MITSUBISHI ELECTRIC

Programmable Controller

MELSEC iQ-R series

MELSEC iQ-R Motion Controller Programming Manual (Positioning Control)

-R16MTCPU
-R32MTCPU
-R64MTCPU

SAFETY PRECAUTIONS

(Read these precautions before using this product.)
Before using this product, please read this manual and the relevant manuals carefully and pay full attention to safety to handle the product correctly.
The precautions given in this manual are concerned with this product only. Refer to MELSEC iQ-R Module Configuration Manual for a description of the PLC system safety precautions.
In this manual, the safety precautions are classified into two levels: "⚠WARNING" and "⚠CAUTION".

⚠ **WARNING**	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠ **CAUTION**	Indicates that incorrect handling may cause hazardous conditions, resulting in minor or moderate injury or property damage.

Under some circumstances, failure to observe the precautions given under "⚠CAUTION" may lead to serious consequences.
Observe the precautions of both levels because they are important for personal and system safety.
Make sure that the end users read this manual and then keep the manual in a safe place for future reference.

[Design Precautions]

⚠WARNING

- Configure safety circuits external to the programmable controller to ensure that the entire system operates safely even when a fault occurs in the external power supply or the programmable controller. Failure to do so may result in an accident due to an incorrect output or malfunction.
  (1) Emergency stop circuits, protection circuits, and protective interlock circuits for conflicting operations (such as forward/reverse rotations or upper/lower limit positioning) must be configured external to the programmable controller.
  (2) When the programmable controller detects an abnormal condition, it stops the operation and all outputs are:
    - Turned off if the overcurrent or overvoltage protection of the power supply module is activated.
    - Held or turned off according to the parameter setting if the self-diagnostic function of the CPU module detects an error such as a watchdog timer error.
  (3) All outputs may be turned on if an error occurs in a part, such as an I/O control part, where the CPU module cannot detect any error. To ensure safety operation in such a case, provide a safety mechanism or a fail-safe circuit external to the programmable controller. For a fail-safe circuit example, refer to "General Safety Requirements" in the MELSEC iQ-R Module Configuration Manual.
  (4) Outputs may remain on or off due to a failure of a component such as a relay and transistor in an output circuit. Configure an external circuit for monitoring output signals that could cause a serious accident.
- In an output circuit, when a load current exceeding the rated current or an overcurrent caused by a load short-circuit flows for a long time, it may cause smoke and fire. To prevent this, configure an external safety circuit, such as a fuse.
- Configure a circuit so that the programmable controller is turned on first and then the external power supply. If the external power supply is turned on first, an accident may occur due to an incorrect output or malfunction.

[Design Precautions]

⚠WARNING

- For the operating status of each station after a communication failure, refer to manuals relevant to the network. Incorrect output or malfunction due to a communication failure may result in an accident.
- When connecting an external device with a CPU module or intelligent function module to modify data of a running programmable controller, configure an interlock circuit in the program to ensure that the entire system will always operate safely. For other forms of control (such as program modification, parameter change, forced output, or operating status change) of a running programmable controller, read the relevant manuals carefully and ensure that the operation is safe before proceeding. Improper operation may damage machines or cause accidents.
- Especially, when a remote programmable controller is controlled by an external device, immediate action cannot be taken if a problem occurs in the programmable controller due to a communication failure. To prevent this, configure an interlock circuit in the program, and determine corrective actions to be taken between the external device and CPU module in case of a communication failure.
- Do not write any data to the "system area" and "write-protect area" of the buffer memory in the module. Also, do not use any "use prohibited" signals as an output signal from the CPU module to each module. Doing so may cause malfunction of the programmable controller system. For the "system area", "write-protect area", and the "use prohibited" signals, refer to the user's manual for the module used.
- If a communication cable is disconnected, the network may be unstable, resulting in a communication failure of multiple stations. Configure an interlock circuit in the program to ensure that the entire system will always operate safely even if communications fail. Failure to do so may result in an accident due to an incorrect output or malfunction.
- To maintain the safety of the programmable controller system against unauthorized access from external devices via the network, take appropriate measures. To maintain the safety against unauthorized access via the Internet, take measures such as installing a firewall.
- Configure safety circuits external to the programmable controller to ensure that the entire system operates safely even when a fault occurs in the external power supply or the programmable controller. Failure to do so may result in an accident due to an incorrect output or malfunction.
- If safety standards (ex., robot safety rules, etc.,) apply to the system using the module, servo amplifier and servo motor, make sure that the safety standards are satisfied.
- Construct a safety circuit externally of the module or servo amplifier if the abnormal operation of the module or servo amplifier differs from the safety directive operation in the system.
- Do not remove the SSCNETⅢ cable while turning on the control circuit power supply of modules and servo amplifier. Do not see directly the light generated from SSCNETⅢ connector of the module or servo amplifier and the end of SSCNETⅢ cable. When the light gets into eyes, you may feel something wrong with eyes. (The light source of SSCNETⅢ complies with class 1 defined in JISC6802 or IEC60825-1.)

[Design Precautions]

⚠CAUTION

- Do not install the control lines or communication cables together with the main circuit lines or power cables. Keep a distance of 100mm or more between them. Failure to do so may result in malfunction due to noise.
- During control of an inductive load such as a lamp, heater, or solenoid valve, a large current (approximately ten times greater than normal) may flow when the output is turned from off to on. Therefore, use a module that has a sufficient current rating.
- After the CPU module is powered on or is reset, the time taken to enter the RUN status varies depending on the system configuration, parameter settings, and/or program size. Design circuits so that the entire system will always operate safely, regardless of the time.
- Do not power off the programmable controller or reset the CPU module while the settings are being written. Doing so will make the data in the flash ROM and SD memory card undefined. The values need to be set in the buffer memory and written to the flash ROM and SD memory card again. Doing so also may cause malfunction or failure of the module.
- When changing the operating status of the CPU module from external devices (such as the remote RUN/STOP functions), select "Do Not Open by Program" for "Opening Method" of "Module Parameter". If "Open by Program" is selected, an execution of the remote STOP function causes the communication line to close. Consequently, the CPU module cannot reopen the line, and external devices cannot execute the remote RUN function.

[Installation Precautions]

⚠WARNING

- Shut off the external power supply (all phases) used in the system before mounting or removing the module. Failure to do so may result in electric shock or cause the module to fail or malfunction.

[Installation Precautions]

⚠CAUTION

- Use the programmable controller in an environment that meets the General Specifications in the Safety Guidelines included with the base unit. Failure to do so may result in electric shock, fire, malfunction, or damage to or deterioration of the product.
- To mount a module, place the concave part(s) located at the bottom onto the guide(s) of the base unit, and push in the module until the hook(s) located at the top snaps into place. Incorrect interconnection may cause malfunction, failure, or drop of the module.
- To mount a module with no module fixing hook, place the concave part(s) located at the bottom onto the guide(s) of the base unit, push in the module, and fix it with screw(s). Incorrect interconnection may cause malfunction, failure, or drop of the module.
- When using the programmable controller in an environment of frequent vibrations, fix the module with a screw.
- Tighten the screws within the specified torque range. Undertightening can cause drop of the screw, short circuit, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.
- When using an extension cable, connect it to the extension cable connector of the base unit securely. Check the connection for looseness. Poor contact may cause malfunction.
- When using an SD memory card, fully insert it into the SD memory card slot. Check that it is inserted completely. Poor contact may cause malfunction.
- Securely insert an extended SRAM cassette into the cassette connector of the CPU module. After insertion, close the cassette cover and check that the cassette is inserted completely. Poor contact may cause malfunction.
- Do not directly touch any conductive parts and electronic components of the module, SD memory card, extended SRAM cassette, or connector. Doing so may cause malfunction or failure of the module.

[Wiring Precautions]

⚠WARNING

- Shut off the external power supply (all phases) used in the system before installation and wiring. Failure to do so may result in electric shock or cause the module to fail or malfunction.
- After installation and wiring, attach a blank cover module (RG60) to each empty slot and an included extension connector protective cover to the unused extension cable connector before powering on the system for operation. Failure to do so may result in electric shock.

[Wiring Precautions]

⚠CAUTION

- Individually ground the FG and LG terminals of the programmable controller with a ground resistance of 100 ohms or less. Failure to do so may result in electric shock or malfunction.
- For terminal block wiring, use solderless terminals with an insulation sleeve. Do not connect more than two solderless terminals to a terminal.
- Use applicable solderless terminals and tighten them within the specified torque range. If any spade solderless terminal is used, it may be disconnected when the terminal screw comes loose, resulting in failure.
- Check the rated voltage and signal layout before wiring to the module, and connect the cables correctly. Connecting a power supply with a different voltage rating or incorrect wiring may cause fire or failure.
- Connectors for external devices must be crimped or pressed with the tool specified by the manufacturer, or must be correctly soldered. Incomplete connections may cause short circuit, fire, or malfunction.
- Securely connect the connector to the module. Poor contact may cause malfunction.
- Do not install the control lines or communication cables together with the main circuit lines or power cables. Keep a distance of 100mm or more between them. Failure to do so may result in malfunction due to noise.
- When an overcurrent caused by a failure of an external device or a module flows for a long time, it may cause smoke and fire. To prevent this, configure an external safety circuit, such as a fuse.
- Place the cables in a duct or clamp them. If not, dangling cable may swing or inadvertently be pulled, resulting in damage to the module or cables or malfunction due to poor contact. Do not clamp the extension cables with the jacket stripped. Doing so may change the characteristics of the cables, resulting in malfunction.
- When disconnecting the communication cable or power cable from the module, do not pull the cable by the cable part. For the cable connected to the terminal block, loosen the terminal screws. Pulling the cable connected to the module may result in malfunction or damage to the module or cable.
- Check the interface type and correctly connect the cable. Incorrect wiring (connecting the cable to an incorrect interface) may cause failure of the module and external device.
- Tighten the terminal screws or connector screws within the specified torque range. Undertightening can cause drop of the screw, short circuit, fire, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, fire, or malfunction.
- Tighten the terminal block mounting screws, terminal screws, and module fixing screws within each specified torque range. Undertightening of the terminal block mounting screws and terminal screws can cause short circuit, fire, or malfunction. Overtightening of them can damage the screw and/or module, resulting in drop, short circuit, or malfunction. Undertightening of the module fixing screws can cause drop of the screw. Overtightening of them can damage the screw and/or module, resulting in drop.
- When disconnecting the cable from the module, do not pull the cable by the cable part. For the cable with connector, hold the connector part of the cable. For the cable connected to the terminal block, loosen the terminal screw. Pulling the cable connected to the module may result in malfunction or damage to the module or cable.
- Prevent foreign matter such as dust or wire chips from entering the module. Such foreign matter can cause a fire, failure, or malfunction.

[Wiring Precautions]

⚠CAUTION

- A protective film is attached to the top of the module to prevent foreign matter, such as wire chips, from entering the module during wiring. Do not remove the film during wiring. Remove it for heat dissipation before system operation.
- Programmable controllers must be installed in control panels. Connect the main power supply to the power supply module in the control panel through a relay terminal block. Wiring and replacement of a power supply module must be performed by qualified maintenance personnel with knowledge of protection against electric shock. For wiring, refer to the MELSEC iQ-R Module Configuration Manual.
- For Ethernet cables to be used in the system, select the ones that meet the specifications in the user's manual for the module used. If not, normal data transmission is not guaranteed.

[Startup and Maintenance Precautions]

⚠WARNING

- Do not touch any terminal while power is on. Doing so will cause electric shock or malfunction.
- Correctly connect the battery connector. Do not charge, disassemble, heat, short-circuit, solder, or throw the battery into the fire. Also, do not expose it to liquid or strong shock. Doing so may cause the battery to generate heat, explode, ignite, or leak, resulting in injury or fire.
- Shut off the external power supply (all phases) used in the system before cleaning the module or retightening the terminal screws, connector screws, or module fixing screws. Failure to do so may result in electric shock.

[Startup and Maintenance Precautions]

⚠CAUTION

- When connecting an external device with a CPU module or intelligent function module to modify data of a running programmable controller, configure an interlock circuit in the program to ensure that the entire system will always operate safely. For other forms of control (such as program modification, parameter change, forced output, or operating status change) of a running programmable controller, read the relevant manuals carefully and ensure that the operation is safe before proceeding. Improper operation may damage machines or cause accidents.
- Especially, when a remote programmable controller is controlled by an external device, immediate action cannot be taken if a problem occurs in the programmable controller due to a communication failure. To prevent this, configure an interlock circuit in the program, and determine corrective actions to be taken between the external device and CPU module in case of a communication failure.
- Do not disassemble or modify the modules. Doing so may cause failure, malfunction, injury, or a fire.
- Use any radio communication device such as a cellular phone or PHS (Personal Handy-phone System) more than 25cm away in all directions from the programmable controller. Failure to do so may cause malfunction.
- Shut off the external power supply (all phases) used in the system before mounting or removing the module. Failure to do so may cause the module to fail or malfunction.
- Tighten the screws within the specified torque range. Undertightening can cause drop of the component or wire, short circuit, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.

[Startup and Maintenance Precautions]

⚠ CAUTION

- After the first use of the product, do not mount/remove the module to/from the base unit, and the terminal block to/from the module, and do not insert/remove the extended SRAM cassette to/from the CPU module more than 50 times (IEC 61131-2 compliant) respectively. Exceeding the limit of 50 times may cause malfunction.
- After the first use of the product, do not insert/remove the SD memory card to/from the CPU module more than 500 times. Exceeding the limit of 500 times may cause malfunction.
- Do not touch the metal terminals on the back side of the SD memory card. Doing so may cause malfunction or failure.
- Do not touch the integrated circuits on the circuit board of an extended SRAM cassette. Doing so may cause malfunction or failure.
- Do not drop or apply shock to the battery to be installed in the module. Doing so may damage the battery, causing the battery fluid to leak inside the battery. If the battery is dropped or any shock is applied to it, dispose of it without using.
- Startup and maintenance of a control panel must be performed by qualified maintenance personnel with knowledge of protection against electric shock. Lock the control panel so that only qualified maintenance personnel can operate it.
- Before handling the module, touch a conducting object such as a grounded metal to discharge the static electricity from the human body. Failure to do so may cause the module to fail or malfunction.
- Before testing the operation, set a low speed value for the speed limit parameter so that the operation can be stopped immediately upon occurrence of a hazardous condition.
- Confirm and adjust the program and each parameter before operation. Unpredictable movements may occur depending on the machine.
- When using the absolute position system function, on starting up, and when the module or absolute position motor has been replaced, always perform a home position return.
- Before starting the operation, confirm the brake function.
- Do not perform a megger test (insulation resistance measurement) during inspection.
- After maintenance and inspections are completed, confirm that the position detection of the absolute position detection function is correct.
- Lock the control panel and prevent access to those who are not certified to handle or install electric equipment.

[Operating Precautions]

⚠CAUTION

- When changing data and operating status, and modifying program of the running programmable controller from an external device such as a personal computer connected to an intelligent function module, read relevant manuals carefully and ensure the safety before operation. Incorrect change or modification may cause system malfunction, damage to the machines, or accidents.
- Do not power off the programmable controller or reset the CPU module while the setting values in the buffer memory are being written to the flash ROM in the module. Doing so will make the data in the flash ROM and SD memory card undefined. The values need to be set in the buffer memory and written to the flash ROM and SD memory card again. Doing so also may cause malfunction or failure of the module.
- Note that when the reference axis speed is specified for interpolation operation, the speed of the partner axis (2nd, 3rd, or 4th axis) may exceed the speed limit value.
- Do not go near the machine during test operations or during operations such as teaching. Doing so may lead to injuries.

[Disposal Precautions]

⚠CAUTION

- When disposing of this product, treat it as industrial waste.
- When disposing of batteries, separate them from other wastes according to the local regulations. For details on battery regulations in EU member states, refer to the MELSEC iQ-R Module Configuration Manual.

[Transportation Precautions]

⚠CAUTION

- When transporting lithium batteries, follow the transportation regulations. For details on the regulated models, refer to the MELSEC iQ-R Module Configuration Manual.
- The halogens (such as fluorine, chlorine, bromine, and iodine), which are contained in a fumigant used for disinfection and pest control of wood packaging materials, may cause failure of the product. Prevent the entry of fumigant residues into the product or consider other methods (such as heat treatment) instead of fumigation. The disinfection and pest control measures must be applied to unprocessed raw wood.

CONDITIONS OF USE FOR THE PRODUCT

(1) Mitsubishi programmable controller ("the PRODUCT") shall be used in conditions;
i) where any problem, fault or failure occurring in the PRODUCT, if any, shall not lead to any major or serious accident; and
ii) where the backup and fail-safe function are systematically or automatically provided outside of the PRODUCT for the case of any problem, fault or failure occurring in the PRODUCT.

(2) The PRODUCT has been designed and manufactured for the purpose of being used in general industries.
MITSUBISHI SHALL HAVE NO RESPONSIBILITY OR LIABILITY (INCLUDING, BUT NOT LIMITED TO ANY AND ALL RESPONSIBILITY OR LIABILITY BASED ON CONTRACT, WARRANTY, TORT, PRODUCT LIABILITY) FOR ANY INJURY OR DEATH TO PERSONS OR LOSS OR DAMAGE TO PROPERTY CAUSED BY the PRODUCT THAT ARE OPERATED OR USED IN APPLICATION NOT INTENDED OR EXCLUDED BY INSTRUCTIONS, PRECAUTIONS, OR WARNING CONTAINED IN MITSUBISHI'S USER, INSTRUCTION AND/OR SAFETY MANUALS, TECHNICAL BULLETINS AND GUIDELINES FOR the PRODUCT.
("Prohibited Application")
Prohibited Applications include, but not limited to, the use of the PRODUCT in;
- Nuclear Power Plants and any other power plants operated by Power companies, and/or any other cases in which the public could be affected if any problem or fault occurs in the PRODUCT.
- Railway companies or Public service purposes, and/or any other cases in which establishment of a special quality assurance system is required by the Purchaser or End User.
- Aircraft or Aerospace, Medical applications, Train equipment, transport equipment such as Elevator and Escalator, Incineration and Fuel devices, Vehicles, Manned transportation, Equipment for Recreation and Amusement, and Safety devices, handling of Nuclear or Hazardous Materials or Chemicals, Mining and Drilling, and/or other applications where there is a significant risk of injury to the public or property.

Notwithstanding the above, restrictions Mitsubishi may in its sole discretion, authorize use of the PRODUCT in one or more of the Prohibited Applications, provided that the usage of the PRODUCT is limited only for the specific applications agreed to by Mitsubishi and provided further that no special quality assurance or fail-safe, redundant or other safety features which exceed the general specifications of the PRODUCTs are required. For details, please contact the Mitsubishi representative in your region.

INTRODUCTION

Thank you for purchasing the Mitsubishi Electric MELSEC iQ-R series programmable controllers.
This manual describes the dedicated signals, parameters, servo programs, and functions required for performing positioning control of the relevant products listed below.
Before using this product, please read this manual and the relevant manuals carefully and develop familiarity with the functions and performance of the MELSEC iQ-R series programmable controller to handle the product correctly.
When applying the program examples provided in this manual to an actual system, ensure the applicability and confirm that it will not cause system control problems.
Please make sure that the end users read this manual.

Relevant products

R16MTCPU, R32MTCPU, R64MTCPU

CONTENTS

CHAPTER 5 POSITIONING CONTROL 250

RELEVANT MANUALS

Manual Name [Manual Number]	Description	Available form
MELSEC iQ-R Motion Controller Programming Manual (Positioning Control) [IB-0300241] (This manual)	This manual explains the servo parameters, positioning instructions, device lists and others.	Print book e-Manual PDF
MELSEC iQ-R Motion Controller User's Manual [IB-0300235]	This manual explains specifications of the Motion CPU modules, SSCNETⅢ cables, synchronous encoder, troubleshooting, and others.	Print book e-Manual PDF
MELSEC iQ-R Motion Controller Programming Manual (Common) [IB-0300237]	This manual explains the Multiple CPU system configuration, performance specifications, common parameters, auxiliary/applied functions, error lists and others.	Print book e-Manual PDF
MELSEC iQ-R Motion Controller Programming Manual (Program Design) [IB-0300239]	This manual explains the functions, programming, debugging for Motion SFC and others.	Print book e-Manual PDF
MELSEC iQ-R Motion Controller Programming Manual (Advanced Synchronous Control) [IB-0300243]	This manual explains the dedicated instructions to use synchronous control by synchronous control parameters, device lists and others.	Print book e-Manual PDF
MELSEC iQ-R Motion Controller Programming Manual (Machine Control) [IB-0300309]	This manual explains the dedicated instructions to use machine control by machine control parameters, machine positioning data, device lists and others.	Print book e-Manual PDF
MELSEC iQ-R Motion Controller Programming Manual (G-Code Control) [IB-0300371]	This manual explains the dedicated instructions to use G-code control by G-code control parameters and G-code programs.	Print book e-Manual PDF

Point

e-Manual refers to the Mitsubishi FA electronic book manuals that can be browsed using a dedicated tool.
e-Manual has the following features:

- Required information can be cross-searched in multiple manuals.
- Other manuals can be accessed from the links in the manual.
- The hardware specifications of each part can be found from the product figures.
- Pages that users often browse can be bookmarked.

TERMS

Unless otherwise specified, this manual uses the following terms.

Term	Description
R64MTCPU/R32MTCPU/R16MTCPU or Motion CPU (module)	Abbreviation for MELSEC iQ-R series Motion controller
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
AMP or Servo amplifier	General name for "Servo amplifier model MR-J4-□B/MR-J4W-□B/MR-J3-□B/MR-J3W-□B"
RnCPU, PLC CPU or PLC CPU module	Abbreviation for MELSEC iQ-R series CPU module
Multiple CPU system or Motion system	Abbreviation for "Multiple PLC system of the R series"
CPUn	Abbreviation for "CPU No.n (n = 1 to 4) of the CPU module for the Multiple CPU system"
Operating system software	General name for "SW10DNC-RMTFW"
Engineering software package	General name for MT Developer2/GX Works3
MELSOFT MT Works2	General product name for the Motion controller engineering software "SW1DND-MTW2"
MT Developer2	Abbreviation for the programming software included in the "MELSOFT MT Works2" Motion controller engineering software
GX Works3	General product name for the MELSEC PLC software package "SW1DND-GXW3"
Serial absolute synchronous encoder or Q171ENC-W8	Abbreviation for "Serial absolute synchronous encoder (Q171ENC-W8)"
SSCNETⅢ/H*1	High speed synchronous network between Motion controller and servo amplifier
SSCNETⅢ*1	
SSCNETⅢ(/H)	General name for SSCNETⅢ/H, SSCNETⅢ
Absolute position system	General name for "system using the servomotor and servo amplifier for absolute position"
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*1	Abbreviation for "MELSEC-L series SSCNETⅢ/H head module (LJ72MS15)"
Optical hub unit or MR-MV200	Abbreviation for SSCNETⅢ/H Compatible Optical Hub Unit (MR-MV200)
Sensing module	General name for SSCNETⅢ/H compatible sensing module MR-MT2000 series
Sensing SSCNETⅢ/H head module*1 or MR-MT2010	Abbreviation for SSCNETⅢ/H head module (MR-MT2010)
Sensing extension module	General name for I/O module (MR-MT2100), pulse I/O module (MR-MT2200), analog I/O module (MR-MT2300), encoder I/F module (MR-MT2400)
Sensing I/O module or MR-MT2100	Abbreviation for I/O module (MR-MT2100)
Sensing pulse I/O module or MR-MT2200	Abbreviation for pulse I/O module (MR-MT2200)
Sensing analog I/O module or MR-MT2300	Abbreviation for analog I/O module (MR-MT2300)
Sensing encoder I/F module or MR-MT2400	Abbreviation for encoder I/F module (MR-MT2400)

*1 SSCNET: Servo System Controller NETwork

MANUAL PAGE ORGANIZATION

Representation of numerical values used in this manual

■Axis No. representation

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

Axis No.	n	Axis No.	n	Axis No.	n	Axis No.	n	Axis No.	n	Axis No.	n	Axis No.	n	Axis No.	n
1	0	9	8	17	16	25	24	33	32	41	40	49	48	57	56
2	1	10	9	18	17	26	25	34	33	42	41	50	49	58	57
3	2	11	10	19	18	27	26	35	34	43	42	51	50	59	58
4	3	12	11	20	19	28	27	36	35	44	43	52	51	60	59
5	4	13	12	21	20	29	28	37	36	45	44	53	52	61	60
6	5	14	13	22	21	30	29	38	37	46	45	54	53	62	61
7	6	15	14	23	22	31	30	39	38	47	46	55	54	63	62
8	7	16	15	24	23	32	31	40	39	48	47	56	55	64	63

- The range of axis No.1 to 16 (n=0 to 15) is valid in the R16MTCPU. The range of axis No.1 to 32 (n=0 to 31) is valid in the R32MTCPU.
- Calculate as follows for the device No. corresponding to each axis.

Ex.

For axis No. 32 in Q series Motion compatible device assignment

M3200+20n ([Rq.1140] Stop command)=M3200+20×31=M3820

M3215+20n ([Rq.1155] Servo OFF command)=M3215+20×31=M3835

In the positioning dedicated signals, "n" in "M10440+10n", etc. of the "Synchronous encoder axis status", "Synchronous encoder axis command signal", "Synchronous encoder axis monitor device" and "Synchronous encoder axis control device" indicates a value corresponding to synchronous encoder axis No. as shown in the following table.

Synchronous encoder axis No.	n	Synchronous encoder axis No.	n	Synchronous encoder axis No.	n
1	0	5	4	9	8
2	1	6	5	10	9
3	2	7	6	11	10
4	3	8	7	12	11

- Calculate as follows for the device No. corresponding to each synchronous encoder.

Ex.

For synchronous encoder axis No.12 in Q series Motion compatible device assignment

M10440+10n ([St.320] Synchronous encoder axis setting valid flag)=M10440+10×11=M10550

D13240+20n ([Md.320] Synchronous encoder axis current value)=D13240+20×11=D13460

■Machine No. representation

In the positioning dedicated signals, "m" in "M43904+32m", etc. indicates a value corresponding to machine No. as shown in the following table.

Machine No.	m	Machine No.	m
1	0	5	4
2	1	6	5
3	2	7	6
4	3	8	7

• Calculate as follows for the device No. corresponding to each machine.

Ex.

For machine No.8 in MELSEC iQ-R Motion device assignment

M43904+32m ([St.2120] Machine error detection) M43904+32×7=M44128

D53168+128m ([Md.2020] Machine type)=M53168+28×7=D54064

■Line No. representation in G-code control

In the positioning dedicated signals, "s" in "D54496+128s", etc. indicates a value corresponding to line No. as shown in the following table.

Line No.	s
1	0
2	1

• Calculate as follows for the device No. corresponding to each line.

Ex.

For line No.2 in MELSEC iQ-R Motion device assignment

D54440.0+4s ([St.3208] During G-code control)=D54440.0+4×1=D54444.0

D54496+128s ([Md.3016] Number of axes on line)=D54496+128×1=D54624

■Line No. and axis No. representation in G-code control

In the positioning dedicated signals, "sn" in "D54278+16sn", etc. indicates a value corresponding to line No. and axis No. as shown in the following table.

Line No.	Axis No.	sn	Line No.	Axis No.	sn
1	1	0	2	1	8
	2	1		2	9
	3	2		3	10
	4	3		4	11
	5	4		5	12
	6	5		6	13
	7	6		7	14
	8	7		8	15

• Calculate as follows for the device No. corresponding to each line.

Ex.

For line No.2, axis No. 8 in MELSEC iQ-R Motion device assignment

D54448.0+2sn ([St.3076] Smoothing zero)=D54448.0+2×15=D54478.0

D54754+32sn ([Md.3146] Rotating axis setting status)=D54754+32×15=D55234

Representation of device No. used in this manual

The "R" and "Q" beside the device No. of positioning dedicated signals such as "[Rq.1140] Stop command (R: M34480+32n/ Q: M3200+20n)" indicate the device No. for the device assignment methods shown below. When "R" and "Q" are not beside the device No., the device No. is the same for both device assignment methods.

Symbol	Device assignment method
R	MELSEC iQ-R Motion device assignment
Q	Q series Motion compatible device assignment

1 POSITIONING CONTROL BY THE MOTION CPU

1.1 Positioning Control by the Motion CPU

The following positioning controls are possible in the Motion CPU.

Motion CPU	Control axes
R64MTCPU	Up to 64 axes
R32MTCPU	Up to 32 axes
R16MTCPU	Up to 16 axes

There are the following six functions as controls toward the servo amplifier/servomotor.
- Servo operation by the servo program positioning instructions.
- Servo operation by the Motion dedicated PLC instruction (Direct positioning start request: M(P).SVSTD/D(P).SVSTD)
- JOG operation by each axis command signal of Motion CPU.
- Manual pulse generator operation by the positioning dedicated device of Motion CPU.
- Speed change, torque limit value change, and target position change during positioning control by the Motion dedicated PLC instruction and Motion dedicated function of operation control step "F".
- Current value change by the Motion dedicated PLC instruction or servo instructions.

Parameters and programs used for positioning control

Positioning control parameters

Positioning control parameters are used for positioning control of the Motion CPU.
Parameter data can be set and corrected using MT Developer2.
Refer to the parameters for positioning control for details of positioning control parameters. (☞ Page 166 PARAMETERS FOR POSITIONING CONTROL)

Servo program

The servo program is used for the positioning control. It comprises a program No., servo instructions and positioning data.
Refer to the servo programs for positioning control for details of servo program. (☞ Page 236 SERVO PROGRAMS FOR POSITIONING CONTROL)

Motion SFC program

Motion SFC program is used to program an operation sequence or transition control combining servo programs, "Step", "Transition", or "End" to perform Motion CPU control.
Refer to the following for details of Motion SFC program.
📖MELSEC iQ-R Motion controller Programming Manual (Program Design)

Sequence program

The Motion CPU control can be performed using the Motion dedicated PLC instruction in the sequence program of PLC CPU.
Refer to the following for details of the Motion dedicated PLC instruction.
📖MELSEC iQ-R Motion controller Programming Manual (Program Design)

Starting a servo program

There are the following two methods for starting a servo program.

Starting by Motion SFC program

Use the Motion control step "K" in the Motion SFC program to start the specified servo program.
Refer to the following for details of starting a Motion SFC program.
MELSEC iQ-R Motion controller Programming Manual (Program Design)

Starting by sequence program

By executing the Motion dedicated PLC instruction (Servo program start request: M(P).SVST/D(P).SVST) in the sequence program of the PLC CPU, the servo program in the Motion CPU can be started.
Refer to the following for details of the Motion dedicated PLC instruction.
MELSEC iQ-R Motion controller Programming Manual (Program Design)

Direct positioning start from the PLC CPU

Execute the Motion dedicated PLC instruction (Direct positioning start request: M(P).SVSTD/D(P).SVSTD) in the sequence program of the PLC CPU, and start the positioning control set in the device of the Motion CPU.
With this instruction, servo operations are possible without using a servo program.
Refer to the following for details of the Motion dedicated PLC instruction.
MELSEC iQ-R Motion controller Programming Manual (Program Design)

JOG operation

JOG operation can be performed by controlling the JOG dedicated device of the Motion CPU.
Refer to the JOG operation for details of JOG operation. (Page 415 JOG Operation)

Manual pulse generator operation

Manual pulse generator operation can be performed with a manual pulse generator connected to a high-speed counter module controlled by the Motion CPU. The manual pulse generator is operated by controlling the manual pulse generator dedicated device of the Motion CPU.
Refer to the manual pulse generator operation for details of manual pulse generator operation. (Page 420 Manual Pulse Generator Operation)

2 POSITIONING DEDICATED SIGNALS

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

Internal signals

The following five devices of the Motion CPU are used as the internal signals of the Motion CPU.
MELSEC iQ-R Motion device assignment and Q series Motion compatible device assignment are available. The ranges used for devices differs depending on the device assignment method used.

Device name	Device range	
	MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment
Internal relay (M)	M16000 to M49151 (33152 points)	M2000 to M3839 (1840 points) M8192 to M12287 (4096 points)
Special relay (SM)	SM0 to SM4095 (4096 points)	
Data register (D)	D32000 to D57343 (25344 points)	D0 to D799 (800 points) D10240 to D19823 (9584 points)
Motion register (#)	—	#8000 to #8639 (640 points)
Special register (SD)	SD0 to SD4095 (4096 points)	

Point

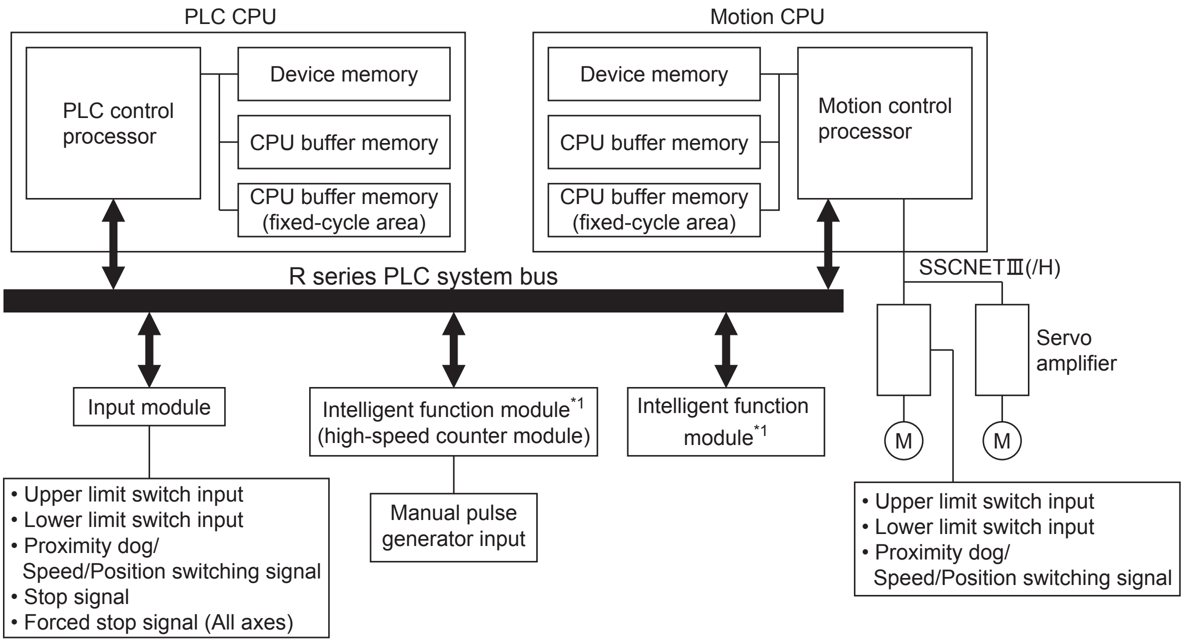
Refer to the following for details on device assignment method.
MELSEC iQ-R Motion Controller Programming Manual (Common)

External signals

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

External input signals	Description
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 signal	ON/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.
Forced stop signal	Signal for forced stop of the servo amplifier.

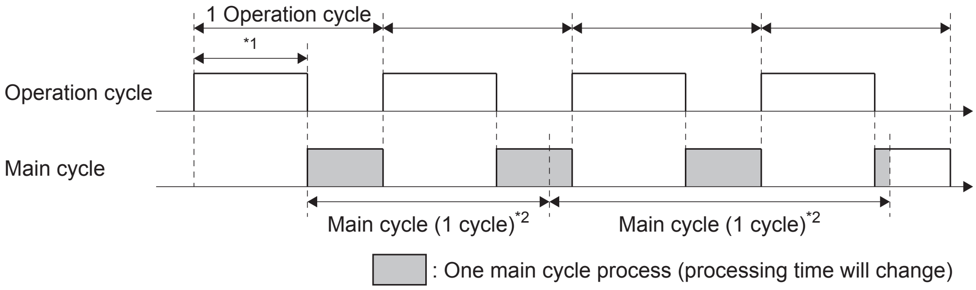
- Configuration between modules



*1 Motion CPU controlled module

Internal processing of the Motion CPU

Internal processing of the Motion CPU is divided into two cycles. The "operation cycle" and the "main cycle".



*1 Can be monitored with "Motion operation cycle (SD522)"

*2 Can be monitored with "Scan time (SD520)" (Maximum value can be monitored with "Maximum scan time (SD521)")

■Operation cycle

The processing required for every operation cycle is executed. This processing includes data communication with the servo amplifier, execution of fixed-cycle tasks of the Motion SFC, and generation of servo command values for every operation cycle.

The processing time changes according to the number of servo axes, the servo program being executed, etc.

When the operation cycle exceeds the setting in [Motion CPU Common Parameter] ⇨ [Basic Setting] ⇨ "Operation Cycle", "[St.1046] Operation cycle over flag (R: M30054/Q: M2054)" turns ON.

■Main cycle

Using the free time after the processing in operation cycle, the automatic refresh and normal tasks of the Motion SFC, as well as communication with MT Developer2 are executed.

The processing time in the main cycle changes according to the free time after the processing in operation cycle, the number of automatic refresh transmissions, and the number of executed normal tasks of the Motion SFC, etc.

When the main cycle becomes longer, it can be shortened by increasing the operation cycle setting time in [Motion CPU Common Parameter] ⇨ [Basic Setting] ⇨ "Operation Cycle " which increases free time.

Point

Refer to the following for the monitoring of processing times of operation cycle and main cycle.

📖MELSEC iQ-R Motion controller Programming Manual (Common)

Cautions

For positioning dedicated signals labelled as "operation cycle" in refresh cycles and fetch cycles, when axes are operating at the low speed operation cycle with the mixed operation cycle function, the refresh cycle and fetch cycle for these axes is the "low speed operation cycle".

2.1 Internal Relays

Internal relay list

■MELSEC iQ-R Motion device assignment

Device No.	Symbol	Purpose	Reference
M0 to	—	User device (16000 points)	—
M16000 to	—	Unusable (14000 points)	—
M30000 to	[St.1040], [St.1041], [St.1045] to [St.1050], [Rq.1120], [Rq.1122] to [Rq.1127]	Common device (640 points)	☞ Page 71 Common devices
M30640 to	—	Unusable (1760 points)	—
M32400 to	[St.1060] to [St.1076], [St.1079]	Axis status (32 points × 64 axes)	☞ Page 27 Axis status
M34448 to	—	Unusable (32 points)	—
M34480 to	[Rq.1140] to [Rq.1145], [Rq.1147] to [Rq.1149], [Rq.1152], [Rq.1155] to [Rq.1159]	Axis command signal (32 points × 64 axes)	☞ Page 37 Axis command signals
M36528 to	—	Unusable (32 points)	—
M36560 to	[St.340] to [St.349]	Command generation axis status (32 points × 64 axes)	☞ Page 46 Command generation axis status
M38608 to	—	Unusable (32 points)	—
M38640 to	[St.320] to [St.325]	Synchronous encoder axis status (16 points × 12 axes)	☞ Page 52 Synchronous encoder axis status
M38832 to	—	Unusable (128 points)	—
M38960 to	[St.420] to [St.424], [St.426]	Output axis status (16 points × 64 axes)	☞ Page 54 Output axis status
M39984 to	—	Unusable (16 points)	—
M40000 to	[St.380]	Synchronous control signal (64 points)	☞ Page 58 Synchronous control signal
M40064 to	—	Unusable (16 points)	—
M40080 to	[St.381]	Synchronous analysis complete signal (64 points)	☞ Page 60 Synchronous analysis complete signal
M40144 to	—	Unusable (16 points)	—
M40160 to	[Rq.341] to [Rq.348]	Command generation axis command signal (32 points × 64 axes)	☞ Page 49 Command generation axis command signal
M42208 to	—	Unusable (32 points)	—
M42240 to	[Rq.320], [Rq.323], [Rq.324]	Synchronous encoder axis command signal (8 points × 12 axes)	☞ Page 53 Synchronous encoder axis command signal
M42336 to	—	Unusable (64 points)	—
M42400 to	[Rq.400] to [Rq.406]	Output axis command signal (16 points × 64 axes)	☞ Page 56 Output axis command signal
M43424 to	—	Unusable (16 points)	—
M43440 to	[Rq.380]	Synchronous control start signal (64 points)	☞ Page 62 Synchronous control start signal
M43504 to	—	Unusable (16 points)	—

Device No.	Symbol	Purpose	Reference
M43520 to	[Rq.381]	Synchronous analysis request signal (64 points)	☞ Page 64 Synchronous analysis request signal
M43584 to	[Rq.2200]	Machine common command signal (32 points)	☞ Page 66 Machine common command signals
M43616 to	[Rq.2240], [Rq.2243] to [Rq.2247], [Rq.2250] to [Rq.2261]	Machine command signal (32 points × 8 machines)	☞ Page 67 Machine command signals
M43872 to	—	Unusable (32 points)	—
M43904 to	[St.2120], [St.2122] to [St.2124], [St.2127], [St.2128]	Machine status (32 points × 8 machines)	☞ Page 69 Machine status
M44160 to M49151	—	Unusable (4992 points)	—

Point

Total number of user device points

- 16000 points

■Q series Motion compatible device assignment

For devices on axis 1 to 32, use Q series Motion compatible device assignment.

For devices on axis 33 to 64, machine command signal (M43616 to M43871), and machine status (M43904 to M44159), use MELSEC iQ-R Motion device assignment.

Device No.	Symbol	Purpose	Reference
M0 to	—	User device (2000 points)	—
M2000 to	[St.1040], [St.1041], [St.1045] to [St.1050],[Rq.1120], [Rq.1122] to [Rq.1127]	Common device (320 points)	☞ Page 71 Common devices
M2320 to	—	Unusable (80 points)	—
M2400 to	[St.1060] to [St.1076], [St.1079]	Axis status (20 points × 32 axes)	☞ Page 27 Axis status
M3040 to	—	Unusable (160 points)	—
M3200 to	[Rq.1140] to [Rq.1145], [Rq.1147] to [Rq.1149], [Rq.1152], [Rq.1155] to [Rq.1159]	Axis command signal (20 points × 32 axes)	☞ Page 37 Axis command signals
M3840 to	—	User device (4352 points)	—
M8192 to	—	System area (1608 points)	—
M9800 to	[St.340] to [St.349]	Command generation axis status (20 points × 32 axes)	☞ Page 46 Command generation axis status
M10440 to	[St.320] to [St.325]	Synchronous encoder axis status (10 points × 12 axes)	☞ Page 52 Synchronous encoder axis status
M10560 to	[St.420] to [St.424], [St.426]	Output axis status (10 points × 32 axes)	☞ Page 54 Output axis status
M10880 to	[St.380]	Synchronous control signal (32 points)	☞ Page 58 Synchronous control signal
M10912 to	[St.381]	Synchronous analysis complete signal (32 points)	☞ Page 60 Synchronous analysis complete signal
M10944 to	—	Unusable (16 points)	—
M10960 to	[Rq.341] to [Rq.348]	Command generation axis command signal (20 points × 32 axes)	☞ Page 49 Command generation axis command signal
M11600 to	[Rq.320], [Rq.323], [Rq.324]	Synchronous encoder axis command signal (4 points × 12 axes)	☞ Page 53 Synchronous encoder axis command signal
M11648 to	—	Unusable (32 points)	—
M11680 to	[Rq.400] to [Rq.406]	Output axis command signal (10 points × 32 axes)	☞ Page 56 Output axis command signal
M12000 to	[Rq.380]	Synchronous control start signal (32 points)	☞ Page 62 Synchronous control start signal
M12032 to	[Rq.381]	Synchronous analysis request signal (32 points)	☞ Page 64 Synchronous analysis request signal
M12064 to M12287	—	Unusable (224 points)	—

Point

Total number of user device points

- 6352 points

Axis status

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
M32400 to M32431	M2400 to M2419	Axis 1 status
M32432 to M32463	M2420 to M2439	Axis 2 status
M32464 to M34495	M2440 to M2459	Axis 3 status
M34496 to M32527	M2460 to M2479	Axis 4 status
M32528 to M32559	M2480 to M2499	Axis 5 status
M32560 to M32591	M2500 to M2519	Axis 6 status
M32592 to M32623	M2520 to M2539	Axis 7 status
M32624 to M32655	M2540 to M2559	Axis 8 status
M32656 to M32687	M2560 to M2579	Axis 9 status
M32688 to M32719	M2580 to M2599	Axis 10 status
M32720 to M32751	M2600 to M2619	Axis 11 status
M32752 to M32783	M2620 to M2639	Axis 12 status
M32784 to M32815	M2640 to M2659	Axis 13 status
M32816 to M32847	M2660 to M2679	Axis 14 status
M32848 to M32879	M2680 to M2699	Axis 15 status
M32880 to M32911	M2700 to M2719	Axis 16 status
M32912 to M32943	M2720 to M2739	Axis 17 status
M32944 to M32975	M2740 to M2759	Axis 18 status
M32976 to M33007	M2760 to M2779	Axis 19 status
M33008 to M33039	M2780 to M2799	Axis 20 status
M33040 to M33071	M2800 to M2819	Axis 21 status
M33072 to M33103	M2820 to M2839	Axis 22 status
M33104 to M33135	M2840 to M2859	Axis 23 status
M33136 to M33167	M2860 to M2879	Axis 24 status
M33168 to M33199	M2880 to M2899	Axis 25 status
M33200 to M33231	M2900 to M2919	Axis 26 status
M33232 to M33263	M2920 to M2939	Axis 27 status
M33264 to M33295	M2940 to M2959	Axis 28 status
M33296 to M33327	M2960 to M2979	Axis 29 status
M33328 to M33359	M2980 to M2999	Axis 30 status
M33360 to M33391	M3000 to M3019	Axis 31 status
M33392 to M33423	M3020 to M3039	Axis 32 status
M33424 to M33455		Axis 33 status
M33456 to M33487		Axis 34 status
M33488 to M33519		Axis 35 status
M33520 to M33551		Axis 36 status
M33552 to M33583		Axis 37 status
M33584 to M33615		Axis 38 status
M33616 to M33647		Axis 39 status
M33648 to M33679		Axis 40 status
M33680 to M33711		Axis 41 status
M33712 to M33743		Axis 42 status
M33744 to M33775		Axis 43 status
M33776 to M33807		Axis 44 status
M33808 to M33839		Axis 45 status
M33840 to M33871		Axis 46 status
M33872 to M33903		Axis 47 status
M33904 to M33935		Axis 48 status
M33936 to M33967		Axis 49 status

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
M33968 to M33999		Axis 50 status
M34000 to M34031		Axis 51 status
M34032 to M34063		Axis 52 status
M34064 to M34095		Axis 53 status
M34096 to M34127		Axis 54 status
M34128 to M34159		Axis 55 status
M34160 to M34191		Axis 56 status
M34192 to M34223		Axis 57 status
M34224 to M34255		Axis 58 status
M34256 to M34287		Axis 59 status
M34288 to M34319		Axis 60 status
M34320 to M34351		Axis 61 status
M34352 to M34383		Axis 62 status
M34384 to M34415		Axis 63 status
M34416 to M34447		Axis 64 status

- Details for each axis

Device No.		Symbol	Signal name		Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment						
M32400+32n	M2400+20n	St.1060	Positioning start complete		Operation cycle	—	Status signal
M32401+32n	M2401+20n	St.1061	Positioning complete				
M32402+32n	M2402+20n	St.1062	In-position				
M32403+32n	M2403+20n	St.1063	Command in-position				
M32404+32n	M2404+20n	St.1064	Speed controlling				
M32405+32n	M2405+20n	St.1065	Speed/position switching latch				
M32406+32n	M2406+20n	St.1066	Zero pass				
M32407+32n	M2407+20n	St.1067	Error detection		Immediate		
M32408+32n	M2408+20n	St.1068	Servo error detection		Operation cycle		
M32409+32n	M2409+20n	St.1069	Home position return request		Main cycle		
M32410+32n	M2410+20n	St.1070	Home position return complete		Operation cycle		
M32411+32n	M2411+20n	St.1071	External signals	FLS			
M32412+32n	M2412+20n	St.1072		RLS			
M32413+32n	M2413+20n	St.1073		STOP			
M32414+32n	M2414+20n	St.1074		DOG/CHANGE			
M32415+32n	M2415+20n	St.1075	Servo ready				
M32416+32n	M2416+20n	St.1076	Torque limiting				
M32417+32n	M2417+20n	—	Unusable		—	—	—
M32418+32n	M2418+20n						
M32419+32n	M2419+20n	St.1079	M-code outputting		Operation cycle	—	Status signal
M32420+32n		—	Unusable		—	—	—
M32421+32n							
M32422+32n							
M32423+32n							
M32424+32n							
M32425+32n							
M32426+32n							
M32427+32n							
M32428+32n							
M32429+32n							
M32430+32n							
M32431+32n							

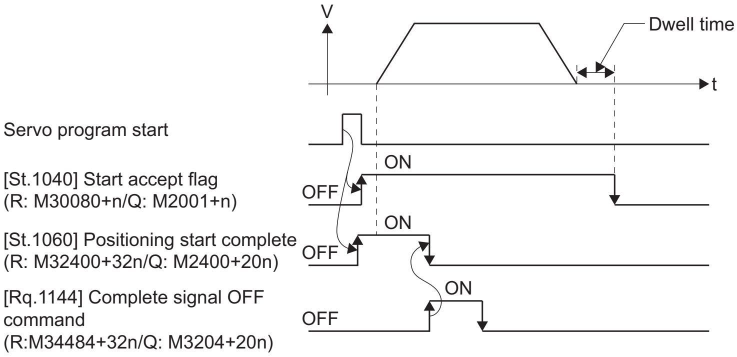
Point

- The following range is valid. R16MTCPU: Axis No.1 to 16, R32MTCPU: Axis No.1 to 32.
- The following device area can be used as a user device. R16MTCPU: 17 axes or more, R32MTCPU: 33 axes or more. However, when the project of R16MTCPU is replaced with R32MTCPU/R64MTCPU, or the project of R32MTCPU is replaced with R64MTCPU, this area cannot be used as a user device.

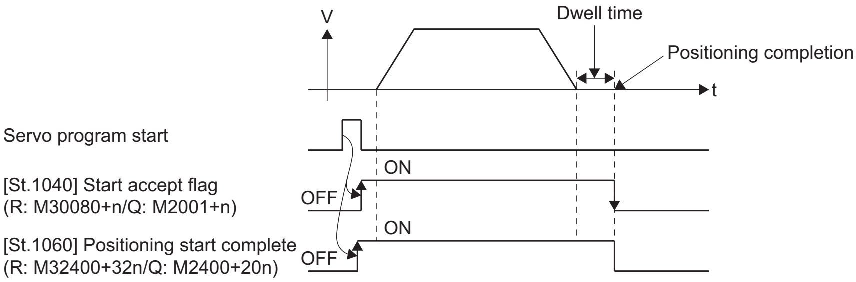
[St.1060] Positioning start complete (R: M32400+32n/Q:M2400+20n)

- 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. (☞ Page 425 M-code Output Function)
- This signal turns off at leading edge of "[Rq.1144] Complete signal OFF command (R: M34484+32n/Q: M3204+20n)" or positioning completion.

[At leading edge of "[Rq.1144] Complete signal OFF command (R: M34484+32n/Q: M3204+20n)"]



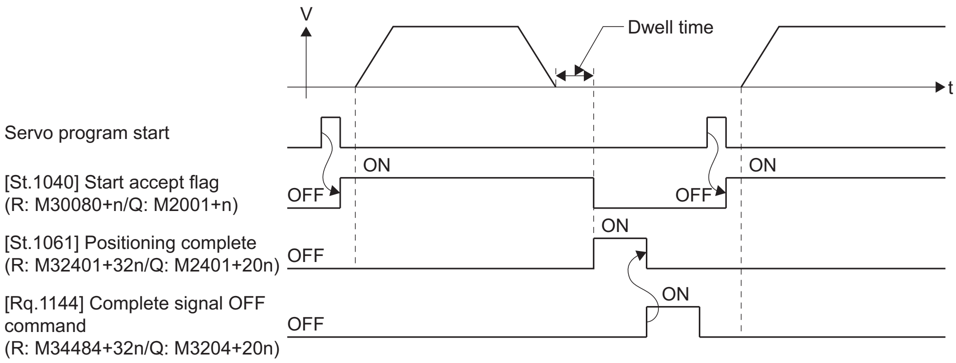
[At positioning completion]



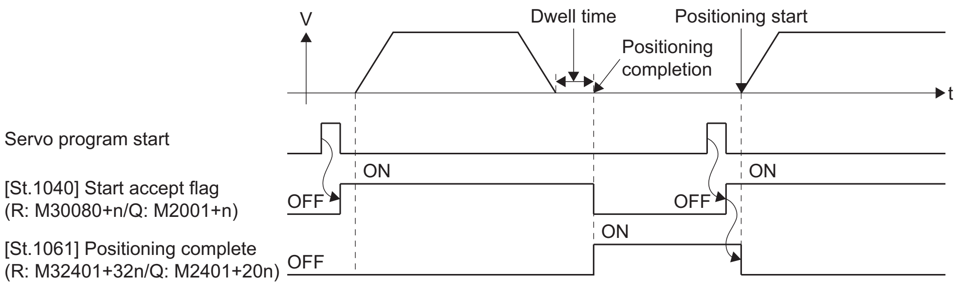
[St.1061] Positioning complete (R:M32401+32n/Q: M2401+20n)

- 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. (☞ Page 425 M-code Output Function)
- This signal turns off at leading edge of "[Rq.1144] Complete signal OFF command (R:M34484+32n/Q: M3204+20n)" or positioning start.

[At leading edge of "[Rq.1144] Complete signal OFF command (R:M34484+32n/Q: M3204+20n)"]



[At next positioning start]



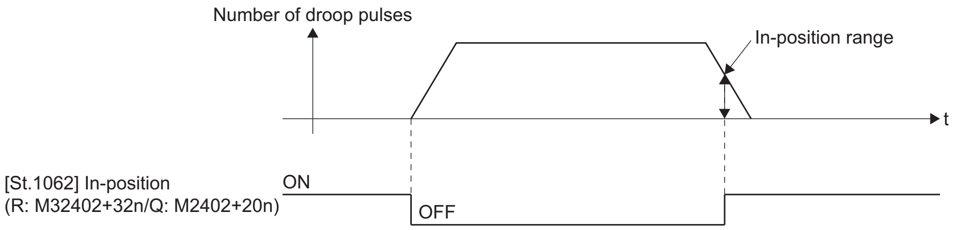
- The positioning complete signal turns ON by the execution of servo program even if the travel value of the axis specified with the servo program is set to "0".

⚠ CAUTION

- The deviation counter value is not considered, so that The "[St.1061] Positioning complete (R: M32401+32n/Q:M2401+20n)" turns on with the completion of the command output to positioning address. Use the "[St.1061] Positioning complete (R: M32401+32n/Q:M2401+20n)" together with the "[St.1062] In-position (R: M32402+32n/Q: M2402+20n)" to confirm the positioning completion of servo axis in the final instruction under program.

[St.1062] In-position (R: M32402+32n/Q: M2402+20n)

- 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.

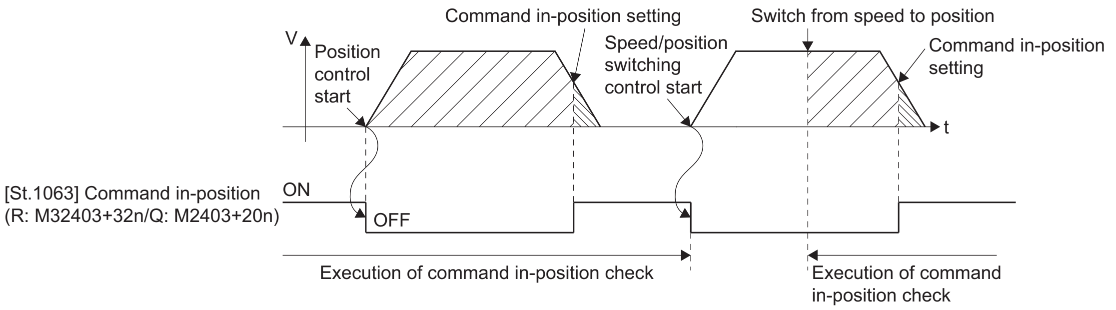


- While the control circuit power supply of the servo amplifier is ON, the status of the in-position signal of the servo amplifier ("[Md.108] Servo status1 (R: D32032+48n/Q: #8010+20n)": b12) is reflected. However, the state of the signal is always OFF for the following.
  - Servo error
  - From positioning start until deceleration start*1
  - Current value change
  - Home position return*2
  - Speed-torque control
  - Pressure control

*1 Except during position follow-up control, high-speed oscillation control, manual pulse generator operation, synchronous control, machine program operation, and G-code control. (The in-position signal is constantly updated during such controls.)
*2 The in-position signal may be updated after the proximity dog turns ON during home position return.

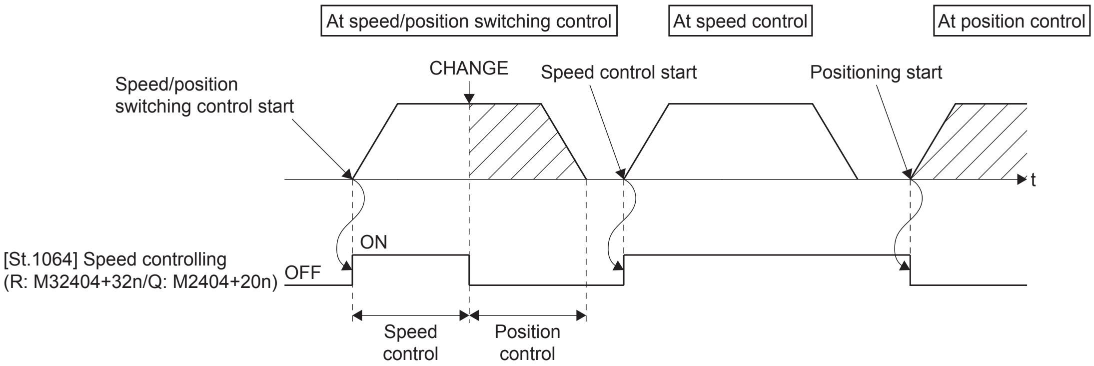
[St.1063] Command in-position (R: M32403+32n/Q: M2403+20n)

- This signal turns on when the absolute value of difference between the command position and feed current value becomes below the "command in-position 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
  - Pressure control
- Command in-position check is continually executed during position control.



[St.1064] Speed controlling (R: M32404+32n/Q: M2404+20n)

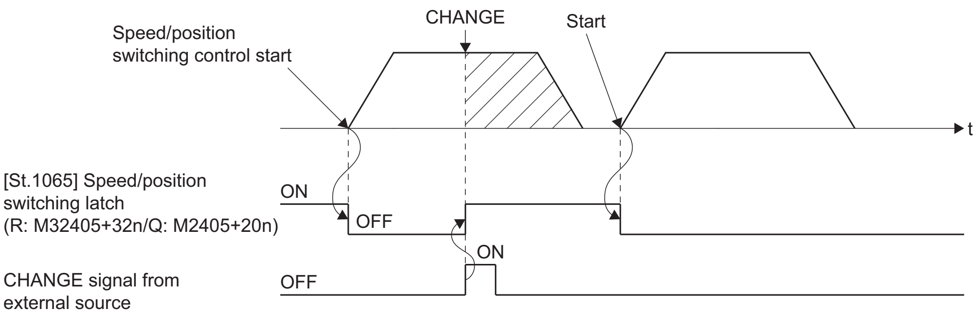
- This signal turns on during speed control, and it is used as judgment of during the speed control or position control. It is turning on while the switching from speed control to position control by the external CHANGE signal at the speed/position switching control.
- This signal turns off at the power supply on and during position control.



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

[St.1065] Speed/position switching latch (R: M32405+32n/Q: M2405+20n)

- 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.
- The signal turns off at the following start.
  - Position control
  - Speed/position switching control
  - Speed control
  - JOG operation
  - Manual pulse generator operation
  - Speed-torque control
  - Pressure control

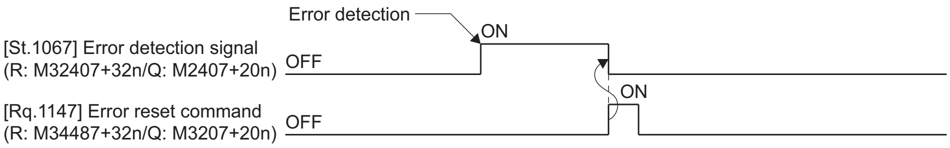


[St.1066] Zero pass (R: M32406+32n/Q: M2406+20n)

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.

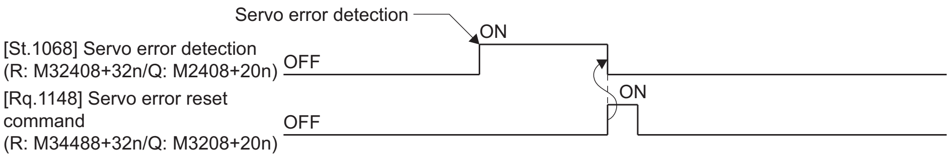
[St.1067] Error detection (R: M32407+32n/Q: M2407+20n)

- This signal turns on with detection of a warning or error, and can be used to judge whether there is a warning or error or not. The applicable warning code is stored in the “[Md.1003] Warning code (R: D32006+48n/Q: D6+20n)” with detection of a warning. The applicable error code is stored in the "[Md.1004] Error code (R: D32007+48n/Q: D7+20n)" with detection of an error. Refer to the following for details of warning codes and error codes.
  MELSEC iQ-R Motion controller Programing Manual (Common)
- This signal turns off when the "[Rq.1147] Error reset command (R: M34487+32n/Q: M3207+20n)" turns on.



[St.1068] Servo error detection (R: M32408+32n/Q: M2408+20n)

- This signal turns on when an error occurs at the servo amplifier side, and can be used to judge whether there is a servo error or not. However, servo warnings are not detected. When an error is detected at the servo amplifier side, the minor error (error code: 1C80H) is stored in the "[Md.1005] Servo error code (R: D32008+48n/Q: D8+20n)" storage register. The error code read from the servo amplifier is stored in "[Md.1019] Servo amplifier display servo error code (R: D32028+48n/Q: #8008+20n)". Refer to the following for servo amplifier error codes.
  Servo amplifier Instruction Manual
- This signal turns off when the "[Rq.1148] Servo error reset command (R: M34488+32n/Q: M3208+20n)" turns on or the servo power supply turns on again.



[St.1069] Home position return request (R: M32409+32n/Q: M2409+20n)

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

■When not using an absolute position system

- 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.)
- This signal turns off by the completion of home position return.

■When using an absolute position system

- 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 memory error
  - When servo error (AL.25) occurs
  - When servo error (AL.E3) occurs
  - When servo error(AL.2B) occurs
  - When warning (error code: 093CH, 093EH) occurs
  - When minor error (error code: 197EH) occurs
  - When the "rotation direction selection" of servo parameter is changed.
- 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 position 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.

[St.1070] Home position return complete (R: M32410+32n/Q: M2410+20n)

- This signal turns on when the home position return operation using the servo program has been completed normally.
- This signal turns off at the positioning start, JOG operation start and manual pulse generator operation start.
- If the home position return of proximity dog, dog cradle or stopper method using the servo program is executed during this signal on, the minor error (error code: 197BH) occurs and home position return cannot start.

2

[St.1071] External signals FLS (R: M32411+32n/Q: M2411+20n)

- This signal indicates the input status of the FLS signal set in the external signal parameter.
- When the setting of the external signal parameter and the state of the FLS signal are as follows, the upper stroke limit is detected. Then, the operation in the direction in which the feed current value increases cannot be executed.
  - When the external signal parameter "Contact" is set to "0: Normal Open" and the FLS signal is ON
  - When the external signal parameter "Contact" is set to "1: Normal Close" and the FLS signal is OFF

[St.1072] External signals RLS (R: M32412+32n/Q: M2412+20n)

- This signal indicates the input status of the RLS signal set in the external signal parameter.
- When the setting of the external signal parameter and the state of the RLS signal are as follows, the lower stroke limit is detected. Then, the operation in the direction in which the feed current value decreases cannot be executed.
  - When the external signal parameter "Contact" is set to "0: Normal Open" and the RLS signal is ON
  - When the external signal parameter "Contact" is set to "1: Normal Close" and the RLS signal is OFF

[St.1073] External signals STOP (R: M32413+32n/Q: M2413+20n)

- This signal indicates the input status of the STOP signal set in the external signal parameter.
- When the setting of the external signal parameter and the state of the STOP signal are as follows, the stop signal is detected and the operation is stopped.
  - When the external signal parameter "Contact" is set to "0: Normal Open" and the STOP signal is ON
  - When the external signal parameter "Contact" is set to "1: Normal Close" and the STOP signal is OFF

[St.1074] External signals DOG/CHANGE (R: M32414+32n/Q: M2414+20n)

- This signal indicates the input state of the DOG signal set in the external signal parameter.
- When the setting of the external signal parameter and the state of the DOG signal are as follows, the proximity dog signal or the speed/position switching signal is detected and the home position return operation or speed-position switching control is performed.
  - When the external signal parameter "Contact" is set to "0: Normal Open" and the state of the DOG signal is ON
  - When the external signal parameter "Contact" is set to "1: Normal Close" and the state of the DOG signal is OFF

[St.1075] Servo ready (R: M32415+32n/Q: M2415+20n)

- This signal turns ON when the servo amplifiers connected to each axis are in the READY state (READY ON and Servo ON). Refer to the following for details of the servo ON/OFF.
  MELSEC iQ-R Motion controller Programming Manual (Common)
- This signal turns off in the following cases.
  - "[Rq.1123] All axes servo ON command (R: M30042/Q: 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 "[Rq.1155] Servo OFF command (R: M34495+32n/Q: M3215+20n)" ON
  - Servo error occurs

Point

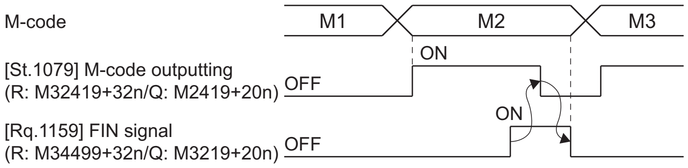
When the part of multiple servo amplifiers connected to the SSCNETⅢ(/H) becomes a servo error, only an applicable axis becomes the servo OFF state.

[St.1076] Torque limiting (R: M32416+32n/Q: M2416+20n)

This signal turns on while torque limit is executed. The signal toward the torque limiting axis turns on.

[St.1079] M-code outputting (R: M32419+32n/Q: M2419+20n)

- This signal turns during M-code is outputting.
- This signal turns off when the stop command, skip signal or FIN signal are inputted.



Point

- The "[Rq.1159] FIN signal (R: M34499+32n/Q: M3219+20n)" and "[St.1079] M-code outputting (R: M32419+32n/Q: M2419+20n)" are both for the FIN signal wait function.
- The "[Rq.1159] FIN signal (R: M34499+32n/Q: M3219+20n)" and "[St.1079] M-code outputting (R: M32419+32n/Q: M2419+20n)" are effective only when FIN acceleration/deceleration is designated in the servo program. Otherwise, the FIN signal wait function is disabled, and "[St.1079] M-code outputting (R: M32419+32n/Q: M2419+20n)" does not turn on.

Axis command signals

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible Device assignment	
M34480 to M34511	M3200 to M3219	Axis 1 command signal
M34512 to M34543	M3220 to M3239	Axis 2 command signal
M34544 to M34575	M3240 to M3259	Axis 3 command signal
M34576 to M34607	M3260 to M3279	Axis 4 command signal
M34608 to M34639	M3280 to M3299	Axis 5 command signal
M34640 to M34671	M3300 to M3319	Axis 6 command signal
M34672 to M34703	M3320 to M3339	Axis 7 command signal
M34704 to M34735	M3340 to M3359	Axis 8 command signal
M34736 to M34767	M3360 to M3379	Axis 9 command signal
M34768 to M34799	M3380 to M3399	Axis 10 command signal
M34800 to M34831	M3400 to M3419	Axis 11 command signal
M34832 to M34863	M3420 to M3439	Axis 12 command signal
M34864 to M34895	M3440 to M3459	Axis 13 command signal
M34896 to M34927	M3460 to M3479	Axis 14 command signal
M34928 to M34959	M3480 to M3499	Axis 15 command signal
M34960 to M34991	M3500 to M3519	Axis 16 command signal
M34992 to M35023	M3520 to M3539	Axis 17 command signal
M65024 to M35055	M3540 to M3559	Axis 18 command signal
M35056 to M35087	M3560 to M3579	Axis 19 command signal
M35088 to M35119	M3580 to M3599	Axis 20 command signal
M35120 to M35151	M3600 to M3619	Axis 21 command signal
M35152 to M35183	M3620 to M3639	Axis 22 command signal
M35184 to M35215	M3640 to M3659	Axis 23 command signal
M35216 to M35247	M3660 to M3679	Axis 24 command signal
M35248 to M35279	M3680 to M3699	Axis 25 command signal
M35280 to M35311	M3700 to M3719	Axis 26 command signal
M35312 to M35343	M3720 to M3739	Axis 27 command signal
M35344 to M35375	M3740 to M3759	Axis 28 command signal
M35376 to M35407	M3760 to M3779	Axis 29 command signal
M35408 to M35439	M3780 to M3799	Axis 30 command signal
M35440 to M35471	M3800 to M3819	Axis 31 command signal
M35472 to M35503	M3820 to M3839	Axis 32 command signal
M35504 to M35535		Axis 33 command signal
M35536 to M35567		Axis 34 command signal
M35568 to M35599		Axis 35 command signal
M35600 to M35631		Axis 36 command signal
M35632 to M35663		Axis 37 command signal
M35664 to M35695		Axis 38 command signal
M35696 to M35727		Axis 39 command signal
M35728 to M35759		Axis 40 command signal
M35760 to M35791		Axis 41 command signal
M35792 to M35823		Axis 42 command signal
M35824 to M35855		Axis 43 command signal
M35856 to M35887		Axis 44 command signal
M35888 to M35919		Axis 45 command signal
M35920 to M35951		Axis 46 command signal
M35952 to M35983		Axis 47 command signal
M35984 to M36015		Axis 48 command signal
M36016 to M36047		Axis 49 command signal

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible Device assignment	
M36048 to M36079		Axis 50 command signal
M36080 to M36111		Axis 51 command signal
M36112 to M36143		Axis 52 command signal
M36144 to M36175		Axis 53 command signal
M36176 to M36207		Axis 54 command signal
M36208 to M36239		Axis 55 command signal
M36240 to M36271		Axis 56 command signal
M36272 to M36303		Axis 57 command signal
M36304 to M36335		Axis 58 command signal
M36336 to M36367		Axis 59 command signal
M36368 to M36399		Axis 60 command signal
M36400 to M36431		Axis 61 command signal
M36432 to M36463		Axis 62 command signal
M36464 to M36495		Axis 63 command signal
M36496 to M36527		Axis 64 command signal

• Details for each axis

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
M34480+32n	M3200+20n	Rq.1140	Stop command	—	Operation cycle	Command signal
M34481+32n	M3201+20n	Rq.1141	Rapid stop command			
M34482+32n	M3202+20n	Rq.1142	Forward rotation JOG start command		Main cycle	
M34483+32n	M3203+20n	Rq.1143	Reverse rotation JOG start command			
M34484+32n	M3204+20n	Rq.1144	Complete signal OFF command			
M34485+32n	M3205+20n	Rq.1145	Speed/position switching enable command		Operation cycle	
M34486+32n	M3206+20n	—	Unusable	—	—	—
M34487+32n	M3207+20n	Rq.1147	Error reset command	—	Main cycle	Command signal
M34488+32n	M3208+20n	Rq.1148	Servo error reset command			
M34489+32n	M3209+20n	Rq.1149	External stop input disable at start command		At start	
M34490+32n	M3210+20n	—	Unusable	—	—	—
M34491+32n	M3211+20n					
M34492+32n	M3212+20n	Rq.1152	Feed current value update command	—	At start	Command signal
M34493+32n	M3213+20n	—	Unusable	—	—	—
M34494+32n	M3214+20n					
M34495+32n	M3215+20n	Rq.1155	Servo OFF command	—	Operation cycle	Command signal
M34496+32n	M3216+20n	Rq.1156	Gain changing command	—	Operation cycle*1	
M34497+32n	M3217+20n	Rq.1157	PI-PID switching command	—		
M34498+32n	M3218+20n	Rq.1158	Control loop changing command	—	Operation cycle	
M34499+32n	M3219+20n	Rq.1159	FIN signal	—		
M34500+32n		—	Unusable	—	—	—
M34501+32n						
M34502+32n						
M34503+32n						
M34504+32n						
M34505+32n						
M34506+32n						
M34507+32n						
M34508+32n						
M34509+32n						
M34510+32n						
M34511+32n						

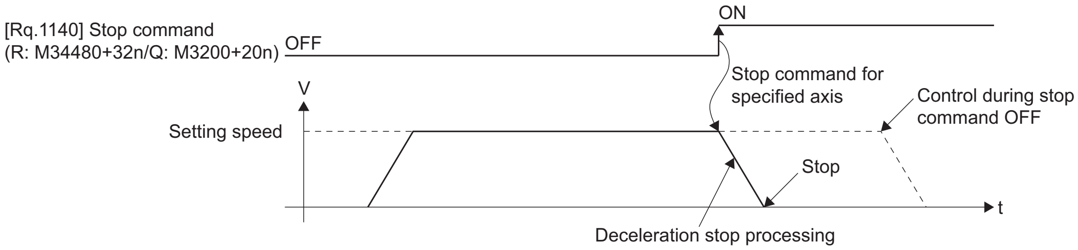
*1 Operation cycle 7.111 [ms] or more: Every 3.555 [ms]

Point

- The following range is valid. R16MTCPU: Axis No.1 to 16, R32MTCPU: Axis No.1 to 32.
- The following device area can be used as a user device. R16MTCPU: 17 axes or more, R32MTCPU: 33 axes or more. However, when the project of R16MTCPU is replaced with R32MTCPU/R64MTCPU, or the project of R32MTCPU is replaced with R64MTCPU, this area cannot be used as a user device.

[Rq.1140] Stop command (R: M34480+32n/Q: M3200+20n)

- 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.)



- The details of stop processing when the stop command turns on are shown below. (Refer to Speed control (Ⅰ) (☞ Page 318 Speed Control (I)), or speed control (Ⅱ) (☞ Page 321 Speed Control (II)) for details of speed control.)

Control details during execution	Processing at the turning stop command on	
	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 (Ⅱ)		
JOG operation		
Speed control with fixed position stop		
Manual pulse generator operation	An immediate stop is executed without deceleration processing.	—
Home position return	• The axis decelerates to a stop in the deceleration time set in the parameter block. • A stop error during home position return occurs and the minor error (error code:1908H) is stored in the "[Md.1004] Error code (R: D32007+48n/Q: D7+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.	—
Pressure control		
Machine program operation	This decelerates to a stop in the deceleration time set in the parameter block or machine positioning data.	The deceleration stop processing is continued.
Machine JOG operation		

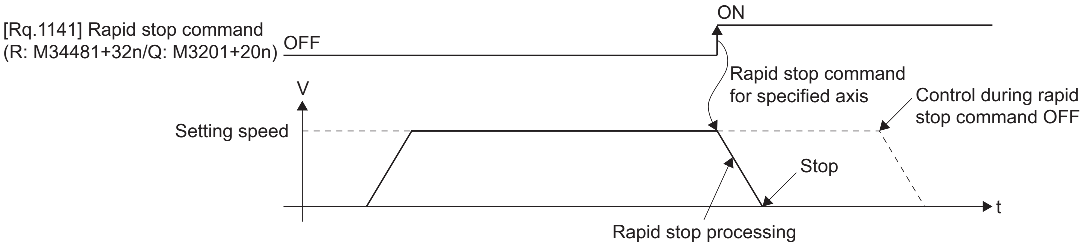
- The stop command in a dwell time is invalid. (After a dwell time, the "[St.1040] Start accept flag (R: M30080+n/Q: M2001+n)" turns OFF, and the "[St.1061] Positioning complete (R: M32401+32n/Q: M2401+20n)" turns ON.)

Point

If it is made to stop by turning on the "[Rq.1140] Stop command (R: M34480+32n/Q: 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.

[Rq.1141] Rapid stop command (R: M34481+32n/Q: M3201+20n)

- 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.)



- The details of stop processing when the rapid stop command turns on are shown below.

Control details during execution	Processing at the turning rapid stop command on	
	During control	During deceleration stop processing
Position control Speed control (Ⅰ) Speed control (Ⅱ) JOG operation Speed control with fixed position stop	The axis decelerates to a rapid stop deceleration time set in the parameter block or servo program.	Deceleration processing is stopped and rapid stop processing is executed.
Manual pulse generator operation	An immediate stop is executed without deceleration processing.	—
Home position return	• The axis decelerates to a stop in the rapid stop deceleration time set in the parameter block. • A "stop error during home position return" occurs and the minor error (error code:192DH) is stored in the "[Md.1004] Error code (R: D32007+48n/Q: D7+20n" for each axis.	
Speed-torque control Pressure 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.	—
Machine program operation Machine JOG operation	This decelerates to a stop in the deceleration time set in the parameter block or machine positioning data.	Deceleration processing is stopped and rapid stop processing is executed.

- The rapid stop command in a dwell time is invalid. (After a dwell time, the "[St.1040] Start accept flag (R: M30080+n/Q: M2001+n)" turns OFF, and the "[St.1061] Positioning complete (R: M32401+32n/Q: M2401+20n)" turns ON.)

Point

If it is made to stop rapidly by turning on the "[Rq.1141] Rapid stop command (R: M34481+32n/Q: 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.

[Rq.1142] Forward rotation JOG start command (R: M34482+32n/Q: M3202+20n)

JOG operation to the address increase direction is executed while "[Rq.1142] Forward rotation JOG start command (R: M34482+32n/Q: M3202+20n)" is turning on. When "[Rq.1142] Forward rotation JOG start command (R: M34482+32n/Q: M3202+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 "[Rq.1142] Forward rotation JOG start command (R: M34482+32n/Q: M3202+20n)" and "[Rq.1143] Reverse rotation JOG start command (R: M34483+32n/Q: M3203+20n)" may not turn on simultaneously.

[Rq.1143] Reverse rotation JOG start command (R: M34483+32n/Q: M3203+20n)

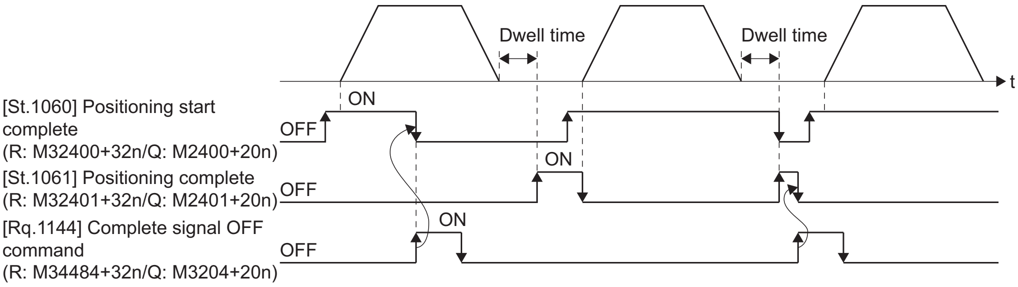
JOG operation to the address decrease direction is executed while "[Rq.1143] Reverse rotation JOG start command (R: M34483+32n/Q: M3203+20n)" is turning on. When "[Rq.1143] Reverse rotation JOG start command (R: M34483+32n/Q: M3203+20n)" is turned off, a deceleration stop is executed in the deceleration time set in the parameter block.

Point

Take an interlock so that the "[Rq.1142] Forward rotation JOG start command (R: M34482+32n/Q: M3202+20n)" and "[Rq.1143] Reverse rotation JOG start command (R: M34483+32n/Q: M3203+20n)" may not turn on simultaneously.

[Rq.1144] Complete signal OFF command (R: M34484+32n/Q: M3204+20n)

This command is used to turn off the "[St.1060] Positioning start complete (R: M32400+32n/Q: M2400+20n)" and "[St.1061] Positioning complete (R: M32401+32n/Q: M2401+20n)".



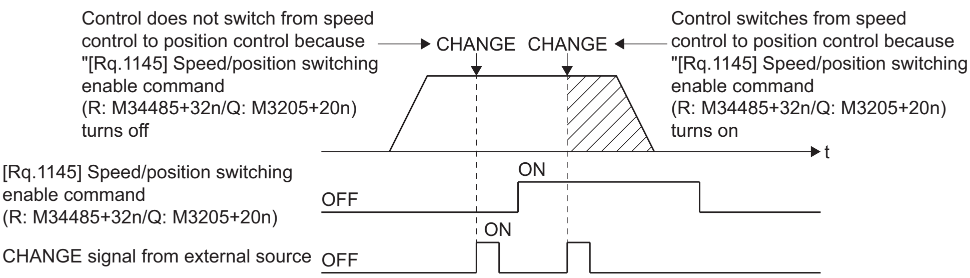
Point

Be sure to turn OFF the "[Rq.1144] Complete signal OFF (R: M34484+32n/Q: M3204+20n)", after confirming the "[St.1060] Positioning start complete (R: M32400+32n/Q: M2400+20n)" and "[St.1061] Positioning complete (R: M32401+32n/Q: M2401+20n)" are OFF.

[Rq.1145] Speed/position switching enable command (R: M34485+32n/Q: M3205+20n)

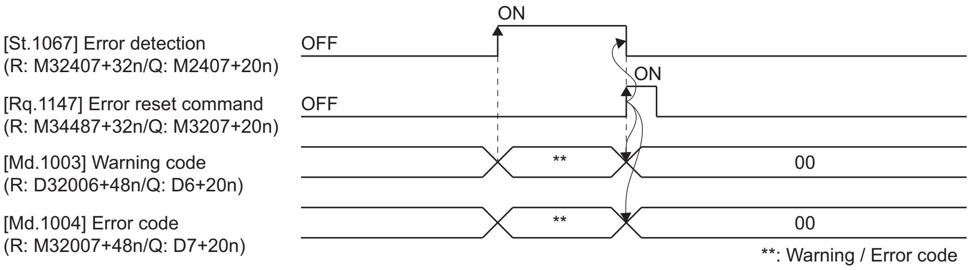
This command is used to make the CHANGE signal (speed/position switching signal) effective from an external source.

Setting value	Description
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.



[Rq.1147] Error reset command (R: M34487+32n/Q: M3207+20n)

This command is used to clear the "[Md.1003] Warning code (R: D32006+48n/Q: D6+20n)" and "[Md.1004] Error code (R: D32007+48n/Q: D7+20n)" of an axis for "[St.1067] Error detection (R: M32407+32n/Q: M2407+20n)": ON, and reset the "[St.1067] Error detection (R: M32407+32n/Q: M2407+20n)".

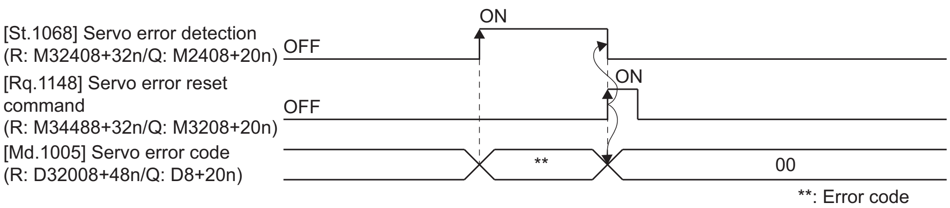


Point

Refer to the following for details on the warning code and error code storage registers.
MELSEC iQ-R Motion controller Programming Manual (Common)

[Rq.1148] Servo error reset command (R: M34488+32n/Q: M3208+20n)

This command is used to clear the "[Md.1005] Servo error code (R: D32008+48n/Q: D8+20n)" of an axis for which the "[St.1068] Servo error detection (R: M32408+32n/Q: M2408+20n)": ON, and reset the "[St.1068] Servo error detection (R: M32408+32n/Q: M2408+20n)".
Even when the servo warning is detected ("[St.1068] Servo error detection (R: M32408+32n/Q: M2408+20n)": OFF), "[Md.1005] Servo error code (R: D32008+48n/Q: D8+20n)" can be cleared by "[Rq.1148] Servo error reset command (R: M34488+32n/Q: M3208+20n)".



Point

Refer to the following for details on the servo error code storage registers.
MELSEC iQ-R Motion controller Programming Manual (Common)

[Rq.1149] External stop input disable at start command (R: M34489+32n/Q: M3209+20n)

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

Setting value	Description
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.

This is ignored during G-code control. When "[Rq.1149] External stop input disable at start command (R: M34489+32n/Q: M3209+20n)" is turned ON, axes with STOP input turned ON cannot be started.

Point

When it stops an axis with the external stop input after it starts by turning on the "[Rq.1149] External stop input disable at start command (R: M34489+32n/Q: M3209+20n)", switch the external stop input from OFF → ON (if the external stop input is turning on at the starting, switch it from ON → OFF → ON).

[Rq.1152] Feed current value update request command (R: M34492+32n/Q: M3212+20n)

This signal is used to set whether the feed current value will be cleared or not at the starting in speed/position switching control or speed control (I).

Setting value	Description
ON	The 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.
OFF	The 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.

Point

When it starts by turning on the "[Rq.1152] Feed current value update request command (R: M34492+32n/Q: M3212+20n)", keep "[Rq.1152] Feed current value update request command (R: M34492+32n/Q: M3212+20n)" on until completion of the positioning control. If "[Rq.1152] Feed current value update request command (R: M34492+32n/Q: M3212+20n)" is turned off on the way, the feed current value may not be reliable.

[Rq.1155] Servo OFF command (R: M34495+32n/Q: M3215+20n)

When "[Rq.1123] All axes servo ON command (R: M30042/Q: M2042)" is ON, this command is used to execute the servo OFF state (free run state).

Setting value	Description
ON	Servo OFF (free run state)
OFF	Servo ON

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 servomotor, such as machine adjustment.

[Rq.1156] Gain changing command (R: M34496+32n/Q: M3216+20n)

This signal is used to change the gain of servo amplifier in the Motion controller by the gain changing command ON/OFF.

Setting value	Description
ON	Gain changing command ON
OFF	Gain changing command OFF

Refer to the following for details of gain changing function.

📖Servo amplifier Instruction Manual

[Rq.1157] PI-PID switching command (R: M34497+32n/Q: M3217+20n)

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.

Setting value	Description
ON	PI-PID switching command ON (PID control)
OFF	PI-PID switching command OFF (PI control)

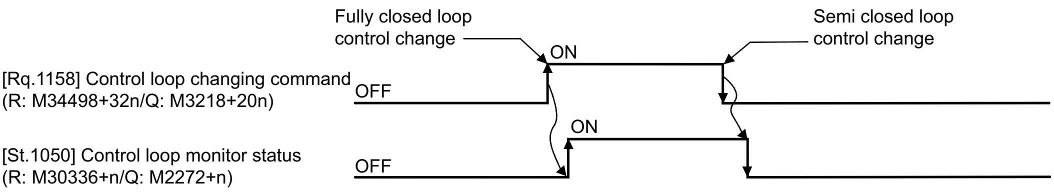
Refer to the following for details of PI-PID switching function.

📖Servo amplifier Instruction Manual

[Rq.1158] Control loop changing command (R: M34498+32n/Q: M3218+20n)

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.

Setting value	Description
ON	During fully closed loop control
OFF	During semi closed loop control



Refer to the following for details of control loop changing function.

📖Servo amplifier Instruction Manual

Point

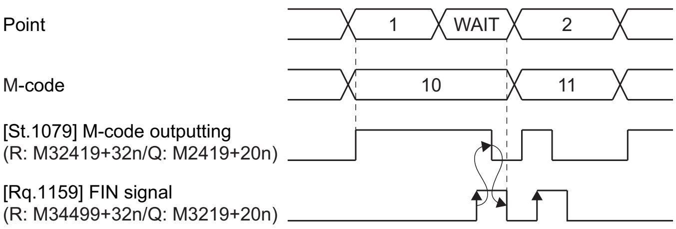
- When the servo amplifier is not started (LED: "AA", "Ab", "AC", "Ad" or "AE"), if the control loop changing command is turned ON/OFF, the command becomes invalid.
- When the following are operated during the fully closed loop, it returns to the semi closed loop control.
  (1) Power supply OFF or reset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

[Rq.1159] FIN signal (R: M34499+32n/Q: M3219+20n)

When a M-code is set in a servo program, transit to the next block does not execute until the FIN signal changes as follows: OFF → ON → OFF. Positioning to the next block begins after the FIN signal changes as above.

It is valid, only when the FIN acceleration/deceleration is set and FIN signal wait function is selected.

```
       <K  0>
       CPSTART2
        Axis       1
Point   Axis       2
        Speed           10000
        FIN               100
    1  ABS-2
        Axis       1,  200000
        Axis       2,  200000
        M-code             10
    2  ABS-2
        Axis       1,  300000
        Axis       2,  250000
        M-code             11
    3  ABS-2
        Axis       1,  350000
        Axis       2,  300000
        M-code             12
    4  ABS-2
        Axis       1,  400000
        Axis       2   400000
       CPEND
```



Timing Chart for Operation Description

1. When the positioning of point 1 starts, M-code 10 is output and the M-code outputting signal turns on.
2. FIN signal turns on after performing required processing in the Motion SFC program. Transition to the next point does not execute until the FIN signal turns on.
3. When the FIN signal turns on, the M-code outputting signal turns off.
4. When the FIN signal turns off after the M-code outputting signal turns off, the positioning to the next point 2 starts.

Point

- The "[Rq.1159] FIN signal (R: M34499+32n/Q: M3219+20n)" and "[St.1079] M-code outputting (R: M32419+32n/Q: M2419+20n)" are both signal for the FIN signal wait function.
- The "[Rq.1159] FIN signal (R: M34499+32n/Q: M3219+20n)" and "[St.1079] M-code outputting (R: M32419+32n/Q: 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 "[St.1079] M-code outputting (R: M32419+32n/Q: M2419+20n)" does not turn on.

Command generation axis status

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
M36560 to M36591	M9800 to M9819	Axis 1 command generation axis status
M36592 to M36623	M9820 to M9839	Axis 2 command generation axis status
M36624 to M36655	M9840 to M9859	Axis 3 command generation axis status
M36656 to M36687	M9860 to M9879	Axis 4 command generation axis status
M36688 to M36719	M9880 to M9899	Axis 5 command generation axis status
M36720 to M36751	M9900 to M9919	Axis 6 command generation axis status
M36752 to M36783	M9920 to M9939	Axis 7 command generation axis status
M36784 to M36815	M9940 to M9959	Axis 8 command generation axis status
M36816 to M36847	M9960 to M9979	Axis 9 command generation axis status
M36848 to M36879	M9980 to M9999	Axis 10 command generation axis status
M36880 to M36911	M10000 to M10019	Axis 11 command generation axis status
M36912 to M36943	M10020 to M10039	Axis 12 command generation axis status
M36944 to M36975	M10040 to M10059	Axis 13 command generation axis status
M36976 to M37007	M10060 to M10079	Axis 14 command generation axis status
M37008 to M37039	M10080 to M10099	Axis 15 command generation axis status
M37040 to M37071	M10100 to M10119	Axis 16 command generation axis status
M37072 to M37103	M10120 to M10139	Axis 17 command generation axis status
M37104 to M37135	M10140 to M10159	Axis 18 command generation axis status
M37136 to M37167	M10160 to M10179	Axis 19 command generation axis status
M37168 to M37199	M10180 to M10199	Axis 20 command generation axis status
M37200 to M37231	M10200 to M10219	Axis 21 command generation axis status
M37232 to M37263	M10220 to M10239	Axis 22 command generation axis status
M37264 to M37295	M10240 to M10259	Axis 23 command generation axis status
M37296 to M37327	M10260 to M10279	Axis 24 command generation axis status
M37328 to M37359	M10280 to M10299	Axis 25 command generation axis status
M37360 to M37391	M10300 to M10319	Axis 26 command generation axis status
M37392 to M37423	M10320 to M10339	Axis 27 command generation axis status
M37424 to M37455	M10340 to M10359	Axis 28 command generation axis status
M37456 to M37487	M10360 to M10379	Axis 29 command generation axis status
M37488 to M37519	M10380 to M10399	Axis 30 command generation axis status
M37520 to M37551	M10400 to M10419	Axis 31 command generation axis status
M37552 to M37583	M10420 to M10439	Axis 32 command generation axis status
M37584 to M37615		Axis 33 command generation axis status
M37616 to M37647		Axis 34 command generation axis status
M37648 to M37679		Axis 35 command generation axis status
M37680 to M37711		Axis 36 command generation axis status
M37712 to M37743		Axis 37 command generation axis status
M37744 to M37775		Axis 38 command generation axis status
M37776 to M37807		Axis 39 command generation axis status
M37808 to M37839		Axis 40 command generation axis status
M37840 to M37871		Axis 41 command generation axis status
M37872 to M37903		Axis 42 command generation axis status
M37904 to M37935		Axis 43 command generation axis status
M37936 to M37967		Axis 44 command generation axis status
M37968 to M37999		Axis 45 command generation axis status
M38000 to M38031		Axis 46 command generation axis status
M38032 to M38063		Axis 47 command generation axis status
M38064 to M38095		Axis 48 command generation axis status
M38096 to M38127		Axis 49 command generation axis status

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
M38128 to M38159		Axis 50 command generation axis status
M38160 to M38191		Axis 51 command generation axis status
M38192 to M38223		Axis 52 command generation axis status
M38224 to M38255		Axis 53 command generation axis status
M38256 to M38287		Axis 54 command generation axis status
M38288 to M38319		Axis 55 command generation axis status
M38320 to M38351		Axis 56 command generation axis status
M38352 to M38383		Axis 57 command generation axis status
M38384 to M38415		Axis 58 command generation axis status
M38416 to M38447		Axis 59 command generation axis status
M38448 to M38479		Axis 60 command generation axis status
M38480 to M38511		Axis 61 command generation axis status
M38512 to M38543		Axis 62 command generation axis status
M38544 to M38575		Axis 63 command generation axis status
M38576 to M38607		Axis 64 command generation axis status

• Details for each axis

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
M36560+32n	M9800+20n	St.340	Command generation axis positioning start complete	Operation cycle	—	Status signal
M36561+32n	M9801+20n	St.341	Command generation axis positioning complete			
M36562+32n	M9802+20n	—	Unusable	—	—	—
M36563+32n	M9803+20n	St.342	Command generation axis command in-position	Operation cycle	—	Status signal
M36564+32n	M9804+20n	St.343	Command generation axis speed controlling			
M36565+32n	M9805+20n	—	Unusable	—	—	—
M36566+32n	M9806+20n					
M36567+32n	M9807+20n	St.344	Command generation axis error detection	Immediate	—	Status signal
M36568+32n	M9808+20n	—	Unusable	—	—	—
M36569+32n	M9809+20n					
M36570+32n	M9810+20n	St.345	Command generation axis start accept flag	Operation cycle	—	Status signal
M36571+32n	M9811+20n	St.346	Command generation axis speed change accepting flag			
M36572+32n	M9812+20n	St.347	Command generation axis speed change "0" accepting flag			
M36573+32n	M9813+20n	St.348	Command generation axis automatic decelerating flag			
M36574+32n	M9814+20n	—	Unusable	—	—	—
M36575+32n	M9815+20n					
M36576+32n	M9816+20n					
M36577+32n	M9817+20n					
M36578+32n	M9818+20n					
M36579+32n	M9819+20n	St.349	Command generation axis M-code outputting	Operation cycle	—	Status signal
M36580+32n		—	Unusable	—	—	—
M36581+32n						
M36582+32n						
M36583+32n						
M36584+32n						
M36585+32n						
M36586+32n						
M36587+32n						
M36588+32n						
M36589+32n						
M36590+32n						
M36591+32n						

Point

- The following range is valid. R16MTCPU: Axis No.1 to 16, R32MTCPU: Axis No.1 to 32.
- The following device area can be used as a user device. R16MTCPU: 17 axes or more, R32MTCPU: 33 axes or more. However, when the project of R16MTCPU is replaced with R32MTCPU/R64MTCPU, or the project of R32MTCPU is replaced with R64MTCPU, this area cannot be used as a user device.
- Refer to the following for details of command generation axis status.
  MELSEC iQ-R Motion Controller Programming Manual (Advanced Synchronous Control)

Command generation axis command signal

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
M40160 to M40191	M10960 to M10979	Axis 1 command generation axis command signal
M40192 to M40223	M10980 to M10999	Axis 2 command generation axis command signal
M40224 to M40255	M11000 to M11019	Axis 3 command generation axis command signal
M40256 to M40287	M11020 to M11039	Axis 4 command generation axis command signal
M40288 to M40319	M11040 to M11059	Axis 5 command generation axis command signal
M40320 to M40351	M11060 to M11079	Axis 6 command generation axis command signal
M40352 to M40383	M11080 to M11099	Axis 7 command generation axis command signal
M40384 to M40415	M11100 to M11119	Axis 8 command generation axis command signal
M40416 to M40447	M11120 to M11139	Axis 9 command generation axis command signal
M40448 to M40479	M11140 to M11159	Axis 10 command generation axis command signal
M40480 to M40511	M11160 to M11179	Axis 11 command generation axis command signal
M40512 to M40543	M11180 to M11199	Axis 12 command generation axis command signal
M40544 to M40575	M11200 to M11219	Axis 13 command generation axis command signal
M40576 to M40607	M11220 to M11239	Axis 14 command generation axis command signal
M40608 to M40639	M11240 to M11259	Axis 15 command generation axis command signal
M40640 to M40671	M11260 to M11279	Axis 16 command generation axis command signal
M40672 to M40703	M11280 to M11299	Axis 17 command generation axis command signal
M40704 to M40735	M11300 to M11319	Axis 18 command generation axis command signal
M40736 to M40767	M11320 to M11339	Axis 19 command generation axis command signal
M40768 to M40799	M11340 to M11359	Axis 20 command generation axis command signal
M40800 to M40831	M11360 to M11379	Axis 21 command generation axis command signal
M40832 to M40863	M11380 to M11399	Axis 22 command generation axis command signal
M40864 to M40895	M11400 to M11419	Axis 23 command generation axis command signal
M40896 to M40927	M11420 to M11439	Axis 24 command generation axis command signal
M40928 to M40959	M11440 to M11459	Axis 25 command generation axis command signal
M40960 to M40991	M11460 to M11479	Axis 26 command generation axis command signal
M40992 to M41023	M11480 to M11499	Axis 27 command generation axis command signal
M41024 to M41055	M11500 to M11519	Axis 28 command generation axis command signal
M41056 to M41087	M11520 to M11539	Axis 29 command generation axis command signal
M41088 to M41119	M11540 to M11559	Axis 30 command generation axis command signal
M41120 to M41151	M11560 to M11579	Axis 31 command generation axis command signal
M41152 to M41183	M11580 to M11599	Axis 32 command generation axis command signal
M41184 to M41215		Axis 33 command generation axis command signal
M41216 to M41247		Axis 34 command generation axis command signal
M41248 to M41279		Axis 35 command generation axis command signal
M41280 to M41311		Axis 36 command generation axis command signal
M41312 to M41343		Axis 37 command generation axis command signal
M41344 to M41375		Axis 38 command generation axis command signal
M41376 to M41407		Axis 39 command generation axis command signal
M41408 to M41439		Axis 40 command generation axis command signal
M41440 to M41471		Axis 41 command generation axis command signal
M41472 to M41503		Axis 42 command generation axis command signal
M41504 to M41535		Axis 43 command generation axis command signal
M41536 to M41567		Axis 44 command generation axis command signal
M41568 to M41599		Axis 45 command generation axis command signal
M41600 to M41631		Axis 46 command generation axis command signal
M41632 to M41663		Axis 47 command generation axis command signal
M41664 to M41695		Axis 48 command generation axis command signal
M41696 to M41727		Axis 49 command generation axis command signal

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
M41728 to M41759		Axis 50 command generation axis command signal
M41760 to M41791		Axis 51 command generation axis command signal
M41792 to M41823		Axis 52 command generation axis command signal
M41824 to M41855		Axis 53 command generation axis command signal
M41856 to M41887		Axis 54 command generation axis command signal
M41888 to M41919		Axis 55 command generation axis command signal
M41920 to M41951		Axis 56 command generation axis command signal
M41952 to M41983		Axis 57 command generation axis command signal
M41984 to M42015		Axis 58 command generation axis command signal
M42016 to M42047		Axis 59 command generation axis command signal
M42048 to M42079		Axis 60 command generation axis command signal
M42080 to M42111		Axis 61 command generation axis command signal
M42112 to M42143		Axis 62 command generation axis command signal
M42144 to M42175		Axis 63 command generation axis command signal
M42176 to M42207		Axis 64 command generation axis command signal

- Details for each axis

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
M40160+32n	M10960+20n	Rq.341	Command generation axis stop command	—	Operation cycle	Command signal
M40161+32n	M10961+20n	Rq.342	Command generation axis rapid stop command			
M40162+32n	M10962+20n	Rq.343	Command generation axis forward rotation JOG start command		Main cycle	
M40163+32n	M10963+20n	Rq.344	Command generation axis reverse rotation JOG start command			
M40164+32n	M10964+20n	Rq.345	Command generation axis complete signal OFF command			
M40165+32n	M10965+20n	—	Unusable	—	—	—
M40166+32n	M10966+20n					
M40167+32n	M10967+20n	Rq.346	Command generation axis error reset command	—	Main cycle	Command signal
M40168+32n	M10968+20n	—	Unusable	—	—	—
M40169+32n	M10969+20n					
M40170+32n	M10970+20n					
M40171+32n	M10971+20n					
M40172+32n	M10972+20n	Rq.347	Feed current value update request command	—	At start	Command signal
M40173+32n	M10973+20n	—	Unusable	—	—	—
M40174+32n	M10974+20n					
M40175+32n	M10975+20n					
M40176+32n	M10976+20n					
M40177+32n	M10977+20n					
M40178+32n	M10978+20n					
M40179+32n	M10979+20n	Rq.348	Command generation axis FIN signal	—	Operation cycle	Command signal
M40180+32n		—	Unusable	—	—	—
M40181+32n						
M40182+32n						
M40183+32n						
M40184+32n						
M40185+32n						
M40186+32n						
M40187+32n						
M40188+32n						
M40189+32n						
M40190+32n						
M40191+32n						

Point

- The following range is valid. R16MTCPU: Axis No.1 to 16, R32MTCPU: Axis No.1 to 32.
- The following device area can be used as a user device. R16MTCPU: 17 axes or more, R32MTCPU: 33 axes or more. However, when the project of R16MTCPU is replaced with R32MTCPU/R64MTCPU, or the project of R32MTCPU is replaced with R64MTCPU, this area cannot be used as a user device.
- Refer to the following for details of command generation axis command signal.
  MELSEC iQ-R Motion Controller Programming Manual (Advanced Synchronous Control)

Synchronous encoder axis status

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
M38640 to M38655	M10440 to M10449	Axis 1 synchronous encoder axis status
M38656 to M38671	M10450 to M10459	Axis 2 synchronous encoder axis status
M38672 to M38687	M10460 to M10469	Axis 3 synchronous encoder axis status
M38688 to M38703	M10470 to M10479	Axis 4 synchronous encoder axis status
M38704 to M38719	M10480 to M10489	Axis 5 synchronous encoder axis status
M38720 to M38735	M10490 to M10499	Axis 6 synchronous encoder axis status
M38736 to M38751	M10500 to M10509	Axis 7 synchronous encoder axis status
M38752 to M38767	M10510 to M10519	Axis 8 synchronous encoder axis status
M38768 to M38783	M10520 to M10529	Axis 9 synchronous encoder axis status
M38784 to M38799	M10530 to M10539	Axis 10 synchronous encoder axis status
M38800 to M38815	M10540 to M10549	Axis 11 synchronous encoder axis status
M38816 to M38831	M10550 to M10559	Axis 12 synchronous encoder axis status

- Details for each axis

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
M38640+16n	M10440+10n	St.320	Synchronous encoder axis setting valid flag	At power on	—	Status signal
M38641+16n	M10441+10n	St.321	Synchronous encoder axis connecting valid flag	Operation cycle		
M38642+16n	M10442+10n	St.322	Synchronous encoder axis counter enable flag			
M38643+16n	M10443+10n	St.323	Synchronous encoder axis current value setting request flag			
M38644+16n	M10444+10n	St.324	Synchronous encoder axis error detection flag	Immediate		
M38645+16n	M10445+10n	—	Unusable	—	—	—
M38646+16n	M10446+10n	St.325	Synchronous encoder axis control complete flag	Immediate	—	Status signal
M38647+16n	M10447+10n	—	Unusable	—	—	—
M38648+16n	M10448+10n					
M38649+16n	M10449+10n					
M38650+16n						
M38651+16n						
M38652+16n						
M38653+16n						
M38654+16n						
M38655+16n						

Point

Refer to the following for details of synchronous encoder axis status.

MELSEC iQ-R Motion Controller Programming Manual (Advanced Synchronous Control)

Synchronous encoder axis command signal

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
M42240 to M42247	M11600 to M11603	Axis 1 synchronous encoder axis command signal
M42248 to M42255	M11604 to M11607	Axis 2 synchronous encoder axis command signal
M42256 to M42263	M11608 to M11611	Axis 3 synchronous encoder axis command signal
M42264 to M42271	M11612 to M11615	Axis 4 synchronous encoder axis command signal
M42272 to M42279	M11616 to M11619	Axis 5 synchronous encoder axis command signal
M42280 to M42287	M11620 to M11623	Axis 6 synchronous encoder axis command signal
M42288 to M42295	M11624 to M11627	Axis 7 synchronous encoder axis command signal
M42296 to M42303	M11628 to M11631	Axis 8 synchronous encoder axis command signal
M42304 to M42311	M11632 to M11635	Axis 9 synchronous encoder axis command signal
M42312 to M42319	M11636 to M11639	Axis 10 synchronous encoder axis command signal
M42320 to M42327	M11640 to M11643	Axis 11 synchronous encoder axis command signal
M42328 to M42335	M11644 to M11647	Axis 12 synchronous encoder axis command signal

- Details for each axis

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
M42240+8n	M11600+4n	Rq.323	Synchronous encoder axis error reset	—	Main cycle	Command signal
M42241+8n	M11601+4n	Rq.320	Synchronous encoder axis control request		Operation cycle	
M42242+8n	M11602+4n	Rq.324	Connection command of synchronous encoder via device/master CPU		Main cycle	
M42243+8n	M11603+4n	—	Unusable	—	—	—
M42244+8n						
M42245+8n						
M42246+8n						
M42247+8n						

Point

Refer to the following for details of synchronous encoder axis command signal.
📖MELSEC iQ-R Motion Controller Programming Manual (Advanced Synchronous Control)

Output axis status

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
M38960 to M38975	M10560 to M10569	Axis 1 output axis status
M38976 to M38991	M10570 to M10579	Axis 2 output axis status
M38992 to M39007	M10580 to M10589	Axis 3 output axis status
M39008 to M39023	M10590 to M10599	Axis 4 output axis status
M39024 to M39039	M10600 to M10609	Axis 5 output axis status
M39040 to M39055	M10610 to M10619	Axis 6 output axis status
M39056 to M39071	M10620 to M10629	Axis 7 output axis status
M39072 to M39087	M10630 to M10639	Axis 8 output axis status
M39088 to M39103	M10640 to M10649	Axis 9 output axis status
M39104 to M39119	M10650 to M10659	Axis 10 output axis status
M39120 to M39135	M10660 to M10669	Axis 11 output axis status
M39136 to M39151	M10670 to M10679	Axis 12 output axis status
M39152 to M39167	M10680 to M10689	Axis 13 output axis status
M39168 to M39183	M10690 to M10699	Axis 14 output axis status
M39184 to M39199	M10700 to M10709	Axis 15 output axis status
M39200 to M39215	M10710 to M10719	Axis 16 output axis status
M39216 to M39231	M10720 to M10729	Axis 17 output axis status
M39232 to M39247	M10730 to M10739	Axis 18 output axis status
M39248 to M39263	M10740 to M10749	Axis 19 output axis status
M39264 to M39279	M10750 to M10759	Axis 20 output axis status
M39280 to M39295	M10760 to M10769	Axis 21 output axis status
M39296 to M39311	M10770 to M10779	Axis 22 output axis status
M39312 to M39327	M10780 to M10789	Axis 23 output axis status
M39328 to M39343	M10790 to M10799	Axis 24 output axis status
M39344 to M39359	M10800 to M10809	Axis 25 output axis status
M39360 to M39375	M10810 to M10819	Axis 26 output axis status
M39376 to M39391	M10820 to M10829	Axis 27 output axis status
M39392 to M39407	M10830 to M10839	Axis 28 output axis status
M39408 to M39423	M10840 to M10849	Axis 29 output axis status
M39424 to M39439	M10850 to M10859	Axis 30 output axis status
M39440 to M39455	M10860 to M10869	Axis 31 output axis status
M39456 to M39471	M10870 to M10879	Axis 32 output axis status
M39472 to M39487		Axis 33 output axis status
M39488 to M39503		Axis 34 output axis status
M39504 to M39519		Axis 35 output axis status
M39520 to M39535		Axis 36 output axis status
M39536 to M39551		Axis 37 output axis status
M39552 to M39567		Axis 38 output axis status
M39568 to M39583		Axis 39 output axis status
M39584 to M39599		Axis 40 output axis status
M39600 to M39615		Axis 41 output axis status
M39616 to M39631		Axis 42 output axis status
M39632 to M39647		Axis 43 output axis status
M39648 to M39663		Axis 44 output axis status
M39664 to M39679		Axis 45 output axis status
M39680 to M39695		Axis 46 output axis status
M39696 to M39711		Axis 47 output axis status
M39712 to M39727		Axis 48 output axis status
M39728 to M39743		Axis 49 output axis status

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
M39744 to M39759		Axis 50 output axis status
M39760 to M39775		Axis 51 output axis status
M39776 to M39791		Axis 52 output axis status
M39792 to M39807		Axis 53 output axis status
M39808 to M39823		Axis 54 output axis status
M39824 to M39839		Axis 55 output axis status
M39840 to M39855		Axis 56 output axis status
M39856 to M39871		Axis 57 output axis status
M39872 to M39887		Axis 58 output axis status
M39888 to M39903		Axis 59 output axis status
M39904 to M39919		Axis 60 output axis status
M39920 to M39935		Axis 61 output axis status
M39936 to M39951		Axis 62 output axis status
M39952 to M39967		Axis 63 output axis status
M39968 to M39983		Axis 64 output axis status

- Details for each axis

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
M38960+16n	M10560+10n	St.420	Main shaft clutch ON/OFF status	Operation cycle	—	Status signal
M38961+16n	M10561+10n	St.421	Main shaft clutch smoothing status			
M38962+16n	M10562+10n	St.423	Auxiliary shaft clutch ON/OFF status			
M38963+16n	M10563+10n	St.424	Auxiliary shaft clutch smoothing status			
M38964+16n	M10564+10n	—	Unusable	—	—	—
M38965+16n	M10565+10n					
M38966+16n	M10566+10n	St.426	Control change complete	Operation cycle	—	Status signal
M38967+16n	M10567+10n	—	Unusable	—	—	—
M38968+16n	M10568+10n					
M38969+16n	M10569+10n					
M38970+16n						
M38971+16n						
M38972+16n						
M38973+16n						
M38974+16n						
M38975+16n						

Point

- The following range is valid. R16MTCPU: Axis No.1 to 16, R32MTCPU: Axis No.1 to 32.
- The following device area can be used as a user device. R16MTCPU: 17 axes or more, R32MTCPU: 33 axes or more. However, when the project of R16MTCPU is replaced with R32MTCPU/R64MTCPU, or the project of R32MTCPU is replaced with R64MTCPU, this area cannot be used as a user device.
- Refer to the following for details of output axis status.
  📖MELSEC iQ-R Motion Controller Programming Manual (Advanced Synchronous Control)

Output axis command signal

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
M42400 to M42415	M11680 to M11689	Axis 1 output axis command signal
M42416 to M42431	M11690 to M11699	Axis 2 output axis command signal
M42432 to M42447	M11700 to M11709	Axis 3 output axis command signal
M42448 to M42463	M11710 to M11719	Axis 4 output axis command signal
M42464 to M42479	M11720 to M11729	Axis 5 output axis command signal
M42480 to M42495	M11730 to M11739	Axis 6 output axis command signal
M42496 to M42511	M11740 to M11749	Axis 7 output axis command signal
M42512 to M42527	M11750 to M11759	Axis 8 output axis command signal
M42528 to M42543	M11760 to M11769	Axis 9 output axis command signal
M42544 to M42559	M11770 to M11779	Axis 10 output axis command signal
M42560 to M42575	M11780 to M11789	Axis 11 output axis command signal
M42576 to M42591	M11790 to M11799	Axis 12 output axis command signal
M42592 to M42607	M11800 to M11809	Axis 13 output axis command signal
M42608 to M42623	M11810 to M11819	Axis 14 output axis command signal
M42624 to M42639	M11820 to M11829	Axis 15 output axis command signal
M42640 to M42655	M11830 to M11839	Axis 16 output axis command signal
M42656 to M42761	M11840 to M11849	Axis 17 output axis command signal
M42762 to M42687	M11850 to M11859	Axis 18 output axis command signal
M42688 to M42703	M11860 to M11869	Axis 19 output axis command signal
M42704 to M42719	M11870 to M11879	Axis 20 output axis command signal
M42720 to M42735	M11880 to M11889	Axis 21 output axis command signal
M42736 to M42751	M11890 to M11899	Axis 22 output axis command signal
M42752 to M42767	M11900 to M11909	Axis 23 output axis command signal
M42768 to M42783	M11910 to M11919	Axis 24 output axis command signal
M42784 to M42799	M11920 to M11929	Axis 25 output axis command signal
M42800 to M42815	M11930 to M11939	Axis 26 output axis command signal
M42816 to M42831	M11940 to M11949	Axis 27 output axis command signal
M42832 to M42847	M11950 to M11959	Axis 28 output axis command signal
M42848 to M42863	M11960 to M11969	Axis 29 output axis command signal
M42864 to M42879	M11970 to M11979	Axis 30 output axis command signal
M42880 to M42895	M11980 to M11989	Axis 31 output axis command signal
M42896 to M42911	M11990 to M11999	Axis 32 output axis command signal
M42912 to M42927		Axis 33 output axis command signal
M42928 to M42943		Axis 34 output axis command signal
M42944 to M42959		Axis 35 output axis command signal
M42960 to M42975		Axis 36 output axis command signal
M42976 to M42991		Axis 37 output axis command signal
M42992 to M43007		Axis 38 output axis command signal
M43008 to M43023		Axis 39 output axis command signal
M43024 to M43039		Axis 40 output axis command signal
M43040 to M43055		Axis 41 output axis command signal
M43056 to M43071		Axis 42 output axis command signal
M43072 to M43087		Axis 43 output axis command signal
M43088 to M43103		Axis 44 output axis command signal
M43104 to M43119		Axis 45 output axis command signal
M43120 to M43135		Axis 46 output axis command signal
M43136 to M43151		Axis 47 output axis command signal
M43152 to M43167		Axis 48 output axis command signal
M43168 to M43183		Axis 49 output axis command signal

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
M43184 to M43199		Axis 50 output axis command signal
M43200 to M43215		Axis 51 output axis command signal
M43216 to M43231		Axis 52 output axis command signal
M43232 to M43247		Axis 53 output axis command signal
M43248 to M43263		Axis 54 output axis command signal
M43264 to M43279		Axis 55 output axis command signal
M43280 to M43295		Axis 56 output axis command signal
M43296 to M43311		Axis 57 output axis command signal
M43312 to M43327		Axis 58 output axis command signal
M43328 to M43343		Axis 59 output axis command signal
M43344 to M43359		Axis 60 output axis command signal
M43360 to M43375		Axis 61 output axis command signal
M43376 to M43391		Axis 62 output axis command signal
M43392 to M43407		Axis 63 output axis command signal
M43408 to M43423		Axis 64 output axis command signal

- Details for each axis

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
M42400+16n	M11680+10n	Rq.400	Main shaft clutch command	—	Operation cycle	Command signal
M42401+16n	M11681+10n	Rq.401	Main shaft clutch control invalid command			
M42402+16n	M11682+10n	Rq.402	Main shaft clutch forced OFF command			
M42403+16n	M11683+10n	—	Unusable	—	—	—
M42404+16n	M11684+10n	Rq.403	Auxiliary shaft clutch command	—	Operation cycle	Command signal
M42405+16n	M11685+10n	Rq.404	Auxiliary shaft clutch control invalid command			
M42406+16n	M11686+10n	Rq.405	Auxiliary shaft clutch forced OFF command			
M42407+16n	M11687+10n	—	Unusable	—	—	—
M42408+16n	M11688+10n	Rq.406	Control change request command	—	Operation cycle	Command signal
M42409+16n	M11689+10n	—	Unusable	—	—	—
M42410+16n						
M42411+16n						
M42412+16n						
M42413+16n						
M42414+16n						
M42415+16n						

Point

- The following range is valid. R16MTCPU: Axis No.1 to 16, R32MTCPU: Axis No.1 to 32.
- The following device area can be used as a user device. R16MTCPU: 17 axes or more, R32MTCPU: 33 axes or more. However, when the project of R16MTCPU is replaced with R32MTCPU/R64MTCPU, or the project of R32MTCPU is replaced with R64MTCPU, this area cannot be used as a user device.
- Refer to the following for details of output axis command signal.
  MELSEC iQ-R Motion Controller Programming Manual (Advanced Synchronous Control)

Synchronous control signal

Axis No.	Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
	MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
1	M40000	M10880	St.380	Synchronous control	Operation cycle	—	Status signal
2	M40001	M10881					
3	M40002	M10882					
4	M40003	M10883					
5	M40004	M10884					
6	M40005	M10885					
7	M40006	M10886					
8	M40007	M10887					
9	M40008	M10888					
10	M40009	M10889					
11	M40010	M10890					
12	M40011	M10891					
13	M40012	M10892					
14	M40013	M10893					
15	M40014	M10894					
16	M40015	M10895					
17	M40016	M10896					
18	M40017	M10897					
19	M40018	M10898					
20	M40019	M10899					
21	M40020	M10900					
22	M40021	M10901					
23	M40022	M10902					
24	M40023	M10903					
25	M40024	M10904					
26	M40025	M10905					
27	M40026	M10906					
28	M40027	M10907					
29	M40028	M10908					
30	M40029	M10909					
31	M40030	M10910					
32	M40031	M10911					
33	M40032						
34	M40033						
35	M40034						
36	M40035						
37	M40036						
38	M40037						
39	M40038						
40	M40039						
41	M40040						
42	M40041						
43	M40042						
44	M40043						
45	M40044						
46	M40045						
47	M40046						

Axis No.	Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
	MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
48	M40047		St.380	Synchronous control	Operation cycle	—	Status signal
49	M40048						
50	M40049						
51	M40050						
52	M40051						
53	M40052						
54	M40053						
55	M40054						
56	M40055						
57	M40056						
58	M40057						
59	M40058						
60	M40059						
61	M40060						
62	M40061						
63	M40062						
64	M40063						

Point

- The following range is valid. R16MTCPU: Axis No.1 to 16, R32MTCPU: Axis No.1 to 32.
- The following device area can be used as a user device. R16MTCPU: 17 axes or more, R32MTCPU: 33 axes or more. However, when the project of R16MTCPU is replaced with R32MTCPU/R64MTCPU, or the project of R32MTCPU is replaced with R64MTCPU, this area cannot be used as a user device.
- Refer to the following for details of synchronous control signal.
  MELSEC iQ-R Motion Controller Programming Manual (Advanced Synchronous Control)

Synchronous analysis complete signal

Axis No.	Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
	MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
1	M40080	M10912	St.381	Synchronous analysis complete	Operation cycle	—	Status signal
2	M40081	M10913					
3	M40082	M10914					
4	M40083	M10915					
5	M40084	M10916					
6	M40085	M10917					
7	M40086	M10918					
8	M40087	M10919					
9	M40088	M10920					
10	M40089	M10921					
11	M40090	M10922					
12	M40091	M10923					
13	M40092	M10924					
14	M40093	M10925					
15	M40094	M10926					
16	M40095	M10927					
17	M40096	M10928					
18	M40097	M10929					
19	M40098	M10930					
20	M40099	M10931					
21	M40100	M10932					
22	M40101	M10933					
23	M40102	M10934					
24	M40103	M10935					
25	M40104	M10936					
26	M40105	M10937					
27	M40106	M10938					
28	M40107	M10939					
29	M40108	M10940					
30	M40109	M10941					
31	M40110	M10942					
32	M40111	M10943					
33	M40112						
34	M40113						
35	M40114						
36	M40115						
37	M40116						
38	M40117						
39	M40118						
40	M40119						
41	M40120						
42	M40121						
43	M40122						
44	M40123						
45	M40124						
46	M40125						
47	M40126						

Axis No.	Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
	MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
48	M40127		St.381	Synchronous analysis complete	Operation cycle	—	Status signal
49	M40128						
50	M40129						
51	M40130						
52	M40131						
53	M40132						
54	M40133						
55	M40134						
56	M40135						
57	M40136						
58	M40137						
59	M40138						
60	M40139						
61	M40140						
62	M40141						
63	M40142						
64	M40143						

Point

- The following range is valid. R16MTCPU: Axis No.1 to 16, R32MTCPU: Axis No.1 to 32.
- The following device area can be used as a user device. R16MTCPU: 17 axes or more, R32MTCPU: 33 axes or more. However, when the project of R16MTCPU is replaced with R32MTCPU/R64MTCPU, or the project of R32MTCPU is replaced with R64MTCPU, this area cannot be used as a user device.
- Refer to the following for details of synchronous analysis complete signal.
  MELSEC iQ-R Motion Controller Programming Manual (Advanced Synchronous Control)

Synchronous control start signal

Axis No.	Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
	MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
1	M43440	M12000	Rq.380	Synchronous control start	—	Operation cycle	Command signal
2	M43441	M12001					
3	M43442	M12002					
4	M43443	M12003					
5	M43444	M12004					
6	M43445	M12005					
7	M43446	M12006					
8	M43447	M12007					
9	M43448	M12008					
10	M43449	M12009					
11	M43450	M12010					
12	M43451	M12011					
13	M43452	M12012					
14	M43453	M12013					
15	M43454	M12014					
16	M43455	M12015					
17	M43456	M12016					
18	M43457	M12017					
19	M43458	M12018					
20	M43459	M12019					
21	M43460	M12020					
22	M43461	M12021					
23	M43462	M12022					
24	M43463	M12023					
25	M43464	M12024					
26	M43465	M12025					
27	M43466	M12026					
28	M43467	M12027					
29	M43468	M12028					
30	M43469	M12029					
31	M43470	M12030					
32	M43471	M12031					
33	M43472						
34	M43473						
35	M43474						
36	M43475						
37	M43476						
38	M43477						
39	M43478						
40	M43479						
41	M43480						
42	M43481						
43	M43482						
44	M43483						
45	M43484						
46	M43485						
47	M43486						

Axis No.	Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
	MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
48	M43487		Rq.380	Synchronous control start	—	Operation cycle	Command signal
49	M43488						
50	M43489						
51	M43490						
52	M43491						
53	M43492						
54	M43493						
55	M43494						
56	M43495						
57	M43496						
58	M43497						
59	M43498						
60	M43499						
61	M43500						
62	M43501						
63	M40502						
64	M40503						

Point

- The following range is valid. R16MTCPU: Axis No.1 to 16, R32MTCPU: Axis No.1 to 32.
- The following device area can be used as a user device. R16MTCPU: 17 axes or more, R32MTCPU: 33 axes or more. However, when the project of R16MTCPU is replaced with R32MTCPU/R64MTCPU, or the project of R32MTCPU is replaced with R64MTCPU, this area cannot be used as a user device.
- Refer to the following for details of synchronous control start signal.
MELSEC iQ-R Motion Controller Programming Manual (Advanced Synchronous Control)

Synchronous analysis request signal

Axis No.	Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
	MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
1	M43520	M12032	Rq.381	Synchronous analysis request	—	At start of synchronous control	Command signal
2	M43521	M12033					
3	M43522	M12034					
4	M43523	M12035					
5	M43524	M12036					
6	M43525	M12037					
7	M43526	M12038					
8	M43527	M12039					
9	M43528	M12040					
10	M43529	M12041					
11	M43530	M12042					
12	M43531	M12043					
13	M43532	M12044					
14	M43533	M12045					
15	M43534	M12046					
16	M43535	M12047					
17	M43536	M12048					
18	M43537	M12049					
19	M43538	M12050					
20	M43539	M12051					
21	M43540	M12052					
22	M43541	M12053					
23	M43542	M12054					
24	M43543	M12055					
25	M43544	M12056					
26	M43545	M12057					
27	M43546	M12058					
28	M43547	M12059					
29	M43548	M12060					
30	M43549	M12061					
31	M43550	M12062					
32	M43551	M12063					
33	M43552						
34	M43553						
35	M43554						
36	M43555						
37	M43556						
38	M43557						
39	M43558						
40	M43559						
41	M43560						
42	M43561						
43	M43562						
44	M43563						
45	M43564						
46	M43565						
47	M43566						

Axis No.	Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
	MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
48	M43567		Rq.381	Synchronous analysis request	—	At start of synchronous control	Command signal
49	M43568						
50	M43569						
51	M43570						
52	M43571						
53	M43572						
54	M43573						
55	M43574						
56	M43575						
57	M43576						
58	M43577						
59	M43578						
60	M43579						
61	M43580						
62	M43581						
63	M43582						
64	M43583						

Point

- The following range is valid. R16MTCPU: Axis No.1 to 16, R32MTCPU: Axis No.1 to 32.
- The following device area can be used as a user device. R16MTCPU: 17 axes or more, R32MTCPU: 33 axes or more. However, when the project of R16MTCPU is replaced with R32MTCPU/R64MTCPU, or the project of R32MTCPU is replaced with R64MTCPU, this area cannot be used as a user device.
- Refer to the following for details of synchronous analysis request signal.
MELSEC iQ-R Motion Controller Programming Manual (Advanced Synchronous Control)

Machine common command signals

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
M43584		Rq.2200	Real current value monitor enable flag	—	Operation cycle	Command signal
M43585		—	Unusable	—	—	—
M43586						
M43587						
M43588						
M43589						
M43590						
M43591						
M43592						
M43593						
M43594						
M43595						
M43596						
M43597						
M43598						
M43599						
M43600						
M43601						
M43602						
M43603						
M43604						
M43605						
M43606						
M43607						
M43608						
M43609						
M43610						
M43611						
M43612						
M43613						
M43614						
M43615						

Point

Refer to the following for details of machine common command signal.
MELSEC iQ-R Motion Controller Programming Manual (Machine Control)

Machine command signals

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
M43616 to M43647		Machine 1 machine command signal
M43648 to M43679		Machine 2 machine command signal
M43680 to M43711		Machine 3 machine command signal
M43712 to M43743		Machine 4 machine command signal
M43744 to M43775		Machine 5 machine command signal
M43776 to M43807		Machine 6 machine command signal
M43808 to M43839		Machine 7 machine command signal
M43840 to M43871		Machine 8 machine command signal

- Details for each machine

Device No.		Symbol	Signal name		Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment						
M43616+32m		Rq.2240	Machine error reset command		—	Main cycle	Command signal
M43617+32m		—	Unusable		—	—	—
M43618+32m							
M43619+32m		Rq.2243	Machine XYZ stroke limit disable command		—	At machine JOG start	Command signal
M43620+32m		Rq.2244	Base/tool translation change command			Operation cycle	
M43621+32m		Rq.2245	Machine stop command				
M43622+32m		Rq.2246	Machine rapid stop command				
M43623+32m		Rq.2247	Execute point switching command				
M43624+32m		—	Unusable		—	—	—
M43625+32m							
M43626+32m							
M43627+32m							
M43628+32m							
M43629+32m							
M43630+32m							
M43631+32m							
M43632+32m		Rq.2250	Machine forward rotation JOG start command	X	—	Main cycle	Command signal
M43633+32m		Rq.2251		Y			
M43634+32m		Rq.2252		Z			
M43635+32m		Rq.2253		A			
M43636+32m		Rq.2254		B			
M43637+32m		Rq.2255		C			
M43638+32m		—	Unusable		—	—	—
M43639+32m							
M43640+32m		Rq.2256	Machine reverse rotation JOG start command	X	—	Main cycle	Command signal
M43641+32m		Rq.2257		Y			
M43642+32m		Rq.2258		Z			
M43643+32m		Rq.2259		A			
M43644+32m		Rq.2260		B			
M43645+32m		Rq.2261		C			
M43646+32m		—	Unusable		—	—	—
M43647+32m							

Point

Refer to the following for details of machine command signal.
MELSEC iQ-R Motion Controller Programming Manual (Machine Control)

Machine status

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
M43904 to M43935		Machine 1 machine status
M43936 to M43967		Machine 2 machine status
M43968 to M43999		Machine 3 machine status
M44000 to M44031		Machine 4 machine status
M44032 to M44063		Machine 5 machine status
M44064 to M44095		Machine 6 machine status
M44096 to M44127		Machine 7 machine status
M44128 to M44159		Machine 8 machine status

- Details for each machine

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
M43904+32m		St.2120	Machine error detection	Immediate	—	Status signal
M43905+32m		—	Unusable	—	—	—
M43906+32m		St.2122	Machine WAIT	Operation cycle	—	Status signal
M43907+32m		St.2123	Joint interpolation velocity limiting			
M43908+32m		St.2124	Base/tool translation change complete			
M43909+32m		—	Unusable	—	—	—
M43910+32m						
M43911+32m		St.2127	Machine start accept flag	Operation cycle	—	Status signal
M43912+32m		St.2128	Machine servo ready			
M43913+32m		—	Unusable	—	—	—
M43914+32m						
M43915+32m						
M43916+32m						
M43917+32m						
M43918+32m						
M43919+32m						
M43920+32m						
M43921+32m						
M43922+32m						
M43923+32m						
M43924+32m						
M43925+32m						
M43926+32m						
M43927+32m						
M43928+32m						
M43929+32m						
M43930+32m						
M43931+32m						
M43932+32m						
M439033+32m						
M43934+32m						
M43935+32m						

Point

Refer to the following for details of machine status.

