform restart.

However, "0" is always stored in parameter error No. (#8009+20n), and "Absolute position lost (b14)" of servo status 1 (#8010+20n).

The errors detected by FR-A700 series are shown in Table 6.2. Refer to the instruction manual of FR-A700 series for details of the errors.

(a) FR-A700 series

Table 6.2 FR-A700 series error list (2000 to 2199)

Error code	FR-A700 series LED display	Name	Remarks
2010	E.OC1	Overcurrent trip during acceleration	
2011	E.OC2	Overcurrent trip during constant speed	
2012	E.OC3	Overcurrent trip during deceleration or stop	
2015	E.OV3	Regenerative overvoltage trip during deceleration or stop	
2016	E.THM	Motor overload trip (electronic thermal relay function)	
2017	E.THT	Inverter overload trip (electronic thermal relay function)	
2018	E.IPF	Instantaneous power failure	
2019	E.UVT	Undervoltage	
2020	E.BE	Brake transistor alarm detection	
2021	E.GF	Output side earth (ground) fault overcurrent	
2022	E.OHT	External thermal relay operation	
2023	E.OLT	Stall prevention stop	
2024	E.OPT	Option fault	
2027	E.PE	Parameter storage device fault	
2028	E.PUE	PU disconnection	
2030	E.CPU	CPU fault	
2031	E.ILF	Input phase loss	
2032	E.FIN	Heatsink overheat	
2033	E.OS	Overspeed occurrence	
2034	E.OSD	Speed deviation excess detection	
2035	E.ECT	Signal loss detection	
2036	E.OD	Excessive position fault	
2045	E.P24	24VDC power output short circuit	
2046	E.CTE	Operation panel power supply short circuit, RS-485 terminal power supply short circuit	
2047	E.LF	Output phase loss	
2048	E.PTC	PTC thermistor operation	
2049	E.PE2	Parameter storage device fault	
2050	E.CDO	Output current detection value exceeded	
2051	E.IOH	Inrush current limit circuit fault	
2052	E.SER	Communication fault (inverter)	
2053	E.AIE	Analog input fault	
2055	E.USB	USB communication fault	

Table 6.2 FR-A700 series error list (2000 to 2199)

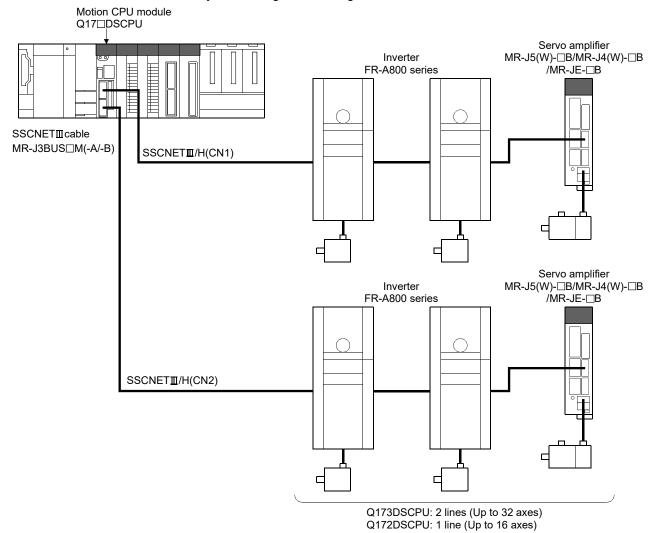
Error code	FR-A700 series LED display	Name	Remarks
2056	E.1		
2057	E.2	Option fault	
2058	E.3		
2060	E.5		
2061	E.6	CPU fault	
2062	E.7		
2070	E.EP	Encoder phase fault	
2088	_	Watchdog	
2090	E.OP3		
2091	E.OP3		
2092	E.OP3	Communication option fault	
2093	E.OP3		
2099	_	SSCNET receive error	
2100	OL	Stall prevention (overcurrent)	
2101	oL	Stall prevention (overvoltage)	
2102	PS	PU stop	
2103	RB	Regenerative brake pre-alarm	
2104	TH	Electronic thermal relay function pre-alarm	
2105	MT	Maintenance signal output	
2106	СР	Parameter copy	
2107	SL	Speed limit indication (Output during speed limit)	
2108	Fn	Fan alarm	
2146		Output stop	
2147		Emergency stop	

APPENDIX 6.3 Inverter FR-A800 series QDS (Ver)

FR-A800 series can be connected via SSCNETI/H by using built-in option FR-A8AP and FR-A8NS.

(1) System configuration

The system configuration using FR-A800 series is shown below.



Ver.!: Refer to Section 1.3 for the software version that supports this function.

(2) Parameter setting

To connect FR-A800 series, set the following in the system setting of MT Developer2.

- Set " SSCNET III/H" for communication type in SSCNET setting.
- Set the amplifier model in amplifier setting to "FR-A800-1" or "FR-A800-2".

(3) Control of FR-A800 series parameters

Parameters set in FR-A800 series are not controlled by Motion CPU. Set the parameters by connecting FR-A800 series directly with the operation panel on the front of inverter (FR-DU08/FR-LU08/FR-PU07) or FR Configurator2 that is inverter setup software. For details on setting items for FR-A800 series, refer to the instruction manual of the FR-A800 series.

POINT

In the state of connecting between FR-A800 series and Motion CPU, only a part of parameters can be set if the parameter of the inverter "Pr.77 Parameter write selection" is in the initial state. Set "2: Write parameters during operation" to rewrite the parameters of FR-A800 series.

(4) In-position range

Set the in-position range in the parameter of the inverter "In-position width (Pr. 426)".

When the position of the cam axis is restored in advanced synchronous control, a check is performed by the servo parameter "In-position range" (PA10). However, because the servo parameter settings are not performed in FR-A800 series, the "In-position range" is checked as 100[pulse] (fixed value).

(5) Optional data monitor setting

The following table shows data types that can be set.

Set the data so that the total number of communication points per axis is no more than 6 points.

Data type	Unit	Number of words	Number of communication data points
Motor load ratio	[%]	1	1
Position F/B	[pulse]	2	0
Encoder position within 1 revolution	[pulse]	2	0
Encoder Multi-revolution counter	[rev]	1	0
Load inertia moment ratio	[× 0.1 times]	1	1
Position loop gain	[rad/s]	1	1
Converter output voltage	[V]	1	1
Cumulative current value	[Position command] (Note-1)	2	0

(Note-1): The position command is the command unit set in the fixed parameter.

POINT

When FR-A800 series is used, each data is delayed for "update delay time + communication cycle" because of the update cycle of the inverter. The update delay time for each data is shown in the table below.

Data type	Update delay time of FR-A800 series	
Motor load ratio	10ms	
Position F/B	222µs	
Encoder position within 1 revolution	222µs	
Encoder Multi-revolution counter	222µs	
Load inertia moment ratio	10ms	
Position loop gain	10ms	
Converter output voltage	5ms	

(6) External input signal

Set as the following to fetch the external input signal (FLS/RLS/DOG) via FR-A800 series.

- (a) Set the following items with MT Developer2. Set "Amplifier input" for every axis with signal type in the servo external signal parameter of servo data setting.
- (b) Refer to the instruction manual of FR-A800 series for parameter settings on the inverter side.

