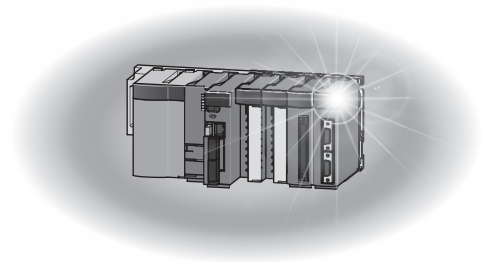


Motion Controller

MELSEC **Q** series

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

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



● SAFETY PRECAUTIONS ●

(Please read these instructions before using this equipment.)

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

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


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

 **DANGER**

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 medium or slight personal injury or physical damage.

Depending on circumstances, procedures indicated by  CAUTION may also be linked to serious results.

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

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

For Safe Operations

1. Prevention of electric shocks

DANGER

- Never open the front case or terminal covers while the power is ON or the unit is running, as this may lead to electric shocks.
- Never run the unit with the front case or terminal cover removed. The high voltage terminal and charged sections will be exposed and may lead to electric shocks.
- Never open the front case or terminal cover at times other than wiring work or periodic inspections even if the power is OFF. The insides of the Motion controller and servo amplifier are charged and may lead to electric shocks.
- Completely turn off the externally supplied power used in the system before mounting or removing the module, performing wiring work, or inspections. Failing to do so may lead to electric shocks.
- When performing wiring work or inspections, turn the power OFF, wait at least ten minutes, and then check the voltage with a tester, etc. Failing to do so may lead to electric shocks.
- Be sure to ground the Motion controller, servo amplifier and servomotor. (Ground resistance : 100 Ω or less) Do not ground commonly with other devices.
- The wiring work and inspections must be done by a qualified technician.
- Wire the units after installing the Motion controller, servo amplifier and servomotor. Failing to do so may lead to electric shocks or damage.
- Never operate the switches with wet hands, as this may lead to electric shocks.
- Do not damage, apply excessive stress, place heavy things on or sandwich the cables, as this may lead to electric shocks.
- Do not touch the Motion controller, servo amplifier or servomotor terminal blocks while the power is ON, as this may lead to electric shocks.
- Do not touch the built-in power supply, built-in grounding or signal wires of the Motion controller and servo amplifier, as this may lead to electric shocks.

2. For fire prevention

CAUTION

- Install the Motion controller, servo amplifier, servomotor and regenerative resistor on incombustible. Installing them directly or close to combustibles will lead to fire.
- If a fault occurs in the Motion controller or servo amplifier, shut the power OFF at the servo amplifier's power source. If a large current continues to flow, fire may occur.
- When using a regenerative resistor, shut the power OFF with an error signal. The regenerative resistor may abnormally overheat due to a fault in the regenerative transistor, etc., and may lead to fire.
- Always take heat measures such as flame proofing for the inside of the control panel where the servo amplifier or regenerative resistor is installed and for the wires used. Failing to do so may lead to fire.
- Do not damage, apply excessive stress, place heavy things on or sandwich the cables, as this may lead to fire.

3. For injury prevention

CAUTION

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

4. Various precautions

Strictly observe the following precautions.

Mistaken handling of the unit may lead to faults, injuries or electric shocks.

(1) System structure

CAUTION

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

CAUTION

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

(2) Parameter settings and programming

CAUTION

- Set the parameter values to those that are compatible with the Motion controller, servo amplifier, servomotor and regenerative resistor model and the system application. The protective functions may not function if the settings are incorrect.
- The regenerative resistor model and capacity parameters must be set to values that conform to the operation mode, servo amplifier and servo power supply module. The protective functions may not function if the settings are incorrect.
- Set the mechanical brake output and dynamic brake output validity parameters to values that are compatible with the system application. The protective functions may not function if the settings are incorrect.
- Set the stroke limit input validity parameter to a value that is compatible with the system application. The protective functions may not function if the setting is incorrect.
- Set the servomotor encoder type (increment, absolute position type, etc.) parameter to a value that is compatible with the system application. The protective functions may not function if the setting is incorrect.
- Set the servomotor capacity and type (standard, low-inertia, flat, etc.) parameter to values that are compatible with the system application. The protective functions may not function if the settings are incorrect.

CAUTION

- Set the servo amplifier capacity and type parameters to values that are compatible with the system application. The protective functions may not function if the settings are incorrect.
- Use the program commands for the program with the conditions specified in the instruction manual.
- Set the sequence function program capacity setting, device capacity, latch validity range, I/O assignment setting, and validity of continuous operation during error detection to values that are compatible with the system application. The protective functions may not function if the settings are incorrect.
- Some devices used in the program have fixed applications, so use these with the conditions specified in the instruction manual.
- The input devices and data registers assigned to the link will hold the data previous to when communication is terminated by an error, etc. Thus, an error correspondence interlock program specified in the instruction manual must be used.
- Use the interlock program specified in the intelligent function module's instruction manual for the program corresponding to the intelligent function module.

(3) Transportation and installation

CAUTION

- Transport the product with the correct method according to the mass.
- Use the servomotor suspension bolts only for the transportation of the servomotor. Do not transport the servomotor with machine installed on it.
- Do not stack products past the limit.
- When transporting the Motion controller or servo amplifier, never hold the connected wires or cables.
- When transporting the servomotor, never hold the cables, shaft or detector.
- When transporting the Motion controller or servo amplifier, never hold the front case as it may fall off.
- When transporting, installing or removing the Motion controller or servo amplifier, never hold the edges.
- Install the unit according to the instruction manual in a place where the mass can be withstood.
- Do not get on or place heavy objects on the product.
- Always observe the installation direction.
- Keep the designated clearance between the Motion controller or servo amplifier and control panel inner surface or the Motion controller and servo amplifier, Motion controller or servo amplifier and other devices.
- Do not install or operate Motion controller, servo amplifiers or servomotors that are damaged or that have missing parts.
- Do not block the intake/outtake ports of the Motion controller, servo amplifier and servomotor with cooling fan.
- Do not allow conductive matter such as screw or cutting chips or combustible matter such as oil enter the Motion controller, servo amplifier or servomotor.

⚠ CAUTION

- The Motion controller, servo amplifier and servomotor are precision machines, so do not drop or apply strong impacts on them.
- Securely fix the Motion controller, servo amplifier and servomotor to the machine according to the instruction manual. If the fixing is insufficient, these may come off during operation.
- Always install the servomotor with reduction gears in the designated direction. Failing to do so may lead to oil leaks.
- Store and use the unit in the following environmental conditions.

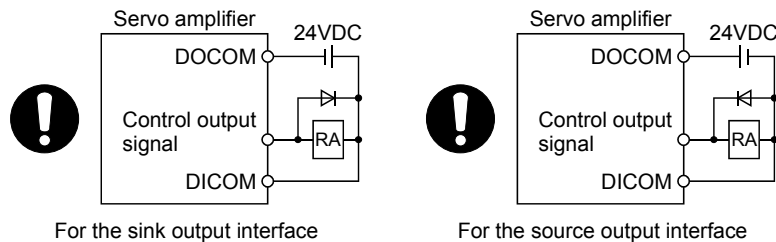
| Environment | Conditions | |
|---------------------|---|---|
| | Motion controller/Servo amplifier | Servomotor |
| Ambient temperature | According to each instruction manual. | 0°C to +40°C (With no freezing) (32°F to +104°F) |
| Ambient humidity | According to each instruction manual. | 80% RH or less (With no dew condensation) |
| Storage temperature | According to each instruction manual. | -20°C to +65°C (-4°F to +149°F) |
| Atmosphere | Indoors (where not subject to direct sunlight). No corrosive gases, flammable gases, oil mist or dust must exist | |
| Altitude | According to each instruction manual | |
| Vibration | According to each instruction manual | |

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

(4) Wiring

⚠ CAUTION

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



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

(5) Trial operation and adjustment

⚠ CAUTION

- Confirm and adjust the program and each parameter before operation. Unpredictable movements may occur depending on the machine.
- Extreme adjustments and changes may lead to unstable operation, so never make them.
- When using the absolute position system function, on starting up, and when the Motion controller or absolute position motor has been replaced, always perform a home position return.
- Before starting test operation, set the parameter speed limit value to the slowest value, and make sure that operation can be stopped immediately by the forced stop, etc. if a hazardous state occurs.

(6) Usage methods

⚠ CAUTION

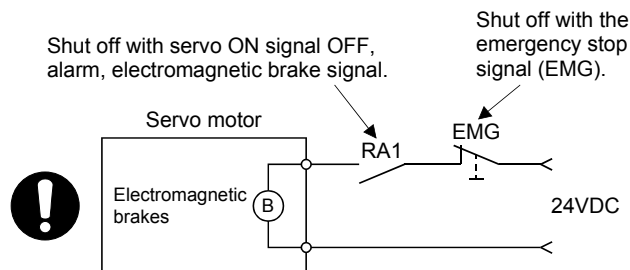
- Immediately turn OFF the power if smoke, abnormal sounds or odors are emitted from the Motion controller, servo amplifier or servomotor.
- Always execute a test operation before starting actual operations after the program or parameters have been changed or after maintenance and inspection.
- Do not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

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

(7) Corrective actions for errors

⚠ CAUTION

- If an error occurs in the self diagnosis of the Motion controller or servo amplifier, confirm the check details according to the instruction manual, and restore the operation.
- If a dangerous state is predicted in case of a power failure or product failure, use a servomotor with electromagnetic brakes or install a brake mechanism externally.
- Use a double circuit construction so that the electromagnetic brake operation circuit can be operated by emergency stop signals set externally.



- If an error occurs, remove the cause, secure the safety and then resume operation after alarm release.
- The unit may suddenly resume operation after a power failure is restored, so do not go near the machine. (Design the machine so that personal safety can be ensured even if the machine restarts suddenly.)

(8) Maintenance, inspection and part replacement

CAUTION

- Perform the daily and periodic inspections according to the instruction manual.
- Perform maintenance and inspection after backing up the program and parameters for the Motion controller and servo amplifier.
- Do not place fingers or hands in the clearance when opening or closing any opening.
- Periodically replace consumable parts such as batteries according to the instruction manual.
- Do not touch the lead sections such as ICs or the connector contacts.
- Before touching the module, always touch grounded metal, etc. to discharge static electricity from human body. Failure to do so may cause the module to fail or malfunction.
- Do not directly touch the module's conductive parts and electronic components. Touching them could cause an operation failure or give damage to the module.
- Do not place the Motion controller or servo amplifier on metal that may cause a power leakage or wood, plastic or vinyl that may cause static electricity buildup.
- Do not perform a megger test (insulation resistance measurement) during inspection.
- When replacing the Motion controller or servo amplifier, always set the new module settings correctly.
- When the Motion controller or absolute value motor has been replaced, carry out a home position return operation using one of the following methods, otherwise position displacement could occur.
 - 1) After writing the servo data to the Motion controller using programming software, switch on the power again, then perform a home position return operation.
 - 2) Using the backup function of the programming software, load the data backed up before replacement.
- After maintenance and inspections are completed, confirm that the position detection of the absolute position detector function is correct.
- Do not drop or impact the battery installed to the module. Doing so may damage the battery, causing battery liquid to leak in the battery. Do not use the dropped or impacted battery, but dispose of it.
- Do not short circuit, charge, overheat, incinerate or disassemble the batteries.
- The electrolytic capacitor will generate gas during a fault, so do not place your face near the Motion controller or servo amplifier.
- The electrolytic capacitor and fan will deteriorate. Periodically replace these to prevent secondary damage from faults. Replacements can be made by our sales representative.
- Lock the control panel and prevent access to those who are not certified to handle or install electric equipment.
- Do not burn or break a module and servo amplifier. Doing so may cause a toxic gas.

(9) About processing of waste

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

CAUTION

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

(10) General cautions

- All drawings provided in the instruction manual show the state with the covers and safety partitions removed to explain detailed sections. When operating the product, always return the covers and partitions to the designated positions, and operate according to the instruction manual.

REVISIONS

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

| Print Date | * Manual Number | Revision |
|------------|------------------|--|
| Sep., 2007 | IB(NA)-0300137-A | First edition |
| Nov., 2009 | IB(NA)-0300137-B | [Additional model] MR-J3W-□B, MR-J3-□B-RJ080W, MR-J3-□BS [Additional correction/partial correction] Safety precautions, About Manuals, Restrictions by the software's version or serial number, Servo amplifier display servo error code (#8008+20), Amplifier-less operation status flag (SM508), SSCNET control (Status_SD508), SSCNET control (Command_SD803), Advanced S-curve acceleration/deceleration, Error code list, Warranty |
| Sep., 2011 | IB(NA)-0300137-C | [Additional model] Q173DCPU-S1, Q172DCPU-S1, GX Works2, MR Configurator2 [Additional correction/partial correction] Safety precautions, About Manuals, Restrictions by the software's version, Error code list |
| Mar., 2012 | IB(NA)-0300137-D | [Additional model] Q173DSCPU, Q172DSCPU, Q171ENC-W8, MR-J4-□B, MR-J4W-□B [Additional function] Speed-torque control [Additional correction/partial correction] About Manuals, Manual page organization, Restrictions by the software's version, Programming software version, PI-PID switching command (M3217+20n), Parameter error number (#8009+20n), Servo status 1 (#8010+20n), Servo status 2 (#8011+20n), Servo status 3 (#8012+20n), Maximum motion operation cycle (SD524), System setting error information (SD550, SD551), Error code list, Processing time of the Motion CPU |
| Sep., 2012 | IB(NA)-0300137-E | [Additional correction/partial correction] About Manuals, Restrictions by the software's version, Programming software version, External forced stop input ON latch flag (SM506), Operation method (SD560), Error code list, Processing time of the Motion CPU |
| Apr., 2013 | IB(NA)-0300137-F | [Additional correction/partial correction] About Manuals, Restrictions by the software's version, Error code list |
| Nov., 2013 | IB(NA)-0300137-G | [Additional correction/partial correction] Safety precautions, Restrictions by the software's version, Error code list |
| Dec., 2015 | IB(NA)-0300137-H | [Additional correction/partial correction] Restrictions by the software's version, Servo status7 (#8018+20n), Error codes stored using the Motion CPU, Warranty |
| Mar., 2017 | IB(NA)-0300137-J | [Additional correction/partial correction] Safety precautions, Restrictions by the software's version, Error code list, Warranty |
| | | |

Japanese Manual Number IB(NA)-0300129

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INTRODUCTION

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

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About Manuals

The following manuals are also related to this product.

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

Related Manuals

(1) Motion controller

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

(2) PLC



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

(3) Servo amplifier

| Manual Name | Manual Number (Model Code) |
|---|-------------------------------|
| SSCNETⅢ/H Interface AC Servo MR-J4-_B_(-RJ) Servo amplifier Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for AC Servo MR-J4-_B_(-RJ) Servo amplifier. | SH-030106 (1CW805) |
| SSCNETⅢ/H Interface Multi-axis AC Servo MR-J4W2-_B_/MR-J4W3-_B_/MR-J4W2-0303B6 Servo amplifier Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for Multi-axis AC Servo MR-J4W2-_B_/MR-J4W3-_B_/MR-J4W2-0303B6 Servo amplifier. | SH-030105 (1CW806) |
| SSCNETⅢ interface MR-J3-□B Servo amplifier Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for MR-J3-□B Servo amplifier. | SH-030051 (1CW202) |
| SSCNETⅢ interface 2-axis AC Servo Amplifier MR-J3W-0303BN6/MR-J3W-□B Servo amplifier Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for 2-axis AC Servo Amplifier MR-J3W-0303BN6/MR-J3W-□B Servo amplifier. | SH-030073 (1CW604) |
| SSCNETⅢ Compatible Linear Servo MR-J3-□B-RJ004U□ Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for Linear Servo MR-J3-□B-RJ004U□ Servo amplifier. | SH-030054 (1CW943) |
| SSCNETⅢ Compatible Fully Closed Loop Control MR-J3-□B-RJ006 Servo amplifier Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for Fully Closed Loop Control MR-J3-□B-RJ006 Servo amplifier. | SH-030056 (1CW304) |
| SSCNETⅢ Interface Direct Drive Servo MR-J3-□B-RJ080W Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for Direct Drive Servo MR-J3-□B-RJ080W Servo amplifier. | SH-030079 (1CW601) |
| SSCNETⅢ interface Drive Safety integrated MR-J3-□B Safety Servo amplifier Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for safety integrated MR-J3-□B Safety Servo amplifier. | SH-030084 (1CW205) |

Manual Page Organization

The symbols used in this manual are shown below.

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

1. OVERVIEW

1.1 Overview

This programming manual describes the dedicated instructions, positioning control parameters and positioning dedicated devices for mechanical system program comprised of a virtual main shaft or mechanical module required to execute the synchronous control in the Motion controller (SV22 virtual mode).

The following positioning control is possible in the Motion controller (SV22 virtual mode).

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

In this manual, the following abbreviations are used.

| Generic term/Abbreviation | Description |
|---|---|
| Q173D(S)CPU/Q172D(S)CPU or Motion CPU (module) | Q173DSCPU/Q172DSCPU/Q173DCPU/Q172DCPU/Q173DCPU-S1/Q172DCPU-S1 Motion CPU module |
| Q172DLX/Q172DEX/Q173DPX/Q173DSXY or Motion module | Q172DLX Servo external signals interface module/ Q172DEX Synchronous encoder interface module ^(Note-1) / Q173DPX Manual pulse generator interface module/ Q173DSXY Safety signal module |
| 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" |
| QCPU, PLC CPU or PLC CPU module | QnUD(E)(H)CPU/QnUDVCPU |
| Multiple CPU system or Motion system | Abbreviation for "Multiple PLC system of the Q series" |
| 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 "SW7DNC-SV□□□/SW8DNC-SV□□□" |
| SV13 | Operating system software for conveyor assembly use (Motion SFC) : SW8DNC-SV13Q□ |
| SV22 | Operating system software for automatic machinery use (Motion SFC) : SW8DNC-SV22Q□ |
| Programming software package | General name for MT Developer2/GX Works2/GX Developer/MR Configurator□ |
| MELSOFT MT Works2 | Abbreviation for "Motion controller engineering environment MELSOFT MT Works2" |
| MT Developer2 ^(Note-2) | Abbreviation for "Motion controller programming software MT Developer2 (Version 1.00A or later)" |
| GX Works2 | Abbreviation for "Programmable controller engineering software MELSOFT GX Works2 (Version 1.15R or later)" |
| GX Developer | Abbreviation for "MELSEC PLC programming software package GX Developer (Version 8.48A or later)" |
| MR Configurator□ ^(Note-2) | General name for "MR Configurator/MR Configurator2" |

1 OVERVIEW

| Generic term/Abbreviation | Description |
|---|---|
| MR Configurator | Abbreviation for "Servo setup software package MR Configurator (Version C0 or later)" |
| MR Configurator2 | Abbreviation for "Servo setup software package MR Configurator2 (Version 1.01B or later)" |
| Manual pulse generator or MR-HDP01 | Abbreviation for "Manual pulse generator (MR-HDP01)" |
| Serial absolute synchronous encoder or Q171ENC-W8/Q170ENC | Abbreviation for "Serial absolute synchronous encoder (Q171ENC-W8/Q170ENC)" |
| SSCNET III/H ^(Note-3) | High speed synchronous network between Motion controller and servo amplifier |
| SSCNET III ^(Note-3) | |
| SSCNET III(/H) ^(Note-3) | |
| Absolute position system | General name for "system using the servomotor and servo amplifier for absolute position" |
| Battery holder unit | Battery holder unit (Q170DBATC) |
| Intelligent function module | General name for module that has a function other than input or output such as A/D converter module and D/A converter module. |
| SSCNET III/H head module | Abbreviation for "MELSEC-L series SSCNET III/H head module (LJ72MS15)" |
| Optical hub unit or MR-MV200 | Abbreviation for "SSCNET III/H compatible optical hub unit (MR-MV200)" |

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

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

(Note-3): SSCNET: Servo System Controller NETwork

1 OVERVIEW

REMARK

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

| Item | | Reference Manual |
|--|--|--|
| Motion CPU module/Motion unit | | Q173D(S)CPU/Q172D(S)CPU Motion controller User's Manual |
| PLC CPU, peripheral devices for sequence program design, I/O modules and intelligent function module | | Manual relevant to each module |
| Operation method for MT Developer2 | | Help of each software |
| SV13/SV22 | <ul style="list-style-type: none"> • Multiple CPU system configuration • Performance specification • Design method for common parameter • Auxiliary and applied functions (common) | Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON) |
| | <ul style="list-style-type: none"> • Design method for Motion SFC program • Design method for Motion SFC parameter • Motion dedicated PLC instruction | Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (Motion SFC) |
| | <ul style="list-style-type: none"> • Design method for positioning control program in the real mode • Design method for positioning control parameter | Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE) |
| | <ul style="list-style-type: none"> • Design method for safety observation parameter • Design method for user made safety sequence program | Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (Safety Observation) |
| SV22 (Advanced synchronous control) | <ul style="list-style-type: none"> • Design method for synchronous control parameter | Q173DSCPU/Q172DSCPU Motion controller (SV22) Programming Manual (Advanced Synchronous Control) |

⚠ CAUTION

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

1 OVERVIEW

1.2 Motion Control in SV13/SV22 Real Mode

- (1) System with servomotor is controlled directly using the servo program in (SV13/SV22) real mode.
- (2) Setting of the positioning parameter and creation of the servo program/Motion SFC program are required.
- (3) The procedure of positioning control is shown below:
 - 1) Motion SFC program is requested to start using the D(P). SFCS instruction of the sequence program.
(Motion SFC program can also be started automatically by parameter setting.)

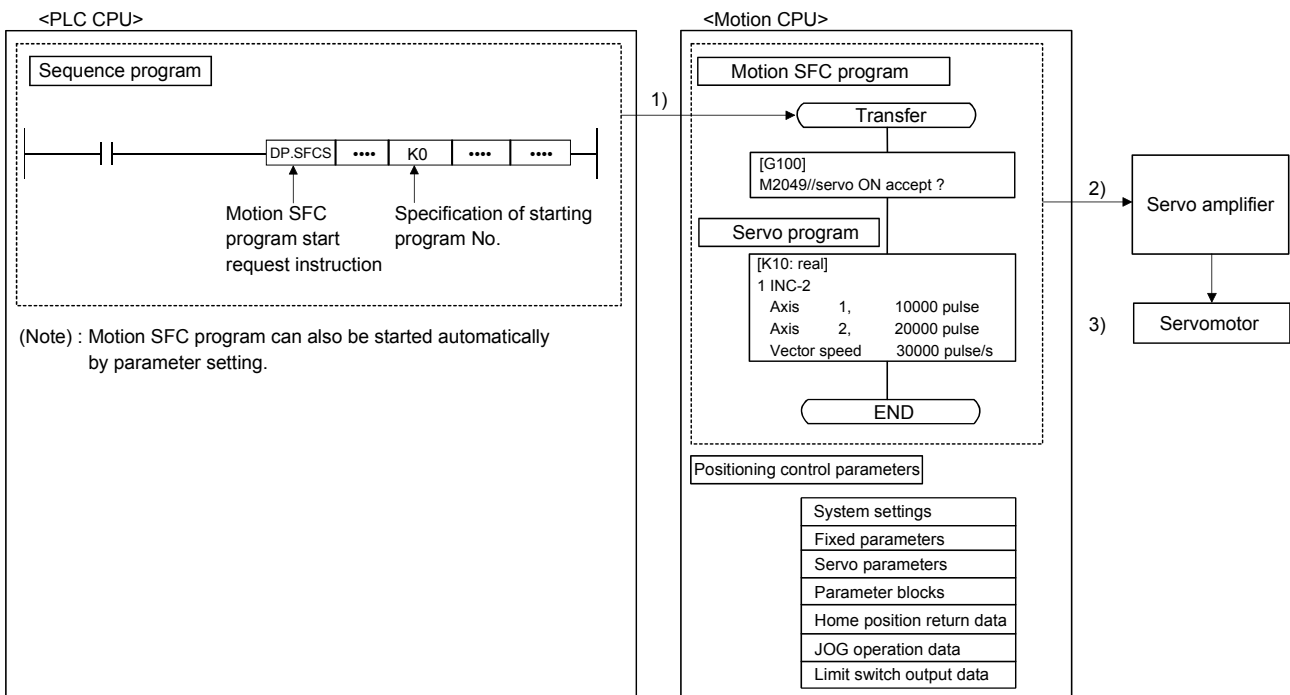
↓

 - 2) Execute the positioning control using the specified Motion SFC program.
(Output to the servo amplifier)

↓

 - 3) The servomotor is controlled.

Program structure in SV13/SV22 real mode

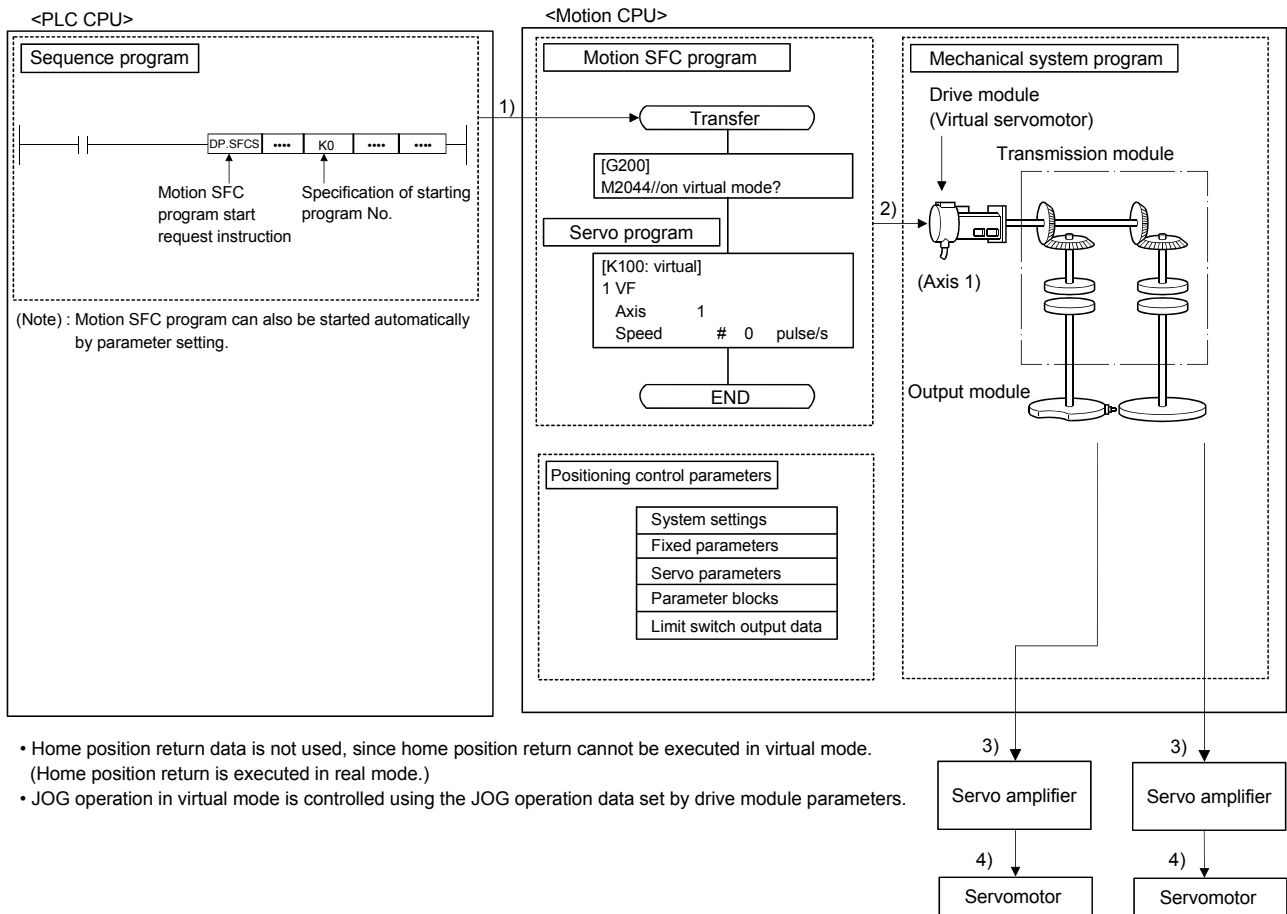


1 OVERVIEW

1.3 Motion Control in SV22 Virtual Mode

- (1) Synchronous control with software is performed using the mechanical system program comprised by virtual main shaft and mechanical module in (SV22) virtual mode.
- (2) Mechanical system programs is required in addition to the positioning parameter, servo program/Motion SFC program used in real mode.
- (3) The procedure of positioning control in virtual mode is shown below:
 - 1) Motion SFC program for virtual mode is requested to start using the D(P). SFCs instruction of the sequence program.
(Motion SFC program can also be started automatically by parameter setting.)
- ↓
- 2) The virtual servomotor of the mechanical system program is started.
- ↓
- 3) Output the operation result obtained through the transmission module to the servo amplifier set as the output module.
- ↓
- 4) The servomotor is controlled.

Program structure in SV22 virtual mode



1 OVERVIEW

1.4 Restrictions by the Software's Version

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

The combination of each version and a function is shown in Table 1.1.

Table 1.1 Restrictions by the Software's Version

| Function | Operating system software version ^{(Note-1), (Note-2)} | | |
|--|---|-----------------------------|--|
| | Q173DSCPU/Q172DSCPU | Q173DCPU(-S1)/Q172DCPU(-S1) | |
| Checking Motion controller's serial number and operating system software version in GX Developer | — | 00D | |
| Advanced S-curve acceleration/deceleration (Except constant-speed control (CPSTART) of servo program.) | — | 00H | |
| Direct drive servo MR-J3-□B-RJ080W | — | 00H | |
| Servo amplifier display servo error code (#8008+20n) | — | 00H | |
| 0.44ms fixed-cycle event task | — | 00H | |
| 444μs coasting timer (SD720, SD721) | — | 00H | |
| Synchronous encoder current value monitor in real mode | — | 00H | |
| Display of the past ten times history in current value history monitor | — | 00H | |
| Amplifier-less operation | — | 00H | |
| Servo instruction (Home position return (ZERO), high speed oscillation (OSC)) and manual pulse generator operation in mixed function of virtual mode/real mode | — | 00H | |
| Advanced S-curve acceleration/deceleration in constant-speed control (CPSTART) of servo program. | — | 00K | |
| External input signal (DOG) of servo amplifier in home position return of count method and speed-position switching control | — | 00G | |
| Communication via PERIPHERAL I/F | — | 00H | |
| Motion SFC operation control instruction Type conversion (DFLT, SFLT) | — | 00L | |
| Vision system dedicated function (MVOPEN, MVLOAD, MVTRG, MVPST, MVIN, MVFIN, MVCLOSE, MVCOM) | — | 00L | |
| Home position return of scale home position signal detection method | — | 00L | |
| Real time display function in digital oscilloscope function | — | 00N | |
| Rapid stop deceleration time setting error invalid function | — | 00S | |

1 OVERVIEW

| | Programming software version | | | | Section of reference |
|--|-----------------------------------|-----------------------------|------------------|-----------------|----------------------------|
| | MELSOFT MT Works2 (MT Developer2) | | MR Configurator2 | MR Configurator | |
| | Q173DSCPU/Q172DSCPU | Q173DCPU(-S1)/Q172DCPU(-S1) | | | |
| | — | — | — | — | (Note-2) |
| | 1.39R | 1.06G | — | — | (Note-4) |
| | 1.39R | 1.06G | 1.01B | C2 | |
| | — | — | — | — | Section 4.3 |
| | 1.39R | 1.06G | — | — | (Note-3) |
| | — | — | — | — | (Note-5) |
| | — | — | — | — | Section 6.2 Section 6.3 |
| | 1.39R | 1.06G | — | — | (Note-5) |
| | — | — | — | — | (Note-5) |
| | 1.39R | 1.09K | — | — | Section 10.1 |
| | 1.39R | 1.09K | — | — | (Note-4) |
| | 1.39R | 1.15R | — | — | |
| | 1.39R | 1.15R | — | — | (Note-5) |
| | 1.39R | 1.15R | — | — | (Note-3) |
| | 1.39R | 1.15R | — | — | (Note-3) |
| | 1.39R | 1.15R | — | — | (Note-4) |
| | 1.39R | 1.17T | — | — | |
| | — | — | — | — | (Note-4) |

—: There is no restriction by the version.

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

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

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

(Note-4): Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)

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

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

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

1 OVERVIEW

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

| Function | Operating system software version ^{(Note-1), (Note-2)} | | |
|--|---|-----------------------------|-------------|
| | Q173DSCPU/Q172DSCPU | Q173DCPU(-S1)/Q172DCPU(-S1) | |
| Vision system dedicated function (MVOOUT) | — | 00S | |
| Motion SFC operation control instruction Program control (IF - ELSE - IEND, SELECT -CASE - SEND, FOR -NEXT, BREAK) | — | 00R | |
| Display format depending on the error setting data information of motion error history device (#8640 to #8735) | — | 00S | |
| Product information list device (#8736 to #8751) | — | 00S | |
| Safety observation function | — | 00S | |
| Feed current value update command (M3212+20n) valid in speed control (I) | 00B | Not support | |
| External forced stop input ON latch (SM506) | 00B | 00S | |
| Operation method (SD560) | 00B | Not support | |
| Advanced synchronous control | 00B | Not support | |
| Limit switch output function expansion | 00B | Not support | |
| Driver communication function (SSCNETⅢ) | 00C | Not support | |
| Intelligent function module support | 00C | Not support | |
| SSCNETⅢ/H head module connection | 00C | Not support | |
| Cam auto-generation (CAMMK) easy stroke ratio cam | 00C | Not support | |
| Acceleration/deceleration time change function | 00C | Not support | |
| Home position return of dogless home position signal reference method | 00C | Not support | |
| Setting range expansion of backlash compensation amount | 00C | Not support | |
| Multiple CPU synchronous control | 00C | Not support | |
| Cam axis length per cycle change during synchronous control | 00C | Not support | |
| Servo driver VCⅡ series manufactured by Nikki Denso Co., Ltd. | SSCNETⅢ | — | 00L |
| | SSCNETⅢ/H | 00D | Not support |
| Inverter FR-A700 series | — | — | |
| Synchronous encoder via servo amplifier | 00D | Not support | |
| Driver communication function (SSCNETⅢ/H) | 00D | Not support | |
| Optical hub unit connection | 00F | Not support | |
| Home position return of driver home position return method | 00H | Not support | |
| Stepping motor module AlphaStep/5-phase manufactured by ORIENTAL MOTOR Co., Ltd. | 00H | Not support | |
| Servo driver VPH series manufactured by Nikki Denso Co., Ltd. | 00H | Not support | |
| IAI electric actuator controller manufactured by IAI Corporation | 00H | Not support | |
| Inverter FR-A800 series | 00J | Not support | |

1 OVERVIEW

| | Programming software version | | | | Section of reference |
|--|-----------------------------------|-----------------------------|------------------|-----------------|----------------------|
| | MELSOFT MT Works2 (MT Developer2) | | MR Configurator2 | MR Configurator | |
| | Q173DSCPU/Q172DSCPU | Q173DCPU(-S1)/Q172DCPU(-S1) | | | |
| | 1.39R | 1.39R | — | — | (Note-3) |
| | 1.39R | 1.39R | — | — | (Note-3) |
| | — | — | — | — | (Note-3) |
| | — | — | — | — | Section 4.3 |
| | 1.39R | 1.39R | — | — | (Note-6) |
| | — | Not support | — | — | (Note-4) |
| | — | — | — | — | (Note-5) |
| | — | Not support | — | — | (Note-5) |
| | 1.47Z | Not support | — | — | (Note-7) |
| | 1.47Z | Not support | — | — | (Note-5) |
| | — | Not support | — | — | (Note-5) |
| | 1.56J | Not support | — | — | (Note-5) |
| | 1.56J | Not support | — | — | (Note-5) |
| | 1.56J | Not support | — | — | (Note-3) |
| | 1.56J | Not support | — | — | (Note-4) |
| | 1.56J | Not support | — | — | (Note-4) |
| | 1.56J | Not support | — | — | (Note-4) |
| | 1.56J | Not support | — | — | (Note-7) |
| | 1.56J | Not support | — | — | (Note-7) |
| | 1.34L | 1.15R | — | — | (Note-4) |
| | 1.56J | Not support | — | — | (Note-4) |
| | 1.34L | 1.15R | — | — | (Note-4) |
| | 1.68W | Not support | 1.23Z | Not support | (Note-7) |
| | 1.68W | Not support | 1.23Z | Not support | (Note-5) |
| | — | Not support | — | — | (Note-4) |
| | 1.118Y | Not support | — | — | (Note-4) |
| | 1.118Y | Not support | — | — | (Note-4) |
| | 1.118Y | Not support | — | — | (Note-4) |
| | 1.118Y | Not support | — | — | (Note-4) |
| | 1.120A | Not support | — | — | (Note-4) |

—: There is no restriction by the version.

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

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

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

(Note-4): Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)

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

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

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

1 OVERVIEW

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

| Function | Operating system software version ^{(Note-1), (Note-2)} | | |
|--|---|-----------------------------|--|
| | Q173DSCPU/Q172DSCPU | Q173DCPU(-S1)/Q172DCPU(-S1) | |
| Improvement of absolute positioning operation for servo driver VCI/VP series manufactured by Nikki Denso Co., Ltd., and stepping motor module AlphaStep/5-phase manufactured by ORIENTAL MOTOR Co., Ltd. | 00L | Not support | |

1 OVERVIEW

| Programming software version | | | | | Section of reference |
|-----------------------------------|-----------------------------|------------------|-----------------|----------|----------------------|
| MELSOFT MT Works2 (MT Developer2) | | MR Configurator2 | MR Configurator | | |
| Q173DSCPU/Q172DSCPU | Q173DCPU(-S1)/Q172DCPU(-S1) | | | | |
| — | Not support | — | — | (Note-4) | |

—: There is no restriction by the version.

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

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

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

(Note-4): Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)

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

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

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

1 OVERVIEW

1.5 Programming Software Version

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

| Motion CPU | MELSOFT MT Works2 (MT Developer2) | | MR Configurator2 | MR Configurator |
|-------------|-----------------------------------|---------------------------|------------------|------------------------|
| | SV13/SV22 | SV43 | | |
| Q173DSCPU | 1.39R ^(Note-1) | | 1.10L | Not support |
| Q172DSCPU | 1.39R ^(Note-1) | | 1.10L | Not support |
| Q173DCPU-S1 | 1.00A ^(Note-2) | 1.03D ^(Note-3) | 1.00A | C0 ^(Note-4) |
| Q172DCPU-S1 | 1.00A ^(Note-2) | 1.03D ^(Note-3) | 1.00A | C0 ^(Note-4) |
| Q173DCPU | 1.00A | 1.03D | 1.00A | C0 ^(Note-4) |
| Q172DCPU | 1.00A | 1.03D | 1.00A | C0 ^(Note-4) |

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

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

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

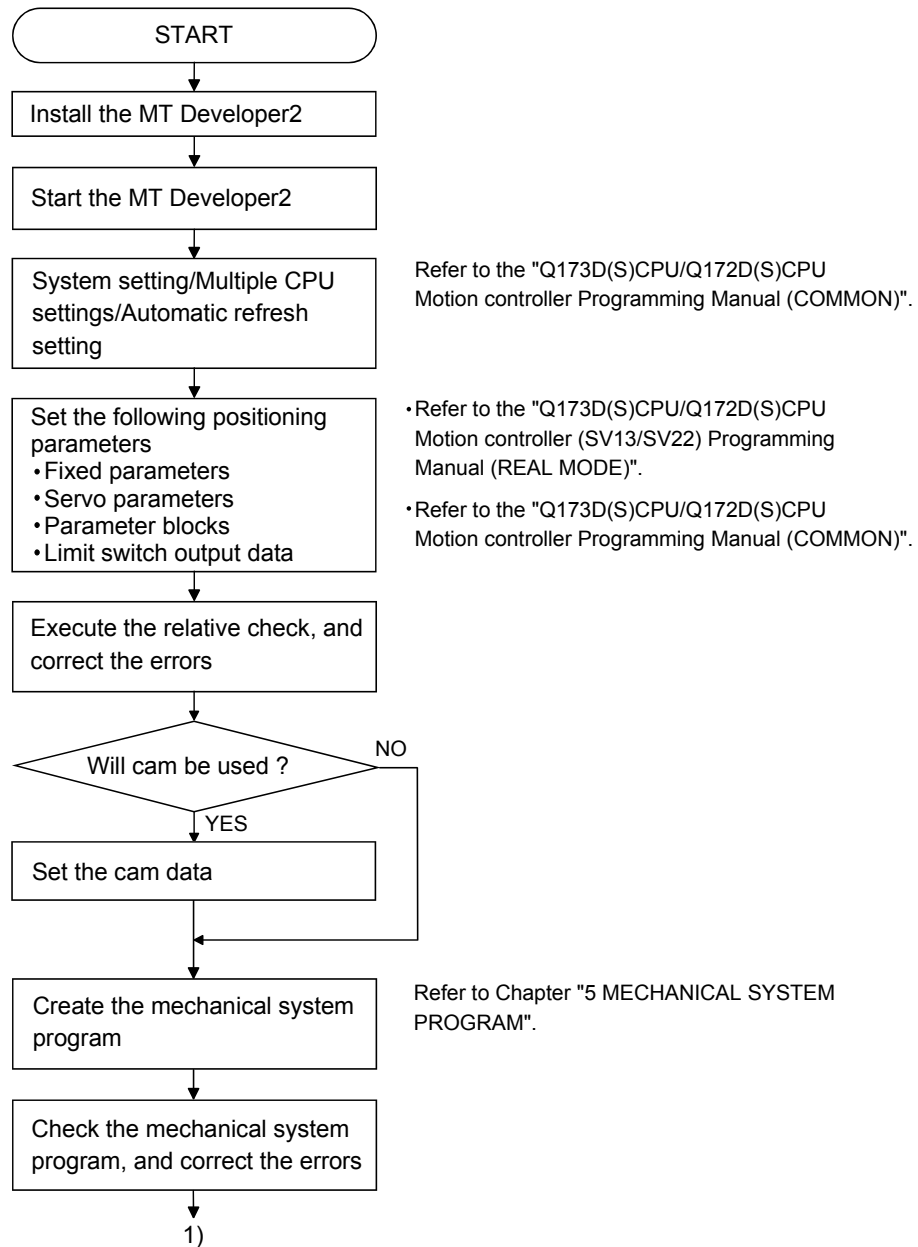
(Note-4): Use version C1 or later to use MR Configurator combination with MT Developer2.

2. STARTING UP THE SYSTEM

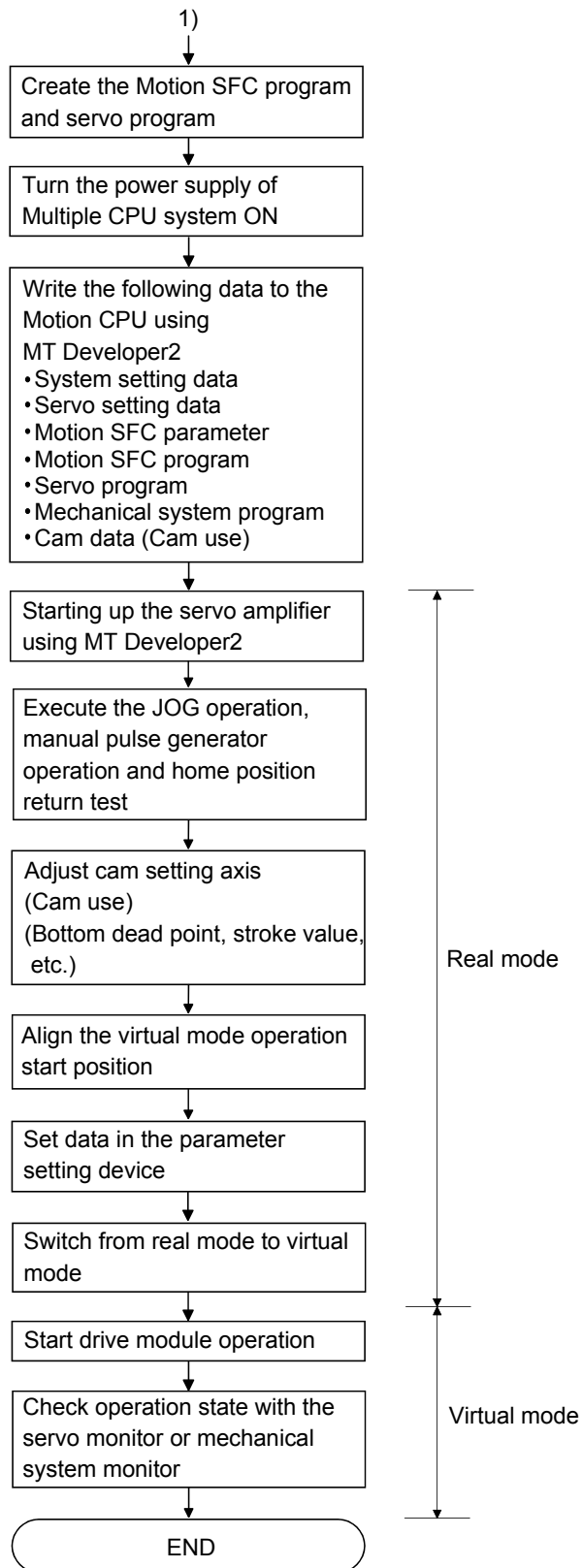
The procedure for virtual mode positioning control is shown below.

2.1 Starting Up the Virtual Mode System

The procedure to start up for virtual mode system is shown below.



2 STARTING UP THE SYSTEM



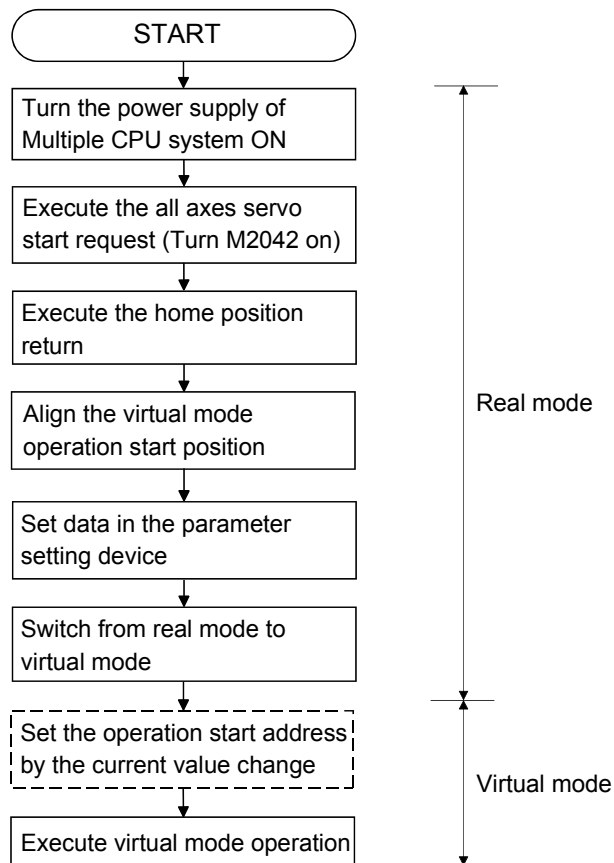
2 STARTING UP THE SYSTEM

2.2 Starting Up the Incremental System and Absolute System

When incremental system or absolute system is used, the procedure for virtual mode operation is shown below.

2.2.1 Operation for incremental system

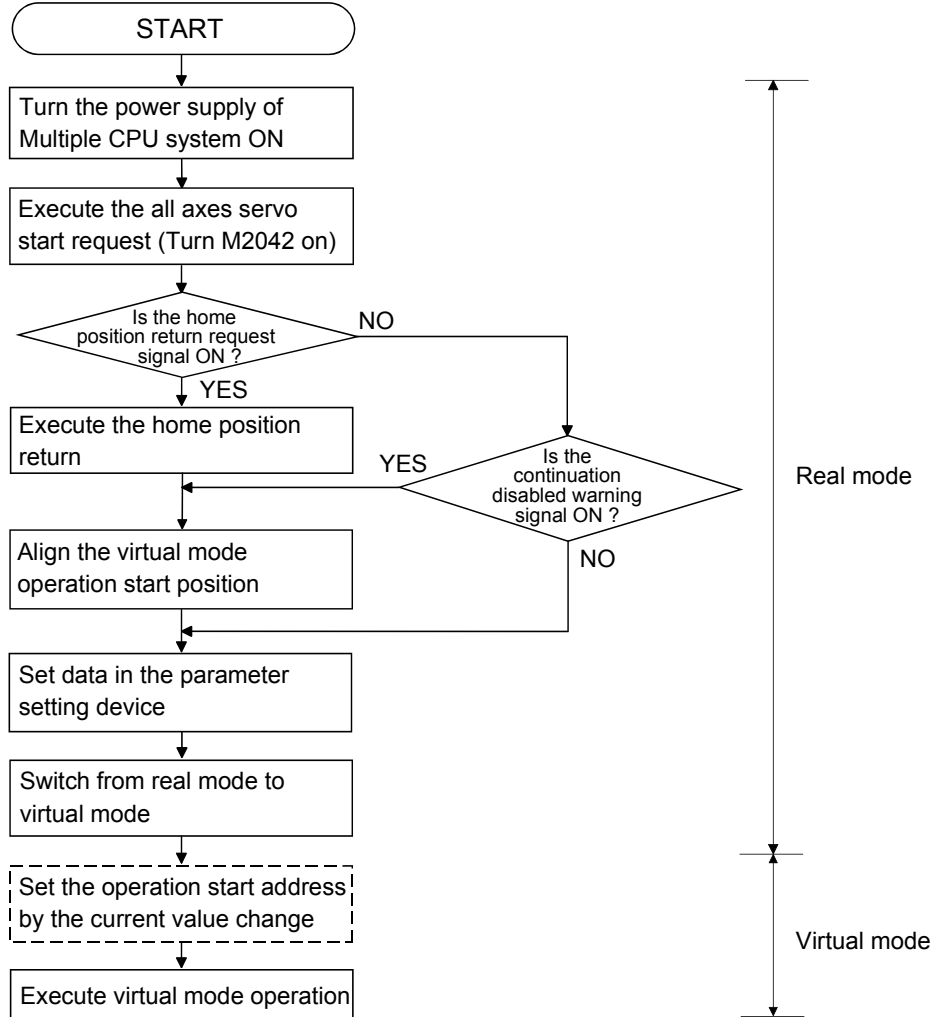
The operation procedure for incremental system is shown below.



2 STARTING UP THE SYSTEM

2.2.2 Operation for absolute (absolute position) system

The operation procedure for absolute system is shown below.



2 STARTING UP THE SYSTEM

2.3 Differences Between Real Mode and Virtual Mode

Specifications of the positioning data, positioning devices and servo programs, etc. used in the real mode differ in part in the virtual mode.

When using them in the virtual mode, refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)" after checking about a different point in the real mode.

2.3.1 Positioning data

Positioning data used in the virtual mode are shown in Table 2.1 below.

Table 2.1 Positioning Data List

| Item | Real mode | Virtual mode | Remark |
|---------------------------|-----------|--------------|---|
| System settings | ○ | ○ | |
| Fixed parameters | ○ | △ | Usable units differ according to the output module. |
| Servo parameters | ○ | ○ | |
| Parameter blocks | ○ | △ | Only [pulse] usable. |
| Home position return data | ○ | — | |
| JOG operation data | ○ | — | |
| Limit switch output data | ○ | △ | |

○ : Used

△ : Used (Restrictions in part)

— : Not used

(Note): Refer to Section 10.1 for the real mode axis at virtual mode.

2.3.2 Positioning devices

The operating ranges of positioning devices used in virtual mode are shown in Table 2.2 below.

Table 2.2 Operating Range of Positioning Devices

| Device name | Real mode | Virtual mode |
|-------------------|--|----------------|
| Internal relays | M2000 to M3839 M4640 to M4687 M5440 to M5487 | M2000 to M5487 |
| Special relays | SM0 to SM2255 | |
| Data registers | D0 to D799 D1120 to D1239 | D0 to D1559 |
| Motion registers | #8000 to #8751 | |
| Special registers | SD0 to SD2255 | |

2 STARTING UP THE SYSTEM

2.3.3 Servo programs

- (1) Servo program area
 - (a) The same servo program (Kn) No. cannot be used in both the real mode and virtual modes. The range of servo program (Kn) used in the virtual mode must be set using MT Developer2 in advance.
- (2) Servo instructions
 - (a) The home position return, speed control (Ⅱ), speed-position switching control, high-speed oscillation control and speed control with fixed position stop among the controls which can be used in the real mode cannot be used in the virtual mode.
 - (b) Control units of the parameter block and the torque limit value among the positioning data which can be set using the servo program are not used.
- (3) Differences of the servo instruction between real mode and virtual mode are shown in Table 2.3 below.

Table 2.3 Differences of Servo Instruction List

| Item | | Real mode | Virtual mode | Remark | |
|--|----------------------------------|--------------------|--------------|------------------|---|
| Servo instruction | Speed-position switching control | VPF | ○ | × | |
| | | VPR | | | |
| | | VPSTART | | | |
| | Speed control (Ⅱ) | VVF | ○ | × | |
| | | VVR | | | |
| | Home position return | ZERO | ○ | × | Switch to virtual mode after home position return in the real mode. |
| | High-speed oscillation | OSC | ○ | × | |
| Speed control with fixed position stop | PVF | ○ | × | | |
| | PVR | | | | |
| Positioning data | Parameter block | Control units | ○ | Fixed as [pulse] | |
| | | Torque limit value | ○ | — | The torque limit value is set with the "output module parameter". |

○ : Used, × : Unusable, — : Not used

(Note-1): Instruction not listed in the table above are common instructions in real mode and virtual mode.

(Note-2): Refer to Section 10.1 for the real mode axis at virtual mode.

2 STARTING UP THE SYSTEM

2.3.4 Control change (Current value change/speed change/target position change)

When a control change is executed in the virtual mode, the feed current value/speed of the drive module is changed.

Control changes are not possible for the output module (except for cam).

Differences between control changes in the real mode and virtual modes are shown in Table 2.4 below.

Table 2.4 Differences List of Control Change

| Item | Real mode | | Virtual mode | | | | | |
|-----------------------------------|-------------|---------------------|---------------------|---------------------|---------------|------------|--------------|-----|
| | Servo motor | Synchronous encoder | Drive module | | Output module | | | |
| | | | Virtual servo motor | Synchronous encoder | Roller | Ball screw | Rotary table | Cam |
| Current value change | ○ | ○ <i>Ver.!</i> | ○ | ○ | × | × | × | ○ |
| Speed change | ○ | × | ○ | × | × (Note-1) | | | |
| Target position change <i>QDS</i> | ○ | × | ○ | × | × | | | |

○ : Used, × : Unusable

(Note-1): If the output module is a roller which uses a speed change gear, a speed change can be executed by changing the speed change gear ratio.

REMARK

Refer to the following Chapters for details of the drive and output modules.

- Drive module : Chapter 5 and 6
- Output module : Chapter 5 and 8

Ver.! : Refer to Section 1.4 for the software version that supports this function.

2 STARTING UP THE SYSTEM

2.3.5 Switching of control mode (Speed-torque control)

When a speed-torque control is executed in the virtual mode, the control mode of the output module (except for cam) and real mode axis is switched.

Differences between speed-torque control in the real mode and virtual modes are shown in Table 2.5 below.

Table 2.5 Differences List of Control Mode Switching

| Item | Real mode | | Virtual mode | | | | | | Real mode axis |
|----------------------|-------------|---------------------|---------------------|---------------------|---------------|------------|--------------|-----|----------------|
| | Servo motor | Synchronous encoder | Drive module | | Output module | | | | |
| | | | Virtual servo motor | Synchronous encoder | Roller | Ball screw | Rotary table | Cam | |
| Speed-torque control | ○ | × | × | × | ○ | ○ | ○ | × | ○ |

○ : Used, × : Unusable

REMARK

Refer to the Section 10.2 for details of the speed-torque control in virtual mode.

3 PERFORMANCE SPECIFICATIONS

3. PERFORMANCE SPECIFICATIONS

Performance specifications of the Motion CPU are shown in Table 3.1 below.