MELSEC iQ-R Motion Controller Programming Manual (Machine Control)

Common devices

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
M30000	M2000	Rq.1120	PLC ready flag	—	Main cycle	Command signal
M30001	—	—	Unusable (37 points)	—	—	—
M30002						
M30003						
M30004						
M30005						
M30006						
M30007						
M30008						
M30009						
M30010						
M30011						
M30012						
M30013						
M30014						
M30015						
M30016						
M30017						
M30018						
M30019						
M30020						
M30021						
M30022						
M30023						
M30024						
M30025						
M30026						
M30027						
M30028						
M30029						
M30030						
M30031						
M30032						
M30033						
M30034						
M30035						
M30036						
M30037						
M30038	M2038	St.1041	Motion SFC debugging flag	At debugging mode transition	—	Status signal
M30039	M2039	—	Unusable	—	—	—
M30040	M2040	Rq.1122	Speed switching point specified flag	—	At start	Command signal
M30041	M2041	—	Unusable	—	—	—
M30042	M2042	Rq.1123	All axes servo ON command	—	Operation cycle	Command signal

Device No.		Symbol	Signal name		Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment						
M30043	M2043	—	Unusable (5 points)		—	—	—
M30044	M2044						
M30045	M2045						
M30046	M2046						
M30047	M2047						
M30048	M2048	Rq.1124	JOG operation simultaneous start command		—	Main cycle	Command signal
M30049	M2049	St.1045	All axes servo ON accept flag		Operation cycle	—	Status signal
M30050	M2050	—	Unusable		—	—	—
M30051	M2051	Rq.1125	Manual pulse generator 1 enable flag		—	Main cycle	Command signal
M30052	M2052	Rq.1126	Manual pulse generator 2 enable flag				
M30053	M2053	Rq.1127	Manual pulse generator 3 enable flag				
M30054	M2054	St.1046	Operation cycle over flag		Operation cycle	—	Status signal
M30055	—	—	Unusable (25 points)		—	—	—
M30056							
M30057							
M30058							
M30059							
M30060							
M30061							
M30062							
M30063							
M30064							
M30065							
M30066							
M30067							
M30068							
M30069							
M30070							
M30071							
M30072							
M30073							
M30074							
M30075							
M30076							
M30077							
M30078							
M30079							
M30080	M2001	St.1040	Axis 1	Start accept flag	Operation cycle	—	Status signal[*1*2]
M30081	M2002		Axis 2				
M30082	M2003		Axis 3				
M30083	M2004		Axis 4				
M30084	M2005		Axis 5				
M30085	M2006		Axis 6				
M30086	M2007		Axis 7				
M30087	M2008		Axis 8				
M30088	M2009		Axis 9				
M30089	M2010		Axis 10				
M30090	M2011		Axis 11				

Device No.		Symbol	Signal name		Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment						
M30091	M2012	St.1040	Axis 12	Start accept flag	Operation cycle	—	Status signal[*1*2]
M30092	M2013		Axis 13				
M30093	M2014		Axis 14				
M30094	M2015		Axis 15				
M30095	M2016		Axis 16				
M30096	M2017		Axis 17				
M30097	M2018		Axis 18				
M30098	M2019		Axis 19				
M30099	M2020		Axis 20				
M30100	M2021		Axis 21				
M30101	M2022		Axis 22				
M30102	M2023		Axis 23				
M30103	M2024		Axis 24				
M30104	M2025		Axis 25				
M30105	M2026		Axis 26				
M30106	M2027		Axis 27				
M30107	M2028		Axis 28				
M30108	M2029		Axis 29				
M30109	M2030		Axis 30				
M30110	M2031		Axis 31				
M30111	M2032		Axis 32				
M30112			Axis 33				
M30113			Axis 34				
M30114			Axis 35				
M30115			Axis 36				
M30116			Axis 37				
M30117			Axis 38				
M30118			Axis 39				
M30119			Axis 40				
M30120			Axis 41				
M30121			Axis 42				
M30122			Axis 43				
M30123			Axis 44				
M30124			Axis 45				
M30125			Axis 46				
M30126			Axis 47				
M30127			Axis 48				
M30128			Axis 49				
M30129			Axis 50				
M30130			Axis 51				
M30131			Axis 52				
M30132			Axis 53				
M30133			Axis 54				
M30134			Axis 55				
M30135			Axis 56				
M30136			Axis 57				
M30137			Axis 58				
M30138			Axis 59				
M30139			Axis 60				

Device No.		Symbol	Signal name		Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment						
M30140		St.1040	Axis 61	Start accept flag	Operation cycle	—	Status signal[*1*2]
M30141			Axis 62				
M30142			Axis 63				
M30143			Axis 64				
M30144	M2061	St.1047	Axis 1	Speed change accepting flag	Operation cycle	—	Status signal[*1*2]
M30145	M2062		Axis 2				
M30146	M2063		Axis 3				
M30147	M2064		Axis 4				
M30148	M2065		Axis 5				
M30149	M2066		Axis 6				
M30150	M2067		Axis 7				
M30151	M2068		Axis 8				
M30152	M2069		Axis 9				
M30153	M2070		Axis 10				
M30154	M2071		Axis 11				
M30155	M2072		Axis 12				
M30156	M2073		Axis 13				
M30157	M2074		Axis 14				
M30158	M2075		Axis 15				
M30159	M2076		Axis 16				
M30160	M2077		Axis 17				
M30161	M2078		Axis 18				
M30162	M2079		Axis 19				
M30163	M2080		Axis 20				
M30164	M2081		Axis 21				
M30165	M2082		Axis 22				
M30166	M2083		Axis 23				
M30167	M2084		Axis 24				
M30168	M2085		Axis 25				
M30169	M2086		Axis 26				
M30170	M2087		Axis 27				
M30171	M2088		Axis 28				
M30172	M2089		Axis 29				
M30173	M2090		Axis 30				
M30174	M2091		Axis 31				
M30175	M2092		Axis 32				
M30176			Axis 33				
M30177			Axis 34				
M30178			Axis 35				
M30179			Axis 36				
M30180			Axis 37				
M30181			Axis 38				
M30182			Axis 39				
M30183			Axis 40				
M30184			Axis 41				
M30185			Axis 42				
M30186			Axis 43				
M30187			Axis 44				
M30188			Axis 45				

Device No.		Symbol	Signal name		Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment						
M30189		St.1047	Axis 46	Speed change accepting flag	Operation cycle	—	Status signal*1*2
M30190			Axis 47				
M30191			Axis 48				
M30192			Axis 49				
M30193			Axis 50				
M30194			Axis 51				
M30195			Axis 52				
M30196			Axis 53				
M30197			Axis 54				
M30198			Axis 55				
M30199			Axis 56				
M30200			Axis 57				
M30201			Axis 58				
M30202			Axis 59				
M30203			Axis 60				
M30204			Axis 61				
M30205			Axis 62				
M30206			Axis 63				
M30207			Axis 64				
M30208	M2128	St.1048	Axis 1	Automatic decelerating flag	Operation cycle	—	Status signal*1*2
M30209	M2129		Axis 2				
M30210	M2130		Axis 3				
M30211	M2131		Axis 4				
M30212	M2132		Axis 5				
M30213	M2133		Axis 6				
M30214	M2134		Axis 7				
M30215	M2135		Axis 8				
M30216	M2136		Axis 9				
M30217	M2137		Axis 10				
M30218	M2138		Axis 11				
M30219	M2139		Axis 12				
M30220	M2140		Axis 13				
M30221	M2141		Axis 14				
M30222	M2142		Axis 15				
M30223	M2143		Axis 16				
M30224	M2144		Axis 17				
M30225	M2145		Axis 18				
M30226	M2146		Axis 19				
M30227	M2147		Axis 20				
M30228	M2148		Axis 21				
M30229	M2149		Axis 22				
M30230	M2150		Axis 23				
M30231	M2151		Axis 24				
M30232	M2152		Axis 25				
M30233	M2153		Axis 26				
M30234	M2154		Axis 27				
M30235	M2155		Axis 28				
M30236	M2156		Axis 29				
M30237	M2157		Axis 30				

Device No.		Symbol	Signal name		Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment						
M30238	M2158	St.1048	Axis 31	Automatic decelerating flag	Operation cycle	—	Status signal*1*2
M30239	M2159		Axis 32				
M30240			Axis 33				
M30241			Axis 34				
M30242			Axis 35				
M30243			Axis 36				
M30244			Axis 37				
M30245			Axis 38				
M30246			Axis 39				
M30247			Axis 40				
M30248			Axis 41				
M30249			Axis 42				
M30250			Axis 43				
M30251			Axis 44				
M30252			Axis 45				
M30253			Axis 46				
M30254			Axis 47				
M30255			Axis 48				
M30256			Axis 49				
M30257			Axis 50				
M30258			Axis 51				
M30259			Axis 52				
M30260			Axis 53				
M30261			Axis 54				
M30262			Axis 55				
M30263			Axis 56				
M30264			Axis 57				
M30265			Axis 58				
M30266			Axis 59				
M30267			Axis 60				
M30268			Axis 61				
M30269			Axis 62				
M30270			Axis 63				
M30271			Axis 64				
M30272	M2240	St.1049	Axis 1	Speed change "0" accepting flag			
M30273	M2241		Axis 2				
M30274	M2242		Axis 3				
M30275	M2243		Axis 4				
M30276	M2244		Axis 5				
M30277	M2245		Axis 6				
M30278	M2246		Axis 7				
M30279	M2247		Axis 8				
M30280	M2248		Axis 9				
M30281	M2249		Axis 10				
M30282	M2250		Axis 11				
M30283	M2251		Axis 12				
M30284	M2252		Axis 13				
M30285	M2253		Axis 14				
M30286	M2254		Axis 15				

Device No.		Symbol	Signal name		Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment						
M30287	M2255	St.1049	Axis 16	Speed change "0" accepting flag	Operation cycle	—	Status signal[*1*2]
M30288	M2256		Axis 17				
M30289	M2257		Axis 18				
M30290	M2258		Axis 19				
M30291	M2259		Axis 20				
M30292	M2260		Axis 21				
M30293	M2261		Axis 22				
M30294	M2262		Axis 23				
M30295	M2263		Axis 24				
M30296	M2264		Axis 25				
M30297	M2265		Axis 26				
M30298	M2266		Axis 27				
M30299	M2267		Axis 28				
M30300	M2268		Axis 29				
M30301	M2269		Axis 30				
M30302	M2270		Axis 31				
M30303	M2271		Axis 32				
M30304			Axis 33				
M30305			Axis 34				
M30306			Axis 35				
M30307			Axis 36				
M30308			Axis 37				
M30309			Axis 38				
M30310			Axis 39				
M30311			Axis 40				
M30312			Axis 41				
M30313			Axis 42				
M30314			Axis 43				
M30315			Axis 44				
M30316			Axis 45				
M30317			Axis 46				
M30318			Axis 47				
M30319			Axis 48				
M30320			Axis 49				
M30321			Axis 50				
M30322			Axis 51				
M30323			Axis 52				
M30324			Axis 53				
M30325			Axis 54				
M30326			Axis 55				
M30327			Axis 56				
M30328			Axis 57				
M30329			Axis 58				
M30330			Axis 59				
M30331			Axis 60				
M30332			Axis 61				
M30333			Axis 62				
M30334			Axis 63				
M30335			Axis 64				

Device No.		Symbol	Signal name		Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment						
M30336	M2272	St.1050	Axis 1	Control loop monitor status	Operation cycle	—	Status signal[*1*2]
M30337	M2273		Axis 2				
M30338	M2274		Axis 3				
M30339	M2275		Axis 4				
M30340	M2276		Axis 5				
M30341	M2277		Axis 6				
M30342	M2278		Axis 7				
M30343	M2279		Axis 8				
M30344	M2280		Axis 9				
M30345	M2281		Axis 10				
M30346	M2282		Axis 11				
M30347	M2283		Axis 12				
M30348	M2284		Axis 13				
M30349	M2285		Axis 14				
M30350	M2286		Axis 15				
M30351	M2287		Axis 16				
M30352	M2288		Axis 17				
M30353	M2289		Axis 18				
M30354	M2290		Axis 19				
M30355	M2291		Axis 20				
M30356	M2292		Axis 21				
M30357	M2293		Axis 22				
M30358	M2294		Axis 23				
M30359	M2295		Axis 24				
M30360	M2296		Axis 25				
M30361	M2297		Axis 26				
M30362	M2298		Axis 27				
M30363	M2299		Axis 28				
M30364	M2300		Axis 29				
M30365	M2301		Axis 30				
M30366	M2302		Axis 31				
M30367	M2303		Axis 32				
M30368			Axis 33				
M30369			Axis 34				
M30370			Axis 35				
M30371			Axis 36				
M30372			Axis 37				
M30373			Axis 38				
M30374			Axis 39				
M30375			Axis 40				
M30376			Axis 41				
M30377			Axis 42				
M30378			Axis 43				
M30379			Axis 44				
M30380			Axis 45				
M30381			Axis 46				
M30382			Axis 47				
M30383			Axis 48				
M30384			Axis 49				

Device No.		Symbol	Signal name		Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment						
M30385		St.1050	Axis 50	Control loop monitor status	Operation cycle	—	Status signal*1*2
M30386			Axis 51				
M30387			Axis 52				
M30388			Axis 53				
M30389			Axis 54				
M30390			Axis 55				
M30391			Axis 56				
M30392			Axis 57				
M30393			Axis 58				
M30394			Axis 59				
M30395			Axis 60				
M30396			Axis 61				
M30397			Axis 62				
M30398			Axis 63				
M30399			Axis 64				
M30400 : M30639	—	—	Unusable (240 points)		—	—	—
—	M2033 : M2037	—	Unusable (5 points)				
	M2055 : M2060		Unusable (6 points)				
	M2093 : M2127		Unusable (35 points)				
	M2160 : M2239		Unusable (80 points)				
	M2304 : M2319		Unusable (16 points)				

*1 The following range is valid. R16MTCPU: Axis No.1 to 16, R32MTCPU: Axis No.1 to 32.

*2 The following device area can be used as a user device. R16MTCPU: 17 axes or more, R32MTCPU: 33 axes or more.

Point

- Internal relays for positioning control are not latched even within the latch range.
- The range devices allocated as internal relays for positioning control cannot be used by the user even if their applications have not been set.

[Rq.1120] PLC ready flag (R: M30000/Q: M2000)

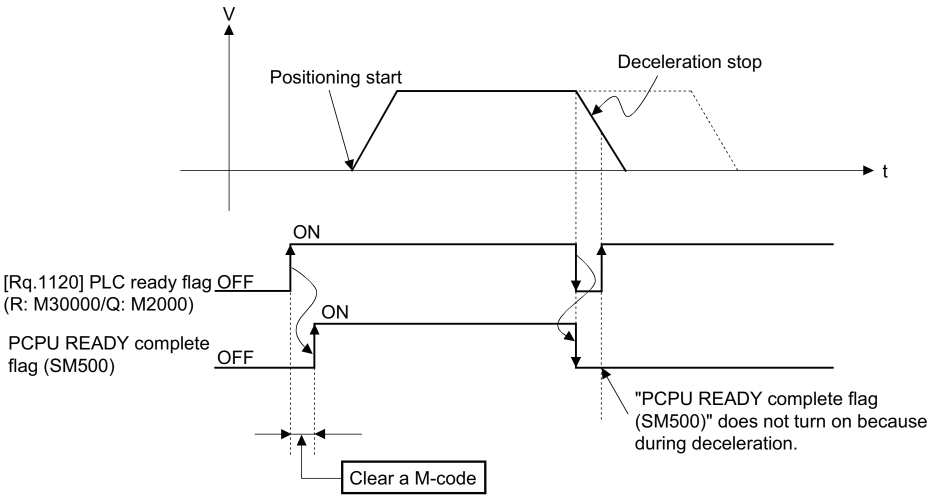
- This signal is used to start the program control of the Motion CPU. When "[Rq.1120] PLC ready flag (R: M30000/Q: M2000)" is ON, execution of the Motion SFC program, starting of axes by the servo program, and the synchronous control operation can be performed.
- "[Rq.1120] PLC ready flag (R: M30000/Q: M2000)" can be switched OFF/ON by the following operation. However, turning from OFF to ON of the "[Rq.1120] PLC ready flag (R: M30000/Q: M2000)" is ignored when the RUN/STOP switch is set to "STOP" or during test mode.

(1) Switching with the RUN/STOP switch

- When the RUN/STOP switch is switched from "STOP" to "RUN", "[Rq.1120] PLC ready flag (R: M30000/Q: M2000)" turns ON.
- When the Multiple CPU system power supply is turned ON when the RUN/STOP switch is set to "RUN", "[Rq.1120] PLC ready flag (R: M30000/Q: M2000)" turns ON.
- When the RUN/STOP switch is switched from "RUN" to "STOP", "[Rq.1120] PLC ready flag (R: M30000/Q: M2000)" turns OFF.

(2) Switching between RUN and STOP by remote operation

- Writing of parameters or files in the program from MT Developer2 is available while "[Rq.1120] PLC ready flag (R: M30000/Q: M2000)" is OFF.
- When turning "[Rq.1120] PLC ready flag (R: M30000/Q: M2000)" from OFF to ON enables the program control of the Motion CPU, "PCPU READY complete flag (SM500)" turns ON. Refer to the following for details of the processing when "[Rq.1120] PLC ready flag (R: M30000/Q: M2000)" turns from OFF to ON, or from ON to OFF.
  📖MELSEC iQ-R Motion controller Programming Manual (Common)



[St.1041] Motion SFC debugging flag (R: M30038/Q: M2038)

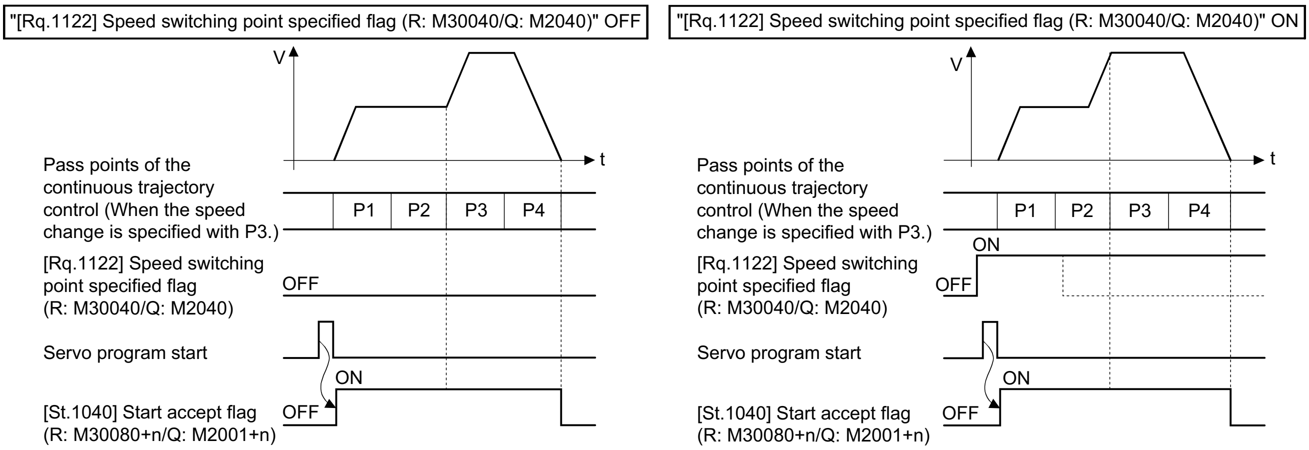
This flag turns on when it switches to the debug mode of the Motion SFC program using MT Developer2. It turns off with release of the debug mode.

[Rq.1122] Speed switching point specified flag (R: M30040/Q: M2040)

This flag is used when the speed change is specified at the pass point of the continuous trajectory control.

- By turning "[Rq.1122] Speed switching point specified flag (R: M30040/Q: M2040)" on before the starting of the continuous trajectory control (before the servo program is started), control with the change speed can be executed from the first of pass point.

Setting value	Description
ON	Speed has been changed to the specified speed at the pass point of the continuous trajectory control.
OFF	Speed is changed to the specified speed from the pass point of the continuous trajectory control.



- When using advanced S-curve acceleration/deceleration and starting continuous trajectory control with "[Rq.1122] Speed switching point specified flag (R: M30040/Q: M2040)" turned ON, the override function is disabled.

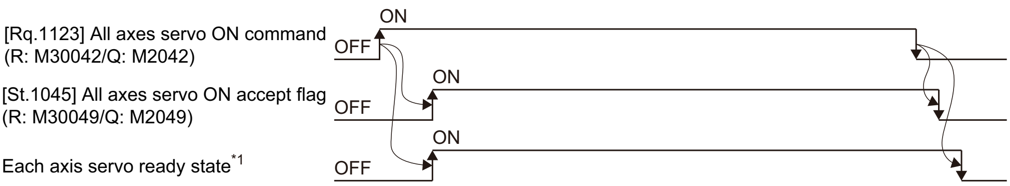
[Rq.1123] All axes servo ON command (R: M30042/Q: M2042)

This command is used to enable servo operation. Refer to the following for details of the servo ON/OFF.

MELSEC iQ-R Motion controller Programming Manual (Common)

Servo operation	Description
Enabled	"[Rq.1123] All axes servo ON command (R: M30042/Q: M2042)" turns on while the "[Rq.1155] Servo OFF command (R: M34495+32n/Q: M3215+20n)" is off and there is no servo error.
Disable	• "[Rq.1123] All axes servo ON command (R: M30042/Q: M2042)" is off • The "[Rq.1155] Servo OFF command (R: M34495+32n/Q: M3215+20n)" is on • Servo error state • Forced stop

Execute "[Rq.1123] All axes servo ON command (R: M30042/Q: M2042)": OFF after positioning completion because it becomes invalid during positioning.



*1 Refer to the "[St.1075] Servo ready (R: M32415+32n/Q: M2415+20n)" for details. (Page 35 [St.1075] Servo ready (R: M32415+32n/Q: M2415+20n))

Point

When "[Rq.1123] All axes servo ON command (R: M30042/Q: M2042)" turns ON, it is not turned off even if the Motion CPU is set in the STOP state.

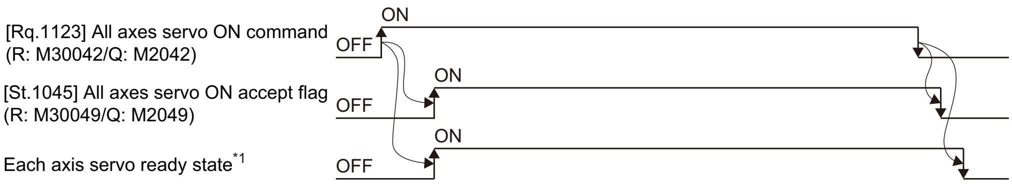
"[Rq.1123] All axes servo ON command (R: M30042/Q: M2042)" turns OFF by the forced stop of Motion CPU.

[Rq.1124] JOG operation simultaneous start command (R: M30048/Q: M2048)

- When "[Rq.1124] JOG operation simultaneous start command (R: M30048/Q: M2048)" turns on, JOG operation simultaneous start based on the JOG operation execution axis set in the "[Cd.1096] JOG operation simultaneous start axis setting register (Forward rotation JOG) (R: D35286 to D35289/Q: D710, D711)" and "[Cd.1097] JOG operation simultaneous start axis setting register (Reverse rotation JOG) (R: D35290 to D35293/Q: D712, D713)".
- When "[Rq.1124] JOG operation simultaneous start command (R: M30048/Q: M2048)" turns OFF, the operating axis decelerates to a stop.

[St.1045] All axes servo ON accept flag (R: M30049/Q: M2049)

This flag turns on when the Motion CPU accepts the "[Rq.1123] all axes servo ON command (R: M30042/Q: M2042)".
Since the servo ready state of each axis is not checked, confirm it in the "[St.1075] Servo ready (R: M32415+32n/Q: M2415+20n)".



*1 Refer to the "[St.1075] Servo ready (R: M32415+32n/Q: M2415+20n)" for details. (☞ Page 35 [St.1075] Servo ready (R: M32415+32n/Q: M2415+20n))

[Rq.1125] Manual pulse generator1 enable flag (R: M30051/Q: M2051)

This flag sets the enabled or disabled state for positioning with the pulse input from the manual pulse generator1 connected to high-speed counter module.

Setting value	Description
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).

[Rq.1126] Manual pulse generator2 enable flag (R: M30052/Q: M2052)

This flag sets the enabled or disabled state for positioning with the pulse input from the manual pulse generator2 connected to high-speed counter module.

Setting value	Description
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).

[Rq.1127] Manual pulse generator3 enable flag (R: M30053/Q: M2053)

This flag sets the enabled or disabled state for positioning with the pulse input from the manual pulse generator3 connected to high-speed counter module.

Setting value	Description
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).

[St.1046] Operation cycle over flag (R: M30054/Q: M2054)

This flag turns on when the time concerning motion operation exceeds the "Motion setting operation cycle (SD523)". Refer to the following for details.

MELSEC iQ-R Motion controller Programming Manual (Common)

Perform the following operation, in making it turn off.

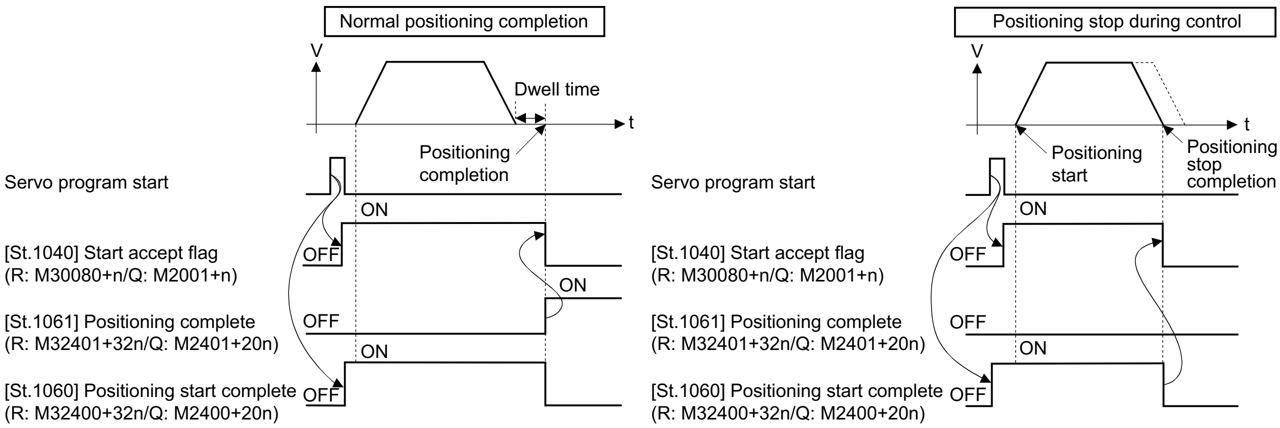
- Turn the Multiple CPU system power supply ON→OFF
- Reset the Multiple CPU system
- Reset using the user program

■Countermeasures for operation cycle over

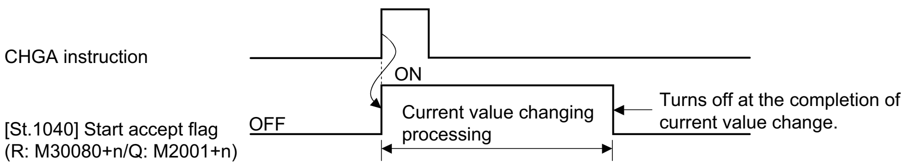
- Change the operation cycle to a larger value in the [Motion CPU Common Parameter] ⇨ [Basic Setting] ⇨ "Operation Cycle".
- Reduce the number of executions of event task and NMI task instructions in the Motion SFC program.

[St.1040] Start accept flag (R: M30080+n/Q: M2001+n)

- This flag turns on when axis control is started by the servo program or the command signals. The start accept flag of the controlled axis turns ON.
- The start accept flag turns ON when the following control is being executed.
  - Servo program
  - Direct positioning control by the Motion dedicated PLC instruction (M(P).SVSTD/D(P).SVSTD)
  - JOG operation
  - Manual pulse generator operation
  - Speed-torque control
  - Synchronous control operation (output axis)
  - Current value change
  - Pressure control
  - Machine program operation
  - Machine JOG operation
  - G-code control
- The state of the start accept flag during positioning control by servo program is shown below.



- The state of the start accept flag of a current value change by the CHGA instruction of servo program or by the Motion dedicated PLC instruction (M(P).CHGA/D(P).CHGA) is shown below.

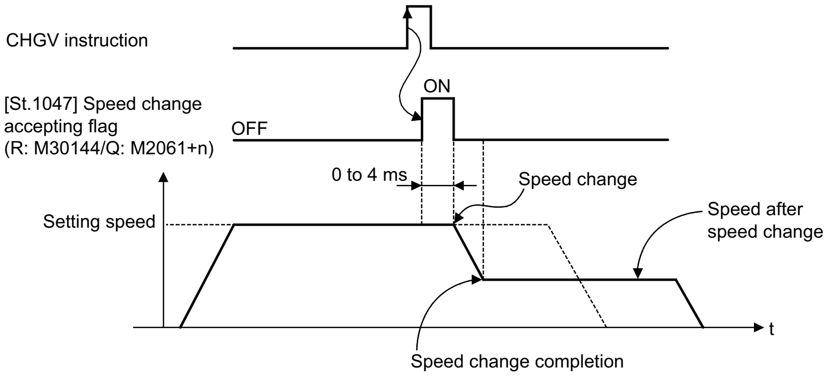


⚠ CAUTION

Do not turn the start accept flags ON/OFF in the user side.
- If the start accept flag is turned off using the program or user operation 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 program or user operation 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.

[St.1047] Speed change accepting flag (R: M30144+n/Q: M2061+n)

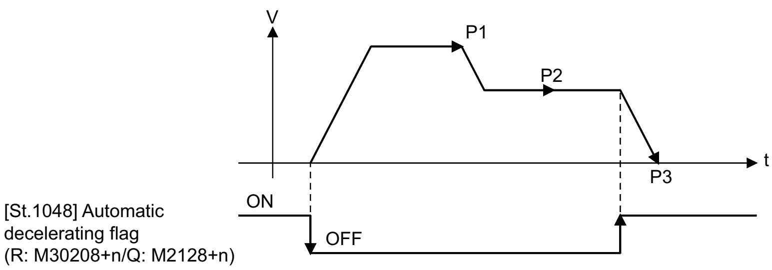
This flag turns on at start of speed change by the control change (CHGV) instruction (or Motion dedicated PLC instruction (M(P).CHGV/D(P).CHGV) of the Motion SFC program.

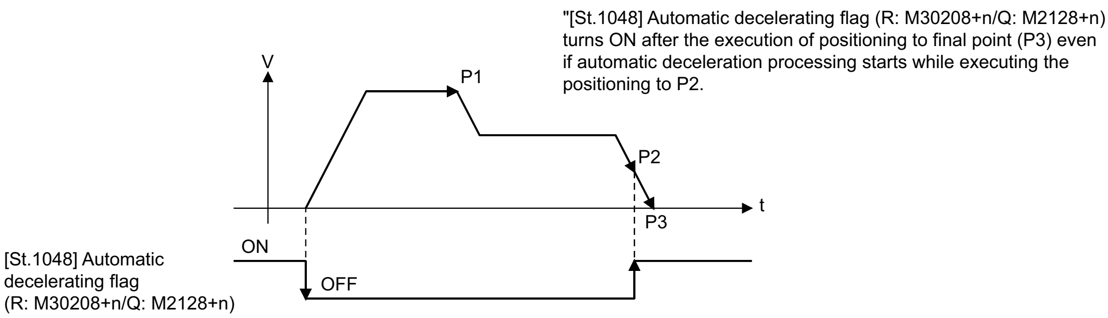


[St.1048] Automatic decelerating flag (R: M30208+n/Q: M2128+n)

This signal turns on while automatic deceleration processing is performed during the positioning control or position follow-up control.

- 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.
- This signal turns on while automatic deceleration processing is performed during execution of positioning to final point while in continuous trajectory control.

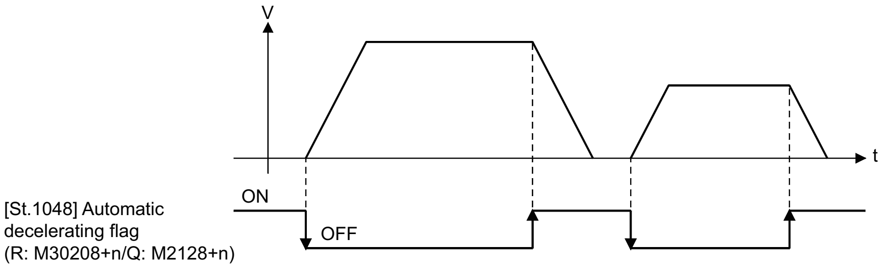




Point

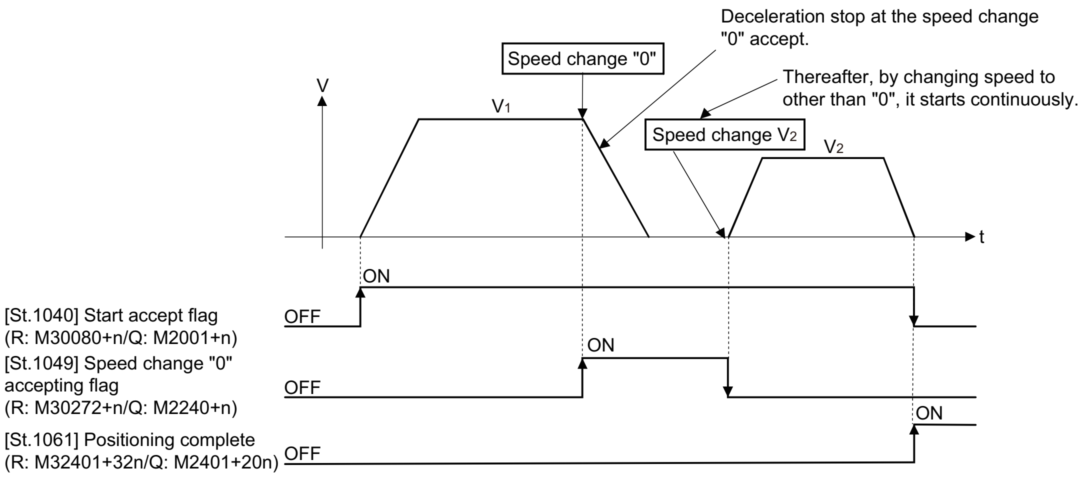
Set a travel value in which automatic deceleration processing can be started at the final positioning point, therefore the automatic decelerating flag turns on at the start point of automatic deceleration processing after this final point.

- During machine program operation, "[St.1048] Automatic decelerating flag (R: M30208+n/Q: M2128+n)" turns ON while automatic deceleration is performed during the execution of positioning at the final point.
- The signal turns off when all normal start complete commands became achieve.
- The "[St.1048] Automatic decelerating flag (R: M30208+n/Q: M2128+n)" might be turned ON even during acceleration at advanced S-curve acceleration/deceleration. (☞ Page 221 Advanced S-curve acceleration/deceleration)
- In any of the following cases, "[St.1048] Automatic decelerating flag (R: M30208+n/Q: M2128+n)" does not turn on.
  - During deceleration due to JOG signal OFF
  - During deceleration due to machine JOG signal OFF
  - During manual pulse generator operation
  - During deceleration due to stop command or stop cause occurrence
  - When travel value is 0
  - During machine program operation due to sequential coordinate command control



[St.1049] Speed change "0" accepting flag (R: M30272+n/Q: M2240+n)

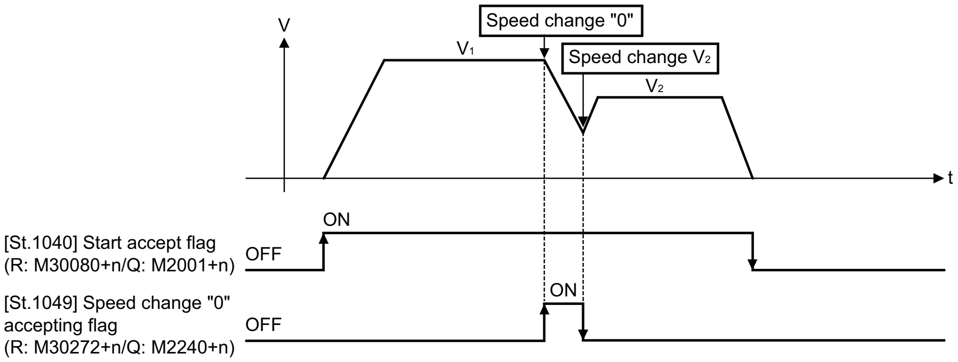
This flag turns on while a speed change request to speed "0" or negative speed change request is being accepted.
It turns on when the speed change request to speed "0" or negative speed change request is accepted during a start. After that, this signal turns off when a speed change is accepted or on completion of a stop due to a stop cause.
This flag also turns on when the override ratio for the override function is set to "0". After that, this signal turns off when the override ratio is set to a value other than "0" or on completion of a stop due to a stop cause.



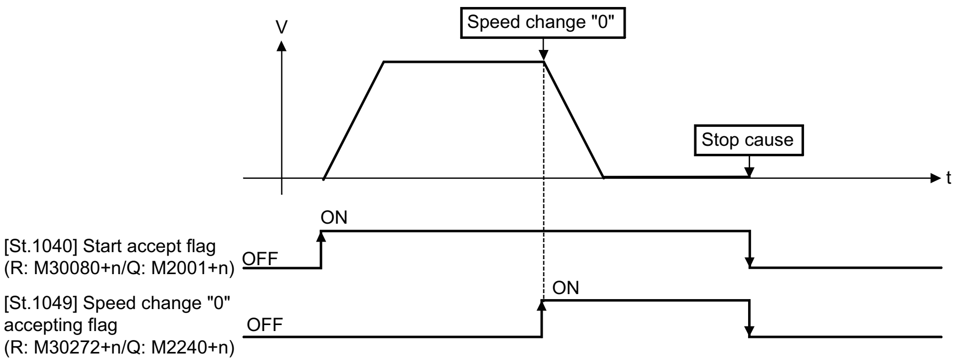
Point

- Even if it has stopped, when the "[St.1040] Start accept flag (R: M30080+n/Q: M2001+n)" is ON state, the state where the request of speed change "0" is accepted is indicated. Confirm by this "[St.1049] Speed change "0" accepting flag (R: M30272+n/Q: M2240+n)".
- During interpolation, the flags corresponding to the interpolation axes are set.
- In any of the following cases, the speed change "0" request is invalid.
  (1) After deceleration by the JOG signal off
  (2) During manual pulse generator operation
  (3) After positioning automatic deceleration start
  (4) After deceleration due to stop cause

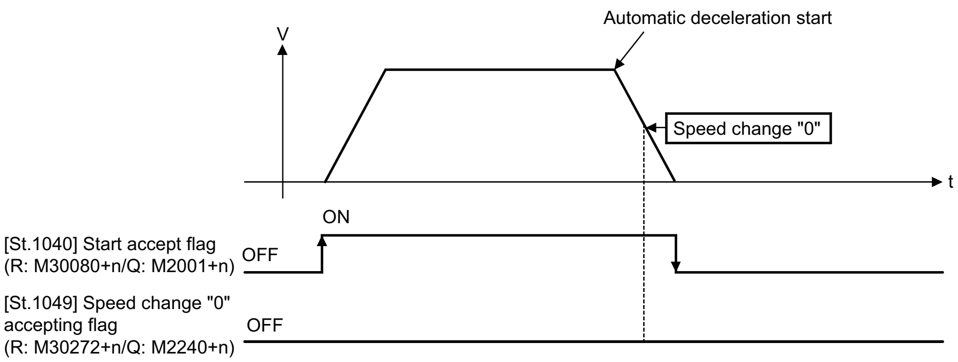
- The flag turns off if a speed change request occurs during deceleration to a stop due to speed change "0".



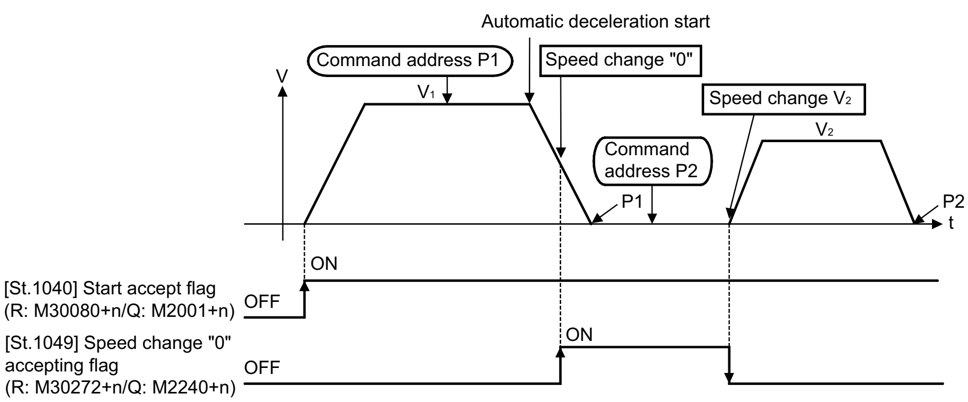
- The flag turns off if a stop cause occurs after speed change "0" accept.



- The "[St.1049] speed change "0" accepting flag (R: M30272+n/Q: M2240+n)" does not turn on if a speed change "0" occurs after an automatic deceleration start.



- Even if it is speed change "0" after the automatic deceleration start to the "command address", "[St.1049] Speed change "0" accepting flag (R: M30272+n/Q: M2240+n)" turns on.



Point

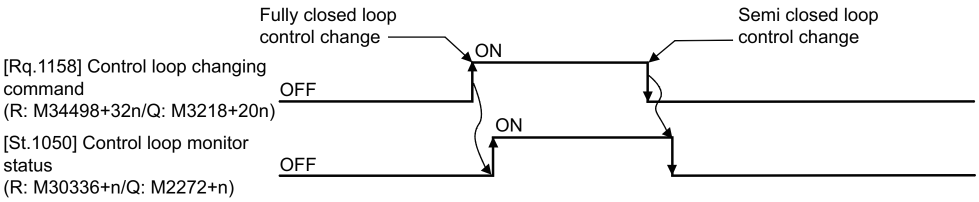
It does not start, even if the "command address" is changed during speed change "0" accepting.

[St.1050] Control loop monitor status (R: M30336+n/Q: M2272+n)

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.

Setting value	Description
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 "[Rq.1158] Control loop changing command (R: M34498+32n/Q: M3218+20n)" ON/OFF.



2.2 Data Registers

Data register list

■MELSEC iQ-R Motion device assignment

Device No.	Symbol	Purpose	Reference
D0 to	—	User device (32000 points)	—
D32000 to	[Md.20], [Md.25], [Md.34], [Md.35], [Md.101], [Md.102], [Md.1003] to [Md.1006], [Md.1008], [Md.1011], [Md.1012]	Axis monitor device (48 points × 64 axes)	☞ Page 91 Axis monitor devices
D35072 to	—	Unusable (48 points)	—
D35120 to	[Cd.1110]	JOG speed setting registers (2 points × 64 axes)	☞ Page 104 JOG speed setting registers
D35248 to	—	Unusable (32 points)	—
D35280 to	[Cd.1096] to [Cd.1104]	Common device (Command signal) (160 points)	☞ Page 155 Common devices
D35440 to	[Md.300] to [Md.303]	Servo input axis monitor device (16 points × 64 axes)	☞ Page 106 Servo input axis monitor device
D36464 to	—	Unusable (32 points)	—
D36480 to	[Md.340] to [Md.348]	Command generation axis monitor device (20 points × 32 axes)	☞ Page 110 Command generation axis monitor device
D38528 to	—	Unusable (32 points)	—
D38560 to	[Md.320] to [Md.324], [Md.326], [Md.327]	Synchronous encoder axis monitor device (32 points × 12 axes)	☞ Page 115 Synchronous encoder axis monitor device
D38944 to	—	Unusable (176 points)	—
D39120 to	[Md.400] to [Md.402], [Md.406] to [Md.412], [Md.422], [Md.425]	Output axis monitor device (32 points × 64 axes)	☞ Page 118 Output axis monitor device
D41168 to	—	Unusable (32 points)	—
D41200 to	[Pr.302]	Servo input axis control device (8 points × 64 axes)	☞ Page 108 Servo input axis control device
D41712 to	—	Unusable (48 points)	—
D41760 to	[Cd.340], [Pr.348]	Command generation axis control device (8 points × 64 axes)	☞ Page 113 Command generation axis control device
D42272 to	—	Unusable (48 points)	—
D42320 to	[Pr.326], [Cd.320] to [Cd.322], [Cd.325]	Synchronous encoder axis control device (16 points × 12 axes)	☞ Page 117 Synchronous encoder axis control device
D42512 to	—	Unusable (128 points)	—
D42640 to	[Pr.400] to [Pr.414], [Pr.418] to [Pr.431], [Pr.434] to [Pr.442], [Pr.444], [Pr.445], [Pr.447], [Pr.448], [Pr.460] to [Pr.468], [Pr.490] to [Pr.493], [Cd.407] to [Cd.409]	Output axis control device (160 points × 64 axes)	☞ Page 121 Output axis control device
D52880 to	—	Unusable (16 points)	—
D52896 to	[Cd.2160] to [Cd.2169],	Machine control device (32 points × 8 machines)	☞ Page 128 Machine control device

Device No.	Symbol	Purpose	Reference
D53152 to	—	Unusable (16 points)	—
D53168 to	[Md.2020] to [Md.2031], [Md.2033] to [Md.2045], [Md.2047] to [Md.2059], [Md.2061] to [Md.2066], [Md.2069] to [Md.2071], [Md.2077] to [Md.2081], [Md.2083] to [Md.2090]	Machine monitor device (128 points × 8 machines)	☞ Page 130 Machine monitor device
D54192 to	—	Unusable (32 points)	—
D54224 to	[Rq.3344]	G-code control common command signal (2 points)	☞ Page 134 G-code control common command signal
D54226 to	[Rq.3376] to [Rq.3384]	G-code control line command signal (4 points)	☞ Page 138 G-code control line command signal
D54230 to	—	Unusable (32 points)	—
D54262 to	[Cd.3305]	G-code control common control device (16 points)	☞ Page 135 G-code control common control device
D54278 to	[Cd.3320] to [Cd.3322]	G-code control line control device (32 points)	☞ Page 139 G-code control line control device
D54310 to	—	Unusable (128 points)	—
D54438 to	[St.3272]	G-code control common status (2 points)	☞ Page 136 G-code control common status
D54440 to	[St.3208] to [St.3225], [St.3234]	G-code control line status (8 points)	☞ Page 140 G-code control line status
D54448 to	[St.3076]	G-code control axis status (32 points)	☞ Page 151 G-code control axis status
D54480 to	[Md.3000] to [Md.3004]	G-code control common monitor device (16 points)	☞ Page 137 G-code control common monitor device
D54496 to	[Md.3016] to [Md.3070]	G-code control line monitor device (256 points)	☞ Page 142 G-code control line monitor device
D54752 to	[Md.3144] to [Md.3150], [Md.3152] to [Md.3154]	G-code control axis monitor device (512 points)	☞ Page 153 G-code control axis monitor device
D55264 to	[Md.3178] to [Md.3180]	G-code control line monitor device (expansion) (320 points)	☞ Page 146 G-code control line monitor device (expansion)
D55584 to D57343	—	Unusable (1760 points)	—

Point

Total number of user device points
- 32000 points

■Q series Motion compatible device assignment

For devices on axis 1 to 32, use Q series Motion compatible device assignment.

For devices on axis 33 to 64, machine control device (D52896 to D53151), and machine status (D53168 to D54191), use MELSEC iQ-R Motion device assignment.

Device No.	Symbol	Purpose	Reference
D0 to	[Md.20], [Md.25], [Md.34], [Md.35], [Md.101], [Md.102], [Md.1003] to [Md.1006], [Md.1008], [Md.1011], [Md.1012]	Axis monitor device (20 points × 32 axes)	☞ Page 91 Axis monitor devices
D640 to	[Cd.1110]	JOG speed setting registers (2 points × 32 axes)	☞ Page 104 JOG speed setting registers
D704 to	[Cd.1096] to [Cd.1104]	Common device (Command signal) (54 points)	☞ Page 155 Common devices
D758 to	—	Unusable (42 points)	—
D800 to	—	User device (9440 points)	—
D10240 to	—	System area (2040 points)	—
D12280 to	[Md.300] to [Md.303]	Servo input axis monitor device (10 points × 32 axes)	☞ Page 106 Servo input axis monitor device
D12600 to	[Md.340] to [Md.348]	Command generation axis monitor device (20 points × 32 axes)	☞ Page 110 Command generation axis monitor device
D13240 to	[Md.320] to [Md.324], [Md.326], [Md.327]	Synchronous encoder axis monitor device (20 points × 12 axes)	☞ Page 115 Synchronous encoder axis monitor device
D13480 to	—	Unusable (120 points)	—
D13600 to	[Md.400] to [Md.402], [Md.406] to [Md.412], [Md.422], [Md.425]	Output axis monitor device (30 points × 32 axes)	☞ Page 118 Output axis monitor device
D14560 to	—	Unusable (40 points)	—
D14600 to	[Pr.302]	Servo input axis control device (2 points × 32 axes)	☞ Page 108 Servo input axis control device
D14664 to	—	Unusable (16 points)	—
D14680 to	[Cd.340], [Pr.348]	Command generation axis control device (4 points × 32 axes)	☞ Page 113 Command generation axis control device
D14808 to	—	Unusable (12 points)	—
D14820 to	[Pr.326], [Cd.320] to [Cd.322], [Cd.325]	Synchronous encoder axis control device (10 points × 12 axes)	☞ Page 117 Synchronous encoder axis control device
D14940 to	—	Unusable (60 points)	—
D15000 to	[Pr.400] to [Pr.414], [Pr.418] to [Pr.431], [Pr.434] to [Pr.442], [Pr.444], [Pr.445], [Pr.447], [Pr.448], [Pr.460] to [Pr.468], [Pr.490] to [Pr.493], [Cd.407] to [Cd.409]	Output axis control device (150 points × 32 axes)	☞ Page 121 Output axis control device
D19800 to	—	Unusable (24 points)	—
D19824 to D20479	—	Unusable (656 points)	—

Point

Total number of user device points

- 10096 points

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 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. (☞ Page 473 Processing Times of the Motion CPU)

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
D32000 to D32047	D0 to D19	Axis 1 monitor device
D32048 to D32095	D20 to D39	Axis 2 monitor device
D32096 to D32143	D40 to D59	Axis 3 monitor device
D32144 to D32191	D60 to D79	Axis 4 monitor device
D32192 to D32239	D80 to D99	Axis 5 monitor device
D32240 to D32287	D100 to D119	Axis 6 monitor device
D32288 to D32335	D120 to D139	Axis 7 monitor device
D32336 to D32383	D140 to D159	Axis 8 monitor device
D32384 to D32431	D160 to D179	Axis 9 monitor device
D32432 to D32479	D180 to D199	Axis 10 monitor device
D32480 to D32527	D200 to D219	Axis 11 monitor device
D32528 to D32575	D220 to D239	Axis 12 monitor device
D32576 to D32623	D240 to D259	Axis 13 monitor device
D32624 to D32671	D260 to D279	Axis 14 monitor device
D32672 to D32719	D280 to D299	Axis 15 monitor device
D32720 to D32767	D300 to D319	Axis 16 monitor device
D32768 to D32815	D320 to D339	Axis 17 monitor device
D32816 to D32863	D340 to D359	Axis 18 monitor device
D32864 to D32911	D360 to D379	Axis 19 monitor device
D32912 to D32959	D380 to D399	Axis 20 monitor device
D32960 to D33007	D400 to D419	Axis 21 monitor device
D33008 to D33055	D420 to D439	Axis 22 monitor device
D33056 to D33103	D440 to D459	Axis 23 monitor device
D33104 to D33151	D460 to D479	Axis 24 monitor device
D33152 to D33199	D480 to D499	Axis 25 monitor device
D33200 to D33247	D500 to D519	Axis 26 monitor device
D33248 to D33295	D520 to D539	Axis 27 monitor device
D33296 to D33343	D540 to D559	Axis 28 monitor device
D33344 to D33391	D560 to D579	Axis 29 monitor device
D33392 to D33439	D580 to D599	Axis 30 monitor device
D33440 to D33487	D600 to D619	Axis 31 monitor device
D33488 to D33535	D620 to D639	Axis 32 monitor device
D33536 to D33583		Axis 33 monitor device
D33584 to D33631		Axis 34 monitor device
D33632 to D33679		Axis 35 monitor device
D33680 to D33727		Axis 36 monitor device
D33728 to D33775		Axis 37 monitor device
D33776 to D33823		Axis 38 monitor device
D33824 to D33871		Axis 39 monitor device
D33872 to D33919		Axis 40 monitor device
D33920 to D33967		Axis 41 monitor device
D33968 to D34015		Axis 42 monitor device

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
D34016 to D34063		Axis 43 monitor device
D34064 to D34111		Axis 44 monitor device
D34112 to D34159		Axis 45 monitor device
D34160 to D34207		Axis 46 monitor device
D34208 to D34255		Axis 47 monitor device
D34256 to D34303		Axis 48 monitor device
D34304 to D34351		Axis 49 monitor device
D34352 to D34399		Axis 50 monitor device
D34400 to D34447		Axis 51 monitor device
D34448 to D34495		Axis 52 monitor device
D34496 to D34543		Axis 53 monitor device
D34544 to D34591		Axis 54 monitor device
D34592 to D34639		Axis 55 monitor device
D34640 to D34687		Axis 56 monitor device
D34688 to D34735		Axis 57 monitor device
D34736 to D34783		Axis 58 monitor device
D34784 to D34831		Axis 59 monitor device
D34832 to D34879		Axis 60 monitor device
D34880 to D34927		Axis 61 monitor device
D34928 to D34975		Axis 62 monitor device
D34976 to D35023		Axis 63 monitor device
D35024 to D35071		Axis 64 monitor device

• Details for each axis

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D32000+48n	D0+20n	Md.20	Feed current value	Operation cycle	—	Monitor device
D32001+48n	D1+20n					
D32002+48n	D2+20n	Md.101	Real current value			
D32003+48n	D3+20n					
D32004+48n	D4+20n	Md.102	Deviation counter value			
D32005+48n	D5+20n					
D32006+48n	D6+20n	Md.1003	Warning code	Immediate		
D32007+48n	D7+20n	Md.1004	Error code			
D32008+48n	D8+20n	Md.1005	Servo error code	Main cycle		
D32009+48n	D9+20n	Md.1006	Home position return re-travel value	Operation cycle		
D32010+48n	D10+20n	Md.34	Travel value after proximity dog ON			
D32011+48n	D11+20n					
D32012+48n	D12+20n	Md.1008	Execute program No.	At start		
D32013+48n	D13+20n	Md.25	M-code	Operation cycle		
D32014+48n	D14+20n	Md.35	Torque limit value			
D32015+48n	D15+20n	Md.1011	Data set pointer for continuous trajectory control	At start/during start		
D32016+48n	D16+20n	—	Unusable*1	—	—	—
D32017+48n	D17+20n					
D32018+48n	D18+20n	Md.1012	Real current value at stop input	Operation cycle	—	Monitor device
D32019+48n	D19+20n					
D32020+48n	#8001+20n	Md.104	Motor current value	*2		
D32021+48n	#8017+20n	—	Unusable	—	—	—
D32022+48n	#8002+20n	Md.103	Motor speed	*2	—	Monitor device
D32023+48n	#8003+20n					
D32024+48n	#8004+20n	Md.28	Command speed	Operation cycle		
D32025+48n	#8005+20n					
D32026+48n	#8006+20n	Md.100	Home position return re-travel value	At home position return re-travel		
D32027+48n	#8007+20n					
D32028+48n	#8008+20n	Md.1019	Servo amplifier display servo error code	Main cycle		
D32029+48n	#8009+20n	Md.107	Parameter error No.			
D32030+48n	#8000+20n	Md.1014	Servo amplifier type	When the servo amplifier power-on		
D32031+48n	#8016+20n	Md.1027	Servo amplifier vendor ID			
D32032+48n	#8010+20n	Md.108	Servo status1	*2		
D32033+48n	#8011+20n	Md.1022	Servo status2			
D32034+48n	#8012+20n	Md.125	Servo status3			
D32035+48n	#8013+20n	—	Unusable	—	—	—
D32036+48n	#8014+20n					
D32037+48n	#8015+20n					
D32038+48n	#8018+20n	Md.500	Servo status7	*2	—	Monitor device
D32039+48n	#8019+20n	—	Unusable	—	—	—
D32040+48n						
D32041+48n						
D32042+48n						
D32043+48n						
D32044+48n						
D32045+48n						
D32046+48n						

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D32047+48n		—	Unusable	—	—	—

*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. (☞ Page 324 Speed/Position Switching Control)
*2 Operation cycle 1.777[ms] or less: Operation cycle, operation cycle 3.555[ms] or more: 3.555[ms]

Point

- The following range is valid. R16MTCPU: Axis No.1 to 16, R32MTCPU: Axis No.1 to 32.
- The following device area can be used as a user device. R16MTCPU: 17 axes or more, R32MTCPU: 33 axes or more. However, when the project of R16MTCPU is replaced with R32MTCPU/R64MTCPU, or the project of R32MTCPU is replaced with R64MTCPU, this area cannot be used as a user device.

[Md.20] Feed current value (R: D32000+48n/Q: D0+20n, D1+20n)

- This register stores the target address output to the servo amplifier on the basis of the positioning address/travel value specified with the servo program.
  - A part for the amount of the travel value from "0" after starting is stored in the fixed-pitch feed control.
  - In the speed/position switching control or speed control (Ⅰ), the address at the start depends on the state of "[Rq.1152] Feed current value update command (R: M34492+32n/Q: M3212+20n)" as shown below.

[Rq.1152] Feed current value update command (R: M34492+32n/Q: M3212+20n)	Description
OFF	Resets the feed current value to "0" at the start.
ON	Not reset the feed current value at the start.

  - "0" is stored during speed control (Ⅱ).
- The stroke range check is performed on this feed current value data.

[Md.101] Real current value (R: D32002+48n, D32003+48n/Q: D2+20n, D3+20n)

- This device stores the converted value (in an axis control unit) of the feedback position of the motor encoder (in pulse unit).
- The "feed current value" is equal to the "real current value" in the stopped state.

[Md.102] Deviation counter value (R: D32004+48n, D32005+48n/Q: D4+20n, D5+20n)

This register stores the droop pulses read from the servo amplifier.

[Md.1003] Warning code (R: D32006+48n/Q: D6+20n)

- This register stores the corresponding warning code at the warning occurrence. If another warning occurs after warning code storing, the previous warning code is overwritten by the new warning code.
- The servo warning (Warning (error code: 0C80H)) is not stored in this device. It is stored in "[Md.1005] Servo error code (R: D32008+48n/Q: D8+20n)".
- Warning codes can be cleared by "[Rq.1147] Error reset command (R: M34487+32n/Q: M3207+20n)" or "Error reset (SM50)".

Point

Refer to the following for details of the warning codes.
📖MELSEC iQ-R Motion controller Programming Manual (Common)

[Md.1004] Error code (R: D32007+48n/Q: D7+20n)

- This register stores the corresponding error code at the error occurrence. If another error occurs after error code storing, the previous error code is overwritten by the new error code.
- The servo error (Minor error (error code: 1C80H)) is not stored in this device. It is stored in "[Md.1005] Servo error code (R: D32008+48n/Q: D8+20n)".
- Error codes can be cleared by "[Rq.1147] Error reset command (R: M34487+32n/Q: M3207+20n)" or "Error reset (SM50)".

2

Point

Refer to the following for details of the error codes.
MELSEC iQ-R Motion controller Programming Manual (Common)

[Md.1005] Servo error code (R: D32008+48n/Q: D8+20n)

- This device stores the applicable minor error (error code: 1C80H) or the warning (error code: 0C80H) when a servo error or a servo warning occurs. The error code or the warning code read from the servo amplifier is stored in "[Md.1019] Servo amplifier display servo error code (R: D32028+48n/Q: #8008+20n)". If another servo error occurs after error code storing, the previous error code is overwritten by the new error code.
- The servo error code is stored several ms to several tens of ms after the servo error or the servo warning is detected. Refer to the following devices when immediate detection of the servo error or the servo warning is required.

Error classification	Device name
Servo error	• "[St.1068] Servo error detection (R: M32408+32n/Q: M2408+20n)" • "Servo alarm (b7)" of "[Md.108] Servo status 1 (R: D32032+48n/Q: #8010+20n)"
Servo warning	"Servo warning (b15)" of "[Md.108] Servo status 1 (R: D32032+48n/Q: #8010+20n)"

- Servo error codes can be cleared by "[Rq.1148] Servo error reset command (R: M34488+32n/Q: M3208+20n)" or "Error reset (SM50)".

[Md.1006] Home position return re-travel value (R: D32009+48n/Q: D9+20n)

If the position stopped in the position specified with the travel value after proximity dog ON (Page 181 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) 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.)
The following value is stored according to the number of feedback pulses of the motor connected.

Number of feedback pulses	Storage data
Less than 131072 [pulse]	Feedback pulses[*1]
131072 [pulse] or more, 262144 [pulse] or less	1/10 of feedback pulses
More than 262144 [pulse]	1/10000 of feedback pulses

*1 Refer to "[Md.100] Home position return re-travel value (R: D32026+48n, D32027+48n/Q: #8006+20n, #8007+20n)". (Page 100 [Md.100] Home position return re-travel value (R: D32026+48n, D32027+48n/Q: #8006+20n, #8007+20n))

[Md.34] Travel value after proximity dog ON (R: D32010+48n, D32011+48n/Q: D10+20n, D11+20n)

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

[Md.1008] Execute program No. (R: D32012+48n/Q: D12+20n)

- This register stores the starting program No. at the servo program starting.
- The following value is stored for the following items.

Item	Monitor value
JOG operation	FFFFh
Manual pulse generator operation	FFFEh
Speed control	FFDFh
Torque control	FFDEh
Continuous operation to torque control	FFDDh
Power supply on	FF00h
Current value change execution by the Motion dedicated PLC instruction (CHGA instruction)	FFE0h
Direct positioning start by the Motion dedicated PLC instruction (SVSTD instruction)	FFE1h
Machine program operation start by the Motion dedicated PLC instruction (MCNST instruction)	FFE2h
Machine program operation start by the Motion SFC program (MCNST instruction)	FFE3h
Machine JOG operation	FFE4h
Pressure control	FFEEh
Advanced synchronous control	FFEFh

- When the following control is being executed using MT Developer2 in the test mode, the following value is stored in this register.

Item	Monitor value
Home position return	FFFDh

Point

During G-code control, "[Md.1008] Execute program No. (R: D32012+48n/Q: D12+20n)" is not updated.

[Md.25] M-code (R: D32013+48n/Q: D13+20n)

- This register stores the M-code*1 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.
- It does not change except positioning start using the servo program.
- The value "0" is stored at leading edge of "[Rq.1120] PLC ready flag (R: M30000/Q: M2000)".
- During machine program operation, the M-code set in positioning data is stored at positioning start completion and at the start of each point.

*1 Refer to the M-code output function for M-codes. (☞ Page 425 M-code Output Function)

[Md.35] Torque limit value (R: D32014+48n/Q: D14+20n)

This device stores the positive direction torque limit value to command the servo (unit: 0.1[%]).
The default value "300.0[%]" is stored when communication with the servo amplifier is established.
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" in [Motion Control Parameter] ⇨ [Axis Setting Parameter] ⇨ "Expansion Parameter". (☞ Page 192 Expansion Parameters)

[Md.1011] Data set pointer for continuous trajectory control (R: D32015+48n/Q: D15+20n)

This pointer is used in the continuous trajectory 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 continuous trajectory control and updated data set pointer are described below using the example servo program below.

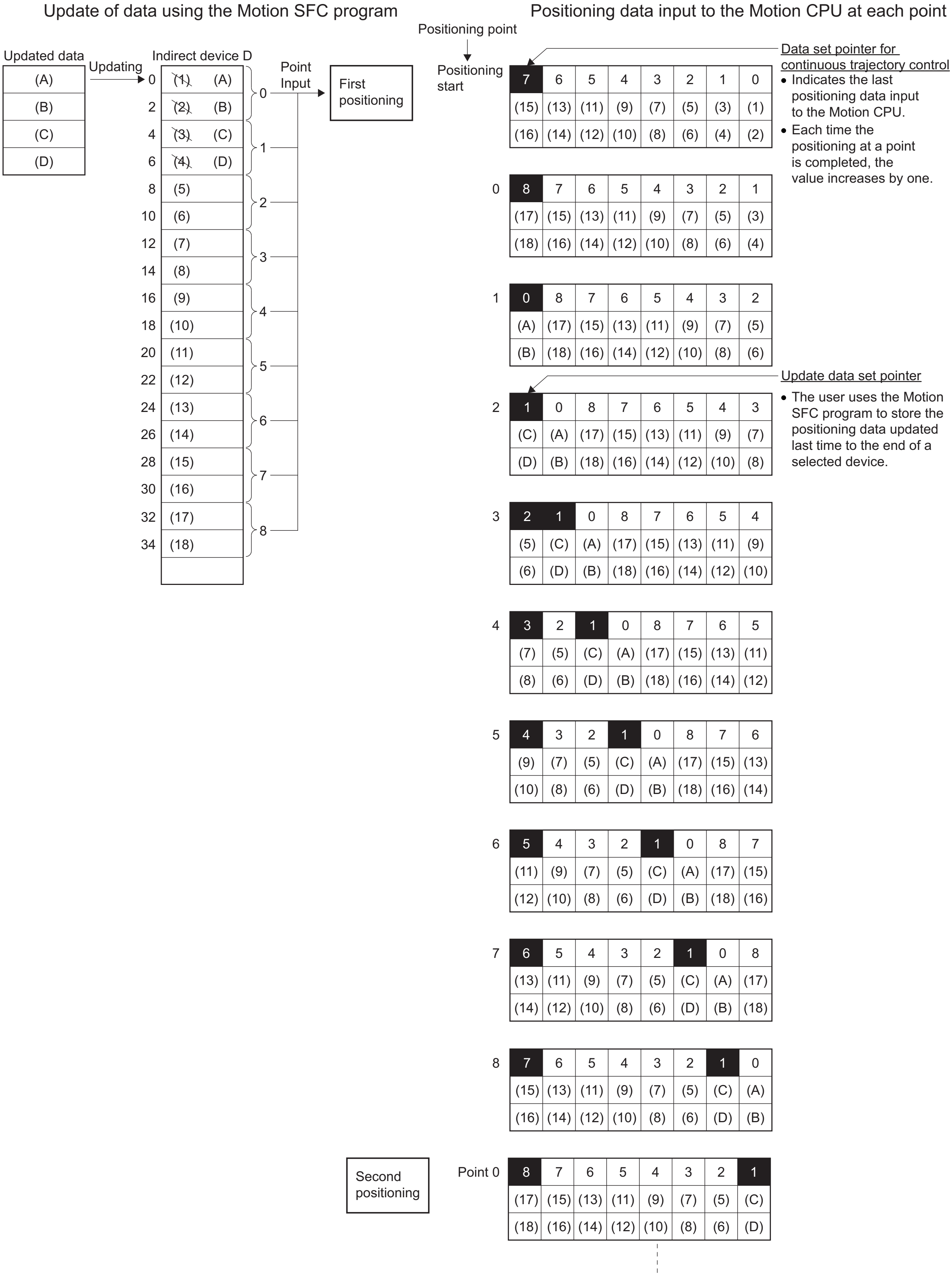
```
              <K  0>
Pass point
   9    CPSTART2
         Axis          1
         Axis          2
         Speed                 D3200
   *    FOR-TIMES
   1    ABS-2                          . . . 0
         Axis          1,      D3000
         Axis          2,      D3002
   2    ABS-2                          . . . 1
         Axis          1,      D3004
         Axis          2,      D3006
   3    ABS-2                          . . . 2
         Axis          1,      D3008
         Axis          2,      D3010
   4    ABS-2                          . . . 3
         Axis          1,      D3012
         Axis          2,      D3014
   5    ABS-2                          . . . 4
         Axis          1,      D3016
         Axis          2,      D3018
   6    ABS-2                          . . . 5
         Axis          1,      D3020
         Axis          2,      D3022
   7    ABS-2                          . . . 6
         Axis          1,      D3024
         Axis          2,      D3026
   8    ABS-2                          . . . 7
         Axis          1,      D3028
         Axis          2,      D3030
   9    ABS-2                          . . . 8
         Axis          1,      D3032
         Axis          2,      D3034
   *    NEXT
  10    CPEND
```

Point
- Repetition instructions
  - FOR-TIMES
  - FOR-ON
  - FOR-OFF
  - NEXT

Set in ascending order (0, 1, 2...) starting from the first instructions defined by the above repetition instructions.

The input situation of positioning data to the Motion CPU is shown the next page by executing the 2-axes continuous trajectory 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

- The positioning data ((1) to (16)) of points 0 to 7 is input to the Motion CPU by the continuous trajectory 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 continuous trajectory 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 continuous trajectory control.
  The "8" stored in the data set pointer for continuous trajectory control indicates that the second updating of the positioning data stored in points 0 to 8 is possible.
- 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.
- 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 continuous trajectory control automatically proceeds and changes to "0".
- 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 continuous trajectory 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 up to 8 points ahead therefore create a servo program of at least 9 points.
- Even if there are 9 points or more, and they include pass points of few travel value, the positioning at each point may be completed, 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.

[Md.1012] Real current value at STOP input (R: D32018+48n, D32019+48n/Q: D18+20n, D19+20n)

The actual current value at the detection of a stop/rapid stop cause is stored in this area.
The value is not stored during advanced synchronous control, or G-code control.

[Md.104] Motor current value (R: D32020+48n/Q: #8001+20n)

This register stores the motor current value (×0.1 [%]) (signed) read from the servo amplifier.

[Md.103] Motor speed (R: D32022+48n, D32023+48n/Q: #8002+20n, #8003+20n)

This register stores the motor speed (×0.01 [r/min]) (signed) read from the servo amplifier.
The motor speed (×0.01 [mm/s]) (signed) is stored at linear servo use.

[Md.28] Command speed (R: D32024+48n, D32025+48n/Q: #8004+20n, #8005+20n)

This register stores the speed (signed) at which command value to the servo amplifier for every operation cycle is converted into [pulse/s].

[Md.100] Home position return re-travel value (R: D32026+48n, D32027+48n/Q: #8006+20n, #8007+20n)

If the position stopped in the position specified with the travel value after proximity dog ON using MT Developer2 (☞ Page 181 Travel value after proximity dog ON) is not zero point, it made to travel to zero point by re-travel in the Motion CPU. The travel value (signed) 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 set method.)

[Md.1019] Servo amplifier display servo error code (R: D32028+48n/Q: #8008+20n)

- This register stores the servo error code read from the servo amplifier. The hexadecimal display is the same as the LED of servo amplifier.

Servo amplifier model	Servo amplifier LED display
MR-J3-□B	The two digits of the LED display are shown.
MR-J3W-□B	The upper two digits of the LED display are shown.
MR-J4(W)-□B	The three digits of the LED display are shown.

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

- The servo error code is stored several ms or to several tens of ms after the servo error or the servo warning is detected. Refer to the following devices when immediate detection of the servo error or the servo warning is required.

Error classification	Device
Servo error	"Servo alarm (b7)" of "[St.1068] Servo error detection (R: M32408+32n/Q: M2408+20n)" or "[Md.108] Servo status 1 (R: D32032+48n/Q: #8010+20n)"
Servo warning	"Servo warning (b15)" of [Md.108] Servo status 1 (R: D32032+48n/Q: #8010+20n)"

[Md.107] Parameter error number (R: D32029+48n/Q: #8009+20n)

The parameter number of error servo parameter is stored in hexadecimal at the servo error occurrence.

H□□□□

→ Parameter No.

→ Parameter group No.

0: PA group	5: PF group
1: PB group	9: Po group
2: PC group	A: PS group
3: PD group	B: PL group
4: PE group	C: PT group

[Md.1014] Servo amplifier type (R: D32030+48n/Q: #8000+20n)

This register stores the servo amplifier type code for each axis at the servo amplifier power supply ON

When this register is combined with "[Md.1027] Servo amplifier Vendor ID (R: D32031+48n/Q: #8016+20n)", the servo amplifier type can be judged. It is not cleared even if the servo amplifier control circuit power supply turns OFF.

[Md.1027] Servo amplifier vendor ID (R: D32031+48n/Q: #8016+20n)	[Md.1014] Servo amplifier type (R: D32030+48n/Q: #8000+20n)	
	Type code	Details
0 (Mitsubishi Electric Corporation)	0	Unused
	256 (0100H)	MR-J3-□B MR-J3W-□B (For 2-axis type)
	257 (0101H)	MR-J3-□B-RJ006 (For fully closed loop control) MR-J3-□B Safety (For drive safety servo)
	258 (0102H)	MR-J3-□B-RJ004 (For Linear servo motor)
	263 (0107H)	MR-J3-□B-RJ080W (For direct drive motor)
	384 (0180H)	MR-J3W-0303BN6
	386 (0182H)	MR-J3W-0303BN6 (For Linear servo motor)
	391 (0187H)	MR-J3W-0303BN6 (For direct drive motor)
	4096 (1000H)	MR-J4-□B MR-J4-□B-RJ MR-J4-□B-LL MR-J4W-□B (For 2-axis type, 3-axis type)
	8191 (1FFFH)	Virtual servo amplifier (MR-J4-B)
	8192 (2000H)	FR-A800-1 (Inverter)
	8193 (2001H)	FR-A800-2 (Inverter)
	12288 (3000H)	LJ72MS15 (SSCNETⅢ/H head module)
	12304 (3010H)	MR-MT2010 (Sensing SSCNETⅢ/H head module)
	12305 (3011H)	MR-MT2010 (Sensing SSCNETⅢ/H head module)+MR-MT2100 (Sensing I/O module Station 1)
	12306 (3012H)	MR-MT2010 (Sensing SSCNETⅢ/H head module)+MR-MT2200 (Sensing pulse I/O module: Station mode Station 1)
	12307 (3013H)	MR-MT2010 (Sensing SSCNETⅢ/H head module)+MR-MT2300 (Sensing analog I/O module Station 1)
	12308 (3014H)	MR-MT2010 (Sensing SSCNETⅢ/H head module)+MR-MT2400 (Sensing encoder I/F module Station 1)
	12309 (3015H)	MR-MT2010 (Sensing SSCNETⅢ/H head module)+MR-MT2200 (Sensing pulse I/O module: Axis mode Station 1)
	12321 (3021H)	MR-MT2100 (Sensing I/O module Station 2 and after)
	12322 (3022H)	MR-MT2200 (Sensing pulse I/O module: Station mode Station 2 and after)
	12323 (3023H)	MR-MT2300 (Sensing analog I/O module Station 2 and after)
	12324 (3024H)	MR-MT2400 (Sensing encoder I/F module Station 2 and after)
	12325 (3025H)	MR-MT2200 (Sensing pulse I/O module: Axis mode Station 2 and after)
	16640 (4100H)	FR-A700 (Inverter)
	16641 (4101H)	FR-A700-NA (Inverter)
	16642 (4102H)	FR-A700-EC (Inverter)
	16643 (4103H)	FR-A700-CHT (Inverter)
	-16384 (C000H)	MR-MT1200
3 (ORIENTAL MOTOR Co., Ltd.)	8233(2029H)	5-phase stepping motor driver
	8234(202AH)	Stepping motor driver AlphaStep (AZ series)
8 (CKD Nikki Denso Co., Ltd.)	258 (0102H)	VCⅡ series (For Linear stage)*1
	263 (0107H)	VCⅡ series (For direct drive motor)*1
	4096 (1000H)	VCⅡ*2
	770(0302H)	VPH series (For linear stage)*1
	775(0307H)	VPH series (For direct drive motor)*1
	4864(1300H)	VPH series*2
10 (IAI Corporation)	8193(2001H)	IAI electric actuator controller

*1 When connecting SSCNETⅢ/H

*2 When connecting SSCNETⅢ

[Md.1027] Servo amplifier Vendor ID (R: D32031+48n/Q: #8016+20n)

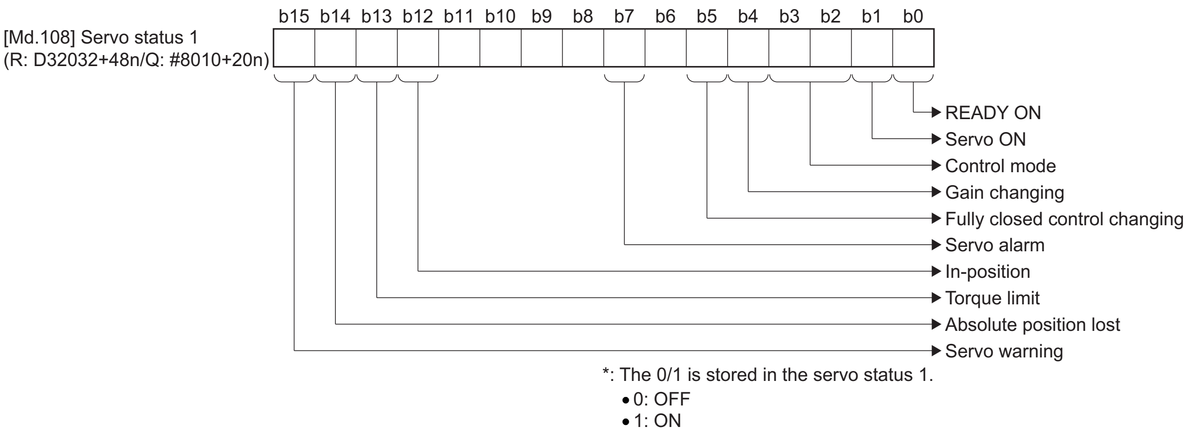
This register stores the servo amplifier vendor ID for each axis when the control circuit power supply of the servo amplifier is turned ON.

The contents are not cleared when the control circuit power supply of the servo amplifier is turned OFF.

Monitor value	Description
0	Mitsubishi Electric Corporation
3	ORIENTAL MOTOR Co., Ltd.
8	CKD Nikki Denso Co., Ltd.
10	IAI Corporation

[Md.108] Servo status1 (R: D32032+48n/Q: #8010+20n)

This register stores the servo status read from the servo amplifier.



Item	Description
READY ON (b0)	Indicates the ready ON/OFF.
Servo ON (b1)	Indicates the servo ON/OFF.
Control mode (b2, b3)*1	Indicates the control mode of servo amplifier.
Gain changing (b4)	Turns ON when servo amplifier is gain changing.
Fully closed control changing (b5)	Turns ON when servo amplifier is fully closed control changing.
Servo alarm (b7)	Turn ON during the servo alarm.
In-position (b12)	The dwell pulse turns ON within the servo parameter "in-position".
Torque limit (b13)	Turns ON when the servo amplifier is having the torque restricted.
Absolute position lost (b14)	Turns ON when the servo amplifier is lost the absolute position.
Servo warning (b15)	Turn ON during the servo warning.

*1 The status of control mode (b2, b3) are as follows.

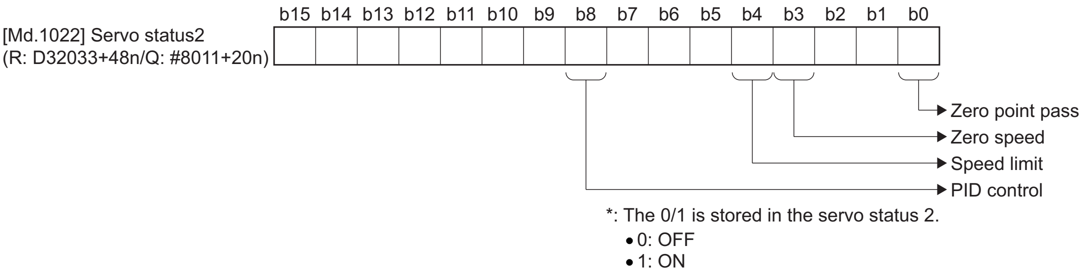
b3	b2	Control mode
0	0	Position control mode
0	1	Speed control mode
1	0	Torque control mode

Point

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

[Md.1022] Servo status2 (R: D32033+48n/Q: #8011+20n)

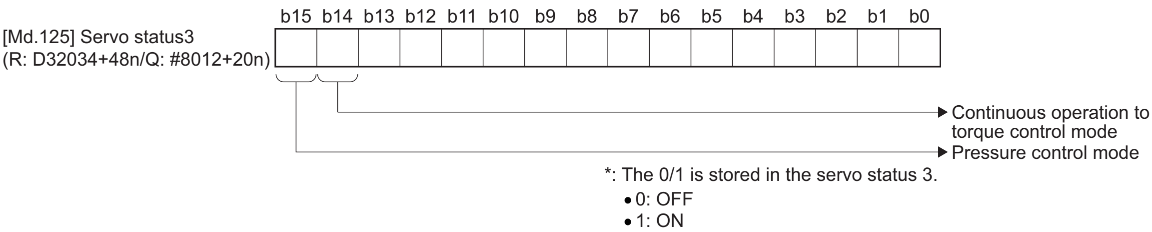
This register stores the servo status read from the servo amplifier.



Item	Description
Zero point pass (b0)	Turns ON if the zero point of the encoder has been passed even once.
Zero speed (b3)	Turns ON when the motor speed is lower than the servo parameter "zero speed."
Speed limit (b4)	Turn ON during the speed limit in torque control mode.
PID control (b8)	Turn ON when the servo amplifier is PID control.

[Md.125] Servo status3 (R: D32034+48n/Q: #8012+20n)

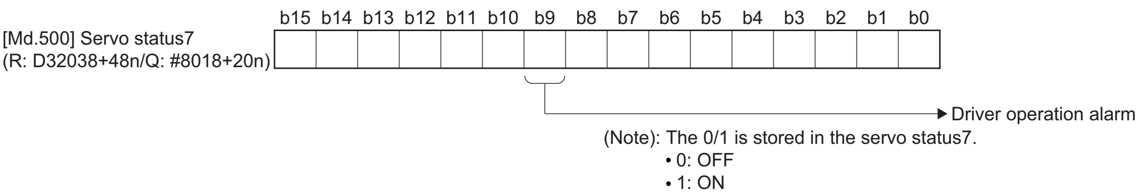
This register stores the servo status read from the servo amplifier.



Item	Description
Continuous operation to torque control mode (b14)	Turn ON when in continuous operation to torque control mode.
Pressure control mode (b15)	Turn ON when in pressure control mode

[Md.500] Servo status7 (R: D32038+48n/Q: #8018+20n)

This register stores the servo status read from the servo amplifier.



Item	Description
Driver operation alarm (b9)	Turn ON when driver operation alarm occurs.

JOG speed setting registers

This area stores the JOG operation speed data.

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
D35120, D35121	D640, D641	Axis 1 JOG speed setting register
D35122, D35123	D642, D643	Axis 2 JOG speed setting register
D35124, D35125	D644, D645	Axis 3 JOG speed setting register
D35126, D35127	D646, D647	Axis 4 JOG speed setting register
D35128, D35129	D648, D649	Axis 5 JOG speed setting register
D35130, D35131	D650, D651	Axis 6 JOG speed setting register
D35132, D35133	D652, D653	Axis 7 JOG speed setting register
D35134, D35135	D654, D655	Axis 8 JOG speed setting register
D35136, D35137	D656, D657	Axis 9 JOG speed setting register
D35138, D35139	D658, D659	Axis 10 JOG speed setting register
D35140, D35141	D660, D661	Axis 11 JOG speed setting register
D35142, D35143	D662, D663	Axis 12 JOG speed setting register
D35144, D35145	D664, D665	Axis 13 JOG speed setting register
D35146, D35147	D666, D667	Axis 14 JOG speed setting register
D35148, D35149	D668, D669	Axis 15 JOG speed setting register
D35150, D35151	D670, D671	Axis 16 JOG speed setting register
D35152, D35153	D672, D673	Axis 17 JOG speed setting register
D35154, D35155	D674, D675	Axis 18 JOG speed setting register
D35156, D35157	D676, D677	Axis 19 JOG speed setting register
D35158, D35159	D678, D679	Axis 20 JOG speed setting register
D35160, D35161	D680, D681	Axis 21 JOG speed setting register
D35162, D35163	D682, D683	Axis 22 JOG speed setting register
D35164, D35165	D684, D685	Axis 23 JOG speed setting register
D35166, D35167	D686, D687	Axis 24 JOG speed setting register
D35168, D35169	D688, D689	Axis 25 JOG speed setting register
D35170, D35171	D690, D691	Axis 26 JOG speed setting register
D35172, D35173	D692, D693	Axis 27 JOG speed setting register
D35174, D35175	D694, D695	Axis 28 JOG speed setting register
D35176, D35177	D696, D697	Axis 29 JOG speed setting register
D35178, D35179	D698, D699	Axis 30 JOG speed setting register
D35180, D35181	D700, D701	Axis 31 JOG speed setting register
D35182, D35183	D702, D703	Axis 32 JOG speed setting register
D35184, D35185		Axis 33 JOG speed setting register
D35186, D35187		Axis 34 JOG speed setting register
D35188, D35189		Axis 35 JOG speed setting register
D35190, D35191		Axis 36 JOG speed setting register
D35192, D35193		Axis 37 JOG speed setting register
D35194, D35195		Axis 38 JOG speed setting register
D35196, D35197		Axis 39 JOG speed setting register
D35198, D35199		Axis 40 JOG speed setting register
D35200, D35201		Axis 41 JOG speed setting register
D35202, D35203		Axis 42 JOG speed setting register
D35204, D35205		Axis 43 JOG speed setting register
D35206, D35207		Axis 44 JOG speed setting register
D35208, D35209		Axis 45 JOG speed setting register
D35210, D35211		Axis 46 JOG speed setting register
D35212, D35213		Axis 47 JOG speed setting register
D35214, D35215		Axis 48 JOG speed setting register

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
D35216, D35217		Axis 49 JOG speed setting register
D35218, D35219		Axis 50 JOG speed setting register
D35220, D35221		Axis 51 JOG speed setting register
D35222, D35223		Axis 52 JOG speed setting register
D35224, D35225		Axis 53 JOG speed setting register
D35226, D35227		Axis 54 JOG speed setting register
D35228, D35229		Axis 55 JOG speed setting register
D35230, D35231		Axis 56 JOG speed setting register
D35232, D35233		Axis 57 JOG speed setting register
D35234, D35235		Axis 58 JOG speed setting register
D35236, D35237		Axis 59 JOG speed setting register
D35238, D35239		Axis 60 JOG speed setting register
D35240, D35241		Axis 61 JOG speed setting register
D35242, D35243		Axis 62 JOG speed setting register
D35244, D35245		Axis 63 JOG speed setting register
D35246, D35247		Axis 64 JOG speed setting register

- Details for each axis

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D35120+2n	D640+2n	Cd.1110	JOG speed setting	—	At start	Command device
D35121+2n	D641+2n					

Point

- The following range is valid. R16MTCPU: Axis No.1 to 16, R32MTCPU: Axis No.1 to 32.
- The following device area can be used as a user device. R16MTCPU: 17 axes or more, R32MTCPU: 33 axes or more. However, when the project of R16MTCPU is replaced with R32MTCPU/R64MTCPU, or the project of R32MTCPU is replaced with R64MTCPU, this area cannot be used as a user device.

[Cd.1110] JOG speed setting (R: D35120+2n, D35121+2n/Q: D640+2n, D641+2n)

- This register stores the JOG speed at the JOG operation.
- Setting range of the JOG speed is shown below.

Item	Setting range			
	mm	inch	degree	pulse
JOG speed	1 to 600000000 ($\times 10^{-2}$ [mm/min])	1 to 600000000 ($\times 10^{-3}$ [inch/min])	1 to 2147483647 ($\times 10^{-3}$ [degree/min])*1	1 to 2147483647 [pulse/s]

*1 When the "speed control 10 × multiplier setting for degree axis" is set to "valid" in the fixed parameter, the unit is 1 to 2147483647 ($\times 10^{-2}$ [degree/min]).

- The JOG speed is the value stored in the "[Cd.1110] JOG speed setting (R: D35120+2n, D35121+2n/Q: D640+2n, D641+2n)" at leading edge of JOG start signal. Even if data is changed during JOG operation, JOG speed cannot be changed.
- Refer to the JOG operation for details of the JOG operation. (☞ Page 415 JOG Operation)

Servo input axis monitor device

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
D35440 to D35455	D12280 to D12289	Axis 1 servo input axis monitor device
D35456 to D35471	D12290 to D12299	Axis 2 servo input axis monitor device
D35472 to D35487	D12300 to D12309	Axis 3 servo input axis monitor device
D35488 to D35503	D12310 to D12319	Axis 4 servo input axis monitor device
D35504 to D35519	D12320 to D12329	Axis 5 servo input axis monitor device
D35520 to D35535	D12330 to D12339	Axis 6 servo input axis monitor device
D35536 to D35551	D12340 to D12349	Axis 7 servo input axis monitor device
D35552 to D35567	D12350 to D12359	Axis 8 servo input axis monitor device
D35568 to D35583	D12360 to D12369	Axis 9 servo input axis monitor device
D35584 to D35599	D12370 to D12379	Axis 10 servo input axis monitor device
D35600 to D35615	D12380 to D12389	Axis 11 servo input axis monitor device
D35616 to D35631	D12390 to D12399	Axis 12 servo input axis monitor device
D35632 to D35647	D12400 to D12409	Axis 13 servo input axis monitor device
D35648 to D35663	D12410 to D12419	Axis 14 servo input axis monitor device
D35664 to D35679	D12420 to D12429	Axis 15 servo input axis monitor device
D35680 to D35695	D12430 to D12439	Axis 16 servo input axis monitor device
D35696 to D35711	D12440 to D12449	Axis 17 servo input axis monitor device
D35712 to D35727	D12450 to D12459	Axis 18 servo input axis monitor device
D35728 to D35743	D12460 to D12469	Axis 19 servo input axis monitor device
D35744 to D35759	D12470 to D12479	Axis 20 servo input axis monitor device
D35760 to D35775	D12480 to D12489	Axis 21 servo input axis monitor device
D35776 to D35791	D12490 to D12499	Axis 22 servo input axis monitor device
D35792 to D35807	D12500 to D12509	Axis 23 servo input axis monitor device
D35808 to D35823	D12510 to D12519	Axis 24 servo input axis monitor device
D35824 to D35839	D12520 to D12529	Axis 25 servo input axis monitor device
D35840 to D35855	D12530 to D12539	Axis 26 servo input axis monitor device
D35856 to D35871	D12540 to D12549	Axis 27 servo input axis monitor device
D35872 to D35887	D12550 to D12559	Axis 28 servo input axis monitor device
D35888 to D35903	D12560 to D12569	Axis 29 servo input axis monitor device
D35904 to D35919	D12570 to D12579	Axis 30 servo input axis monitor device
D35920 to D35935	D12580 to D12589	Axis 31 servo input axis monitor device
D35936 to D35951	D12590 to D12599	Axis 32 servo input axis monitor device
D35952 to D35967		Axis 33 servo input axis monitor device
D35968 to D35983		Axis 34 servo input axis monitor device
D35984 to D35999		Axis 35 servo input axis monitor device
D36000 to D36015		Axis 36 servo input axis monitor device
D36016 to D36031		Axis 37 servo input axis monitor device
D36032 to D36047		Axis 38 servo input axis monitor device
D36048 to D36063		Axis 39 servo input axis monitor device
D36064 to D36079		Axis 40 servo input axis monitor device
D36080 to D36095		Axis 41 servo input axis monitor device
D36096 to D36111		Axis 42 servo input axis monitor device
D36112 to D36127		Axis 43 servo input axis monitor device
D36128 to D36143		Axis 44 servo input axis monitor device
D36144 to D36159		Axis 45 servo input axis monitor device
D36160 to D36175		Axis 46 servo input axis monitor device
D36176 to D36191		Axis 47 servo input axis monitor device
D36192 to D36207		Axis 48 servo input axis monitor device
D36208 to D36223		Axis 49 servo input axis monitor device

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
D36224 to D36239		Axis 50 servo input axis monitor device
D36240 to D36255		Axis 51 servo input axis monitor device
D36256 to D36271		Axis 52 servo input axis monitor device
D36272 to D36287		Axis 53 servo input axis monitor device
D36288 to D36303		Axis 54 servo input axis monitor device
D36304 to D36319		Axis 55 servo input axis monitor device
D36320 to D36335		Axis 56 servo input axis monitor device
D36336 to D36351		Axis 57 servo input axis monitor device
D36352 to D36367		Axis 58 servo input axis monitor device
D36368 to D36383		Axis 59 servo input axis monitor device
D36384 to D36399		Axis 60 servo input axis monitor device
D36400 to D36415		Axis 61 servo input axis monitor device
D36416 to D36431		Axis 62 servo input axis monitor device
D36432 to D36447		Axis 63 servo input axis monitor device
D36448 to D36463		Axis 64 servo input axis monitor device

- Details for each axis

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D35440+16n	D12280+10n	Md.300	Servo input axis current value	Operation cycle	—	Monitor device
D35441+16n	D12281+10n					
D35442+16n	D12282+10n	Md.301	Servo input axis speed			
D35443+16n	D12283+10n					
D35444+16n	D12284+10n	Md.302	Servo input axis phase compensation amount			
D35445+16n	D12285+10n					
D35446+16n	D12286+10n	Md.303	Servo input axis rotation direction restriction amount			
D35447+16n	D12287+10n					
D35448+16n	D12288+10n	—	Unusable	—	—	—
D35449+16n	D12289+10n					
D35450+16n						
D35451+16n						
D35452+16n						
D35453+16n						
D35454+16n						
D35455+16n						

Point

- The following range is valid. R16MTCPU: Axis No.1 to 16, R32MTCPU: Axis No.1 to 32.
- The following device area can be used as a user device. R16MTCPU: 17 axes or more, R32MTCPU: 33 axes or more. However, when the project of R16MTCPU is replaced with R32MTCPU/R64MTCPU, or the project of R32MTCPU is replaced with R64MTCPU, this area cannot be used as a user device.
- Refer to the following for details of servo input axis monitor device.
  MELSEC iQ-R Motion Controller Programming Manual (Advanced Synchronous Control)

Servo input axis control device

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
D41200 to D41207	D14600, D14601	Axis 1 servo input axis control device
D41208 to D41215	D14602, D14603	Axis 2 servo input axis control device
D41216 to D41223	D14604, D14605	Axis 3 servo input axis control device
D41224 to D41231	D14606, D14607	Axis 4 servo input axis control device
D41232 to D41239	D14608, D14609	Axis 5 servo input axis control device
D41240 to D41247	D14610, D14611	Axis 6 servo input axis control device
D41248 to D41255	D14612, D14613	Axis 7 servo input axis control device
D41256 to D41263	D14614, D14615	Axis 8 servo input axis control device
D41264 to D41271	D14616, D14617	Axis 9 servo input axis control device
D41272 to D41279	D14618, D14619	Axis 10 servo input axis control device
D41280 to D41287	D14620, D14621	Axis 11 servo input axis control device
D41288 to D41295	D14622, D14623	Axis 12 servo input axis control device
D41296 to D41303	D14624, D14625	Axis 13 servo input axis control device
D41304 to D41311	D14626, D14627	Axis 14 servo input axis control device
D41312 to D41319	D14628, D14629	Axis 15 servo input axis control device
D41320 to D41327	D14630, D14631	Axis 16 servo input axis control device
D41328 to D41335	D14632, D14633	Axis 17 servo input axis control device
D41336 to D41343	D14634, D14635	Axis 18 servo input axis control device
D41344 to D41351	D14636, D14637	Axis 19 servo input axis control device
D41352 to D41359	D14638, D14639	Axis 20 servo input axis control device
D41360 to D41367	D14640, D14641	Axis 21 servo input axis control device
D41368 to D41375	D14642, D14643	Axis 22 servo input axis control device
D41376 to D41383	D14644, D14645	Axis 23 servo input axis control device
D41384 to D41391	D14646, D14647	Axis 24 servo input axis control device
D41392 to D41399	D14648, D14649	Axis 25 servo input axis control device
D41400 to D41407	D14650, D14651	Axis 26 servo input axis control device
D41408 to D41415	D14652, D14653	Axis 27 servo input axis control device
D41416 to D41423	D14654, D14655	Axis 28 servo input axis control device
D41424 to D41431	D14656, D14657	Axis 29 servo input axis control device
D41432 to D41439	D14658, D14659	Axis 30 servo input axis control device
D41440 to D41447	D14660, D14661	Axis 31 servo input axis control device
D41448 to D41455	D14662, D14663	Axis 32 servo input axis control device
D41456 to D41463		Axis 33 servo input axis control device
D41464 to D41471		Axis 34 servo input axis control device
D41472 to D41479		Axis 35 servo input axis control device
D41480 to D41487		Axis 36 servo input axis control device
D41488 to D41495		Axis 37 servo input axis control device
D41496 to D41503		Axis 38 servo input axis control device
D41504 to D41511		Axis 39 servo input axis control device
D41512 to D41519		Axis 40 servo input axis control device
D41520 to D41527		Axis 41 servo input axis control device
D41528 to D41535		Axis 42 servo input axis control device
D41536 to D41543		Axis 43 servo input axis control device
D41544 to D41551		Axis 44 servo input axis control device
D41552 to D41559		Axis 45 servo input axis control device
D41560 to D41567		Axis 46 servo input axis control device
D41568 to D41575		Axis 47 servo input axis control device
D41576 to D41583		Axis 48 servo input axis control device
D41584 to D41591		Axis 49 servo input axis control device

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
D41592 to D41599		Axis 50 servo input axis control device
D41600 to D41607		Axis 51 servo input axis control device
D41608 to D41615		Axis 52 servo input axis control device
D41616 to D41623		Axis 53 servo input axis control device
D41624 to D41631		Axis 54 servo input axis control device
D41632 to D41639		Axis 55 servo input axis control device
D41640 to D41647		Axis 56 servo input axis control device
D41648 to D41655		Axis 57 servo input axis control device
D41656 to D41663		Axis 58 servo input axis control device
D41664 to D41671		Axis 59 servo input axis control device
D41672 to D41679		Axis 60 servo input axis control device
D41680 to D41687		Axis 61 servo input axis control device
D41688 to D41695		Axis 62 servo input axis control device
D41696 to D41703		Axis 63 servo input axis control device
D41704 to D41711		Axis 64 servo input axis control device

- Details for each axis

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D41200+8n	D14600+2n	Pr.302	Servo input axis phase compensation advance time	—	Operation cycle	Command device
D41201+8n	D14601+2n					
D41202+8n		—	Unusable	—	—	—
D41203+8n						
D41204+8n						
D41205+8n						
D41206+8n						
D41207+8n						

Point

- The following range is valid. R16MTCPU: Axis No.1 to 16, R32MTCPU: Axis No.1 to 32.
- The following device area can be used as a user device. R16MTCPU: 17 axes or more, R32MTCPU: 33 axes or more. However, when the project of R16MTCPU is replaced with R32MTCPU/R64MTCPU, or the project of R32MTCPU is replaced with R64MTCPU, this area cannot be used as a user device.
- Refer to the following for details of servo input axis control device.
MELSEC iQ-R Motion Controller Programming Manual (Advanced Synchronous Control)

Command generation axis monitor device

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
D36480 to D36511	D12600 to D12619	Axis 1 command generation axis monitor device
D36512 to D36543	D12620 to D12639	Axis 2 command generation axis monitor device
D36544 to D36575	D12640 to D12659	Axis 3 command generation axis monitor device
D36576 to D36607	D12660 to D12679	Axis 4 command generation axis monitor device
D36608 to D36639	D12680 to D12699	Axis 5 command generation axis monitor device
D36640 to D36671	D12700 to D12719	Axis 6 command generation axis monitor device
D36672 to D36703	D12720 to D12739	Axis 7 command generation axis monitor device
D36704 to D36735	D12740 to D12759	Axis 8 command generation axis monitor device
D36736 to D36767	D12760 to D12779	Axis 9 command generation axis monitor device
D36768 to D36799	D12780 to D12799	Axis 10 command generation axis monitor device
D36800 to D36831	D12800 to D12819	Axis 11 command generation axis monitor device
D36832 to D36863	D12820 to D12839	Axis 12 command generation axis monitor device
D36864 to D36895	D12840 to D12859	Axis 13 command generation axis monitor device
D36896 to D36927	D12860 to D12879	Axis 14 command generation axis monitor device
D36928 to D36959	D12880 to D12899	Axis 15 command generation axis monitor device
D36960 to D36991	D12900 to D12919	Axis 16 command generation axis monitor device
D36992 to D37023	D12920 to D12939	Axis 17 command generation axis monitor device
D37024 to D37055	D12940 to D12959	Axis 18 command generation axis monitor device
D37056 to D37087	D12960 to D12979	Axis 19 command generation axis monitor device
D37088 to D37119	D12980 to D12999	Axis 20 command generation axis monitor device
D37120 to D37151	D13000 to D13019	Axis 21 command generation axis monitor device
D37152 to D37183	D13020 to D13039	Axis 22 command generation axis monitor device
D37184 to D37215	D13040 to D13059	Axis 23 command generation axis monitor device
D37216 to D37247	D13060 to D13079	Axis 24 command generation axis monitor device
D37248 to D37279	D13080 to D13099	Axis 25 command generation axis monitor device
D37280 to D37311	D13100 to D13119	Axis 26 command generation axis monitor device
D37312 to D37343	D13120 to D13139	Axis 27 command generation axis monitor device
D37344 to D37375	D13140 to D13159	Axis 28 command generation axis monitor device
D37376 to D37407	D13160 to D13179	Axis 29 command generation axis monitor device
D37408 to D37439	D13180 to D13199	Axis 30 command generation axis monitor device
D37440 to D37471	D13200 to D13219	Axis 31 command generation axis monitor device
D37472 to D37503	D13220 to D13239	Axis 32 command generation axis monitor device
D37504 to D37535		Axis 33 command generation axis monitor device
D37536 to D37567		Axis 34 command generation axis monitor device
D37568 to D37599		Axis 35 command generation axis monitor device
D37600 to D37631		Axis 36 command generation axis monitor device
D37632 to D37663		Axis 37 command generation axis monitor device
D37664 to D37695		Axis 38 command generation axis monitor device
D37696 to D37727		Axis 39 command generation axis monitor device
D37728 to D37759		Axis 40 command generation axis monitor device
D37760 to D37791		Axis 41 command generation axis monitor device
D37792 to D37823		Axis 42 command generation axis monitor device
D37824 to D37855		Axis 43 command generation axis monitor device
D37856 to D37887		Axis 44 command generation axis monitor device
D37888 to D37919		Axis 45 command generation axis monitor device
D37920 to D37951		Axis 46 command generation axis monitor device
D37952 to D37983		Axis 47 command generation axis monitor device
D37984 to D38015		Axis 48 command generation axis monitor device
D38016 to D38047		Axis 49 command generation axis monitor device

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
D38048 to D38079		Axis 50 command generation axis monitor device
D38080 to D38111		Axis 51 command generation axis monitor device
D38112 to D38143		Axis 52 command generation axis monitor device
D38144 to D38175		Axis 53 command generation axis monitor device
D38176 to D38207		Axis 54 command generation axis monitor device
D38208 to D38239		Axis 55 command generation axis monitor device
D38240 to D38271		Axis 56 command generation axis monitor device
D38272 to D38303		Axis 57 command generation axis monitor device
D38304 to D38335		Axis 58 command generation axis monitor device
D38336 to D38367		Axis 59 command generation axis monitor device
D38368 to D38399		Axis 60 command generation axis monitor device
D38400 to D38431		Axis 61 command generation axis monitor device
D38432 to D38463		Axis 62 command generation axis monitor device
D38464 to D38495		Axis 63 command generation axis monitor device
D38496 to D38527		Axis 64 command generation axis monitor device

• Details for each axis

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D36480+32n	D12600+20n	Md.340	Command generation axis feed current value	Operation cycle	—	Monitor device
D36481+32n	D12601+20n					
D36482+32n	D12602+20n	Md.341	Command generation axis warning code	Immediate		
D36483+32n	D12603+20n	Md.342	Command generation axis error code			
D36484+32n	D12604+20n	Md.343	Command generation axis execute program No.	At start		
D36485+32n	D12605+20n	Md.344	Command generation axis M-code	Operation cycle		
D36486+32n	D12606+20n	Md.345	Command generation axis accumulative current value			
D36487+32n	D12607+20n					
D36488+32n	D12608+20n	—	Unusable	—	—	—
D36489+32n	D12609+20n	Md.346	Command generation axis data set pointer for constant-speed control	At start/during start	—	Monitor device
D36490+32n	D12610+20n	Md.347	Command generation axis current value per cycle	Operation cycle		
D36491+32n	D12611+20n					
D36492+32n	D12612+20n	Md.348	Command generation axis command speed			
D36493+32n	D12613+20n					
D36494+32n	D12614+20n	—	Unusable	—	—	—
D36495+32n	D12615+20n					
D36496+32n	D12616+20n					
D36497+32n	D12617+20n					
D36498+32n	D12618+20n					
D36499+32n	D12619+20n					
D36500+32n						
D36501+32n						
D36502+32n						
D36503+32n						
D36504+32n						
D36505+32n						
D36506+32n						
D36507+32n						
D36508+32n						
D36509+32n						
D36510+32n						
D36511+32n						

Point

• The following range is valid. R16MTCPU: Axis No.1 to 16, R32MTCPU: Axis No.1 to 32.

• The following device area can be used as a user device. R16MTCPU: 17 axes or more, R32MTCPU: 33 axes or more. However, when the project of R16MTCPU is replaced with R32MTCPU/R64MTCPU, or the project of R32MTCPU is replaced with R64MTCPU, this area cannot be used as a user device.

• Refer to the following for details of command generation axis monitor device.

MELSEC iQ-R Motion Controller Programming Manual (Advanced Synchronous Control)

Command generation axis control device

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
D41760 to D41767	D14680 to D14683	Axis 1 command generation axis control device
D41768 to D41775	D14684 to D14687	Axis 2 command generation axis control device
D41776 to D41783	D14688 to D14691	Axis 3 command generation axis control device
D41784 to D41791	D14692 to D14695	Axis 4 command generation axis control device
D41792 to D41799	D14696 to D14699	Axis 5 command generation axis control device
D41800 to D41807	D14700 to D14703	Axis 6 command generation axis control device
D41808 to D41815	D14704 to D14707	Axis 7 command generation axis control device
D41816 to D41823	D14708 to D14711	Axis 8 command generation axis control device
D41824 to D41831	D14712 to D14715	Axis 9 command generation axis control device
D41832 to D41839	D14716 to D14719	Axis 10 command generation axis control device
D41840 to D41847	D14720 to D14723	Axis 11 command generation axis control device
D41848 to D41855	D14724 to D14727	Axis 12 command generation axis control device
D41856 to D41863	D14728 to D14731	Axis 13 command generation axis control device
D41864 to D41871	D14732 to D14735	Axis 14 command generation axis control device
D41872 to D41879	D14736 to D14739	Axis 15 command generation axis control device
D41880 to D41887	D14740 to D14743	Axis 16 command generation axis control device
D41888 to D41895	D14744 to D14747	Axis 17 command generation axis control device
D41896 to D41903	D14748 to D14751	Axis 18 command generation axis control device
D41904 to D41911	D14752 to D14755	Axis 19 command generation axis control device
D41912 to D41919	D14756 to D14759	Axis 20 command generation axis control device
D41920 to D41927	D14760 to D14763	Axis 21 command generation axis control device
D41928 to D41935	D14764 to D14767	Axis 22 command generation axis control device
D41936 to D41943	D14768 to D14771	Axis 23 command generation axis control device
D41944 to D41951	D14772 to D14775	Axis 24 command generation axis control device
D41952 to D41959	D14776 to D14779	Axis 25 command generation axis control device
D41960 to D41967	D14780 to D14783	Axis 26 command generation axis control device
D41968 to D41975	D14784 to D14787	Axis 27 command generation axis control device
D41976 to D41983	D14788 to D14791	Axis 28 command generation axis control device
D41984 to D41991	D14792 to D14795	Axis 29 command generation axis control device
D41992 to D41999	D14796 to D14799	Axis 30 command generation axis control device
D42000 to D42007	D14800 to D14803	Axis 31 command generation axis control device
D42008 to D42015	D14804 to D14807	Axis 32 command generation axis control device
D42016 to D42023		Axis 33 command generation axis control device
D42024 to D42031		Axis 34 command generation axis control device
D42032 to D42039		Axis 35 command generation axis control device
D42040 to D42047		Axis 36 command generation axis control device
D42048 to D42055		Axis 37 command generation axis control device
D42056 to D42063		Axis 38 command generation axis control device
D42064 to D42071		Axis 39 command generation axis control device
D42072 to D42079		Axis 40 command generation axis control device
D42080 to D42087		Axis 41 command generation axis control device
D42088 to D42095		Axis 42 command generation axis control device
D42096 to D42103		Axis 43 command generation axis control device
D42104 to D42111		Axis 44 command generation axis control device
D42112 to D42119		Axis 45 command generation axis control device
D42120 to D42127		Axis 46 command generation axis control device
D42128 to D42135		Axis 47 command generation axis control device
D42136 to D42143		Axis 48 command generation axis control device
D42144 to D42151		Axis 49 command generation axis control device

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
D42152 to D42159		Axis 50 command generation axis control device
D42160 to D42167		Axis 51 command generation axis control device
D42168 to D42175		Axis 52 command generation axis control device
D42176 to D42183		Axis 53 command generation axis control device
D42184 to D42191		Axis 54 command generation axis control device
D42192 to D42199		Axis 55 command generation axis control device
D42200 to D42207		Axis 56 command generation axis control device
D42208 to D42215		Axis 57 command generation axis control device
D42216 to D42223		Axis 58 command generation axis control device
D42224 to D42231		Axis 59 command generation axis control device
D42232 to D42239		Axis 60 command generation axis control device
D42240 to D42247		Axis 61 command generation axis control device
D42248 to D42255		Axis 62 command generation axis control device
D42256 to D42263		Axis 63 command generation axis control device
D42264 to D42271		Axis 64 command generation axis control device

- Details for each axis

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D41760+8n	D14680+4n	Cd.340	Command generation axis JOG speed setting	—	At start of JOG operation	Command device
D41761+8n	D14681+4n					
D41762+8n	D14682+4n	Pr.348	Command generation axis JOG operation parameter block setting			
D41763+8n	D14683+4n	—	Unusable	—	—	—
D41764+8n						
D41765+8n						
D41766+8n						
D41767+8n						

Point

- The following range is valid. R16MTCPU: Axis No.1 to 16, R32MTCPU: Axis No.1 to 32.
- The following device area can be used as a user device. R16MTCPU: 17 axes or more, R32MTCPU: 33 axes or more. However, when the project of R16MTCPU is replaced with R32MTCPU/R64MTCPU, or the project of R32MTCPU is replaced with R64MTCPU, this area cannot be used as a user device.
- Refer to the following for details of command generation axis control device.
  MELSEC iQ-R Motion Controller Programming Manual (Advanced Synchronous Control)

Synchronous encoder axis monitor device

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
D38560 to D38591	D13240 to D13259	Axis 1 synchronous encoder axis monitor device
D38592 to D38623	D13260 to D13279	Axis 2 synchronous encoder axis monitor device
D38624 to D38655	D13280 to D13299	Axis 3 synchronous encoder axis monitor device
D38656 to D38687	D13300 to D13319	Axis 4 synchronous encoder axis monitor device
D38688 to D38719	D13320 to D13339	Axis 5 synchronous encoder axis monitor device
D38720 to D38751	D13340 to D13359	Axis 6 synchronous encoder axis monitor device
D38752 to D38783	D13360 to D13369	Axis 7 synchronous encoder axis monitor device
D38784 to D38815	D13380 to D13399	Axis 8 synchronous encoder axis monitor device
D38816 to D38847	D13400 to D13419	Axis 9 synchronous encoder axis monitor device
D38848 to D38879	D13420 to D13439	Axis 10 synchronous encoder axis monitor device
D38880 to D38911	D13440 to D13459	Axis 11 synchronous encoder axis monitor device
D38912 to D38943	D13460 to D13479	Axis 12 synchronous encoder axis monitor device

• Details for each axis

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D38560+32n	D13240+20n	Md.320	Synchronous encoder axis current value	Operation cycle	—	Monitor device
D38561+32n	D13241+20n					
D38562+32n	D13242+20n	Md.321	Synchronous encoder axis current value per cycle			
D38563+32n	D13243+20n					
D38564+32n	D13244+20n	Md.322	Synchronous encoder axis speed			
D38565+32n	D13245+20n					
D38566+32n	D13246+20n	Md.323	Synchronous encoder axis phase compensation amount			
D38567+32n	D13247+20n					
D38568+32n	D13248+20n	Md.324	Synchronous encoder axis rotation direction restriction amount			
D38569+32n	D13249+20n					
D38570+32n	D13250+20n	Md.327	Synchronous encoder axis warning code	Immediate		
D38571+32n	D13251+20n	Md.326	Synchronous encoder axis error code			
D38572+32n	D13252+20n	—	Unusable	—	—	—
D38573+32n	D13253+20n					
D38574+32n	D13254+20n					
D38575+32n	D13255+20n					
D38576+32n	D13256+20n					
D38577+32n	D13257+20n					
D38578+32n	D13258+20n					
D38579+32n	D13259+20n					
D38580+32n						
D38581+32n						
D38582+32n						
D38583+32n						
D38584+32n						
D38585+32n						
D38586+32n						
D38587+32n						
D38588+32n						
D38589+32n						

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D38590+32n		—	Unusable	—	—	—
D38591+32n						

Point

Refer to the following for details of synchronous encoder axis monitor device.
📖MELSEC iQ-R Motion Controller Programming Manual (Advanced Synchronous Control)

Synchronous encoder axis control device

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
D42320 to D42335	D14820 to D14829	Axis 1 Synchronous encoder axis control device
D42336 to D42351	D14830 to D14839	Axis 2 Synchronous encoder axis control device
D42352 to D42367	D14840 to D14849	Axis 3 Synchronous encoder axis control device
D42368 to D42383	D14850 to D14859	Axis 4 Synchronous encoder axis control device
D42384 to D42399	D14860 to D14869	Axis 5 Synchronous encoder axis control device
D42400 to D42415	D14870 to D14879	Axis 6 Synchronous encoder axis control device
D42416 to D42431	D14880 to D14889	Axis 7 Synchronous encoder axis control device
D42432 to D42447	D14890 to D14899	Axis 8 Synchronous encoder axis control device
D42448 to D42463	D14900 to D14909	Axis 9 Synchronous encoder axis control device
D42464 to D42479	D14910 to D14919	Axis 10 Synchronous encoder axis control device
D42480 to D42495	D14920 to D14929	Axis 11 Synchronous encoder axis control device
D42496 to D42511	D14930 to D14939	Axis 12 Synchronous encoder axis control device

- Details for each axis

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D42320+16n	D14820+10n	Pr.326	Synchronous encoder axis phase compensation advance time	—	Operation cycle	Command device
D42321+16n	D14821+10n					
D42322+16n	D14822+10n	Cd.320	Synchronous encoder axis control start condition		At synchronous encoder axis control start	
D42323+16n	D14823+10n	Cd.321	Synchronous encoder axis control method			
D42324+16n	D14824+10n	Cd.322	Synchronous encoder axis current value setting address			
D42325+16n	D14825+10n					
D42326+16n	D14826+10n	Cd.325	Input value for synchronous encoder via device		Operation cycle	
D42327+16n	D14827+10n					
D42328+16n	D14828+10n	—	Unusable	—	—	—
D42329+16n	D14829+10n					
D42330+16n						
D42331+16n						
D42332+16n						
D42333+16n						
D42334+16n						
D42335+16n						

Point

Refer to the following for details of synchronous encoder axis control device.

MELSEC iQ-R Motion Controller Programming Manual (Advanced Synchronous Control)

Output axis monitor device

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
D39120 to D39151	D13600 to D13629	Axis 1 output axis monitor device
D39152 to D39183	D13630 to D13659	Axis 2 output axis monitor device
D39184 to D39215	D13660 to D13689	Axis 3 output axis monitor device
D39216 to D39247	D13690 to D13719	Axis 4 output axis monitor device
D39248 to D39279	D13720 to D13749	Axis 5 output axis monitor device
D39280 to D39311	D13750 to D13779	Axis 6 output axis monitor device
D39312 to D39343	D13780 to D13809	Axis 7 output axis monitor device
D39344 to D39375	D13810 to D13839	Axis 8 output axis monitor device
D39376 to D39407	D13840 to D13869	Axis 9 output axis monitor device
D39408 to D39439	D13870 to D13899	Axis 10 output axis monitor device
D39440 to D39471	D13900 to D13929	Axis 11 output axis monitor device
D39472 to D39503	D13930 to D13959	Axis 12 output axis monitor device
D39504 to D39535	D13960 to D13989	Axis 13 output axis monitor device
D39536 to D39567	D13990 to D14019	Axis 14 output axis monitor device
D39568 to D39599	D14020 to D14049	Axis 15 output axis monitor device
D39600 to D39631	D14050 to D14079	Axis 16 output axis monitor device
D39632 to D39663	D14080 to D14109	Axis 17 output axis monitor device
D39664 to D39695	D14110 to D14139	Axis 18 output axis monitor device
D39696 to D39727	D14140 to D14169	Axis 19 output axis monitor device
D39728 to D39759	D14170 to D14199	Axis 20 output axis monitor device
D39760 to D39791	D14200 to D14229	Axis 21 output axis monitor device
D39792 to D39823	D14230 to D14259	Axis 22 output axis monitor device
D39824 to D39855	D14260 to D14289	Axis 23 output axis monitor device
D39856 to D39887	D14290 to D14319	Axis 24 output axis monitor device
D39888 to D39919	D14320 to D14349	Axis 25 output axis monitor device
D39920 to D39951	D14350 to D14379	Axis 26 output axis monitor device
D39952 to D39983	D14380 to D14409	Axis 27 output axis monitor device
D39984 to D40015	D14410 to D14439	Axis 28 output axis monitor device
D40016 to D40047	D14440 to D14469	Axis 29 output axis monitor device
D40048 to D40079	D14470 to D14499	Axis 30 output axis monitor device
D40080 to D40111	D14500 to D14529	Axis 31 output axis monitor device
D40112 to D40143	D14530 to D14559	Axis 32 output axis monitor device
D40144 to D40175		Axis 33 output axis monitor device
D40176 to D40207		Axis 34 output axis monitor device
D40208 to D40239		Axis 35 output axis monitor device
D40240 to D40271		Axis 36 output axis monitor device
D40272 to D40303		Axis 37 output axis monitor device
D40304 to D40335		Axis 38 output axis monitor device
D40336 to D40367		Axis 39 output axis monitor device
D40368 to D40399		Axis 40 output axis monitor device
D40400 to D40431		Axis 41 output axis monitor device
D40432 to D40463		Axis 42 output axis monitor device
D40464 to D40495		Axis 43 output axis monitor device
D40496 to D40527		Axis 44 output axis monitor device
D40528 to D40559		Axis 45 output axis monitor device
D40560 to D40591		Axis 46 output axis monitor device
D40592 to D40623		Axis 47 output axis monitor device
D40624 to D40655		Axis 48 output axis monitor device
D40656 to D40687		Axis 49 output axis monitor device

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
D40688 to D40719		Axis 50 output axis monitor device
D40720 to D40751		Axis 51 output axis monitor device
D40752 to D40783		Axis 52 output axis monitor device
D40784 to D40815		Axis 53 output axis monitor device
D40816 to D40847		Axis 54 output axis monitor device
D40848 to D40879		Axis 55 output axis monitor device
D40880 to D40911		Axis 56 output axis monitor device
D40912 to D40943		Axis 57 output axis monitor device
D40944 to D40975		Axis 58 output axis monitor device
D40976 to D41007		Axis 59 output axis monitor device
D41008 to D41039		Axis 60 output axis monitor device
D41040 to D41071		Axis 61 output axis monitor device
D41072 to D41103		Axis 62 output axis monitor device
D41104 to D41135		Axis 63 output axis monitor device
D41136 to D41167		Axis 64 output axis monitor device

• Details for each axis

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D39120+32n	D13600+30n	Md.400	Current value after composite main shaft gear	Operation cycle	—	Monitor device
D39121+32n	D13601+30n					
D39122+32n	D13602+30n	Md.401	Current value per cycle after main shaft gear			
D39123+32n	D13603+30n					
D39124+32n	D13604+30n	Md.402	Current value per cycle after auxiliary shaft gear			
D39125+32n	D13605+30n					
D39126+32n	D13606+30n	Md.422	Main shaft clutch slippage (accumulative)			
D39127+32n	D13607+30n					
D39128+32n	D13608+30n	Md.425	Auxiliary shaft clutch slippage (accumulative)			
D39129+32n	D13609+30n					
D39130+32n	D13610+30n	Md.406	Cam axis phase compensation amount			
D39131+32n	D13611+30n					
D39132+32n	D13612+30n	Md.407	Cam axis current value per cycle			
D39133+32n	D13613+30n					
D39134+32n	D13614+30n	Md.408	Cam reference position			
D39135+32n	D13615+30n					
D39136+32n	D13616+30n	Md.409	Cam axis current feed value			
D39137+32n	D13617+30n					
D39138+32n	D13618+30n	Md.410	Execute cam No.			
D39139+32n	D13619+30n	—	Unusable	—	—	—
D39140+32n	D13620+30n	Md.411	Execute cam stroke amount	Operation cycle	—	Monitor device
D39141+32n	D13621+30n					
D39142+32n	D13622+30n	Md.412	Execute cam axis length per cycle			
D39143+32n	D13623+30n					
D39144+32n	D13624+30n	—	Unusable	—	—	—
D39145+32n	D13625+30n					
D39146+32n	D13626+30n					
D39147+32n	D13627+30n					
D39148+32n	D13628+30n					
D39149+32n	D13629+30n					
D39150+32n						
D39151+32n						

Point

- The following range is valid. R16MTCPU: Axis No.1 to 16, R32MTCPU: Axis No.1 to 32.
- The following device area can be used as a user device. R16MTCPU: 17 axes or more, R32MTCPU: 33 axes or more. However, when the project of R16MTCPU is replaced with R32MTCPU/R64MTCPU, or the project of R32MTCPU is replaced with R64MTCPU, this area cannot be used as a user device.
- Refer to the following for details of output axis monitor device.
  MELSEC iQ-R Motion Controller Programming Manual (Advanced Synchronous Control)

Output axis control device

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
D42640 to D42799	D15000 to D15149	Axis 1 output axis control device
D42800 to D42959	D15150 to D15299	Axis 2 output axis control device
D42960 to D43119	D15300 to D15449	Axis 3 output axis control device
D43120 to D43279	D15450 to D15599	Axis 4 output axis control device
D43280 to D43439	D15600 to D15749	Axis 5 output axis control device
D43440 to D43599	D15750 to D15899	Axis 6 output axis control device
D43600 to D43759	D15900 to D16049	Axis 7 output axis control device
D43760 to D43919	D16050 to D16199	Axis 8 output axis control device
D43920 to D44079	D16200 to D16349	Axis 9 output axis control device
D44080 to D44239	D16350 to D16499	Axis 10 output axis control device
D44240 to D44399	D16500 to D16649	Axis 11 output axis control device
D44400 to D44559	D16650 to D16799	Axis 12 output axis control device
D44560 to D44719	D16800 to D16949	Axis 13 output axis control device
D44720 to D44879	D16950 to D17099	Axis 14 output axis control device
D44880 to D45039	D17100 to D17249	Axis 15 output axis control device
D45040 to D45199	D17250 to D17399	Axis 16 output axis control device
D45200 to D45359	D17400 to D17549	Axis 17 output axis control device
D45360 to D45519	D17550 to D17699	Axis 18 output axis control device
D45520 to D45679	D17700 to D17849	Axis 19 output axis control device
D45680 to D45839	D17850 to D17999	Axis 20 output axis control device
D45840 to D45999	D18000 to D18149	Axis 21 output axis control device
D46000 to D46159	D18150 to D18299	Axis 22 output axis control device
D46160 to D46319	D18300 to D18449	Axis 23 output axis control device
D46320 to D46479	D18450 to D18599	Axis 24 output axis control device
D46480 to D46639	D18600 to D18749	Axis 25 output axis control device
D46640 to D46799	D18750 to D18899	Axis 26 output axis control device
D46800 to D46959	D18900 to D19049	Axis 27 output axis control device
D46960 to D47119	D19050 to D19199	Axis 28 output axis control device
D47120 to D47279	D19200 to D19349	Axis 29 output axis control device
D47280 to D47439	D19350 to D19499	Axis 30 output axis control device
D47440 to D47599	D19500 to D19649	Axis 31 output axis control device
D47600 to D47759	D19650 to D19799	Axis 32 output axis control device
D47760 to D47919		Axis 33 output axis monitor device
D47920 to D48079		Axis 34 output axis monitor device
D48080 to D48239		Axis 35 output axis monitor device
D48240 to D48399		Axis 36 output axis monitor device
D48400 to D48559		Axis 37 output axis monitor device
D48560 to D48719		Axis 38 output axis monitor device
D48720 to D48879		Axis 39 output axis monitor device
D48880 to D49039		Axis 40 output axis monitor device
D49040 to D49199		Axis 41 output axis monitor device
D49200 to D49359		Axis 42 output axis monitor device
D49360 to D49519		Axis 43 output axis monitor device
D49520 to D49679		Axis 44 output axis monitor device
D49680 to D49839		Axis 45 output axis monitor device
D49840 to D49999		Axis 46 output axis monitor device
D50000 to D50159		Axis 47 output axis monitor device
D50160 to D50319		Axis 48 output axis monitor device
D50320 to D50479		Axis 49 output axis monitor device

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
D50480 to D50639		Axis 50 output axis monitor device
D50640 to D50799		Axis 51 output axis monitor device
D50800 to D50959		Axis 52 output axis monitor device
D50960 to D51119		Axis 53 output axis monitor device
D51120 to D51279		Axis 54 output axis monitor device
D51280 to D51439		Axis 55 output axis monitor device
D51440 to D51599		Axis 56 output axis monitor device
D51600 to D51759		Axis 57 output axis monitor device
D51760 to D51919		Axis 58 output axis monitor device
D51920 to D52079		Axis 59 output axis monitor device
D52080 to D52239		Axis 60 output axis monitor device
D52240 to D52399		Axis 61 output axis monitor device
D52400 to D52559		Axis 62 output axis monitor device
D52560 to D52719		Axis 63 output axis monitor device
D52720 to D52879		Axis 64 output axis monitor device

• Details for each axis

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D42640+160n	D15000+150n	Pr.400	Main input axis No.	—	At start of synchronous control	Command device
D42641+160n	D15001+150n	Pr.401	Sub input axis No.			
D42642+160n	D15002+150n	Pr.402	Composite main shaft gear		Operation cycle	
D42643+160n	D15003+150n	—	Unusable	—	—	—
D42644+160n	D15004+150n	Pr.403	Main shaft gear: Numerator	—	At start of synchronous control	Command device
D42645+160n	D15005+150n					
D42646+160n	D15006+150n	Pr.404	Main shaft gear: Denominator			
D42647+160n	D15007+150n					
D42648+160n	D15008+150n	Pr.405	Main shaft clutch control setting		Operation cycle	
D42649+160n	D15009+150n	Pr.406	Main shaft clutch reference address setting		At start of synchronous control	
D42650+160n	D15010+150n	Pr.407	Main shaft clutch ON address		Operation cycle	
D42651+160n	D15011+150n					
D42652+160n	D15012+150n	Pr.408	Travel value before main shaft clutch ON		At completing clutch ON condition	
D42653+160n	D15013+150n					
D42654+160n	D15014+150n	Pr.409	Main shaft clutch OFF address		Operation cycle	
D42655+160n	D15015+150n					
D42656+160n	D15016+150n	Pr.410	Travel value before main shaft clutch OFF		At completing clutch OFF condition	
D42657+160n	D15017+150n					
D42658+160n	D15018+150n	Pr.411	Main shaft clutch smoothing method		At start of synchronous control	
D42659+160n	D15019+150n	Pr.412	Main shaft clutch smoothing time constant			
D42660+160n	D15020+150n	Pr.413	Slippage amount at main shaft clutch ON		At turning clutch ON	
D42661+160n	D15021+150n					
D42662+160n	D15022+150n	Pr.414	Slippage amount at main shaft clutch OFF		At turning clutch OFF	
D42663+160n	D15023+150n					
D42664+160n	D15024+150n	Pr.418	Auxiliary shaft axis No.		At start of synchronous control	
D42665+160n	D15025+150n	Pr.419	Composite auxiliary shaft gear		Operation cycle	
D42666+160n	D15026+150n	Pr.420	Auxiliary shaft gear: Numerator		At start of synchronous control	
D42667+160n	D15027+150n					
D42668+160n	D15028+150n	Pr.421	Auxiliary shaft gear: Denominator			
D42669+160n	D15029+150n					
D42670+160n	D15030+150n	Pr.422	Auxiliary shaft clutch control setting		Operation cycle	
D42671+160n	D15031+150n	Pr.423	Auxiliary shaft clutch reference address setting		At start of synchronous control	
D42672+160n	D15032+150n	Pr.424	Auxiliary shaft clutch ON address		Operation cycle	
D42673+160n	D15033+150n					
D42674+160n	D15034+150n	Pr.425	Travel value before auxiliary shaft clutch ON		At completing clutch ON condition	
D42675+160n	D15035+150n					
D42676+160n	D15036+150n	Pr.426	Auxiliary shaft clutch OFF address		Operation cycle	
D42677+160n	D15037+150n					
D42678+160n	D15038+150n	Pr.427	Travel value before auxiliary shaft clutch OFF		At completing clutch OFF condition	
D42679+160n	D15039+150n					

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D42680+160n	D15040+150n	Pr.428	Auxiliary shaft clutch smoothing method	—	At start of synchronous control	Command device
D42681+160n	D15041+150n	Pr.429	Auxiliary shaft clutch smoothing time constant			
D42682+160n	D15042+150n	Pr.430	Slippage amount at auxiliary shaft clutch ON		At turning clutch ON	
D42683+160n	D15043+150n					
D42684+160n	D15044+150n	Pr.431	Slippage amount at auxiliary shaft clutch OFF		At turning clutch OFF	
D42685+160n	D15045+150n					
D42686+160n	D15046+150n	Pr.434	Speed change gear 1		At start of synchronous control	
D42687+160n	D15047+150n	Pr.435	Speed change gear 1 smoothing time constant			
D42688+160n	D15048+150n	Pr.436	Speed change ratio 1: Numerator		Operation cycle	
D42689+160n	D15049+150n					
D42690+160n	D15050+150n	Pr.437	Speed change ratio 1: Denominator		Operation cycle	
D42691+160n	D15051+150n					
D42692+160n	D15052+150n	Pr.490	Speed change gear 2		At start of synchronous control	
D42693+160n	D15053+150n	Pr.491	Speed change gear 2 smoothing time constant			
D42694+160n	D15054+150n	Pr.492	Speed change ratio 2: Numerator		Operation cycle	
D42695+160n	D15055+150n					
D42696+160n	D15056+150n	Pr.493	Speed change ratio 2: Denominator			
D42697+160n	D15057+150n					
D42698+160n	D15058+150n	Pr.438	Cam axis cycle unit setting		At start of synchronous control	
D42699+160n	D15059+150n	Pr.442	Cam axis length per cycle change setting			
D42700+160n	D15060+150n	Pr.439	Cam axis length per cycle			
D42701+160n	D15061+150n					
D42702+160n	D15062+150n	Pr.440	Cam No.		At start of synchronous control, At passing through the 0th point of cam data	
D42703+160n	D15063+150n	—	Unusable	—	—	—
D42704+160n	D15064+150n	Pr.441	Cam stroke amount	—	At start of synchronous control, At passing through the 0th point of cam data	Command device
D42705+160n	D15065+150n					
D42706+160n	D15066+150n	Pr.444	Cam axis phase compensation advance time		Operation cycle	
D42707+160n	D15067+150n					
D42708+160n	D15068+150n	Pr.445	Cam axis phase compensation time constant		At start of synchronous control	
D42709+160n	D15069+150n	Pr.448	Synchronous control parameter block No.			
D42710+160n	D15070+150n	Pr.447	Output axis smoothing time constant			

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D42711+160n	D15071+150n	—	Unusable	—	—	—
D42712+160n	D15072+150n					
D42713+160n	D15073+150n					
D42714+160n	D15074+150n					
D42715+160n	D15075+150n					
D42716+160n	D15076+150n					
D42717+160n	D15077+150n					
D42718+160n	D15078+150n					
D42719+160n	D15079+150n					
D42720+160n	D15080+150n					
D42721+160n	D15081+150n					
D42722+160n	D15082+150n					
D42723+160n	D15083+150n					
D42724+160n	D15084+150n					
D42725+160n	D15085+150n					
D42726+160n	D15086+150n					
D42727+160n	D15087+150n					
D42728+160n	D15088+150n					
D42729+160n	D15089+150n					
D42730+160n	D15090+150n					
D42731+160n	D15091+150n					
D42732+160n	D15092+150n					
D42733+160n	D15093+150n					
D42734+160n	D15094+150n					
D42735+160n	D15095+150n					
D42736+160n	D15096+150n					
D42737+160n	D15097+150n					
D42738+160n	D15098+150n					
D42739+160n	D15099+150n					
D42740+160n	D15100+150n	Pr.460	Setting method of current value per cycle after main shaft gear	—	At start of synchronous control	Command device
D42741+160n	D15101+150n	Pr.461	Setting method of current value per cycle after auxiliary shaft gear			
D42742+160n	D15102+150n	Pr.462	Cam axis position restoration object			
D42743+160n	D15103+150n	Pr.463	Setting method of cam reference position			
D42744+160n	D15104+150n	Pr.464	Setting method of cam axis current value per cycle			
D42745+160n	D15105+150n	—	Unusable	—	—	—
D42746+160n	D15106+150n	Pr.465	Current value per cycle after main shaft gear (Initial setting)	—	At start of synchronous control	Command device
D42747+160n	D15107+150n					
D42748+160n	D15108+150n	Pr.466	Current value per cycle after auxiliary shaft gear (Initial setting)			
D42749+160n	D15109+150n					
D42750+160n	D15110+150n	Pr.467	Cam reference position (Initial setting)			
D42751+160n	D15111+150n					
D42752+160n	D15112+150n	Pr.468	Cam axis current value per cycle (Initial setting)			
D42753+160n	D15113+150n					

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D42754+160n	D15114+150n	—	Unusable	—	—	—
D42755+160n	D15115+150n					
D42756+160n	D15116+150n					
D42757+160n	D15117+150n					
D42758+160n	D15118+150n					
D42759+160n	D15119+150n					
D42760+160n	D15120+150n					
D42761+160n	D15121+150n					
D42762+160n	D15122+150n					
D42763+160n	D15123+150n					
D42764+160n	D15124+150n					
D42765+160n	D15125+150n					
D42766+160n	D15126+150n					
D42767+160n	D15127+150n					
D42768+160n	D15128+150n					
D42769+160n	D15129+150n					
D42770+160n	D15130+150n	Cd.407	Synchronous control change command	—	At requesting synchronous control change	Command device
D42771+160n	D15131+150n	Cd.409	Synchronous control reflection time			
D42772+160n	D15132+150n	Cd.408	Synchronous control change value			
D42773+160n	D15133+150n					
D42774+160n	D15134+150n	—	Unusable	—	—	—
D42775+160n	D15135+150n					
D42776+160n	D15136+150n					
D42777+160n	D15137+150n					
D42778+160n	D15138+150n					
D42779+160n	D15139+150n					
D42780+160n	D15140+150n					
D42781+160n	D15141+150n					
D42782+160n	D15142+150n					
D42783+160n	D15143+150n					
D42784+160n	D15144+150n					
D42785+160n	D15145+150n					
D42786+160n	D15146+150n					
D42787+160n	D15147+150n					
D42788+160n	D15148+150n					
D42789+160n	D15149+150n					
D42790+160n						
D42791+160n						
D42792+160n						
D42793+160n						
D42794+160n						
D42795+160n						
D42796+160n						
D42797+160n						
D42798+160n						
D42799+160n						

Point

- The following range is valid. R16MTCPU: Axis No.1 to 16, R32MTCPU: Axis No.1 to 32.
- The following device area can be used as a user device. R16MTCPU: 17 axes or more, R32MTCPU: 33 axes or more. However, when the project of R16MTCPU is replaced with R32MTCPU/R64MTCPU, or the project of R32MTCPU is replaced with R64MTCPU, this area cannot be used as a user device.
- Refer to the following for details of output axis monitor device.
  MELSEC iQ-R Motion Controller Programming Manual (Advanced Synchronous Control)

Machine control device

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
D52896 to D52927		Machine 1 machine control device
D52928 to D52959		Machine 2 machine control device
D52960 to D52991		Machine 3 machine control device
D52992 to D53023		Machine 4 machine control device
D53024 to D53055		Machine 5 machine control device
D53056 to D53087		Machine 6 machine control device
D53088 to D53119		Machine 7 machine control device
D53120 to D53151		Machine 8 machine control device

- Details for each machine

Device No.		Symbol	Signal name		Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment						
D52896+32m		Cd.2160	Machine JOG speed setting(mm)		—	At machine JOG start	Command device
D52897+32m							
D52898+32m		Cd.2161	Machine JOG speed setting(degree)				
D52899+32m							
D52900+32m		Cd.2162	Machine JOG coordinate system setting				
D52901+32m		Cd.2163	Base/tool translation change method			At base/tool translation change command ON	
D52902+32m		Cd.2164	Base/tool translation setting	X			
D52903+32m							
D52904+32m		Cd.2165		Y			
D52905+32m							
D52906+32m		Cd.2166		Z			
D52907+32m							
D52908+32m		Cd.2167		A			
D52909+32m							
D52910+32m		Cd.2168		B			
D52911+32m							
D52912+32m		Cd.2169		C			
D52913+32m							
D52914+32m		—	Unusable		—	—	—
D52915+32m							
D52916+32m							
D52917+32m							
D52918+32m							
D52919+32m							
D52920+32m							
D52921+32m							
D52922+32m							
D52923+32m							
D52924+32m							
D52925+32m							
D52926+32m							
D52927+32m							

Point

Refer to the following for details of machine command signal.