(7) Comparisons of specifications with MR-J5(W)-□B/MR-J4(W)-□B /MR-JE-□B

Item	FR-A800 series (Note-1)	MR-J5(W)-□B	MR-J4(W)-□B	MR-JE-□B		
Amplifier type	FR-A800-1, FR-A800-2	MR-J5(W)-B(-RJ)	MR-J4(W)-B(-RJ)	MR-JE-B(F)		
Control of servo amplifier parameters	Set directly by inverter. (Not controlled by Motion CPU.)	Controlled by Motion CPU.				
External input signal	External input signals of FR-A800 series, and bit devices are available.	External input signals of servo amplifier, and bit devices are available.				
Optional data monitor (Data type)	Motor load ratio Position F/B Encoder position within 1 revolution Encoder multi-revolution counter Load inertia moment ratio Position loop gain Converter output voltage Cumulative current value	Effective load ratio Regenerative load ratio Peak load ratio Position F/B Encoder position within 1 revolution Encoder multi-revolution counter Load inertia moment ratio Model loop gain Bus voltage Cumulative current value Servo motor speed Selected droop pulse Unit power consumption Unit total power consumption Instantaneous torque Load side encoder information1 Load side encoder information2 Z-phase counter Servo motor thermistor temperature Torque equivalent to disturbance Overload alarm margin Excessive error alarm margin Settling time Overshoot amount Servo motor/Load side position deviation		Effective load ratio Regenerative load ratio Peak load ratio Position F/B Encoder position within 1 revolution Encoder multi-revolution counter Load inertia moment ratio Model loop gain Bus voltage Cumulative current value Servo motor speed Selected droop pulse Unit power consumption Unit total power consumption Instantaneous torque Torque equivalent to disturbance Overload alarm margin Excessive error alarm margin Settling time Overshoot amount Internal temperature of encoder		
Absolute position detection system	Unusable		Usable			
Home position return method	Proximity dog method (1, 2), Count method (1 to 3), Data set method (1), Dog cradle method, Limit switch combined method, Scale home position signal detection method	p 3),), Proximity dog method (1, 2), Count method (1 to 3), Data set method, l, Dog cradle method, Stopper method (1, 2), Limit switch combined Scale home position signal detection method, Dogless home position signal reference method				
Speed-torque control	Position control mode, Speed control mode, Torque control mode	Position control mode, Speed control mode, Torque control mode, Continuous operation to torque control mode				
Gain changing command	Valid	Valid				
PI-PID switching command	Valid		Valid			

Item	FR-A800 series (Note-1)	MR-J5(W)-□B	MR-J4(W)-□B	MR-JE-□B	
Control loop changing command	Invalid	Va	alid	Invalid	
Servo parameter read/write	Unusable		Usable		
Amplifier-less operation function (Note-2)	Usable ^(Note-3)	Usable			
Driver communication	Unusable	Usable (Note-4)		Unusable	
Monitoring of servo parameter error No.	Unusable		Usable		
Servo error (Motion error history)	Error codes detected by FR-A800 series are stored.	Error codes detected by servo amplifier are stored.			
Programming tool	MR Configurator2 is not available. Use FR-DU08/FR- LU08/FR-PU07, or FR Configurator2.	MR Configurator2 is available.			

(Note-1): For details of FR-A800 series, refer to FR-A800 series instruction manual.

(Note-2): During amplifier-less operation function, the following are spuriously connected.

	FR-A800 series	MR-J4(W)-□B	MR-J5(W)-□B	MR-JE-□B
Servo amplifier	MR-J4-10B		MR-J5-10B	MR-JE-10B
Servo motor	HG-KR053		HK-KT053	HG-KN13

(Note-3): Parameters set in FR-A800 series are not controlled by Motion CPU. Therefore, the operation is the same as when the servo parameter "Rotation direction selection/travel direction selection (PA14)" is set as below during amplifier-less operation mode.

Setting item	Setting value	Details
Rotation direction selection/travel		Positioning address increase: CCW or positive direction
direction selection (PA14)	0	Positioning address decrease: CW of negative direction

(Note-4): Refer to the "Servo Amplifier Instruction Manual" for the servo amplifiers that can be used.

(8) Precautions during control

- (a) Absolute position system (ABS)/Incremental system (INC) When using FR-A800 series, absolute position system (ABS) cannot be used.
- (b) Control mode

Control modes that can be used are shown below.

- Position control mode (position control, and speed control including position loop)
- Speed control mode (speed control not including position loop)
- Torque control mode (torque control)

However, it is not available to switch to continuous operation to torque control mode of "Speed-torque control". If the mode is switched to continuous operation to torque control mode, a minor error (error code: 318) occurs and the operation stops.

"1: Feedback torque" cannot be set in "Torque initial value selection at control mode switching". If it is set, a minor error (error code: 154) occurs and the command value immediately after switching is the same as the case of selecting "0: Command torque".

(c) Driver communication

The driver communication is not supported. If the driver communication is set in a servo parameter, a major error (error code: 1363) will occur when the power supply of the Multiple CPU system is turned ON.

(d) Monitor devices (#8000 to #8639)

1) Servo amplifier type (#8000+20n)

This register stores the servo amplifier types below when using FR-A800 series.

- 8192 FR-A800-1 (Inverter)
- 8193 FR-A800-2 (Inverter)

(e) Command speed

If FR-A800 series is operated at a command speed more than the maximum speed, the stop position may be overshoot.

(9) FR-A800 series detection error

When an error occurs on FR-A800 series, the servo error detection signal (M2408 + 20n) turns ON. Eliminate the error cause, reset the servo amplifier error by turning ON servo error reset command (M3208 + 20n) and perform restart

However, "0" is always stored in parameter error No. (#8009 + 20n), and "Absolute position lost (b14)" of servo status 1 (#8010 + 20n).

The errors detected by FR-A800 series are shown in Table 6.3. Refer to the instruction manual of FR-A800 series for details of the errors.

(a) FR-A800 series

Table 6.3 FR-A800 series error list (2000 to 2209)

Error code	FR-A800 series LED display	Name	Remarks
2010	E.OC1	Overcurrent trip during acceleration	
2011	E.OC2	Overcurrent trip during constant speed	
2012	E.OC3	Overcurrent trip during deceleration or stop	
2013	E.OV1	Regenerative overvoltage trip during acceleration	
2014	E.OV2	Regenerative overvoltage trip during constant speed	
2015	E.OV3	Regenerative overvoltage trip during deceleration or stop	
2016	E.THM	Motor overload trip (electronic thermal relay function)	
2017	E.THT	Inverter overload trip (electronic thermal relay function)	
2018	E.IPF	Instantaneous power failure	
2019	E.UVT	Undervoltage	
2020	E.BE	Brake transistor alarm detection	
2021	E.GF	Output side earth (ground) fault overcurrent	
2022	E.OHT	External thermal relay operation	
2023	E.OLT	Stall prevention stop	
2024	E.OPT	Option fault	
2025	E.OP3	Communication antique foult	
2026	E.OP2	Communication option fault	
2027	E.PE	Parameter storage device fault	
2028	E.PUE	PU disconnection	
2029	E.RET	Retry count excess	