Table 3.1 Motion CPU Performance Specifications (Virtual Mode)

| Item | | Q173DSCPU | Q172DSCPU | Q173DCPU(-S1) | Q172DCPU(-S1) | | | | | |
|---|---------------------------------|---|--|---|--|----------|----|----------|---|---------|
| Number of control axes | | Up to 32 axes (Simultaneous: 2 to 4/ Independent: 32 axes) | Up to 16 axes (Simultaneous: 2 to 4/ Independent: 16 axes) | Up to 32 axes (Simultaneous: 2 to 4/ Independent: 32 axes) | Up to 8 axes (Simultaneous: 2 to 4/ Independent: 8 axes) | | | | | |
| Control method | | Synchronous control, PTP (Point to Point) control, speed control, fixed-pitch feed, constant-speed control, position follow-up control, speed-switching control, speed-torque control | | Synchronous control, PTP (Point to Point) control, speed control, fixed-pitch feed, constant-speed control, position follow-up control, speed-switching control | | | | | | |
| Control units | Drive module | Virtual servo motor | pulse | | | | | | | |
| | | Synchronous encoder | | | | | | | | |
| | Output module | Roller | mm, inch | | | | | | | |
| | | Ball screw | | | | | | | | |
| Rotary table | | Fixed as "degree" | | | | | | | | |
| Cam | mm, inch, degree, pulse | | mm, inch, pulse | | | | | | | |
| Program language | | Dedicated instructions (Servo program + mechanical system program) | | | | | | | | |
| Servo program | Capacity | 16k steps (16384 steps) ^(Note-2) | | | | | | | | |
| | Number of positioning points | Total of 3200 points (It changes with programs, indirect specification is possible.) | | | | | | | | |
| Mechanical system program Number of modules which can be set per CPU | Drive module | Virtual servo motor | 32 axes | 16 axes | 32 axes | 8 axes | | | | |
| | | Synchronous encoder | 12 axes | 12 axes | 12 axes | 8 axes | | | | |
| | Virtual axis | Virtual main shaft | 32 | 16 | 32 | 8 | | | | |
| | | Virtual auxiliary input axis | 32 | 16 | 32 | 8 | | | | |
| | Transmission module | Gear | 64 | 32 | 64 | 16 | | | | |
| | | Clutch ^(Note-1) | 64 | 32 | 64 | 16 | | | | |
| | | Speed change gear | 64 | 32 | 64 | 16 | | | | |
| | | Differential gear | 32 | 16 | 32 | 8 | | | | |
| | Differential gear to main shaft | 32 | 16 | 32 | 8 | | | | | |
| | Output module | Roller | 32 | Total 32 | 16 | Total 16 | 32 | Total 32 | 8 | Total 8 |
| | | Ball screw | 32 | | 16 | | 32 | | 8 | |
| | | Rotary table | 32 | | 16 | | 32 | | 8 | |
| | | Cam | 32 | | 16 | | 32 | | 8 | |
| | Cam | Types | Up to 256 ^(Note-3) | | | | | | | |
| Resolution per cycle | | 256 • 512 • 1024 • 2048 ^(Note-3) | | | | | | | | |
| Memory capacity | | 132k bytes | | | | | | | | |
| Storage memory for cam data | | CPU internal RAM memory | | | | | | | | |
| Stroke resolution | | 32767 | | | | | | | | |
| Control mode | Two-way cam/feed cam | | | | | | | | | |

3

3 PERFORMANCE SPECIFICATIONS

Table 3.1 Motion CPU Performance Specifications (Virtual Mode) (Continued)

| Item | | Q173DSCPU | Q172DSCPU | Q173DCPU(-S1) | Q172DCPU(-S1) | | | | | | | |
|--|--|---|--|---------------|--|--------------------------------------|-------------------------------------|--|-------------------------------------|--|--|--|
| Virtual servomotor | Interpolation functions | Linear interpolation (2 to 4 axes), circular interpolation (2 axes) | | | | | | | | | | |
| | Control methods | PTP (Point to Point) control, speed control, fixed-pitch feed, constant-speed control, position follow-up control | | | | | | | | | | |
| | Positioning | Method | PTP control : Selection of absolute or incremental data method Fixed-pitch feed : Incremental data method Constant-speed control : Both absolute and incremental data method can be used together Position follow-up control : Absolute data method | | | | | | | | | |
| | | Position command | Address setting range : -2147483648 to 2147483647 [pulse] | | | | | | | | | |
| | | Speed command | Speed setting range : 1 to 2147483647 [pulse/s] | | | | | | | | | |
| | Acceleration/ deceleration control | Trapezoidal acceleration/ deceleration | <table border="1"> <thead> <tr> <th>Acceleration-fixed acceleration/deceleration</th> <th>Time-fixed acceleration/deceleration</th> </tr> </thead> <tbody> <tr> <td>Acceleration time : 1 to 65535 [ms]</td> <td>Acceleration/deceleration time: 1 to 5000 [ms]</td> </tr> <tr> <td>Deceleration time : 1 to 65535 [ms]</td> <td>(Only constant-speed control is possible.)</td> </tr> </tbody> </table> | | Acceleration-fixed acceleration/deceleration | Time-fixed acceleration/deceleration | Acceleration time : 1 to 65535 [ms] | Acceleration/deceleration time: 1 to 5000 [ms] | Deceleration time : 1 to 65535 [ms] | (Only constant-speed control is possible.) | | |
| | | Acceleration-fixed acceleration/deceleration | Time-fixed acceleration/deceleration | | | | | | | | | |
| | | Acceleration time : 1 to 65535 [ms] | Acceleration/deceleration time: 1 to 5000 [ms] | | | | | | | | | |
| | Deceleration time : 1 to 65535 [ms] | (Only constant-speed control is possible.) | | | | | | | | | | |
| | S-curve acceleration/ deceleration | S-curve ratio: 0 to 100[%] | | | | | | | | | | |
| Advanced S-curve acceleration/ deceleration | Acceleration section ratio: 0.0 to 100.0[%] Deceleration section ratio: 0.0 to 100.0[%] | | | | | | | | | | | |
| JOG operation function | Provided | | | | | | | | | | | |
| M-code function | M-code output function provided, M-code complete wait function provided | | | | | | | | | | | |
| Manual pulse generator operation function (Test mode only) | Up to 3 units can be connected. Up to 3 axes can be operated simultaneously. Setting of magnification : 1 to 10000 Setting of smoothing magnification provided. | | | | | | | | | | | |

(Note-1): When the TREN input signal is used as "external input mode clutch", the high speed reading function cannot be used.

(Note-2): Capacity matching the servo program for real mode.

(Note-3): Relation between a resolution per cycle of cam and type are shown below.

| Resolution per cycle | 256 | 512 | 1024 | 2048 |
|----------------------|-----|-----|------|------|
| Type | 256 | 128 | 64 | 32 |

4. POSITIONING DEDICATED SIGNALS

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

(1) Internal signals

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

- Internal relay (M) M2000 to M5487 (3488 points)
- Special relay (SM) SM0 to SM2255 (2256 points)
- Data register (D) D0 to D1599 (1600 points)
- Motion register (#) #8000 to #8751 (752 points)
- Special register (SD) SD0 to SD2255 (2256 points)

(2) External signals

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

- Upper/lower limit switch input The upper/lower limit of the positioning range is controlled.
- Stop signal This signal makes the starting axis stop.
- Proximity dog 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.

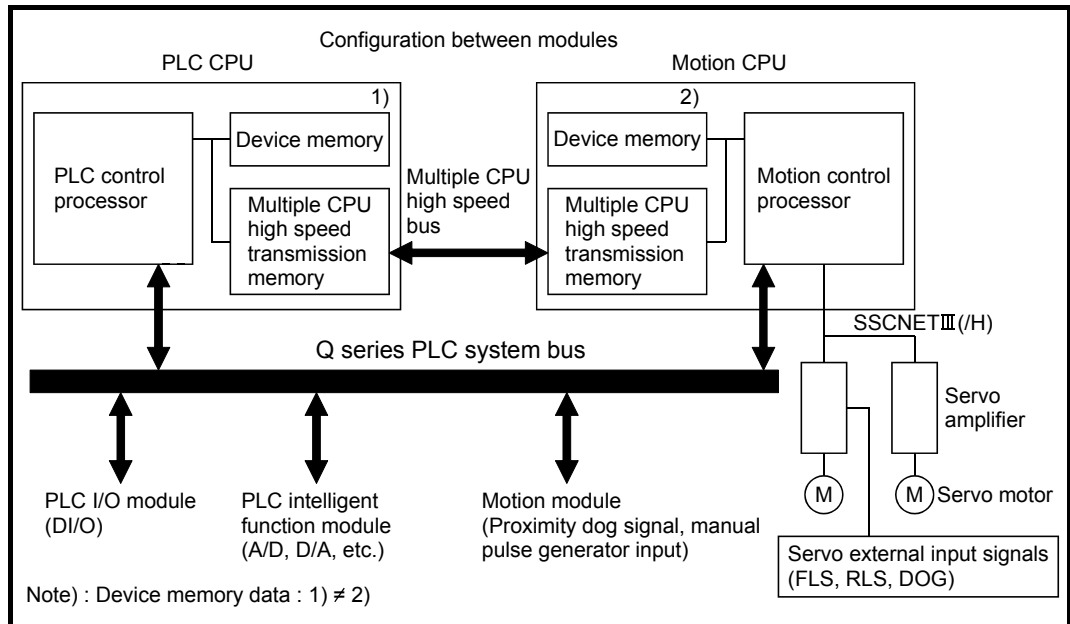


Fig.4.1 Flow of the internal signals/external signals

4 POSITIONING DEDICATED SIGNALS

The positioning dedicated devices are shown below.

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

The operation cycle and main cycle of the Motion CPU are shown below.

(a) Operation cycle

| Item | | Q173DSCPU | Q172DSCPU | Q173DCPU(-S1) | Q172DCPU(-S1) |
|------------------------------|------|-----------------------|----------------------|-----------------------|---------------------|
| Number of control axes | | Up to 32 axes | Up to 16 axes | Up to 32 axes | Up to 8 axes |
| Operation cycle (Default) | SV22 | 0.44ms/ 1 to 6 axes | 0.44ms/ 1 to 6 axes | 0.44ms/ 1 to 4 axes | 0.44ms/ 1 to 4 axes |
| | | 0.88ms/ 7 to 16 axes | 0.88ms/ 7 to 16 axes | 0.88ms/ 5 to 12 axes | 0.88ms/ 5 to 8 axes |
| | | 1.77ms/ 17 to 32 axes | | 1.77ms/ 13 to 28 axes | |
| | | | | 3.55ms/ 29 to 32 axes | |

(b) Main cycle is not fixed-cycle as operation cycle. The cycle is dozens[ms] to hundreds[ms].

REMARK

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

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

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

(Example) For axis 32 $M3200+20n$ (Stop command)= $M3200+20 \times 31=M3820$

$M3215+20n$ (Servo OFF command)= $M3215+20 \times 31=M3835$

• The following range is valid.

• Q172DSCPU : Axis No.1 to 16 (n=0 to 16)

• Q172DCPU(-S1) : Axis No.1 to 8 (n=0 to 7)

(2) In the positioning dedicated signals, "n" in "M4640+4n", etc. of the "Synchronous encoder axis status", "Synchronous encoder axis command signal" and "Synchronous encoder axis monitor device" indicates a value corresponding to synchronous encoder No. such as the following tables.

| Synchronous encoder No. | n | Synchronous encoder No. | n | Synchronous encoder No. | n |
|-------------------------|---|-------------------------|---|-------------------------|----|
| P1 | 0 | P5 | 4 | P9 | 8 |
| P2 | 1 | P6 | 5 | P10 | 9 |
| P3 | 2 | P7 | 6 | P11 | 10 |
| P4 | 3 | P8 | 7 | P12 | 11 |

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

(Example) For synchronous encoder No.12

$M4640+4n$ (Error detection)= $M4640+4 \times 11=M4684$

$D1122+10n$ (Minor error code)= $D1122+10 \times 11= D1232$

• The range (n=0 to 7) of synchronous encoder No. P1 to P8 is valid in the Q172DCPU(-S1).

4 POSITIONING DEDICATED SIGNALS

4.1 Internal Relays

(1) Internal relay list

| SV22 | | | |
|---------------------------------|---|--------|---------|
| Device No. | Application | Real | Virtual |
| M0 to | User device (2000 points) | | |
| M2000 to | Common device (320 points) | ○ | ○ |
| M2320 to | Unusable (80 points) | — | — |
| M2400 to | Axis status (20 points × 32 axes) Real mode : Each axis Virtual mode : Output module | ○ | ○ |
| M3040 to | Unusable (32 points) | — | — |
| M3072 to | Common device (Command signal) (64 points) | ○ | ○ |
| M3136 to | Unusable (64 points) | — | — |
| M3200 to | Axis command signal (20 points × 32 axes) Real mode : Each axis Virtual mode : Output module | ○ | ○ |
| M3840 to | Unusable (160 points) | — | — |
| M4000 ^(Note-1) to | Virtual servomotor axis status (20 points × 32 axes) ^(Note-2) | Backup | ○ |
| M4640 ^(Note-1) to | Synchronous encoder axis status (4 points × 12 axes) | ○ | ○ |
| M4688 ^(Note-1) to | Unusable (112 points) | — | — |
| M4800 ^(Note-1) to | Virtual servomotor axis command signal (20 points × 32 axes) ^(Note-2) | × | ○ |
| M5440 ^(Note-1) to | Synchronous encoder axis command signal (4 points × 12 axes) | × | ○ |
| M5488 to M8191 | User device ^(Note-3) (2704 points) | | |

Real/virtual
community

Virtual

○ : Valid, × : Invalid

□ It can be used as a user device.

4 POSITIONING DEDICATED SIGNALS

| POINT |
|-------|
|-------|

- | |
|---|
| <p>(1) Total number of user device points 4704 points</p> <p>(2) (Note-1): Do not set M4000 to M5487 as the latch range in virtual mode.</p> <p>(3) (Note-2): This signal occupies only the area of the axis set in the mechanical system program. The unused axis areas in the mechanical system program can be used as a user device.</p> <p>(4) (Note-3): The cam axis command signal and smoothing clutch complete signal can be set as the optional device at the parameter.</p> <p>(5) (Note-4): It is valid for the version (Refer to Section 1.4) that supports "synchronous encoder current value monitor in real mode".</p> <p>(6) This manual describes only details for internal relays used in the virtual mode. If it is required, refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)".</p> |
|---|


4 POSITIONING DEDICATED SIGNALS

(2) Axis status list

| Axis No. | Device No. | Signal name | | | | | | | | | |
|----------|----------------|-------------|------|--------------|-----|--|--|-------------------|-----------------|---------------|------------------|
| | | Signal name | Real | Virtual | | | | Real Mode axis | Refresh cycle | Fetch cycle | Signal direction |
| Roller | Ball screw | | | Rotary table | Cam | | | | | | |
| 1 | M2400 to M2419 | | | | | | | | | | |
| 2 | M2420 to M2439 | | | | | | | | | | |
| 3 | M2440 to M2459 | | | | | | | | | | |
| 4 | M2460 to M2479 | | | | | | | | | | |
| 5 | M2480 to M2499 | | | | | | | | | | |
| 6 | M2500 to M2519 | 0 | | OFF | | | | | Operation cycle | Status signal | |
| 7 | M2520 to M2539 | 1 | | OFF | | | | | | | |
| 8 | M2540 to M2559 | 2 | | ○ | | | | | | | |
| 9 | M2560 to M2579 | 3 | | OFF | | | | | | | |
| 10 | M2580 to M2599 | 4 | | OFF | | | | | | | |
| 11 | M2600 to M2619 | 5 | | OFF | | | | | | | |
| 12 | M2620 to M2639 | 6 | | OFF | | | | | | | |
| 13 | M2640 to M2659 | 7 | | OFF | | | | Immediately | | | |
| 14 | M2660 to M2679 | 8 | ○ | OFF | | | | Operation cycle | | | |
| 15 | M2680 to M2699 | 9 | | OFF | | | | Main cycle | | | |
| 16 | M2700 to M2719 | 10 | | OFF | | | | Operation cycle | | | |
| 17 | M2720 to M2739 | 11 | | OFF | | | | Main cycle | | | |
| 18 | M2740 to M2759 | 12 | | OFF | | | | Main cycle | | | |
| 19 | M2760 to M2779 | 13 | | OFF | | | | Main cycle | | | |
| 20 | M2780 to M2799 | 14 | | OFF | | | | Main cycle | | | |
| 21 | M2800 to M2819 | 15 | | OFF | | | | Operation cycle | | | |
| 22 | M2820 to M2839 | 16 | | OFF | | | | Operation cycle | | | |
| 23 | M2840 to M2859 | 17 | | OFF | | | | Operation cycle | | | |
| 24 | M2860 to M2879 | 18 | | OFF | | | | Operation cycle | | | |
| 25 | M2880 to M2899 | 19 | | OFF | | | | Operation cycle | | | |
| 26 | M2900 to M2919 | 20 | | OFF | | | | Operation cycle | | | |
| 27 | M2920 to M2939 | 21 | | OFF | | | | Operation cycle | | | |
| 28 | M2940 to M2959 | 22 | | OFF | | | | Operation cycle | | | |
| 29 | M2960 to M2979 | 23 | | OFF | | | | Operation cycle | | | |
| 30 | M2980 to M2999 | 24 | | OFF | | | | Operation cycle | | | |
| 31 | M3000 to M3019 | 25 | | OFF | | | | Operation cycle | | | |
| 32 | M3020 to M3039 | 26 | | OFF | | | | Operation cycle | | | |
| | | 27 | | OFF | | | | Operation cycle | | | |
| | | 28 | | OFF | | | | Operation cycle | | | |
| | | 29 | | OFF | | | | Operation cycle | | | |
| | | 30 | | OFF | | | | Operation cycle | | | |
| | | 31 | | OFF | | | | Operation cycle | | | |
| | | 32 | | OFF | | | | Operation cycle | | | |
| | | 33 | | OFF | | | | Operation cycle | | | |
| | | 34 | | OFF | | | | Operation cycle | | | |
| | | 35 | | OFF | | | | Operation cycle | | | |
| | | 36 | | OFF | | | | Operation cycle | | | |
| | | 37 | | OFF | | | | Operation cycle | | | |
| | | 38 | | OFF | | | | Operation cycle | | | |
| | | 39 | | OFF | | | | Operation cycle | | | |
| | | 40 | | OFF | | | | Operation cycle | | | |
| | | 41 | | OFF | | | | Operation cycle | | | |
| | | 42 | | OFF | | | | Operation cycle | | | |
| | | 43 | | OFF | | | | Operation cycle | | | |
| | | 44 | | OFF | | | | Operation cycle | | | |
| | | 45 | | OFF | | | | Operation cycle | | | |
| | | 46 | | OFF | | | | Operation cycle | | | |
| | | 47 | | OFF | | | | Operation cycle | | | |
| | | 48 | | OFF | | | | Operation cycle | | | |
| | | 49 | | OFF | | | | Operation cycle | | | |
| | | 50 | | OFF | | | | Operation cycle | | | |
| | | 51 | | OFF | | | | Operation cycle | | | |
| | | 52 | | OFF | | | | Operation cycle | | | |
| | | 53 | | OFF | | | | Operation cycle | | | |
| | | 54 | | OFF | | | | Operation cycle | | | |
| | | 55 | | OFF | | | | Operation cycle | | | |
| | | 56 | | OFF | | | | Operation cycle | | | |
| | | 57 | | OFF | | | | Operation cycle | | | |
| | | 58 | | OFF | | | | Operation cycle | | | |
| | | 59 | | OFF | | | | Operation cycle | | | |
| | | 60 | | OFF | | | | Operation cycle | | | |
| | | 61 | | OFF | | | | Operation cycle | | | |
| | | 62 | | OFF | | | | Operation cycle | | | |
| | | 63 | | OFF | | | | Operation cycle | | | |
| | | 64 | | OFF | | | | Operation cycle | | | |
| | | 65 | | OFF | | | | Operation cycle | | | |
| | | 66 | | OFF | | | | Operation cycle | | | |
| | | 67 | | OFF | | | | Operation cycle | | | |
| | | 68 | | OFF | | | | Operation cycle | | | |
| | | 69 | | OFF | | | | Operation cycle | | | |
| | | 70 | | OFF | | | | Operation cycle | | | |
| | | 71 | | OFF | | | | Operation cycle | | | |
| | | 72 | | OFF | | | | Operation cycle | | | |
| | | 73 | | OFF | | | | Operation cycle | | | |
| | | 74 | | OFF | | | | Operation cycle | | | |
| | | 75 | | OFF | | | | Operation cycle | | | |
| | | 76 | | OFF | | | | Operation cycle | | | |
| | | 77 | | OFF | | | | Operation cycle | | | |
| | | 78 | | OFF | | | | Operation cycle | | | |
| | | 79 | | OFF | | | | Operation cycle | | | |
| | | 80 | | OFF | | | | Operation cycle | | | |
| | | 81 | | OFF | | | | Operation cycle | | | |
| | | 82 | | OFF | | | | Operation cycle | | | |
| | | 83 | | OFF | | | | Operation cycle | | | |
| | | 84 | | OFF | | | | Operation cycle | | | |
| | | 85 | | OFF | | | | Operation cycle | | | |
| | | 86 | | OFF | | | | Operation cycle | | | |
| | | 87 | | OFF | | | | Operation cycle | | | |
| | | 88 | | OFF | | | | Operation cycle | | | |
| | | 89 | | OFF | | | | Operation cycle | | | |
| | | 90 | | OFF | | | | Operation cycle | | | |
| | | 91 | | OFF | | | | Operation cycle | | | |
| | | 92 | | OFF | | | | Operation cycle | | | |
| | | 93 | | OFF | | | | Operation cycle | | | |
| | | 94 | | OFF | | | | Operation cycle | | | |
| | | 95 | | OFF | | | | Operation cycle | | | |
| | | 96 | | OFF | | | | Operation cycle | | | |
| | | 97 | | OFF | | | | Operation cycle | | | |
| | | 98 | | OFF | | | | Operation cycle | | | |
| | | 99 | | OFF | | | | Operation cycle | | | |
| | | 100 | | OFF | | | | Operation cycle | | | |
| | | 101 | | OFF | | | | Operation cycle | | | |
| | | 102 | | OFF | | | | Operation cycle | | | |
| | | 103 | | OFF | | | | Operation cycle | | | |
| | | 104 | | OFF | | | | Operation cycle | | | |
| | | 105 | | OFF | | | | Operation cycle | | | |
| | | 106 | | OFF | | | | Operation cycle | | | |
| | | 107 | | OFF | | | | Operation cycle | | | |
| | | 108 | | OFF | | | | Operation cycle | | | |
| | | 109 | | OFF | | | | Operation cycle | | | |
| | | 110 | | OFF | | | | Operation cycle | | | |
| | | 111 | | OFF | | | | Operation cycle | | | |
| | | 112 | | OFF | | | | Operation cycle | | | |
| | | 113 | | OFF | | | | Operation cycle | | | |
| | | 114 | | OFF | | | | Operation cycle | | | |
| | | 115 | | OFF | | | | Operation cycle | | | |
| | | 116 | | OFF | | | | Operation cycle | | | |
| | | 117 | | OFF | | | | Operation cycle | | | |
| | | 118 | | OFF | | | | Operation cycle | | | |
| | | 119 | | OFF | | | | Operation cycle | | | |
| | | 120 | | OFF | | | | Operation cycle | | | |
| | | 121 | | OFF | | | | Operation cycle | | | |
| | | 122 | | OFF | | | | Operation cycle | | | |
| | | 123 | | OFF | | | | Operation cycle | | | |
| | | 124 | | OFF | | | | Operation cycle | | | |
| | | 125 | | OFF | | | | Operation cycle | | | |
| | | 126 | | OFF | | | | Operation cycle | | | |
| | | 127 | | OFF | | | | Operation cycle | | | |
| | | 128 | | OFF | | | | Operation cycle | | | |
| | | 129 | | OFF | | | | Operation cycle | | | |
| | | 130 | | OFF | | | | Operation cycle | | | |
| | | 131 | | OFF | | | | Operation cycle | | | |
| | | 132 | | OFF | | | | Operation cycle | | | |
| | | 133 | | OFF | | | | Operation cycle | | | |
| | | 134 | | OFF | | | | Operation cycle | | | |
| | | 135 | | OFF | | | | Operation cycle | | | |
| | | 136 | | OFF | | | | Operation cycle | | | |
| | | 137 | | OFF | | | | Operation cycle | | | |
| | | 138 | | OFF | | | | Operation cycle | | | |
| | | 139 | | OFF | | | | Operation cycle | | | |
| | | 140 | | OFF | | | | Operation cycle | | | |
| | | 141 | | OFF | | | | Operation cycle | | | |
| | | 142 | | OFF | | | | Operation cycle | | | |
| | | 143 | | OFF | | | | Operation cycle | | | |
| | | 144 | | OFF | | | | Operation cycle | | | |
| | | 145 | | OFF | | | | Operation cycle | | | |
| | | 146 | | OFF | | | | Operation cycle | | | |
| | | 147 | | OFF | | | | Operation cycle | | | |
| | | 148 | | OFF | | | | Operation cycle | | | |
| | | 149 | | OFF | | | | Operation cycle | | | |
| | | 150 | | OFF | | | | Operation cycle | | | |
| | | 151 | | OFF | | | | Operation cycle | | | |
| | | 152 | | OFF | | | | Operation cycle | | | |
| | | 153 | | OFF | | | | Operation cycle | | | |
| | | 154 | | OFF | | | | Operation cycle | | | |
| | | 155 | | OFF | | | | Operation cycle | | | |
| | | 156 | | OFF | | | | Operation cycle | | | |
| | | 157 | | OFF | | | | Operation cycle | | | |
| | | 158 | | OFF | | | | Operation cycle | | | |
| | | 159 | | OFF | | | | Operation cycle | | | |
| | | 160 | | OFF | | | | Operation cycle | | | |
| | | 161 | | OFF | | | | Operation cycle | | | |
| | | 162 | | OFF | | | | Operation cycle | | | |
| | | 163 | | OFF | | | | Operation cycle | | | |
| | | 164 | | OFF | | | | Operation cycle | | | |
| | | 165 | | OFF | | | | Operation cycle | | | |
| | | 166 | | OFF | | | | Operation cycle | | | |
| | | 167 | | OFF | | | | Operation cycle | | | |
| | | 168 | | OFF | | | | Operation cycle | | | |
| | | 169 | | OFF | | | | Operation cycle | | | |
| | | 170 | | OFF | | | | Operation cycle | | | |
| | | 171 | | OFF | | | | Operation cycle | | | |
| | | 172 | | OFF | | | | Operation cycle | | | |
| | | 173 | | OFF | | | | Operation cycle | | | |
| | | 174 | | OFF | | | | Operation cycle | | | |
| | | 175 | | OFF | | | | Operation cycle | | | |
| | | 176 | | OFF | | | | Operation cycle | | | |
| | | 177 | | OFF | | | | Operation cycle | | | |
| | | 178 | | OFF | | | | Operation cycle | | | |
| | | 179 | | OFF | | | | Operation cycle | | | |
| | | 180 | | OFF | | | | Operation cycle | | | |
| | | 181 | | OFF | | | | Operation cycle | | | |
| | | 182 | | OFF | | | | Operation cycle | | | |
| | | 183 | | OFF | | | | Operation cycle | | | |
| | | 184 | | OFF | | | | Operation cycle | | | |
| | | 185 | | OFF | | | | Operation cycle | | | |
| | | 186 | | OFF | | | | Operation cycle | | | |
| | | 187 | | OFF | | | | Operation cycle | | | |
| | | 188 | | OFF | | | | Operation cycle | | | |
| | | 189 | | OFF | | | | Operation cycle | | | |
| | | 190 | | OFF | | | | Operation cycle | | | |
| | | 191 | | OFF | | | | Operation cycle | | | |
| | | 192 | | OFF | | | | Operation cycle | | | |
| | | 193 | | OFF | | | | Operation cycle | | | |
| | | 194 | | OFF | | | | Operation cycle | | | |
| | | 195 | | OFF | | | | Operation cycle | | | |
| | | 196 | | OFF | | | | Operation cycle | | | |
| | | 197 | | OFF | | | | Operation cycle | | | |
| | | 198 | | OFF | | | | Operation cycle | | | |
| | | 199 | | OFF | | | | Operation cycle | | | |
| | | 200 | | OFF | | | | Operation cycle | | | |
| | | 201 | | OFF | | | | Operation cycle | | | |
| | | 202 | | OFF | | | | Operation cycle | | | |
| | | 203 | | OFF | | | | Operation cycle | | | |
| | | 204 | | OFF | | | | Operation cycle | | | |
| | | 205 | | OFF | | | | Operation cycle | | | |
| | | 206 | | OFF | | | | Operation cycle | | | |
| | | 207 | | OFF | | | | Operation cycle | | | |
| | | 208 | | OFF | | | | Operation cycle | | | |
| | | 209 | | OFF | | | | Operation cycle | | | |
| | | 210 | | OFF | | | | Operation cycle | | | |
| | | 211 | | OFF | | | | Operation cycle | | | |
| | | 212 | | OFF | | | | Operation cycle | | | |
| | | 213 | | OFF | | | | Operation cycle | | | |
| | | 214 | | OFF | | | | Operation cycle | | | |
| | | 215 | | OFF | | | | Operation cycle | | | |
| | | 216 | | OFF | | | | Operation cycle | | | |
| | | 217 | | OFF | | | | Operation cycle | | | |
| | | 218 | | OFF | | | | Operation cycle | | | |
| | | 219 | | OFF | | | | Operation cycle | | | |
| | | 220 | | OFF | | | | Operation cycle | | | |
| | | 221 | | OFF | | | | Operation cycle | | | |
| | | 222 | | OFF | | | | Operation cycle | | | |
| | | 223 | | OFF | | | | Operation cycle | | | |
| | | 224 | | OFF | | | | Operation cycle | | | |
| | | 225 | | OFF | | | | Operation cycle | | | |
| | | 226 | | OFF | | | | Operation cycle | | | |
| | | 227 | | OFF | | | | Operation cycle | | | |
| | | 228 | | OFF | | | | Operation cycle | | | |
| | | 229 | | OFF | | | | Operation cycle | | | |
| | | 230 | | OFF | | | | Operation cycle | | | |
| | | 231 | | OFF | | | | Operation cycle | | | |
| | | 232 | | OFF | | | | Operation cycle</ | | | |

4 POSITIONING DEDICATED SIGNALS

(3) Axis command signal list

| Axis No. | Device No. | Signal name | | | | | | | | | |
|----------|----------------|-------------|--|--------------|-----|----------------|---|---------------|----------------------------|------------------|------------|
| | | Signal name | Real | Virtual | | | | Refresh cycle | Fetch cycle | Signal direction | |
| Roller | Ball screw | | | Rotary table | Cam | Real mode axis | | | | | |
| 1 | M3200 to M3219 | | | | | | | | | | |
| 2 | M3220 to M3239 | | | | | | | | | | |
| 3 | M3240 to M3259 | | | | | | | | | | |
| 4 | M3260 to M3279 | | | | | | | | | | |
| 5 | M3280 to M3299 | | | | | | | | | | |
| 6 | M3300 to M3319 | 0 | Stop command | | | | | | Operation cycle | Command signal | |
| 7 | M3320 to M3339 | 1 | Rapid stop command | | | | | | Main cycle | | |
| 8 | M3340 to M3359 | 2 | Forward rotation JOG start command | | | | | Main cycle | | | |
| 9 | M3360 to M3379 | 3 | Reverse rotation JOG start command | ○ | | × | | | ○ | | Main cycle |
| 10 | M3380 to M3399 | 4 | Complete signal OFF command | | | | | | Operation cycle | | |
| 11 | M3400 to M3419 | 5 | Speed/position switching enable command | | | | | | Operation cycle | | |
| 12 | M3420 to M3439 | 6 | Unusable | — | | — | | — | — | — | |
| 13 | M3440 to M3459 | 7 | Error reset command | | | | | | | | |
| 14 | M3460 to M3479 | 8 | Servo error reset command | ○ | | ○ | | ○ | Main cycle | Command signal | |
| 15 | M3480 to M3499 | 9 | External stop input disable at start command | | | × | | | At start | | |
| 16 | M3500 to M3519 | 10 | Unusable | — | | — | | — | — | — | |
| 17 | M3520 to M3539 | 11 | Unusable | — | | — | | — | — | — | |
| 18 | M3540 to M3559 | 12 | Feed current value update command | ○ | | × | | ○ | At start | Command signal | |
| 19 | M3560 to M3579 | 13 | Address clutch reference setting command (Note-1) | | × | | ○ | | At virtual mode transition | | |
| 20 | M3580 to M3599 | 14 | Cam reference position setting command (Note-1) | × | | × | | × | | | |
| 21 | M3600 to M3619 | 15 | Servo OFF command | | | | | | Operation cycle | | |
| 22 | M3620 to M3639 | 16 | Gain changing command | | | | | | Operation cycle | | |
| 23 | M3640 to M3659 | 17 | PI-PID switching command  | ○ | | ○ | | ○ | Operation cycle (Note-2) | | |
| 24 | M3660 to M3679 | 18 | Control loop changing command | | | | | | Operation cycle | | |
| 25 | M3680 to M3699 | 19 | FIN signal | | | × | | | Operation cycle | | |

○ : Valid, × : Invalid

(Note-1): It is unusable in the SV22 real mode.

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

POINT

(1) The following range is valid.

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

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

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

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

4 POSITIONING DEDICATED SIGNALS

(4) Virtual servomotor axis status list

| Axis No. | Device No. | Signal name | | | | | | | | | |
|----------|----------------|-------------|----------------------------|--------------|-----|----------------|---|---------------|-----------------|------------------|---------------|
| | | Signal name | Real | Virtual | | | | Refresh cycle | Fetch cycle | Signal direction | |
| Roller | Ball screw | | | Rotary table | Cam | Real mode axis | | | | | |
| 1 | M4000 to M4019 | | | | | | | | | | |
| 2 | M4020 to M4039 | | | | | | | | | | |
| 3 | M4040 to M4059 | | | | | | | | | | |
| 4 | M4060 to M4079 | | | | | | | | | | |
| 5 | M4080 to M4099 | | | | | | | | | | |
| 6 | M4100 to M4119 | 0 | Positioning start complete | Backup | | | | × | Operation cycle | / | Status signal |
| 7 | M4120 to M4139 | 1 | Positioning complete | | | | | ○ | | | |
| 8 | M4140 to M4159 | 2 | Unusable | — | — | — | — | — | — | — | — |
| 9 | M4160 to M4179 | 3 | Command in-position | | | | | | | | |
| 10 | M4180 to M4199 | 4 | Speed controlling | Backup | | | | × | Operation cycle | / | Status signal |
| 11 | M4200 to M4219 | 5 | | | | | | | | | |
| 12 | M4220 to M4239 | 6 | Unusable | — | — | — | — | — | — | — | — |
| 13 | M4240 to M4259 | 7 | Error detection | Backup | | | | × | Immediately | / | Status signal |
| 14 | M4260 to M4279 | 8 | | | | | | | | | |
| 15 | M4280 to M4299 | 9 | | | | | | | | | |
| 16 | M4300 to M4319 | 10 | | | | | | | | | |
| 17 | M4320 to M4339 | 11 | | | | | | | | | |
| 18 | M4340 to M4359 | 12 | | | | | | | | | |
| 19 | M4360 to M4379 | 13 | Unusable | — | — | — | — | — | — | — | — |
| 20 | M4380 to M4399 | 14 | | | | | | | | | |
| 21 | M4400 to M4419 | 15 | | | | | | | | | |
| 22 | M4420 to M4439 | 16 | | | | | | | | | |
| 23 | M4440 to M4459 | 17 | | | | | | | | | |
| 24 | M4460 to M4479 | 18 | | | | | | | | | |
| 25 | M4480 to M4499 | 19 | M-code outputting | Backup | | | | × | Operation cycle | / | Status signal |
| 26 | M4500 to M4519 | | | | | | | | | | |
| 27 | M4520 to M4539 | | | | | | | | | | |
| 28 | M4540 to M4559 | | | | | | | | | | |
| 29 | M4560 to M4579 | | | | | | | | | | |
| 30 | M4580 to M4599 | | | | | | | | | | |
| 31 | M4600 to M4619 | | | | | | | | | | |
| 32 | M4620 to M4639 | | | | | | | | | | |

○ : Valid, × : Invalid

POINT

(1) The following range is valid.

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

(2) The unused axis areas in the mechanical system program can be used as a user device.

4 POSITIONING DEDICATED SIGNALS

(5) Virtual servomotor axis command signal list

| Axis No. | Device No. | Signal name | | | | | | | | | |
|----------|----------------|-------------|--|--------------|-----|----------------|--|---------------|-----------------|------------------|----------------|
| | | Signal name | Real | Virtual | | | | Refresh cycle | Fetch cycle | Signal direction | |
| Roller | Ball screw | | | Rotary table | Cam | Real mode axis | | | | | |
| 1 | M4800 to M4819 | | | | | | | | | | |
| 2 | M4820 to M4839 | | | | | | | | | | |
| 3 | M4840 to M4859 | | | | | | | | | | |
| 4 | M4860 to M4879 | | | | | | | | | | |
| 5 | M4880 to M4899 | | | | | | | | | | |
| 6 | M4900 to M4919 | 0 | Stop command | | | | | | Operation cycle | Command signal | |
| 7 | M4920 to M4939 | 1 | Rapid stop command | | | | | | | | |
| 8 | M4940 to M4959 | 2 | Forward rotation JOG start command | | | | | | | | |
| 9 | M4960 to M4979 | 3 | Reverse rotation JOG start command | × | | ○ | | × | | | Main cycle |
| 10 | M4980 to M4999 | 4 | Complete signal OFF command | | | | | | | | |
| 11 | M5000 to M5019 | 5 | Unusable | — | | | | | | | |
| 12 | M5020 to M5039 | 6 | Unusable | — | | | | | | | |
| 13 | M5040 to M5059 | 7 | Error reset command | × | | | | | × | Main cycle | Command signal |
| 14 | M5060 to M5079 | 8 | Unusable | — | | | | | | | |
| 15 | M5080 to M5099 | 9 | External stop input disable at start command | × | | | | | × | At start | Command signal |
| 16 | M5100 to M5119 | 10 | Unusable | — | | | | | | | |
| 17 | M5120 to M5139 | 11 | | | | | | | | | |
| 18 | M5140 to M5159 | 12 | | | | | | | | | |
| 19 | M5160 to M5179 | 13 | | | | | | | | | |
| 20 | M5180 to M5199 | 14 | | | | | | | | | |
| 21 | M5200 to M5219 | 15 | | | | | | | | | |
| 22 | M5220 to M5239 | 16 | | | | | | | | | |
| 23 | M5240 to M5259 | 17 | | | | | | | | | |
| 24 | M5260 to M5279 | 18 | | | | | | | | | |
| 25 | M5280 to M5299 | 19 | FIN signal | × | | | | | × | Operation cycle | Command signal |
| 26 | M5300 to M5319 | | | | | | | | | | |
| 27 | M5320 to M5339 | | | | | | | | | | |
| 28 | M5340 to M5359 | | | | | | | | | | |
| 29 | M5360 to M5379 | | | | | | | | | | |
| 30 | M5380 to M5399 | | | | | | | | | | |
| 31 | M5400 to M5419 | | | | | | | | | | |
| 32 | M5420 to M5439 | | | | | | | | | | |

○ : Valid, × : Invalid

POINT

- (1) The following range is valid.
 - Q172DSCPU : Axis No.1 to 16
 - Q172DCPU(-S1) : Axis No.1 to 8
- (2) The unused axis areas in the mechanical system program can be used as a user device.

4 POSITIONING DEDICATED SIGNALS

(6) Synchronous encoder axis status list

| Axis No. | Device No. | Signal name | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|----------------|--|--|--|--|--|-------------|---------------|-------------|------------------|-------------|------------------|-------------------|--|--|-------------|---|---------------|------------------------|---|---|------------|---|--|--|------------|---|---|---|---|---|
| 1 | M4640 to M4643 | <table border="1"> <thead> <tr> <th>Signal name</th> <th>Real</th> <th>Virtual</th> <th>Refresh cycle</th> <th>Fetch cycle</th> <th>Signal direction</th> </tr> </thead> <tbody> <tr> <td>0 Error detection</td> <td></td> <td></td> <td>Immediately</td> <td rowspan="3" style="text-align: center;">/</td> <td rowspan="3">Status signal</td> </tr> <tr> <td>1 External signal TREN</td> <td style="text-align: center;">○</td> <td style="text-align: center;">○</td> <td rowspan="2">Main cycle</td> </tr> <tr> <td>2 Virtual mode continuation operation disable warning</td> <td></td> <td></td> </tr> <tr> <td>3 Unusable</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> </tr> </tbody> </table> | | | | | Signal name | Real | Virtual | Refresh cycle | Fetch cycle | Signal direction | 0 Error detection | | | Immediately | / | Status signal | 1 External signal TREN | ○ | ○ | Main cycle | 2 Virtual mode continuation operation disable warning | | | 3 Unusable | — | — | — | — | — |
| Signal name | Real | | | | | | Virtual | Refresh cycle | Fetch cycle | Signal direction | | | | | | | | | | | | | | | | | | | | | |
| 0 Error detection | | | | | | | | Immediately | / | Status signal | | | | | | | | | | | | | | | | | | | | | |
| 1 External signal TREN | ○ | | | | | | ○ | Main cycle | | | | | | | | | | | | | | | | | | | | | | | |
| 2 Virtual mode continuation operation disable warning | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 Unusable | — | | | | | | — | — | — | — | | | | | | | | | | | | | | | | | | | | | |
| 2 | M4644 to M4647 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | M4648 to M4651 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | M4652 to M4655 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | M4656 to M4659 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | M4660 to M4663 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | M4664 to M4667 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | M4668 to M4671 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | M4672 to M4675 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | M4676 to M4679 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | M4680 to M4683 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | M4684 to M4687 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

○ : Valid

POINT

- (1) The range of axis No.1 to 8 is valid in the Q172DCPU(-S1).
- (2) The device area of 9 axes or more can be used as a user device in the Q172DCPU (-S1).
However, when the project of Q172DCPU(-S1) is replaced with Q173DSCPU/ Q172DSCPU/Q173DCPU(-S1), this area cannot be used.

(7) Synchronous encoder axis command signal list

| Axis No. | Device No. | Signal name | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------|----------------|---|--|--|--|--|-------------|---------------|-------------|------------------|-------------|------------------|---------------|---------------|---|---|------------|---------------|---|--|--|------------|---|---|---|---|---|---|--|--|--|--|--|
| 1 | M5440 to M5443 | <table border="1"> <thead> <tr> <th>Signal name</th> <th>Real</th> <th>Virtual</th> <th>Refresh cycle</th> <th>Fetch cycle</th> <th>Signal direction</th> </tr> </thead> <tbody> <tr> <td>0 Error reset</td> <td style="text-align: center;">× (Note-1)</td> <td style="text-align: center;">○</td> <td rowspan="3" style="text-align: center;">/</td> <td rowspan="3">Main cycle</td> <td rowspan="3">Status signal</td> </tr> <tr> <td>1</td> <td></td> <td></td> </tr> <tr> <td>2 Unusable</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> </tr> <tr> <td>3</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> | | | | | Signal name | Real | Virtual | Refresh cycle | Fetch cycle | Signal direction | 0 Error reset | × (Note-1) | ○ | / | Main cycle | Status signal | 1 | | | 2 Unusable | — | — | — | — | — | 3 | | | | | |
| Signal name | Real | | | | | | Virtual | Refresh cycle | Fetch cycle | Signal direction | | | | | | | | | | | | | | | | | | | | | | | |
| 0 Error reset | × (Note-1) | | | | | | ○ | / | Main cycle | Status signal | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 Unusable | — | | | | | | — | | | | — | — | — | | | | | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | M5444 to M5447 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | M5448 to M5451 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | M5452 to M5455 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | M5456 to M5459 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | M5460 to M5463 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | M5464 to M5467 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | M5468 to M5471 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | M5472 to M5475 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | M5476 to M5479 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | M5480 to M5483 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | M5484 to M5487 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

○ : Valid, × : Invalid

(Note-1): It is valid for the version (Refer to Section 1.4) that supports "synchronous encoder current value monitor in real mode".

POINT

- (1) The range of axis No.1 to 8 is valid in the Q172DCPU(-S1).
- (2) The device area of 9 axes or more can be used as a user device in the Q172DCPU (-S1).
However, when the project of Q172DCPU(-S1) is replaced with Q173DSCPU/ Q172DSCPU/Q173DCPU(-S1), this area cannot be used.

4 POSITIONING DEDICATED SIGNALS

(8) Common device list

| Device No. | Signal name | Refresh cycle | Fetch cycle | Signal direction | Remark (Note-6) | Device No. | Signal name | Refresh cycle | Fetch cycle | Signal direction | Remark (Note-6) | |
|------------|--|------------------------------|----------------------------|--|-----------------|------------|---------------------|--|-----------------|--|--|--|
| M2000 | PLC ready flag | / | Main cycle | Command signal | M3072 | M2055 | Unusable (6 points) | — | — | — | — | |
| M2001 | Axis 1 | Start accept flag | Operation cycle | Status signal (Note-1), (Note-2), (Note-3), (Note-4) | | M2056 | | Speed change accepting flag | Operation cycle | | Status signal (Note-1), (Note-2), (Note-3), (Note-4) | |
| M2002 | Axis 2 | | | | | | | | | | | |
| M2003 | Axis 3 | | | | | | | | | | | |
| M2004 | Axis 4 | | | | | | | | | | | |
| M2005 | Axis 5 | | | | | | | | | | | |
| M2006 | Axis 6 | | | | | | | | | | | |
| M2007 | Axis 7 | | | | | | | | | | | |
| M2008 | Axis 8 | | | | | | | | | | | |
| M2009 | Axis 9 | | | | | | | | | | | |
| M2010 | Axis 10 | | | | | | | | | | | |
| M2011 | Axis 11 | | | | | | | | | | | |
| M2012 | Axis 12 | | | | | | | | | | | |
| M2013 | Axis 13 | | | | | | | | | | | |
| M2014 | Axis 14 | | | | | | | | | | | |
| M2015 | Axis 15 | | | | | | | | | | | |
| M2016 | Axis 16 | | | | | | | | | | | |
| M2017 | Axis 17 | | | | | | | | | | | |
| M2018 | Axis 18 | | | | | | | | | | | |
| M2019 | Axis 19 | | | | | | | | | | | |
| M2020 | Axis 20 | | | | | | | | | | | |
| M2021 | Axis 21 | | | | | | | | | | | |
| M2022 | Axis 22 | | | | | | | | | | | |
| M2023 | Axis 23 | | | | | | | | | | | |
| M2024 | Axis 24 | | | | | | | | | | | |
| M2025 | Axis 25 | | | | | | | | | | | |
| M2026 | Axis 26 | | | | | | | | | | | |
| M2027 | Axis 27 | | | | | | | | | | | |
| M2028 | Axis 28 | | | | | | | | | | | |
| M2029 | Axis 29 | | | | | | | | | | | |
| M2030 | Axis 30 | | | | | | | | | | | |
| M2031 | Axis 31 | | | | | | | | | | | |
| M2032 | Axis 32 | | | | | | | | | | | |
| M2033 | Unusable (2 points) | — | — | — | — | M2061 | Axis 1 | Speed change accepting flag | Operation cycle | Status signal (Note-1), (Note-2), (Note-3), (Note-4) | | |
| M2034 | Unusable (2 points) | — | — | — | — | M2062 | Axis 2 | | | | | |
| M2035 | Motion error history clear request flag | / | Main cycle | Command signal | M3080 | M2063 | Axis 3 | | | | | |
| M2036 | Unusable (2 points) | — | — | — | — | M2064 | Axis 4 | | | | | |
| M2037 | Unusable (2 points) | — | — | — | — | M2065 | Axis 5 | | | | | |
| M2038 | Motion SFC debugging flag | At debugging mode transition | / | Status signal | | M2066 | Axis 6 | | | | | |
| M2039 | Motion error detection flag | Immediate | / | Status signal | | M2067 | Axis 7 | | | | | |
| M2040 | Speed switching point specified flag | / | At start | Command signal | M3073 | M2068 | Axis 8 | | | | | |
| M2041 | System setting error flag | Operation cycle | / | Status signal | | M2069 | Axis 9 | | | | | |
| M2042 | All axes servo ON command | / | Operation cycle | Command signal | M3074 | M2070 | Axis 10 | | | | | |
| M2043 | Real mode/virtual mode switching request (SV22) | / | At virtual mode transition | Command signal | M3075 | M2071 | Axis 11 | | | | | |
| M2044 | Real mode/virtual mode switching status (SV22) | / | / | Status signal | | M2072 | Axis 12 | | | | | |
| M2045 | Real mode/virtual mode switching error detection signal (SV22) | At virtual mode transition | / | Status signal | | M2073 | Axis 13 | | | | | |
| M2046 | Out-of-sync warning (SV22) | / | / | Status signal | | M2074 | Axis 14 | | | | | |
| M2047 | Motion slot fault detection flag | Operation cycle | / | Status signal | | M2075 | Axis 15 | | | | | |
| M2048 | JOG operation simultaneous start command | / | Main cycle | Command signal | M3076 | M2076 | Axis 16 | | | | | |
| M2049 | All axes servo ON accept flag | Operation cycle | / | Status signal | | M2077 | Axis 17 | | | | | |
| M2050 | Unusable | — | — | — | — | M2078 | Axis 18 | | | | | |
| M2051 | Manual pulse generator 1 enable flag | / | Main cycle | Command signal | M3077 | M2079 | Axis 19 | | | | | |
| M2052 | Manual pulse generator 2 enable flag | | | | | | | | | | | |
| M2053 | Manual pulse generator 3 enable flag | | | | | | | | | | | |
| M2054 | Operation cycle over flag | Operation cycle | / | Status signal | | M2080 | Axis 20 | | | | | |
| | | | | | | M2081 | Axis 21 | | | | | |
| | | | | | | M2082 | Axis 22 | | | | | |
| | | | | | | M2083 | Axis 23 | | | | | |
| | | | | | | M2084 | Axis 24 | | | | | |
| | | | | | | M2085 | Axis 25 | | | | | |
| | | | | | | M2086 | Axis 26 | | | | | |
| | | | | | | M2087 | Axis 27 | | | | | |
| | | | | | | M2088 | Axis 28 | | | | | |
| | | | | | | M2089 | Axis 29 | | | | | |
| | | | | | | M2090 | Axis 30 | | | | | |
| | | | | | | M2091 | Axis 31 | | | | | |
| | | | | | | M2092 | Axis 32 | | | | | |
| | | | | | | M2093 | Unusable (8 points) | — | — | — | — | |
| | | | | | | M2094 | | | | | | |
| | | | | | | M2095 | | | | | | |
| | | | | | | M2096 | | | | | | |
| | | | | | | M2097 | | | | | | |
| | | | | | | M2098 | | | | | | |
| | | | | | | M2099 | | | | | | |
| | | | | | | M2100 | | | | | | |
| | | | | | | M2101 | Axis 1 | Synchronous encoder current value changing flag (Note-5) | Operation cycle | Status signal (Note-2), (Note-4) | | |
| | | | | | | M2102 | Axis 2 | | | | | |
| | | | | | | M2103 | Axis 3 | | | | | |
| | | | | | | M2104 | Axis 4 | | | | | |
| | | | | | | M2105 | Axis 5 | | | | | |
| | | | | | | M2106 | Axis 6 | | | | | |
| | | | | | | M2107 | Axis 7 | | | | | |
| | | | | | | M2108 | Axis 8 | | | | | |
| | | | | | | M2109 | Axis 9 | | | | | |

4 POSITIONING DEDICATED SIGNALS

Common device list (Continued)

| Device No. | Signal name | Refresh cycle | Fetch cycle | Signal direction | Remark (Note-6) | Device No. | Signal name | Refresh cycle | Fetch cycle | Signal direction | Remark (Note-6) |
|------------|-------------------------------|---------------------------------|-----------------|--|--|------------|-------------------------------|---------------|-------------|------------------|-----------------|
| M2110 | Axis 10 | Operation cycle | / | Status signal (Note-2), (Note-4) | | M2179 | Unusable (45 points) (Note-7) | - | - | - | - |
| M2111 | Axis 11 | | | | | M2180 | | | | | |
| M2112 | Axis 12 | | | | | M2181 | | | | | |
| M2113 | Unusable (15 points) | - | - | - | - | M2182 | | | | | |
| M2114 | | | | | | M2183 | | | | | |
| M2115 | | | | | | M2184 | | | | | |
| M2116 | | | | | | M2185 | | | | | |
| M2117 | | | | | | M2186 | | | | | |
| M2118 | | | | | | M2187 | | | | | |
| M2119 | | | | | | M2188 | | | | | |
| M2120 | | | | | | M2189 | | | | | |
| M2121 | | | | | | M2190 | | | | | |
| M2122 | | | | | | M2191 | | | | | |
| M2123 | | | | | | M2192 | | | | | |
| M2124 | | | | | | M2193 | | | | | |
| M2125 | | | | | | M2194 | | | | | |
| M2126 | | | | | | M2195 | | | | | |
| M2127 | | | | | | M2196 | | | | | |
| M2128 | Axis 1 | Operation cycle | / | Status signal (Note-1), (Note-2), (Note-3), (Note-4) | | M2197 | | | | | |
| M2129 | Axis 2 | | | | | M2198 | | | | | |
| M2130 | Axis 3 | | | | | M2199 | | | | | |
| M2131 | Axis 4 | | | | | M2200 | | | | | |
| M2132 | Axis 5 | | | | | M2201 | | | | | |
| M2133 | Axis 6 | | | | | M2202 | | | | | |
| M2134 | Axis 7 | | | | | M2203 | | | | | |
| M2135 | Axis 8 | | | | | M2204 | | | | | |
| M2136 | Axis 9 | | | | | M2205 | | | | | |
| M2137 | Axis 10 | | | | | M2206 | | | | | |
| M2138 | Axis 11 | | | | | M2207 | | | | | |
| M2139 | Axis 12 | | | | | M2208 | | | | | |
| M2140 | Axis 13 | | | | | M2209 | | | | | |
| M2141 | Axis 14 | | | | | M2210 | | | | | |
| M2142 | Axis 15 | | | | | M2211 | | | | | |
| M2143 | Axis 16 | | | | | M2212 | | | | | |
| M2144 | Axis 17 | | | | | M2213 | | | | | |
| M2145 | Axis 18 | | | | | M2214 | | | | | |
| M2146 | Axis 19 | | | | | M2215 | | | | | |
| M2147 | Axis 20 | | | | | M2216 | | | | | |
| M2148 | Axis 21 | | | | | M2217 | | | | | |
| M2149 | Axis 22 | | | | | M2218 | | | | | |
| M2150 | Axis 23 | | | | | M2219 | | | | | |
| M2151 | Axis 24 | | | | | M2220 | | | | | |
| M2152 | Axis 25 | | | | | M2221 | | | | | |
| M2153 | Axis 26 | | | | | M2222 | | | | | |
| M2154 | Axis 27 | | | | | M2223 | | | | | |
| M2155 | Axis 28 | | | | | M2224 | | | | | |
| M2156 | Axis 29 | | | | | M2225 | | | | | |
| M2157 | Axis 30 | | | | | M2226 | | | | | |
| M2158 | Axis 31 | | | | | M2227 | | | | | |
| M2159 | Axis 32 | | | | | M2228 | | | | | |
| M2160 | Unusable (19 points) (Note-7) | - | - | - | - | M2229 | | | | | |
| M2161 | | | | | | M2230 | | | | | |
| M2162 | | | | | | M2231 | | | | | |
| M2163 | | | | | | M2232 | | | | | |
| M2164 | | | | | | M2233 | | | | | |
| M2165 | | | | | | M2234 | | | | | |
| M2166 | | | | | | M2235 | | | | | |
| M2167 | | | | | | M2236 | | | | | |
| M2168 | | | | | | M2237 | | | | | |
| M2169 | | | | | | M2238 | | | | | |
| M2170 | M2239 | | | | | | | | | | |
| M2171 | Axis 1 | Speed change "0" accepting flag | Operation cycle | / | Status signal (Note-1), (Note-2), (Note-3), (Note-4) | M2240 | | | | | |
| M2172 | Axis 2 | | | | | M2241 | | | | | |
| M2173 | Axis 3 | | | | | M2242 | | | | | |
| M2174 | Axis 4 | | | | | M2243 | | | | | |
| M2175 | Axis 5 | | | | | M2244 | | | | | |
| M2176 | Axis 6 | | | | | M2245 | | | | | |
| M2177 | Axis 7 | | | | | M2246 | | | | | |
| M2178 | Axis 8 | | | | | M2247 | | | | | |

4 POSITIONING DEDICATED SIGNALS

Common device list (Continued)

| Device No. | Signal name | Refresh cycle | Fetch cycle | Signal direction | Remark (Note-6) | Device No. | Signal name | Refresh cycle | Fetch cycle | Signal direction | Remark (Note-6) |
|------------|-------------|-----------------|-------------|------------------|--|------------|-------------|-----------------|-------------|------------------|--|
| M2248 | Axis 9 | Operation cycle | | | Status signal (Note-1), (Note-2), (Note-3), (Note-4) | M2284 | Axis 13 | Operation cycle | | | Status signal (Note-1), (Note-2), (Note-3), (Note-4) |
| M2249 | Axis 10 | | | | | M2285 | Axis 14 | | | | |
| M2250 | Axis 11 | | | | | M2286 | Axis 15 | | | | |
| M2251 | Axis 12 | | | | | M2287 | Axis 16 | | | | |
| M2252 | Axis 13 | | | | | M2288 | Axis 17 | | | | |
| M2253 | Axis 14 | | | | | M2289 | Axis 18 | | | | |
| M2254 | Axis 15 | | | | | M2290 | Axis 19 | | | | |
| M2255 | Axis 16 | | | | | M2291 | Axis 20 | | | | |
| M2256 | Axis 17 | | | | | M2292 | Axis 21 | | | | |
| M2257 | Axis 18 | | | | | M2293 | Axis 22 | | | | |
| M2258 | Axis 19 | | | | | M2294 | Axis 23 | | | | |
| M2259 | Axis 20 | | | | | M2295 | Axis 24 | | | | |
| M2260 | Axis 21 | | | | | M2296 | Axis 25 | | | | |
| M2261 | Axis 22 | | | | | M2297 | Axis 26 | | | | |
| M2262 | Axis 23 | | | | | M2298 | Axis 27 | | | | |
| M2263 | Axis 24 | | | | | M2299 | Axis 28 | | | | |
| M2264 | Axis 25 | | | | | M2300 | Axis 29 | | | | |
| M2265 | Axis 26 | | | | | M2301 | Axis 30 | | | | |
| M2266 | Axis 27 | | | | | M2302 | Axis 31 | | | | |
| M2267 | Axis 28 | | | | | M2303 | Axis 32 | | | | |
| M2268 | Axis 29 | M2304 | | | | | | | | | |
| M2269 | Axis 30 | M2305 | | | | | | | | | |
| M2270 | Axis 31 | M2306 | | | | | | | | | |
| M2271 | Axis 32 | M2307 | | | | | | | | | |
| M2272 | Axis 1 | M2308 | | | | | | | | | |
| M2273 | Axis 2 | M2309 | | | | | | | | | |
| M2274 | Axis 3 | M2310 | | | | | | | | | |
| M2275 | Axis 4 | M2311 | Unusable | | | | | | | | |
| M2276 | Axis 5 | M2312 | (16 points) | | | | | | | | |
| M2277 | Axis 6 | M2313 | | | | | | | | | |
| M2278 | Axis 7 | M2314 | | | | | | | | | |
| M2279 | Axis 8 | M2315 | | | | | | | | | |
| M2280 | Axis 9 | M2316 | | | | | | | | | |
| M2281 | Axis 10 | M2317 | | | | | | | | | |
| M2282 | Axis 11 | M2318 | | | | | | | | | |
| M2283 | Axis 12 | M2319 | | | | | | | | | |

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

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

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

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

(Note-5): It is unusable in the real mode.

(It can be used in the real mode for the version (Refer to Section 1.4) that supports "synchronous encoder current value monitor in real mode".)

(Note-6): It can also be ordered the device of a remark column.

(Note-7): These devices can be used as the clutch statuses.

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

Refer to Section 7.2.2.

4 POSITIONING DEDICATED SIGNALS

(9) Common device list (Command signal)

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

(Note-1): The state of a device is not in agreement when the device of a remark column is turned ON/OFF directly. In addition, when the request from a data register and the request from the above device are performed simultaneously, the request from the above device becomes effective.

(Note-2): It can also be ordered the device of a remark column.

(Note-3): Do not use it as a user device. It can be used as a device that performs automatic refresh because of area for the reserve of command signal.

POINT

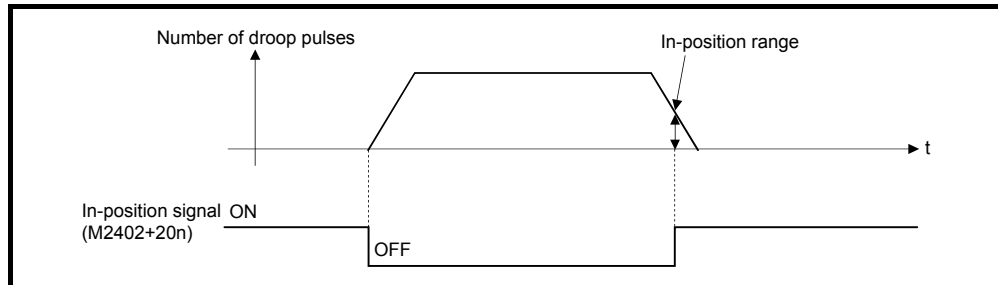
The device of a remark column turns ON by OFF to ON of the above device, and turns OFF by ON to OFF of the above device.
 The command signal cannot be turned ON/OFF by the PLC CPU in the automatic refresh because the statuses and commands are mixed together in M2000 to M2053. Use the above devices in the case.
 And, it can also be turned ON/OFF by the data register. (Refer to Section 4.2.8)


4 POSITIONING DEDICATED SIGNALS

4.1.1 Axis statuses


(1) In-position signal (M2402+20n) Status signal

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



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

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

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

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

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

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

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

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

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

4 POSITIONING DEDICATED SIGNALS

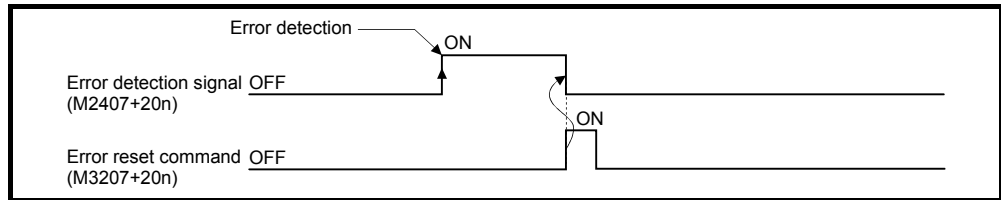
(3) Error detection signal (M2407+20n) Status signal

(a) This signal turns on with detection of a minor error or major error, and it is used as judgement of the error available/not available.