MELSEC iQ-R Motion Controller Programming Manual (Machine Control)

2

Machine monitor device

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
D53168 to D53295		Machine 1 machine monitor device
D53296 to D53423		Machine 2 machine monitor device
D53424 to D53551		Machine 3 machine monitor device
D53552 to D53679		Machine 4 machine monitor device
D53680 to D53807		Machine 5 machine monitor device
D53808 to D53935		Machine 6 machine monitor device
D53936 to D54063		Machine 7 machine monitor device
D54064 to D54191		Machine 8 machine monitor device

- Details for each machine

Device No.		Symbol	Signal name		Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment						
D53168+128m		Md.2020	Machine type		At power ON	—	Monitor device
D53169+128m		Md.2021	Machine operating range type				
D53170+128m		Md.2022	Machine error code		Immediate		
D53171+128m		Md.2023	Machine warning code				
D53172+128m		Md.2024	Machine axes configuration		At power ON		
D53173+128m							
D53174+128m							
D53175+128m							
D53176+128m		Md.2025	Feed current value (world coordinate system)	X	Operation cycle		
D53177+128m							
D53178+128m		Md.2026		Y			
D53179+128m							
D53180+128m		Md.2027		Z			
D53181+128m							
D53182+128m		Md.2028		A			
D53183+128m							
D53184+128m		Md.2029		B			
D53185+128m							
D53186+128m		Md.2030		C			
D53187+128m							
D53188+128m		Md.2031		FL1			
D53189+128m		—	Unusable		—	—	—
D53190+128m		Md.2033	Feed current value (joint coordinate system)	J1	Operation cycle	—	Monitor device
D53191+128m							
D53192+128m		Md.2034		J2			
D53193+128m							
D53194+128m		Md.2035		J3			
D53195+128m							
D53196+128m		Md.2036		J4			
D53197+128m							
D53198+128m		Md.2037		J5			
D53199+128m							
D53200+128m		Md.2038		J6			
D53201+128m							

Device No.		Symbol	Signal name		Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment						
D53202+128m		Md.2039	Command coordinate value (world coordinate system)	X	Operation cycle	—	Monitor device
D53203+128m							
D53204+128m		Md.2040		Y			
D53205+128m							
D53206+128m		Md.2041		Z			
D53207+128m							
D53208+128m		Md.2042		A			
D53209+128m							
D53210+128m		Md.2043		B			
D53211+128m							
D53212+128m		Md.2044		C			
D53213+128m							
D53214+128m		Md.2045		FL1			
D53215+128m		—	Unusable		—	—	—
D53216+128m		Md.2047	Command coordinate value (joint coordinate system)	J1	Operating cycle	—	Monitor device
D53217+128m							
D53218+128m		Md.2048		J2			
D53219+128m							
D53220+128m		Md.2049		J3			
D53221+128m							
D53222+128m		Md.2050		J4			
D53223+128m							
D53224+128m		Md.2051		J5			
D53225+128m							
D53226+128m		Md.2052		J6			
D53227+128m							
D53228+128m		Md.2053	Feed current value (base coordinate system)	X			
D53229+128m							
D53230+128m		Md.2054		Y			
D53231+128m							
D53232+128m		Md.2055		Z			
D53233+128m							
D53234+128m		Md.2056		A			
D53235+128m							
D53236+128m		Md.2057		B			
D53237+128m							
D53238+128m		Md.2058		C			
D53239+128m							
D53240+128m		Md.2059		FL1			
D53241+128m		—	Unusable		—	—	—

Device No.		Symbol	Signal name		Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment						
D53242+128m		Md.2061	Base translation	X	Operation cycle	—	Monitor device
D53243+128m							
D53244+128m		Md.2062		Y			
D53245+128m							
D53246+128m		Md.2063		Z			
D53247+128m							
D53248+128m		Md.2064		A			
D53249+128m							
D53250+128m		Md.2065		B			
D53251+128m							
D53252+128m		Md.2066		C			
D53253+128m							
D53254+128m		—	Unusable		—	—	—
D53255+128m							
D53256+128m		Md.2069	Tool translation	X	Operation cycle	—	Monitor device
D53257+128m							
D53258+128m		Md.2070		Y			
D53259+128m							
D53260+128m		Md.2071		Z			
D53261+128m							
D53262+128m		—	Unusable		—	—	—
D53263+128m							
D53264+128m							
D53265+128m							
D53266+128m							
D53267+128m							
D53268+128m							
D53269+128m							
D53270+128m		Md.2077	Machine execute program No.		At start	—	Monitor device
D53271+128m		Md.2078	Machine execute point No.		Operation cycle		
D53272+128m		Md.2079	Positioning point block No.				
D53273+128m		Md.2080	Machine M-code				
D53274+128m		Md.2081	Arrival rate				
D53275+128m		—	Unusable		—	—	—
D53276+128m		Md.2083	Machine program operation target speed		Operation cycle	—	Monitor device
D53277+128m							
D53278+128m		Md.2084	Real current value (World coordinate system)	X			
D53279+128m							
D53280+128m		Md.2085		Y			
D53281+128m							
D53282+128m		Md.2086		Z			
D53283+128m							
D53284+128m		Md.2087		A			
D53285+128m							
D53286+128m		Md.2088		B			
D53287+128m							
D53288+128m		Md.2089		C			
D53289+128m							
D53290+128m		Md.2090		FL1			

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D53291+128m		—	Unusable	—	—	—
D53292+128m						
D53293+128m						
D53294+128m						
D53295+128m						

Point

Refer to the following for details of machine command signal.
MELSEC iQ-R Motion Controller Programming Manual (Machine Control)

G-code control common command signal

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D54224.0		—	Unusable	—	—	—
D54224.1						
D54224.2						
D54224.3						
D54224.4						
D54224.5						
D54224.6						
D54224.7						
D54224.8						
D54224.9						
D54224.A						
D54224.B						
D54224.C						
D54224.D						
D54224.E						
D54224.F						
D54225.0		Rq.3344	Program load request while running	—	Main cycle	Command signal
D54225.1		—	Unusable	—	—	—
D54225.2						
D54225.3						
D54225.4						
D54225.5						
D54225.6						
D54225.7						
D54225.8						
D54225.9						
D54225.A						
D54225.B						
D54225.C						
D54225.D						
D54225.E						
D54225.F						

Point

Refer to the following for details of G-code control common command signal.

MELSEC iQ-R Motion Controller Programming Manual (G-Code Control)

G-code control common control device

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D54262		—	Unusable	—	—	—
D54263						
D54264		Cd.3305	Program No. for loading while running	—	At running program load request ON	Command device
D54265		—	Unusable	—	—	—
D54266						
D54267						
D54268						
D54269						
D54270						
D54271						
D54272						
D54273						
D54274						
D54275						
D54276						
D54277						

Point

Refer to the following for details of G-code control common control device.

MELSEC iQ-R Motion Controller Programming Manual (G-Code Control)

G-code control common status

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D54438.0		St.3272	G-code control operation cycle over flag	G-code control operation cycle	—	Status signal
D54438.1		—	Unusable	—	—	—
D54438.2						
D54438.3						
D54438.4						
D54438.5						
D54438.6						
D54438.7						
D54438.8						
D54438.9						
D54438.A						
D54438.B						
D54438.C						
D54438.D						
D54438.E						
D54438.F						
D54439.0						
D54439.1						
D54439.2						
D54439.3						
D54439.4						
D54439.5						
D54439.6						
D54439.7						
D54439.8						
D54439.9						
D54439.A						
D54439.B						
D54439.C						
D54439.D						
D54439.E						
D54439.F						

Point

Refer to the following for details of G-code control common status.

📖MELSEC iQ-R Motion Controller Programming Manual (G-Code Control)

G-code control common monitor device

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D54480		Md.3000	G-code control setting operation cycle	STOP→RUN	—	Monitor device
D54481		Md.3001	G-code control operation cycle	G-code control operation cycle		
D54482		Md.3002	G-code control maximum operation cycle			
D54483		—	Unusable	—	—	—
D54484						
D54485						
D54486						
D54487						
D54488						
D54489						
D54490						
D54491						
D54492		Md.3003	Program load status while running	Main cycle	—	Monitor device
D54493		Md.3004	Program load error information while running			
D54494		—	Unusable	—	—	—
D54495						

Point

Refer to the following for details of G-code control common monitor device.
MELSEC iQ-R Motion Controller Programming Manual (G-Code Control)

G-code control line command signal

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
D54226 to D54227		Line 1 G-code control line command signal
D54228 to D54229		Line 2 G-code control line command signal

• Details for each line

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D54226.0+2s		Rq.3376	G-code control request	—	Main cycle/G-code control operation cycle	Command signal
D54226.1+2s		Rq.3377	Automatic operation start (cycle start)		G-code control operation cycle	
D54226.2+2s		Rq.3378	Automatic operation hold (feed hold)			
D54226.3+2s		Rq.3379	Single block			
D54226.4+2s		Rq.3380	Reset command			
D54226.5+2s		—	Unusable	—	—	—
D54226.6+2s						
D54226.7+2s						
D54226.8+2s		Rq.3381	Program operation mode (memory mode)	—	G-code control operation cycle	Command signal
D54226.9+2s		—	Unusable	—	—	—
D54226.A+2s						
D54226.B+2s						
D54226.C+2s		Rq.3384	Macro single	—	At G-code program start	Command signal
D54226.D+2s		—	Unusable	—	—	—
D54226.E+2s						
D54226.F+2s						
D54227.0+2s		Rq.3382	Auxiliary function complete 1 (FIN1)	—	G-code control operation cycle	Command signal
D54227.1+2s		Rq.3383	Auxiliary function complete 2 (FIN2)			
D54227.2+2s		—	Unusable	—	—	—
D54227.3+2s						
D54227.4+2s						
D54227.5+2s						
D54227.6+2s						
D54227.7+2s						
D54227.8+2s						
D54227.9+2s						
D54227.A+2s						
D54227.B+2s						
D54227.C+2s						
D54227.D+2s						
D54227.E+2s						
D54227.F+2s						

Point

Refer to the following for details of G-code control line command signal.

MELSEC iQ-R Motion Controller Programming Manual (G-Code Control)

G-code control line control device

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
D54278 to D54293		Line 1 G-code control line control device
D54294 to D54309		Line 2 G-code control line control device

- Details for each line

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D54278+16s		Cd.3320	Program No. setting register	—	G-code control operation cycle	Command signal
D54279+16s		—	Unusable	—	—	—
D54280+16s		Cd.3321	Sequence No. setting register	—	G-code control operation cycle	Command signal
D54281+16s						
D54282+16s		Cd.3322	Block No. setting register			
D54283+16s						
D54284+16s		—	Unusable	—	—	—
D54285+16s						
D54286+16s						
D54287+16s						
D54288+16s						
D54289+16s						
D54290+16s						
D54291+16s						
D54292+16s						
D54293+16s						

Point

Refer to the following for details of G-code control line control device.

MELSEC iQ-R Motion Controller Programming Manual (G-Code Control)

G-code control line status

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
D54440 to D54443		Line 1 G-code control line status
D54444 to D54447		Line 2 G-code control line status

- Details for each line

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D54440.0+4s		St.3208	During G-code control	Main cycle	—	Status signal
D54440.1+4s		St.3209	G-code control error detection	Immediate		
D54440.2+4s		St.3210	All axes smoothing zero	G-code control operation cycle		
D54440.3+4s		—	Unusable	—	—	—
D54440.4+4s						
D54440.5+4s						
D54440.6+4s						
D54440.7+4s						
D54440.8+4s		St.3211	During memory mode	G-code control operation cycle	—	Status signal
D54440.9+4s		—	Unusable	—	—	—
D54440.A+4s						
D54440.B+4s						
D54440.C+4s						
D54440.D+4s						
D54440.E+4s						
D54440.F+4s						
D54441.0+4s		St.3212	During automatic operation	G-code control operation cycle	—	Status signal
D54441.1+4s		St.3213	Automatic operation starting			
D54441.2+4s		St.3214	Automatic operation holding			
D54441.3+4s		St.3215	G-code control finishing			
D54441.4+4s		—	Unusable	—	—	—
D54441.5+4s						
D54441.6+4s						
D54441.7+4s						
D54441.8+4s		St.3216	Resetting	G-code control operation cycle	—	Status signal
D54441.9+4s		St.3217	Reset complete			
D54441.A+4s		—	Unusable	—	—	—
D54441.B+4s						
D54441.C+4s						
D54441.D+4s						
D54441.E+4s						

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D54441.F+4s		St.3234	Macro single enabled	G-code control operation cycle	—	Status signal
D54442.0+4s		St.3218	M-code output M00			
D54442.1+4s		St.3219	M-code output M01			
D54442.2+4s		St.3220	M-code output M02			
D54442.3+4s		St.3221	M-code output M30			
D54442.4+4s		St.3222	Auxiliary function strobe 1			
D54442.5+4s		St.3223	Auxiliary function strobe 2			
D54442.6+4s		St.3224	Auxiliary function strobe 3			
D54442.7+4s		St.3225	Auxiliary function strobe 4			
D54442.8+4s		—	Unusable	—	—	—
D54442.9+4s						
D54442.A+4s						
D54442.B+4s						
D54442.C+4s						
D54442.D+4s						
D54442.E+4s						
D54442.F+4s						
D54443.0+4s						
D54443.1+4s						
D54443.2+4s						
D54443.3+4s						
D54443.4+4s						
D54443.5+4s						
D54443.6+4s						
D54443.7+4s						
D54443.8+4s						
D54443.9+4s						
D54443.A+4s						
D54443.B+4s						
D54443.C+4s						
D54443.D+4s						
D54443.E+4s						
D54443.F+4s						

Point

Refer to the following for details of G-code control line status.

MELSEC iQ-R Motion Controller Programming Manual (G-Code Control)

G-code control line monitor device

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
D54496 to D54623		Line 1 G-code control line monitor device
D54624 to D54751		Line 2 G-code control line monitor device

- Details for each line

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D54496+128s		Md.3016	Number of axes on line	STOP→RUN	—	Monitor device
D54497+128s		—	Unusable	—	—	—
D54498+128s		Md.3017	G-code control axis configuration	STOP→RUN	—	Monitor device
D54499+128s						
D54500+128s						
D54501+128s						
D54502+128s		Md.3018	Speed	G-code control operation cycle	—	
D54503+128s						
D54504+128s		Md.3019	G-code control error code	Immediate		
D54505+128s		Md.3020	G-code control error details code 1			
D54506+128s		Md.3021	G-code control error details code 2			
D54507+128s		—	Unusable	—	—	—
D54508+128s		Md.3022	Program No. being executed (main)	At G-code program start	—	Monitor device
D54509+128s		—	Unusable	—	—	—
D54510+128s		Md.3023	Sequence No. being executed (main)	G-code control operation cycle	—	Monitor device
D54511+128s						
D54512+128s		Md.3024	Block No. being executed (main)			
D54513+128s						
D54514+128s		Md.3025	Program No. being executed (sub)			
D54515+128s		—	Unusable	—	—	—
D54516+128s		Md.3026	Sequence No. being executed (sub)	G-code control operation cycle	—	Monitor device
D54517+128s						
D54518+128s		Md.3027	Block No. being executed (sub)			
D54519+128s						
D54520+128s		Md.3028	Group 01 modal status			
D54521+128s		Md.3029	Group 02 modal status			
D54522+128s		Md.3030	Group 03 modal status			
D54523+128s		—	Unusable	—	—	—
D54524+128s						
D54525+128s						
D54526+128s		Md.3034	Group 07 modal status	G-code control operation cycle	—	Monitor device
D54527+128s		Md.3035	Tool radius compensation No.			
D54528+128s		Md.3036	Tool radius compensation amount			
D54529+128s						
D54530+128s		—	Unusable	—	—	—
D54531+128s						

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D54532+128s		Md.3038	Group 08 modal status	G-code control operation cycle	—	Monitor device
D54533+128s		Md.3039	Tool length compensation No.			
D54534+128s		Md.3040	Tool length compensation amount			
D54535+128s						
D54536+128s		—	Unusable	—	—	—
D54537+128s						
D54538+128s		Md.3042	Tool length compensation axis No.	G-code control operation cycle	—	Monitor device
D54539+128s		—	Unusable	—	—	—
D54540+128s						
D54541+128s						
D54542+128s		Md.3046	Group 12 modal status	G-code control operation cycle	—	Monitor device
D54543+128s		Md.3047	Group 13 modal status			
D54544+128s		—	Unusable	—	—	—
D54545+128s		Md.3049	Group 15 modal status	G-code control operation cycle	—	Monitor device
D54546+128s		Md.3050	Group 16 modal status			
D54547+128s		—	Unusable	—	—	—
D54548+128s						
D54549+128s						
D54550+128s						
D54551+128s		Md.3055	Group 21 modal status	G-code control operation cycle	—	Monitor device
D54552+128s		—	Unusable	—	—	—
D54553+128s						
D54554+128s		Md.3058	M-code data 1	G-code control operation cycle	—	Monitor device
D54555+128s						
D54556+128s		Md.3059	M-code data 2			
D54557+128s						
D54558+128s		Md.3060	M-code data 3			
D54559+128s						
D54560+128s		Md.3061	M-code data 4			
D54561+128s						

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D54562+128s		—	Unusable	—	—	—
D54563+128s						
D54564+128s						
D54565+128s						
D54566+128s						
D54567+128s						
D54568+128s						
D54569+128s						
D54570+128s						
D54571+128s						
D54572+128s						
D54573+128s						
D54574+128s						
D54575+128s						
D54576+128s						
D54577+128s						
D54578+128s						
D54579+128s						
D54580+128s						
D54581+128s						
D54582+128s						
D54583+128s						
D54584+128s						
D54585+128s						
D54586+128s						
D54587+128s						
D54588+128s		Md.3070	Program comment being executed	At G-code program start	—	Monitor device
D54589+128s						
D54590+128s						
D54591+128s						
D54592+128s						
D54593+128s						
D54594+128s						
D54595+128s						

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D54596+128s		—	Unusable	—	—	—
D54597+128s						
D54598+128s						
D54599+128s						
D54600+128s						
D54601+128s						
D54602+128s						
D54603+128s						
D54604+128s						
D54605+128s						
D54606+128s						
D54607+128s						
D54608+128s						
D54609+128s						
D54610+128s						
D54611+128s						
D54612+128s						
D54613+128s						
D54614+128s						
D54615+128s						
D54616+128s						
D54617+128s						
D54618+128s						
D54619+128s						
D54620+128s						
D54621+128s						
D54622+128s						
D54623+128s						

Point

Refer to the following for details of G-code control line monitor device.

MELSEC iQ-R Motion Controller Programming Manual (G-Code Control)

G-code control line monitor device (expansion)

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
D55264 to D55423		Line 1 G-code control line monitor device (expansion)
D55424 to D55583		Line 2 G-code control line monitor device (expansion)

- Details for each line

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D55264+160s		Md.3178	Program monitor being executed (1st line)	At block change	—	Monitor device
D55265+160s						
D55266+160s						
D55267+160s						
D55268+160s						
D55269+160s						
D55270+160s						
D55271+160s						
D55272+160s						
D55273+160s						
D55274+160s						
D55275+160s						
D55276+160s						
D55277+160s						
D55278+160s						
D55279+160s						
D55280+160s						
D55281+160s						
D55282+160s						
D55283+160s						
D55284+160s						
D55285+160s						
D55286+160s						
D55287+160s						
D55288+160s						
D55289+160s						
D55290+160s						
D55291+160s						
D55292+160s						
D55293+160s						
D55294+160s						
D55295+160s						

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D55296+160s		Md.3179	Program monitor being executed (2nd line)	At block change	—	Monitor device
D55297+160s						
D55298+160s						
D55299+160s						
D55300+160s						
D55301+160s						
D55302+160s						
D55303+160s						
D55304+160s						
D55305+160s						
D55306+160s						
D55307+160s						
D55308+160s						
D55309+160s						
D55310+160s						
D55311+160s						
D55312+160s						
D55313+160s						
D55314+160s						
D55315+160s						
D55316+160s						
D55317+160s						
D55318+160s						
D55319+160s						
D55320+160s						
D55321+160s						
D55322+160s						
D55323+160s						
D55324+160s						
D55325+160s						
D55326+160s						
D55327+160s						

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D55328+160s		Md.3180	Program monitor being executed (3rd line)	At block change	—	Monitor device
D55329+160s						
D55330+160s						
D55331+160s						
D55332+160s						
D55333+160s						
D55334+160s						
D55335+160s						
D55336+160s						
D55337+160s						
D55338+160s						
D55339+160s						
D55340+160s						
D55341+160s						
D55342+160s						
D55343+160s						
D55344+160s						
D55345+160s						
D55346+160s						
D55347+160s						
D55348+160s						
D55349+160s						
D55350+160s						
D55351+160s						
D55352+160s						
D55353+160s						
D55354+160s						
D55355+160s						
D55356+160s						
D55357+160s						
D55358+160s						
D55359+160s						
D55360+160s		—	Unusable	—	—	—
D55361+160s						
D55362+160s						
D55363+160s						
D55364+160s						
D55365+160s						
D55366+160s						
D55367+160s						
D55368+160s						
D55369+160s						
D55370+160s						
D55371+160s						
D55372+160s						
D55373+160s						
D55374+160s						
D55375+160s						
D55376+160s						

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D55377+160s		—	Unusable	—	—	—
D55378+160s						
D55379+160s						
D55380+160s						
D55381+160s						
D55382+160s						
D55383+160s						
D55384+160s						
D55385+160s						
D55386+160s						
D55387+160s						
D55388+160s						
D55389+160s						
D55390+160s						
D55391+160s						
D55392+160s						
D55393+160s						
D55394+160s						
D55395+160s						
D55396+160s						
D55397+160s						
D55398+160s						
D55399+160s						
D55400+160s						
D55401+160s						
D55402+160s						
D55403+160s						
D55404+160s						
D55405+160s						
D55406+160s						
D55407+160s						
D55408+160s						
D55409+160s						
D55410+160s						
D55411+160s						
D55412+160s						
D55413+160s						
D55414+160s						
D55415+160s						
D55416+160s						
D55417+160s						
D55418+160s						
D55419+160s						
D55420+160s						
D55421+160s						
D55422+160s						
D55423+160s						

Point

Refer to the following for details of G-code control line monitor device (expansion).

MELSEC iQ-R Motion Controller Programming Manual (G-Code Control)

G-code control axis status

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
D54448, D54449		Line 1 G-code control axis status of axis 1
D54450, D54451		Line 1 G-code control axis status of axis 2
D54452, D54453		Line 1 G-code control axis status of axis 3
D54454, D54455		Line 1 G-code control axis status of axis 4
D54456, D54457		Line 1 G-code control axis status of axis 5
D54458, D54459		Line 1 G-code control axis status of axis 6
D54460, D54461		Line 1 G-code control axis status of axis 7
D54462, D54463		Line 1 G-code control axis status of axis 8
D54464, D54465		Line 2 G-code control axis status of axis 1
D54466, D54467		Line 2 G-code control axis status of axis 2
D54468, D54469		Line 2 G-code control axis status of axis 3
D54470, D54471		Line 2 G-code control axis status of axis 4
D54472, D54473		Line 2 G-code control axis status of axis 5
D54474, D54475		Line 2 G-code control axis status of axis 6
D54476, D54477		Line 2 G-code control axis status of axis 7
D54478, D54479		Line 2 G-code control axis status of axis 8

- Details for each line

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D54448.0+2sn		St.3076	Smoothing zero	G-code control operation cycle	—	Status signal
D54448.1+2sn		—	Unusable	—	—	—
D54448.2+2sn						
D54448.3+2sn						
D54448.4+2sn						
D54448.5+2sn						
D54448.6+2sn						
D54448.7+2sn						
D54448.8+2sn						
D54448.9+2sn						
D54448.A+2sn						
D54448.B+2sn						
D54448.C+2sn						
D54448.D+2sn						
D54448.E+2sn						
D54448.F+2sn						
D54449.0+2sn						
D54449.1+2sn						
D54449.2+2sn						
D54449.3+2sn						
D54449.4+2sn						
D54449.5+2sn						
D54449.6+2sn						
D54449.7+2sn						

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D54449.8+2sn		—	Unusable	—	—	—
D54449.9+2sn						
D54449.A+2sn						
D54449.B+2sn						
D54449.C+2sn						
D54449.D+2sn						
D54449.E+2sn						
D54449.F+2sn						

Point

Refer to the following for details of G-code control axis status.

MELSEC iQ-R Motion Controller Programming Manual (G-Code Control)

G-code control axis monitor device

Device No.		Signal name
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment	
D54752 to D54783		Line 1 G-code control axis monitor device of axis 1
D54784 to D54815		Line 1 G-code control axis monitor device of axis 2
D54816 to D54847		Line 1 G-code control axis monitor device of axis 3
D54848 to D54879		Line 1 G-code control axis monitor device of axis 4
D54880 to D54911		Line 1 G-code control axis monitor device of axis 5
D54912 to D54943		Line 1 G-code control axis monitor device of axis 6
D54944 to D54975		Line 1 G-code control axis monitor device of axis 7
D54976 to D55007		Line 1 G-code control axis monitor device of axis 8
D55008 to D55039		Line 2 G-code control axis monitor device of axis 1
D55040 to D55071		Line 2 G-code control axis monitor device of axis 2
D55072 to D55103		Line 2 G-code control axis monitor device of axis 3
D55104 to D55135		Line 2 G-code control axis monitor device of axis 4
D55136 to D55167		Line 2 G-code control axis monitor device of axis 5
D55168 to D55199		Line 2 G-code control axis monitor device of axis 6
D55200 to D55231		Line 2 G-code control axis monitor device of axis 7
D55232 to D55263		Line 2 G-code control axis monitor device of axis 8

- Details of each line

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D54752+32sn		Md.3144	Axis No.	STOP→RUN	—	Monitor device
D54753+32sn		Md.3145	Axis name			
D54754+32sn		Md.3146	Rotating axis setting status			
D54755+32sn		Md.3153	Tandem function enabled information	STOP→RUN/ MCFUN instruction execution		
D54756+32sn		Md.3154	Local coordinate offset	Transition to G-code control/ G52 execution/ G54 to G59 instruction execution		
D54757+32sn						
D54758+32sn		—	Unusable	—	—	—
D54759+32sn						
D54760+32sn						
D54761+32sn						
D54762+32sn						
D54763+32sn						
D54764+32sn						
D54765+32sn						
D54766+32sn						
D54767+32sn						

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D54768+32sn		Md.3147	Machine position	Operation cycle	—	Monitor device
D54769+32sn						
D54770+32sn		Md.3148	Machine target position	G-code control operation cycle		
D54771+32sn						
D54772+32sn		Md.3149	Relative position	Operation cycle		
D54773+32sn						
D54774+32sn		Md.3150	Relative target position	G-code control operation cycle		
D54775+32sn						
D54776+32sn		—	Unusable	—	—	—
D54777+32sn						
D54778+32sn		Md.3152	Program target position	G-code control operation cycle	—	Monitor device
D54779+32sn						
D54780+32sn		—	Unusable	—	—	—
D54781+32sn						
D54782+32sn						
D54783+32sn						

Point

Refer to the following for details of G-code control axis monitor device.
📖MELSEC iQ-R Motion Controller Programming Manual (G-Code Control)

Common devices

Device No.		Symbol	Signal name		Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment						
D35280	D704	—	Unusable (6 points)		—	—	—
D35281	D705						
D35282	D706						
D35283	D707						
D35284	D708						
D35285	D709						
D35286	D710	Cd.1096	JOG operation simultaneous start axis setting register (Forward rotation JOG)		—	At start	Command device
D35287	D711						
D35288							
D35289							
D35290	D712	Cd.1097	JOG operation simultaneous start axis setting register (Reverse rotation JOG)				
D35291	D713						
D35292							
D35293							
D35294	D714	Cd.1098	Manual pulse generator axis 1 No. setting register			At the manual pulse generator enable flag OFF → ON	
D35295	D715						
D35296							
D35297							
D35298	D716	Cd.1099	Manual pulse generator axis 2 No. setting register				
D35299	D717						
D35300							
D35301							
D35302	D718	Cd.1100	Manual pulse generator axis 3 No. setting register				
D35303	D719						
D35304							
D35305							
D35306	D720	Cd.1101	Axis 1	Manual pulse generators 1 pulse input magnification setting register*1*2			
D35307	D721		Axis 2				
D35308	D722		Axis 3				
D35309	D723		Axis 4				
D35310	D724		Axis 5				
D35311	D725		Axis 6				
D35312	D726		Axis 7				
D35313	D727		Axis 8				
D35314	D728		Axis 9				
D35315	D729		Axis 10				
D35316	D730		Axis 11				
D35317	D731		Axis 12				
D35318	D732		Axis 13				
D35319	D733		Axis 14				
D35320	D734		Axis 15				
D35321	D735		Axis 16				
D35322	D736		Axis 17				
D35323	D737		Axis 18				
D35324	D738		Axis 19				
D35325	D739		Axis 20				
D35326	D740		Axis 21				

Device No.		Symbol	Signal name		Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	**Q series Motion compatible device assignment**						
D35327	D741	Cd.1101	Axis 22	Manual pulse generators 1 pulse input magnification setting register*1*2	—	At the manual pulse generator enable flag OFF → ON	Command device
D35328	D742		Axis 23				
D35329	D743		Axis 24				
D35330	D744		Axis 25				
D35331	D745		Axis 26				
D35332	D746		Axis 27				
D35333	D747		Axis 28				
D35334	D748		Axis 29				
D35335	D749		Axis 30				
D35336	D750		Axis 31				
D35337	D751		Axis 32				
D35338			Axis 33				
D35339			Axis 34				
D35340			Axis 35				
D35341			Axis 36				
D35342			Axis 37				
D35343			Axis 38				
D35344			Axis 39				
D35345			Axis 40				
D35346			Axis 41				
D35347			Axis 42				
D35348			Axis 43				
D35349			Axis 44				
D35350			Axis 45				
D35351			Axis 46				
D35352			Axis 47				
D35353			Axis 48				
D35354			Axis 49				
D35355			Axis 50				
D35356			Axis 51				
D35357			Axis 52				
D35358			Axis 53				
D35359			Axis 54				
D35360			Axis 55				
D35361			Axis 56				
D35362			Axis 57				
D35363			Axis 58				
D35364			Axis 59				
D35365			Axis 60				
D35366			Axis 61				
D35367			Axis 62				
D35368			Axis 63				
D35369			Axis 64				
D35370	D752	Cd.1102	Manual pulse generator 1 smoothing magnification setting register				
D35371	D753	Cd.1103	Manual pulse generator 2 smoothing magnification setting register				
D35372	D754	Cd.1104	Manual pulse generator 3 smoothing magnification setting register				

Device No.		Symbol	Signal name	Refresh cycle	Fetch cycle	Signal type
MELSEC iQ-R Motion device assignment	Q series Motion compatible device assignment					
D35373 : D35439	—	—	Unusable (67 points)	—	—	—
—	D755 : D799	—	Unusable (45 points)			

*1 The following range is valid. R16MTCPU: Axis No.1 to 16, R32MTCPU: Axis No.1 to 32.
*2 The following device area can be used as a user device. R16MTCPU: 17 axes or more, R32MTCPU: 33 axes or more.

[Cd.1096] JOG operation simultaneous start axis setting registers (Forward rotation JOG) (R: D35286 to D35289/Q: D710, D711)

- This register sets the axis No. and direction which start the forward rotation JOG operation simultaneously.

[Cd.1096] JOG operation simultaneous start axis setting registers (Forward rotation JOG)

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
R: D35286/ Q: D710	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
R: D35287/ Q: D711	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
R: D35288	Axis 48	Axis 47	Axis 46	Axis 45	Axis 44	Axis 43	Axis 42	Axis 41	Axis 40	Axis 39	Axis 38	Axis 37	Axis 36	Axis 35	Axis 34	Axis 33
R: D35289	Axis 64	Axis 63	Axis 62	Axis 61	Axis 60	Axis 59	Axis 58	Axis 57	Axis 56	Axis 55	Axis 54	Axis 53	Axis 52	Axis 51	Axis 50	Axis 49

*1: Make JOG operation simultaneous start axis setting with 1/0.
1: Simultaneous start execution
0: Simultaneous start not execution
*2: The following range is valid. R16MTCPU: Axis No.1 to 16, R32MTCPU: Axis No.1 to 32.

- Refer to the JOG operation simultaneous start for details of the JOG operation simultaneous start. (☞ Page 418 Simultaneous start)

[Cd.1097] JOG operation simultaneous start axis setting registers (Reverse rotation JOG) (R: D35290 to D35293/Q: D712, D713)

- This register sets the axis No. and direction which start the reverse rotation JOG operation simultaneously.

[Cd.1097] JOG operation simultaneous start axis setting registers (Reverse rotation JOG)

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
R: D35290/ Q: D712	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
R: D35291/ Q: D713	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
R: D35292	Axis 48	Axis 47	Axis 46	Axis 45	Axis 44	Axis 43	Axis 42	Axis 41	Axis 40	Axis 39	Axis 38	Axis 37	Axis 36	Axis 35	Axis 34	Axis 33
R: D35293	Axis 64	Axis 63	Axis 62	Axis 61	Axis 60	Axis 59	Axis 58	Axis 57	Axis 56	Axis 55	Axis 54	Axis 53	Axis 52	Axis 51	Axis 50	Axis 49

*1: Make JOG operation simultaneous start axis setting with 1/0.
1: Simultaneous start execution
0: Simultaneous start not execution
*2: The following range is valid. R16MTCPU: Axis No.1 to 16, R32MTCPU: Axis No.1 to 32.

- Refer to the JOG operation simultaneous start for details of the JOG operation simultaneous start. (☞ Page 418 Simultaneous start)

[Cd.1098] Manual pulse generator 1 axis No. setting registers (R: D35294 to D35297/Q: D714, D715)

- This register stores the axis No. controlled with the manual pulse generator 1.

[Cd.1098] Manual pulse generator 1 axis No. setting registers (P1)

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
R: D35294/ Q: D714	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
R: D35295/ Q: D715	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
R: D35296	Axis 48	Axis 47	Axis 46	Axis 45	Axis 44	Axis 43	Axis 42	Axis 41	Axis 40	Axis 39	Axis 38	Axis 37	Axis 36	Axis 35	Axis 34	Axis 33
R: D35297	Axis 64	Axis 63	Axis 62	Axis 61	Axis 60	Axis 59	Axis 58	Axis 57	Axis 56	Axis 55	Axis 54	Axis 53	Axis 52	Axis 51	Axis 50	Axis 49

*1: Make the axis No. controlled with the manual pulse generator setting with 1/0.
1: Specified axis
0: Unspecified axis
*2: The following range is valid. R16MTCPU: Axis No.1 to 16, R32MTCPU: Axis No.1 to 32.

- Refer to the manual pulse generator operation for details of the manual pulse generator operation. (Page 420 Manual Pulse Generator Operation)

[Cd.1099] Manual pulse generator 2 axis No. setting registers (R: D35298 to D35301/Q: D716, D717)

- This register stores the axis No. controlled with the manual pulse generator 2.

[Cd.1099] Manual pulse generator 2 axis No. setting registers (P2)

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
R: D35298/ Q: D716	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
R: D35299/ Q: D717	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
R: D35300	Axis 48	Axis 47	Axis 46	Axis 45	Axis 44	Axis 43	Axis 42	Axis 41	Axis 40	Axis 39	Axis 38	Axis 37	Axis 36	Axis 35	Axis 34	Axis 33
R: D35301	Axis 64	Axis 63	Axis 62	Axis 61	Axis 60	Axis 59	Axis 58	Axis 57	Axis 56	Axis 55	Axis 54	Axis 53	Axis 52	Axis 51	Axis 50	Axis 49

*1: Make the axis No. controlled with the manual pulse generator setting with 1/0.
1: Specified axis
0: Unspecified axis
*2: The following range is valid. R16MTCPU: Axis No.1 to 16, R32MTCPU: Axis No.1 to 32.

- Refer to the manual pulse generator operation for details of the manual pulse generator operation. (Page 420 Manual Pulse Generator Operation)

[Cd.1100] Manual pulse generator 3 axis No. setting registers (R: D35302 to D35305/Q: D718, D719)

- This register stores the axis No. controlled with the manual pulse generator 3.

[Cd.1100] Manual pulse generator 3 axis No. setting registers (P3)

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
R: D35302/ Q: D718	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
R: D35303/ Q: D719	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
R: D35304	Axis 48	Axis 47	Axis 46	Axis 45	Axis 44	Axis 43	Axis 42	Axis 41	Axis 40	Axis 39	Axis 38	Axis 37	Axis 36	Axis 35	Axis 34	Axis 33
R: D35305	Axis 64	Axis 63	Axis 62	Axis 61	Axis 60	Axis 59	Axis 58	Axis 57	Axis 56	Axis 55	Axis 54	Axis 53	Axis 52	Axis 51	Axis 50	Axis 49

*1: Make the axis No. controlled with the manual pulse generator setting with 1/0.
1: Specified axis
0: Unspecified axis
*2: The following range is valid. R16MTCPU: Axis No.1 to 16, R32MTCPU: Axis No.1 to 32.

- Refer to the manual pulse generator operation for details of the manual pulse generator operation. (Page 420 Manual Pulse Generator Operation)

[Cd.1101] Manual pulse generator 1-pulse input magnification setting registers (R: D35306+n/Q: D720+n)

- This register sets the magnification (1 to 10000) per pulse of number of the input pulses from manual pulse generator at the pulse generator operation.

Setting range
1 to 10000

- Refer to the manual pulse generator operation for details of the manual pulse generator operation. (☞ Page 420 Manual Pulse Generator Operation)

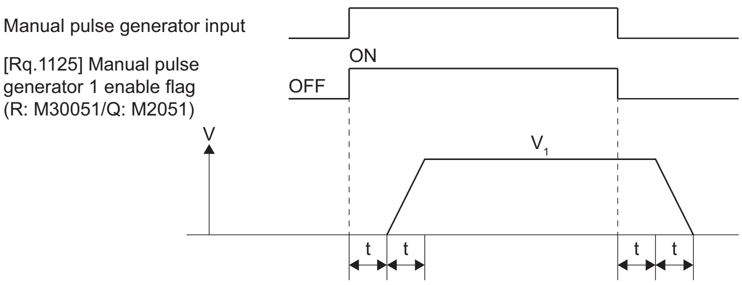
[Cd.1102] Manual pulse generator 1 smoothing magnification setting registers (R: D35370/Q: D752)

- This register sets the smoothing time constants of manual pulse generators 1 (P1).

Setting range
0 to 59

- 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]

- Operation



Output speed (V_1) [pulse/s] = (Number of input pulses/s) × (Manual pulse generator 1-pulse input magnification setting)
Travel value (L) = (Travel value per pulse) × (Number of input pulses) × (Manual pulse generator 1-pulse input magnification setting)

Point

- The travel value per pulse of the manual pulse generator is shown below.

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

- The smoothing time constant is 56.8[ms] to 3408[ms].

[Cd.1103] Manual pulse generator 2 smoothing magnification setting registers (R: D35371/Q: D753)

- This register sets the smoothing time constants of manual pulse generators 2 (P2).

Setting range
0 to 59

The operation details are the same as "[Cd.1102] Manual pulse generator 1 smoothing magnification setting registers (R: M35370/Q: D752)". (☞ Page 159 [Cd.1102] Manual pulse generator 1 smoothing magnification setting registers (R: D35370/Q: D752))

[Cd.1104] Manual pulse generator 3 smoothing magnification setting registers (R: D35372/Q: D754)

- This register sets the smoothing time constants of manual pulse generators 3 (P3).

Setting range
0 to 59

The operation details are the same as "[Cd.1102] Manual pulse generator 1 smoothing magnification setting registers (R: M35370/Q: D752)". (☞ Page 159 [Cd.1102] Manual pulse generator 1 smoothing magnification setting registers (R: D35370/Q: D752))

2.3 Motion Registers (#)

There are motion registers (#0 to #12287) in the Motion CPU. When using Q series Motion device assignment, #8000 to #8639 are used as the monitor device 2 of each axis.

Motion Registers List

■MELSEC iQ-R Motion device assignment

In MELSEC iQ-R Motion device assignment, the entire range of the motion registers can be used as user device.

Device No.	Symbol	Purpose	Reference
#0 to #12287	—	User device (12288 points)	—

Point

Total number of the user device points

• 12288 points

■Q series Motion compatible device assignment

The devices of axis 1 to 32 use Q series Motion compatible device assignment, and the devices of axis 33 to 64 use the monitor devices of each axis (D32020+48n to D32039+48n) in MELSEC iQ-R Motion device assignment.

Device No.	Symbol	Purpose	Reference
#0 to	—	User device (8000 points)	—
#8000 to	[Md.28], [Md.100], [Md.103], [Md.104], [Md.107], [Md.108], [Md.125], [Md.1014], [Md.1019], [Md.1022], [Md.1027]	Axis monitor device 2 (20 points × 32 axes)	☞ Page 162 Monitor devices 2 of each axis
#8640 to #12287	—	Unusable (3648 points)	—

Point

Total number of the user device points

• 8000 points

Monitor devices 2 of each axis

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

Device No.		Signal name
Q series Motion compatible device assignment	MELSEC iQ-R Motion device assignment	
#8000 to #8019	D32020 to D32039	Axis 1 monitor device 2
#8020 to #8039	D32068 to D32087	Axis 2 monitor device 2
#8040 to #8059	D32116 to D32135	Axis 3 monitor device 2
#8060 to #8079	D32164 to D32183	Axis 4 monitor device 2
#8080 to #8099	D32212 to D32231	Axis 5 monitor device 2
#8100 to #8119	D32260 to D32279	Axis 6 monitor device 2
#8120 to #8139	D32308 to D32327	Axis 7 monitor device 2
#8140 to #8159	D32356 to D32375	Axis 8 monitor device 2
#8160 to #8179	D32404 to D32423	Axis 9 monitor device 2
#8180 to #8199	D32452 to D32471	Axis 10 monitor device 2
#8200 to #8219	D32500 to D32519	Axis 11 monitor device 2
#8220 to #8239	D32548 to D32567	Axis 12 monitor device 2
#8240 to #8259	D32596 to D32615	Axis 13 monitor device 2
#8260 to #8279	D32644 to D32663	Axis 14 monitor device 2
#8280 to #8299	D32692 to D32711	Axis 15 monitor device 2
#8300 to #8319	D32740 to D32759	Axis 16 monitor device 2
#8320 to #8339	D32788 to D32807	Axis 17 monitor device 2
#8340 to #8359	D32836 to D32855	Axis 18 monitor device 2
#8360 to #8379	D32884 to D32903	Axis 19 monitor device 2
#8380 to #8399	D32932 to D32951	Axis 20 monitor device 2
#8400 to #8419	D32980 to D32999	Axis 21 monitor device 2
#8420 to #8439	D33028 to D33047	Axis 22 monitor device 2
#8440 to #8459	D33076 to D33095	Axis 23 monitor device 2
#8460 to #8479	D33124 to D33143	Axis 24 monitor device 2
#8480 to #8499	D33172 to D33191	Axis 25 monitor device 2
#8500 to #8519	D33220 to D33239	Axis 26 monitor device 2
#8520 to #8539	D33268 to D33287	Axis 27 monitor device 2
#8540 to #8559	D33316 to D33335	Axis 28 monitor device 2
#8560 to #8579	D33364 to D33383	Axis 29 monitor device 2
#8580 to #8599	D33412 to D33431	Axis 30 monitor device 2
#8600 to #8619	D33460 to D33479	Axis 31 monitor device 2
#8620 to #8639	D33508 to D33527	Axis 32 monitor device 2
D33556 to D33575		Axis 33 monitor device 2
D33604 to D33623		Axis 34 monitor device 2
D33652 to D33671		Axis 35 monitor device 2
D33700 to D33719		Axis 36 monitor device 2
D33748 to D33767		Axis 37 monitor device 2
D33796 to D33815		Axis 38 monitor device 2
D33844 to D33863		Axis 39 monitor device 2
D33892 to D33911		Axis 40 monitor device 2
D33940 to D33959		Axis 41 monitor device 2
D33988 to D34007		Axis 42 monitor device 2
D34036 to D34055		Axis 43 monitor device 2
D34084 to D34103		Axis 44 monitor device 2
D34132 to D34151		Axis 45 monitor device 2
D34180 to D34199		Axis 46 monitor device 2
D34228 to D34247		Axis 47 monitor device 2
D34276 to D34295		Axis 48 monitor device 2

Device No.		Signal name
Q series Motion compatible device assignment	MELSEC iQ-R Motion device assignment	
D34324 to D34343		Axis 49 monitor device 2
D34372 to D34391		Axis 50 monitor device 2
D34420 to D34439		Axis 51 monitor device 2
D34468 to D34487		Axis 52 monitor device 2
D34516 to D34535		Axis 53 monitor device 2
D34564 to D34583		Axis 54 monitor device 2
D34612 to D34631		Axis 55 monitor device 2
D34660 to D34679		Axis 56 monitor device 2
D34708 to D34727		Axis 57 monitor device 2
D34756 to D34775		Axis 58 monitor device 2
D34804 to D34823		Axis 59 monitor device 2
D34852 to D34871		Axis 60 monitor device 2
D34900 to D34919		Axis 61 monitor device 2
D34948 to D34967		Axis 62 monitor device 2
D34996 to D35015		Axis 63 monitor device 2
D35044 to D35063		Axis 64 monitor device 2

- Details for each axis

Device No.		Symbol	Signal name	Refresh cycle	Signal type
Q series Motion compatible device assignment	MELSEC iQ-R Motion device assignment				
#8000+20n	D32030+48n	Md.1014	Servo amplifier type	When the servo amplifier power-on	Monitor device
#8001+20n	D32020+48n	Md.104	Motor current value	Operation cycle 1.777[ms] or less: Operation cycle Operation cycle 3.555[ms] or more: 3.555[ms]	
#8002+20n	D32022+48n	Md.103	Motor speed		
#8003+20n	D32023+48n				
#8004+20n	D32024+48n	Md.28	Command speed	Operation cycle	
#8005+20n	D32025+48n				
#8006+20n	D32026+48n	Md.100	Home position return re-travel value	At home position return re-travel	
#8007+20n	D32027+48n				
#8008+20n	D32028+48n	Md.1019	Servo amplifier display servo error code	Main cycle	
#8009+20n	D32029+48n	Md.107	Parameter error No.		
#8010+20n	D32032+48n	Md.108	Servo status1	Operation cycle 1.777[ms] or less: Operation cycle Operation cycle 3.555[ms] or more: 3.555[ms]	
#8011+20n	D32033+48n	Md.1022	Servo status2		
#8012+20n	D32034+48n	Md.125	Servo status3		
#8013+20n	D32035+48n	—	Unusable	—	—
#8014+20n	D32036+48n				
#8015+20n	D32037+48n				
#8016+20n	D32031+48n	Md.1027	Servo amplifier vendor ID	At servo amplifier power supply ON	Monitor device
#8017+20n	D32021+48n	—	Unusable	—	—
#8018+20n	D32038+48n	Md.500	Servo status7	Operation cycle 1.777[ms] or less: Operation cycle Operation cycle 3.555[ms] or more: 3.555[ms]	Monitor device
#8019+20n	D32039+48n	—	Unusable	—	—

Point

- The following range is valid. R16MTCPU: Axis No.1 to 16, R32MTCPU: Axis No.1 to 32.
- The following device area can be used as a user device. R16MTCPU: 17 axes or more, R32MTCPU: 33 axes or more. However, when the project of R16MTCPU is replaced with R32MTCPU/R64MTCPU, or the project of R32MTCPU is replaced with R64MTCPU, this area cannot be used as a user device.
- Refer to monitor device of each axis for details of monitor device 2 of each axis (#8000 to #8639). (☞ Page 91 Axis monitor devices)

2.4 Special Relays (SM)

There are 4096 special relay points of SM0 to SM4095 in the Motion CPU.

Refer to the following for details of special relays.

MELSEC iQ-R Motion controller Programming Manual (Common)

2.5 Special Registers (SD)

There are 4096 special register points of SD0 to SD4095 in the Motion CPU.

Refer to the following for details of special registers.

MELSEC iQ-R Motion controller Programming Manual (Common)

3 PARAMETERS FOR POSITIONING CONTROL

3.1 Parameters Used by the Motion CPU

The parameters used by the Motion CPU are as follows.

Parameters	Details
R series common parameters	Common parameters for R series CPU modules
Motion CPU common parameters	Common parameters for Motion CPU modules
Motion control parameters	Positioning control parameters and synchronous control parameters used by the Motion CPU for Motion control

The list of the parameters used by the Motion CPU is shown below.

○: Input ×: Not input

Parameter item			Parameter input timing		Details	Reference
			At ON/reset of Multiple CPU system power supply	At STOP to RUN/ test mode request		
R series common parameter	System parameter		○	×	Set the R series CPU common parameters for the base, slot, and module settings and the Multiple CPU system settings. The system parameters for each CPU in the Multiple CPU system must be matched.	*1
	CPU parameter		○	×		
	Module parameter		○	×		
Motion CPU common parameter	Basic setting		○	×	Set the basic parameters of the Motion system, such as operation cycle and the external forced stop input.	
	Servo network setting		○	×	Set the servo network type, and the connected servo amplifiers, SSCNETⅢ/H head modules, and sensing modules.	
	Limit output data		○	○	Set the output device and watch data for limit switch output.	
	High-speed input request signal		○	×	Set the high precision input request signal used for synchronous control or mark detection.	
	Mark detection		○	×	Set the data for mark detection.	
	Manual pulse generator connection setting		○	×	Set the data required for connecting the manual pulse generator to the module.	
	Vision system parameter		×	○	Set the parameters used for connecting the vision system.	
	Head module		○	×	Set the parameters used for connecting the SSCNETⅢ/H head module and sensing module.	
	Refresh (END/I45 executing) setting		○	×	Set the multiple CPU refresh (main cycle/ operation cycle).	
Motion control parameter	Axis setting parameter	Fixed parameter	○	×	Set the fixed data based on the mechanical system, etc. of the controlled axis.	☞ Page 168 Fixed Parameters
		Home position return data	○	×	Set the data required for the home position return.	☞ Page 178 Home Position Return Data
		JOG operation data	○	○	Set the data to perform the JOG operation.	☞ Page 188 JOG Operation Data
		External signal parameter	○	×	Set the external signals (upper stroke limit (FLS), lower stroke limit (RLS), stop (STOP), and proximity dog or speed/position switching (DOG/CHANGE)) used for each axis.	☞ Page 189 External Signal Parameter

Parameter item			Parameter input timing		Details	Reference
			At ON/reset of Multiple CPU system power supply	At STOP to RUN/ test mode request		
Motion control parameter	Axis setting parameter	Expansion parameter	○	○	Set when the following functions are used. • Monitor individually the positive and negative direction torque limit value. • Change the acceleration/deceleration time when changing speed. • Set the maximum speed of the servo motor. • When performing positioning control in the absolute data method on a degrees axis, specify the positioning direction.	☞ Page 192 Expansion Parameters
		Speed-torque control data	○	×	Set when the speed-torque control is performed.	☞ Page 201 Speed-torque control data
		Optional data monitor	○	×	Set the type of the monitored data and the storage device when the servo amplifier status, etc. is monitored.	*1
		Pressure control data	○	×	Set when performing pressure control that uses a profile.	☞ Page 207 Pressure control data
		Override data	○	×	Set when using the override function.	☞ Page 210 Override Data
		Vibration suppression command filter data	○	×	Set when using the vibration suppression command filter function.	☞ Page 211 Vibration Suppression Command Filter Data
	Servo parameter		○	○	Parameters of the servo amplifier and sensing module are set based on the specifications of the servo amplifier, servo motor, and sensing module.	☞ Page 214 Servo Parameters
	Parameter block		○	○	Set the data for acceleration/deceleration control, etc. used for each positioning processing.	☞ Page 215 Parameter Block
	Synchronous control parameter	Input axis parameter	○	×	Set the input axis used for advanced synchronous control.	*2
		Synchronous parameter	○	×	Set the synchronous parameters of the output axis used for advanced synchronous control.	
		Multiple CPU advanced synchronous control setting	○	×	Set the master CPU and slave CPU for performing Multiple CPU advanced synchronous control.	
	Machine control parameter	Machine common parameter	○	×	Set the common parameters such as point block used in machine control.	*3
		Machine parameter	○	×	Set the parameters for conducting machine control.	
	G-code control parameter	G-code control system parameter	×	○*4	Set the parameters used on a line for each G-code control line.	*5
		G-code control axis parameter	×	○*4	Set the parameters for each axis in each G-code control line.	
		G-code control work parameter	×	○*4	Set the parameters for processing in G-code control.	

*1 MELSEC iQ-R Motion controller Programming Manual (Common)
*2 MELSEC iQ-R Motion controller Programming Manual (Advanced Synchronous Control)
*3 MELSEC iQ-R Motion controller Programming Manual (Machine Control)
*4 Not input at test mode request.
*5 MELSEC iQ-R Motion controller Programming Manual (G-Code Control)

3.2 Indirect Setting Method by Devices for Parameters

Some Motion control parameters can be set indirectly by devices.
However, special relays (SM) and special registers (SD) cannot be set as devices for indirect setting.
Refer to the following for the details of devices.
MELSEC iQ-R Motion controller Programming Manual (Common)

3.3 Fixed Parameters

The fixed parameters are set for each axis and their data is fixed based on the mechanical system, etc.

[Motion Control Parameter] ⇨ [Axis Setting Parameter] ⇨ "Fixed Parameter"

No.	Item		Default value	Setting range				Direct setting*1	Indirect setting		Reference Section
				mm	inch	degree	pulse	Valid/ invalid	Valid/ invalid (Required size)	Fetch cycle	
1	Unit setting		3	0	1	2	3	○	×	—	Page 169
2	Travel value per pulse (A)	Number of pulses per rotation (AP)	20000 [pulse]	1 to 2147483647 [pulse]				○	×	—	Page 169
3		Travel value per rotation (AL)	20000 [pulse]	1 to 2147483647 ($\times 10^{-1}$ [μm])	1 to 2147483647 ($\times 10^{-5}$ [inch])	1 to 2147483647 ($\times 10^{-5}$ [degree])	1 to 2147483647 [pulse]	○	×	—	
4	Backlash compensation amount		0 [pulse]	0 to 65535 ($\times 10^{-1}$ [μm])	0 to 65535 ($\times 10^{-5}$ [inch])	0 to 65535 ($\times 10^{-5}$ [degree])	0 to 65535 [pulse]	○	×	—	Page 172 Page 427
5	Upper stroke limit		2147483647 [pulse]	-2147483648 to 2147483647 ($\times 10^{-1}$ [μm])	-2147483648 to 2147483647 ($\times 10^{-5}$ [inch])	0 to 35999999 ($\times 10^{-5}$ [degree])	-2147483648 to 2147483647 [pulse]	○	×	—	Page 172
6	Lower stroke limit		0 [pulse]	-2147483648 to 2147483647 ($\times 10^{-1}$ [μm])	-2147483648 to 2147483647 ($\times 10^{-5}$ [inch])	0 to 35999999 ($\times 10^{-5}$ [degree])	-2147483648 to 2147483647 [pulse]	○	×	—	
7	Command in-position range		100 [pulse]	1 to 2147483647 ($\times 10^{-1}$ [μm])	1 to 2147483647 ($\times 10^{-5}$ [inch])	1 to 35999999 ($\times 10^{-5}$ [degree])	1 to 2147483647 [pulse]	○	×	—	Page 174
8	Speed control 10 × multiplier setting for degree axis		—	—	—	0: Invalid 1: Valid	—	○	×	—	Page 174

*1 For direct setting using MT Developer2, use the decimal format instead of the exponential format.

Unit Setting

Set the unit used for defining positioning operations.
Choose from the following units depending on the type of the control target: mm, inch, degree, or pulse.

Ex.
Different units (mm, inch, degree, and pulse) are applicable to different systems:

Unit	System
mm, inch	X-Y table, conveyor (Select mm or inch depending on the machine specifications.)
degree	Rotating body (360 degrees/rotation)
pulse	X-Y table, conveyor

When you change the unit, note that the values of other parameters and data will not be changed automatically. After changing the unit, check if the parameter and data values are within the allowable range.

Number of pulses per rotation/Travel value per rotation

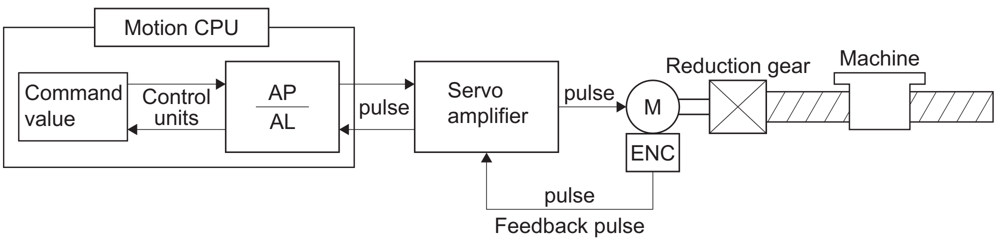
The "Electronic gear function" adjusts the actual machine movement amount and number of pulse output to servo amplifier according to the parameter set in the Motion CPU.
It is defined by the "Number of pulses per rotation" and "Travel value per revolution".

Point

- The mechanical system error of the command travel value and real travel value is rectified by adjustment the "electronic gear".
- 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.
- 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, 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.)

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 servomotor in order to make it a machine as the travel value ordered by the program.
The position control toward the servomotor is controlled with the number of feedback pulses of the encoder connected to the servomotor in the servo amplifier.
The control content of the Motion CPU is shown below.



For example, suppose that the servomotor was connected to the ball screw.
Because the travel value (ΔS) 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 servomotor 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

$$\text{Electronic gear} = \frac{AP}{AL} \quad \cdots\cdots (1)$$

(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.)
Example of the real setting is shown below. Refer to the Number of pulses/travel value at linear servo use for the setting at linear servo. (☞ Page 171 Number of pulses/travel value at linear servo use)

■For ball screw

When the ball screw pitch is 20 [mm], the servomotor is HG-KR (4194304 [pulse/rev]) and direct connection (No reduction gear) is set.
First, find how many millimeters the load (machine) will travel (AL) when the servomotor runs for one rotation (AP).
AP (Number of pulses per motor rotation) = 4194304 [pulse]
AL (Travel value of machine per rotation) = Ball screw pitch × Reduction ratio = 20 [mm]
Substitute this for the above expression (1).

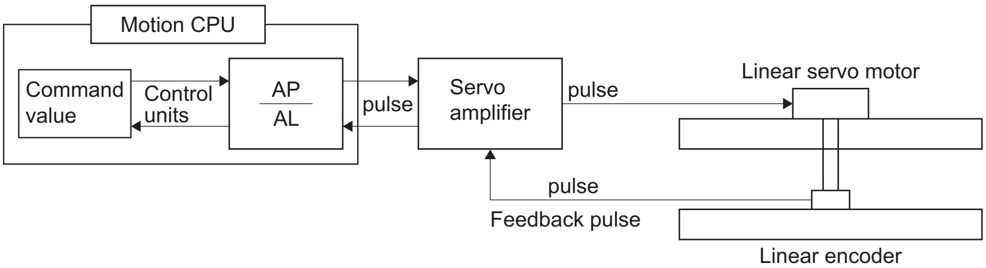
$$\frac{AP}{AL} = \frac{4194304\ [\text{pulse}]}{20\ [\text{mm}]}$$

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].

$$\frac{AP}{AL} = \frac{4194304\ [\text{pulse}]}{20000.0\ [\mu\text{m}]}$$

The travel value per motor rotation in this example is 0.0000047 [mm].
For example, when ordering the travel value of 19 [mm], it becomes 3984588.8 [pulse] and the fraction of 0.8 [pulse]. At this time, the Motion CPU orders the travel value of 3984588 [pulse] to the servomotor and the fraction is memorized in the Motion CPU. Positioning is performed by seasoning the travel value with this fraction at the next positioning.

Number of pulses/travel value at linear servo use



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

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

Linear encoder resolution: 0.05 [μm]

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

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

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)".

Refer to the following for details.

📖Servo amplifier Instruction Manual

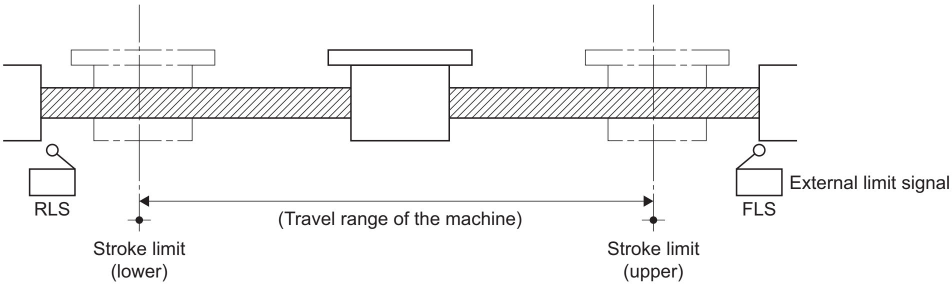
Servo amplifier type	Instruction manual name
MR-J4-□B	SSCNETⅢ/H interface MR-J4-_B(-RJ)/ MR-J4-_B4(-RJ)/ MR-J4-_B1(-RJ) Servo amplifier Instruction Manual (SH-030106)
MR-J4W-□B	SSCNETⅢ/H interface Multi-axis AC Servo MR-J4W2-_B/MR-J4W3-_B Servo amplifier Instruction Manual (SH-030105)
MR-J3-□B-RJ004	SSCNETⅢ Compatible Linear Servo MR-J3-□B-RJ004U□ Instruction Manual (SH-030054)

Backlash compensation amount

The machine backlash amount is set in the backlash compensation amount. Whenever the positioning direction changes during positioning control, compensation is performed using the backlash compensation amount.
Refer to the Backlash Compensation Function for details. (☞ Page 427 Backlash Compensation Function)

Upper/lower stroke limit value

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



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 Continuous trajectory control Positioning control Fixed-pitch feed control Speed control (Ⅰ)*1	Check	• It is checked whether the feed current value is within the stroke limit range or not at the positioning start. If it outside the range, a minor error occurs (error code: 1993H,1995H) and positioning is not executed. • When positioning is outside of the stroke limit range, a minor error (error code: 1A18H, 1A1AH) occurs, and positioning is not executed. • If the interpolation path exceeds the stroke limit range during circular interpolation start, a minor error occurs (error codes: 1993H, 1995H, 19EDH) and deceleration stop is executed. • If the current value exceeds the stroke limit range, deceleration stop is executed.
Speed control (Ⅰ)*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)	Check	It is checked after the switch to position control without checking the stroke limit range while executing speed control.
JOG operation		When the current value is executed a deceleration stop from current command speed, if the current value exceeds the stroke limit range, a minor error occurs (error code: 1993H, 1995H), and deceleration stop is made before a stroke limit. Travel from outside the stroke 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 range is different. • When upper stroke limit value > lower stroke limit value When "Feed current value > upper stroke limit value", movement in the reverse direction is possible. When "Feed current value < lower stroke limit value", movement in the forward direction is possible. • When upper stroke limit value < lower stroke limit value Movement in both the forward and reverse direction is possible.
Manual pulse generator operation		If the current value exceeds the stroke limit range, a minor error occurs (error code: 1993H, 1995H), and it stops at stroke limit. In this case, a deceleration stop is not made. Travel from outside the stroke 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 range is different. • When upper stroke limit value > lower stroke limit value When "Feed current value > upper stroke limit value", movement in the reverse direction is possible. When "Feed current value < lower stroke limit value", movement in the forward direction is possible. • When upper stroke limit value < lower stroke limit value Movement in both the forward and reverse direction is possible.
Speed-torque control		If the current feed value exceeds the stroke limit range, a minor error occurs (error code: 1993H, 1995H), and the mode is switched to position control.
Pressure control		

*1 When "[Rq.1152] Feed current value update command (R: M34492+32n/Q: M3212+20n)" is ON
*2 When "[Rq.1152] Feed current value update command (R: M34492+32n/Q: M3212+20n)" is OFF

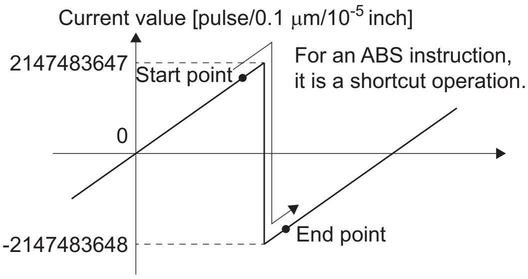
Point

- 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).
- 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.

Stroke limit invalid setting

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 control in the control unit "degree" for details of degree axis. (☞ Page 257 Control in the control unit "degree")



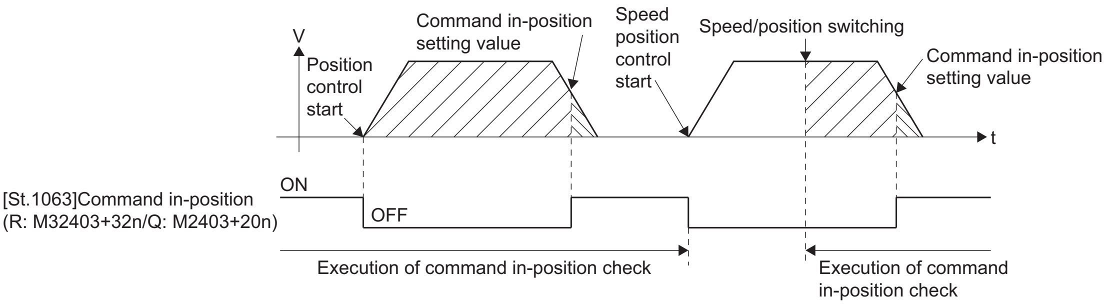
Point

- If the current feed value and real current value exceeds 2147483647 [pulse/0.1 μm/10^{-5}inch], it is controlled with -2147483648 [pulse/0.1μm/10^{-5} inch]. If those values are less than -2147483648 [pulse/0.1μm/10^{-5}inch], it is controlled with 2147483647 [pulse/0.1μm/10^{-5}inch].
- 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: 19E8H) will occur, and operation does not start.
- The high-speed oscillation function cannot be used in the axis that set the stroke limit invalid.
- 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)	Negative speed-change accept.
Speed control (Ⅱ)	
Home position return	Warning (error code: 09EDH) occurs and speed change is ignored.
Speed-position control	Warning (error code: 0991H) occurs and speed change is ignored.
Position follow-up control	
Speed control with fixed position stop	
Speed-position switching control	
JOG operation	
Manual pulse generator operation	Speed change is ignored.
Speed-torque control	
Pressure control	
Others	Warning (error code: 09EFH) occurs and speed change is ignored.

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 "[St.1063] Command in-position (R: M32403+32n/Q: 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) ≤ (command in-position range)".
The command in-position range check is executed continuously during position control.

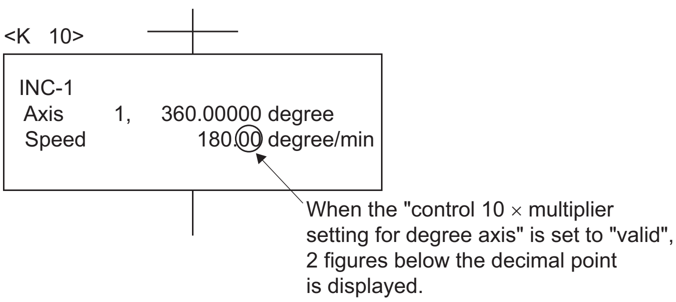


- Command in-position can be set within the following range.
  1 ≤ Command in-position range ≤ 2147483647

Speed control 10 x 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 × multiplier setting for degree axis" is set to "valid" in the fixed parameter the speed setting range increases 10 × multiplier "0.01 to 21474836.47 [degree/min]".

- 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.
- 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.
- 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.



- Speed setting range in the interpolation operation is shown below.

Command speed	Details
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]"
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 for positioning control

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.

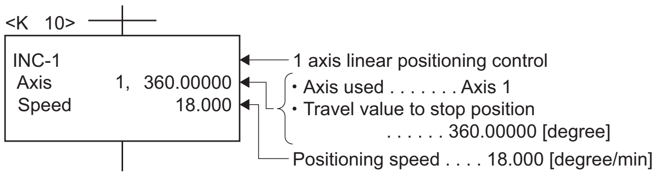
- Speed control 10 × multiplier setting for degree axis

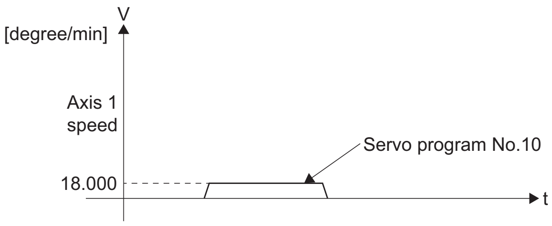
Axis	Speed control 10 × multiplier setting for degree axis
Axis 1	Invalid
Axis 2	Valid

- Interpolation control unit of parameter block

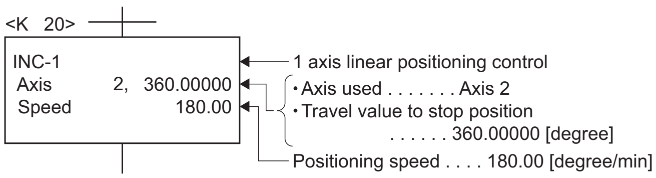
Item	Block 10
Interpolation control unit	degree

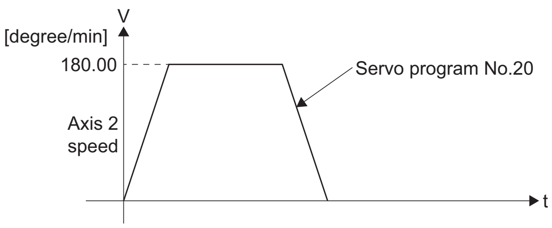
■1 axis linear positioning control program (Axis 1)





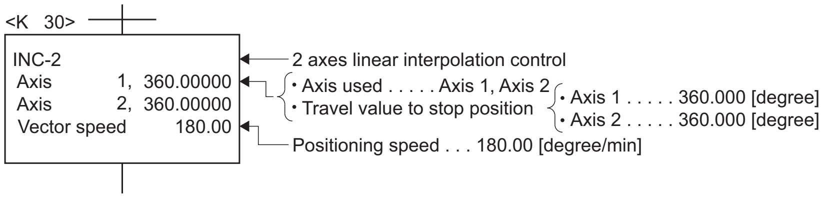
■1 axis linear positioning control program (Axis 2)

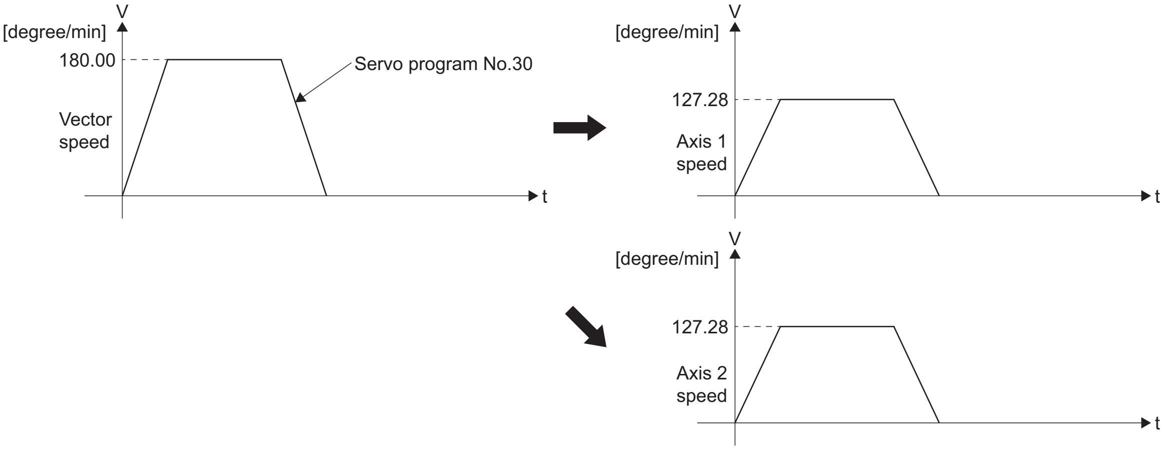




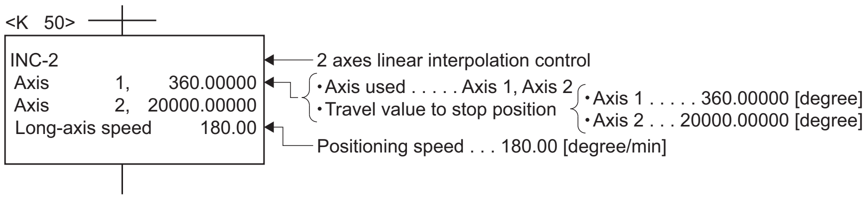
■2 axis linear interpolation control program (Axis 1, Axis 2)

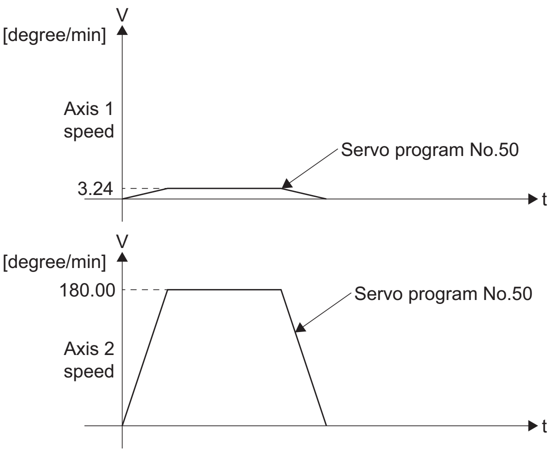
- Vector speed specification



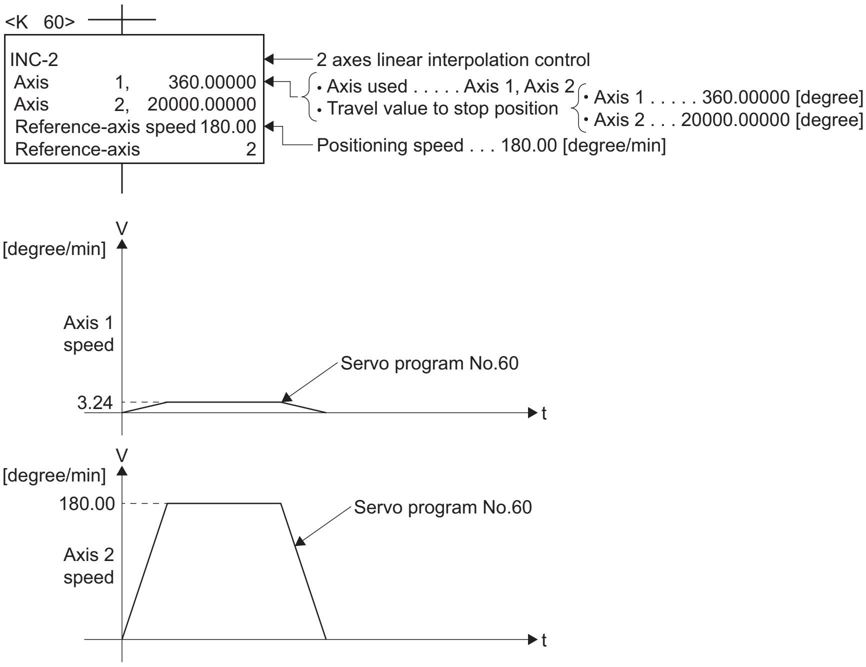


- Long-axis reference specification





- Reference-axis speed setting



Point

When a speed change is executed by the Motion dedicated PLC instruction (M(P).CHGV/D(P).CHGV) or Motion SFC program (CHGV instruction) after setting the "speed control 10 × multiplier setting for degree axis" to "valid", positioning control is executed at 10 × the speed of the set command speed.

3.4 Home Position Return Data

The home position return data is used to perform the home position return.

[Motion Control Parameter] ⇨ [Axis Setting Parameter] ⇨ "Home Position Return Data"

No.	Item	Default value	Setting range				Direct setting[*1]	Indirect setting[*2]		Reference Section
			mm	inch	degree	pulse	Valid/ invalid	Valid/ invalid (Required size)	Fetch cycle	
1	Home position return direction	0	0: Reverse direction (Address decrease direction) 1: Forward direction (Address increase direction)				○	×	—	☞ Page 179
2	Home position return method	2	0: Proximity dog method 1 4: Proximity dog method 2 1: Count method 1 5: Count method 2 6: Count method 3 2: Data set method 1 3: Data set method 2 14: Data set method 3 7: Dog cradle method 8: Stopper method 1 9: Stopper method 2 10: Limit switch combined method 11: Scale home position signal detection method 12: Dogless home position signal reference method 13: Driver home position return method				○	×	—	☞ Page 180
3	Home position address	0 [pulse]	-2147483648 to 2147483647 ($\times 10^{-1}$ [μm])	-2147483648 to 2147483647 ($\times 10^{-5}$ [inch])	0 to 35999999 ($\times 10^{-5}$ [degree])	-2147483648 to 2147483647 [pulse]	○	○ (2 word)	At the home position return start	☞ Page 180
4	Home position return speed	—	1 to 600000000 ($\times 10^{-2}$ [mm/ min])	1 to 600000000 ($\times 10^{-3}$ [inch/ min])	1 to 2147483647 ($\times 10^{-3}$ [degree/ min])[*3]	1 to 2147483647 [pulse/s]	○	○ (2 word)		☞ Page 180
5	Creep speed	—	1 to 600000000 ($\times 10^{-2}$ [mm/ min])	1 to 600000000 ($\times 10^{-3}$ [inch/ min])	1 to 2147483647 ($\times 10^{-3}$ [degree/ min])[*3]	1 to 2147483647 [pulse/s]	○	○ (2 word)		☞ Page 180
6	Travel value after proximity dog ON	—	0 to 2147483647 ($\times 10^{-1}$ [μm])	0 to 2147483647 ($\times 10^{-5}$ [inch])	0 to 2147483647 ($\times 10^{-5}$ [degree])	0 to 2147483647 [pulse]	○	○ (2 word)		☞ Page 181
7	Parameter block setting	—	1 to 64				○	×	—	☞ Page 182
8	Home position return retry function	—	0: Invalid (Do not execute the home position return retry by limit switch.) 1: Valid (Execute the home position return retry by limit switch.)				○	×		☞ Page 183
9	Dwell time at the home position return retry	—	0 to 5000 [ms]				○	○ (1 word)	At the home position return start	
10	Home position shift amount	—	-2147483648 to 2147483647 ($\times 10^{-1}$ [μm])	-2147483648 to 2147483647 ($\times 10^{-5}$ [inch])	-2147483648 to 2147483647 ($\times 10^{-5}$ [degree])	-2147483648 to 2147483647 [pulse]	○	○ (2 word)		☞ Page 184
11	Speed set at the home position shift	—	0: Home position return speed 1: Creep speed				○	×	—	
12	Torque limit value at the creep speed	—	1 to 10000 ($\times 10^{-1}$[%])				○	○ (1 word)	At the home position return start	☞ Page 185

No.	Item	Default value	Setting range				Direct setting[*1]	Indirect setting[*2]		Reference Section
			mm	inch	degree	pulse	Valid/ invalid	Valid/ invalid (Required size)	Fetch cycle	
13	Operation setting for incompletion of home position return	1	0: Execute a servo program 1: Not execute a servo program				○	×	—	Page 185
14	Home position return request setting in pulse conversion unit[*4]	—	0: Home position return request ON during servo OFF 1: Home position return request not ON during servo OFF				○	×		*5
15	Standby time after clear signal output in pulse conversion unit[*4]	—	1 to 1000 [ms]				○	○ (1 word)	At the home position return start	

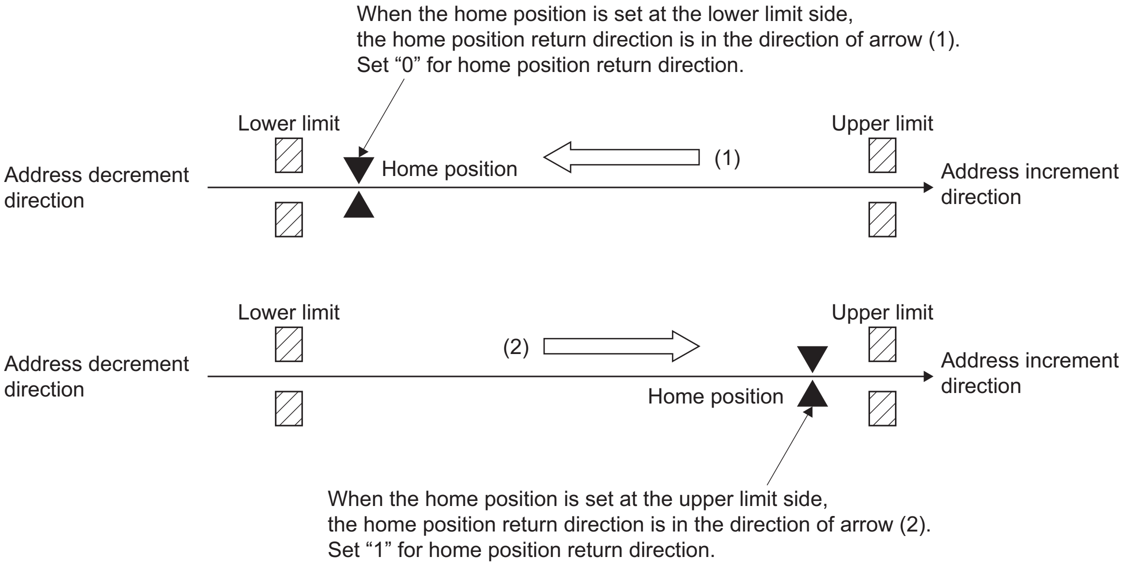
*1 For direct setting using MT Developer2, use the decimal format instead of the exponential format.
*2 Refer to the indirect setting method by devices for Parameters for the range of devices used for indirect setting. (Page 168 Indirect Setting Method by Devices for Parameters)
*3 When the "speed control 10 × multiplier setting for degree axis" is set to "valid" in the fixed parameter, the unit is 1 to 2147483647 ($\times 10^{-2}$ [degree/min]).
*4 Pulse conversion use only.
*5 MELSEC iQ-R Motion Controller Programming Manual (Common)

Home position return direction

When the home position return is started, the operation starting direction is set.

Home position return direction	Details
0: Reverse direction (Address decrease direction)	The operation is executed in the direction in which the address decreases. (Arrow (1))
1: Forward direction (Address increase direction)	The operation is executed in the direction in which the address increases. (Arrow (2))

As the home position is normally set near the lower or upper limit, the "home position return direction" is set as shown below.



Home position return method

The home position return method for executing home position return is set.
Refer to the following for details of the home position return methods.

Home position return methods	Reference
0: Proximity dog method 1	☞ Page 380 Home position return by the proximity dog method 1
4: Proximity dog method 2	☞ Page 382 Home position return by the proximity dog method 2
1: Count method 1	☞ Page 384 Home position return by the count method 1
5: Count method 2	☞ Page 385 Home position return by the count method 2
6: Count method 3	☞ Page 386 Home position return by the count method 3
2: Data set method 1	☞ Page 388 Home position return by the data set method 1
3: Data set method 2	☞ Page 389 Home position return by the data set method 2
14: Data set method 3	☞ Page 390 Home position return by the data set method 3
7: Dog cradle method	☞ Page 391 Home position return by the dog cradle method
8: Stopper method 1	☞ Page 394 Home position return by the stopper method 1
9: Stopper method 2	☞ Page 395 Home position return by the stopper method 2
10: Limit switch combined method	☞ Page 396 Home position return by the limit switch combined method
11: Scale home position signal detection method	☞ Page 398 Home position return by the scale home position signal detection method
12: Dogless home position signal reference method	☞ Page 400 Home position return by the dogless home position signal reference method
13: Driver home position return method	☞ Page 405 Home position return by the driver home position return method

Home position address

Set the address used as the reference point for positioning control (absolute data method).
(When the home position return is completed, the stop position address is changed to the set address. At the same time, it is stored in the feed current value.)

Home position return speed

Set the speed for home position return.
Set the home position return speed to the speed limit value or less.
If the speed limit value is exceeded, a minor error (error code: 1B04H) will occur, and home position return will not be executed.
The home position return speed should be equal to or faster than the bias speed at start and creep speed.

Creep speed

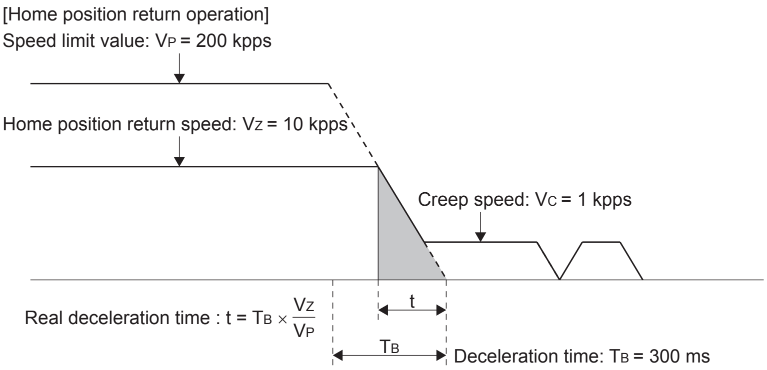
Set the creep speed after proximity dog ON (the low speed just before stopping after decelerating from the home position return speed).
The creep speed is set within the following range.
Home position return speed ≥ Creep speed ≥ Bias speed at start

Travel value after proximity dog ON

The travel value after proximity dog ON is set to execute the count method home position return.
After the proximity dog ON, the home position is the first zero-point after travel by the setting travel value.
Set the travel value after proximity dog ON more than the deceleration distance from the home position return speed.

Ex.

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)]

$$= \frac{1}{2} \times \frac{V_Z}{1000} \times t$$

Converts in speed per millisecond

$$= \frac{V_Z}{2000} \times \frac{T_B \times V_Z}{V_P}$$

$$= \frac{10 \times 10^3}{2000} \times \frac{300 \times 10 \times 10^3}{200 \times 10^3}$$

= 75. . . . . . Set 75 or more

Point

A home position return must be made after the servomotor 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 servomotor 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 servomotor must also have been rotated more than one revolution by JOG operation or the like to pass the axis through the Z-phase.
When "1: No servomotor 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.

Parameter block setting

Set the number of the parameter block (1 to 64) used for home position return. (☞ Page 215 Parameter Block)

Valid/invalid of the parameter block setting for each home position return method is shown below.

○: Valid ×: Invalid

Home position return methods		Valid/invalid of the parameter block setting
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	Operation A	○
	Operation B	○
	Operation C	○
Driver home position return method		×

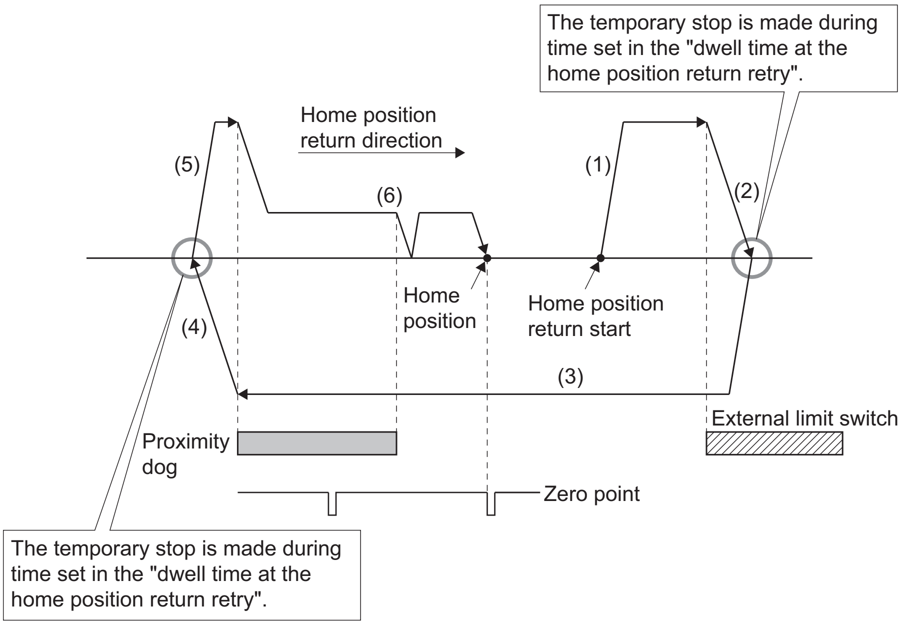
Home position return retry function/dwell time at the home position return retry

Valid/invalid of home position return retry is set.

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.

Operation for the proximity dog method home position return by setting "valid" for home position return retry function is shown below.

- Acceleration time ≠ Deceleration time



(1) It travels to preset direction of home position return.
(2) If the external upper/lower limit switch turns OFF before the detection of proximity dog, a deceleration stop is made.
(3) After a deceleration stop, the temporary stop is made during time set in the "dwell time at the home position return retry" and it travels to reverse direction of home position return with the home position return speed.
(4) A deceleration stop is made by the proximity dog OFF.
(5) After a deceleration stop, the temporary stop is made during time set in the "dwell time at the home position return retry" and it travels to direction of home position return.
(6) Home position return ends.

Valid/invalid of home position return retry function by the home position return method is shown below.

○: Valid ×: Invalid

Home position return methods		Valid/invalid of the parameter block setting
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	Operation A	○
	Operation B	×
	Operation C	×
Driver home position return method		×

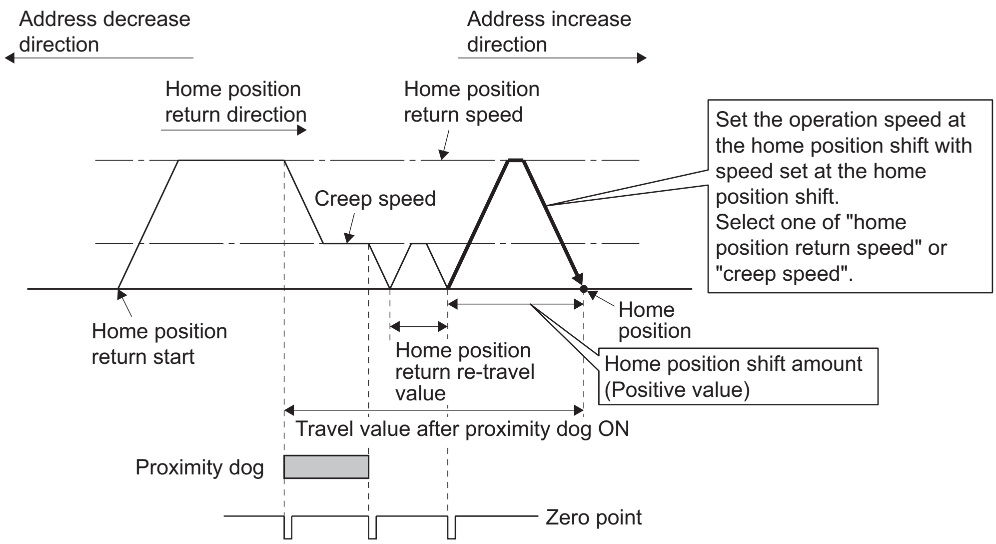
Home position shift amount/speed set at the home position shift

The shift (travel) amount from position stopped by home position return is set.

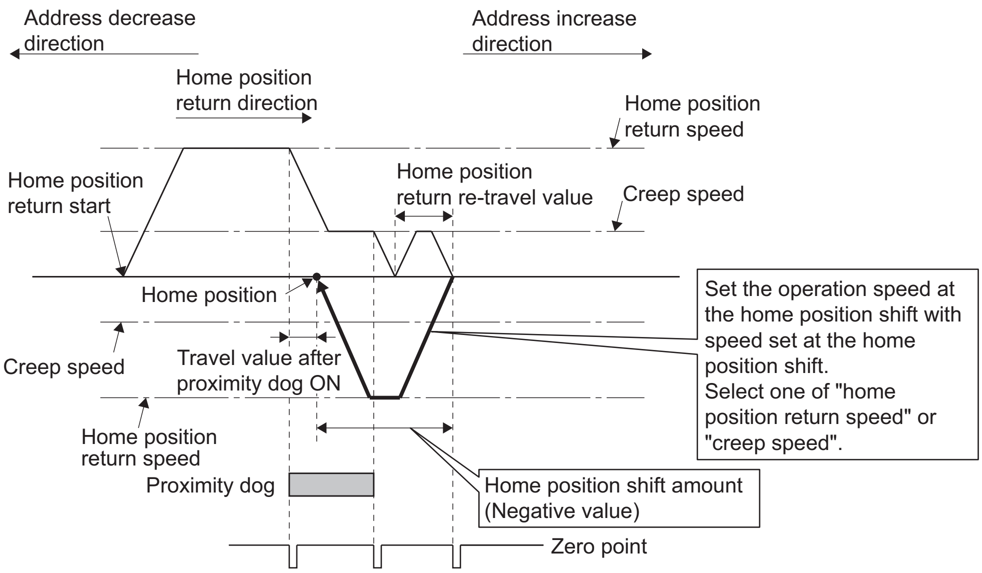
If the home position shift amount is positive value, it shifts from detected zero point signal to address increase direction. If it is negative value, it shifts from detected zero point signal to address decrease direction.

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".

- Home position shift amount is positive value



- Home position shift amount is negative value



Valid/invalid of the setting value for home position shift amount by the home position return method is shown below.

○: Valid ×: Invalid

Home position return methods	Valid/invalid of home position shift amount
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	○
Driver home position return method	×

Point

- 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. Also, by using the home position shift function, it is not necessary to care the zero point for mounting of servomotor.
- After proximity dog ON, if the travel value including home position shift amount exceeds the range of "-2147483648 to 2147483647" [$\times 10^{-1}\mu m$, $\times 10^{-5}$inch, $\times 10^{-5}$degree, pulse], "travel value after proximity dog ON" of monitor register is not set correctly.

3

Torque limit value at the creep speed

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.

Valid/invalid of the torque limit value at the creep speed by the home position return method is shown below.

○: Valid ×: Invalid

Home position return methods	Valid/invalid of home position shift amount
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	×
Driver home position return method	×

Operation setting for incompletion of home position return

Set the operation for executing or not executing the servo program when the state of the home position return request signal is ON.

When the home position return request signal is ON while G-code control is running, a minor error (error code: 1FC1H (details code: 0116H)) occurs regardless of this setting.

Operation in selecting "1: Not execute servo program"

- Servo program cannot be executed if the "[St.1069] Home position return request (R: M32409+32n/Q: M2409+20n)" is ON. However, the servo program can be executed even if the "[St.1069] Home position return request (R: M32409+32n/Q: M2409+20n)" is ON in the case of only servo program of home position return instruction (ZERO).
- 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 "[St.1069] Home position return request (R: M32409+32n/Q: M2409+20n)" is ON exists also with one axis, a minor error (error code: 19A6H) occurs and the servo program does not start.
- JOG operation and manual pulse generator operation can be executed regardless of the "[St.1069] Home position return request (R: M32409+32n/Q: M2409+20n)" ON/OFF.
- 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 "[St.1069] Home position return request (R: M32409+32n/Q: 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.
- Same operation is executed in TEST mode.

Operation in selecting "0: Execute servo program"

- Servo program can be executed even if the "[St.1069] Home position return request (R: M32409+32n/Q: M2409+20n)" is ON.

⚠CAUTION

- Do not execute the positioning control in "[St.1069] Home position return request (R: M32409+32n/Q: M2409+20n)" is ON for the axis which uses in the positioning control. Failure to observe this could lead to an accident such as a collision.

Setting items for home position return data

The home position return data that require setting are listed below by home position return method.

◎: Must be set (Indirect setting) ○: Must be set —: Must be not set

Items			Home position return methods																
			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	Data set method 3	Dog cradle method	Stopper method 1	Stopper method 2	Limit switch combined method	Scale home position signal detection method	Dogless home position reference method			Driver home position return method
																Operation A	Operation B	Operation C	
Home position return data	Home position return direction		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Home position address		◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎
	Home position return speed		◎	◎	◎	◎	◎	—	—	—	◎	◎	—	◎	◎	◎	◎	◎	—
	Creep speed		◎	◎	◎	◎	◎	—	—	—	◎	◎	◎	◎	◎	◎	◎	◎	—
	Travel value after proximity dog ON		—	—	◎	◎	◎	—	—	—	—	—	—	—	—	—	—	—	—
	Parameter block setting		○	○	○	○	○	—	—	—	○	○	○	○	○	○	○	○	—
	Home position return retry function		○	○	○	○	○	—	—	—	○	—	—	—	—	○	—	—	—
	Dwell time at the home position return retry		◎	◎	◎	◎	◎	—	—	—	◎	—	—	—	—	◎	—	—	—
	Home position shift amount		◎	◎	◎	◎	◎	—	—	—	◎	—	—	◎	◎	◎	◎	◎	—
	Speed set at the home position shift		○	○	○	○	○	—	—	—	○	—	—	○	○	○	○	○	—
	Torque limit value at the creep speed		—	—	—	—	—	—	—	—	—	◎	◎	—	—	—	—	—	—
	Operation setting for incompletion of home position return		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Parameter blocks	Interpolation control unit		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Speed limit value		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Acceleration time		○	○	○	○	○	—	—	—	○	○	○	○	○	○	○	○	—
	Deceleration time		○	○	○	○	○	—	—	—	○	○	○	○	○	○	○	○	—
	Rapid stop deceleration time		○	○	○	○	○	—	—	—	○	○	○	○	○	○	○	○	—
	S-curve ratio		○	○	○	○	○	—	—	—	○	○	○	○	○	○	○	○	—
	Advanced S-curve acceleration / deceleration	Acceleration/ deceleration system	○	○	○	○	○	—	—	—	○	○	○	○	○	○	○	○	—
		Acceleration section 1 ratio	○	○	○	○	○	—	—	—	○	○	○	○	○	○	○	○	—
		Acceleration section 2 ratio	○	○	○	○	○	—	—	—	○	○	○	○	○	○	○	○	—
		Deceleration section 1 ratio	○	○	○	○	○	—	—	—	○	○	○	○	○	○	○	○	—
		Deceleration section 2 ratio	○	○	○	○	○	—	—	—	○	○	○	○	○	○	○	○	—
	Torque limit value		○	○	○	○	○	—	—	—	○	○	○	○	○	○	○	○	—
	Deceleration processing at the stop time		○	○	○	○	○	—	—	—	○	○	○	○	○	○	○	○	—
	Allowable error range for circular interpolation		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Bias speed at start		○	○	○	○	○	—	—	—	○	○	○	○	○	○	○	○	—

3.5 JOG Operation Data

JOG operation data is the data required to execute JOG operation.

[Motion Control Parameter] ⇨ [Axis Setting Parameter] ⇨ "JOG Operation Data"

No.	Item	Default value	Setting range				Direct setting*1	Indirect setting	
			mm	inch	degree	pulse	Valid/ invalid	Valid/ invalid (Required size)	Fetch cycle
1	JOG speed limit value	20000 [pulse/s]	1 to 600000000 ($\times 10^{-2}$ [mm/ min])	1 to 600000000 ($\times 10^{-3}$ [inch/ min])	1 to 2147483647 ($\times 10^{-3}$ [degree/ min])*2	1 to 2147483647 [pulse/s]	○	×	—
2	Parameter block setting	1	1 to 64				○	×	—

*1 For direct setting using MT Developer2, use the decimal format instead of the exponential format.
*2 When the "speed control 10 × multiplier setting for degree axis" is valid in the fixed parameter, the setting range is 1 to 2147483647 ($\times 10^{-2}$ [degree/min]).

JOG speed limit value

Set the maximum speed during JOG operation.
Set the "JOG operation speed" not higher than the JOG speed limit value.
When the JOG speed exceeds the limit value, the "JOG operation speed" is limited to the JOG speed limit value.

Parameter block setting

Set the number of the parameter block used for JOG operation.

JOG operation data check

A relative check of the JOG operation data is executed at the following timing:

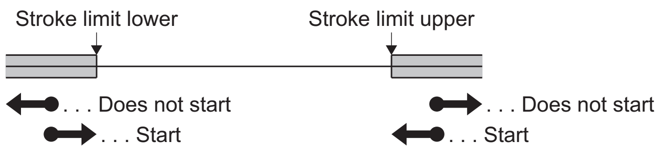
- JOG operation Individual start
- JOG operation simultaneous start
- JOG operation request

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 range is different.

- When upper stroke limit value > lower stroke limit value
  When "Feed current value > upper stroke limit value", movement in the reverse direction is possible.
  When "Feed current value < lower stroke limit value", movement in the forward direction is possible.
- When upper stroke limit value < lower stroke limit value
  Movement in both the forward and reverse direction is possible.

3.6 External Signal Parameter

This parameter is used to the servo external signal (Upper stroke limit (FLS), Lower stroke limit (RLS), Stop signal (STOP), Proximity dog/Speed-position switching (DOG/CHANGE)) used for each axis.

[Motion Control Parameter] ⇨ [Axis Setting Parameter] ⇨ "External Signal Parameter"

Item		Setting range			Default value
		Invalid	Amplifier input	Bit device	
FLS signal	Signal type	0: Invalid	1: Amplifier input	2: Bit device	0: Invalid
	Device	—	—	Bit device	—
	Contact	—	0: Normal open 1: Normal close	0: Normal open 1: Normal close	—
RLS signal	Signal type	0: Invalid	1: Amplifier input	2: Bit device	0: Invalid
	Device	—	—	Bit device	—
	Contact	—	0: Normal open 1: Normal close	0: Normal open 1: Normal close	—
STOP signal	Signal type	0: Invalid	—	2: Bit device	0: Invalid
	Device	—		Bit device	—
	Contact	—		0: Normal open 1: Normal close	—
DOG signal	Signal type	0: Invalid	1: Amplifier input	2: Bit device	0: Invalid
	Device	—	—	Bit device	—
	Contact	—	0: Normal open 1: Normal close	0: Normal open 1: Normal close	—
	Precision	—	0: General	0: General 1: High Precision	—

Signal type

Set the signal type to use as the external signal.

■Invalid

The external signal is invalid.

■Amplifier input

The input signal of servo amplifier is used as the following external signals.

Input signal	External signal
DI1	Upper stroke limit (FLS)
DI2	Lower stroke limit (RLS)
DI3	Proximity dog (DOG)

■Bit device

The optional bit device is used as the servo external signal.

Device

Set the bit device used when the signal type is set to the bit device.

Refer to the indirect setting method by devices for parameters for the range of usable devices. (☞ Page 168 Indirect Setting Method by Devices for Parameters)

Contact

Set the signal contact used as the external signal.

■Normal open

External signal	Details
FLS signal ON	The upper stroke limit is detected, and "operation of direction that the feed current value increase" cannot be executed.
RLS signal ON	The lower stroke limit is detected, and "operation of direction that the feed current value decrease" cannot be executed.
STOP signal ON	The stop signal is detected, and an operation stops.
DOG signal ON	The proximity dog/speed-position switching signal is detected, and the home position return operation and speed-position control switching is executed.

■Normal close

External signal	Details
FLS signal OFF	The upper stroke limit is detected, and "operation of direction that the feed current value increase" cannot be executed.
RLS signal OFF	The lower stroke limit is detected, and "operation of direction that the feed current value decrease" cannot be executed.
STOP signal OFF	The stop signal is detected, and an operation stops.
DOG signal OFF	The proximity dog/speed-position switching signal is detected, and the home position return operation and speed-position control switching is executed.

⚠CAUTION

- For the stroke limit wiring, always use negative logic (normally closed contact). Using the positive logic (normally open contact) may cause serious accidents.
- The input signal of the servo amplifier is always turned OFF when the communication with the servo amplifier is disconnected. If using the state of the external signal of the disconnected axis ([St.1071] External signals FLS (R: M32411+32n/Q: M2411+20n) / [St.1072] External signals RLS (R: M32412+32n/Q: M2412+20n) / [St.1074] External signals DOG/CHANGE (R: M32414+32n/Q: M2414+20n)) as the external signal of another axis that is not disconnected, design the system so that the machine will not go into a dangerous state due to the connection state of the servo amplifier.

Precision

Set the precision when the DOG signal is used for the count method home position return or the speed-position switching control.

Precision	Signal type	Setting required on the module side	Detection precision [μs]
General	Bit device	None	222*1
	Amplifier input (DI3)	None	• Operation cycle 1.777 [ms] or less: Operation cycle • Operation cycle 3.555 [ms] or more: 3555
High precision	Bit device (Actual X device)	• Enable the inter-module synchronization function.*2 • Set the input response time.	*3

*1 When an actual device with the inter-module synchronization setting is used, the inter-module synchronization cycle is used.
*2 When the function is not enabled, a moderate error (error code: 30D2H) occurs.
*3 Detection precision of the high precision setting of the bit device

Input response time [ms]	Detection precision	
	Theoretical value [μs]	Measured value [μs]
0.10	4.9	7
0.20	9.9	12
0.40	19.8	22
0.60	25.0	27
1.00	39.5	41
5.00	158	160
10.00	316	318
20.00	630	632
70.00	2500	2502

■General

The detection precision is based on the fixed-cycle processing of the Motion CPU.

When the input module setting is "Inter-module synchronization valid" and the servo amplifier DI3 signal setting is "high precision input", the general detection precision is applied.

■High precision

When the input module setting is "Inter-module synchronization valid", the stopping precision of the count method home position return or the speed-position switching control can be high by setting the DOG signal precision setting to "high precision".

Refer to the following for the input module setting method.

📖MELSEC iQ-R Motion controller Programming Manual (Common)

When this setting is applied to a signal that does not support high precision input a moderate error (error code: 30D2H) occurs.

3.7 Expansion Parameters

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.
- When performing positioning control in the absolute data method on a degrees axis, specify the positioning direction.

[Motion Control Parameter] ⇨ [Axis Setting Parameter] ⇨ [Axis Setting Parameter]

No.	Item		Default value	Setting range				Direct setting*1	Indirect setting*2		Refresh cycle	Reference section
				mm	inch	degree	pulse	Valid/ invalid	Valid/ invalid (Required size)	Fetch cycle		
1	Positive direction torque limit value monitor device*3		—	—				×	○ (1 word)	—	Operation cycle	☞ Page 193
2	Negative direction torque limit value monitor device*3		—	—				×	○ (1 word)	—		
3	Acceleration/ deceleration time change parameter	Acceleration/ deceleration time change enable device*3	—	—				×	○ (1 bit)	At request of speed change	—	☞ Page 194
4		New acceleration time value device*3	—	—				×	○ (2 word)		—	
5		New deceleration time value device*3	—	—				×	○ (2 word)		—	
6	Servo motor maximum speed check parameter	Maximum servo motor speed	0 (×10-2 [r/min])	0 to 10000000(×10^{-2}[r/min])				○	○ (2 word)	At machine operation start	—	☞ Page 195
		Deceleration time constant	0[ms]	0 to 20000[ms]*4				○	×		—	
7	ABS direction in degrees device*3*5		—	—				×	○ (1 word)	At program start*6*7	—	☞ Page 197

*1 For direct setting using MT Developer2, use the decimal format instead of the exponential format.

*2 Refer to the indirect setting method by devices for parameters for the range of devices used for indirect setting. (☞ Page 168 Indirect Setting Method by Devices for Parameters)

*3 This setting can be omitted.

*4 When 0 is set, a deceleration stop is executed according to the stop deceleration time set in the parameter block.

*5 Can be set when the unit setting of the fixed parameter is "degree".

*6 During position follow-up control, the values of devices that were indirectly set at the change of the positioning address are input again.

*7 For continuous trajectory control, operation is by the settings at the start, even if the settings were changed during operation.

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.

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 control circuit power supply of servo amplifier ON.

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 "[Md.35] Torque limit value (R: D32014+48n/Q: D14+20n)" in 0.1 [%] unit. (The negative torque limit value is not stored.)

Acceleration/deceleration time change parameter

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 (M(P).CHGV/D(P).CHGV)).

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.

Setting value	Details
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.

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.

Setting value	Details
1 to 8388608 [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 setting value
Other than above	Acceleration time change is disabled, and speed change is maintained at the current acceleration time.

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.

Setting value	Details
1 to 8388608 [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 setting value.
Other than above	Deceleration time change is disabled, and speed change is maintained at the current deceleration time.

Point

- 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.
- 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.

Servo motor maximum speed check parameter

Setting the servo motor maximum speed avoids an incorrect command value being sent to the servo amplifier, and shortens the braking distance when the servo motor stops. The servo motor maximum speed check parameter is enabled only on axes set as "Joint axis structure" in the machine parameter. Refer to the following for details on machine parameter.

MELSEC iQ-R Motion Controller Programming Manual (Machine Control)

The servo motor maximum speed check parameter checks that the command value to the servo amplifier is within the servo motor maximum speed settings during machine program operation and machine JOG operation. When the servo motor maximum speed setting value is exceeded a minor error (error code: 1FE2H (details code: 0007H) occurs, and a deceleration stop is executed according to the stop deceleration time set in the parameter block, or a separate deceleration time.

(Page 259 Stop processing and restarting after stop)

3

Servo motor maximum speed

Set the maximum speed determined by the mechanical system, etc. for each of the controlled axes as the servo motor maximum speed.

The servo motor maximum speed is used in the joint interpolation speed restriction function, and servo motor maximum speed check. Refer to the following for details of joint interpolation speed restriction function, and servo motor maximum speed check.

MELSEC iQ-R Motion Controller Programming Manual (Machine Control)

When the servo motor maximum speed value is set to "0", the maximum speed check is disabled.

When the servo motor maximum speed is set by indirect setting, the settings are imported at the start of machine operation (machine program operation, machine JOG operation). When the servo motor maximum speed is outside of the setting range, a warning (error code: 0EE0H (details code: 00F0H)) occurs, and the servo motor maximum speed check becomes the maximum value for the servo motor maximum speed.

When used in conjunction with coordinate transformation, because operation stops temporarily use the smoothing filter of the vibration suppression command filter function. When smoothing filter is not set during machine program operation, a warning (error code: 0EE0H (details code: 00F1H)) occurs. Refer to vibration suppression command filter for vibration suppression command filter function. (Page 467 Vibration Suppression Command Filter)

■Settings when using linear servo motor

When using a linear servo motor, use the number of pulses set in servo parameter "(Linear servo motor function selection 1(PL01)(stop interval selection at the home position return))" to convert to number of revolutions. Use the following formula to calculate the value to be set servo motor maximum speed.

$$\text{Set value[rpm]} = \frac{\text{Linear servo motor restriction value[mm/min]} \times \text{AP[pulse]} \times 1000}{\text{AL}[\mu\text{m}] \times \text{Number of pulses for stop interval selection at home position return[pulse]}}$$

AP: Number of pulses per revolution, AL: Travel value per revolution, 1000: [μm] converted to [mm]

Deceleration time constant

Set the time it takes from servo motor maximum speed to stop when the command value to the servo amplifier exceeds the servo motor maximum speed set value.

The deceleration time constant is used in the servo motor maximum speed check. Refer to the following for details on the servo motor maximum speed check.

MELSEC iQ-R Motion Controller Programming Manual (Machine Control)

When deceleration time constant is set to "0", a deceleration stop is executed according to the stop deceleration time set in the parameter block.

Point

- Relationship between the servo motor maximum speed and speed limit value
  When setting the servo motor maximum speed, make sure to set it so that the speed calculated from the servo motor maximum speed([r/min]) is larger than the speed limit value. If the speed calculated from the servo motor maximum speed is smaller than the speed limit value, the motor stops before reaching the speed limit value.
- Servo motor maximum speed check during interpolation control
  The servo motor maximum speed check during interpolation control is not valid for positioning speed at interpolation control (☞ Page 251 Positioning speed at the interpolation control), but for the positioning speed of each axis.
  When the servo motor speed exceeds the set value during interpolation control, stop processing is performed on the interpolation axis.

ABS direction in degrees device

If performing positioning control in the absolute data method on an axis where the control unit is degrees and when the stroke limit is invalid, a shortcut operation occurs. By setting the positioning direction in the ABS direction in degrees device expansion parameter, positioning control can be performed in a specified direction.

Supported positioning controls

ABS direction in degrees is enabled only for the following positioning controls.

Positioning control		Instruction symbol	Processing
Linear interpolation control	1 axis	ABS-1	Absolute 1-axis linear interpolation
	2 axis	ABS-2	Absolute 2-axes linear interpolation
	3 axis	ABS-3	Absolute 3-axes linear interpolation
	4 axis	ABS-4	Absolute 4-axes linear interpolation
Helical interpolation control*1	Auxiliary point-specified	ABH	Absolute auxiliary point- specified helical interpolation
	Radius-specified	ABH	Absolute radius-specified helical interpolation less than CW 180°
		ABH	Absolute radius-specified helical interpolation CW 180° or more
		ABH	Absolute radius-specified helical interpolation less than CCW 180°
		ABH	Absolute radius-specified helical interpolation CCW 180° or more
	Central point-specified	ABH	Absolute central point-specified helical interpolation CW
		ABH	Absolute central point-specified helical interpolation CCW
Continuous trajectory control		ABS-1	Continuous trajectory control passing point absolute specification
		ABS-2	
		ABS-3	
		ABS-4	
		ABH	Continuous trajectory control passing point helical absolute specification*1
		ABH	
		ABH	
		ABH	
		ABH	
		ABH	
		ABH	
Position follow-up control		PFSTART	Position follow-up control start

*1 Linear axis valid only

Setting range of ABS direction in degrees device

Positioning control is performed in the specified direction based on the value of ABS direction in degrees device at the start.
The following values can be set in ABS direction in degrees device.

ABS direction in degrees device value	Positioning direction
0	Shortcut
1	Forward direction (address increasing)
2	Reverse direction (address decreasing)

When the value of the ABS direction in degrees device is outside of range at the start of positioning control, a minor error (error code: 19A4H) occurs, and positioning control does not start.
When setting is changed during operation, the operation continues with the setting at the start of operation.
However, during position follow-up control, the value of the ABS direction in degrees device is input again at the time of when the positioning address is changed.
When the value of the ABS direction in degrees device that is input again is out of range, a minor error (error code: 19A4H) occurs, and a deceleration stop is made.

Operation 1

Operation 1 for when ABS direction in degrees device is set is shown below.

■Positioning conditions

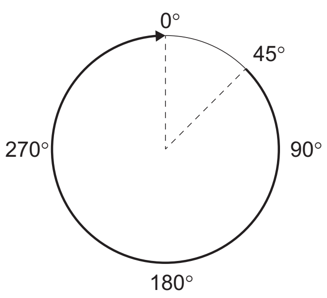
Item	Setting
Servo program No.	10
Control axis	1
Positioning address	0.00000 [degree]
Positioning speed	18.000 [degree/min]
ABS direction in degrees device	1 (forward direction) / 2 (reverse direction)
Current value	45.00000 [degree]

■Servo program

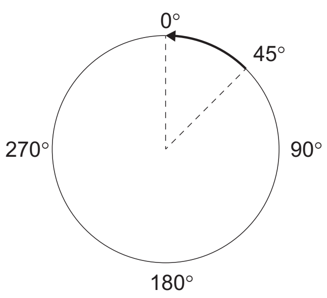
```
<K    10>
ABS-1
Axis     1,    0.00000degree
Speed             18.000degree/min
```

■Operation when positioning direction is set to "1: Forward direction", "2: Reverse direction" in ABS direction in degrees device

When "1: Forward direction" is set



When "2: Reverse direction" is set



Point

- When the setting of ABS direction in degrees device is omitted, a shortcut operation occurs.
- If one of the following conditions is not satisfied, the setting of ABS direction in degrees device is disabled.
  (1) Control unit is set to a degrees axis.
  (2) Stroke limit is set to invalid.
  (3) A servo instruction with ABS direction in degrees enabled is used.
- Positioning address is within the range of "0° to 359.99999°". If performing positioning for one revolution or more, use the incremental system.

Operation 2

Operation 2 for when ABS direction in degrees device is set is shown below.

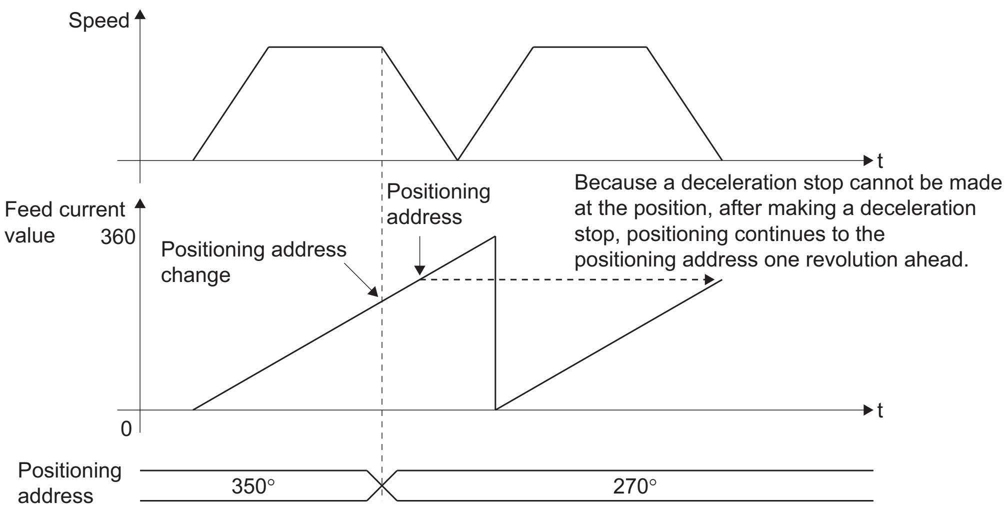
■Positioning conditions

Item	Setting
Servo program No.	11
Control axis	1
Positioning address	D6000 [degree]
Positioning speed	18.000 [degree/min]
ABS direction in degrees device	1 (forward direction)

■Servo program

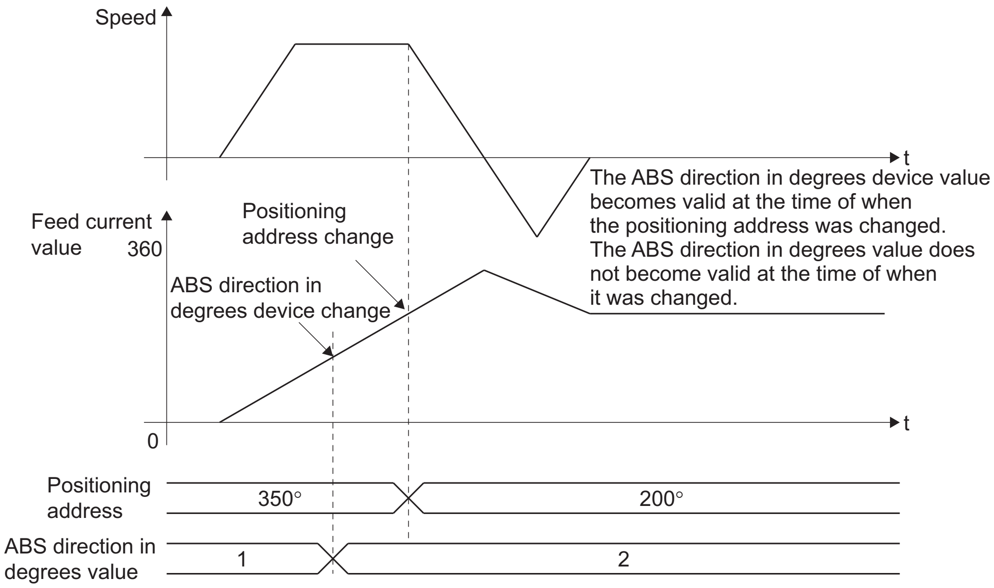
```
<K    11>
PFSTART
Axis      1,      D6000degree
Speed             18.000degree/min
```

■When "Movement amount from current value < deceleration stop distance" at positioning address change



■When value of ABS direction in degrees is changed at positioning address change

Changing the ABS direction in degrees device from "1: Forward direction" to "2: Reverse direction"



3.8 Speed-torque control data

Speed-torque control data are for executing "speed-torque control".

[Motion Control Parameter] ⇨ [Axis Setting Parameter] ⇨ "Speed-Torque Control Data"

No.	Setting item	Setting necessity			Default value	Setting range				Direct setting*1	Indirect setting*2		Reference section
		Speed control	Torque control	Continuous operation to torque control		mm	inch	degree	pulse	Valid/ invalid	Valid/ invalid (Required size)	Fetch cycle	
1	Control mode switching request device*3	○	○	○	—	—				×	○(1 bit)	Operation cycle	Page 203
2	Control mode setting device*3	○	○	○	—	—				×	○(1 word)	At switching of the control mode	Page 203
3	Speed limit value at speed control-torque	○	○	○	200000 [Selected unit]	1 to 600000000 ($\times 10^{-2}$[mm/min])	1 to 600000000 ($\times 10^{-3}$[inch/min])	1 to 2147483647 ($\times 10^{-3}$[degree/min])*4	1 to 2147483647 [pulse/s]	○	○(2 words)		Page 203
4	Torque limit value at speed-torque control	○	○	○	3000 ($\times 10^{-1}$[%])	1 to 10000($\times 10^{-1}$[%])				○	○(1 word)		Page 203
5	Speed command device*3	○	○	○	—	—				×	○(2 words)	Operation cycle	Page 203
6	Command speed acceleration time	○	×	○	1000[ms]	0 to 8388608[ms]				○	○(2 words)	At switching of the control mode	Page 204
7	Command speed deceleration time	○	×	○	1000[ms]	0 to 8388608[ms]				○	○(2 words)		
8	Torque command device*3	×	○	○	—	—				×	○(1 word)		Page 204
9	Command torque time constant (positive direction)	×	○	○	1000[ms]	0 to 8388608[ms]				○	○(2 words)		Page 205
10	Command torque time constant (negative direction)	×	○	○	1000[ms]	0 to 8388608[ms]				○	○(2 words)		
11	Speed initial value selection at control mode switching	○	×	○	0	0: Command speed 1: Feedback speed 2: Automatic selection				○	×	—	Page 206

No.	Setting item	Setting necessity			Default value	Setting range				Direct setting*1	Indirect setting*2		Reference section
		Speed control	Torque control	Conti-nuous operat-ion to torque control		mm	inch	degree	pulse	Valid/ invalid	Valid/ invalid (Requir ed size)	Fetch cycle	
12	Torque initial value selection at control mode switching	×	○	○	0	0: Command torque 1: Feedback torque				○	×	—	☞ Page 206
13	Invalid selection during zero speed at control mode switching	○	○	○	0	0: Condition at control mode switching: valid 1: Condition during zero speed at control mode switching: invalid				○	×	—	☞ Page 206

*1 For direct setting using MT Developer2, use the decimal format instead of the exponential format.

*2 Refer to the indirect setting method by devices for parameters for the range of devices used for indirect setting. (☞ Page 168 Indirect Setting Method by Devices for Parameters)

*3 This setting can be omitted.

*4 When the "speed control 10 × multiplier setting for degree axis" is set to "valid", the setting range is 1 to 2147483647($\times 10^{-2}$ [degree/min].

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.

Control mode setting device

Set the device to set the control mode after switching.
When the control mode switching request device is turned from 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 warning (error code: 09E8H) will occur, and the control mode is not switched.

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 warning (error code: 0A5FH) will occur, and the control is executed with the speed limit value at speed-torque control.

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 warning (error code: 09E4H) will occur, and the control is executed with the torque limit value at speed-torque control.

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.
The following values can be set to the speed command device.

Units	Setting range
mm	-600000000 to 600000000($\times10^{-2}$ [mm/min])
inch	-600000000 to 600000000($\times10^{-3}$ [inch/min])
degree	-2147483648 to 2147483647($\times10^{-3}$ [degree/min])*1
pulse	-2147483648 to 2147483647($\times10^{-2}$ [pulse/s])

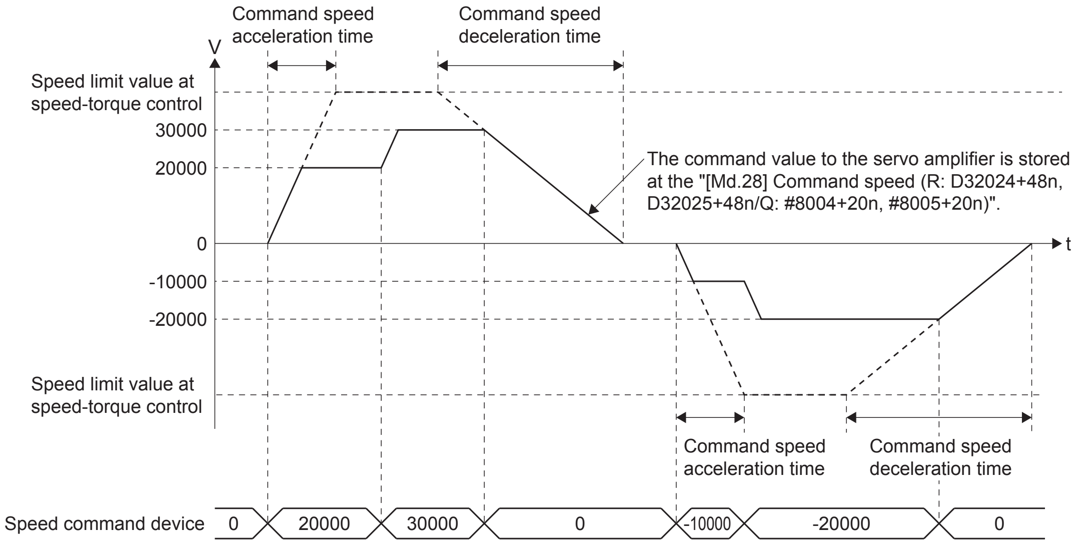
*1 When the "speed control 10 $\times$ multiplier setting for degree axis" is valid, the setting range is -2147483648 to 2147483647($\times10^{-2}$ [degree/min]).

Point

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.

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.

Torque command device

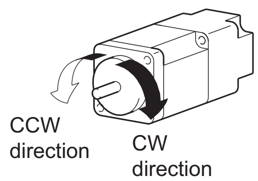
Set the command torque at torque control and continuous operation to torque control.
Command torque can be changed at any time.
The following values can be set to the torque command device.

Setting range
-10000 to 10000 (×0.1[%])

Torque control

The relation between setting of command torque and torque generation direction of servomotor differs from the setting of servo parameter "Rotation direction selection (PA14)" and "Function selection C-B (PC29) (POL reflection selection at torque control)".

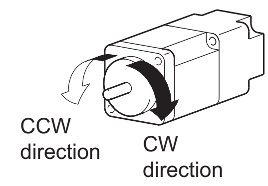
Function selection C-B (PC29) (POL reflection selection at torque control)"	Rotation direction selection (PA14)	Torque command device	Torque generation direction of servo motor
0: Valid	0: Forward rotation (CCW) with the increase of the positioning address	Positive value (Forward direction)	CCW direction
		Negative value (Reverse direction)	CW direction
	1: Reverse rotation (CW) with the increase of the positioning address	Positive value (Forward direction)	CW direction
		Negative value (Reverse direction)	CCW direction
1: Invalid	0: Forward rotation (CCW) with the increase of the positioning address	Positive value (Forward direction)	CCW direction
		Negative value (Reverse direction)	CW direction
	1: Reverse rotation (CW) with the increase of the positioning address	Positive value (Forward direction)	CCW direction
		Negative value (Reverse direction)	CW direction



Continuous operation to torque control

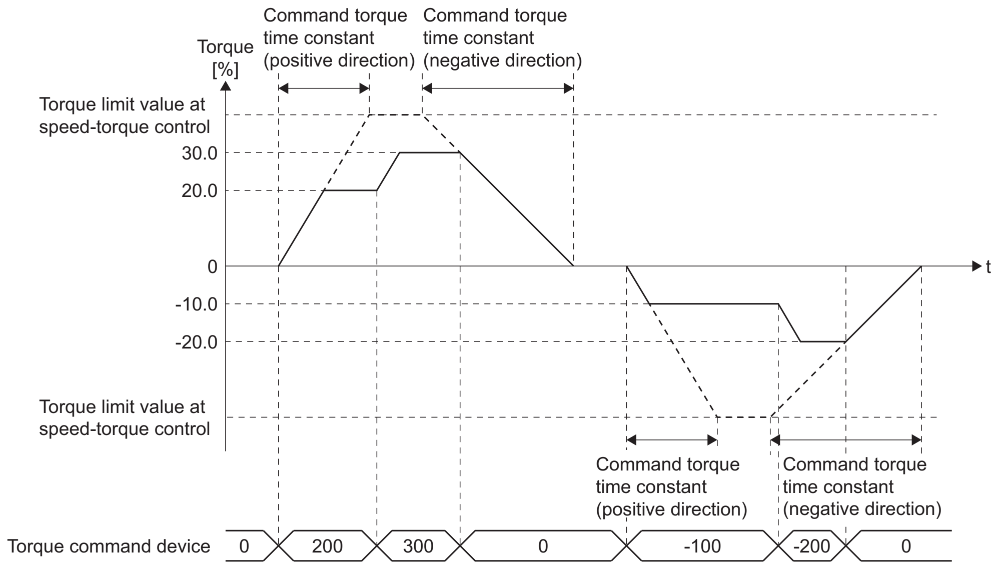
The relation between setting of command torque and torque generation direction of servomotor is fixed regardless of the setting of servo parameter "Rotation direction selection (PA14)" and "Function selection C-B (PC29) (POL reflection selection at torque control)".

Function selection C-B (PC29) (POL reflection selection at torque control)"	Rotation direction selection (PA14)	Torque command device	Torque generation direction of servo motor
0: Valid	0: Forward rotation (CCW) with the increase of the positioning address	Positive value (Forward direction)	CCW direction
		Negative value (Reverse direction)	CW direction
	1: Reverse rotation (CW) with the increase of the positioning address	Positive value (Forward direction)	CCW direction
		Negative value (Reverse direction)	CW direction
1: Invalid	0: Forward rotation (CCW) with the increase of the positioning address	Positive value (Forward direction)	CCW direction
		Negative value (Reverse direction)	CW direction
	1: Reverse rotation (CW) with the increase of the positioning address	Positive value (Forward direction)	CCW direction
		Negative value (Reverse direction)	CW direction



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).

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".

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.

Invalid selection during zero speed at control mode switching

Set to switch the control mode without waiting for stop of servo motor.

Invalid selection during zero speed at control mode switching
0: Condition at control mode switching: valid
1: Condition during zero speed at control mode switching: invalid

Point

Set normally "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.

3.9 Pressure control data

Set pressure control parameters when using a pressure profile.
Pressure control data for up to 8 axes can be set.

[Motion Control Parameter] ⇨ [Axis Setting Parameter] ⇨ "Pressure Control Data"

No.	Item	Default value	Setting range				Direct setting	Indirect setting*1		Reference Section
			mm	inch	degree*2	pulse	Valid/ invalid	Valid/ invalid (Required size)	Fetch cycle	
1	Pressure control selection	0	0: Do not use pressure control 1: Use pressure control				○	×	At power supply ON	Page 208
2	Feed/dwell startup device	—	—				×	○ (1 bit)	Main cycle	Page 208
3	Dwell forced switching device*3	—	—				×	○ (1 bit)		Page 208
4	Pressure release startup device*3	—	—				×	○ (1 bit)		Page 208
5	Pressure command reference	—	1 to 32767				○	×	At pressure control start	Page 208
6	Speed limit reference	—	0.01 to 21474836.47 [mm/min]	0.001 to 2147483.647 [inch/min]	—	1 to 2147483647 [pulse/s]	○	×		Page 208
7	Abnormal pressure switching mode	—	0: Unselect 1: Select				○	×		Page 208
8	Abnormal pressure setting	—	0 to 32767				○	○ (1 word)		Page 208
9	Abnormal pressure setting time	—	0 to 327670 [ms]				○	○ (2 word)		Page 209
10	Mode reset selection after passing dwell time	—	0: Do not reset mode after passing dwell time 1: Reset mode after passing dwell time				○	×		Page 209
11	Pressure profile start-device	—	—				×	○ (344 word)		Page 209
12	Pressure control status device*3	—	—				×	○ (1 word)	At power supply ON	Page 209
13	Feed execution point device*3	—	—				×	○ (1 word)		Page 209
14	Dwell execution point device*3	—	—				×	○ (1 word)		Page 209
15	Pressure release execution point device*3	—	—				×	○ (1 word)		Page 209

*1 Refer to the indirect setting method by devices for parameters for the range of devices used for indirect setting. (Page 168 Indirect Setting Method by Devices for Parameters)
*2 Cannot be set when the unit setting of fixed parameter is "degree".
*3 This setting can be omitted.

Pressure control selection

Set whether to use pressure control, or not use pressure control. Pressure control data for up to 8 axes can be set.
When pressure control selection is enabled on an axis on a SSCNETⅢ line or the number of axes set to pressure control selection enabled exceeds eight, a moderate error (error code: 30F7H) occurs.

Pressure control selection
0: Do not use pressure control
1: Use pressure control

Feed/dwell startup device

Set the device to start feed/dwell operation.
When the feed/dwell start device turns OFF to ON, control switches to pressure control, and drives the system with the feed/dwell operation.
When the feed/dwell startup device turns ON to OFF, the mode is reset, and switches from pressure control to positioning control.

Dwell forced switching device

Set the device to force the switch to dwell operation during feed operation.
Operation switches to dwell operation automatically by specifying a feed/dwell switching mode in the pressure profile.
However, by turning the force switch to dwell device OFF to ON, switch to dwell operation can be made even when conditions for switching to dwell operation are not satisfied.

Pressure release startup device

Set the device to start pressure release operation.
When the pressure release startup device turns OFF to ON, control switches to pressure control, and drives the system with the pressure release operation. When load cell pressure drops below the set pressure, or when the pressure release startup device turns ON to OFF, the mode is reset, and control switches from pressure control to positioning control.

Pressure command reference

Set the reference for the time constant of the pressure command.
The time constant of the pressure command is the time taken to reach the pressure command reference.

Speed limit reference

Set the reference for the time constant of the speed limit.
The time constant of the speed limit is the time taken to reach the speed limit reference from 0.

Abnormal pressure switching mode

Set whether to switch to dwell mode or not when the pressure reaches the value set as abnormal pressure setting during feed operation.
If "1: Select" is set, operation is forcibly switched from feed mode to dwell mode when the time in an abnormal state exceeds the time that was set to abnormal pressure.

Abnormal pressure switching mode
0: Unselect
1: Select

Abnormal pressure setting

Set the abnormal pressure value.

Abnormal pressure setting time

Set the value for forcibly switching to dwell operation when abnormal pressure exceeds the set time during feed operation.

Mode reset selection after passing dwell time

Set whether to reset mode or not after passing dwell time.
If "1: Reset mode after passing dwell time" is selected, the system (Motion CPU) automatically resets mode after passing the set time of the dwell final step. (Operation is returned to positioning control from pressure control.)
Without turning the feed/dwell startup device ON to OFF, control automatically switches to positioning control when the set dwell time passes.

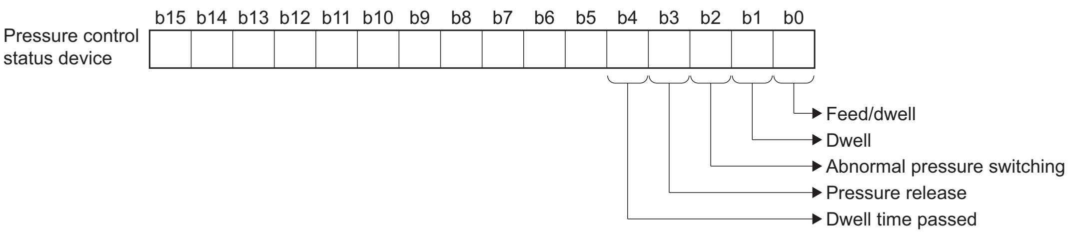
Mode reset selection after passing dwell time
0: Do not reset mode after passing dwell time
1: Reset mode after passing dwell time

Pressure profile start device

Specify the start device of the pressure profile.
Refer to the pressure profile for details of pressure profile. (☞ Page 453 Pressure profile)

Pressure control status device

Set the device to store the status of the pressure control operation.



*: 0 or 1 is stored in the pressure control status device.
- 0: OFF
- 1: ON

Feed execution point device

Set the device to store the status of the feed operation execution point.
The execution point is displayed in bits, and shifts left by 1 bit for every step advanced.
For execution point 1, 1 is displayed, and for execution point 3, 4 is displayed.

Dwell execution point device

Set the device to store the status of the dwell operation execution point.
The execution point is displayed in bits, and shifts left by 1 bit for every step advanced.
For execution point 1, 1 is displayed, and for execution point 3, 4 is displayed.

Pressure release execution point device

Set the device to store the status of the pressure release operation execution point.
The execution point is displayed in bits, and shifts left by 1 bit for every step advanced.
For execution point 1, 1 is displayed, and for execution point 3, 4 is displayed.

3.10 Override Data

Override data is for using the override function.

[Motion Control Parameter] ⇨ [Axis Setting Parameter] ⇨ "Override Data"

No.	Item	Default value	Setting range				Direct setting	Indirect setting[*1]		Reference Section
			mm	inch	degree	pulse	Valid/ invalid	Valid/ invalid (Required size)	Fetch cycle	
1	Override ratio setting device[*2]	—	—				×	○ (1 word)	Operation cycle	☞ Page 210

*1 Refer to the indirect setting method by devices for parameters for the range of devices used for indirect setting. (☞ Page 168 Indirect Setting Method by Devices for Parameters)

*2 This setting can be omitted.

Override ratio setting device

Set the device that sets the override ratio of the override function.

Set override ratio setting device to the override ratio values below.

Refer to override function for details of the override ratio setting device. (☞ Page 462 Override Function)

Override ratio
0 to 3000($\times10^{-1}$[%])

3.11 Vibration Suppression Command Filter Data

Vibration suppression command filter data is for using the vibration suppression command filter.