Table 6.3 FR-A800 series error list (2000 to 2209) (continued)

		T-A000 Selles elloi list (2000 to 2209) (col	1
Error code	FR-A800 series LED display	Name	Remarks
2030	E.CPU	CPU fault	
2031	E.ILF	Input phase loss	
2032	E.FIN	Heatsink overheat	
2033	E.OS	Overspeed occurrence	
2034	E.OSD	Speed deviation excess detection	
2035	E.ECT	Signal loss detection	
2036	E.OD	Excessive position fault	
2037	E.ECA	Encoder signal loss for orientation	
2038	E.MB1		
2039	E.MB2		
2040	E.MB3		
2041	E.MB4	Brake sequence fault	
2042	E.MB5		
2043	E.MB6		
2043	E.MB7	1	
2044	E.P24	24VDC power fault	
		Operation panel power supply short circuit/	
2046	E.CTE	RS-485 terminals power supply short circuit	
2047	E.LF	Output phase loss	
2048	E.PTC	PTC thermistor operation	
2049	E.PE2	Parameter storage device fault	
2050	E.CDO	Abnormal output current detection	
2051	E.IOH	Inrush current limit circuit fault	
2052	E.SER	Communication fault (inverter)	
2053	E.AIE	Analog input fault	
2055	E.USB	USB communication fault	
2056	E.1		
2057	E.2	Option fault	
2058	E.3		
2060	E.5		
2061	E.6	CPU fault	
2062	E.7		
2066	E.11	Opposite rotation deceleration fault	
2068	E.13	Error 13	
2069	E.14	Other errors	
2070	E.EP	Encoder phase fault	
2072	E.16	,	
2072	E.17	1	
2073	E.18	User definition error by the PLC function	
2074	E.19		
2076	E.20	1	
2076		Watchdog	
	— E OP1		
2090	E.OP1	1	
2091	E.OP1	Communication option fault	
2092	E.OP1	-	
2093	E.OP1	OCCUET :	
2099		SSCNET receive error	
2100	OL	Stall prevention (overcurrent)	
2101	oL	Stall prevention (overvoltage)	

Table 6.3 FR-A800 series error list (2000 to 2209) (continued)

Error code	FR-A800 series LED display	Name	Remarks
2102	PS	PU stop	
2103	Rb	Regenerative brake pre-alarm	
2104	TH	Electronic thermal relay function pre-alarm	
2106	CP	Parameter copy	
2107	SL	Speed limit indication	
2108	FN	Fan alarm	
2111	E.SOT	Loss of synchronism detection	
2112	E.EHR	Est.	
2113	EHR	Ethernet communication error	
2114	RD	Backup in progress	
2115	WR	Restoration in progress	
2117	E.EF	External fault during output operation	
2130	SA	Safety stop	
2131	HD1	Low flow rate input warning	
2132	FN2	Internal fan alarm	
2133	UF	USB host error	
2134	MT1	Maintenance signal output	
2135	MT2	Maintenance signal output	
2136	MT3	Maintenance signal output	
2137	HP3	Home position return parameter setting error	
2138	HP2	Home position return uncompleted	
2139	HP1	Home position return setting error	
2146	_	Output stop	
2147	_	Emergency stop	
2159	_	Other warnings	
2200	E.SAF	Safety circuit fault	
2201	E.PBT	Internal circuit fault	
2202	E.MP	Magnetic pole position unknown	
2204	E.IAH	Abnormal internal temperature	
2207	E.LCI	4mA input fault	
2208	E.PCH	Pre-charge fault	
2209	E.PID	PID signal fault	

APPENDIX 6.4 Optical hub unit QDS(Ver)

The SSCNETII/H Compatible Optical Hub Unit (MR-MV200) is a unit that enables the branching of SSCNETI/H communication on 1 line (3 branches for 1 input).

SSCNETII/H communication can be branched by installing an optical hub unit in a SSCNETII/H system. The optical hub unit is compatible with all slave equipment (servo amplifiers etc.) that supports SSCNET**I**/H communication.

Setting the optical hub unit station settings on Motion CPUs and MT Developer2 is not required.

The power supply of equipment connected to the optical hub unit can be turned OFF/ON (Disconnect/Reconnect) during operation.

(1) Restrictions on SSCNET communication

Set the communication type to "SSCNET **I**/H" for the SSCNET setting connecting the optical hub unit.

SSCNETII/H communication equipment set in MT Developer2 can be connected. There are no restrictions on connection order or connection position.

The servo amplifiers and SSCNETⅢ/H compatible equipment that can be used with the optical hub unit are shown below.

SSCNET		Servo a	SSCNETⅢ/H compatible		
setting	MR-J5(W)-□B	MR-J4(W)-□B	equipment		
SSCNETⅢ/H	0 0 × 0				0
SSCNETII	×	×	×	×	×

○: Available ×: Not available

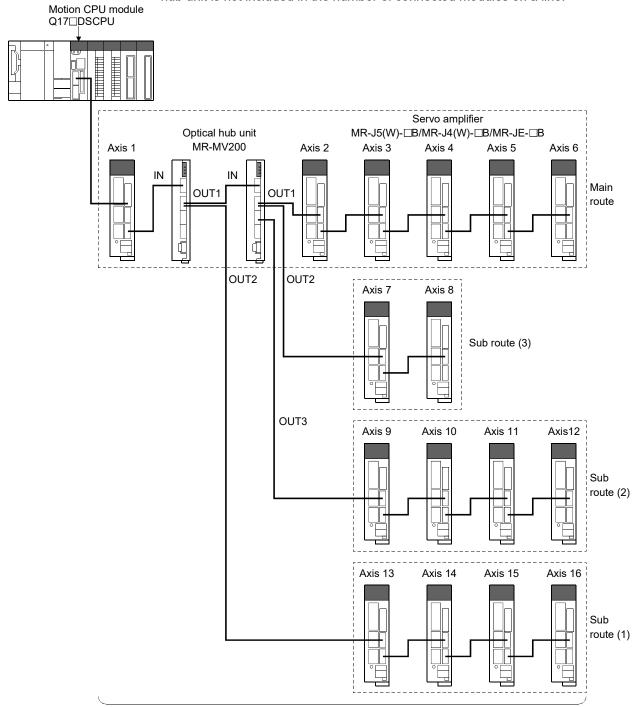
Ver.!: Refer to Section 1.3 for the software version that supports this function.

(2) System configuration

A connection example using optical hub units is shown below.

The transmission route that passes through the optical hub unit IN connector (CN1A connector for servo amplifier) and OUT1 connector (CN1B connector for servo amplifier) is called the "Main route", and the transmission routes that pass through OUT2 connector and OUT3 connectors are called the "Sub route". The optical hub unit can only be connected on the main route. Also, the optical

The optical hub unit can only be connected on the main route. Also, the optical hub unit is not included in the number of connected modules on a line.