The applicable error code ^(Note-1) is stored in the minor error code storage register (D6+20n) with detection of a minor error.

The applicable error code ^(Note-1) is stored in the major error code storage register (D7+20n) with detection of a major error.

(b) This signal turns off when the error reset command (M3207+20n) turns on.



REMARK

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

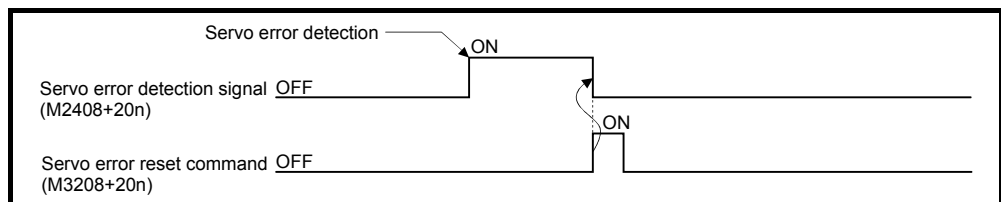
(4) Servo error detection signal (M2408+20n) Status signal

(a) This signal turns on when an error occurs at the servo amplifier side (except for errors cause of alarms and emergency stops) ^(Note-1) and it is used as judgement of the servo error available/not available.

When an error is detected at the servo amplifier side, the applicable error code ^(Note-1) is stored in the servo error code storage register (D8+20n).

(b) This signal turns off when the servo error reset command (M3208+20n) turns on or the servo power supply turns on again.

(Servo error reset is valid in the real mode only.)



REMARK

(Note-1) : Refer to APPENDIX 1.5 for the error codes on errors detected at the servo amplifier side.

4 POSITIONING DEDICATED SIGNALS

(5) Home position return request signal (M2409+20n)

..... Status signal

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

(a) When not using an absolute position system

1) This signal turns on in the following cases:

- Multiple CPU system power supply on or reset
- Servo amplifier power supply on
- Home position return start in the real mode
(Unless a home position return is completed normally, the home position return request signal does not turn off.)

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

(b) When using an absolute position system

1) This signal turns on in the following cases:

- When not executing a home position return once after system start.
- Home position return start in the real mode
(Unless a home position return is completed normally, the home position return request signal does not turn off.)
- Erase of an absolute data in Motion CPU according to causes, such as battery error
- Servo error [2025] (absolute position erase) occurrence
- Servo error [2143] (absolute position counter warning) occurrence
- Servo error [2913] (encoder counter error) occurrence
- Major error [1201], [1202], [1203] or [1204] occurrence
- When the "rotation direction selection" of servo parameter is changed.

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

CAUTION

- When using the absolute position system function, on starting up, and when the Motion controller or absolute value motor has been replaced, always perform a home position return in real mode. 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.

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

..... Status signal

(a) This signal turns on when the home position return operation using the servo program has been completed normally.

(b) This signal turns off at the positioning start, JOG operation start and manual pulse generator operation start.

(c) If the home position return of proximity dog, dog cradle or stopper method using the servo program is executed during this signal on, a minor error (error code: 115) occurs and it cannot be start the home position return.

4 POSITIONING DEDICATED SIGNALS

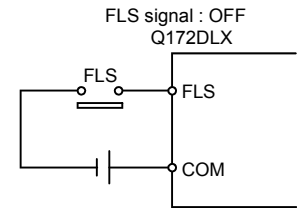
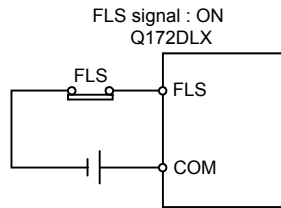
(7) FLS signal (M2411+20n) ^(Note-1) Status signal

(a) This signal is controlled by the ON/OFF state for the upper stroke limit switch input (FLS) of the Q172DLX/servo amplifier and bit device **QDS**.

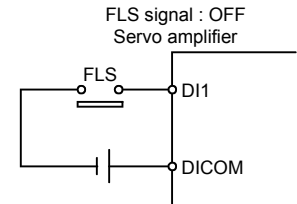
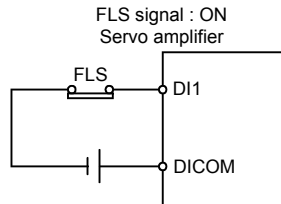
- Upper stroke limit switch input OFF FLS signal: ON
- Upper stroke limit switch input ON FLS signal: OFF

(b) The state for the upper stroke limit switch input (FLS) when the FLS signal is ON/OFF is shown below.

1) Q172DLX use ^(Note-2)



2) Servo amplifier input use ^(Note-3)



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

The set bit device is the FLS signal.

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

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

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

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

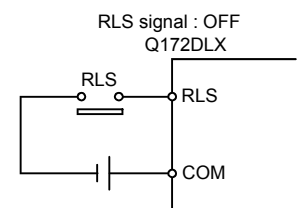
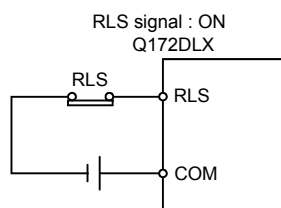
(8) RLS signal (M2412+20n) ^(Note-1) Status signal

(a) This signal is controlled by the ON/OFF state for the lower stroke limit switch input (RLS) of the Q172DLX/servo amplifier and bit device **QDS**.

- Lower stroke limit switch input OFF RLS signal: ON
- Lower stroke limit switch input ON RLS signal: OFF

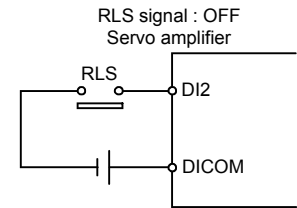
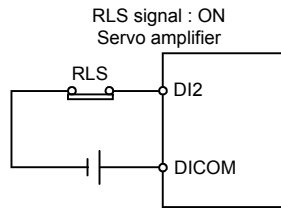
(b) The state of the lower stroke limit switch input (RLS) when the RLS signal is ON/OFF is shown below.

1) Q172DLX use ^(Note-2)



4 POSITIONING DEDICATED SIGNALS

2) Servo amplifier input use ^(Note-3)



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

The set bit device is the RLS signal.

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

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

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

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

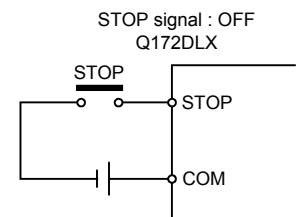
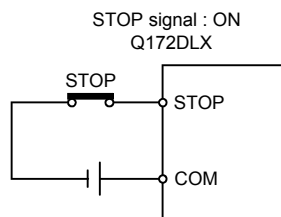
(9) STOP signal (M2413+20n) ^(Note-1) Status signal

(a) This signal is controlled by the ON/OFF state for the stop signal input (STOP) of the Q172DLX and bit device **QDS**.

- Stop signal input of the Q172DLX OFF STOP signal: OFF
- Stop signal input of the Q172DLX ON STOP signal: ON

(b) The state of the stop signal input (STOP) when the STOP signal input is ON/OFF is shown below.

1) Q172DLX use ^(Note-2)



2) Bit device use ^(Note-1) **QDS**

The set bit device is the STOP signal.

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

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

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

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

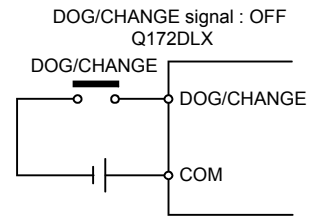
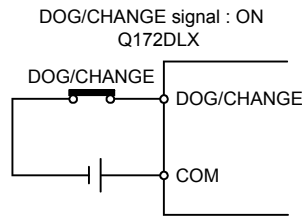
(a) This signal turns on/off by the proximity dog input (DOG) of the Q172DLX/ servo amplifier/input (DI) of built-in interface in Motion CPU **QDS**/bit device **QDS** at the home position return in the real mode.

This signal turns on/off by the speed/position switching input (CHANGE) of the Q172DLX/proximity dog input (DOG) of servo amplifier/input (DI) of built-in interface in Motion CPU **QDS**/bit device **QDS** at the speed-position switching control in the real mode. ^(Note-2)

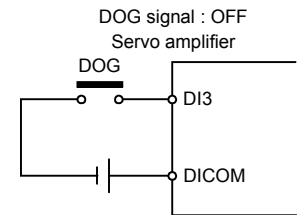
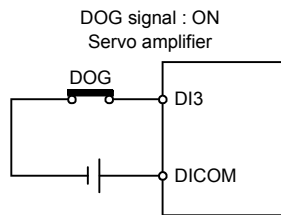
(There is no CHANGE signal in the servo amplifier.)

(b) The state of the speed/position switching input (CHANGE) when the CHANGE signal is ON/OFF is shown below.

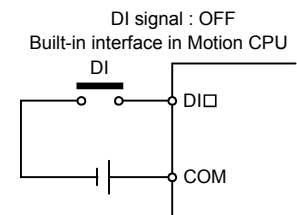
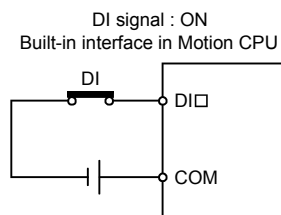
1) Q172DLX use ^(Note-3)



2) Servo amplifier input use ^(Note-4)



3) Built-in interface in Motion CPU use ^(Note-3) **QDS**



4) Bit device use ^(Note-1) **QDS**

The set bit device is the DOG/CHANGE signal.

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

(Note-2): When using the Q173DCPU(-S1)/Q172DCPU(-S1), the external input signal (DOG) of servo amplifier can also be used in the speed-position switching control. (Refer to Section 1.4 for the software version that supports this function.)

(Note-3): Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller User's Manual" for a pin configuration.

(Note-4): Refer to the "Servo Amplifier Instruction Manual" for a pin configuration.

4 POSITIONING DEDICATED SIGNALS

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

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

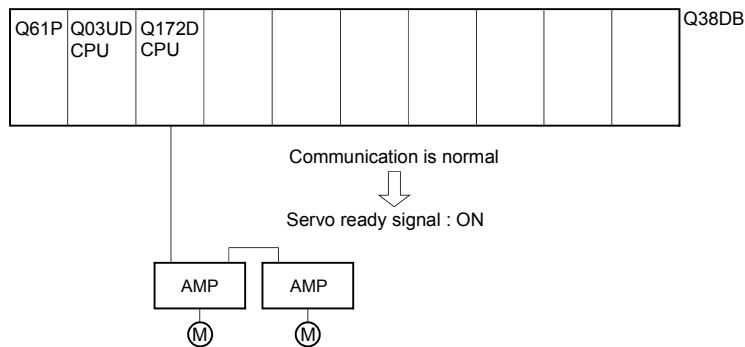
(11) Servo ready signal (M2415+20n) Status signal

- (a) This signal turns on when the servo amplifiers connected to each axis are in the READY state (READY ON and Servo ON).

- (b) This signal turns off in the following cases.

- All axes servo ON command (M2042) is off
- Servo amplifier is not mounted
- Servo parameter is not set
- It is received the forced stop input from an external source
- Servo OFF by the servo OFF command (M3215+20n) ON of each axis
- Servo error occurs

Refer to "APPENDIX 1.5 Servo errors" for details.



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.

(12) Torque limiting signal (M2416+20n) Status signal

This signal turns on while torque limit is executed.

The signal toward the torque limiting axis turns on.

4 POSITIONING DEDICATED SIGNALS

(13) Virtual mode continuation operation disable warning signal (M2418+20n) Status signal

When the difference between the final servo command value in previous virtual mode last time and the servo current value at virtual mode switching next time exceeds the "Allowable travel value during power off (× Number of feedback pulses)" set in the "System setting", "Virtual mode continuation operation disable warning signal device" of the applicable axis is turned on as warning of being uncontinuable in virtual mode operation.

It checks for the following cases.

| No. | Check | Remark |
|-----|--|---|
| 1 | Servo amplifier power supply ON for absolute axis. | <ul style="list-style-type: none"> • A minor error (error code: 901 (power supply on in real mode)/9010 (power supply on in virtual mode)) are also set. |
| 2 | Anytime during real mode operation. | <ul style="list-style-type: none"> • It also turns on at the following cases. <ol style="list-style-type: none"> 1) Home position return 2) Current value change 3) Fixed-pitch feed, speed control (I), (II) or speed-position switching control. |

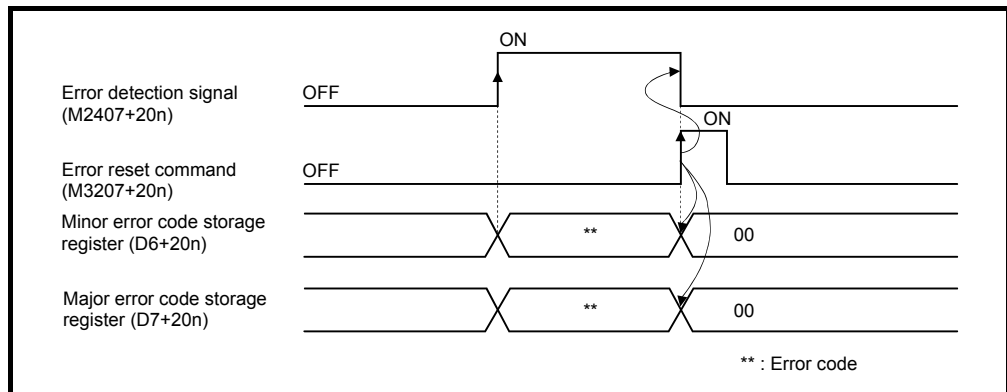
Reset the "Virtual mode continuation operation disable warning signal device" using the Motion SFC program.

4 POSITIONING DEDICATED SIGNALS

4.1.2 Axis command signals

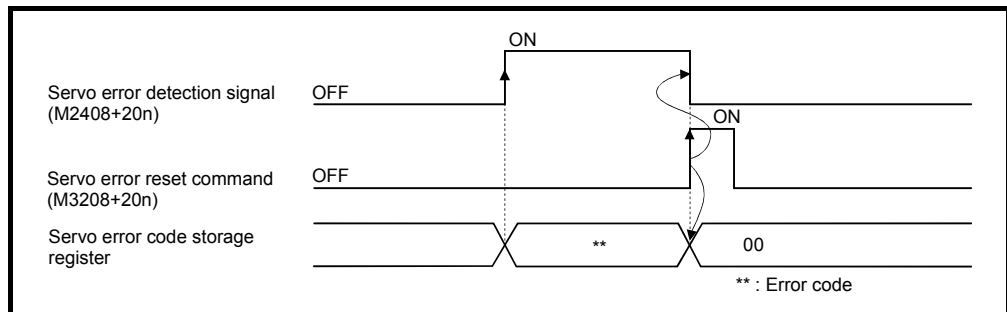
(1) Error reset command (M3207+20n) Command signal

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



(2) Servo error reset command (M3208+20n) Command signal

This command is used to clear the servo error code storage register (D8+20) of an axis for which the servo error detection signal has turn on (M2408+20n: ON), and reset the servo error detection signal (M2408+20n).



(3) Address clutch reference setting command (M3213+20n) Command signal

This signal is only effective when the output module is a cam connected an address mode clutch or a rotary table, and it is used to specify the "0" reference position for the current value within 1 virtual axis revolution.

The following processes are executed based on the ON/OFF state of the address clutch reference setting command at the real mode/virtual mode switching request.

(a) M3213+20n : ON

Virtual mode operation starts as "0" for the current value within 1 virtual axis revolution of the main shaft and auxiliary input axis.

(b) M3213+20n : OFF

- If the drive module is a virtual servomotor or an incremental synchronous encoder, operation will be continued from the current value within 1 virtual axis revolution for the main shaft and auxiliary input axis in the previous virtual mode.
- If the drive module is an absolute synchronous encoder, operation will be continued from the current value within 1 virtual axis revolution for the main shaft and auxiliary input axis calculated from the current value of synchronous encoder.

(4) Cam reference position setting command (M3214+20n)

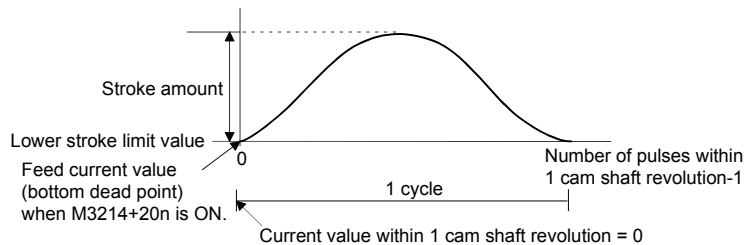
..... Command signal

This signal is only effective when the output module is a cam, and it is used to specify the cam reference position.

The following processes are executed based on the ON/OFF state of the cam reference position setting command at the real mode/virtual mode switching request.

(a) M3214+20n : ON

- The current value is cam reference position.
- The current feed current value is lower stroke limit value (bottom dead point). Moreover, a cam table search is conducted from the beginning of a cycle, and the bottom dead point (0) is specified as the current value within 1 cam shaft revolution.



- After the bottom dead point alignment of cam is completed at the system start-up, it must be turned on at the first real mode to virtual mode switching. Once the bottom dead point setting is set, operation will be continued with M3214+20n ON by switching from real mode to virtual mode. (The bottom dead point position is stored in the backup memory.)

4 POSITIONING DEDICATED SIGNALS

(b) M3214+20n : OFF

(Final servo command value in previous virtual mode operation)
 – (Current servo current value) ≤ (In-position)1)

- For formula 1)
 Operation will be continued by making the lower stroke limit value and current value within 1 cam shaft revolution into the lower stroke limit value and current value within 1 cam shaft revolution at the previous virtual mode operation.

(Final servo command value in previous virtual mode operation)
 – (Current servo current value) > (In-position)2)

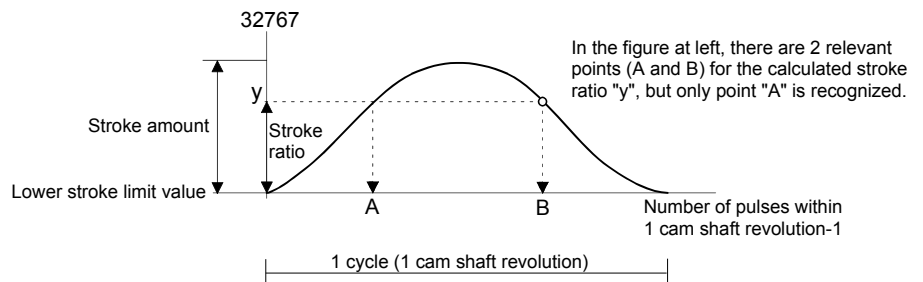
- For formula 2)
 Current value within 1 cam shaft revolution for current feed current value is calculated and operation will be continued by making the lower stroke limit value into the lower stroke limit value at the previous virtual mode operation.

[Calculation of current value within 1 cam shaft revolution]

(Feed current value) = (Stroke amount) × (Stroke ratio) + (Lower stroke limit value)

The stroke ratio(y) used as above formula is calculated, the cam table of the setting cam No. is searched from the beginning of a cycle, and the current value within 1 cam shaft revolution for applicable point is calculated. Because the current value within 1 cam shaft revolution is searched always from the beginning of a cycle, beware of cases where the same stroke ratio appears more than once in the cycle.

(Make the necessary position adjustment at the real mode/virtual mode switching.)



(5) Servo OFF command (M3215+20n) Command signal

This command is used to execute the servo OFF state (free run state) when all axes servo ON command (M2042) is ON.

- OFF Servo ON
- ON Servo OFF (free run state)

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

When the servo OFF command is executed in virtual mode, the clutch will be disengaged first. If it is executed while a "clutch ON" state, a minor error occurs and the servo OFF command becomes invalid.

⚠ CAUTION

- Turn the power supply of the servo amplifier side off before touching a servomotor, such as machine adjustment.

(6) Gain changing command (M3216+20n) Command signal

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

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

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

(7) PI-PID switching command (M3217+20n) **QDS** Command signal

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

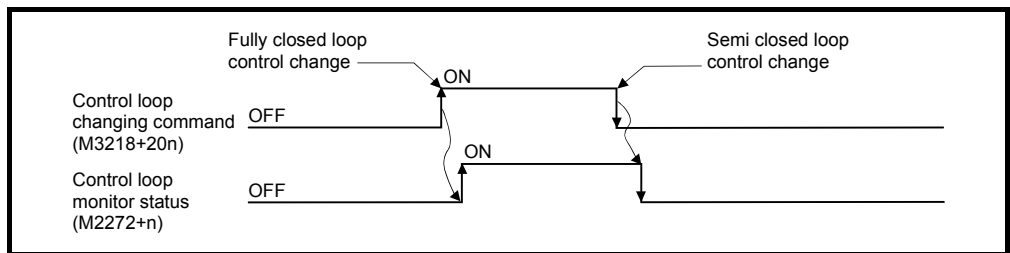
- ON PI-PID switching command ON(PID control)
- OFF PI-PID switching command OFF(PI control)

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

(8) Control loop changing command (M3218+20n) Command signal

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

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



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

4 POSITIONING DEDICATED SIGNALS

POINTS

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

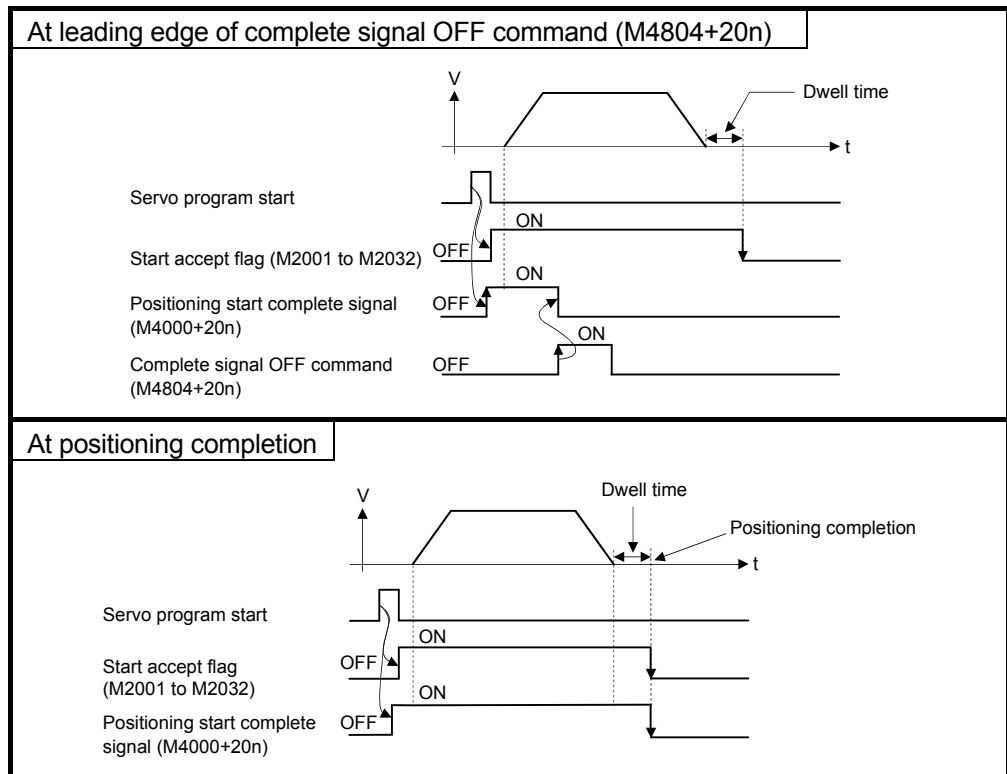
4 POSITIONING DEDICATED SIGNALS

4.1.3 Virtual servomotor axis statuses

(1) Positioning start complete signal (M4000+20n)

..... Status signal

- (a) This signal turns on with the start completion for the positioning control of the axis specified with the servo program. It does not turn on at JOG operation. It can be used to read an M-code ^(Note-1) at the positioning start.
- (b) This signal turns off at leading edge of complete signal OFF command (M4804+20n) or positioning completion.



REMARK

(Note-1): Refer to Chapter 7 of the "Q173D(S)CPU/ Q172D(S)CPU Motion controller (SV13/SV22) Programming manual (REAL MODE)".

4 POSITIONING DEDICATED SIGNALS

(2) Positioning complete signal (M4001+20n) Status signal

(a) This signal turns on with the completion for the positioning control of the axis specified with the servo program.

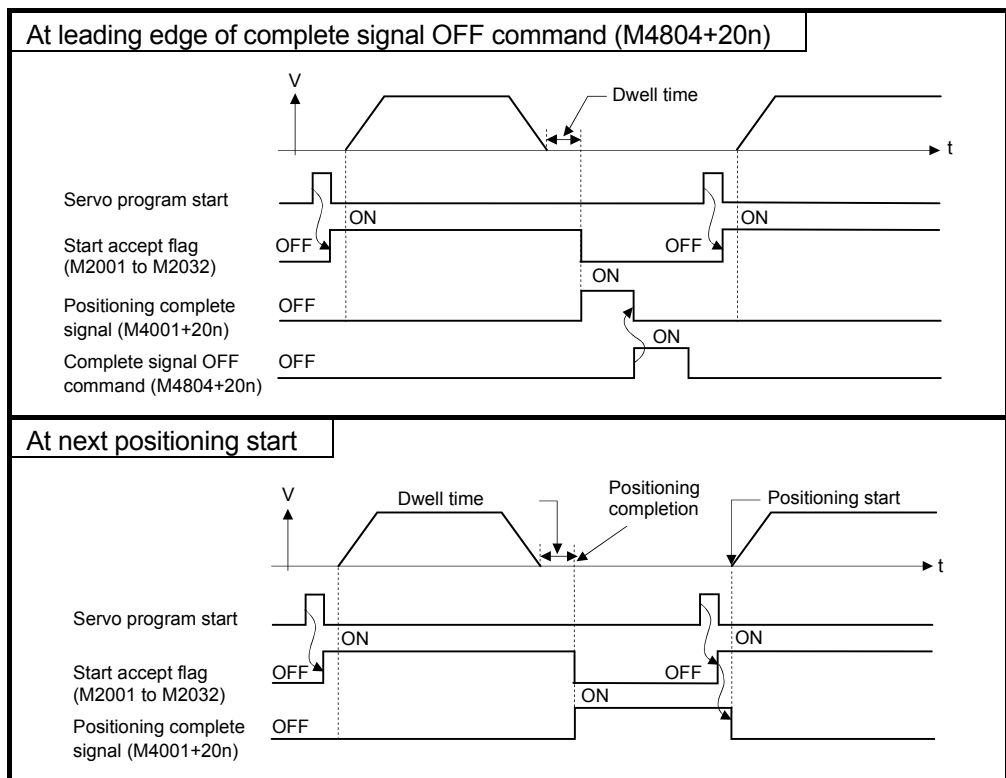
It does not turn on at the start or stop on the way using JOG operation or speed control.

It does not turn on at the stop on the way during positioning.

It can be used to read an M-code at the positioning completion.

(Refer to Chapter 7 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV/13/SV22) Programming Manual (REAL MODE)".)


(b) This signal turns off at leading edge of complete signal OFF command (M4804+20n) or positioning start.



(3) Command in-positioning signal (M4003+20n) Status signal

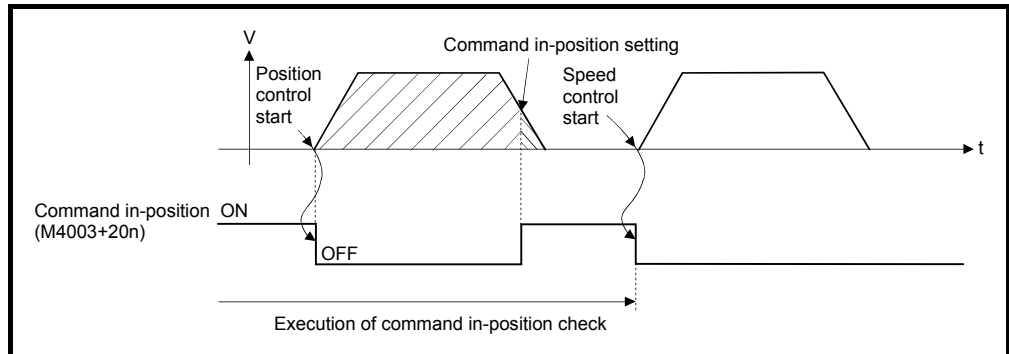
(a) This signal turns on when the absolute value of the difference between the command position and the feed current value becomes below the "command in-position range" set in the parameters of virtual servomotor (Refer to Section 6.1.2).

This signal turns off in the following cases.

- Positioning control start
- Speed control
- JOG operation
- Speed-torque control 

4 POSITIONING DEDICATED SIGNALS

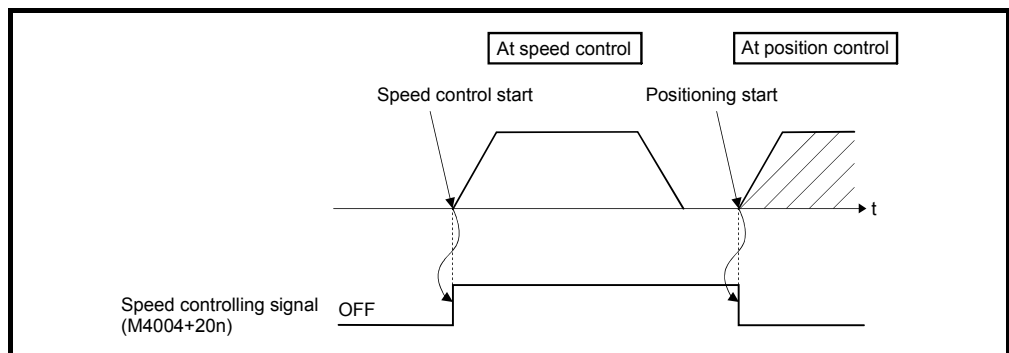
- (b) Command in-position check is continually executed during position control. This check is not executed during speed control.



(4) Speed controlling signal (M4004+20n) Status signal

- (a) This signal turns on during speed control, and it is used as judgement of during the speed control or position control. The speed controlling signal that turned on with speed control turns off at the positioning control start of following figure.

- (b) This signal turns off at the power supply on and during position control.



(5) Error detection signal (M4007+20n) Status signal

- (a) This signal turns on when a minor error or major error is detected in a virtual servomotor or output module connected to a virtual servomotor. It is used as judgement of the error available/not available by turning the error detection signal on/off.

- (b) When the error detection signal turns on, the applicable error code is stored in the error code storage register.

- Minor error code ^(Note-1) ... Stored in the minor error code storage register (D802+20n) ^(Note-2).
- Major error code ^(Note-1) ... Stored in the major error code storage register (D803+20n) ^(Note-2).

The judgement of the virtual servomotor/output module for detected error can be confirmed by the error code details or turning the error detection signal of output module on/off.

4 POSITIONING DEDICATED SIGNALS

- (c) When the error reset command (M4807+20n) turns on in the state where the virtual servomotor or output module connected to the virtual servomotor turns on is normal, the error detection signal turns off.

REMARK

(Note-1) : Refer to APPENDIX 1.4 for details of the virtual servomotor minor/major error codes.

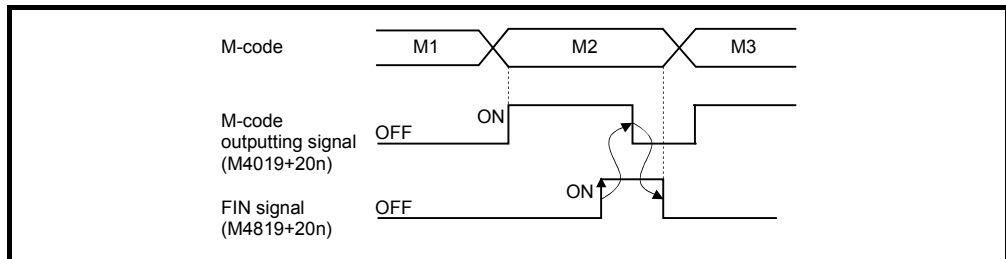
Refer to APPENDIX 1.6 for details of the output module minor/major error codes.

(Note-2) : Refer to Section 4.2.3 for details of the minor error storage code register (D802+20n) and major error code storage register (D803+20n).

(6) M-code outputting signal (M4019+20n) Status signal

(a) This signal turns during M-code is outputting.

(b) This signal turns off when the stop command, cancel signal, skip signal or FIN signal are inputted.



POINT

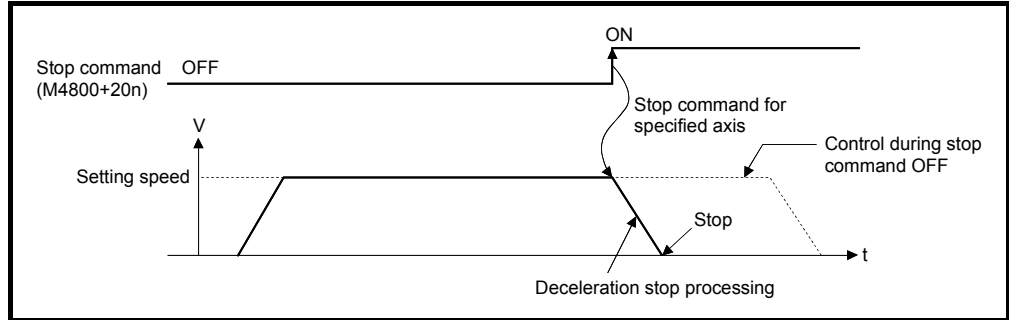
- (1) The FIN signal (M4819+20n) and M-code outputting signal (M4019+20n) are both signal for the FIN signal wait function.
- (2) The FIN signal (M4819+20n) and M-code outputting signal (M4019+20n) are effective only when FIN acceleration/deceleration is designated in the servo program. Otherwise, the FIN signal wait function is disabled, and the M-code outputting signal (M4019+20n) does not turn on.

4 POSITIONING DEDICATED SIGNALS

4.1.4 Virtual servomotor axis command signals

(1) Stop command (M4800+20n) Command signal

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



- (b) It can also be used as the stop command during the speed control. (Refer to Section "6.13 Speed Control (I)" of the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)" for details of the speed control.

- (c) Stop processing details when the stop command turned on is shown in Table 4.1.

Table 4.1 Stop Processing at Stop command ON

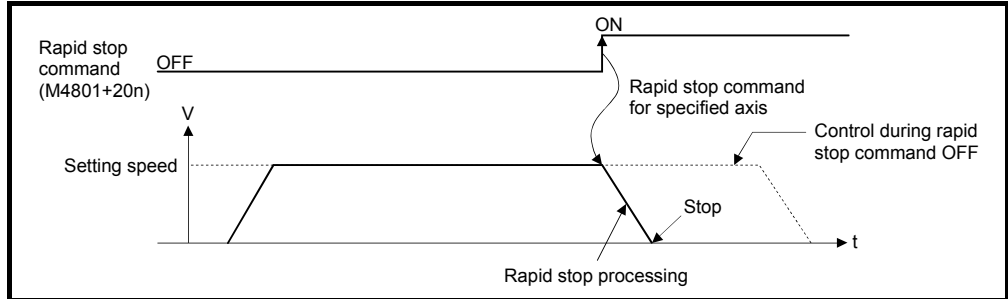
| Control details during execution | Processing at the turning stop command on | |
|----------------------------------|--|--|
| | During control | During deceleration stop processing |
| Positioning control | The axis decelerates to a stop in the deceleration time set in the parameter block or servo program. | The stop command is ignored and deceleration stop processing is continued. |
| Speed control | | |
| JOG operation | | |

- (d) The stop command in a dwell time is invalid. (After a dwell time, the start accept flag (M2001+n) turns OFF, and the positioning complete signal (M4001+20n) turns ON.)

4 POSITIONING DEDICATED SIGNALS

(2) Rapid stop command (M4801+20n) Command signal

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



- (b) The details of stop processing when the rapid stop command turns on are shown in Table 4.2.

Table 4.2 Details of stop processing when the rapid stop command turns on

| Control details during execution | Processing at the turning rapid stop command on | |
|----------------------------------|---|---|
| | During control | During deceleration stop processing |
| Positioning control | Rapid stop processing is executed. | Deceleration processing is stopped and rapid stop processing is executed. |
| Speed control | | |
| JOG operation | | |

- (c) The rapid stop command in a dwell time is invalid. (After a dwell time, the start accept flag (M2001+n) turns OFF, and the positioning complete signal (M4001+20n) turns ON.)

REMARK

(Note-1) : Rapid stop processing is deceleration stop with deceleration time set in the parameter block or servo program.

4 POSITIONING DEDICATED SIGNALS

(3) Forward rotation JOG start command (M4802+20n)/Reverse rotation JOG start command (M4803+20n) Command signal

(a) JOG operation to the address increase direction is executed while forward rotation JOG start command (M4802+20n) is turning on.

When M4802+20n is turned off, a deceleration stop is executed in the deceleration time set in the parameter block.

(b) JOG operation to the address decrease direction is executed while reverse rotation JOG start command (M4803+20n) is turning on.

When M4803+20n is turned off, a deceleration stop is executed in the deceleration time set in the parameter block.

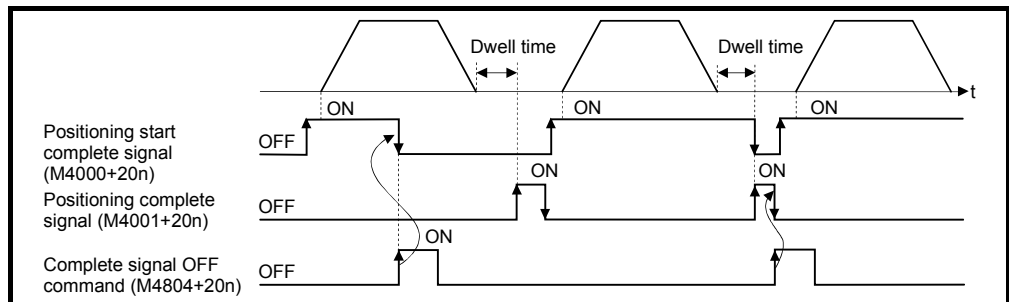
POINT

Take an interlock so that the forward rotation JOG start command (M4802+20n) and reverse rotation JOG start command (M4803+20n) may not turn on simultaneously.

(4) Complete signal OFF command (M4804+20n)

..... Command signal

(a) This command is used to turn off the positioning start complete signal (M4000+20n) and positioning complete signal (M4001+20n).



POINT

Do not turn the complete signal OFF command on with a PLS instruction. If it is turned on with a PLS instruction, it cannot be turned off the positioning start complete signal (M4000+20n) and the positioning complete signal (M4001+20n).

(5) Error reset command (M4807+20n) Command signal

(a) This command is used to clear the minor error code storage register (D802+20n) and major error code storage register (D803+20n) of an axis for which the error detection signal has turned on (M4007+20n : ON), and reset the error detection signal (M4007+20n).

(b) The following processing is executed when the error reset command turns on.

- If the virtual servomotor and output module are normal, the minor error code storage register (D802+20n) and major error code storage register (D803+20n) are cleared and the error detection signal (M4007+20n) is reset.
- If the virtual servomotor and output module error has not been canceled, the error code is again stored in the minor error code storage register (D802+20n) and major error code storage register (D803+20n). In this case, the error detection signal (M4007+20n) remains on. Reset the output module error by error reset of each axis command signal to the output module.

(6) External stop input disable at start command (M4809+20n) Command signal

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

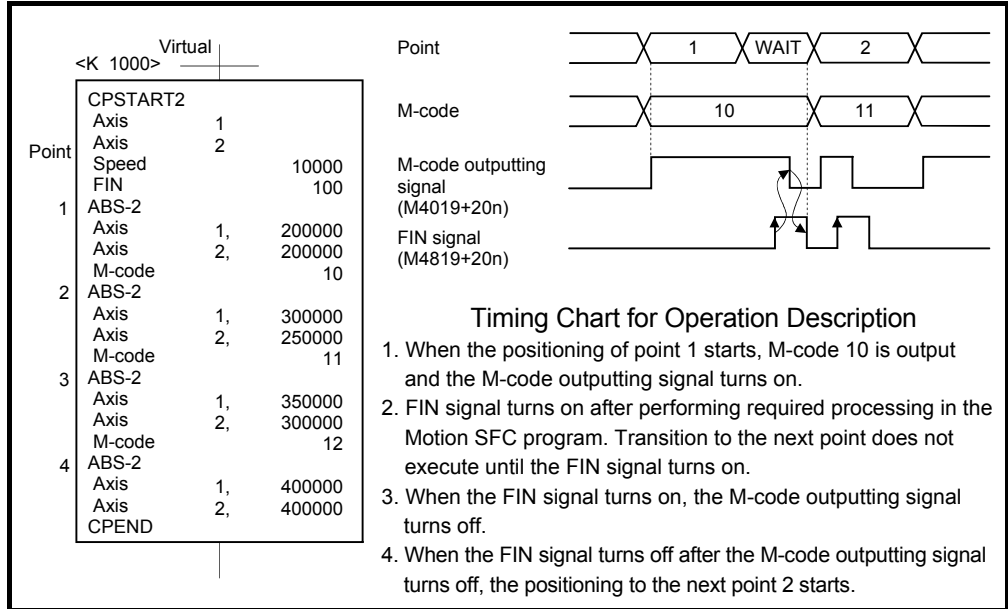
- ON..... External stop input is set as invalid, and even axes which stop input is turning on can be started.
- OFF External stop input is set as valid, and axes which stop input is turning on cannot be started.

| |
|--------------|
| POINT |
|--------------|

| |
|---|
| When it stops an axis with the external stop input after it starts by turning on the external stop input disable at start command (M4809+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). |
|---|

4 POSITIONING DEDICATED SIGNALS

- (7) FIN signal (M4819+20n) Command signal
- 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 effective, only when the FIN acceleration/deceleration is set and FIN signal wait function is selected.



POINT

- (1) The FIN signal (M4819+20n) and M-code outputting signal (M4019+20n) are both signal for the FIN signal wait function.
- (2) The FIN signal (M4819+20n) and M-code outputting signal (M4019+20n) are valid only when FIN acceleration/deceleration is designated in the servo program. Otherwise, the FIN signal wait function is disabled, and the M-code outputting signal does not turn on.

4 POSITIONING DEDICATED SIGNALS

4.1.5 Synchronous encoder axis statuses

- (1) Error detection signal (M4640+4n) Status signal
- (a) This signal turns on when a minor error or major error is detected in a synchronous encoder or output module connected to the synchronous encoder.
It is used as judgement of the error available/not available by turning the error detection signal on/off.
- (b) When the error detection signal turns on, the applicable error code is stored in the error code storage register.
- Minor error code ^(Note-1) ... Stored in the minor error code storage register (D1122+10n) ^(Note-2)
 - Major error code ^(Note-1) ... Stored in the major error code storage register (D1123+10n) ^(Note-2)
- The judgement of the synchronous encoder/output module for detected error can be confirmed by the error code details or turning the error detection signal of output module on/off.
- (c) When the error reset command (M5440+4n) turns on in the state where the synchronous encoder or output module connected to the synchronous encoder is normal, the error detection signal turns off.
- (2) External signal TREN (M4641+4n) Status signal
- (a) This signal is used for clutch control in the external input mode. It turns on by turning on the Q173DPX "TREN" input terminal, and indicates the input ON/OFF state of the "TREN" terminal.
Q172DEX does not turn ON regardless of the input status of TREN terminal.
- (3) Virtual mode continuation operation disabled warning signal (M4642+4n) Status signal
- (a) When the inputted current value at the power supply on of the Multiple CPU system differs from the memorized current value (Final current value in virtual mode operation) at the power supply off of the Multiple CPU system, like the absolute synchronous encoder is moved during the power supply off of the Multiple CPU system, this signal turns on.
The validity of continuation operation in virtual mode can be confirmed at the power supply on or resetting of the Multiple CPU system.

REMARK

(Note-1): Refer to APPENDIX 1.4 for details of the minor/major error code for the synchronous encoder.
Refer to APPENDIX 1.6 for details of the minor/major error code for the output module.

(Note-2): Refer to Section 4.2.5 for details of the minor error code storage register (D1122+10n) and major error code storage register (D1123+10n).

4.1.6 Synchronous encoder axis command signals

- (1) Error reset command (M5440+4n) Command signal
- (a) This command is used to clear the minor error code storage register (D1122+10n) and major error code storage register (D1123+10n) of synchronous encoder of an axis for which the error detection signal has turned on (M4640+4n : ON), and reset the error detection signal (M4640+4n).
- (b) The following processing is executed when the error reset command turns on.
- If the synchronous encoder and output module are normal, the minor error code storage register (D1122+10n) and major error code storage register (D1123+10n) are cleared and the error detection signal (M4640+4n) is reset.
 - If the synchronous encoder and output module error has not been canceled, the error code is again stored in the minor error code storage register (D1122+10n) and major error code storage register (D1123+10n). In this case, the error detection signal (M4640+4n) remains on. Reset the output module error by error reset of each axis command signal to the output module.

4 POSITIONING DEDICATED SIGNALS

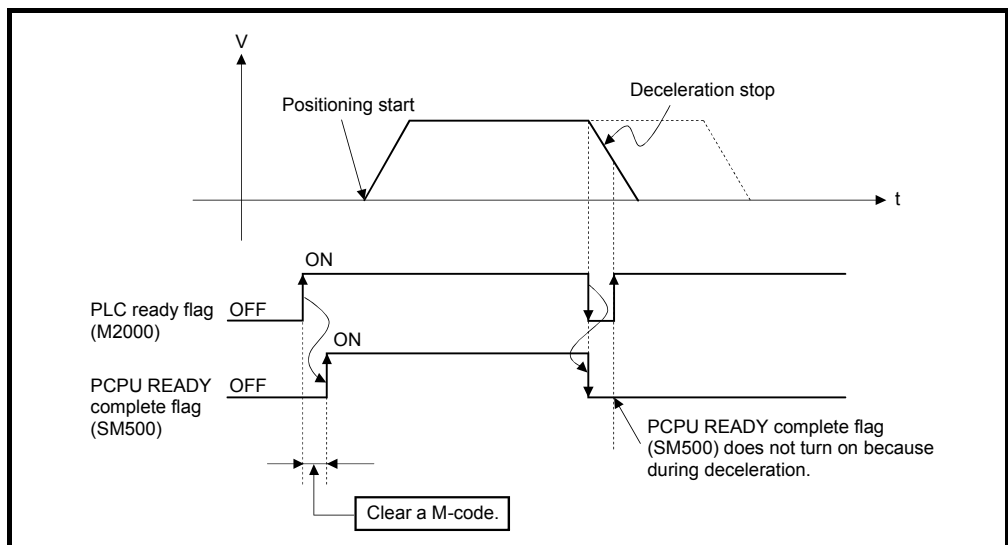
4.1.7 Common devices

POINT

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

(1) PLC ready flag (M2000) Command signal

- (a) This signal informs the Motion CPU that the PLC CPU is normal.
 - 1) The positioning control, home position return or JOG operation using the servo program which performs the Motion SFC program when the M2000 is ON.
 - 2) The above 1) control is not performed even if the M2000 is turned on during the test mode [TEST mode ON flag (SM501) : ON] using MT Developer2.
- (b) The setting data such as the fixed parameters, servo parameters and limit switch output data can be changed using MT Developer2 when the M2000 is OFF only.
The above data using MT Developer2 cannot be written when the M2000 is ON.
- (c) The following processing are performed when the M2000 turns OFF to ON.
 - 1) Processing details
 - Clear the M-code storage area of all axes.
 - Turn the PCPU READY complete flag (SM500) on.
(Motion SFC program can be executed.)
 - Start to execute the Motion SFC program of the automatic starting from the first.
 - 2) If there is a starting axis, an error occurs, and the processing in above (c) 1) is not executed.
 - 3) The processing in above (c) 1) is not executed during the test mode.
It is executed when the test mode is cancelled and M2000 is ON.



4 POSITIONING DEDICATED SIGNALS

(d) The following processes are performed when the M2000 turns ON to OFF.

1) Processing details

- Turn the PCPU READY complete flag (SM500) off.
- Deceleration stop of the starting axis.
- Stop to execute the Motion SFC program.
- Turn all points of the real output PY off.

(e) Operation at STOP to RUN

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

1) M2000 turns ON by switching from STOP to RUN. (Default)

Condition in which the M2000 turns from OFF to ON.

- Move the RUN/STOP switch from STOP to RUN.
- Turn ON the Multiple CPU system's power supply with the RUN/STOP switch set to RUN.

Condition in which the M2000 turns from ON to OFF

- Move the RUN/STOP switch from RUN to STOP.

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

Condition in which the M2000 turns from OFF to ON

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

Condition in which the M2000 turns from ON to OFF

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

4 POSITIONING DEDICATED SIGNALS

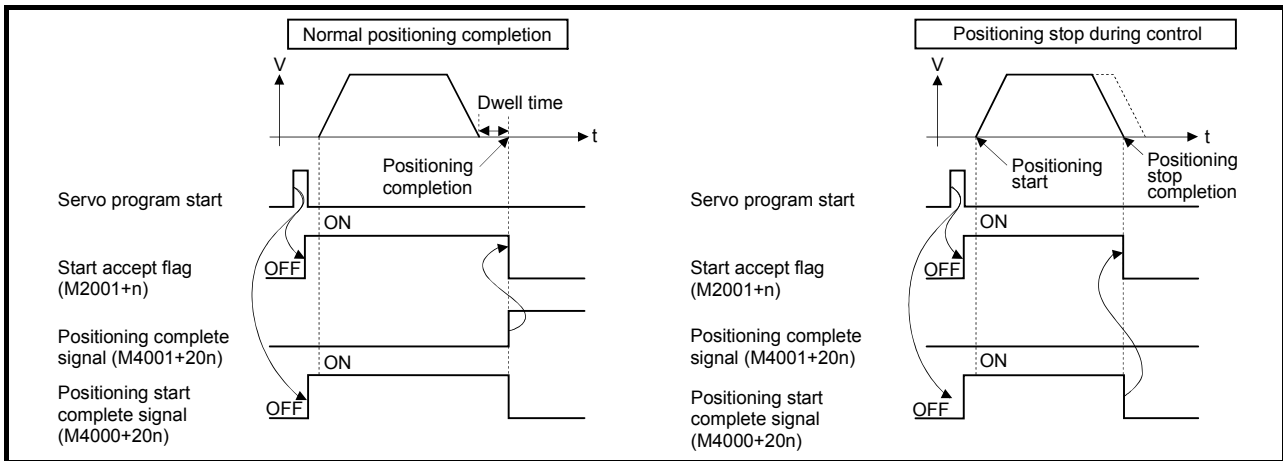
(2) Virtual servo start accept flag (M2001 to M2032)

..... Status signal

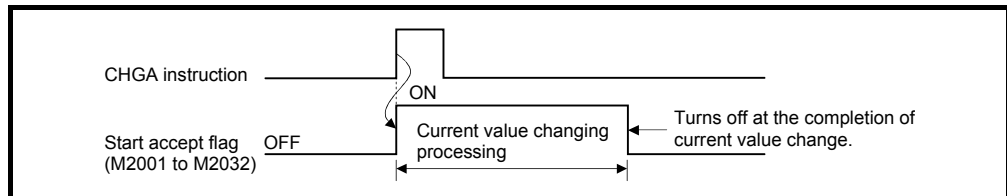
(a) This flag turns on when the servo program is started. The start accept flag corresponding to an axis specified with the servo program turns on.

(b) The ON/OFF processing of the start accept flag is shown below.

- 1) When the servo program is started using the Motion SFC program or Motion dedicated PLC instruction (D(P).SVST), the start accept flag corresponding to an axis specified with the servo program turns on and it turns off at the positioning completion. This flag also turns off when it is made to stopping on the way. (When it is made to stop on the way by the speed change to speed "0", this flag remains on.)



- 2) This flag turns on at the positioning control by turning on the JOG start command (M4802+20n or M4803+20n), and turns off at the positioning stop by turning off the JOG start command.
- 3) This flag turns on during the manual pulse generator enable (M2051 to M2053: ON), and turns off at the manual pulse generator disable (M2051 to M2053: OFF).
- 4) This flag turns on during a current value change by the CHGA instruction of servo program or Motion dedicated PLC instruction (D(P).CHGA), and turns off at the completion of the current value change.



4 POSITIONING DEDICATED SIGNALS

The start accept flag list is shown below.

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

(Note): The following range is valid.

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

⚠ CAUTION

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

(3) Motion error history clear request flag (M2035)

..... Command signal

This flag is used to clear the backed-up Motion error history (#8640 to #8735).

The Motion error history is cleared at leading edge of M2035.

After detection of the leading edge of M2035, the Motion error history is cleared, and then the M2035 is automatically turned OFF.

(4) Motion SFC debugging flag (M2038) Status signal

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.

(5) Motion error detection flag (M2039) Status signal

This flag turns on with error occurrence of the Motion CPU.

Turn off this flag by the user side, after checking the error contents and removing the error cause.

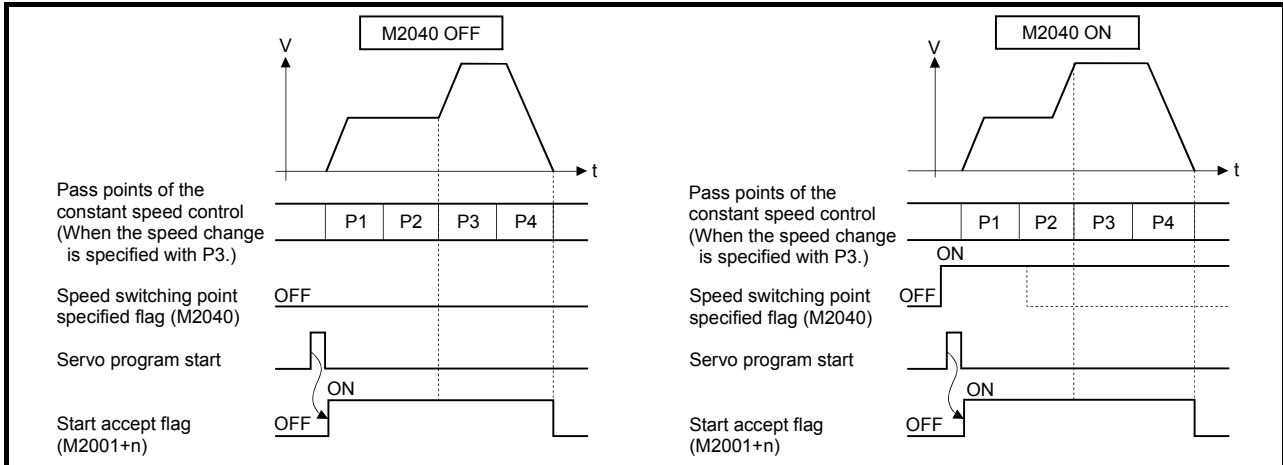
The self-diagnosis error information except stop error is cleared at the turning M2039 ON to OFF.

(6) Speed switching point specified flag (M2040) Command signal

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

4 POSITIONING DEDICATED SIGNALS

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



- (7) System setting error flag (M2041) Status signal
- This flag inputs the "system setting data" set by MT Developer2 and performs an adjustment check with a real mounting state (main base unit/extension base units) at Multiple CPU system's power supply on or reset.
- ON Error
 - OFF Normal
- (a) When an error occurs, the 7-segment LED at the front side of Motion CPU shows the system setting error.
The error contents can be confirmed using the monitor of MT Developer2.
- (b) When M2041 is ON, positioning cannot be started. Remove an error factor, and turn the Multiple CPU system's power supply on again or reset.

REMARK

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

4 POSITIONING DEDICATED SIGNALS

(8) All axes servo ON command (M2042) Command signal

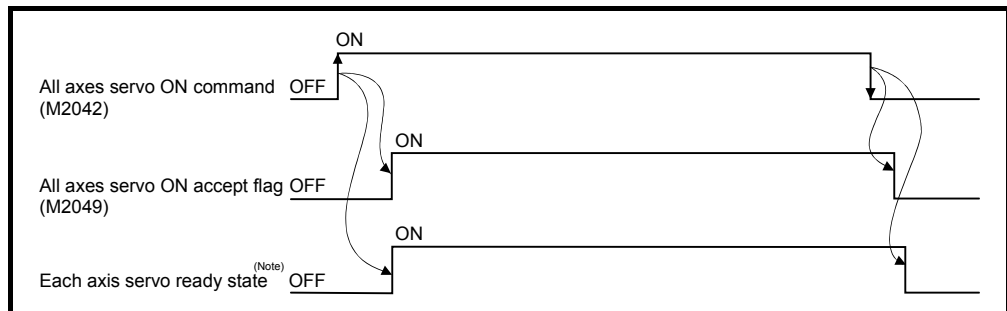
This command is used to enable servo operation.

(a) Servo operation enabled M2042 turns on while the servo OFF command (M3215+20n) is off and there is no servo error.

(b) Servo operation disable • M2042 is off

- The servo OFF command (M3215+20n) is on
- Servo error state
- Forced stop

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



(Note): Refer to servo ready signal (M2415+20n) in Section 4.1.1 for details.

POINT

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

M2042 turns OFF by the forced stop of Motion CPU.

(9) Real mode/virtual mode switching request flag (M2043) Command signal

This flag is used for switching between the real mode and virtual modes.

(a) Turn the M2043 on after the PCPU READY complete flag (SM500) has turned on for switching from the real mode to virtual mode.

- An error check is executed when the M2043 is switched from off to on. If no error is detected, switch to the virtual mode, and the real mode/virtual mode status switching status flag (M2044) turns on.
- If an error is detected, do not switch to the virtual mode. In this case, the real mode/virtual mode switching error detection flag (M2045) turns on, and the error code is stored in the real mode/virtual mode switching error code storage register (SD504).

(b) Turn the M2043 off for switching from the virtual mode to real mode.

- If all axes of the virtual servomotors stopped, switch to the real mode, and the real mode/virtual mode status switching status flag (M2044) turns off.
- If the virtual servomotor is operating also with 1 axis, do not switch to the real mode. In this case, the real mode/virtual mode switching error detection flag (M2045) turns on, and the error code is stored in the real mode/virtual mode switching error code storage register (SD504).

(c) Refer to Chapter 9 for switching between the real mode and virtual modes.

(10) Real mode/virtual mode switching status flag (M2044) Status signal

This flag checks the switching completion between the real mode and virtual modes, and the current mode.

- This flag turns off with during the real mode or switching completion from the virtual mode to real mode.
- This flag turns on with switching completion from the real mode to virtual mode.

It can be used as an interlock for the servo program start or control change (speed change, current value change).

(11) Real mode/virtual mode switching error detection flag (M2045) Status signal

This flag is used as judgement of the error available/not available at the mode switching (between the real mode and virtual modes).