[Motion Control Parameter] ⇨ [Axis Setting Parameter] ⇨ "Vibration Suppression Command Filter Data"

No.	Item		Default value	Setting range				Direct setting	Indirect setting[*1]		Reference Section
				mm	inch	degree	pulse	Valid/ invalid	Valid/ invalid (Required size)	Fetch cycle	
1	Vibration suppression command filter 1[*2]	Mode selection device	—	—				×	○ (1 word)	Operation cycle	☞ Page 212
2		Frequency	—	20 to 25000[$\times 10^{-2}$Hz]				○	○ (1 word)		
3		Depth	—	0:-40dB 1:-24.1dB 2:-18.1dB 3:-14.5dB 4:-12.0dB 5:-10.1dB 6:-8.5dB 7:-7.2dB 8:-6.0dB 9:-5.0dB 10:-4.1dB 11:-3.3dB 12:-2.5dB 13:-1.8dB 14:-1.2dB 15:-0.6dB				○	○ (1 word)		
4	Vibration suppression command filter 2[*2]	Mode selection device	—	—				×	○ (1 word)		☞ Page 213
5		Frequency	—	100 to 25000[$\times 10^{-2}$Hz]				○	○ (1 word)		
6	Feed current value monitor device after filter[*2]		—	—				×	○ (2 words)		☞ Page 213
7	Command output complete signal after filter[*2]		—	—				×	○ (1 bit)		☞ Page 213

*1 Refer to the indirect setting method by devices for parameters for the range of devices used for indirect setting. (☞ Page 168 Indirect Setting Method by Devices for Parameters)

*2 This setting can be omitted.

Vibration suppression command filter 1

Mode selection device

Set the device that assigns vibration suppression command filter 1 as the filter method.
With the filter enabled, the device is reflected while command output is stopped after filter (Command output complete signal after filter: ON).
With the filter disabled, a sudden operation may occur if vibration suppression command filter is enabled during positioning operation. Check command speed and travel distance, and ensure safety before using the vibration suppression command filter.
The following values are set to the mode selection device.

Setting value	Filter method
0	Disabled
1	Smoothing filter
2	FIR filter

When the mode selection device is a value outside of range, a warning (error code: 0A3AH) occurs, and the mode setting is not reflected even if changed.

Frequency

Set the frequency for suppressing vibration of the vibration suppression command filter 1.
The valid frequency range is shown below according to operation cycle and filter method set by the mode selection device.
The vibration suppression command filter is invalid when operation cycle is set to 7.111[ms].

Operation cycle[ms]	Valid range[Hz]	
	Smoothing filter	FIR filter
0.222	0.20 to 250.00	0.20 to 250.00
0.444	0.20 to 250.00	0.20 to 250.00
0.888	0.20 to 250.00	0.20 to 250.00
1.777	0.20 to 140.00	0.20 to 140.00
3.555	0.20 to 70.00	0.20 to 70.00

When the frequency is a value outside of range, a warning (error code: 0A3BH) occurs, and the value is changed to the lower limit value if the input value is lower than the range, and changed to the upper limit value if the input value is higher than the range.

Depth

Set the attenuation depth of the frequency that suppressing the vibration of vibration suppression command filter 1.
Setting a deeper value increases the effect of vibration suppression.
This setting is invalid for smoothing filter. (Depth is fixed at -40dB.)
For the FIR filter setting, when the depth is a value outside of range, a warning (error code: 0A3CH) occurs, and the value is changed to the lower limit value if the input value is lower than the range, and changed to the upper limit value if the input value is higher than the range.

Vibration suppression command filter 2

Mode selection device

Set the device that assigns vibration suppression command filter 2 as the filter method.
With the filter enabled, the device is reflected while command output is stopped after filter (Command output complete signal after filter: ON).
With the filter disabled, a sudden operation may occur if vibration suppression command filter is enabled during positioning operation. Check command speed and travel distance, and ensure safety before using the vibration suppression command filter.
The following values are set to the mode selection device.

Setting value	Filter method
0	Disabled
3	IIR filter

When the mode selection device is a value outside of range, a warning (error code: 0A3AH) occurs, and the mode setting is not reflected even if changed.

Frequency

Set the frequency for suppressing vibration of the vibration suppression command filter 1.
The valid frequency range is shown below according to operation cycle and filter method set by the mode selection device.
The vibration suppression command filter is invalid when operation cycle is set to 7.111[ms].

Operation cycle[ms]	Valid range[Hz]
	IIR filter
0.222	1.00 to 250.00
0.444	1.00 to 200.00
0.888	1.00 to 100.00
1.777	1.00 to 50.00
3.555	1.00 to 25.00

When the frequency is a value outside of range, a warning (error code: 0A3BH) occurs, and the value is changed to the lower limit value if the input value is lower than the range, and changed to the upper limit value if the input value is higher than the range.

Feed current value monitor device after filter

Set the device that monitors the feed current value after filter that includes the delay caused by the vibration suppression command filter.
"[Md.20] Feed current value (R: D32000+48n, D32001+48n/Q: D0+20n, D1+20n)" does not include the delay from the vibration suppression command filter. In order to check the actual send value to the servo amplifier after filter, set this device and monitor it.
For speed control mode, torque control mode, continuous operation to torque control mode, and pressure control mode, the same value as the feed current value is stored when filter is disabled.
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 this device.

Command output complete signal after filter

Set the device that monitors command output complete after filter for the servo amplifier.
This device turns OFF during command output after filter, and turns ON when command output is stopped after filter. The device remains ON when filter is disabled.
For operation patterns that repeat forward rotation and reverse rotation, as this device turns ON/OFF during positioning operations, use the device with complete signals of operation patterns such as "[St.1061] Positioning complete (R: M32401+32n/Q: M2401+20n)" or "[St.1040] Start accept flag (R: M30080+n/Q: M2001+n)".

3.12 Servo Parameters

The servo parameters are the data set in each axis and are determined by the specifications of the servo amplifier, servo motor, and sensing module to be controlled. The data is used to control the servo motors .

[Motion Control Parameter] ⇨ [Servo Parameter]

Refer to the following for details of servo parameters.

Servo amplifier Instruction Manual

Sensing Module Instruction Manual

Servo amplifier and sensing module instruction manual lists are shown below.

- Servo amplifier

Type	Instruction manual name
MR-J4-□B	SSCNETⅢ/H interface MR-J4-_B(-RJ)/ MR-J4-_B4(-RJ)/ MR-J4-_B1(-RJ) Servo amplifier Instruction Manual (SH-030106)
MR-J4W-□B	SSCNETⅢ/H interface Multi-axis AC Servo MR-J4W2-_B/MR-J4W3-_B 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-□B/MR-J3W-0303BN6 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 Fully Closed Loop Control MR-J3-□B-RJ006 Servo amplifier Instruction Manual (SH-030056)
MR-J3-□B-RJ080W	SSCNETⅢ interface Direct Drive Servo MR-J3-□B-RJ080W/TM-RFM Instruction Manual (SH-030079)
MR-J3-□BS	SSCNETⅢ interface Drive Safety integrated MR-J3-□B Safety Servo amplifier Instruction Manual (SH-030084)

- Sensing module

Type	Instruction manual name
MR-MT2010	MR-MT Sensing Module Instruction Manual (SH-030251ENG)
MR-MT2100	
MR-MT2200	
MR-MT2300	
MR-MT2400	

Point

Refer to the following for how to control servo parameters by the Motion CPU.

MELSEC iQ-R Motion Controller Programming Manual (Common)

3.13 Parameter Block

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.

A maximum 64 blocks can be set.

[Motion Control Parameter] ⇨ [Parameter Block]

No.	Setting item		Default value	Setting range				Direct setting*1	Indirect setting		Reference section
				mm	inch	degree	pulse	Valid/invalid	Valid/invalid (Required size)	Fetch cycle	
1	Interpolation control unit		3	0	1	2	3	○	×	—	Page 217
2	Speed limit value		200000 [pulse/s]	1 to 600000000 (×10^{-2}[mm/min])	1 to 600000000 (×10^{-3}[inch/min])	1 to 2147483647 (×10^{-3}[degree/min])*2	1 to 2147483647 [pulse/s]	○	×	—	Page 218
3	Acceleration time		1000[ms]	1 to 8388608[ms]				○	×	—	
4	Deceleration time		1000[ms]	1 to 8388608[ms]				○	×	—	
5	Rapid stop deceleration time		1000[ms]	1 to 8388608[ms]				○	×	—	
6	S-curve ratio		0[%]	0 to 100[%]				○	×	—	Page 220
7	Advanced S-curve acceleration/deceleration	Acceleration/deceleration system	0: Trapezoid/S-curve	0: Trapezoid/S-curve: Trapezoidal acceleration/deceleration/S-curve acceleration/deceleration 1: Advanced S-curve: Advanced S-curve acceleration/deceleration				○	×	—	Page 221
		Acceleration section 1 ratio	200 (×10^{-1}[%])	0 to 1000(×10^{-1}[%])				○	×	—	
		Acceleration section 2 ratio									
		Deceleration section 1 ratio									
		Deceleration section 2 ratio									
8	Torque limit value		3000 (×10^{-1}[%])	1 to 10000(×10^{-1}[%])				○	×	—	Page 233
9	Deceleration processing on STOP input		0	0: Deceleration stop 1: Rapid stop				○	×	—	Page 233
10	Allowable error range for circular interpolation		100[pulse]	0 to 100000 (×10^{-1}[μm])	0 to 100000 (×10^{-5}[inch])	0 to 100000 (×10^{-5}[degree])	0 to 100000 [pulse]	○	×	—	Page 234
11	Bias speed at start		0[pulse/s]	0 to 600000000 (×10^{-2}[mm/min])	0 to 600000000 (×10^{-3}[inch/min])	0 to 2147483647 (×10^{-3}[degree/min])*3	0 to 2147483647 [pulse/s]	○	×	—	Page 234

*1 For direct setting using MT Developer2, use the decimal format instead of the exponential format.

*2 When the "speed control 10 × multiplier setting for degree axis" is set to "valid", the setting range is 1 to 214748367 (×10^{-2} [degree/min]).

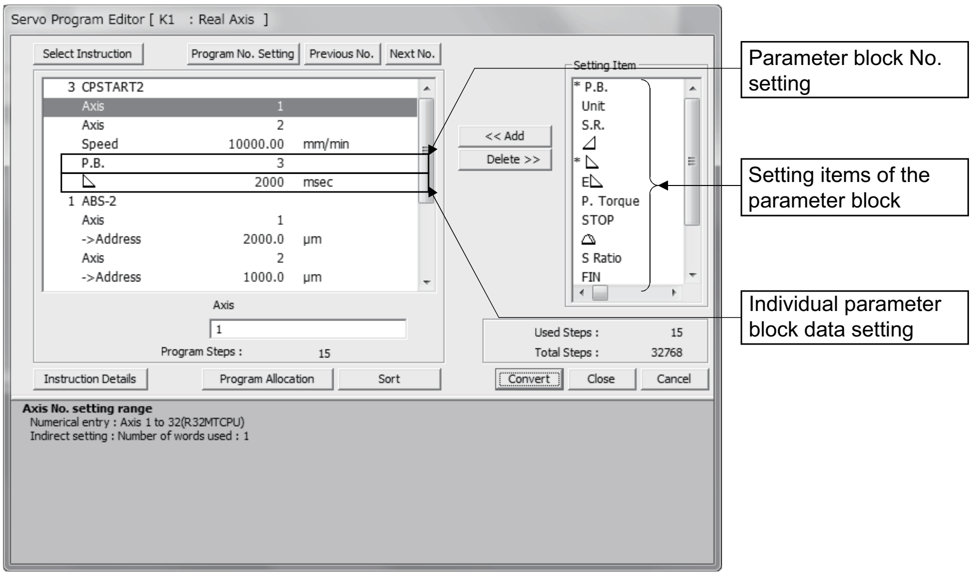
*3 When the "speed control 10 × multiplier setting for degree axis" is set to "valid", the setting range is 0 to 214748367 (×10^{-2} [degree/min]).

Data set in the parameter block

- Parameter blocks are specified in the home position return data, JOG operation data or servo program.
- The various parameter block data can be changed using the servo program. (☞ Page 242 Positioning Data)
- The data set in the parameter block is used in the positioning control, home position return and JOG operation.

- 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.

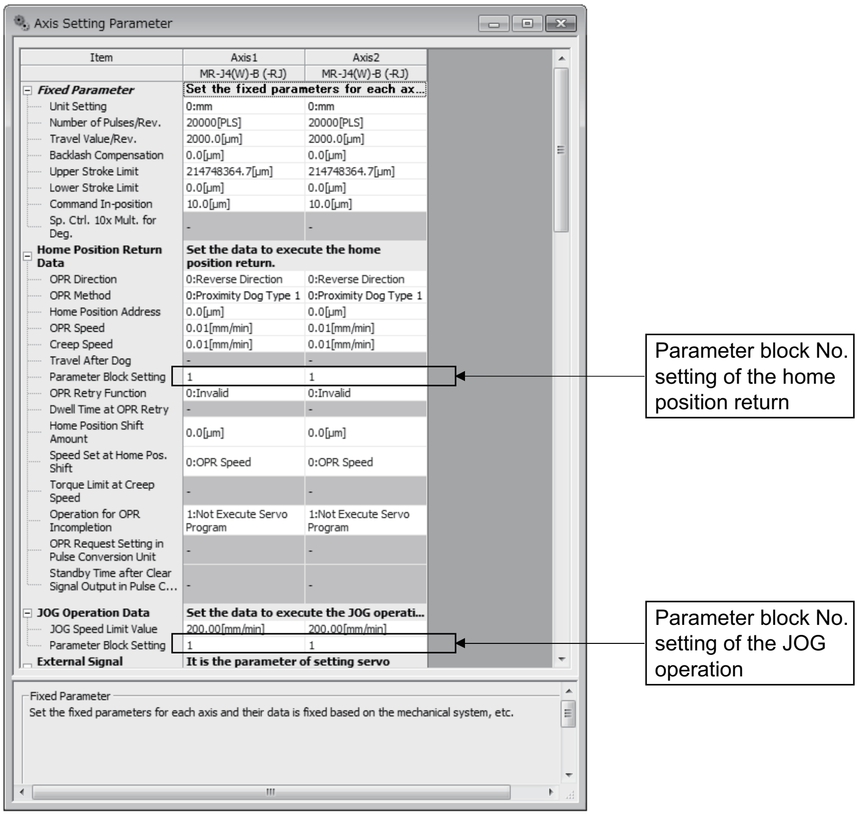
[Servo program editor screen]



Unit	: Interpolation control unit	S.R.	: Speed limit value
⊿	: Acceleration time	◺	: Deceleration time
E◺	: Rapid stop deceleration time	P. Torque	: Torque limit value
STOP	: Deceleration processing on STOP input	⌓	: Allowable error range for circular interpolation
S Ratio	: S-curve ratio when S-pattern processing is executed	Adv. S-curve	: Advanced S-curve acceleration/deceleration
Bias speed	: Bias speed at start		

• 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. (☞ Page 178 Home Position Return Data, ☞ Page 188 JOG Operation Data)

[Home position return data setting screen]



• The processing method of acceleration/deceleration is set by the acceleration/deceleration method and S-curve ratio set in the parameter block.

• 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.
• Set "Advanced S-curve" to execute the Advanced S-curve acceleration/deceleration. At this time, the S-curve ratio is invalid.

Item	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	—

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

Interpolation control unit

Set the unit for interpolation control.

The unit is also used as the unit for the command speed and the allowable error range for circular interpolation set by the servo program or the Motion dedicated PLC instruction (M(P).SVSTD/D(P).SVSTD).

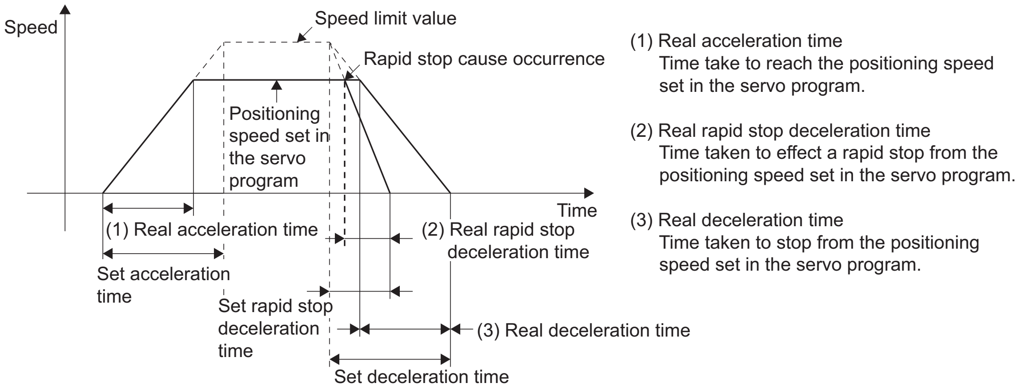
Refer to the control units for interpolation control for details. (☞ Page 256 Control units for interpolation control)

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.



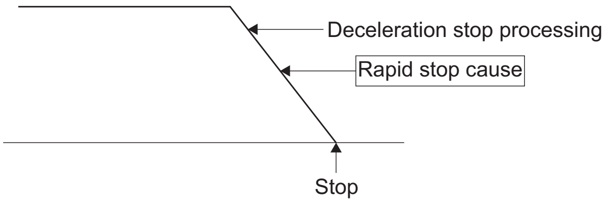
Refer to the advanced S-curve acceleration/deceleration for acceleration time, deceleration time and rapid stop deceleration time of the advanced S-curve acceleration/deceleration processing. (☞ Page 221 Advanced S-curve acceleration/ deceleration)

The relationship between rapid stop time and deceleration time

Set a short time than the deceleration time for the rapid stop deceleration time.

■Deceleration time < Rapid stop deceleration time

- The warning (error code 0A54H) is stored in the "Latest self-diagnosis error (SD0)" at start, and the "Latest self-diagnosis error detection (SM0)" is turned ON. When the rapid stop cause occurs during deceleration, the axis decelerates to a stop in the deceleration time.

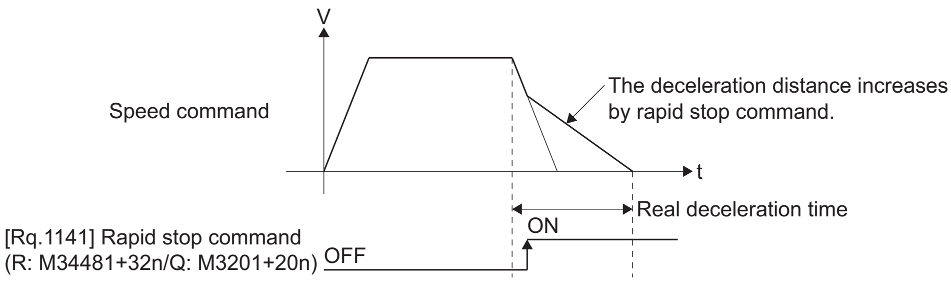


- The large value than deceleration time can be set as rapid stop deceleration time by turning ON the "Rapid stop deceleration time setting error invalid flag (SM805)".

- 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.)
- 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.

Point

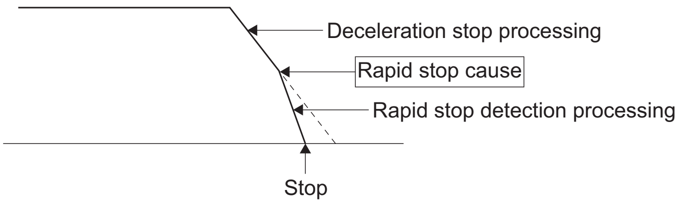
- If the rapid stop deceleration time is long than the deceleration time, an overrun may occur.



- If a large value than 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.

■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.



S-curve ratio

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

(Refer to S-curve acceleration/deceleration processing (☞ Page 266 S-curve acceleration/deceleration processing) for S-curve acceleration/deceleration processing.)

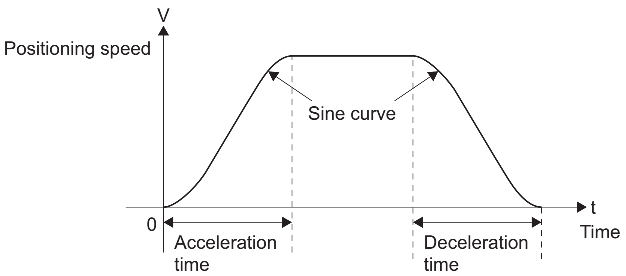
Setting range of the S-curve ratio is 0 to 100[%].

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).

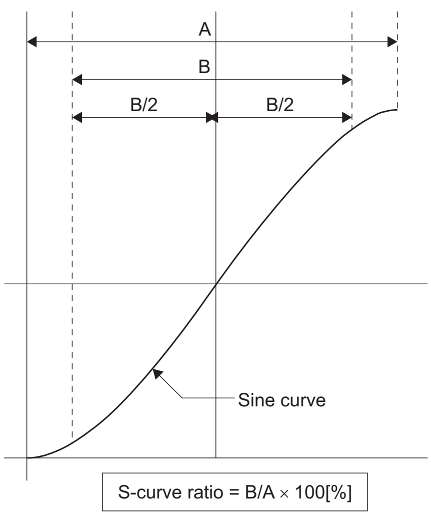
Errors are set in the "Latest self-diagnosis error (SD0)".

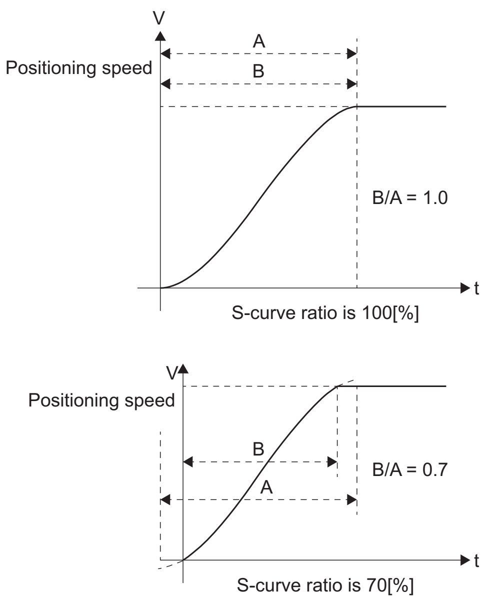
Setting of the S-curve ratio enables acceleration/deceleration processing to be executed gently.

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.

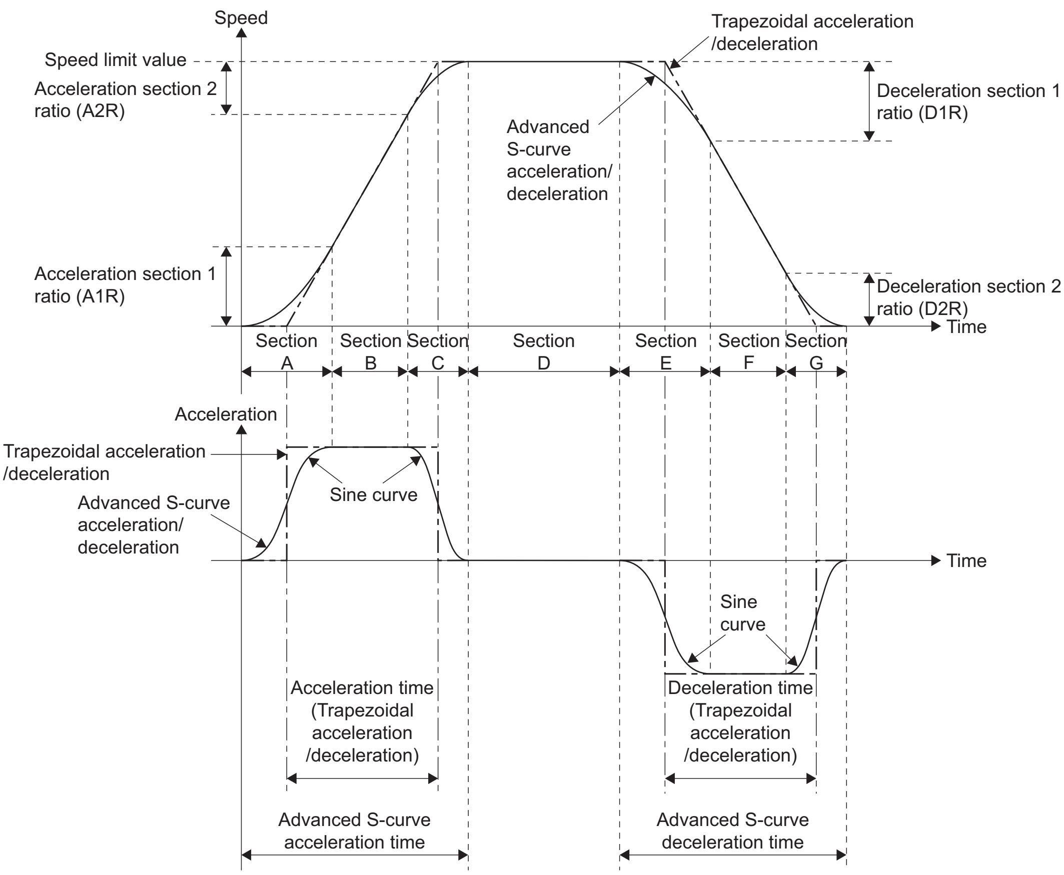




Advanced S-curve acceleration/deceleration

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.



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

Section		Processing	Operation		
			Acceleration	**Deceleration**	**Rapid stop**
A	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).	○	—	—
B	Maximum acceleration section	The maximum acceleration for trapezoidal acceleration/deceleration			
C	Acceleration section 2	At the end of acceleration, acceleration continuously changes in a sinusoidal manner until reaching zero acceleration. Set this section in acceleration section 2 ratio (A2R).			
D	Constant-speed section	The specified control positioning speed	—	—	—
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			
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.

Item	Abbre-viation	Setting range[*1]		Processing	Operation		
					Accele-ration	Decele-ration	Rapid stop
Speed limit value	S.R.	mm	1 to 600000000 ($\times 10^{-2}$ [mm/min])	Maximum speed at positioning/ home position return	○	○	○
		inch	1 to 600000000 ($\times 10^{-3}$ [inch/min])				
		degree	1 to 2147483647 ($\times 10^{-3}$ [degree/min])[*2]				
		pulse	1 to 2147483647 [pulse/s]				
Acceleration time	AT	1 to 8388608 [ms]		Time to reach the speed limit value (S.R.) after positioning start. (During trapezoidal acceleration)	○	—	—
Deceleration time	DT			Time to stop from the speed limit value (S.R.). (During trapezoidal deceleration)	—	○	—
Rapid stop deceleration time	ET			Time to stop from the speed limit value (S.R.) at rapid stop. (Trapezoidal deceleration)	—	—	○
Acceleration section 1 ratio	A1R	0 to 1000 ($\times 10^{-1}$[%]) (A1R + A2R $\leq$ 1000 ($\times 10^{-1}$[%]))		Ratio of speed limit value (S.R.) to acceleration peak from zero acceleration.	○	—	—
Acceleration section 2 ratio	A2R			Ratio of speed limit value (S.R.) to zero acceleration from acceleration peak.	○	—	—
Deceleration section 1 ratio	D1R	0 to 1000 ($\times 10^{-1}$[%]) (D1R + D2R $\leq$ 1000 ($\times 10^{-1}$[%]))		Ratio of speed limit value (S.R.) to negative acceleration peak from zero acceleration.	—	○	○
Deceleration section 2 ratio	D2R			Ratio of speed limit value (S.R.) to zero acceleration from negative acceleration peak.	—	○	○

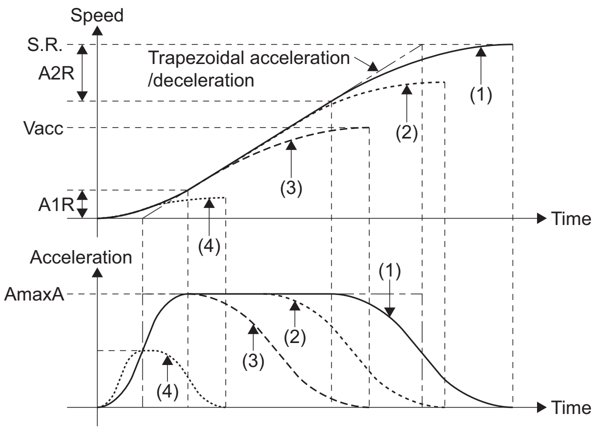
*1 For direct setting using MT Developer2, use the decimal format instead of the exponential format.
*2 When the "speed control 10 × multiplier setting for degree axis" is set to "valid", the setting range is 1 to 2147483647 ($\times 10^{-2}$ [degree/min]).

Point

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.

Positioning speeds of acceleration patterns/deceleration patterns

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



Pattern (1): Positioning speed = S.R.
Pattern (2): Vacc < Positioning speed < S.R.
Pattern (3): Positioning speed = Vacc
Pattern (4): Positioning speed < Vacc

*: The graph of deceleration is opposite to acceleration because the deceleration pattern is negative acceleration.

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

■Actual acceleration time

Positioning speed	Pattern	Positioning speed	Description	Actual acceleration time	Actual maximum acceleration
High ↑ ↓ Low	(1)	Positioning speed = S.R.	It accelerates with the acceleration section 1, maximum acceleration section and acceleration section 2.	AAT	AmaxA
	(2)	Vacc < Positioning speed < S.R.	Maximum acceleration section is short than pattern 1.	$AAT - \frac{(S.R.\text{-Positioning speed})}{AmaxA}$	
	(3)	Positioning speed = Vacc	• No maximum acceleration section • It accelerates with only acceleration section 1 and acceleration section 2.	A1T + A2T	
	(4)	Positioning speed < Vacc	• No maximum acceleration section • Maximum acceleration and acceleration increase/ decrease time of acceleration section 1 and 2 are shortened.	$(A1T+A2T) \times \sqrt{(\text{Positioning speed/Vacc})}$	$AmaxA \times \sqrt{(\text{Positioning speed/Vacc})}$

■Actual deceleration time

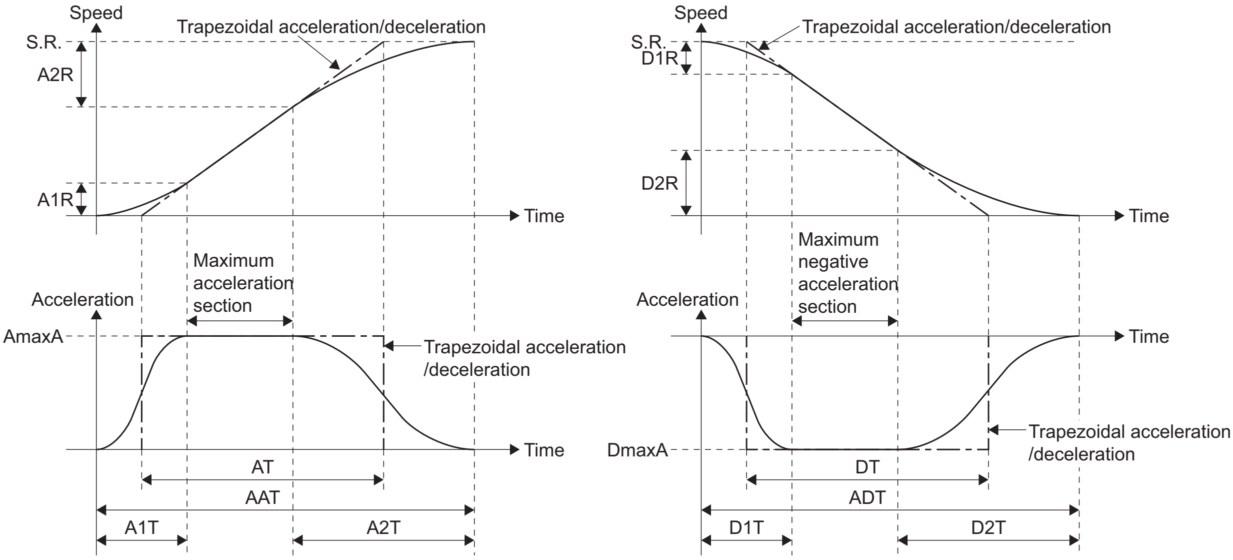
Positioning speed	Pattern	Positioning speed	Description	Actual Deceleration time	Negative actual maximum acceleration
High ↑ ↓ Low	(1)	Positioning speed = S.R.	It accelerates with the deceleration section 1, maximum negative acceleration section and deceleration section 2.	ADT	DmaxA
	(2)	Vdac < Positioning speed < S.R.	Maximum negative acceleration section is shortened than pattern 1.	$ADT - \frac{(S.R.\text{-Positioning speed})}{DmaxA}$	
	(3)	Positioning speed = Vdac	• No maximum negative acceleration section • It decelerates with only deceleration section 1 and deceleration section 2.	D1T + D2T	
	(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.	$(D1T+D2T) \times \sqrt{(\text{Positioning speed/Vdac})}$	$DmaxA \times \sqrt{(\text{Positioning speed/Vdac})}$

When the positioning speed is slower than the speed limit value, adjust the acceleration in the following procedure.

- Shorten time of maximum acceleration section. (Pattern (2), (3))
- Reduce maximum acceleration and acceleration increase/decrease time of acceleration section 1 and 2. (Pattern (4))

Parameter calculations

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



Item	Abbre-viation	Description	Calculation expression	Operation		
				Accele-ration	Decele-ration	Rapid stop
Maximum acceleration	AmaxA	• Maximum acceleration • Same acceleration as trapezoidal acceleration/deceleration	S.R. ÷ AT	○	—	—
Maximum negative acceleration	DmaxA	• Maximum negative acceleration at (rapid stop) deceleration • Same negative acceleration as trapezoidal acceleration/deceleration	S.R. ÷ DT	—	○	—
Maximum negative acceleration at rapid stop	EmaxA		S.R. ÷ ET	—	—	○
Advanced S-curve acceleration time*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 × (100.0 + A1R + A2R) ÷ 100.0	○	—	—
Advanced S-curve deceleration time*1	ADT	• Time to stop from the speed limit value (S.R.) at (rapid stop) deceleration. (Advanced S-curve acceleration/deceleration) • It can be lengthened more than trapezoidal acceleration/deceleration by using D1R or D2R.	DT × (100.0 + D1R + D2R) ÷ 100.0	—	○	—
Advanced S-curve rapid stop deceleration time*1	AET		ET × (100.0 + D1R + D2R) ÷ 100.0	—	—	○
Time of acceleration section 1	A1T	Time to reach acceleration peak from zero acceleration.	AT × (A1R ÷ 100.0) × 2	○	—	—
Time of acceleration section 2	A2T	Time to reach zero acceleration from acceleration peak.	AT × (A2R ÷ 100.0) × 2	○	—	—
Time of deceleration section 1	D1T	Time to reach negative acceleration peak from zero acceleration.	DT × (D1R ÷ 100.0) × 2	—	○	—
Time of deceleration section 2	D2T	Time to reach zero acceleration from negative acceleration peak.	DT × (D2R ÷ 100.0) × 2	—	○	—
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	○	—	—
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	—	○	—

*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.

Acceleration/deceleration time and the parameter block acceleration/deceleration time

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.

Deceleration process at rapid stop

Deceleration processing is executed by using the deceleration section 1 ratio (D1R) and deceleration section 2 ratio (D2R) at rapid stop deceleration.

Settings for continuous trajectory control

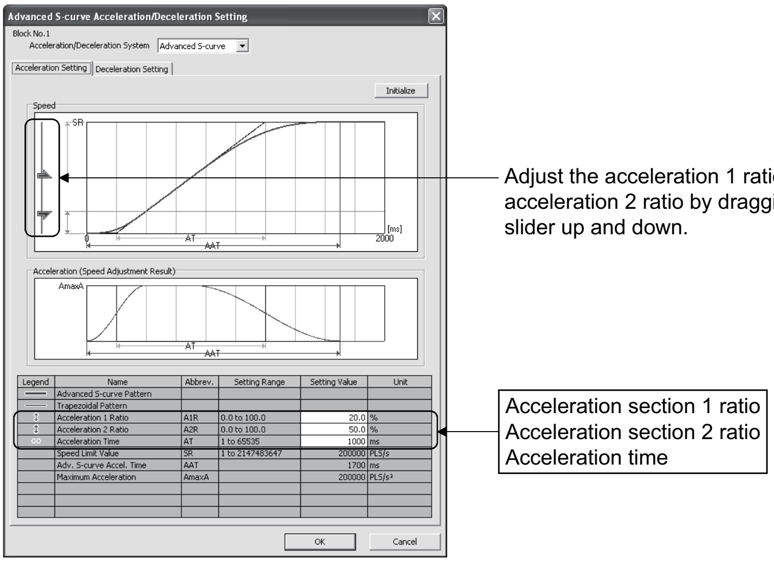
When the FIN acceleration/deceleration (Fixed acceleration/deceleration time method) is set in the continuous trajectory control, the setting for advanced S-curve acceleration/deceleration is invalid. However, advanced S-curve acceleration/deceleration can be used regardless whether the "[Rq.1122] Speed switching point specified flag (R: M30040/Q: M2040)" is ON or OFF.

At home position return operation

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.

Point

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

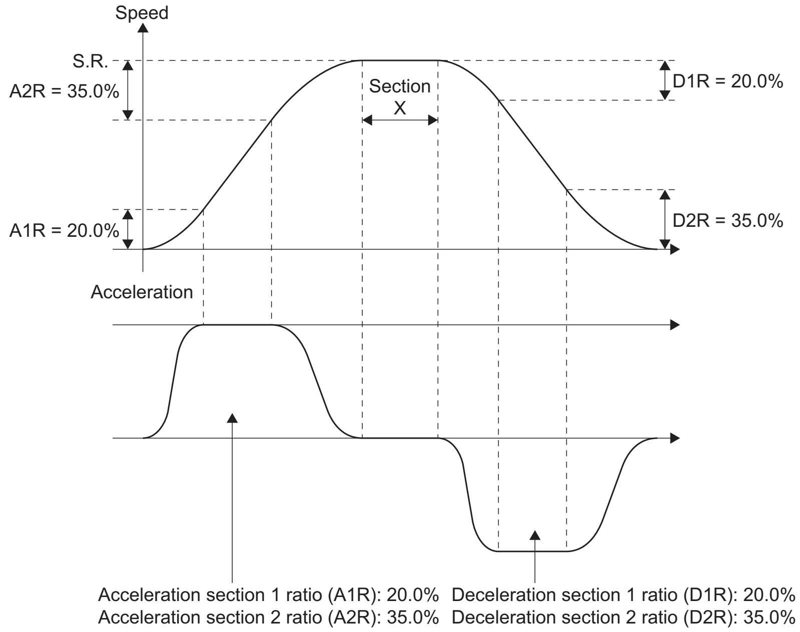
In the following cases, warning (error code :0A4EH to 0A53H) will occur, and controls will be executed as trapezoidal acceleration/deceleration (A1R = A2R = D1R = D2R = 0.0).

- 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.

```
ABS-1
Axis          4,    1200000pulse
Speed                500000pulse/s
S.R.                 500000pulse/s
ASC System              1
ASC Accel.1          20.0%
ASC Accel.2          35.0%
ASC Decel.1          20.0%
ASC Decel.2          35.0%
```



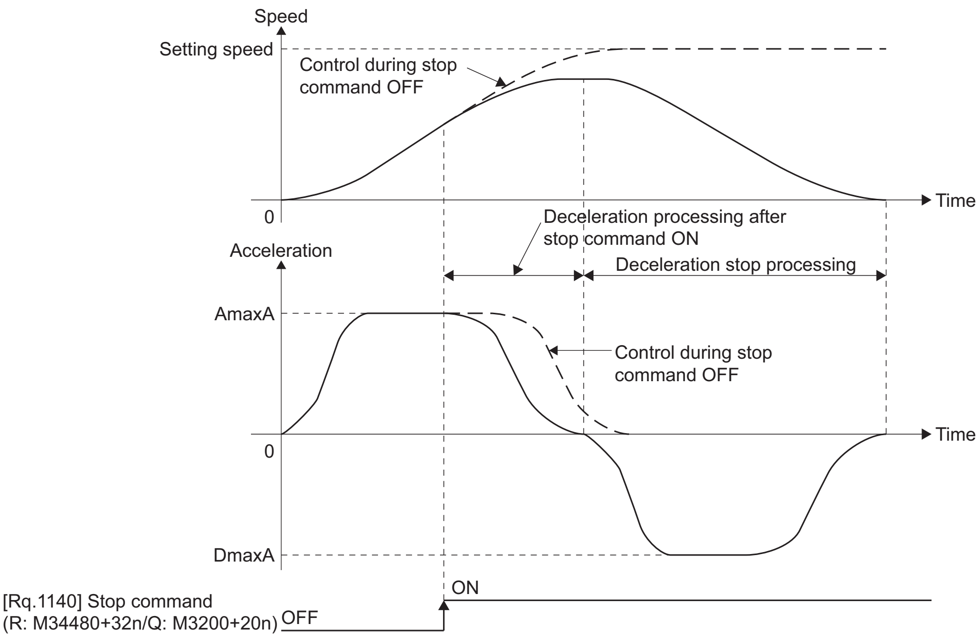
Point

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

■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.)



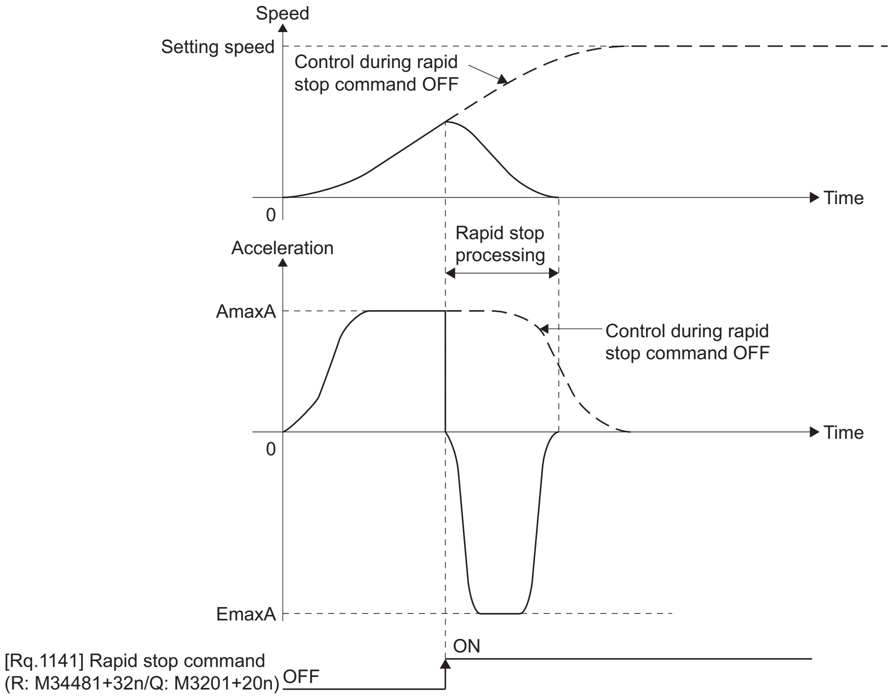
Point

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.

■Rapid stop processing

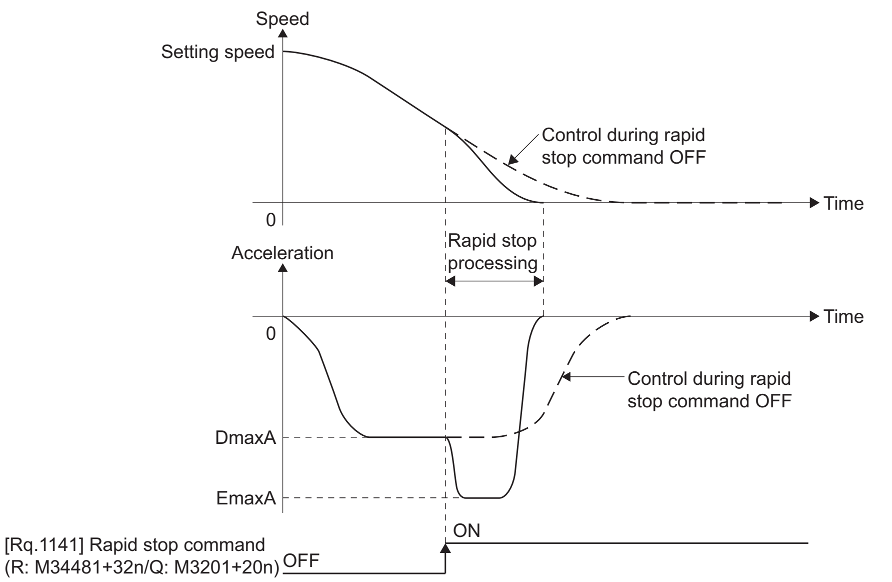
- Rapid stop during acceleration

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



- 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.

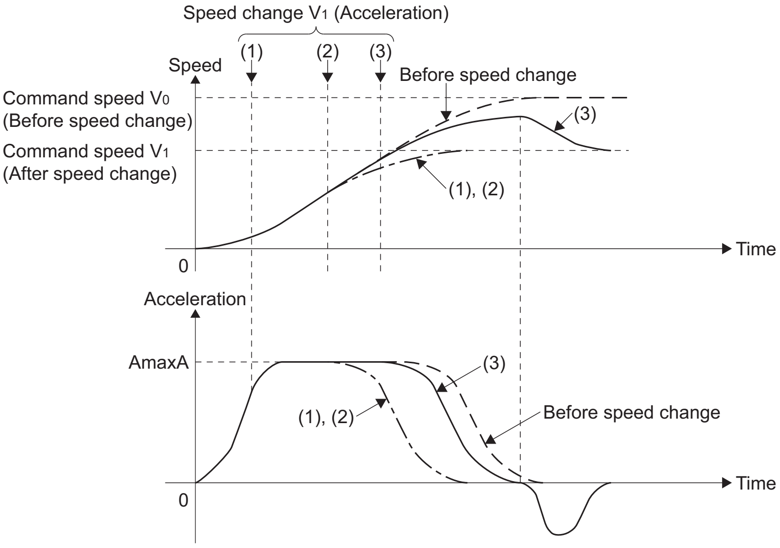


Point

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.

■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)	Speed change V_1 (Acceleration)	Acceleration section 1 (Increasing acceleration section)	• Length of maximum acceleration section is adjusted to reach speed V_1 at acceleration end. • The acceleration is decreased until the acceleration reaches zero.
(2)		Maximum acceleration section	
(3)		Maximum acceleration section (When the speed change occurs in situations where V_0 will surpass V_1 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 V_1.

■Speed control with fixed position stop processing

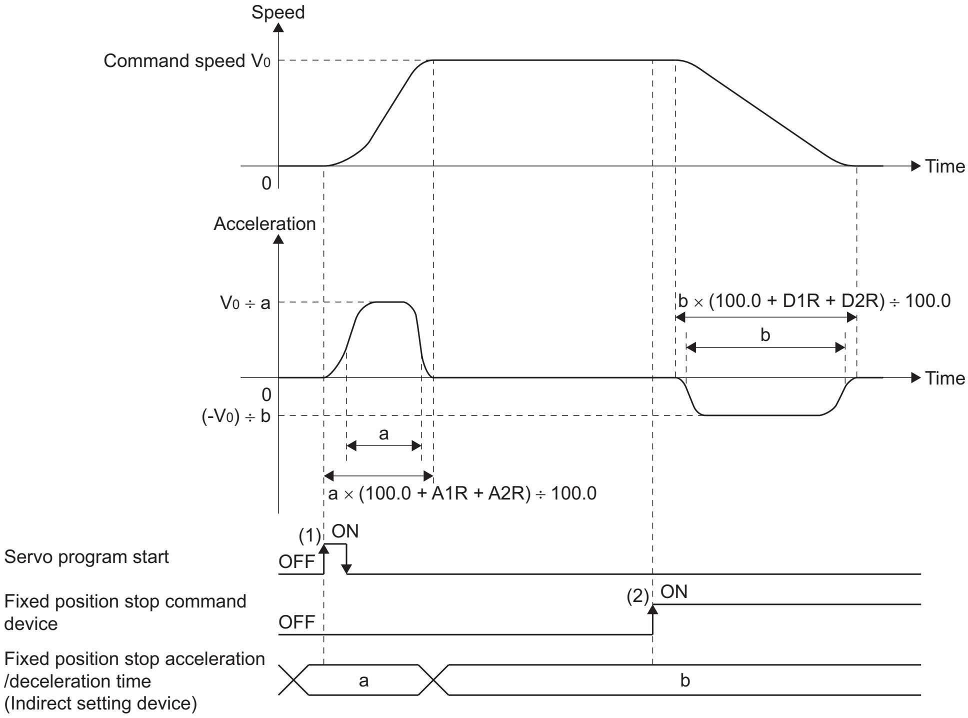
The "fixed position stop acceleration/deceleration time" set in the servo program is used during acceleration/deceleration processing when a positioning start, speed change request (CHGV) or fixed position stop command ON occurs.

It operates in the fixed acceleration/deceleration time method.

- 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) × (100.0 + A1R + A2R) ÷ 100.0
Deceleration time	Specified deceleration time (DT) × (100.0 + D1R + D2R) ÷ 100.0
Maximum acceleration	Speed difference ÷ Specified acceleration/deceleration time

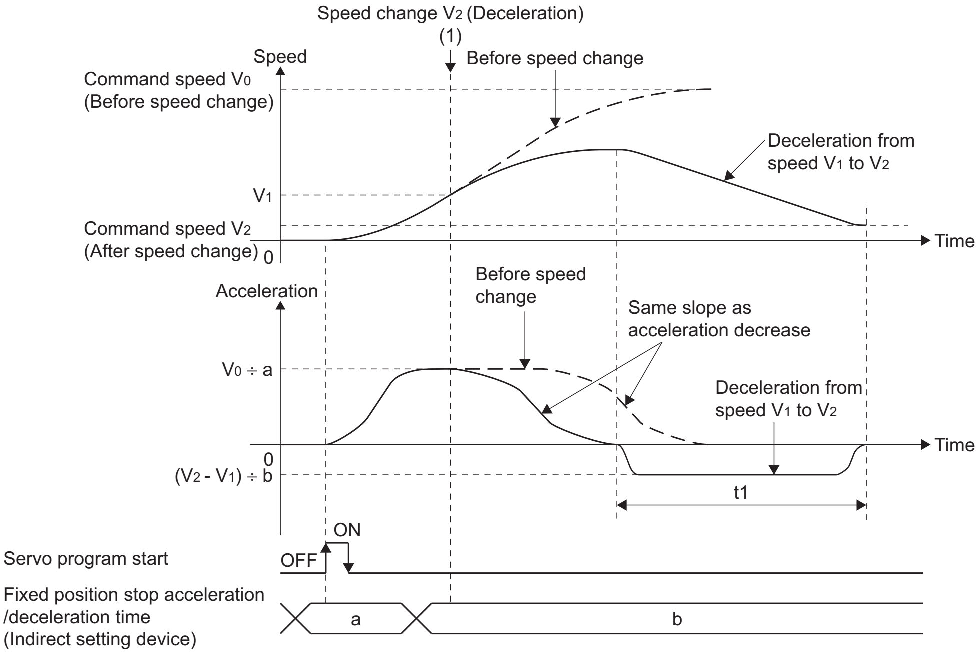
- Acceleration processing from zero speed and deceleration processing to zero speed (fixed time method)
  Operation for positioning to fixed position stop command position at servo program start is shown below.



Speed change command	Speed difference	Acceleration/ deceleration time	Maximum acceleration	Operation
(1) Servo program start (Acceleration from speed 0 to V_0)	V_0	a	V_0 ÷ a	Actual acceleration time "a × (100.0 + A1R + A2R) ÷ 100.0"
(2) Positioning to fixed position stop command position (Deceleration from speed V_0 to 0)	$-V_0$	b	$(-V_0)$ ÷ b	Actual deceleration time "b × (100.0 + D1R + D2R) ÷ 100.0"

■Speed change (fixed time method)

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



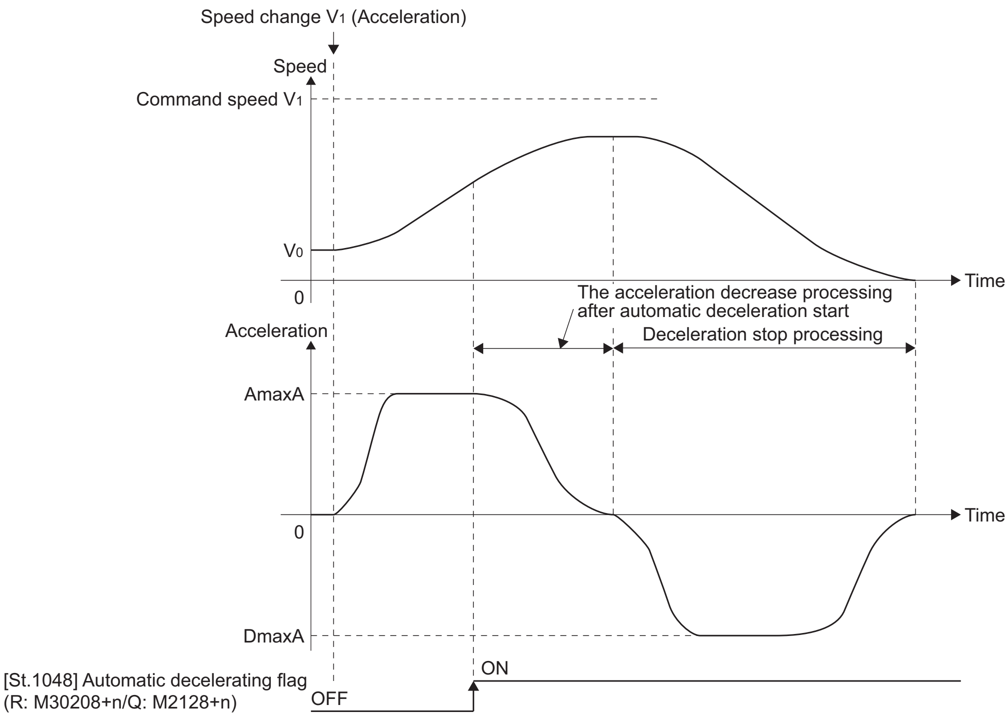
Speed change command	Speed difference	Acceleration/ deceleration time	Maximum acceleration	Operation
(1) Deceleration from speed V_1 to V_2	$(V_2 - V_1)$	b	$(V_2 - V_1) \div b$	• The acceleration is decreased until the acceleration becomes from acceleration to "0" at speed change. This inclination of acceleration section 2 (acceleration decrease section) is calculated based on the acceleration/deceleration time before speed change. • Deceleration processing is executed. • 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.

Point

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.

■[St.1048] Automatic decelerating flag (R: M30208+n/Q: M2128+n)

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.)



Point

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.

Torque limit value

Set the torque limit value in the servo program.

Refer to the torque limit function for details of the torque limit value. (☞ Page 428 Torque Limit Function)

Deceleration processing on STOP input

Set the deceleration processing on the external signal (STOP signal, FLS signal, or RLS signal) input.

Deceleration processing on STOP
0: Deceleration stop
1: Rapid stop

Allowable error range for circular interpolation

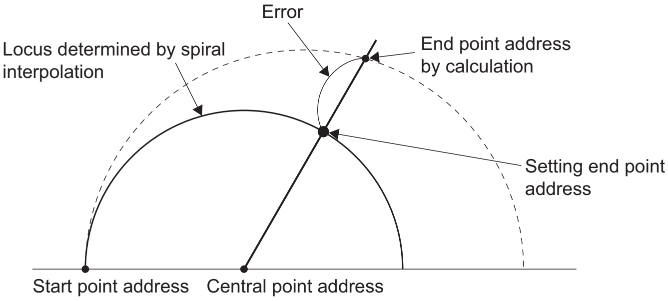
The locus of the arc calculated from the start point address and central point address may not coincide with the set end point address for the central-specified control.

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 error code area.



Bias speed at start

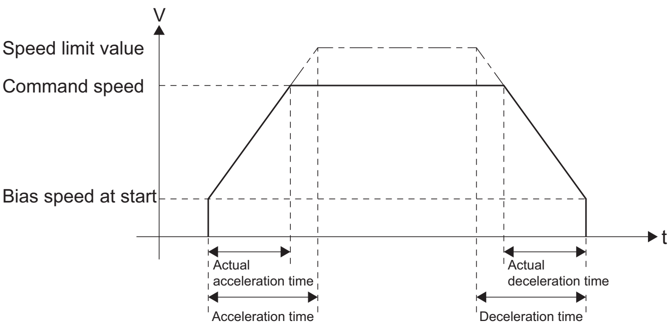
Set the bias speed (minimum speed) upon starting.

When using a stepping motor, etc., set it to start the motor smoothly. (If the motor speed at start is low, the stepping motor does not start smoothly.)

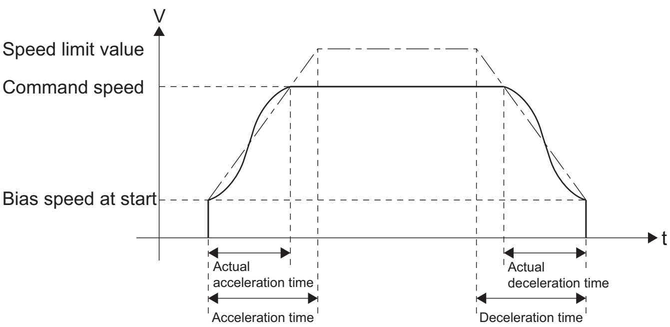
The specified "bias speed at start" will be valid during the following operations:

- Positioning operation
- Home position return operation
- JOG operation

Trapezoidal acceleration/deceleration (S-curve ratio is 0%)



S-curve acceleration/deceleration (S-curve ratio is other than 0%)



Point

For the 2-axes or more interpolation control, the bias speed at start is applied to the composite command speed.

Cautions

- Bias speed at start is valid regardless of motor type. Set "0" when using the motor other than the stepping motor. Otherwise, it may cause vibration or impact even though a warning does not occur.
- Set bias speed at start according to the specification of stepping motor driver. If the setting is outside the range, it may cause the following troubles by rapid speed change or overload.
  - Stepping motor steps out.
  - An error occurs in the stepping motor driver.
- Set the bias speed at start to a value not more than the speed limit value. If the bias speed at start is set to a value larger than the speed limit value, a warning (error code: 0A4CH) occurs, and the bias speed at start is "0"
- The setting range for the command speed is "bias speed at start to speed limit value". When the command speed is out of range by starting a servo program or executing a speed change instruction (M(P).CHGV/D(P).CHGV,CHGV), a warning (error code: 0A4CH), or warning (error code: 0A5DH) occurs and speed change is not performed. When bias speed at start is other than "0", a warning (error code: 0A5DH) occurs when a speed change to "0" is performed.
- When FIN acceleration/deceleration and advanced S-curve acceleration/deceleration methods are used with bias speed at start, a warning (error code: 0A4DH) occurs, and the bias speed at start is "0".
- For servo programs where speed specification at a pass point is possible (CPSTART), if the speed at the pass point is set to less than the bias speed at start, a warning (error code: 0A5AH) occurs, and the bias speed at start is "0" for the points afterwards.

4 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 the positioning control for details of the servo program. (☞ Page 250 POSITIONING CONTROL)

4.1 Servo Program Composition Area

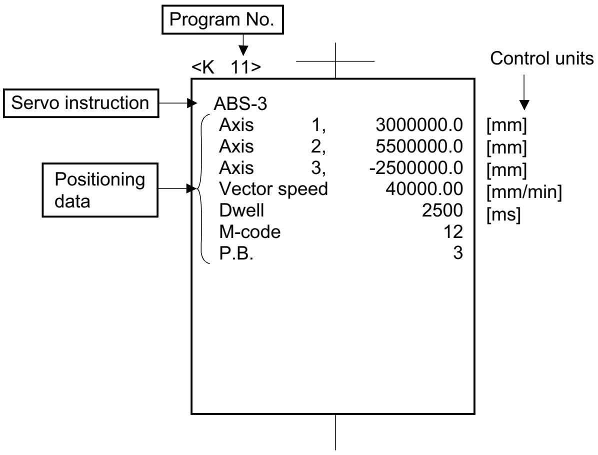
This section is described the composition of servo programs and the area in which stores the servo program.

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.

Servo program composition example

■Explanation of the program



Servo program contents	Setting details	Setting value
K11	Program No.	11
ABS-3	3 axes linear interpolation control as absolute data method.	ABS-3 (combination)
Axis1, 3000000.0	Axis used	1
	Positioning address	3000000.0 [μm]
Axis2, 5500000.0	Axis used	2
	Positioning address	5500000.0 [μm]
Axis3, -2500000.0	Axis used	3
	Positioning address	-2500000.0 [μm]
Vector speed	Command speed for the 3 axes (axis 1, axis 2, axis 3) combination	40000.00 [mm/min]
Dwell	Dwell time	2500 [ms]
M-code	M-code	12
P.B.	Parameter block No.	3

- Program No.
  This No. is specified using the Motion SFC program. Any No. in the range of 0 to 8191 (for operating system software version "09" or earlier, 0 to 4095) can be set.
- Servo instruction
  Type of positioning control is indicated. (☞ Page 238 Servo Instructions)

- Positioning data

  This is the data required to execute servo instructions. The data required to execute is fixed for each servo instruction.
  (☞ Page 242 Positioning Data)

  The following table applies to the servo program shown above.

Setting condition	Item
Items which must be set	• Axis used and positioning address • Command speed
Items which are set when required	• Dwell time • M-code • P.B. (parameter block) (Controlled with the default value (Parameter block 1 if not set.)

4.2 Servo Instructions

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

Refer to positioning control for details of the servo instruction. (☞ Page 250 POSITIONING CONTROL)

The servo instructions that can be used in servo programs are shown in the table below.

Refer to positioning data for details of the positioning data set in the servo instructions. (☞ Page 242 Positioning Data)

○: Usable ×: Unusable

Positioning control		Instruction symbol	Processing	Command generation axis usable/unusable	Reference
Linear interpolation control	1 axis	ABS-1	Absolute 1-axis positioning	○	☞ Page 270 1 Axis Linear Positioning Control
		INC-1	Incremental 1-axis positioning	○	
	2 axes	ABS-2	Absolute 2-axes linear interpolation	○	☞ Page 273 2 Axes Linear Interpolation Control
		INC-2	Incremental 2-axes linear interpolation	○	
	3 axes	ABS-3	Absolute 3-axes linear interpolation	○	☞ Page 276 3 Axes Linear Interpolation Control
		INC-3	Incremental 3-axes linear interpolation	○	
	4 axes	ABS-4	Absolute 4-axes linear interpolation	○	☞ Page 280 4 Axes Linear Interpolation Control
		INC-4	Incremental 4-axes linear interpolation	○	
Circular interpolation control	Auxiliary point-specified	ABS	Absolute auxiliary point-specified circular interpolation	○	☞ Page 283 Auxiliary Point-Specified Circular Interpolation Control
		INC	Incremental auxiliary point-specified circular interpolation	○	
	Radius-specified	ABS	Absolute radius-specified circular interpolation less than CW 180°	○	☞ Page 287 Radius-Specified Circular Interpolation Control
		ABS	Absolute radius-specified circular interpolation CW 180° or more	○	
		ABS	Absolute radius-specified circular interpolation less than CCW 180°	○	
		ABS	Absolute radius-specified circular interpolation CCW 180° or more	○	
		INC	Incremental radius-specified circular interpolation less than CW 180°	○	
		INC	Incremental radius-specified circular interpolation CW 180° or more	○	
		INC	Incremental radius-specified circular interpolation less than CCW 180°	○	
		INC	Incremental radius-specified circular interpolation CCW 180° or more	○	
	Central point-specified	ABS	Absolute central point-specified circular interpolation CW	○	☞ Page 291 Central Point-Specified Circular Interpolation Control
		ABS	Absolute central point-specified circular interpolation CCW	○	
		INC	Incremental central point-specified circular interpolation CW	○	
		INC	Incremental central point-specified circular interpolation CCW	○	

Positioning control		Instruction symbol	Processing	Command generation axis usable/unusable	Reference
Helical interpolation control	Auxiliary point-specified	ABH	Absolute auxiliary point- specified helical interpolation	○	☞ Page 295 Helical Interpolation Control
		INH	Incremental auxiliary point- specified helical interpolation	○	
	Radius-specified	ABH	Absolute radius-specified helical interpolation less than CW 180°	○	
		ABH	Absolute radius-specified helical interpolation CW 180° or more	○	
		ABH	Absolute radius-specified helical interpolation less than CCW 180°	○	
		ABH	Absolute radius-specified helical interpolation CCW 180° or more	○	
		INH	Incremental radius-specified helical interpolation less than CW 180°	○	
		INH	Incremental radius-specified helical interpolation CW 180° or more	○	
		INH	Incremental radius-specified helical interpolation less than CCW 180°	○	
		INH	Incremental radius-specified helical interpolation CCW 180° or more	○	
	Central point-specified	ABH	Absolute central point-specified helical interpolation CW	○	
		ABH	Absolute central point-specified helical interpolation CCW	○	
		INC	Incremental central point-specified helical interpolation CW	○	
		INC	Incremental central point-specified helical interpolation CCW	○	
Fixed-pitch feed	1 axis	FEED-1	1-axis fixed-pitch feed start	○	☞ Page 309 Axis Fixed-Pitch Feed Control
	2 axes	FEED-2	2-axes linear interpolation fixed-pitch feed start	○	☞ Page 312 Fixed-Pitch Feed Control Using 2 Axes Linear Interpolation
	3 axes	FEED-3	3-axes linear interpolation fixed-pitch feed start	○	☞ Page 315 Fixed-Pitch Feed Control Using 3 Axes Linear Interpolation
Speed control (I)	Forward rotation	VF	Speed control (I) forward rotation start	○	☞ Page 318 Speed Control (I)
	Reverse rotation	VR	Speed control (I) reverse rotation start	○	
Speed control (II)	Forward rotation	VVF	Speed control (II) forward rotation start	×	☞ Page 321 Speed Control (II)
	Reverse rotation	VVR	Speed control (II) reverse rotation start	×	
Speed-position switching control	Forward rotation	VPF	Speed-position switching control forward rotation start	×	☞ Page 324 Speed/ position switching control start
	Reverse rotation	VPR	Speed-position switching control reverse rotation start	×	
	Restart	VPSTART	Speed-position switching control restart	×	☞ Page 330 Re-starting after stop during control
Speed control with fixed position stop	Forward rotation	PVF	Speed control with fixed position stop absolute specification	○	☞ Page 334 Speed Control with Fixed Position Stop
	Reverse rotation	PVR		○	

Positioning control	Instruction symbol	Processing	Command generation axis usable/unusable	Reference
Continuous trajectory control	CPSTART1	1-axis continuous trajectory control start	○	☞ Page 348 1 axis continuous trajectory control
	CPSTART2	2-axis continuous trajectory control start	○	☞ Page 351 2 to 4 axes continuous trajectory control
	CPSTART3	3-axis continuous trajectory control start	○	
	CPSTART4	4-axis continuous trajectory control start	○	
	ABS-1	Continuous trajectory control passing point absolute specification	○	☞ Page 348 1 axis continuous trajectory control
	ABS-2		○	☞ Page 351 2 to 4 axes continuous trajectory control
	ABS-3		○	
	ABS-4		○	
	ABS		○	
	ABS		○	
	ABS		○	
	ABS		○	
	ABS		○	
	ABS		○	
	ABS		○	
	ABH	Continuous trajectory control passing point helical absolute specification	○	☞ Page 355 Continuous trajectory control for helical interpolation
	ABH		○	
	ABH		○	
	ABH		○	
	ABH		○	
	ABH		○	
	ABH		○	
	INC-1	Continuous trajectory control passing point incremental specification	○	☞ Page 348 1 axis continuous trajectory control
	INC-2		○	☞ Page 351 2 to 4 axes continuous trajectory control
	INC-3		○	
	INC-4		○	
	INC		○	
	INC		○	
	INC		○	
	INC		○	
	INC		○	
	INC		○	
	INC		○	

Positioning control	Instruction symbol	Processing	Command generation axis usable/unusable	Reference
Continuous trajectory control	INH	Continuous trajectory control passing point helical incremental specification	○	☞ Page 355 Continuous trajectory control for helical interpolation
	INH		○	
	INH		○	
	INH		○	
	INH		○	
	INH		○	
	INH		○	
	FOR-TIMES	Repeat range start setting for repeat of the same control	○	☞ Page 341 Specification of pass points by repetition instructions
	FOR-ON		○	
	FOR-OFF		○	
	NEXT	Repeat range end setting for repeat of the same control	○	
	CPEND	Continuous trajectory control end	○	☞ Page 348 1 axis continuous trajectory control ☞ Page 351 2 to 4 axes continuous trajectory control
Position follow-up control	PFSTART	Position follow-up control start	○	☞ Page 369 Position Follow-Up Control
High speed oscillation	OSC	High-speed oscillation	×	☞ Page 373 High-Speed Oscillation
Simultaneous start	START	Simultaneous start	○	☞ Page 375 Simultaneous Start
Home position return	ZERO	Home position return start	×	☞ Page 378 Servo program for home position return
Current value change	CHGA	Shaft Current Value Change	○	☞ Page 413 Current Value Change

4.3 Positioning Data

The positioning data set in the servo instructions that are used in the servo programs is shown below.

<table>
<tr><th colspan="3" rowspan="2">Name</th><th rowspan="2">Default value</th><th colspan="4">Setting range</th><th colspan="2">Valid/invalid</th><th rowspan="2">Number of steps</th></tr>
<tr><th>mm</th><th>inch</th><th>degree</th><th>pulse</th><th>Direct setting *1</th><th>Indirect (Number of used words)</th></tr>
<tr><td rowspan="11">Common Settings</td><td colspan="2">Parameter block No.</td><td>1</td><td colspan="4">1 to 64</td><td>○</td><td>○
(1 word)</td><td>2</td></tr>
<tr><td colspan="2">Axis</td><td>—</td><td colspan="4">1 to 64</td><td>○</td><td>○
(1 word)</td><td>1</td></tr>
<tr><td rowspan="5">Address/ travel value</td><td>Absolute data method</td><td>—</td><td>-2147483648 to 2147483647 (×10^{-1} [μm])</td><td>-2147483648 to 214748647 (×10^{-5} [inch])</td><td>0 to 35999999 (×10^{-5} [degree])</td><td>-2147483648 to 2147483647</td><td>○</td><td>○
(2 word)</td><td>1</td></tr>
<tr><td rowspan="4">Incremental data method</td><td rowspan="4">—</td><td colspan="4">Except for speed/position switching control</td><td rowspan="4">○</td><td rowspan="4">○
(2 word)</td><td rowspan="4">1</td></tr>
<tr><td>-2147483647 to 2147483647 (×10^{-1} [μm])</td><td>-2147483647 to 214748647 (×10^{-5} [inch])</td><td>-2147483647 to 214748647 (×10^{-5} [degree])</td><td>-2147483647 to 2147483647</td></tr>
<tr><td colspan="4">Speed/position switching control</td></tr>
<tr><td>0 to 2147483647 (×10^{-1} [μm])</td><td>0 to 2147483647 (×10^{-5} [inch])</td><td>0 to 2147483647 (×10^{-5} [degree])</td><td>0 to 2147483647</td></tr>
<tr><td colspan="2">Command speed</td><td>—</td><td>1 to 600000000 (×10^{-2} [mm/ min])</td><td>1 to 600000000 (×10^{-3} [inch/ min])</td><td>1 to 2147483647 (×10^{-3} [degree/ min])*2</td><td>1 to 2147483647 [pulse/s]</td><td>○</td><td>○
(2 word)</td><td>1</td></tr>
<tr><td colspan="2">Dwell time</td><td>0 [ms]</td><td colspan="4">0 to 5000 [ms]</td><td>○</td><td>○
(1 word)</td><td>2</td></tr>
<tr><td colspan="2">M-code</td><td>—</td><td colspan="4">0 to 32767</td><td>○</td><td>○
(1 word)</td><td>2</td></tr>
<tr><td colspan="2">Torque limit value</td><td>Torque limit setting valued [%] in the parameter block</td><td colspan="4">1 to 10000 (×10^{-1} [%])</td><td>○</td><td>○
(1 word)</td><td>2</td></tr>
</table>

Name			Default value	Setting range				Valid/invalid		Number of steps
				mm	inch	degree	pulse	Direct setting *1	Indirect (Number of used words)	
Circular interpolation /Helical interpolation	Auxiliary point	Absolute data method	—	-2147483648 to 2147483647 (×10^{-1} [μm])	-2147483648 to 2147483647 (×10^{-5} [inch])	0 to 35999999 (×10^{-5} [degree])	-2147483648 to 2147483647	○	○ (2 word)	1
		Incremental data method		-2147483647 to 2147483647 (×10^{-1} [μm])	-2147483647 to 214748647 (×10^{-5} [inch])	-2147483647 to 214748647 (×10^{-5} [degree])	-2147483647 to 2147483647	○	○ (2 word)	1
	Radius	Absolute data method	—	1 to 4294967295 (×10^{-1} [μm])	1 to 4294967295 (×10^{-5} [inch])	0 to 35999999 (×10^{-5} [degree])	1 to 4294967295	○	○ (2 word)	1
		Incremental data method		1 to 2147483647 (×10^{-1} [μm])	1 to 2147483647 (×10^{-5} [inch])	1 to 2147483647 (×10^{-5} [degree])	1 to 2147483647	○	○ (2 word)	1
	Central point	Absolute data method	—	-2147483648 to 2147483647 (×10^{-1} [μm])	-2147483648 to 2147483647 (×10^{-5} [inch])	0 to 35999999 (×10^{-5} [degree])	-2147483648 to 2147483647	○	○ (2 word)	1
		Incremental data method		-2147483647 to 2147483647 (×10^{-1} [μm])	-2147483647 to 214748647 (×10^{-5} [inch])	-2147483647 to 214748647 (×10^{-5} [degree])	-2147483647 to 2147483647	○	○ (2 word)	1
	Number of pitches		—	0 to 999				○	○ (1 word)	1
OSC	Starting angle		—	0 to 359.9 [degree]				○	○ (2 word)	1
	Amplitude		—	1 to 2147483647 (×10^{-1} [μm])	1 to 2147483647 (×10^{-5} [inch])	1 to 2147483647 (×10^{-5} [degree])	1 to 2147483647	○	○ (2 word)	1
	Frequency		—	1 to 5000 [CPM]				○	○ (2 word)	1
Reference axis No.*3			—	1 to 64				○	○ (1 word)	2

Name			Default value	Setting range				Valid/invalid		Number of steps
				mm	inch	degree	pulse	Direct setting *1	Indirect (Number of used words)	
Parameter block	Interpolation control unit		3	0	1	2	3	○	○ (1 word)	2
	Speed limit value		200000 [pulse/s]	1 to 600000000 ($\times 10^{-2}$ [mm/min])	1 to 600000000 ($\times 10^{-3}$ [inch/min])	1 to 2147483647 ($\times 10^{-3}$ [degree/min])*2	1 to 2147483647 [pulse/s]	○	○ (2 word)	2
	Acceleration time		1000 [ms]	1 to 8388608 [ms]				○	○ (2 word)	2
	Deceleration time		1000 [ms]	1 to 8388608 [ms]				○	○ (2 word)	2
	Rapid stop deceleration time		1000 [ms]	1 to 8388608 [ms]				○	○ (2 word)	2
	S-curve ratio		0[%]	0 to 100[%]				○	○ (1 word)	2
	Advanced S-curve acceleration / deceleration	Acceleration /deceleration system	0	0: Trapezoidal acceleration/deceleration/S-curve acceleration/deceleration 1: Advanced S-curve acceleration/deceleration*4				○	○ (1 word)	2
		Acceleration section 1 ratio	20.0[%]	0 to 1000 ($\times 10^{-1}$ [%])				○	○ (1 word)	2
		Acceleration section 2 ratio	20.0[%]	0 to 1000 ($\times 10^{-1}$ [%])				○	○ (1 word)	2
		Deceleration section 1 ratio	20.0[%]	0 to 1000 ($\times 10^{-1}$ [%])				○	○ (1 word)	2
		Deceleration section 2 ratio	20.0[%]	0 to 1000 ($\times 10^{-1}$ [%])				○	○ (1 word)	2
	Torque limit value		300.0[%]	1 to 10000 ($\times 10^{-1}$ [%])				○	○ (1 word)	2
	Deceleration processing on STOP input		0	0: Deceleration stop based on the deceleration time 1: Deceleration stop based on the rapid stop deceleration time*4				○	○ (1 word)	2
	Allowable error range for circular interpolation		100 [pulse]	1 to 100000 ($\times 10^{-1}$ [µm])	1 to 100000 ($\times 10^{-5}$ [inch])	1 to 100000 ($\times 10^{-5}$ [degree])	1 to 100000 [pulse]	○	○ (2 word)	2
	Bias speed at start		0 [pulse/s]	0 to 600000000 ($\times 10^{-2}$ [mm/min])	0 to 600000000 ($\times 10^{-3}$ [inch/min])	0 to 2147483647 ($\times 10^{-3}$ [degree/min])*5	0 to 2147483647 [pulse/s]	○	○ (2 word)	2

Name		Default value	Setting range				Valid/invalid		Number of steps
			mm	inch	degree	pulse	Direct setting *1	Indirect (Number of used words)	
Others	Repeat condition (Number of repetitions)	—	1 to 32767				○	○ (1 word)	1
	Repeat condition (ON/OFF)	—	—				×	○ (1 bit)	1
	Program No.	—	0 to 8191*6				○	○ (1 word)	1
	Command speed (continuous trajectory)	—	1 to 600000000 (×10^{-2} [mm/min])	1 to 600000000 (×10^{-3} [inch/min])	1 to 2147483647 (×10^{-3} [degree/min])*2	1 to 2147483647 [pulse/s]	○	○ (2 word)	2
	Skip	—	—				×	○ (1 bit)	2
	FIN acceleration/deceleration	—	1 to 5000 [ms]				○	○ (1 word)	2
	WAIT-ON/OFF	—	—				×	○ (1 bit)	2
	Fixed position stop acceleration/deceleration time	1000 [ms]	1 to 8388608 [ms]				○	○ (2 word)	1
	Fixed position stop	—	—				×	○ (1 bit)	1

*1 For direct setting using MT Developer2, use the decimal format instead of the exponential format.
*2 When the "speed control 10 × multiplier setting for degree axis" is valid, the setting range is 1 to 2147483647 (×10^{-2} [degree/min]).
*3 Only when the reference axis speed is specified
*4 Only bit0 is valid. If the value outside the range is set, the state except bit0 is ignored.
*5 When the "speed control 10 × multiplier setting for degree axis" is valid, the setting range is 0 to 2147483647 (×10^{-2} [degree/min]).
*6 For operating system software version "09" or earlier, 0 to 4095.

Common

Data that is common through all servo instructions.

■Parameter block No.

Set based on which parameter block performs deceleration processing at the acceleration/deceleration processing and STOP input for every start.

■Axis

Set the starting axis.

It becomes the interpolation starting axis No. at the interpolation.

■Address/Travel value

- Address (Absolute data method)
  Set the positioning address as an absolute method with an absolute address.
- Travel value (Incremental data method)
  Set the positioning address as an incremental data method with a travel value. Travel direction is indicated by the sign.
  Only positive settings can be made at the speed/position switching control.

Travel direction	Description
Positive	Forward rotation (address increase direction)
Negative	Reverse rotation (address decrease direction)

■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)

■Dwell time

Set the time until outputs the "[St.1061] Positioning complete (R: M32401+32n/Q: M2401+20n)" after positioning to positioning address.

■M-code

Set the M-code.
Set for every point at the continuous trajectory control.
Updated at the start or specified point.

■Torque limit value

Set the torque limit value.
The torque limit value is set in speed control (Ⅱ), speed/position switching control, and continuous trajectory control.
The torque limit is performed based on the parameter block data at the start but can also be changed during operation.

Positioning control	Description
Speed control (Ⅱ)	Changes torque limit value during operation.
Speed/position switching control	Changes torque limit value during operation.
Continuous trajectory control	Sets torque limit value for every point. Performs the set torque limit at the specified point.

Circular interpolation/Helical interpolation

Data that is set in the servo programs for starting circular interpolation and helical interpolation.

■Auxiliary point (Absolute data method, incremental data method)

Set at the auxiliary point-specified circular interpolation, or auxiliary point-specified helical interpolation.

■Radius (Absolute data method, incremental data method)

Set at the radius-specified circular interpolation, or radius-specified helical interpolation.

■Central point (Absolute data method, incremental data method)

Set at the central point-specified circular interpolation, or central point-specified helical interpolation.

■Number of pitches

Set at the helical interpolation.

OSC

Data that is set in high-speed oscillation. Refer to the high-speed oscillation for details. (☞ Page 373 High-Speed Oscillation)

- Starting angle
- Amplitude
- Frequency

Reference axis No.

Data that is set when a specified reference axis speed is set in 2 to 4 axes linear interpolation control.
Set the axis which is to be reference for positioning speed.

Parameter block

Set when changing the parameter block (if not set, the default value) set in the servo program. (The data of the parameter block is not changed.)

Only the data in the specified parameter block that is changed can be set.

Refer to Parameter block for details. (☞ Page 215 Parameter Block)

- Interpolation control unit
- Speed limit value
- Acceleration time
- Deceleration time
- Rapid stop deceleration time
- S-curve ratio
- Advanced S-curve acceleration/deceleration (acceleration/deceleration system, acceleration section 1 ratio, acceleration section 2 ratio, deceleration section 1 ratio, deceleration section 2 ratio)
- Torque limit value
- Deceleration processing on STOP input
- Allowable error range for circular interpolation
- Bias speed at start

Others

■Repeat condition

- Number of repetitions

  Set the repeat conditions between FOR-TIMES instruction and NEXT instruction.
- ON/OFF

  Set the repeat conditions between FOR-ON/OFF instruction and NEXT instruction.

■Program No.

Set the program No. for simultaneous start.

■Command speed (continuous trajectory)

Set the speed for points on the way in the servo program.

■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 continuous trajectory control instruction.

■FIN acceleration/deceleration

Set to execute positioning to each pass point for continuous trajectory control instruction by turning on the FIN signal.

■WAIT-ON/OFF

Set to make state of the waiting for execution by continuous trajectory control and execute the positioning immediately by turning on/off the command bit device.

■Fixed position stop acceleration/deceleration time

Set the acceleration/deceleration time used in the starting of speed control with fixed position stop, speed change request (CHGV) or fixed position stop command ON.

■Fixed position stop

Set the command bit device of fixed position stop.

4.4 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:

- Direct setting of data by numerical values (☞ Page 248 Setting method for direct setting by numerical values)
- Indirect setting by devices (☞ Page 248 Indirect setting method by devices)

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

Point

If the servo program area has insufficient capacity, perform multiple positioning control operations with one program by the indirect setting of positioning data used in the servo program. (☞ Page 248 Indirect setting method by devices)

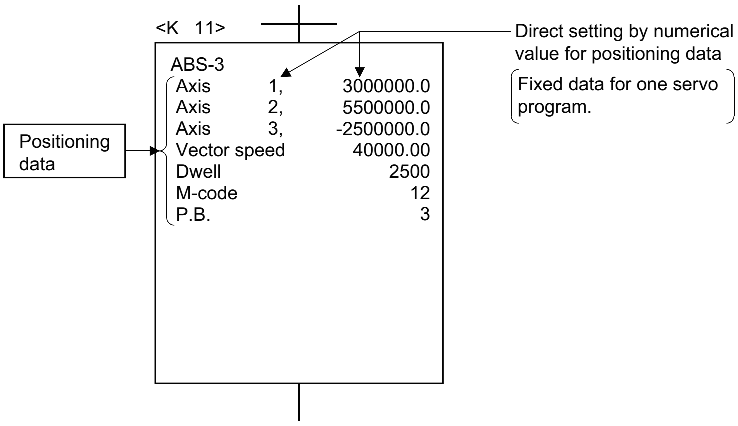
Setting method for direct setting by numerical values

In the setting by 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.

Ex.

Direct setting example of positioning data by numerical value



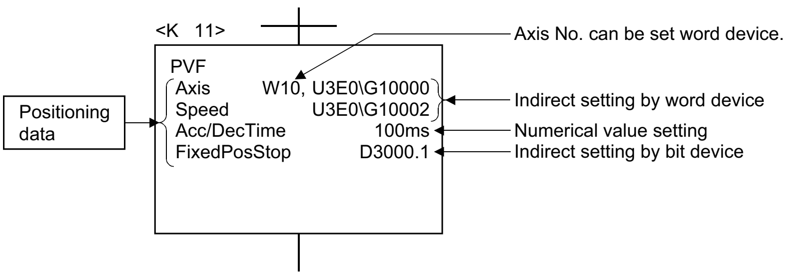
Indirect setting method by devices

In the indirect setting method by devices, the positioning data specified with the servo program is set by devices.

By using the contents of specified device as data for the servo program, the operation pattern can be changed with one servo program.

Ex.

Indirect setting example of positioning data by device



Point

Refer to the following for the details of devices.

📖MELSEC iQ-R Motion controller Programming Manual (Common)

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.

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. ↓ Read the value of "data set pointer for continuous trajectory control" of the start axis, and update the data input by Motion CPU.	Refer to the axis monitor devices for details. (☞ Page 97 [Md.1011] Data set pointer for continuous trajectory control (R: D32015+48n/Q: D15+20n))

Point

- Take an interlock condition by using a "[St.1040] Start accept flag (R: M30080+n/Q: M2001+n)" 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.
- For data that uses 2 words, always set a device with an even number.

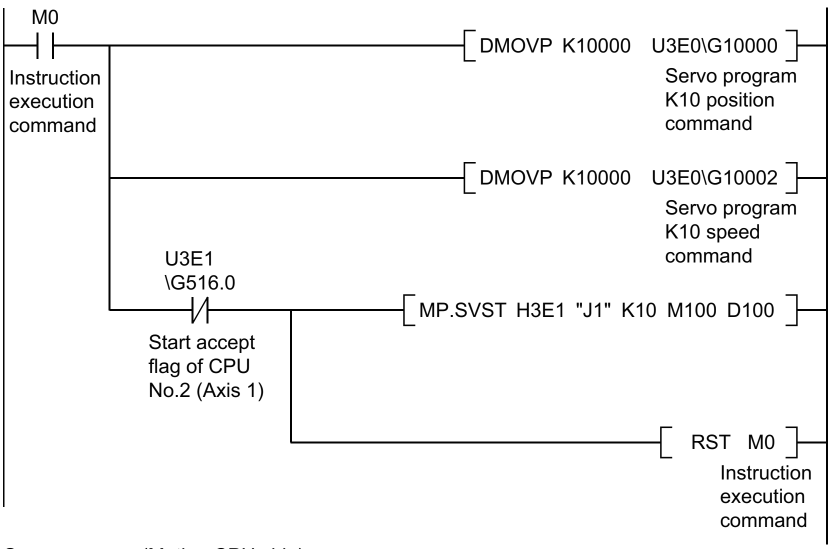
Program example that uses the CPU buffer memory

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

■Program

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

Sequence program (PLC CPU side)



Servo program (Motion CPU side)

```
[K 10: Real]
1  INC-1
   Axis 1,  U3E0\G10000  µm
   Speed    U3E0\G10002  mm/min
```

5 POSITIONING CONTROL

This section describes the positioning control methods.

5.1 Basics of Positioning Control

This section describes the common items for positioning control, which is described in detail after Section 5.2. (☞ Page 270 1 Axis Linear Positioning Control)

Positioning speed

The positioning speed is set using the servo program.

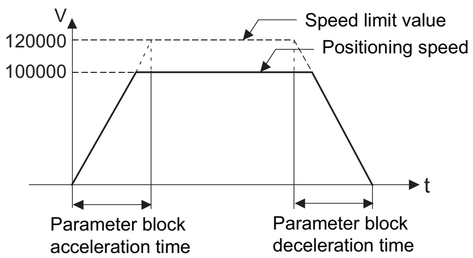
Refer to servo programs for positioning control for details of the servo programs. (☞ Page 236 SERVO PROGRAMS FOR POSITIONING CONTROL)

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

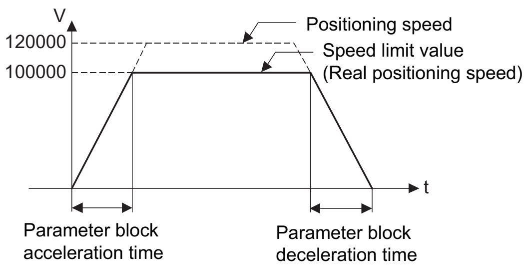
- If the positioning speed setting is less than speed limit value, the positioning is executed with the set positioning speed.
- If the positioning speed setting is greater than speed limit value, the positioning is executed with the speed limit value.

Ex.

(Example 1) If the speed limit value is 120000 [mm/min] and the positioning speed setting is 100000 [mm/min]



(Example 2) If the speed limit value is 100000 [mm/min] and the positioning speed setting is 120000 [mm/min]



Positioning speed at the interpolation control

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

1 axis linear control

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

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.

■Vector speed specification

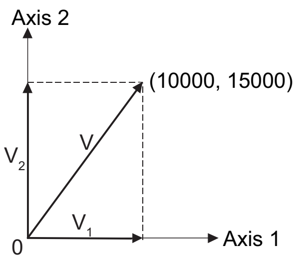
The Motion CPU calculates the positioning speed of each axis (V_1 to V_2) using the travel value (D_1 to D_2) of each axis based on the positioning speed (V) of the setting control system.

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

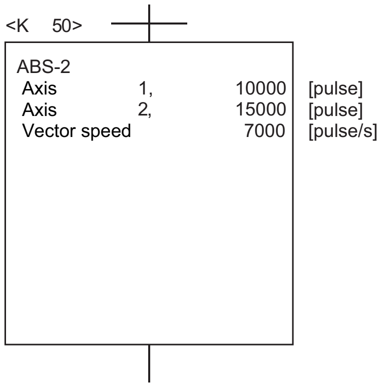
Set the vector speed and the travel value of each axis in the servo program.

Ex.

2 axes linear interpolation control



[Program example]



Setting item	Setting value
Axis 1 travel value (D_1)	10000 [pulse]
Axis 2 travel value (D_2)	15000 [pulse]
Vector speed (V)	7000 [pulse/s]

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

Axis	Calculation expression
Axis 1 positioning speed	$V_1 = V \times D_1 / \sqrt{D_1^2 + D_2^2}$
Axis 2 positioning speed	$V_2 = V \times D_2 / \sqrt{D_1^2 + D_2^2}$

■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 (V_1 to V_3) using each axis travel value (D_1 to D_4).

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

Ex.

4 axes linear interpolation control

[Program example]

```
<K    51>
ABS-4
 Axis          1,      10000   [pulse]
 Axis          2,      15000   [pulse]
 Axis          3,       5000   [pulse]
 Axis          4,      20000   [pulse]
 Long-axis speed        7000   [pulse/s]
```

Setting item	Setting value
Axis 1 travel value (D_1)	10000 [pulse]
Axis 2 travel value (D_2)	15000 [pulse]
Axis 3 travel value (D_3)	5000 [pulse]
Axis 4 travel value (D_4)	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	Calculation expression
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.

- Combination of axes set in [mm] and [inch]

Interpolation control unit	Item	Description
mm	Travel value	Convert the travel value of axis set in [inch] into [mm] using the formula: inch setting value × 25.4.
	Speed	The largest travel value axis is controlled with the long-axis speed and the other axes are controlled with the speed based on the long-axis speed, as the result of conversion.
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 long-axis speed and the other axes are controlled with the speed based on the long-axis speed, as the result of conversion.

- Discrepancy between interpolation control units and control units

Item	Description
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 long-axis 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.

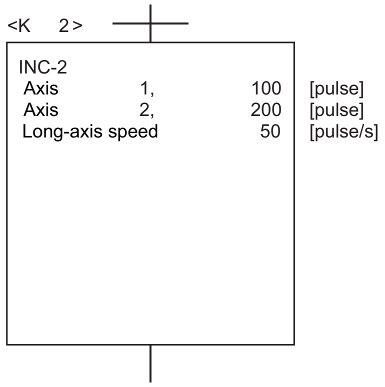
Point

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.

(Example)

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

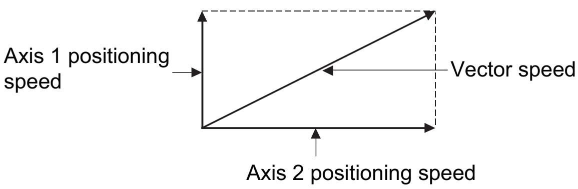


Setting item	Setting value
Axis 1 travel value	100 [pulse]
Axis 2 travel value	200 [pulse]
Long-axis speed	50 [pulse/s]
Speed limit value	55 [pulse/s]

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:

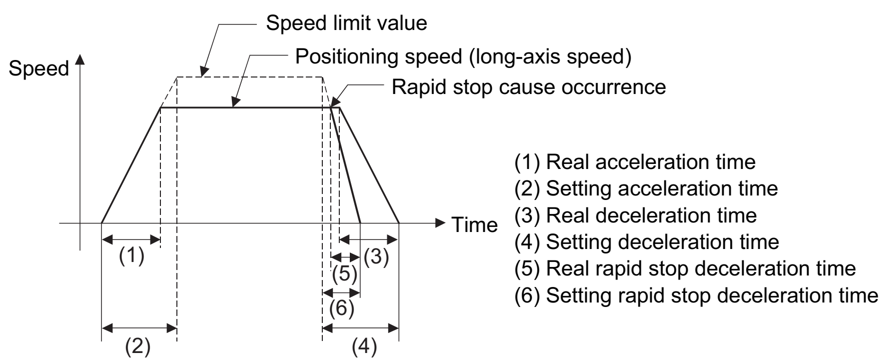
Setting item	Speed
Axis 1 positioning speed	$100 / 200 \times 50 = 25$ [pulse/s]
Axis 2 positioning speed	50 [pulse/s]
Vector speed	$\sqrt{25^2 + 50^2} = 55.9$ [pulse/s]



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

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.



■Reference-axis speed specification

The Motion CPU calculates the positioning speed of other axes (V_1 to V_3) based on the positioning speed (reference-axis speed: V) of the setting reference-axis using each axis travel value (D_1 to D_4).

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

Ex.

4 axes linear interpolation control

[Program example]

```
<K   52>
ABS-4
 Axis          1,       10000   [pulse]
 Axis          2,       15000   [pulse]
 Axis          3,        5000   [pulse]
 Axis          4,       20000   [pulse]
 Reference-axis speed    7000   [pulse/s]
 Reference-axis             4
```

Setting item	Setting value
Axis 1 travel value (D_1)	10000 [pulse]
Axis 2 travel value (D_2)	15000 [pulse]
Axis 3 travel value (D_3)	5000 [pulse]
Axis 4 travel value (D_4)	20000 [pulse]
Reference axis speed (V)	7000 [pulse/s]
Reference axis	Axis 4

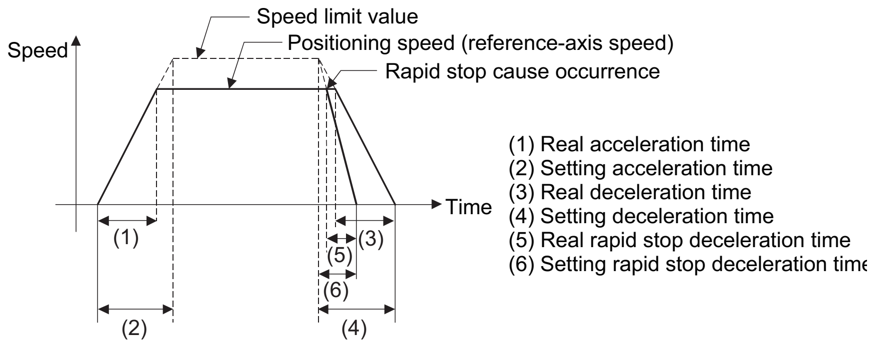
In this example, since the reference-axis is axis 4, it is controlled with the positioning speed specified with axis 4.

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

Axis	Calculation expression
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	$V_3 = D_3 / D_4 \times V$

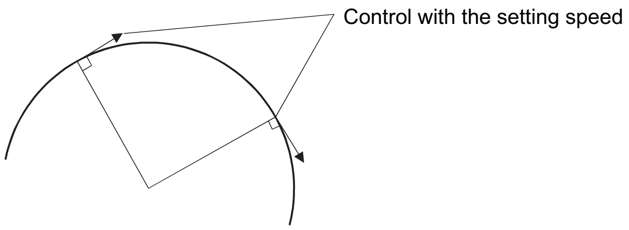
Point

- 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.
- Indirect specification of the reference-axis
  The reference-axis can be set indirectly using the word devices. (☞ Page 248 Indirect setting method by devices)
- 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.



Circular interpolation control

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



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.)

Control units for interpolation control

Interpolation control unit check

- 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.

	Interpolation control units in the parameter block				Starting method
	mm	inch	degree	pulse	
Normal start	There are axes whose control unit set in the fixed parameter is [mm] and [inch].		There are axes whose control unit set in the fixed parameter is [degree].	There are axes whose control unit set in the fixed parameter is [pulse].	Positioning control starts by the interpolation control units of parameter block.
Unit mismatch (Warning (error code: 093DH))	Control units of the fixed parameter for all axes differ from the interpolation control units specified with parameter block.				• 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].

Interpolation unit combinations

- 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

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.

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 × 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.

Discrepancy units: (3)

- The travel value and positioning speed are calculated for each axis.
  - The electronic gear converts the travel value for the axis to [pulse].
  - 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.

Point

Although electric gear is not set for the command generation axis, the electric gear is set to "1" when calculating the position command value or the positioning speed.

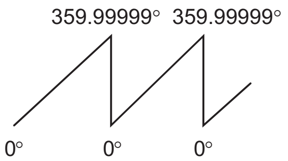
Control in the control unit "degree"

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

5

Current value address

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

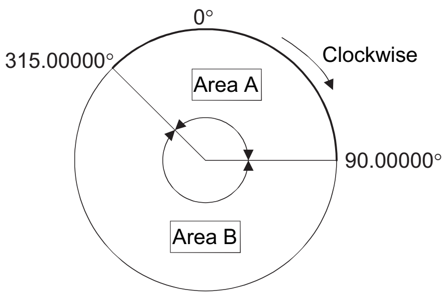


Stroke limit valid/invalid setting

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

■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.



- If travel range in area A is set, the limit values are as follows:

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

■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.

Point

- Circular interpolation including the axis which set the stroke limit as invalid cannot be executed.
- 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.
- When the stroke limit is set as valid in the incremental data system, perform the home position return after power supply on.
- Do not use the high-speed oscillation in the axis that invalidates a stroke limit of control unit "degree".
- 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). (☞ Page 173 Stroke limit invalid setting)

Positioning control

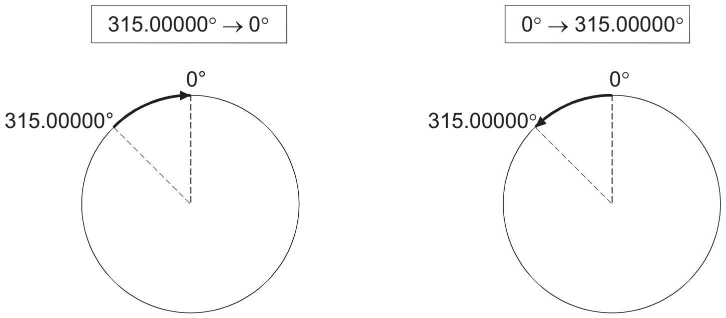
Positioning control method in the control unit "degree" is shown below.

■Absolute data method (ABS□ instructions)

Positioning in a near direction to the specified address is performed based on the current value.

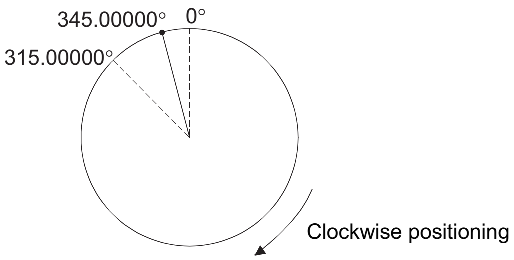
Ex.

Positioning is executed in a clockwise direction to travel from the current value of 315.00000° to 0°.
Positioning is executed in a counter clockwise direction to travel from the current value of 0° to 315.00000°.



Point

- 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°.



- Set the positioning address within the range of 0° to 360°. Use the incremental data method for positioning of one revolution or more.

■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:

- Positive travel value: Clockwise rotation
- Negative travel value: Counter clockwise rotation

Point

Positioning of 360° or more can be executed in the incremental data method.

Stop processing and restarting after stop

This section describes the stop processing after a stop cause is input during positioning and restarting after stop.

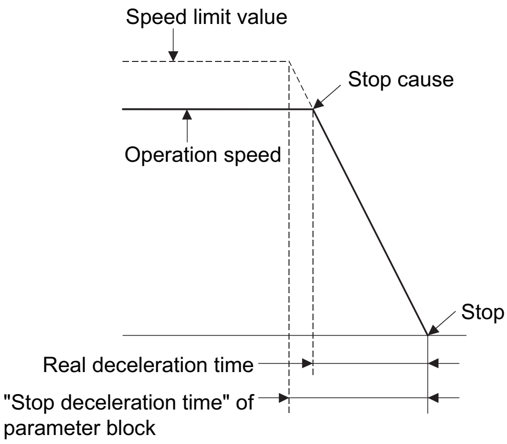
Stop processing

■Stop processing methods

Stop processing during positioning by stop cause are as follows.

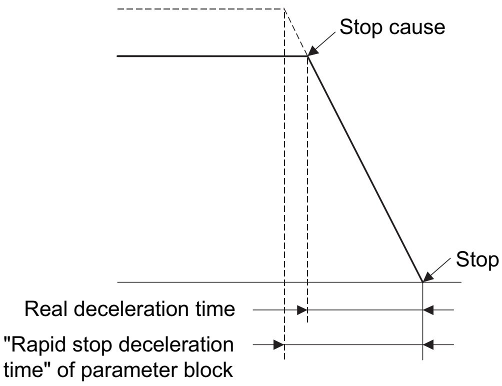
- Deceleration stop

  Deceleration stop by "stop deceleration time" of parameter block.



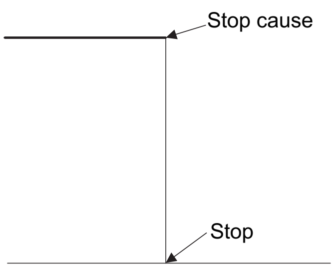
- Rapid stop

  Deceleration stop by "rapid stop deceleration time" of parameter block.



- Immediate stop

  Stop without deceleration processing.



- Deceleration stop (individual)

  Deceleration stop not using "stop deceleration time" of parameter block.

  (1) During manual pulse generator operation, the deceleration time is "(Smoothing magnification + 1) × 56.8 [ms]".

  (2) During speed-torque control of speed control, the deceleration time is the deceleration time specified in the command speed deceleration time.

5

■Priority for stop processing

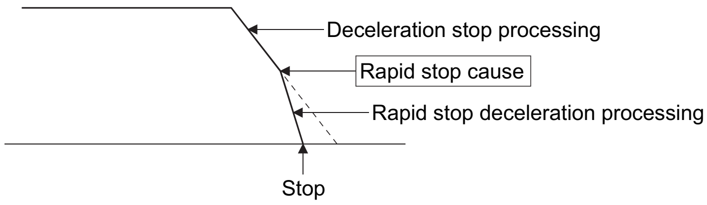
Priority for stops when a stop cause is input is as follows:

Deceleration stop < Rapid stop < Immediate stop

Ex.

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.



■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.

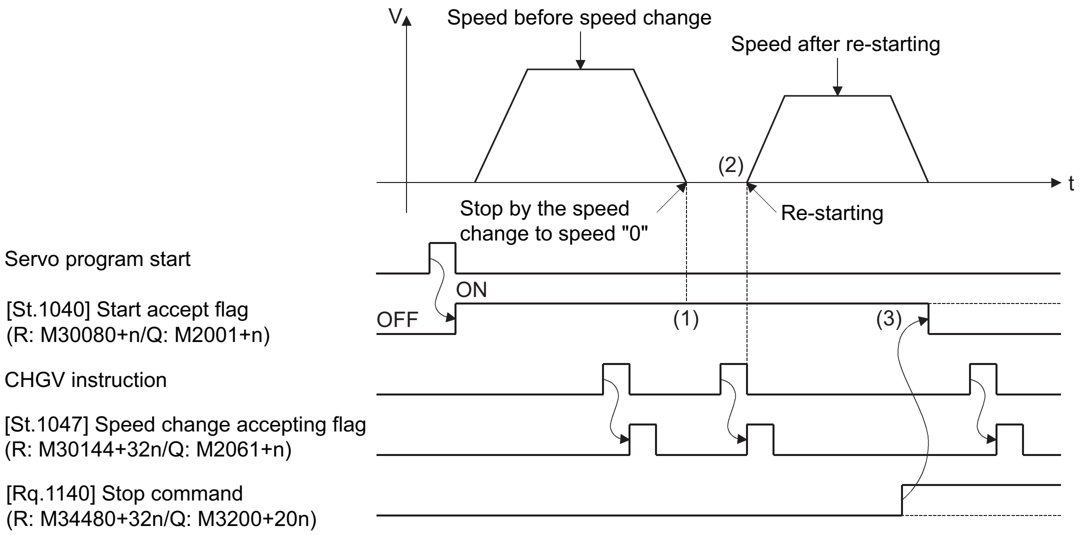
<table>
<tr><th rowspan="2">Stop cause</th><th rowspan="2">Axis classification</th><th colspan="6">Stop processing</th></tr>
<tr><th>Servo program/ JOG operation</th><th>Advanced synchronous control*1</th><th>Torque control*2/ Continuous operation to torque control mode*2/ Pressure control*3</th><th>Manual pulse generator operation/ Speed control*2</th><th>Machine program operation/ Machine JOG operation*4</th><th>G-code control*5</th></tr>
<tr><td>STOP signal input (STOP) of the external signal ON</td><td rowspan="6">Individual axes</td><td colspan="2" rowspan="3">Deceleration stop or rapid stop*6</td><td rowspan="10">Immediate stop</td><td rowspan="10">Deceleration stop (individual)</td><td rowspan="3">Deceleration stop or rapid stop*6</td><td rowspan="3">Deceleration stop</td></tr>
<tr><td>FLS input signal OFF of external signal</td></tr>
<tr><td>RLS input signal OFF of external signal</td></tr>
<tr><td>"[Rq.1140] Stop command (R: M34480+32n/Q: M3200 + 20n)" ON</td><td colspan="2">Deceleration stop</td><td>Deceleration stop</td><td rowspan="2">—</td></tr>
<tr><td>"[Rq.1141] Rapid stop command (R: M34481+32n/Q: M3201 + 20n)" ON</td><td colspan="2">Rapid stop</td><td rowspan="2">Rapid stop</td></tr>
<tr><td>"[St.1068] Servo error detection (R: M32408+32n/ Q: M2408 +20n)"*7 ON</td><td>Rapid stop</td><td>Immediate stop</td><td>Immediate stop</td></tr>
<tr><td>Deceleration stop using MT Developer2*8</td><td rowspan="8">All axes</td><td colspan="2">Deceleration stop</td><td colspan="2" rowspan="2">—</td></tr>
<tr><td>Rapid stop of the all axes using MT Developer2*8</td><td colspan="2">Rapid stop</td></tr>
<tr><td>Motion CPU stop</td><td colspan="2" rowspan="2">Deceleration stop</td><td colspan="2" rowspan="2">Deceleration stop</td></tr>
<tr><td>Other CPU stop error</td></tr>
<tr><td>Multiple CPU system reset*7</td><td colspan="6" rowspan="5">Immediate stop</td></tr>
<tr><td>Motion CPU WDT error*7</td></tr>
<tr><td>Multiple CPU system power off*7</td></tr>
<tr><td>Forced stop</td></tr>
<tr><td>Servo amplifier control circuit power off*7</td><td>Individual axes</td></tr>
<tr><td>Speed change to speed "0"</td><td>Individual axes*9</td><td>Deceleration stop</td><td colspan="5">—</td></tr>
<tr><td>Servo motor maximum speed over</td><td rowspan="3">Individual axes</td><td colspan="4">—</td><td>Stop</td><td rowspan="7">—</td></tr>
<tr><td>Override ratio set to "0"</td><td>Deceleration stop</td><td colspan="3">—</td><td>Deceleration stop</td></tr>
<tr><td>Software stroke limit error</td><td colspan="2">Deceleration stop</td><td>Immediate stop</td><td>Deceleration stop (individual)</td><td rowspan="3">Immediate stop</td></tr>
<tr><td>XYZ stroke limit error</td><td rowspan="4">Individual machines</td><td colspan="4" rowspan="4">—</td></tr>
<tr><td>Operation outside of range error/Indefinite solutions error</td></tr>
<tr><td>"[Rq.2245] Machine stop command (M43621+32m)" ON</td><td>Deceleration stop</td></tr>
<tr><td>"[Rq.2246] Machine rapid stop command (M43622+32m)" ON</td><td>Rapid stop</td></tr>
</table>

Stop cause	Axis classification	Stop processing					
		Servo program/ JOG operation	Advanced synchronous control*1	Torque control*2/ Continuous operation to torque control mode*2/ Pressure control*3	Manual pulse generator operation/ Speed control*2	Machine program operation/ Machine JOG operation*4	G-code control*5
"[Rq.3376] G-code control request (D54226.0+2s)" OFF	G-code control lines	—					Deceleration stop
"[Rq.3380] Reset command (D54226.4+2s)" ON							
"[Rq.3378] Automatic operation hold (feed hold) (D54226.2+2s)" ON							
G-code control error detection							
Fast forward rate override/ cutting feed rate override is set to "0"							

*1 Refer to the following for details.
MELSEC iQ-R Motion controller Programming Manual (Advanced Synchronous Control)
*2 Refer to speed-torque control for details. (Page 431 Speed-Torque Control)
*3 Refer to pressure control for details. (Page 450 Pressure Control)
*4 Refer to the following for details.
MELSEC iQ-R Motion controller Programming Manual (Machine Control)
*5 Refer to the following for details.
MELSEC iQ-R Motion controller Programming Manual (G-Code Control)
*6 Stops according to the setting of "Deceleration processing on STOP input" of the parameter block.
*7 The servo motor stops with dynamic brake.
*8 Test mode
*9 Applies to all axes used in the servo program set in the speed "0".

Re-starting after stop

- 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 external signal ON, the "[Rq.1140] Stop command (R: M34480+32n/Q: M3200+20n)" ON or the "[Rq.1141] Rapid stop command (R: M34481+32n/Q: M3201+20n)" ON during speed/position switching control, re-starting is possible using VPSTART instruction.
- If it stopped by the speed change to speed "0" using CHGV instruction, re-starting is possible by executing the speed change to speed other than "0".



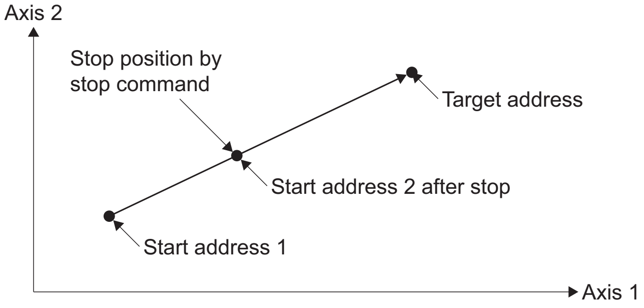
(1) The "[St.1040] Start accept flag (R: M30080+n/Q: M2001+n)" remains on after stop by the speed change to "0".
(2) Re-starting by changing the speed again.
(3) However, if the "[Rq.1040] Stop command (R: M30080+n/Q: M2001+n)" turns off by turning on the "[Rq.1140] Stop command (R: M34480+32n/Q: M3200+20n)", re-starting is not possible even if make a speed change again.

Continuation of positioning control

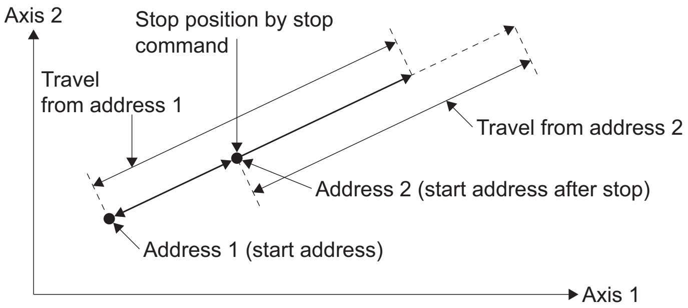
This section describes the processing which performed servo program No. which was being performed before the stop, after stop by turning on the STOP input of the external signal ON, the "[Rq.1140] Stop command (R: M34480+32n/Q: M3200+20n)" ON or the "[Rq.1141] Rapid stop command (R: M34481+32n/Q: M3201+20n)" ON.

■1 axis linear control/2 or 3 axes linear interpolation control

- For ABS□Positioning control from the stop address to target address by the target address specification.



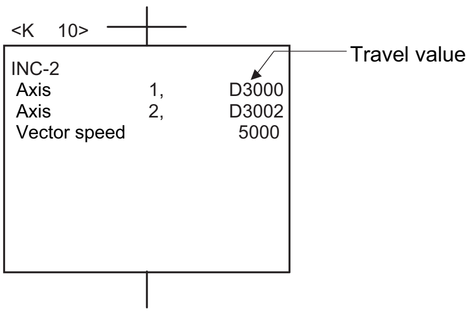
- For INC□Positioning control of the travel value from the stop address.



When the address 2 is moved to the same address (address which calculates with start address + specified travel value) using the INC□, the following processing using the servo program and Motion SFC program is required.

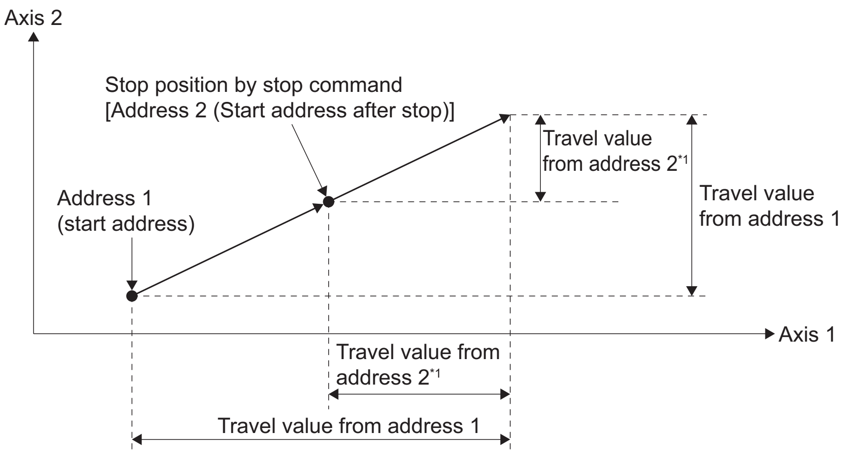
Servo Program

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.



*1 Store in registers for travel value.

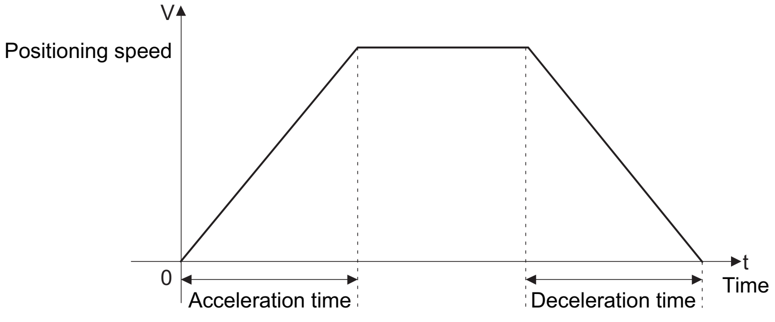
5

Acceleration/deceleration processing

Acceleration/deceleration are processed by the following three methods.

Trapezoidal acceleration/deceleration processing

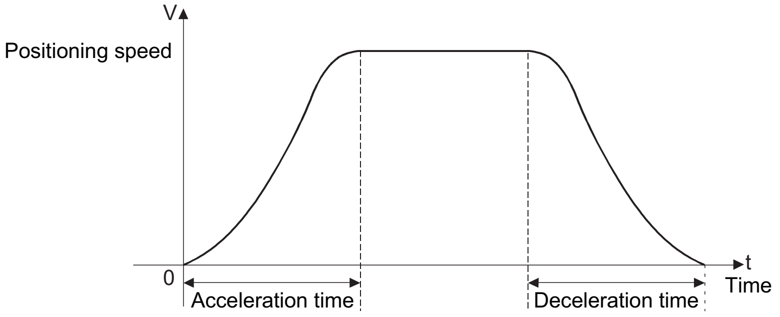
This is a conventional linear acceleration/deceleration processing. The acceleration/deceleration graph resembles a trapezoid, as shown in the diagram below.



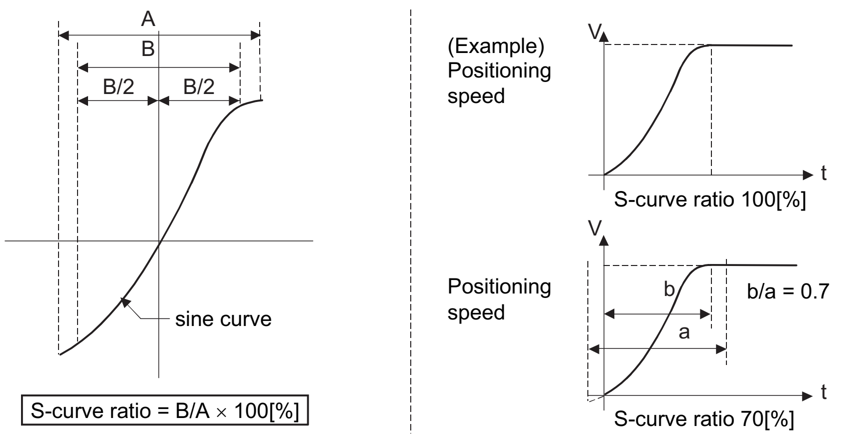
S-curve acceleration/deceleration processing

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 (☞ Page 220 S-curve ratio) or using the servo program.



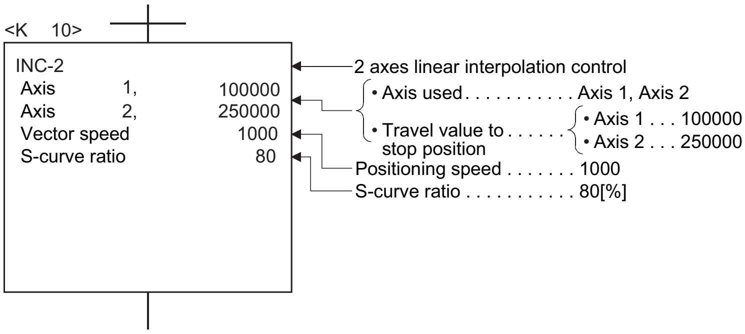
S-curve ratio set the part of the sine curve used to produce the acceleration and deceleration curve as shown in the diagram below.



S-curve ratio can be set by the servo program is following two methods.

■Specification by numerical value

S-curve ratio is set a numerical value from 0 to 100.

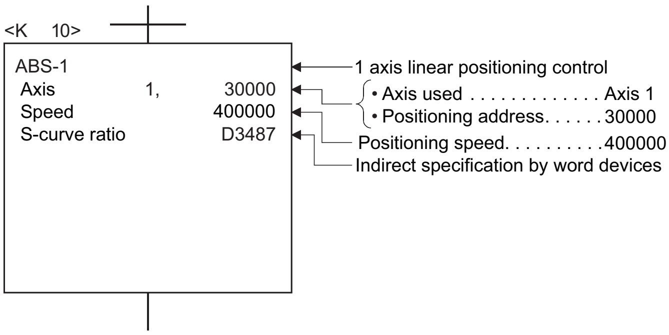


■Indirect specification by devices

S-curve ratio is set by devices.

Refer to the following for the setting range of usable devices.

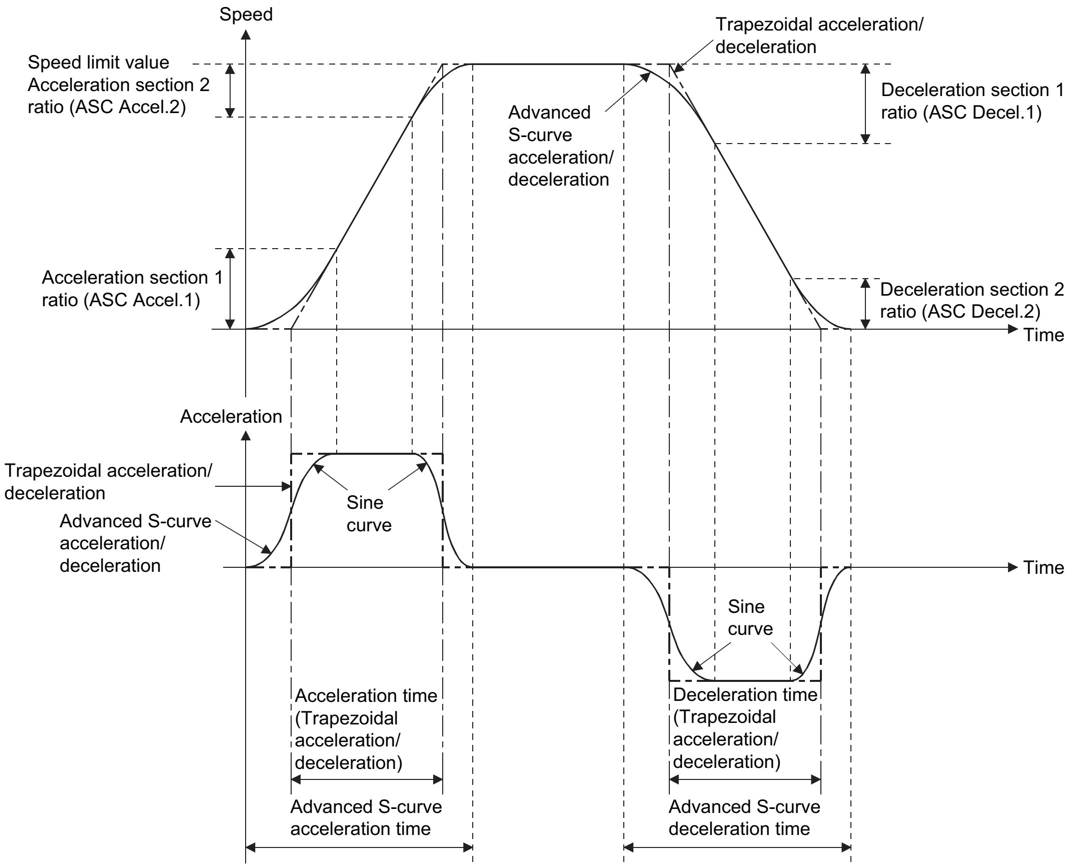
MELSEC iQ-R Motion controller Programming Manual (Common)



Advanced S-curve acceleration/deceleration processing

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 (☞ Page 221 Advanced S-curve acceleration/deceleration) or servo program.



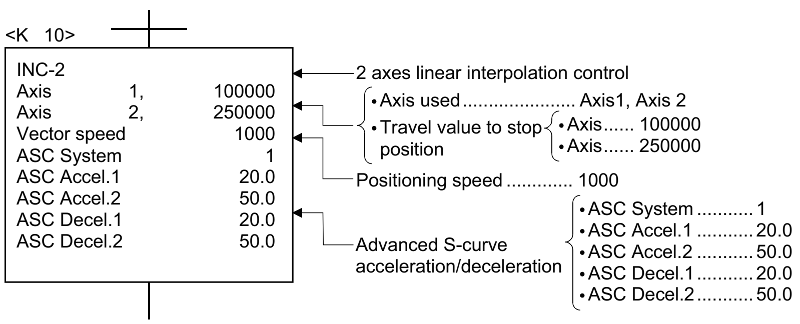
Advanced S-curve acceleration/deceleration can be set by the servo program is following two methods.

■Specification by numerical value

Advanced S-curve acceleration/deceleration system and advanced S-curve acceleration/deceleration ratio are set a numerical value.

Setting items	Setting range
ASC System	0: Trapezoidal/S-curve acceleration/deceleration 1: Advanced S-curve acceleration/deceleration
ASC Accel.1	0.0 to 100.0[%]*1
ASC Accel.2	
ASC Decel.1	
ASC Decel.2	

*1 ASC Accel.1 + ASC Accel.2 ≤ 100.0%, ASC Decel.1 + ASC Decel.2 ≤ 100.0%

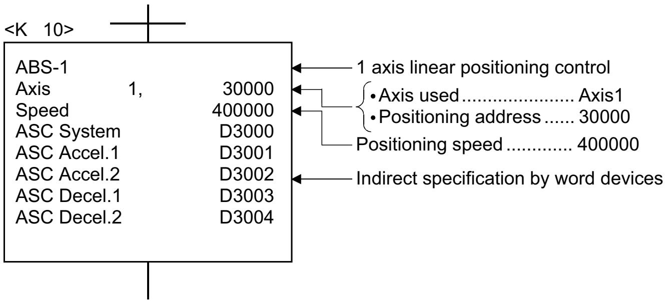


■Specification by devices

Advanced S-curve acceleration/deceleration system and advanced S-curve acceleration/deceleration ratio is set by devices.

Refer to the following for the setting range of usable devices.

MELSEC iQ-R Motion controller Programming Manual (Common)



5.2 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.

○: Must be set, △: Set if required

Servo instruction	Positioning method	Number of control axes	Positioning data set in servo instructions																																	
			Common							Arc				OSC				Parameter block											Others							
			Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Number of pitches	Starting angle	Amplitude	Frequency	Reference axis No. *1	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	Bias speed at start	Repeat condition	Program No.	Command speed (Continuous trajectory)	Skip	FIN acceleration/deceleration	WAIT-ON/OFF	Fixed position stop acceleration/deceleration time	Fixed position stop
ABS-1	Absolute	1	△	○	○	○	△	△											△	△	△	△	△	△		△	△	△								
INC-1	Incremental																																			

*1 Only when the reference axis speed is specified.

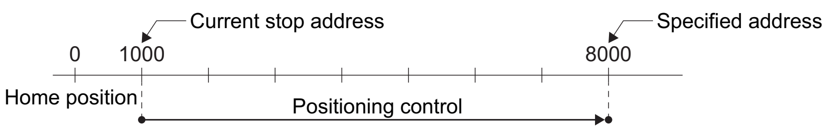
Processing details

■Control using ABS-1 (Absolute data method)

- Positioning control from the current stop address (pre-positioning address) based on the home position to the specified address is executed.
- The travel direction is set by the current stop address and the specified address.

Ex.

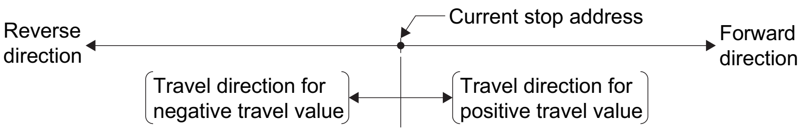
When the current stop address is 1000, and the specified address is 8000.



■Control using INC-1 (Incremental data method)

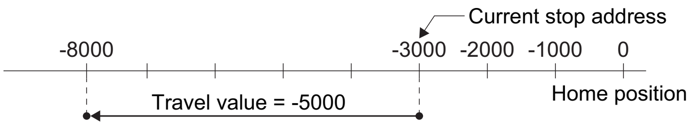
- Positioning control of the specified travel value from the current stop position address is executed.
- The travel direction is set by the sign (+/ -) of the travel value, as follows:

Travel direction	Description
Positive	Positioning control to forward direction (Address Increase direction)
Negative	Positioning control to reverse direction (Address decrease direction)



Ex.

When the current stop address is -3000, and the travel value is -5000.



Program example

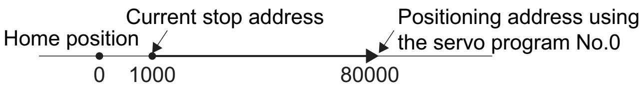
The servo program No.0 for performing the 1 axis linear positioning control of Axis 4 is explained as an example.

This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■Positioning operation details

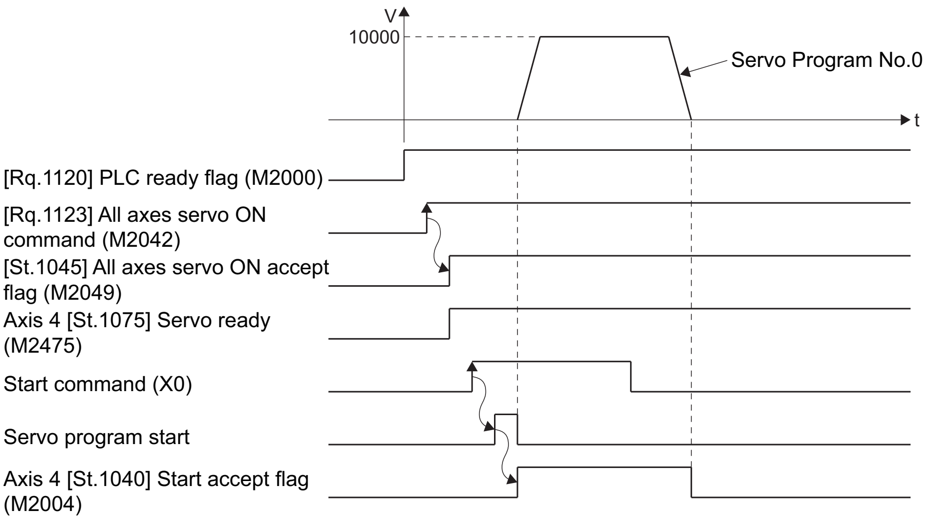
Positioning using the servo program No.0 is shown below.

In this example, Axis 4 is used in servo program No.0.



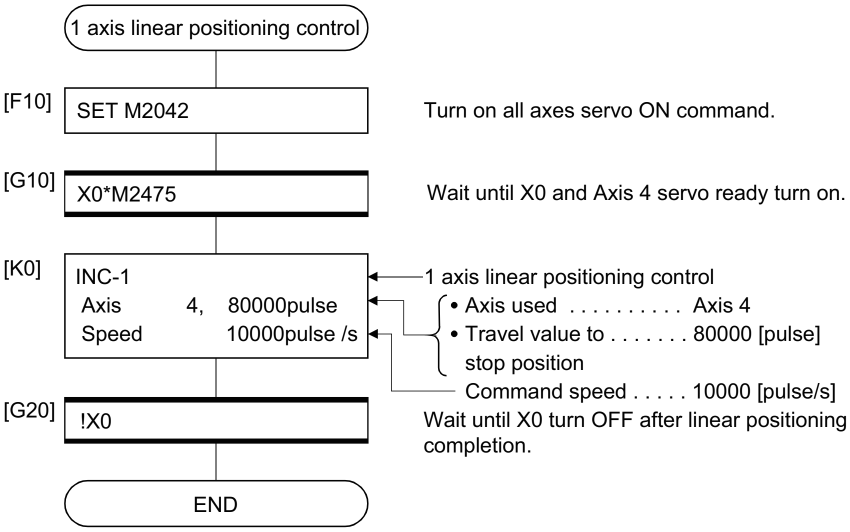
■Operation timing

Operation timing for the servo program No.0 is shown below.



■Motion SFC program

The Motion SFC program for executing the servo program (No. 0) for 1 axis linear positioning control is shown below.



*1 Example of the above Motion SFC program is started using the automatic start or sequence program.

5.3 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.

○: Must be set, △: Set if required

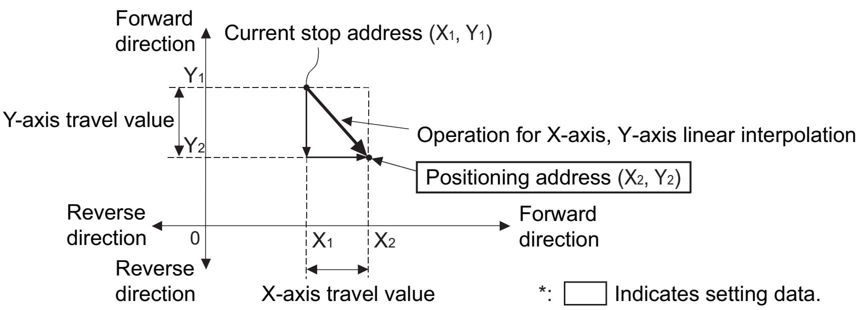
Servo instruction	Positioning method	Number of control axes	Positioning data set in servo instructions																																	
			Common							Arc				OSC				Parameter block											Others							
			Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Number of pitches	Starting angle	Amplitude	Frequency	Reference axis No. *1	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	Bias speed at start	Repeat condition	Program No.	Command speed (Continuous trajectory)	Skip	FIN acceleration/deceleration	WAIT-ON/OFF	Fixed position stop acceleration/deceleration time	Fixed position stop
ABS-2	Absolute	2	△	○	○	○	△	△										△	△	△	△	△	△	△		△	△	△								
INC-2	Incremental																																			

*1 Only when the reference axis speed is specified

Processing details

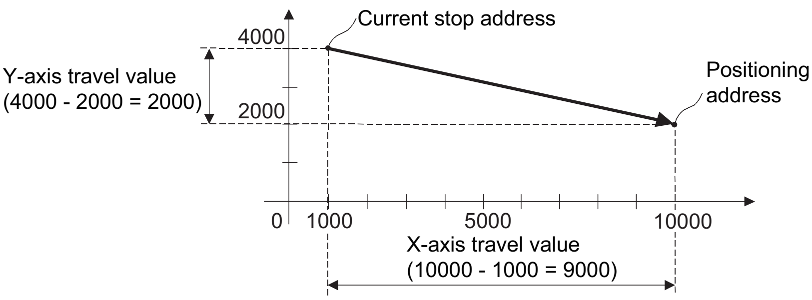
■Control using ABS-2 (Absolute data method)

- 2 axes linear interpolation from the current stop address (X_1 or Y_1) based on the home position to the specified address (X_2 or Y_2) is executed.
- The travel direction is set by the stop address (starting address) and positioning address of each axis.



Ex.

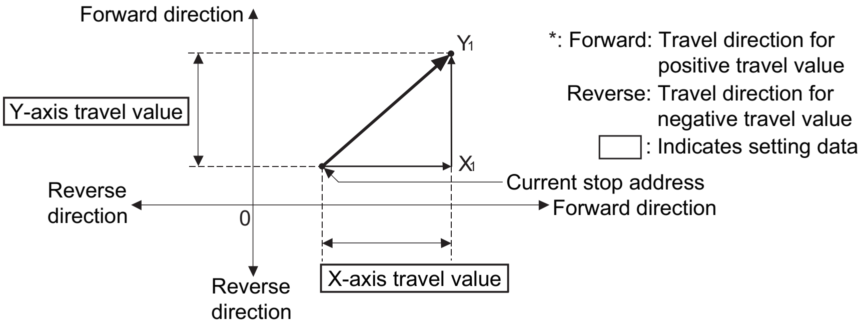
When the current stop address is (1000, 4000), and the positioning address is (10000, 2000).