Q173DSCPU: 2 lines (Up to 32 axes (Up to 16 axes per line))

Q172DSCPU: 1 line (Up to 16 axes)

(Note): The optical hub unit is not included in the count

POINTS

- (1) If the optical hub unit is connected to a sub route, an error occurs, and the optical hub unit does not communicate with the Motion CPU.
- (2) A servo amplifier can be connected between two optical hub units, and between a Motion CPU and an optical hub unit.
- (3) When turning OFF the control circuit power supply of SSCNET**II**/H compatible equipment connected to an optical hub unit, use the "connect/disconnect function of SSCNET communication". Refer to "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for details of "connect/disconnect function of SSCNET communication".

(3) Checking the status of the optical hub unit

The connection status of the optical hub unit can be checked with the special registers below.

Device No.	Name	Meaning	Details	Set by
SD724	SSCNETI/H compatible optical hub unit loading information (Line 1)	SSCNETIMH compatible optical hub unit loading information (Line 1)	Checks the connection status (Installed: 1/Not installed: 0) of the optical hub unit and stores as bit data. SD724: b0 to b15 (Optical hub unit No.1 to No.16 on line 1) SD725: b0 to b15 (Optical hub unit No.1 to No.16 on line 2) (Note): No. 1 to No. 16 is the connection order from the Motion CPU	
SD725	SSCNETI/H compatible optical hub unit loading information (Line 2)	SSCNETI/H compatible optical hub unit loading information (Line 2)	 "1" is stored to the installation status of an optical hub unit with a servo amplifier connected. "0" is stored to the installation status when an optical hub unit is not connected after an optical hub unit that is not connected to a servo amplifier, or when the optical hub unit connected after an optical hub unit is not connected to a servo amplifier either. For optical hub units connected before an optical hub unit connected to a servo amplifier, "1" is stored to the installation status, regardless of whether there is a servo amplifier connection or not. 	System (Operation cycle)
SD726	SSCNETIM/H compatible optical hub unit communication error information (Line 1)	SSCNETIM/H compatible optical hub unit communication error information (Line 1)	Checks the communication status (Communication error detected: 1/No communication error detected: 0) of the optical hub unit and stores as bit data. SD726: b0 to b15 (Optical hub unit No.1 to No.16 on line 1) SD727: b0 to b15 (Optical hub unit No.1 to No.16 on line 2)	System (Occur an
SD727	SSCNETIM/H compatible optical hub unit communication error information (Line 2)	SSCNETII/H compatible optical hub unit communication error information (Line 2)	(Note): No. 1 to No. 16 is the connection order from the Motion CPU • The device contents are not reset by turning power supply of optical hub unit OFF/reset, or by disconnecting/reconnecting communication with the Motion CPU. Reset the device contents manually.	error)

(4) Driver communication function

Driver communication function is only supported between servo amplifiers on the same route starting from the Motion CPU until the last module.

Driver communication is not performed between servo amplifiers on different sub routes, or between a servo amplifier connected on the main route after an optical hub unit and a servo amplifier on a sub route connected to an optical hub unit. When an axis set for driver communication is in a position where driver communication cannot be performed, or when the connection of an axis set for driver communication is not confirmed, all servo amplifiers including those that are on axes not set to driver communication, cannot communicate with the Motion CPU.

Routes where driver communication function is possible are shown below.

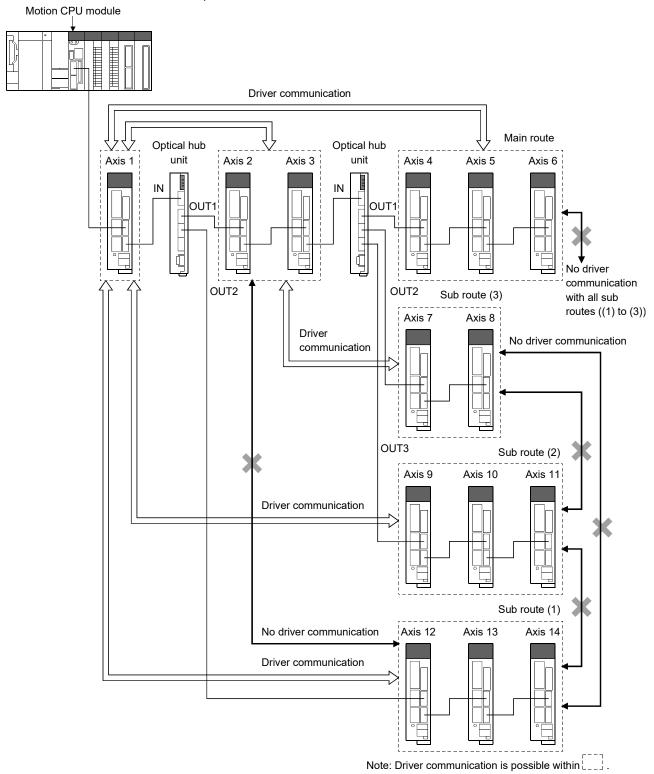
Route	Supported
Within the main route	0
Within the same sub route	0
Between different sub routes	×
Between main route and sub route	
(Between slaves on first optical hub unit (main route) and sub route)	O
Between main route and sub route	
(Between slaves on later optical hub unit (main route) and sub route)	×

○: Driver communication ×: No driver communication

POINTS

Refer to "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for details of "Driver communication function".

(a) Servo amplifier layout for driver communication
A connection example showing where driver communication is possible/not possible is shown below.



APPENDIX 6.5 AlphaStep/5-phase stepping motor driver manufactured by ORIENTAL MOTOR Co., Ltd. QDS (Ver.)

The ORIENTAL MOTOR Co., Ltd. made stepping motor driver AlphaStep/5-phase can be connected via SSCNETII/H.

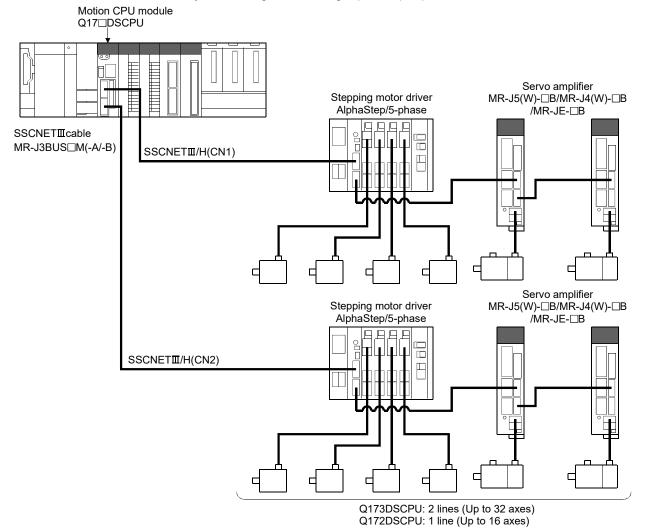
Contact to ORIENTAL MOTOR Co., Ltd. overseas sales office for details of AlphaStep/5-phase.

POINT

AlphaStep/5-phase cannot be used on a line where the communication type in SSCNET setting of MT Developer2 is set to "SSCNETII".

(1) System configuration

The system configuration using AlphaStep/5-phase is shown below.



Ver.!: Refer to Section 1.3 for the software version that supports this function.

(2) Parameter setting

To connect AlphaStep/5-phase, set the following in the system setting of MT Developer2.

- Set "SSCNET II/H" for communication type in SSCNET setting.
- Set the amplifier model in amplifier setting to "AlphaStep/5-phase (ORIENTAL MOTOR)".