- This flag remains off if no error was detected at mode switching.
- This flag turns on if an error was detected at mode switching.

In this case, the error code is stored in the real mode/virtual mode switching error code storage register (SD504).

(12) Out-of-sync warning flag (M2046) Status signal

(a) This signal turns on mode when a discrepancy of synchronized positions between the drive module and output module occurs during the virtual mode.

It is used as judgement for validity of the continuation operation when the drive module has stopped.

- ON.....Continuation operation disabled
- OFFContinuation operation enabled

(b) This out-of-sync warning flag (M2046) turns on the following cases.

- Stop by the forced stop.
- The servo error in the output module.

(c) When the out-of-sync warning flag (M2046) turns on, resume operation by the following procedure.

1) Return to the real mode and eliminate the error cause.

↓

2) Synchronize the axes.

↓

3) Turn the out-of-sync warning flag (M2046) off.

↓

4) Switch to the virtual mode.

↓

5) Resume operation.

4 POSITIONING DEDICATED SIGNALS

(13) Motion slot fault detection flag (M2047) Status signal

This flag is used as judgement of which modules installed in the slot of Motion management are "normal" or "abnormal".

- ON Installed module is abnormal
- OFF Installed module is normal

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

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

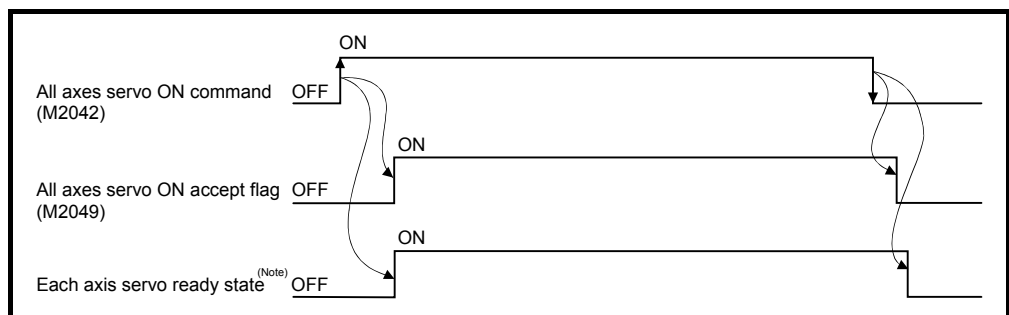
(14) JOG operation simultaneous start command (M2048) Command signal

- (a) When M2048 turns on, JOG operation simultaneous start based on the JOG operation execution axis set in the JOG operation simultaneous start axis setting register (D710 to D713).
- (b) When M2048 turns OFF, the operating axis decelerates to a stop.

(15) All axes servo ON accept flag (M2049) Status signal

This flag turns on when the Motion CPU accepts the all axes servo ON command (M2042).

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



(Note) : Refer to servo ready signal (M2415+20n) in Section 4.1.1 for details.

(16) Manual pulse generator enable flag (M2051 to M2053) Command signal

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

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

Default value is invalid (OFF).

REMARK

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

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

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

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

[Operation cycle over measures]

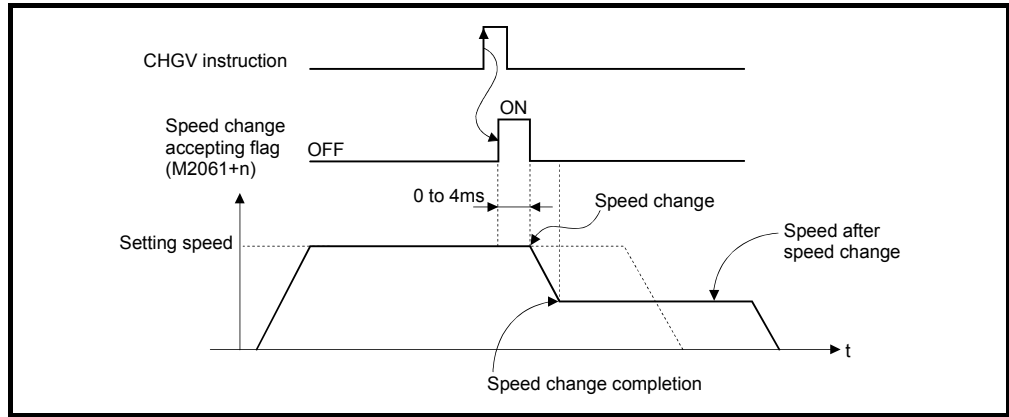
- 1) Change the operation cycle into a large value in the system setting.
- 2) The number of instruction completions of an event task or NMI task in the Motion SFC program.

4 POSITIONING DEDICATED SIGNALS

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

..... Status signal

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



The speed change accepting flag list is shown below.

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

(Note): The following range is valid.

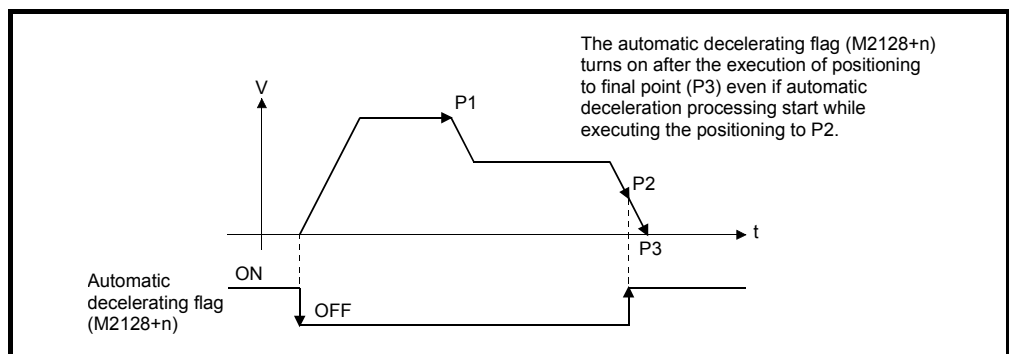
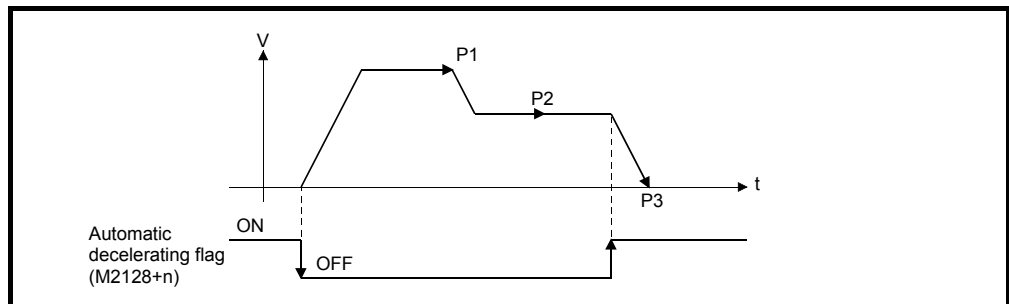
- Q172DSCPU : Axis No.1 to 16
- Q172DCPU(-S1) : Axis No.1 to 8

4 POSITIONING DEDICATED SIGNALS

(19) Automatic decelerating flag (M2128 to M2159) Status signal

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

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



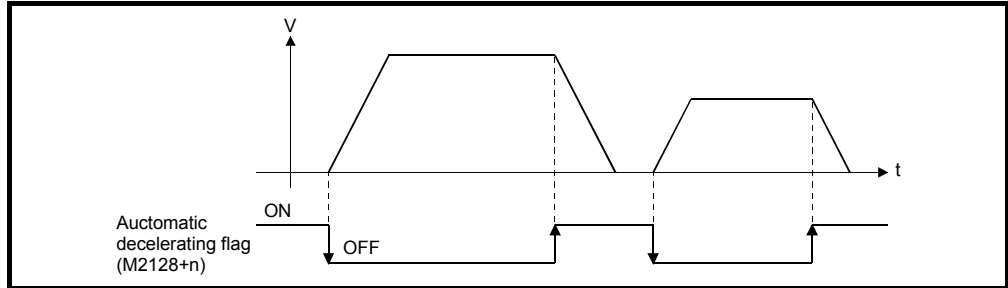
POINT

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

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

4 POSITIONING DEDICATED SIGNALS

- (e) In any of the following cases, the automatic decelerating flag (M2128+20n) does not turn off.
- During deceleration due to JOG signal off
 - During manual pulse generator operation
 - During deceleration due to stop command or stop cause occurrence
 - When travel value is 0



The automatic decelerating flag list is shown below.

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

(Note): The following range is valid.

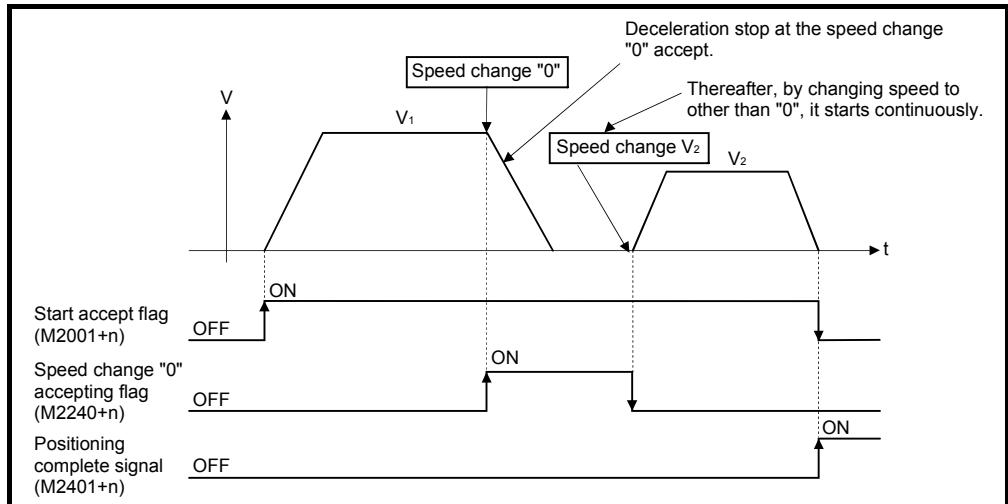
- Q172DSCPU : Axis No.1 to 16
- Q172DCPU(-S1) : Axis No.1 to 8

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

..... Status signal

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

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



4 POSITIONING DEDICATED SIGNALS

The speed change "0" accepting flag list is shown below.

| Axis No. | Device No. | Axis No. | Device No. | Axis No. | Device No. | Axis No. | Device No. |
|----------|------------|----------|------------|----------|------------|----------|------------|
| 1 | M2240 | 9 | M2248 | 17 | M2256 | 25 | M2264 |
| 2 | M2241 | 10 | M2249 | 18 | M2257 | 26 | M2265 |
| 3 | M2242 | 11 | M2250 | 19 | M2258 | 27 | M2266 |
| 4 | M2243 | 12 | M2251 | 20 | M2259 | 28 | M2267 |
| 5 | M2244 | 13 | M2252 | 21 | M2260 | 29 | M2268 |
| 6 | M2245 | 14 | M2253 | 22 | M2261 | 30 | M2269 |
| 7 | M2246 | 15 | M2254 | 23 | M2262 | 31 | M2270 |
| 8 | M2247 | 16 | M2255 | 24 | M2263 | 32 | M2271 |

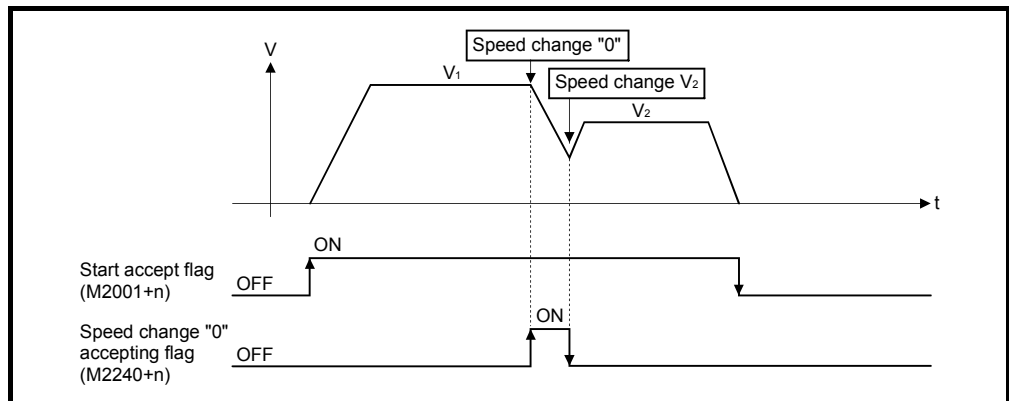
(Note): The following range is valid.

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

REMARK

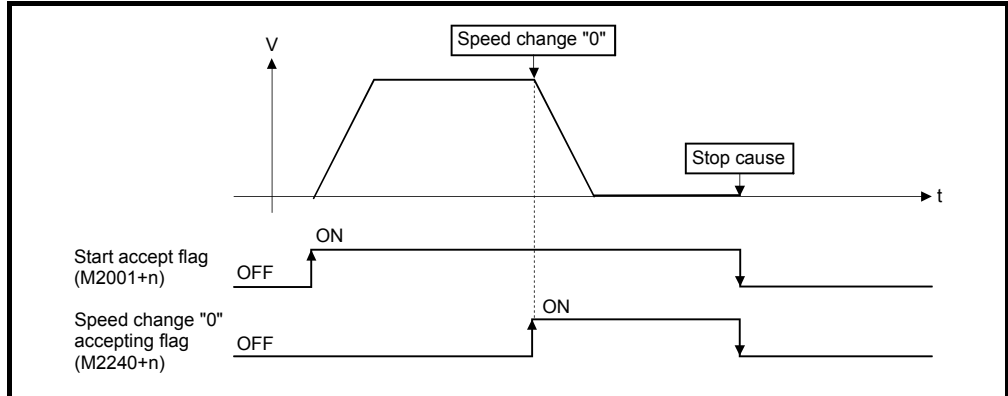
- (1) Even if it has stopped, when the start accept flag (M2001+n) is ON state, the state where the request of speed change "0" is accepted is indicated. Confirm by this speed change "0" accepting flag (M2240+n).
- (2) During interpolation, the flags corresponding to the interpolation axes are set.
-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

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

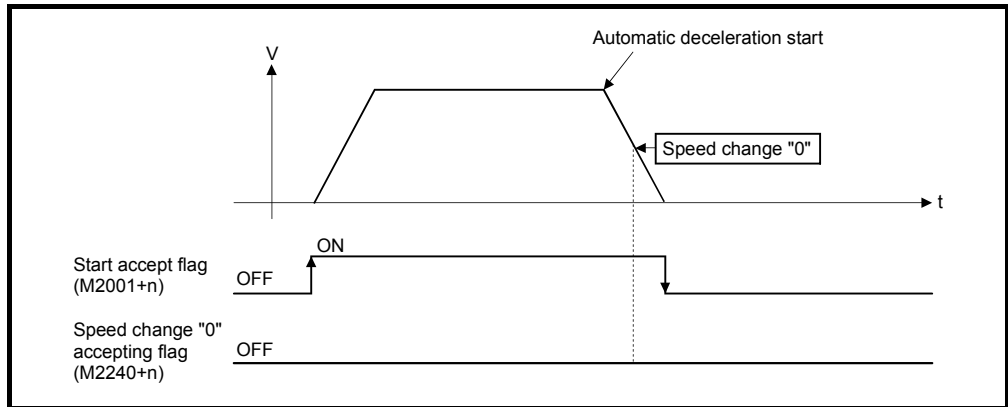


4 POSITIONING DEDICATED SIGNALS

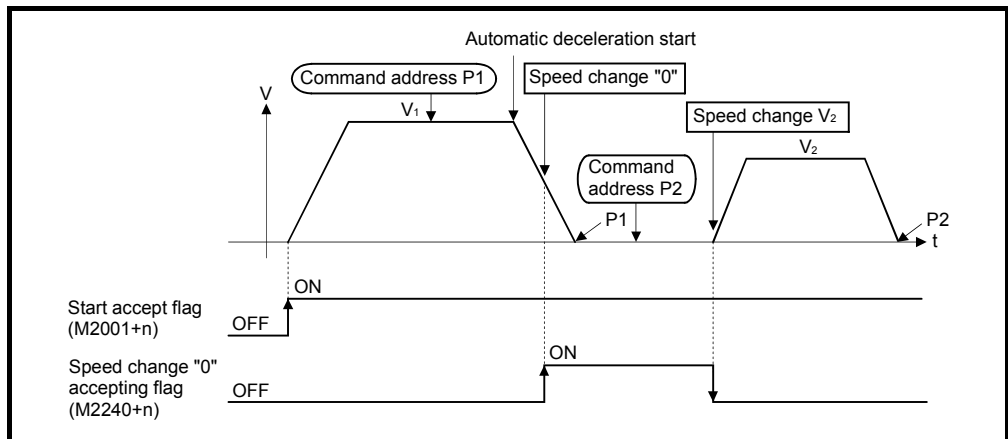
(b) The flag turns off if a stop cause occurs after speed change "0" accept.



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



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



REMARK

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

4 POSITIONING DEDICATED SIGNALS

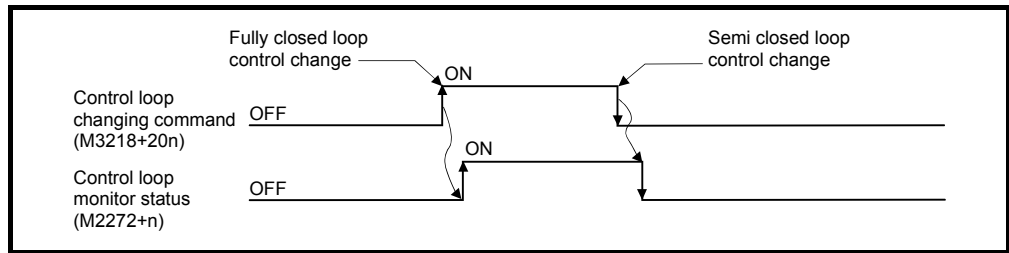
(21) Control loop monitor status (M2272 to M2303)

..... Command signal

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

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

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



The Control loop monitor status list is shown below.

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

(Note): The following range is valid.

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

4 POSITIONING DEDICATED SIGNALS

4.2 Data Registers

(1) Data register list

| SV22 | | | |
|----------------------|--|-----------------------------------|---------|
| Device No. | Application | Real | Virtual |
| D0 to | Axis monitor device (20 points × 32 axes) Real mode : Each axis Virtual mode : Output module | ○ | ○ |
| D640 to | Control change register (2 points × 32 axes) | ○ | ○ |
| D704 to | Common device (Command signal) (54 points) | ○ | ○ |
| D758 to | Unusable (42 points) | — | — |
| D800 | Virtual servomotor axis monitor device (6 points × 32 axes) <small>(Note-1)</small> | Backup | |
| | Current value after virtual servomotor axis main shaft's differential gear (4 points × 32 axes) <small>(Note-1)</small> | | |
| D1120 to | Synchronous encoder axis monitor device (6 points × 12 axes) | Backup <small>(Note-2)</small> | ○ |
| | Current value after synchronous encoder axis main shaft's differential gear (4 points × 12 axes) | Backup | |
| D1240 to | Cam axis monitor device (10 points × 32 axes) <small>(Note-1)</small> | | |
| D1560 to D8191 | User device (6632 points) | | |

Real/virtual community

Virtual

○ : Valid

□ It can be used as a user device.

4 POSITIONING DEDICATED SIGNALS

| POINT |
|---|
| (1) Total number of points for the user devices <u>6632 points</u> |
| (2) (Note-1) : This device occupies only the areas of the axes set in the mechanical system program. The unused axis areas in the mechanical system program can be used as a user side. |
| (3) (Note-2) : It is valid for the version (Refer to Section 1.4) that supports "synchronous encoder current value monitor in real mode". |
| (4) This manual describes only details for data registers used in the virtual mode. If it is required, refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)". |

4 POSITIONING DEDICATED SIGNALS

(2) Axis monitor device list

| Axis No. | Device No. | Signal name | | | | | | | | | |
|----------|--------------|-------------|---|--------------|-----|--|--|----------------|-----------------|-------------|------------------|
| | | Signal name | Real | Virtual | | | | Real mode axis | Refresh cycle | Fetch cycle | Signal direction |
| Roller | Ball screw | | | Rotary table | Cam | | | | | | |
| 1 | D0 to D19 | | | | | | | | | | |
| 2 | D20 to D39 | | | | | | | | | | |
| 3 | D40 to D59 | | | | | | | | | | |
| 4 | D60 to D79 | | | | | | | | | | |
| 5 | D80 to D99 | | | | | | | | | | |
| 6 | D100 to D119 | 0 | Feed current value/roller cycle speed | | | | | | Operation cycle | Immediately | Main cycle |
| 7 | D120 to D139 | 1 | Real current value | | | | | | | | |
| 8 | D140 to D159 | 2 | Deviation counter value | | | | | | | | |
| 9 | D160 to D179 | 3 | Minor error code | | | | | | | | |
| 10 | D180 to D199 | 4 | Major error code | | | | | | | | |
| 11 | D200 to D219 | 5 | Servo error code | | | | | | | | |
| 12 | D220 to D239 | 6 | Home position return re-travel value | | | | | | | | |
| 13 | D240 to D259 | 7 | Travel value after proximity dog ON | | | | | | | | |
| 14 | D260 to D279 | 8 | Execute program No. | | | | | | | | |
| 15 | D280 to D299 | 9 | M-code | | | | | | | | |
| 16 | D300 to D319 | 10 | Torque limit value | | | | | | | | |
| 17 | D320 to D339 | 11 | Data set pointer for constant-speed control | | | | | | | | |
| 18 | D340 to D359 | 12 | Unusable (Note-1) | | | | | | | | |
| 19 | D360 to D379 | 13 | Real current value at stop input | | | | | | | | |
| 20 | D380 to D399 | 14 | | | | | | | | | |
| 21 | D400 to D419 | 15 | | | | | | | | | |
| 22 | D420 to D439 | 16 | | | | | | | | | |
| 23 | D440 to D459 | 17 | | | | | | | | | |
| 24 | D460 to D479 | 18 | | | | | | | | | |
| 25 | D480 to D499 | 19 | | | | | | | | | |
| 26 | D500 to D519 | | | | | | | | | | |
| 27 | D520 to D539 | | | | | | | | | | |
| 28 | D540 to D559 | | | | | | | | | | |
| 29 | D560 to D579 | | | | | | | | | | |
| 30 | D580 to D599 | | | | | | | | | | |
| 31 | D600 to D619 | | | | | | | | | | |
| 32 | D620 to D639 | | | | | | | | | | |

○ : Valid, × : Invalid

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

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

POINT

(1) The following range is valid.

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

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

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

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

4 POSITIONING DEDICATED SIGNALS

(3) Control change register list

| Axis No. | Device No. | Signal name | | | | | | | | | | | | | | | | | | | |
|----------|-------------------|--|---|---|----------|----------------|------|-------------|---------------|-------------|------------------|-------------|------------------|---|-------------------|---|---|---|----------|----------------|---|
| 1 | D640, D641 | | | | | | | | | | | | | | | | | | | | |
| 2 | D642, D643 | | | | | | | | | | | | | | | | | | | | |
| 3 | D644, D645 | | | | | | | | | | | | | | | | | | | | |
| 4 | D646, D647 | | | | | | | | | | | | | | | | | | | | |
| 5 | D648, D649 | | | | | | | | | | | | | | | | | | | | |
| 6 | D650, D651 | <table border="1"> <thead> <tr> <th></th> <th>Signal name</th> <th>Real</th> <th>Virtual</th> <th>Refresh cycle</th> <th>Fetch cycle</th> <th>Signal direction</th> </tr> </thead> <tbody> <tr> <td>0</td> <td rowspan="2">JOG speed setting</td> <td rowspan="2">○</td> <td rowspan="2">○</td> <td rowspan="2">/</td> <td rowspan="2">At start</td> <td rowspan="2">Command device</td> </tr> <tr> <td>1</td> </tr> </tbody> </table> | | | | | | Signal name | Real | Virtual | Refresh cycle | Fetch cycle | Signal direction | 0 | JOG speed setting | ○ | ○ | / | At start | Command device | 1 |
| | Signal name | | | | | | Real | Virtual | Refresh cycle | Fetch cycle | Signal direction | | | | | | | | | | |
| 0 | JOG speed setting | ○ | ○ | / | At start | Command device | | | | | | | | | | | | | | | |
| 1 | | | | | | | | | | | | | | | | | | | | | |
| 7 | D652, D653 | | | | | | | | | | | | | | | | | | | | |
| 8 | D654, D655 | | | | | | | | | | | | | | | | | | | | |
| 9 | D656, D657 | | | | | | | | | | | | | | | | | | | | |
| 10 | D658, D659 | | | | | | | | | | | | | | | | | | | | |
| 11 | D660, D661 | | | | | | | | | | | | | | | | | | | | |
| 12 | D662, D663 | | | | | | | | | | | | | | | | | | | | |
| 13 | D664, D665 | | | | | | | | | | | | | | | | | | | | |
| 14 | D666, D667 | | | | | | | | | | | | | | | | | | | | |
| 15 | D668, D669 | | | | | | | | | | | | | | | | | | | | |
| 16 | D670, D671 | | | | | | | | | | | | | | | | | | | | |
| 17 | D672, D673 | | | | | | | | | | | | | | | | | | | | |
| 18 | D674, D675 | | | | | | | | | | | | | | | | | | | | |
| 19 | D676, D677 | | | | | | | | | | | | | | | | | | | | |
| 20 | D678, D679 | | | | | | | | | | | | | | | | | | | | |
| 21 | D680, D681 | | | | | | | | | | | | | | | | | | | | |
| 22 | D682, D683 | | | | | | | | | | | | | | | | | | | | |
| 23 | D684, D685 | | | | | | | | | | | | | | | | | | | | |
| 24 | D686, D687 | | | | | | | | | | | | | | | | | | | | |
| 25 | D688, D689 | | | | | | | | | | | | | | | | | | | | |
| 26 | D690, D691 | | | | | | | | | | | | | | | | | | | | |
| 27 | D692, D693 | | | | | | | | | | | | | | | | | | | | |
| 28 | D694, D695 | | | | | | | | | | | | | | | | | | | | |
| 29 | D696, D697 | | | | | | | | | | | | | | | | | | | | |
| 30 | D698, D699 | | | | | | | | | | | | | | | | | | | | |
| 31 | D700, D701 | | | | | | | | | | | | | | | | | | | | |
| 32 | D702, D703 | | | | | | | | | | | | | | | | | | | | |

○ : Valid

POINT

(1) The following range is valid.

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

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

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

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

4 POSITIONING DEDICATED SIGNALS

(4) Virtual servomotor axis monitor device list

| Axis No. | Device No. | Signal name | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|----------------|--|-------------|------------|--------------|-----|----------------|-----------------|----------|----------------|-----------------|------------------|---------------|-------------|------------------|-----|----------------|----------------------|--------|---|--|--|--|--|-----------------|----------|----------------|---|-----------------|--------------------|-------------|--------------------|-----------------------|-----------------|----------|--|---|--------------------------------|---|--|--|--|--|--|--|--|--|--|
| 1 | D800 to D809 | <table border="1"> <thead> <tr> <th rowspan="2">Signal name</th> <th rowspan="2">Real</th> <th colspan="5">Virtual</th> <th rowspan="2">Refresh cycle</th> <th rowspan="2">Fetch cycle</th> <th rowspan="2">Signal direction</th> </tr> <tr> <th>Roller</th> <th>Ball screw</th> <th>Rotary table</th> <th>Cam</th> <th>Real mode axis</th> </tr> </thead> <tbody> <tr> <td>0 Feed current value</td> <td rowspan="10">Backup</td> <td colspan="5" rowspan="10">○</td> <td rowspan="4">Operation cycle</td> <td rowspan="4">At start</td> <td rowspan="10">Monitor device</td> </tr> <tr> <td>1</td> <td rowspan="4">Operation cycle</td> </tr> <tr> <td>2 Minor error code</td> <td rowspan="2">Immediately</td> </tr> <tr> <td>3 Major error code</td> </tr> <tr> <td>4 Execute program No.</td> <td rowspan="5">Operation cycle</td> </tr> <tr> <td>5 M-code</td> </tr> <tr> <td>6 Current value after virtual servomotor axis main shaft's differential gear</td> </tr> <tr> <td>7</td> </tr> <tr> <td>8 Error search output axis No.</td> </tr> <tr> <td>9 Data set pointer for constant-speed control</td> </tr> </tbody> </table> | Signal name | Real | Virtual | | | | | Refresh cycle | Fetch cycle | Signal direction | Roller | Ball screw | Rotary table | Cam | Real mode axis | 0 Feed current value | Backup | ○ | | | | | Operation cycle | At start | Monitor device | 1 | Operation cycle | 2 Minor error code | Immediately | 3 Major error code | 4 Execute program No. | Operation cycle | 5 M-code | 6 Current value after virtual servomotor axis main shaft's differential gear | 7 | 8 Error search output axis No. | 9 Data set pointer for constant-speed control | | | | | | | | | |
| Signal name | Real | | | | Virtual | | | | | | | | Refresh cycle | Fetch cycle | Signal direction | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Roller | Ball screw | Rotary table | Cam | Real mode axis | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 Feed current value | Backup | | ○ | | | | | Operation cycle | At start | Monitor device | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | | | | | | | | | | Operation cycle | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 Minor error code | | | | | | | | | | | | Immediately | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 Major error code | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 Execute program No. | | | | | | | | Operation cycle | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 M-code | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 Current value after virtual servomotor axis main shaft's differential gear | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 Error search output axis No. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 Data set pointer for constant-speed control | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | D810 to D819 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | D820 to D829 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | D830 to D839 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | D840 to D849 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | D850 to D859 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | D860 to D869 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | D870 to D879 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | D880 to D889 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | D890 to D899 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | D900 to D909 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | D910 to D919 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13 | D920 to D929 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 | D930 to D939 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | D940 to D949 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16 | D950 to D959 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 17 | D960 to D969 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 18 | D970 to D979 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 19 | D980 to D989 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20 | D990 to D999 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 21 | D1000 to D1009 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 22 | D1010 to D1019 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 23 | D1020 to D1029 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 24 | D1030 to D1039 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25 | D1040 to D1049 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 26 | D1050 to D1059 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 27 | D1060 to D1069 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 28 | D1070 to D1079 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 29 | D1080 to D1089 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 30 | D1090 to D1099 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 31 | D1100 to D1109 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 32 | D1110 to D1119 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

○ : Valid, × : Invalid

POINT

(1) The following range is valid.

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

(2) The unused axis areas in the mechanical system program can be used as a user device.

4 POSITIONING DEDICATED SIGNALS

(5) Synchronous encoder axis monitor device list

| Axis No. | Device No. | Signal name | | | | | Signal direction | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|----------|---|--|--------------------|-------------|-----------------|-------------|------------------|-------------|------------------|---|---------------|--------------------|---|-----------------|---|----------------|---|-------------|---|------------------|--------|--|--|--|--|---|------------------|---|----------|---|---|---|---|---|---|--|--|--|--|--|---|---|--------|---|-----------------|---|----------------|---|--|---|------------------------------|--|--|--|--|--|---|----------|---|---|---|---|---|--|
| 1 | D1120 to D1129 | <table border="1"> <thead> <tr> <th></th> <th>Signal name</th> <th>Real</th> <th>Virtual</th> <th>Refresh cycle</th> <th>Fetch cycle</th> <th>Signal direction</th> </tr> </thead> <tbody> <tr> <td>0</td> <td rowspan="2">Current value</td> <td rowspan="2">Backup (Note-1)</td> <td rowspan="2">○</td> <td>Operation cycle</td> <td rowspan="2">/</td> <td rowspan="2">Monitor device</td> </tr> <tr> <td>1</td> <td>Immediately</td> </tr> <tr> <td>2</td> <td>Minor error code</td> <td rowspan="2">Backup</td> <td rowspan="2"></td> <td rowspan="2"></td> <td rowspan="2"></td> <td rowspan="2"></td> </tr> <tr> <td>3</td> <td>Major error code</td> </tr> <tr> <td>4</td> <td rowspan="2">Unusable</td> <td>—</td> <td>—</td> <td>—</td> <td>—</td> <td>—</td> </tr> <tr> <td>5</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>6</td> <td rowspan="2">Current value after synchronous encoder axis main shaft's differential gear</td> <td rowspan="2">Backup</td> <td rowspan="2">○</td> <td rowspan="2">Operation cycle</td> <td rowspan="2">/</td> <td rowspan="2">Monitor device</td> </tr> <tr> <td>7</td> <td></td> </tr> <tr> <td>8</td> <td>Error search output axis No.</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>9</td> <td>Unusable</td> <td>—</td> <td>—</td> <td>—</td> <td>—</td> <td>—</td> </tr> </tbody> </table> | | Signal name | Real | Virtual | Refresh cycle | Fetch cycle | Signal direction | 0 | Current value | Backup (Note-1) | ○ | Operation cycle | / | Monitor device | 1 | Immediately | 2 | Minor error code | Backup | | | | | 3 | Major error code | 4 | Unusable | — | — | — | — | — | 5 | | | | | | 6 | Current value after synchronous encoder axis main shaft's differential gear | Backup | ○ | Operation cycle | / | Monitor device | 7 | | 8 | Error search output axis No. | | | | | | 9 | Unusable | — | — | — | — | — | |
| | Signal name | | Real | Virtual | Refresh cycle | Fetch cycle | Signal direction | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | Current value | | Backup (Note-1) | ○ | Operation cycle | / | Monitor device | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | | | | Immediately | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Minor error code | | Backup | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | Major error code | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | Unusable | | — | — | — | — | — | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | Current value after synchronous encoder axis main shaft's differential gear | | Backup | ○ | Operation cycle | / | Monitor device | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | Error search output axis No. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | Unusable | | — | — | — | — | — | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | D1130 to D1139 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | D1140 to D1149 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | D1150 to D1159 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | D1160 to D1169 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | D1170 to D1179 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | D1180 to D1189 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | D1190 to D1199 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | D1200 to D1209 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | D1210 to D1219 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | D1220 to D1229 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | D1230 to D1239 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

○ : Valid

(Note-1): It is valid for the version (Refer to Section 1.4) that supports "synchronous encoder current value monitor in real mode".

POINT

- (1) It is unusable in the SV22 real mode.
- (2) The range of axis No.1 to 8 is valid in the Q172DCPU(-S1).
- (3) The device area of 9 axes or more can be used as a user device.
However, when the project of Q172DCPU(-S1) is replaced with Q173DSCPU/
Q172DSCPU/Q173DCPU(-S1), this area cannot be used.

4 POSITIONING DEDICATED SIGNALS

(6) Cam axis monitor device list

| Axis No. | Device No. | Signal name | | | | |
|----------|----------------|-------------|-----------------------|--------|---|-----------------|
| 1 | D1240 to D1249 | | | | | |
| 2 | D1250 to D1259 | | | | | |
| 3 | D1260 to D1269 | | | | | |
| 4 | D1270 to D1279 | 0 | Unusable | — | — | — |
| 5 | D1280 to D1289 | 1 | Execute cam No. | Backup | ○ | Operation cycle |
| 6 | D1290 to D1299 | 2 | Execute stroke amount | | | |
| 7 | D1300 to D1309 | 3 | | | | |
| 8 | D1310 to D1319 | 4 | | | | |
| 9 | D1320 to D1329 | 5 | revolution | | | |
| 10 | D1330 to D1339 | 6 | Unusable | — | — | — |
| 11 | D1340 to D1349 | 7 | | | | |
| 12 | D1350 to D1359 | 8 | | | | |
| 13 | D1360 to D1369 | 9 | | | | |
| 14 | D1370 to D1379 | | | | | |
| 15 | D1380 to D1389 | | | | | |
| 16 | D1390 to D1399 | | | | | |
| 17 | D1400 to D1409 | | | | | |
| 18 | D1410 to D1419 | | | | | |
| 19 | D1420 to D1429 | | | | | |
| 20 | D1430 to D1439 | | | | | |
| 21 | D1440 to D1449 | | | | | |
| 22 | D1450 to D1459 | | | | | |
| 23 | D1460 to D1469 | | | | | |
| 24 | D1470 to D1479 | | | | | |
| 25 | D1480 to D1489 | | | | | |
| 26 | D1490 to D1499 | | | | | |
| 27 | D1500 to D1509 | | | | | |
| 28 | D1510 to D1519 | | | | | |
| 29 | D1520 to D1529 | | | | | |
| 30 | D1530 to D1539 | | | | | |
| 31 | D1540 to D1549 | | | | | |
| 32 | D1550 to D1559 | | | | | |

○ : Valid

POINT

(1) The following range is valid.

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

(2) The unused axis areas in the mechanical system program can be used as a user device.

4 POSITIONING DEDICATED SIGNALS

(7) Common device list

| Device No. | Signal name | Refresh cycle | Fetch cycle | Signal direction | Device No. | Signal name | Refresh cycle | Fetch cycle | Signal direction |
|------------|--|---------------|---|------------------|------------|---|---------------|---|------------------|
| D704 | PLC ready flag request | / | Main cycle | Command device | D752 | Manual pulse generator 1 smoothing magnification setting register | / | At the manual pulse generator enable flag OFF to ON | Command device |
| D705 | Speed switching point specified flag request | | | | D753 | Manual pulse generator 2 smoothing magnification setting register | | | |
| D706 | All axes servo ON command request | | | | D754 | Manual pulse generator 3 smoothing magnification setting register | | | |
| D707 | Real mode/virtual mode switching request (SV22) | | | | D755 | Manual pulse generator 1 enable flag request | | | |
| D708 | JOG operation simultaneous start command request | | | | D756 | Manual pulse generator 2 enable flag request | | | |
| D709 | Unusable | — | — | — | D757 | Manual pulse generator 3 enable flag request | / | Main cycle | Command device |
| D710 | JOG operation simultaneous start axis setting register | / | At start | Command device | D758 | Unusable (42 points) | — | — | — |
| D711 | | | At the manual pulse generator enable flag OFF to ON | | D759 | | | | |
| D712 | | | | | D760 | | | | |
| D713 | | | | | D761 | | | | |
| D714 | Manual pulse generator axis 1 No. setting register | D762 | | | | | | | |
| D715 | Manual pulse generator axis 2 No. setting register | D763 | | | | | | | |
| D716 | Manual pulse generator axis 3 No. setting register | D764 | | | | | | | |
| D717 | Axis 1 | D765 | | | | | | | |
| D718 | Axis 2 | D766 | | | | | | | |
| D719 | Axis 3 | D767 | | | | | | | |
| D720 | Axis 4 | D768 | | | | | | | |
| D721 | Axis 5 | D769 | | | | | | | |
| D722 | Axis 6 | D770 | | | | | | | |
| D723 | Axis 7 | D771 | | | | | | | |
| D724 | Axis 8 | D772 | | | | | | | |
| D725 | Axis 9 | D773 | | | | | | | |
| D726 | Axis 10 | D774 | | | | | | | |
| D727 | Axis 11 | D775 | | | | | | | |
| D728 | Axis 12 | D776 | | | | | | | |
| D729 | Axis 13 | D777 | | | | | | | |
| D730 | Axis 14 | D778 | | | | | | | |
| D731 | Axis 15 | D779 | | | | | | | |
| D732 | Axis 16 | D780 | | | | | | | |
| D733 | Axis 17 | D781 | | | | | | | |
| D734 | Axis 18 | D782 | | | | | | | |
| D735 | Axis 19 | D783 | | | | | | | |
| D736 | Axis 20 | D784 | | | | | | | |
| D737 | Axis 21 | D785 | | | | | | | |
| D738 | Axis 22 | D786 | | | | | | | |
| D739 | Axis 23 | D787 | | | | | | | |
| D740 | Axis 24 | D788 | | | | | | | |
| D741 | Axis 25 | D789 | | | | | | | |
| D742 | Axis 26 | D790 | | | | | | | |
| D743 | Axis 27 | D791 | | | | | | | |
| D744 | Axis 28 | D792 | | | | | | | |
| D745 | Axis 29 | D793 | | | | | | | |
| D746 | Axis 30 | D794 | | | | | | | |
| D747 | Axis 31 | D795 | | | | | | | |
| D748 | Axis 32 | D796 | | | | | | | |
| D749 | Axis 1 | D797 | | | | | | | |
| D750 | Axis 2 | D798 | | | | | | | |
| D751 | Axis 3 | D799 | | | | | | | |

(Note-1): The following range is valid.

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

(Note-2): The following device area is unusable.

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

4 POSITIONING DEDICATED SIGNALS

4.2.1 Axis monitor devices

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

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

Refer to "APPENDIX 3 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.

(1) Feed current value/roller cycle speed storage register (D0+20n, D1+20n) Monitor device

- (a) The target address which is output to the servo amplifier is stored in this register. The target address is based on the command address calculated from the mechanical system program settings.
- (b) The stroke range check is performed on this feed current value data.
- (c) Roller cycle speed is stored.

The storage range for cycle speed the roller cycle speed storage register is shown below.

| Setting Units | Storage Range | Real Roller Cycle Speed |
|---------------|----------------|--------------------------------|
| mm | 1 to 600000000 | 0.01 to 6000000.00 [mm/min] |
| inch | | 0.001 to 600000.000 [inch/min] |

(2) Real current value storage register (D2+20n, D3+20n) Monitor device

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

(3) Deviation counter value storage register (D4+20n, D5+20n) Monitor device

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

(4) Minor error code storage register (D6+20n) Monitor device

- (a) This register stores the corresponding error code (Refer to APPENDIX 1.4 and 1.6) at the minor error occurrence. If another minor error occurs after error code storing, the previous error code is overwritten by the new error code.
- (b) Minor error codes can be cleared by an error reset command (M3207+20n).

- (5) Major error code storage register (D7+20n) Monitor device
- (a) This register stores the corresponding error code (Refer to APPENDIX 1.4 and 1.6) at the major error occurrence. If another major error occurs after error code storing, the previous error code is overwritten by the new error code.
 - (b) Major error codes can be cleared by an error reset command (M3207+20n).
- (6) Servo error code storage register (D8+20n) Monitor device
- (a) This register stores the corresponding error code (Refer to APPENDIX 1.5) at the servo error occurrence. If another servo error occurs after error code storing, the previous error code is overwritten by the new error code.
 - (b) It returns to the real mode by the servo error.
- (7) Torque limit value storage register (D14+20n) Monitor device
- (a) This register stores the positive direction torque limit value to command the servo amplifier (unit: [%]).
The default value "300[%]" is stored at the power supply of servo amplifier ON.
 - (b) To monitor the positive/negative direction torque limit value, set "Positive Direction Torque Limit Value Monitor Device" and "Negative Direction Torque Limit Value Monitor Device" with the expansion parameter. **QDS**
(Refer to "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)" for details of expansion parameter.)

4 POSITIONING DEDICATED SIGNALS

4.2.2 Control change registers

This area stores the JOG operation speed data of the virtual servomotor axis.

Table 4.3 Data storage area for control change list

| Name | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 |
|----------------------------|------------|------------|------------|------------|------------|------------|------------|------------|
| JOG speed setting register | D641, D640 | D643, D642 | D645, D644 | D647, D646 | D649, D648 | D651, D650 | D653, D652 | D655, D654 |
| | Axis 9 | Axis 10 | Axis 11 | Axis 12 | Axis 13 | Axis 14 | Axis 15 | Axis 16 |
| | D657, D656 | D659, D658 | D661, D660 | D663, D662 | D665, D664 | D667, D666 | D669, D668 | D671, D670 |
| | Axis 17 | Axis 18 | Axis 19 | Axis 20 | Axis 21 | Axis 22 | Axis 23 | Axis 24 |
| | D673, D672 | D675, D674 | D677, D676 | D679, D678 | D681, D680 | D683, D682 | D685, D684 | D687, D686 |
| | Axis 25 | Axis 26 | Axis 27 | Axis 28 | Axis 29 | Axis 30 | Axis 31 | Axis 32 |
| | D689, D688 | D691, D690 | D693, D692 | D695, D694 | D697, D696 | D699, D698 | D701, D700 | D703, D702 |

(Note): The following range is valid.

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

(1) JOG speed setting registers (D640+2n, D641+2n)

..... Command device

(a) This register stores the JOG speed at the JOG operation.

(b) Setting range of the JOG speed is shown below.

| Item | Unit | pulse | |
|-----------|-----------------|-----------|--|
| | Setting Range | Unit | |
| JOG speed | 1 to 2147483647 | [pulse/s] | |

(c) The JOG speed is the value stored in the JOG speed setting registers (D640+2n, D641+2n) at leading edge of the JOG start signal.

Even if data is changed during JOG operation, JOG speed cannot be changed.

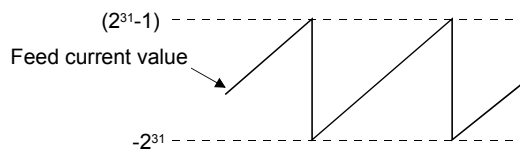
(d) Refer to Section 6.21 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)" for details of the JOG operation.

4 POSITIONING DEDICATED SIGNALS

4.2.3 Virtual servomotor axis monitor devices

(1) Feed current value storage register (D800+10n, D801+10n)
..... Monitor device

- (a) This register stores the target address output to the servo amplifier based on the positioning address/travel value specified with the servo program.
- (b) The stroke range check is performed on this feed current value data.
- (c) Ring address is -2^{31} [-2^{31}] [pulse] to $2^{31}-1$ [$2^{31}-1$] [pulse] in the infinite operation.



- (d) The data of feed current value storage register is also stored in a backup memory at the power supply off or resetting of the Multiple CPU system.

(2) Minor error code storage register (D802+10n)
..... Monitor device

- (a) This register stores the corresponding error code (refer to APPENDIX 1.4 and 1.6) at the minor error occurrence in the virtual servomotor or output module. If another minor error occurs after error code storing, the previous error code is overwritten by the new error code.
- (b) Minor error codes in the virtual servomotor can be cleared by an error reset command ^(Note-1) of the drive module.
Minor error codes in the output module can be cleared by an error reset command ^(Note-2) of the output module.

REMARK

(Note-1): Refer to Section 4.1.4 for details of the error reset command for the virtual servomotor axis.

(Note-2): Refer to Section 4.1.2 for details of the error reset command for the output module.

(3) Major error code storage register (D803+10n) Monitor device

- (a) This register stores the corresponding error code (refer to APPENDIX 1.4 and 1.6) at the major error occurrence in the virtual servomotor or output module. If another major error occurs after error code storing, the previous error code is overwritten by the new error code.

- (b) Major error codes in the virtual servomotor can be cleared by an error reset command ^(Note-1) of the drive module.
Major error codes in the output module can be cleared by an error reset command ^(Note-2) of the output module.

REMARK

(Note-1): Refer to Section 4.1.4 for details of the error reset command for the virtual servomotor axis.

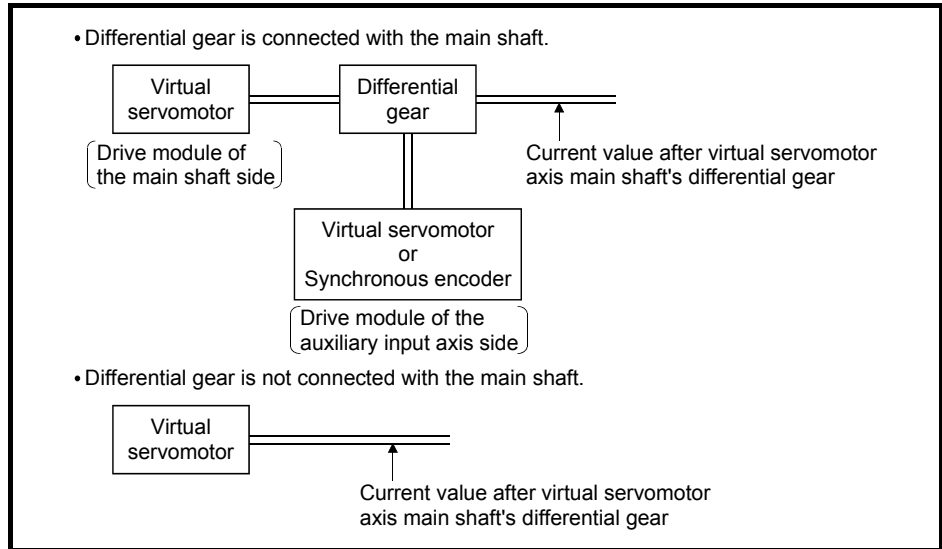
(Note-2): Refer to Section 4.1.2 for details of the error reset command for the output module.

4 POSITIONING DEDICATED SIGNALS

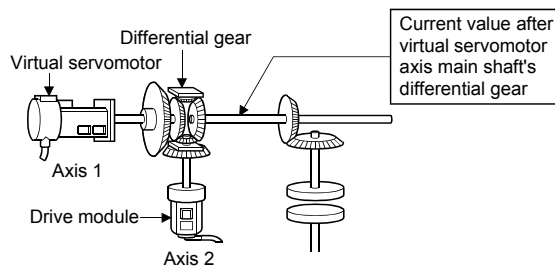
4.2.4 Current value after virtual servomotor axis main shaft's differential gear

- (1) Current value after virtual servomotor axis main shaft's differential gear storage register (D806+10n, D807+10n)

..... Monitor device



- (a) The current value will be the same as the drive module current value of the main shaft side at the virtual mode switching.
- (b) When the current value change is executed toward the drive module current value of the main shaft side, the current value after main shaft's differential gear is also simultaneous changed to the specified current value.
- (c) If the differential gear is not connected with the main shaft, drive module feed current value of the main shaft side is always stored in the current value storage register after main shaft's differential gear.
- (d) In the case of following figure, use "current value after virtual servomotor axis main shaft's differential gear" of axis 1 as "current value after virtual servomotor axis main shaft's differential gear".
(The drive module feed current value of the auxiliary input axis side is stored as "current value after virtual servomotor axis main shaft's differential gear" of axis 2.)



- (2) Error search output axis No. storage register (D808+10n)
..... Monitor device
- (a) This register stores the axis No. of the output module in error by the error search function in the virtual mode.
 - (b) If there are no errors at the virtual servomotor axes of the main shaft and auxiliary input axis, the error occurrence output axis No. is stored into the error search output axis No. storage register of the corresponding drive module No. when a minor or major error occurs at the connected output axis.
 - (c) Error search and error reset
 - 1) Searching the main shaft for error
The output axes connected to the main shaft are searched for an error in order of lower to higher numbers. If either a minor or major error has occurred, the corresponding output axis No. is stored into the error search output axis No. storage register.
Resetting the error of the corresponding output axis stores the other error occurrence output axis No. connected to the same main shaft.
 - 2) Searching the auxiliary input axis for error
If either a minor or major error has occurred at the output axis connected to the auxiliary input axis, the corresponding output axis No. is stored into the error search output axis No. storage register.
However, when the differential gear (for virtual main shaft connection) is used to provide auxiliary input to the main shaft, the output axis connected to the auxiliary input axis is not searched for an error. Use the main shaft side error search output axis No. storage register to confirm the error occurrence output axis No.
 - (d) When error occurs at the drive module axis
When an error occurs at the main shaft/auxiliary input axis to which the output axis is connected, "0" (no error) is stored into the error search output axis No. storage device if an error occurred at the output axis.

4.2.5 Synchronous encoder axis monitor devices

- (1) Current value storage register (D1120+10n, D1121+10n) Monitor device
 - (a) This register stores the synchronous encoder current value.
 - (b) Ring address is "-2147483648 (-2^{31}) to 2147483647 ($2^{31}-1$)" [pulse].
 - (c) The current value storage register data is also stored in a backup memory at the power supply off or resetting of the Multiple CPU system.

- (2) Minor error code storage register (D1122+10n) Monitor device
 - (a) This register stores the corresponding error code (refer to APPENDIX 1.4 and 1.6) at the minor error occurrence in the synchronous encoder or output module. If another minor error occurs after error code storing, the previous error code is overwritten by the new error code.

 - (b) Minor error codes in the synchronous encoder can be cleared by an error reset command ^(Note-1) of the synchronous encoder axis.
Minor error codes in the output module can be cleared by an error reset command ^(Note-2) of the output module.

| |
|---------------|
| REMARK |
|---------------|

(Note-1): Refer to Section 4.1.6 for details of the error reset command for the synchronous encoder axis.

(Note-2): Refer to Section 4.1.2 for details of the error reset command for the output module.

- (3) Major error code storage register (D1123+10n) Monitor device
 - (a) This register stores the corresponding error code (refer to APPENDIX 1.4 and 1.6) at the major error occurrence in the synchronous encoder or output module. If another major error occurs after error code storing, the previous error code is overwritten by the new error code.

 - (b) Major error codes in the synchronous encoder axis can be cleared by an error reset command ^(Note-1) of the synchronous encoder.
Major error codes in the output module can be cleared by an error reset command ^(Note-2) of the output module.

| |
|---------------|
| REMARK |
|---------------|

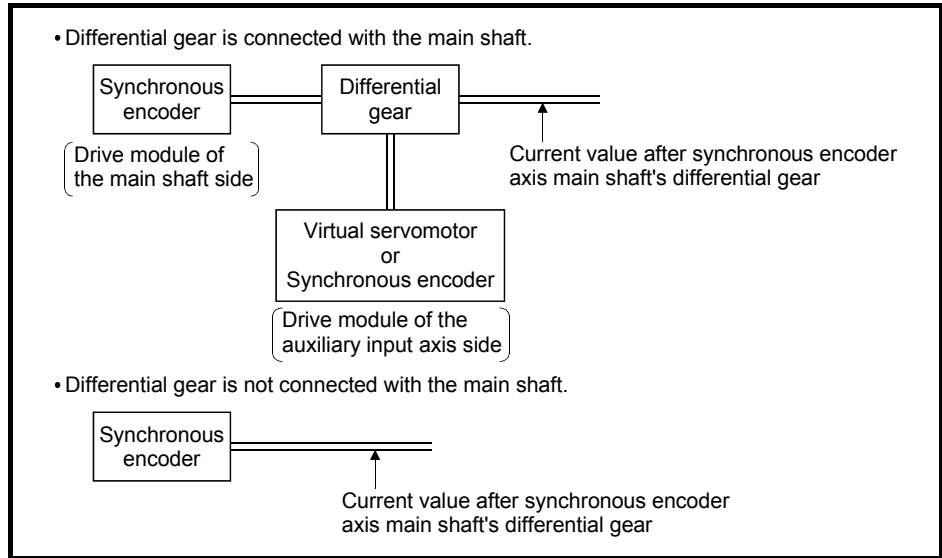
(Note-1): Refer to Section 4.1.6 for details of the error reset command for the synchronous encoder axis.

(Note-2): Refer to Section 4.1.2 for details of the error reset command for the output module.

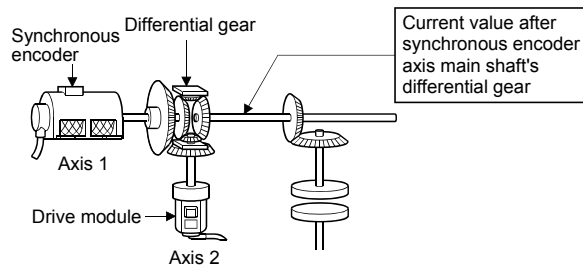
4 POSITIONING DEDICATED SIGNALS

4.2.6 Current value after synchronous encoder axis main shaft's differential gear

- (1) Current value after synchronous encoder axis main shaft's differential gear storage registers (D1126+10n, D1127+10n)
 Monitor device



- (a) The current value will be the same as the drive module current value of the main shaft side at the virtual mode switching.
- (b) When the current value change is executed toward the drive module current value of the main shaft side, the current value after main shaft's differential gear is also simultaneous changed to the specified current value.
- (c) If the differential gear is not connected with the main shaft, drive module current value of the main shaft side is always stored in the current value storage register after main shaft's differential gear.
- (d) In the case of following figure, use "current value after synchronous encoder axis main shaft's differential gear" of axis 1 as "current value after synchronous encoder axis main shaft's differential gear".
 (The drive module feed current value of the auxiliary input axis side is stored as "current value after synchronous encoder axis main shaft's differential gear" of axis 2.)

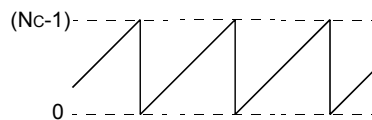


- (2) Error search output axis No. storage register (D1128+10n)
..... Monitor device
- (a) This register stores the axis No. of the output module in error by the error search function in the virtual mode.
 - (b) If there are no errors at the synchronous encoder axes of the main shaft and auxiliary input axis, the error occurrence output axis No. is stored into the error search output axis No. storage register of the corresponding drive module No. when a minor or major error occurs at the connected output axis.
 - (c) Error search and error reset
 - 1) Searching the main shaft for error
The output axes connected to the main shaft are searched for an error in order of lower to higher numbers. If either a minor or major error has occurred, the corresponding output axis No. is stored into the error search output axis No. storage register.
Resetting the error of the corresponding output axis stores the other error occurrence output axis No. connected to the same main shaft.
 - 2) Searching the auxiliary input axis for error
If either a minor or major error has occurred at the output axis connected to the auxiliary input axis, the corresponding output axis No. is stored into the error search output axis No. storage register.
However, when the differential gear (for virtual main shaft connection) is used to provide auxiliary input to the main shaft, the output axis connected to the auxiliary input axis is not searched for an error. Use the main shaft side error search output axis No. storage register to confirm the error occurrence output axis No.
 - (d) When error occurs at the drive module axis
When an error occurs at the main shaft/auxiliary input axis to which the output axis is connected, "0" (no error) is stored into the error search output axis No. storage device if an error occurred at the output axis.

4 POSITIONING DEDICATED SIGNALS

4.2.7 Cam axis monitor devices

- (1) Execute cam No. storage register (D1241+10n) Monitor device
 - (a) This register stores the cam No. currently being controlled.
 - (b) Cam No. of the execute cam No. storage register is held until next cam is executed. (Cam No. is not cleared, even if cam control is completed.)
- (2) Execute stroke amount storage register (D1242+10n, D1243+10n) Monitor device
 - (a) This register stores the stroke amount currently being controlled.
- (3) Current value within 1 cam shaft revolution storage register (D1244+10n, D1245+10n) Monitor device
 - (a) This register stores the current value within 1 cam shaft revolution set in the parameter.
The current value is a ring address of "0 to [Number of pulses per cam shaft revolution (Nc)-1]".



4 POSITIONING DEDICATED SIGNALS

4.2.8 Common devices

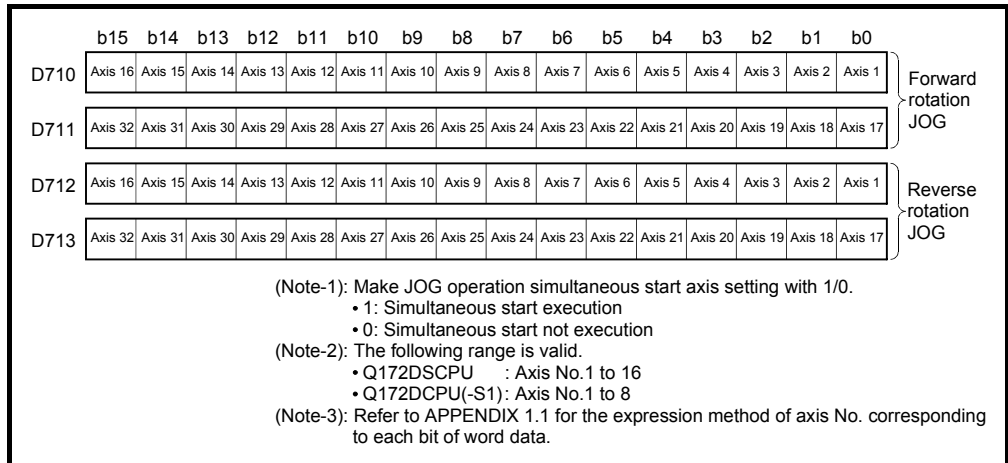
- (1) Common bit device SET/RST request register (D704 to D708, D755 to D757) Command device
 Because cannot be turn on/off in every bit from the PLC CPU, the bit device is assigned to data register (D), and each bit device turns on with the lowest rank bit 0 to 1 and each bit device becomes off with 1 to 0.
 The details of request register are shown below.
 (Refer to Section "4.1.7 Common devices" for the bit device M2000 to M2053.)