■Control using INC-2 (Incremental data method)

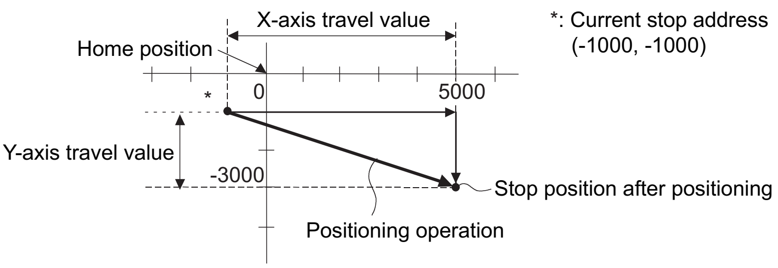
- Positioning control from the current stop address to the position which combined travel direction and travel value specified with each axis is executed.
- The travel direction for each axis is set by the sign (+/ -) of the travel value for each axis, as follows:

Travel direction	Description
Positive	Positioning control to forward direction (Address increase direction)
Negative	Positioning control to reverse direction (Address decrease direction)



Ex.

When the X-axis travel value is 6000 and Y-axis travel value is -2000.

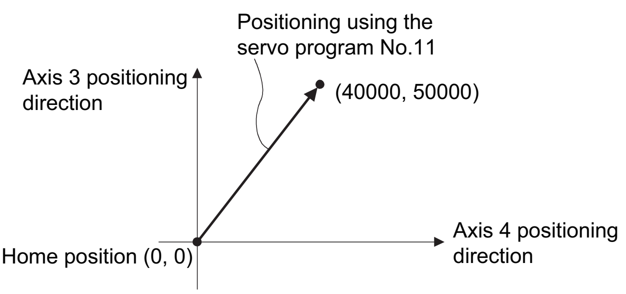


Program example

The program for performing 2 axes linear interpolation control of Axis 3 and Axis 4 is explained as an example.
This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■Positioning operation details

The positioning is used the Axis 3 and Axis 4 servomotors.
The positioning operation by the Axis 3 and Axis 4 servomotors is shown in the diagram below.



■Positioning conditions

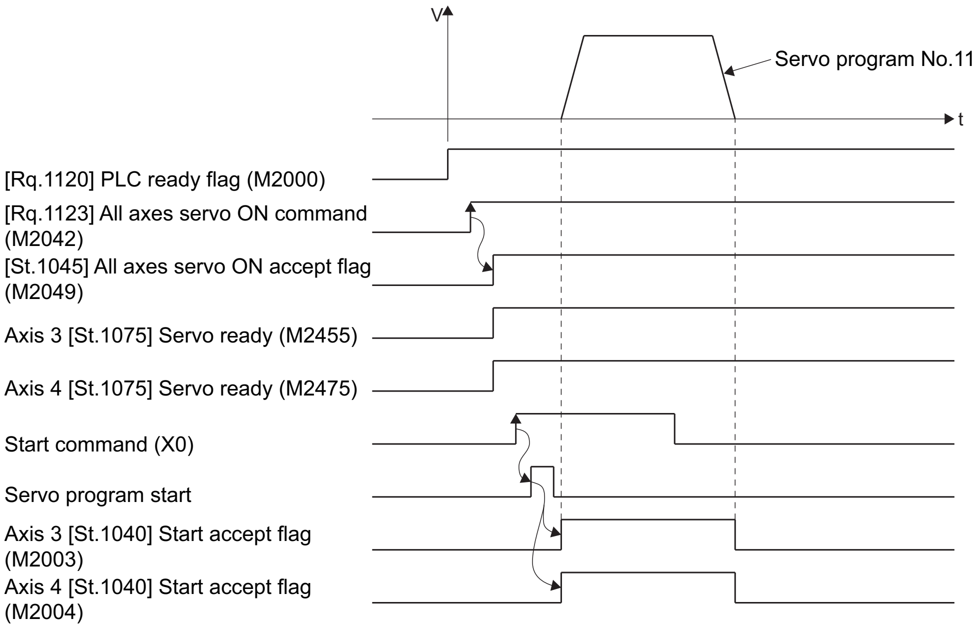
- Positioning conditions are shown below.

Item	Servo Program No.
	No.11
Positioning speed	30000

- Positioning start command: X0 Leading edge (OFF → ON)

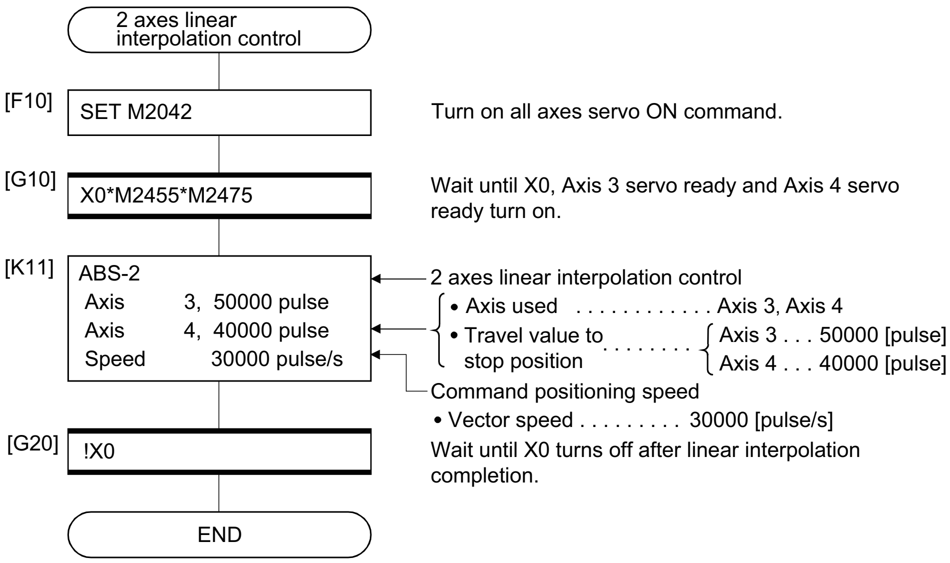
■Operation timing

Operation timing for 2 axes linear interpolation control is shown below.



■Motion SFC program

The Motion SFC program for executing the servo program (No. 11) for 2 axes linear interpolation control is shown below.



*1 Example of the above Motion SFC program is started using the automatic start or sequence program.

5.4 3 Axes Linear Interpolation Control

Linear interpolation control from the current stop position with the specified 3 axes is executed.

○: Must be set, △: Set if required

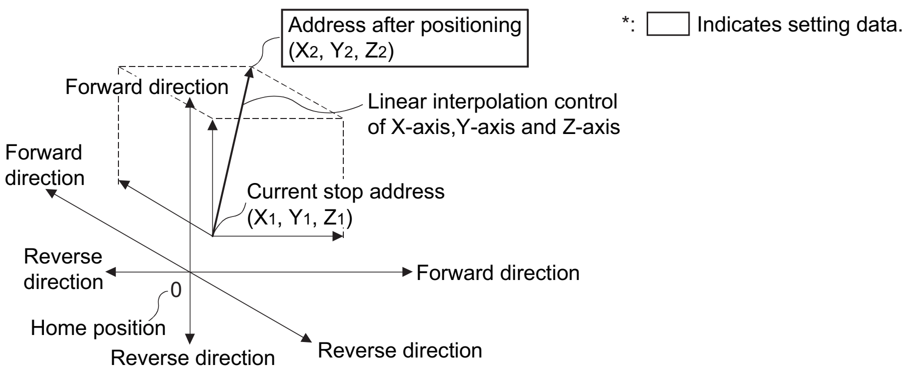
Servo instruction	Positioning method	Number of control axes	Positioning data set in servo instructions																																	
			Common							Arc				OSC				Parameter block											Others							
			Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Number of pitches	Starting angle	Amplitude	Frequency	Reference axis No. *1	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	Bias speed at start	Repeat condition	Program No.	Command speed (Continuous trajectory)	Skip	FIN acceleration/deceleration	WAIT-ON/OFF	Fixed position stop acceleration/deceleration time	Fixed position stop
ABS-3	Absolute	3	△	○	○	○	△	△										△	△	△	△	△	△	△		△	△	△								
INC-3	Incremental																																			

*1 Only when the reference axis speed is specified

Processing details

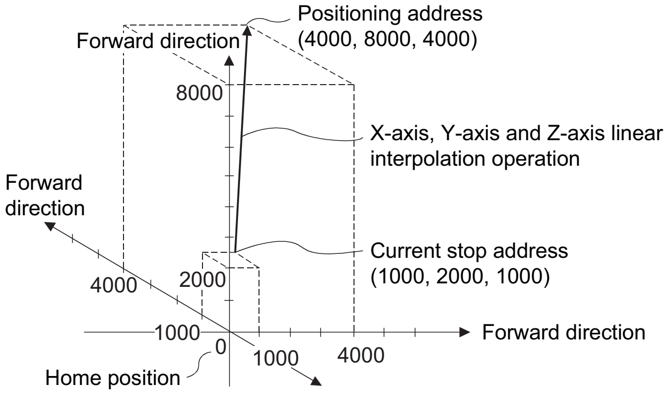
■Control using ABS-3 (Absolute data method)

- 3 axes linear interpolation from the current stop address (X_1, Y_1 or Z_1) based on the home position to the specified positioning address (X_2, Y_2, Z_2) is executed.
- The travel direction is set by the stop address and specified address of each axis.



Ex.

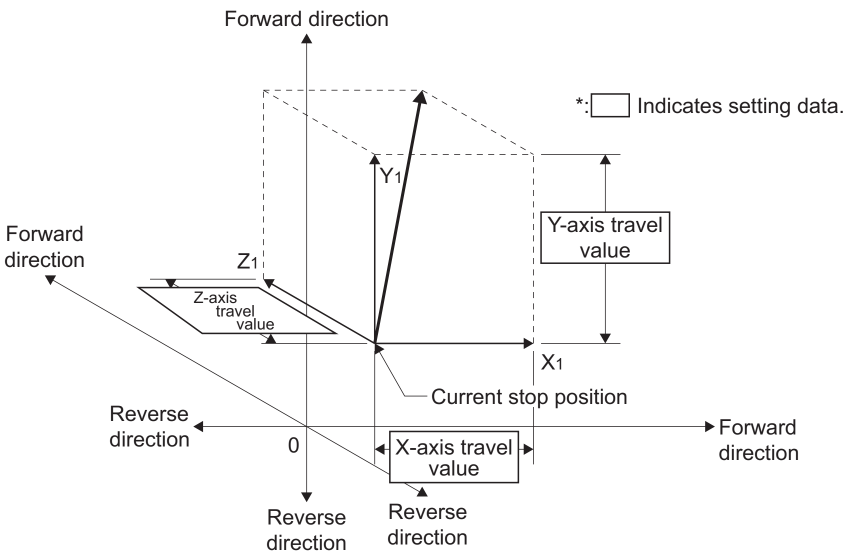
When the current stop address is (1000, 2000, 1000), and the specified address is (4000, 8000, 4000).



■Control using INC-3 (Incremental data method)

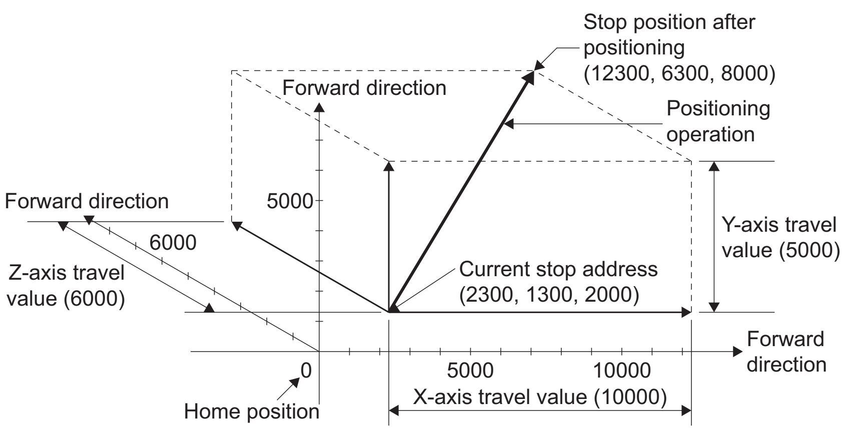
- Positioning control from the current stop address to the position which combined travel direction and travel value specified with each axis is executed.
- The travel direction for each axis is set by the sign (+/ -) of the travel value for each axis, as follows:

Travel direction	Description
Positive	Positioning control to forward direction (Address increase direction)
Negative	Positioning control to reverse direction (Address decrease direction)



Ex.

X-axis travel value is 10000, Y-axis travel value is 5000 and Z-axis value is 6000.



Program example

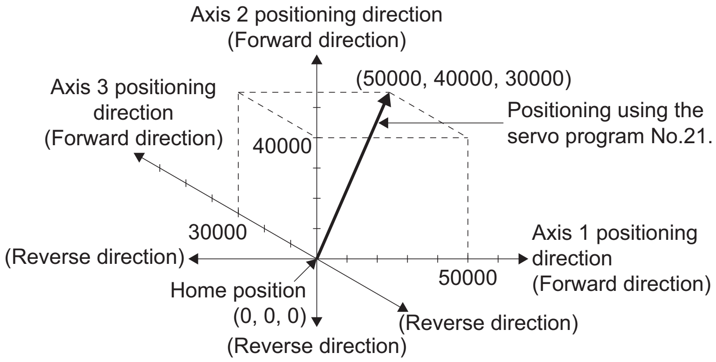
The program for performing 3 axes linear interpolation control of Axis 1, Axis 2, and Axis 3 is explained as an example

This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■Positioning operation details

The positioning is used the Axis 1, Axis 2 and Axis 3 servomotors.

The positioning operation by the Axis 1, Axis 2 and Axis 3 servomotors is shown in the diagram below.



■Positioning conditions

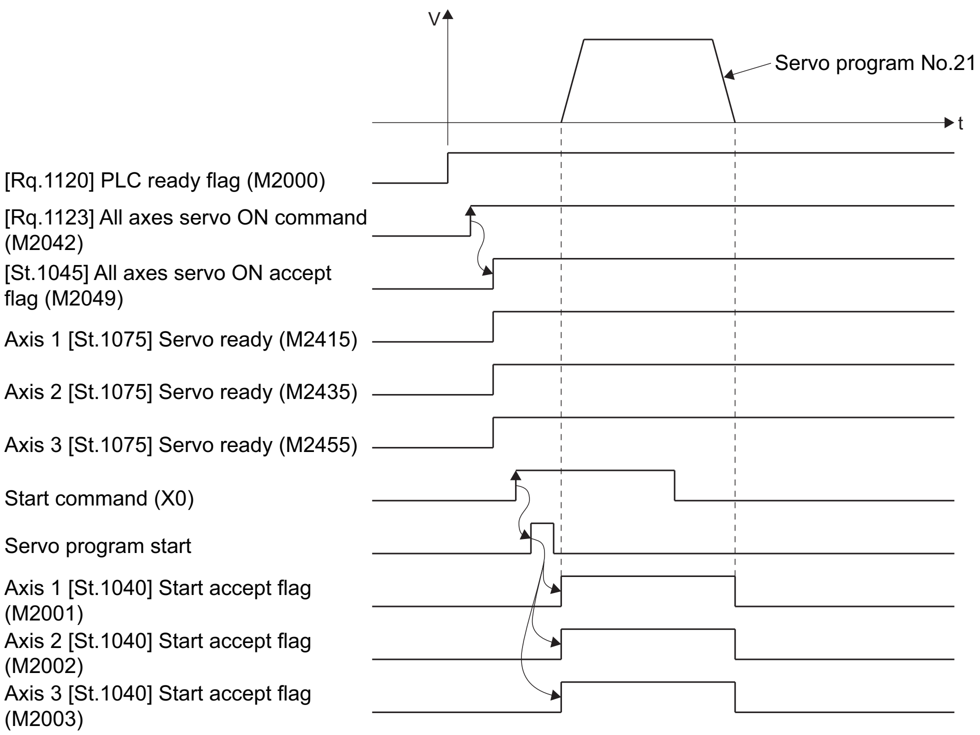
• Positioning conditions are shown below.

Item	Servo Program No.
	No.21
Positioning method	Absolute data method
Positioning speed	1000

• Positioning start command: X0 Leading edge (OFF → ON)

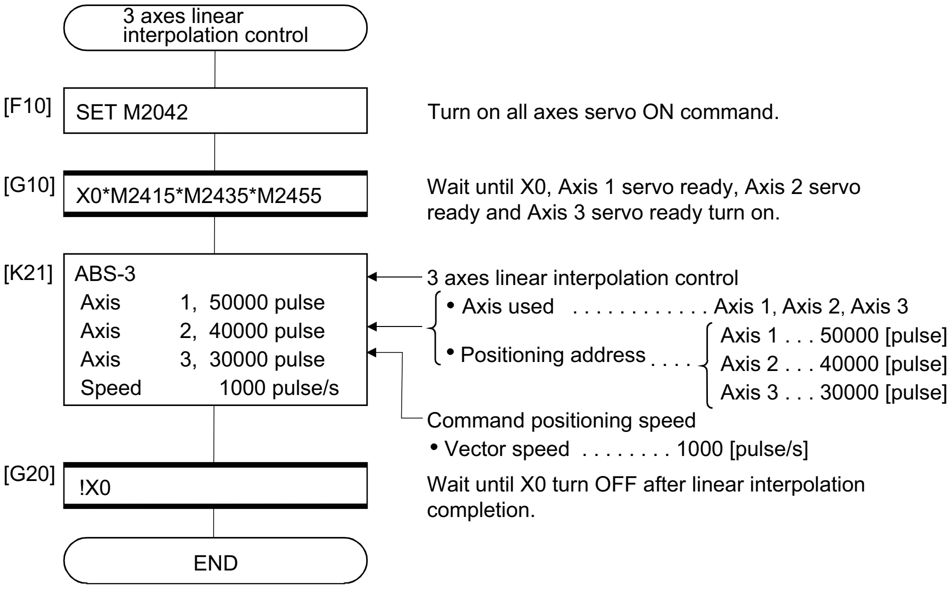
■Operation timing

Operation timing for 3 axes linear interpolation control is shown below.



■Motion SFC program

The Motion SFC program for executing the servo program (No. 21) for 3 axes linear interpolation control is shown below.



*1 Example of the above Motion SFC program is started using the automatic start or sequence program.

5.5 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.

○: Must be set, △: Set if required

Servo instruction	Positioning method	Number of control axes	Positioning data set in servo instructions																																	
			Common							Arc				OSC				Parameter block											Others							
			Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Number of pitches	Starting angle	Amplitude	Frequency	Reference axis No. *1	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	Bias speed at start	Repeat condition	Program No.	Command speed (Continuous trajectory)	Skip	FIN acceleration/deceleration	WAIT-ON/OFF	Fixed position stop acceleration/deceleration time	Fixed position stop
ABS-4 INC-4	Absolute Incremental	4	△	○	○	○	△	△										△	△	△	△	△	△	△		△	△	△								

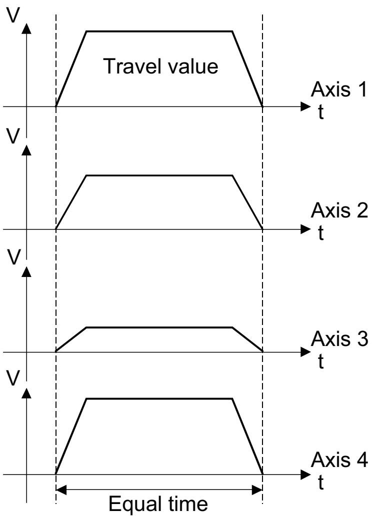
*1 Only when the reference axis speed is specified

Processing details

Positioning control which starts and completes the 4 axes simultaneously is executed.

Ex.

4 axes linear interpolation

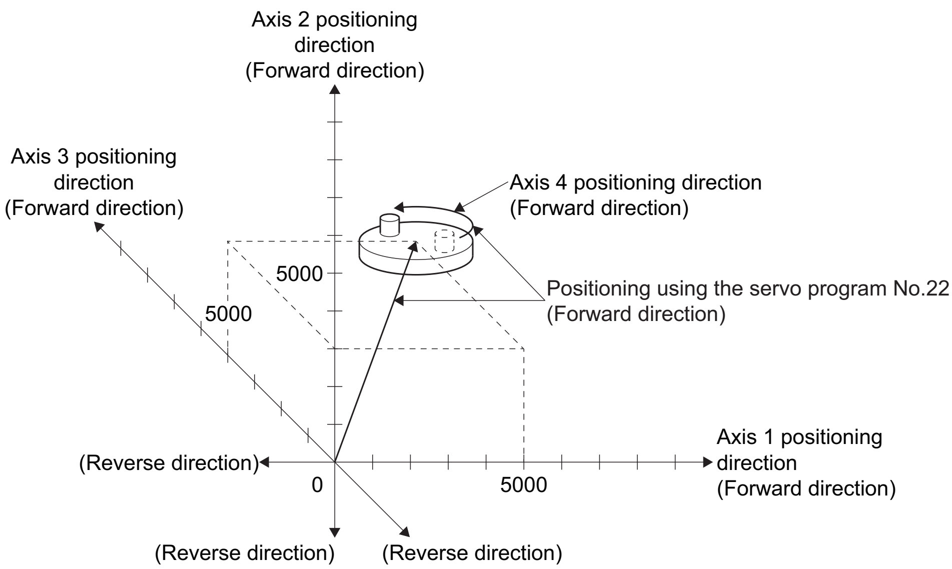


Program example

The program for performing 4 axes linear interpolation control of Axis 1, Axis 2, Axis 3, and Axis 4 is explained as an example. This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■Positioning operation details

The positioning is used the Axis 1, Axis 2, Axis 3 and Axis 4 servomotors.
The positioning by the Axis 1, Axis 2, Axis 3 and Axis 4 servomotors is shown in the diagram below.



■Positioning conditions

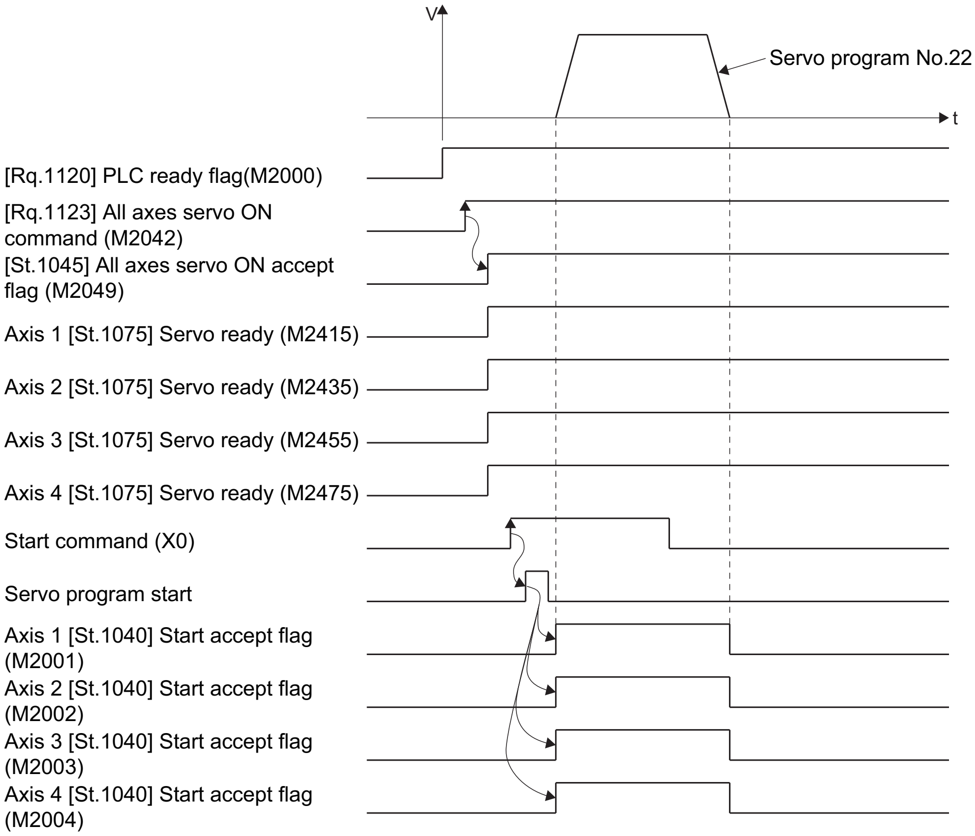
- Positioning conditions are shown below.

Item	Servo Program No.
	No.22
Positioning method	Incremental data method
Positioning speed	10000

- Positioning start command: X0 Leading edge (OFF → ON)

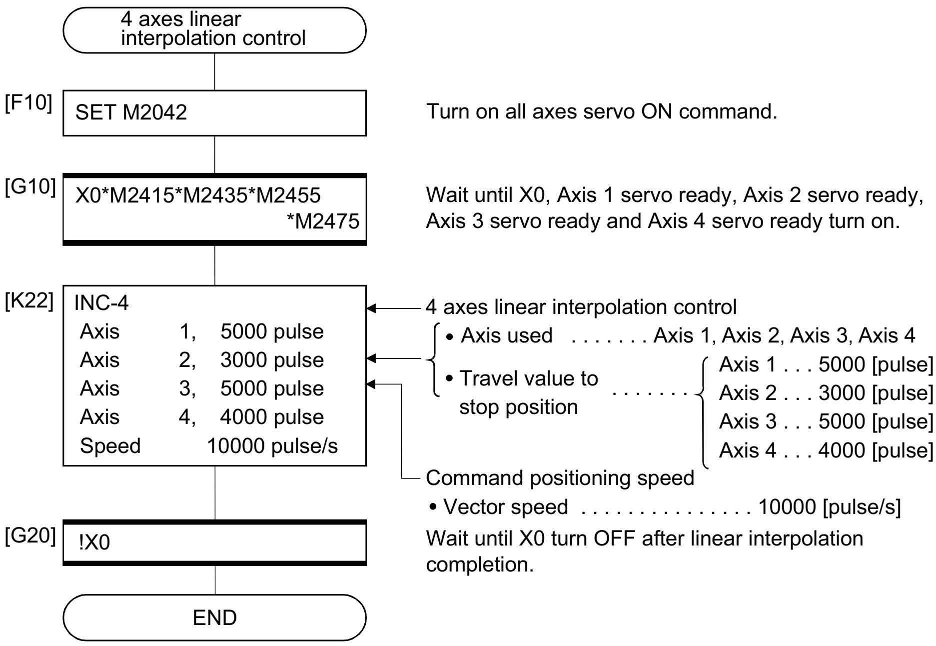
■Operation timing

Operation timing for 4 axes linear interpolation control is shown below.



■Motion SFC program

The Motion SFC program for executing the servo program (No. 22) for 4 axes linear interpolation control is shown below.



*1 Example of the above Motion SFC program is started using the automatic start or sequence program.

5.6 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.

○: Must be set, △: Set if required

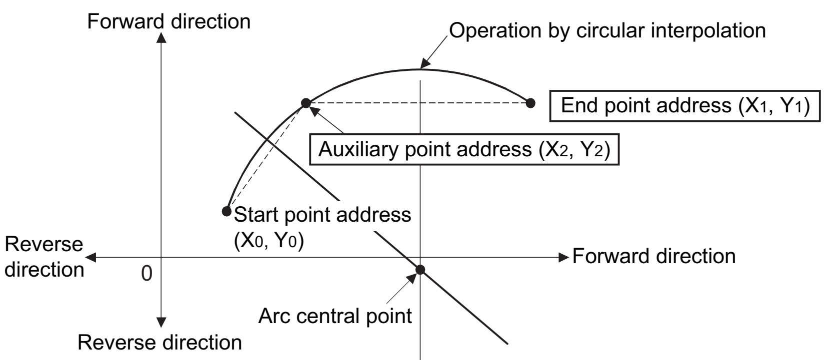
Servo instruction	Positioning method	Number of control axes	Positioning data set in servo instructions																																			
			Common							Arc				OSC				Parameter block											Others							
			Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Number of pitches	Starting angle	Amplitude	Frequency	Reference axis No.*1	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	Bias speed at start	Repeat condition	Program No.	Command speed (Continuous trajectory)	Skip	FIN acceleration/deceleration	WAIT-ON/OFF	Fixed position stop acceleration/deceleration time	Fixed position stop
ABS	Absolute	2	△	○	○	○	△	△		○								△	△	△	△	△	△	△	△	△	△	△								
INC	Incremental																																			

*1 Only when the reference axis speed is specified

Processing details

■Control using ABS (Absolute data method)

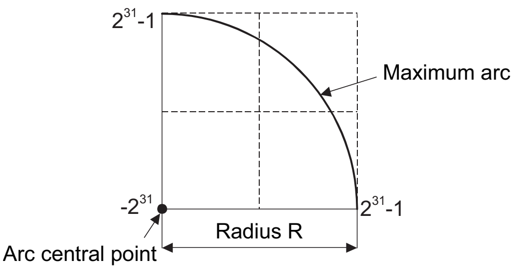
- Circular interpolation from the current stop address (address before positioning) based on the home position through the specified auxiliary point address to the end point address is executed.
- The center of the arc is the point of intersection of the perpendicular bisectors of the start point address (current stop address) to the auxiliary point address, and the auxiliary point address to the end point address.



*: Indicates setting data.

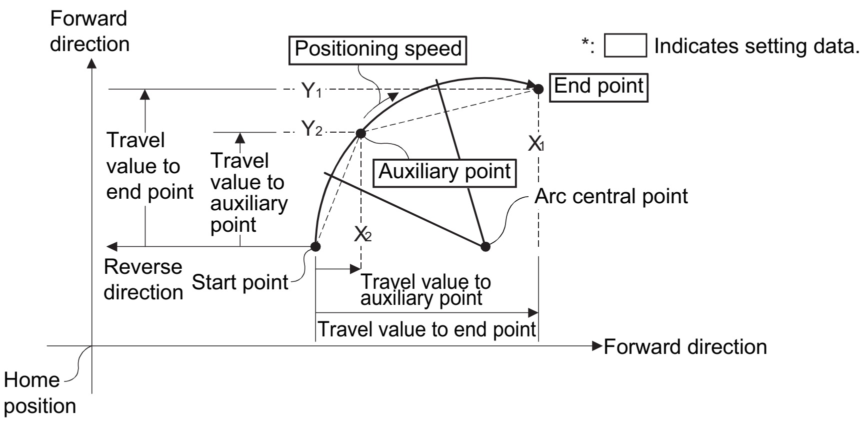
- The setting range of the end point address and auxiliary point address is (-2^{31}) to (2^{31}-1).

- The maximum arc radius is 2^{32}-1.

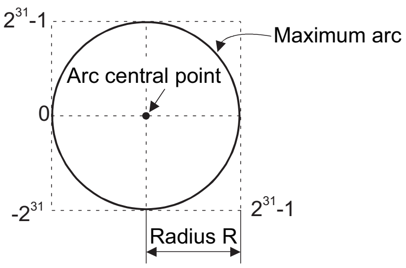


■Control using INC (Incremental data method)

- Circular interpolation from the current stop address through the specified auxiliary point address to the end point address is executed.
- 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.



- The setting range for the travel value to the end point address and auxiliary point address is 0 to ± (2^{31}-1).
- The maximum arc radius is 2^{31}-1. If the end point and auxiliary point are set more than a radius of 2^{31}-1, an error occurs at the start and minor error (error code: 1A2AH) is stored in the data register.



Program example

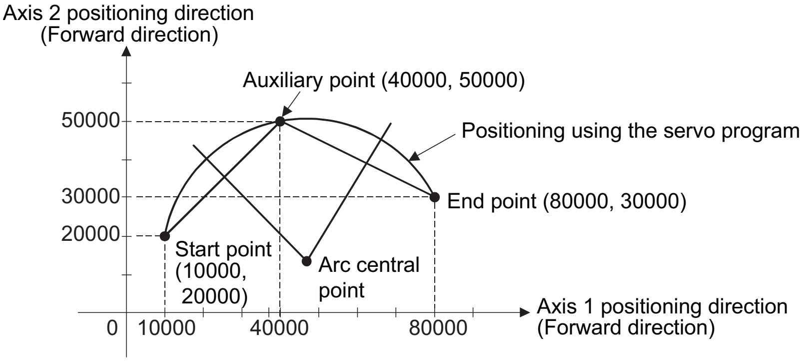
The program for performing auxiliary point-specified circular interpolation control of Axis 1 and Axis 2 is explained as an example.

This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■Positioning details

The positioning uses the Axis 1 and Axis 2 servomotors.

The positioning by the Axis 1 and Axis 2 servomotors is shown in the diagram below.



■Positioning conditions

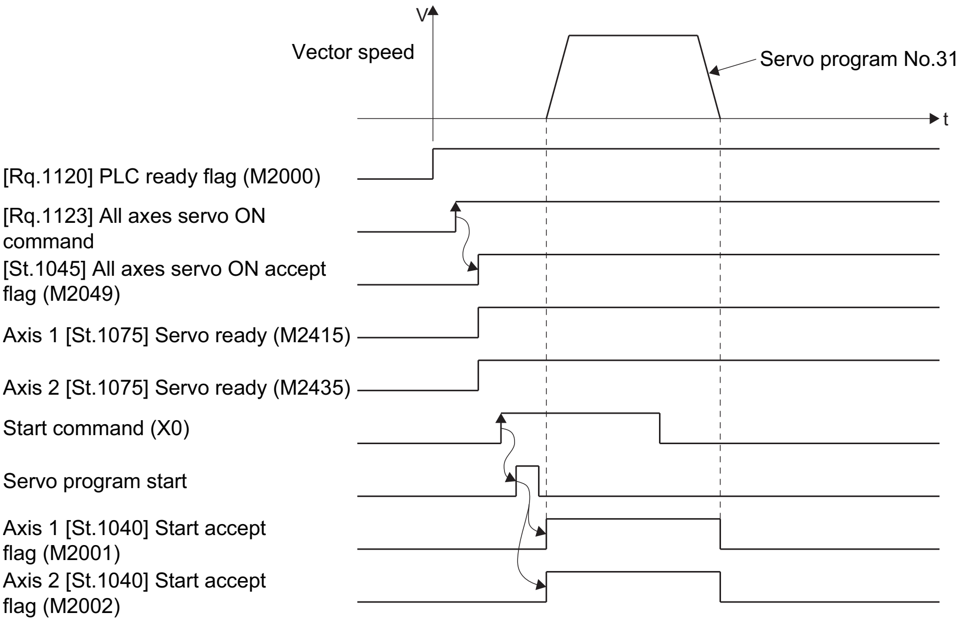
- Positioning conditions are shown below.

Item	Servo program No.
	No.31
Positioning method	Absolute data method
Positioning speed	1000

- Positioning start command: X0 Leading edge (OFF → ON)

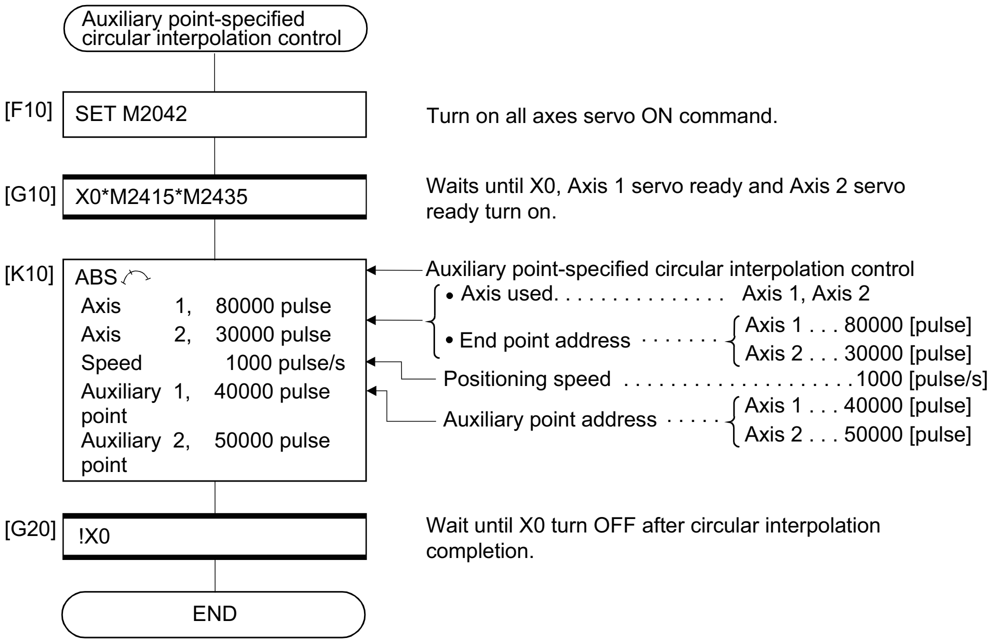
■Operation timing

Operation timing for auxiliary point-specified circular interpolation control is shown below.



■Motion SFC program

The Motion SFC program for executing the servo program (No. 31) for auxiliary point-specified circular interpolation control is shown below.



*1 Example of the above Motion SFC program is started using the automatic start or sequence program.

5.7 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.

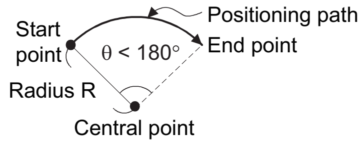
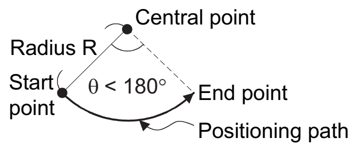
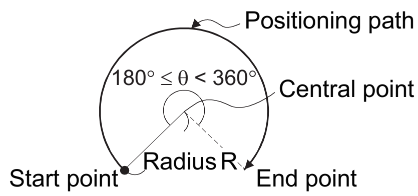
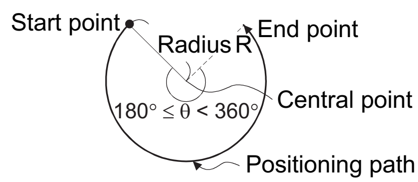
○: Must be set, △: Set if required

Servo instruction	Positioning method	Number of control axes	Positioning data set in servo instructions: Common							Arc				OSC				Parameter block											Others							
			Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Number of pitches	Starting angle	Amplitude	Frequency	Reference axis No. *1	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	Bias speed at start	Repeat condition	Program No.	Command speed (Continuous trajectory)	Skip	FIN acceleration/deceleration	WAIT-ON/OFF	Fixed position stop acceleration/deceleration time	Fixed position stop
ABS ABS ABS ABS INC INC INC INC	Absolute (ABS) Incremental (INC)	2	△	○	○	○	△	△			○							△	△	△	△	△	△	△	△	△	△	△								

*1 Only when the reference axis speed is specified

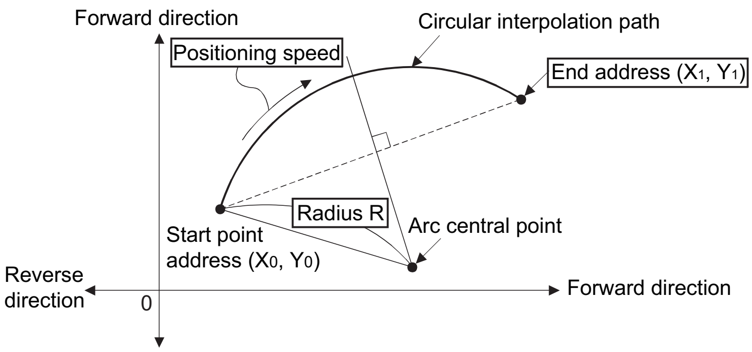
Processing details

Details for the servo instructions are shown in the table below.

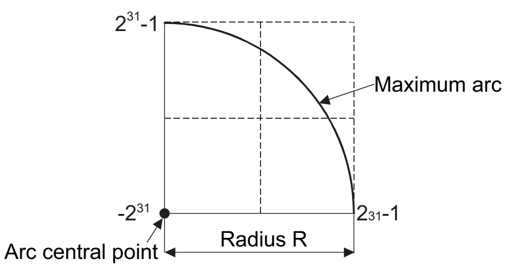
Instruction	Rotation direction of the servomotors	Maximum controllable angle of arc	Positioning path
ABS	Clockwise	0° < θ < 180°	
INC			
ABS	Counter clockwise		
INC			
ABS	Clockwise	180° ≤ θ < 360°	
INC			
ABS	Counter clockwise		
INC			

■Control using ABS , ABS , ABS , ABS (Absolute data method)

- 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.
- 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.

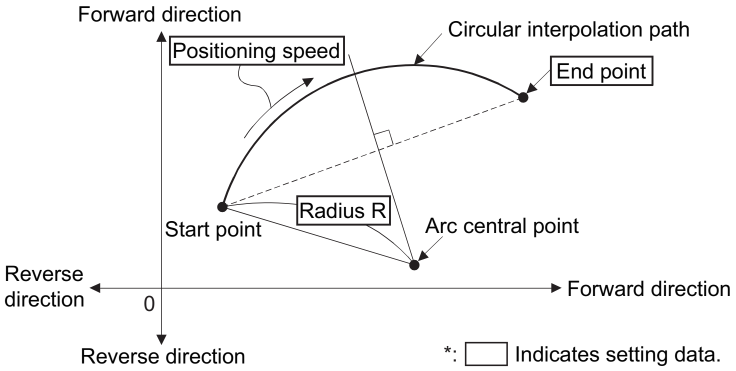


- The setting range of end point address is (-2^{31}) to (2^{31}-1).
- The setting range for the radius is 1 to (2^{31}-1).
- The maximum arc radius is (2^{32}-1).

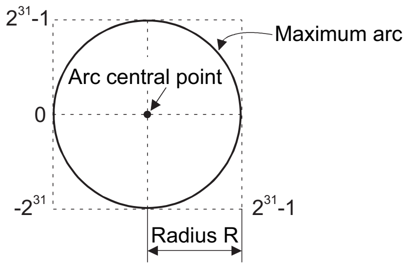


■Control using INC ↷, INC ↷, INC ↶, INC ↶ (Incremental data method)

- Circular interpolation from the current stop address (0, 0) to the specified end point with specified radius.
- 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.



- Setting range of end point address is (-2^{31}) to $(2^{31}-1)$.
- Setting range of radius is 1 to $(2^{31}-1)$.
- Maximum arc radius is $(2^{31}-1)$.

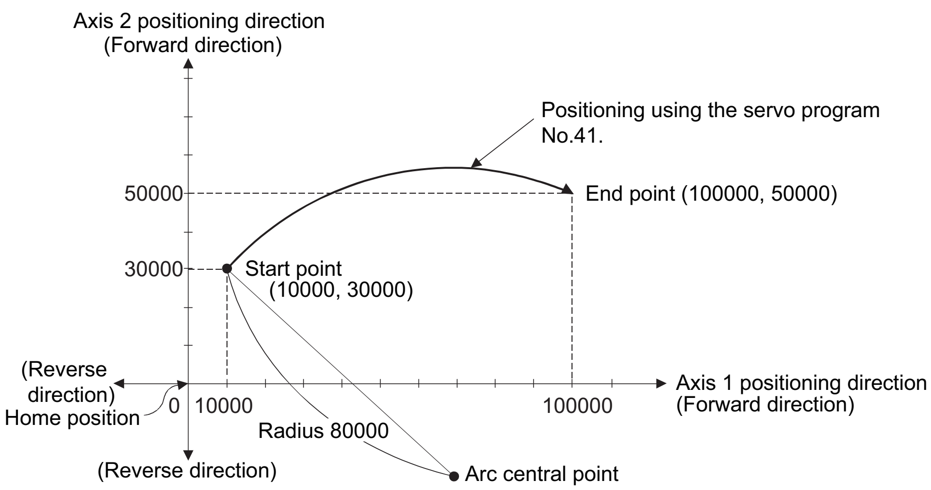


Program example

The program for performing radius-specified circular interpolation control of Axis 1 and Axis 2 is explained as an example.
This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■Positioning operation details

The positioning uses the Axis 1 and Axis 2 servomotors.
The positioning by the Axis 1 and Axis 2 servomotors is shown in the diagram below.



5

■Positioning conditions

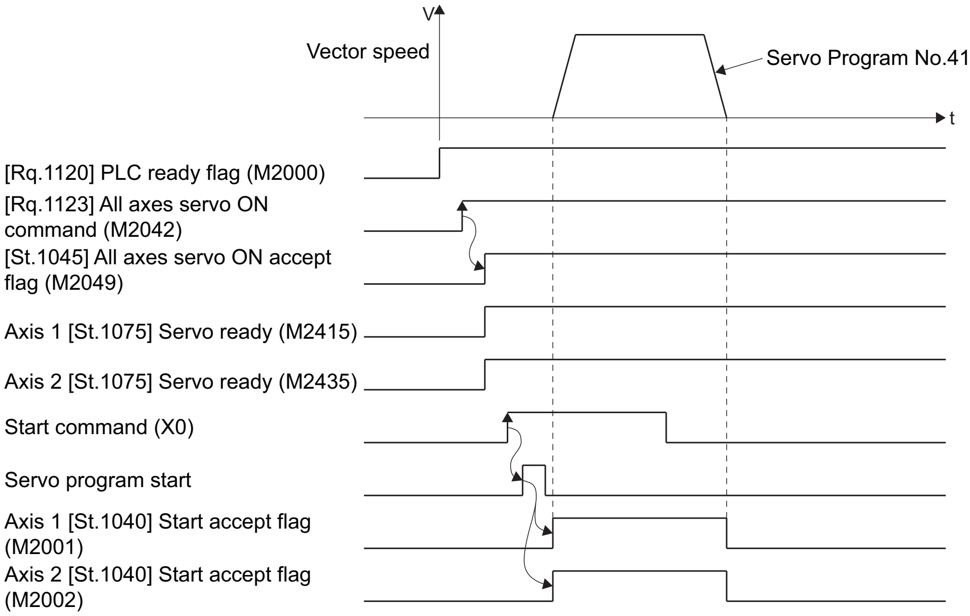
- Positioning conditions are shown below.

Item	Servo Program No.
	No.41
Positioning method	Absolute data method
Positioning speed	1000

- Positioning start command: X0 Leading edge (OFF → ON)

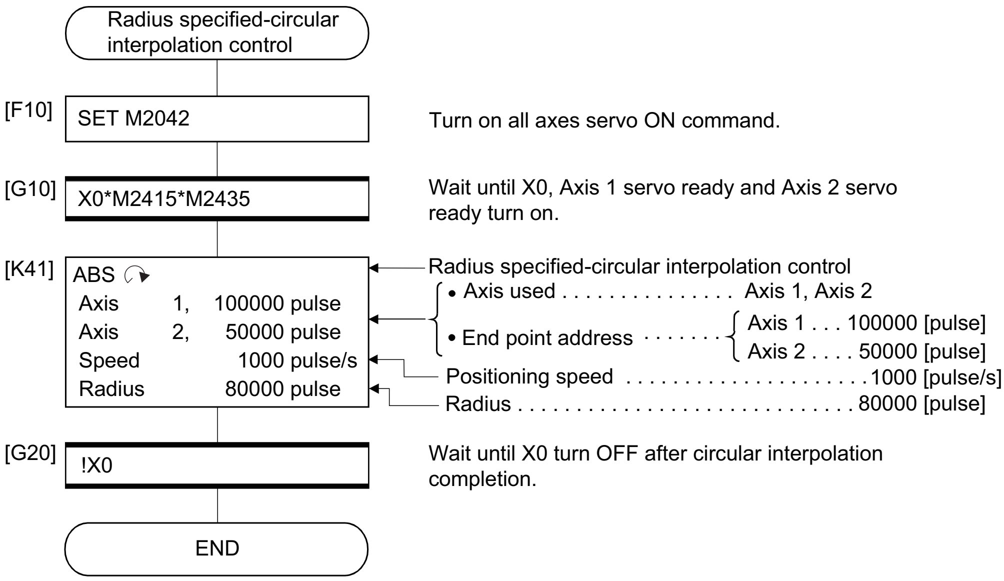
■Operation timing

Operation timing for radius-specified circular interpolation control is shown below.



■Motion SFC program

The Motion SFC program for executing the servo program (No. 41) for radius-specified circular interpolation control is shown below.



*1 Example of the above Motion SFC program is started using the automatic start or sequence program.

5.8 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.

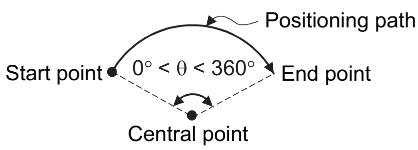
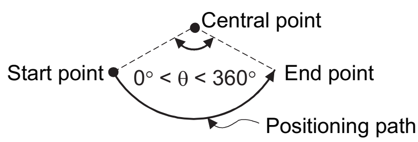
○: Must be set, △: Set if required

Servo instruction	Positioning method	Number of control axes	Positioning data set in servo instructions																															
			Common							Arc				OSC				Parameter block											Others							
			Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Number of pitches	Starting angle	Amplitude	Frequency	Reference axis No. *1	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	Bias speed at start	Repeat condition	Program No.	Command speed (Continuous trajectory)	Skip	FIN acceleration/deceleration	WAIT-ON/OFF	Fixed position stop acceleration/deceleration time	Fixed position stop
ABS ↷ ABS ↶ INC ↷ INC ↶	Absolute Incremental	2	△	○	○	○	△	△				○						△	△	△	△	△	△	△	△	△	△	△								

*1 Only when the reference axis speed is specified

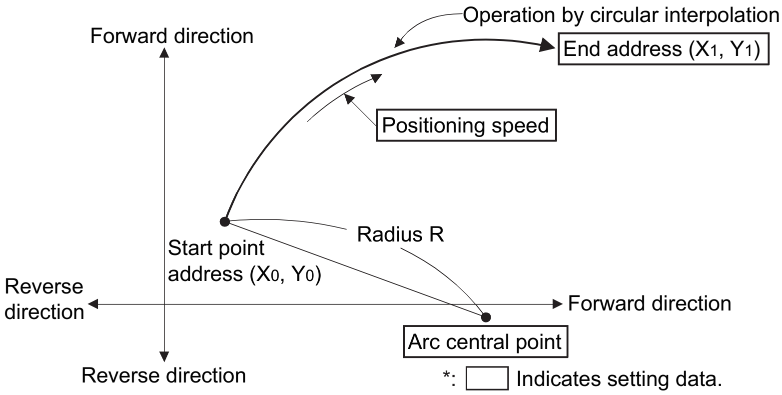
Processing details

Details for the servo instructions are shown in the table below.

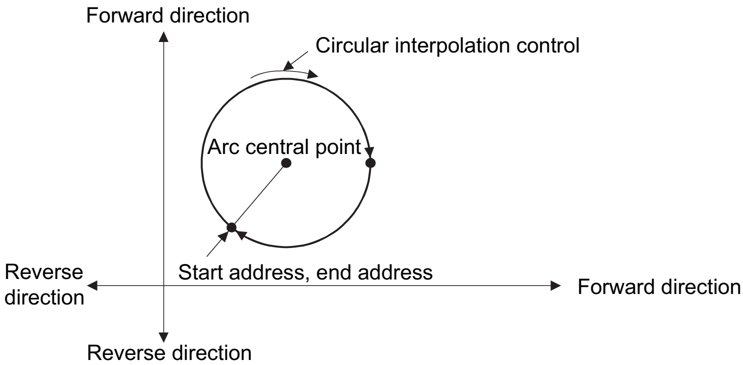
Instruction	Rotation direction of the servomotors	Maximum controllable angle of arc	Positioning path
ABS ↷ INC ↷	Clockwise	0° < θ < 360°	
ABS ↶ INC ↶	Counter clockwise		

■Control using ABS , ABS (Absolute data method)

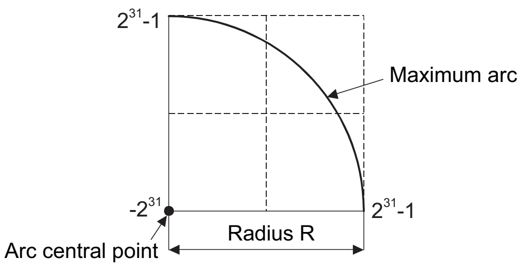
- Circular interpolation of an arc with a radius equivalent to the distance between the start point and central point, between the current stop address (address before positioning) based on the home position and the specified end point address.



- Positioning control of a complete round is possible in the central point-specified circular interpolation control.

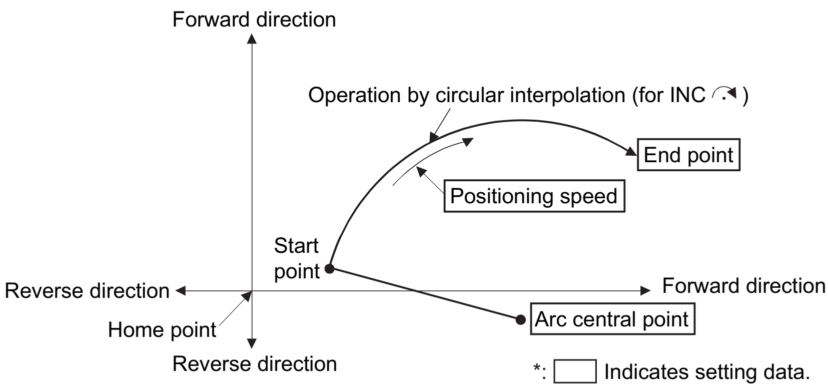


- Setting range of end point address and arc central point is (-2^{31}) to ($2^{31}-1$).
- The maximum arc radius is ($2^{32}-1$).

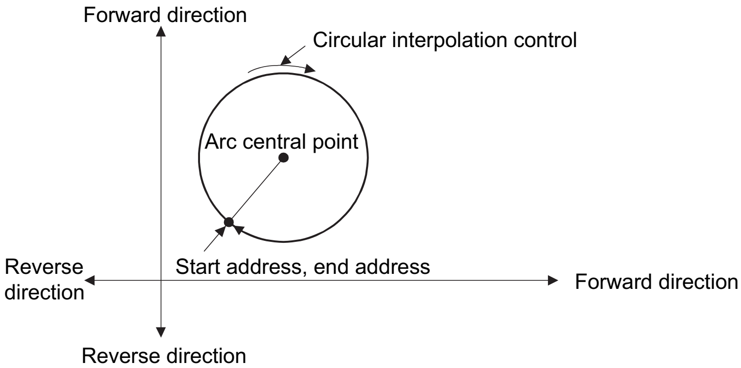


■Control using INC , INC (Incremental method)

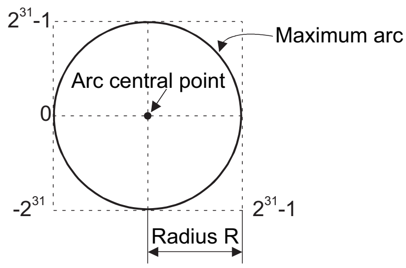
- Circular interpolation from the current stop address (0, 0) with a radius equivalent to the distance between the start point (0, 0) and central point.



- Positioning control of a complete round is possible in the central point-specified circular interpolation control.



- Setting range of travel value to end point address and arc central point is 0 to ± (2^{31}-1).
- The maximum arc radius is (2^{31}-1). If the end point and central point are set more than a radius of (2^{31}-1), an error occurs at the start and minor error (error code: 1A2FH) is stored in the data register.



Program example

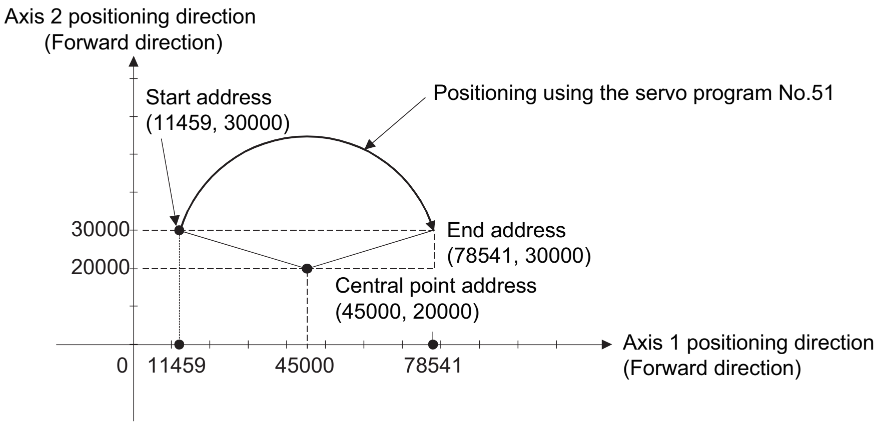
The program for performing central point-specified circular interpolation control of Axis 1 and Axis 2 is explained as an example.

This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■Positioning operation details

The positioning uses the Axis 1 and Axis 2 servomotors.

The positioning by the Axis 1 and Axis 2 servomotors is shown in the diagram below.



■Positioning conditions

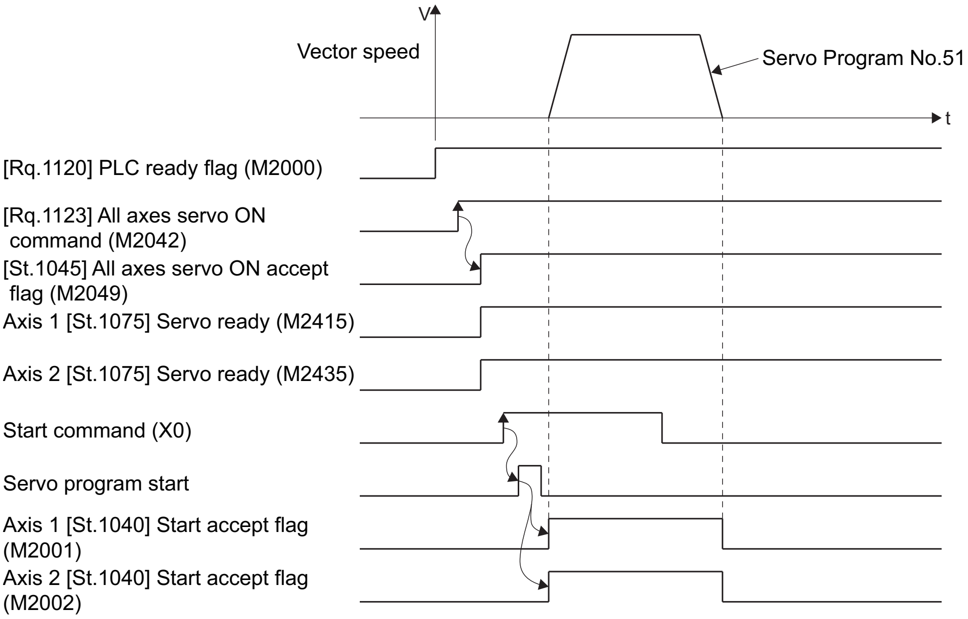
- Positioning conditions are shown below.

Item	Servo Program No.
	No.51
Positioning method	Absolute data method
Positioning speed	1000

- Positioning start command: X0 Leading edge (OFF → ON)

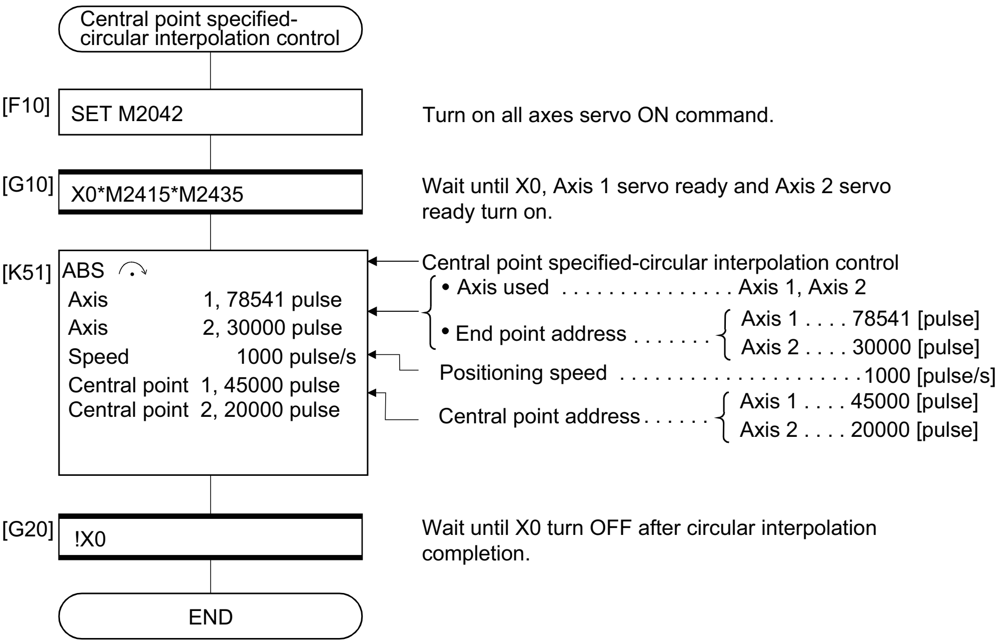
■Operation timing

Operation timing for central point-specified circular interpolation is shown below.



■Motion SFC program

The Motion SFC program for executing the servo program (No. 51) for central point-specified circular interpolation control is shown below.



*1 Example of the above Motion SFC program is started using the automatic start or sequence program.

5.9 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.

○: Must be set, △: Set if required

Servo instruction	Positioning method	Number of control axes	Positioning data set in servo instructions																																	
			Common							Arc				OSC				Parameter block											Others							
			Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Number of pitches	Starting angle	Amplitude	Frequency	Reference axis No. *1	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	Bias speed at start	Repeat condition	Program No.	Command speed (Continuous trajectory)	Skip	FIN acceleration/deceleration	WAIT-ON/OFF	Fixed position stop acceleration/deceleration time	Fixed position stop
ABH ABH ABH ABH	Absolute	3	△	○	○	○	△	△			○		○					△	△	△	△	△	△	△		△	△	△								
INH INH INH INH	Incremental	3	△	○	○	○	△	△			○		○					△	△	△	△	△	△	△		△	△	△								
ABH ABH	Absolute	3	△	○	○	○	△	△				○	○					△	△	△	△	△	△	△		△	△	△								
INH INH	Incremental	3	△	○	○	○	△	△				○	○					△	△	△	△	△	△	△		△	△	△								
ABH	Absolute	3	△	○	○	○	△	△		○			○					△	△	△	△	△	△	△		△	△	△								
INH	Incremental	3	△	○	○	○	△	△		○			○					△	△	△	△	△	△	△		△	△	△								

*1 Only when the reference axis speed is specified

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 less than CW180°
INH	Incremental	
ABH	Absolute	Radius-specified method less than CCW180°
INH	Incremental	
ABH	Absolute	Radius-specified method CW180° or more.
INH	Incremental	
ABH	Absolute	Radius-specified method CCW180° or more.
INH	Incremental	
ABH	Absolute	Central point-specified method CW
INH	Incremental	
ABH	Absolute	Central point- specified method CCW
INH	Incremental	
ABH	Absolute	Auxiliary point-specified method
INH	Incremental	

Precautions

- 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. (Allowable error range for circular interpolation can be set.)
Number of pitches is not 0	Linear interpolation to linear axis does not executed, circle for the number of pitches is drawn on the circle plane. (Allowable error range for circular interpolation can be set.)

- Units for linear axis have not restrictions.
- 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.
- 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.
- 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 (error code: 1A2BH) occurs at the start and cannot be start.
- 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.
- Allowable error range for circular interpolation can be set.

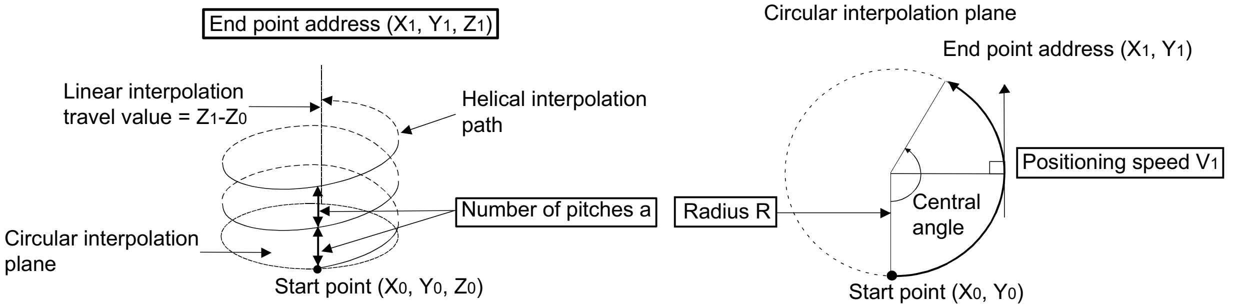
ABH, ABH, ABH, ABH Absolute radius-specified helical interpolation control

Processing details

The linear interpolation to other linear axis is executed performing 2 axes circular interpolation from current stop position (X_0, Y_0, Z_0) to specified circular end address (X_1, Y_1) or linear axis end point address (Z_1), and the absolute helical interpolation is executed so that it may become a spiral course.

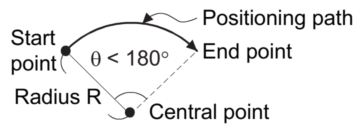
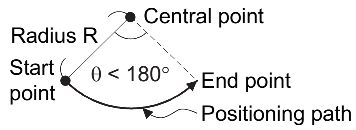
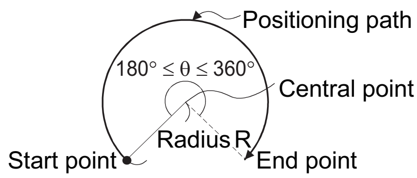
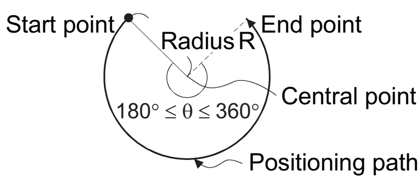
It goes around on the specified circle for the specified number of pitches, the circular interpolation which had remainder specified is executed, and positioning to end address is executed. The radius-specified circle specifies circular interpolation method connected start point and end point at the seeing on the plane for which performs circular interpolation.

Operation details for absolute radius-specified helical interpolation are shown below.

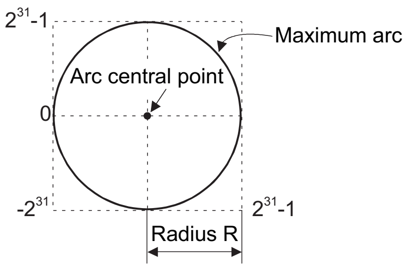


*: ☐ Indicates setting data.

Control details for the servo instructions are shown below.

Instruction	Rotation direction of servomotor	Controllable angle of arc	Positioning path
ABH Radius-specified helical interpolation less than CW 180°	Clockwise (CW)	0° < θ < 180°	
ABH Radius-specified helical interpolation less than CCW 180°	Counter clockwise (CCW)		
ABH Radius-specified helical interpolation CW 180° or more	Clockwise (CW)	180° ≤ θ ≤ 360°	
ABH Radius-specified helical interpolation CCW 180° or more	Counter clockwise (CCW)		

- The setting range of end point address for the both of circular interpolation axis and linear interpolation axis is (-2^{31}) to ($2^{31}-1$).
- 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].



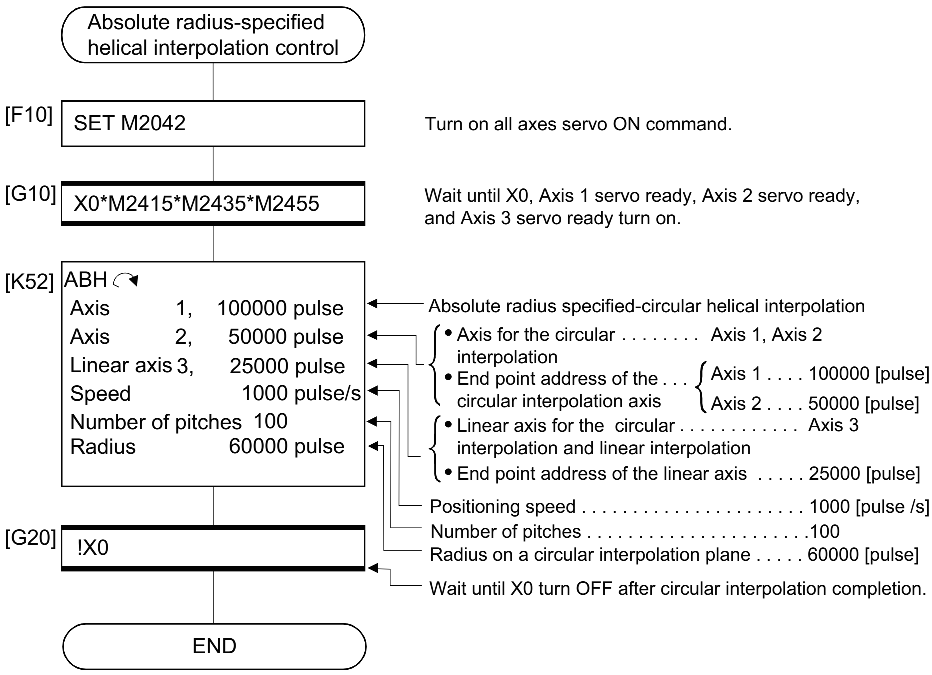
- Set the command speed with the vector speed for 2 axes circular interpolation axis.
- The command speed unit is specified in the parameter block.
- Set the number of pitches within the range of 0 to 999. If it is set outside the setting range, the minor error (error code: 1A36H) occurs, and cannot be started.
- 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 example

This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■Motion SFC program

The Motion SFC program for executing the servo program (No. 52) for absolute radius-specified helical interpolation control is shown below.

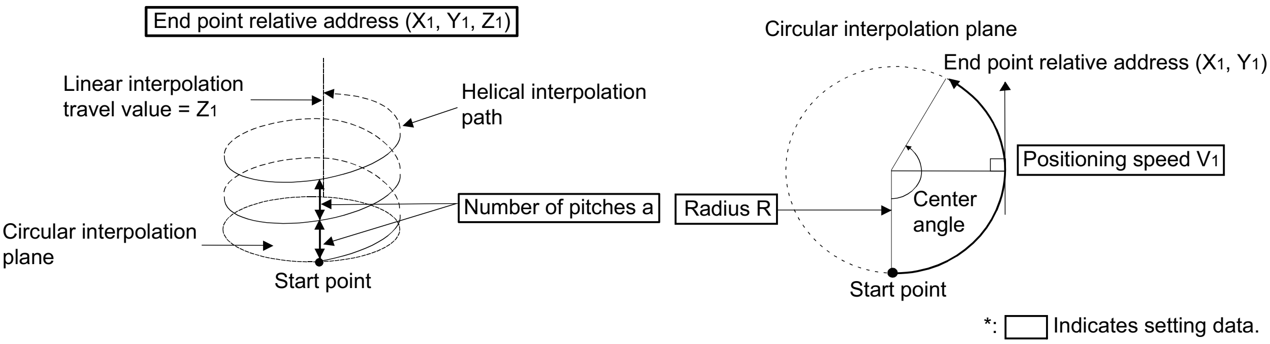


*1 Example of the above Motion SFC program is started using the automatic start or sequence program.

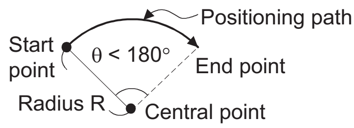
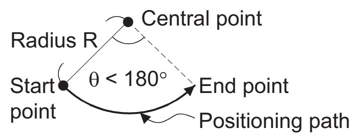
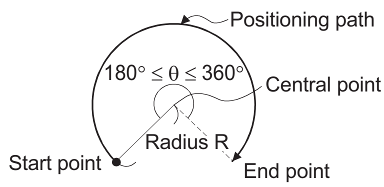
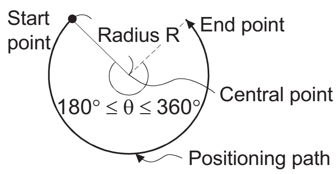
INH, INH, INH, INH Incremental radius-specified helical interpolation control

Processing 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 (X_1, Y_1) or linear axis end point relative address (Z_1), 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.



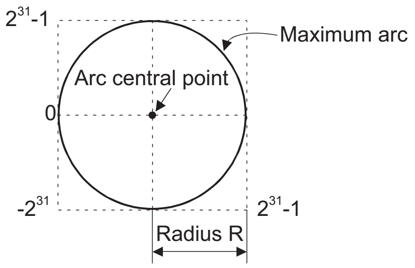
Control details for the servo instructions are shown below.

Instruction	Rotation direction of servomotor	Controllable angle of arc	Positioning path
INH Radius-specified helical interpolation less than CW 180°	Clockwise (CW)	0° < θ < 180°	
INH Radius-specified helical interpolation less than CCW 180°	Counter clockwise (CCW)		
INH Radius-specified helical interpolation CW 180° or more	Clockwise (CW)	180° ≤ θ ≤ 360°	
INH Radius-specified helical interpolation CCW 180° or more	Counter clockwise (CCW)		

- The setting range of end point relative address for the both of circular interpolation axis and linear interpolation axis is 0 to $\pm(2^{31}-1)$. The travel direction is set by the sign (+/ -) of the travel value, as follows:

Travel direction	Description
Positive	Positioning control to forward direction (Address increase direction)
Negative	Positioning control to reverse direction (Address decrease direction)

- 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].



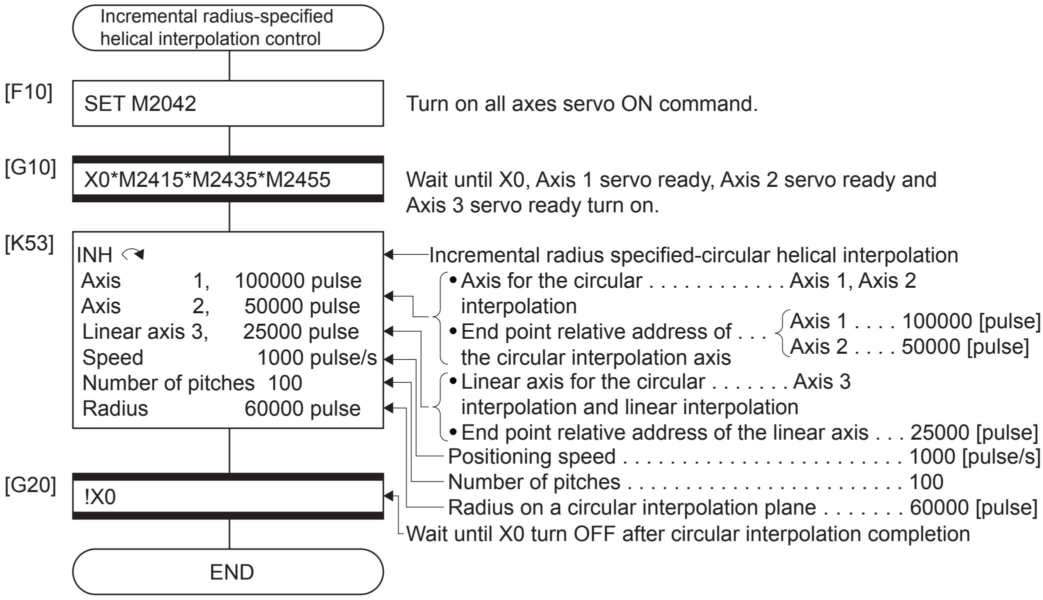
- Set the command speed with the vector speed for 2 axes circular interpolation axis.
- The command speed unit is specified in the parameter block.
- Set the number of pitches within the range of 0 to 999. If it is set outside the setting range, the minor error (error code: 1A36H) occurs and operation does not start.
- 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 example

This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■Motion SFC program

The Motion SFC program for executing the servo program (No. 53) for incremental radius-specified helical interpolation control is shown below.



*1 Example of the above Motion SFC program is started using the automatic start or sequence program.

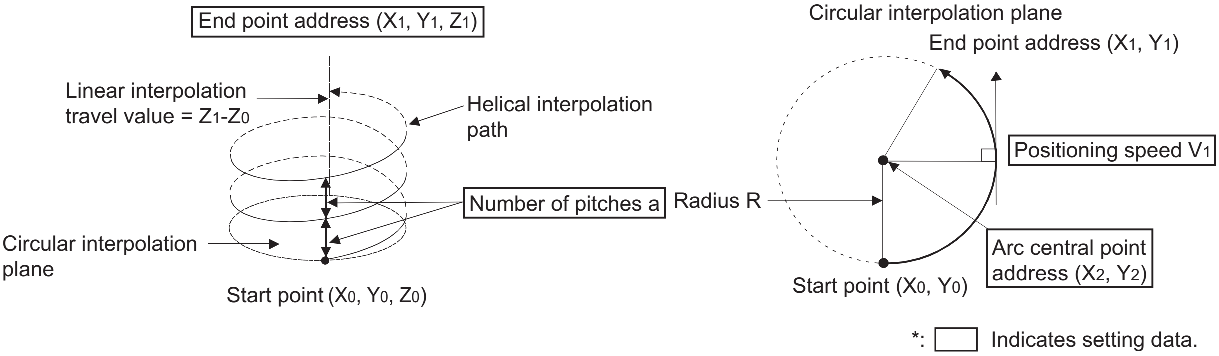
ABH , ABH Absolute central point-specified helical interpolation control

Processing details

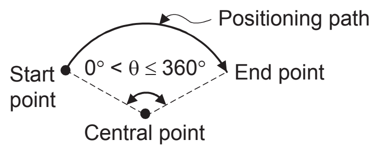
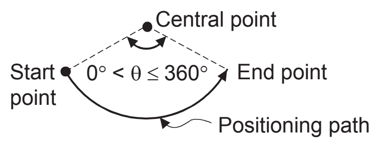
The linear interpolation to other linear axis is executed performing 2 axes circular interpolation from current stop position (X_0, Y_0, Z_0) to specified circular end address (X_1, Y_1) or linear axis end point address (Z_1), and the absolute helical interpolation is executed so that it may become a 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.

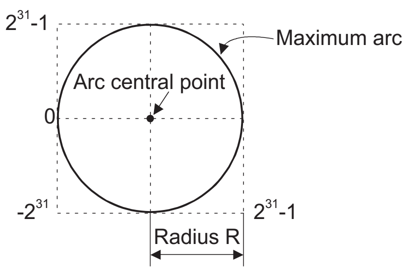
Operation details for absolute central point-specified helical interpolation are shown below.



Control details for the servo instructions are shown below.

Instruction	Rotation direction of servomotor	Controllable angle of arc	Positioning path
ABH Central point- specified helical interpolation CW	Clockwise (CW)	0° < θ ≤ 360°	
ABH Central point- specified helical interpolation CCW	Counter clockwise (CCW)		

- 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).
- The setting range of central point address is (-2^{31}) to (2^{31}-1).
- 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].



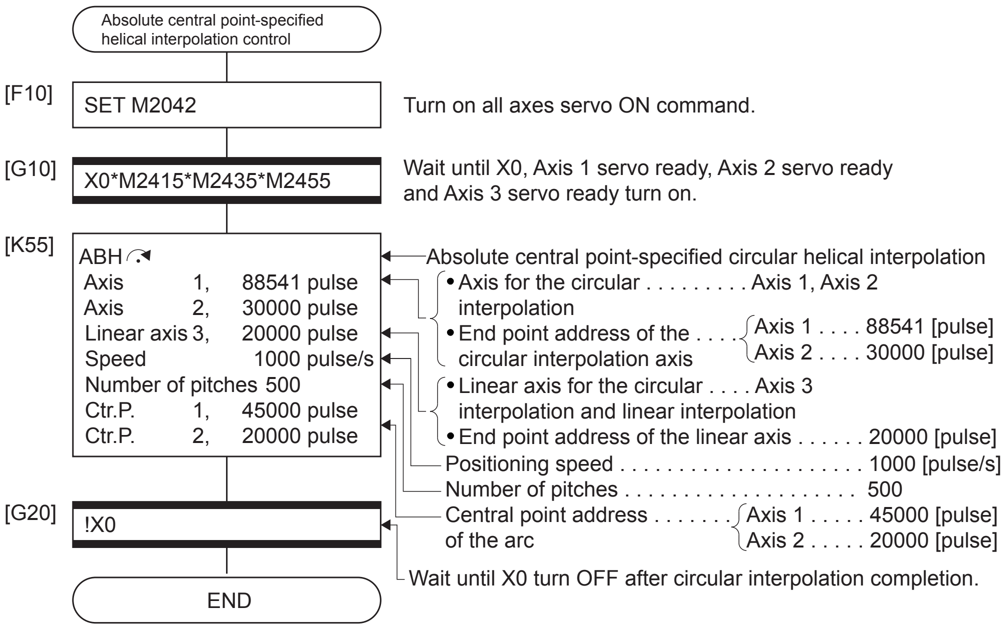
- Set the command speed with the vector speed for 2 axes circular interpolation axis.
- The command speed unit is specified in the parameter block.
- Set the number of pitches within the range of 0 to 999. If it is set outside the setting range, the minor error (error code: 1A36H) occurs and operation does not start.
- 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.
- 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 example

This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■Motion SFC program

The Motion SFC program for executing the servo program (No. 55) for absolute central point-specified helical interpolation control is shown below.

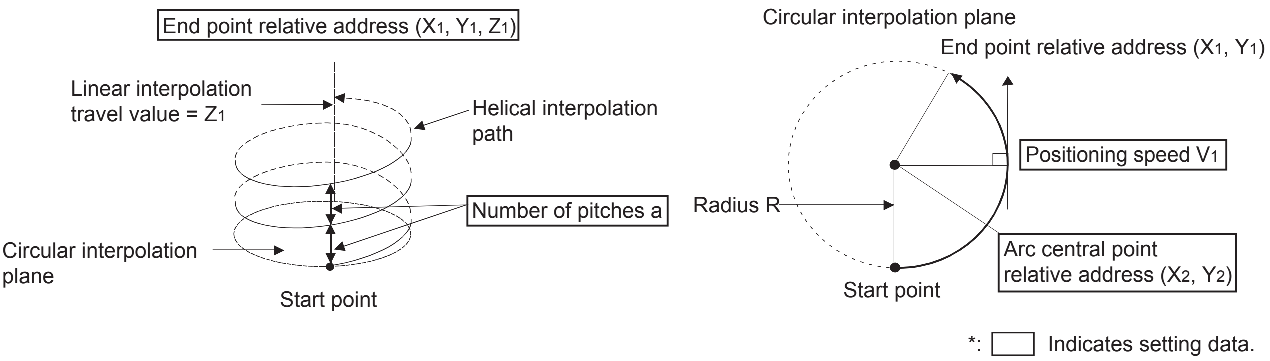


*1 Example of the above Motion SFC program is started using the automatic start or sequence program.

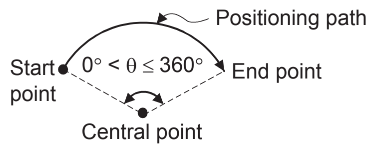
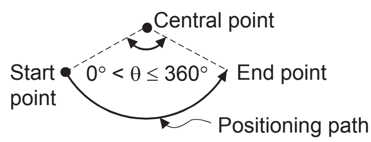
INH , INH Incremental central point-specified helical interpolation control

Processing details

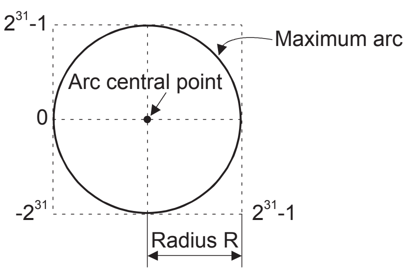
The linear interpolation to other linear axis is executed performing circular interpolation from current stop position (start point) to specified circular relative end address (X_1, Y_1) or linear axis end point relative address (Z_1), and the incremental helical interpolation control is executed so 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 of servomotor	Controllable angle of arc	Positioning path
INH Central point-specified helical interpolation CW	Clockwise (CW)	0° < θ ≤ 360°	
INH Central point-specified helical interpolation CCW	Counter clockwise (CCW)		

- The setting range of end point relative address for the both of circular interpolation axis and linear interpolation axis is 0 to $\pm(2^{31}-1)$.
- The setting range of central point relative is 0 to $\pm(2^{31}-1)$.
- 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].



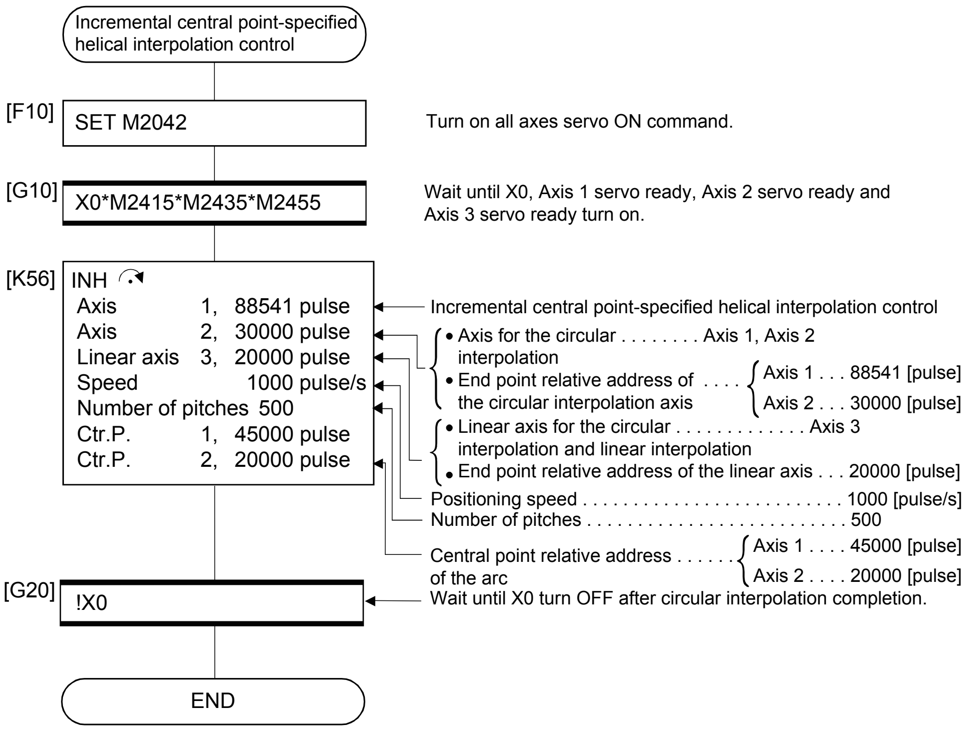
- Set the command speed with the vector speed for 2 axes circular interpolation axis.
- The command speed unit is specified in the parameter block.
- Set the number of pitches within the range of 0 to 999. If it is set outside the setting range, the minor error (error code: 1A36H) occurs and operation does not start.
- 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.
- 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 example

This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■Motion SFC program

The Motion SFC program for executing the servo program (No. 56) for incremental central point-specified helical interpolation control is shown below.

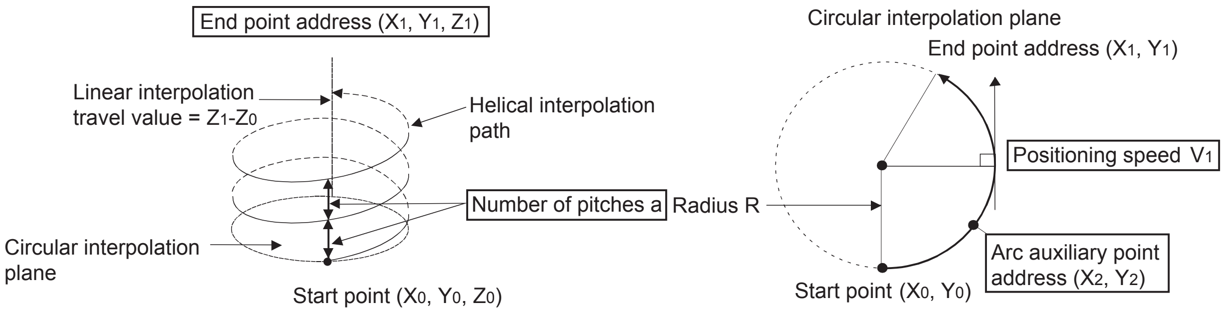


*1 Example of the above Motion SFC program is started using the automatic start or sequence program.

ABH Absolute auxiliary point-specified helical interpolation control

Processing details

The linear interpolation to other linear axis is executed performing 2 axes circular interpolation from current stop position (X_0, Y_0, Z_0) to specified circular end address (X_1, Y_1) or linear axis end point address (Z_1), 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.

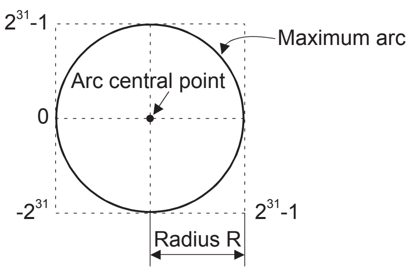


*: Indicates setting data.

Control details for the servo instructions are shown below.

Instruction	Rotation direction of servomotor	Controllable angle of arc
ABH Auxiliary point-specified helical interpolation	Clockwise (CW)/ Counter clockwise (CCW)	$0° < \theta \leq 360°$

- The setting range of end point address for the both of circular interpolation axis and linear interpolation axis is (-2^{31}) to ($2^{31}-1$).
- The setting range of auxiliary point address is (-2^{31}) to ($2^{31}-1$).
- 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].



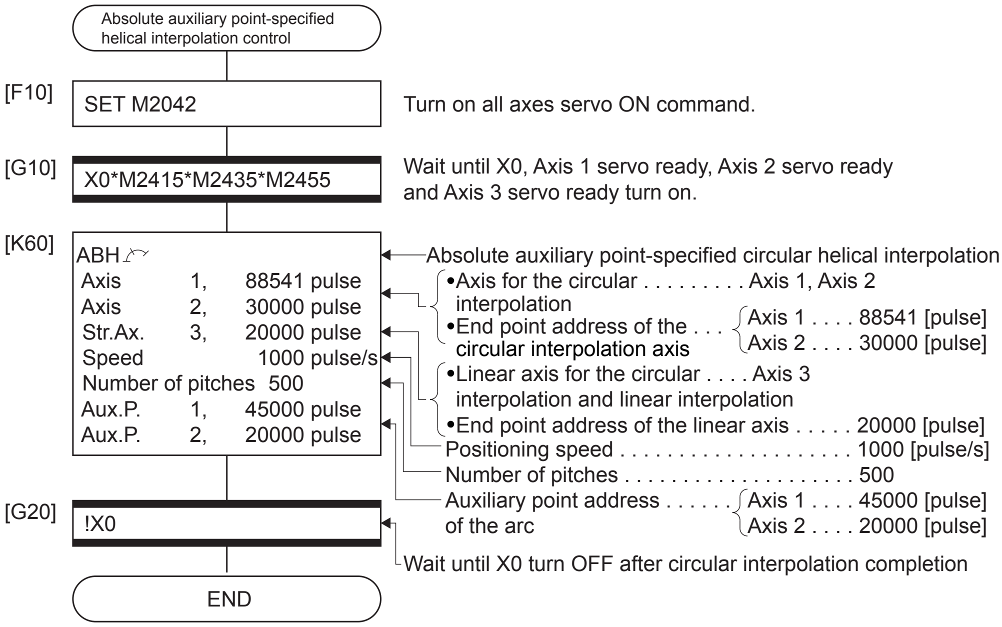
- Set the command speed with the vector speed for 2 axes circular interpolation axis.
- The command speed unit is specified in the parameter block.
- Set the number of pitches within the range of 0 to 999. If it is set outside the setting range, the minor error (error code: 1A36H) occurs and operation does not start.
- 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 example

This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■Motion SFC program

The Motion SFC program for executing the servo program (No. 60) for absolute auxiliary point-specified helical interpolation control is shown below.

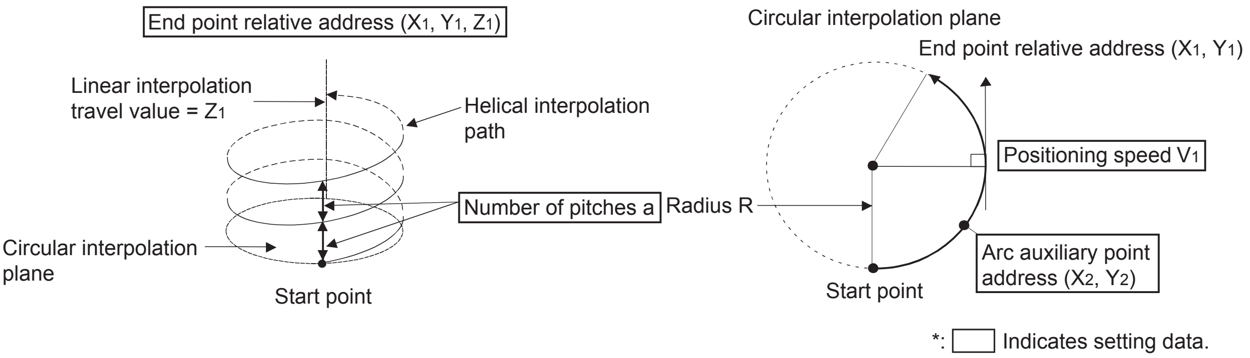


*1 Example of the above Motion SFC program is started using the automatic start or sequence program.

INH Incremental auxiliary point-specified helical interpolation control

Processing details

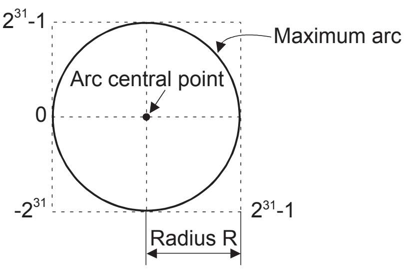
The linear interpolation to other linear axis is executed performing circular interpolation from current stop position (start point) to specified circular relative end address (X_1, Y_1) or linear axis end point relative address (Z_1), and the incremental helical interpolation control is executed so 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 servomotor	Controllable angle of arc
INH Auxiliary point-specified helical interpolation	Clockwise (CW)/ Counter clockwise (CCW)	$0° < \theta \leq 360°$

- The setting range of end point relative address for the both of circular interpolation axis and linear interpolation axis is 0 to $\pm(2^{31}-1)$.
- The setting range of auxiliary point relative is 0 to $\pm(2^{31}-1)$.
- 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].



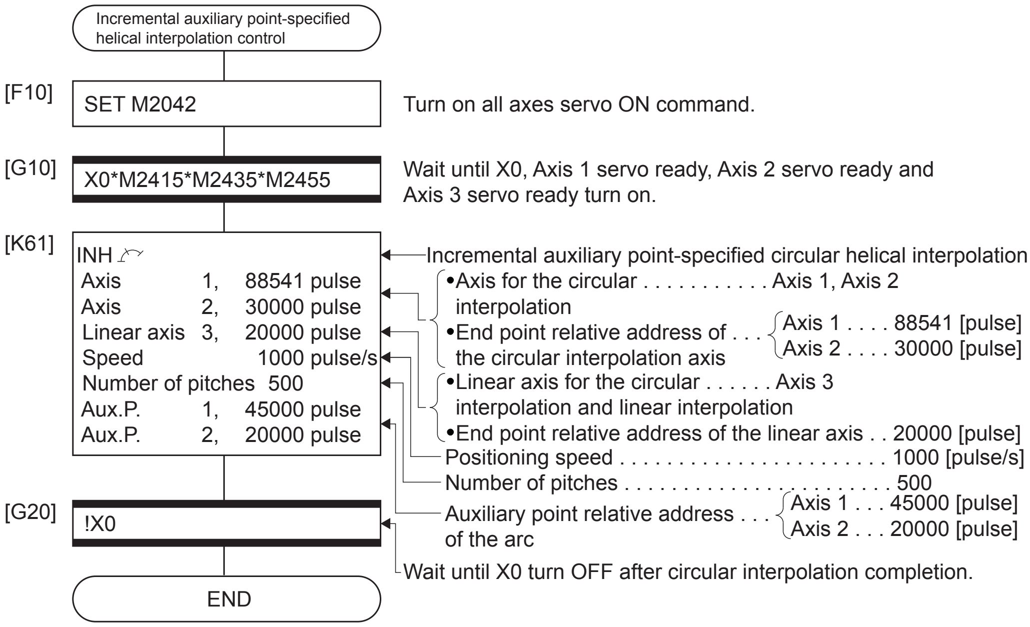
- Set the command speed with the vector speed for 2 axes circular interpolation axis.
- The command speed unit is specified in the parameter block.
- Set the number of pitches within the range of 0 to 999. If it is set outside the setting range, the minor error (error code: 1A36H) occurs and operation does not start.
- 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 example

This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■Motion SFC program

The Motion SFC program for executing the servo program (No. 61) for incremental auxiliary point-specified helical interpolation control is shown below.



*1 Example of the above Motion SFC program is started using the automatic start or sequence program.

5.10 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.

○: Must be set, △: Set if required

Servo instruction	Positioning method	Number of control axes	Positioning data set in servo instructions: Common							Arc				OSC				Parameter block											Others							
			Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Number of pitches	Starting angle	Amplitude	Frequency	Reference axis No. *1	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	Bias speed at start	Repeat condition	Program No.	Command speed (Continuous trajectory)	Skip	FIN acceleration/deceleration	WAIT-ON/OFF	Fixed position stop acceleration/deceleration time	Fixed position stop
FEED-1	Incremental	1	△	○	○	○	△	△											△	△	△	△	△	△		△	△	△								

*1 Only when the reference axis speed is specified

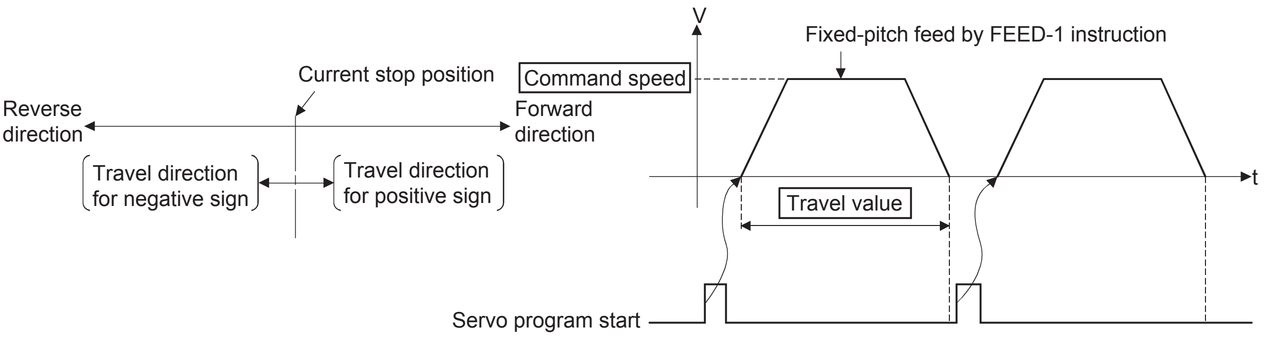
Processing details

- Positioning control for the specified travel value from the current stop position "0" is executed.
- The travel direction is set by the sign (+/ -) of the travel value, as follows:

Travel direction	Description
Positive	Positioning control to forward direction (Address increase direction)
Negative	Positioning control to reverse direction (Address decrease direction)

Positioning direction

Operation timing



*: ☐ Indicates setting data.

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.

Precautions

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 example

The program for repeating 1 axis fixed-pitch feed control of Axis 4 is explained as an example.
This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■Fixed-pitch feed control conditions

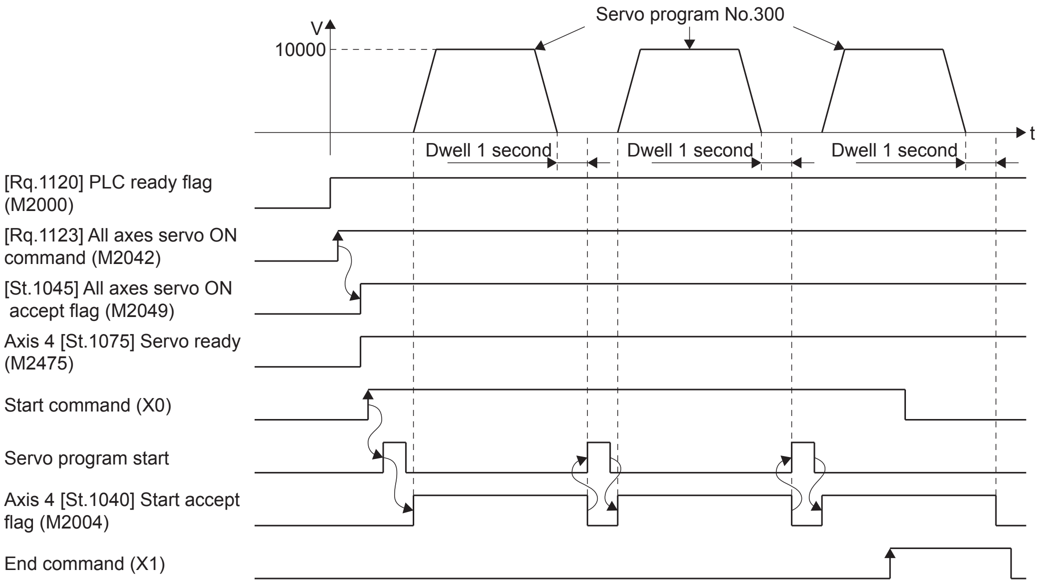
- Positioning conditions are shown below.

Item	Setting
Servo program No.	No.300
Control axis	Axis 4
Control speed	10000
Travel value	80000

- Fixed-pitch feed control start command: X0 Leading edge (OFF → ON)
- Fixed-pitch feed control end command: X1 Leading edge (OFF → ON)

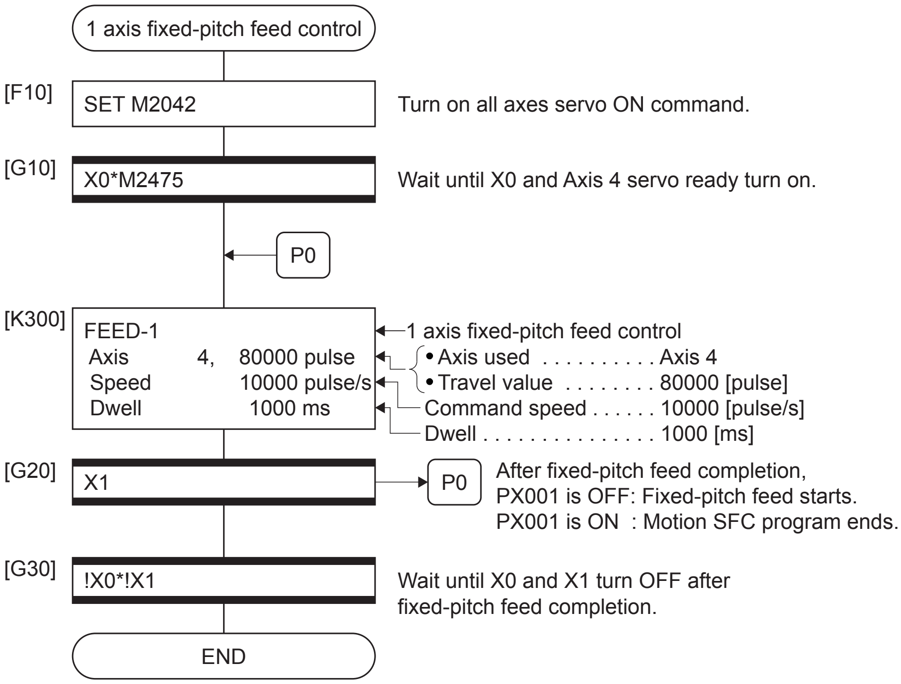
■Operation timing

Operation timing for fixed-pitch feed control is shown below.



■Motion SFC program

The Motion SFC program for executing servo program (No. 300) for 1 axis fixed-pitch feed control is shown below.



*1 Example of the above Motion SFC program is started using the automatic start or sequence program.

5

5.11 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.
○: Must be set, △: Set if required

Servo instruction	Positioning method	Number of control axes	Positioning data set in servo instructions																																	
			Common							Arc				OSC				Parameter block											Others							
			Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Number of pitches	Starting angle	Amplitude	Frequency	Reference axis No. *1	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	Bias speed at start	Repeat condition	Program No.	Command speed (Continuous trajectory)	Skip	FIN acceleration/deceleration	WAIT-ON/OFF	Fixed position stop acceleration/deceleration time	Fixed position stop
FEED-2	Incremental	2	△	○	○	○	△	△										△	△	△	△	△	△	△		△	△	△								

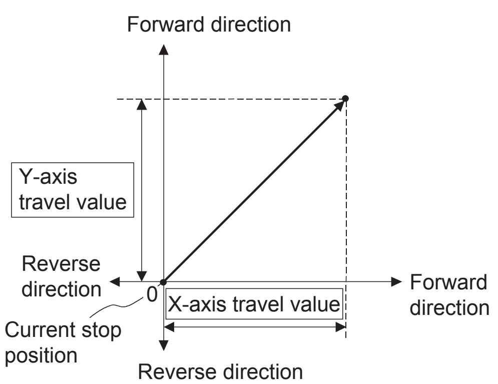
*1 Only when the reference axis speed is specified

Processing details

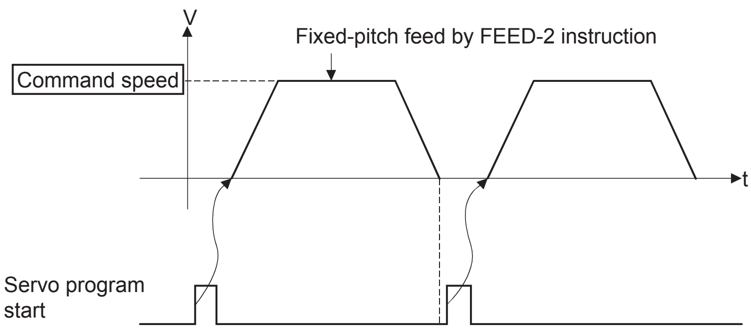
- Positioning control from the current stop position "0" to the position which combined travel direction and travel value specified with each axis is executed.
- The travel direction for each axis is set by the sign (+/ -) of the travel value for each axis, as follows:

Travel direction	Description
Positive	Positioning control to forward direction (Address increase direction)
Negative	Positioning control to reverse direction (Address decrease direction)

Positioning direction



Operation timing



*: ☐ Indicates setting data.

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":
- If the travel value of both is set to "0", fixed-pitch feed completion without fixed-pitch feed.

Precautions

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 example

The program for performing fixed-pitch feed control using 2 axes linear interpolation with Axis 2 and Axis 3 is explained as an example.
This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■Fixed-pitch feed control

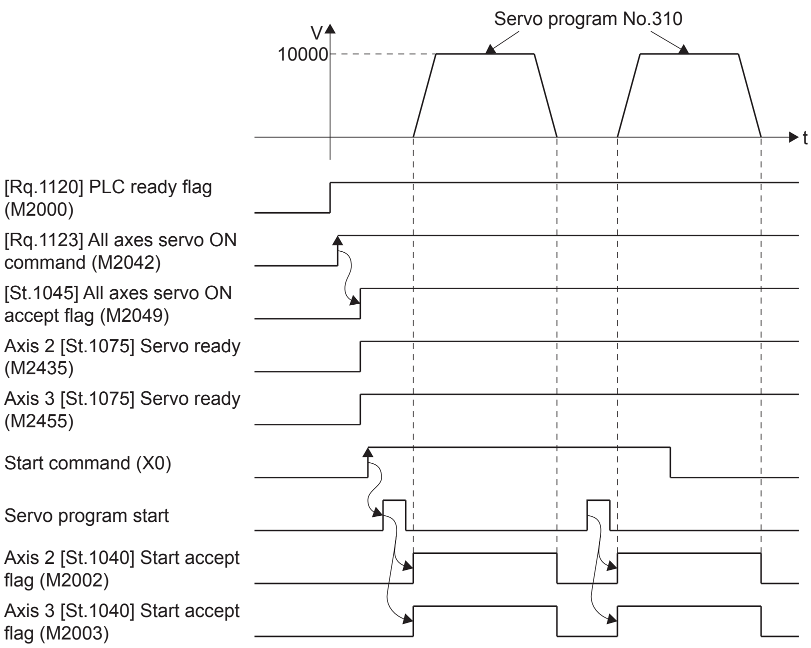
• Fixed-pitch feed control conditions are shown below.

Item	Setting	
Servo program No.	No.310	
Positioning speed	10000	
Control axis	Axis 2	Axis 3
Travel value	500000	300000

• Fixed-pitch feed control start command: X0 Leading edge (OFF → ON)

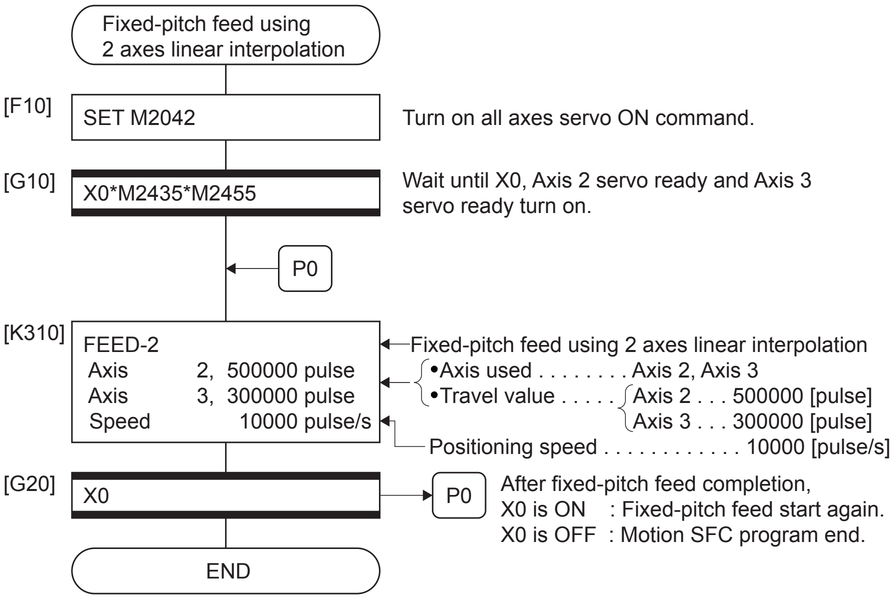
■Operation timing

Operation timing for fixed-pitch feed control using 2 axes linear interpolation is shown below.



■Motion SFC program

The Motion SFC program for executing the servo program (No. 310) for fixed-pitch feed control using 2 axes linear interpolation is shown below.



*1 Example of the above Motion SFC program is started using the automatic start or sequence program.

5.12 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.
○: Must be set, △: Set if required

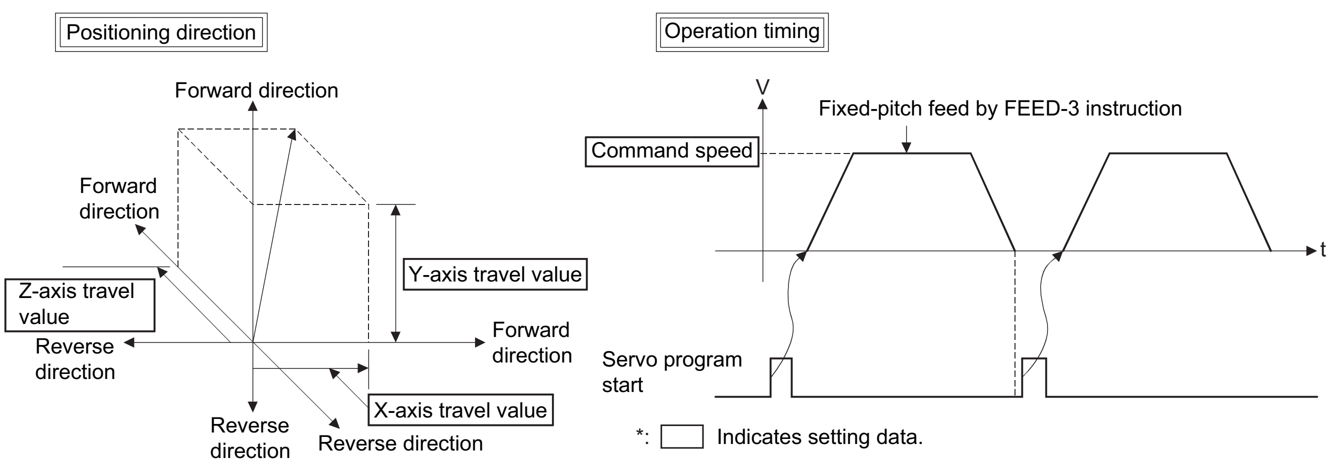
Servo instruction	Positioning method	Number of control axes	Positioning data set in servo instructions																																		
			Common							Arc				OSC				Parameter block											Others								
			Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Number of pitches	Starting angle	Amplitude	Frequency	Reference axis No. *1	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	Bias speed at start	Repeat condition	Program No.	Command speed (Continuous trajectory)	Skip	FIN acceleration/deceleration	WAIT-ON/OFF	Fixed position stop acceleration/deceleration time	Fixed position stop
FEED-3	Incremental	3	△	○	○	○	△	△										△	△	△	△	△	△	△		△	△	△								

*1 Only when the reference axis speed is specified

Processing details

- Positioning control from the current stop position "0" to the position which combined travel direction and travel value specified with each axis is executed.
- The travel direction for each axis is set by the sign (+/ -) of the travel value for each axis, as follows:

Travel direction	Description
Positive travel value	Positioning control to forward direction (Address increase direction)
Negative travel value	Positioning control to reverse direction (Address decrease direction)



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":
- If the travel value of all axes are set to "0", fixed-pitch feed completion without fixed-pitch feed.

Precautions

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 example

The program for performing fixed-pitch feed control using 3 axes linear interpolation with Axis 1, Axis 2, and Axis 3 is explained as an example.
This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■Fixed-pitch feed control

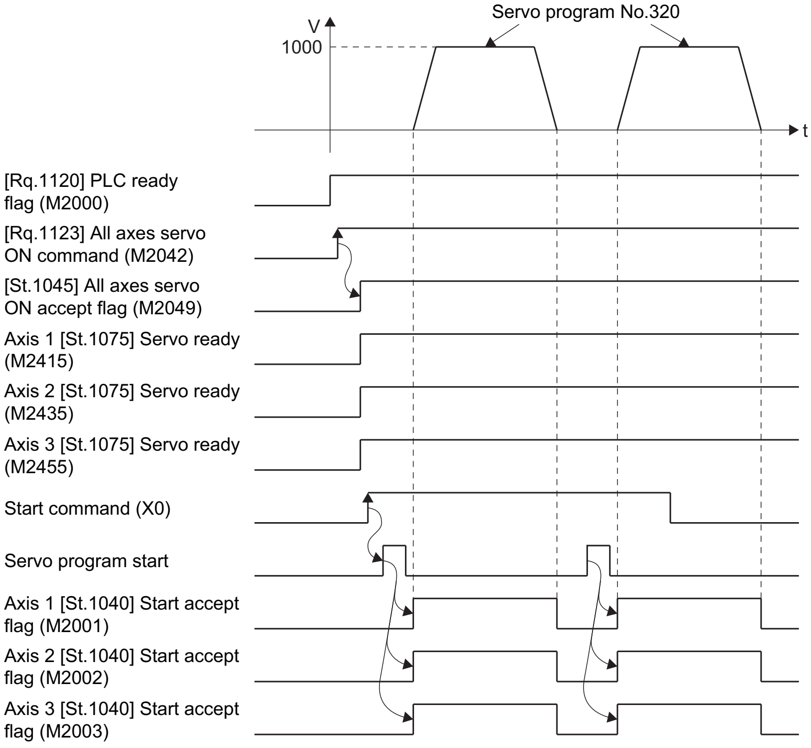
- Fixed-pitch feed control conditions are shown below.

Item	Setting		
Servo program No.	No.320		
Positioning speed	1000		
Control axes	Axis 1	Axis 2	Axis 3
Travel value	50000	40000	30000

- Fixed-pitch feed control start command: X0 Leading edge (OFF → ON)

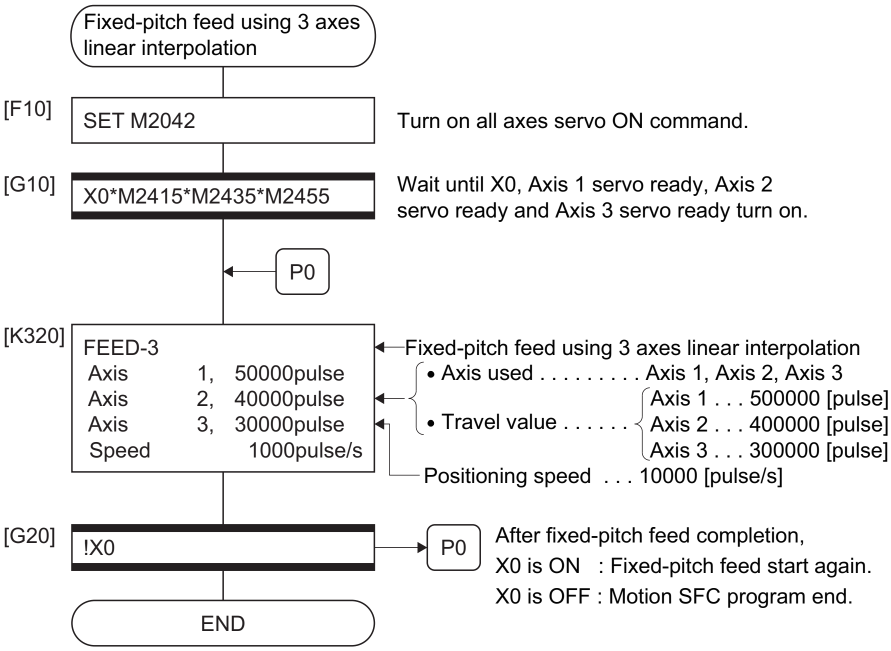
■Operation timing

Operation timing for fixed-pitch feed control using 3 axes linear interpolation is shown below.



■Motion SFC program

The Motion SFC program for executing the servo program (No. 320) for fixed-pitch feed control using 3 axes linear interpolation is shown below.



*1 Example of the above Motion SFC program is started using the automatic start or sequence program.

5.13 Speed Control (I)

- Speed control for the specified axis is executed.
- Control includes positioning loops for control of servo amplifiers.

Point

Refer to the speed-torque control for performing speed control that does not include positioning loops without using the servo program. (☞ Page 431 Speed-Torque Control)

- Speed control (I) uses the VF (Forward) and VR (Reverse) servo instructions.

○: Must be set, △: Set if required

Servo instruction	Positioning method	Number of control axes	Positioning data set in servo instructions																																	
			Common							Arc				OSC				Parameter block											Others							
			Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Number of pitches	Starting angle	Amplitude	Frequency	Reference axis No. *1	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	Bias speed at start	Repeat condition	Program No.	Command speed (Continuous trajectory)	Skip	FIN acceleration/deceleration	WAIT-ON/OFF	Fixed position stop acceleration/deceleration time	Fixed position stop
VF VR	—	1	△	○		○		△											△	△	△	△	△	△		△	△	△								

*1 Only when the reference axis speed is specified

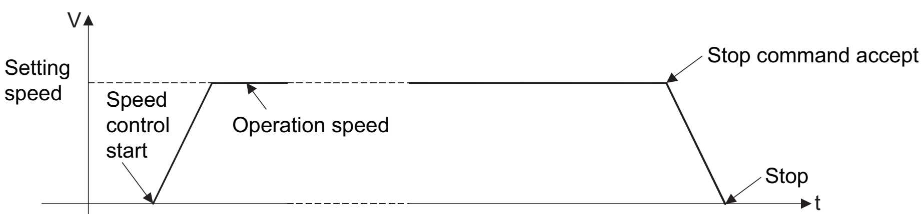
Processing details

- Controls the axis at the specified speed until the input of the stop command after starting of the servomotors.

Servo instruction	Description
VF	Forward direction start
VR	Reverse direction start

- The operation of the feed current value during speed control is as follows depending on the status of the "[Rq.1152] Feed current value update command (R: M34492+32n/Q: M3212+20n)".

Setting value	Description
ON	The feed current value is updated. The software stroke limit is valid.
OFF	"0" is stored in the feed current value.



- Refer to the stop processing and restarting after stop for stop commands and stop processing during speed control. (☞ Page 259 Stop processing and restarting after stop)

Precautions

- When "[Rq.1152] Feed current value update command (R: M34492+32n/Q: M3212+20n)" is OFF, the feed current value is changed to "0". 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.
- The dwell time cannot be set.

Program example

The program for performing speed control (I) of Axis 1 is explained as an example.
This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■Speed control (I) conditions

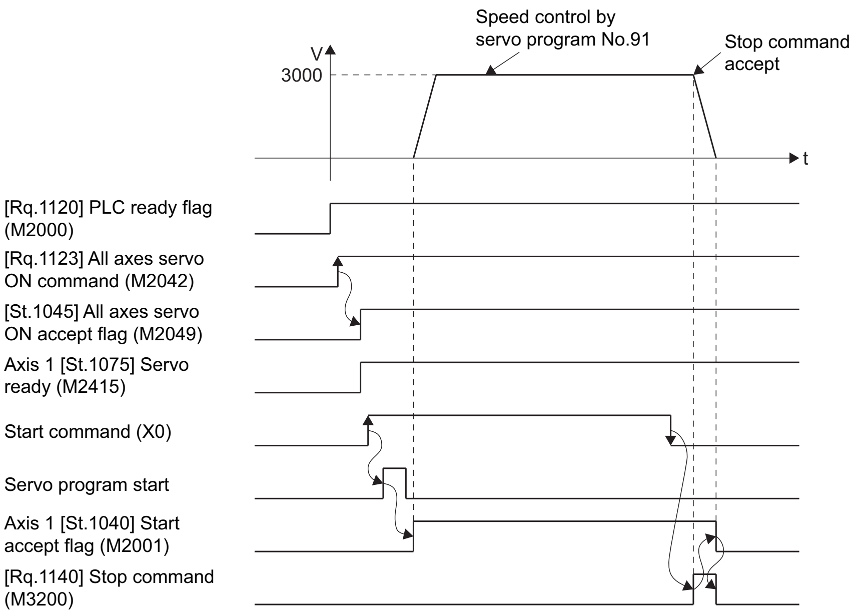
- Speed control (I) conditions are shown below.

Item	Setting
Servo program No.	No.91
Control axis	Axis 1
Control speed	3000
Rotation direction	Forward

- Speed control (I) start command: X0 Leading edge (OFF → ON)
- Stop command: X0 Trailing edge (ON → OFF)

■Operation timing

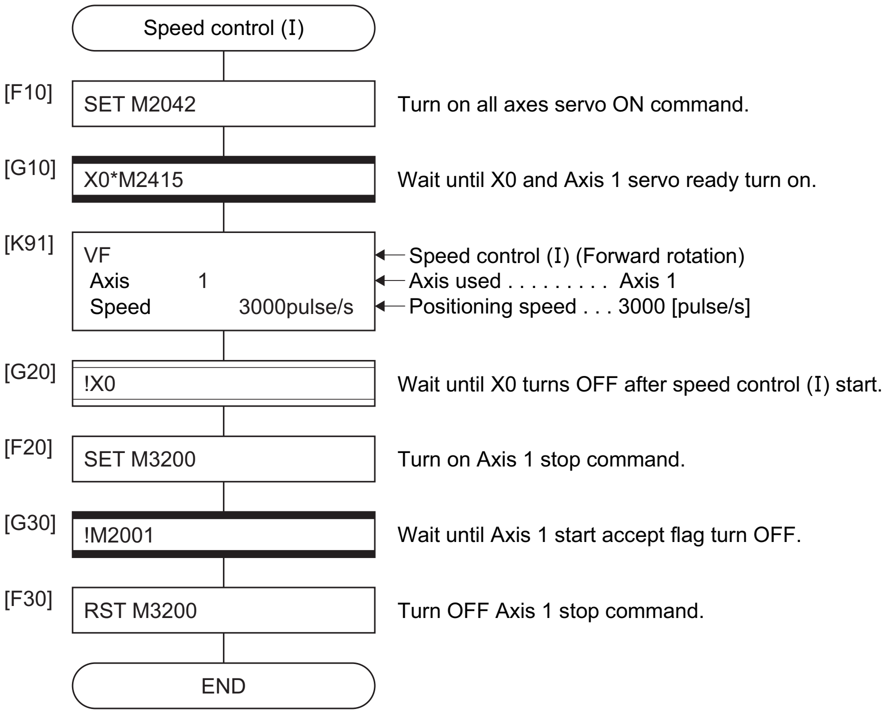
Operation timing for speed control (I) is shown below.



5

■Motion SFC program

The Motion SFC program for executing the servo program (No. 91) for speed control (Ⅰ) is shown below.



*1 Example of the above Motion SFC program is started using the automatic start or sequence program.

5.14 Speed Control (II)

- Speed control for the specified axis is executed.
- Speed control not includes positioning loops for control of servo amplifiers. It can be used for control, etc. so that it may not become error excessive.

Point

Refer to the speed-torque control for executing speed control that does not include positioning loops without using the servo program. (☞ Page 431 Speed-Torque Control)

- Speed control (Ⅱ) uses the VVF (Forward) and VVR (Reverse) servo instructions.

○: Must be set, △: Set if required

Servo instruction	Positioning method	Number of control axes	Positioning data set in servo instructions																																	
			Common							Arc			OSC					Parameter block											Others							
			Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Number of pitches	Starting angle	Amplitude	Frequency	Reference axis No. *1	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	Bias speed at start	Repeat condition	Program No.	Command speed (Continuous trajectory)	Skip	FIN acceleration/deceleration	WAIT-ON/OFF	Fixed position stop acceleration/deceleration time	Fixed position stop
VVF VVR	—	1	△	○		○		△	△										△	△	△	△	△	△		△	△	△								

*1 Only when the reference axis speed is specified

Processing details

- Controls the axis at the specified speed until the input of the stop command after starting of the servomotors.

Servo instruction	Description
VVF	Forward direction start
VVR	Reverse direction start

- Current value or deviation counter do not change at "0".
- 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.
- The stop command and stop processing are the same as for speed control (Ⅰ). (☞ Page 259 Stop processing and restarting after stop)

Precautions

- 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.
- The dwell time cannot be set.

Program example

The program for performing speed control (Ⅱ) of Axis 3 is explained as an example.

This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■Speed control (II) conditions

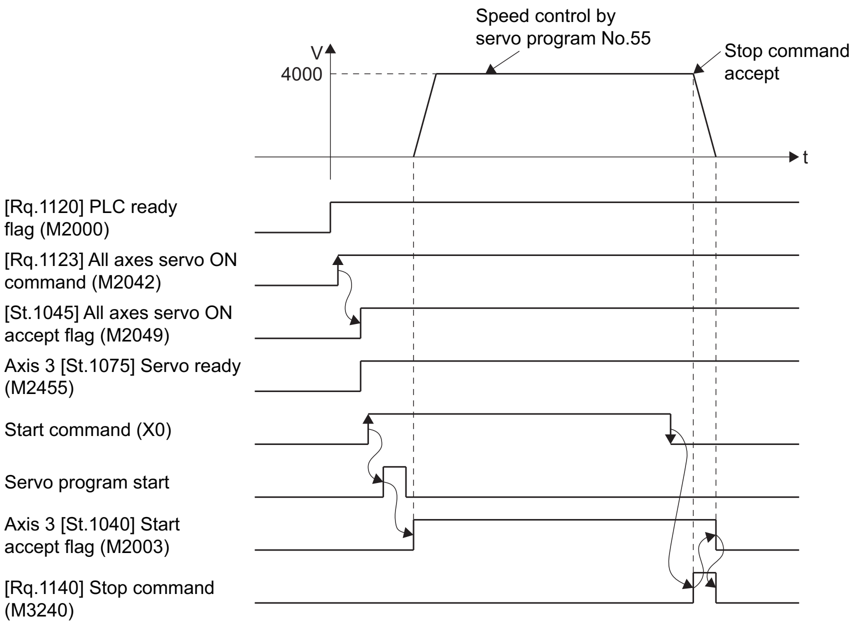
- Speed control (Ⅱ) conditions are shown below.

Item	Setting
Servo program No.	No.55
Control axis	Axis 3
Control speed	4000
Rotation direction	Forward

- Speed control (Ⅱ) start command: X0 Leading edge (OFF → ON)
- Stop command: X0 Trailing edge (ON → OFF)

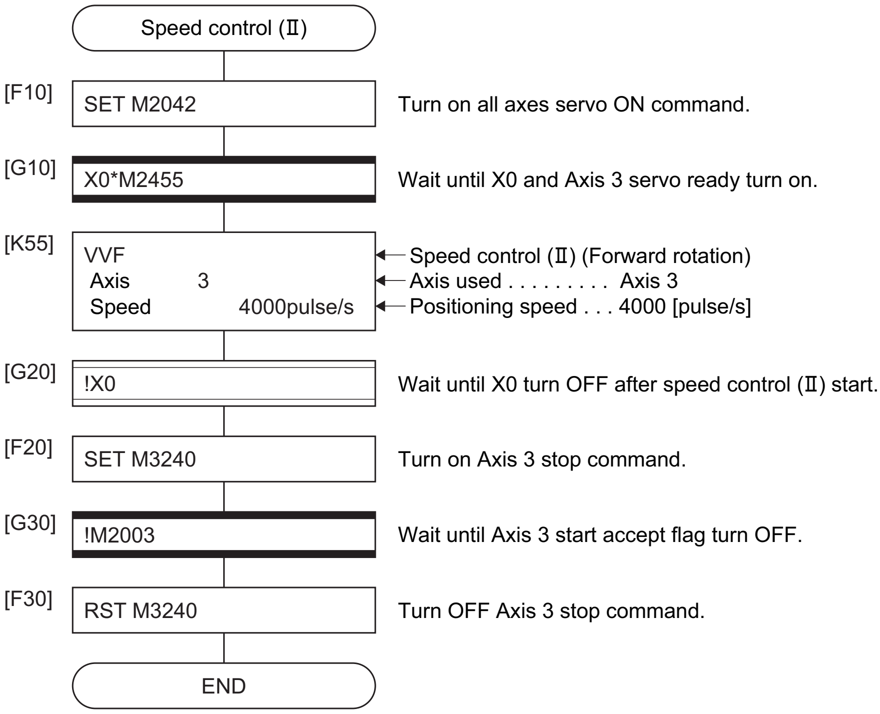
■Operation timing

Operation timing for speed control (Ⅱ) is shown below.



■Motion SFC program

The Motion SFC program for executing the servo program (No. 55) for speed control (Ⅱ) is shown below.



*1 Example of the above Motion SFC program is started using the automatic start or sequence program.

5.15 Speed/Position Switching Control

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.

○: Must be set, △: Set if required

Servo instruction	Positioning method	Number of control axes	Positioning data set in servo instructions																																			
			Common							Arc				OSC				Parameter block											Others							
			Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Number of pitches	Starting angle	Amplitude	Frequency	Reference axis No.*1	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	Bias speed at start	Repeat condition	Program No.	Command speed (Continuous trajectory)	Skip	FIN acceleration/deceleration	WAIT-ON/OFF	Fixed position stop acceleration/deceleration time	Fixed position stop
VPF VPR	—	1	△	○	○	○	△	△	△										△	△	△	△	△	△		△	△	△								

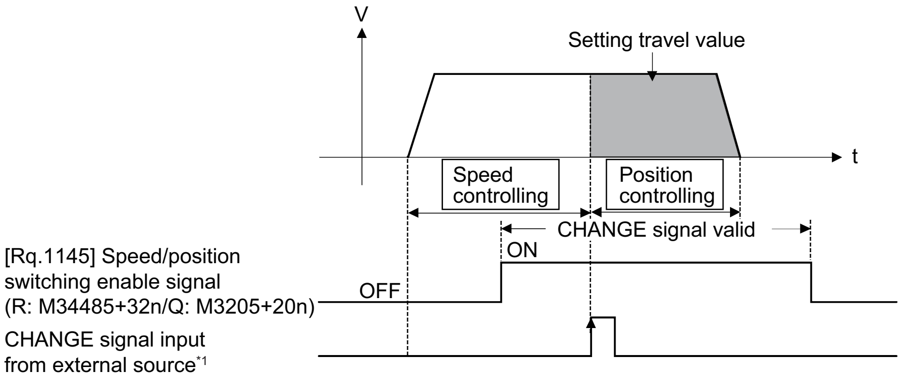
*1 Only when the reference axis speed is specified

Processing details

- The speed control (including positioning loops) is executed after the start of the servomotor, 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.

Servo instruction	Description
VPF	Forward rotation direction (Address increase direction) start
VPR	Reverse rotation direction (Address decrease direction) start

• The CHANGE signal from external source is effective during "[Rq.1145] Speed/position switching enable signal (R: M34485+32n/Q: M3205+20n)" is on only. If "[Rq.1145] Speed/position switching enable signal (R: M34485+32n/Q: 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.



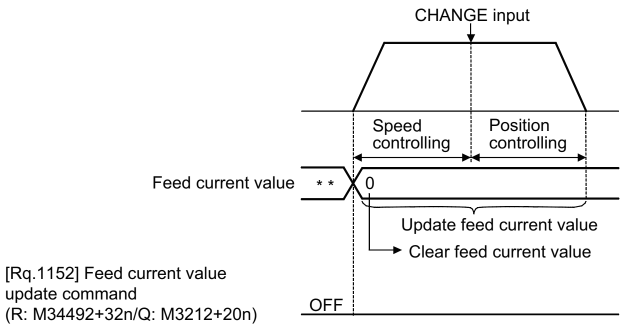
*1 The CHANGE input signal from external source uses the input set for the DOG signal in the external signal parameter. When "normally open contact input" is set, CHANGE input occurs at the CHANGE signal on, and when "normally closed contact input" is set, CHANGE input occurs at the CHANGE signal off. (☞ Page 189 External Signal Parameter)

■Feed current value processing

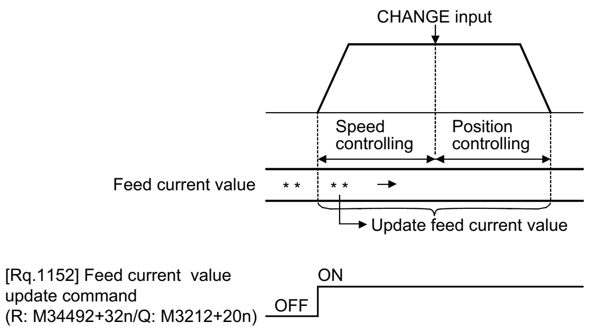
The feed current value is as follows by turning "[Rq.1152] Feed current value update command (R: M34492+32n/Q: M3212+20n)" on/off at the speed/position switching control start.

"[Rq.1152] Feed current value update command (R: M34492+32n/Q: M3212+20n)"	Description
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: Feed current value after stop = Travel value during speed control + Travel value for position control
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: Feed current value after stop = Address before speed control start + Travel value during speed control + Travel value for position control

"[Rq.1152] Feed current value update command (R: M34492+32n/Q: M3212+20n)" OFF



"[Rq.1152] Feed current value update command (R: M34492+32n/Q: M3212+20n)" ON



5

Point

If it is started with "[Rq.1152] Feed current value update command (R: M34492+32n/Q: M3212+20n)" on, leave "[Rq.1152] Feed current value update command (R: M34492+32n/Q: M3212+20n)" on until positioning control is completed.

If it is turns off during control, the feed current value cannot be guaranteed.

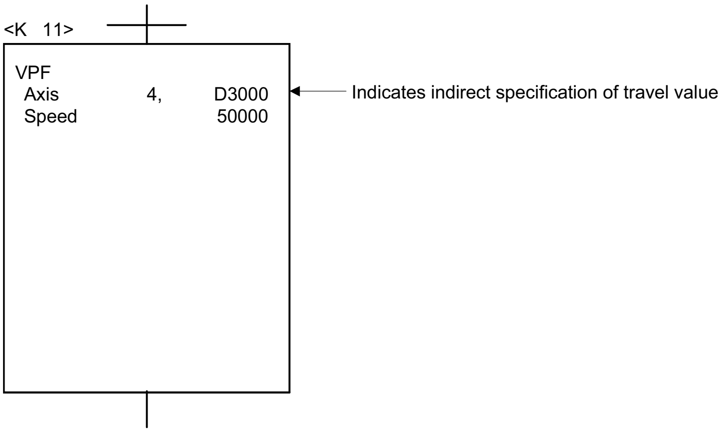
■Change of the travel value during speed control

The travel value for position control can be changed during speed control after speed/position switching control start.