(3) Control of AlphaStep/5-phase parameters

Parameters set in AlphaStep/5-phase are not controlled by Motion CPU. They are set directly using AlphaStep/5-phase data editing software. For details on setting items for AlphaStep/5-phase, refer to the instruction manual of the AlphaStep/5-phase.

(4) Comparisons of specifications with MR-J5(W)-□B/MR-J4(W)-□B/MR-JE-□B

Item	AlphaStep/5-phase (Note-1)	MR-J5(W)-□B	MR-J4(W)-□B	MR-JE-□B			
Amplifier type	AlphaStep/5-phase (ORIENTAL MOTOR)	MR-J5(W)-B(-RJ)	MR-J4(W)-B(-RJ)	MR-JE-B(F)			
Control of servo	Controlled by AlphaStep/		Controlled by Motion CPU	1			
amplifier parameters	5-phase		Controlled by Motion CFO				
External input signal	External input signals of AlphaStep/5-phase, and bit devices are available.	External input signals of servo amplifier, and bit devices are available.					
Optional data monitor (Data type)	Position F/B Encoder position within 1 revolution Encoder Multi-revolution counter Cumulative current value External encoder counter value	Effective load ratio Regenerative load ratio Peak load ratio Position F/B Encoder position within 1 r Encoder Multi-revolution c Load inertia moment ratio Model loop gain Bus voltage Cumulative current value Servo motor speed Selected droop pulse Unit power consumption Unit total power consumpt Instantaneous torque Load side encoder informa Load side encoder informa Z-phase counter Servo motor thermistor ter Torque equivalent to disture Overload alarm margin Excessive error alarm mar Settling time Overshoot amount Servo motor/Load side pos Servo motor/Load side spee Internal temperature of en	ion ation1 ation2 mperature rbance gin sition deviation eed deviation	Effective load ratio Regenerative load ratio Peak load ratio Position F/B Encoder position within 1 revolution Encoder Multi-revolution counter Load inertia moment ratio Model loop gain Bus voltage Cumulative current value Servo motor speed Selected droop pulse Unit power consumption Unit total power consumption Instantaneous torque Torque equivalent to disturbance Overload alarm margin Excessive error alarm margin Settling time Overshoot amount Internal temperature of encoder			

Item	AlphaStep/5-phase (Note-1)	MR-J5(W)-□B	MR-J4(W)-□B	MR-JE-□B		
Absolute position detection system	Usable	Usable				
Unlimited length feed	Usable		Usable			
Home position return method	Count method (2), Data set method (1), Driver home position return method	Proximity dog method (1, 2), Count method (1 to 3), Data set method (1, 2), Dog cradle method, Stopper method (1, 2), Limit switch combined method, Scale home position signal detection method, Dogless home position signal reference method				
Speed-torque control	Position control mode		node, Speed control mode, To uous operation to torque cont	•		
Gain changing command	Invalid	Valid				
PI-PID switching command	Invalid	Valid				
Control loop changing command	Invalid	V	alid	Invalid		
Amplifier-less operation function	Unusable		Usable			
Servo parameter read/change	Usable		Usable			
Driver communication	Unusable	Usable	(Note-2)	Unusable		
Servo error (Motion error history)	Error codes detected by AlphaStep/5-phase are stored	Error codes detected by servo amplifier are stored.				
Programming tool	MR Configurator2 is not available. Use AlphaStep/5-phase editing software.	MR Configurator2 is available.				

(Note-1): Confirm the specifications of AlphaStep/5-phase for details.

(Note-2): Refer to the "Servo Amplifier Instruction Manual" for the servo amplifiers that can be used.

(5) Precautions during control

- (a) Absolute position system (ABS)/Incremental system (INC). Set the ABS/INC settings with the AlphaStep/5-phase
 - Incremental system (INC)
 When the Multiple CPU system power supply is turned OFF and turned ON again, the home position request turns ON, and the feed current value from the AlphaStep/5-phase is displayed.
 - 2) Absolute position system (ABS)
 - a) "3: Servo command value" and "4: Feedback value" for [Pr.300] Servo input axis type cannot be used. If they are used the current value of the servo input axis may not be correctly restored therefore use "1: Feed current value" and "2: Actual current value".
 - b) When control units are degree axis and the stroke limit is valid, the following positioning controls may not operate correctly when they are started, therefore do not use them.

Operating system software version	Positioning control
"00L" or later	Absolute specification instructions in speed-switching control (VSTART instruction)
"00K" or later	Instructions for pass point absolute specifications in constant-speed control (CPSTART instruction) (linear interpolation, circular interpolation, helical interpolation) Position follow-up control (PFSTART instruction) Absolute specification instructions in speed-switching control (VSTART instruction)

(b) Home position return

Home position return operation types
 The home position return methods that can be used in AlphaStep/5-phase are shown below.

Home position	on return method	Possible/Not possible
Description de constitue d	Proximity dog method 1	× (Note-1)
Proximity dog method	Proximity dog method 2	× (Note-1)
	Count method 1	× (Note-1)
Count method	Count method 2	0
	Count method 3	× (Note-1)
Data and models ad	Data set method 1	0
Data set method	Data set method 2	× (Note-1)
Dog cradle method		× (Note-1)
Chamban machband	Stopper method 1	× (Note-1)
Stopper method	Stopper method 2	× (Note-1)
Limit switch combined r	method	× (Note-1)
Scale home position signal detection method		× (Note-1)
Dogless home position	signal reference method	× (Note-1)
Driver home position re	turn method	Ō

○: Possible, ×: Not possible

(Note-1): Minor error (error code: 194) occurs, and home position return is not performed.

2) Servo external signals when using driver home position return method At driver home position return method home position return, check the status of the servo external signals. Also check that external signals are OFF when external signal parameters are not set. For contacts (normally open contact/normally closed contact), match each setting of the AlphaStep/5-phase with the servo external signal parameters of MT Developer2.

Refer to AlphaStep/5-phase instruction manual for details.

(c) Control mode

Control modes that can be used are shown below.

 Position control mode (position control, and speed control including position loop)

However, speed-torque control (speed control not including position loop, torque control, continuous operation to torque control) cannot be used. If a control mode switch is performed, a minor error (error code: 159) occurs.

(d) Servo OFF

The following occurs for 5-phase (open loop control configuration).

- When servo OFF occurs, if the motor is moved by an external force it is not possible to detect the position and position information is not updated.
 Do not rotate the motors during servo OFF. If the motors are rotated a position displacement occurs.
- 2) In a servo OFF state the home position return request turns ON. After turning servo ON, perform a home position return again.
- 3) When an encoder is installed, checking position displacement and maladjustments is possible by monitoring "position F/B" and "external encoder counter value" in the optional data monitor. Refer to the instruction manual of AlphaStep/5-phase for the units and increase direction of the encoder count value, and checking methods.

(e) Servo instructions

Speed control (\mathbb{I}) (VVF instruction, VVR instruction) cannot be used. If the VVF instruction or VVR instruction are started, a minor error (error code: 136) occurs.