Details of the request register

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

(Note-1): It can also be ordered the device of a remark column.

- (2) JOG operation simultaneous start axis setting registers (D710 to D713) Command device
 (a) These registers set the virtual servomotor axis No. and direction which start simultaneously the JOG operation.

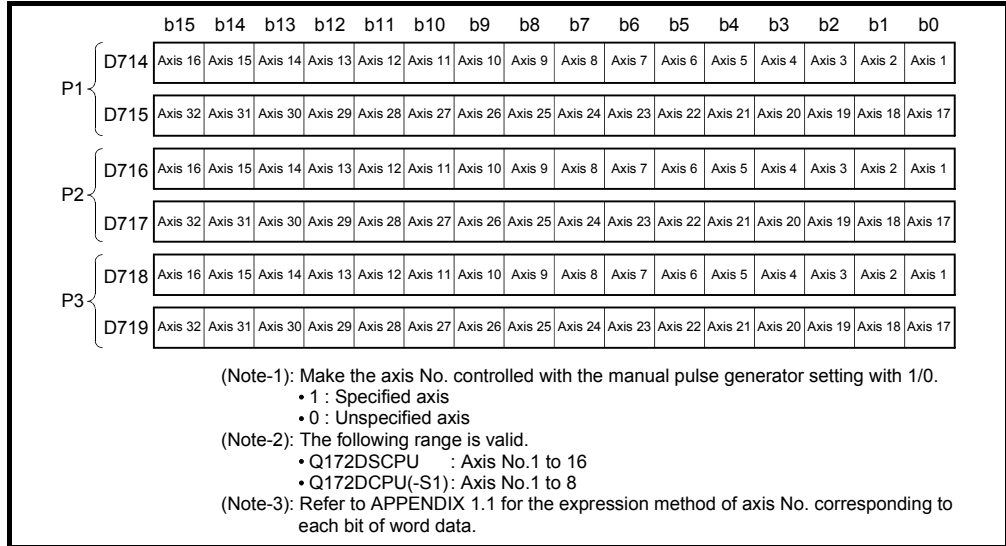


- (b) Refer to Section 6.21.3 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)" for details of the JOG operation simultaneous start.

4 POSITIONING DEDICATED SIGNALS

(3) Manual pulse generator axis No. setting registers (D714 to D719) Command signal

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



(b) Refer to Section 6.22 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)" for details of the manual pulse generator operation.

(4) Manual pulse generator 1-pulse input magnification setting registers (D720 to D751) Command device

(a) These register set the magnification (1 to 10000) per pulse of number of the input pulses from manual pulse generator at the pulse generator operation.

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

(Note): The following range is valid.
 • Q172DSCPU : Axis No.1 to 16
 • Q172DCPU(-S1): Axis No.1 to 8

4 POSITIONING DEDICATED SIGNALS

(b) Refer to Section 6.22 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)" for details of the manual pulse generator operation.

(5) Manual pulse generator smoothing magnification setting registers (D752 to D754) Command device

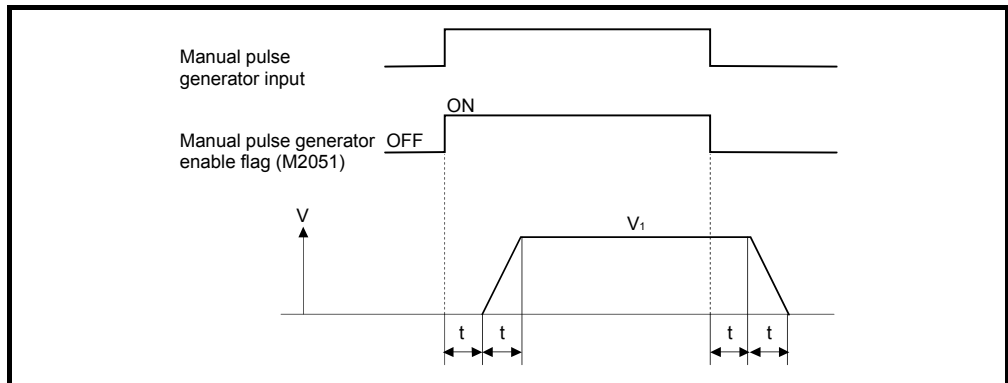
(a) These registers set the smoothing time constants of manual pulse generators.

| Manual pulse generator smoothing magnification setting register | Setting range |
|---|---------------|
| Manual pulse generator 1 (P1): D752 | 0 to 59 |
| Manual pulse generator 2 (P2): D753 | |
| Manual pulse generator 3 (P3): D754 | |

(b) When the smoothing magnification is set, the smoothing time constant is as indicated by the following expression.

$$\text{Smoothing time constant (t)} = (\text{Smoothing magnification} + 1) \times 56.8 \text{ [ms]}$$

(c) Operation



$$\text{Output speed (V}_1\text{) [pulse/s]} = (\text{Number of input pulses/s}) \times (\text{Manual pulse generator 1-pulse input magnification setting})$$

$$\text{Travel value (L)} = (\text{Number of input pulses}) \times (\text{Manual pulse generator 1-pulse input magnification setting})$$

(d) The manual pulse operation in the virtual mode is effective at the only test mode.

REMARK

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

4 POSITIONING DEDICATED SIGNALS

4.3 Motion Registers (#)

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

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

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

| Axis No. | Device No. | Signal name | | |
|----------|----------------|-------------|--|--|
| 1 | #8000 to #8019 | | | |
| 2 | #8020 to #8039 | | | |
| 3 | #8040 to #8059 | | | |
| 4 | #8060 to #8079 | | | |
| 5 | #8080 to #8099 | | | |
| 6 | #8100 to #8119 | | | |
| 7 | #8120 to #8139 | | | |
| 8 | #8140 to #8159 | | | |
| 9 | #8160 to #8179 | | | |
| 10 | #8180 to #8199 | | | |
| 11 | #8200 to #8219 | | | |
| 12 | #8220 to #8239 | | | |
| 13 | #8240 to #8259 | | | |
| 14 | #8260 to #8279 | | | |
| 15 | #8280 to #8299 | | | |
| 16 | #8300 to #8319 | | | |
| 17 | #8320 to #8339 | | | |
| 18 | #8340 to #8359 | | | |
| 19 | #8360 to #8379 | | | |
| 20 | #8380 to #8399 | | | |
| 21 | #8400 to #8419 | | | |
| 22 | #8420 to #8439 | | | |
| 23 | #8440 to #8459 | | | |
| 24 | #8460 to #8479 | | | |
| 25 | #8480 to #8499 | | | |
| 26 | #8500 to #8519 | | | |
| 27 | #8520 to #8539 | | | |
| 28 | #8540 to #8559 | | | |
| 29 | #8560 to #8579 | | | |
| 30 | #8580 to #8599 | | | |
| 31 | #8600 to #8619 | | | |
| 32 | #8620 to #8639 | | | |

| Signal name | Refresh cycle | Signal direction |
|--|--|------------------|
| 0 Servo amplifier type | When the servo amplifier power-on | Monitor device |
| 1 Motor current | Operation cycle 1.7[ms] or less : Operation cycle Operation cycle 3.5[ms] or more : 3.5[ms] | |
| 2 Motor speed | | |
| 3 | | |
| 4 Command speed | Operation cycle | |
| 5 | | |
| 6 Home position return re-travel value | At home position return re-travel | |
| 7 | | |
| 8 Servo amplifier display servo error code | Main cycle | |
| 9 Parameter error No. | | |
| 10 Servo status1 | Operation cycle 1.7[ms] or less : Operation cycle Operation cycle 3.5[ms] or more : 3.5[ms] | |
| 11 Servo status2 | | |
| 12 Servo status3 | | |
| 13 Unusable | — | — |
| 14 | | |
| 15 | | |
| 16 | | |
| 17 | | |
| 18 Servo status7 | Operation cycle 1.7[ms] or less : Operation cycle Operation cycle 3.5[ms] or more : 3.5[ms] | Monitor device |
| 19 Unusable | — | — |

: Refer to Section 1.4 for the software version that supports this function.

4 POSITIONING DEDICATED SIGNALS

(a) Servo amplifier type (#8000+20n) Monitor device

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

- 0 Unused
- 256 MR-J3-□B
MR-J3W-□B (For 2-axis type)
- 257 MR-J3-□B-RJ006 (For fully closed loop control)
MR-J3-□B Safety (For drive safety servo)
- 258 MR-J3-□B-RJ004 (For Linear servo motor)
- 263 MR-J3-□B-RJ080W (For direct drive motor) **Ver.!**
- 4096 MR-J4-□B **QDS**
MR-J4W-□B (For 2-axis type, 3-axis type) **QDS**
- 4352 VCII series ^(Note-1) (Nikki Denso Co., Ltd. make) **QDS** **Ver.!**
- 4354 VCII series (For Linear stage) ^(Note-2)
(Nikki Denso Co., Ltd. make) **Ver.!**
- 4359 VCII series (For direct drive motor) ^(Note-2)
(Nikki Denso Co., Ltd. make) **Ver.!**
- 4864 VPH series ^(Note-1) (Nikki Denso Co., Ltd. make) **QDS** **Ver.!**
- 4866 VPH series (For Linear stage) ^(Note-2)
(Nikki Denso Co., Ltd. make) **QDS** **Ver.!**
- 4871 VPH series (For direct drive motor) ^(Note-2)
(Nikki Denso Co., Ltd. make) **QDS** **Ver.!**
- 8192 FR-A800-1 (Inverter) **QDS** **Ver.!**
- 8193 FR-A800-2 (Inverter) **QDS** **Ver.!**
- 8193 IAI electric actuator controller
(IAI Corporation make) **QDS** **Ver.!**
- 8233 5-phase stepping motor driver
(ORIENTAL MOTOR Co., Ltd. make) **QDS** **Ver.!**
- 8234 Stepping motor driver AlphaStep (AZ series)
(ORIENTAL MOTOR Co., Ltd. make) **QDS** **Ver.!**
- 16640 FR-A700 series (Inverter) **Ver.!**
(Note-1): When connecting SSCNETIII/H
(Note-2): When connecting SSCNETIII

It is not cleared even if the servo amplifier power supply turns OFF.

(b) Motor current (#8001+20n) Monitor device

This register stores the motor current ($\times 0.1$ [%]) (signed) read from the servo amplifier.

(c) Motor speed (#8002+20n, #8003+20n) Monitor device

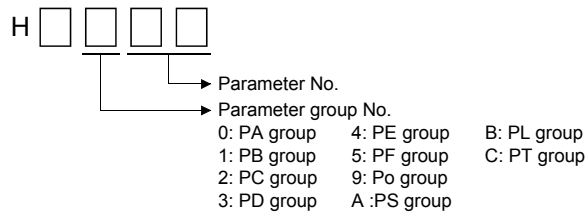
This register stores the motor speed ($\times 0.1$ [r/min]) (signed) read from the servo amplifier.

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

Ver.!: Refer to Section 1.4 for the software version that supports this function.

4 POSITIONING DEDICATED SIGNALS

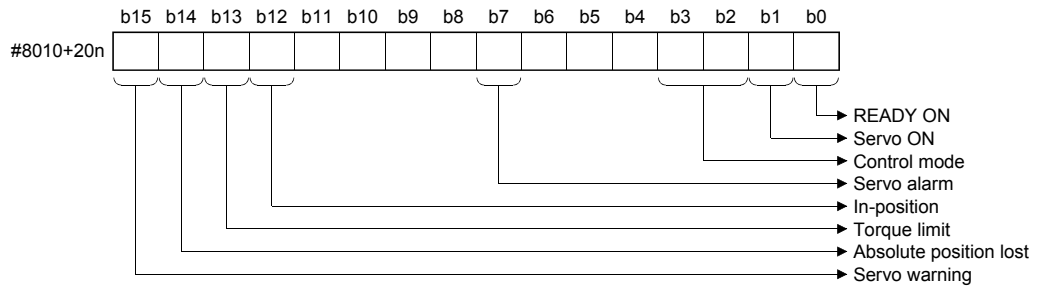
- (d) Command speed (#8004+20n, #8005+20n)..... Monitor device
 This register stores the speed (signed) at which command value to the servo amplifier for every operation cycle is converted into [pulse/s].
- (e) Home position return re-travel value (#8006+20n, #8007+20n)
Monitor device
 If the position stopped in the position specified with the travel value after proximity dog ON using MT Developer2 is not zero point, it made to travel to zero point by re-travel in the Motion CPU. The travel value (signed) of making it travel to zero point by re-travel at this time is stored.
 (Data does not change with the last value in the data setting type.)
- (f) Servo amplifier display servo error code (#8008+20n) **Ver.!** Monitor device
 This register stores the servo error code read from the servo amplifier.
 The hexadecimal display is the same as the LED of servo amplifier.
 Refer to the "Servo amplifier Instruction Manual" for details of the servo error codes.
- (g) Parameter error number (#8009+20n) **QDS** Monitor device
 The parameter number of error servo parameter is stored in hexadecimal at the servo error occurrence.



Ver.! : Refer to Section 1.4 for the software version that supports this function.

4 POSITIONING DEDICATED SIGNALS

- (h) Servo status1 (#8010+20n) **QDS** Monitor device
 This register stores the servo status read from the servo amplifier.



(Note): The 0/1 is stored in the servo status 1.
 • 0: OFF
 • 1: ON

- READY ON (b0)..... Indicates the ready ON/OFF.
- Servo ON (b1)..... Indicates the servo ON/OFF.
- Control mode (b2, b3)..... Indicates the control mode of servo amplifier.

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

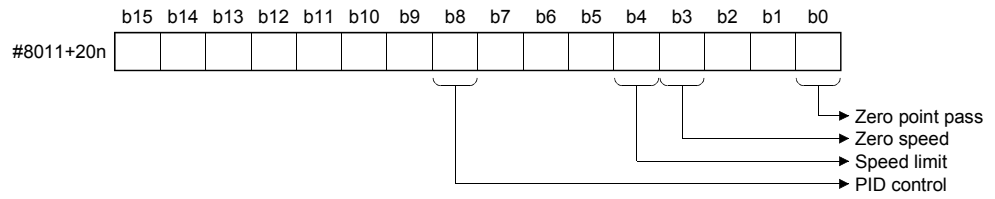
- Servo alarm (b7) Turn ON during the servo alarm.
- In-position (b12) The dwell pulse turns ON within the servo parameter "in-position".
- Torque limit (b13) Turns ON when the servo amplifier is having the torque restricted.
- Absolute position lost (b14) Turns ON when the servo amplifier is lost the absolute position.
- Servo warning (b15) Turn ON during the servo warning.

POINT

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

4 POSITIONING DEDICATED SIGNALS

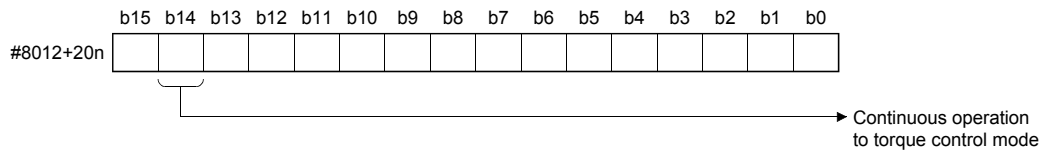
- (i) Servo status2 (#8011+20n) **QDS** Monitor device
 This register stores the servo status read from the servo amplifier.



(Note): The 0/1 is stored in the servo status 2.
 • 0: OFF
 • 1: ON

- 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.

- (j) Servo status3 (#8012+20n) **QDS** Monitor device
 This register stores the servo status read from the servo amplifier.



(Note): The 0/1 is stored in the servo status 3.
 • 0: OFF
 • 1: ON

- Continuous operation to torque control mode (b14) Turn ON when the continuous operation to torque control mode.

- (k) Servo status7 (#8018+20n) **QDS Ver.!** Monitor device
 This register stores the servo status read from the servo amplifier.



(Note): The 0/1 is stored in the servo status 7.
 • 0: OFF
 • 1: ON

- Driver operation alarm (b9) Turn ON when the driver operation alarm occurs.

Ver.! : Refer to Section 1.4 for the software version that supports this function.

4 POSITIONING DEDICATED SIGNALS

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

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

The product information list devices are shown below.

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

(a) Operating system software version (#8736 to #8743) Monitor device

The operating system software version of Motion CPU displayed on the system monitor (product information list) of GX Works2/GX Developer is stored in ASCII code.

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

| | Device No. | | | | | | | | | | | | | | | |
|------------|------------|------|-------|------|-------|------|-------|------|-------|------|-------|------|-------|------|-------|------|
| | #8736 | | #8737 | | #8738 | | #8739 | | #8740 | | #8741 | | #8742 | | #8743 | |
| | Low | High | Low | High | Low | High | Low | High | Low | High | Low | High | Low | High | Low | High |
| ASCII code | 20H | 53H | 56H | 32H | 32H | 6AH | 20H | 20H | 56H | 45H | 52H | 33H | 30H | 30H | 41H | 20H |
| Character | ␣ | S | V | 2 | 2 | j | ␣ | ␣ | V | E | R | 3 | 0 | 0 | A | ␣ |

␣ : Space.

(b) Motion CPU module serial number (#8744 to #8751) Monitor device

The serial number of Motion CPU displayed on the system monitor (product information list) of GX Works2/GX Developer is stored in ASCII code.

(Example) Serial number: "A7Z123015"

| | Device No. | | | | | | | | | | | | | | | |
|------------|------------|------|-------|------|-------|------|-------|------|-------|------|-------|------|-------|------|-------|------|
| | #8744 | | #8745 | | #8746 | | #8747 | | #8748 | | #8749 | | #8750 | | #8751 | |
| | Low | High | Low | High | Low | High | Low | High | Low | High | Low | High | Low | High | Low | High |
| ASCII code | 41H | 37H | 5AH | 31H | 32H | 33H | 30H | 31H | 35H | 20H | 20H | 20H | 20H | 20H | 20H | 20H |
| Character | A | 7 | Z | 1 | 2 | 3 | 0 | 1 | 5 | ␣ | ␣ | ␣ | ␣ | ␣ | ␣ | ␣ |

␣ : Space.

POINT

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

 : Refer to Section 1.4 for the software version that supports this function.

4 POSITIONING DEDICATED SIGNALS

4.4 Special Relays (SM)

There are 2256 special relay points of SM0 to SM2255 in the Motion CPU. Of these, devices in a Table 4.4 are used for the positioning control. The special relay list used for the positioning control is shown below. (Refer to "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for the application of special relays except below.)

Table 4.4 Special relay list

| Device No. | Signal name | Refresh cycle | Fetch cycle | Signal type |
|------------|---|-----------------|-------------|---------------|
| SM500 | PCPU READY complete flag | Main cycle | / | Status signal |
| SM501 | TEST mode ON flag | | | |
| SM502 | External forced stop input flag | Operation cycle | | |
| SM503 | Digital oscilloscope executing flag | Main cycle | | |
| SM506 | External forced stop input ON latch flag <small>Ver.1</small> | Operation cycle | | |
| SM508 | Amplifier-less operation status flag | Main cycle | | |
| SM510 | TEST mode request error flag | | | |
| SM512 | Motion CPU WDT error flag | | | |
| SM513 | Manual pulse generator axis setting error flag | | | |
| SM516 | Servo program setting error flag | | | |

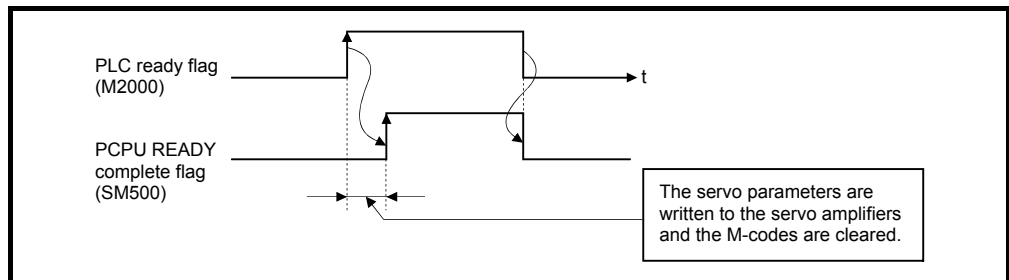
(1) PCPU READY complete flag (SM500) Status signal

This flag is used as judgement of the normal or abnormal in the Motion CPU side using the sequence program.

- (a) At leading edge of PLC ready flag (M2000), the fixed parameters, servo parameters and limit switch output data are checked, and if error is not detected, this flag turns on.

The servo parameters are written to the servo amplifiers and the M-codes are cleared.

- (b) This flag turns off when the PLC ready flag (M2000) turns off.



Ver.1 : Refer to Section 1.4 for the software version that supports this function.

- (2) TEST mode ON flag (SM501) Status signal
- (a) This flag is used as judgement of during the test mode or not using MT Developer2.
Use it for an interlock, etc. at the starting of the servo program using the Motion SFC program.
- OFFExcept the test mode
 - ON.....During the test mode
- (b) If the test mode is not executed in the test mode request from MT Developer2, the TEST mode request error flag (SM510) turns on.
- (3) External forced stop input flag (SM502) Status signal
- This flag is used to check the external forced stop input signal ON/OFF.
- OFF External forced stop input ON
 - ON External forced stop input OFF

| POINT | |
|-------|--|
| (1) | <p>If the forced stop signal is input during positioning, the operation is as follows.</p> <ul style="list-style-type: none"> • When using Q173DSCPU/Q172DSCPU The feed current value becomes the same value as the real current value. • When using Q173DCPU(-S1)/Q172DCPU(-S1) The feed current value is advanced within the rapid stop deceleration time set in the parameter block. <p>At the same time, the servo OFF state is established because the all axes servo ON command (M2042) turns off.</p> <p>When the rapid stop deceleration time has elapsed after input of the forced stop signal, the feed current value returns to the value at the point when the emergency stop was initiated.</p> |
| (2) | <p>If the forced stop is cancelled while the rapid stop deceleration time isn't progressing, an overspeed error or error excessive error may occur.</p> |

- (4) Digital oscilloscope executing flag (SM503) Status signal
- This flag is used to check the state of execution for the digital oscilloscope.
- OFF Digital oscilloscope has stopped.
 - ON Digital oscilloscope is executing.
- (5) External forced stop input ON latch flag (SM506) Status signal
- This flag turns on when an external forced stop input is detected.
After that, it remains ON even if the external forced stop input is cancelled.
Reset the external forced stop input ON latch flag using the Motion SFC program.
- OFF External forced stop input is not detected.
 - ON External forced stop input is detected.

: Refer to Section 1.4 for the software version that supports this function.

4 POSITIONING DEDICATED SIGNALS





- (6) Amplifier-less operation status flag (SM508) Status signal
This flag is used to check the state of amplifier-less operation.
• OFF During normal operation
• ON During amplifier-less operation
- (7) TEST mode request error flag (SM510) Status signal
(a) This flag turns on when the test mode is not executed in the test mode request using MT Developer2.
(b) When SM510 turns on, the error contents are stored in the test mode request error information (SD510, SD511).
- (8) Motion CPU WDT error flag (SM512)..... Status signal
This flag turns on when a WDT error (watchdog timer error) is detected of the Motion CPU self-diagnosis function.
When the Motion CPU detects a WDT error, it executes an immediate stop without deceleration of the operating axes.
If the Motion CPU WDT error flag has turn on, reset the Multiple CPU system.
If SM512 remains on after resetting, there is a fault at the Motion CPU side.
The error cause is stored in the "Motion CPU WDT error cause (SD512)".
(Refer to Section 4.5(7)).
- (9) Manual pulse generator axis setting error flag (SM513) Status signal
(a) This flag is use as judgement of normal or abnormal setting of the manual pulse generator axis No. setting registers (D714 to D719).
• OFFD714 to D719 is normal
• ON.....D714 to D719 is abnormal
(b) This flag turns ON by turning ON the manual pulse generator enable flag (M2051 to M2053) with the manual pulse generator axis P1 to P3 unused after setting the manual pulse generator interface module (Q173DPX) in the system setting.
(c) When SM513 turns on, the error contents are stored in the manual pulse generator axis setting error information (SD513 to SD515).
- (10) Servo program setting error flag (SM516) Status signal
This flag is used as judgement of normal or abnormal for the servo program positioning data.
• OFF Normal
• ON Abnormal

4 POSITIONING DEDICATED SIGNALS

4.5 Special Registers (SD)

There are 2256 special register points of SD0 to SD2255 in the Motion CPU. Of these, devices in a Table 4.5 are used for the positioning control. The special register list used for the positioning control is shown below. (Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for the applications of special registers except below.)

Table 4.5 Special register list

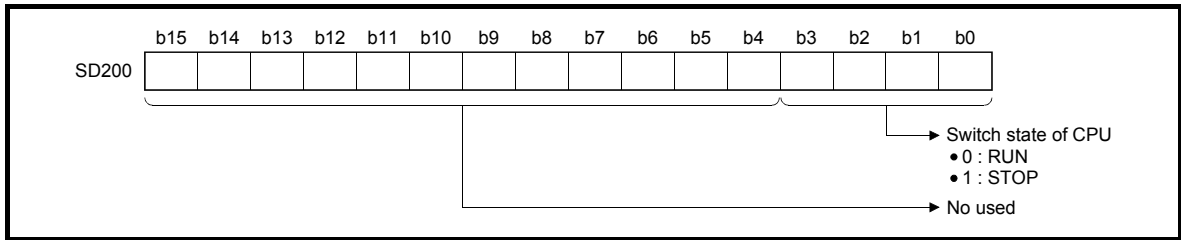
| Device No. | Signal name | Refresh cycle | Fetch cycle | Signal direction |
|------------|--|--|-------------|------------------|
| SD200 | State of switch | Main cycle | Main cycle | Monitor device |
| SD500 | Real mode axis information register (SV22) | | | |
| SD501 | | | | |
| SD502 | Servo amplifier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

: Refer to Section 1.4 for the software version that supports this function.

4 POSITIONING DEDICATED SIGNALS

(1) State of switch (SD200) Monitor device

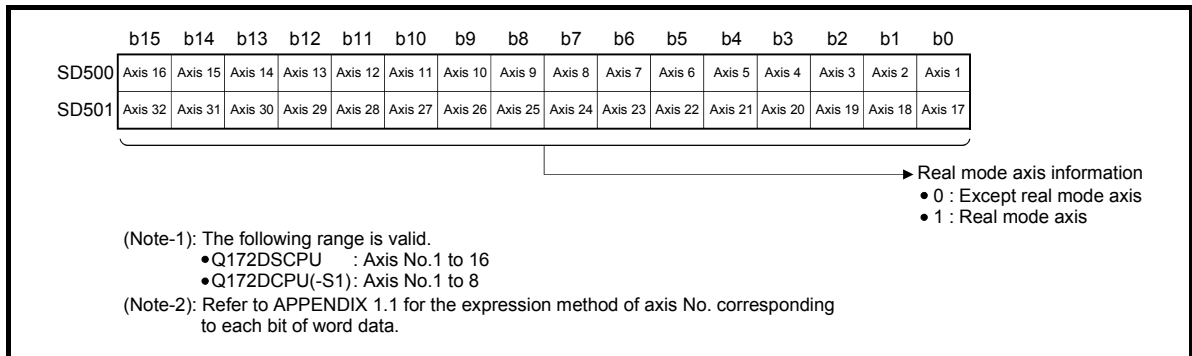
The switch state of CPU is stored in the form of the following.



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

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

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

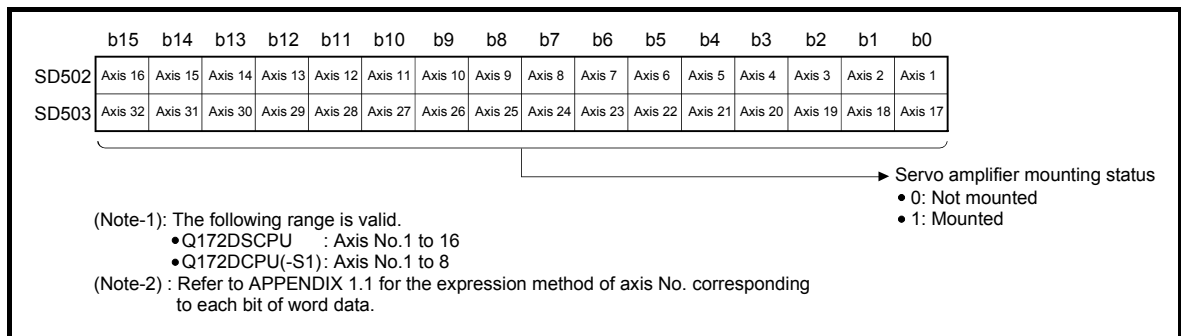


(3) Servo amplifier loading information (SD502, SD503) Monitor device

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

If communication with servo amplifier stops, it is reset.

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



4 POSITIONING DEDICATED SIGNALS

(a) Servo amplifier mounting status

1) Mounting status

- Mounted The servo amplifier is normal. (Communication with the servo amplifier is normal.)
- Not mounted The servo amplifier is not mounted.
The servo amplifier control circuit power is off.
Normal communication with the servo amplifier is not possible due to a connecting cable fault, etc.

2) The system settings and servo amplifier mounting status are shown below.

| System Settings | Servo amplifier | |
|-------------------------|-----------------|-------------|
| | Mounted | Not mounted |
| Used (axis No. setting) | 1 is stored | 0 is stored |
| Unused | 0 is stored | |

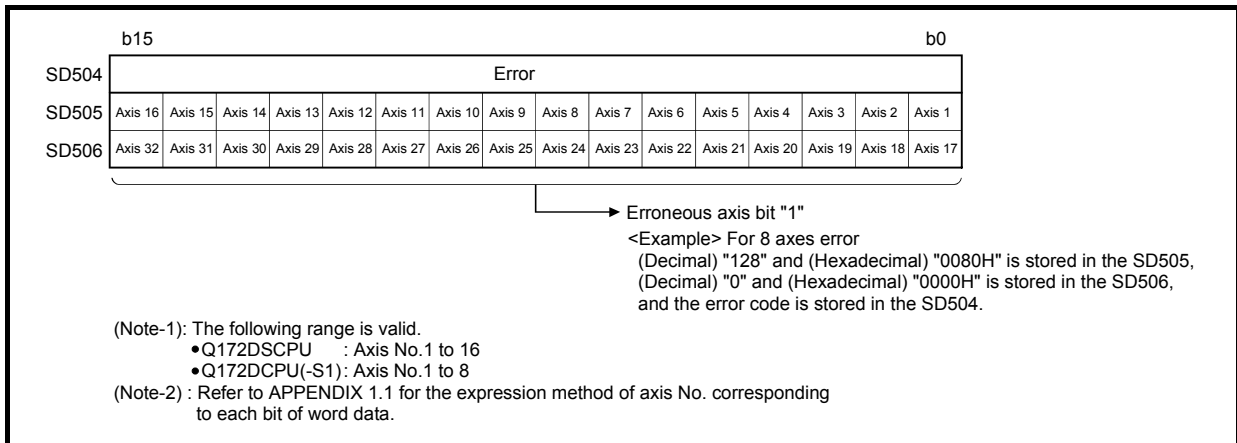
(4) Real mode/virtual mode switching error information

(SD504 to SD506) Monitor device

When a mode switching error occurs in real-to-virtual or virtual-to-real mode switching, or a mode continuation error occurs in the virtual mode, its error information is stored.

Refer to APPENDIX 1.7 for details of the stored error code.

The axis error code among the error codes stored in SD504 to SD506 is shown below.



(5) SSCNET control (status) (SD508) Monitor device

SSCNET control (status) (SD508) stores the executing state for connect/disconnect of SSCNET communication and start/release of amplifier-less operation.

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

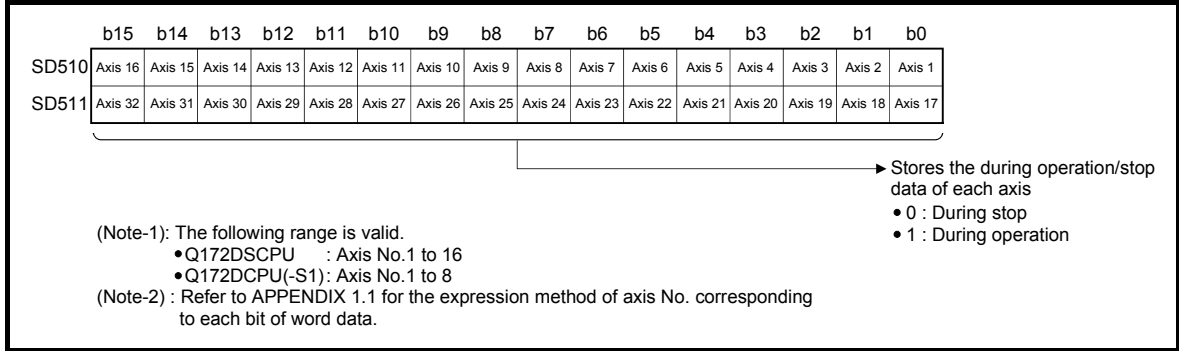
Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller programming Manual (COMMON)" for details of the SSCNET control function.

4 POSITIONING DEDICATED SIGNALS

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

..... Monitor device

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



(7) Motion CPU WDT error cause (SD512) Monitor device

This register is used as judgement of the error contents in the Motion CPU.

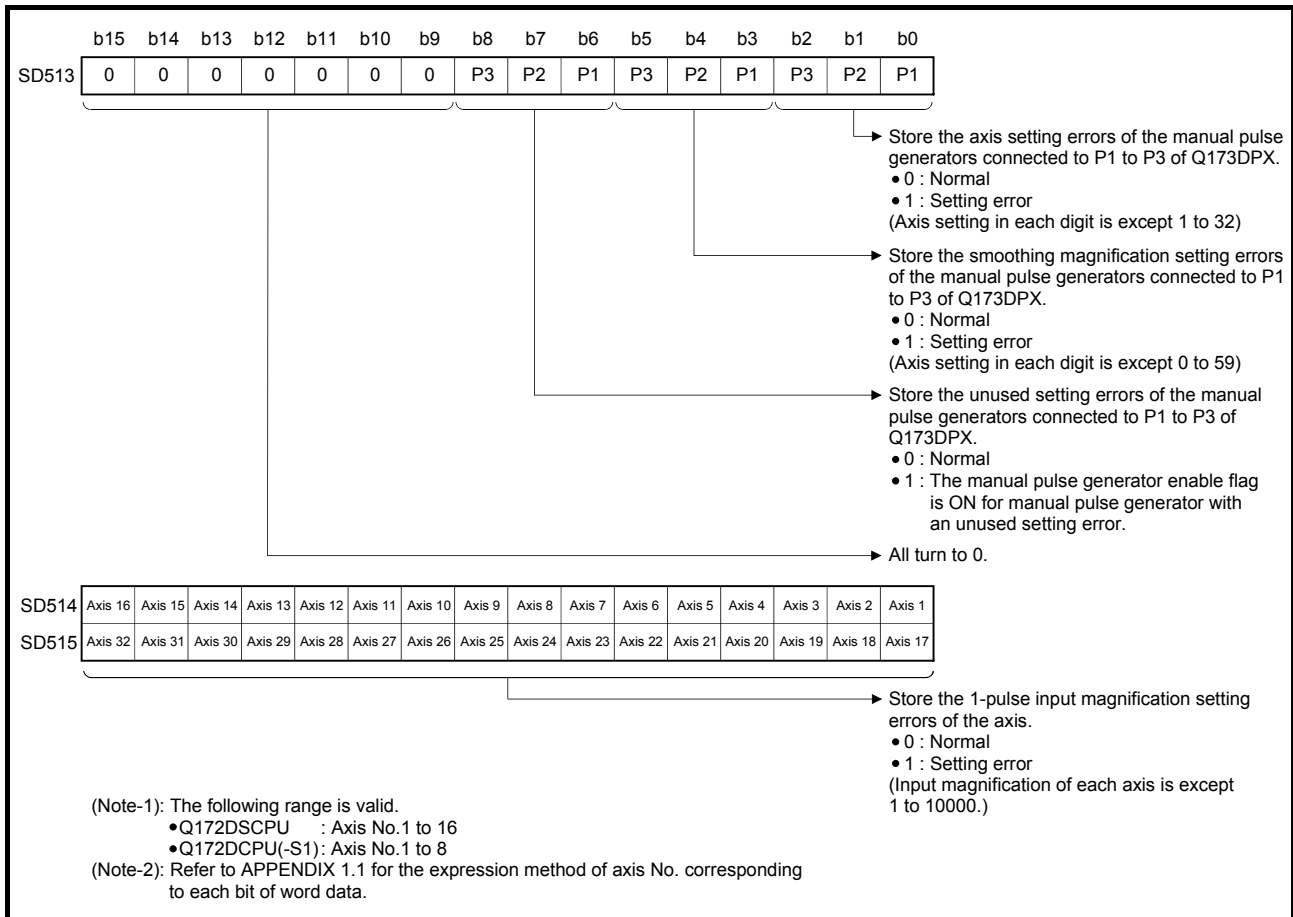
| Error code | Error cause | Operation when error occurs | Action to take |
|------------|---------------------------|---|--|
| 1 | S/W fault 1 | All axes stop immediately, after which operation cannot be started. | <ul style="list-style-type: none"> • Reset the Multiple CPU system. • If the an operation cycle time over reoccurs after resetting, or a main cycle is lengthened (more than 1.0[s]), 1) Change the operation cycle into a large value in the system setting. 2) Reduce the number of command execution of the event task or NMI task in the system setting. |
| 2 | Operation cycle time over | | |
| 4 | WDT error | | <ul style="list-style-type: none"> • Reset the Multiple CPU system. • If the error reoccurs after resetting, explain the error symptom and get advice from our sales representative. |
| 300 | S/W fault 3 | | |
| 303 | S/W fault 4 | | |
| 304 | RIO WDT error | | |

4 POSITIONING DEDICATED SIGNALS

(8) Manual pulse generator axis setting error information (SD513 to SD515) Monitor device

The setting information is checked at leading edge of manual pulse generator enable signal, if an error is found, the following error information is stored into SD513 to SD515 and the manual pulse generator axis setting error flag (SM513) turns on.

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



(9) Error program No. (SD516) Monitor device

(a) When the servo program error occurs at the servo program start, the servo program setting error flag (SM516) turns on and the error servo program No. (0 to 4095).

(b) If an error occurs in another servo program when error program No. has been stored, the program No. of the new error is stored.

(10) Error item information (SD517) Monitor device

When the servo program error occurs at the servo program start, the servo program setting error flag (SM516) turns on and the error code corresponds to the error setting item is stored.

Refer to APPENDIX 1.3 for details of servo program setting errors.

- (11) Motion operation cycle (SD522) Monitor device
The time which motion operation took for every motion operation cycle is stored in [μ s] unit.
- (12) Operation cycle of the Motion CPU setting (SD523) Monitor device
The setting operation cycle is stored in [μ s] unit.
When the "Default Setting" is set in the system setting, the operation cycle corresponding to the number of setting axes. When "0.2[ms]^{QDS} / 0.4[ms] / 0.8[ms] / 1.7[ms] / 3.5[ms] / 7.1[ms] / 14.2[ms]^{QD}" is set in the system setting, the operation cycle corresponding to each setting.
(Note): If the servo amplifiers of 9 axes or more are connected to one SSCNETⅢ line, it does not support an operation cycle of 0.4[ms].
0.8[ms] is used as the real operation cycle, even if 0.4[ms] is set in the system setting.
- (13) Maximum Motion operation cycle (SD524) ^{QDS} Monitor device
The maximum time for motion operation is stored every motion operation cycle in [μ s] unit.
- (14) System setting error information (SD550,SD551) ^{QDS} Monitor device
The error code and error individual information are stored at the system setting error occurrence.
Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for details of the system setting errors.
- (15) Operation method (SD560) ^{QDS} ^{Ver.!} Monitor device
When the operating system software is SV22, the operation method information is stored.
- 0 Virtual mode switching method
 - 1 Advanced synchronous control method

Ver.!: Refer to Section 1.4 for the software version that supports this function.

4 POSITIONING DEDICATED SIGNALS

- (16) SSCNET control (command) (SD803) Command device
SSCNET control (command) (SD803) is required for connect/disconnect of
SSCNET communication and start/release of amplifier-less operation.
- 0 No command
 - 1 to 32 Disconnect command of SSCNET communication
 - -10 Re-connect command of SSCNET communication
 - -20 Start command 1 of amplifier-less operation (EMI invalid)
 - -21 Start command 2 of amplifier-less operation (EMI valid)
 - -25 Release command of amplifier-less operation
 - -2 Execute command

Refer to the "Q173DCPU/Q172DCPU Motion controller Programming Manual (COMMON)" for details of the SSCNET control function.

5. MECHANICAL SYSTEM PROGRAM

This section describes the mechanical system program in the virtual mode.

In the mechanical system program (Mechanical support language), what was performing synchronous control by hardware using the gear, shaft, belt, pulley, cam or infinitely variable speed changer, etc. is transposed to software, and same operation control is performed.

The mechanical system program is composed with the mechanical module connection diagram and mechanical module parameter.

- The mechanical module connection diagram shows the virtual mechanical system which connected the virtual mechanical modules.
- The mechanical module parameters are used to control of the mechanical modules used at the mechanical module connection diagram.

Refer to the mechanical module parameter lists shown in Chapters 6 to 8 for the mechanical module parameters.

5 MECHANICAL SYSTEM PROGRAM

5.1 Mechanical Module Connection Diagram

The mechanical module connection diagram shows a virtual system diagram which arranged the mechanical modules and was composed.

Configuration of the mechanical module connection is shown in Fig. 5.1 below.

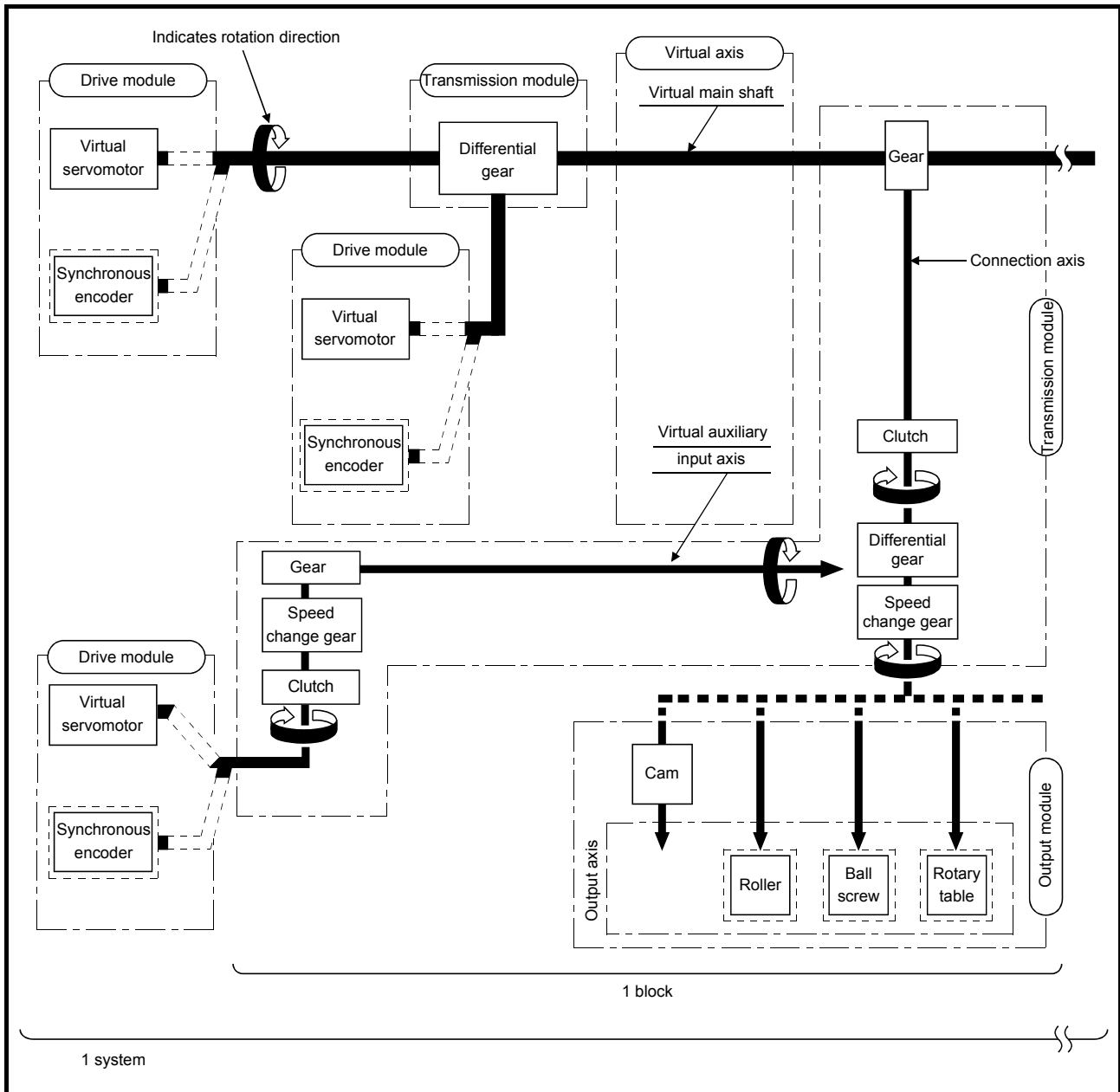


Fig. 5.1 Configuration of the Mechanical Module Connection

POINT

- (1) Either a virtual servomotor or a synchronous encoder can be connected in the drive module.
- (2) One of the cam, roller, ball screw or rotary table can be connected in the output module.

5 MECHANICAL SYSTEM PROGRAM

(1) Block

The term "block" is one relation from the virtual transmission module (gear) connected to the virtual main shaft to the output module.

Refer to Section 5.2 for the number of mechanical modules which can be connected in one block.

(2) System

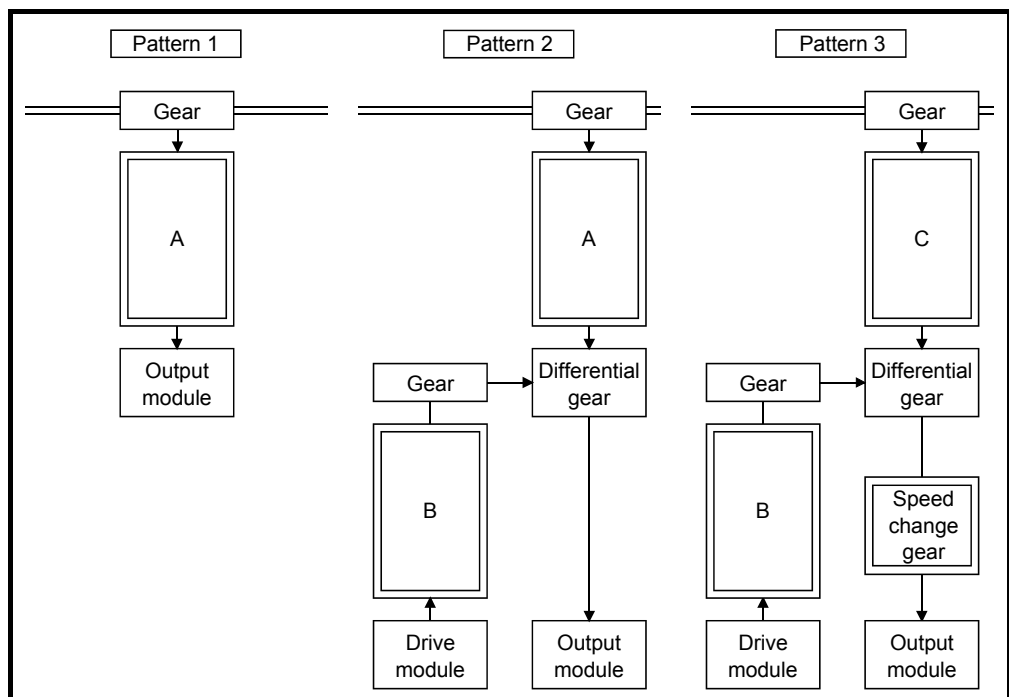
The term "system" is a generic term of multiple blocks connected to one virtual main shaft.

The number of blocks connectable with one system is up to 32 blocks.

(3) Transmission module connections

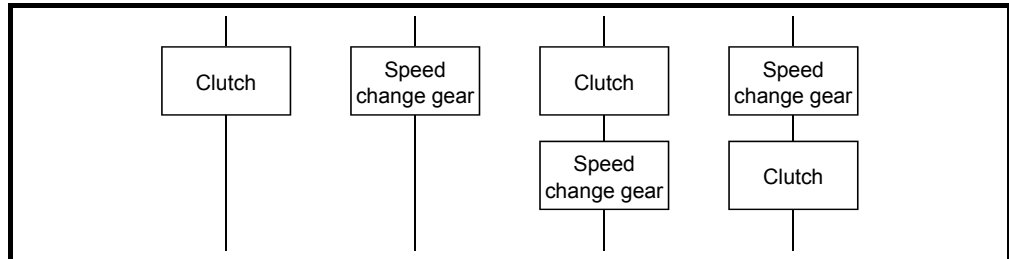
There are 3 transmission module connection patterns:

- Pattern 1..... Without a differential gear.
- Pattern 2..... Without a speed change gear at the output side of the differential gear.
- Pattern 3..... With a speed change gear at the output side of the differential gear.



5 MECHANICAL SYSTEM PROGRAM

- (a) Transmission modules which can be connected at "A" and "B" above
- 1) A clutch, speed change gear, and "clutch + speed change gear" can be connected at "A" and "B".
 - 2) If a "clutch + speed change gear" are used, connection constraints have not restrictions.



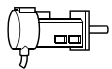
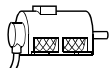

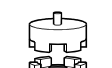
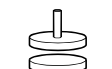

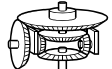
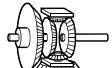
- (b) Transmission module which can be connected at "C" (pattern 3)
Only a clutch can be connected at "C".

5 MECHANICAL SYSTEM PROGRAM

5.2 Mechanical Module List

An overview of the mechanical modules used at the mechanical module connection diagrams in the virtual mode is shown in Tables 5.1.
Refer to Chapter 6 to 8 for details of each mechanical module.

Table 5.1 Mechanical Module List





| Classification | Mechanical Module | | Maximum Number of Usable | | | | | | | | | | | |
|---------------------|---------------------------------|---|------------------------------|-----------------------|---------------------------|----------------------|---------------------------|------------------------------|-------------------|------------------|----|----------|---|---|
| | | | Q173DSCPU | | | | | Q172DSCPU | | | | | | |
| | Name | Appearance | Number Per Motion CPU module | Number Per System | | Number Per Block | | Number Per Motion CPU module | Number Per System | Number Per Block | | | | |
| | | | | Connection Shaft Side | Auxiliary Input Axis Side | Connection Axis Side | Auxiliary Input Axis Side | | | | | | | |
| Drive module | Virtual servomotor |  | 32 | Total 44 | 32 | Total 34 | — | — | 16 | Total 28 | 16 | Total 18 | — | — |
| | Synchronous encoder |  | 12 | | 12 | | — | — | 12 | | 12 | | — | — |
| Virtual axis | Virtual main shaft | — | 32 | Total 64 | 32 | — | — | 16 | Total 32 | 16 | — | — | — | — |
| | Virtual auxiliary input axis | — | 32 | | 32 | — | — | 16 | | 16 | — | — | | |
| Transmission module | Gear |  | 64 | 64 | 1 | 1 | 32 | 32 | 1 | 1 | — | — | — | — |
| | Direct clutch |  | 64 | 64 | 1 | 1 | 32 | 32 | 1 | 1 | — | — | — | — |
| | Smoothing clutch |  | 64 | 64 | 1 | 1 | 32 | 32 | 1 | 1 | — | — | — | — |
| | Speed change gear |  | 64 | 64 | 1 | 1 | 32 | 32 | 1 | 1 | — | — | — | — |
| | Differential gear |  | 32 | 32 | 1 | — | 16 | 16 | 1 | — | — | — | — | — |
| | Differential gear to main shaft |  | 32 | 1 | — | — | 16 | 1 | — | — | — | — | — | — |
| | | | | | | | | | | | | | | |

5 MECHANICAL SYSTEM PROGRAM

| | | Maximum Number of Usable | | | | | | | | | | Function Description | Section | | |
|----|-------------|------------------------------|-------------|-------------------|----|-----------------------|---------------------------|------------------------------|-------------|-------------------|---|--|-------------|----------------------|---------------------------|
| | | Q173DCPU(-S1) | | | | | Q172DCPU(-S1) | | | | | | | | |
| | | Number Per Motion CPU module | | Number Per System | | Number Per Block | | Number Per Motion CPU module | | Number Per System | | | | Number Per Block | |
| | | | | | | Connection Shaft Side | Auxiliary Input Axis Side | | | | | | | Connection Axis Side | Auxiliary Input Axis Side |
| 32 | Total 44 | 32 | Total 34 | — | — | 8 | Total 16 | 8 | Total 10 | — | — | • It is used to drive the virtual axis of mechanical system program by the servo program or JOG operation. | Section 6.1 | | |
| 12 | | 12 | | — | — | 8 | | 8 | | — | — | • It is used to drive the virtual axis by the input pulses from the external synchronous encoder. | Section 6.2 | | |
| 32 | Total 64 | 32 | 32 | — | — | 8 | Total 16 | 8 | 8 | — | — | • This is a virtual "link shaft". • Drive module rotation is transferred to the transmission module. | — | | |
| 32 | | 32 | | — | — | 8 | | 8 | | — | — | • This is the auxiliary input axis for input to the differential gear of transmission module. • It is automatically displayed when a differential gear and gear are connected. | — | | |
| 64 | 64 | 1 | 1 | 16 | 16 | 1 | 1 | 1 | 1 | 1 | 1 | • The drive module rotation is transmitted to the output axis. • A setting gear ratio is applied to the travel value (pulse) input from the drive module, and then transmits to the output axis that it becomes in the setting rotation direction. | Section 7.1 | | |
| 64 | 64 | 1 | 1 | 16 | 16 | 1 | 1 | 1 | 1 | 1 | 1 | • Transmit or separate the drive module rotation to the output module. • There are a direct clutch transmitted directly and the smoothing clutch which performs the acceleration/deceleration and transmission by the smoothing time constant setting at the switching ON/OFF of the clutch. • It can be selected the ON/OFF mode, address mode or the external input mode depending on the application. • Time constant system or slippage system can be selected as a smoothing method. | Section 7.2 | | |
| 64 | 64 | 1 | 1 | 16 | 16 | 1 | 1 | 1 | 1 | 1 | 1 | • It is used to change the speed of output module (roller). • The setting speed change ratio is applied to input axis speed, and transmits to the output axis. | Section 7.3 | | |
| 32 | 32 | 1 | — | 8 | 8 | 1 | — | — | — | — | — | • Auxiliary input axis rotation is subtracted from virtual main shaft rotation and the result is transmitted to the output axis. | Section 7.4 | | |
| 32 | 1 | — | — | 8 | 1 | — | — | — | — | — | — | • Auxiliary input axis rotation is subtracted from virtual main shaft rotation, and the result is transmitted to the output axis. (Connected to the virtual main shaft) | | | |

5 MECHANICAL SYSTEM PROGRAM

Table 5.1 Mechanical Module List (Continued)

| Classification | Mechanical Module | | Maximum Number of Usable | | | | | | | | | |
|----------------|-------------------|---|------------------------------|-------------------|-----------------------|---------------------------|------------------------------|-------------------|----------------------|---------------------------|----|--|
| | | | Q173DSCPU | | | | | Q172DSCPU | | | | |
| | Name | Appearance | Number Per Motion CPU module | Number Per System | Number Per Block | | Number Per Motion CPU module | Number Per System | Number Per Block | | | |
| | | | | | Connection Shaft Side | Auxiliary Input Axis Side | | | Connection Axis Side | Auxiliary Input Axis Side | | |
| Output module | Roller |  | 32 | 32 | 1 | 1 | 16 | 16 | 1 | 1 | | |
| | Ball screw |  | 32 | 32 | | | 16 | | | | 16 | |
| | Rotary table |  | 32 | 32 | | | 16 | | | | 16 | |
| | Cam |  | 32 | 32 | | | 16 | | | | 16 | |
| | | | Total 32 | Total 32 | | | Total 16 | Total 16 | | | | |

5 MECHANICAL SYSTEM PROGRAM

| Maximum Number of Usable | | | | | | | | | | | | Function Description | Section |
|------------------------------|----------|-------------------|----------|-----------------------|---------------------------|---|-------------|-------------------|---------|----------------------|---------------------------|---|-------------|
| Q173DCPU(-S1) | | | | | | Q172DCPU(-S1) | | | | | | | |
| Number Per Motion CPU module | | Number Per System | | Number Per Block | | Number Per Motion CPU module | | Number Per System | | Number Per Block | | | |
| | | | | Connection Shaft Side | Auxiliary Input Axis Side | | | | | Connection Axis Side | Auxiliary Input Axis Side | | |
| 32 | | 32 | | 1 | 1 | 8 | | 8 | | 1 | 1 | • It is used to perform the speed control at the final output. | Section 8.1 |
| 32 | Total 32 | 32 | Total 32 | | | 8 | Total 8 | 8 | Total 8 | | | • It is used to perform the linear positioning control at the final output. | Section 8.2 |
| 32 | | 32 | | | | 8 | | 8 | | | | • It is used to perform the angle control at the final output. | Section 8.3 |
| 32 | 32 | 8 | 8 | | | • It is used to perform the position control based on the cam pattern setting data. • There are 2 cam control modes: the two-way cam and feed cam. | Section 8.4 | | | | | | |

6. DRIVE MODULE

The drive module is the source of drive for the virtual axis (virtual main shaft, virtual auxiliary input axis).

There are following 2 types drive module.

- Virtual servomotor Refer to Section 6.1
- Synchronous encoder Refer to Section 6.2

| |
|--------------|
| POINT |
|--------------|

| |
|--|
| Set the travel value of drive module so large as possible to prevent the speed fluctuation of output module in the mechanical system program. If the travel value of drive module is small, the speed fluctuation of output module may occur depending on the setting for transmission module. |
|--|

6.1 Virtual Servomotor

The virtual servomotor is used to operate the virtual axis (virtual main shaft, virtual auxiliary input axis) using the servo program or JOG operation.
 Virtual servomotor operation and parameters are shown below.

6.1.1 Operation description

(1) Operation

When the virtual servomotor is started, the pulses are transmitted to the virtual axis (virtual main shaft, virtual auxiliary input axis) by the start conditions (command speed, travel value).