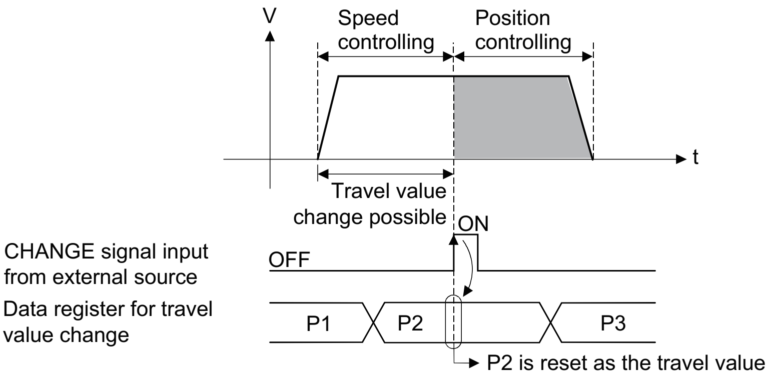
- The travel value is set in indirect specification by optional device (2-word data) in the servo program. When a negative value is set in the travel value, a deceleration stop is made after switching to the position control.

Ex.

Servo program which performs the speed control for axis 4 to the forward direction at speed 50000, and the position control of the travel value set in D3000, D3001 after the CHANGE signal from external source turns on.



- 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.



■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 "[Md.34] After proximity dog ON (R: D32010+48n, D32011+48n/Q: D10+20n, D11+20n)".

Precautions

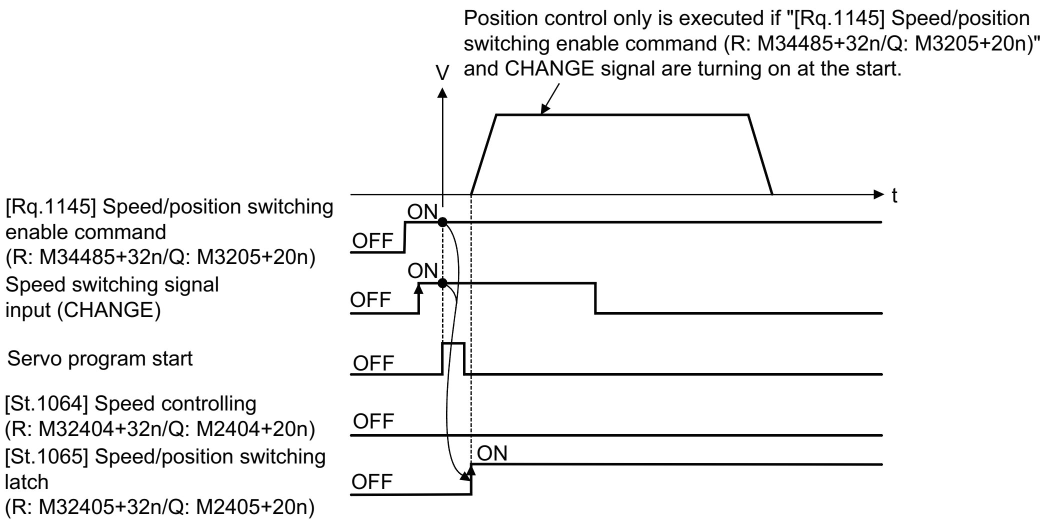
■Item check at the CHANGE signal ON from external source

When the external CHANGE signal turns on, speed control switches to position control if the following conditions are met:

- "[St.1040] Start accept flag (R: M30080+n/Q: M2001+n)" is turning on.
- Speed control is executing after starting of the speed/position switching control.
- "[Rq.1145] Speed/position switching enable command (R: M34485+32n/Q: M3205+20n)" is turning on.

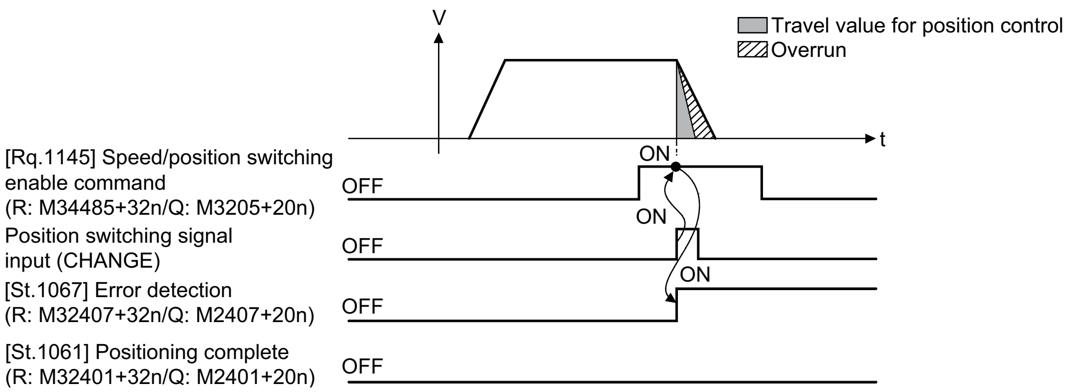
■No speed control

Position control only is executed if "[Rq.1145] Speed/position switching enable command (R: M34485+32n/Q: M3205+20n)" and CHANGE signal are turning on at the start. The "[Rq.1064] Speed controlling (R: M32404+32n/Q: M2404+20n)" does not turn on.



■"Travel value for position control" is less than "deceleration distance"

- If the travel value for position control is less than the deceleration distance at controlling speed, deceleration processing starts immediately when CHANGE is input.
- The difference between travel value for the deceleration stop and position control is the overrun. At this time, the "[St.1067] Error detection signal (R: M32407+32n/Q: M2407+20n)" turns on and minor error (error code: 1A57H) is stored in the data register.
- The "[St.1061] Positioning complete (R: M32401+32n/Q: M2401+20n)" does not turn on.



■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: 19EEH) occurs when position mode is selected, and performs a deceleration stop.

■When "[Rq.1152] Feed current value update command (R: M34492+32n/Q: M3212+20n)" is OFF

When "[Rq.1152] Feed current value update command (R: M34492+32n/Q: 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 example

The program for performing speed/position switching control of Axis 4 is explained as an example.

This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■Positioning conditions

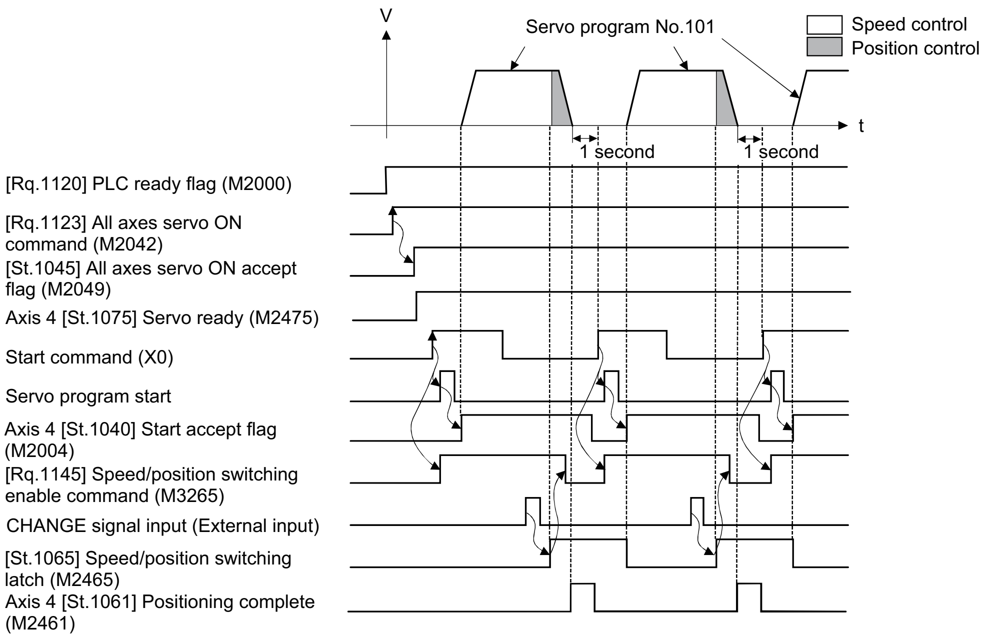
- Positioning conditions are shown below.

Item	Positioning conditions
Servo program No.	101
Control axis	Axis 4
Travel value for positioning control	40000
Command speed	1000

- Positioning start command: X0 Leading edge (OFF → ON)
- Speed/position switching enable command: M3265

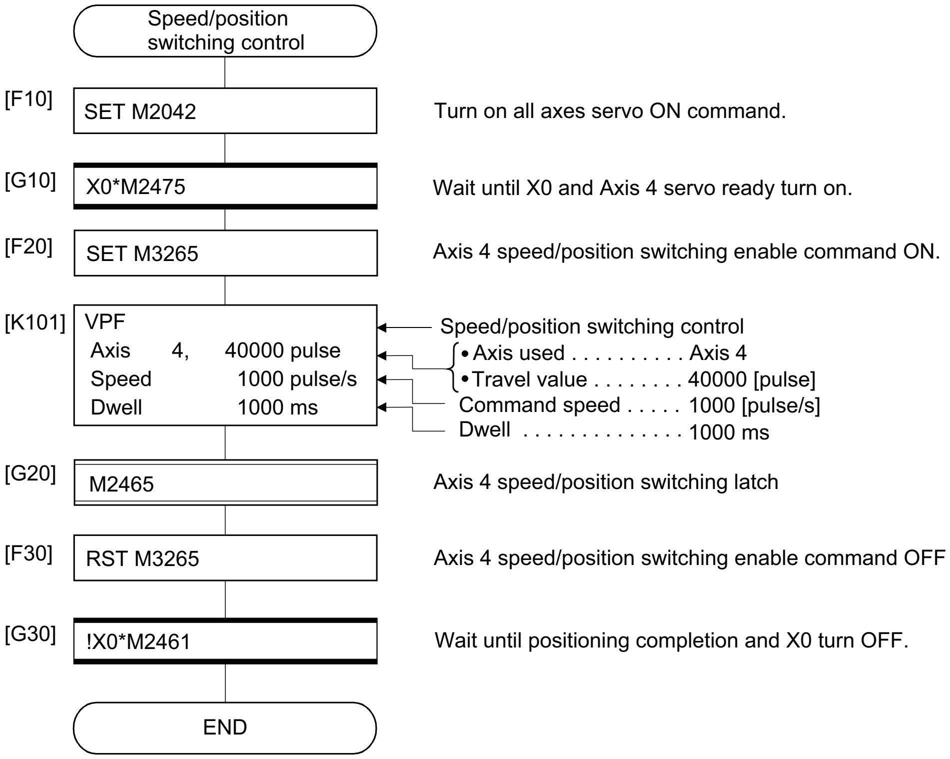
■Operation timing

Operation timing for speed/position switching control is shown below.



■Motion SFC program

The Motion SFC program for executing the servo program (No. 101) for speed-position switching control is shown below.



*: Shift transition is used to transit into the next processing during the positioning.

*1 Example of the above Motion SFC program is started using the automatic start or sequence program.

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.

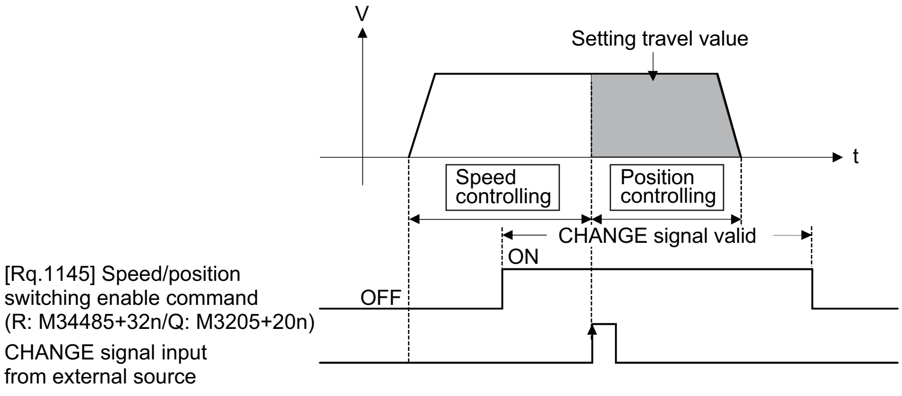
○: Must be set, △: Set if required

Servo instruction	Positioning method	Number of control axes	Positioning data set in servo instructions																																		
			Common							Arc				OSC				Parameter block											Others							
			Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Number of pitches	Starting angle	Amplitude	Frequency	Reference axis No.*1	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	Bias speed at start	Repeat condition	Program No.	Command speed (Continuous trajectory)	Skip	FIN acceleration/deceleration	WAIT-ON/OFF	Fixed position stop acceleration/deceleration time	Fixed position stop
VPSTART	Incremental	1		○																																

*1 Only when the reference axis speed is specified

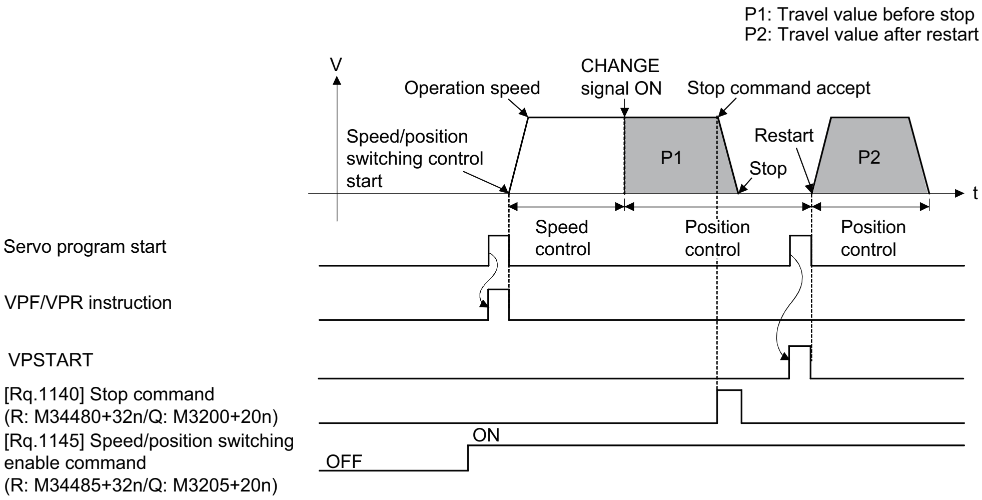
Processing details

- The continuous control after stop during speed control is executed, after speed/position switching control start.
- Re-starting using the VPSTART is effective by stop during speed control or position control.
- 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. (☞ Page 324 Speed/position switching control start)

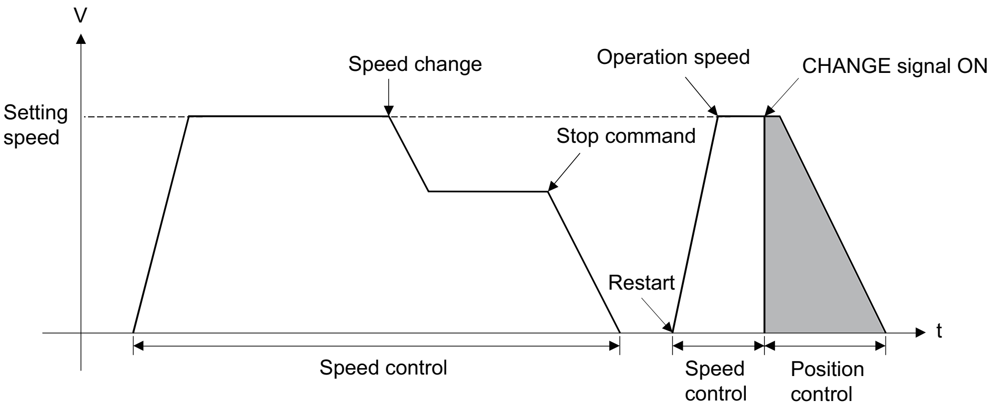


• If the stop occurred during position control, re-start with position, and the positioning control of setting travel value. The travel value after the re-start is calculated as follows:

Travel value after re-start (P2) = Setting travel value (P) - Travel value before stop (P1)



• It controls at the speed stored at the VPF/VPR instruction execution in the re-starting. Therefore, even if the speed change before stop during control, it becomes the speed at the VPF/VPR instruction execution.



Program example

The program for performing restarting after stop during control with the speed/position switching control of Axis 4 is explained as an example.

This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■Positioning conditions

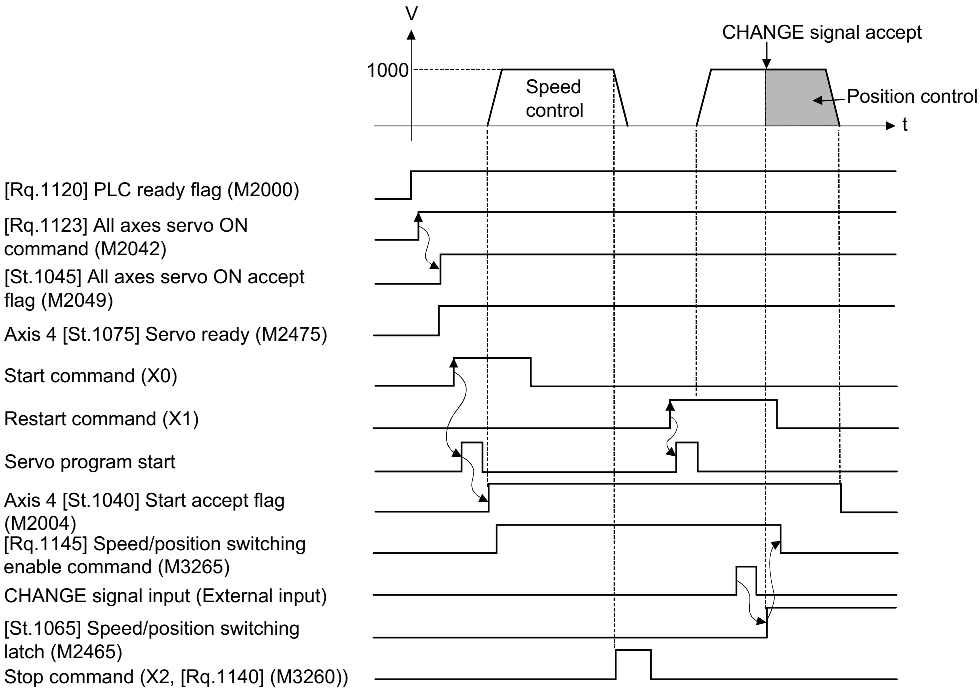
• Positioning conditions are shown below.

Item	Positioning conditions	
	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	—

• Positioning start command: X0 Leading edge (OFF → ON)
• Speed/position switching enable command: M3265
• Re-start command: X1 Leading edge (OFF → ON)
• Stop command: X2 Leading edge (OFF → ON)

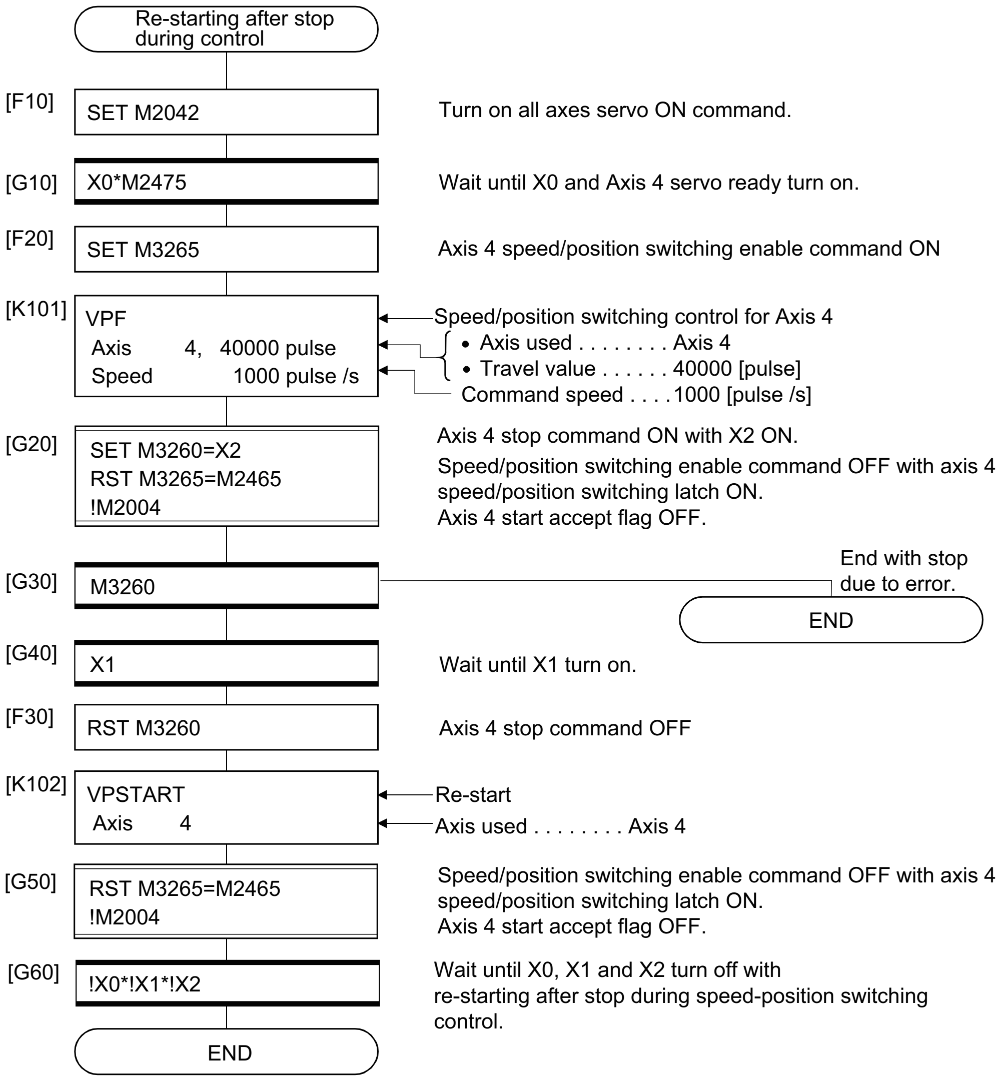
■Operation timing

Operation timing for speed/position switching control and re-starting are shown below.



■Motion SFC program

The Motion SFC program for executing the servo programs (No. 101 and No. 102) for re-starting after stop during control is shown below.



*1 Example of the above Motion SFC program is started using the automatic start or sequence program.

5

5.16 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.

○: Must be set, △: Set if required

Servo instruction	Positioning method	Number of control axes	Positioning data set in servo instructions																																	
			Common							Arc				OSC				Parameter block											Others							
			Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Number of pitches	Starting angle	Amplitude	Frequency	Reference axis No. *1	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	Bias speed at start	Repeat condition	Program No.	Command speed (Continuous trajectory)	Skip	FIN acceleration/deceleration	WAIT-ON/OFF	Fixed position stop acceleration/deceleration time	Fixed position stop
PVF PVR	Absolute	1	△	○	○	○	△	△											△		△	△	△	△		△	△	△							○	○

*1 Only when the reference axis speed is specified

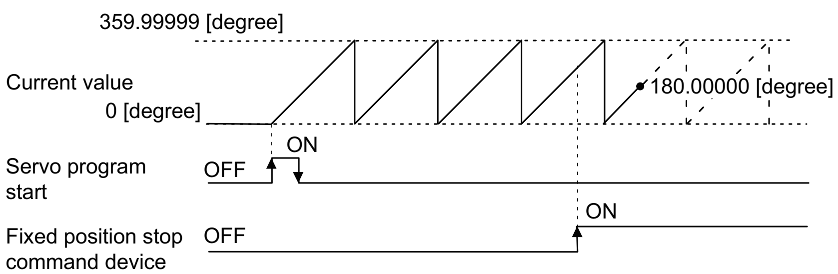
Processing details

- After starting of servomotor, control at the specified speed is executed until the fixed position stop command turns on.

Servo instruction	Description
PVF	Forward rotation direction (Address increase direction) start
PVR	Reverse rotation direction (Address decrease direction) start

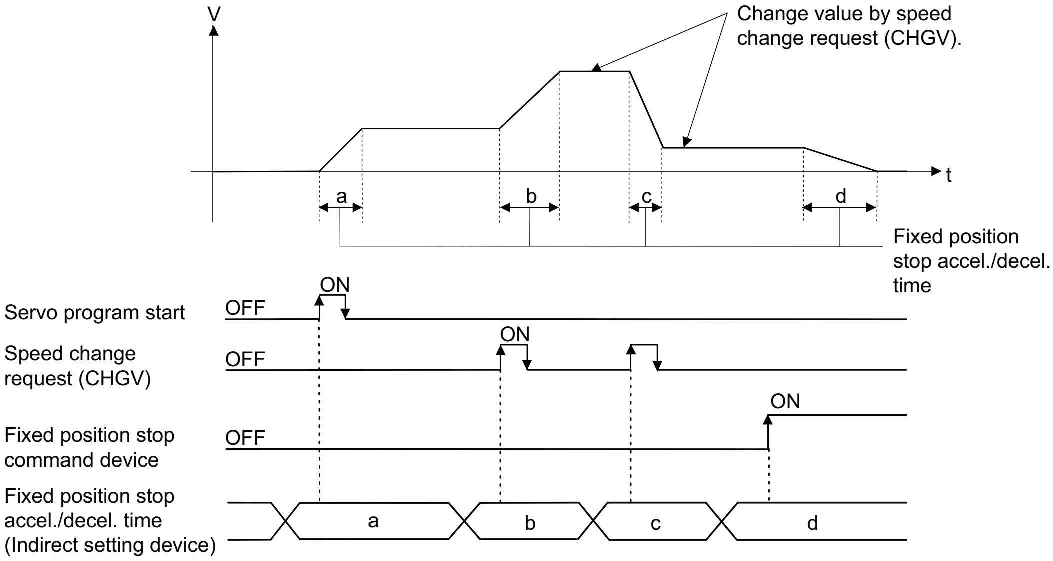
- When the fixed position stop command turns on, a positioning control to the specified address is executed.

[Positioning address: 180.00000 [degree]]

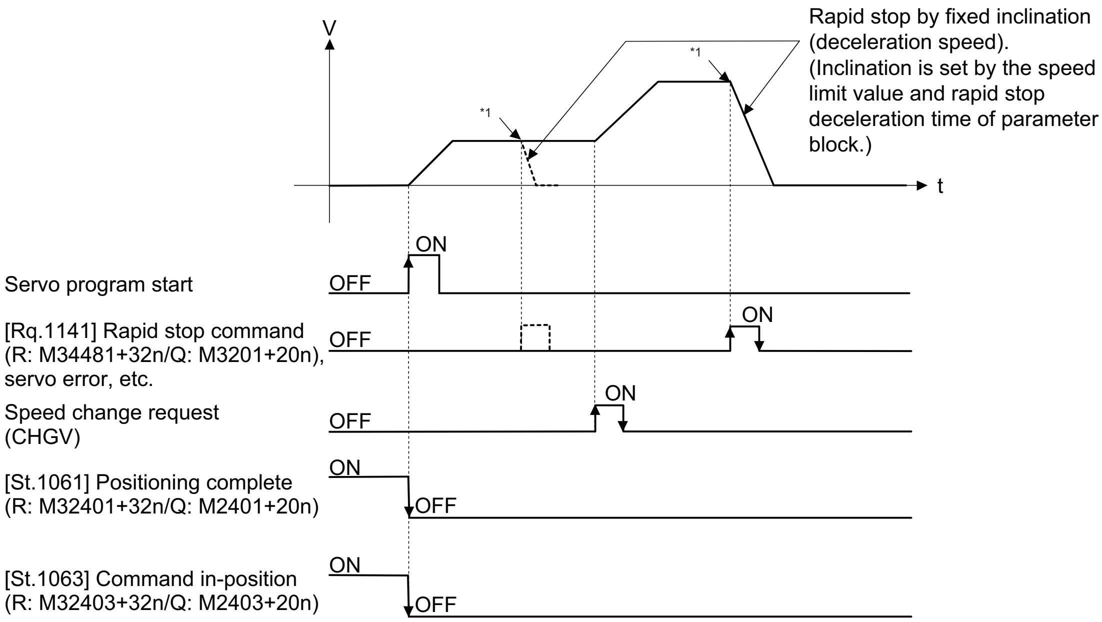


- It can be controlled in the axis which "control unit is [degree] and stroke limit is invalid ("upper stroke limit value" equal to "lower stroke limit value")". If it is started for axis which "control unit is except [degree] or stroke limit is not invalid", a minor error (error code: 19EAH) occurs and it does not start.
- 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 minor error (error code: 1A31H) occurs and it does not start. Positioning address is input at the program start.

- 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.
- The setting range of fixed position stop acceleration/deceleration time is 1 to 8388608 [ms].
- 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
- When the positioning to specified address completes, the "[St.1061] Positioning complete (R: M32401+32n/Q: M2401+20n)" turns on. It does not turn on at the time of stop by the "[Rq.1140] Stop command (R: M34480+32n/Q: M3200+20n)" / "[Rq.1141] Rapid stop command (R: M34481+32n/Q: M3201+20n)". The "[St.1061] Positioning complete (R: M32401+32n/Q: M2401+20n)" turns off at leading edge of "[Rq.1144] Complete signal OFF command (R: M34484+32n/Q: M3204+20n)" or positioning start.
- Speed change can be executed any number of times by the speed change request (CHGV) instruction during operation.



- Deceleration speed by the "[Rq.1140] Stop command (R: M34480+32n/Q: M3200+20n)" / "[Rq.1141] Rapid stop command (R: M34481+32n/Q: 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.



*1: Rapid stop cause

- 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 "[St.1063] Command in-position (R: M32403+32n/Q: M2403+20n)" turns on. The "[St.1063] Command in-position (R: M32403+32n/Q: M2403+20n)" turns OFF by a positioning start.
- When speed control with fixed position stop is started with the fixed position stop command turned ON, or when the fixed position stop command is turned ON after a speed change to "0", positioning is executed at the speed that was specified by the speed limit value.

Program example

The program for performing speed control with fixed position stop of Axis 1 is explained as an example.
This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■Positioning conditions

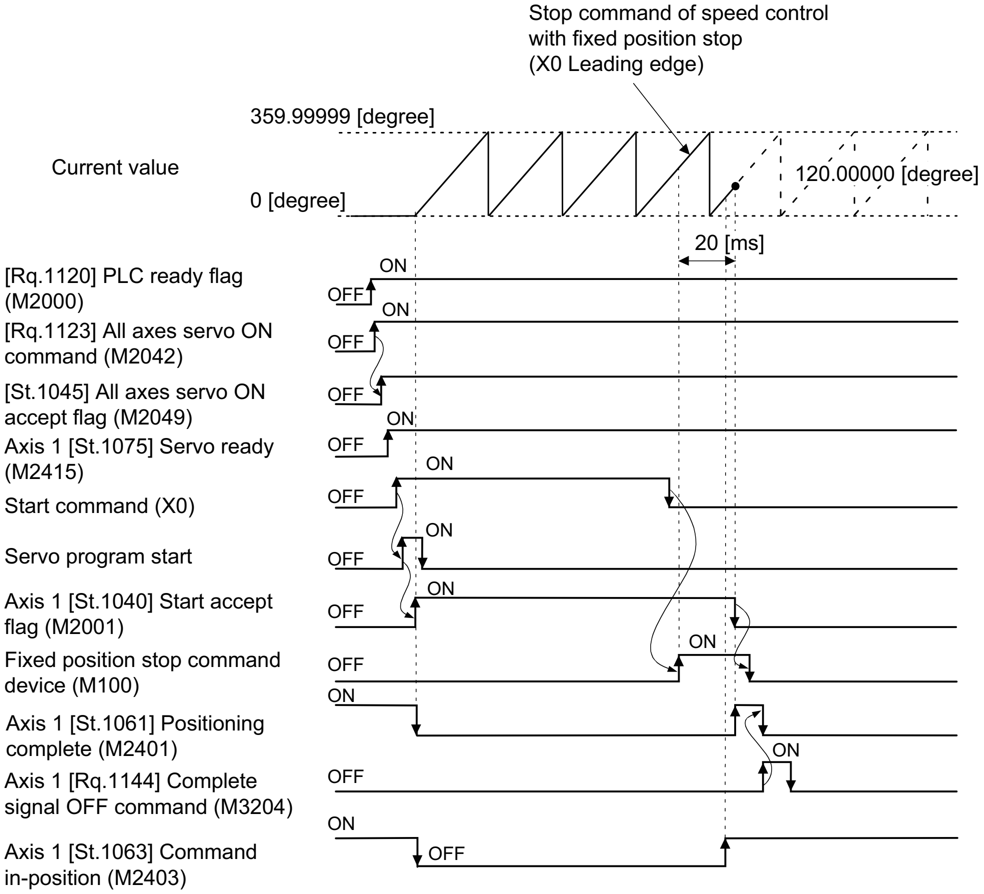
- Speed control with fixed position stop conditions are shown below.

Item	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	20 ms
Fixed position stop command device	M100

- Speed control with fixed position stop start command: X0 Leading edge (OFF → ON)
- Speed control with fixed position stop command: X0 Trailing edge (ON → OFF)

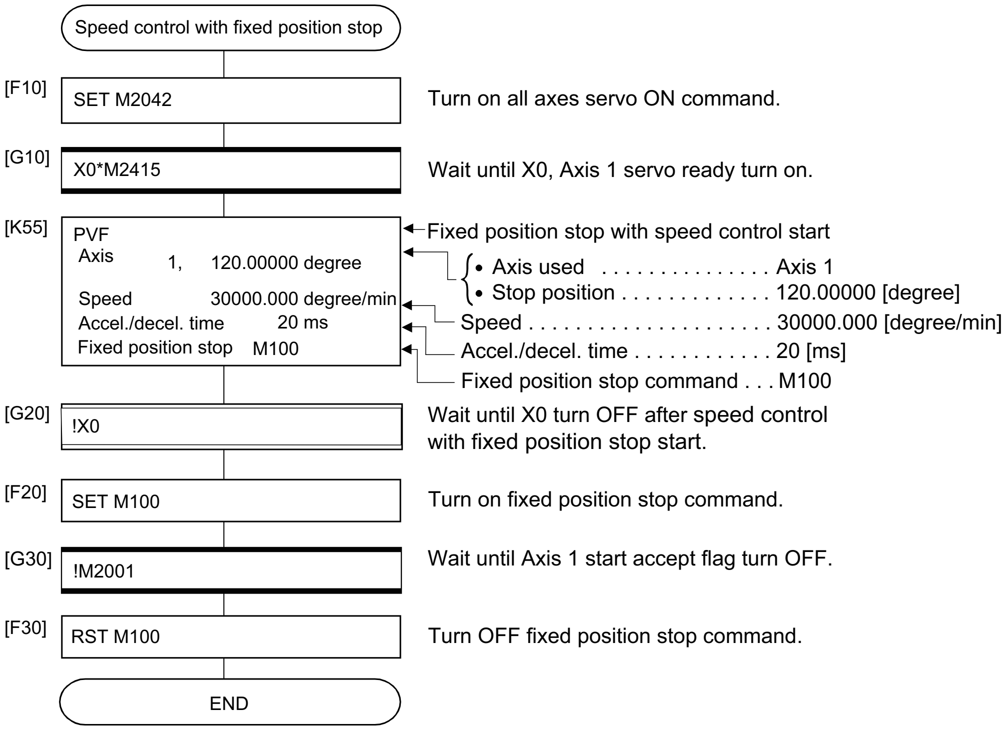
■Operation timing

Operation timing for speed control with fixed position stop is shown below.



■Motion SFC program

The Motion SFC program for executing the servo program (No. 55) for speed control with fixed position stop is shown below.



*1 Example of the above Motion SFC program is started using the automatic start or sequence program.

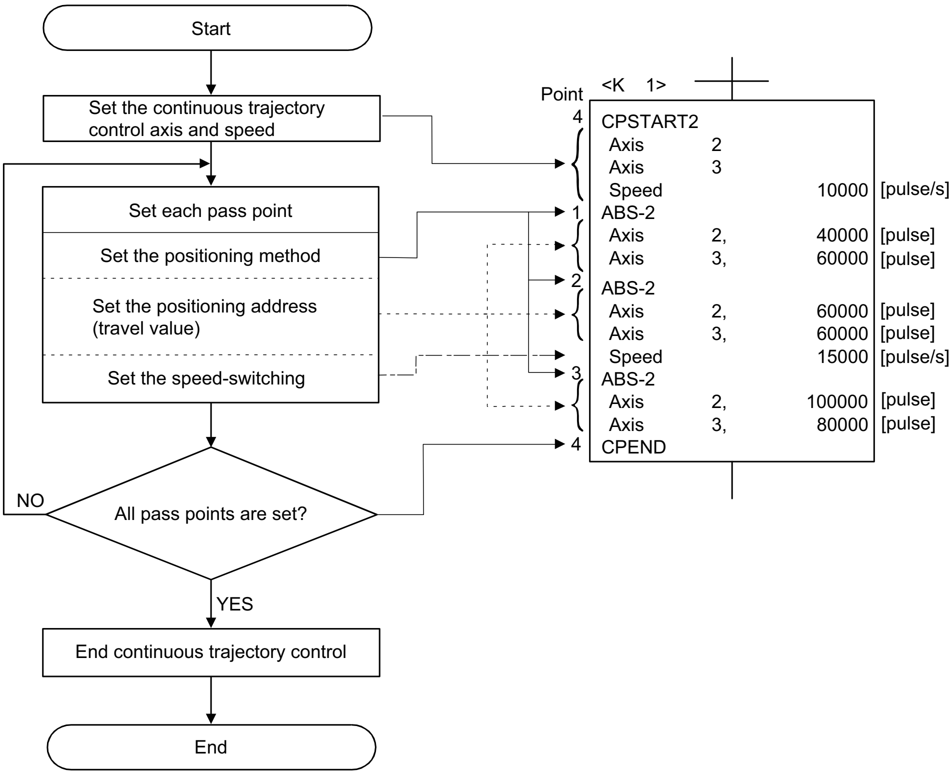
5.17 Continuous Trajectory Control

- Positioning to the pass point beforehand set by one starting is executed with the specified positioning method and positioning speed.
- The positioning method and positioning speed can be changed for each pass point.
- 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.
- Repetition control between any pass points can be performed by using repetition instructions.
- M-codes and torque limit values can be changed at each speed-switching point.
- 1 to 4 axes can be controlled.

Procedure to write servo programs

The method to write the servo programs for continuous trajectory control is shown below.

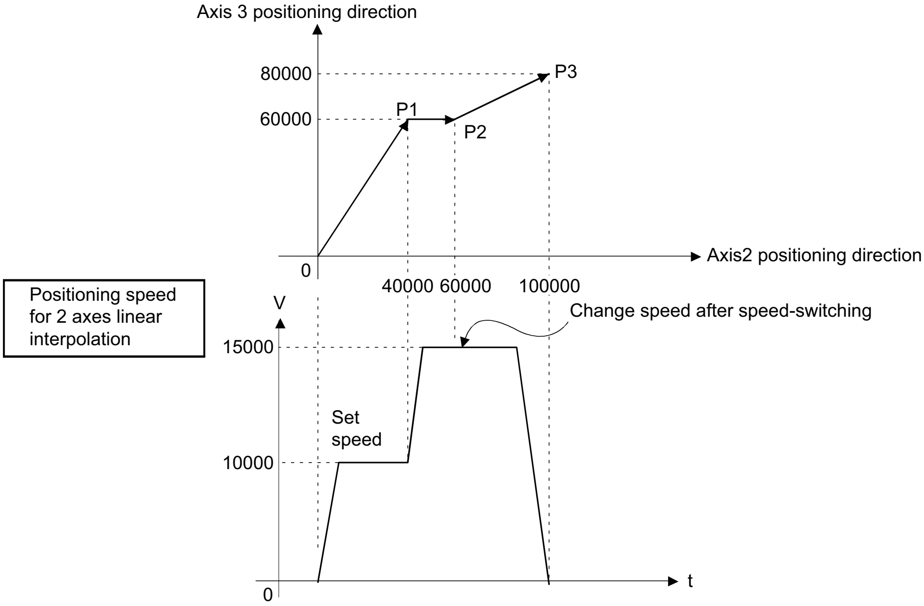
■Example servo program for 2 axes continuous trajectory control



Operation timing

Operation timing for continuous trajectory control is shown below.

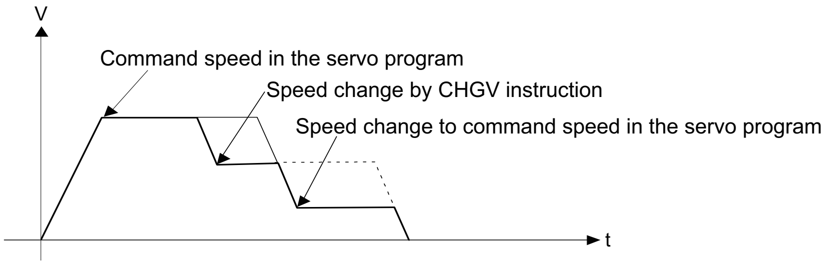
■Example operation timing for 2 axes continuous trajectory control



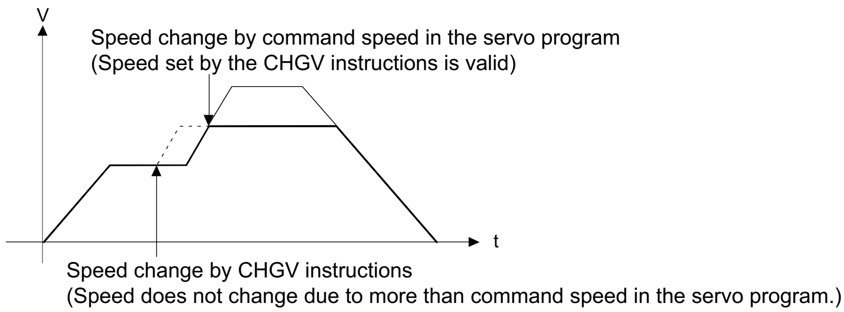
Caution

- The number of control axes cannot be changed during control.
- The pass point can be specified the absolute data method (ABS□) and incremental method (INC□) by mixed use.
- 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 continuous trajectory control. However, the acceleration/deceleration processing at a pass point is not executed for 2 to 4 axes continuous trajectory control, so be careful of the servo error occurrence, etc.
- When the FIN acceleration/deceleration is not set in the program with only one pass point, this operation is the same as PTP control.
- Speed change is possible after the start. Note the following points at the speed change.
  - The central point-specified circular interpolation is included the continuous trajectory 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 (☞ Page 234 Allowable error range for circular interpolation) may not function normally.
    When the central point-specified circular interpolation as positioning method is used at the continuous trajectory control, set the start address, central point address and end address becomes arc correctly.
  - 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.



- 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: 1A58H) is stored in the "[Md.1004] Error code (R: D32007+48n/Q: D7+20n)" for each axis.
- If positioning to outside the stroke limit range is executed after the start, the minor error (error code: 1A18H, 1A1AH) is stored in the "[Md.1004] Error code (R: D32007+48n/Q: D7+20n)" for each axis and a deceleration stop is executed.
- The minimum travel value between continuous trajectory control pass points is shown below:
  Positioning speed drops if the distance between pass points is short the minimum travel value.

Command speed per second (control unit/s) × Main cycle [s] < Travel distance [control unit]

Ex.

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] × 0.02 [s] = 0.2 [mm]

Set the travel distance to more than 0.2 [mm].

Specification of pass points by repetition instructions

This section describes the method of the pass points for which executes between any pass points repeatedly.

○: Must be set, △: Set if required

Servo instruction	Positioning method	Number of control axes	Positioning data set in servo instructions																																	
			Common							Arc				OSC				Parameter block											Others							
			Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Number of pitches	Starting angle	Amplitude	Frequency	Reference axis No. *1	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	Bias speed at start	Repeat condition	Program No.	Command speed (Continuous trajectory)	Skip	FIN acceleration/deceleration	WAIT-ON/OFF	Fixed position stop acceleration/deceleration time	Fixed position stop
FOR-TIMES FOR-ON FOR-OFF	—	—																											○							
NEXT	—	—																																		

*1 Only when the reference axis speed is specified

Processing details

The first of repetition range is set by the following instructions.

■FOR-TIMES (number of loops setting)

- The repetition range set specified number of times is executed repeatedly.
- The setting range is 1 to 32767. Outside the range of -32768 to 0 is controlled as a setting of "1".
- A decimal constant (K), a hexadecimal constant (H), or a word device can be used for the number of repetition times. Refer to the following for the setting range of usable devices.

  MELSEC iQ-R Motion controller Programming Manual (Common)

■FOR-ON (Loop-out trigger condition setting)

- The repetition range set until the specified bit device turns on is executed repeatedly.
- A bit device (or a specified bit in a word device) can be used for the loop-out trigger condition. Refer to the following for the setting range of usable devices.

  MELSEC iQ-R Motion controller Programming Manual (Common)

■FOR-OFF (loop-out trigger condition setting)

- The repetition range set until the specified bit device turns off is executed repeatedly.
- A bit device (or a specified bit in a word device) can be used for the loop-out trigger condition. Refer to the following for the setting range of usable devices.

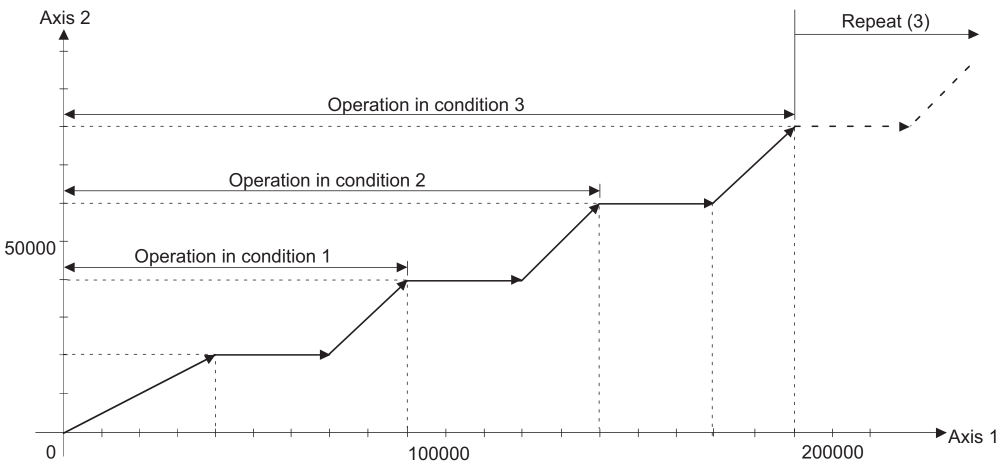
  MELSEC iQ-R Motion controller Programming Manual (Common)

■Repetition control operation

The repetition control operation using FOR-TIMES, FOR-ON and FOR-OFF is shown below.

```
<K 701>
CPSTART2
  Axis        1
  Axis        2
  Speed               1000
ABS-2
  Axis        1,     40000
  Axis        2,     20000
 (1)
                       (2)
INC-2
  Axis        1,     30000 ┐
  Axis        2,         0 │
INC-2                      ├ (3)
  Axis        1,     20000 │
  Axis        2,     20000 ┘
NEXT
CPEND
```

(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)



Precautions

- 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.

Travel value of one operation cycle [control unit] = Command speed per second [control unit/s] × Operation cycle [s]

Ex.

Command speed: 100.00 [mm/min], Operation cycle: 0.444 [ms]

$$\frac{100}{60}\ [\text{mm/s}] \times 0.444\ [\text{ms}] = 0.74\ [\mu\text{m}]$$

If the travel value of the pass point exceeds 0.74 [μm], it will loop-out normally.

• 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

• At the end positioning address detection, an overrun occurs if the deceleration distance is insufficient for the output speed, and a minor error (error code: 1A58H) occurs. If the end point has a movement amount 0, a minor error does not occur.

Program example

The program for repeating continuous trajectory control of Axis 2 and Axis 3 is explained as an example.
This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■Positioning conditions

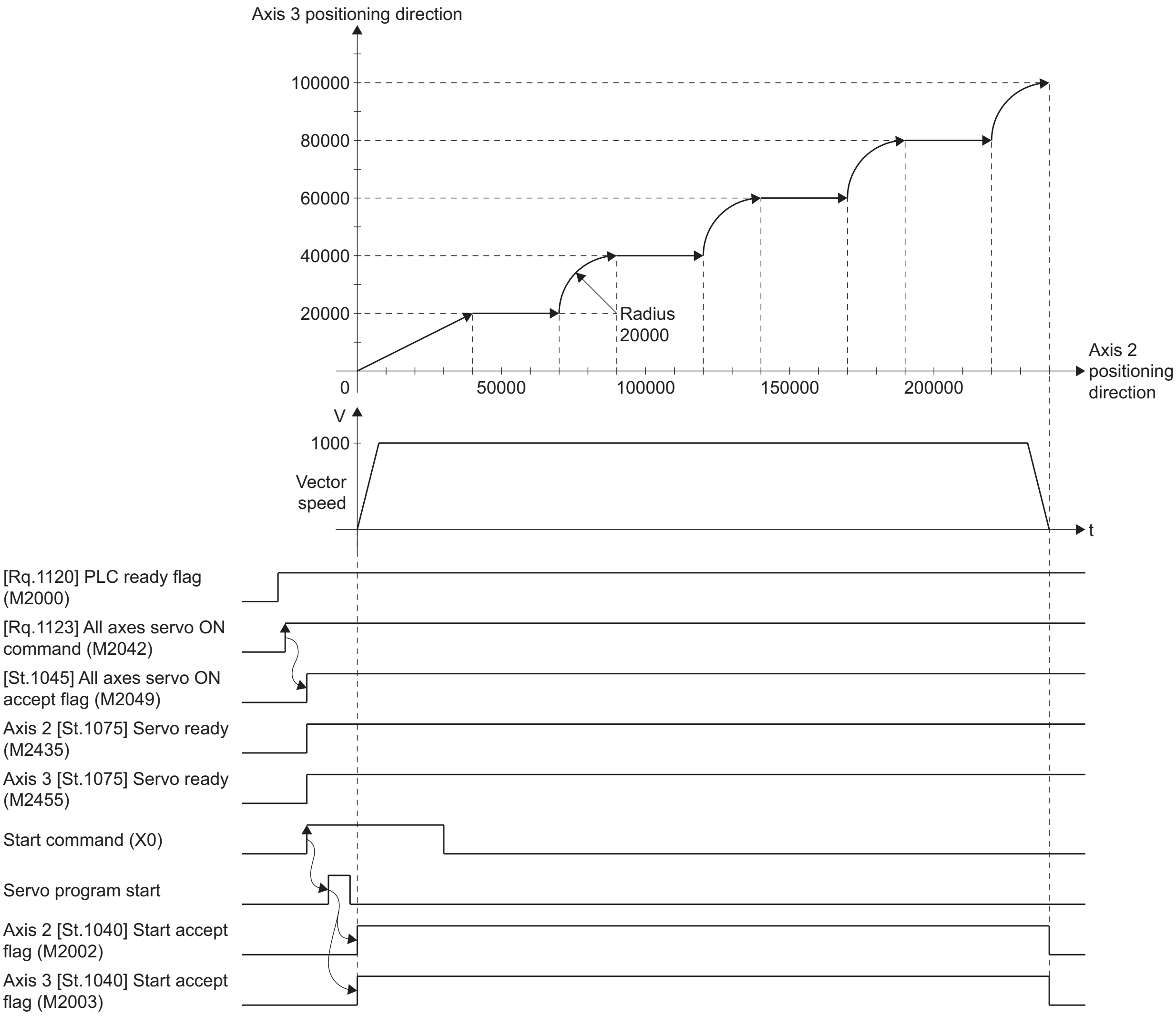
• Continuous trajectory control conditions are shown below.

Item	Setting
Servo program No.	510
Control axis	Axis 2, Axis 3
Positioning speed	10000

• Continuous trajectory control start command: X0 Leading edge (OFF → ON)

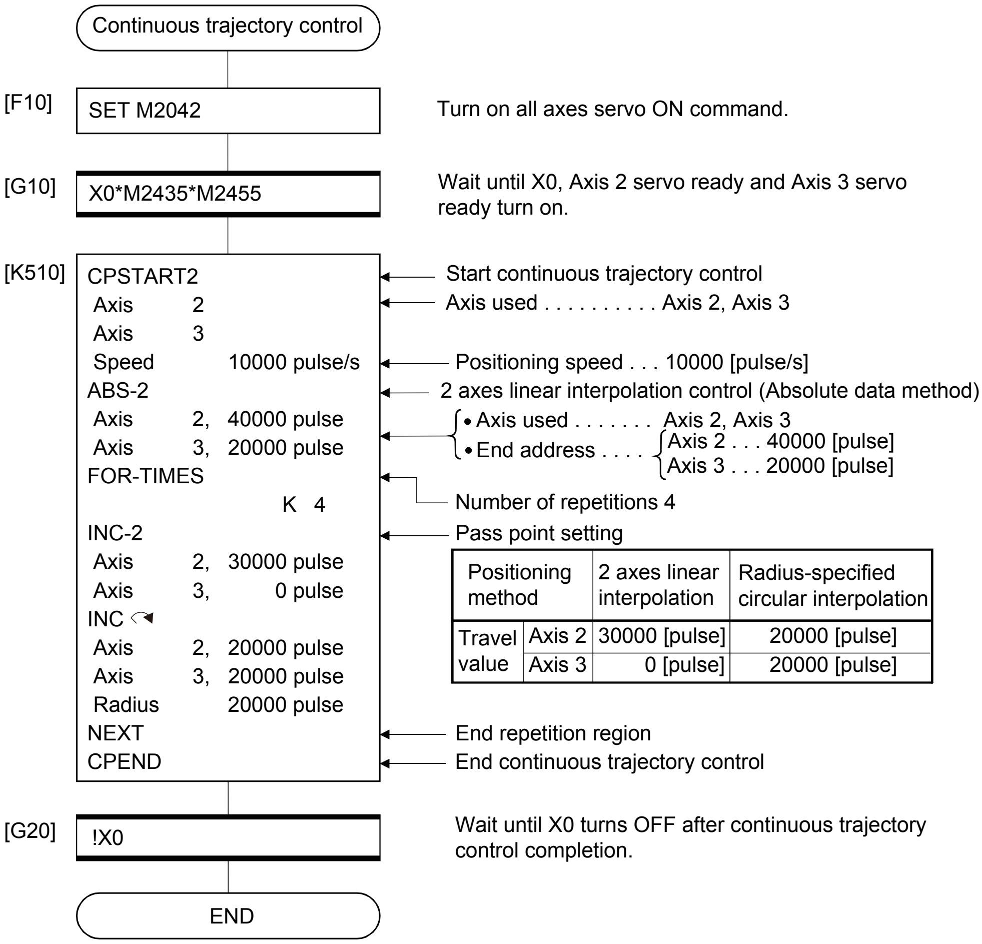
■Operation timing

Operation timing for continuous trajectory control is shown below.



■Motion SFC program

The Motion SFC program for executing the servo program (No.510) for continuous trajectory control is shown below.



Positioning method		2 axes linear interpolation	Radius-specified circular interpolation
Travel value	Axis 2	30000 [pulse]	20000 [pulse]
	Axis 3	0 [pulse]	20000 [pulse]

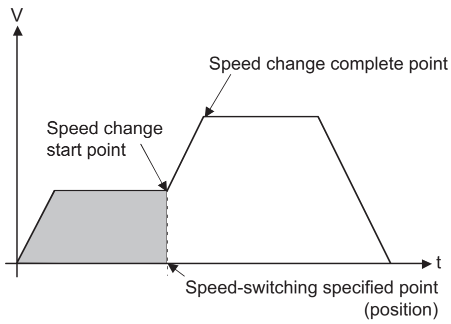
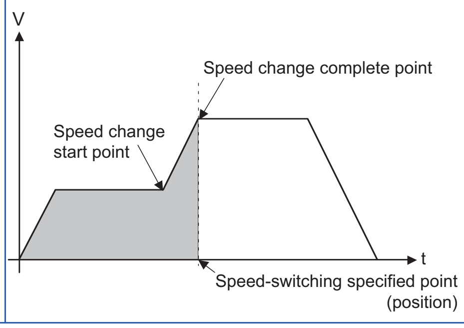
*1 Example of the above Motion SFC program is started using the automatic start or sequence program.

Speed-switching by instruction execution

The speed can be specified for each pass point during the continuous trajectory control instruction.
The speed change from a point can be specified directly or indirectly in the servo program.

Precautions

- The speed switching during servo instruction is possible at the continuous trajectory control for 1 to 4 axes.
- The speed command can be set for point.
- By turning on the "[Rq.1122] Speed-switching point specified flag (R: M30040/Q: M2040)" before the start, the point which completes speed change can be specified. The speed change timing at the flag ON/OFF.

[Rq.1122] Speed-switching point specified flag (R: M30040/Q: M2040)	**Details**
OFF	The speed change starts with the specified speed-switching point. 
ON	The speed change ends with the specified speed-switching point. 

Program example

The program for switching speed of Axis 1 and Axis 2 by turning ON "[Rq.1122] Speed-switching point specified flag (M2040)" during the continuous trajectory control instruction is explained as an example.

This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■Positioning conditions

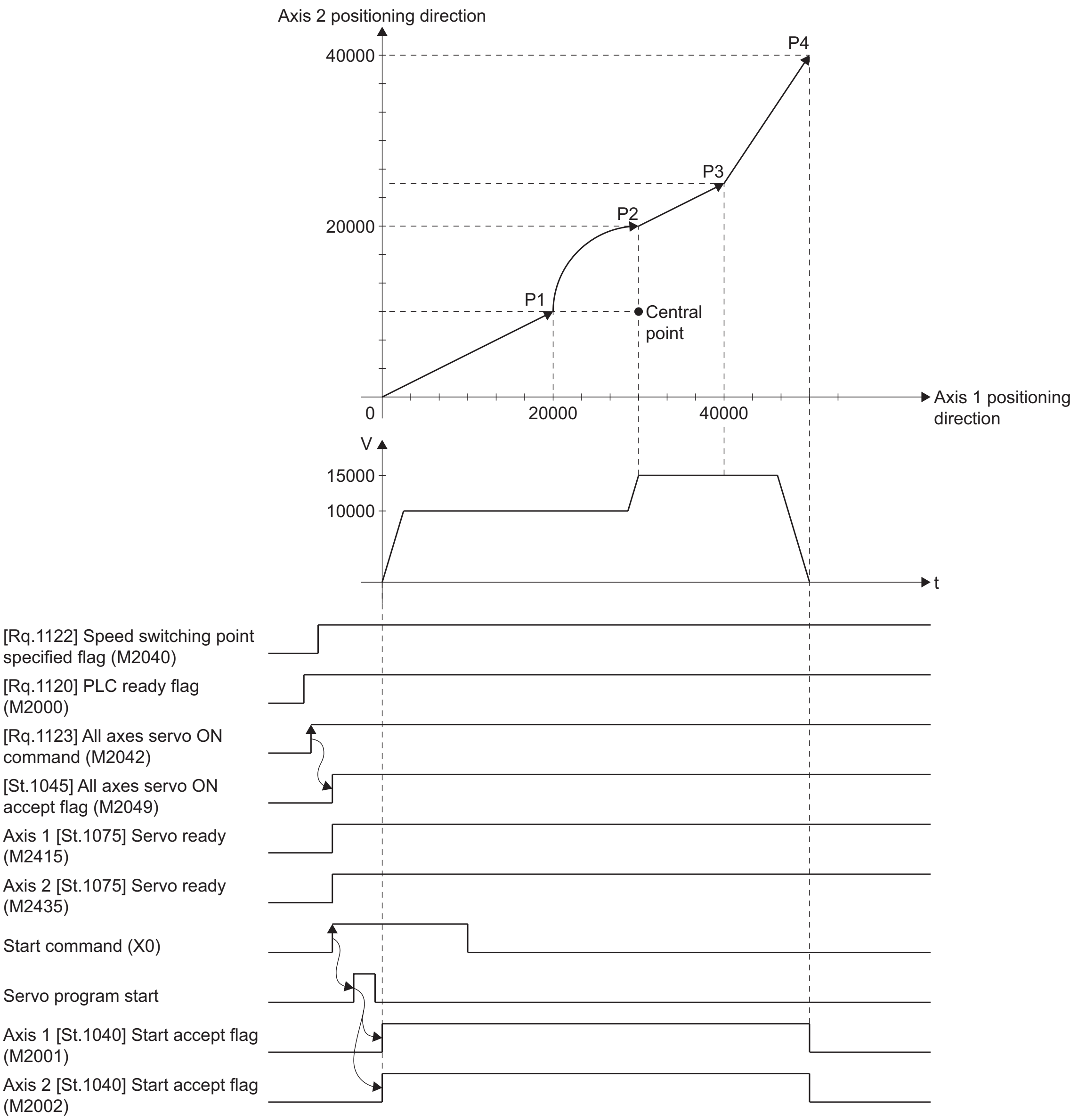
- Speed switching conditions are shown below.

Item		Setting			
Servo program No.		310			
Positioning speed		10000		15000	
Positioning method		2 axes linear interpolation	Central point-specified circular interpolation	2 axes linear interpolation	2 axes linear interpolation
Pass point	Axis 1	20000	30000	40000	50000
	Axis 2	10000	20000	25000	40000

- The continuous trajectory control start command for speed switching: X0 Leading edge (OFF → ON)

■Operation timing and speed-switching positions

Operation timing and positions for speed switching are shown below.



■Motion SFC program

The Motion SFC program for executing the servo program (No. 310) for speed switching during instruction is shown below.

```
        Speed-switching during
        instruction execution

[F10]   SET M2042                      Turn on all axes servo ON command.

[G10]   X0*M2415*M2435                 Wait until X0, Axis 1 servo ready and Axis 2 servo
                                       ready turn ON.

[F20]   SET M2040=X10                  Speed-switching point specified flag turn ON when
        RST M2040=!X10                 X10 turn ON.
                                       Speed-switching point specified flag turn OFF
                                       when X10 turn OFF.

[K310]  CPSTART2
         Axis     1
         Axis     2
         Speed        10000 pulse/s
        ABS-2                          <---- Set P1
         Axis     1,  20000 pulse
         Axis     2,  10000 pulse
        ABS                            <---- Set P2
         Axis     1,  30000 pulse
         Axis     2,  20000 pulse
         Center   1,  30000 pulse
         Center   2,  10000 pulse
        ABS-2                          <---- Set P3
         Axis     1,  40000 pulse
         Axis     2,  25000 pulse
         Speed        15000 pulse/s    <---- Speed change
        ABS-2                          <---- Set P4
         Axis     1,  50000 pulse
         Axis     2,  40000 pulse
        CPEND

[G20]   !X0                            Wait until X0 turn OFF after continuous trajectory
                                       control completion.

        END
```

*1 Example of the above Motion SFC program is started using the automatic start or sequence program.

1 axis continuous trajectory control

Continuous trajectory control for 1 axis.

○: Must be set, △: Set if required

Servo instruction		Positioning method	Number of control axes	Positioning data set in servo instructions																																	
				Common							Arc				OSC				Parameter block											Others							
				Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Number of pitches	Starting angle	Amplitude	Frequency	Reference axis No.[*1]	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	Bias speed at start	Repeat condition	Program No.	Command speed (Continuous trajectory)	Skip	FIN acceleration/deceleration	WAIT-ON/OFF	Fixed position stop acceleration/deceleration time	Fixed position stop
Start	CPSTART1	—	1	△	○		○												△	△	△	△	△	△	△		△	△	△					△			
End	CPEND	—	—					△																													
Pass point	ABS-1	Absolute	1		○	○			△	△																						△	△		△		
	INC-1	Incremental	1		○	○			△	△																						△	△		△		

*1 Only when the reference axis speed is specified

Processing details

■Start and end for 1 axis continuous trajectory control

1 axis continuous trajectory control is started and ended by the following instructions:

Instruction	Description
CPSTART1	Starts the 1 axis continuous trajectory control. Sets the axis No. and command speed.
CPEND	Ends the 1 axis continuous trajectory control for CPSTART1.

■Positioning control method to the pass point

The positioning control to change control is specified with the following instructions:

Instruction	Description
ABS-1, INC-1	Sets the 1 axis linear positioning control. Control details are identical to 1 axis linear positioning control. (☞ Page 270 1 Axis Linear Positioning Control)

Program example

The program for repeating 1 axis continuous trajectory control of Axis 4 is explained as an example.
This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

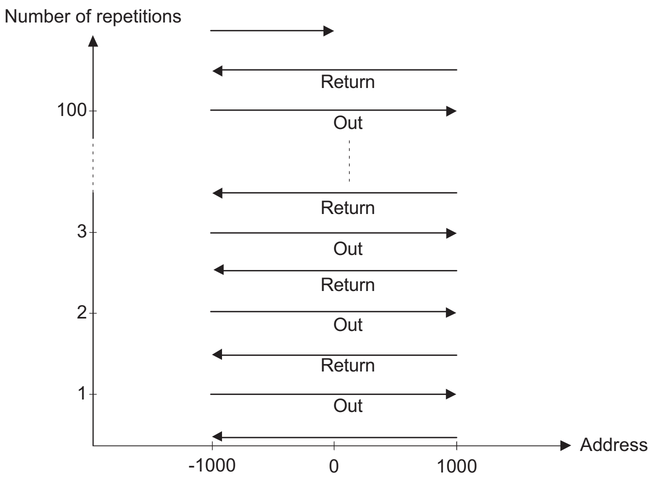
■Positioning conditions

• Continuous trajectory control conditions are shown below.

Item		Setting
Servo program No.		500
Control axis		Axis 4
Positioning speed		10000
Number of repetitions		100
Pass point travel value	P1	-1000
	P2	2000
	P3	-2000
	P4	1000

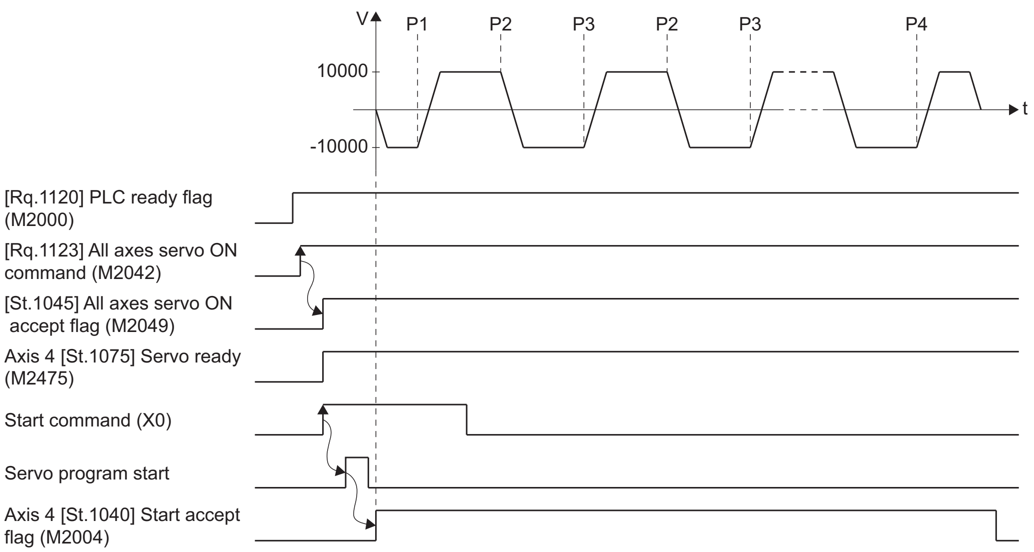
• Continuous trajectory control start command: X0 Leading edge (OFF → ON)

■Details of positioning operation



■Operation timing

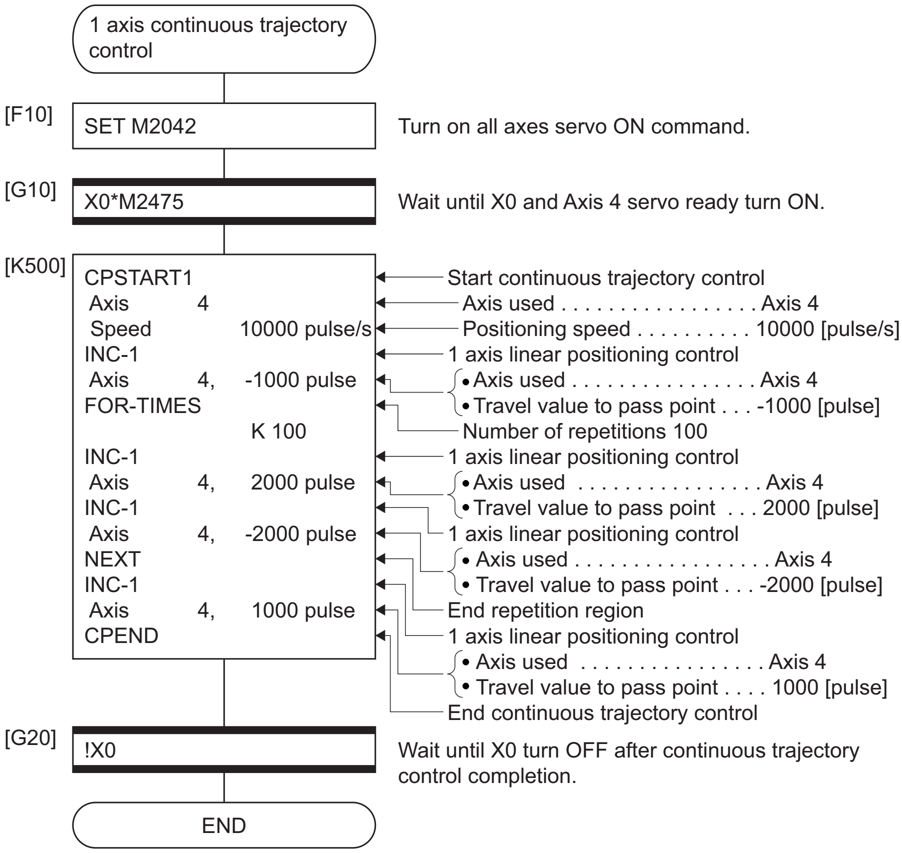
Operation timing for servo program No.500 is shown below.



5

■Motion SFC program

The Motion SFC program for executing the servo program (No. 500) for 1 axis continuous trajectory control is shown below.



*1 Example of the above Motion SFC program is started using the automatic start or sequence program.

2 to 4 axes continuous trajectory control

Continuous trajectory control for 2 to 4 axes.

○: Must be set, △: Set if required

	Servo instruction	Positioning method	Number of control axes	Positioning data set in servo instructions																																	
				Common							Arc			OSC				Parameter block											Others								
				Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Number of pitches	Starting angle	Amplitude	Frequency	Reference axis No. *1	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	Bias speed at start	Repeat condition	Program No.	Command speed (Continuous trajectory)	Skip	FIN acceleration/deceleration	WAIT-ON/OFF	Fixed position stop acceleration/deceleration time	Fixed position stop
Start	CPSTART2	—	2	△	○		○												△	△	△	△	△	△	△	△	△	△	△					△			
	CPSTART3	—	3	△	○		○												△	△	△	△	△	△	△	△	△	△	△					△			
	CPSTART4	—	4	△	○		○												△	△	△	△	△	△	△	△	△	△	△					△			
End	CPEND	—	—					△																													
Pass point	ABS-2	Absolute	2		○	○			△	△																						△	△		△		
	ABS-3		3		○	○			△	△																						△	△		△		
	ABS-4		4		○	○			△	△																						△	△		△		
	ABS		2		○	○			△	△	○																					△	△		△		
	ABS ABS ABS ABS				○	○			△	△		○																				△	△		△		
	ABS ABS				○	○			△	△			○																			△	△		△		
	INC-2	Incremental	2		○	○			△	△																						△	△		△		
	INC-3		3		○	○			△	△																						△	△		△		
	INC-4		4		○	○			△	△																						△	△		△		
	INC		2		○	○			△	△	○																					△	△		△		
	INC INC INC INC				○	○			△	△		○																				△	△		△		
	INC INC				○	○			△	△			○																			△	△		△		

*1 Only when the reference axis speed is specified

Processing details

■Start and end for 2 to 4 axes continuous trajectory control

2 to 4 axes continuous trajectory control is started and ended using the following instructions:

Instruction	Description
CPSTART2	Starts the 2 axes continuous trajectory control. Sets the axis No. and command speed.
CPSTART3	Starts the 3 axes continuous trajectory control. Sets the axis No. and command speed.
CPSTART4	Starts the 4 axes continuous trajectory control. Sets the axis No. and command speed.
CPEND	Ends the 2, 3, or 4 axes continuous trajectory control for CPSTART2, CPSTART3, or CPSTART4.

■Positioning control method to the pass point

Positioning control to change control is specified using the following instructions:

Instruction	Description
ABS-2, INC-2	Sets 2 axes linear interpolation control. Control details are identical to 2 axes linear interpolation control. (☞ Page 273 2 Axes Linear Interpolation Control)
ABS-3, INC-3	Sets 3 axes linear interpolation control. Control details are identical to 3 axes linear interpolation control. (☞ Page 276 3 Axes Linear Interpolation Control)
ABS-4, INC-4	Sets 4 axes linear interpolation control. Control details are identical to 4 axes linear interpolation control. (☞ Page 280 4 Axes Linear Interpolation Control)
ABS/INC	Sets circular interpolation control using auxiliary point specification. Control details are identical to auxiliary point-specified circular interpolation control. (☞ Page 283 Auxiliary Point-Specified Circular Interpolation Control)
ABS/INC , ABS/INC , ABS/INC , ABS/INC	Sets circular interpolation control using radius specification. Control details are identical to radius-specified circular interpolation control. (☞ Page 287 Radius-Specified Circular Interpolation Control)
ABS/INC , ABS/INC	Sets circular interpolation control using center point specification. Control details are identical to central point-specified circular interpolation control. (☞ Page 291 Central Point-Specified Circular Interpolation Control)

Precautions

For circular interpolation control at the pass points for continuous trajectory 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 example

This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■Program example 1

The program for repeating 2 axis continuous trajectory control of Axis 2 and Axis 3 is explained as an example.

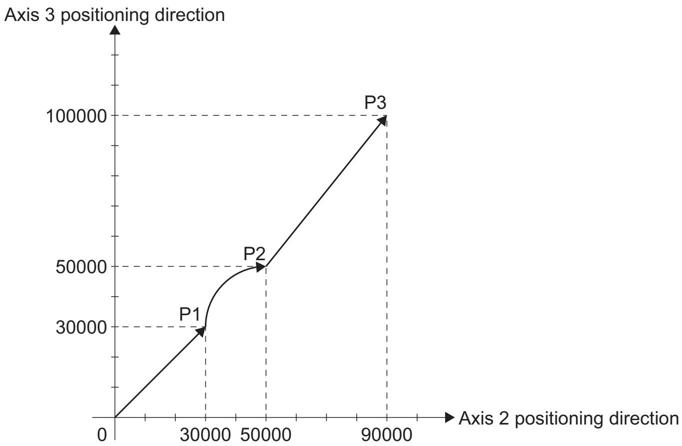
- Positioning conditions
  - Continuous trajectory control conditions are shown below.

Item		Setting		
Servo program No.		505		
Positioning speed		10000		
Positioning method		2 axes linear interpolation	Radius-specified circular interpolation	2 axes linear interpolation
Pass point	Axis 2	30000	50000	90000
	Axis 3	30000	50000	100000

- Continuous trajectory control start command: X0 Leading edge (OFF → ON)

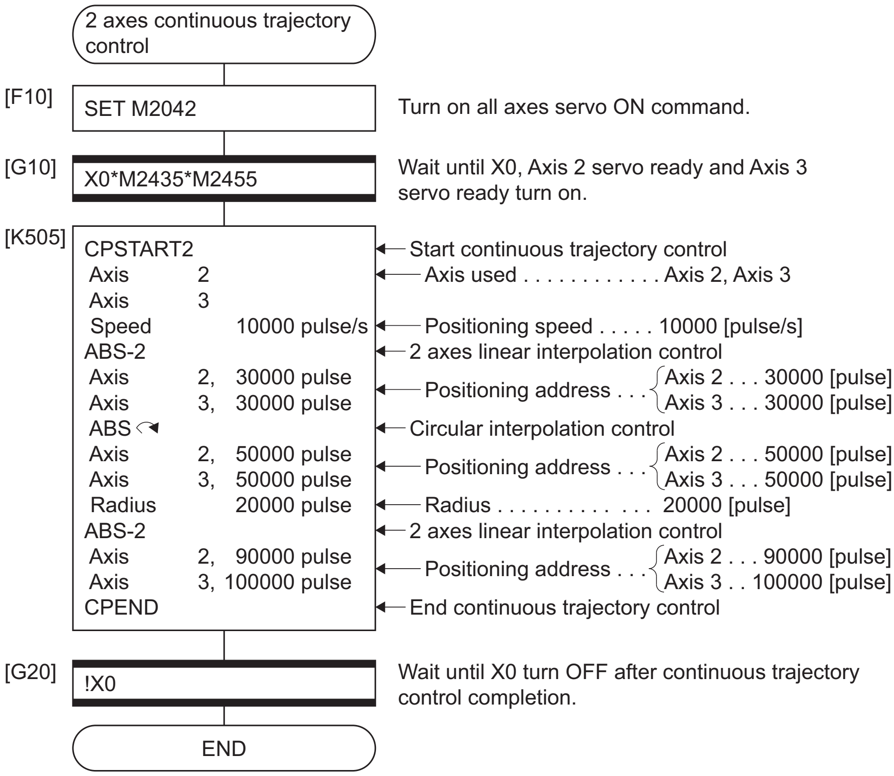
- Positioning operation details

  Axis 2 and axis 3 servomotors is used for positioning operation. Positioning details for Axis 2 and Axis 3 servomotors are shown below.



- Motion SFC program

  The Motion SFC program for executing the servo program (No. 505) for 2 axes continuous trajectory control is shown below.



*1 Example of the above Motion SFC program is started using the automatic start or sequence program.

■Program example 2

The program for performing 4 axes continuous trajectory control of Axis 1, Axis 2, Axis 3, and Axis 4 is explained as an example.

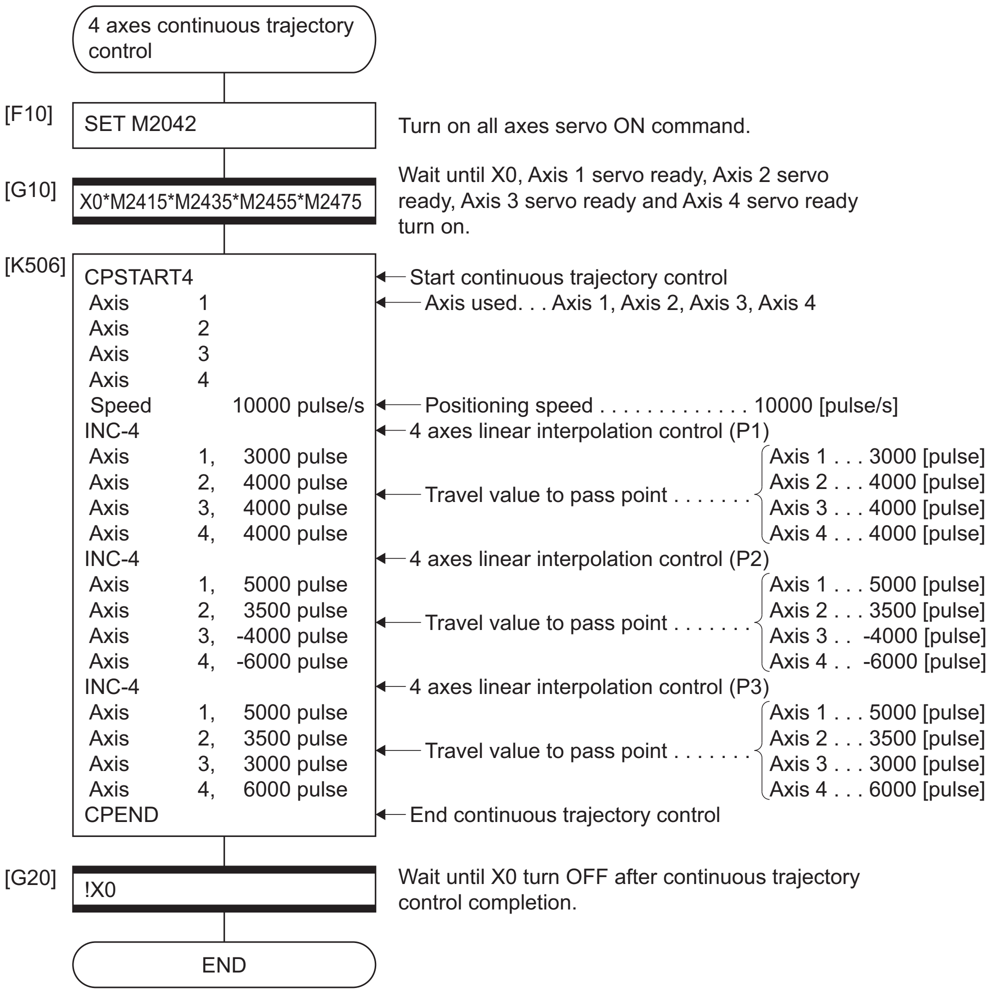
- Positioning conditions
  - Continuous trajectory control conditions are shown below.

Item		Setting		
Servo program No.		506		
Positioning speed		10000		
Positioning method		4 axes linear interpolation	4 axes linear interpolation	4 axes linear interpolation
Pass point	Axis 1	3000	5000	5000
	Axis 2	4000	3500	3500
	Axis 3	4000	-4000	3000
	Axis 4	4000	-6000	6000

  - Continuous trajectory control start command: X0 Leading edge (OFF → ON)

- Motion SFC program

  The Motion SFC program for executing the servo program (No. 506) for 4 axes continuous trajectory control is shown below.



*1 Example of the above Motion SFC program is started using the automatic start or sequence program.

Continuous trajectory control for helical interpolation

The helical interpolation can be specified as the positioning control method to pass point for 3 or 4 axes continuous trajectory control.

Starting or ending instruction for continuous trajectory control uses the same CPSTART3, CPSTART4 or CPEND as 3 or 4 axes continuous trajectory control instruction.

○: Must be set, △: Set if required

<table>
<tr><th rowspan="3">Servo instruction</th><th rowspan="3">Positioning method</th><th rowspan="3">Number of control axes</th><th colspan="34">Positioning data set in servo instructions</th></tr>
<tr><th colspan="7">Common</th><th colspan="4">Arc</th><th colspan="3">OSC</th><th rowspan="2">Reference axis No. *1</th><th colspan="11">Parameter block</th><th colspan="8">Others</th></tr>
<tr><th>Parameter block No.</th><th>Axis</th><th>Address/travel value</th><th>Command speed</th><th>Dwell time</th><th>M-code</th><th>Torque limit value</th><th>Auxiliary point</th><th>Radius</th><th>Central point</th><th>Number of pitches</th><th>Starting angle</th><th>Amplitude</th><th>Frequency</th><th>Interpolation control unit</th><th>Speed limit value</th><th>Acceleration time</th><th>Deceleration time</th><th>Rapid Stop deceleration time</th><th>Torque limit value</th><th>Deceleration processing on stop input</th><th>Allowable error range for circular interpolation</th><th>S-curve ratio</th><th>Advanced S-curve acceleration/deceleration</th><th>Bias speed at start</th><th>Repeat condition</th><th>Program No.</th><th>Command speed (Continuous trajectory)</th><th>Skip</th><th>FIN acceleration/deceleration</th><th>WAIT-ON/OFF</th><th>Fixed position stop acceleration/deceleration time</th><th>Fixed position stop</th></tr>
<tr><td>ABH</td><td rowspan="7">Absolute</td><td rowspan="14">2</td><td></td><td>○</td><td>○</td><td></td><td></td><td>△</td><td>△</td><td>○</td><td></td><td></td><td>○</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>△</td><td>△</td><td></td><td>△</td><td></td><td></td></tr>
<tr><td>ABH</td><td rowspan="4"></td><td rowspan="4">○</td><td rowspan="4">○</td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4">△</td><td rowspan="4">△</td><td rowspan="4"></td><td rowspan="4">○</td><td rowspan="4"></td><td rowspan="4">○</td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4">△</td><td rowspan="4">△</td><td rowspan="4"></td><td rowspan="4">△</td><td rowspan="4"></td><td rowspan="4"></td></tr>
<tr><td>ABH</td></tr>
<tr><td>ABH</td></tr>
<tr><td>ABH</td></tr>
<tr><td>ABH</td><td rowspan="2"></td><td rowspan="2">○</td><td rowspan="2">○</td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2">△</td><td rowspan="2">△</td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2">○</td><td rowspan="2">○</td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2">△</td><td rowspan="2">△</td><td rowspan="2"></td><td rowspan="2">△</td><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>ABH</td></tr>
<tr><td>INH</td><td rowspan="7">Incremental</td><td></td><td>○</td><td>○</td><td></td><td></td><td>△</td><td>△</td><td>○</td><td></td><td></td><td>○</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>△</td><td>△</td><td></td><td>△</td><td></td><td></td></tr>
<tr><td>INH</td><td rowspan="4"></td><td rowspan="4">○</td><td rowspan="4">○</td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4">△</td><td rowspan="4">△</td><td rowspan="4"></td><td rowspan="4">○</td><td rowspan="4"></td><td rowspan="4">○</td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4">△</td><td rowspan="4">△</td><td rowspan="4"></td><td rowspan="4">△</td><td rowspan="4"></td><td rowspan="4"></td></tr>
<tr><td>INH</td></tr>
<tr><td>INH</td></tr>
<tr><td>INH</td></tr>
<tr><td>INH</td><td rowspan="2"></td><td rowspan="2">○</td><td rowspan="2">○</td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2">△</td><td rowspan="2">△</td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2">○</td><td rowspan="2">○</td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2">△</td><td rowspan="2">△</td><td rowspan="2"></td><td rowspan="2">△</td><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>INH</td></tr>
</table>

*1 Only when the reference axis speed is specified

Processing details

Helical interpolation specified methods for continuous trajectory control are shown below.

Servo instruction	Positioning method	Circular interpolation specified method
ABH	Absolute	Radius-specified method less than CW180°
INH	Incremental	
ABH	Absolute	Radius-specified method less than CCW180°
INH	Incremental	
ABH	Absolute	Radius-specified method CW180° or more.
INH	Incremental	
ABH	Absolute	Radius-specified method CCW180° or more.
INH	Incremental	
ABH	Absolute	Central point-specified method CW
INH	Incremental	
ABH	Absolute	Central point-specified method CCW
INH	Incremental	
ABH	Absolute	Auxiliary point-specified method
INH	Incremental	

Precautions

- Specify any 3 axes among 4 controlled axes in the helical interpolation control at the pass point for 4 axes continuous trajectory control (CPSTART4). When axes other than the axes specified for helical interpolation control are detected, an error occurs, resulting in a deceleration stop.
- 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.)
- Skip function toward the helical interpolation-specified each point for continuous trajectory 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.
- FIN signal wait function toward the helical interpolation specified each pass point for continuous trajectory 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.
- If negative speed change toward the helical interpolation-specified each pass point for continuous trajectory control is executed, it can be returned before 1 point during positioning control.
- Speed-switching point-specified flag is effective toward the helical interpolation-specified each pass point for continuous trajectory control.

Program example

This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■Program 1

- Motion SFC program

  The Motion SFC program for executing the servo program (No. 510) for specifying helical interpolation at the pass points of 3 axes continuous trajectory control is shown below.

Helical interpolation

[F10]	SET M2042	Turn ON all axes servo ON command.
[G10]	X0*M2415*M2435*M2455	Wait until X0, Axis 1 servo ready, Axis 2 servo ready and Axis 3 servo ready turn ON

[K510]

```
CPSTART3                              ← Continuous trajectory control
 Axis        1                        ← Axis used . . . Axis 1, Axis 2, Axis 3
 Axis        2
 Axis        3
 Speed                   10000        ← Positioning speed . . . . . 10000
ABS-3                                 ← 3 axes linear interpolation control (P1)
 Axis        1,           3000          Axis 1 . . . . . . . . . . . 3000
 Axis        2,           4000        ← Positioning address . . . Axis 2 . . . . . . . . . . . 4000
 Axis        3,           4000          Axis 3 . . . . . . . . . . . 4000
ABH                                   ← 3 axes helical interpolation control (P2)
 Axis        1,           5000          Axis 1 . . . . . . . . . . . 5000
 Axis        2,           3500          Axis 2 . . . . . . . . . . . 3500
 Linear axis 3,          -4000        ← Positioning address . . . Axis 3 . . . . . . . . . . -4000
 Number of pitches           6          Number of pitches . . . . 6
 Radius                   1000          Radius . . . . . . . . . . 1000
ABS-3                                 ← 3 axes linear interpolation control (P3)
 Axis        1,           5000          Axis 1 . . . . . . . . . . . 5000
 Axis        2,           3500        ← Positioning address . . . Axis 2 . . . . . . . . . . . 3500
 Axis        3,           3000          Axis 3 . . . . . . . . . . . 3000
CPEND                                 ← End continuous trajectory control
```

[G12]	!M2001*!M2002*!M2003	Wait until Axis 1, Axis 2 and Axis 3 start accept flag turn OFF

END

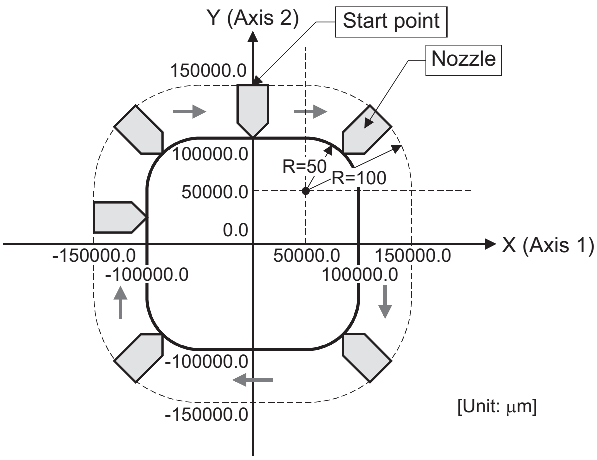
Control with the following speed.
- For linear/circular interpolation : Vector speed for number of interpolation axes.
- For helical interpolation : 2 axes vector speed for circular interpolation.

■Program 2

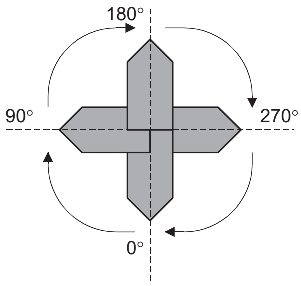
The program that controls the nozzle direction so that the nozzle stays perpendicular to the circular arc curve by 3 axes continuous trajectory control of Axis 1, Axis 2, and Axis 3 is explained as an example.

- Positioning operation details

  The operation to start as the following figure from start point and witch keeps a nozzle at right angles toward the contour of line and that it goes around the contour and witch is returned to start point. It is the following program when a helical interpolation function is used.



X,Y-axis plane



Z-axis (Rotation angle)

- Positioning conditions
  - Helical interpolation conditions for continuous trajectory control are shown below.

Item		Setting				
Servo program No.		61, 62				
Positioning speed		1000.00 [mm/min]				
Control axis		Positioning address			Central point	
		Axis 1 [μm]	Axis 2 [μm]	Axis 3 [degree]	Axis 1 [μm]	Axis 2 [μm]
Pass point	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	—	—
	P4	50000.0	-150000.0	180.00000	50000.0	-50000.0
	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.

- Continuous trajectory control start command: X0 Leading edge (OFF → ON)

• Motion SFC program

Motion SFC program for is shown below.

Helical interpolation

[F10]
```
SET M2042
```
Turn ON all axes servo ON command.

[G10]
```
X0*M2415*M2435*M2455
```
Wait until X0, Axis 1 servo ready, Axis 2 servo ready and Axis 3 servo ready turn ON

[K61]
```
ABS-3
 Axis        1,         0.0 µm
 Axis        2,    150000.0 µm
 Axis        3,     0.00000 degree
 Vector speed      30000.00 mm/min
```
3 axes linear interpolation control (Travel to start point)
- Axis used .... Axis 1, Axis 2, Axis 3
- Positioning address ....
  - Axis 1 ....0.0 [µm]
  - Axis 2 ....150000.0 [µm]
  - Axis 3 ....0.00000 [degree]

Command positioning speed
- Vector speed .... 30000.00 [mm/min]

[G11]
```
!M2001*!M2002*!M2003
```
Wait until Axis 1, Axis 2 and Axis 3 start accept flag turn OFF

[K62]
```
CPSTART3
 Axis        1
 Axis        2
 Axis        3
 Speed              1000.00 mm/min
ABS-3
 Axis        1,     50000.0 µm
 Axis        2,    150000.0 µm
 Axis        3,     0.00000 degree
ABH
 Axis        1,    150000.0 µm
 Axis        2,     50000.0 µm
 Linear Axis 3,    90.00000 degree
 Number of pitches        0
 Ctr.P.      1,     50000.0 µm
 Ctr.P.      2,     50000.0 µm
ABS-3
 Axis        1,    150000.0 µm
 Axis        2,    -50000.0 µm
 Axis        3,    90.00000 degree
ABH
 Axis        1,     50000.0 µm
 Axis        2,   -150000.0 µm
 Linear Axis 3,   180.00000 degree
 Number of pitches        0
 Ctr.P.      1,     50000.0 µm
 Ctr.P.      2,    -50000.0 µm
ABS-3
 Axis        1,    -50000.0 µm
 Axis        2,   -150000.0 µm
 Axis        3,   180.00000 degree
ABH
 Axis        1,   -150000.0 µm
 Axis        2,    -50000.0 µm
 Linear Axis 3,   270.00000 degree
 Number of pitches        0
 Ctr.P.      1,    -50000.0 µm
 Ctr.P.      2,    -50000.0 µm
ABS-3
 Axis        1,   -150000.0 µm
 Axis        2,     50000.0 µm
 Axis        3,   270.00000 degree
ABH
 Axis        1,    -50000.0 µm
 Axis        2,    150000.0 µm
 Linear Axis 3,     0.00000 degree
 Number of pitches        0
 Ctr.P.      1,    -50000.0 µm
 Ctr.P.      2,     50000.0 µm
ABS-3
 Axis        1,         0.0 µm
 Axis        2,    150000.0 µm
 Axis        3,     0.00000 degree
CPEND
```
3 axes continuous trajectory control start

Axis used .... Axis 1, Axis 2, Axis 3

Positioning speed ..... 1000.00 [mm/min]

3 axes linear interpolation control (P1)
- Positioning address ....
  - Axis 1 .... 50000.0 [µm]
  - Axis 2 .... 150000.0 [µm]
  - Axis 3 .... 0.00000 [degree]

3 axes helical interpolation control (P2)
- Positioning address ....
  - Axis 1 .... 150000.0 [µm]
  - Axis 2 .... 50000.0 [µm]
  - Axis 3 .... 90.00000 [degree]
  - Number of pitches 0
- Central point address of the arc ....
  - Axis 1 .... 50000.0 [µm]
  - Axis 2 .... 50000.0 [µm]

3 axes linear interpolation control (P3)
- Positioning address ....
  - Axis 1 .... 150000.0 [µm]
  - Axis 2 .... -50000.0 [µm]
  - Axis 3 .... 90.00000 [degree]

3 axes helical interpolation control (P4)
- Positioning address ....
  - Axis 1 .... 50000.0 [µm]
  - Axis 2 .... -150000.0 [µm]
  - Axis 3 .... 180.00000 [degree]
  - Number of pitches 0
- Central point address of the arc ....
  - Axis 1 .... 50000.0 [µm]
  - Axis 2 .... -50000.0 [µm]

3 axes linear interpolation control (P5)
- Positioning address ....
  - Axis 1 .... -50000.0 [µm]
  - Axis 2 .... -150000.0 [µm]
  - Axis 3 .... 180.00000 [degree]

3 axes helical interpolation control (P6)
- Positioning address ....
  - Axis 1 .... -150000.0 [µm]
  - Axis 2 .... -50000.0 [µm]
  - Axis 3 .... 270.00000 [degree]
  - Number of pitches 0
- Central point address of the arc ....
  - Axis 1 .... -50000.0 [µm]
  - Axis 2 .... -50000.0 [µm]

3 axes linear interpolation control (P7)
- Positioning address ....
  - Axis 1 .... -150000.0 [µm]
  - Axis 2 .... 50000.0 [µm]
  - Axis 3 .... 270.00000 [degree]

3 axes helical interpolation control (P8)
- Positioning address ....
  - Axis 1 .... -50000.0 [µm]
  - Axis 2 .... 150000.0 [µm]
  - Axis 3 .... 0.00000 [degree]
  - Number of pitches 0
- Central point address of the arc ....
  - Axis 1 .... -50000.0 [µm]
  - Axis 2 .... 50000.0 [µm]

3 axes linear interpolation control Start point
- Positioning address ....
  - Axis 1 .... 0.0 [µm]
  - Axis 2 .... 150000.0 [µm]
  - Axis 3 .... 0.00000 [degree]

[G12]
```
!M2001*!M2002*!M2003
```
Wait until Axis 1, Axis 2 and Axis 3 start accept flag turn OFF

END

Pass point skip function

This function stops positioning to executing point and executes positioning to next point, by setting a skip signal toward each pass point for continuous trajectory control.

Setting data

■Skip signal devices

A bit device (or a specified bit in a word device) can be used.

Refer to the following for the setting range of usable devices.

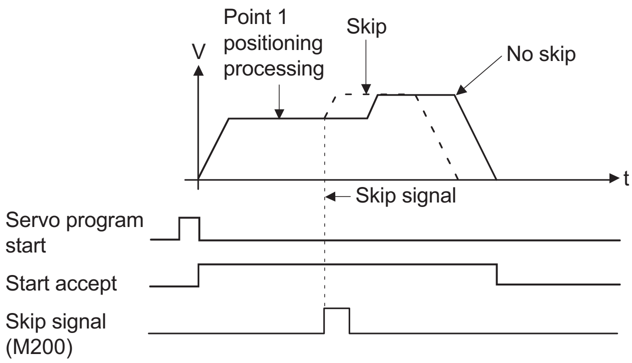
📖MELSEC iQ-R Motion controller Programming Manual (Common)

Precautions

- When an absolute circular interpolation or absolute helical interpolation is specified to since 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.
- If a skip signal is inputted at the end point, a deceleration stop occurs at that point and the program is ended.

Program example

```
<K   0>
CPSTART2
 Axis      1
 Axis      2
 Speed               10000
ABS-2
 Axis      1,       100000
 Axis      2,       200000
 Speed               10000
 Skip                 M200
ABS-2
 Axis      1,       200000
 Axis      2,       200000
 Speed               15000
CPEND
```



⚠CAUTION

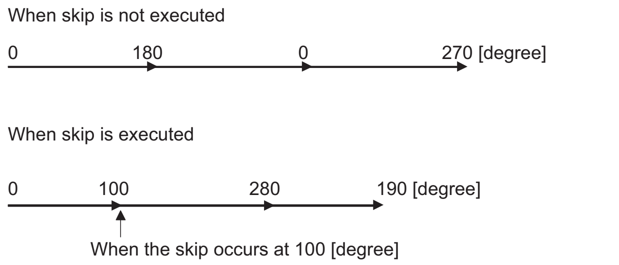
When a skip is specified during continuous trajectory control and the axis which has no stroke range [degree] is included, the operation at the execution of skip is described.

- 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:

Program example

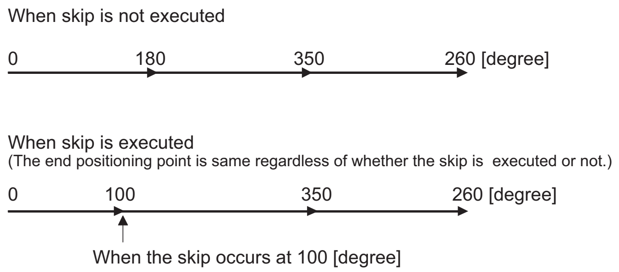
```
CPSTART1
 Axis          1
 Speed                  10.000
INC-1
 Axis          1,    180.00000
 Skip                     M100
INC-1
 Axis          1,    180.00000
INC-1
 Axis          1,    270.00000
CPEND
```



(2) Instruction immediately after the skip is ABS instruction:

Program example

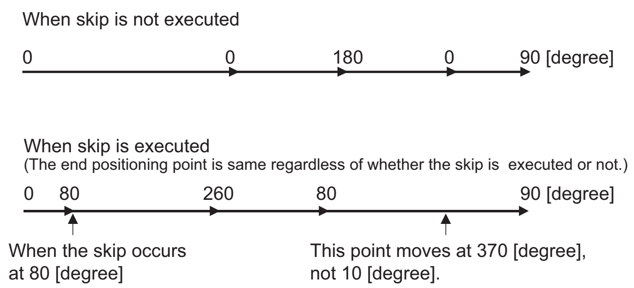
```
CPSTART1
 Axis          1
 Speed                  10.000
INC-1
 Axis          1,    180.00000
 Skip                     M100
ABS-1
 Axis          1,    350.00000
INC-1
 Axis          1,    270.00000
CPEND
```



(3) Instruction immediately after the skip is INC instruction and there is ABS instruction after that:

Program example

```
CPSTART1
 Axis          1
 Speed                  10.000
INC-1
 Axis          1,    360.00000
 Skip                     M100
INC-1
 Axis          1,    180.00000
INC-1
 Axis          1,    180.00000
ABS-1
 Axis          1,     90.00000
CPEND
```



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.

Setting data

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).

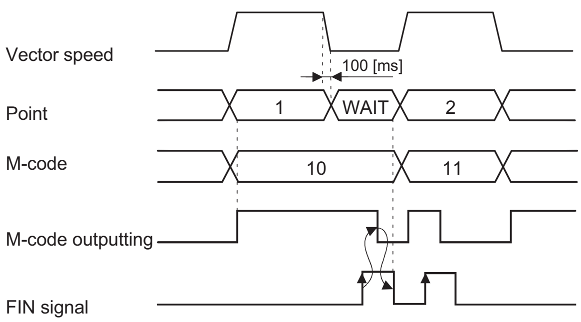
Precautions

- If the acceleration/deceleration time is specified outside the setting range, the warning (error code: 0A44H) will occur at the start and it is controlled with the acceleration/deceleration time of 1000 [ms].
- 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.
- When M-code is set at the end point, positioning ends after the FIN signal has turn OFF to ON to OFF.
- When the FIN acceleration/deceleration (Fixed acceleration/deceleration time method) is set in the continuous trajectory, the setting for advanced S-curve acceleration/deceleration is invalid.

Processing details

Servo program K0 for FIN signal wait function is shown below.

```
<K   0>
CPSTART2
 Axis          1
 Axis          2
 Speed              10000
 FIN                  100   [ms]
ABS-2
 Axis          1,  200000
 Axis          2,  200000
 M code                10
ABS-2
 Axis          1,  300000
 Axis          2,  250000
 M code                11
ABS-2
 Axis          1,  350000
 Axis          2,  300000
 M code                12
ABS-2
 Axis          1,  400000
 Axis          2,  400000
CPEND
```



Explanatory

1. When the positioning of point 1 starts, M-code 10 is output and M-code outputting signal turns ON.
2. FIN signal turns ON after performing required processing in the Motion SFC program.
   Transition to the next point does not execute until the FIN signal turns ON.
3. When the FIN signal turns ON, M-code outputting signal turns OFF.
4. When the FIN signal turns OFF after the M-code outputting signal turns OFF, the positioning to the next point 2 starts.

Program example

This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■FIN signal wait function by the PLC program

The program for executing the FIN signal wait function for continuous trajectory control of Axis 1 and Axis 2 is explained as an example.

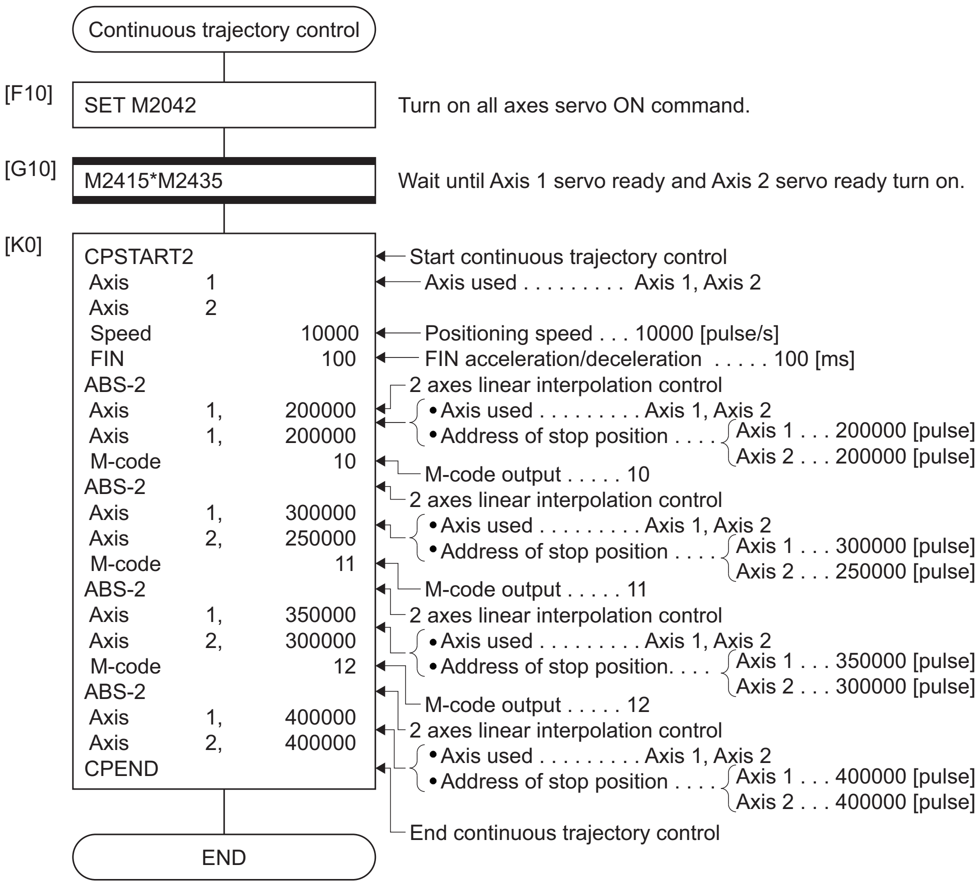
- Positioning conditions
  - Continuous trajectory control conditions are shown below.

Item		Setting			
Servo program No.		0			
Positioning speed		10000			
FIN acceleration/deceleration time		100 [ms]			
Positioning method		2 axes linear interpolation control			
Pass point	Axis 1	200000	300000	350000	400000
	Axis 2	200000	250000	300000	400000
M-code		10	11	12	—

  - Continuous trajectory control start command: X0 Leading edge (OFF → ON) (PLC CPU device)

- Motion SFC program

  The Motion SFC program for executing the servo program (No. 0) for continuous trajectory control is shown below.



• Sequence program

Sequence program for FIN signal wait function is shown below.

```
      X0
0   --| |------------------------[ DP.SFCS  H3E1   K110   M0   D0    ]-  Motion SFC program start request
      M0
11  --| |------------------------------------[ MOVP   K1     D51   ]-  Substitutes 1 for D51 after program start.
    M2419                                                              Reads data of D13 for Multiple CPU
14  --| |----+-----------[DP.DDRD   H3E1   D50   "D13"   D1   M2    ]-  system No.2 by turning M2419 on,
             |                                                         and stores in the data area D1 of self
             +--------------------------------------[ SET    M3219 ]-  M3219 is set
    M2419
26  --|/|-------------------------------------------[ RST    M3219 ]-  Resets M3219 by turning M2419 OFF.

28  ------------------------------------------------------[ END    ]-
```

*: Details of D1 is used as control.

*1 The automatic refresh setting example for FIN signal wait function is shown below.

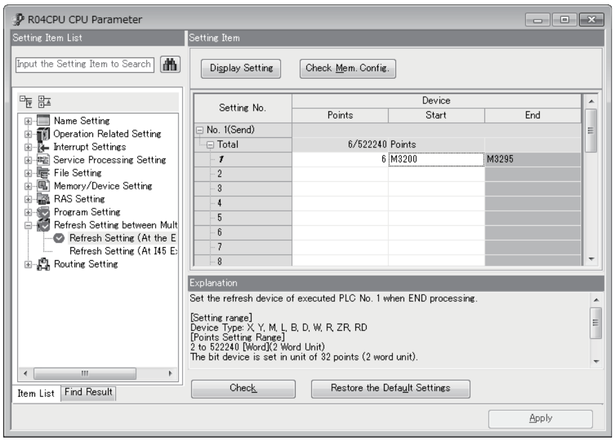
• Parameter setting

The refresh (END) setting example for FIN signal wait function is shown below.

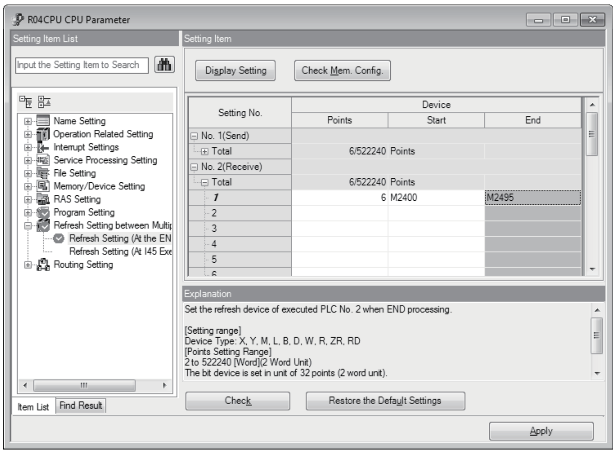
[Example of allocating the devices allocated as Motion dedicated devices to the PLC CPU]

■CPU No. 1 (PLC CPU) (GX Works3)

• Set the device transmitted to CPU No.2 (M3200 to M3295)

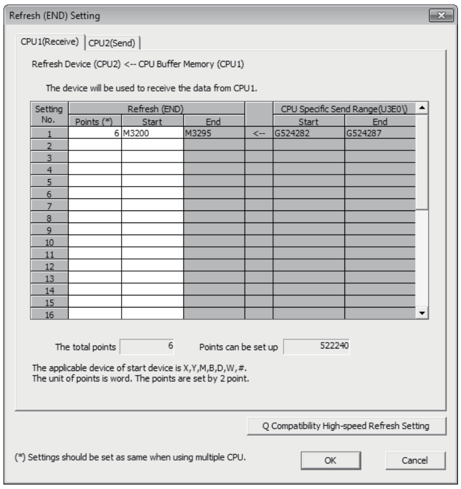


• Set the device received from CPU No.2 (M2400 to M2495)

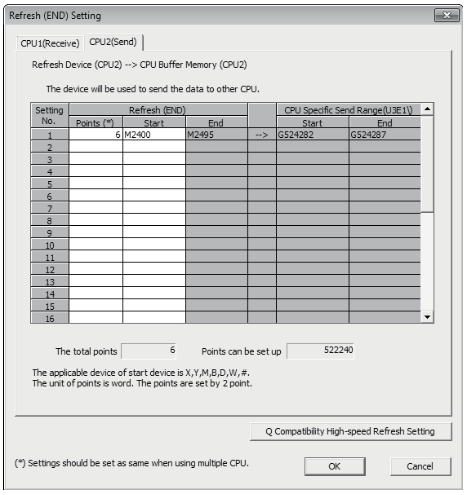


■CPU No. 2 (Motion CPU) (MT Developer2)

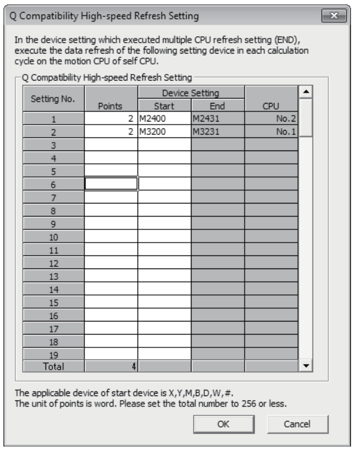
• Set the device received from CPU No.1 (M3200 to M3295)



• Set the device transmitted to CPU No.1 (M2400 to M2495)



• Q Compatibility high-speed refresh setting (MT Developer2 only)



■FIN signal wait function using the Motion SFC program

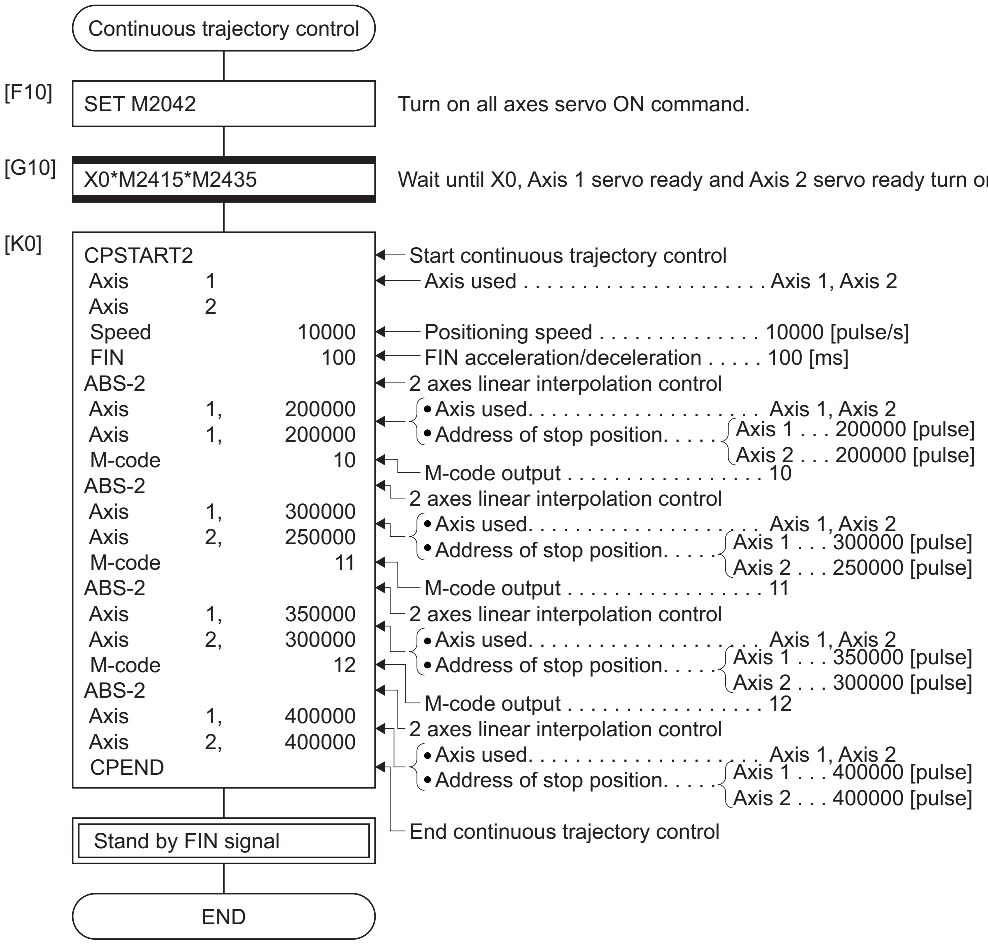
The program for executing the FIN signal wait function for continuous trajectory control of Axis 1 and Axis 2 is explained as an example.

- Positioning conditions
  - Continuous trajectory control conditions are shown below.

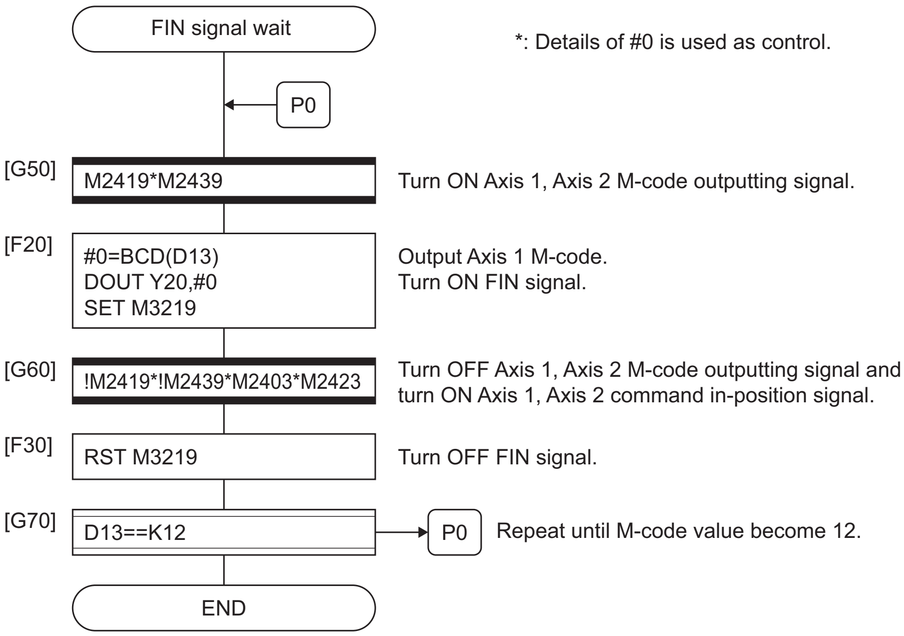
Item		Setting			
Servo program No.		0			
Positioning speed		10000			
FIN acceleration/deceleration time		100 [ms]			
Positioning method		2 axes linear interpolation control			
Pass point	Axis 1	200000	300000	350000	400000
	Axis 2	200000	250000	300000	400000
M-code		10	11	12	—

  - Continuous trajectory control start command: X0 Leading edge (OFF → ON)

- Motion SFC program
  - The Motion SFC program for executing the servo program (No. 0) for continuous trajectory control is shown below.



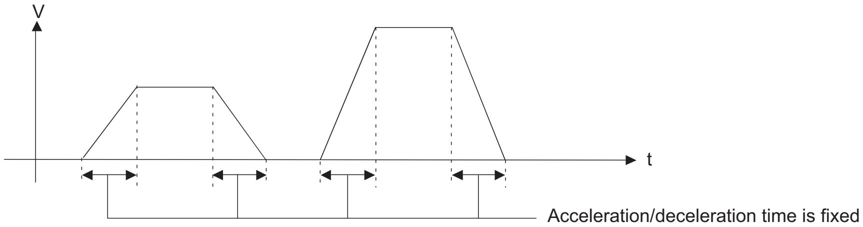
• The Motion SFC program which outputs M-code of each point for continuous trajectory control to Y20 to Y2F by BCD code is shown below.



5

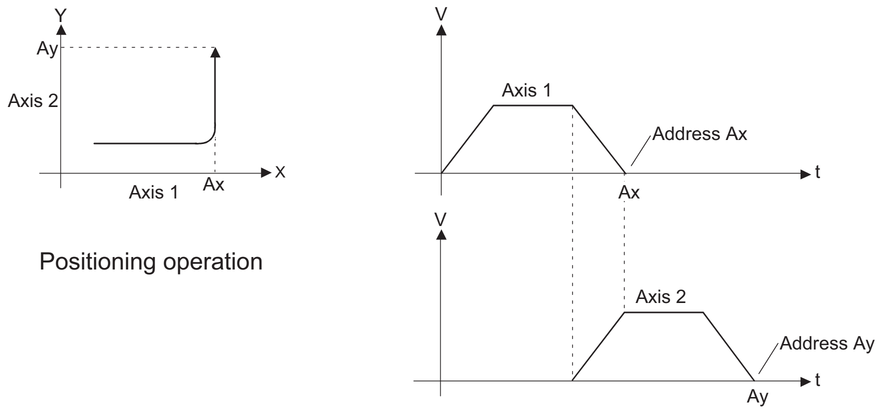
Point

- 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.



(1) Rapid stop deceleration time in parameter block, completion point specification method for speed change point, and S-curve acceleration/deceleration processing and parameters are invalid in the fixed acceleration/deceleration time method.

(2) The speed processing for each axis is as shown below in positioning operation (continuous trajectory) as shown in the following figure.

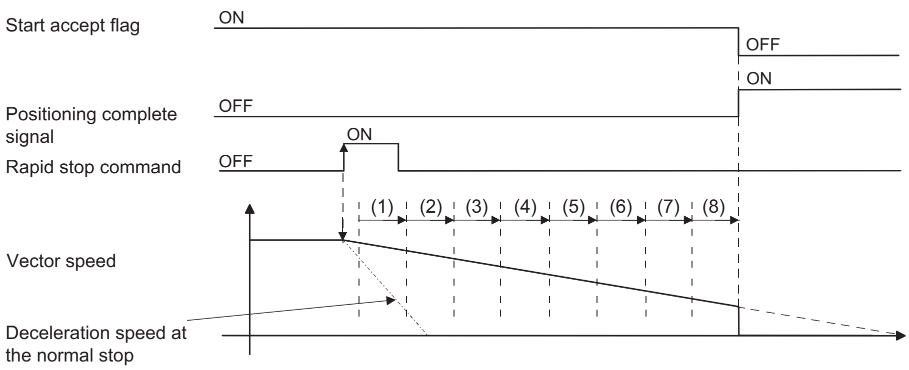


Continuous-trajectory control processing of each axis

- When the rapid stop command is executed by the setting "deceleration time < rapid stop deceleration time" during continuous trajectory 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.

Travel value by the point data currently executed at the rapid stop command (Up to 9 points) < speed at rapid stop command input × rapid stop deceleration time / 2

[Operation pattern]



5.18 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.
○: Must be set, △: Set if required

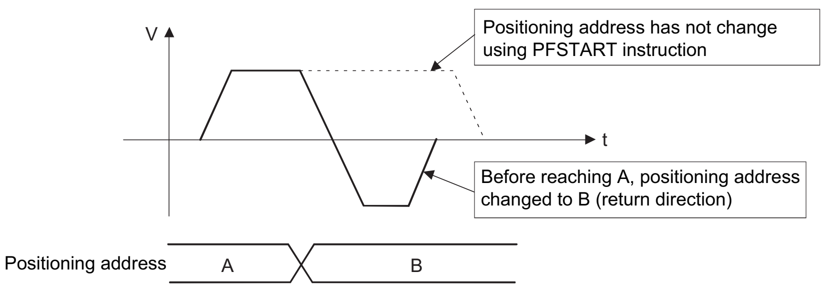
Servo instruction	Positioning method	Number of control axes	Positioning data set in servo instructions																																	
			Common							Arc				OSC				Parameter block											Others							
			Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Number of pitches	Starting angle	Amplitude	Frequency	Reference axis No. *1	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	Bias speed at start	Repeat condition	Program No.	Command speed (Continuous trajectory)	Skip	FIN acceleration/deceleration	WAIT-ON/OFF	Fixed position stop acceleration/deceleration time	Fixed position stop
PFSTART	Absolute	1	△	○	○	○		△											△	△	△	△	△	△		△	△	△								

*1 Only when the reference axis speed is specified

Processing details

■Control using PFSTART instruction

- Positioning to the address set in the word device of the Motion CPU specified with the servo program is executed.
- 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.



Precautions

- Number of control axes is 1 axis.
- Only the absolute data method (ABS□) is used for positioning control to the pass points.
- The speed can be changed during the start. The changed speed is effective until the stop command is input.
- Set the positioning address in the servo program using indirect setting with the word devices.
- Use only even-numbered devices for indirect setting of positioning address in the servo program.
- 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.

Program example

The program for performing Axis 3 position follow-up control for PLC CPU (CPU No.1) to Motion CPU (CPU No.2) is explained as an example.

This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■Positioning conditions

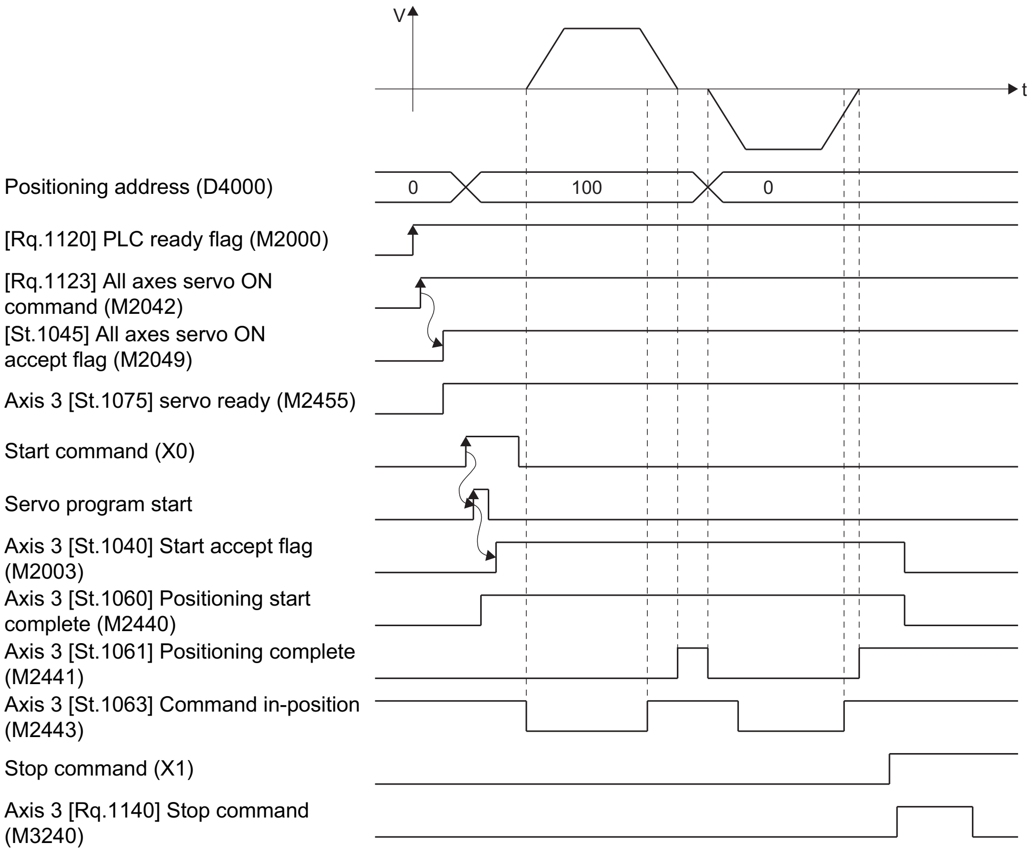
- Position follow-up conditions are shown below.

Item	Setting
Servo program No.	100
Control axis	Axis 3
Positioning address	D4000
Positioning speed	20000

- Position follow-up control start command: X0 Leading edge (OFF → ON) (PLC CPU device)

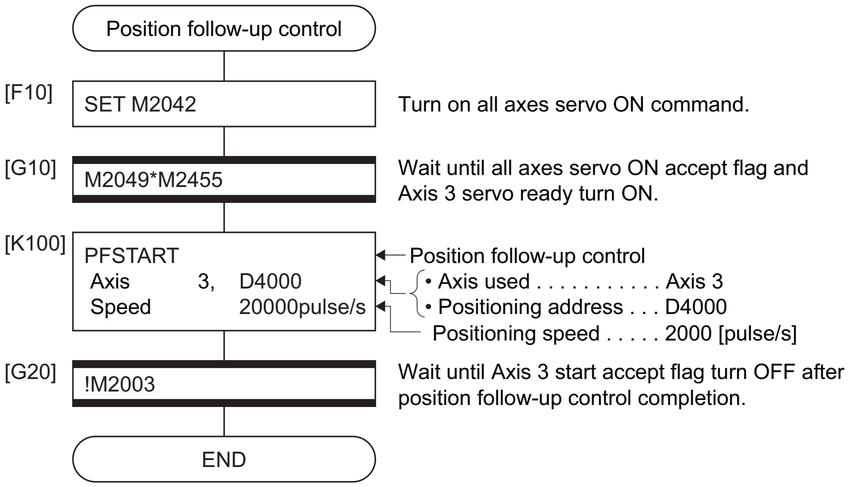
■Operation timing

Operation timing for position follow-up control is shown below.



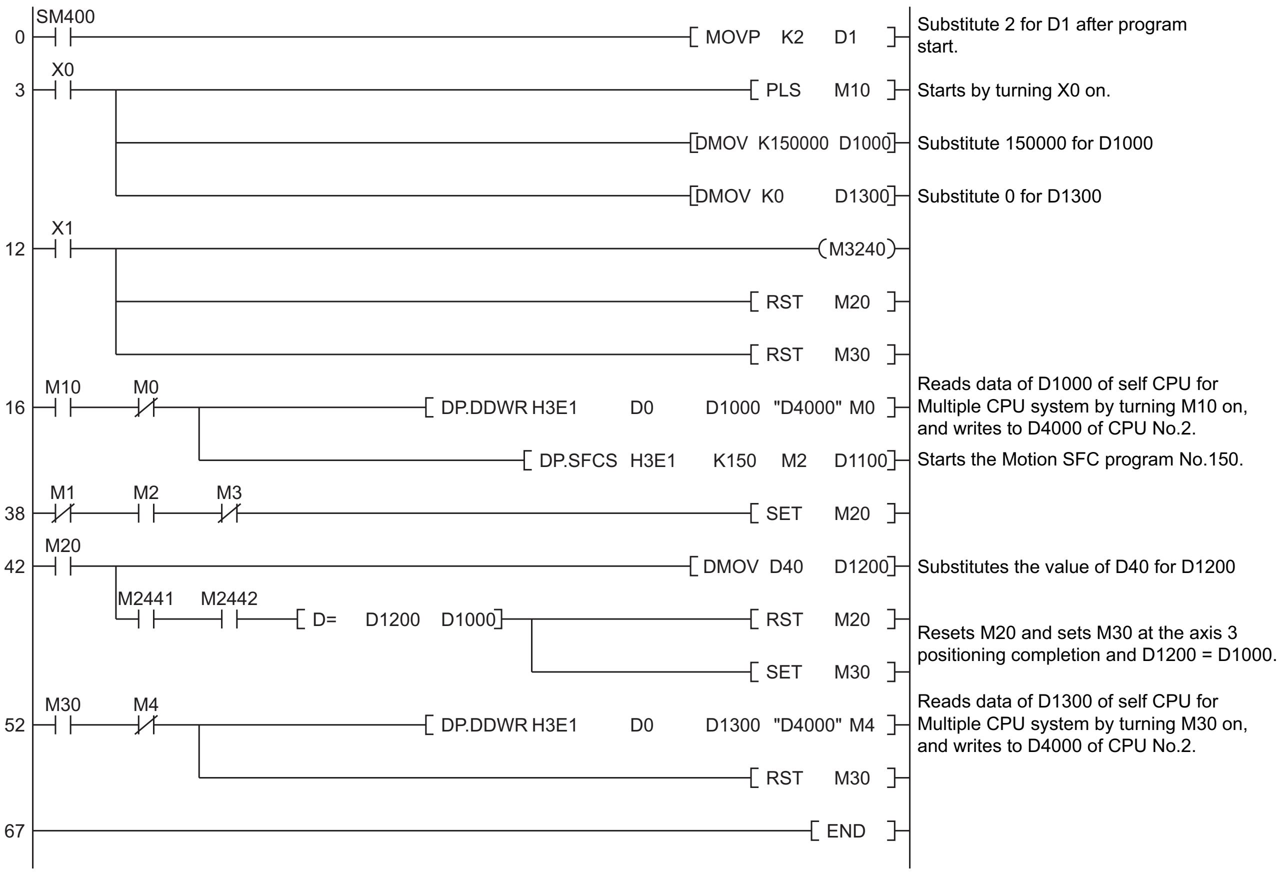
■Motion SFC program

The Motion SFC program for executing the servo program (No. 100) for position follow-up control is shown below.
This program is started using D(P).SFCS instruction from PLC CPU (CPU No. 1).



■Sequence program

Sequence program example for position follow-up control is shown below.



*1 The automatic refresh setting example for position follow-up control is shown below.

5

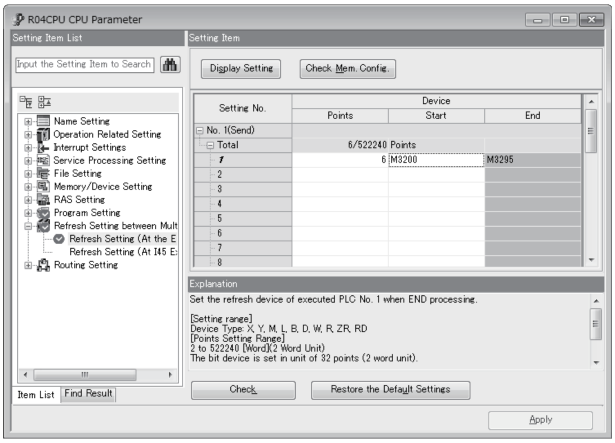
■Parameter setting

The refresh (END) setting example for position follow-up control is shown below.

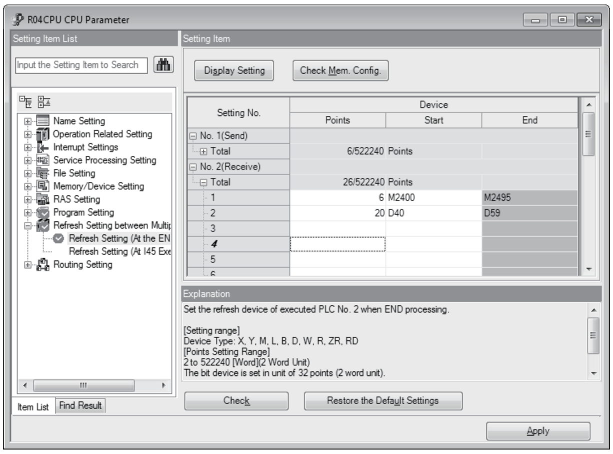
[Allocation example of devices allocated in the Motion dedicated device to the PLC CPU]

■CPU No. 1 (PLC CPU) (GX Works3)

- Set the device transmitted to CPU No.2 (M3200 to M3295)

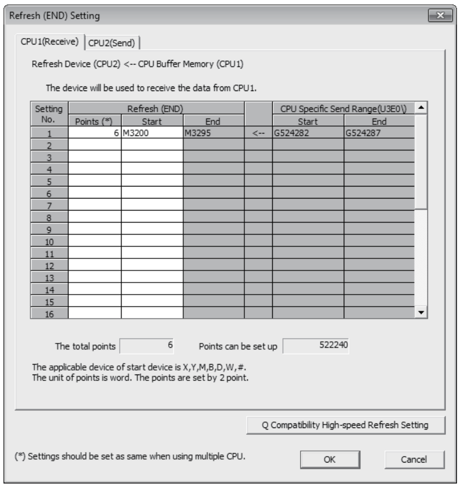


- Set the device received from CPU No.2 (M2400 to M2495, D40 to D59)

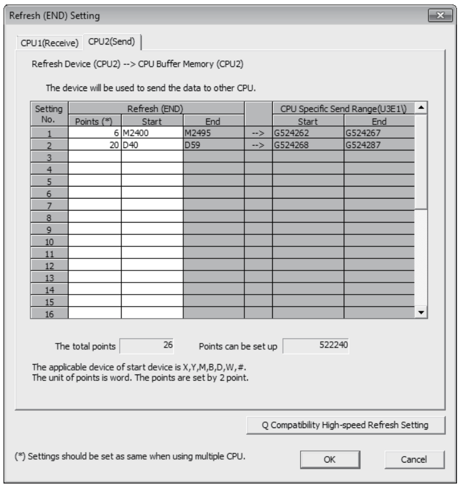


■CPU No. 2 (Motion CPU) (MT Developer2)

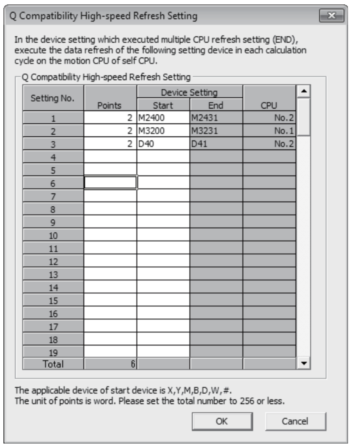
- Set the device received from CPU No.1 (M3200 to M3295)



- Set the device transmitted to CPU No.1 (M2400 to M2495, D40 to D59)



- Q Compatibility high-speed refresh setting (MT Developer2 only)



5.19 High-Speed Oscillation

Positioning of a specified axis is caused to oscillate on a sine wave.