(f) Servo parameter

1) Control of servo parameters

Parameters of AlphaStep/5-phase are not controlled by Motion CPU. Therefore, even though the parameter of AlphaStep/5-phase is changed during the communication between Motion CPU and AlphaStep/5-phase, it does not process, and is not reflected to the parameter.

- 2) Servo parameter change function
 - a) Change function of servo parameter can be executed.
 - b) When the power of AlphaStep/5-phase is turned OFF, the parameter changed by the servo parameter change function becomes invalid, and the value written by AlphaStep/5-phase data editing software becomes valid.

 c) "Servo parameter write/read" device
 Store the value in the following special registers to change or display the servo parameter.

No.	Name	Meaning	Details	Set by
SD552		Servo parameter read value	The read value of servo parameter which executed "2: 1 word read request" in "servo parameter write/read request (SD804)" is stored.	System (At read request)
SD804 (Note-1)		Servo parameter write/read request flag	The "write/read request" is executed after setting of the axis No. and servo parameter No. 1: 1 word write request 2: 1 word read request "0" is automatically set by Motion CPU after completion of servo parameter write/read request. ("-1" is stored by Motion CPU at write/read error.)	User/ System
SD805	Servo parameter write/read request	Axis No.	The axis No. to write/read servo parameter is stored. Q173DSCPU: 1 to 32 Q172DSCPU: 1 to 16	
SD806		Servo parameter No.	The servo parameter No. to be written/read is stored in hexadecimal. H	User
SD807		Servo parameter setting value	The setting value of servo parameter to be written is stored when "1: 1 word write request" is set in "servo parameter write/read request (SD804)".	

(Note-1): Do not execute the automatic refresh.

(g) Optional data monitor setting

The following table shows data types that can be set.

Set the data so that the total number of communication points per axis is no more than 6 points.

Data type	Unit	Number of words	Number of communication data points
Position F/B	[pulse]	2	0
Encoder position within 1 revolution	[pulse]	2	0
Encoder Multi-revolution counter	[rev]	1	0
Cumulative current value	[Position command] (Note-1)	2	0
External encoder counter value	[pulse]	2	2

(Note-1): The position command is the command unit set in the fixed parameter.

(h) Gain changing command, PI-PID switching command, control loop changing command

Gain changing command, PI-PID switching command, and control loop changing command becomes invalid.

(i) Amplifier-less operation

Amplifier-less operation cannot be used for axes connected to AlphaStep/5-phase. When amplifier-less operation is executed, the axis changes to a disconnected state, and servo ready does not turn ON.

(j) Driver communication

The driver communication is not supported. If the driver communication is set in a servo parameter, a major error (error code: 1363) will occur when the power of Multiple CPU system is turned ON.

(k) Monitor devices (#8000 to #8639)

1) Servo amplifier type (#8000+20n)

This register stores the servo amplifier types below when using AlphaStep/5-phase.

Sephase stepping motor driver
 (ORIENTAL MOTOR Co., Ltd. make)

 8234 Stepping motor driver AlphaStep (AZ series) (ORIENTAL MOTOR Co., Ltd. make)

2) Motor current value (#8001+20n) is always "0".

(I) Torque limit

The torque limit value set by the Motion CPU is ignored. Set the torque limit value with the parameter on the AlphaStep/5-phase side.

(m) In-position range

When the position of the cam axis is restored during virtual mode switching or in advanced synchronous control, a check is performed by the servo parameter "In-position range (PA10)". However, because the servo parameter settings are not performed in AlphaStep/5-phase, the "In-position range" is checked as 100[pulse].

(n) Operation cycle

The operation cycle of 0.22[ms] cannot be used.

Furthermore, even if the operation cycle is set to 0.22[ms] in the setting for axes 1 to 4 for 1 line, if the servo amplifier is mixed with the AlphaStep/5-phase, the servo amplifier operates with an operation cycle of 0.44[ms].

(6) AlphaStep/5-phase detection error

When an error occurs on AlphaStep/5-phase, the servo error detection signal (M2408+20n) turns ON. Also, when an error occurs during home position return by driver home position return method, "Driver operation alarm (b9)" of servo status7 (#8018+20n) turns ON. Eliminate the error cause, reset the servo amplifier error by turning ON servo error reset command (M3208+20n) and perform re-start.

However, "0" is always stored in parameter error No. (#8009+20n). Refer to the instruction manual of AlphaStep/5-phase for details of the errors.





The IAI Corporation made IAI electric actuator controller can be connected via SSCNET**I**/H.

Contact your nearest IAI sales office for details of IAI electric actuator controller.

POINT

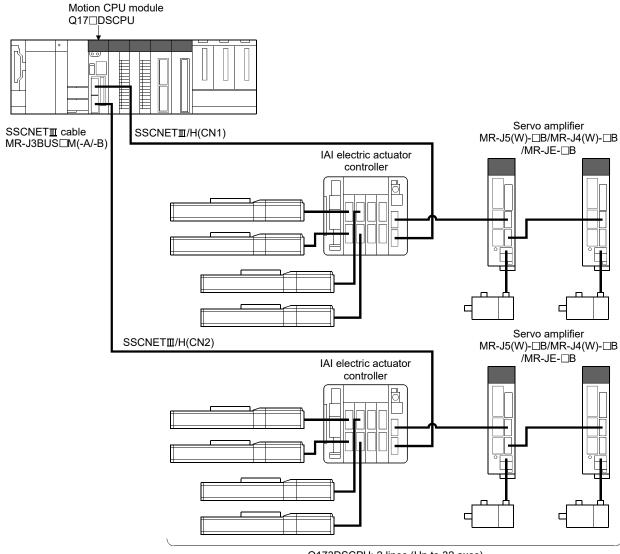
IAI electric actuator controller cannot be used on a line where the communication type in SSCNET setting of MT Developer2 is set to "SSCNETII".



Ver.!): Refer to Section 1.3 for the software version that supports this function.

(1) System configuration

The system configuration using IAI electric actuator controller is shown below.



Q173DSCPU: 2 lines (Up to 32 axes) Q172DSCPU: 1 line (Up to 16 axes)

POINT

The IAI electric actuator controller can only be set on even-numbered axes.

(2) Parameter setting

To connect IAI electric actuator controller, set the following in the system setting of MT Developer2.

- Set "SSCNET **I**/H" for communication type in SSCNET setting.
- Set the amplifier model in amplifier setting to "IAI Driver for Electric Actuator (IAI)".

(3) Control of IAI electric actuator controller parameters

Parameters set in IAI electric actuator controller are not controlled by Motion

CPU. They are set directly using IAI electric actuator controller data editing

software. For details on setting items for IAI electric actuator controller, refer to
the instruction manual of the IAI electric actuator controller.