The transmitted pulses are transmitted to the output module connected via the transmission module (gear, differential gear, clutch, speed change gear).

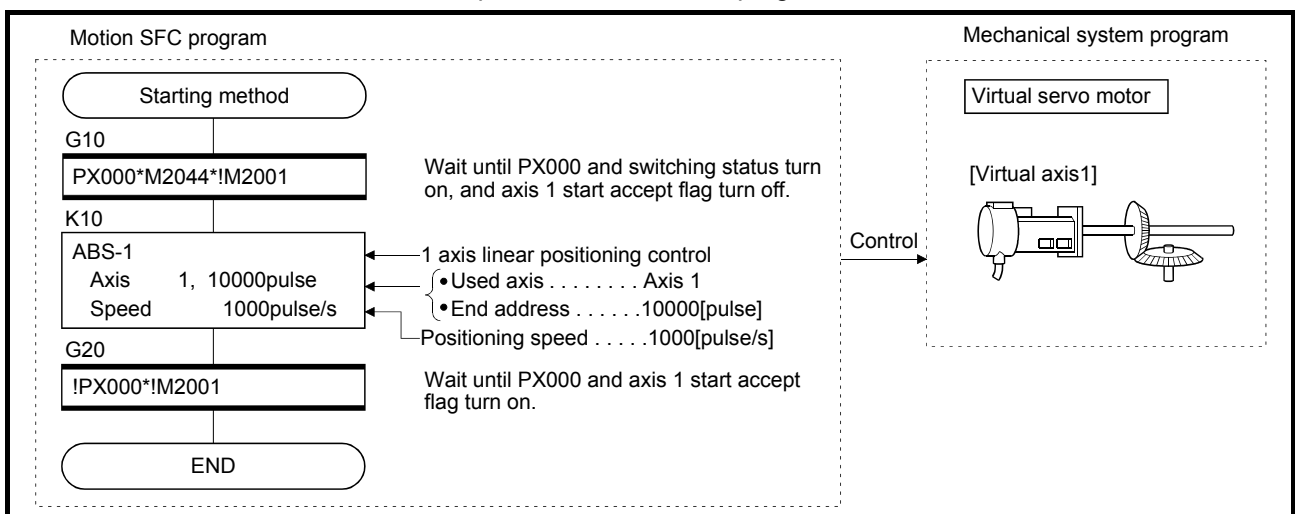
(2) Starting method

The virtual servomotor is started using the servo program or JOG operation.

(a) Start using the servo program

The servo program of Motion SFC program (motion control step) is executed. At this time, the start accept flag ^(Note-1) (M2001 to M2032) of the starting axis turns on.

Example of the Motion SFC program is shown below.



(Note) : Example of the above Motion SFC program is started using the automatic start or sequence program.

REMARK

(Note-1): Refer to Section 4.1.7 (2) for details of the start accept flag.

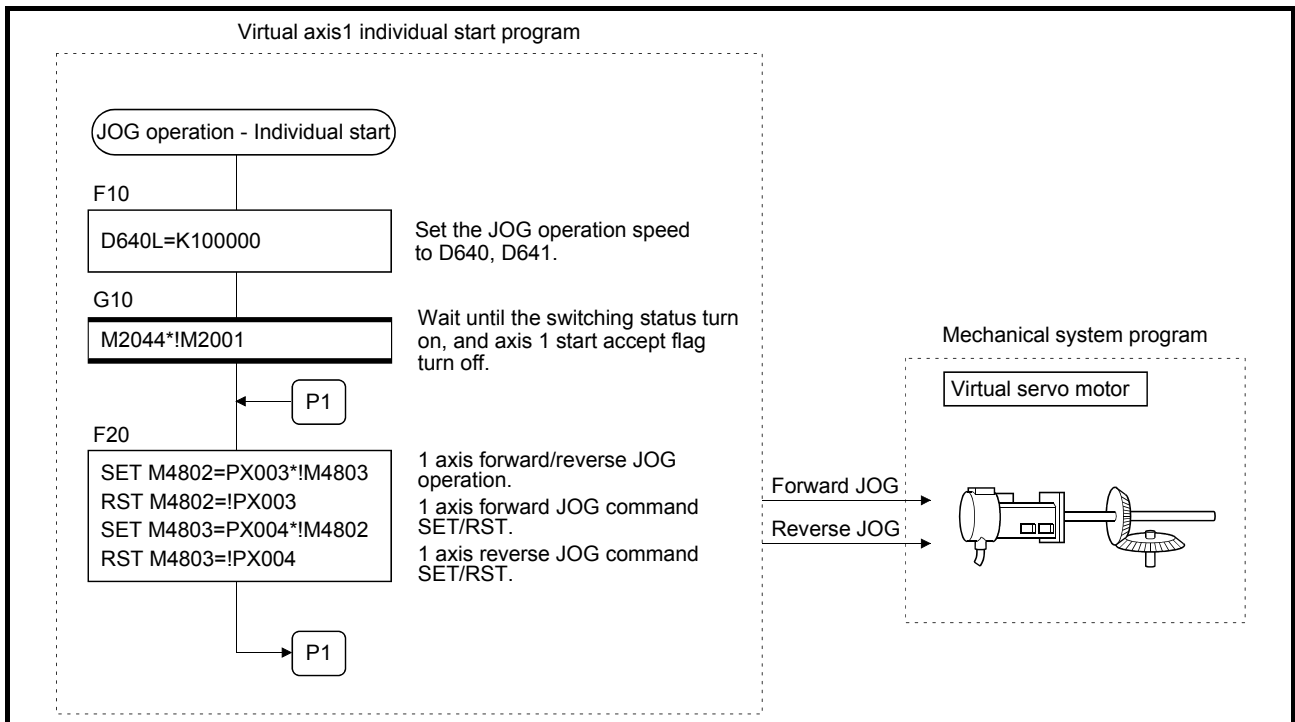
(b) Start using the JOG operation

An individual start and simultaneous start can be executed in the JOG operation (Note-1).

1) Individual start

.....It is started by turning on the forward/reverse JOG command (Note-2) of each axis.

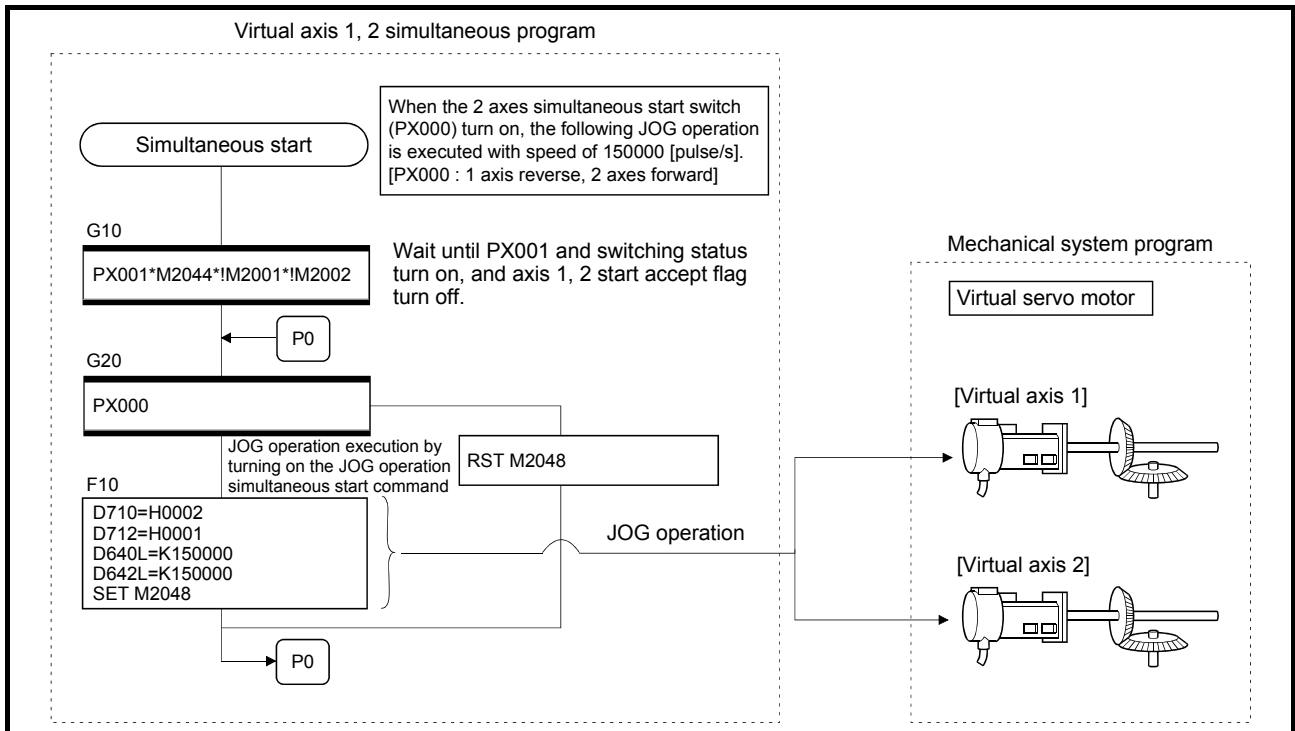
Motion SFC program for which executes the JOG operation is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

2) Simultaneous start

.....The simultaneous start axis No. and directions (forward/reverse) are set by the JOG operation simultaneous start axis setting register (D710 to D713) (Note-3), and it is started by turning on the JOG operation simultaneous start command flag (M2048) (Note-3).



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

REMARK

(Note-1): Refer to Section "6.21 JOG Operation" of the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)" for details of the JOG operation.

(Note-2): Refer to Section 4.1.4 (3) for details of the forward/reverse rotation JOG start commands.

(Note-3): Refer to Section 4.2.8 (2) for details of the JOG operation simultaneous start axis setting registers, and Section 4.1.7 (14) for details of the JOG operation simultaneous start command.

(3) Stopping method during operation

When the virtual servomotor is stopped during operation after the start, turn the stop command (M4800+20n)/rapid stop command (M4801+20n) on using the Motion SFC program.

(There are no external stop causes (STOP, FLS, RLS) for the virtual servomotor.)

(4) Control items

- (a) It is controlled as the virtual servomotor backlash compensation amount "0" at the positioning control.
- (b) The deviation counter value and the real current value are not stored, so that the virtual servomotor has no feedback pulse.
- (c) The feed current value of virtual servomotor is recorded in a backup memory, and it is restored at the switching from real mode to virtual mode after the power supply of the Multiple CPU system turned on.
 - 1) When the output module is using the absolute position system, continuation operation is possible. However, if the servomotor of the output module connected to the virtual servomotor is operated while the power supply of the Multiple CPU system turns off, continuation operation is impossible even if the absolute position system is being used.

At this time, the virtual mode continuation operation disabled warning signal ^(Note-1) turns on.

Set the virtual servomotor or servomotor of output module to the position which synchronous operation is possible.
 - 2) When the output module is not using the absolute position system, correct the feed current value of virtual servomotor by the current value change switching from real mode to virtual mode.

(5) Control change

The following control changes are possible for the virtual servomotor.

- Current value change
- Speed change
- Target position change **QDS**

Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (Motion SFC)" for details of the current value change, speed change or target position change.

REMARK

(Note-1): Refer to Section 4.1.5 (3) for details of the virtual mode continuation operation disabled warning signal.

(6) Error-time operation mode

The processings are shown below when major errors occurred with the output modules per 1 system.

The following control is executed based on the parameter settings (Refer to Section 6.1.2) of the virtual servomotor connected to the virtual main shaft.

(a) Continuation

Even if a major error occurs with the output module, the output module continues operation. At this time, the error detection signal (M2407+20n) turns on, and the applicable error code is stored in the major error code storage register.

Use the Motion SFC program for continue/stop of the system and the output module operation at the major error occurrence.

(b) Clutch OFF

If a major error occurs with the output module, the clutch within 1 system turns off and stops connected output modules. (The smoothing processing is executed by the clutch setting.)

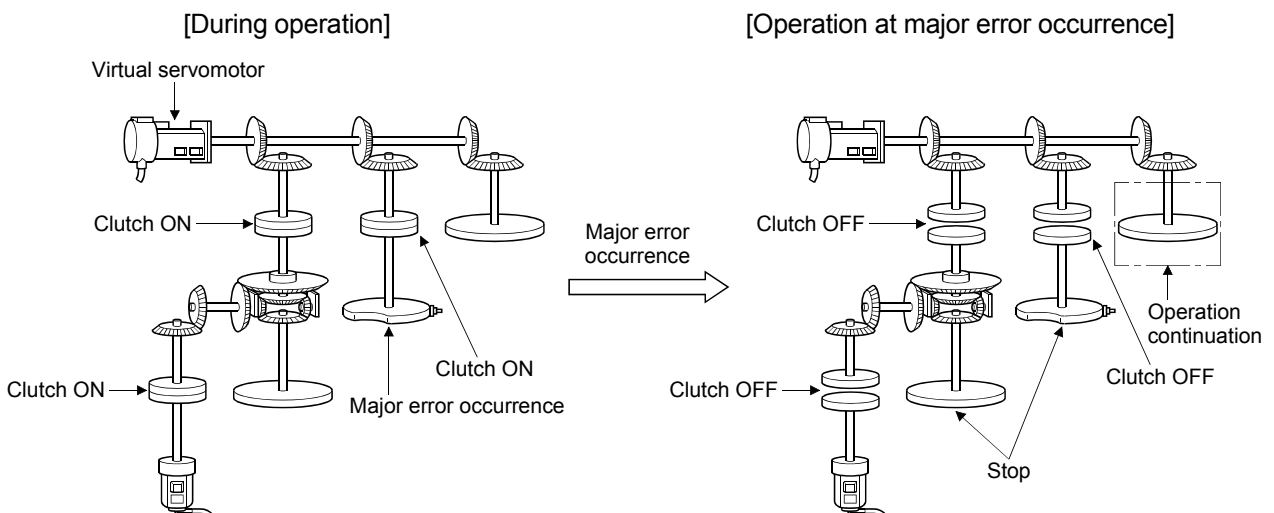
At this time, the clutch ON/OFF command device does not turn off.

However, the clutch status storage device turns off regardless of the clutch ON/OFF command device's ON/OFF status.

Operation continues at axes where no clutch is connected.

Use the Motion SFC program to stop the drive module.

Eliminate the error cause, then turn the clutch ON/OFF command device off to on to resume the operation.



(7) Virtual servomotor axis infinite operation

By setting the upper stroke limit value and lower stroke limit value of the virtual servomotor parameters such that the "upper stroke limit value = lower stroke limit value", the stroke limit becomes invalid and infinite operation becomes possible. When the stroke limit is invalid, it is also possible for the start of the feed current value to take place in a direction that exceeds 32 bits. In this case, the feed current value is converted to a 32 bits ring address.

→ -2147483648.....2147483647 ←

The following operations are possible by the control mode.

| Control mode | Control contents |
|------------------------------------|---|
| Positioning (Linear) | <ul style="list-style-type: none"> When the ABS command is used for the start, it starts in a direction within the 32 bits range. It does not start in a direction that exceeds the 32 bits range. |
| Speed-switching | |
| Constant-speed (Linear) | <ul style="list-style-type: none"> When the INC command is used for the start, it starts in the specified direction, so it also can be start in a direction that exceeds 32 bits. |
| Fixed-pitch feed | <ul style="list-style-type: none"> It starts in the specified direction, it also can be start in a direction that exceeds 32 bits. |
| Position follow-up | <ul style="list-style-type: none"> The command address is controlled by the absolute method so it does not start in a direction that exceeds the 32 bits range. |
| Speed | <ul style="list-style-type: none"> Stroke is invalid. (It is ignored.) Moves in the specified direction. |
| JOG | |
| Manual pulse generator (Test mode) | |
| Positioning (Circular, Helical) | <ul style="list-style-type: none"> A start error (107, 108, 109) accompanies the ABS, ABH, INC or INH command and start is not possible. |
| Constant-speed (Circular, Helical) | |

(8) Reverse return during positioning

By specifying a negative speed and making a speed change request by the CHGV instruction during the start, allow the axis start deceleration at that point and return in the opposite direction upon completion of deceleration.

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

(9) Target position change **QDS**

Making a target position change request by the CHGP instruction during the start. Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (Motion SFC)" for details.

6.1.2 Parameter list

The virtual servomotor parameters are shown in Table 6.1 and the parameters shown in this table are explained in items (1) to (4) below.

Refer to the help of MT Developer2 for the parameter setting method of virtual servomotor.

A parameter is requested except for the above for program operation of the virtual servomotor. Refer to the item (5) for precautions of the parameter blocks.

Table 6.1 Virtual Servomotor Parameter List

| No. | Setting item | | Default value | | Setting range | |
|-----|------------------------------------|-----------------------|---------------|---------|---|---------|
| 1 | Virtual axis No. | | — | — | Q173DSCPU/Q173DCPU(-S1): 1 to 32 Q172DSCPU : 1 to 16 Q172DCPU(-S1) : 1 to 8 | — |
| 2 | Upper stroke limit value | | 2147483647 | pulse | -2147483648 to 2147483647 | pulse |
| 3 | Lower stroke limit value | | 0 | pulse | -2147483648 to 2147483647 | pulse |
| 4 | Command in-position range | | 100 | pulse | Q173DSCPU/Q172DSCPU : 1 to 2147483647 Q173DCPU(-S1)/Q172DCPU(-S1) : 1 to 32767 | pulse |
| 5 | JOG operation-time | JOG speed restriction | 20000 | pulse/s | 1 to 2147483647 | pulse/s |
| 6 | parameter | Parameter block No. | 1 | — | 1 to 64 | — |
| 7 | Operation mode at error occurrence | | Continuation | — | Continuation/Clutch OFF | — |

(1) Virtual axis No. setting

The virtual axis No. is set in the servo program at the virtual mode operation. The axis No. of the virtual servomotor connected to the virtual main shaft or virtual auxiliary input axis.

(2) Upper/lower stroke limit value settings

The stroke limit range of the virtual servomotor axis is set.

(a) When the stroke limit value is made valid:

Set the stroke range of the "Lower stroke limit value < upper stroke limit value".

The stroke limit check and control details at the start/during start are shown below.

| Control mode | | Error check ^(Note) | | | | Remarks |
|------------------------|----------|-------------------------------|--------------|-----|-----|--|
| | | At start | During start | | | |
| | | 106 | 207 | 208 | 220 | |
| Positioning | Linear | ○ | — | — | — | Start in the return direction in a stroke limit range from outside the stroke limit range is possible. |
| | Circular | ○ | ○ | ○ | — | |
| Fixed-pitch feed | | ○ | — | — | — | |
| Speed-switching | | ○ | ○ | ○ | — | |
| Constant-speed/Helical | | ○ | ○ | ○ | — | |
| Position follow-up | | ○ | ○ | — | ○ | |
| Speed | | — | — | — | — | Stroke limit is invalid. |
| JOG | | — | ○ | — | — | Start in the return direction in a stroke limit range from outside the stroke limit range is possible. |
| Manual pulse generator | | — | ○ | ○ | — | |

(Note): ○ Code detected at the error check.

<Error check at start>

| Error code | Contents | Operation |
|------------|--|---------------------------|
| 106 | Command position is outside the stroke limit range at start. | Operation does not start. |

<Error check during start>

| Error code | Contents | Operation |
|------------|---|--------------------|
| 207 | Feed current value is outside the stroke limit range during start. | Deceleration stop. |
| 208 | Feed current value of another axis is outside the stroke limit range at the circular interpolation start. | |
| 220 | Command address is outside the stroke limit range during position follow-up control. | |

(b) When the stroke limit value is invalid.

Set the stroke range of the "Lower stroke limit value = upper stroke limit value".

When the stroke limit is invalid, feed current value startup in a direction that exceeds 32 bits is possible.

In such a case the feed current value is converted to a 32 bit ring address.

▶ -2147483648.....2147483647 ◀

The following operations are possible by the control mode.

| Control mode | Control contents |
|------------------------------------|--|
| Positioning (Linear) | <ul style="list-style-type: none"> When the ABS command is used at the start, it starts in a direction within the 32 bits range. It does not start in a direction that exceeds the 32 bits range. |
| Speed-switching | |
| Constant-speed (Linear) | <ul style="list-style-type: none"> When the INC command is used at the start, it starts in the specified direction, so it also can be start in a direction that exceeds 32 bits. |
| Fixed-pitch feed | <ul style="list-style-type: none"> It starts in the specified direction, it also can be start in a direction that exceeds 32 bits. |
| Position follow-up | <ul style="list-style-type: none"> The command address is controlled by the absolute method so it does not start in a direction that exceeds the 32 bits range. |
| Speed | <ul style="list-style-type: none"> Stroke is invalid. (It is ignored.) Travel in the specified direction. |
| JOG | |
| Manual pulse generator | |
| Positioning (Circular, Helical) | <ul style="list-style-type: none"> A start error (107, 108, 109) occurs in the ABS, ABH, INC or INH command and start is not possible. |
| Constant-speed (Circular, Helical) | |

(3) Command in-position range

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

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

The command in-position check is executed, continuously during position control. (The command in-position range is not checked during the speed control and JOG operation.)

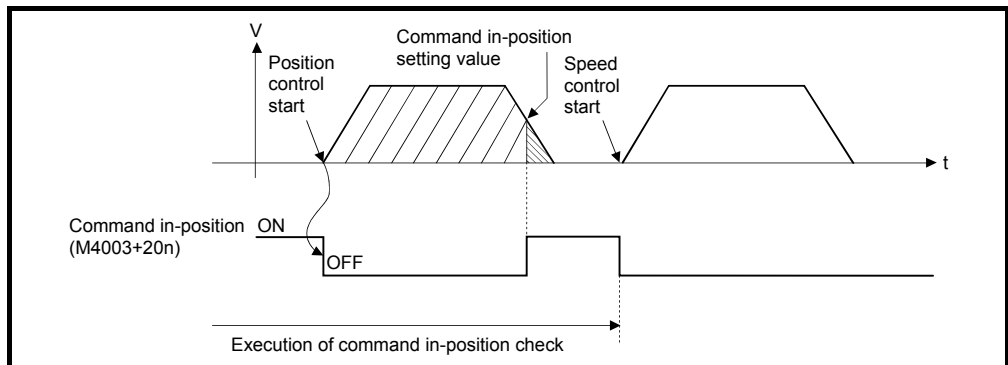


Fig. 6.1 Command in-position range

(4) Setting of the JOG speed restriction and parameter block No.

The JOG speed restriction and parameter block No. used in the JOG operation are shown below.

(a) JOG speed restriction

This is the maximum speed setting at the JOG operation for virtual axis. If the JOG speed exceeds the JOG speed restriction, the JOG speed is controlled with the JOG speed restriction.

(b) Parameter block No. setting

This is the parameter block No. setting at the JOG operation. The following parameter block data items are valid in the JOG operation.

- Acceleration time
- Deceleration time
- Rapid stop deceleration time

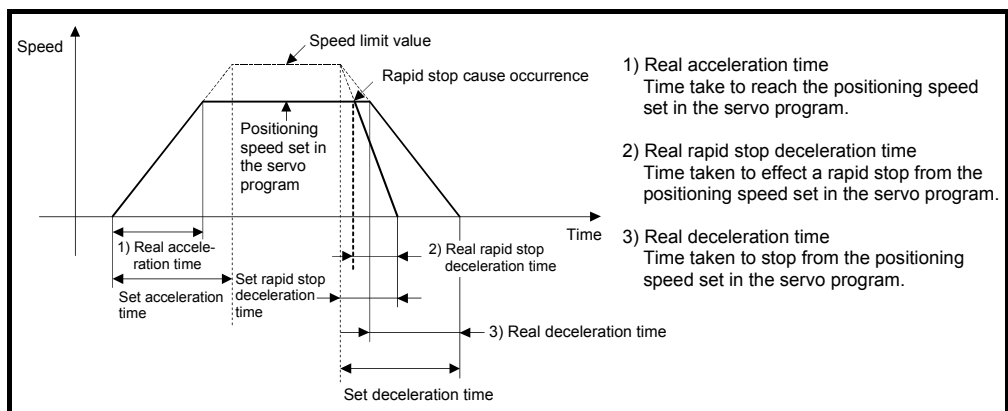
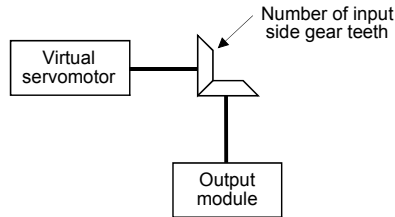


Fig. 6.2 Relationships between the JOG speed restriction, acceleration time, deceleration time and rapid stop time

POINT

- (1) Unit is fixed at [pulse] regardless of the interpolation control unit setting of parameter block in the JOG operation.
- (2) Even if the JOG speed of virtual servomotor is within the JOG speed restriction, when the JOG speed has not satisfied the condition "(Command speed [pulse/s]) × (Operation cycle [ms]) × (Number of input side gear teeth) < 2147483647 × 10³", the speed of output module becomes abnormal. Be sure to use within the range of above conditional expression.



(Example) Relation between an operation cycle, number of input side gear teeth and maximum speed

| Operation cycle [ms] | Speed [Unit: pulse/s] | | |
|-------------------------|---------------------------------|-----------|-----------|
| | Number of input side gear teeth | | |
| | 1 | 10000 | 65535 |
| 0.22 QDS | 2147483647 | 900000000 | 137331200 |
| 0.44 | | 450000000 | 68665600 |
| 0.88 | | 225000000 | 34332800 |
| 1.77 | | 112500000 | 17166400 |
| 3.55 | | 56250000 | 8583200 |
| 7.11 | | 28125000 | 4291600 |
| 14.2 QD | | 14062500 | 2145800 |

REMARK

Regardless of the speed limit value of parameter block for also program start of virtual servomotor, when the command speed has not satisfied the condition "(Command speed [pulse/s]) × (Operation cycle [ms]) × (Number of input side gear teeth) < 2147483647 × 10³", the speed of output module becomes abnormal. Be sure to use within the range of above conditional expression.

- (5) The parameter block No. for the program operation of virtual servomotor is set in the servo program for virtual mode. (If the parameter block No. setting is omitted, it is controlled with the contents of parameter block No.1.)

The valid parameter block data are shown below.

| Item | | Control unit |
|--|----------------------------------|------------------------------------|
| Interpolation control unit | | [pulse] only ^(Note-1) |
| Speed limit value | | [pulse/s] only ^(Note-1) |
| 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 | | × ^(Note-2) |
| STOP input-time deceleration processing | | × |
| Circular interpolation error permissible range | | [pulse] only ^(Note-1) |

○: Valid, ×: Invalid

(Note-1): If it is set except for the [pulse] or [pulse/s], the program operation is executed as [pulse] automatically.

(Note-2): It is set for every output module with a parameter of output module.

<Example>

| Item | | Specified parameter block setting value | Value used for the program operation |
|--|----------------------------------|---|--------------------------------------|
| Interpolation control unit | | [mm] | [pulse] |
| Speed limit value | | 2000.00[mm/min] | 200000[pulse/s] |
| Acceleration time | | 1000[ms] | 1000[ms] |
| Deceleration time | | 1000[ms] | 1000[ms] |
| Rapid stop deceleration time | | 1000[ms] | 1000[ms] |
| S-curve ratio | | 0[%] | 0[%] |
| Advanced S-curve acceleration/ deceleration | Acceleration/deceleration system | Trapezoid/S-curve | Trapezoid/S-curve |
| | Acceleration section 1 ratio | 20.0[%] | 20.0[%] |
| | Acceleration section 2 ratio | 20.0[%] | 20.0[%] |
| | Deceleration section 1 ratio | 20.0[%] | 20.0[%] |
| | Deceleration section 2 ratio | 20.0[%] | 20.0[%] |
| Torque limit value | | 300[%] | — |
| STOP input-time deceleration processing | | Deceleration stop | — |
| Circular interpolation error permissible range | | 0.0100[mm] | 100[pulse] |

6.1.3 Virtual servomotor axis devices (Internal relays, data registers)

(1) Virtual servomotor axis status

Refer to Section 4.1.3 for details of the virtual servomotor axis statuses.

(2) Virtual servomotor axis command signal

Refer to Section 4.1.4 for details of the virtual servomotor axis command signals.

(3) Virtual servomotor axis monitor device

Refer to Section 4.2.3 for details of the virtual servomotor axis monitor devices.

(4) Current value after virtual servomotor axis main shaft's differential gear

Refer to Section 4.2.4 for details of the current value after virtual servomotor axis main shaft's differential gear.

6.2 Synchronous Encoder

The synchronous encoder is used to operate the virtual axis (virtual main shaft, virtual auxiliary input axis) with the external input pulse.

Synchronous encoder operation and parameters are shown below.

6.2.1 Operation description

(1) Operations

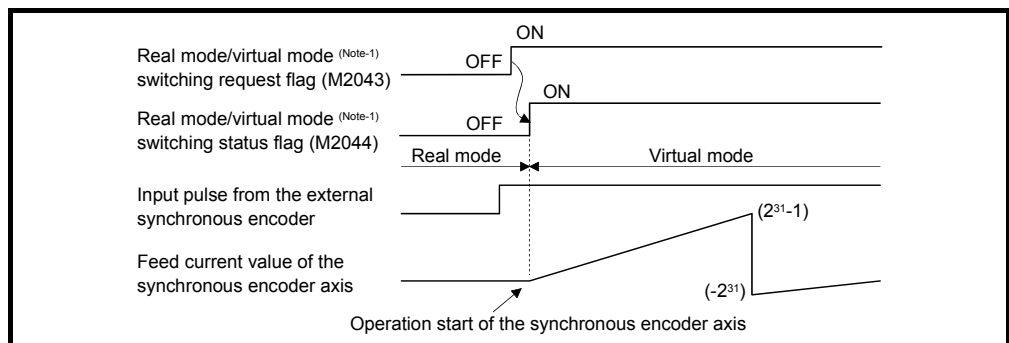
Although a synchronous encoder does not need to start using the servo program etc. in order to operate it by external devices, it needs cautions for the timing which begins to input the input pulse from a synchronous encoder.

(a) Operation start

The input timing of input pulse ^(Note-4) from an external synchronous encoder is shown below.

- At the switching from real mode to virtual mode
- At the external signal ^(Note-2) (TREN : Synchronous encoder input start signal) input

- 1) When the input pulse is started to input at the switching from real mode to virtual mode. ^(Note-4)
 - a) The input pulse is input from the external synchronous encoder at the switching from real mode to virtual mode.



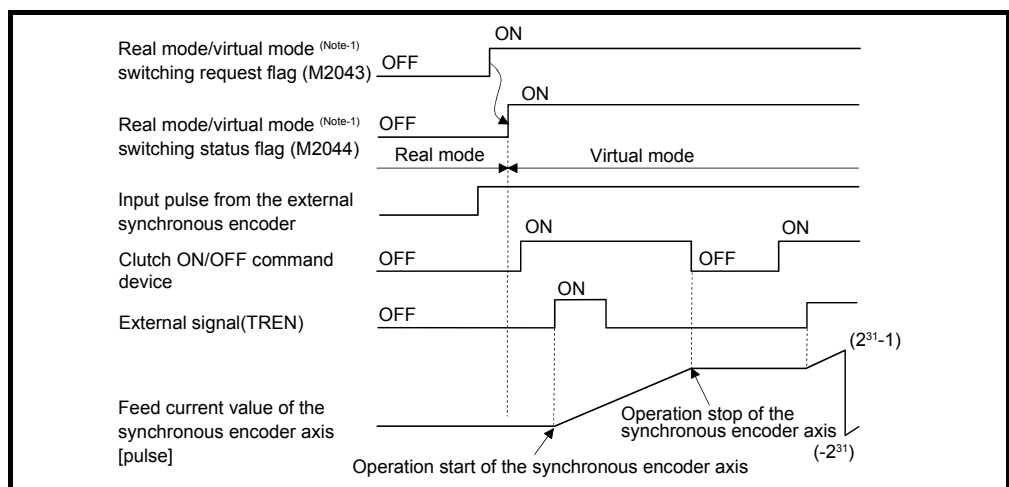
- b) The control mode (Note-3) of a clutch is operation in the case of ON/OFF mode and address mode. It can be used with the synchronous encoder for the incremental/absolute data method.
- c) Operating of the synchronous encoder axis starts when switched to the virtual mode by executing the switching request from real mode to virtual mode (M2043 OFF to ON). It depends on the state of connected clutch whether synchronous encoder operation in virtual mode is transmitted or not to the output module.
 - Clutch ON Transmit to the output module.
 - Clutch OFF Not transmit to the output module.

⚠ CAUTION

- If the mode is switched from real mode to virtual mode in the state of clutch ON, use the smoothing clutch. If the direct clutch is used and the mode is switched from real mode to virtual mode in the state of clutch ON, the rapid acceleration occurs at the output module axis, causing a servo error, and the machine will be subjected to a jolt.

2) When the input pulse is inputted from an external synchronous encoder.
(Note-4)

a) The input pulse is started to input from the external synchronous encoder, when the clutch is switched on in virtual mode.



b) The control mode ^(Note-3) of a clutch is operation in the case of external input mode.
Operation of the synchronous encoder and clutch corresponds.
It can be used with the synchronous encoder for the incremental data method connected to Q173DPX only.

(b) Operation end

1) Operation of the synchronous encoder axis is executed the real mode/virtual mode switching request (M2043 : ON → OFF) and ends at the switching to real mode. ^(Note-4)

2) The procedure for ending operation of the synchronous encoder axis is shown below.

a) Stop the output module

- Stop the external synchronous encoder.
- Switch the connected clutch OFF.

b) Switch from the virtual mode to real mode.

⚠ CAUTION

- If the mode is switched from virtual mode to real mode while the synchronous encoder axis and connected output module are operating, the rapid stop occurs at the output module axis, causing a servo error, and the machine will be subjected to a jolt.

(c) Stopping method

Stop the external synchronous encoder for stopping the external synchronous encoder.

There are no external inputs (FLS, RLS, STOP) or stop command/rapid stop command from the Motion SFC program for the synchronous encoder.

(d) Control items

- 1) The deviation counter value and the real current value are not stored, so that the synchronous encoder has no feedback pulse.
- 2) The current value of synchronous encoder is recorded in a backup memory, and it is restored at the switching from real mode to virtual mode after the power supply of the Multiple CPU system turned on. ^(Note-4)

a) When the output module is using the absolute position system, continuation operation is possible. However, if the servomotor of the output module connected to the synchronous encoder or synchronous encoder for the absolute data method is operated by 180° or more while the power supply of the Multiple CPU system turns off, continuation operation is impossible even if the absolute position system is being used.

At this time, the virtual mode continuation operation disabled warning signal turns on.

Set the servomotor of output module to the position which synchronous operation is possible.

b) When the output module is not using the absolute position system, correct the feed current value by the current value change switching from real mode to virtual mode.

(e) Control change

The following current value change is possible for the synchronous encoder. Refer to Section 7.3 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (Motion SFC)" for details of the current value change.

REMARK

(Note-1): Refer to Section 4.1.7 (9) (10) for details of the real mode/virtual mode switching request flag and real mode/virtual mode switching status flag. Refer to Chapter 9 for switching from real mode to virtual mode.

(Note-2): The synchronous encoder input start signal is inputted to the Q173DPX "TREN" terminal.

Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller User's Manual" for details of the Q173DPX "TREN" terminal.

(Note-3): Refer to Section 7.2.1 for details of the clutch control mode.

(Note-4): The input pulse is always input after Multiple CPU system's power supply ON in the real mode for the version (Refer to Section 1.4) that supports "synchronous encoder current value monitor in real mode".

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

(f) Error-time operation mode

The processings are shown below when major errors occurred with the output modules per 1 system.

The following control is executed based on the parameter settings (Refer to Table 6.2) of the synchronous encoder connected to the virtual main shaft.

1) Continuation

Even if a major error occurs with the output module, the output module continues operation. At this time, the error detection signal (M2407+20n) turns on, and the applicable error code is stored in the major error code storage register.

Use the Motion SFC program for continue/stop of the system and the output module operation at the major error occurrence.

2) Clutch OFF

If a major error occurs with the output module, the clutch within 1 system turns off and stops connected output modules.

At this time, the clutch ON/OFF command device does not turn off.

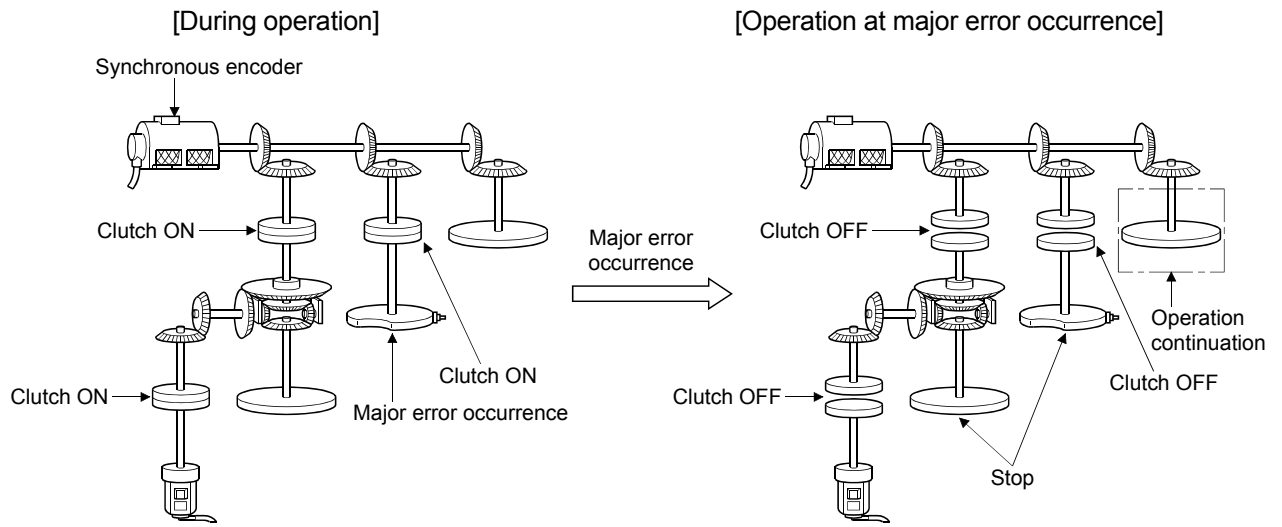
However, the clutch status storage device turns off regardless of the clutch ON/OFF command device's ON/OFF status.

Operation continues at axes where no clutch is connected.

Use the Motion SFC program to stop the drive module.

Eliminate the error cause, then turn the clutch ON/OFF command device off to on to resume the operation.

6 DRIVE MODULE



6.2.2 Parameter list

The synchronous encoder parameters are shown in Table 6.2 and the parameters shown in this table are explained in items (1) below.
 Refer to the help of MT Developer2 for the parameter setting method of synchronous encoder.

Table 6.2 Synchronous Encoder Parameter List

| No. | Setting item | Default value | Setting range |
|-----|---------------------------|---------------|---|
| 1 | Synchronous encoder No. | — | Q173DSCPU/Q172DSCPU/Q173DCPU(-S1) : 1 to 12 Q172DCPU(-S1) : 1 to 8 |
| 2 | Error-time operation mode | Continuation | Continuation/ Clutch OFF |

(1) Synchronous encoder No.

The synchronous encoder No. is set connected to the Q172DEX/Q173DPX/built-in interface in Motion CPU (DI)^{QDS}.

| Connecting position | Synchronous encoder No. |
|---------------------|-------------------------|
| P1 | 1 |
| P2 | 2 |
| P3 | 3 |
| P4 | 4 |
| P5 | 5 |
| P6 | 6 |
| P7 | 7 |
| P8 | 8 |
| P9 | 9 |
| P10 | 10 |
| P11 | 11 |
| P12 | 12 |

REMARK


(Note-1): The absolute and incremental synchronous encoders can be used (set) together.

6.2.3 Synchronous encoder axis devices (Internal relays, data registers)

- (1) **Synchronous encoder axis status**
Refer to Section 4.1.5 for details of the synchronous encoder axis statuses.
- (2) **Synchronous encoder axis command signal**
Refer to Section 4.1.6 for details of the synchronous encoder axis command signals.
- (3) **Synchronous encoder axis monitor device**
Refer to Section 4.2.5 for details of the synchronous encoder axis monitor devices.
- (4) **Current value after synchronous encoder axis main shaft's differential gear**
Refer to Section 4.2.6 for details of the current value after synchronous encoder axis main shaft's differential gear.

6.3 Virtual Servomotor/Synchronous Encoder Control Change

The current value change and JOG speed change of the virtual servomotor and the current value of synchronous encoder.

Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (Motion SFC)" for details of the current value change/speed change/target position change .

6.3.1 Virtual servomotor control change

(1) Control change registers

| Axis No. | Device No. | Signal name | | | | | | | | | | | | | | | | | | | |
|----------|-------------------|--|---|---|----------|----------------|------|-------------|---------------|-------------|------------------|-------------|------------------|---|-------------------|---|---|---|----------|----------------|---|
| 1 | D640, D641 | | | | | | | | | | | | | | | | | | | | |
| 2 | D642, D643 | | | | | | | | | | | | | | | | | | | | |
| 3 | D644, D645 | | | | | | | | | | | | | | | | | | | | |
| 4 | D646, D647 | | | | | | | | | | | | | | | | | | | | |
| 5 | D648, D649 | | | | | | | | | | | | | | | | | | | | |
| 6 | D650, D651 | <table border="1"> <thead> <tr> <th></th> <th>Signal name</th> <th>Real</th> <th>Virtual</th> <th>Refresh cycle</th> <th>Fetch cycle</th> <th>Signal direction</th> </tr> </thead> <tbody> <tr> <td>0</td> <td rowspan="2">JOG speed setting</td> <td rowspan="2">○</td> <td rowspan="2">○</td> <td rowspan="2" style="text-align: center;">/</td> <td rowspan="2">At start</td> <td rowspan="2">Command device</td> </tr> <tr> <td>1</td> </tr> </tbody> </table> | | | | | | Signal name | Real | Virtual | Refresh cycle | Fetch cycle | Signal direction | 0 | JOG speed setting | ○ | ○ | / | At start | Command device | 1 |
| | Signal name | | | | | | Real | Virtual | Refresh cycle | Fetch cycle | Signal direction | | | | | | | | | | |
| 0 | JOG speed setting | ○ | ○ | / | At start | Command device | | | | | | | | | | | | | | | |
| 1 | | | | | | | | | | | | | | | | | | | | | |
| 7 | D652, D653 | | | | | | | | | | | | | | | | | | | | |
| 8 | D654, D655 | | | | | | | | | | | | | | | | | | | | |
| 9 | D656, D657 | | | | | | | | | | | | | | | | | | | | |
| 10 | D658, D659 | | | | | | | | | | | | | | | | | | | | |
| 11 | D660, D661 | | | | | | | | | | | | | | | | | | | | |
| 12 | D662, D663 | | | | | | | | | | | | | | | | | | | | |
| 13 | D664, D665 | | | | | | | | | | | | | | | | | | | | |
| 14 | D666, D667 | | | | | | | | | | | | | | | | | | | | |
| 15 | D668, D669 | | | | | | | | | | | | | | | | | | | | |
| 16 | D670, D671 | | | | | | | | | | | | | | | | | | | | |
| 17 | D672, D673 | | | | | | | | | | | | | | | | | | | | |
| 18 | D674, D675 | | | | | | | | | | | | | | | | | | | | |
| 19 | D676, D677 | | | | | | | | | | | | | | | | | | | | |
| 20 | D678, D679 | | | | | | | | | | | | | | | | | | | | |
| 21 | D680, D681 | | | | | | | | | | | | | | | | | | | | |
| 22 | D682, D683 | | | | | | | | | | | | | | | | | | | | |
| 23 | D684, D685 | | | | | | | | | | | | | | | | | | | | |
| 24 | D686, D687 | | | | | | | | | | | | | | | | | | | | |
| 25 | D688, D689 | | | | | | | | | | | | | | | | | | | | |
| 26 | D690, D691 | | | | | | | | | | | | | | | | | | | | |
| 27 | D692, D693 | | | | | | | | | | | | | | | | | | | | |
| 28 | D694, D695 | | | | | | | | | | | | | | | | | | | | |
| 29 | D696, D697 | | | | | | | | | | | | | | | | | | | | |
| 30 | D698, D699 | | | | | | | | | | | | | | | | | | | | |
| 31 | D700, D701 | | | | | | | | | | | | | | | | | | | | |
| 32 | D702, D703 | | | | | | | | | | | | | | | | | | | | |

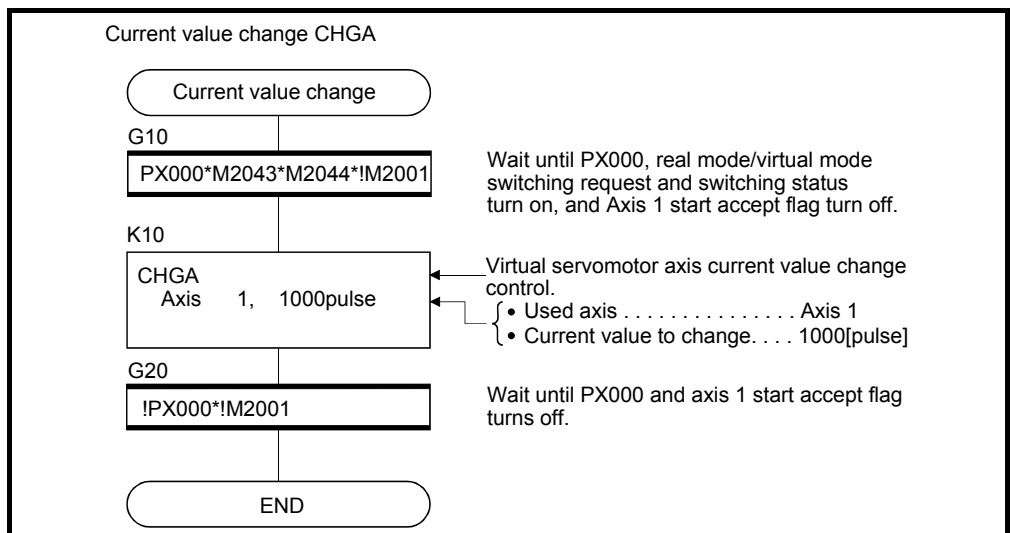
○ : Valid

| POINT |
|--|
| <p>(1) The following range is valid.</p> <ul style="list-style-type: none"> • Q172DSCPU : Axis No.1 to 16 • Q172DCPU(-S1): Axis No.1 to 8 <p>(2) The following device area can be used as a user device.</p> <ul style="list-style-type: none"> • Q172DSCPU : 17 axes or more • Q172DCPU(-S1): 9 axes or more <p>However, when the project of Q172DSCPU/Q172DCPU(-S1) is replaced with Q173DSCPU/Q173DCPU(-S1), this area cannot be used as a user device.</p> |

- (a) JOG speed setting registers (D640+2n, D641+2n)Command device
- 1) This register stores the JOG speed at the JOG operation.
 - 2) Setting range of the JOG speed is 1 to 2147483647 [pulse/s].
 - 3) The JOG speed is the value stored in the JOG speed setting registers at leading edge of JOG start signal.
Even if data is changed during JOG operation, JOG speed cannot be changed.
- (Note): Refer to Section 6.21 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)" for details of the JOG operation.

(2) Current value change

- (a) Current value change by the CHGA instruction
Motion SFC program for which executes the servo program is shown below.
Current value change program of the virtual servomotor (When 1 axis feed current value of the virtual servomotor is changed to 1000 pulse.)

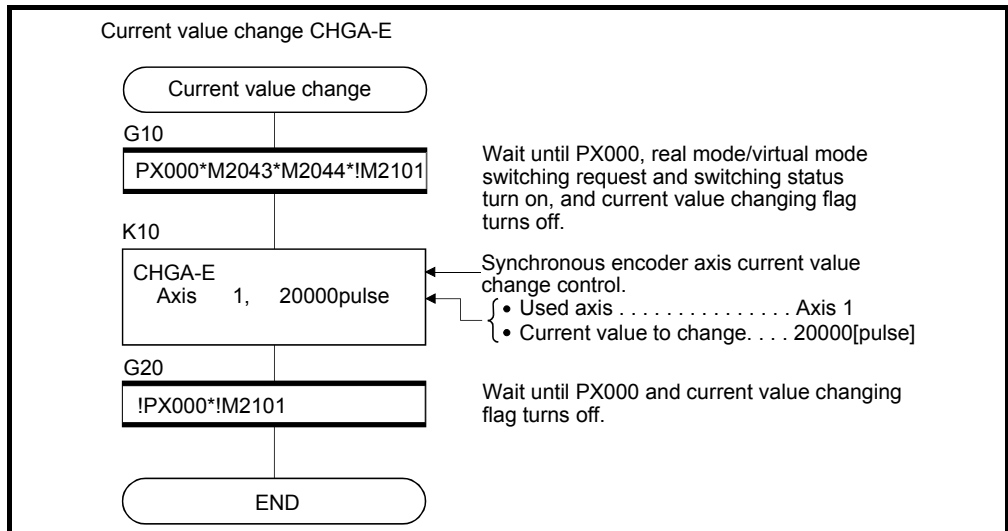


(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

6.3.2 Synchronous encoder control change

(1) Current value change by the CHGA-E instruction

Example of Motion SFC program for which executes the servo program is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

(a) The current value to change uses the following devices.

- Indirect setting..... Data register (D)
 - Link register (W)
 - Motion register (#)
 - Multiple CPU area device (U□\G)
 - Direct setting
 - Decimal constant (K)
- } 2 word

(b) Precautions

- When the synchronous encoder current value is changed in the real mode, an error occurs and the current value change is not executed. ^(Note-1)
- The synchronous encoder current value change can be executed even during operation in the virtual mode operation (during pulse input from the synchronous encoder). ^(Note-1)
When the current value is changed, the synchronous encoder current value will be continued from the changed value.
- Even if a synchronous encoder current value is changed, it will have no effect on the output module current value.

(Note-1): The current value change can be executed in real mode for the version (Refer to Section 1.4) that supports "synchronous encoder current value monitor in real mode".

7. TRANSMISSION MODULE

The transmission module transmits the pulse outputted from the drive module to output module.

There are following 4 types transmission modules.

- Gear Section 7.1
- Clutch Section 7.2
- Speed change gear Section 7.3
- Differential gear Section 7.4

The device range and setting procedure for indirect setting in the parameter setting of the transmission module are show below.

(1) Device range

The number of device words and device range at the indirect setting are shown below.

| Module | Item | Number of device words | Device setting range | Remark | | | | | | | | | | | | | | |
|---|--|--|--|--------|-------|-----------|----------------------------------|--------------|--------------|-----------|-----------|--|--------------|---|-----------|------|--|--|
| Clutch | Clutch ON/OFF command device | Bit | <table border="1"> <thead> <tr> <th>Device</th> <th>Range</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>0000 to 1FFF ^(Note-1)</td> </tr> <tr> <td>Y</td> <td>0000 to 1FFF</td> </tr> <tr> <td>M</td> <td>0 to 8191</td> </tr> <tr> <td>B</td> <td>0000 to 1FFF</td> </tr> <tr> <td>F</td> <td>0 to 2047</td> </tr> <tr> <td>U□\G</td> <td>10000.0 to (10000+p-1).F ^(Note-2)</td> </tr> </tbody> </table> | Device | Range | X | 0000 to 1FFF ^(Note-1) | Y | 0000 to 1FFF | M | 0 to 8191 | B | 0000 to 1FFF | F | 0 to 2047 | U□\G | 10000.0 to (10000+p-1).F ^(Note-2) | |
| | Device | | Range | | | | | | | | | | | | | | | |
| | X | | 0000 to 1FFF ^(Note-1) | | | | | | | | | | | | | | | |
| | Y | | 0000 to 1FFF | | | | | | | | | | | | | | | |
| | M | | 0 to 8191 | | | | | | | | | | | | | | | |
| B | 0000 to 1FFF | | | | | | | | | | | | | | | | | |
| F | 0 to 2047 | | | | | | | | | | | | | | | | | |
| U□\G | 10000.0 to (10000+p-1).F ^(Note-2) | | | | | | | | | | | | | | | | | |
| Smoothing clutch complete signal | | | | | | | | | | | | | | | | | | |
| Clutch status | | | | | | | | | | | | | | | | | | |
| Mode setting device | 1 | <table border="1"> <thead> <tr> <th>Device</th> <th>Range</th> </tr> </thead> <tbody> <tr> <td>D</td> <td>0 to 8191</td> </tr> <tr> <td>W</td> <td>0000 to 1FFF</td> </tr> <tr> <td>#</td> <td>0 to 7999</td> </tr> <tr> <td>U□\G</td> <td>10000 to (10000+p-1) ^(Note-2)</td> </tr> </tbody> </table> | Device | Range | D | 0 to 8191 | W | 0000 to 1FFF | # | 0 to 7999 | U□\G | 10000 to (10000+p-1) ^(Note-2) | | | | | | |
| Device | Range | | | | | | | | | | | | | | | | | |
| D | 0 to 8191 | | | | | | | | | | | | | | | | | |
| W | 0000 to 1FFF | | | | | | | | | | | | | | | | | |
| # | 0 to 7999 | | | | | | | | | | | | | | | | | |
| U□\G | 10000 to (10000+p-1) ^(Note-2) | | | | | | | | | | | | | | | | | |
| Clutch ON address setting device | 2 | | | | | | | | | | | | | | | | | |
| Clutch OFF address setting device | 2 | | | | | | | | | | | | | | | | | |
| Slippage setting device | 2 | | | | | | | | | | | | | | | | | |
| Slippage in-position range setting device | 2 | | | | | | | | | | | | | | | | | |
| Gear | Input axis side tooth count | 1 | | | | | | | | | | | | | | | | |
| | Output axis side tooth count | 1 | | | | | | | | | | | | | | | | |
| Speed change gear | Speed change ratio setting device | 1 | | | | | | | | | | | | | | | | |

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

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

| POINT |
|--|
| (1) Be sure to set even-numbered devices of the items set as 2-word. Be sure to set as 32-bit integer type when the data is set in these devices using the Motion SFC programs. |
| (2) When a 2-word monitor device is read in the Motion SFC program, read it as 32-bit integer type. |
| (3) Refer to Chapter 2 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for the user setting area points of the Multiple CPU high speed transmission area. |



7 TRANSMISSION MODULE

(2) Device data input

The all device data set indirectly is inputted as "initial value" at the switching from real mode to virtual mode, thereafter the input control for module is executed during the virtual mode operation.

The input timing of each setting device and refresh cycle of setting device are shown below.

| Module | Item | Input device | Refresh device | Device input timing | | Refresh cycle |
|-------------------|---|--------------|----------------|---|---|---------------------------|
| | | | | Real mode/ Virtual mode switching | During the virtual mode operation | |
| Clutch | Clutch ON/OFF command device | ○ | — | ○ | Input for every operation cycle. (Note) | — |
| | Smoothing clutch complete signal | — | ○ | — | — | Operation cycle (Note) |
| | Clutch status | — | ○ | — | — | |
| | Mode setting device | ○ | — | ○ | Input for every operation cycle. (Note) | — |
| | Clutch ON address setting device | ○ | — | ○ | | |
| | Clutch OFF address setting device | ○ | — | ○ | | |
| | Slippage setting device | ○ | — | ○ | Input when switching mode setting device. | |
| | Slippage in-position range setting device | ○ | — | ○ | Input for every operation cycle. (Note) | |
| Gear | Input axis side tooth count | ○ | — | ○ | Input when the current value change of the connection source drive module (virtual servomotor axis/synchronous encoder axis) is executed and the gear ratio is changed. | |
| | Output axis side tooth count | ○ | — | ○ | | |
| Speed change gear | Speed change ratio setting device | ○ | — | ○ | Input for every operation cycle. (Note) | |

REMARK

(Note): The operation cycle is set in the "operation cycle setting" of system basic setting.

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

7 TRANSMISSION MODULE

7.1 Gear

This section describes the gear operation and the parameters required to use a gear.

7.1.1 Operation

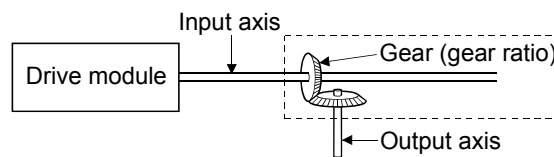
Relation between the number of pulses outputted from the synchronous encoder or virtual servomotor and the output module is adjusted by parameter setting of the encoder resolution of servomotor, the gear ratio in consideration of the deceleration ratio for machine system etc. and rotation direction.

The gear operation is shown below.

- (1) The gear transmits the number of pulses which applied the gear ratio set in the gear parameter to the travel value (number of pulses) of drive module (virtual servomotor, synchronous encoder) to the output axis.

$$\left[\begin{array}{c} \text{Number of output} \\ \text{axis pulses} \end{array} \right] = \left[\begin{array}{c} \text{Number of input} \\ \text{axis pulses} \end{array} \right] \times [\text{Gear ratio}] \quad [\text{pulse}]$$

- (2) The rotation direction of output axis is set in the gear parameters.



REMARK

Refer to Section 7.1.2 for details of the gear parameters.

7.1.2 Parameters

The gear parameters are shown in Table 7.1 and the parameters shown in this table are explained in items (1) to (2) below.

Refer to the help of MT Developer2 for the gear parameter setting method.

Table 7.1 Gear Parameter List

| No. | Setting Item | | Default | Setting range | |
|-----|-----------------------------------|-----------------------------------|------------------|--------------------------------------|--|
| | | | | Direct setting | Indirect setting |
| 1 | Gear ratio | Input axis side tooth count (GI) | 1 | 1 to 65535 | D0 to D8191 ^(Note-1) |
| | | Output axis side tooth count (GO) | | | W0 to W1FFF |
| | | | | | #0 to #7999 |
| | | | | | U□\G10000 to U□\G(10000+p-1) ^(Note-2) |
| 2 | Rotation direction of output axis | | Forward rotation | Forward rotation Reverse rotation | — |

(Note-1): D800 to D1559 are dedicated devices of the virtual servomotor axis, synchronous encoder axis and output module "Cam" in the virtual mode. Unused areas of virtual servomotor axis and cam axis can be used as a user device.

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

(1) Gear ratio

- (a) The number of pulses transmitted to the output axis through 1 pulse outputted from the drive module by the gear module is set in the gear ratio.
- (b) The gear ratio is based on the settings for the input axis side tooth count (GI) and output axis side tooth count (GO).

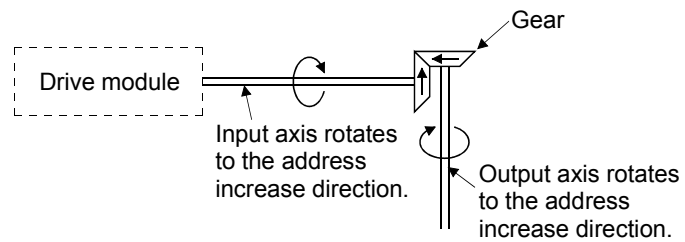
| |
|--|
| $\text{Gear ratio} = \frac{\text{Input axis side tooth count (GI)}}{\text{Output axis side tooth count (GO)}}$ |
|--|

(2) Rotation direction of output axis

- (a) The rotation direction of the output axis forward the rotation direction of the input axis is set.
- (b) There are two types for rotation directions of the output axis: forward and reverse.