○: Must be set, △: Set if required

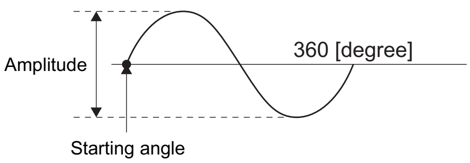
Servo instruction	Positioning method	Number of control axes	Positioning data set in servo instructions																																		
			Common							Arc				OSC				Parameter block											Others								
			Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Number of pitches	Starting angle	Amplitude	Frequency	Reference axis No. *1	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	Bias speed at start	Repeat condition	Program No.	Command speed (Continuous trajectory)	Skip	FIN acceleration/deceleration	WAIT-ON/OFF	Fixed position stop acceleration/deceleration time	Fixed position stop
OSC	—	1	△	○				△						○	○	○							△													

*1 Only when the reference axis speed is specified

Processing details

The designated axis caused to oscillate on a specified sine wave.

Acceleration/deceleration processing is not performed.



■Amplitude

Set the amplitude of the oscillation in the setting units.

The amplitude can be set within the range of 1 to 2147483647.

■Starting angle

Set the angle on the sine curve at which oscillation is to start.

The setting range is 0 to 359.9 [degree]

■Frequency

Set how many sine curve cycles occur in one minute.

The setting range is 1 to 5000 [CPM].

Point

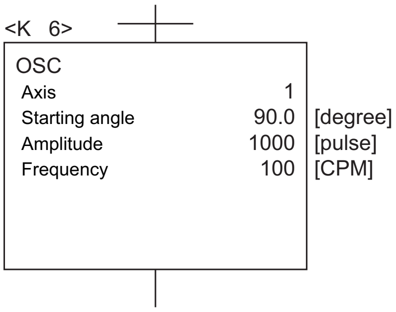
Since acceleration/deceleration processing is not performed, you should set the starting angle to 90 or 270 [degree] in order to avoid an abrupt start.

Precautions

- If the amplitude setting is outside the range, the minor error (error code: 1A52H) occurs and operation does not start.
- If the starting angle setting is outside the range, the minor error (error code: 1A53H) occurs and operation does not start.
- If the frequency setting is outside the range, the minor error (error code: 1A54H) occurs and operation does not start.
- Operation is continually repeated until a stop signal is input after the start.
- Speed changes during operation are not possible. Attempted speed changes will cause warning (error code: 09EEH).
- Do not use the high-speed oscillation in the axis that invalidates a stroke limit of control unit "degree".

Program example

An example of a program for high-speed oscillation is shown below.



5.20 Simultaneous Start

Simultaneous start of the specified servo program at one start is executed.
Simultaneous start is started using the START servo program instruction.
○: Must be set, △: Set if required

Servo instruction	Positioning method	Number of control axes	Positioning data set in servo instructions																																	
			Common							Arc				OSC				Parameter block											Others							
			Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Number of pitches	Starting angle	Amplitude	Frequency	Reference axis No. *1	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	Bias speed at start	Repeat condition	Program No.	Command speed (Continuous trajectory)	Skip	FIN acceleration/deceleration	WAIT-ON/OFF	Fixed position stop acceleration/deceleration time	Fixed position stop
START	*2	*2																												○						

*1 Only when the reference axis speed is specified
*2 It changes depending on the servo program for simultaneous start

Processing details

■Control using START instruction

- Simultaneous start of the specified servo programs is executed.
- The servo program except for the simultaneous start (START instruction) can be specified.
- Up to 3 servo programs can be specified.
- A word device can be used as the servo program number. Refer to the following for the setting range of usable devices.
  📖MELSEC iQ-R Motion controller Programming Manual (Common)
- When the servo program number is specified using a word device, the device value can be set to start the program or not start the program.

Setting value	Description
-1	Servo program number not specified
0 to 8191*1	Program number to start

*1 For operating system software version "09" or earlier, 0 to 4095.

- Each axis is controlled using the specified servo program after the simultaneous start.

Precautions

A check is made at the start. An error occurs and operation does not start in the following cases.

- Specified servo program does not exist.
- START instruction is set as the specified servo program.
- The specified servo program start axis is already used.
- A servo program cannot start by an error.
- The specified program number for simultaneous start is already used.
- The program number for simultaneous start is set as the self program number.
- The real axis program and command generation axis program are mixed.
- The program to start does not exist.
- All of the specified program numbers are "-1".

Program example

The program for performing simultaneous start of Axis 1, Axis 2, Axis 3, and Axis 4 is explained as an example.
This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■Number of specified servo programs and program No.

- Number of specified servo programs: 3
- Specified servo program No.

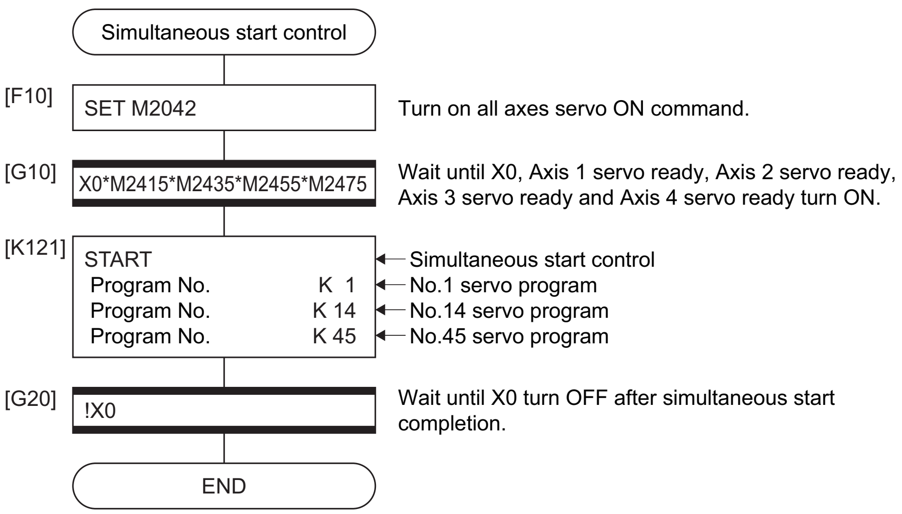
Servo Program No.	Used axis	Control Details
No.1	Axis 1, Axis 2	Circular interpolation control
No.14	Axis 3	Speed control
No.45	Axis 4	Home position return control

■Start conditions

- Simultaneous start servo program No.: No.121
- Simultaneous start execute command: X0 Leading edge (OFF → ON)

■Motion SFC program

The Motion SFC program for executing the servo program (No. 121) for simultaneous start control is shown below.



*1 Example of the above Motion SFC program is started using the automatic start or sequence program

5.21 Home Position Return

- 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.
- The home position return data must be set for each axis to execute the home position return. Refer to the following details of the home position return data. (☞ Page 178 Home Position Return Data)
- 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.

Home position return methods		Reference position	External signal[*1]	Applications
Proximity dog method	Proximity dog method 1	Motor zero point	DOG (FLS/RLS)	• 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.
	Proximity dog method 2			• 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 can be started.
Count method	Count method 1			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".
	Count method 2	Command position		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 1" 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.
	Data set method 3			It is used to perform home position return during servo OFF.
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 method	Stopper method 1	Motor actual position	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 the stopper.
	Stopper method 2		—	
Limit switch combined method		Motor zero point	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			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		Position in driver settings	—	The driver performs home position return operation autonomously according to the settings on the driver-side.

*1 The signal in parentheses is required when the home position return retry function is used.

Servo program for home position return

The home position return executed using the ZERO servo instruction.

○: Must be set, △: Set if required

Servo instruction	Positioning method	Number of control axes	Positioning data set in servo instructions																																	
			Common							Arc				OSC				Parameter block											Others							
			Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Number of pitches	Starting angle	Amplitude	Frequency	Reference axis No. *1	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	Bias speed at start	Repeat condition	Program No.	Command speed (Continuous trajectory)	Skip	FIN acceleration/deceleration	WAIT-ON/OFF	Fixed position stop acceleration/deceleration time	Fixed position stop
ZERO	—	1		○																																

*1 Only when the reference axis speed is specified

Processing details

Home position return is executed by the home position return method specified with the home position return data (☞ Page 178 Home Position Return Data).

Refer to the following for details of the home position return methods.

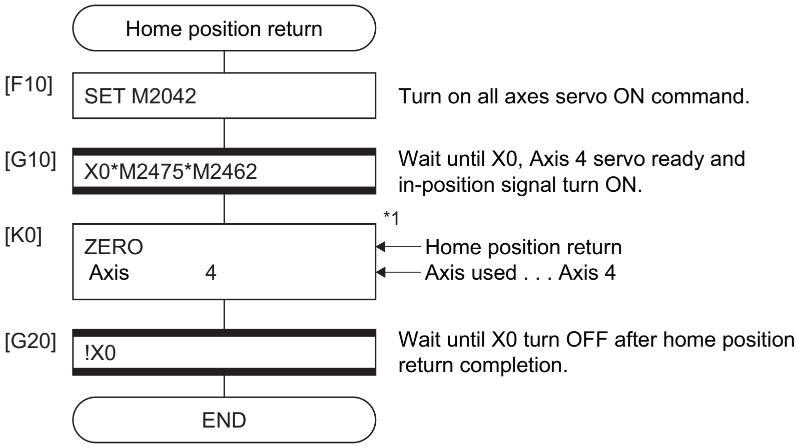
Home position return methods	Reference
Proximity dog method 1	☞ Page 380 Home position return by the proximity dog method 1
Proximity dog method 2	☞ Page 382 Home position return by the proximity dog method 2
Count method 1	☞ Page 384 Home position return by the count method 1
Count method 2	☞ Page 385 Home position return by the count method 2
Count method 3	☞ Page 386 Home position return by the count method 3
Data set method 1	☞ Page 388 Home position return by the data set method 1
Data set method 2	☞ Page 389 Home position return by the data set method 2
Data set method 3	☞ Page 390 Home position return by the data set method 3
Dog cradle method	☞ Page 391 Home position return by the dog cradle method
Stopper method 1	☞ Page 394 Home position return by the stopper method 1
Stopper method 2	☞ Page 395 Home position return by the stopper method 2
Limit switch combined method	☞ Page 396 Home position return by the limit switch combined method
Scale home position signal detection method	☞ Page 398 Home position return by the scale home position signal detection method
Dogless home position signal reference method	☞ Page 400 Home position return by the dogless home position signal reference method
Driver home position return method	☞ Page 405 Home position return by the driver home position return method

Program example

The servo program No. 0 for performing home position return of Axis 4 is explained as an example.
This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■Motion SFC program

The Motion SFC program for executing the servo program (No. 0) for home position return is shown below.



*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.

*2 Example of the above Motion SFC program is started using the automatic start or sequence program.

Precautions

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.

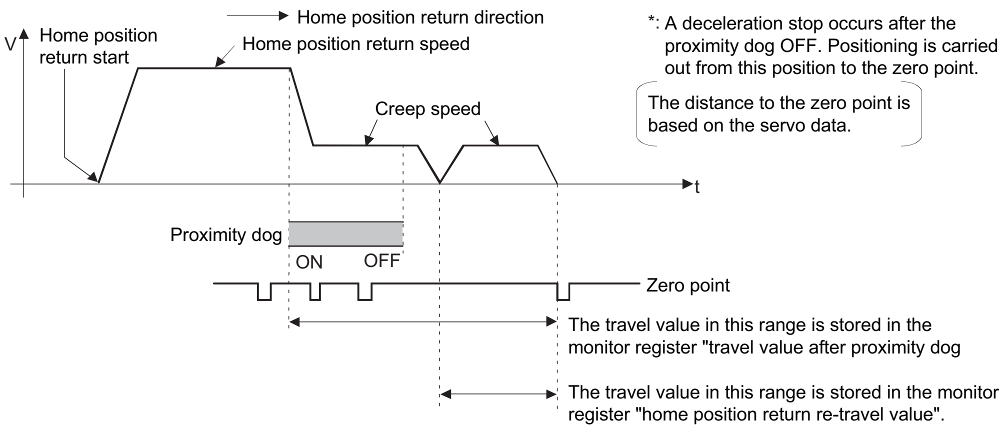
Home position return by the proximity dog method 1

Proximity dog method 1

Zero point position after proximity dog ON to OFF is home position in this method. When it does not pass ("[St.1066] Zero pass (R: M32406+32n/Q: 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.

Home position return by the proximity dog method 1

Operation of home position return by proximity dog method 1 for passing ("[St.1066] Zero pass (R: M32406+32n/Q: M2406+20n)" ON) the zero point from home position return start to deceleration stop by proximity dog ON to OFF is shown below.

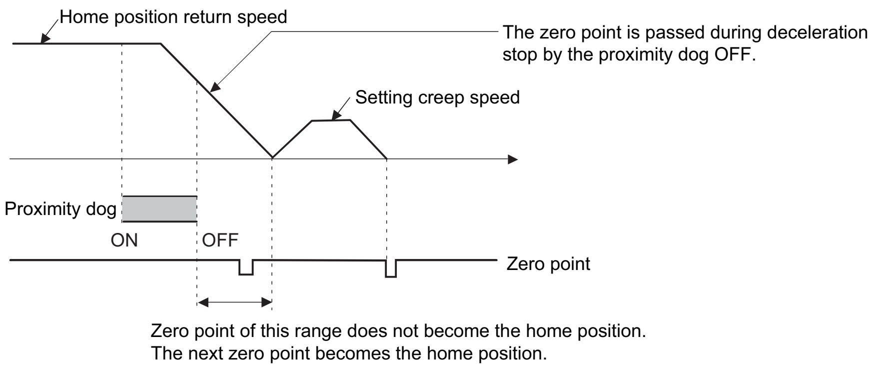


Home position return execution

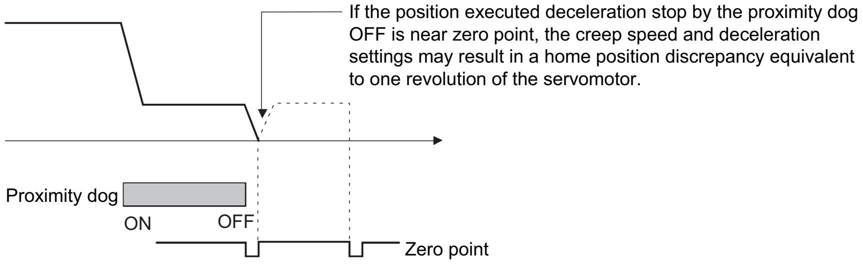
Home position return by the proximity dog method 1 is executed using the servo program. (☞ Page 378 Servo program for home position return)

Cautions

- 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.



• The position executed deceleration stop by the proximity dog OFF is near zero point, a home position discrepancy equivalent to one revolution of the servomotor 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 servomotor.



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.
- Home position return with a position after the proximity dog ON to OFF.
- When the power supply turned OFF to ON after home position return end.

- When it does not pass ("[St.1066] Zero pass (R: M32406+32n/Q: 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: 197AH) 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.
- If home position return is executed in the proximity dog ON, a minor error (error code: 197DH) will occur, the home position return is not executed. Use the proximity dog method 2 in this case.
- 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: 197BH) will occur, the home position return is not executed.
- If "[St.1062] In-position (R: M32402+32n/Q: M2402+20n)" does not turn ON, home position return is not ended.

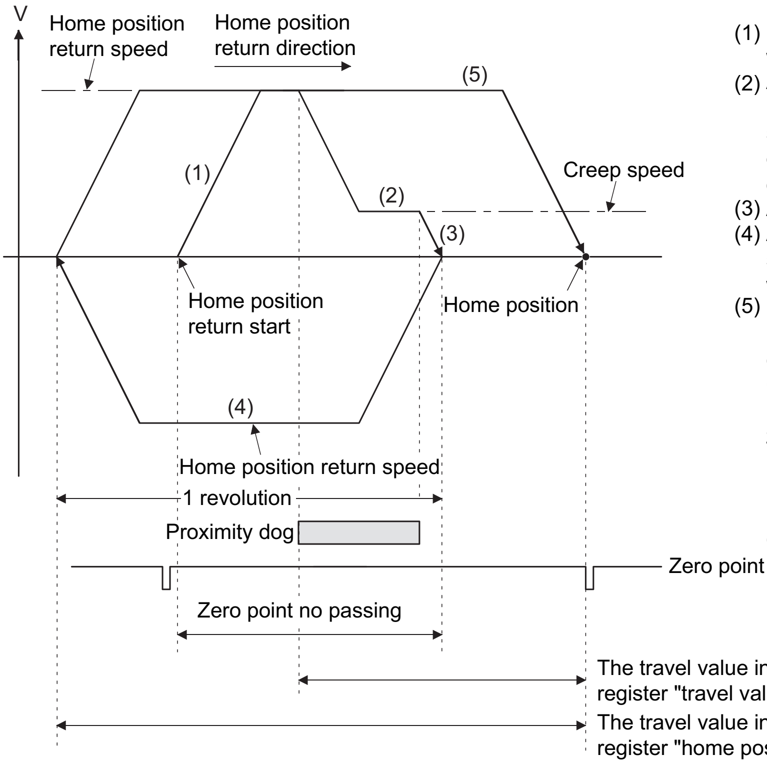
Home position return by the proximity dog method 2

Proximity dog method 2

Zero point position after proximity dog ON to OFF is home position in this method.
When it passed ("[St.1066] Zero pass (R: M32406+32n/Q: 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". (☞ Page 380 Home position return by the proximity dog method 1)
When it does not pass ("[St.1066] Zero pass (R: M32406+32n/Q: 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 servomotor 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.

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.



(1) It travels to preset direction of home position return with the home position return speed.
(2) A deceleration is made to the creep speed by the proximity dog ON, after that, it travels with the creep speed. (If the proximity dog turns OFF during a deceleration, a deceleration stop is made and the operation for 4) starts.)
(3) A deceleration stop is made by the proximity dog OFF.
(4) After a deceleration stop, it travels for one revolution of servomotor to reverse direction of home position return with the home position return speed.
(5) It travels to direction of home position return with the home position return speed, the home position return ends with first zero point after the proximity dog ON to OFF. (At this time, a deceleration to the creep speed is not made with the proximity dog OFF to ON. And if the zero point is not passed because of droop pulses for processing of (4) and (5), a minor error (error code: 197AH) will occur, a deceleration stop is made and the home position return does not end normally. In this case, adjust a position of proximity dog OFF.)

Home position return execution

Home position return by the proximity dog method 2 is executed using the servo program. (☞ Page 378 Servo program for home position return)

Cautions

- A system which the servomotor can rotate one time or more is required.
- When a servomotor stops with specified condition enables and rotates to reverse direction one time after proximity dog ON, make a system for which does not turn OFF the external upper/lower stroke limit.
- 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.
- If home position return is executed in the proximity dog ON, it starts with the creep speed.
- 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: 197BH) will occur, the home position return is not executed.
- 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 "[St.1066] Zero pass (R: M32406+32n/Q: M2406+20n)" turns ON. This operation is the same as proximity dog method 1.
- If "[St.1062] In-position (R: M32402+32n/Q: M2402+20n)" does not turn ON, home position return is not ended.

Home position return by the count method 1

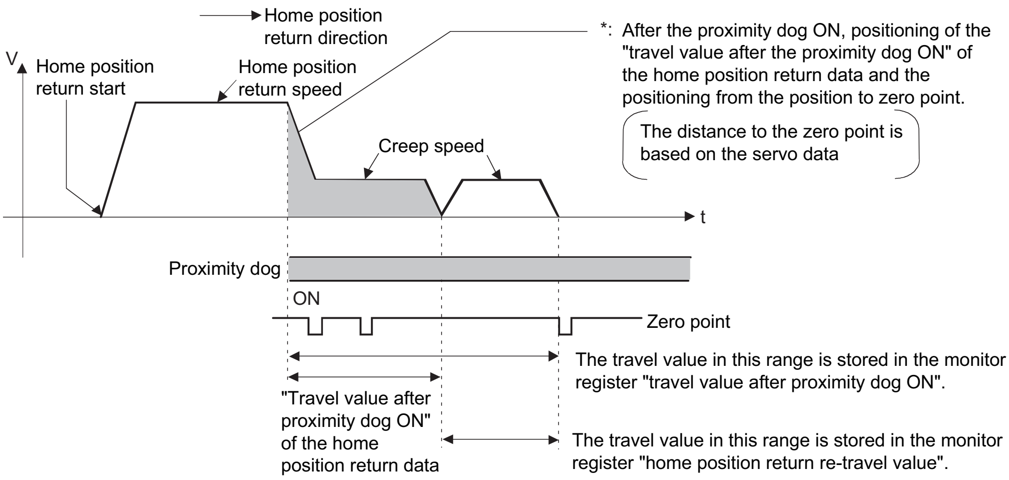
Count method 1

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 ("[St.1066] Zero pass "(R: M32406+32n/Q: 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 (☞ Page 178 Home Position Return Data).

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.



Home position return execution

Home position return by the count method 1 is executed using the servo program. (☞ Page 378 Servo program for home position return)

Cautions

- 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.
- When the zero point is not passed ("[St.1066] Zero pass (R: M32406+32n/Q: 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: 197AH) 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.
- 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: 1A57H) will occur and deceleration stop is made.
- If "[St.1062] In-position (R: M32402+32n/Q: M2402+20n)" does not turn ON, home position return is not ended.

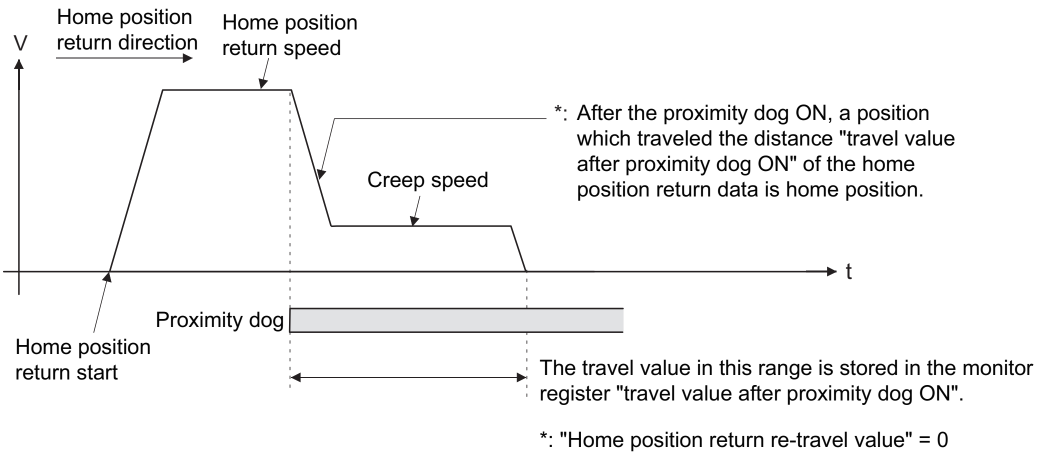
Home position return by the count method 2

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 (☞ Page 178 Home Position Return Data).

Home position return by the count method 2

Operation of home position return by count method 2 is shown below.



Home position return execution

Home position return by the count method 2 is executed using the servo program. (☞ Page 378 Servo program for home position return)

Cautions

- 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.
- 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: 1A57H) will occur and deceleration stop is made.
- Command position is the home position.
- If "[St.1062] In-position (R: M32402+32n/Q: M2402+20n)" does not turn ON, home position return is not ended.

Home position return by the count method 3

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.

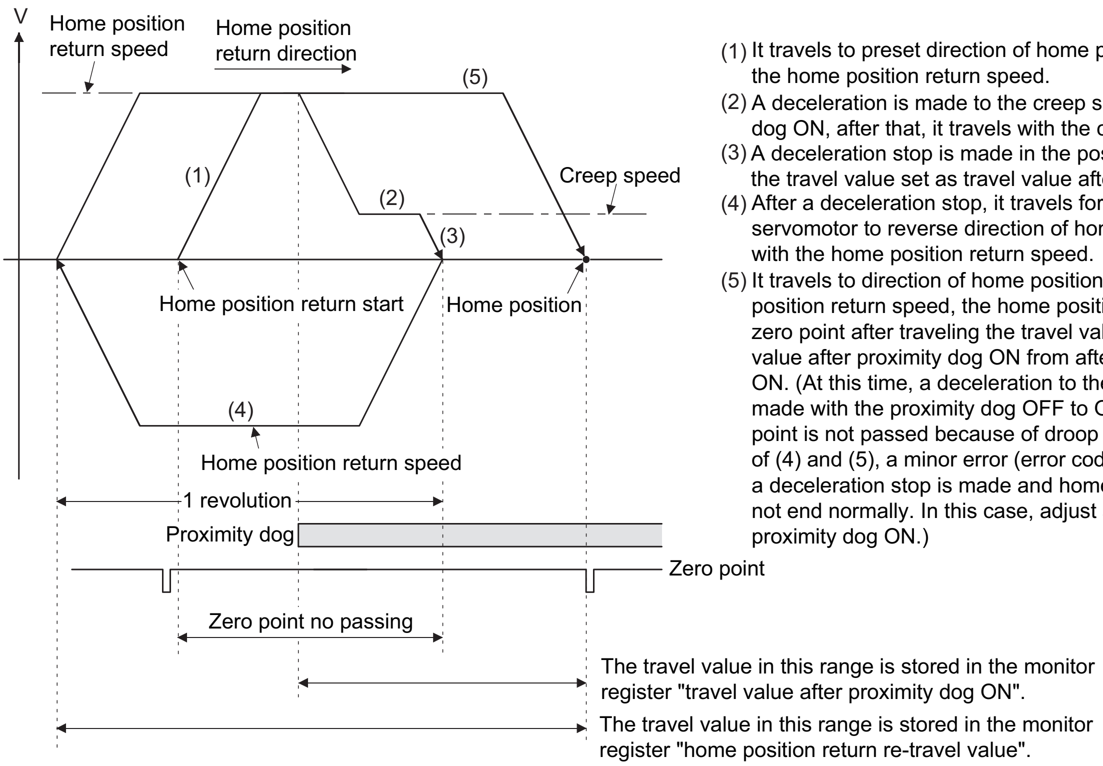
When the zero point is passed ("[St.1066] Zero pass (R: M32406+32n/Q: M2406+20n)" ON) during travel of specified distance set in the "travel value after proximity dog ON" from the home position return start, home position return operation is the same as "count method 1". (☞ Page 384 Home position return by the count method 1)

When a zero point is not passed ("[St.1066] Zero pass (R: M32406+32n/Q: 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 (☞ Page 178 Home Position Return Data).

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.



(1) It travels to preset direction of home position return with the home position return speed.
(2) A deceleration is made to the creep speed by the proximity dog ON, after that, it travels with the creep speed.
(3) A deceleration stop is made in the position which traveled the travel value set as travel value after proximity dog ON.
(4) After a deceleration stop, it travels for one revolution of servomotor to reverse direction of home position return with the home position return speed.
(5) It travels to direction of home position return with the home position return speed, the home position return with first zero point after traveling the travel value set as travel value after proximity dog ON from after the proximity dog ON. (At this time, a deceleration to the creep speed is not made with the proximity dog OFF to ON. And if the zero point is not passed because of droop pulses for processing of (4) and (5), a minor error (error code: 197AH) will occur, a deceleration stop is made and home position return does not end normally. In this case, adjust a position of proximity dog ON.)

Home position return execution

Home position return by the count method 3 is executed using the servo program (☞ Page 378 Servo program for home position return).

Cautions

- A system which the servomotor can rotate one time or more is required.
- After the proximity dog ON, when a servomotor 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.
- 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.
- 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: 1A57H) will occur and deceleration stop is made.
- 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 "[St.1066] Zero pass (R: M32406+32n/Q: M2406+20n)" turns ON. This operation is the same as count method 1.
- If "[St.1062] In-position (R: M32402+32n/Q: M2402+20n)" does not turn ON, home position return is not ended.

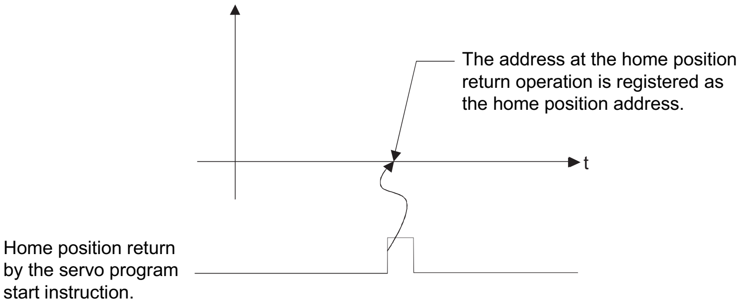
Home position return by the data set method 1

Data set method 1

The proximity dog is not used in this method.

Home position return by the data set method 1

Home position is the command position at the home position return operation.



Home position return execution

Home position return by the data set method 1 is executed using the servo program (☞ Page 378 Servo program for home position return).

Cautions

- A zero point must be passed ("[St.1066] Zero pass (R: M32406+32n/Q: 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, minor error (error code: 197AH) occurs. If minor error (error code: 197AH) occurred, perform the home position return again, after reset the error and turn the servo motor at least one revolution by the JOG operation. The zero point passing can be confirmed with the "[St.1066] Zero pass (R: M32406+32n/Q: 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 "[St.1066] Zero pass (R: M32406+32n/Q: M2406+20n)" turns ON.
- 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.
- The home position return data required for the data set method 1 are the home position return direction and home position address.
- If "[St.1062] In-position (R: M32402+32n/Q: M2402+20n)" does not turn ON, home position return is not ended.

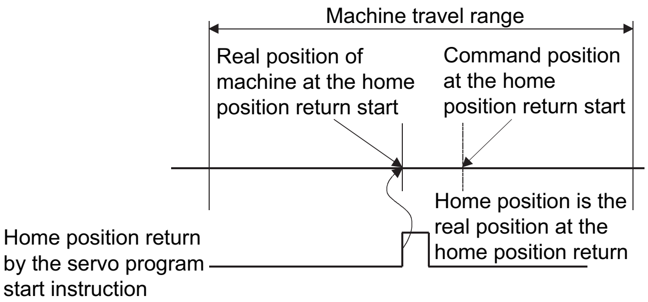
Home position return by the data set method 2

Data set method 2

The proximity dog is not used in this method.

Home position return by the data set method 2

Home position is the real position of servo motor at the home position return operation.



Home position return execution

Home position return by the data set method 2 is executed using the servo program (☞ Page 378 Servo program for home position return).

Cautions

- A zero point must be passed ("[St.1066] Zero pass (R: M32406+32n/Q: 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, minor error (error code: 197AH) occurs. If minor error (error code: 197AH) occurred, perform the home position return again, after reset the error and turn the servo motor at least one revolution by the JOG operation. The zero point passing can be confirmed with the "[St.1066] Zero pass (R: M32406+32n/Q: 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 "[St.1066] Zero pass (R: M32406+32n/Q: M2406+20n)" turns ON.
- The home position return data required for the data set method 2 are the home position return direction and home position address.

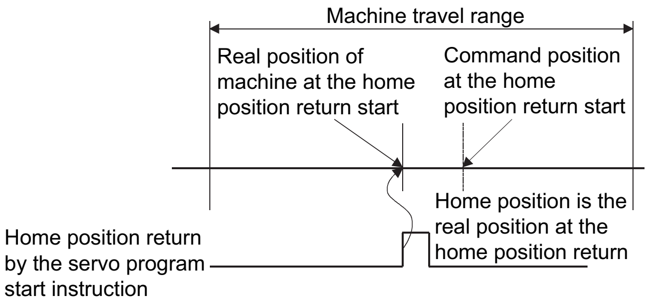
Home position return by the data set method 3

Data set method 3

The proximity dog is not used in this method that allows home position return to be performed during servo ON/OFF.

Home position return by the data set method 3

Home position is the real position of servo motor at the home position return operation.



Home position return execution

Home position return by the data set method 3 is executed using the servo program (☞ Page 378 Servo program for home position return).

Cautions

- A zero point must be passed ("[St.1066] Zero pass (R: M32406+32n/Q: 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, minor error (error code: 197AH) occurs. If minor error (error code: 197AH) occurred, perform the home position return again, after reset the error and turn the servo motor at least one revolution by the JOG operation. The zero point passing can be confirmed with the "[St.1066] Zero pass (R: M32406+32n/Q: 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 "[St.1066] Zero pass (R: M32406+32n/Q: M2406+20n)" turns ON.
- When executing home position return during servo OFF, fix the home position return target axis. (For servo motor speed of 20[r/min] or less, the home position return is completed.)
- Home position return is not performed at a servo error or forced stop. Perform a home position return after removing the error cause and resetting the error.
- When performing data set method 3 home position return, do not change the servo ON/OFF status of the home position return target axis while the home position return is being executed.
- The home position return data required for the data set method 3 are the home position return direction and home position address.

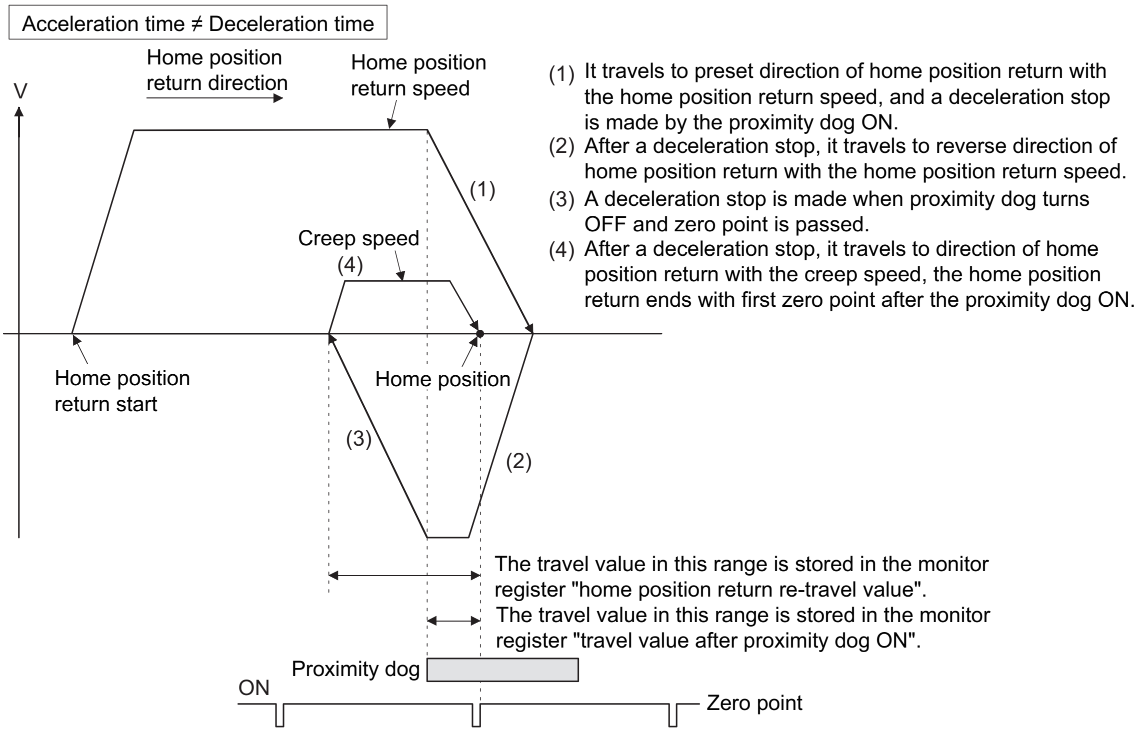
Home position return by the dog cradle method

Dog cradle method

After deceleration stop by the proximity dog ON, it travels to reverse direction. If the zero point is passed ("[St.1066] Zero pass (R: M32406+32n/Q: M2406+20n)" ON) after traveling to reverse direction and turning the proximity dog OFF, a deceleration stop is made. It then moves in the direction of home position return again with creep speed and the first zero point after proximity dog ON is home position in this method.

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.



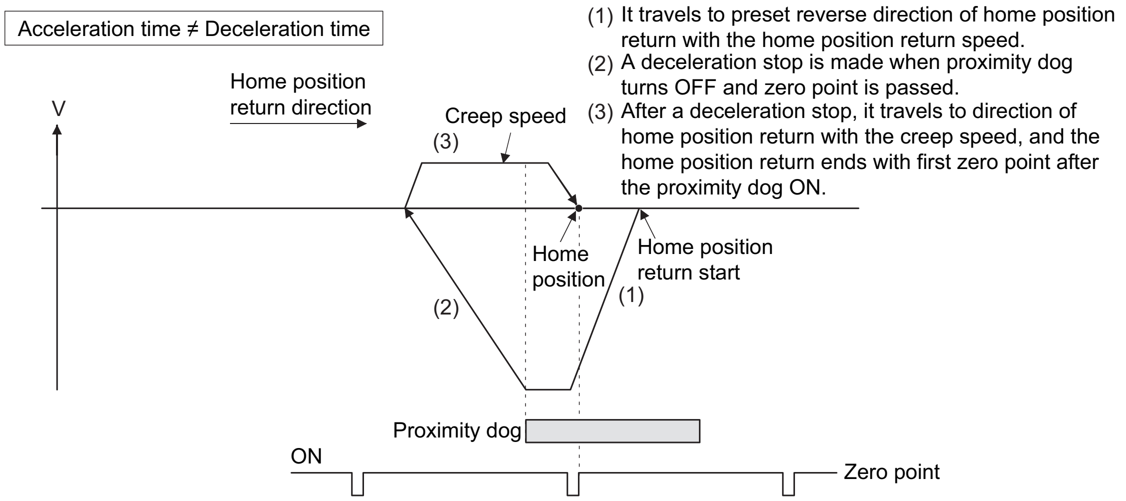
(1) It travels to preset direction of home position return with the home position return speed, and a deceleration stop is made by the proximity dog ON.
(2) After a deceleration stop, it travels to reverse direction of home position return with the home position return speed.
(3) A deceleration stop is made when proximity dog turns OFF and zero point is passed.
(4) After a deceleration stop, it travels to direction of home position return with the creep speed, the home position return ends with first zero point after the proximity dog ON.

Home position return execution

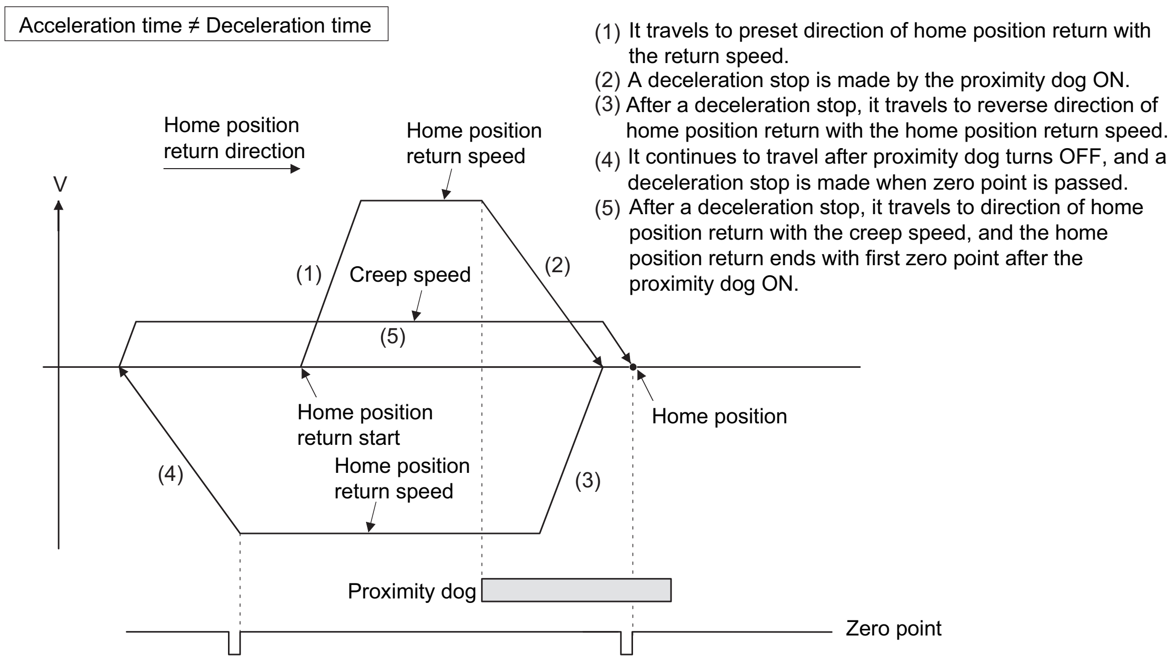
Home position return by the dog cradle method is executed using the servo program (☞ Page 378 Servo program for home position return).

Cautions

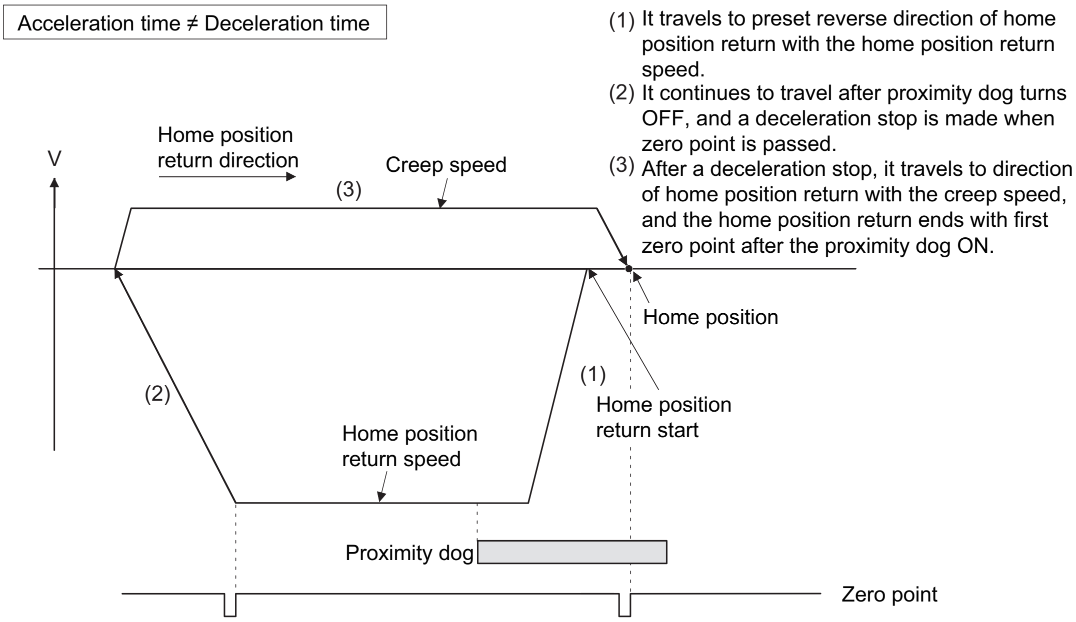
- When home position return retry function is not set, if home position return is executed again after home position return end, a minor error (error code: 197BH) will occur, the home position return is not executed.
- If the home position return is executed in the proximity dog, it travels to reverse 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.



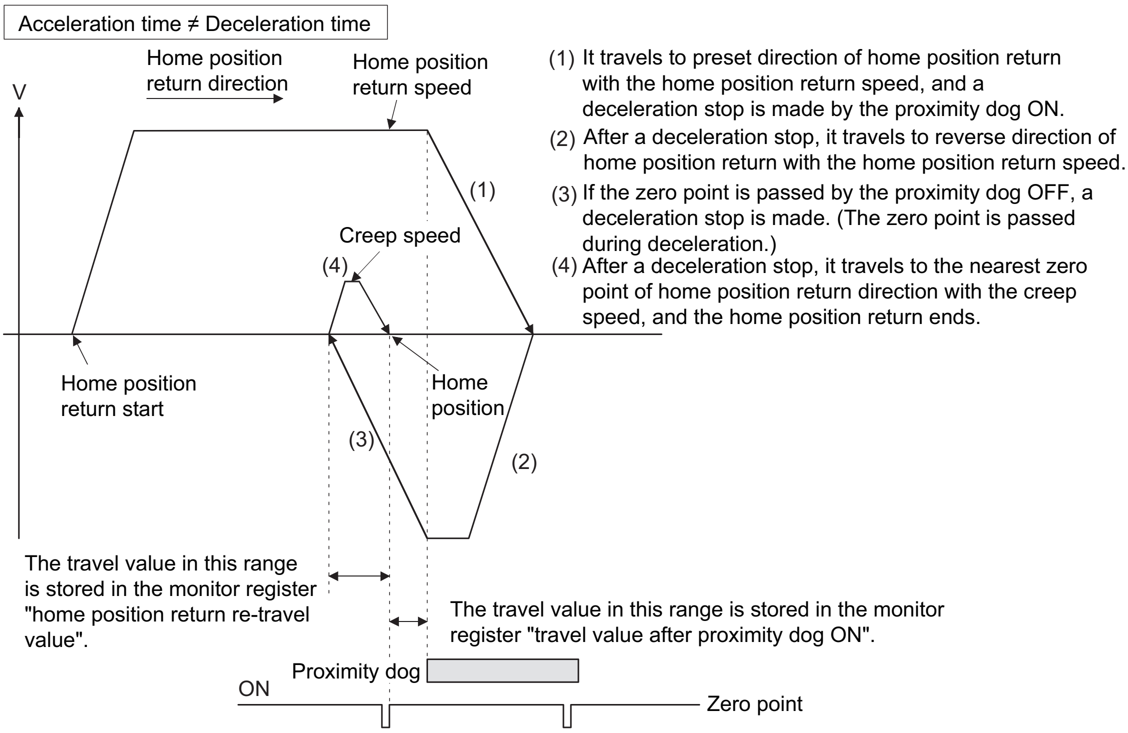
- When the proximity dog is set in the home position return direction, the proximity dog is turned OFF during travel to reverse direction of home position return, and the zero point is not passed ("[St.1066] Zero pass (R: M32406+32n/Q: M2406+20n)" OFF). It continues to travel in the reverse direction 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.



- When it starts in the proximity dog, the zero point is not passed ("[St.1066] Zero pass (R: M32406+32n/Q: 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.



- 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.



Home position return by the stopper method 1

Stopper method 1

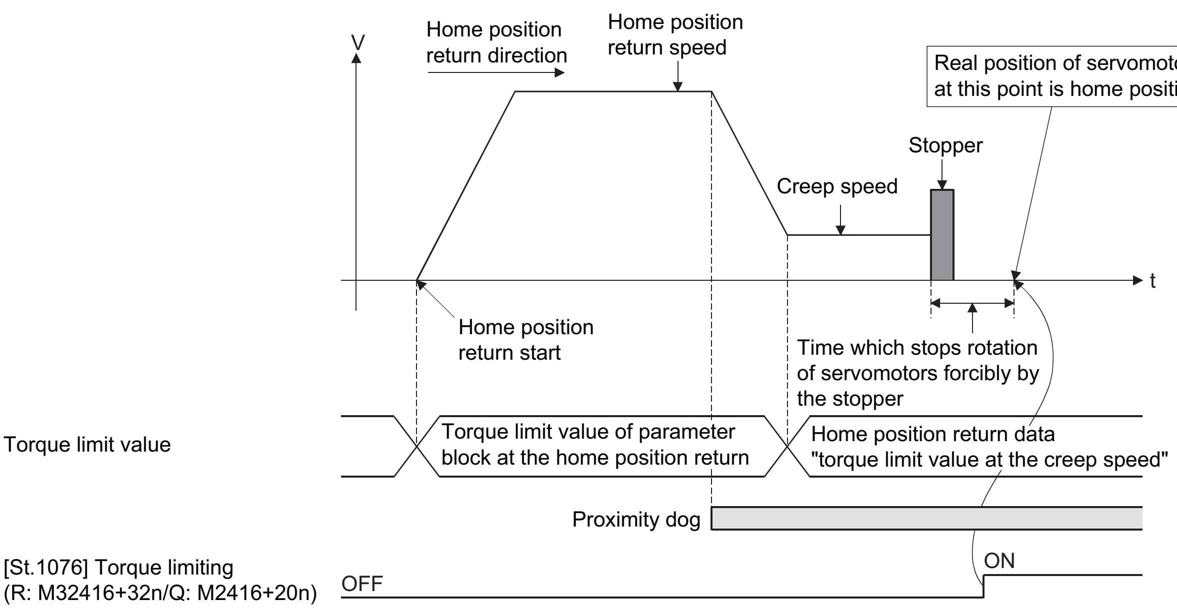
Position of stopper is home position in this method.

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. Real position of servomotor at the time of detection for turning the torque limiting signal OFF to ON is 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.

Home position return by the stopper method 1

Operation of home position return by the stopper method 1 is shown below.



*: "Travel value after proximity dog ON" storage register becomes "0" at the home position return start.

Home position return execution

Home position return by the stopper method 1 is executed using the servo program (☞ Page 378 Servo program for home position return).

Cautions

- A zero point does not must be passed ("[St.1066] Zero pass (R: M32406+32n/Q: M2406+20n)" ON) between turning on the power supply and executing home position return.
- Home position return retry function cannot be used in the stopper method 1.
- Set the torque limit value after reaching the creep speed for system. When the torque limit value is too large, servomotors 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.
- If the home position return is executed again after home position return completion, a minor error (error code: 197BH) will occur, the home position return is not executed.
- Home position return is started during the proximity dog ON, it is started from the "creep speed".

Home position return by the stopper method 2

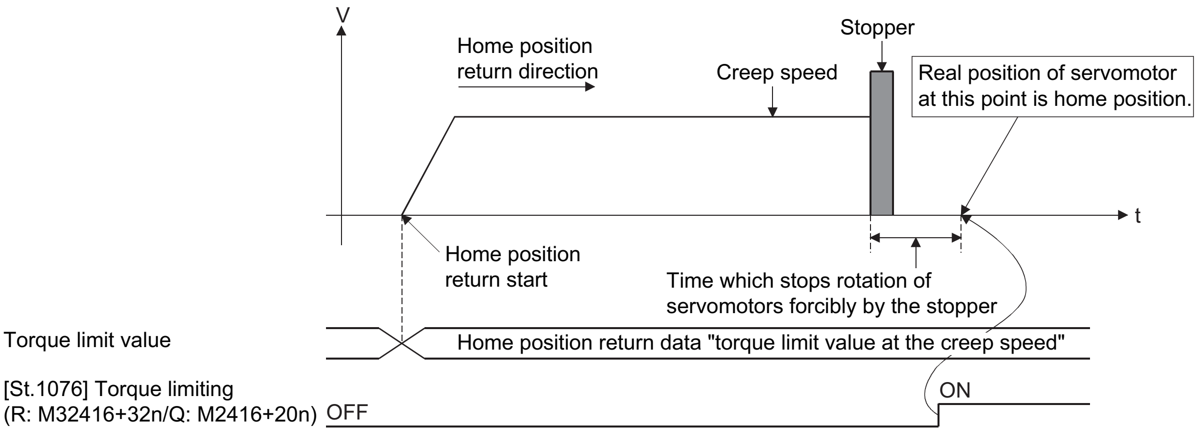
Stopper method 2

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.) Real position of servomotor at the time of detection for turning the torque limiting signal OFF to ON is 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.

Home position return by the stopper method 2

Operation of home position return by the stopper method 2 is shown below.



*: "Travel value after proximity dog ON" storage register becomes "0" at the home position return start.

Home position return execution

Home position return by the stopper method 2 is executed using the servo program (☞ Page 378 Servo program for home position return).

Cautions

- A zero point does not must be passed ("[St.1066] Zero pass (R: M32406+32n/Q: M2406+20n)" ON) between turning on the power supply and executing home position return.
- Home position return retry function cannot be used in the stopper method 2.
- Set the torque limit value at the reaching creep speed for system. When the torque limit value is too large, servomotors 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.
- If the home position return is executed again after home position return completion, a minor error (error code: 197BH) will occur, the home position return is not executed.

Home position return by the limit switch combined method

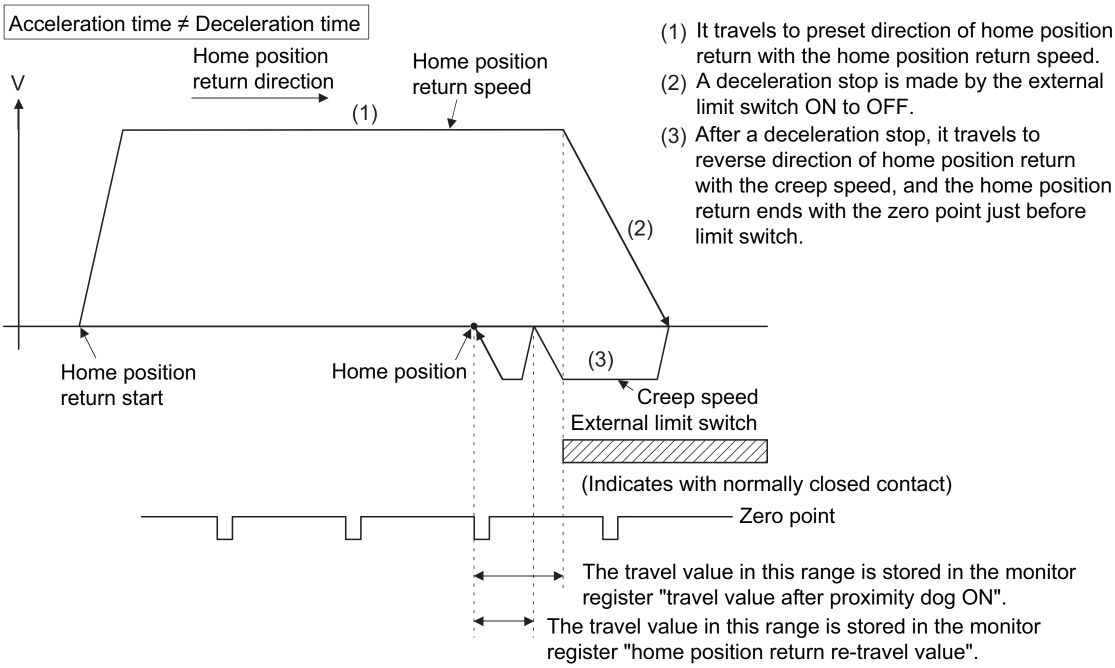
Limit switch combined method

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.

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.



Home position return execution

Home position return by the limit switch combined method is executed using the servo program (☞ Page 378 Servo program for home position return).

Cautions

- For the axis which executes the home position return by the limit switch combined method, if the external input signal has not been set in [Motion Control Parameter] → [Axis Setting Parameter] → "External Signal Parameter", a minor error (error code: 19ECH) will occur and home position return is not executed.
- 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 minor error (error code: 1905H, 1907H) will occur.
- Home position return retry function cannot be used in the limit switch combined method.
- 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.
- When it does not pass ("[St.1066] Zero pass (R: M32406+32n/Q: M2406+20n)" ON) the zero point from home position return start to deceleration stop by limit switch OFF, a minor error (error code: 197AH) 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.
- Deceleration stop is executed after the limit switch OFF. Set the limit switch in expectation of deceleration distance.
- If the "[St.1062] In-position (R: M32402+32n/Q: M2402+20n)" is turned ON, home position return is not ended.
- 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.

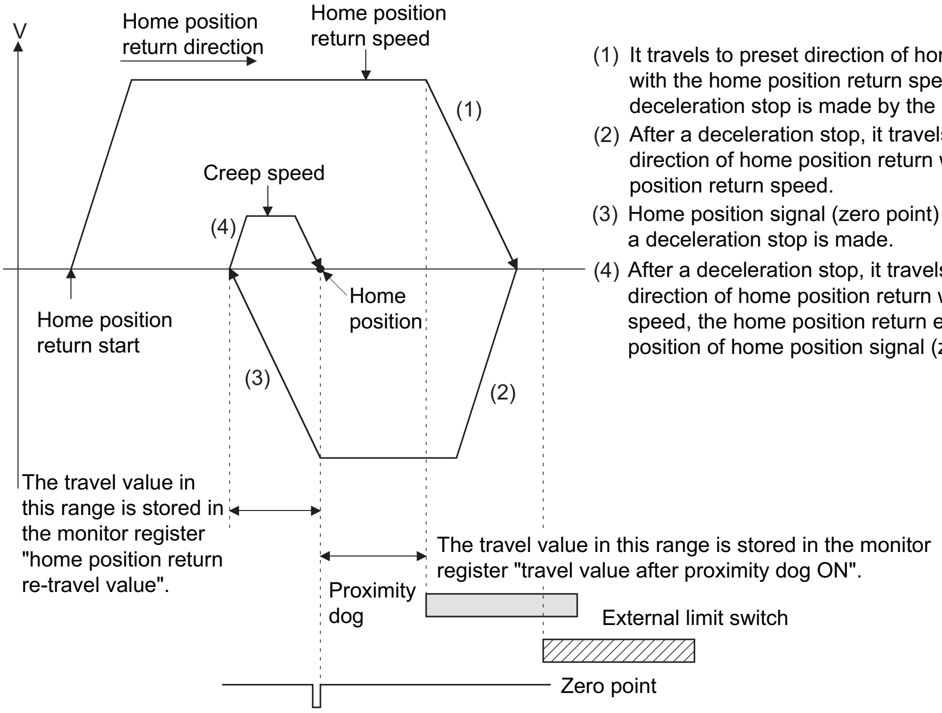
Home position return by the scale home position signal detection method

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.

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.



(1) It travels to preset direction of home position return with the home position return speed, and a deceleration stop is made by the proximity dog ON.
(2) After a deceleration stop, it travels to reverse direction of home position return with the home position return speed.
(3) Home position signal (zero point) is detected, and a deceleration stop is made.
(4) After a deceleration stop, it travels to preset direction of home position return with the creep speed, the home position return ends with the position of home position signal (zero point).

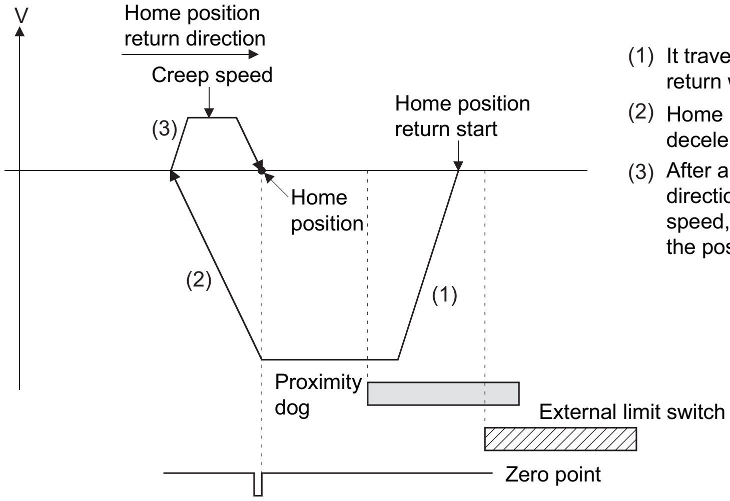
Home position return execution

Home position return by the scale home position signal detection method is executed using the servo program (☞ Page 378 Servo program for home position return).

Cautions

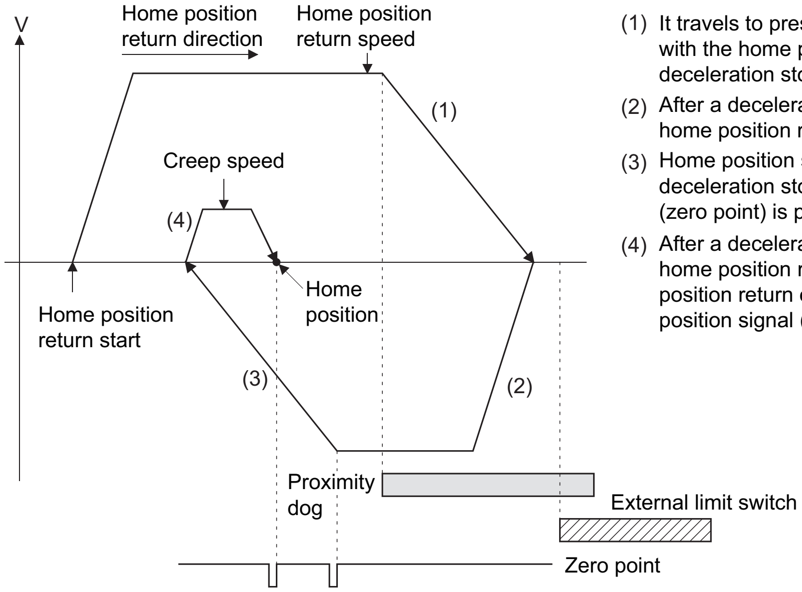
- When home position is in the proximity dog, if home position return is executed again after home position return end, a minor error (error code: 1940H) will occur, the home position return is not executed.
- Set "0: Need to pass motor Z phase after the power supply is switched on" in the "function 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: 1978H) will occur at home position return by the scale home position signal detection method starting, the home position return is not executed.
- When "[St.1066] Zero pass (R: M32406+32n/Q: 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.

• 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.



(1) It travels to preset reverse direction of home position return with the home position return speed.
(2) Home position signal (zero point) is detected, and a deceleration stop is made.
(3) After a deceleration stop, it travels to preset direction of home position return with the creep speed, and the home position return ends with the position of home position signal (zero point).

• 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.



(1) It travels to preset direction of home position return with the home position return speed, and a deceleration stop is made by the proximity dog ON.
(2) After a deceleration stop, it travels to reverse direction of home position return with the home position return speed.
(3) Home position signal (zero point) is detected, and a deceleration stop is made. (The home position signal (zero point) is passed during deceleration.)
(4) After a deceleration stop, it travels to preset direction of home position return with the creep speed, the home position return ends with the nearest position of home position signal (zero point).

• Home position return retry function cannot be used in the scale home position signal detection method.
• An error always occurs without the proximity dog in home position return direction from home position return starting position. Make the proximity dog overlap in limit switch as shown in the figure above so that the proximity dog is set before limit switch of home position return direction. 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.
• 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.
• If the "[St.1062] In-position (R: M32402+32n/Q: M2402+20n)" is not turned ON, home position return is not ended.

Home position return by the dogless home position signal reference method

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*1	Home position return data		servo parameter "Function selection C-4 (PC17) (Selection of home position setting condition)"
					Home position return retry function	Dwell time at the home position return retry	
MR-J4-□B MR-J4W-□B MR-J4-□B-RJ MR-J4-□B-LL	Standard	—	Home position signal (zero point)	Operation B	Invalid		1: Not need to pass motor Z phase after the power supply is switched on.
	Direct drive motor	—		Operation A	Valid		0: Need to pass motor Z phase after the power supply is switched on.
	Linear servo	Absolute position type	Position where address of absolute linear encoder becomes 0.	Operation C	Invalid		Both
		Incremental type	Reference mark	Operation A	Valid		0: Need to pass motor Z phase after the power supply is switched on.
	Fully closed loop control*2	Absolute position type	Position where address of absolute linear encoder becomes 0.	Operation C	Invalid		Both
		Incremental type	Reference mark	Operation A	Valid		0: Need to pass motor Z phase after the power supply is switched on.
MR-J3-□B MR-J3-□B Safety		—	Home position signal (zero point)	Operation B	Invalid		1: Not need to pass motor Z phase after the power supply is switched on.
MR-J3W-□B		—					
MR-J3-□B-RJ004 MR-J3-□B Safety		Absolute position type	Position where address of absolute linear encoder becomes 0.	Operation C			Both
		Incremental type	Reference mark	Operation A	Valid		0: Need to pass motor Z phase after the power supply is switched on.
MR-J3-□B-RJ006*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	Operation A	Valid		0: Need to pass motor Z phase after the power supply is switched on.
MR-J3-□B-RJ080W		—	Home position signal (zero point)				

*1 For the home position return operations, refer to home position return by the dogless home position signal reference method.
- Operation A (☞ Page 401 Operation A)
- Operation B (☞ Page 402 Operation B)
- Operation C (☞ Page 402 Operation C)

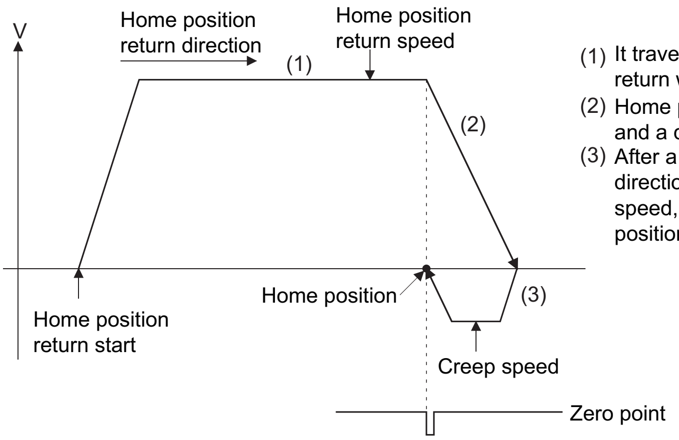
*2 During semi closed loop control is equivalent to MR-J3-□B and MR-J4-□B (standard).

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 method is shown below.

- When the zero point is in the home position return direction



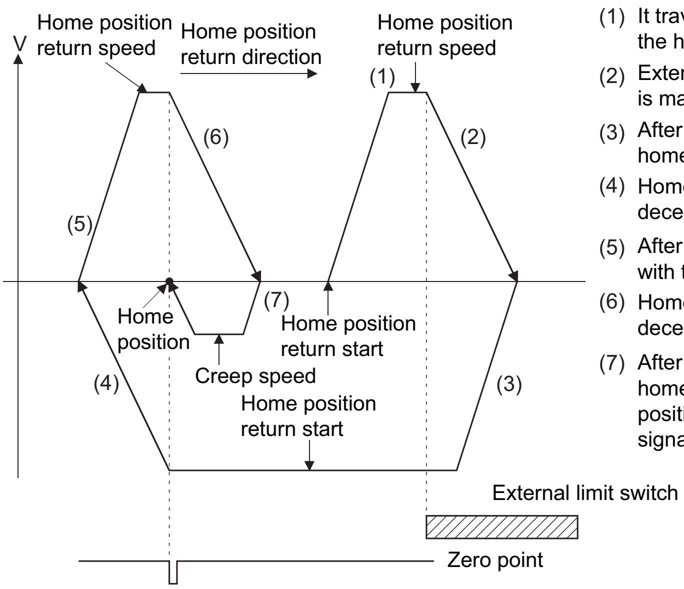
(1) It travels to preset direction of home position return with the home position return speed.
(2) Home position signal (zero point) is detected, and a deceleration stop is made.
(3) After a deceleration stop, it travels to reverse direction of home position return with the creep speed, the home position return ends with the position of home position signal (zero point).

Point

- 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.
- 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-J4-□B MR-J4W-□B MR-J4-□B-RJ MR-J4-□B-LL	Direct drive motor	Home position return ends at the position of the last home position signal (zero point) passed.
	Linear servo	Home position return ends at the position of the first home position signal (zero point) passed.
	Fully closed loop control	
MR-J3-□B-RJ004		
MR-J3-□B-RJ006		
MR-J3-□B-RJ080W		Home position return ends at the position of the last home position signal (zero point) passed.

- When the zero point is not in the home position return direction



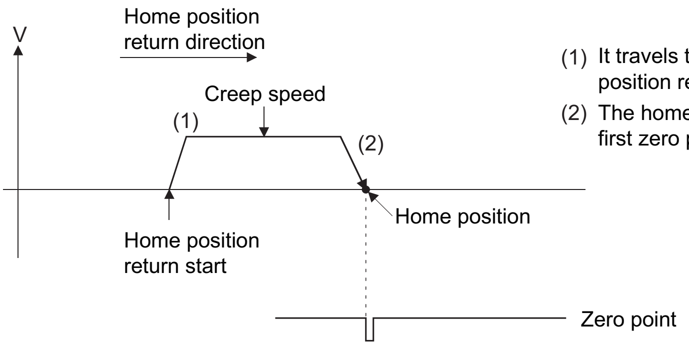
(1) It travels to preset direction of home position return with the home position return speed.
(2) External limit switch is detected, and a deceleration stop is made.
(3) After a deceleration stop, it travels to reverse direction of home position return with the home position return speed.
(4) Home position signal (zero point) is detected, and a deceleration stop is made.
(5) After a deceleration stop, it travels to home position return with the home position return speed.
(6) Home position signal (zero point) is detected, and a deceleration stop is made.
(7) After a deceleration stop, it travels to reverse direction of home position return with the creep speed, the home position return ends with the position of home position signal (zero point).

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.

■Operation B

"Operation B" of a home position return by the dogless home position signal reference method is shown below.



(1) It travels to preset direction of home position return with the creep speed.
(2) The home position return ends with first zero point.

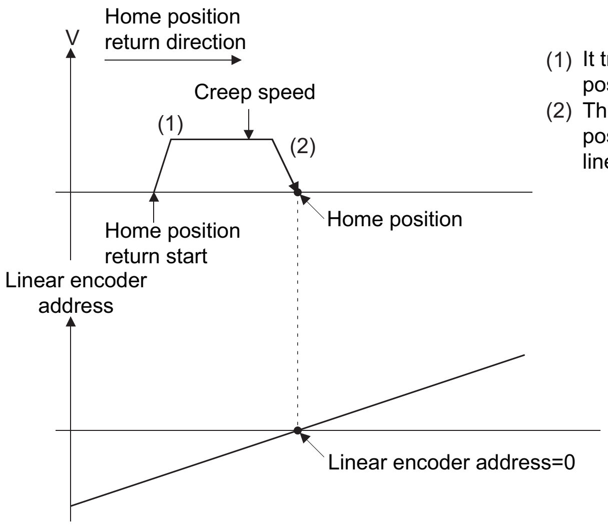
Point

- 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.

■Operation C

"Operation C" of a home position return by the dogless home position signal reference method is shown below.

- When the position where address of absolute linear encoder becomes 0 is in the home position return direction

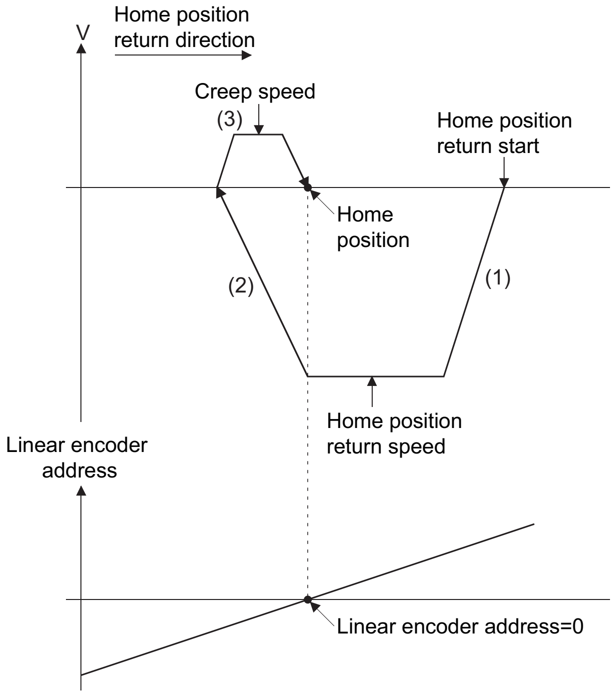


(1) It travels to preset direction of home position return with the creep speed.
(2) The home position return ends the position where address of absolute linear encoder becomes 0.

Point

- 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.

• When the position where address of absolute linear encoder becomes 0 is not in the home position return direction



(1) It travels to reverse of preset direction of home position return with the home position return speed.
(2) The position where address of absolute linear encoder becomes 0 is detected, and a deceleration stop is made.
(3) After a deceleration stop, it travels to direction of home position return with the creep speed, and the home position return ends with the position where address of absolute linear encoder becomes 0.

Point

• 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.

Home position return execution

Home position return by dogless home position signal reference method is executed using the servo program (☞ Page 378 Servo program for home position return).

Cautions

• If a home position return is started for an axis connected with servo amplifiers other than MR-J3(W)-□B, MR-J4(W)-□B, a minor error (error code: 1979H) will occur and the home position return is not executed.
• If home position return is executed again after home position return end, a minor error (error code: 197BH) will occur, the home position return is not executed.
• If connecting a rotational motor on the load side with a fully closed loop control servo amplifier (MR-J3-□B-RJ006, MR-J4-□B), 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.

- If executing home position return with a fully closed loop control servo amplifier (MR-J3-□B-RJ006, MR-J4-□B), 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
- 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 reverse direction of home position return direction.
- The operation for when home position return is executed during the operation of amplifier-less operation function is shown below.

Servo amplifier	Operation
MR-J3(W)-□B	Regardless of the servo amplifier model, home position return is executed by the home position return operation of "Operation B".
MR-J4(W)-□B	Home position return is performed by the home position return operation that complies with the amplifier operation mode that is set in [Motion CPU Common Parameter] ⇨ [Servo Network Setting] ⇨ "Amplifier Setting".

- The following describes precautions for the home position return operations for the home position return by dogless home position signal reference method.

Home position return operation	Cautions
Operation A	• 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: 1978H) will occur and the home position return is not executed. • If the "[St.1066] Zero pass (R: M32406+32n/Q: 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. • 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. • 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.
Operation B	• 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: 1978H) will occur and the home position return is not executed. • Home position return retry function cannot be used.
Operation C	• 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.

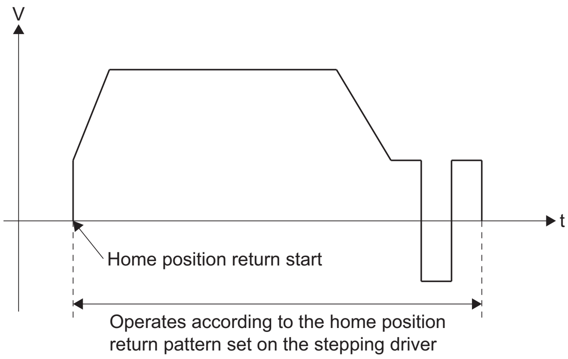
Home position return by the driver home position return method

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 manual of the stepping driver being used for home position return operations and parameters.

Home position return by driver home position return method

The operation for home position return by driver home position return method is shown below.



Home position return execution

Home position return by driver home position return method is executed using a servo program. (☞ Page 378 Servo program for home position return)

Cautions

- If a home position return is started for an axis that is not connected to a stepping driver, a minor error (error code: 1979H) will occur and the home position return is not executed.
- 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 manual of the stepping driver being used for details.
- 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.

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 the following for home position return method by using the home position return retry function. (☞ Page 187 Setting items for home position return data)

Setting data

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.

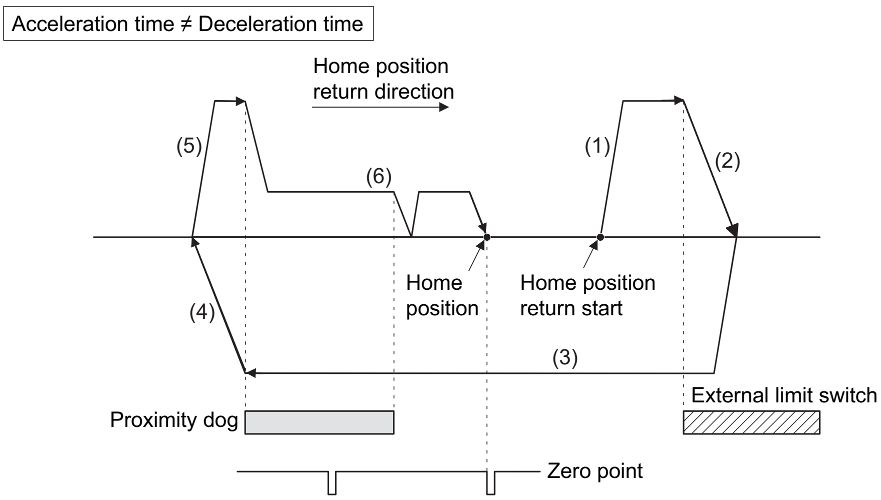
■Home position return data

Items	Setting details	Setting value	Initial value
Home position return retry function	0: Invalid (Do not execute the home position return retry by limit switch.) 1: 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

Processing details

Operation for the home position return retry function is shown below.

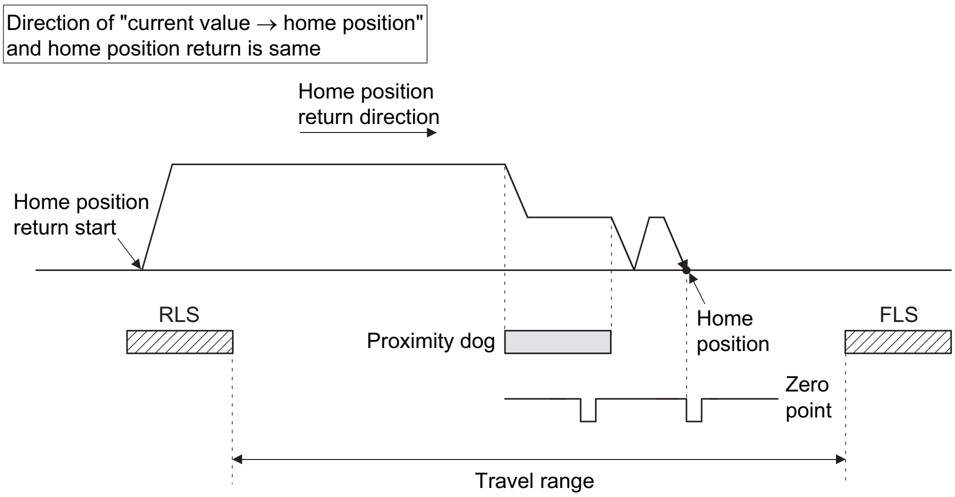
■Home position return retry operation setting a current value within the range of external limit switch



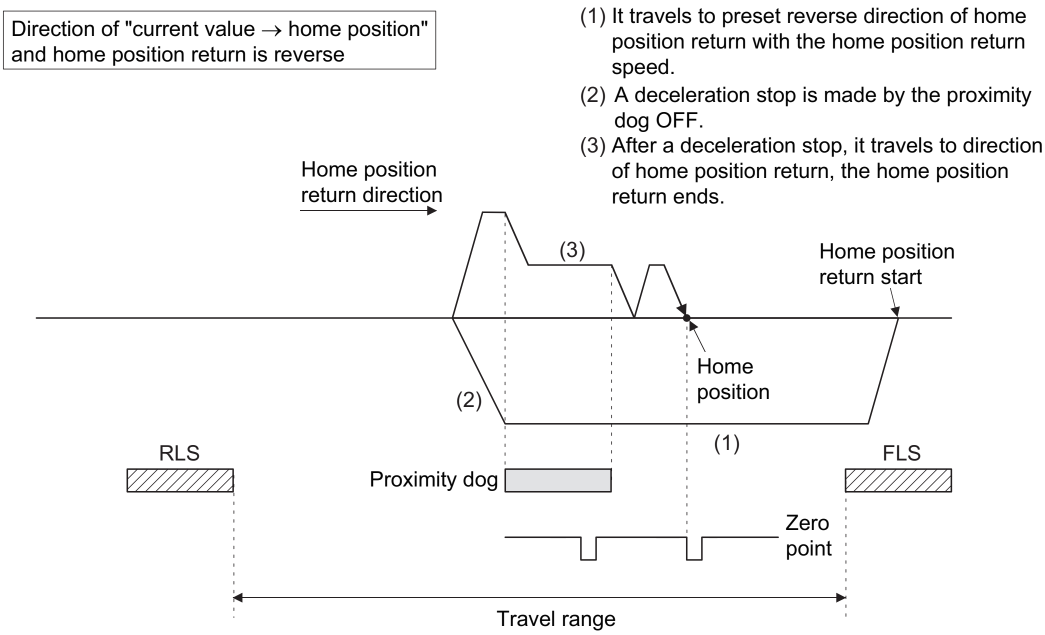
(1) It travels to preset direction of home position return.
(2) If the external upper/lower limit switch turns OFF before the detection of proximity dog, a deceleration stop is made.
(3) After a deceleration stop, it travels to reverse direction of home position return with the home position return speed.
(4) A deceleration stop is made by the proximity dog OFF.
(5) After a deceleration stop, it travels to direction of home position return.
(6) Home position return ends.

■Home position return retry operation setting a current value outside the range of external limit switch

- When the direction of "current value → home position" and home position return is same, normal home position return is operated.



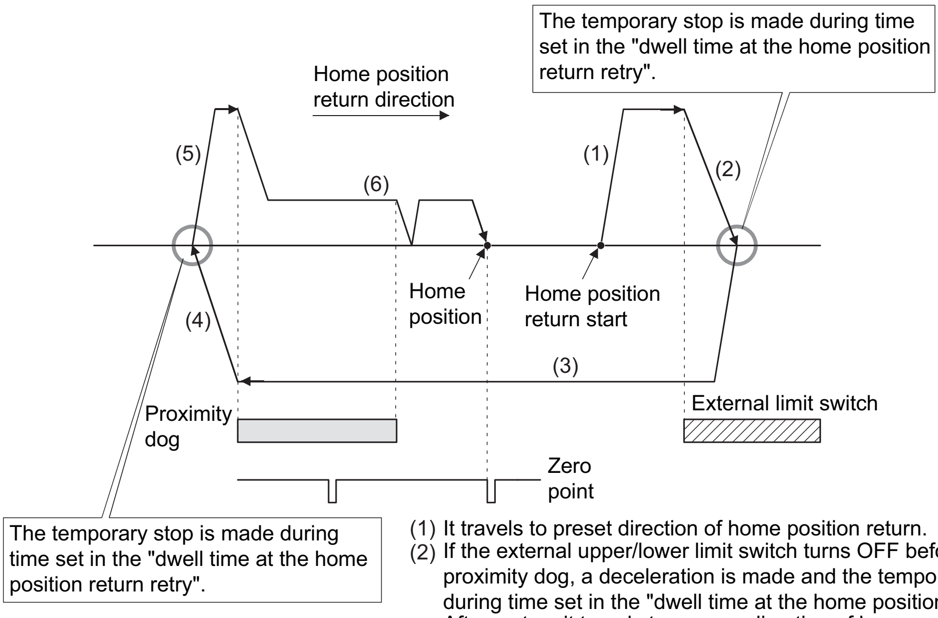
- When the direction of "current value → home position" and home position return is reverse, deceleration stop is made with the proximity dog OFF and home position return is operated to preset direction of home position return.



■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.)



(1) It travels to preset direction of home position return.
(2) If the external upper/lower limit switch turns OFF before the detection of proximity dog, a deceleration is made and the temporary stop is made during time set in the "dwell time at the home position return retry".
(3) After a stop, it travels to reverse direction of home position return with the home position return speed.
(4) A deceleration is made by the proximity dog OFF and the temporary stop is made during time set in the "dwell time at the home position return retry".
(5) After a stop, it travels to direction of home position return.
(6) Home position return ends. At this time, the "dwell time at the home position return retry" is invalid.

Precautions

- Possible/not possible of home position return retry function by the home position return method is shown below.

○: Possible, ×: Not possible

Home position return methods		Possible/not possible of home position return retry function
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	Operation A	○
	Operation B	×
	Operation C	×
Driver home position return method		×

- 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.
- 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 minor error (error codes: 1904H to 1907H) 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, servomotors continue rotating.

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.

Setting data

Set the following "home position return data" using MT Developer2 to use the home position shift function.
Refer to the following for home position return method by using the home position shift function. (☞ Page 187 Setting items for home position return data)
Set the parameters for every axis.

■Home position return data

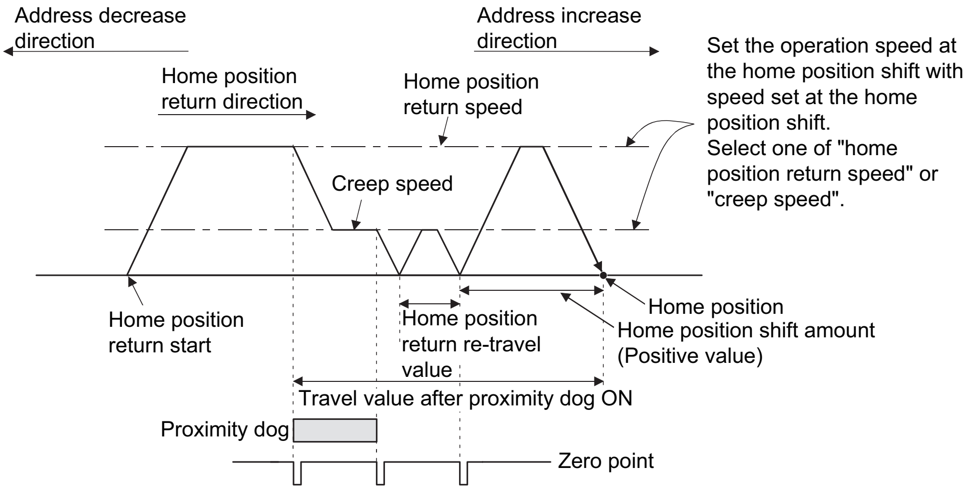
Items	Setting details	Setting value	Initial value
Home position shift amount	The shift amount at the home position shift is set.	-2147483648 to 2147483647 [$\times10^{-1}$ μm, $\times10^{-5}$ inch, $\times10^{-5}$ degree, pulse]	0
Speed set at the home position shift	The speed at the home position shift is set.	0: Home position return speed 1: Creep speed	0

Processing details

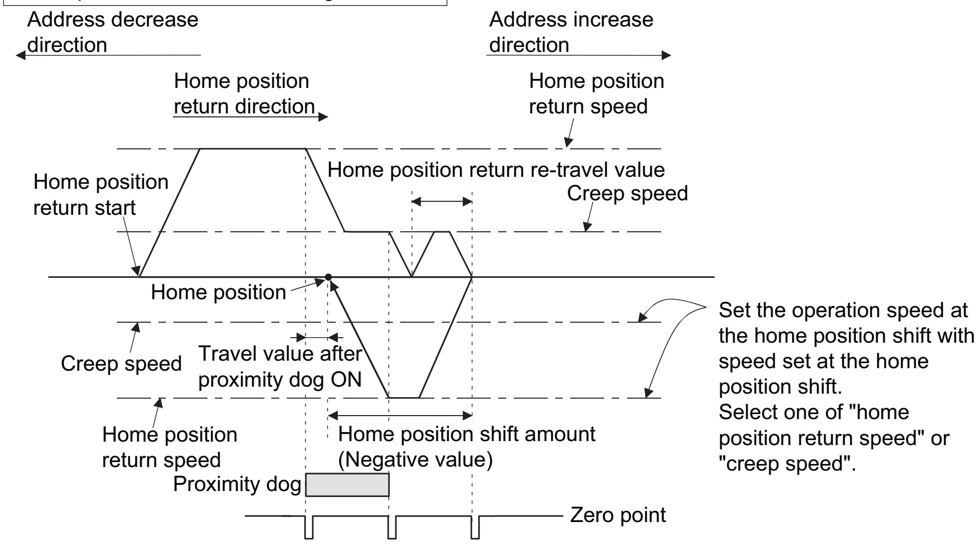
■Home position shift operation

Operation for the home position shift function is shown below.

Home position shift amount is positive value

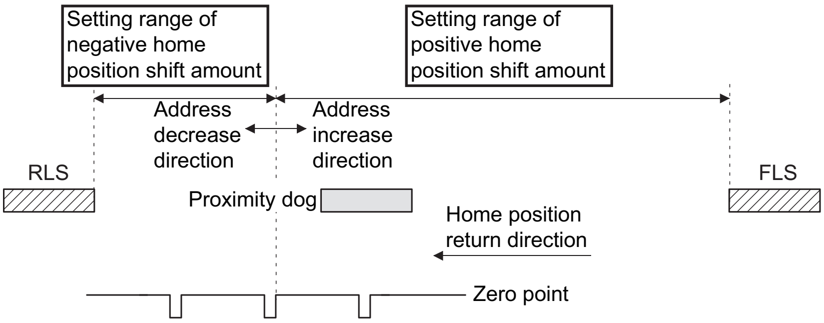


Home position shift amount is negative value



■Setting range of home position shift amount

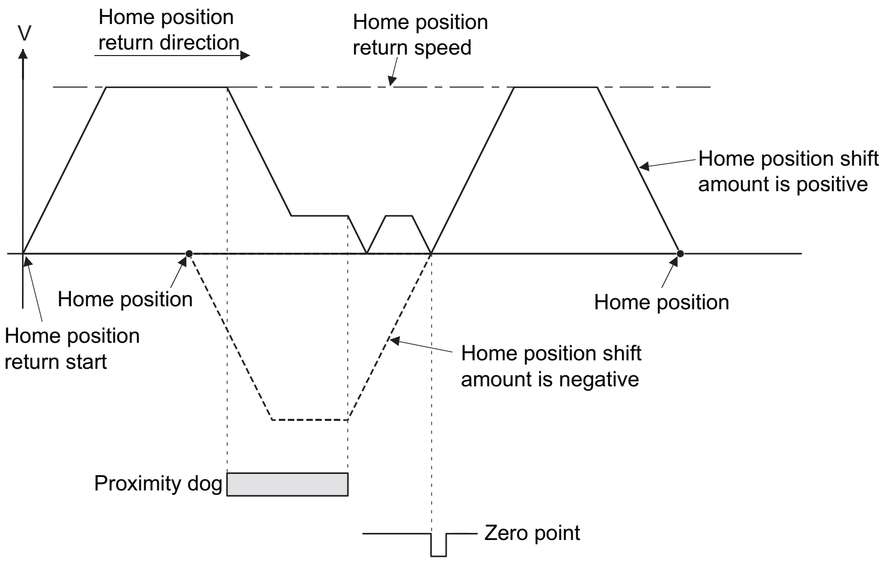
Set the home position shift amount within the range of from the detected zero signal to external upper/lower limit switch (FLS/RLS). If the range of external upper/lower limit switch is exceeded, a minor error (error codes: 1905H, 1907H) will occur at that time and the home position return is not ended.



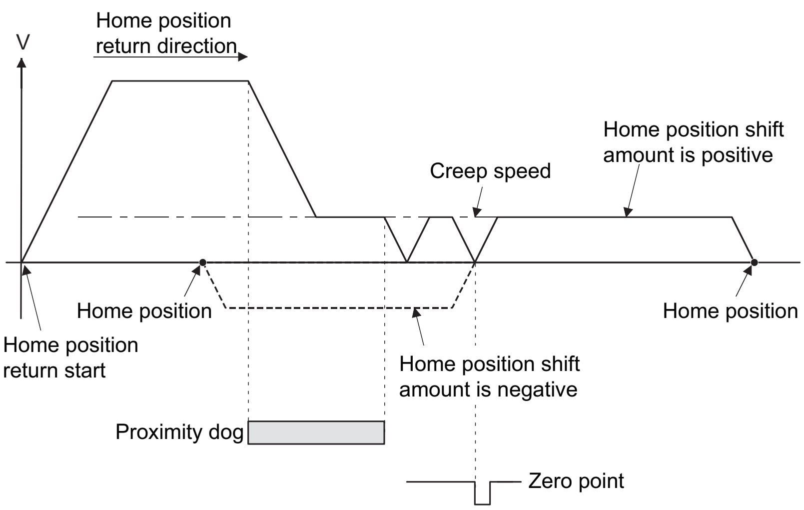
■Travel speed at the home position shift

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.

- Home position shift operation with the "home position return speed"



- Home position shift operation with the "creep speed"



Precautions

- Valid/invalid of home position shift amount setting value by the home position return method.

○: Valid, ×: Invalid

Home position return methods	Possible/not possible of home position return retry function
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	○
Driver home position return method	×

- Axis monitor devices and axis statuses are set after completion of home position shift.
- 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" [$\times 10^{-1}\mu m$, $\times 10^{-5}$inch, $\times 10^{-5}$degree, pulse].

Condition selection of home position set

A home position return must be made after the servomotor has been rotated more than one revolution to pass the axis through the Z-phase (motor reference position signal) and the "[St.1066] Zero pass (R: M32406+32n/Q: 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 the "function selection C-4 (PC17), Condition selection of home position set" of servo parameter (expansion setting parameter), if it does not pass zero point with the motor rotation after turning the servo amplifier power ON, the "[St.1066] Zero pass (R: M32406+32n/Q: M2406+20n)" can be turned ON.

Setting data

Set the following "servo parameter" using MT Developer2 to select the "function selection C-4 (PC17)".
Set the servo parameters for every axis.

■Servo parameter (expansion setting parameter)

Items	Setting details	Setting value	Initial value
Function selection C-4 (PC17) Condition selection of home position set	Set the condition selection of home position set in the absolute position system.	0: 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

Precautions

- 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 servomotor is rotated more than one revolution to pass the axis through the Z-phase (motor reference position signal)" is lost.
- 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 "[St.1066] Zero pass (R: M32406+32n/Q: M2406+20n)" turns ON.
- When the above parameter is changed, control circuit power supply of the servo amplifier is turned OFF to ON after resetting or turning power OFF to ON of Multiple CPU system.

Point

- 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: 1978H) will occur at the home position return start and the home position return is not executed.
- 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. (☞ Page 400 Home position return by the dogless home position signal reference method)

5.22 Current Value Change

The current value of the specified servo motor/command generation axis is changed.

○: Must be set, △: Set if required

Servo instruction	Positioning method	Number of control axes	Positioning data set in servo instructions																																	
			Common							Arc				OSC				Parameter block											Others							
			Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Number of pitches	Starting angle	Amplitude	Frequency	Reference axis No. *1	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	Bias speed at start	Repeat condition	Program No.	Command speed (Continuous trajectory)	Skip	FIN acceleration/deceleration	WAIT-ON/OFF	Fixed position stop acceleration/deceleration time	Fixed position stop
CHGA	Absolute	1		○	○																															

*1 Only when the reference axis speed is specified

Processing details

- Executing the CHGA instruction changes the current value in the following procedure.

1. The "[St.1040] Start accept flag (R: M30080+n/Q: M2001+n)" corresponding to the specified axis is turned on. For the command generation axis, "[St.345] Command generation axis start accept flag (R: M36570+32n/Q: M9810+20n)" corresponding to the specified axis is turned on.

2. The feed current value of the specified axis is changed to the specified address. In this case, the servo motor (output axis) does not move.

3. Start accept flag is turned off at completion of the feed current value change.

- When the servo program is not assigned to the command generation axis program, the operation is as follows.
  - The current value of the specified servo motor axis is changed.
  - The address which made the current value change by CHGA instruction is valid on the power supply turning on
  - The feed current value that is restored after the Multiple CPU system power supply or the control circuit power supply of the servo amplifier is turned ON again, is returned to the state before the performing of the current value change by the CHGA instruction.
- When the servo program is assigned to the command generation axis program, a current value change is performed for the specified command generation axis.

Program example

A program for performing the current value change control of Axis 2 is explained as an example.

This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■The current value change control conditions

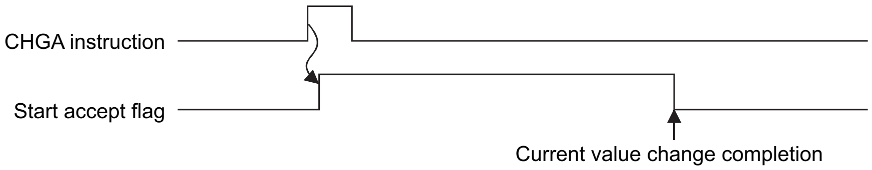
- The current value change control conditions are shown below.

Items	Setting value
Servo program No.	10
Control axis No.	2
Current value change address	50

- Start command of current value change control: Leading edge of X0 (OFF → ON)

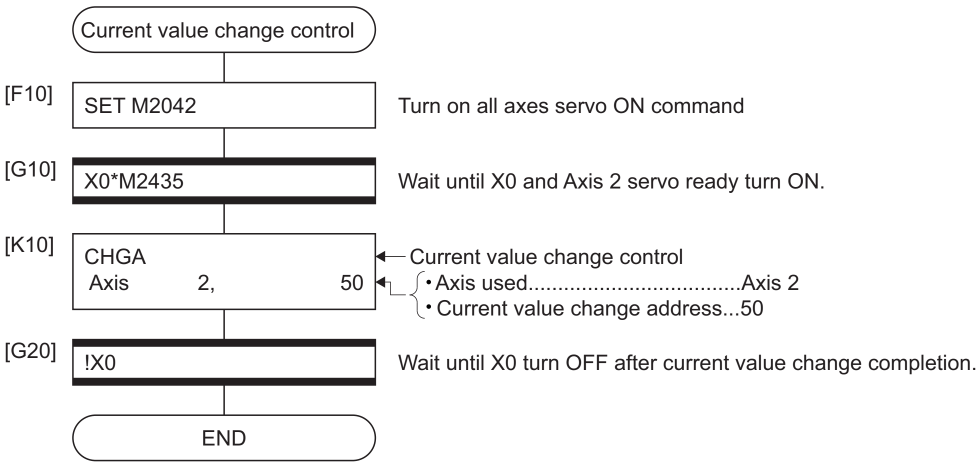
■Operation timing

The operation timing for current value change is shown below.



■Motion SFC program

The Motion SFC program for executing the servo program (No. 10) for current value change is shown below.



Point

[Current value changing instructions]

- When "[Rq.1120] PLC ready flag (R: M30000/Q: M2000)" or "PCPU READY complete flag (SM500)" is OFF, a minor error (error code: 19A1H) occurs and a current value change is not made.
- If a current value change is made while the specified axis is starting, a minor error (error code: 192AH) (start accept signal of the corresponding axis is ON) occurs and the current value change is not made.
- If the servo of the corresponding axis is not servo on, a minor error (error code: 1901H) occurs and the current value change is not made.
- If the corresponding axis is in a servo error, a minor error (error code: 1927H) occurs and the current value change is not made.
- Set the current value change program of the command generation axis within the command generation axis program No. range set in "Command generation axis program allocation setting" of MT Developer2.

6 MANUAL CONTROL

This section describes the manual control methods.

6.1 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 following for JOG operation method in the test mode of MT Developer2.

Help of MT Developer2

JOG operation data must be set for each axis for JOG operation. (☞ Page 188 JOG Operation Data)

Individual start

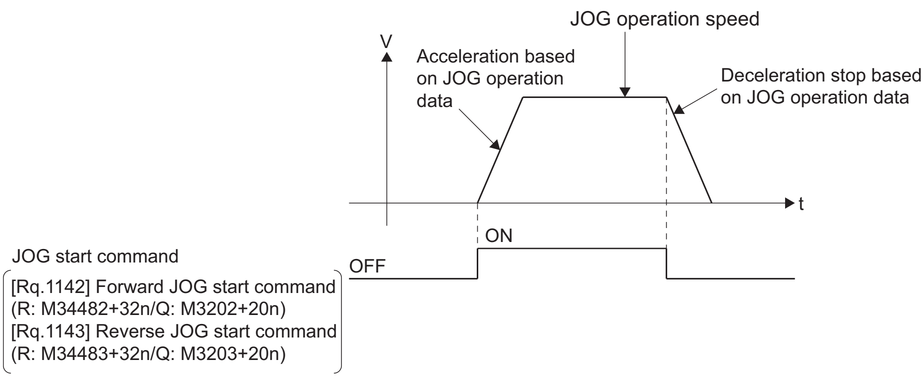
JOG operation for the specified axes is started.

JOG operation is executed by the following JOG start commands:

- [Rq.1142] Forward JOG start command (R: M34482+32n/Q: M3202+20n)
- [Rq.1143] Reverse JOG start command (R: M34483+32n/Q: M3203+20n)

Processing details

- JOG operation continues at the "[Cd.1110] JOG speed setting (R: D35120+2n, D35121+2n/Q: 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.



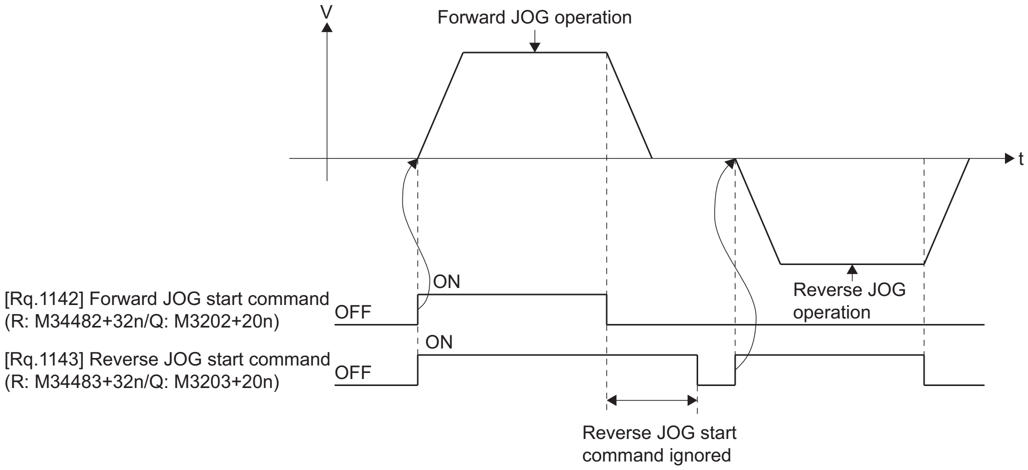
- The setting range for "[Cd.1110] JOG speed setting (R: D35120+2n, D35121+2n/Q: D640+2n, D641+2n)" are shown below.

Device name	Setting range			
	mm	inch	degree	pulse
[Cd.1110] JOG speed setting (R: D35120+2n, D35121+2n/ Q: D640+2n, D641+2n)	1 to 600000000 (× 10^{-2} [mm/min])	1 to 600000000 (× 10^{-3} [inch/min])	1 to 2147483647 (× 10^{-3} [degree/min])*1	1 to 2147483647 [pulse/s]

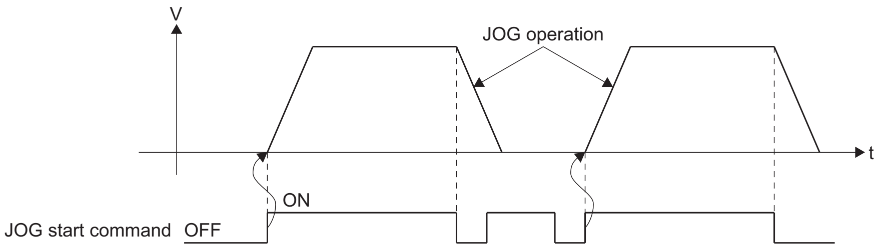
*1 When the "speed control 10 × multiplier setting for degree axis" is set to "valid" in the fixed parameter, the unit is "×10^{-2} [degree/min]"

Precautions

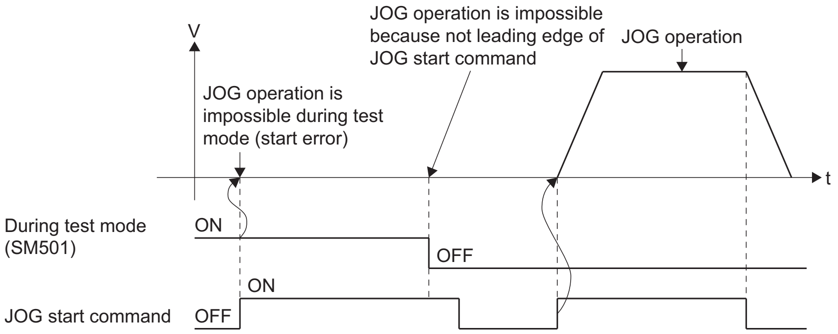
- If the "[Rq.1142] Forward JOG start command (R: M34482+32n/Q: M3202+20n)" and "[Rq.1143] Reverse JOG start command (R: M34483+32n/Q: M3203+20n)" turn on simultaneously for a single axis, the forward JOG operation is executed. When a deceleration stop is made by the "[Rq.1142] Forward JOG start command (R: M34482+32n/Q: M3202+20n)" OFF the reverse JOG operation is not executed even if the "[Rq.1143] Reverse JOG start command (R: M34483+32n/Q: M3203+20n)" is ON. After that, when the reverse JOG start command turns off to on, the reverse JOG operation is executed.



- If the JOG start command ("[Rq.1142] Forward JOG start command (R: M34482+32n/Q: M3202+20n)" / "[Rq.1143] Reverse JOG start command (R: M34483+32n/Q: 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.



- JOG operation by the JOG start command ("[Rq.1142] Forward JOG start command (R: M34482+32n/Q: M3202+20n)" / "[Rq.1143] Reverse JOG start command (R: M34483+32n/Q: 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 example

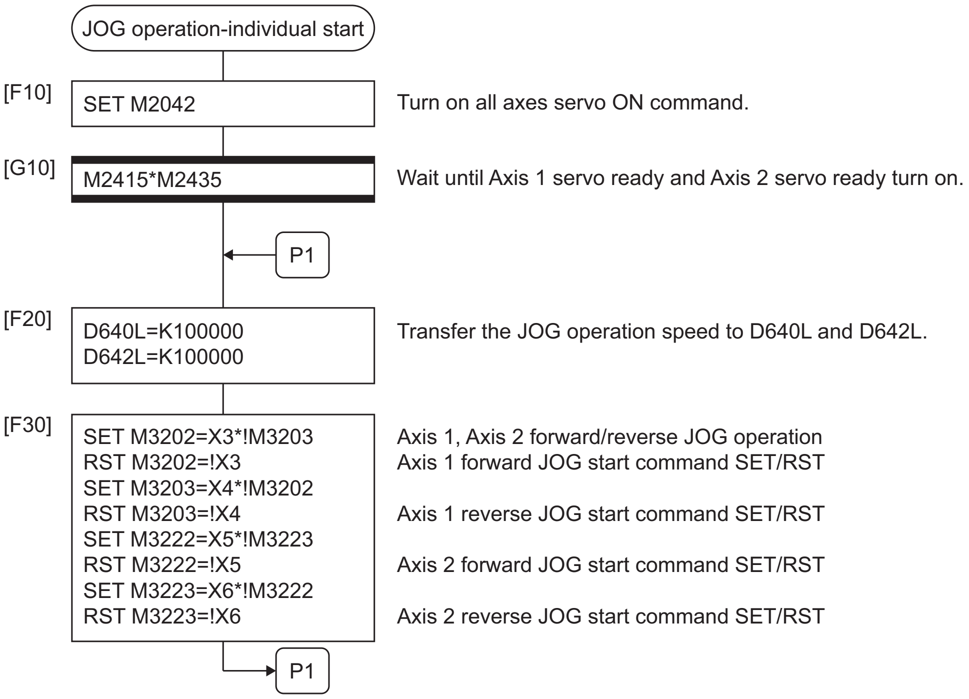
The program for performing JOG operation of Axis 1 and Axis 2 is explained as an example.
This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■JOG operation conditions

Item			JOG operation conditions
Axis No.			Axis 1, Axis 2
JOG start speed			100000 (1000.00 [mm/min])
JOG start commands	Forward JOG start	Axis 1	X3 ON
		Axis 2	X5 ON
	Reverse JOG start	Axis 1	X4 ON
		Axis 2	X6 ON

■Motion SFC program

Motion SFC program for which executes JOG operation is shown below.



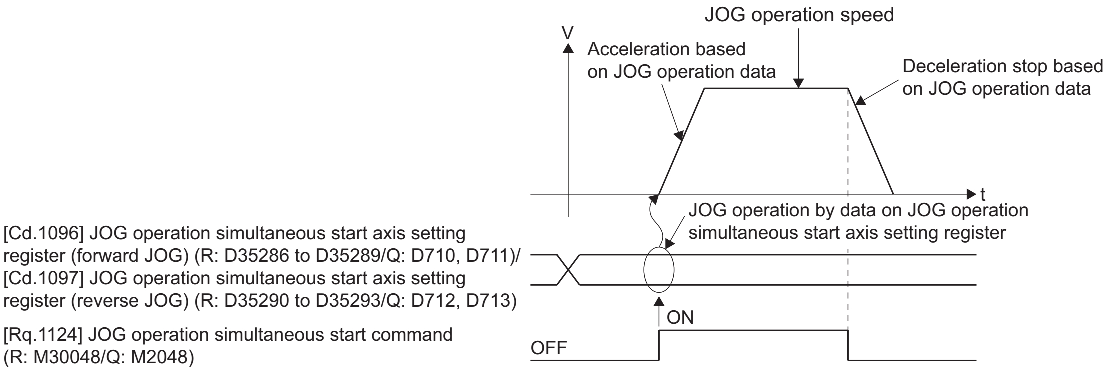
*1 Example of the above Motion SFC program is started using the automatic start or sequence program.

Simultaneous start

Simultaneous start JOG operation for specified multiple axes.

Processing details

- JOG operation continues at the JOG speed setting register value for each axis while the "[Rq.1124] JOG operation simultaneous start command (R: M30048/Q: M2048)" turns on, and a deceleration stop is made by the "[Rq.1124] JOG operation simultaneous start command (R: M30048/Q: M2048)" OFF. Control of acceleration/deceleration is based on the data set in the JOG operation data.



- JOG operation axis is set in the "[Cd.1096] JOG operation simultaneous start axis setting register (forward JOG) (R: D35286 to D35289/Q: D710, D711)" / "[Cd.1097] JOG operation simultaneous start axis setting register (reverse JOG) (R: D35290 to D35293/Q: D712, D713)".

		b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
[Cd.1096] JOG operation simultaneous start axis setting registers (Forward rotation JOG)	R: D35286/ Q: D710	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
	R: D35287/ Q: D711	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
	R: D35288	Axis 48	Axis 47	Axis 46	Axis 45	Axis 44	Axis 43	Axis 42	Axis 41	Axis 40	Axis 39	Axis 38	Axis 37	Axis 36	Axis 35	Axis 34	Axis 33
	R: D35289	Axis 64	Axis 63	Axis 62	Axis 61	Axis 60	Axis 59	Axis 58	Axis 57	Axis 56	Axis 55	Axis 54	Axis 53	Axis 52	Axis 51	Axis 50	Axis 49
[Cd.1097] JOG operation simultaneous start axis setting registers (Reverse rotation JOG)	R: D35290/ Q: D712	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
	R: D35291/ Q: D713	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
	R: D35292	Axis 48	Axis 47	Axis 46	Axis 45	Axis 44	Axis 43	Axis 42	Axis 41	Axis 40	Axis 39	Axis 38	Axis 37	Axis 36	Axis 35	Axis 34	Axis 33
	R: D35293	Axis 64	Axis 63	Axis 62	Axis 61	Axis 60	Axis 59	Axis 58	Axis 57	Axis 56	Axis 55	Axis 54	Axis 53	Axis 52	Axis 51	Axis 50	Axis 49

*1: Make JOG operation simultaneous start axis setting with 1/0.
1: Simultaneous start execution
0: Simultaneous start not execution
*2: The following range is valid. R16MTCPU: Axis No.1 to 16, R32MTCPU: Axis No.1 to 32.

- The setting range for "[Cd.1110] JOG speed setting (R: D35120+2n, D35121+2n/Q: D640+2n, D641+2n)" are shown below.

Device name	Setting range			
	mm	inch	degree	pulse
[Cd.1110]JOG speed setting (R: D35120+2n, D35121+2n/ Q: D640+2n, D641+2n)	1 to 600000000 ($\times 10^{-2}$ [mm/min])	1 to 600000000 ($\times 10^{-3}$ [inch/min])	1 to 2147483647 ($\times 10^{-3}$ [degree/min])*1	1 to 2147483647 [pulse/s]

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

Program example

The program for performing simultaneous start of JOG operations of Axis 1 and Axis 2 is explained as an example.
This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■JOG operation conditions

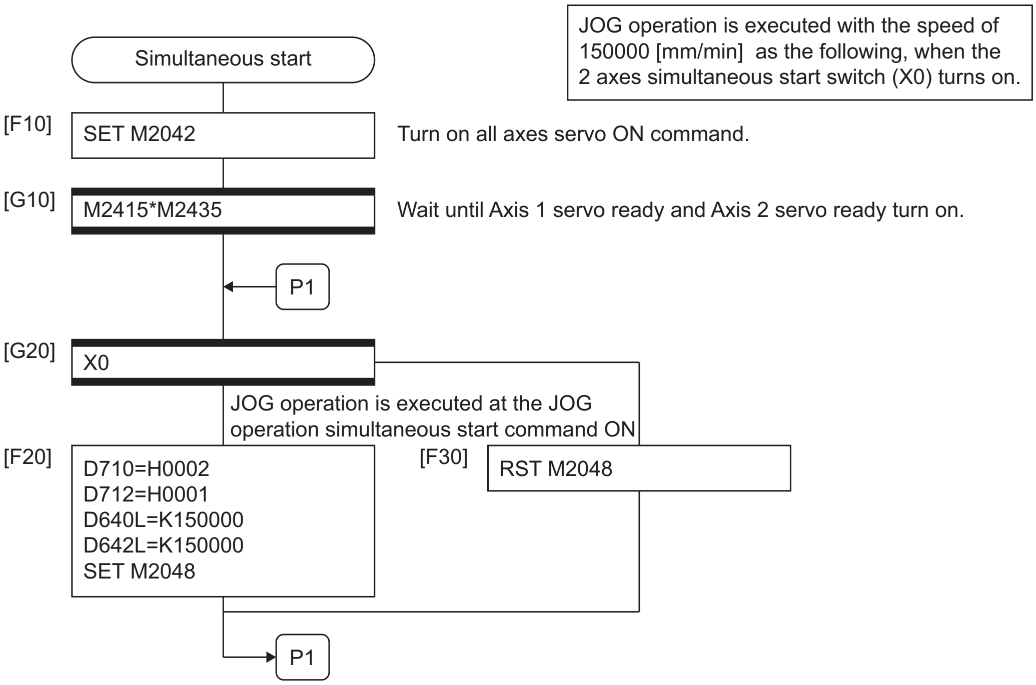
• JOG operation conditions are shown below.

Item	JOG operation conditions	
Axis No.	Axis 1	Axis 2
JOG operation speed	150000	150000

• JOG start command: During X0 ON

■Motion SFC program

Motion SFC program for which executes the simultaneous start of JOG operation is shown below.



*1 Example of the above Motion SFC program is started using the automatic start or sequence program.

6.2 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

Setting data

■Usable modules

The manual pulse generator is connected to a high-speed counter module controlled by the self CPU. The following high-speed counter modules can be used.

Module	Model
High-speed counter modules	RD62P2
	RD62D2

■Manual pulse generator connection setting

Set the manual pulse generator to be connected (P1 to P3) in [Motion CPU common parameter] ⇨[manual pulse generator connection setting]. Refer to the following for details of the pulse generator connection.

📖MELSEC iQ-R Motion controller Programming Manual (Common)

No.	Item	Setting Range
1	Validity setting	0: Invalid/1: Valid
2	Start XY	0000h to 0FF0h
3	Channel number	1 to 2

■High-speed counter module setting

Setting of the high-speed counter module for connecting the manual pulse generator is as follows.

- Setting of GX Works3
  Set the self Motion CPU as the control CPU in control CPU setting.

[System Parameter] ⇨ [I/O Assignment Setting] ⇨ "Control CPU Setting".

- Setting of MT Developer2
  Set the following in the detailed settings of the module.

[R Series Common Parameter] ⇨ [Module Configuration List] ⇨ "Setting item" ⇨ "Detail" button

Setting item	Details
Counter type	Set to "Ring counter".
Counter operation mode	Set to "Pulses counter mode".

If a fault is detected when the above setting is checked during initialization of a Motion CPU, a moderate error (error code: 30D4H) is output and the Motion CPU does not run.

Point

The count enable command (Y signal) is set to "Always ON" for the relevant channel of the high-speed counter module for which the manual pulse generator is set to connect to.

Processing details

■Manual pulse generator enable flag

- 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 connecting position	Manual pulse generator axis No. setting register	Manual pulse generator enable flag
P1	[Cd.1098] Manual pulse generator 1 axis No. setting register (R: D35294 to D35297/Q: D714, D715)	[Rq.1125] Manual pulse generator 1 enable flag (R: M30051/Q: M2051)
P2	[Cd.1099] Manual pulse generator 2 axis No. setting register (R: D35298 to D35301/Q: D716, D717)	[Rq.1126] Manual pulse generator 2 enable flag (R: M30052/Q: M2052)
P3	[Cd.1100] Manual pulse generator 3 axis No. setting register (R: D35302 to D35305/Q: D718, D719)	[Rq.1127] Manual pulse generator 3 enable flag (R: M30053/Q: M2053)

■Travel value and output speed for positioning control

The travel value and output speed for positioning control based on the pulse input from manual pulse generator are shown below.

- 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] × [Number of input pulses] × [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 [μm]) × (1 [pulse]) × (Manual pulse generator 1-pulse input magnification setting)

- 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]

■Setting of the axis operated by the manual pulse generator

The axis operated by the manual pulse generator is set in the following manual pulse generator axis setting register.
The bit corresponding to the axis controlled (1 to 64) is set.

- [Cd.1098] Manual pulse generator 1 axis No. setting register (R: D35294 to D35297/Q: D714, D715)
- [Cd.1099] Manual pulse generator 2 axis No. setting register (R: D35298 to D35301/Q: D716, D717)
- [Cd.1100] Manual pulse generator 3 axis No. setting register (R: D35302 to D35305/Q: D718, D719)

■Manual pulse generator 1-pulse input magnification setting

Make magnification setting for 1-pulse input from the manual pulse generator for each axis.

Device name	Setting range
[Cd.1101] 1-pulse input magnification setting register (R: D35306+n/Q: D720+n)	1 to 10000

*1 The manual pulse generator does not have the speed limit value, so they set the magnification setting within the related speed of servomotor.

6

■Check of the manual pulse generator 1-pulse input magnification

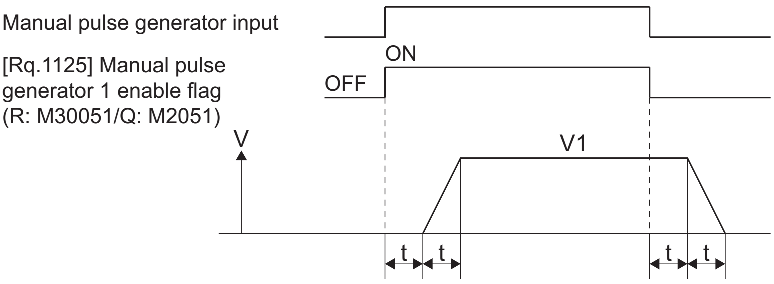
The setting manual pulse generator 1-pulse input magnification checks the "1-pulse input magnification setting registers of the manual pulse generator" of the applicable axis at leading edge of manual pulse generator enable flag. If the value is outside of range, a warning (error code: 0988H) occurs and a value of "1" is used for the magnification.

■Manual pulse generator smoothing magnification setting

A magnification to smooth leading edge/trailing edge of manual pulse generator operation is set. When a value outside the range is set, a warning (error code: 098FH) occurs, and the magnification "0" is applied.

	Manual pulse generator smoothing magnification setting register	Setting range
Manual pulse generator 1 (P1)	[Cd.1102] Manual pulse generator 1 smoothing magnification setting register (R: D35370/Q: D752)	0 to 59
Manual pulse generator 2 (P2)	[Cd.1103] Manual pulse generator 2 smoothing magnification setting register (R: D35371/Q: D753)	
Manual pulse generator 3 (P3)	[Cd.1104] Manual pulse generator 3 smoothing magnification setting register (R: D35372/Q: D754)	

- Operation



Output speed (V1) = [Number of input pulses/ms] × [Manual pulse generator 1-pulse input magnification setting]

Travel value (L) = [Travel value per pulse] × [Number of input pulses] × [Manual pulse generator 1-pulse input magnification setting]

- When the smoothing magnification is set, the smoothing time constant is as following formula.

Smoothing time constant (t) = [Smoothing magnification + 1] × 56.8 [ms]

Point

The smoothing time constant is within the range of 56.8 to 3408 [ms].

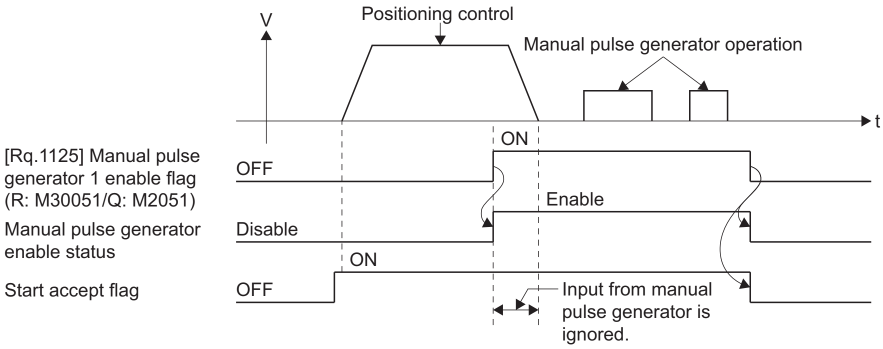
■Errors when setting manual pulse operation data

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	A warning (error code: 098EH) occurs, and a 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.	A minor error (error code: 198FH) occurs, and a manual pulse generator operation is not executed.

Precautions

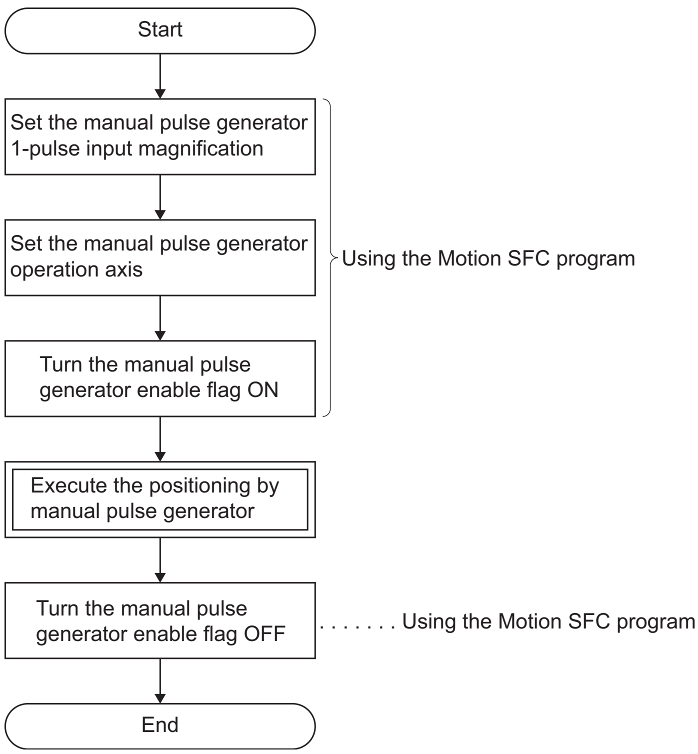
- The start accept flag turns on for axis during manual pulse generator operation. Positioning control or home position return cannot be started using the Motion CPU or MT Developer2. Turn off the manual pulse generator enable flag after the manual pulse generator operation end.
- When the torque limit value is not specified with M(P).CHGT/D(P).CHGT (torque limit value change request instruction form the PLC CPU to the Motion CPU), or CHGT (torque limit value change request), the torque limit value is fixed at 300.0 [%] during manual pulse generator operation.
- 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: 192AH) occurs, and manual pulse generator input is not enabled.



- 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, a minor error (error code: 198EH) occurs, and the manual pulse generator input is not enabled. At this time, include the start accept flag OFF for specified axis as an interlock condition for turning ON the manual pulse generator enable flag.

Operating procedure

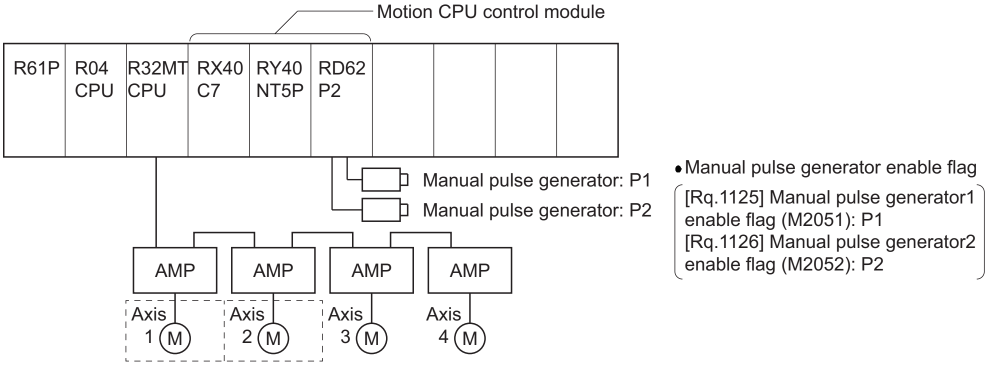
Procedure for manual pulse generator operation is shown below.



Program example

The program for performing manual pulse generator operation of Axis 1 and Axis 2 is explained as an example.
This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

■System configuration

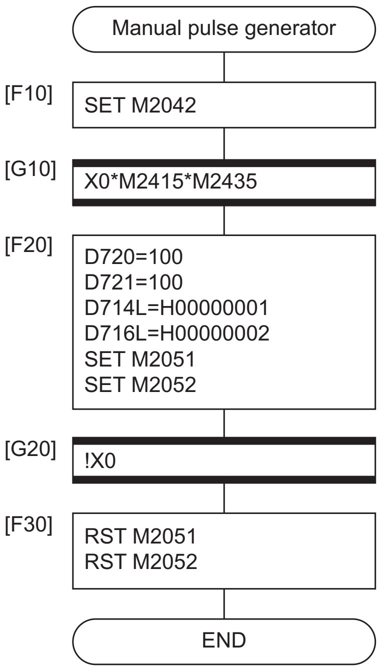


■Manual pulse generator operation conditions

Item	Manual pulse generator operation conditions
Manual pulse generator operation axis	Axis 1, Axis 2
Manual pulse generator 1-pulse input magnification	100
Manual pulse generator operation enable	M2051(Axis 1) ON: P1 M2052(Axis 2) ON: P2
Manual pulse generator operation end	M2051(Axis 1) OFF: P1 M2052(Axis 2) OFF: P2

■Motion SFC program

Motion SFC program for manual pulse generator operation is shown below.



Wait until X0, Axis 1 servo ready and Axis 2 servo ready turn ON.

Manual pulse generator 1-pulse input magnification for Axis 1, Axis 2.
Control Axis 1 by P1.
Control Axis 2 by P2.
Manual pulse generator 1 enable flag ON for P1
Manual pulse generator 2 enable flag ON for P2

Wait until X0 turn OFF after manual pulse generator operation end.

Manual pulse generator 1 enable flag OFF for P1
Manual pulse generator 2 enable flag OFF for P2
*: Turn the manual pulse generator enable flag OFF for P1, P2, so that the operation may not continue for safety.

*1 Example of the above Motion SFC program is started using the automatic start or sequence program.

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.

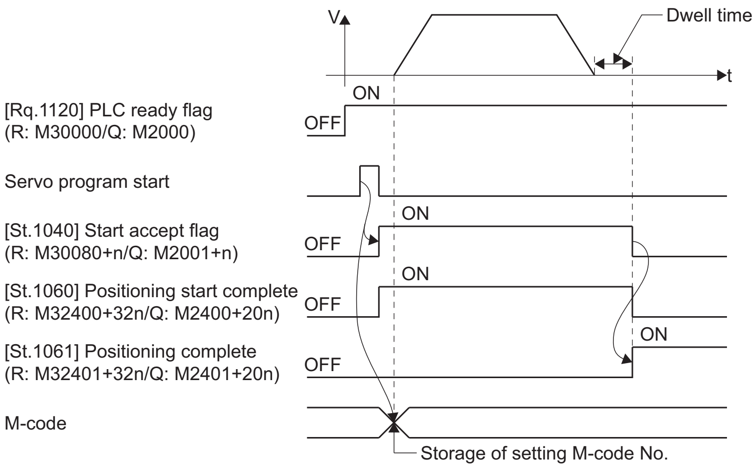
Setting of M-codes

M-code can be set using MT Developer2 at the creation and correction of the servo program.

Storage of M-code and read timing

- M-codes are stored in the M-code storage register of the axis specified with the positioning start completion and specified points (continuous trajectory control). During interpolation control, the M-codes are stored in all axes which perform interpolation control.
- When the M-code is read at the positioning start completion, use the "[St.1060] Positioning start complete (R: M32400+32n/Q: M2400+20n)" as the reading command.
- When the M-code is read at positioning completion, use the "[St.1061] Positioning complete (R: M32401+32n/Q: M2401+20n)" as the read command.

■At the position control or speed control



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 continuous trajectory control, the M-code output of the servo program takes priority.

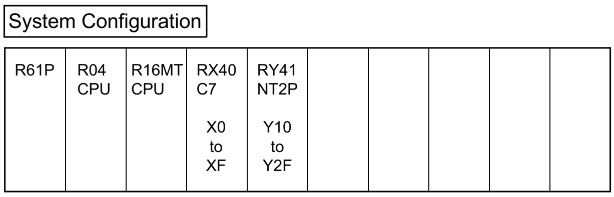
Program example

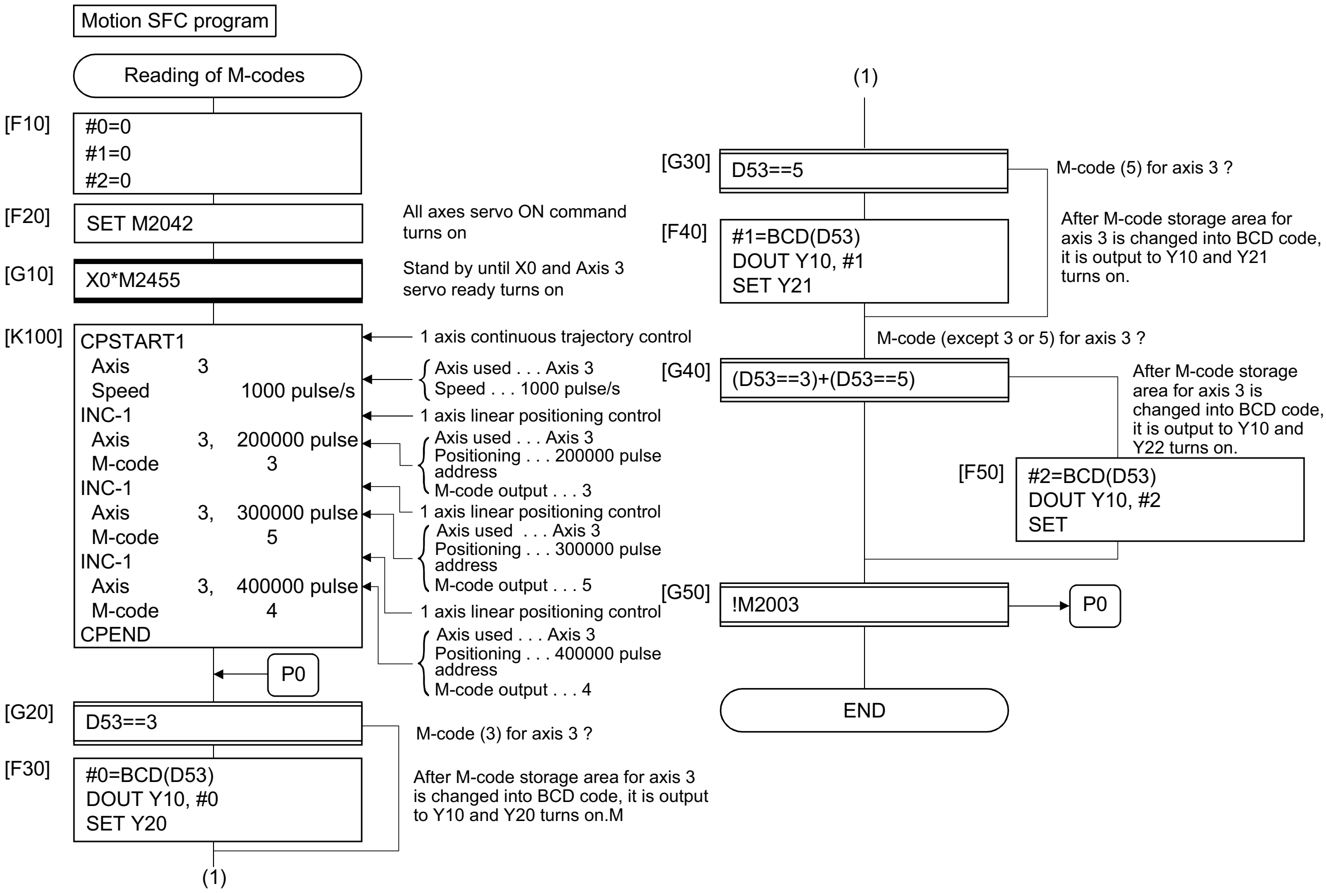
This program example is explained in the "Q series Motion compatible device assignment" device assignment method.

- The Motion SFC program to read M-codes is shown as the following conditions.

Item		Condition of use
Axis used No.		Axis 3
Processing at the positioning start by M-code		M-code No. is output as BCD code to Y10 to Y1F
Processing at the positioning completion by M-code	M-code = 3	Y20 turns on
	M-code = 5	Y21 turns on
	M-code is except for (3 or 5)	Y22 turns on

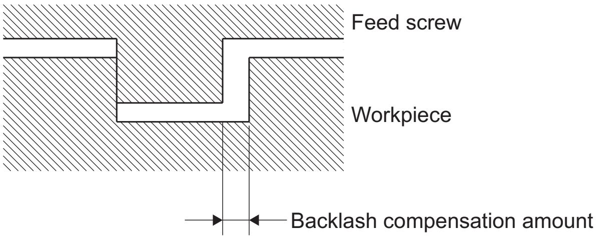
- Motion SFC program with the above conditions are shown below.





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.



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.

Units	Setting range
mm	0 to 65535 ($\times 10^{-1}$ [μm])
inch	0 to 65535 ($\times 10^{-5}$ [inch])
degree	0 to 65535 ($\times 10^{-5}$ [degree])
pulse	0 to 65535 [pulse]

A servo error (AL.35 etc.) may occur depending on the type of the servo amplifier (servo motor) or operation cycle even if the backlash compensation amount fulfils the above condition. Set the backlash compensation amount within the following range to avoid an error occurrence.

$$A \leq \frac{\text{Maximum motor speed [r/min]} \times 1.2 \times \text{Encoder resolution [Pulse]} \times \text{Operation cycle [ms]}}{60\ \text{[s]} \times 1000\ \text{[ms]}}\ \text{[pulse]}$$

Backlash compensation processing

Details of backlash compensation processing are shown below.

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.

Point

- 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.
- 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

7.3 Torque Limit Function

This function restricts the generating torque of the servomotor 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.

Default of the torque limit value

The default 300.0[%] is set as torque limit value at the servo amplifier's control circuit power supply or Multiple CPU system's power supply ON.