(4) Comparisons of specifications with MR-J5(W)-□B/MR-J4(W)-□B /MR-JE-□B

,					
ltem	IAI electric actuator controller ^(Note-1)	MR-J5(W)-□B	MR-J4(W)-□B	MR-JE-□B	
Amplifier type	IAI Driver for Electric Actuator (IAI)	MR-J5(W)-B(-RJ)	MR-J4(W)-B(-RJ)	MR-JE-B(F)	
Control of servo	Controlled by IAI electric		Controlled by Motion CPU		
amplifier parameters	actuator controller		Controlled by Motion CPO		
External input signal	Bit devices are available.	External input signa	ls of servo amplifier, and bit o	devices are available.	
Optional data monitor (Data type)	Position F/B Cumulative current value	Regenerative load ratio Peak load ratio Position F/B Encoder position within 1 revolution Encoder Multi-revolution counter Load inertia moment ratio Model loop gain Bus voltage Cumulative current value Servo motor speed Selected droop pulse Unit power consumption Instantaneous torque Load side encoder information1 Load side encoder information2 Z-phase counter Servo motor thermistor temperature Torque equivalent to disturbance Overload alarm margin Servo motor/Load side position deviation Servo motor/Load side speed deviation In land side speed deviation Servo motor/Load side speed deviation In land Servo motor/Load side speed deviation		Effective load ratio Regenerative load ratio Peak load ratio Position F/B Encoder position within 1 revolution Encoder Multi-revolution counter Load inertia moment ratio Model loop gain Bus voltage Cumulative current value Servo motor speed Selected droop pulse Unit power consumption Unit total power consumption Instantaneous torque Torque equivalent to disturbance Overload alarm margin Excessive error alarm margin Settling time Overshoot amount Internal temperature of encoder	
detection system	Unusable		Usable		
Unlimited length feed	Unusable	Usable			
Home position return method	Driver home position return method	Proximity dog method (1, 2), Count method (1 to 3), Data set method (1, 2), Dog cradle method, Stopper method (1, 2), Limit switch combined method, Scale home position signal detection method, Dogless home position signal reference method		witch combined method, method,	
Speed-torque control	Position control mode	Position control mode, Speed control mode, Torque control mode, Continuous operation to torque control mode			
Gain changing command	Invalid	Valid			

Item	IAI electric actuator controller (Note-1)	MR-J5(W)-□B	MR-J4(W)-□B	MR-JE-□B
PI-PID switching command	Invalid	Valid		
Control loop changing command	Invalid	Va	ilid	Invalid
Amplifier-less operation function	Unusable	Usable		
Servo parameter read/change	Usable	Usable		
Driver communication	Unusable	Usable (Note-2) Unusable		Unusable
Servo error (Motion error history)	Error codes detected by IAI electric actuator controller are stored			are stored.
Programming tool	MR Configurator2 is not available. Use IAI electric actuator controller editing software.	MR Configurator2 is available.		э.

(Note-1): Confirm the specifications of IAI electric actuator controller for details.

(Note-2): Refer to the "Servo Amplifier Instruction Manual" for the servo amplifiers that can be used.

(5) Precautions during control

(a) Absolute position system (ABS)/Incremental system (INC). The IAI electric actuator controller is not compatible with the absolute position system. When the Multiple system power supply is turned OFF and ON again, home position return request turns ON, and the feed current value taken from the IAI electric actuator controller is displayed.

(b) Home position return

Home position return operation types
 The home position return methods that can be used in IAI electric actuator controller are shown below.

Home position	on return method	Possible/Not possible
B : " #	Proximity dog method 1	× (Note-1)
Proximity dog method	Proximity dog method 2	× (Note-1)
	Count method 1	× (Note-1)
Count method	Count method 2	× (Note-1)
	Count method 3	× (Note-1)
5	Data set method 1	× (Note-1)
Data set method	Data set method 2	× (Note-1)
Dog cradle method		× (Note-1)
	Stopper method 1	× (Note-1)
Stopper method	Stopper method 2	× (Note-1)
Limit switch combined r	method	× (Note-1)
Scale home position sig	gnal detection method	× (Note-1)
Dogless home position	signal reference method	× (Note-1)
Driver home position re	turn method	0

○: Possible, ×: Not possible

(Note-1): Minor error (error code: 194) occurs, and home position return is not performed.

2) Servo external signals when using driver home position return method At driver home position return method home position return, check the status of the servo external signals. Also check that external signals are OFF when external signal parameters are not set. For contacts (normally open contact/normally closed contact), match each setting of the IAI electric actuator controller with the servo external signal parameters of MT Developer2.

Refer to IAI electric actuator controller instruction manual for details.

(c) Control mode

Control modes that can be used are shown below.

 Position control mode (position control, and speed control including position loop)

However, speed-torque control (speed control not including position loop, torque control, continuous operation to torque control) cannot be used. If a control mode switch is performed, a minor error (error code: 159) occurs.

(d) Servo OFF

When the motor is moved by an external force during servo OFF, position information is updated.

(e) Servo instructions

Speed control (II) (VVF instruction, VVR instruction) cannot be used. If the VVF instruction or VVR instruction are started, a minor error (error code: 136) occurs.

(f) Servo parameter

1) Control of servo parameters

Parameters of IAI electric actuator controller are not controlled by Motion CPU

Therefore, even though the parameter of IAI electric actuator controller is changed during the communication between Motion CPU and IAI electric actuator controller, it does not process, and is not reflected to the parameter.

2) Servo parameter change function

a) Change function of servo parameter can be executed.
 The operation for the servo parameter change function is shown below.

	Operation for the servo parameter change function		
	The servo parameter of IAI electric actuator controller is controlled in a unit of 2 words, so		
Servo	that it is necessary to set "3: 2 words write request" in servo parameter write/read request		
parameter	(SD804) for executing the parameter write. If "1: 1 word write request" is executed to IAI		
write request	electric actuator controller, the parameter write fails, and "-1" is stored in servo parameter		
	write/read request (SD804).		
	The servo parameter of IAI electric actuator controller is controlled in a unit of 2 words, so		
Servo	that it is necessary to set "4: 2 words read request" in servo parameter write/read request		
parameter read	(SD804) for executing the parameter read. If "2: 1 word read request" is executed to IAI		
request	electric actuator controller, the parameter read fails, and "-1" is stored in servo parameter		
	write/read request (SD804).		

- b) The parameter changed by the servo parameter change function can be saved by writing to the Motion CPU. The changed parameter becomes valid by turning ON the power supply of the IAI electric actuator controller again.
- c) "Servo parameter write/read" device
 Store the value in the following special registers to change or display the servo parameter.

No.	Name	Meaning	Details	Set by
SD552		Servo parameter	The read value (low 1 word) of servo parameter which executed "4: 2 word read request" in SD804 is stored.	System
SD553	1 ' T		The read value (high 1 word) of servo parameter which executed "4: 2 word read request" in SD804 is stored.	(At read request)
SD804 (Note-1)	Servo parameter	Servo parameter write/read request flag	The "write/read request" is executed after setting of the axis No. and servo parameter No. 2 word write request 2 word read request "0" is automatically set by Motion CPU after completion of servo parameter write/read request. "-1" is stored by Motion CPU at write/read error.)	User/ System
SD805	write/read request	Axis No.	The axis No. to write/read servo parameter is stored. Q173DSCPU: 1 to 32 Q172DSCPU: 1 to 16	
SD806		Servo parameter No.	The servo parameter No. to be written/read is stored in hexadecimal. H	User
SD808		Servo parameter	The setting value of servo parameter to be written is	
SD809		setting value (2 word)	stored when "3: 2 word write request" is set in SD804.	

(Note-1): Do not execute the automatic refresh.