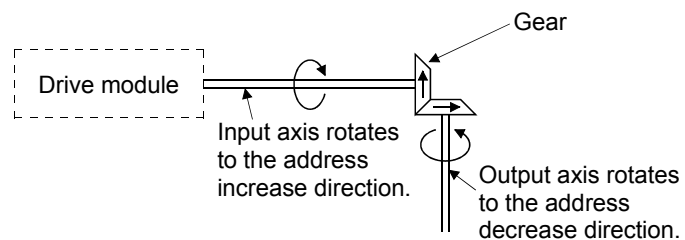
1) Forward

When the input axis rotates to the address increase direction, the output axis also rotates to the address increase direction.



2) Reverse

When the input axis rotates to the address increase direction, the output axis rotates to the address decrease direction.



| | |
|--------------|--|
| POINT | <p>If the gear ratio is set indirectly, the timing that the gear ratio set in Motion SFC program becomes valid is shown below.</p> <ul style="list-style-type: none"> (1) When the real mode is switched to virtual mode. (2) When the current value of the drive module is changed in the virtual mode. |
|--------------|--|

7.2 Clutch

The clutch is used to transmit/disengage the command pulse from drive module side to output module side, and to control the operation/stop of servomotor.

There are two types for clutch: smoothing clutch and direct clutch.

These two clutches operate in the same way, but these have the difference in whether the acceleration/deceleration processing by the smoothing processing is executed or not at the switching of the clutch on/off.

(1) Smoothing clutch and direct clutch

(a) Smoothing clutch

When the clutch is switched on/off, output to the output axis with the acceleration/deceleration processing (smoothing processing) set in the clutch parameters.

There are following three systems for smoothing clutch.

1) Time constant system

2) Slippage system

- Exponential function system • Linear acceleration/deceleration system

(b) Direct clutch

When the clutch is switched on/off, output to the output axis without the acceleration/deceleration processing.

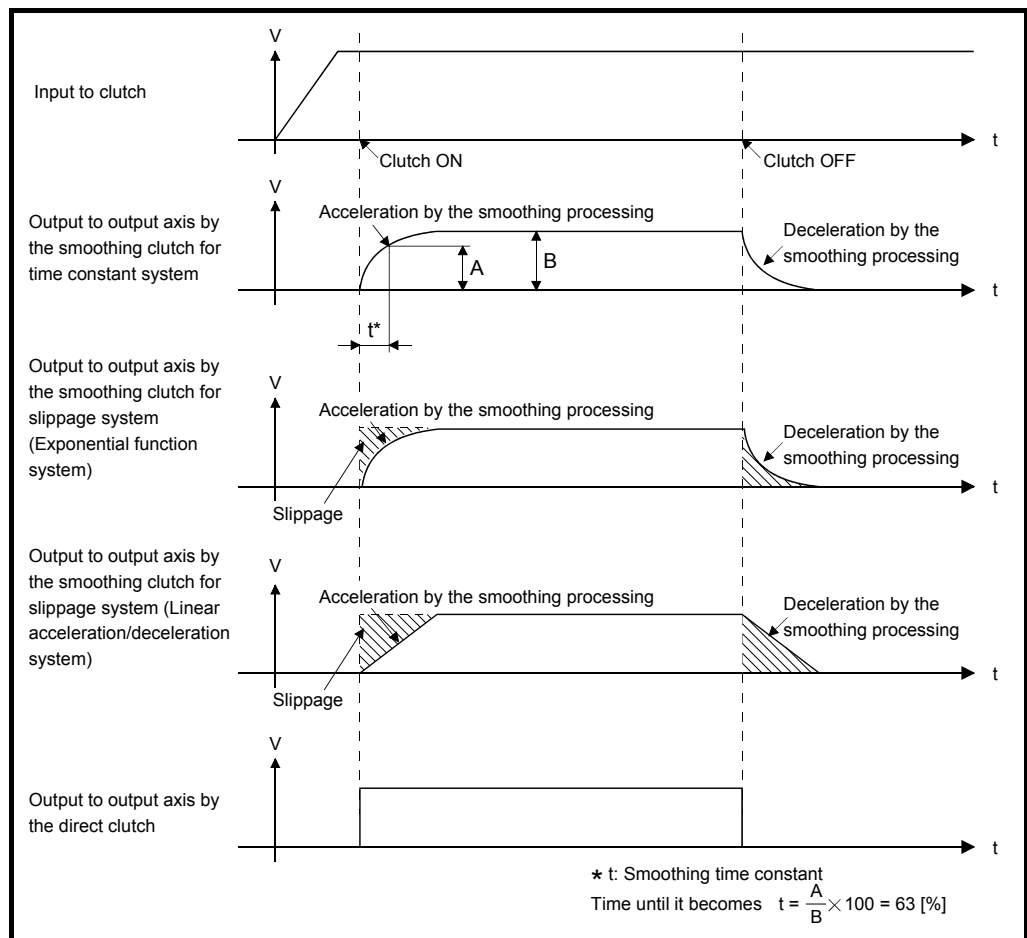
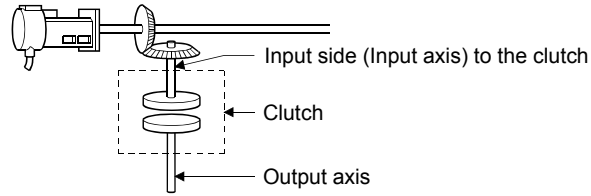


Fig. 7.1 Output to the Output axis by the Smoothing and Direct Clutch

REMARK

(1) Clutch ON/OFF state is shown below.

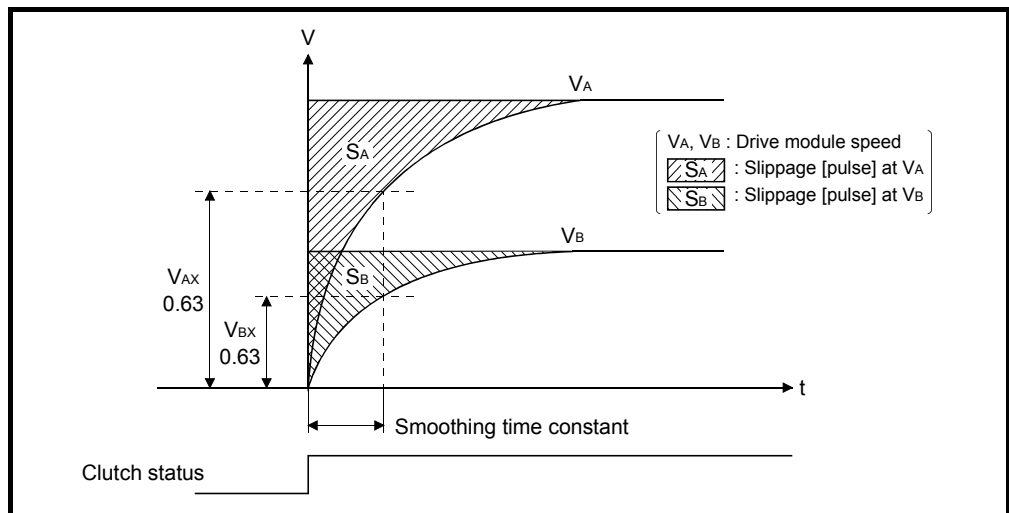


- Clutch ON state.....The state in which pulses inputted to the clutch are output to the output axis.
- Clutch OFF state.....The state in which pulses inputted to the clutch are not output to the output axis.

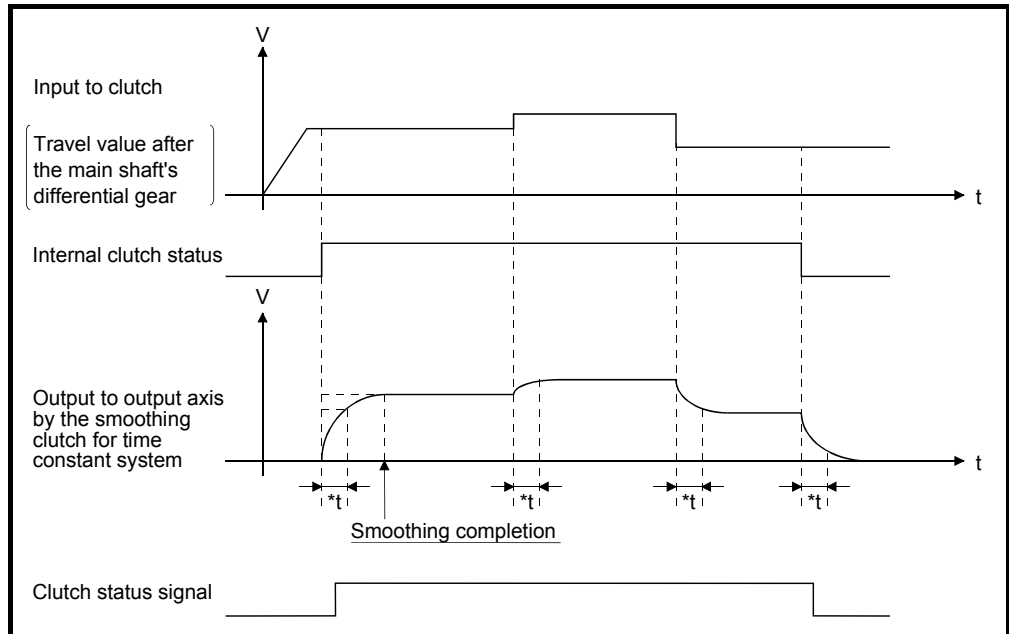
(2) Smoothing processing

(a) Time constant system

1) Since the time constant is fixed, the slippage of clutch changes according to the speed of drive module.



2) If input to clutch (travel value after the main shaft's differential gear) changes after smoothing completion, the smoothing processing is executed at that point.



*t : Smoothing time constant

(b) Slippage system

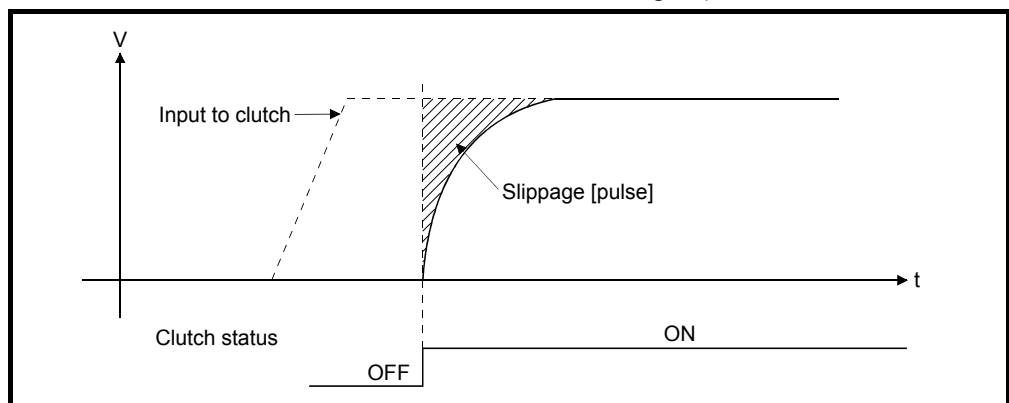
There are following two systems for slippage system.

- Exponential function system
- Linear acceleration/deceleration system

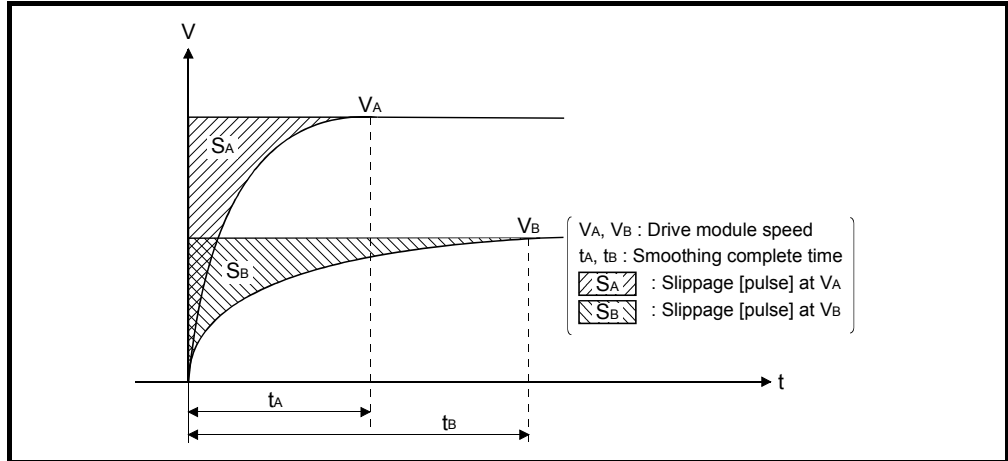
1) Exponential function system

a) Set the slippage indicated by the shaded area in the diagram below.

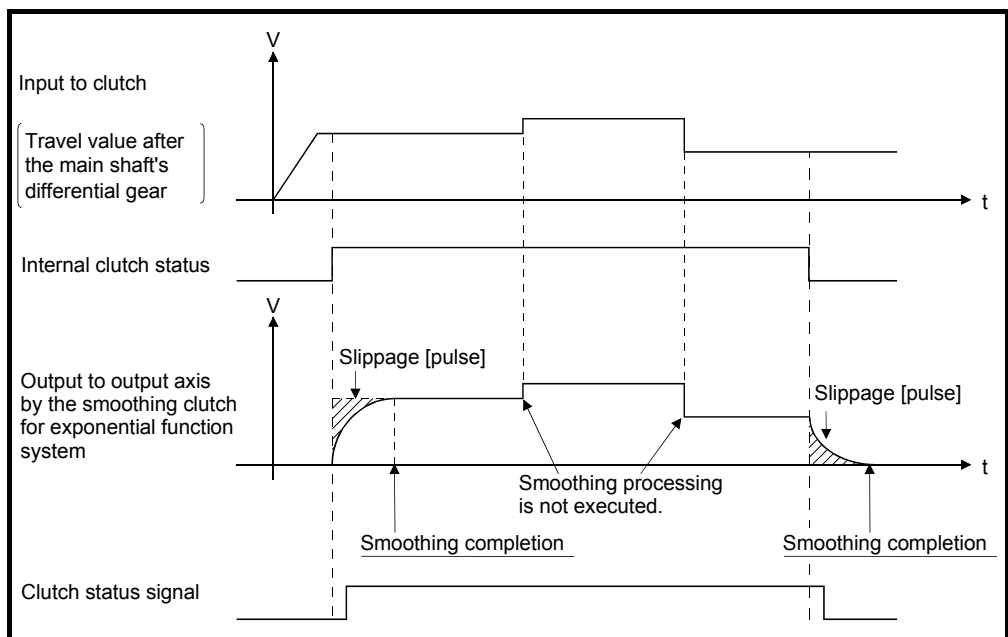
Slippage is recommended to be set greater than input to clutch (travel value after the main shaft's differential gear).



b) Since the slippage remains constant even if the drive module speed changes, the clutch ON/OFF position can be controlled without any influence from speed changes.



c) If input to clutch (travel value after the main shaft's differential gear) changes after smoothing completion, the smoothing processing is not executed at that point and output directly.

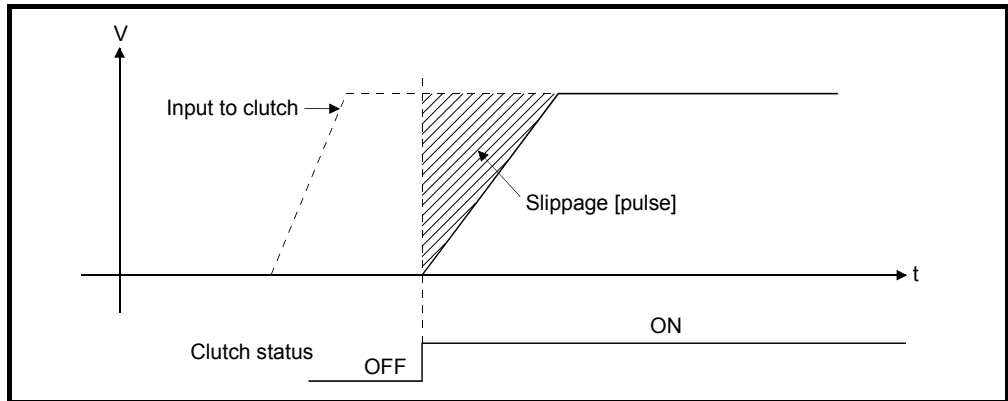


- d) The smoothing clutch complete signal turns ON after completion of smoothing processing.
- ON ... "(Remainder slippage) < (Slippage in-position range)"
 - OFF ... Smoothing processing start (Clutch ON/OFF)

The smoothing clutch complete signal is used to check the completion of smoothing processing, etc.

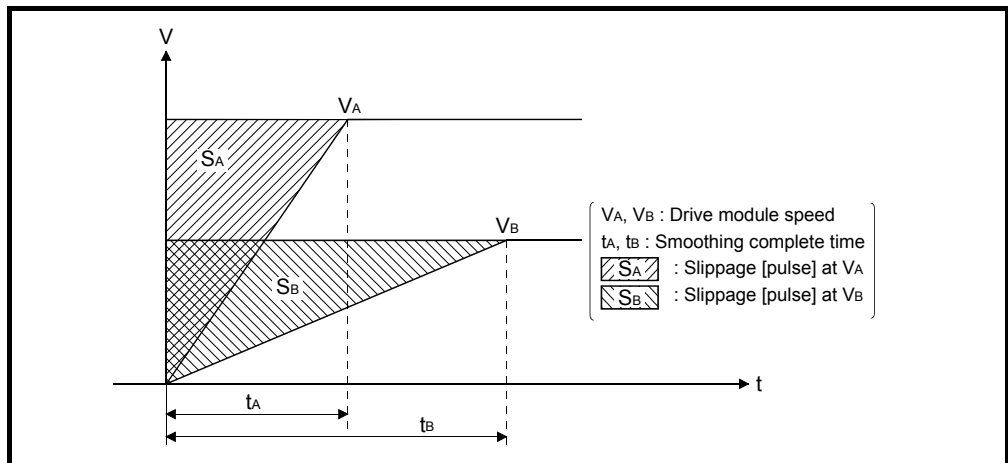
2) Linear acceleration/deceleration system

- a) Set the slippage indicated by the shaded area in the diagram below. Slippage is recommended to be set greater than input to clutch (travel value after the main shaft's differential gear).

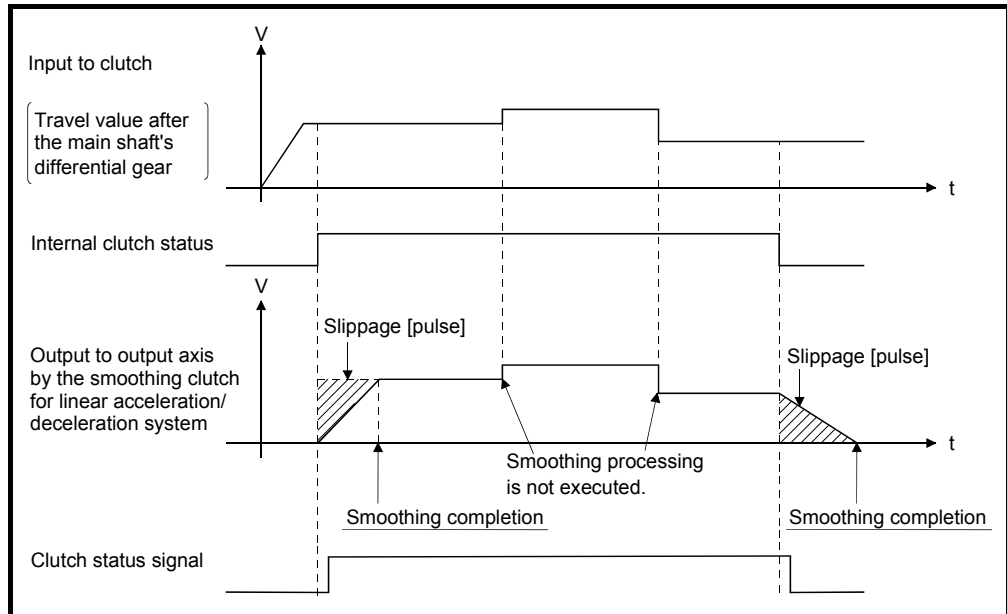


- b) Execute the smoothing processing so that the slippage may become the shaded area by the linear acceleration/deceleration system at clutch ON/OFF.

- c) Since the slippage remains constant even if the drive module speed changes, the clutch ON/OFF position can be controlled without any influence from speed changes.



d) If input to clutch (travel value after the main shaft's differential gear) changes after smoothing completion, the smoothing processing is not executed and output directly.



- e) The smoothing clutch complete signal turns ON after completion of smoothing processing.
- ON "(Remainder slippage) < (Slippage in-position range)"
 - OFF... Smoothing processing start (Clutch ON/OFF)

The smoothing clutch complete signal is used to check the completion of smoothing processing, etc.

7.2.1 Operation

There are following five clutch operation modes.

| Operation mode | Description |
|---------------------|---|
| ON/OFF mode | Clutch ON/OFF control is executed by turning the clutch ON/OFF command device on/off. |
| Address mode | Clutch ON/OFF control is executed by turning the clutch ON/OFF command device on/off and an address of clutch ON/OFF address setting device. |
| Address mode 2 | After clutch ON/OFF command device turns on, Clutch ON/OFF control by an address of clutch ON/OFF address setting device. |
| One-shot mode | Clutch ON/OFF control is executed based on the drive module current value, setting travel value before clutch ON and setting travel value after clutch ON after the clutch ON/OFF command device from off to on. |
| External input mode | Only axis that the incremental synchronous encoder (manual pulse generator) is set as drive module can be set. Clutch ON/OFF control is executed by turning the clutch ON/OFF command device on/off and an external input (TREN signal: Synchronous encoder start signal). |

Operations for every clutch mode are shown below.

(1) ON/OFF mode

- (a) The clutch ON/OFF control is executed by turning the clutch ON/OFF command device on/off.

| Conditions | Clutch operation |
|-----------------------------------|------------------|
| Clutch ON/OFF command device: ON | ON |
| Clutch ON/OFF command device: OFF | OFF |

- (b) It takes a time for maximum operation cycle until a clutch will be in the ON/OFF state after turning the clutch ON/OFF command device on/off. If greater accuracy is required, use the "address mode".

| POINT |
|---|
| (1) The mode setting device of except "0 to 4" is regarded as an error, and it controls continuously at the previous setting value. |
| (2) Clutch operation mode can be changed at any time. |

- (c) The clutch ON/OFF state can be checked by the clutch status signal.

(d) The refresh cycle of clutch status signal is an operation cycle.

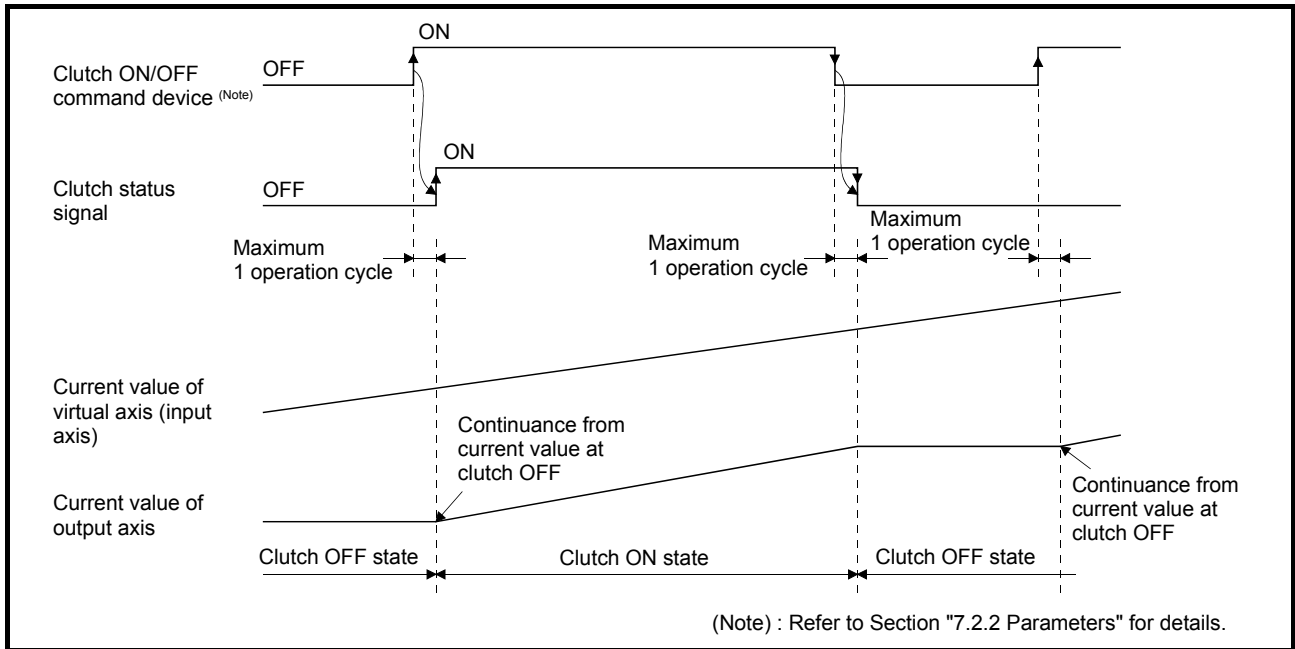


Fig. 7.2 Operation Timing for ON/OFF Mode

(2) Address mode

(a) When the current value of virtual axis reaches an address of clutch ON/OFF address setting device, the clutch ON/OFF is executed. (Mode setting device is "1".)

- 1) When the clutch ON/OFF command device is ON and the current value of virtual axis reaches an address set in the clutch ON address setting device, the clutch is set to the ON state.
- 2) When the clutch ON/OFF command device is OFF and the current value of virtual axis reaches an address set in the clutch OFF address setting device, the clutch is set to the OFF state.

(b) The clutch ON/OFF control differs according to the output module connected as follows.

- 1) For a ball screw or roller
 - The ON/OFF control is executed by the current value of virtual axis.
 - When a differential gear is connected to the main shaft, the ON/OFF control is executed by the current value after the main shaft's differential gear.
- 2) For a rotary table or cam
 - The ON/OFF control can be executed by setting the current value of virtual axis or current value within 1 virtual axis revolution.
 - (Refer to a rotary table or cam of output module for details.)

(c) Turn the clutch ON/OFF command device on/off after setting an address of clutch ON/OFF address setting device.

- 1) When the clutch ON/OFF command device is OFF, even if the current value of virtual axis reaches an address of clutch ON address setting device, the clutch is not set to the ON state.
- 2) When the clutch ON/OFF command device is ON, even if the current value of virtual axis reaches an address of clutch OFF address setting device, the clutch is not set to the OFF state.

(d) The clutch ON/OFF state can be checked by clutch status signal.

(e) The refresh cycle of clutch status signal is an operation cycle.

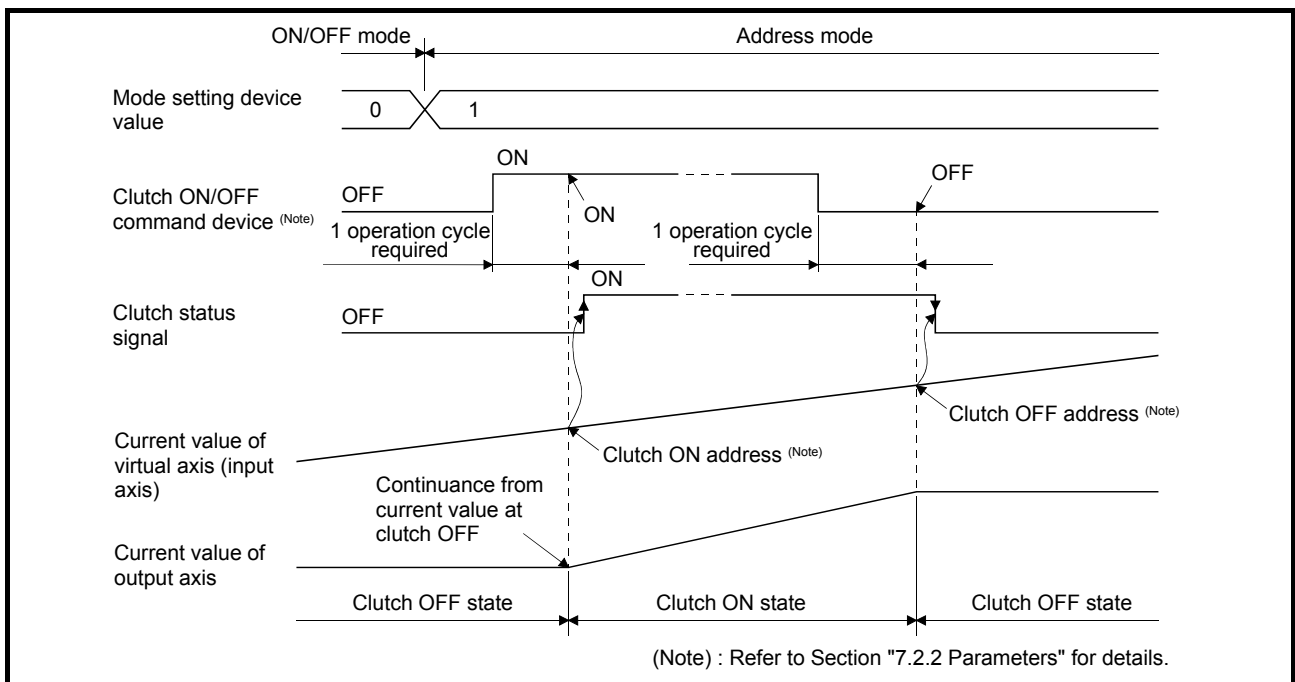


Fig. 7.3 Operation Timing for Address Mode

| POINT |
|--|
| (1) The mode setting device of except for "0 to 4" is regarded as an error, and control is continued at the previous setting value. |
| (2) Clutch operation mode changes are valid at any time. |
| (3) Clutch ON/OFF address setting device changes are valid at any time. Since they have 2-word data, set it as 32-bit integer type data. |

(3) Address mode 2

- (a) When the current value of virtual axis reaches an address of clutch ON/OFF address setting device, the clutch ON/OFF is executed. (Mode setting device is "2".)
- (b) When the clutch ON/OFF command device is ON, the following controls are executed according to the current clutch status.
 - 1) When the current clutch status is OFF.
 - When the current value of virtual axis reaches an address set in the clutch ON address setting device, the clutch is set to the ON state. After that, it is set the state in 2).
 - 2) When the current clutch status is ON.
 - When the current value of virtual axis reaches an address set in the clutch OFF address setting device, the clutch is set to the OFF state. After that, it is set the state in 1).
- (c) When the clutch ON/OFF command device is OFF, the clutch is turned off and the above control (b) is not executed. Therefore, the above control is resumed by turning the clutch ON/OFF command device on.

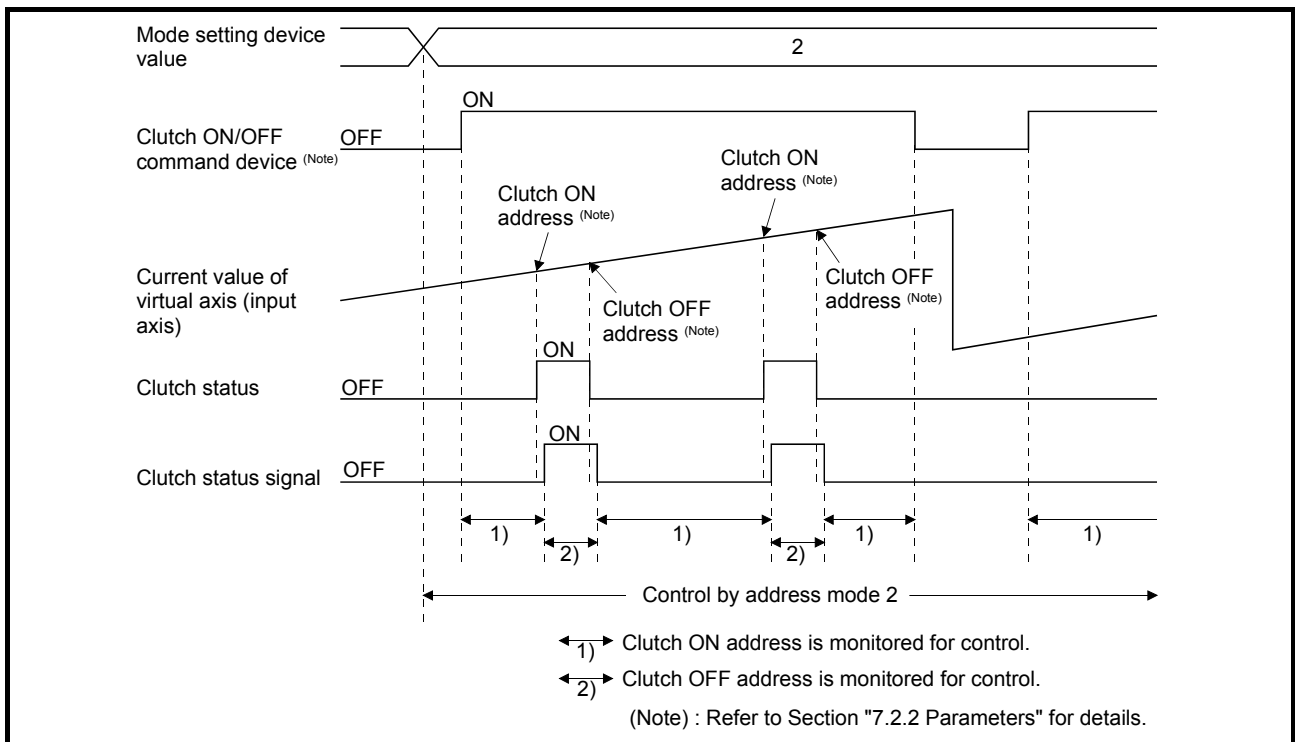


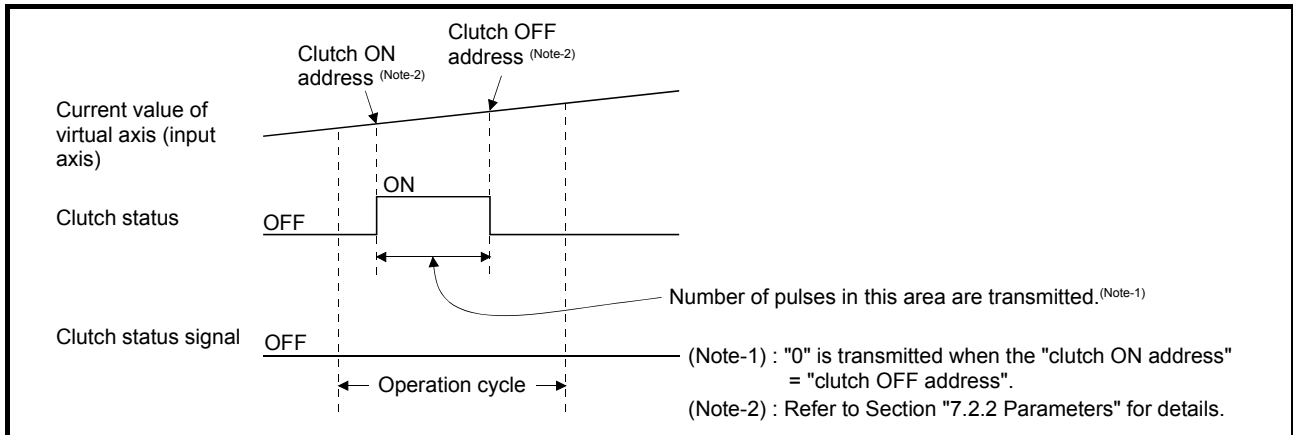
Fig. 7.4 Operation Timing for Address Mode 2

| POINT |
|--|
| (1) The mode setting device of except for "0 to 4" is regarded as an error, and control is continued at the previous setting value. |
| (2) Clutch control mode changes are valid at any time. |
| (3) Clutch ON/OFF address setting device changes are valid at any time. Since they have 2-word data, set it as 32-bit integer type data. |

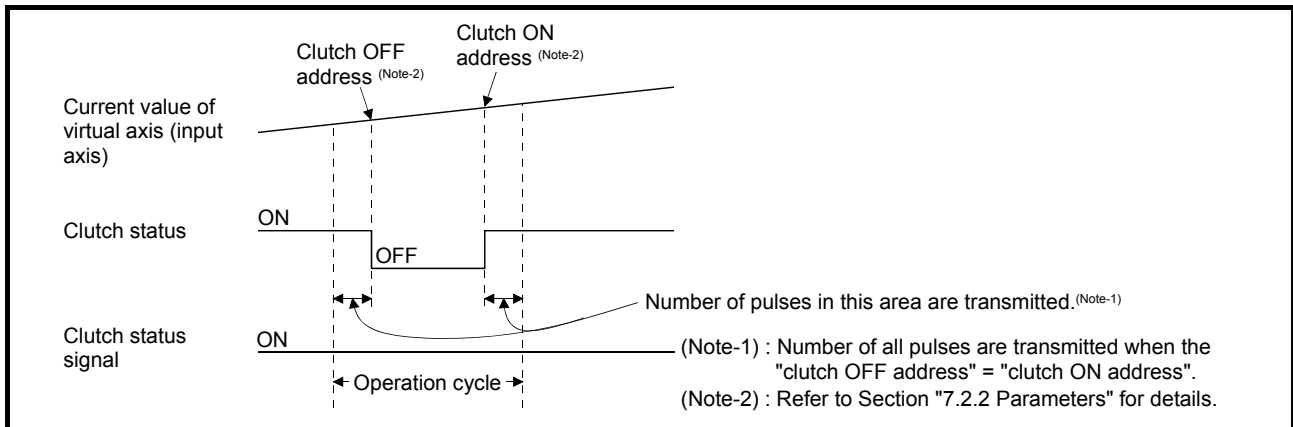
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- (d) The clutch ON/OFF control is executed for every operation cycle. When the current value passes through an address set in the clutch ON/OFF address setting device for 1 operation cycle, the internal control is executed correctly but the clutch status signal does not change.

- 1) When the clutch status signal is OFF and the current value passes through an address set in the clutch ON/OFF address setting device.



- 2) When the clutch status signal is ON and the current value passes through an address set in the clutch ON/OFF address setting device.



- (e) When the "Clutch OFF" is set in the parameter "Error-time operation mode" of drive module and a major error occurs in the output module, the operating system software turns off the clutch.

The procedure to resume an operation after an error occurrence is shown below.

- 1) Remove a major error factor.
- 2) Turn the clutch ON/OFF command device off.
 - It returns to normal state.
- 3) Turn the clutch ON/OFF command device on.
 - The clutch ON address is monitored and control is resumed.

- (f) The procedure to execute the axis servo OFF or power supply OFF of servo amplifier during operation is shown below.
 - 1) Turn the clutch ON/OFF command device off.
 - The clutch status is set to the OFF state. After that, the axis servo OFF command becomes valid.
 - 2) Execute the axis servo OFF command or the power supply OFF of servo amplifier.
- (g) The procedure to resume an operation after the axis servo OFF or power supply OFF of servo amplifier during operation is shown below.
 - 1) Turn the power supply of servo amplifier on.
 - 2) Execute the axis servo ON command.
 - 3) Turn the clutch ON/OFF command device on.
 - The clutch ON address is monitored and control is resumed.

(4) One-shot mode

- (a) When the mode setting device is "3: One-shot mode clutch ON command is valid" or "4: One-shot mode clutch ON command is invalid", it switches to one-shot mode control.
- (b) When the mode setting device is "3", the clutch ON/OFF command device becomes valid, and the following controls are executed based on the clutch ON address setting device (setting travel value after clutch ON)/clutch OFF address setting device (setting travel value before clutch ON) by the clutch ON/OFF command device.
 - 1) When the clutch ON/OFF command device switches from OFF to ON.

The clutch is set to the ON state after moving the travel value set in the setting travel value before clutch ON, and it is set to the OFF state after moving the travel value set in the setting travel value after clutch ON.
 - 2) When the clutch ON/OFF command device switches from ON to OFF.

It has no influence on the clutch processing. The clutch state is held.

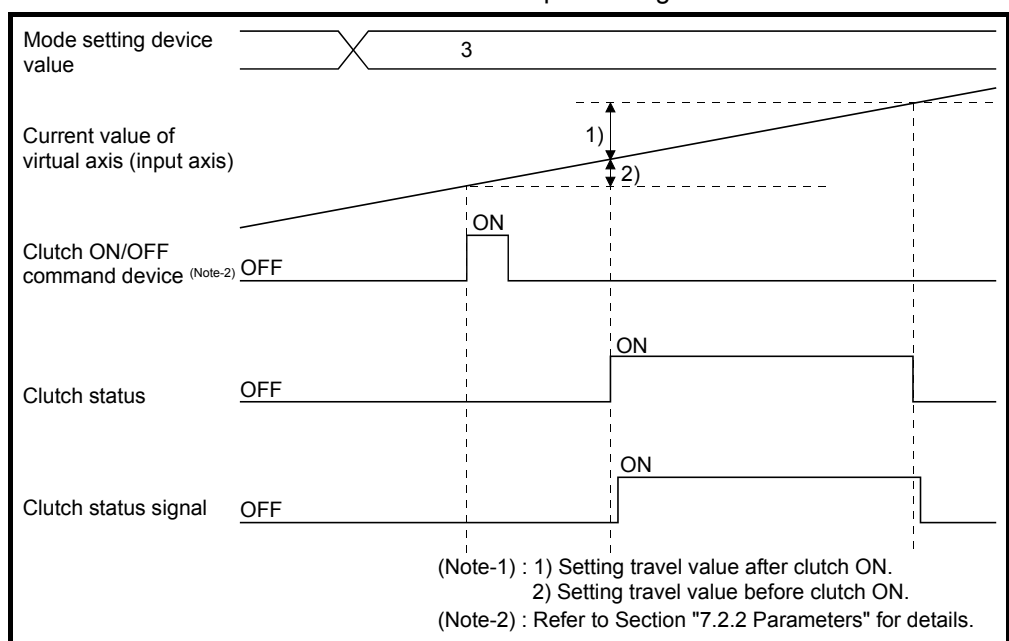
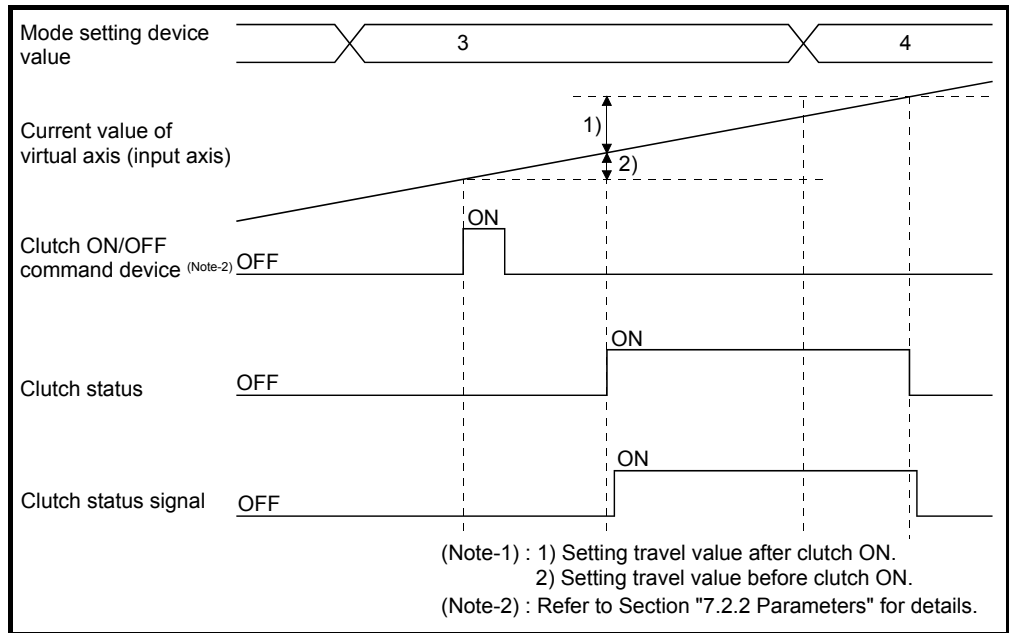


Fig. 7.5 Operation Timing for One-shot Mode

- (c) When the mode setting device is "4", the clutch ON/OFF command device becomes invalid, and the clutch remains OFF. However, when the mode setting device is changed from "3" to "4" during execution of clutch ON/OFF processing by turning the clutch ON/OFF command device on, the clutch ON/OFF processing in execution is executed till the end and the next clutch ON/OFF command or later becomes invalid. The clutch ON/OFF command device becomes valid by changing the mode setting device value to "3" again.



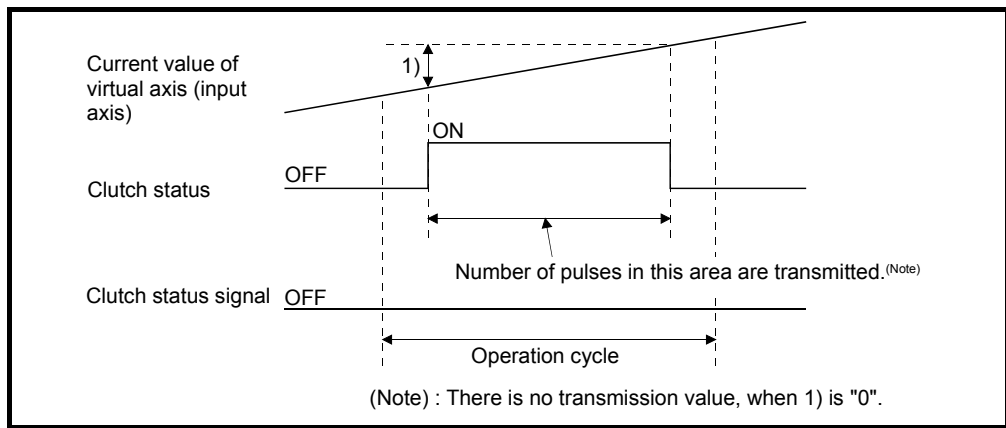
- (d) The details for setting items are shown below.

| Setting items | Description |
|-----------------------------------|--|
| Clutch ON/OFF command device | The clutch ON/OFF processing of one-shot mode starts at leading edge of this device. |
| Clutch ON address setting device | The transmitted travel value (setting travel value after clutch ON) of connected drive module from turning on clutch to turning off is set. A positive travel value is stored to indicate a positive direction travel value from the point of clutch ON, and a negative value to indicate a negative travel direction travel value. (Setting range: -2147483648 (-2 ³¹) to 2147483647 (2 ³¹ -1) [pulse]) |
| Clutch OFF address setting device | The travel value (setting travel value before clutch ON) of connected drive module from turning on clutch ON/OFF command device to turning on the clutch actually is set. A positive travel value is stored to indicate a positive direction travel value from the point of clutch ON, and a negative value to indicate a negative travel direction travel value. (Setting range: -2147483648 (-2 ³¹) to 2147483647 (2 ³¹ -1) [pulse]) |

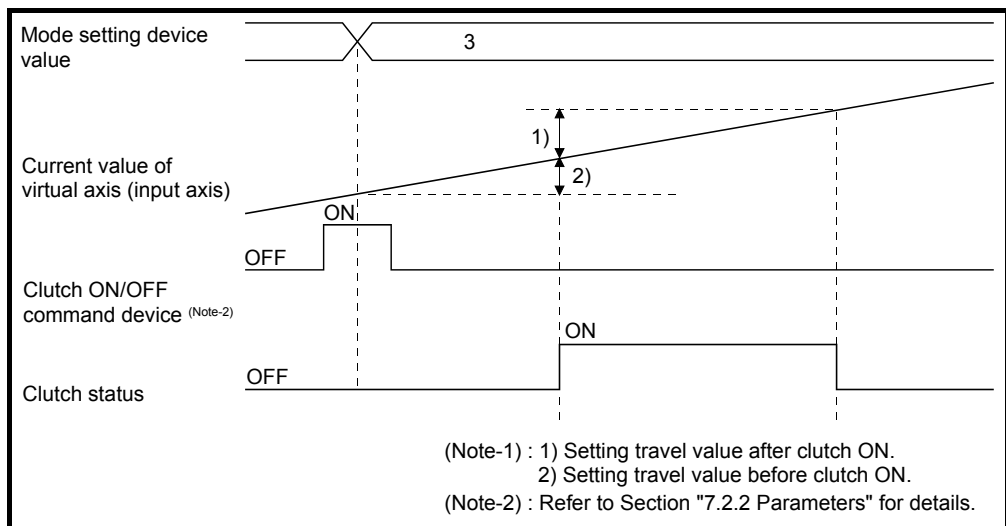
(Note) : When the setting travel value before clutch ON is "0", the clutch also becomes ON state simultaneously by turning the clutch ON/OFF command device off to on.

| POINT |
|--|
| (1) The mode setting device of except for "0 to 4" is regarded as an error, and control is continued at the previous setting value. |
| (2) Clutch control mode changes are valid at any time. |
| (3) Clutch ON/OFF address setting device changes are valid at any time. Since they have 2-word data, set it as 32-bit integer type data. |

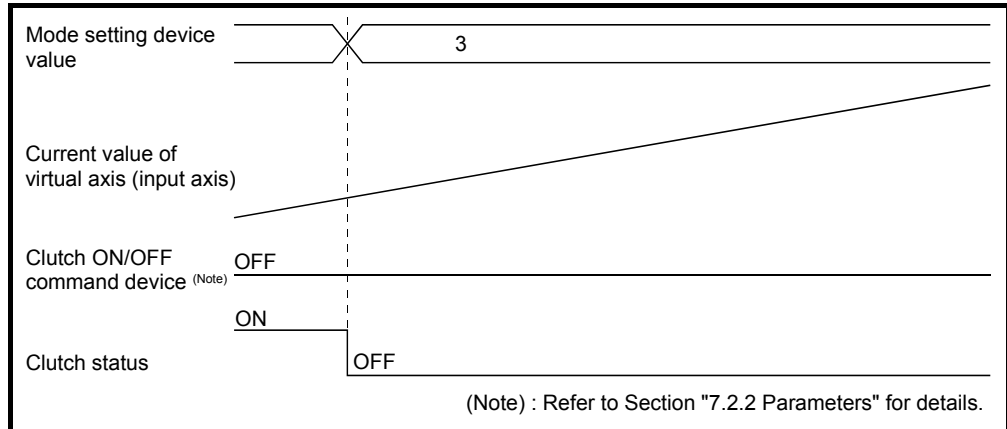
(e) The clutch ON/OFF control is executed for every operation cycle. The internal control is executed correctly but the clutch status signal does not change for the setting travel value that the clutch status turns from off to on to off for 1 operation cycle.



(f) When the mode setting device becomes "3", the clutch ON/OFF control starts based on the setting data while the clutch ON/OFF command device is ON.

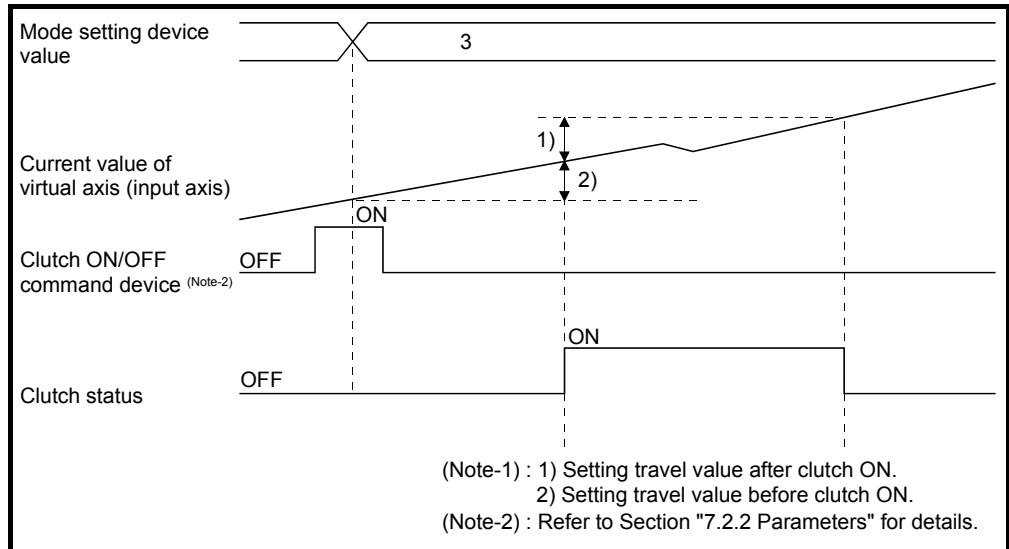


- (g) When the mode setting device becomes "3", the clutch status turns OFF, while the clutch ON/OFF command device is OFF and the clutch status is ON.



- (h) When the mode setting device is changed from "except 3" to "4", the clutch status turns off regardless of the clutch ON/OFF command device.
- (i) When the clutch ON/OFF address setting device data is changed during the clutch processing of one-shot mode, it becomes valid by turning the next clutch ON/OFF command device off to on.
- (j) When the drive module stops during the clutch ON/OFF processing by turning the clutch ON/OFF command device on, or if the clutch ON/OFF command device is turned on though the drive module stops, the one-shot mode clutch does not end until the travel value condition set to the setting travel value before clutch ON or setting travel value after clutch ON is satisfied.
- (k) When the current value change is made to the drive module during the clutch ON/OFF processing by turning the clutch ON/OFF command device on, the clutch turns off at the position where the setting travel value before clutch ON or setting travel value after clutch ON from the clutch ON position is satisfied.

- (l) When the travel direction of drive module changes during the clutch ON/OFF processing by turning the clutch ON/OFF command device on, the clutch ON/OFF control is executed at the position in which not the travel value of drive module but the setting travel value before clutch ON/ setting travel value after clutch ON to the position where the clutch ON command is given was added.



- (m) The setting travel value before clutch ON/setting travel value after clutch ON differs according to the output module connected as follows.
- 1) For a ball screw or roller

The clutch ON/OFF control is executed by the current travel value of virtual axis connected.

When a differential gear is connected to the main shaft, the clutch ON/OFF control is executed by the current travel value after the main shaft's differential gear.
 - 2) For a rotary table or cam

The clutch ON/OFF control is executed by the travel value of current value within 1 virtual axis revolution. The setting travel value can be set outside the range of current value within 1 virtual axis revolution.
- (n) When the travel direction set in the setting travel value before clutch ON/ setting travel value after clutch ON does not match the virtual axis or current value within 1 virtual axis revolution, note that the clutch will turn on/off even if the condition is not satisfied when the data found by subtracting the travel value from the specified travel value comes out of the range -2147483648 to 2147483647 [pulse] and changes from "+" to "-" or from "-" to "+".

- (o) When the "Clutch OFF" is set in the parameter "Error-time operation mode" of drive module and a major error occurs in the output module, the operating system software turns off the clutch.

The procedure to resume an operation after an error occurrence is shown below.

- 1) Remove a major error factor.
 - 2) Turn the clutch ON/OFF command device off.
→ It returns to normal state.
 - 3) Turn the clutch ON/OFF command device on.
→ The clutch control of one-shot mode is resumed.
- (p) The procedure to execute the axis servo ON/OFF or power supply OFF of servo amplifier during operation is shown below.
 - 1) Turn the clutch revolution OFF command device off, when the clutch status is ON state, wait until the clutch status becomes OFF.
→ After the clutch status to be set to OFF state, the axis servo OFF command becomes valid.
 - 2) Execute the axis servo OFF command or the power supply OFF of servo amplifier off.
 - (q) The procedure to resume an operation after the axis servo OFF or the power supply OFF of servo amplifier during operation is shown below.
 - 1) Turn the power supply of servo amplifier on.
 - 2) Execute the axis servo ON command.
 - 3) Turn the clutch ON/OFF command device on.
→ The clutch control of one-shot mode is resumed.

(5) External input mode

- (a) The clutch ON/OFF control is executed by turning the clutch ON/OFF command device on/off and external input (TREN signal: Synchronous encoder start signal).

Since the input pulses from synchronous encoder are counted at leading edge of external input, a high-speed response and high accuracy clutch control is possible.

- 1) The clutch is set to the ON state at leading edge of external input (OFF → ON) after the clutch ON/OFF command device turns on.
- 2) When the clutch ON/OFF command device turns off, the clutch is set to the OFF state after maximum 2 operation cycles.

- (b) Turn the external input (TREN signal) on after turning the clutch ON/OFF command device on.

In this mode, a time for maximum 2 operation cycles is required to turn the external input on after the clutch ON/OFF command device turns on.

- 1) If the external input turns from off to on when the clutch ON/OFF command device is OFF, the clutch is not set to the ON state.
- 2) If the clutch ON/OFF device turns on when the external input is ON, the clutch is not set to the ON state.
- 3) If the external input turns off after the clutch is set to the ON state, the clutch state remain ON.

- (c) The clutch status signal ON/OFF is refreshed by the operation cycle.

- (d) The current value of input axis (synchronous encoder) changes at the clutch ON state only.

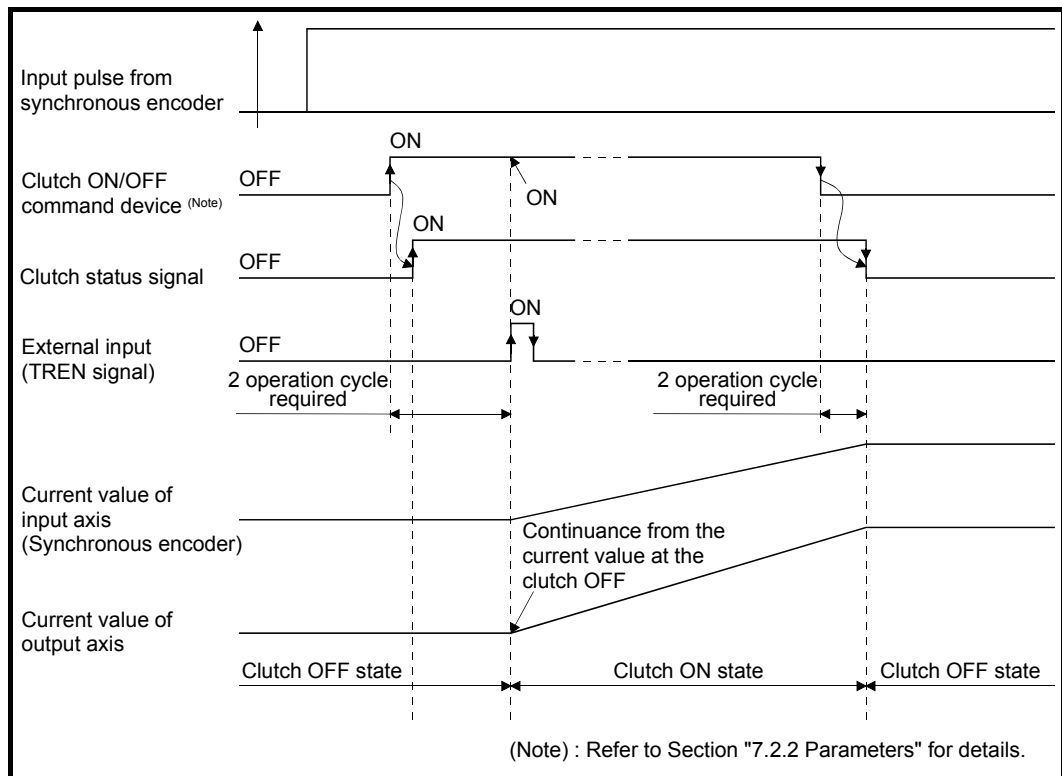


Fig. 7.6 Operation Timing for External Input Mode

- (e) Only axis that the incremental synchronous encoder (manual pulse generator) is set as drive module can be used in this mode. When an absolute synchronous encoder is set as the drive module, it cannot be used.