Point

Even while the Multiple CPU system power supply is ON, the torque limit value is returned to the default value of 300.0[%] 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.

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.

Setting method		Setting details	Setting range	Setting units	Reference
Parameter block		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.	1 to 10000	0.1[%]	☞ Page 215 Parameter Block
		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.			
Servo program		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.			☞ Page 242 Positioning Data
Motion SFC program	Torque limit value change request (CHGT)	Executing the torque limit value change request (CHGT) in the operating control step of Motion SFC program changes the torque limit value of specified axis. A different value for positive direction and negative direction can be specified.			*1
Motion dedicated PLC instruction	Torque limit value change request instruction (M(P).CHGT/D(P).CHGT) .	Executing the torque limit value change request instruction (M(P).CHGT/D(P).CHGT) in the PLC CPU changes the torque limit value of specified axis. A different value for positive direction and negative direction can be specified.			

*1 📖MELSEC iQ-R Motion Controller Programming Manual (Program Design)

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 or Motion dedicated PLC instruction.

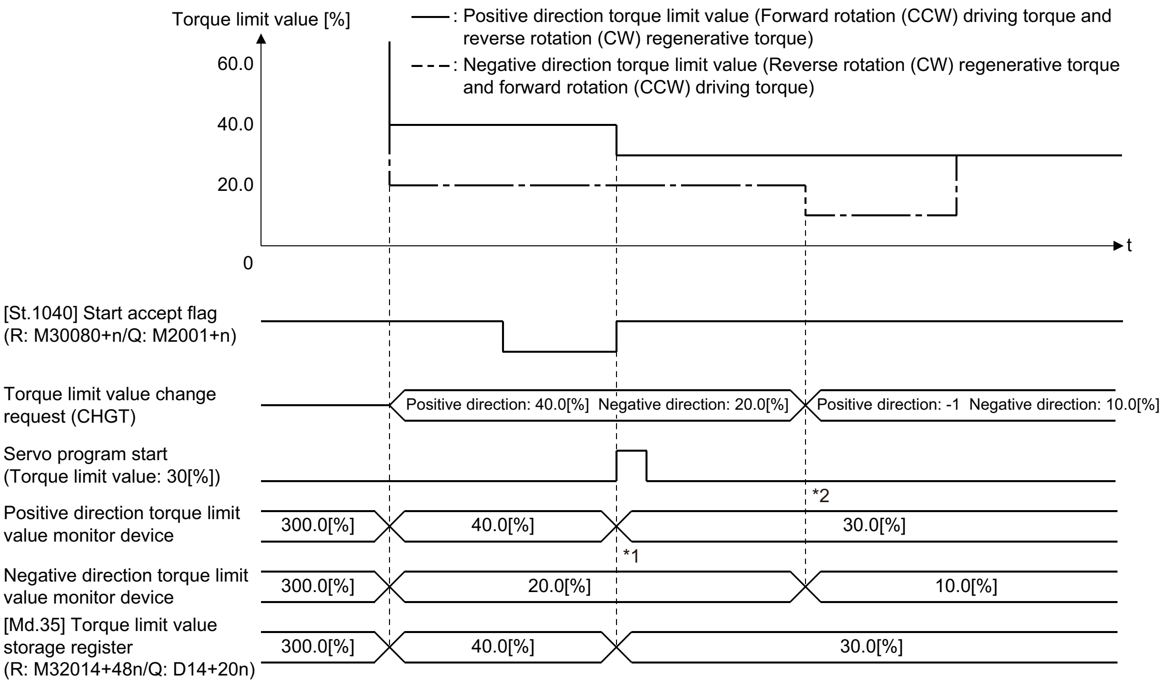
Point

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.

Monitoring of torque limit status

The torque limit value of each axis can be monitored with "[Md.35] Torque limit value (R: D32014+48n/Q: 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 of Motion control parameter.
The torque limit status of each axis can be also monitored with "[St.1076] Torque limiting (R: M32416+32n/Q: M2416+20n)".

Operation description



*1 The torque limit value specified with servo program is clamped with the negative direction torque limit value changed by CHGT.
*2 The torque limit value is not changed so that "-1" is set as the positive direction torque limit value of CHGT.

7

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).

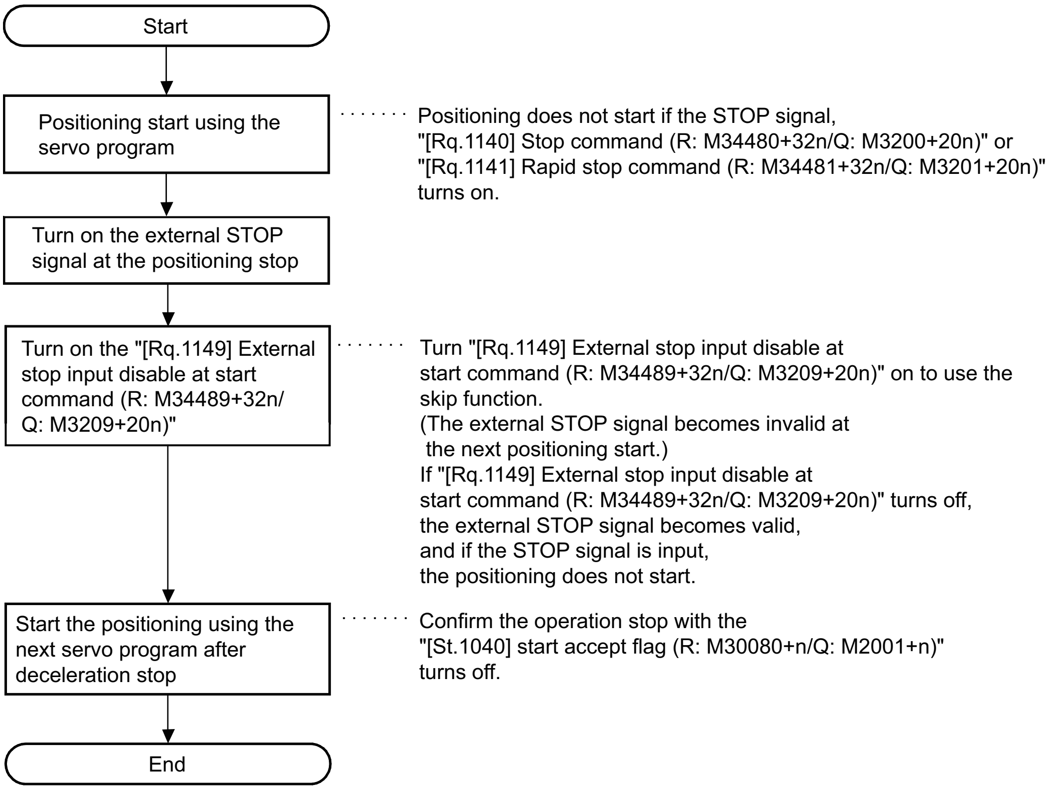
There are following tow functions in the function called "Skip".

- Skip during CP command (☞ Page 360 Pass point skip function)
- Skip in which disregards stop command

  Usually, although an error [***] occurs with the servo program start during the STOP signal on, if "[Rq.1149] External stop input disable at start command (R: M34489+32n/Q: M3209+20n)" turns on and the servo program starts, the next servo program starts even if during the STOP signal on.

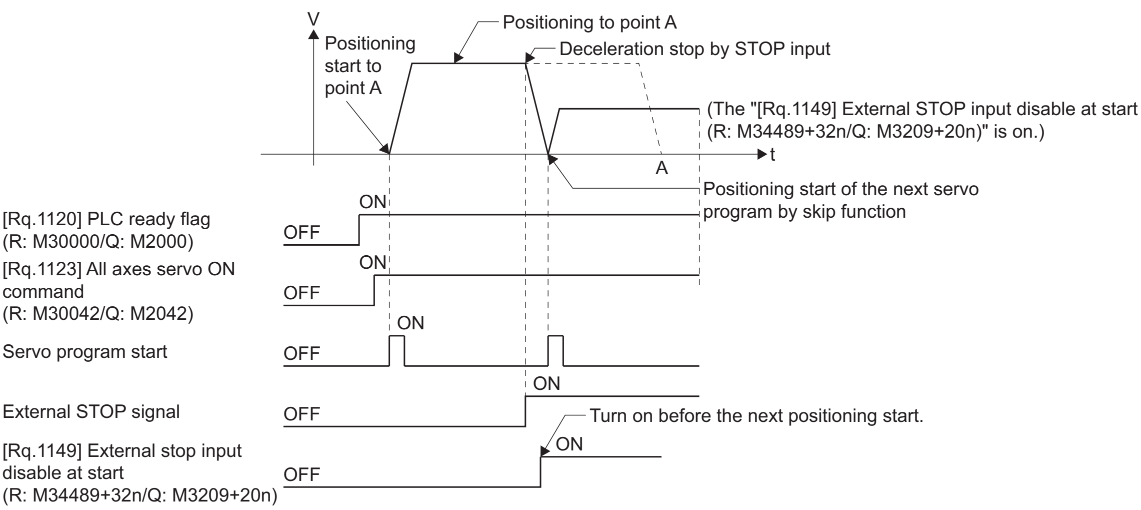
Skip function procedure

The procedure for the skip function by the external STOP signal and Motion SFC program is shown below.



Operation timing

The operation timing for the skip function is shown below.



7.5 Speed-Torque Control

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" that switches the control mode to torque control mode without stop of servomotor 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.
For performing the speed-torque control, setting the speed-torque control data is required for every axis. (☞ Page 201 Speed-torque control data)

Control mode	Control	Remark
Position control mode	Positioning control[*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	Speed-torque control	Control that does not include the position loop for the command to servo amplifier.
Torque control mode		
Continuous operation to torque control mode		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.

*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.
—: There is no restriction by the version.

Servo amplifier model	Software version		
	Speed control	Torque control[*1]	Continuous operation to torque control
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

*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)". (☞ Page 204 Torque command device)
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 30 r/min or less low-speed operation status, the servo amplifier may malfunction regardless of the electronic thermal relay protection.

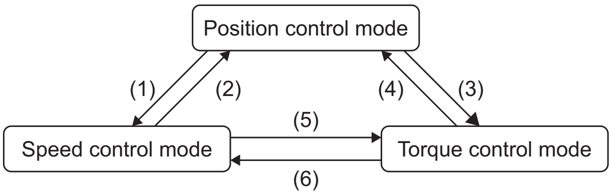
7

Operation of speed-torque control

Switching of control mode (Speed control/Torque control)

■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 "[St.1040] Start accept flag (R: M30080+n/Q: M2001+n)" turns ON.
A Warning (error code: 09E7H) or minor error (error code: 192AH) 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)	Position control mode → Speed control mode	Not during positioning[*1] and during motor stop[*2]
(2)	Seed control mode → Position control mode	During motor stop[*2]
(3)	Position control mode → Torque control mode	Not during positioning[*1] and during motor stop[*2]
(4)	Torque control mode → Position control mode	During motor stop[*2]
(5)	Seed control mode → Torque control mode	None
(6)	Torque control mode → Speed control mode	

*1 The "[St.1040] Start accept flag (R: M30080+n/Q: M2001+n)" is OFF.
*2 ZERO speed (b3) of "[Md.1022] Servo status2 (R: D32033+48n/Q: #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 "[Md. 108] Servo status 1 (R: D32032+48n/Q: #8010+20n)".
- Control mode (b2, b3) of "[Md.108] Servo status 1 (R: D32032+48n/Q: #8010+20n)"

b3	b2	Control mode
0	0	Position control mode
0	1	Speed control mode
1	0	Torque control mode

■Precautions at control mode switching

- The "[St.1060] Positioning start complete (R: M32400+32n/Q: M2400+20n)" and "[St.1061] Positioning complete (R: M32401+32n/Q: M2401+20n)" do not turn ON at control mode switching.
- During speed control or torque control, the "[St.1040] Start accept flag (R: M30080+n/Q: M2001+n)" turns ON.
- 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 servomotors are stopped.
- Cannot use press with limited torque during speed control mode.
- "[St.1064] In speed controlling (R: M32404+32n/Q: M2404+20n)" does not turn ON during speed control mode in the speed-torque control.

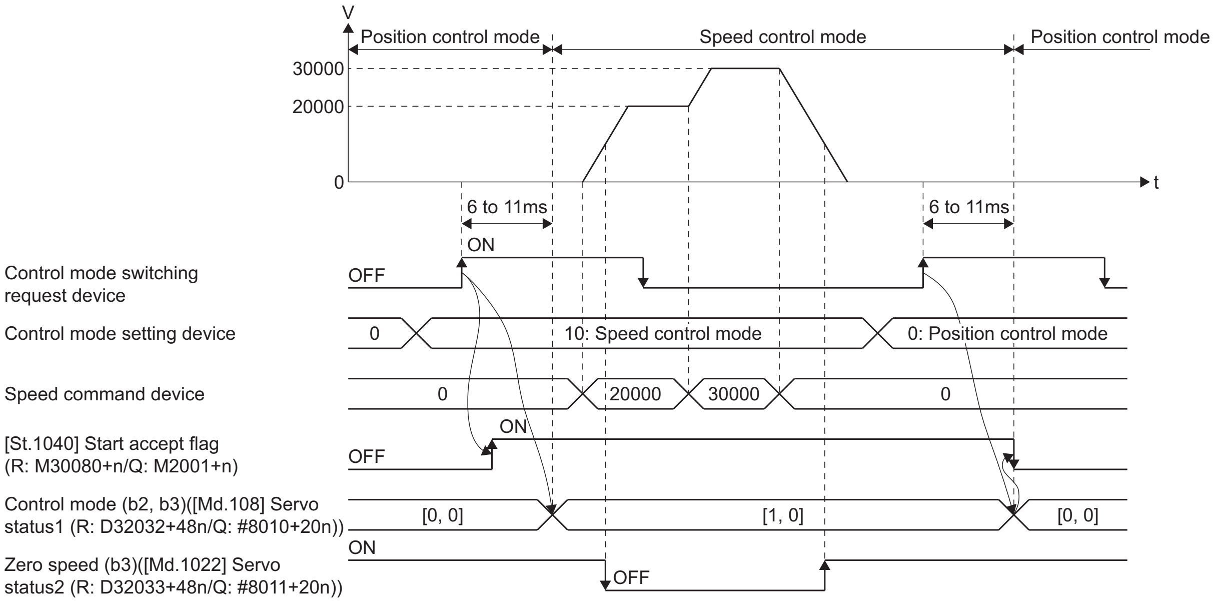
■Operation for "Position control mode ⇔ Speed control mode switching"

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 control mode switching	Command speed to servo amplifier immediately after 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.

The following chart shows the operation timing.



■Operation for "Position control mode ⇔ torque 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".

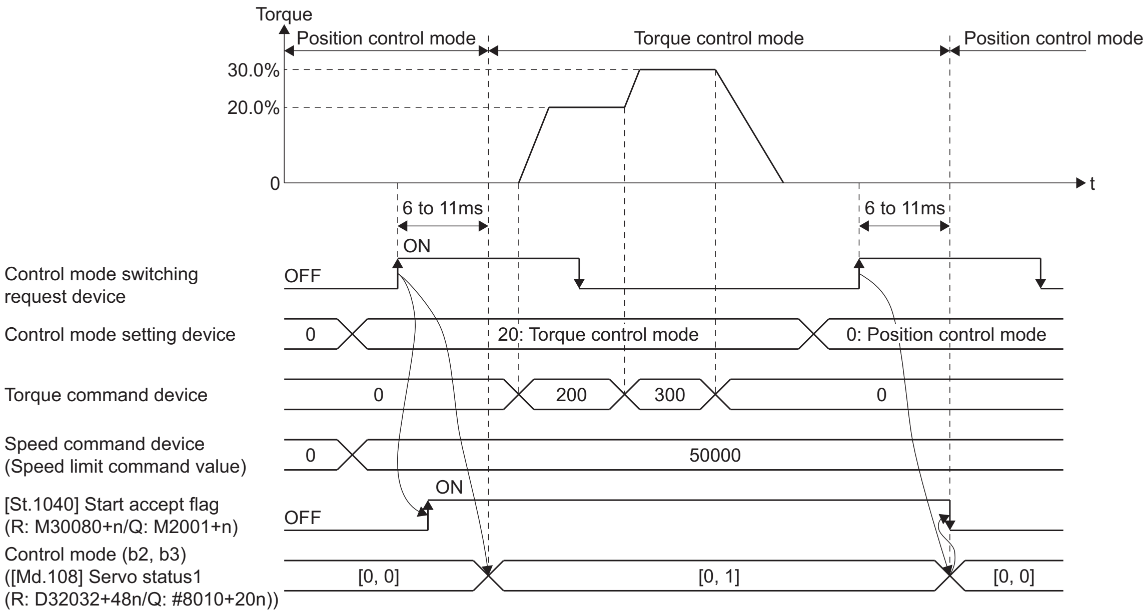
Torque initial value selection at control mode switching	Command torque to servo amplifier immediately after switching from position control mode to torque control mode
0: Command torque	Immediately after switching the control mode, the value of torque command device is the torque to servo amplifier 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 warning (error code: 0A55H) 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.

The following chart shows the operation timing.



■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".

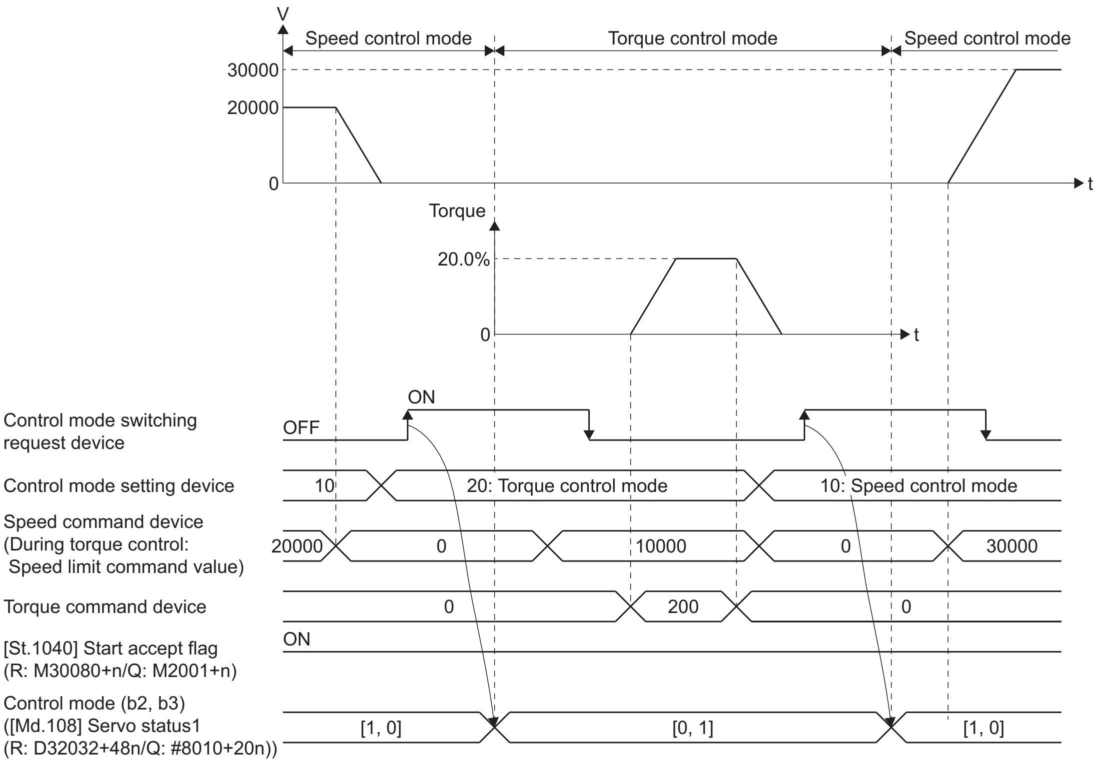
Torque initial value selection at control mode switching	Command torque to servo amplifier immediately after switching from speed control mode to torque control mode
0: Command torque	Immediately after switching the control mode, the value of torque command device is the torque to servo amplifier regardless 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 warning (error code: 0A55H) 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.

The following chart shows the operation timing.



Switching of control mode (Continuous operation to torque control)

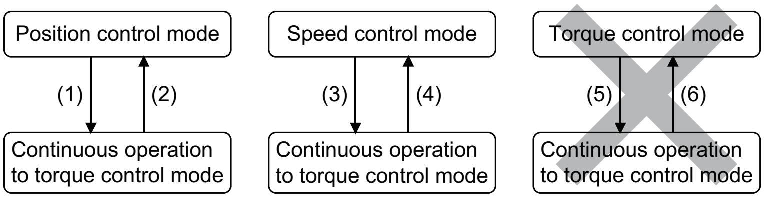
■Switching method of control mode

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 "[St.1040] Start accept flag (R: M30080+n/Q: 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*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 • CPSTART1: 1-axis continuous trajectory control • PVF: Speed control with fixed position stop (Forward) • PVR: Speed control with fixed position stop (Reverse) *: JOG operation, Speed control (II) (VVF, VVR), High-speed oscillation control (OSC) are not supported.
(2)	Continuous operation to torque control mode → Position control mode	During motor stop*2
(3)	Speed control mode → Continuous operation to torque control mode	None
(4)	Continuous operation to torque control mode → Speed control mode	
(5)	Torque control mode → Continuous operation to torque control mode	Switching not possible
(6)	Continuous operation to torque control mode → Torque control mode	

*1 The "[St.1040] Start accept flag (R: M30080+n/Q: M2001+n)" is OFF.

*2 ZERO speed (b3) of "[Md.1022] Servo status2 (R: D32033+48n/Q: #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 "[Md.125] Servo status3 (R: D32034+48n/Q: #8012+20n)". When the mode is switched to continuous operation to torque control mode, the value in "control mode (b2, b3)" of "[Md.108] Servo status1 (R: D32032+48n/Q: #8010+20n)" will stay the same before control mode switching.

• Continuous operation to torque control mode (b14) of "[Md.125] Servo status3 (R: D32034+48n/Q: #8012+20n)"

b14	Continuous operation to torque control mode
0	Not continuous operation to torque control mode
1	Continuous operation to torque control mode

Point

- 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 warning (error code: 09E8H) will occur, and the control mode is not switched.
- 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 warning (error code: 09E8H) will occur, and the control mode is not switched.

■Precautions at control mode switching

- The "[St.1060] Positioning start complete (R: M32400+32n/Q: M2400+20n)" and "[St.1061] Positioning complete (R: M32401+32n/Q: M2401+20n)" do not turn ON at control mode switching.
- During continuous operation to torque control, the "[St.1040] start accept flag (R: M30080+n/Q: M2001+n)" turns ON.
- 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: 19E7H) 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.)

■Operation for "Position control mode ⇔ 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".

- Command torque

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.

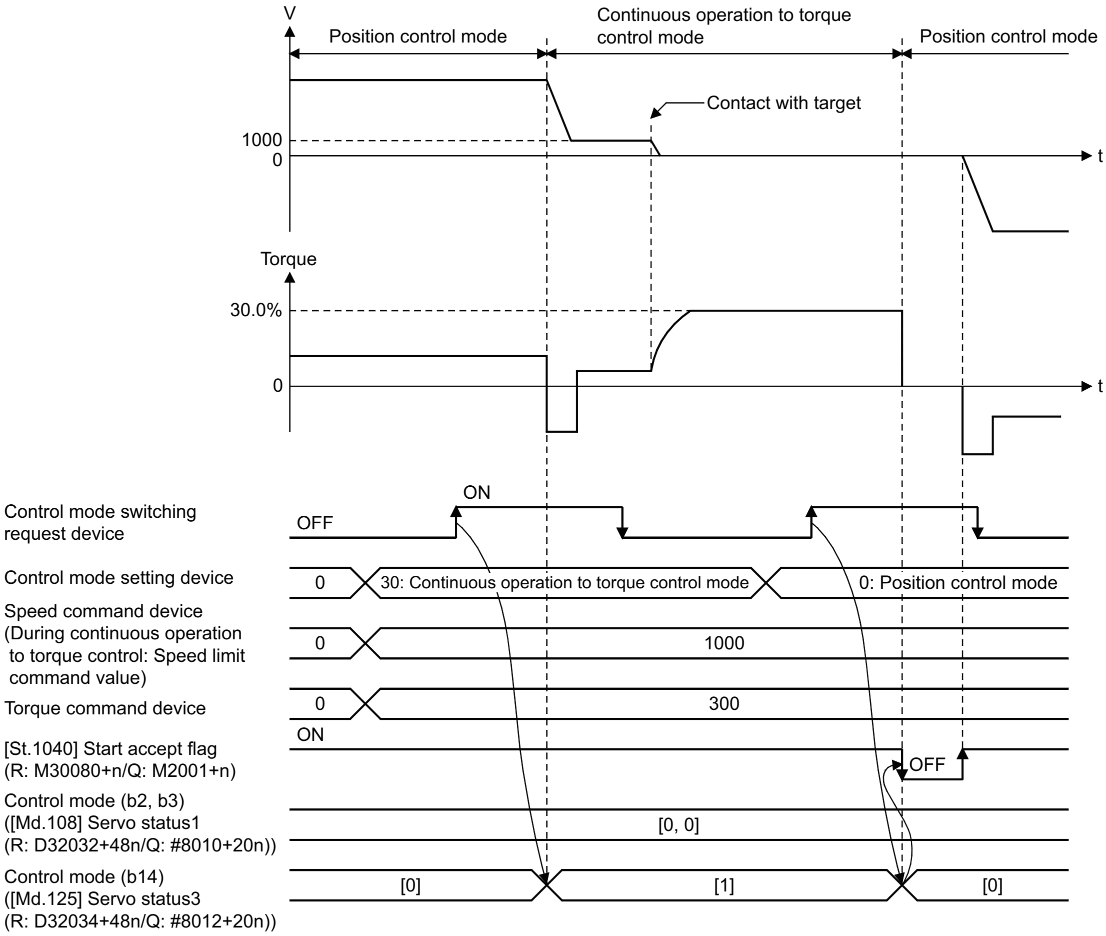
- Command speed

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".

The following chart shows the operation timing.



■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".

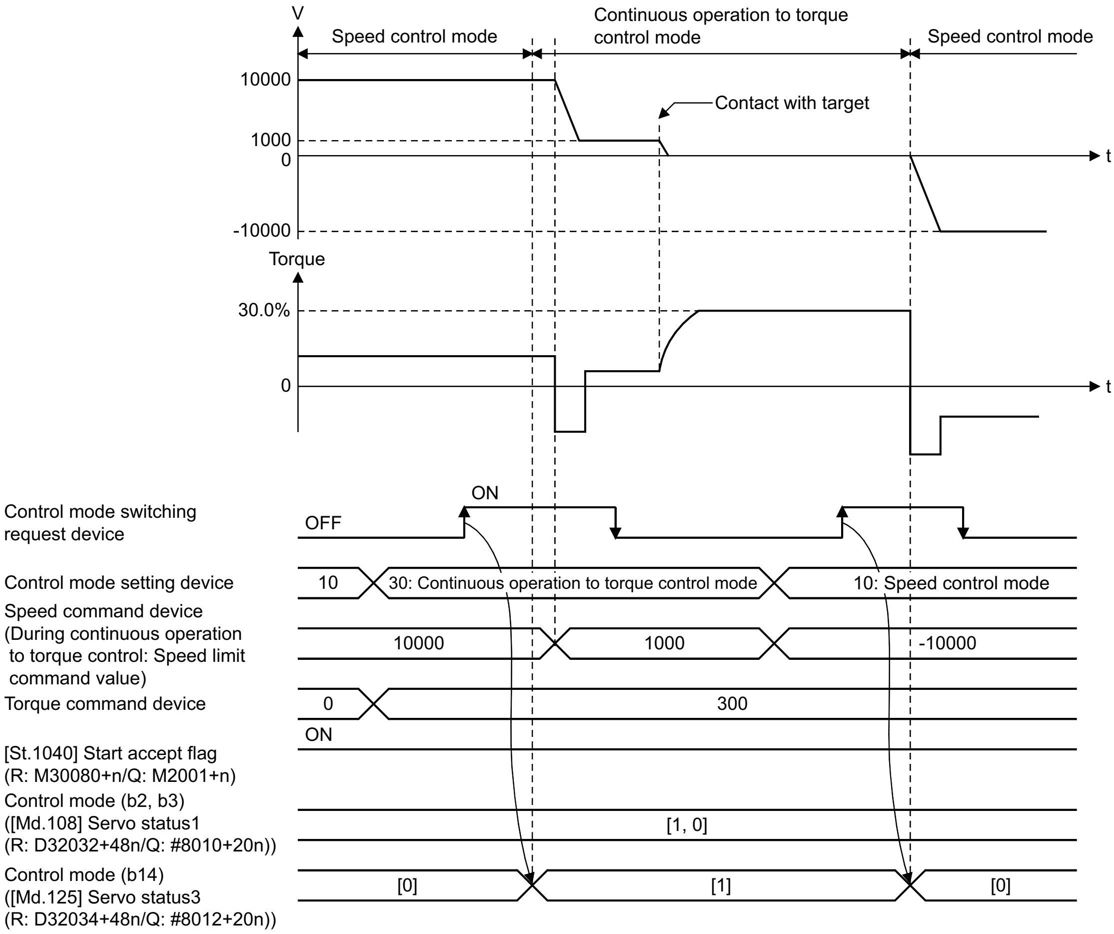
- Command torque

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.

- Command speed

Speed initial value selection at control mode switching	Command speed to servo amplifier immediately after switching from 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".

The following chart shows the operation timing.



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.

Speed control mode

■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 warning (error code: 0A5FH) will occur, and the operation is controlled with speed limit value.

Confirm the command speed to servo amplifier the "[Md.28] Command speed (R: D32024+48n, D32025+48n/Q: #8004+20n, #8005+20n)".

Speed change request (CHGV, M(P).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, M(P).CHGT/D(P).CHGT). If the change outside the range of "Torque limit value at speed-torque control" is requested by torque limit value change request, a warning (error code: 0A5EH) will occur, and the torque limit value is not changed.

■Current feed value during speed control mode

"[Md.20] Feed current value (R: D32000+48n, D32001+48n/Q: D0+20n, D1+20n)" and "[Md.101] Real current value (R: D32002+48n, D32003+48n/Q: 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: 1993H, 1995H) will occur and the operation is switched to position control mode. Invalidate the software stroke limit to execute one-way feed.

■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 "[Rq.1140] Stop command (R: M34480+32n/Q: M3200+20n)" turned ON.	The motor decelerates to speed "0" by setting value of "command speed deceleration time". The mode is switched to position control mode when "ZERO speed (b3)" of "[Md.1022] Servo status2 (R: D32033+48n/Q: #8011+20)" turns ON, and the operation stops.
The "[Rq.1141] Rapid stop command (R: M34481+32n/Q: M3201+20n)" turned ON.	
The external stop input turned ON.	
The "[Rq.1123] All axis servo ON (R: M30042/Q: M2042)" turned OFF.	The servo OFF is not executed during speed control mode. The command status at that time becomes valid when the mode is switched to position control mode.
The "[Rq.1155] Servo OFF command (R: M34495+32n/Q: M3215+20n)" turned ON.	
The current value reached to software stroke limit.	A minor error (error code: 1900H, 1905H, 1907H, 1993H, 1995H) will occur, and the motor decelerates to speed "0" by setting value of "Command speed deceleration time". The mode is switched to position control when "ZERO speed (b3)" of "[Md.1022] Servo status2 (R: D32033+48n/Q: #8011+20n) turns ON, and the operation stops.
The position of motor reached to hardware stroke limit	
The "[Rq.1120] PLC ready flag (R: M30000/Q: M2000)" turned OFF.	
The forced stop input to Motion CPU.	The mode is switched to position control mode when the servo OFF (The "[St.1075] Servo ready (R: M32415+32n/Q: M2415+20n)" turns OFF) is executed. (While the servo amplifier is servo OFF, even if the mode is switched to position control mode, the servomotor occurs to the free run. (The operation stops with dynamic brake.))
The forced stop input to servo amplifier.	
The servo error occurred.	
The servo amplifier's control circuit 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.)

Torque control mode

■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 warning (error code: 09E4H) will occur, the operation is controlled with torque limit value at speed-torque control.
Speed change request (CHGV, M(P).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, M(P).CHGT/D(P).CHGT) 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, a warning (error code: 0A5EH) will occur, and the torque limit value is not changed.

■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 "[Md.1022] Servo status2 (R: D32033+48n/Q: #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 warning (error code: 0A5FH) 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".

Point

The actual motor speed may not reach the speed limit command value depending on the machine load situation during torque control.

■Current feed value during torque control mode

"[Md.20] Feed current value (R: D32000+48n, D32001+48n/Q: D0+20n, D1+20n)" and "[Md.101] Real current value (R: D32002+48n, D32003+48n/Q: 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: 1993H, 1995H) will occur and the operation is switched to position control mode. Invalidate the software stroke limit to execute one-way feed.

■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 "[Rq.1140] Stop command (R: M34480+32n/Q: M3200+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 mode when "ZERO speed (b3)" of "[Md.1022] Servo status2 (R: D32033+48n/Q: #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 "[Rq.1141] Rapid stop command (R: M34481+32n/Q: M3201+20n)" turned ON.	
The external stop input turned ON.	
The "[Rq.1123] All axis servo ON command (R: M30042/Q: M2042)" turned OFF.	The servo OFF is not executed during torque control mode. The command status at that time becomes valid when the mode is switched to position control mode.
The "[Rq.1155] servo OFF command (R: M34495+32n/Q: M3215+20n)" turned ON.	
The current value reached to software stroke limit.	The minor error (error code: 1900H, 1905H, 1907H, 1993H, 1995H) will occur. The mode is switched to position control mode at current position, and the operation immediately stops. (Deceleration processing is not executed.)
The position of motor reached to hardware stroke limit	
The "[Rq.1120] PLC ready flag (R: M30000/Q: M2000)" turned OFF.	
The forced stop input to Motion CPU.	The mode is switched to position control mode when the servo OFF (The "[St.1075] Servo ready signal (R: M32415+32n/Q: M2415+20n)" turns OFF) is executed. (While the servo amplifier is servo OFF, even if the mode is switched to position control mode, the servomotor occurs to the free run. (The operation stops with dynamic brake.))
The forced stop input to servo amplifier.	
The servo error occurred.	
The servo amplifier's control circuit 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.)

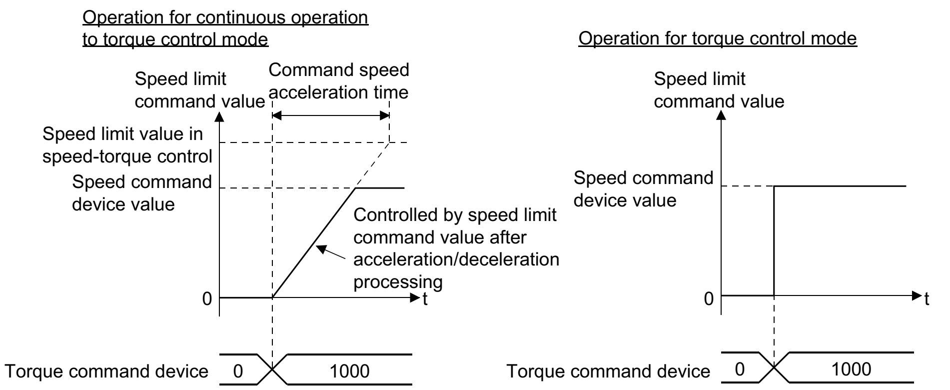
Continuous operation to torque control mode

■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.

Ex.

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, M(P).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, M(P).CHGT/D(P).CHGT) 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 a warning (error code: 0A5EH) will occur, and the torque limit value is not changed.

■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 warning (error code: 09E4H) will occur, and the operation is controlled with torque limit value at speed-torque control.

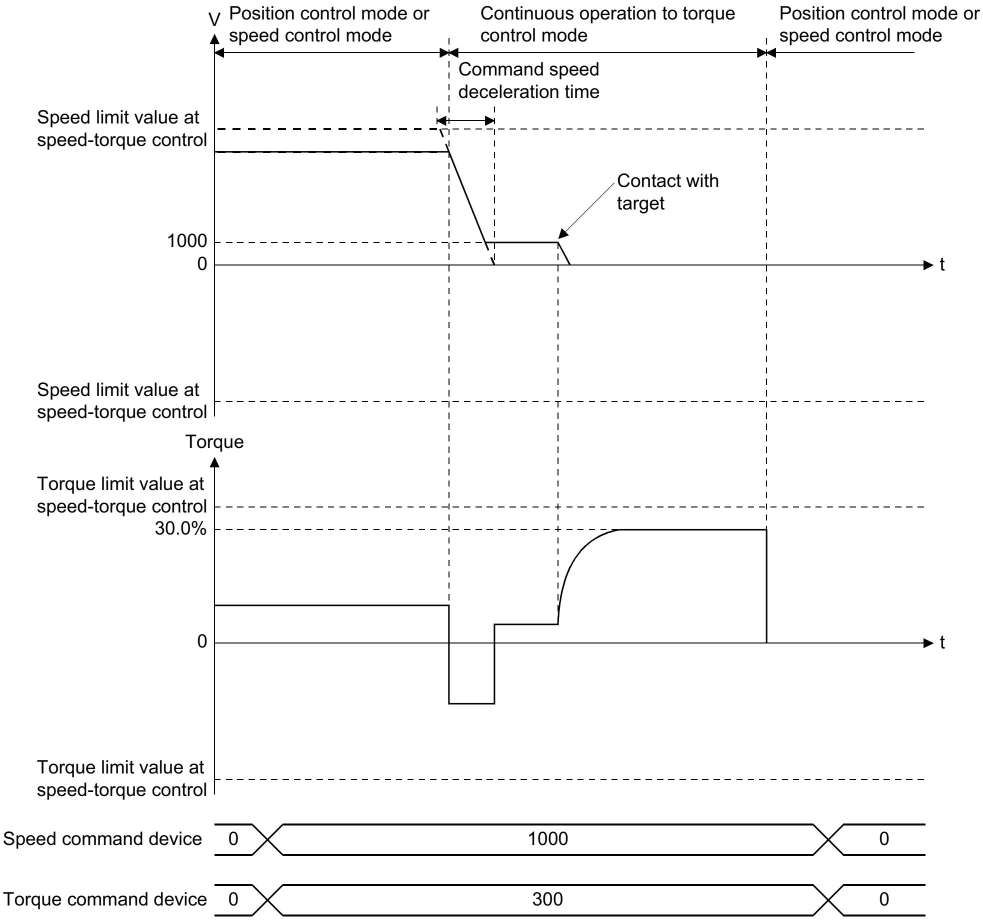
■Acceleration/deceleration processing at continuous operation to torque control mode

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 warning (error code: 0A5FH) will occur, and the operation is controlled with speed limit value.

Confirm the command speed to servo amplifier with "[Md.28] Command speed (R: D32024+48n, D32025+48n/Q: #8004+20n, #8005+20n)".



■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

■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 "[Md.1022] Servo status2 (R: D32033+48n/Q: #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 warning (error code: 0A5FH) will occur, and the operation is controlled with speed limit value at speed-torque control.

Point

- 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.
- 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.

■Current feed value during continuous operation to torque control mode

"[Md.20] Feed current value (R: D32000+48n, D32001+48n/Q: D0+20n, D1+20n)" and "[Md.101] Real current value (R: D32002+48n, D32003+48n/Q: 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: 1993H, 1995H) will occur and the operation is switched to position control mode. Invalidate the software stroke limit to execute one-way feed.

■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 "[Rq.1140] Stop command (R: M34480+32n/Q: M3200+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 mode when "ZERO speed (b3)" of "[Md.1022] Servo status2 (R: D32033+48n/Q: #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 "[Rq.1141] Rapid stop command (R: M34481+32n/Q: M3201+20n)" turned ON.	
The external stop input turned ON.	
The "[Rq.1123] All axis servo ON command (R: M30042/Q: M2042)" turned OFF.	The servo OFF is not executed during torque control mode. The command status at that time becomes valid when the mode is switched to position control mode.
"[Rq.1155] Servo OFF command (R: M34495+32n/Q: M3215+20n)" turned ON.	
The current value reached to software stroke limit.	The minor error (error code: 1900H, 1905H, 1907H, 1993H, 1995H) will occur. The mode is switched to 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 position of motor reached to hardware stroke limit	
The "[Rq.1120] PLC ready flag (R: M30000/Q: M2000)" turned OFF.	
The forced stop input to Motion CPU.	The mode is switched to position control mode when the servo OFF (The "[St.1075] Servo ready signal (R: M32415+32n/Q: M2415+20n)" turns OFF) is executed. (While the servo amplifier is servo OFF, even if the mode is switched to position control mode, the servomotor occurs to the free run. (The operation stops with dynamic brake.))
The forced stop input to servo amplifier.	
The servo error occurred.	
The servo amplifier's control circuit 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.)

7.6 Acceleration/Deceleration Time Change Function

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 M(P).CHGV/D(P).CHGV, M(P).CHGVS/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.

Point

"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".)

Speed change instructions for acceleration/deceleration time change

The speed change instructions for acceleration/deceleration time change are shown below.

Classification	Instruction	Description
Motion SFC program (Motion dedicated function)	CHGV	Speed change request
	CHGVS	Command generation axis speed change request
Motion dedicated PLC instruction	M(P).CHGV/D(P).CHGV	Speed change request of the specified axis
	M(P).CHGVS/D(P).CHGVS	Speed change request of the specified command generation axis

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 [Motion Control Parameter] ⇨ [Axis Setting Parameter] ⇨ "Expansion Parameter" of MT Developer2. Refer to the Expansion Parameter for details of acceleration/deceleration time change parameter. (☞ Page 192 Expansion Parameters)

Refer to the following for details of command generation axis parameter.

MELSEC iQ-R Motion Controller Programming Manual (Advanced Synchronous Control)

- Set the change value of acceleration/deceleration time in the device set by acceleration time change value device/deceleration time change value device.

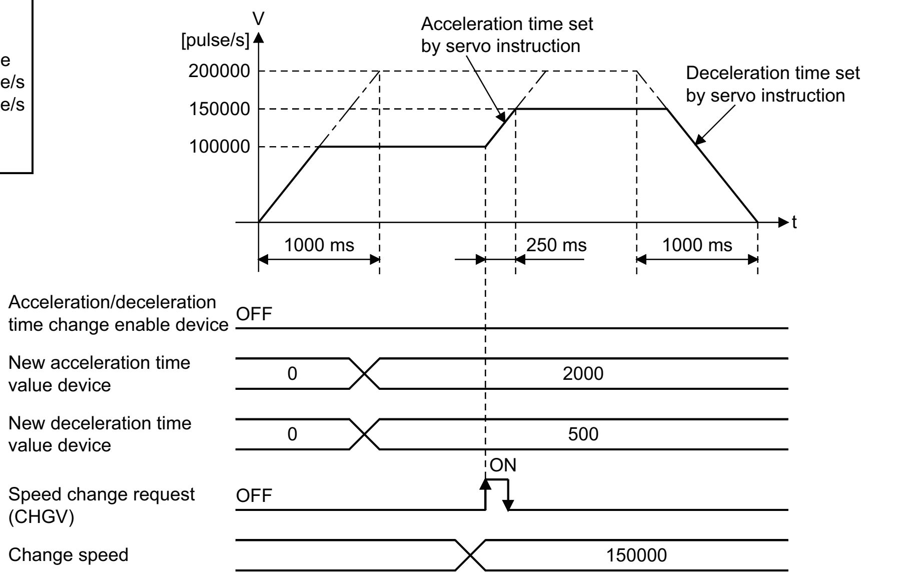
Name	Setting range
New acceleration time value device	1 to 8388608 [ms] Other than above: Time change invalid
New deceleration time value device	

- Device set by the acceleration/deceleration time change enable device turns ON (valid).

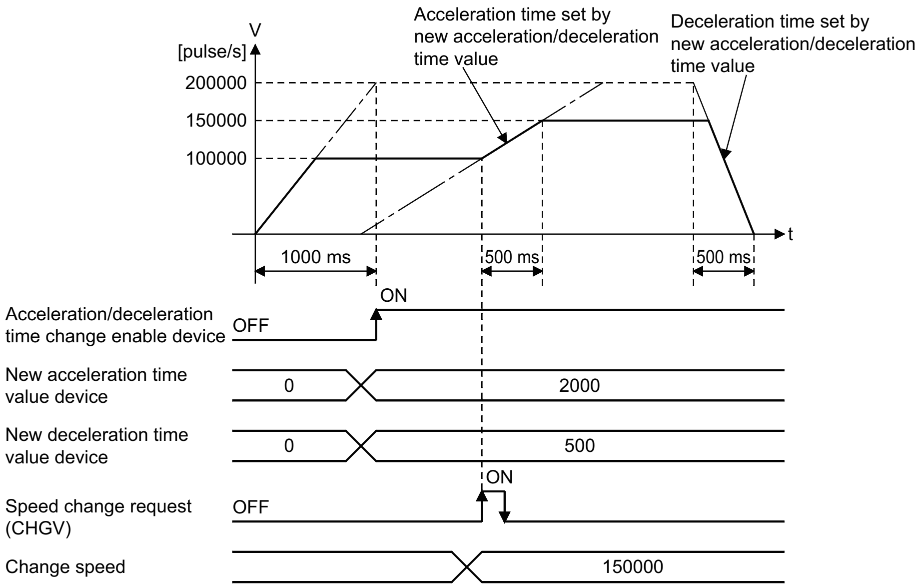
• Operation at acceleration/deceleration time change is shown below.

[K100]	
INC-1	
Axis	1
Travel	1000000 pulse
Speed	100000 pulse/s
S.R.	200000 pulse/s
◺	1000 ms
◿	1000 ms

[When acceleration/deceleration time change enable is invalid]

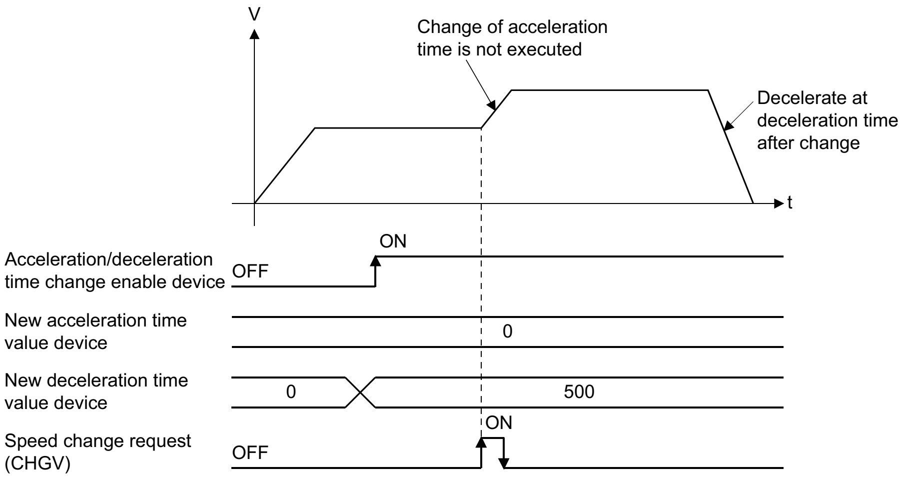


[When acceleration/deceleration time change enable is valid]

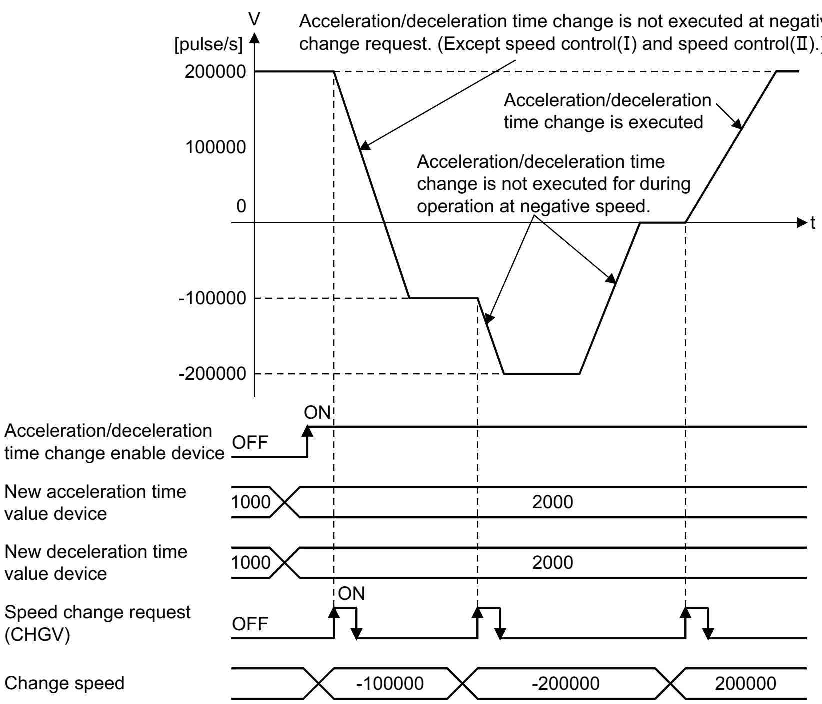


Cautions

- 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".



- 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.
- 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
- Acceleration/deceleration time change function becomes invalid for axes executing the following acceleration/deceleration methods:
  - FIN acceleration/deceleration
  - Advanced S-curve acceleration/deceleration control
- 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 (II). 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.



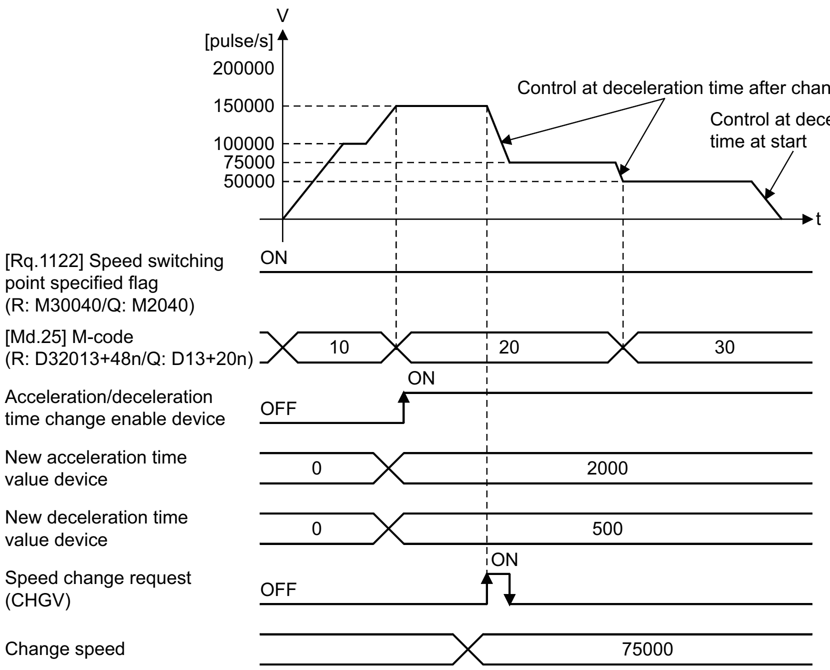
- After changing deceleration time, operations for a stop or rapid stop are shown below:

Operation	Description
Stop	Deceleration stop by the deceleration speed after change.
Rapid stop	Rapid stop by parameter setting values at start.

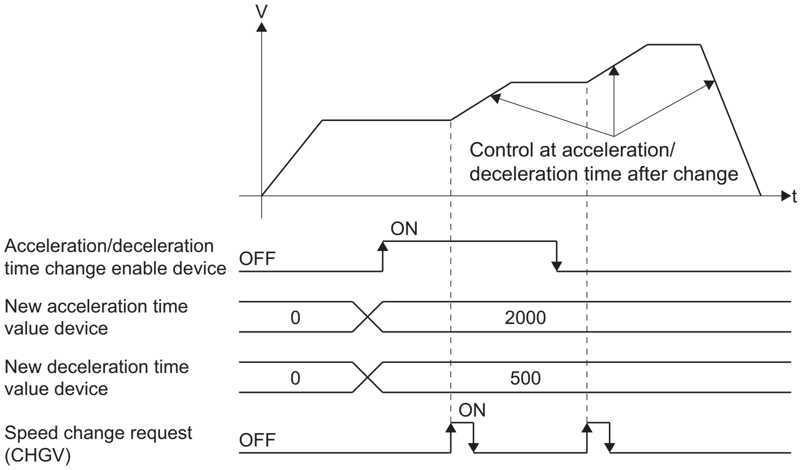
If changing deceleration time by the acceleration/deceleration time change function, regardless of whether the "Rapid stop deceleration time setting error invalid flag (SM805)" is ON or OFF, deceleration time can be changed. Therefore, if the setting values of the rapid stop deceleration time are larger than the deceleration time change value after change, an overrun may occur.
Refer to the Speed limit value, acceleration time, deceleration time and rapid stop deceleration time for details of operation.
(☞ Page 218 Speed limit value, acceleration time, deceleration time and rapid stop deceleration time)

- 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: 1993H, 1995H) 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.
- 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: 1A58H) 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.
- 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.
- If acceleration/deceleration time is changed during continuous trajectory 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 "[Rq.1122] Speed switching point specified flag (R: M30040/Q: M2040)" is ON in continuous trajectory 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).

```
[K101]
CPSTART-1
  Axis          1
  Speed    1500000 pulse/s
  S.R.     2000000 pulse/s
              1000 ms
              1000 ms
INC-1
  Axis          1
  Travel    800000 pulse
  Speed     100000 pulse/s
  M-code        10
INC-1
  Axis          1
  Travel   1000000 pulse
  Speed     150000 pulse/s
  M-code        20
INC-1
  Axis          1
  Travel    600000 pulse
  Speed      50000 pulse/s
  M-code        30
CPEND
```



- 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.



- 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 (such as AL.35) can occur. Add "[St.1048] Automatic decelerating flag (R: M30208+n/Q: 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.

7

7.7 Pressure Control

In "pressure control" the pressure value of a load cell is controlled by performing pressure control with a pressure control compatible servo amplifier (MR-J4-□B-LL).
By setting the feed, dwell, and pressure release processes to devices as profiles, and turning ON the "feed/dwell startup device", control switches to "pressure control mode" and executes pressure control.
When performing pressure control, setting pressure control data for each axis is required. Refer to the pressure control for details on pressure control data. (☞ Page 207 Pressure control data)

For performing "pressure control", use a pressure control compatible servo amplifier and software version.
The software versions for pressure control compatible servo amplifiers are shown in the table below.

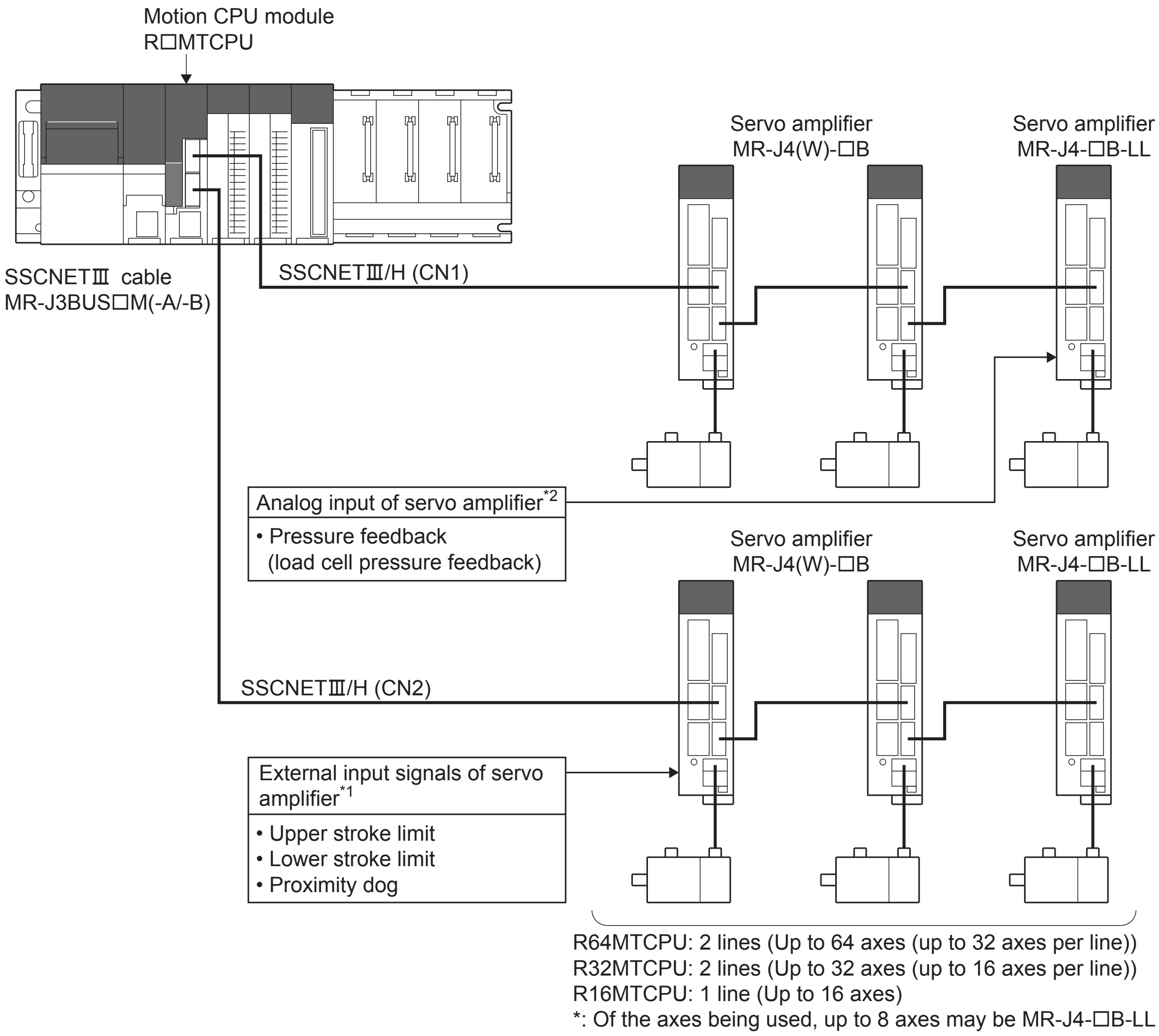
Servo amplifier model	Software version	
	Basic operation	Pressure increasing direction selection for positioning address (Servo parameter "Pressure control function selection 1 (PT12)")
MR-J4(W)-□B	Not supported	Not supported
MR-J4-□B-LL	B0 or later	B7 or later
MR-J3(W)-□B	Not supported	Not supported

Point

- Pressure control is not supported when control unit is [degree]. If the control unit is set to [degree] and the pressure control parameters are enabled, a moderate error (error code: 30F7H) occurs.
- Up to 8 axes can be controlled with pressure control. When the number of axes set for pressure control exceeds 8 axes, a moderate error (error code: 30F7H) occurs.
- Set the "Stop function at forward/reverse side" of the servo parameter "Pressure control function selection 1 (PT12)" to "1 (Stop at forward side: Valid, stop at reverse side: Invalid)". When stop at reverse side is set to "Valid", a minor error (error code: 19DFH) occurs.

System configuration

A system configuration that uses a pressure control compatible servo amplifier (MR-J4-☐B-LL) is shown below.



*1 External input signals of the servo amplifier (proximity dog, upper/lower stroke limit) cannot be input with the MR-J4-☐B-LL. When using external input signals, use "bit device" for the signal type in external signal parameters. When the external signal parameter is set to "amplifier input" external input signals cannot be used.

*2 Wire the load cell servo amplifier output to the analog input. For more details about MR-J4-☐B-LL, please consult your local Mitsubishi representative.

Outline of pressure control

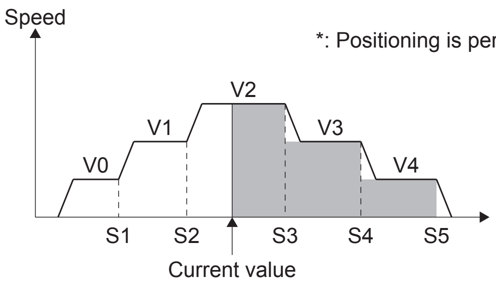
Pressure control

Pressure control for feed/dwell is available.

The load cell pressure can be monitored with the optional data monitor function. (The load cell pressure is used for feedback for pressure control in the servo amplifier)

Change speed switching point

In the feed operation, the setting of switching points that are before the current value are skipped.

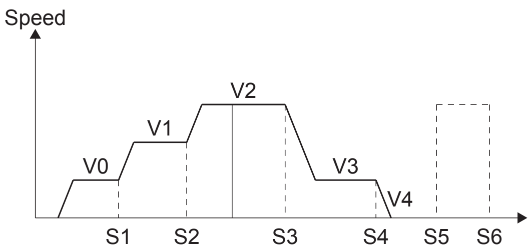


Stop at speed zero setting

When in feed/dwell operation and a switching point is set to speed 0, a deceleration stop from that point is made.

Ex.

When "V4=0", a deceleration stop from S4 is made.



Precautions for when backlash compensation is conducted on a pressure control axis

Determining rotation direction at the command level is difficult. Therefore the real current value and the feed current value at the time of changing to position control mode may be displaced by the maximum backlash compensation amount. (Displacement does not accumulate)

Pressure profile

Set the pressure profile data specified by the pressure profile start device in order to perform feed/dwell operation.

Setting pressure profile data

Pressure profile data can be set with a Motion SFC program, or with MT Developer2.

■Setting with Motion SFC program

Write the values directly from the Motion SFC program to the devices on or after the pressure profile start device set in the pressure control data.

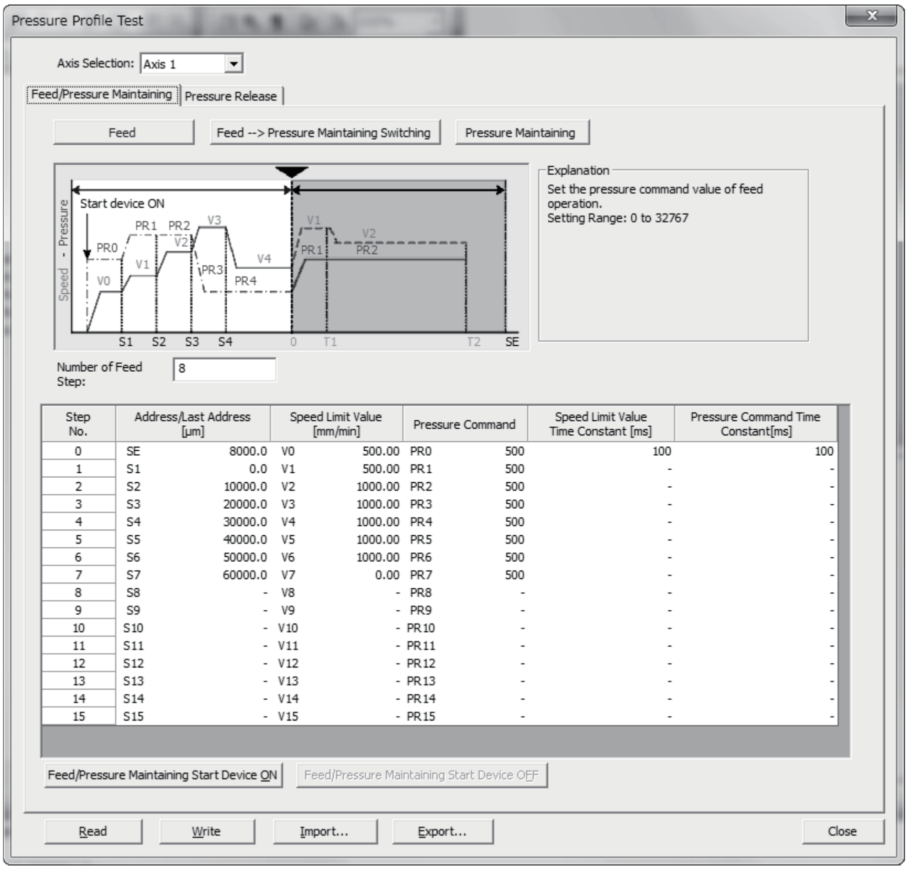
■Setting with MT Developer2

Write the devices in the pressure profile test of MT Developer2.

Refer to the following for details of operation method.

📖Help of MT Developer2

[Online] ⇨ [Pressure profile test]



Step No.	Address/Last Address [μm]		Speed Limit Value [mm/min]		Pressure Command		Speed Limit Value Time Constant [ms]	Pressure Command Time Constant[ms]
0	SE	8000.0	V0	500.00	PR0	500	100	100
1	S1	0.0	V1	500.00	PR1	500	-	-
2	S2	10000.0	V2	1000.00	PR2	500	-	-
3	S3	20000.0	V3	1000.00	PR3	500	-	-
4	S4	30000.0	V4	1000.00	PR4	500	-	-
5	S5	40000.0	V5	1000.00	PR5	500	-	-
6	S6	50000.0	V6	1000.00	PR6	500	-	-
7	S7	60000.0	V7	0.00	PR7	500	-	-
8	S8	-	V8	-	PR8	-	-	-
9	S9	-	V9	-	PR9	-	-	-
10	S10	-	V10	-	PR10	-	-	-
11	S11	-	V11	-	PR11	-	-	-
12	S12	-	V12	-	PR12	-	-	-
13	S13	-	V13	-	PR13	-	-	-
14	S14	-	V14	-	PR14	-	-	-
15	S15	-	V15	-	PR15	-	-	-

Point

The profile data set in the pressure profile test is not saved to the project. In order to enable profile data when starting up the Motion CPU, perform the following.

- Set the device area of devices set by the pressure profile data to the latch range.
- Create a Motion SFC program to set pressure profile data.

7

Device assignment of pressure profile data

Pressure profile data is stored to the device that is set as the pressure profile start device as follows.

Offset	Name			Description	Range
+0	Feed data	Number of steps		Set the number of steps for feed data. Set the data for the set number of steps.	1 to 16
+1		Unusable		Set 0.	0
+2 +3		Step No.0	End address (SE)	Set the final intended position in feed/dwell operation. Cannot be changed while running.	-2147483648 to 2147483647
+4 +5			Start speed (V0)	Set the start speed limit value for feed operation. Can be changed during feed operation.	mm : 0 to 600000000 inch : 0 to 600000000 pulse : 0 to 2147483647
+6 +7			Start pressure (PR0)	Set the start pressure command value for feed operation. Cannot be changed while running.	0 to 32767
+8 +9			Speed limit value time constant	Set the acceleration/deceleration time for the speed limit value. Set the time taken for speed limit value to reach the pressure control speed limit reference from 0.	0 to 8388608 [ms]
+10 +11			Pressure command time constant	Set the pressurization/depressurization time for the pressure command. Set the time taken for pressure command to reach the pressure command reference from 0.	0 to 8388608 [ms]
+12 +13		Step No.1	Switching address (S1)	Set the switching address of the speed setting/pressure for feed operation. Cannot be changed while running.	-2147483648 to 2147483647
+14 +15			Switching speed (V1)	Set the speed limit value for feed operation. Can be changed during feed operation.	mm : 0 to 600000000 inch : 0 to 600000000 pulse : 0 to 2147483647
+16 +17			Switching pressure (PR1)	Set the pressure command for feed operation. Cannot be changed while running.	0 to 32767
+18 +19 +20 +21			Unusable	Set 0.	0
+22 +23		Step No.2	Switching address (S2)	Data for the number of steps set in "Number of steps" is valid. Setting of data for steps after the set number of steps is not necessary.	-2147483648 to 2147483647
+24 +25			Switching speed (V2)		mm : 0 to 600000000 inch : 0 to 600000000 pulse : 0 to 2147483647
+26 +27			Switching pressure (PR2)		0 to 32767
+28 +29 +30 +31			Unusable		0
⋮		⋮			⋮
+152 +153		Step No.15	Switching address (S15)		-2147483648 to 2147483647
+154 +155			Switching speed (V15)		mm : 0 to 600000000 inch : 0 to 600000000 pulse : 0 to 2147483647
+156 +157			Switching pressure (PR15)		0 to 32767
+158 +159 +160 +161			Unusable		0

Offset	Name			Description	Range
+162 +163	Feed to dwell switching conditions	Switching address (SC)		Specify the feed to dwell switching address.	-2147483648 to 2147483647
+164 +165		Feed/dwell switching mode		Specify the feed to dwell switching condition.	0: Address 1: Address & load cell pressure
+166 +167		Switching pressure (PRC)		Specify the feed to dwell switching pressure value when "1: Address & load cell pressure" is specified in feed/dwell switching mode.	0 to 32767
+168 +169		Feed to dwell switching Speed limit value time constant		Set the acceleration/deceleration time of the speed limit value for when switching from feed to dwell. Set the time taken for speed limit value to reach the pressure control speed limit reference from 0.	0 to 8388608 [ms]
+170 +171		Feed to dwell switching Pressure command time constant		Set the pressurization/depressurization time of position command for when switching from feed to dwell. Set the time taken for pressure command to reach the pressure command reference from 0.	0 to 8388608 [ms]
+172	Dwell data	Number of steps		Set the number of steps for dwell data. Set the data for the set number of steps.	1 to 16
+173		Mode selection		Set the dwell operation mode. The time constant is valid for the speed limit value.	0: The time constant is valid for the second step and after 1: The time constant is invalid and pressure command points for the second step and after are connected with a straight line
+174 +175		Step No.1	Set time (T1)	Set the dwell speed/pressure switching time. Cannot be changed while running.	0 to 999999 [ms]
+176 +177			Set speed (V1)	Set the speed limit value for dwell operation. Cannot be changed while running.	mm : 0 to 600000000 inch : 0 to 600000000 pulse : 0 to 2147483647
+178 +179			Set pressure (PR1)	Set the pressure command for dwell operation. When mode selection is "0", can be changed during dwell operation. When mode selection is "1", cannot be changed during dwell operation.	0 to 32767
+180 +181 +182 +183			Unusable	Set 0.	0
+184 +185		Step No.2	Set time (T2)	Data for the number of steps set in "Number of steps" is valid. Setting of data for steps after the set number of steps is not necessary.	0 to 999999 [ms]
+186 +187			Set speed (V2)		mm : 0 to 600000000 inch : 0 to 600000000 pulse : 0 to 2147483647
+188 +189			Set pressure (PR2)		0 to 32767
+190 +191 +192 +193			Unusable		0
⋮		⋮			⋮

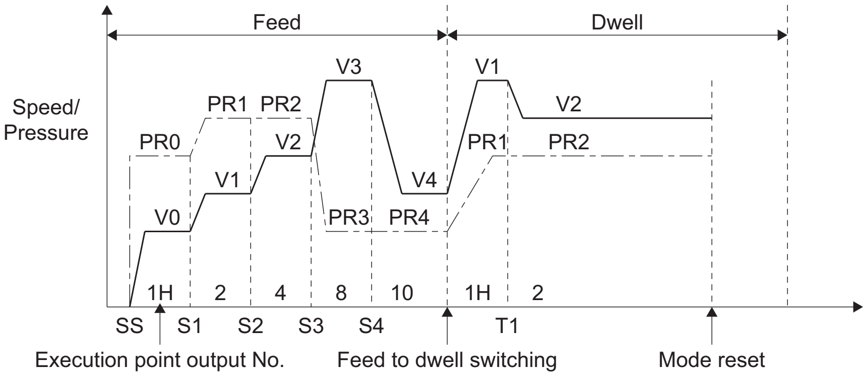
Offset	Name			Description	Range
+324 +325	Dwell data	Step No.16	Set time (T16)	Data for the number of steps set in "Number of steps" is valid. Setting of data for steps after the set number of steps is not necessary.	0 to 999999 [ms]
+326 +327			Set speed (V16)		mm : 0 to 600000000 inch : 0 to 600000000 pulse : 0 to 2147483647
+328 +329			Set pressure (PR16)		0 to 32767
+330 +331 +332 +333			Unusable		0
+334 +335	Pressure release data	End address (SE2)		Set the final intended position in pressure release operation. Cannot be changed during pressure release operation.	-2147483648 to 2147483647
+336 +337		Start speed (V0)		Set the start speed limit value for pressure release operation. Cannot be changed during pressure release operation.	mm : 0 to 600000000 inch : 0 to 600000000 pulse : 0 to 2147483647
+338 +339		Start pressure (PR0)		Set the start pressure command value for pressure release operation. Can be changed during pressure release operation.	0 to 32767
+340 +341		Speed limit value time constant		Set the acceleration/deceleration time for the speed limit value of speed limit value time constant pressure release operation. Set the time taken for speed limit value to reach the pressure control speed limit reference from 0.	0 to 8388608 [ms]
+342 +343		Speed limit value stop time constant		Set the deceleration time of the speed limit value that decelerates to the end address. Set the time taken for speed limit value to reach the pressure control speed limit reference from 0.	0 to 8388608 [ms]

Point

- The M-code output function is not supported. Determine the current point with the execution point device.
- The unit of the pressure command value differs to that of the pressure unit. The analog input value from the load cell is processed as A/D conversion data within the range of 0 to 32767. (The A/D converted data unit is the analog input conversion value of the 10 V parameter in the servo amplifier)
- If the applicable axis is already starting at startup of pressure control, pressure control does not startup.
- The speed change processing by CHGV instruction to an axis that is running pressure control is invalid.
- If the difference between the end address and real current value exceeds 2^{-31} [pulse] in motor encoder pulse units, a minor error (error code: 19E0H) may occur. Operate within a stroke range that does not exceed 2^{-31} [pulse] in motor encoder pulse units.

Feed/dwell operation

A servo program for feed/dwell operation is not necessary. Pressure profile data from the device specified with the pressure control parameter "Pressure profile start device" is written to the device, and feed/dwell operation starts by turning the feed/dwell startup device from OFF to ON. The acceleration/deceleration time or pressurization/depressurization time for the speed limit value and pressure command can be set separately.
An acceleration/deceleration time or pressurization/depressurization time for speed limit value or pressure command that is valid only when switching from feed operation to dwell operation can also be set.
By setting "1: The time constant is invalid and pressure command points for the second step and after are connected with a straight line" in "Mode selection" of the pressure profile data, the time constant can be made invalid for the pressure command of the second step of dwell data and after, and the operation can connect steps with a straight line.
When the "Pressure increasing direction selection for positioning address" of the servo parameter "Pressure control function selection 1 (PT12)" is set to "0: Increase pressure with the decrease of positioning address", or for servo amplifiers that do not support "Pressure increasing direction selection for positioning address", set the address direction of the servo amplifier so that forward direction is a negative direction.



Point

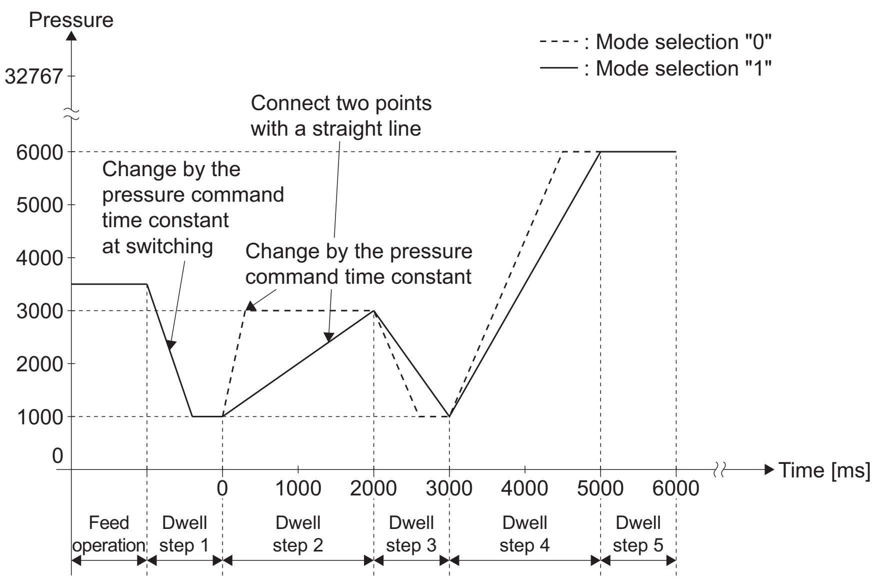
When the servo parameter "Pressure control function selection 1 (PT12)" is changed, turn the power supply of the Multiple CPU system OFF to ON again, or reset the Multiple CPU system.
If operated without the new settings being reflected in the system, an unintended operation such as the movement to the end address without referring to load cell pressure may occur.

Processing details

- Feed/dwell operation starts by turning ON the feed/dwell startup device from the sequence program or Motion SFC program. When feed/dwell operation is started, a check of set data, change speed switching point, and speed zero check is performed.
- Based on the mode switching information set in the feed to dwell switching conditions, the Motion CPU automatically determines the switching point to dwell mode.
- After starting operation, control is performed with the values that were set.
- Upon reaching the end address, the mode is reset. (Switch from pressure control to positioning control)
- Speed/pressure changes can be ended at the number of feed/dwell steps that are set.
- The switching timer is ignored, and the end pressure of the dwell operation continues until the feed/dwell startup device is turned OFF. This setting can also be changed to mode reset at the passing of the switching timer in the mode reset selection after passing dwell time. The dwell time passed (b4) of the pressure control status device turns ON after the passing of the switching timer for the end pressure, and turns OFF with the feed/dwell startup device turning OFF to ON.
- The feed start step operates at "pressure command time constant = 0" without referring to the settings. Step 2 and after, operates at the set time constant.
- The execution point No. is stored as the execution step in bits.
- The pressure release operation cannot be executed during feed/dwell operation.
- When the required setting values at the startup of pressure control are outside the range, the pressure control status device (feed/dwell (b0)) does not turn ON, and a minor error (error code: 19E1H) occurs.
- When the required setting values are changed to values outside the range during pressure control, the setting values are ignored, operation continues with the present setting values, and a warning (error code: 09E3H) occurs.
- Abnormal pressure switching forcibly switches from feed mode to dwell mode when the time in an abnormal state exceeds the time that was set to abnormal pressure. Selecting the abnormal pressure switching mode beforehand is necessary. When "[Rq.2000] PLC ready flag (R: M30000/Q: M2000)" turns OFF at feed or pressure release operation, pressure control mode ends. Set the "Stop function at forward/reverse side" of the servo parameter "Pressure control function selection 1 (PT12)" to "1 (Stop at forward side: Valid, stop at reverse side: Invalid)". When stop at reverse side is set to "Valid", a minor error (error code: 19DFH) occurs. Set a software stroke limit in a mode where the pressure control axis will continue reversing due to a failure in the load cell during pressure control.
- When an axis that has pressure control set to valid does not support pressure control, a minor error (error code: 1CB1H) occurs.

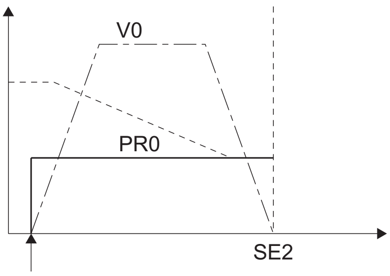
Mode selection

By setting the mode selection, "0: The time constant is valid for the second step and after", or "1: The time constant is invalid and pressure command points for the second step and after are connected with a straight line" can be selected for the pressure command of the second step of dwell operation and after.



Pressure release operation

A servo program for pressure release operation is not necessary. Pressure profile data from the device specified with the pressure control parameter "Pressure profile start device" is written to the device, and pressure release operation starts by turning the pressure release startup device from OFF to ON. The speed limit value time constant can be set.



Processing details

- Pressure release operation starts by turning ON the pressure release startup device from the sequence program or Motion SFC program. If the load cell pressure drops below the set pressure, the mode resets.
- When the deceleration start point of the speed limit value stop time constant to the end address is reached, deceleration starts automatically. If the pressure release startup device is turned OFF at this time, a deceleration stop that uses the speed limit value time constant is made.
- Pressure can be changed during pressure release operation. Speed and address cannot be changed during pressure release operation.
- Feed/dwell operation cannot be executed during pressure release operation.
- When the required setting values at the startup of pressure release operation are outside the range, the pressure control status device (pressure release (b3)) does not turn ON, and a minor error (error code: 19E1H) occurs.
- When the required setting values are changed to values outside the range during pressure release control, the setting values are ignored, operation continues with the present setting values, and a warning (error code: 09E3H) occurs.
- "1" is stored in the execution point device of pressure release operation.

Operation by stroke limit

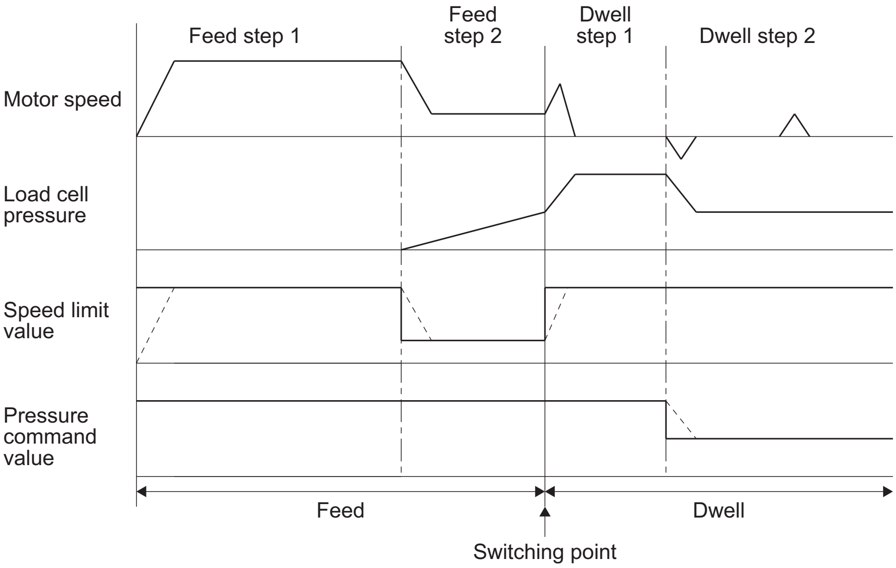
When the real current value exceeds the software stroke limit, a minor error (error code: 1993H, 1995H) occurs, and control switches to positioning control.
Be sure to set a software stroke limit because the pressure control axis has modes that continue reversing due to a failure in the load cell during pressure control.

Using point No. to substitute M-code

The execution point No. stores the execution step in a value converted to hexadecimal. Each step is displayed in bits, and shifts left by 1 bit for every step advanced.

Pressure control settings

This section explains the address for feed/dwell operation, and setting method for speed/pressure.



*: - - - - is change by the time constant setting.

- The time constant of the switching point is set in "Feed to dwell switching speed limit value time constant" and "Feed to dwell switching pressure command time constant". Set the switching point slightly before the position where load cell pressure increases dramatically. When setting the mode switching point, and switching by position only, specify "0: Address" to the feed/dwell switching mode. When also making the load cell pressure as a switching condition, specify "1: Address & load cell pressure" to the feed/dwell switching mode, and set the switching pressure.
- For points that start deceleration at low speeds, set the point so that the motor is at a low speed until pressure increases even slightly.
- Set pressure settings so that feed step 1 = dwell step 1. During feed, the pressure command is clamped by the speed limit value, therefore it is not true pressure control.
- When the load cell pressure overshoots at the switching point, make the feed to dwell switching speed limit value time constant longer.
- To make operation smooth, make the speed limit value time constant and pressure command time constant longer.
- When the motor speed at the start of operation does not reach the set speed, make the first step of pressure command during feed larger. (Changing the value of the first step of dwell is not required.)
- When a load cell fails and becomes a high pressure, the motor continues reversing in order to lower pressure and may collide with machinery. Set a stroke limit to prevent a collision.
- The servo parameter "Pressure control F/B input offset (PT21)" is normally set to "0". When adjusting offset with the user program, change the servo parameter with the servo parameter read/change function. Refer to the following for details on the servo parameter read/change function.

  MELSEC iQ-R Motion Controller Programming Manual (Common)

Mode reset after passing dwell time

When "1: Reset mode after passing dwell time" is set in mode reset selection after passing dwell time, the system (Motion CPU) automatically resets mode after passing the set time of the dwell final step. (Operation is returned to positioning control from pressure control.)
Without turning the feed/dwell startup device OFF, control automatically returns to positioning control when the set dwell time passes.
When "0: Do not reset mode after passing dwell time" is set, "[St.1040] Start accept flag (R: M30080+n/Q: M2001+n)" stays turned ON even after passing the set time of the dwell final step.
Regardless of the setting for the mode reset selection after passing dwell time, if the real current value reaches the final address, "[St.1040] Start accept flag (R: M30080+n/Q: M2001+n)" turns OFF, and the mode resets. (Returns to positioning control from pressure control)

Precautions

The feed/dwell startup device is not turned OFF automatically.
Check if the control mode has been changed to position control mode by viewing the status of pressure control status devices (feed/dwell (B0), dwell (B1)).
When starting pressure control again, turn OFF the feed/dwell startup device, and turn it back ON again to execute pressure control.

Stop causes during pressure control mode

The following describes the operations for stop causes during pressure control mode.

Item	Operation during torque control mode
The "[Rq.1140] Stop command (R: M34480+32n/Q: M3200+20n)" turned ON	The speed limit command value commanded to servo amplifier is 0 regardless of the setting value of "speed limit value". The mode is switched to position control mode when "ZERO speed (b3)" of "[Md.1022] Servo status2 (R: D32033+48n/Q: #8011+20n)" turns ON, and the operation stops immediately. (Deceleration processing is not executed.)
The "[Rq.1141] Rapid stop command (R: M34481+32n/Q: M3201+20n)" turned ON	
The external stop input turned ON	
The "[Rq.1123] All axis servo ON command (R: M30042/Q: M2042)" turned OFF	The servo OFF is not executed during pressure control mode. The command status at that time becomes valid when the mode is switched to position control mode.
The "[Rq.1155] servo OFF command (R: M34495+32n/Q: M3215+20n)" turned ON	
The software stroke limit is reached	The minor error (error code: 1900H, 1905H, 1907H, 1993H, 1995H) will occur. The mode is switched to position control mode at current position, and the operation immediately stops. (Deceleration processing is not executed.)
The hardware stroke limit is reached	
The "[Rq.1120] PLC ready flag (R: M30000/Q: M2000)" turned OFF.	
The forced stop input to Motion CPU.	The mode is switched to position control mode when the servo OFF (The "[St.1075] Servo ready (R: M32415+32n/Q: M2415+20n)" turns OFF) is executed. (While the servo amplifier is servo OFF, even if the mode is switched to position control mode, the servomotor occurs to the free run. (The operation stops with dynamic brake.))
The forced stop input to servo amplifier.	
The servo error occurred.	
The servo amplifier's control circuit 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 Override Function

The override function sets an override ratio of 0.0 to 300.0[%] in increments of 0.1[%] to be applied to the command speed during positioning control. The speed command with the override ratio applied is the actual feed speed. For interpolation operations or machine operations, the override ratio setting of the lowest axis is valid.

The types of controls where override function can be used are shown below.

○: Usable, ×: Unusable

Control mode	Servo instruction	Usable/unusable	
		Servo axis	Command generation axis
Linear control	ABS-1 ABS-2 ABS-3 ABS-4 INC-1 INC-2 INC-3 INC-4	○	○
Circular interpolation control	ABS circular INC circular	○	○
Helical interpolation control	ABS helical INC helical	○	○
Fixed-pitch feed control	FEED-1 FEED-2 FEED-3	○	○
Continuous trajectory control	CPSTART1 CPSTART2 CPSTART3 CPSTART4	○	○
Speed control (I)	VF VR	○	○
Speed control (II)	VVF VVR	○	—
Speed-position switching control	VPF VPR VPSTART	○	—
Position follow-up control	PFSTART	○	○
Speed control with fixed position stop	PVF PVR	○	○
Simultaneous start	START	○	○
JOG operation		○	○
Manual pulse generator operation		×	—
High-speed oscillation*1	OSC	○	—
Home position return	ZERO	×	—
Speed-torque control		×	—
Pressure control		×	—
Machine control		○	×
Direct positioning control by Motion dedicated PLC instruction (M(P).SVSTD/D(P).SVSTD)		○	○
G-code control*2		×	—

*1 In high-speed oscillation, the override is applied to the frequency.

*2 The override of axes assigned as G-code control axes is ignored. The override for G-code control is used.

Setting the override

The change of speed by override function is set in the override ratio setting device. The override ratio setting device sets override data, and each axis in the command generation axis parameter.

Refer to override data for details on override data. (☞ Page 210 Override Data)

Refer to the following for details of the command generation axis parameter.

MELSEC iQ-R Motion Controller Programming Manual (Advanced Synchronous Control)

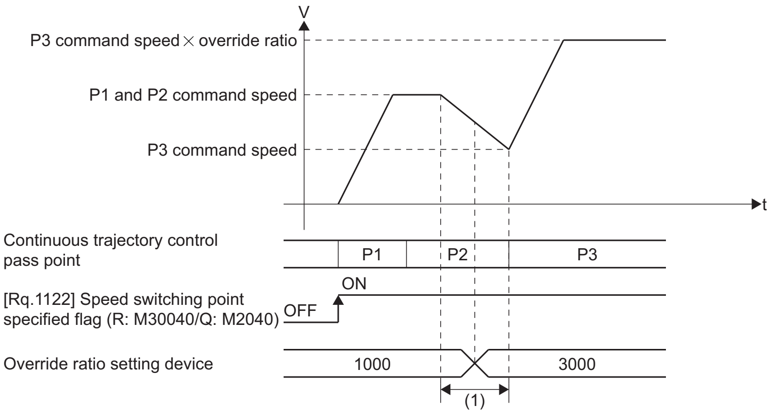
- Set the value of the override ratio to the device set as the override ratio setting device.

Name	Setting range
Override ratio setting device	0 to 3000($\times 10^{-1}$[%])

Precautions

- The acceleration/deceleration processing for when the override ratio is changed during positioning control is performed at the acceleration/deceleration time set in the parameter block (or positioning data of the servo instruction) at the start. However when the acceleration/deceleration time change function is valid, acceleration/deceleration processing is performed at the acceleration/deceleration time set in the acceleration/deceleration time change function. The positioning controls for which acceleration/deceleration time change is valid are shown below.
  - Linear control
  - Fixed-pitch feed
  - Speed control (Ⅰ)
  - Speed control (Ⅱ)
  - Speed-position switching control
  - Position follow-up control
  - Continuous trajectory control (linear control only)
  - JOG operation
- When the data set to the override ratio is outside of range, a warning (error code: 09E2H) occurs, and speed is not changed. (At startup, operation is at 100.0[%] of the program command speed, when running, operation is at the speed before the change.)
  For machine control, a warning (error code: 0EE0H(details code: 00F2H)) occurs.
- At startup, if "[Rq.1122] Speed switching point specified flag (R: M30040/Q: M2040)" is ON and advanced S-curve acceleration/deceleration is being used, the override function is disabled.
- When the override ratio is changed after performing a speed change request (CHGV) for speed "0", the speed is "0" even after applying the override to speed "0". Change the override ratio after changing the speed change request (CHGV) to a speed other than "0".
- For a speed change by override function, "[St.1047] Speed change accepting flag (R: M30144+n/Q: M2061+n)" and "[St.346] Command generation axis speed change accepting flag (R: M36571+32n/Q: M9811+20n)" do not turn ON.
- When override ratio is set to "0", "[St.1049] Speed change "0" accepting flag (R: M30272+n/Q: M2240+n)" and "[St.347] Command generation axis speed change "0" accepting flag (R: M36572+32n/Q: M9812+20n)" turn ON. In this case, an event history is recorded.
- When the speed after "program command speed × override ratio" exceeds the speed limit value, the feed speed is clamped at the speed limit value and a warning (error code: 0991H) occurs.
  For machine control, a warning (error code: 0EE0H(details code: 00F3H)) occurs.
- When the speed after "program command speed × override ratio" is less than bias speed at start, a warning (error code: 0A5DH) occurs and speed is not changed. (At startup, operation is at 100.0[%] of the program command speed, when running, operation is at the speed before the change.)
- In high-speed oscillation the override is applied to the frequency. There is a possibility of operating at a frequency that exceeds the frequency set by the program due to the override ratio. When the range for frequency (1 to 5000[CPM) is exceeded due to the override ratio, a warning (error code: 09E1H) occurs, and frequency is clamped at 5000[CPM].
- Speed is not changed by override ratio after the fixed position stop command is turned ON during speed control with fixed position stop.
- Speed is not changed by override ratio when override ratio is changed during automatic deceleration, or during stop/rapid stop.
- The values of "[Md.28] Command speed (R: D32024+48n, D32025+48n/Q: #8004+20n, #8005+20n)" and "[Md.348] Command generation axis command speed (R: D36492+48n, D36493+48n/Q: D12612+20n, D12613+20n)" are updated with the value including the override ratio when override is being used.
  In machine program operation,"[Md.2083] Machine program operation target speed (D53276+128m, D53277+128m)" is also updated with the value including the override ratio when override is being used.
- Override is disabled in the output axes of advanced synchronous control.
- Override is disabled in positioning control in test mode.

- When "[Rq.1122] Speed switching point specified flag (R: M30040/Q: M2040)" is ON in continuous trajectory control, speed is not changed by override ratio if the override ratio is changed during deceleration for a speed change at a pass point. For this case, from the pass point, speed is changed to the speed calculated by "command speed of the next point × override ratio".



When the override ratio is changed during deceleration of the speed change to P3 (section (1)), the speed is not changed.
Speed is changed to the speed of "P3 command speed × override ratio" from the beginning of P3.

- In machine control, the override ratio setting of the machine configuration axis with the lowest axis No. is valid.

Ex.

For the following machine configuration axes

The override ratio setting of axis 1 is valid.

Item	Machine configuration axis
Joint axis JNT1	Axis 3
Joint axis JNT2	Axis 1
Joint axis JNT3	Axis 2

- In sequential coordinate command control of machine program operation, override is invalid.

Combining with speed change request (CHGV)

The following describes the operation for when speed is changed with Motion dedicated functions (CHGV, CHGVS), or Motion dedicated PLC instructions (M(P).CHGV/D(P).CHGV) when using override.

- Operation is at the speed of "speed change request (CHGV) speed × override ratio". However, when the speed of "speed change request (CHGV) speed × override ratio" exceeds the speed limit value, a warning (error code: 0991H) occurs, and the feed speed is clamped at the speed limit value.
- When the speed after "speed change request (CHGV) speed × override ratio" is less than bias speed at start, a warning (error code: 0A5DH) occurs and speed is not changed.
- For continuous trajectory control, "speed change request (CHGV) speed > command speed in servo program" is permitted. (For continuous trajectory control where override is not used, the command speed in servo program cannot not be exceeded.)
- For continuous trajectory control, speed is maintained unless the command speed is specified at a point. For points where command speed is specified, speed change request (CHGV) is cancelled, and the speed becomes "program command speed × override ratio".
- When the override ratio is changed during acceleration or deceleration for a speed change request (CHGV), speed is changed to the speed of "speed change request (CHGV) speed × override ratio" from the point where the override ratio was changed.

Operation timing

The operation timing of a speed change by the override function is shown below.

■When override ratio is changed

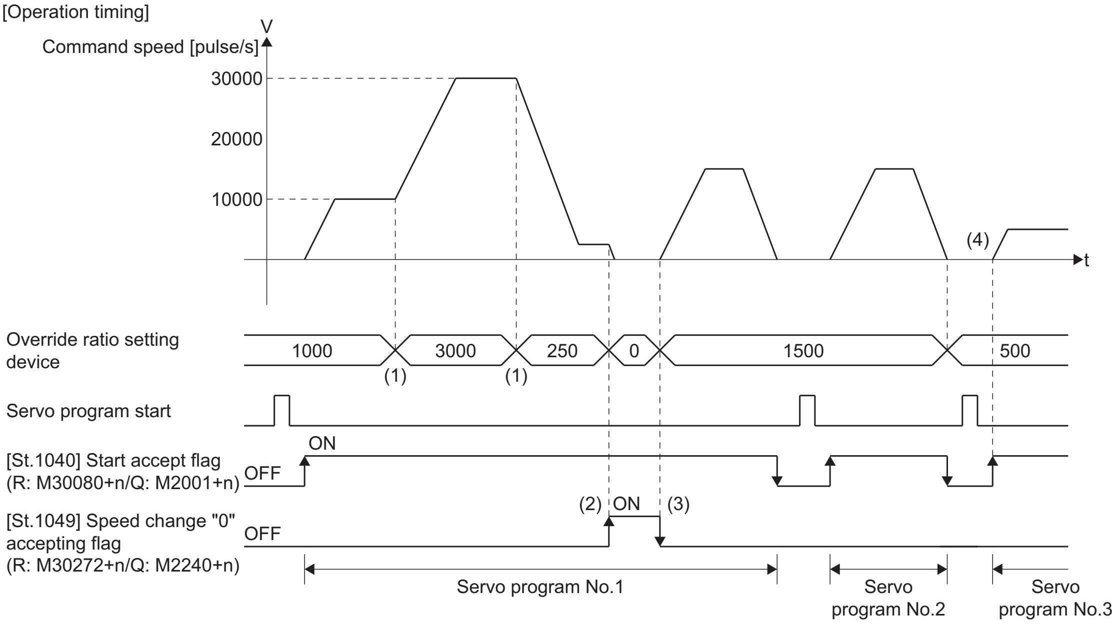
[Servo program]

```
[K   1]
INC-1
 Axis               1
Travel value    50000 pulse
Speed           10000 pulse/s
```

```
[K   2]
INC-1
 Axis               1
Travel value    10000 pulse
Speed           10000 pulse/s
```

```
[K   3]
INC-1
 Axis               1
Travel value   100000 pulse
Speed           10000 pulse/s
```

[Operation timing]



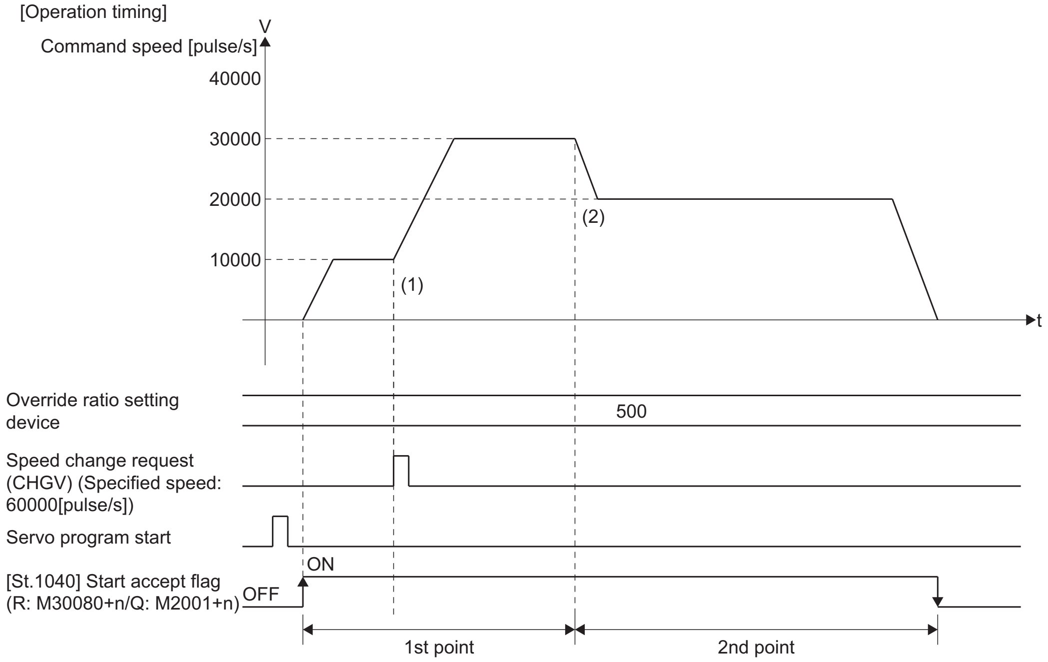
(1) When running, speed change starts from the position where override ratio was changed.
(2) When override ratio is set to "0", just as when speed is changed to "0", a deceleration stop is performed and "[St.1049] Speed change "0" accepting flag (R: M30272+n/Q: M2240+n)" turns ON.
(3) Operation is restarted by changing the override ratio from "0".
(4) Even when the override ratio has been changed at the start, acceleration/deceleration is performed with the speed including the override ratio.

■When speed change request (CHGV) is executed

[Servo program]

```
[K1]
CPSTART1
 Axis              1
 Speed         20000 pulse/s
INC-1
 Axis              1
 Travel value  50000 pulse
INC-1
 Axis              1
 Travel value  80000 pulse
 Speed         40000 pulse/s
CPEND
```

[Operation timing]



(1) When speed change request (CHGV) is executed, speed is changed to "speed change request (CHGV) × override ratio".
During continuous trajectory control, speed can be changed to a speed that exceeds the command speed of each point.

(2) Speed change request (CHGV) for switching to a point with command speed specified, is cancelled and the speed is "program command speed × override ratio".

7.9 Vibration Suppression Command Filter

The vibration suppression command filter function is used to suppress vibrations in position control on the load-side such as vibrations of the work platform and shaking of the machine frame. The function is used to suppress vibrations of low frequencies that cannot be set in a filter such as the servo amplifier command notch filter, and applications where frequency is changed during operation. By setting the vibration frequency, a command that suppresses that frequency is generated, thus controlling vibration. Up to two vibration suppression command filters can be set simultaneously to one servo amplifier axis.
When activating the vibration suppression command filter, the vibration suppression command filter data for each axis must be set. Refer to vibration suppression command filter data for details of vibration suppression command filter data. (☞ Page 211 Vibration Suppression Command Filter Data)

The control modes that support vibration suppression command filter are shown in the chart below.
The vibration suppression command filter is only valid in positioning control mode, however if the filter is set during home position return, it stays invalid.
○: Valid ×: Invalid

Control mode	Vibration suppression command filter valid/invalid
Positioning control mode	○ (Invalid during speed control(Ⅱ) and during home position return)
Speed control mode	×
Torque control mode	
Continuous operation to torque control mode	
Pressure control mode	

Vibration suppression command filter operation

There are two types of filter that are set in vibration suppression command filter data: "Vibration suppression command filter 1", and "Vibration suppression command filter 2".
Before starting positioning control, set the "frequency" of "vibration suppression command filter 1" and "vibration suppression command filter 2", and change "mode selection device" in "vibration suppression command filter 1" and "Vibration suppression command filter 2" from "0: Invalid" to the filter method to be set (1: Smoothing filter, 2: FIR filter, 3: IIR filter).
Smoothing filter and FIR filter can be set to vibration suppression command filter 1. When changing settings such as the filter frequency, change with the status of the device set in command output complete signal after filter turned ON. If the value is changed while the filter is operating, the filter becomes invalid.
IIR filter can be set to vibration suppression command filter 2. When IIR filter is set, the filter frequency setting can be changed immediately during positioning operation.
Parameters written from MT Developer2 are fetched by turning the power supply of the Multiple CPU system OFF and ON again. When parameter settings are changed, turn the Multiple CPU system back ON again, or reset the system.

Filter method selection

The operation examples and application examples for filter method selection are shown below.

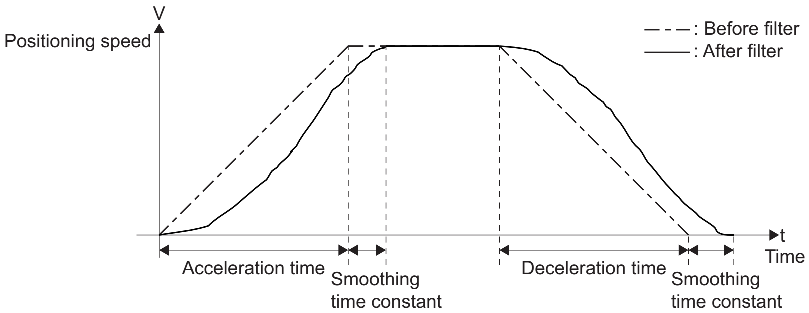
■Application examples

Application example	Filter method
Minimizing torque change of the motor	Smoothing filter
Suppressing a frequency below 1Hz	Smoothing filter FIR filter
Minimizing the command delay caused by the filter	FIR filter
Changing frequency during positioning operation	IIR filter
Suppressing more than one frequency	Use filter methods together • Low frequency: Smoothing filter or FIR filter • High frequency: IIR filter

■Operation example

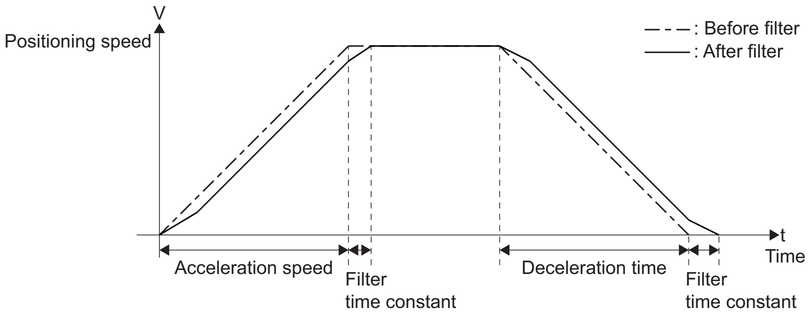
- Smoothing filter

The smoothing filter can remove frequencies higher than the set frequency creating smooth acceleration/deceleration waveforms from all waveforms higher than the set value. The smoothing time constant is 1/frequency[s], and the acceleration/deceleration times are extended by the smoothing time constant only. Depth setting is invalid in the smoothing filter.



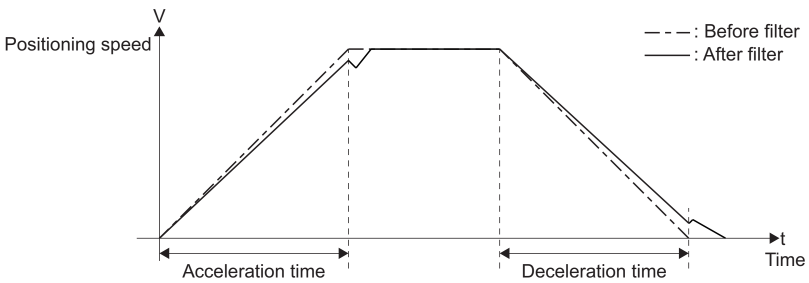
- FIR filter

The FIR filter removes only the specified frequencies by superimposing the waveforms that delay phases for only half of the vibration cycle for position control. The filter time constant is "1/(frequency×2)[s]", and the acceleration/deceleration times are extended by the filter time constant only. Filter depth can be set. When the effect of the filter is too small, make the depth larger.



- IIR filter

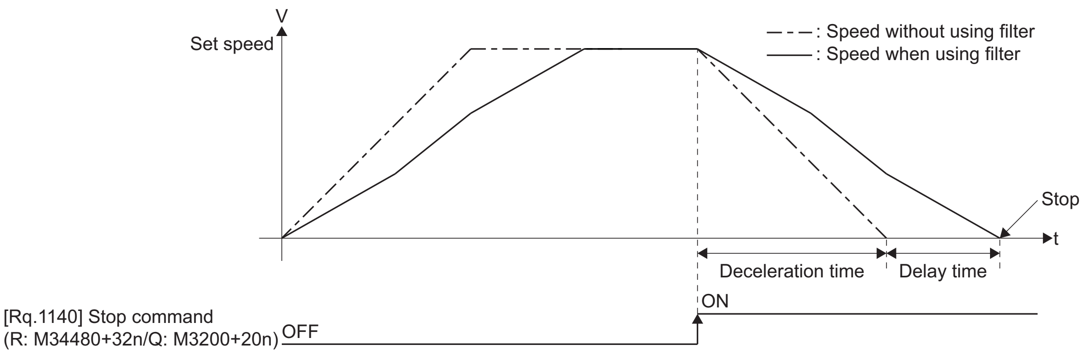
The IIR filter removes only the specified frequencies for position control. Although the delay time changes depending on the pattern, acceleration/deceleration times are extended 1/frequency[s] to approximately 1/1.5×frequency. For the IIR filter, the frequency value can also be changed during positioning operation. However, if the frequency value is changed drastically in a short period of time, a sudden operation can occur, and an alarm or warning can occur. When changing frequency during operation, while checking operation, gradually change the value by units such as 0.01[Hz].



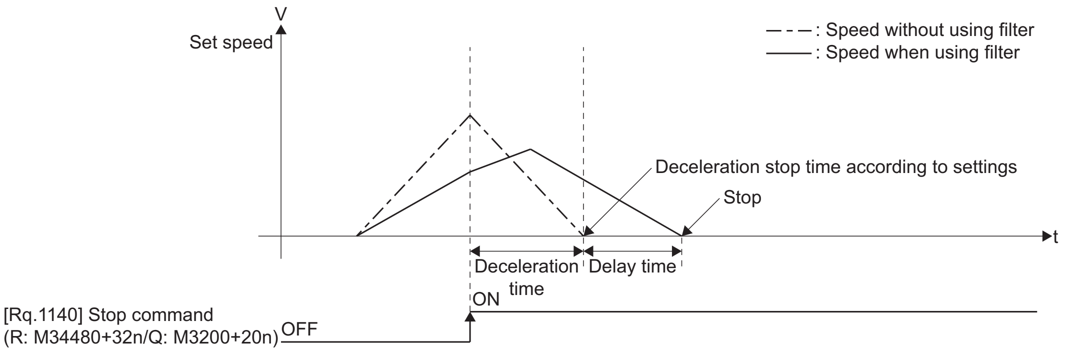
Deceleration stop by stop command/rapid stop command

Because a deceleration stop at a stop command/rapid stop command is conducted at command values after filter, the travel distance after a stop signal is longer compared to when filter is invalid.
Also, when a stop command and rapid stop command are input during acceleration, because of the delay from the filter, a time delay occurs until speed begins to decelerate, thus the stop takes more time.
When using stop command/rapid stop command with vibration suppression command filter, check the actual delay time and travel distance by taking the estimated stop position and stopping distance into consideration and use only after ensuring safety.

■When stop signal turns ON during a fixed speed

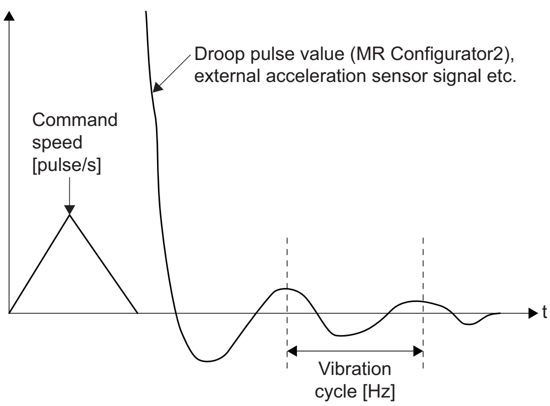


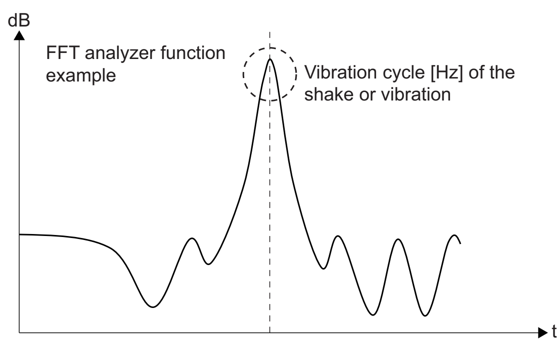
■When stop signal turns ON during acceleration



Measuring vibration

With the filter invalid, measure the vibration cycle with the vibration of the deviation counter occurring after command stop (after command speed 0), or the value of the external acceleration sensor signal with a graph function (MR Configurator2) etc., and set that frequency.
The frequency can be analyzed by using the FFT analyzer function of MR Configurator2. Refer to the following for details.
📖Help of MR Configurator2





7

Monitor values when using vibration suppression command filter

Although the positioning complete signal is turned ON after positioning control, because of the delay caused by the filter, the actual positioning operation may not be complete. To check the completion of command outputs to the positioning address, check the command output complete signal after the filter.

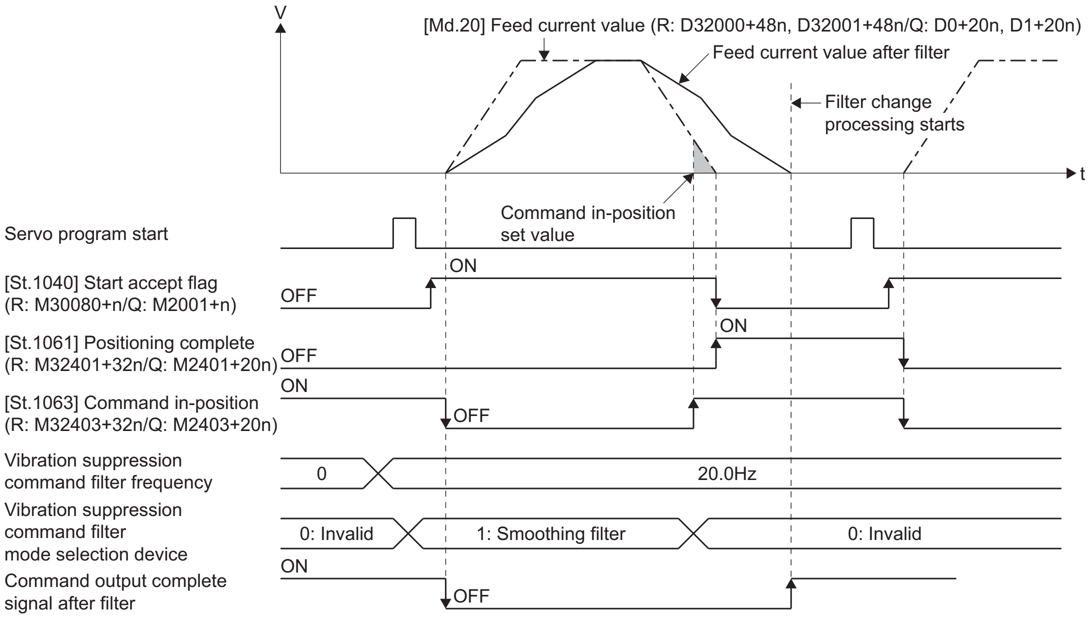
Each monitor value is as follows when filter is set.

Monitor value for before filter	Monitor value for after filter
• [St.1040] Start accept flag (R: M30080+n/Q: M20001+n) • [St.1061] Positioning complete (R: M32401+32n/Q: M2401+20n) • [St.1063] Command in-position (R: M32403+32n/Q: M2403+20n) • [Md.20] Feed current value (R: D32000+48n, D32001+48n/Q: D0+20n, D1+20n) • [Pr.300] Servo input axis type (feed current value, servo command value) • [St.1048] Automatic decelerating flag (R: M30208+n/Q: M2128+n)	• Feed current value monitor device after filter • Command output complete signal after filter • [Md.101] Real current value (R: D32002+48n, D32003+48n/Q: D2+20n, D3+20n) • [Md.102] Deviation counter value (R: D32004+48n, D32005+48n/Q: D4+20n, D5+20n) • [Md.28] Command speed (R: D32024+48n, D32025+48n/Q: #8004+20n, #8005+20n) • [Pr.300] Servo input axis type (real current value, feedback value) • Optional data monitor (registered monitor: Servo command value) • Mark detection data (servo command value) • Limit output data (Watch data: Servo command value)

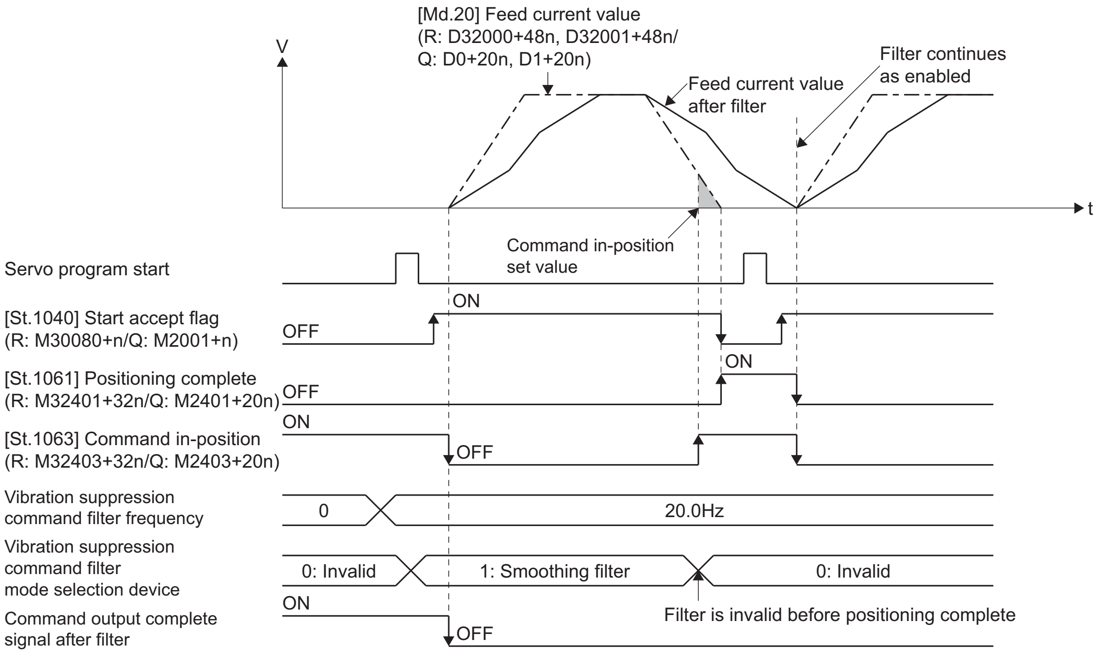
Precautions when using vibration suppression command filter

- The filter is performed when processing send commands to the servo amplifier and the results are reflected in "[Md.28] Command speed (R: D32024+48n, D32025+48n/Q: #8004+20n, #8005+20n)", "feed current value monitor device after filter", and "servo command value" in the optional data monitor, but values before filter are reflected in "[Md.20] Feed current value (R: D32000+48n, D32001+48n/Q: D0+20n, D1+20n)", "[St.1063] Command in-position (R: M32403+32n/Q: M2403+20n)", "[St.1040] Start accept flag (R: M30080+n/Q: M2001+n)", "[St.1061] Positioning complete (R: M32401+32n/Q: M2401+20n)" etc. When checking the actual completion of positioning operation, use "[St.1062] In-position (R: M32402+32n/Q: M2402+20n)" and "command output complete signal after filter" together.
- When using vibration suppression command filter 1, FIN acceleration/deceleration cannot be used. With mode selection device set , and FIN acceleration/deceleration set in continuous trajectory control, a warning (error code: 0A39H) occurs and FIN acceleration/deceleration is disabled. When using FIN acceleration/deceleration, do not set the mode selection device of vibration suppression command filter 1.
- "[Md.20] Feed current value (R: D32000+48n, D32001+48n/Q: D0+20n, D1+20n)" is updated with the value before filter, and "[St.1040] Start accept flag (R: M30080+n/Q: M2001+n)", "[St.1061] Positioning complete (R: M32401+32n/Q: M2401+20n)", and "[St.1063] Command in-position (R: M32403+32n/Q: M2403+20n)" operate based on "[Md.20] Feed current value (R: D32000+48n, D32001+48n/Q: D0+20n, D1+20n)". Check the positioning command being sent to the servo amplifier with "feed current value monitor device after filter", or "servo command value" in the optional data monitor. "[St.1040] Start accept flag (R: M30080+n/Q: M2001+n)" turns OFF with the value before filter, however at this stage the command being sent to the servo amplifier may not have reached the target position. To confirm if the command has reached the target position, check that the "command output complete signal after filter" is turned ON.

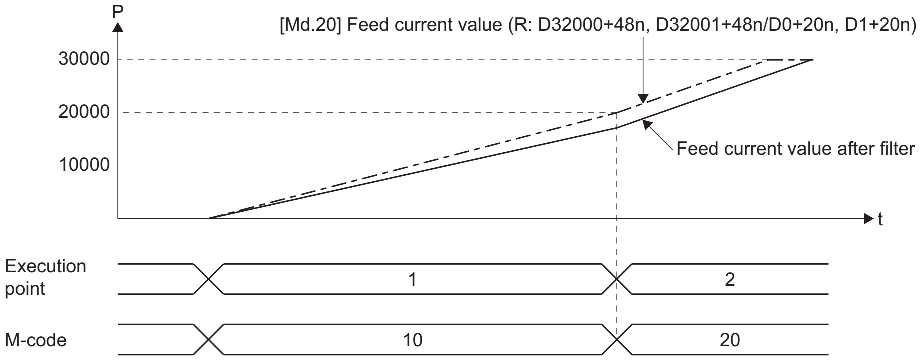
• If the filter method setting (1: Smoothing filter, 2: FIR filter, 3: IIR filter) for the "mode selection device" of "vibration suppression filter 1/2" is changed to "0: Invalid" while the vibration suppression command filter is operating, the vibration suppression command filter is not invalid immediately. The vibration suppression command filter is invalid when command output complete signal after filter turns ON.



• When a servo program is started up consecutively before the command output complete signal after filter turns ON, filter processing continues and does not become invalid even by changing the mode selection device to "0: Invalid".



• M-code output for continuous trajectory control (CPSTART instruction) is output at the time when the feed current value before filter reaches the specified point. Consequently, due to the delay by the filter, M-code may be updated before the feed current value after filter reaches the specified point.

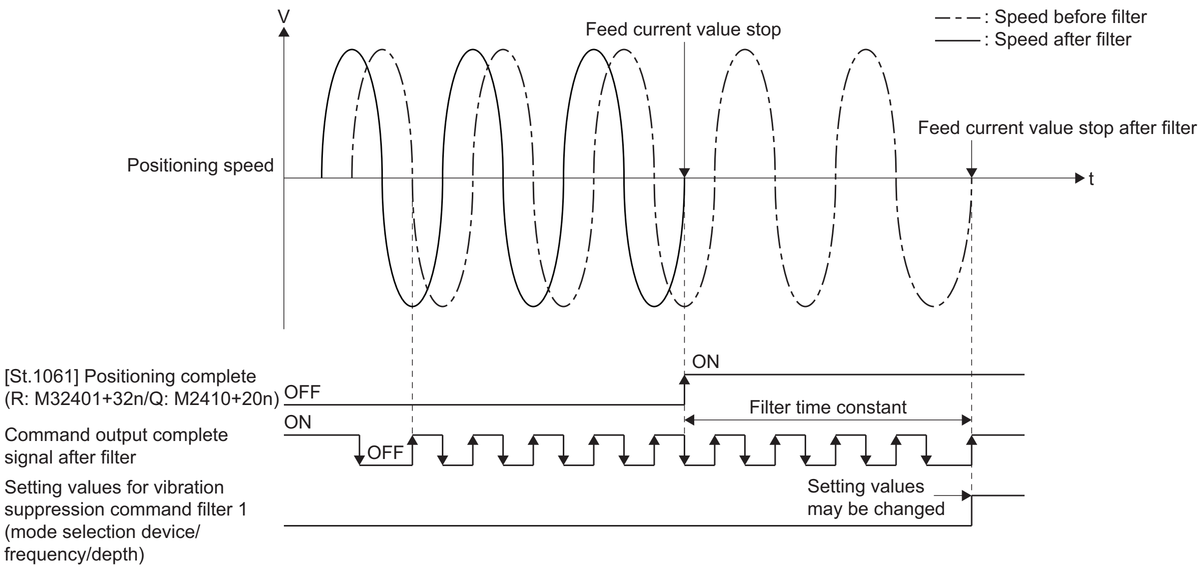


• In advanced synchronous control, filter is applied to feed current values of output axis modules.
• Each monitor value for advanced synchronous control is the value before filter.
• The vibration suppression filter is not supported for command generation axis.
• When input axis modules for advanced synchronous control are servo input axes, filter valid/invalid is as follows.

○: Valid, ×: Invalid

Specified value for "[Pr.300] Servo input axis type"	Filter valid/invalid
1: Feed current value	×
2: Real current value	○
3: Servo command value	×
4: Feedback value	○

• For operation patterns that repeat forward rotation and reverse rotation in vibration suppression command filter 1, the command output complete signal after filter may turn ON during operation as illustrated below. If the vibration suppression command filter 1 values (mode selection device/frequency/depth) are changed with the filter operation not settled, the values are discontinued in the middle of operation which causes the feed current value and feed current value after filter to misalign. When changing the setting values for vibration suppression command filter 1, after checking that the operation pattern before filter is complete with "[St.1061] Positioning complete (R: M32401+32n/Q: M2401+20n)" or "[St.1040] Start accept flag (R: M30080+n/Q: M2001+n)", wait for a filter time constant before changing the values.



APPENDICES

Appendix 1 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.

Motion operation cycle [ms] (Default)

The following shows the operation cycles of the Motion CPU.

Motion CPU	No. of set axes	Operation cycle[ms]
R64MTCPU	1 to 2	0.222
	3 to 8	0.444
	9 to 20	0.888
	21 to 38	1.777
	39 to 64	3.555
R32MTCPU	1 to 2	0.222
	3 to 8	0.444
	9 to 20	0.888
	21 to 32	1.777
R16MTCPU	1 to 2	0.222
	3 to 8	0.444
	9 to 16	0.888

A

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.)

		R64MTCPU/R32MTCPU/R16MTCPU					
Operation cycle [ms]		**0.222**	**0.444**	**0.888**	**1.777**	**3.555**	**7.111**
Servo program start processing time*1	"WAIT ON/OFF" + Motion control step	0.444	0.888	1.777	3.554	7.110	14.222
	Only Motion control step	0.666 to 0.888	1.110 to 1.554	1.998 to 2.886	3.776 to 5.553	7.332 to 10.887	14.444 to 21.555
	Dedicated instruction (D(P).SVST) from the PLC CPU	1.332 to 1.554	1.776 to 2.220	2.664 to 3.552	3.554 to 5.331	7.110 to 10.665	14.222 to 21.333
	Dedicated instruction (M(P).SVST) from the PLC CPU	0.888 to 1.110	1.332 to 1.776	2.220 to 3.108	2.666 to 4.443	5.333 to 8.888	10.667 to 14.222
Direct positioning start request processing time	Dedicated instruction (D(P).SVSTD) from the PLC CPU	1.332 to 1.554	1.776 to 2.220	2.664 to 3.552	3.554 to 5.331	7.110 to 10.665	14.222 to 21.333
	Dedicated instruction (M(P).SVSTD) from the PLC CPU	0.888 to 1.110	1.332 to 1.776	2.220 to 3.108	2.666 to 4.443	5.333 to 8.888	10.667 to 14.222
Speed change processing time	Instruction (CHGV) from the Motion SFC	0.444 to 0.888	0.888 to 1.332	1.776 to 2.664	2.665 to 4.442	4.443 to 7.998	7.999 to 15.110
	Dedicated instruction (D(P).CHGV) from the PLC CPU	0.888 to 1.110	1.332 to 1.776	2.220 to 3.108	3.109 to 4.886	4.887 to 8.442	11.998 to 19.109
	Dedicated instruction (M(P).CHGV) from the PLC CPU	0.666 to 0.888	1.110 to 1.554	1.998 to 2.886	2.887 to 4.664	4.665 to 8.220	11.776 to 18.887
Command generation axis speed change processing time	Instruction (CHGVS) from the Motion SFC	0.444 to 0.888	0.888 to 1.332	1.776 to 2.664	2.665 to 4.442	4.443 to 7.998	7.999 to 15.110
	Dedicated instruction (D(P).CHGVS) from the PLC CPU	0.888 to 1.110	1.332 to 1.776	2.220 to 3.108	3.109 to 4.886	4.887 to 8.442	11.998 to 19.109
	Dedicated instruction (M(P).CHGVS) from the PLC CPU	0.666 to 0.888	1.110 to 1.554	1.998 to 2.886	2.887 to 4.664	4.665 to 8.220	11.776 to 18.887
Torque limit value change processing time	Instruction (CHGT) from the Motion SFC	0.444 to 0.888	0.888 to 1.332	1.776 to 2.664	2.665 to 4.442	4.443 to 7.998	7.999 to 15.110
	Dedicated instruction (D(P).CHGT) from the PLC CPU	0.888 to 1.110	1.332 to 1.776	2.220 to 3.108	3.109 to 4.886	4.887 to 8.442	8.443 to 15.554
	Dedicated instruction (M(P).CHGT) from the PLC CPU	0.666 to 0.888	1.110 to 1.554	1.998 to 2.886	2.887 to 4.664	4.665 to 8.220	8.221 to 15.332
Target position change processing time	Instruction (CHGP) from the Motion SFC	0.444 to 0.888	0.888 to 1.332	1.776 to 2.664	2.665 to 4.442	4.443 to 7.998	7.999 to 15.110
Machine program operation start processing time*3	Instruction (MCNST) from the Motion SFC	—	1.332 to 1.776	1.776 to 2.664	2.665 to 4.442	4.443 to 7.998	—
	Dedicated instruction (D(P).MCNST) from the PLC CPU	—	1.776 to 2.220	2.664 to 3.552	3.554 to 5.331	7.110 to 10.665	—
	Dedicated instruction (M(P).MCNST) from the PLC CPU	—	1.332 to 1.776	2.220 to 3.108	2.666 to 4.443	5.333 to 8.888	—
G-code control program start processing time	Automatic operation start (cycle start) ON	—	—	15.111 to 19.556	30.222 to 39.111	60.444 to 78.222	120.889 to 156.444
Time from "[Rq.1120] PLC ready flag (R: M30000/Q: M2000)" ON to "PCPU READY complete flag (SM500)" ON		22 to 165*2					

*1 FEED instruction varies greatly depending on the condition (whether other axes are operating).
*2 The processing time gets larger depending on the number of axes set.
*3 CPU processing time when "Number of positioning points = 1".

MEMO

A

REVISIONS

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

Revision date	*Manual number	Description
July 2014	IB(NA)-0300241-A	First edition
March 2015	IB(NA)-0300241-B	■Added functions ABS direction in degrees setting, Pressure control, Servo amplifier (MR-J4□-B-LL) compatible ■Added or modified parts SAFETY PRECAUTIONS, RELEVANT MANUALS, TERMS, Section 2.1, 2.2, 2.3, 3.1, 3.3, 3.7, 3.9, 3.10, 3.11, 5.1, 6.2, 7.5, 7.6, 7.7, Appendix 1
June 2015	IB(NA)-0300241-C	■Added functions Override function, vibration suppression command filter ■Added or modified parts TERMS, Section 2.1, 3.1, 3.10, 3.11, 3.12, 3.13, 5.21, 7.2, 7.7, 7.8, 7.9
February 2016	IB(NA)-0300241-D	■Added models R64MTCPU ■Added functions Servo motor maximum speed check parameter, Home position return by driver home position return method ■Added or modified parts SAFETY PRECAUTIONS, INTRODUCTION, RELEVANT MANUALS, TERMS, MANUAL PAGE ORGANIZATION, Section 1.1, 2, 2.1, 2.2, 2.3, 3.1, 3.3, 3.4, 3.6, 3.7, 3.11, 3.13, 4.3, 4.4, 5.1, 5.15, 5.16, 5.17, 5.21, 5.22, 6.1, 6.2, 7.1, 7.3, 7.4, 7.5, 7.6, 7.7, 7.8, 7.9, Appendix 1, WARRANTY
June 2016	IB(NA)-0300241-E	■Added functions Home position return by data set method 3 ■Added or modified parts SAFETY PRECAUTIONS, INTRODUCTION, Section 2.1, 2.2, 3.4, 5.1, 5.21, 7.8
September 2016	IB(NA)-0300241-F	■Added or modified parts TERMS, Section 2.1, 2.2, 3.1, 3.12, 5.17, Appendix 1
December 2016	IB(NA)-0300241-G	■Added or modified parts SAFETY PRECAUTIONS, Chapter 2, Section 2.2, 4.1, 4.3, 5.20, 7.5
December 2017	IB(NA)-0300241-H	■Added or modified parts SAFETY PRECAUTIONS, RELEVANT MANUALS, MANUAL PAGE ORGANIZATION, Section 2.1, 2.2, 3.1, 3.3, 3.4, 3.5, 5.1, 5.17, 5.21, 7.8, Appendix 1
June 2018	IB(NA)-0300241-J	■Added or modified parts SAFETY PRECAUTIONS, Section 2.1, 2.2, 2.3, 3.9

Japanese manual number: IB-0300240-J

WARRANTY

Please confirm the following product warranty details before using this product.

1. Gratis Warranty Term and Gratis Warranty Range

If any faults or defects (hereinafter "Failure") found to be the responsibility of Mitsubishi occurs during use of the product within the gratis warranty term, the product shall be repaired at no cost via the sales representative or Mitsubishi Service Company.

However, if repairs are required onsite at domestic or overseas location, expenses to send an engineer will be solely at the customer's discretion. Mitsubishi shall not be held responsible for any re-commissioning, maintenance, or testing on-site that involves replacement of the failed module.

[Gratis Warranty Term]

The gratis warranty term of the product shall be for one year after the date of purchase or delivery to a designated place. Note that after manufacture and shipment from Mitsubishi, the maximum distribution period shall be six (6) months, and the longest gratis warranty term after manufacturing shall be eighteen (18) months. The gratis warranty term of repair parts shall not exceed the gratis warranty term before repairs.

[Gratis Warranty Range]

(1) The range shall be limited to normal use within the usage state, usage methods and usage environment, etc., which follow the conditions and precautions, etc., given in the instruction manual, user's manual and caution labels on the product.

(2) Even within the gratis warranty term, repairs shall be charged for in the following cases.

1. Failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by the user's hardware or software design.
2. Failure caused by unapproved modifications, etc., to the product by the user.
3. When the Mitsubishi product is assembled into a user's device, Failure that could have been avoided if functions or structures, judged as necessary in the legal safety measures the user's device is subject to or as necessary by industry standards, had been provided.
4. Failure that could have been avoided if consumable parts (battery, backlight, fuse, etc.) designated in the instruction manual had been correctly serviced or replaced.
5. Failure caused by external irresistible forces such as fires or abnormal voltages, and Failure caused by force majeure such as earthquakes, lightning, wind and water damage.
6. Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
7. Any other failure found not to be the responsibility of Mitsubishi or that admitted not to be so by the user.

2. Onerous repair term after discontinuation of production

(1) Mitsubishi shall accept onerous product repairs for seven (7) years after production of the product is discontinued. Discontinuation of production shall be notified with Mitsubishi Technical Bulletins, etc.

(2) Product supply (including repair parts) is not available after production is discontinued.

3. Overseas service

Overseas, repairs shall be accepted by Mitsubishi's local overseas FA Center. Note that the repair conditions at each FA Center may differ.

4. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation 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. Changes in product specifications

The specifications given in the catalogs, manuals or technical documents are subject to change without prior notice.

TRADEMARKS

Ethernet is a registered trademark of Fuji Xerox Corporation in Japan.

Microsoft, Microsoft Access, Excel, SQL Server, Visual Basic, Visual C++, Visual Studio, Windows, Windows NT, Windows Server, Windows Vista, and Windows XP are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.

The company names, system names and product names mentioned in this manual are either registered trademarks or trademarks of their respective companies.

In some cases, trademark symbols such as '™' or '®' are not specified in this manual.

IB(NA)-0300241-J

IB(NA)-0300241-J(1806)MEE
MODEL: RMT-P-POS-E
MODEL CODE: 1XB008

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE : TOKYO BUILDING, 2-7-3 MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN
NAGOYA WORKS : 1-14 , YADA-MINAMI 5-CHOME , HIGASHI-KU, NAGOYA , JAPAN

When exported from Japan, this manual does not require application to the Ministry of Economy, Trade and Industry for service transaction permission.

Specifications subject to change without notice.