(g) Optional data monitor setting

The following table shows data types that can be set.

Set the data so that the total number of communication points per axis is no more than 6 points.

Data type	Unit	Number of words	Number of communication data points
Position F/B	[pulse]	2	0
Cumulative current value	[Position command] (Note-1)	2	0

(Note-1): The position command is the command unit set in the fixed parameter.

(h) Gain changing command, PI-PID switching command, control loop changing command

Gain changing command, PI-PID switching command, and control loop changing command becomes invalid.

(i) Amplifier-less operation

Amplifier-less operation cannot be used for axes connected to IAI electric actuator controller. When amplifier-less operation is executed, the axis changes to a disconnected state, and servo ready does not turn ON.

(j) Driver communication

The driver communication is not supported. If the driver communication is set in a servo parameter, a major error (error code: 1363) will occur when the power of Multiple CPU system is turned ON.

(k) Monitor devices (#8000 to #8639)

1) Servo amplifier type (#8000+20n)

This register stores the servo amplifier types below when using IAI electric actuator controller.

• 8193 IAI electric actuator controller (IAI Corporation make)

2) Motor current value (#8001+20n) is always "0".

(I) Torque limit

The torque limit value set by the Motion CPU is ignored. Set the torque limit value with the parameter on the IAI electric actuator controller side.

(m) In-position range

When the position of the cam axis is restored during virtual mode switching or in advanced synchronous control, a check is performed by the servo parameter "In-position range (PA10)". However, because the servo parameter settings are not performed in IAI electric actuator controller, the "In-position range" is checked as 100[pulse].

(n) Operation cycle

For each operation cycle, the following number of axes per controller can be set. When the number of axes is more than what can be set, and an operation cycle other than those below is set, a major error (error code: 1350) occurs.

Operation cycle	Number of axes per controller available
0.22ms or longer	1 to 2 axes
0.44ms or longer	3 to 4 axes
0.88ms or longer	5 axes or more

(6) IAI electric actuator controller detection error

When an error occurs on IAI electric actuator controller, the servo error detection signal (M2408+20n) turns ON. Also, when an error occurs during home position return by driver home position return method, "Driver operation alarm (b9)" of servo status7 (#8018+20n) turns ON. Eliminate the error cause, reset the servo amplifier error by turning ON servo error reset command (M3208+20n) and perform re-start.

However, "0" is always stored in parameter error No. (#8009+20n). Refer to the instruction manual of IAI electric actuator controller for details of the errors.

WARRANTY

Please confirm the following product warranty details before using this product.

1. Gratis Warranty Term and Gratis Warranty Range

We will repair any failure or defect hereinafter referred to as "failure" in our FA equipment hereinafter referred to as the "Product" arisen during warranty period at no charge due to causes for which we are responsible through the distributor from which you purchased the Product or our service provider. However, we will charge the actual cost of dispatching our engineer for an on-site repair work on request by customer in Japan or overseas countries. We are not responsible for any on-site readjustment and/or trial run that may be required after a defective unit is repaired or replaced.

[Gratis Warranty Term]

The term of warranty for Product is thirty six (36) months after your purchase or delivery of the Product to a place designated by you or forty two (42) months from the date of manufacture whichever comes first "Warranty Period". Warranty period for repaired Product cannot exceed beyond the original warranty period before any repair work.

[Gratis Warranty Range]

- (1) You are requested to conduct an initial failure diagnosis by yourself, as a general rule. It can also be carried out by us or our service company upon your request and the actual cost will be charged. However, it will not be charged if we are responsible for the cause of the failure.
- (2) This limited warranty applies only when the condition, method, environment, etc. of use are in compliance with the terms and conditions and instructions that are set forth in the instruction manual and user manual for the Product and the caution label affixed to the Product.
- (3) Even during the term of warranty, the repair cost will be charged on you in the following cases;
 - 1) A failure caused by your improper storing or handling, carelessness or negligence, etc., and a failure caused by your hardware or software problem
 - 2) A failure caused by any alteration, etc. to the Product made on your side without our approval
 - 3) A failure which may be regarded as avoidable, if your equipment in which the Product is incorporated is equipped with a safety device required by applicable laws and has any function or structure considered to be indispensable according to a common sense in the industry
 - 4) A failure which may be regarded as avoidable if consumable parts designated in the instruction manual, etc. are duly maintained and replaced
 - 5) Any replacement of consumable parts (battery, fan, etc.)
 - 6) A failure caused by external factors such as inevitable accidents, including without limitation fire and abnormal fluctuation of voltage, and acts of God, including without limitation earthquake, lightning and natural disasters
 - 7) A failure generated by an unforeseeable cause with a scientific technology that was not available at the time of the shipment of the Product from our company
 - 8) Any other failures which we are not responsible for or which you acknowledge we are not responsible for

2. Onerous Repair Term after Discontinuation of Production

(1) We may accept the repair at charge for another seven (7) years after the production of the product is discontinued

The announcement of the stop of production for each model can be seen in our Sales and Service, etc.

(2) Please note that the Product (including its spare parts) cannot be ordered after its stop of production.

3. Service in overseas countries

Our regional FA Center in overseas countries will accept the repair work of the Product; However, the terms and conditions of the repair work may differ depending on each FA Center. Please ask your local FA center for details.

4. Exclusion of Loss in Opportunity and Secondary Loss from Warranty Liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to:

- (1) Damages caused by any cause found not to be the responsibility of Mitsubishi.
- (2) Loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products.
- (3) Special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products.
- (4) Replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Change of Product specifications

Specifications listed in our catalogs, manuals or technical documents may be changed without notice.

6. Precautions for Choosing the Products

- (1) For the use of our Motion controller, its applications should be those that may not result in a serious damage even if any failure or malfunction occurs in Motion controller, and a backup or fail-safe function should operate on an external system to Motion controller when any failure or malfunction occurs.
- (2) Our Motion controller is designed and manufactured as a general purpose product for use at general industries. Therefore, applications substantially influential on the public interest for such as atomic power plants and other power plants of electric power companies, and also which require a special quality assurance system, including applications for railway companies and government or public offices are not recommended, and we assume no responsibility for any failure caused by these applications when used.
 - In addition, applications which may be substantially influential to human lives or properties for such as airlines, medical treatments, railway service, incineration and fuel systems, man-operated material handling equipment, entertainment machines, safety machines, etc. are not recommended, and we assume no responsibility for any failure caused by these applications when used.
 - We will review the acceptability of the abovementioned applications, if you agree not to require a specific quality for a specific application. Please contact us for consultation.
- (3) Mitsubishi Electric shall have no responsibility or liability for any problems involving programmable controller trouble and system trouble caused by DoS attacks, unauthorized access, computer viruses, and other cyberattacks.

INFORMATION AND SERVICES

For further information and services, please contact your local Mitsubishi Electric sales office or representative. Visit our website to find our locations worldwide.

MITSUBISHI ELECTRIC Factory Automation Global Website Locations Worldwide www.MitsubishiElectric.com/fa/about-us/overseas/

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MODEL: Q173D-P-SV13/22REALE

MODEL CODE: 1XB930

MITSUBISHI ELECTRIC CORPORATION

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Specifications subject to change without notice.