- (f) A synchronous encoder, external input and external input mode clutch can be set in only 1:1 ratio.

The relationship between the synchronous encoder and external input is shown in the table below.

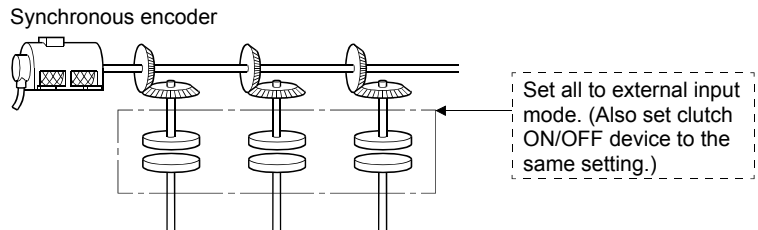
| Synchronous encoder No. | External input (TREN signal) | Synchronous encoder No. | External input (TREN signal) |
|-------------------------|------------------------------|-------------------------|------------------------------|
| P1 | TREN 1 | P7 | TREN 7 |
| P2 | TREN 2 | P8 | TREN 8 |
| P3 | TREN 3 | P9 | TREN 9 |
| P4 | TREN 4 | P10 | TREN 10 |
| P5 | TREN 5 | P11 | TREN 11 |
| P6 | TREN 6 | P12 | TREN 12 |

(Note): The range of synchronous encoder No. P1 to P8 is valid in the Q172DCPU(-S1).

- (g) Set all clutches connected to the same encoder No. to the external input mode to use the clutch connected to an encoder in the external input mode. However, it is permissible to use a combination of direct clutches and smoothing clutches.

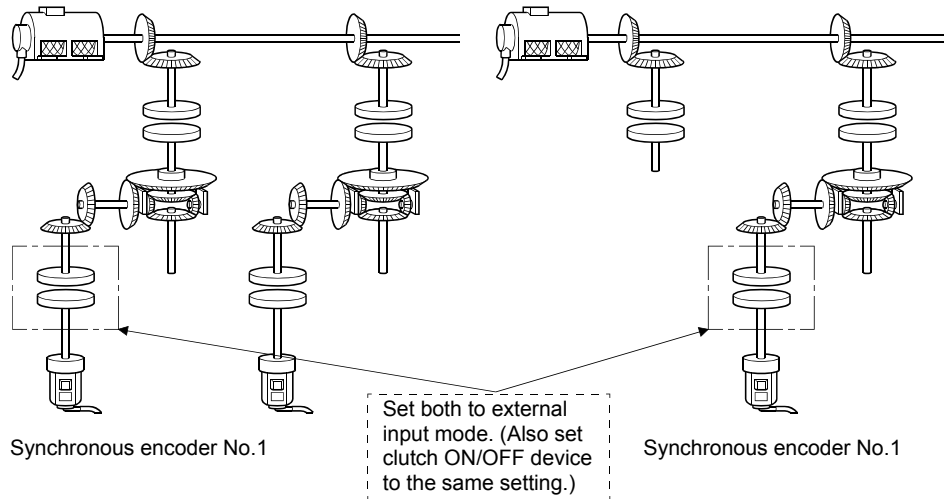
< Example 1 > **Synchronous encoder is connected to a drive axis**

When an external input mode clutch is used, set all clutches connected to the synchronous encoder to the external input mode. (Also set clutch ON/OFF devices to the same setting.)



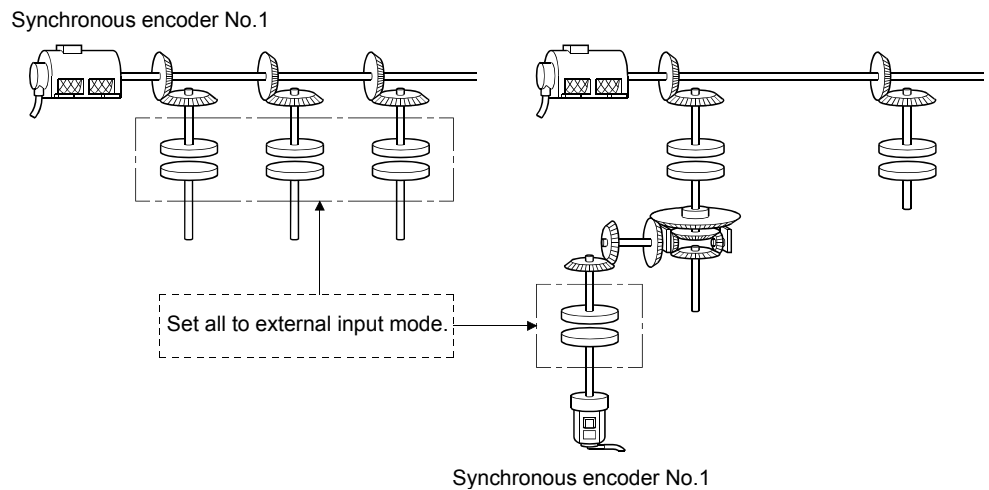
< Example 2 > **Same synchronous encoder is connected to auxiliary input axis**

Set all the clutches connected to the same synchronous encoder set to the external input mode. (Also set clutch ON/OFF devices to the same setting.)



< Example 3 > **Same synchronous encoder is connected to a drive axis and auxiliary input axis**

Set all the connected clutches to the external input mode. (Refer to examples 1 and 2)



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7.2.2 Parameters

The clutch parameters are shown in Table 7.2 and the parameters shown in this table are explained in items (1) to (11) below.

Refer to the help of MT Developer2 for the clutch parameter setting method.

Table 7.2 Clutch Parameter List

| No. | Setting item | Default value | Setting range | | | | Setting possible | |
|-----|---|--|---|--|--------------|---------------------|---|------------------|
| 1 | Operation mode | ON/OFF mode | ON/OFF mode | ON/OFF mode Address mode Address mode 2 One-shot mode | combined use | External input mode | Direct clutch | Smoothing clutch |
| 2 | Mode setting device (1 word) | — | — | Word device | | — | ○ | ○ |
| 3 | Clutch ON/OFF command device | — | Bit device | | | | ○ | ○ |
| 4 | Clutch status | — | —/Bit device (Note-1) | | | | ○ | ○ |
| 5 | Clutch ON address setting device (2 words) | — | — | Word device | | — | ○ | ○ |
| 6 | Clutch OFF address setting device (2 words) | | | | | | | |
| 7 | Smoothing method | Time constant system | Time constant system/slippage system (Exponential function system/Linear acceleration deceleration system) | | | | — | ○ |
| 8 | Smoothing time constant | — | 1 to 65535 [ms] | | | | — | ○ |
| 9 | Slippage setting device (2 words) | — | Word device | | | | — | ○ |
| 10 | Slippage in-position range setting device (2 words) | — | Word device | | | | — | ○ |
| 11 | Address mode clutch control system | Current value within 1 virtual axis revolution | Current value within 1 virtual axis revolution/ Current value of virtual axis | | | | ○ Valid when a cam/rotary table is set as the output module. | |
| 12 | Smoothing clutch complete signal | — | —/Bit device (Note-1) | | | | — | ○ |

(Note-1): The devices set in other clutch parameter cannot be used.

(1) Operation mode

(a) This device is used to set the mode to switch clutch ON/OFF.

The following three modes can be set.

- ON/OFF mode
- ON/OFF mode, address mode, address mode 2 and one-shot mode combined use
- External input mode

Refer to Section "7.2.1 Operation" for each operation modes.

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- (b) If a synchronous encoder is used as the drive module, the operation modes that can be set differ depending on the encoder interface connected to the Q173DPX/Q172DEX.

| Encoder interface | Clutch operation mode | | |
|---|-----------------------|---|------------------------|
| | ON/OFF mode | Address mode, Address mode 2, One-Shot mode | External input mode |
| Manual pulse generator input (Q173DPX) | ○ | ○ | ○ |
| Serial encoder input (Q172DEX) | ○ | ○ | × |

○ : Enable, × : Disable

- (2) Mode setting device (only ON/OFF mode, address mode, address mode 2 and one-shot mode combined use, 1 word)

- (a) This device is used to switch the ON/OFF mode and address mode.

The mode by mode setting device value are as follows:

| Mode setting device No. | Name |
|-------------------------|----------------|
| 0 | ON/OFF mode |
| 1 | Address mode |
| 2 | Address mode 2 |
| 3, 4 | One-shot mode |

The mode setting device of except for "0 to 4" is regarded as an error, and an operation is continued at the previous setting value.

- (b) The following devices can be used as the mode setting device.

| Name | Setting range |
|--------------------------|--|
| Data register | D0 to D8191 ^(Note-1) |
| Link register | W0 to W1FFF |
| Motion register | #0 to #7999 |
| Multiple CPU area device | U□\G10000 to U□\G(10000+p-1) ^(Note-2) |

(Note-1): D800 to D1559 are dedicated devices of virtual servomotor axis, synchronous encoder axis and output module "cam" in the virtual mode. Unused areas of virtual servomotor axis and cam axis can be used as a user device.

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

(3) Clutch ON/OFF command device

(a) This device is used to execute the clutch ON/OFF command.

(b) The following devices can be used as the clutch ON/OFF command device.

| Name | Setting range |
|--------------------------|--|
| Input | X0 to X1FFF ^(Note-1) |
| Output | Y0 to Y1FFF |
| Internal relay | M0 to M8191 ^(Note-2) |
| Link relay | B0 to B1FFF |
| Annunciator | F0 to F2047 |
| Multiple CPU area device | U□\G10000.0 to U□\G(10000+p-1).F ^(Note-3) |

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

(Note-2): "M4000 to M4639 and M4800 to M5439" are the dedicated devices of virtual servomotor axis in the virtual mode.

Unused area of virtual servomotor axis can be used as a user side.

(Note-3): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

(4) Clutch status

(a) This device is used to indicate the clutch ON/OFF state.

(b) The following devices can be used as the clutch status.

| Name | Setting range |
|--------------------------|---|
| Input | X0 to X1FFF ^(Note-1) |
| Output | Y0 to Y1FFF |
| Internal relay | M0 to M8191 ^{(Note-2), (Note-3)} |
| Link relay | B0 to B1FFF |
| Annunciator | F0 to F2047 |
| Multiple CPU area device | U□\G10000.0 to U□\G(10000+p-1).F ^{(Note-4), (Note-5)} |

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

(Note-2): "M4000 to M4639 and M4800 to M5439" are the dedicated devices of virtual servomotor axis in the virtual mode. Unused area of virtual servomotor axis can be used as a user side.

(Note-3): Use these parameters to use the device (M2160 to M2223) allocated to Q17□CPUN/Q17□HCPU.

(Note-4): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

(Note-5): Only device of the self CPU can be used.

(5) Clutch ON/OFF address setting device (only ON/OFF mode, address mode, address mode 2 and one-shot mode combined use, 2 words)

(a) This device is used to set an address to turn the clutch on/off in the address mode.

(b) The following devices can be used as the clutch ON/OFF address setting devices.

| Name | Setting range ^(Note-1) |
|--------------------------|--|
| Data register | D0 to D8191 ^(Note-2) |
| Link register | W0 to W1FFF |
| Motion register | #0 to #7999 |
| Multiple CPU area device | U□\G10000 to U□\G(10000+p-1) ^(Note-3) |

(Note-1): Set an even numbered the first device.

(Note-2): D800 to D1559 are dedicated devices of virtual servomotor axis, synchronous encoder axis and output module "cam" in the virtual mode. Unused areas of virtual servomotor axis and cam axis can be used as a user device.

(Note-3): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

(c) The clutch ON/OFF address settings range is as follows.

1) The output module is a ball screw/roller, or output module is a cam/rotary table and the address mode clutch control system is current value of virtual axis.

-2147483648 (-2^{31}) to 2147483647 ($2^{31}-1$) [pulse]

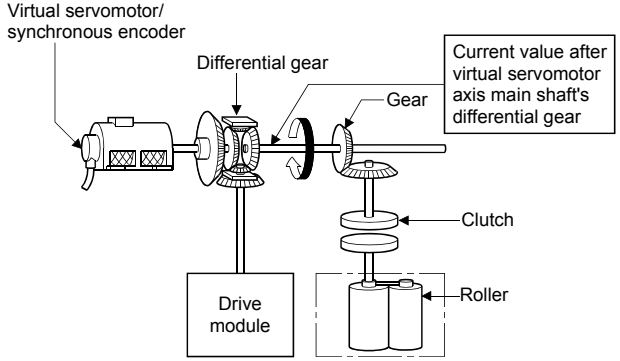
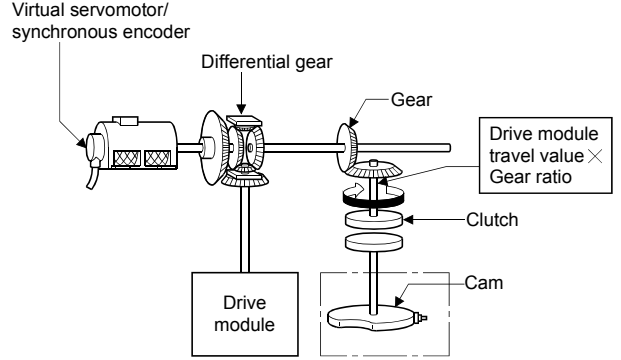
2) The output module is a cam/rotary table, and the address mode clutch control system is current value within virtual axis revolution.

0 to number of pulses within 1 output axis revolution -1 [pulse]

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- (d) The clutch ON/OFF address setting device value according to the output module is as follows.

Refer to Section 7.2.1 (1) to (5) for details of each mode operation.

| Ball screw/Roller | Rotary table/Cam |
|---|---|
| <p>• Current value of virtual axis If the differential gear is connected to the main shaft, the device is current value after virtual servomotor axis main shaft's differential gear.</p> <p>[Example]</p>  | <p>Select between the following depending on the setting for address mode clutch.</p> <ul style="list-style-type: none"> • Current value of virtual axis • Current value within 1 virtual axis revolution (Drive module travel value × Gear ratio %Nc) % : Remainder operator Nc : Number of pulses within 1 cam axis revolution <p>[Example]</p>  |

(6) Smoothing method

- (a) The method for smoothing processing of the clutch is set.

The following three methods can be set:

- Time constant system
- Slippage system
 - Exponential function system
 - Linear acceleration/deceleration system

- (b) Refer to Section 7.2 for each system operation.

(7) Smoothing time constant

This is the time taken to reach 63[%] of the output axis speed.

(8) Slippage setting device (2 words)

(a) This device is used to set the slippage of clutch.

(b) The following devices can be used as the slippage setting device.

| Name | Setting range ^(Note-1) |
|--------------------------|--|
| Data register | D0 to D8191 ^(Note-2) |
| Link register | W0 to W1FFF |
| Motion register | #0 to #7999 |
| Multiple CPU area device | U□\G10000 to U□\G(10000+p-1) ^(Note-3) |

(Note-1): Set an even numbered the first device.

(Note-2): D800 to D1559 are dedicated devices of virtual servomotor axis, synchronous encoder axis and output module "cam" in the virtual mode. Unused areas of virtual servomotor axis and cam axis can be used as a user device.

(Note-3): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

(c) The setting range for slippage is 0 to 2147483647 [pulse].

(9) Slippage in-position range setting device (2 words)

(a) This device is used to set the remainder slippage range for judge as smoothing completion.

(b) The following devices can be used as the slippage in-position range setting device.

| Name | Setting range ^(Note-1) |
|--------------------------|--|
| Data register | D0 to D8191 ^(Note-2) |
| Link register | W0 to W1FFF |
| Motion register | #0 to #7999 |
| Multiple CPU area device | U□\G10000 to U□\G(10000+p-1) ^(Note-3) |

(Note-1): Set an even numbered the first device.

(Note-2): D800 to D1559 are dedicated devices of virtual servomotor axis, synchronous encoder axis and output module "cam" in the virtual mode. Unused areas of virtual servomotor axis and cam axis can be used as a user device.

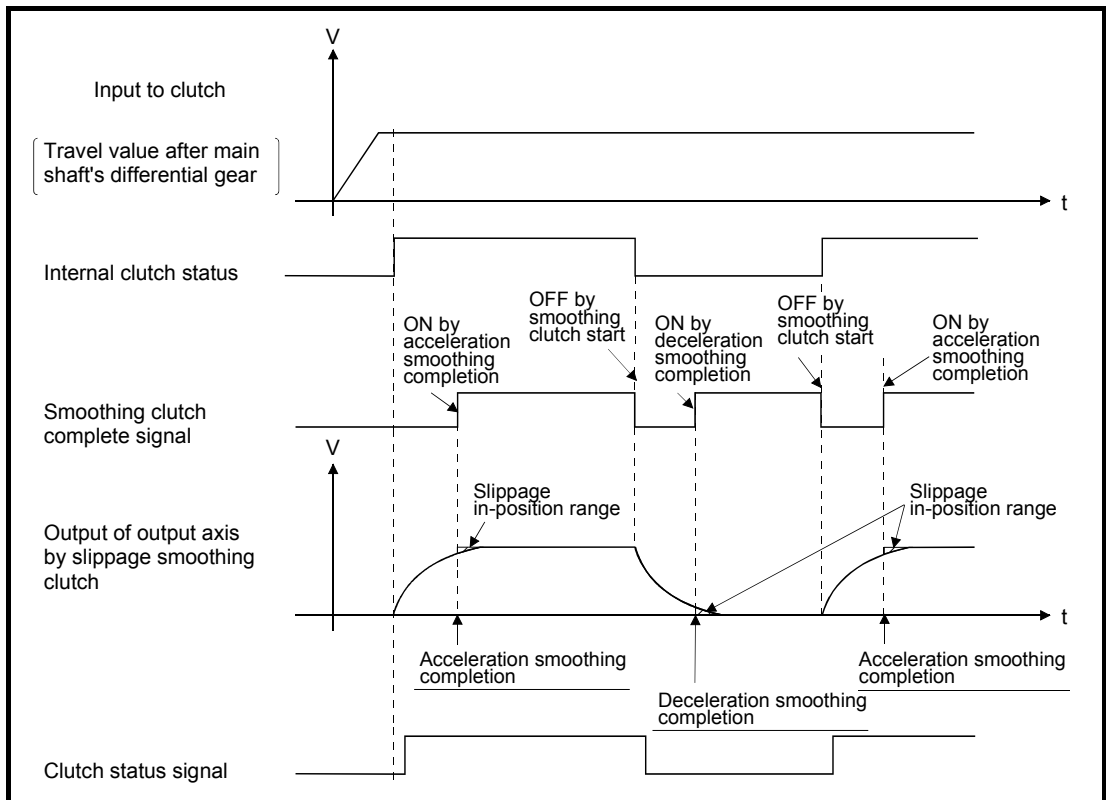
(Note-3): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

(c) The setting range for remainder slippage is 0 to 2147483647 [pulse].

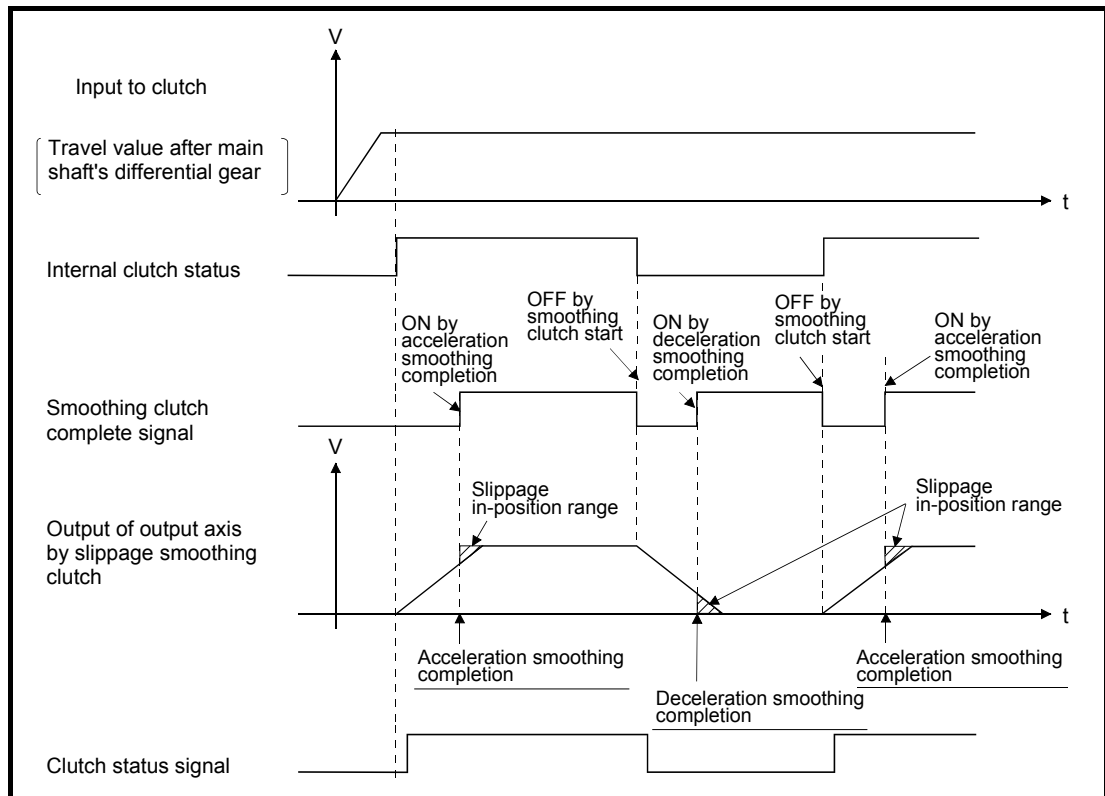
(d) When "(Remainder slippage) < (Slippage in-position range)" is set, the smoothing clutch complete signal turns on.
 The smoothing clutch complete signal ON/OFF is refreshed by the operation cycle.

- 1) ON/OFF state of smoothing clutch is indicated. (Only exponential function system and linear acceleration/deceleration system are valid.)
 - ON"(Remainder slippage) < (Slippage in-position range)"
 - OFF.... Smoothing processing start (Clutch ON/OFF)
- 2) Set the slippage in-position range setting device to use the smoothing clutch complete signal.
- 3) Operation for smoothing clutch

a) Exponential function system



b) Linear acceleration/deceleration system



- (e) When "0" is set in the slippage in-position range setting device, when a clutch is connected/disconnected completely (Remainder slippage=0), the smoothing clutch complete signal turns on.
- (f) Slippage in-position range can be changed at any time.
- (g) When the slippage in-position range setting device is not set, the smoothing clutch complete signal does not turns on.
- (h) When the setting value for slippage in-position range setting device is outside the range, a minor error [5430] of output module will occur at the time of switching from real mode to virtual mode. In this case, it controls as a setting value "0".
Besides, the setting value for slippage in-position range is set outside the range during virtual mode operation, a minor error [6170] of output module will occur, and it controls as a setting value "0".

- (10) Address mode clutch control system
 - (a) When a clutch is turned on by the setting value of ON/OFF address setting device in the address mode/address mode 2, the current value (current value within 1 virtual axis revolution/current value of virtual axis) of virtual axis to be used is selected.
 - 1) Current value within 1 virtual axis revolution
 - The ON/OFF control is executed by the current value within 1 virtual axis revolution system.
 - 2) Current value of virtual axis
 - The ON/OFF control is executed by the current value of virtual axis. When a differential gear is connected to the main shaft, the ON/OFF control is executed by the current value after the main shaft's differential gear.

(b) The output module connected to clutch is valid for cam/rotary table

(11) Smoothing clutch complete signal

(a) This device is used to confirm the completion of smoothing processing.

(b) The following devices can be used as the smoothing clutch complete signal.

| Name | Setting range |
|--------------------------|---|
| Input | X0 to X1FFF ^(Note-1) |
| Output | Y0 to Y1FFF |
| Internal relay | M0 to M8191 ^{(Note-2), (Note-3)} |
| Link relay | B0 to B1FFF |
| Annunciator | F0 to F2047 |
| Multiple CPU area device | U□\G10000.0 to U□\G(10000+p-1).F ^{(Note-4), (Note-5)} |

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

(Note-2): "M4000 to M4639 and M4800 to M5439" are the dedicated devices of virtual servomotor axis in the virtual mode.
Unused area of virtual servomotor axis can be used as a user side.

(Note-3): Use these parameters to use the device (M5520 to M5583) allocated to Q17□CPUN/Q17□HCPU.

(Note-4): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

(Note-5): Only device of the self CPU can be used.

7.3 Speed Change Gear

Speed change gear is used to change the rotation speed to output module and travel value during operation.

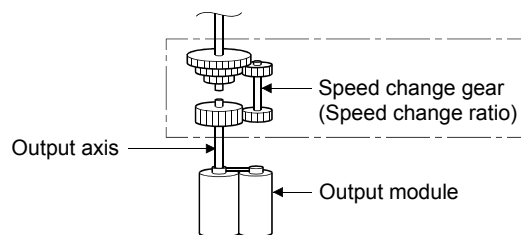
The operation of speed change gear and parameters required to use it are shown below.

7.3.1 Operation

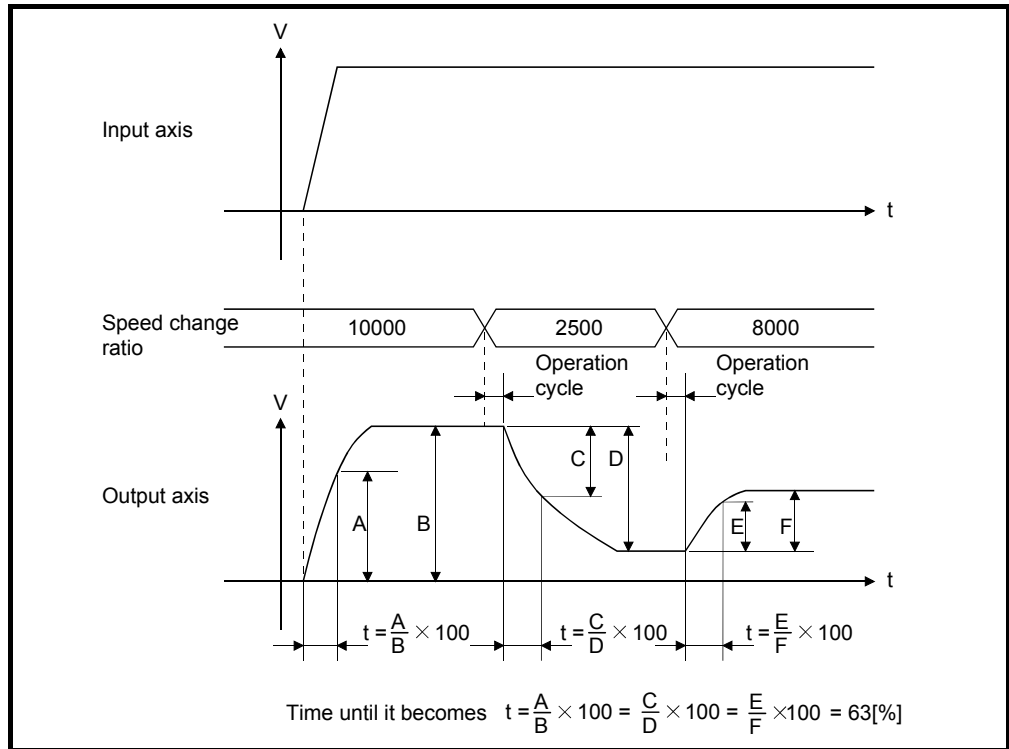
This section describes the operation of speed change gear.

- (1) The speed that the input axis speed multiplied by a speed change ratio set in the speed change ratio setting device is transmitted to output axis.

$$[\text{Output axis speed}] = [\text{Input axis speed}] \times \frac{[\text{Speed change ratio}]}{10000} [\text{pulse/s}]$$



- (2) When a speed change ratio changes, the acceleration/deceleration processing is executed by the smoothing time constant (t) set in the speed change gear parameters.



7.3.2 Parameters

The speed change gear parameters are shown in Table 7.3 and the parameters shown in this table are explained in items (1) to (3) below.

Refer to the help of MT Developer2 for the speed change gear parameter setting method.

Table 7.3 Speed Change Gear Parameter List

| No. | Setting Item | Default | Setting range |
|-----|--|---------|---------------------------------------|
| 1 | Speed change ratio upper limit value | 10000 | 0 to 65535 |
| 2 | Speed change ratio lower limit value | 1 | 0 to 65535 |
| 3 | Speed change ratio setting device (1 word) | — | D0 to D8191 |
| | | | W0 to W1FFF |
| | | | #0 to #7999 |
| | | | U□\G10000 to U□\G(10000+p-1) (Note-1) |
| 4 | Smoothing time constant | 0 | 0 to 65535 [ms] |

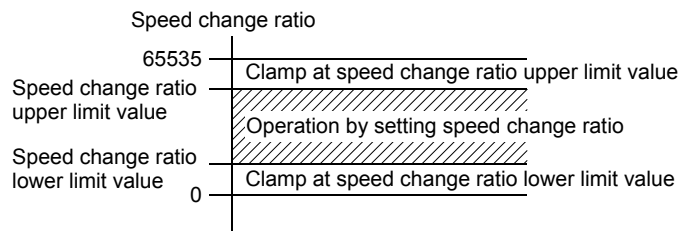
(Note-1): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

(1) Speed change ratio upper/lower limit value

(a) The validate range (0.00 to 655.35[%]) of speed change ratio set in the speed change ratio setting device is set.

(b) When the setting value of speed change ratio setting device is greater than the speed change ratio upper limit value, an operation is executed by a speed change ratio clamped at the upper limit value.

When the setting value of speed change ratio setting device is smaller than the speed change ratio lower limit value, an operation is executed by a speed change ratio clamped at the lower limit value.



(c) The speed change ratio upper/lower limit value is set in the range of 0 to 65535, i.e. 100 times the settings actually made: 0.00 to 655.35%.

(d) Set the speed change ratio upper/lower limit value as formula below.

$$0 \leq (\text{Speed change ratio lower limit value}) \leq (\text{Speed change ratio upper limit value}) \leq 65535$$

(2) Speed change ratio setting device

(a) The device to set a speed change ratio of speed change gear.

(b) The following devices can be used as the speed change ratio setting devices.

| Name | Setting range |
|--------------------------|--|
| Data register | D0 to D8191 ^(Note-1) |
| Link register | W0 to W1FFF |
| Motion register | #0 to #7999 |
| Multiple CPU area device | U□\G10000 to U□\G(10000+p-1) ^(Note-2) |

(Note-1): D800 to D1559 are dedicated devices of virtual servomotor axis, synchronous encoder axis and output module "cam" in the virtual mode. Unused areas of virtual servomotor axis and cam axis can be used as a user device.

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

(c) The setting range is "Speed change ratio lower limit value" to "Speed change ratio upper limit value".

(3) Smoothing time constant

This is the time taken to reach 63[%] of the output axis speed.

7.4 Differential Gear

The differential gear is used for the following purposes;

- Output module phase is shifted or alignment of operation start position is executed.
- Individual operation separated from the virtual main shaft is executed.

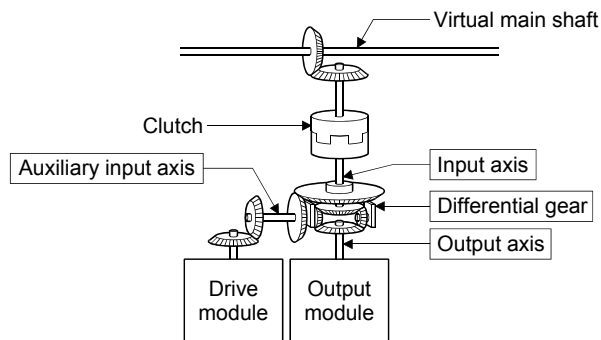
7.4.1 Operation

- (1) When the output module phase is shifted or alignment of the operation start position is executed.

- (a) When the input axis clutch is ON.

The differential gear subtracts the auxiliary input shaft travel value from the input shaft travel value and transmits this to the output axis.

$$\left(\begin{array}{c} \text{Output axis} \\ \text{travel value} \end{array} \right) = \left(\begin{array}{c} \text{Input axis} \\ \text{travel value} \end{array} \right) - \left(\begin{array}{c} \text{Auxiliary input axis} \\ \text{travel value} \end{array} \right) \text{ [pulse]}$$

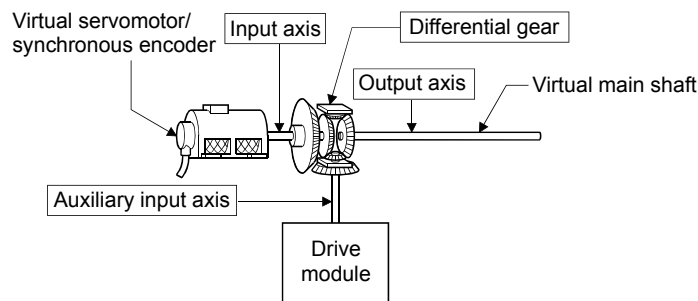


- (b) When the input axis clutch is OFF.

Individual operation is possible using the auxiliary input axis since the differential gear transmits only the travel value from the auxiliary input axis to the output axis.

- (2) When the differential gear is used to connect to the virtual main shaft.

This is used for operation in which the main shaft is switched or when the same drive module is used as auxiliary input to control all blocks.



Set the different drive modules for virtual main shaft side and auxiliary input axis side.

7.4.2 Parameters

No parameters need to be set for the differential gear.

8. OUTPUT MODULE

The command pulse output from drive module is input to output module via the transmission module.

The travel value of servomotor is controlled by the command pulse from output module.

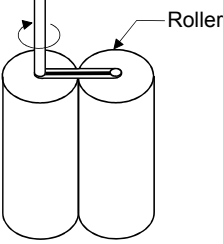
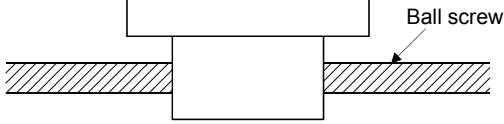
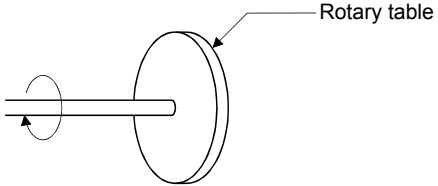
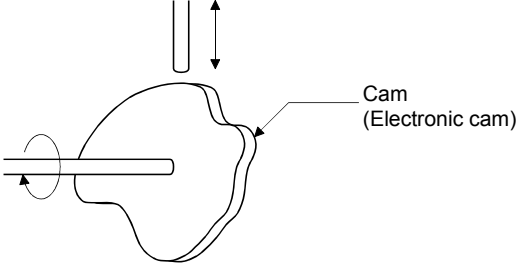
There are following four output modules.

The parameters in accordance with that mechanism is set if necessary.

- Roller..... Section 8.1
- Ball screw..... Section 8.2
- Rotary table..... Section 8.3
- Cam Section 8.4

(1) Output module types

Output module types are shown below.

| Module | Details | Applications |
|--------------|--|--|
| Roller | The speed control is executed with the final output (axis). |  |
| Ball screw | The linear position control is executed with the final output (axis). |  |
| Rotary table | The angle control is executed with the final output (axis). |  |
| Cam | The electronic cam operation is executed with the final output (axis). |  |


8 OUTPUT MODULE

(2) Device range of output module parameters and device data input


The device range and setting method of items set in the indirect setting by devices among the output module parameters are shown below.

(a) Device range

The number of device words and device range in the indirect setting are shown below.

| Module | Item | Number of device words | Device range | Remark | | | | | | | | | | | | |
|--------------|--|------------------------|---|--------|-------|---|-------------------------------|---|-----------|---|-----------|------|--|---|-----------|------|
| Roller | Torque limit value setting device | 1 | <table border="1"> <thead> <tr> <th>Device</th> <th>Range</th> </tr> </thead> <tbody> <tr> <td>D</td> <td>0 to 8191</td> </tr> <tr> <td>W</td> <td>0 to 1FFF</td> </tr> <tr> <td>#</td> <td>0 to 7999</td> </tr> <tr> <td>U□\G</td> <td>10000 to (10000+p-1) ^(Note-1)</td> </tr> </tbody> </table> | Device | Range | D | 0 to 8191 | W | 0 to 1FFF | # | 0 to 7999 | U□\G | 10000 to (10000+p-1) ^(Note-1) | | | |
| Device | Range | | | | | | | | | | | | | | | |
| D | 0 to 8191 | | | | | | | | | | | | | | | |
| W | 0 to 1FFF | | | | | | | | | | | | | | | |
| # | 0 to 7999 | | | | | | | | | | | | | | | |
| U□\G | 10000 to (10000+p-1) ^(Note-1) | | | | | | | | | | | | | | | |
| Ball screw | Torque limit value setting device | 1 | | | | | | | | | | | | | | |
| Rotary table | Torque limit value setting device | 1 | | | | | | | | | | | | | | |
| | Current value within 1 virtual axis revolution storage device (Main shaft side) | 2 | | | | | | | | | | | | | | |
| | Current value within 1 virtual axis revolution storage device (Auxiliary input axis side) | 2 | | | | | | | | | | | | | | |
| Cam | Number of pulses per cam shaft revolution (Nc)  | 2 | | | | | | | | | | | | | | |
| | Cam No. setting device | 1 | | | | | | | | | | | | | | |
| | Stroke amount setting device | 2 | | | | | | | | | | | | | | |
| | Torque limit value setting device | 1 | | | | | | | | | | | | | | |
| | Lower stroke limit value storage device | 2 | | | | | | | | | | | | | | |
| | Current value within 1 virtual axis revolution storage device (Main shaft side) | 2 | | | | | | | | | | | | | | |
| | Current value within 1 virtual axis revolution storage device (Auxiliary input axis side) | 2 | | | | | | | | | | | | | | |
| | Cam/ball screw switching command device | Bit | <table border="1"> <thead> <tr> <th>Device</th> <th>Range</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>0 to 1FFF ^(Note-2)</td> </tr> <tr> <td>Y</td> <td>0 to 1FFF</td> </tr> <tr> <td>M</td> <td>0 to 8191</td> </tr> <tr> <td>B</td> <td>0 to 1FFF</td> </tr> <tr> <td>F</td> <td>0 to 2047</td> </tr> <tr> <td>U□\G</td> <td>10000.0 to (10000+p-1).F ^(Note-1)</td> </tr> </tbody> </table> | Device | Range | X | 0 to 1FFF ^(Note-2) | Y | 0 to 1FFF | M | 0 to 8191 | B | 0 to 1FFF | F | 0 to 2047 | U□\G |
| Device | Range | | | | | | | | | | | | | | | |
| X | 0 to 1FFF ^(Note-2) | | | | | | | | | | | | | | | |
| Y | 0 to 1FFF | | | | | | | | | | | | | | | |
| M | 0 to 8191 | | | | | | | | | | | | | | | |
| B | 0 to 1FFF | | | | | | | | | | | | | | | |
| F | 0 to 2047 | | | | | | | | | | | | | | | |
| U□\G | 10000.0 to (10000+p-1).F ^(Note-1) | | | | | | | | | | | | | | | |

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

(Note-2): The range of "PXn+4 to PXn+F" cannot be used (fixed at 0) for the input device (PXn+0 to PXn+F) allocated to the built-in interface in Motion CPU (DI). (n: First input No.) 


8 OUTPUT MODULE

| POINT |
|--|
| (1) Be sure to set even-numbered device of the items set as 2-word. Be sure to set as 32-bit integer type when the data is set in these devices using the Motion SFC programs. |
| (2) When a 2-word monitor device is read in the Motion SFC program, read it as 32-bit integer type. |
| (3) Refer to Chapter 2 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for the user setting area points of the Multiple CPU high speed transmission area. |

(b) Device data input

All indirect setting device data are input as "initial value" at the switching real mode/virtual mode, thereafter the input control for module is executed during the virtual mode operation.

The input timing and refresh cycle of setting device are shown below.

| Module | Item | Input device | Refresh device | Device input timing | | Refresh cycle | |
|--------------|--|--------------|----------------|-----------------------------------|--|-----------------------------------|---|
| | | | | Real mode /Virtual mode switching | During the Virtual mode operation | | |
| Roller | Torque limit value setting device | ○ | — | ○ | Input for every operation cycle. ^(Note) | — | |
| Ball screw | Torque limit value setting device | ○ | — | ○ | | | |
| Rotary table | Torque limit value setting device | ○ | — | ○ | | | |
| | Current value within 1 virtual axis revolution storage device (Main shaft side) | — | ○ | — | — | Operation cycle ^(Note) | |
| | Current value within 1 virtual axis revolution storage device (Auxiliary input axis side) | — | ○ | — | | | |
| Cam | Number of pulses per cam shaft revolution (Nc)  | ○ | — | ○ | — | — | |
| | Cam No. setting device | ○ | — | ○ | | | Input for every operation cycle. ^(Note) However, the cam No. and stroke amount switching position pass point are valid. |
| | Stroke amount setting device | ○ | — | ○ | | | |
| | Torque limit value setting device | ○ | — | ○ | Input for every operation cycle. ^(Note) | — | Operation cycle ^(Note) |
| | Lower stroke limit value storage device | — | ○ | — | — | | |
| | Current value within 1 virtual axis revolution storage device (Main shaft side) | — | ○ | — | | | |
| | Current value within 1 virtual axis revolution storage device (Auxiliary input axis side) | — | ○ | — | | | |
| | Cam/ball screw switching command device | ○ | — | ○ | Input for every operation cycle. ^(Note) | | |

REMARK

(Note): The operation cycle is set in the "operation cycle setting" of system basic setting.

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

8 OUTPUT MODULE

8.1 Rollers

The rollers are used in the following cases.

- The machine connected to the servomotor is operated continuously.
- The system which does not need position control.
(It is used when the speed control (cycle speed/number of rotations) mainly is controlled without the current value and position data.)

This section describes the roller operation and parameters required to use a roller.

8.1.1 Operation

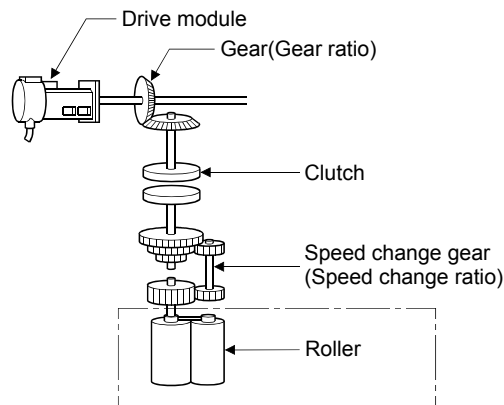
(1) Operation

- (a) The roller is controlled with the speed that the speed/travel value of drive module multiplied by a gear ratio/speed change ratio of transmission module, and it rotates for the travel value.

$$\text{Roller speed} = (\text{Drive module speed [pulse/s]}) \times (\text{Gear ratio}) \times (\text{Speed change ratio}) [\text{pulse/s}]$$

$$\text{Number of roller revolution} = (\text{Drive module travel value [pulse]}) \times (\text{Gear ratio}) \times (\text{Speed change ratio}) [\text{pulse}]$$

The speed/travel value of drive module transmitted to the roller is commanded to the servo amplifier.



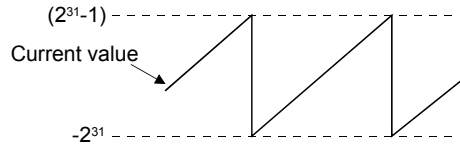
- (b) When a clutch is used, the roller is controlled at clutch ON.

(2) Control details

(a) The roller has no current value.

However, when it switches from the virtual mode to real mode, it reaches the current value corresponding to the position moved in the virtual mode.

- The current value is a ring address within the range of -2^{31} to $2^{31}-1$ [pulse].



(b) Backlash compensation processing is continued with the settings value of fixed parameters even if it switches the real mode/virtual mode.

(c) The roller cycle speed can be monitored using MT Developer2 and the roller cycle speed storage register.

Refer to Section 8.1.2 for the calculation formula of roller cycle speed, and refer to Section 4.2.1 for details of the roller cycle speed storage register.

8.1.2 Parameter list

The roller parameters are shown in Table 8.1 and the parameters shown in this table are explained in items (1) to (6) below.

Refer to the help of MT Developer2 for the roller parameter setting method.

Table 8.1 Roller Parameter List

| No. | Setting item | Default | Setting range | |
|-----|---|---------|---|-----------------------------------|
| 1 | Output axis No. | 0 | Q173DSCPU/Q173DCPU(-S1): 1 to 32 Q172DSCPU : 1 to 16 Q172DCPU(-S1) : 1 to 8 | |
| 2 | Output unit | mm | mm | inch |
| 3 | Roller diameter (L) | 0 | 0.1 to 214748364.7 [μm] | 0.00001 to 21474.83647 [inch] |
| 4 | Number of pulses per roller revolution (NL) | 0 | 1 to 2147483647 [pulse] | |
| 5 | Permissible droop pulse value | 6553500 | 1 to 1073741824 [pulse] | |
| 6 | Speed limit value (VL) | 0 | 0.01 to 6000000.00 [mm/min] | 0.001 to 600000.000 [inch/min] |
| 7 | Torque limit value setting device (1 word) | — | -(300[%]) / word device (D, W, #, U□\G) | |
| 8 | Comment | None | 32 characters | |

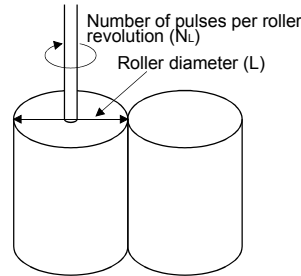
(1) Output unit

(a) This device is used to set the unit ([mm]/[inch]) of roller.

(b) The unit (unit in the fixed parameter) for the axis which execute the roller setting in the real mode is permissible to use the any of [mm], [inch], [degree] and [pulse].

(2) Roller diameter (L)/Number of pulses per roller revolution (NL)

- (a) The roller diameter connected to servomotor and the number of pulses per roller revolution are displayed.



- (b) The roller cycle speed is calculated by the roller diameter and number of pulses per roller revolution as the formula below.

1) Unit : [mm]

$$[\text{Roller cycle speed}] = \left(\text{Number of input pulses per minute} \right) \times \frac{\pi \times L}{NL} [\text{mm/min}] \quad L : [\text{mm}]$$

2) Unit : [inch]

$$[\text{Roller cycle speed}] = \left(\text{Number of input pulses per minute} \right) \times \frac{\pi \times L}{NL} [\text{inch/min}] \quad L : [\text{inch}]$$

The value calculated by calculations 1) and 2) is stored with an integer value in the roller cycle speed storage register.

| Output unit | Roller cycle speed storage register |
|-------------|-------------------------------------|
| mm | Calculated value × 100 |
| inch | Calculated value × 1000 |

(3) Permissible droop pulse value

- (a) This device is used to set the permissible droop pulse value of deviation counter.

- (b) The deviation counter value is continually checked, and if it becomes larger than the permissible droop pulse value, the error detection signal (M2407+20n) turns on.

However, since the roller axis operation continues, execute the error processing by user side.

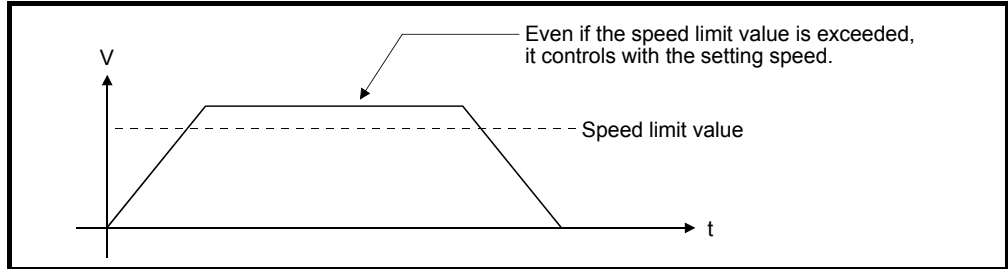
(4) Speed control limit (VL)

- (a) This device is used to set the maximum speed of roller axis.

- (b) Set the speed limit value within the following range.

$$1 \leq \frac{VL \times NL}{60 \times \pi \times L} \leq 2147483647 [\text{pulse/s}] \quad \begin{array}{l} VL : [\text{mm/min}] \text{ or } [\text{inch/min}] \\ L : [\text{mm}] \text{ or } [\text{inch}] \end{array}$$

- (c) When the roller axis speed exceeds the speed limit value, the error detection signal (M2407+20n) turns on.
However, the roller axis speed is not clamped.



(5) Torque limit value setting device (1 word)

- (a) This device is used to set the torque limit value of roller axis.
When the device is set, the torque control is executed with the preset device value.
In the virtual mode, the torque limit setting is always valid.
If the device is not set, the torque limit is set at 300[%].
- (b) The following devices can be set as the torque limit setting device.

| Name | Setting range |
|--------------------------|--|
| Data register | D0 to D8191 ^(Note-1) |
| Link register | W0 to W1FFF |
| Motion register | #0 to #7999 |
| Multiple CPU area device | U□\G10000 to U□\G(10000+p-1) ^(Note-2) |

(Note-1): D800 to D1559 are dedicated devices of virtual servomotor axis, synchronous encoder axis and output module "cam" in the virtual mode. Unused areas of virtual servomotor axis and cam axis can be used as a user device.

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

- (c) The setting range for torque limit value is 1 to 1000[%].

(6) Comment

- (a) This device is used to create a comment such as purpose of roller axis.
Made comment can be displayed at monitoring using MT Developer2.
- (b) Comments up to 32 characters long can be created.

| POINT |
|---|
| (1) "Roller diameter" or "number of pulses per roller revolution" set in the roller parameter is used for only the cycle speed monitor of servomotor, and it is not related to the rotation speed/travel value of servomotor. |
| (2) The roller cycle speed monitor device is the same for the "feed current value" in the real mode. Therefore, the position address (current value) of roller axis cannot be monitored in the virtual mode. When it switches from the virtual mode to real mode, the certain value is stored in the position address (current value). The value at this time is an unfixed value. |

8 OUTPUT MODULE

8.2 Ball Screw

The ball screw is used to make a machine connected to servomotor operate linearly. This section describes the ball screw operation and parameters required to use ball screws.

8.2.1 Operation

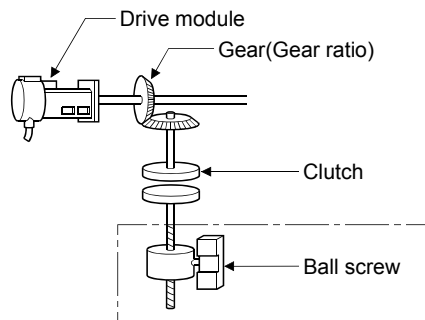
(1) Operation

- (a) The ball screw is controlled with the speed that the speed/travel value of drive module multiplied by a gear ratio of transmission module, and the travel value is output.

$$\text{(Ball screw speed)} = \text{(Drive module speed [pulse/s])} \times \text{(Gear ratio) [pulse/s]}$$

$$\text{(Ball screw travel value)} = \text{(Drive module travel value [pulse])} \times \text{(Gear ratio) [pulse]}$$

The speed/travel value of drive module transmitted to the ball screw is commanded to the servo amplifier.



- (b) When a clutch is used, the ball screw is controlled at clutch ON.

(2) Control details

- (a) Feed current value is continued, even if it switches from the real mode to virtual mode/from the virtual mode to real mode.
- (b) Backlash compensation processing is continued with the settings value of fixed parameters, even if it switches the real/virtual mode.

8 OUTPUT MODULE

8.2.2 Parameter list

The ball screw parameters are shown in Table 8.2 and the parameters shown in this table are explained in items (1) to (7) below.

Refer to the help of MT Developer2 for the ball screw parameter setting method.

Table 8.2 Ball Screw Parameter List

| No. | Setting Item | Default | Setting range | |
|-----|---|--|---|---------------------------------------|
| 1 | Output axis No. | 0 | Q173DSCPU/Q173DCPU(-S1): 1 to 32 Q172DSCPU : 1 to 16 Q172DCPU(-S1) : 1 to 8 | |
| 2 | Output unit | mm | mm | inch |
| 3 | Ball screw pith (P) | Must be not set. It is controlled with the fixed parameter. | | |
| 4 | Number of pulses per ball screw revolution (NP) | | | |
| 5 | Permissible droop pulse value | 6553500 | 1 to 1073741824 [pulse] | |
| 6 | Upper stroke limit value | 214748364.7 | -214748364.8 to 214748364.7 [μ m] | -21474.83648 to 21474.83647 [inch] |
| 7 | Lower stroke limit value | 0 | | |
| 8 | Speed limit value (VL) | 0 | 0.01 to 6000000.00 [mm/min] | 0.001 to 600000.000 [inch/min] |
| 9 | Torque limit value setting device (1 word) | — | -(300[%]) / word device (D, W, #, U□\G) | |
| 10 | Comment | None | 32 characters | |

(1) Output unit

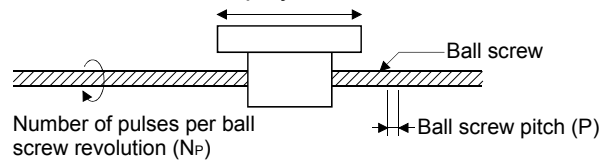
(a) This device is used to set the unit ([mm]/[inch]) of ball screw.

(b) Set the same unit as used in the real mode (unit in the fixed parameters) for the ball screw unit.

If the ball screw unit differs unit in the real mode, a mode switching error will occur at the switching from real mode to virtual mode.

(2) Ball screw pitch(P)/Number of pulses per ball screw revolution(NP)

- (a) The ball screw pitch connected to the servomotor and number of pulses per ball screw revolution are displayed.



- (b) The travel value per pulse is calculated by the ball screw pitch and number of pulses per ball screw revolution as the formula below.

$$[\text{Travel value per pulse}] = \frac{P}{NP}$$

POINT

"Ball screw pitch" or "number of pulses per ball screw revolution" is used for only the cycle speed monitor of servomotor, and it is not related to the rotation speed/travel value of servomotor.

(3) Permissible droop pulse value

- (a) This device is used to set the permissible droop pulse value of deviation counter.
- (b) The deviation counter value is continually checked, and if it becomes larger than the permissible droop pulse value, the error detection signal (M2407+20n) turns on.
However, since the ball screw axis operation continues, execute the error processing by user side.

(4) Upper/lower stroke limit value

- (a) This device is used to set the stroke range in the virtual mode.
- (b) When it exceeds the stroke range during operation, the error detection signal (M2407+20n) turns on.
However, a stop processing of ball screw axis is not executed.

(5) Speed limit value (VL)

- (a) This device is used to set the maximum speed of ball screw axis.

- (b) Set the speed limit value within the following range.

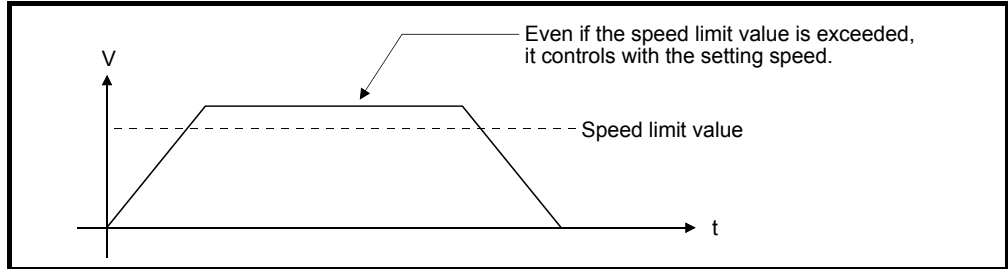
1) Unit : [mm]

$$1 \leq \frac{VL \times 10^4 \times NP}{60 \times P} \leq 2147483647 \quad [\text{pulse/s}]$$

2) Unit : [inch]

$$1 \leq \frac{VL \times 10^5 \times NP}{60 \times P} \leq 2147483647 \quad [\text{pulse/s}]$$

- (c) When the ball screw axis speed exceeds the speed limit value, the error detection signal (M2407+20n) turns on.
 However, the ball screw axis speed is not clamped.



(6) Torque limit value setting device (1 word)

- (a) This device is used to set the torque limit value of ball screw axis.
 When the device is set, the torque control is executed with the preset device value.
 In the virtual mode, the torque limit setting is always valid.
 If the device is not set, the torque limit is set at 300[%].
- (b) The following devices can be set as the torque limit value setting device.

| Name | Setting range |
|--------------------------|--|
| Data register | D0 to D8191 ^(Note-1) |
| Link register | W0 to W1FFF |
| Motion register | #0 to #7999 |
| Multiple CPU area device | U□\G10000 to U□\G(10000+p-1) ^(Note-2) |

(Note-1): D800 to D1559 are dedicated devices of virtual servomotor axis, synchronous encoder axis and output module "Cam" in the virtual mode. Unused areas of virtual servomotor axis and cam axis can be used as a user device.

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

- (c) The setting range for the torque limit value is 1 to 1000[%].

(7) Comment

- (a) This device is used to create a comment such as purpose of ball screw axis.
 Made comment can be displayed at monitoring using MT Developer2.
- (b) Comments up to 32 characters long can be created.

8.3 Rotary Tables

The rotary table is used to make a machine connected to servomotor gyrate. This section describes the rotary table operation and parameters required to use rotary table.

8.3.1 Operation

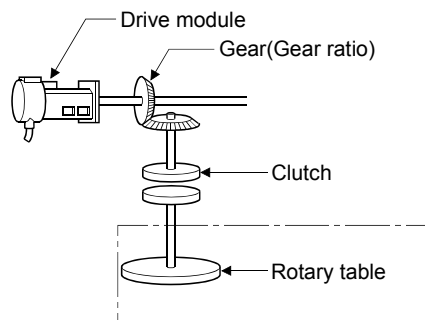
(1) Operation

- (a) The rotary table is controlled with the speed that the speed/travel value of drive module multiplied by a gear ratio of transmission module, and the travel value is output.

$$\text{(Rotary table speed)} = \text{(Drive module speed) [pulse/s]} \times \text{(Gear ratio) [pulse/s]}$$

$$\text{(Rotary table travel value)} = \text{(Drive module travel value) [pulse]} \times \text{(Gear ratio) [pulse]}$$

The speed/travel value of drive module transmitted to the rotary table is commanded to the servo amplifier.



- (b) When a clutch is used, the rotary table is controlled at clutch ON.

(2) Control details

- (a) Feed current value is continued, even if it switches from the real mode to virtual mode/from the virtual mode to real mode.
- (b) Backlash compensation processing is continued with the settings value of fixed parameters, even if it switches the real mode/virtual mode.

8.3.2 Parameter list

The rotary table parameters are shown in Table 8.3 and the parameters shown in this table are explained in items (1) to (8) below.

Refer to the help of MT Developer2 for the rotary table parameter setting method.

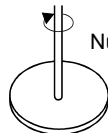
Table 8.3 Rotary Table Parameter List

| No. | Setting Item | Default | Setting range |
|-----|---|---------|---|
| 1 | Output axis No. | 0 | Q173DSCPU/Q173DCPU(-S1): 1 to 32 Q172DSCPU : 1 to 16 Q172DCPU(-S1) : 1 to 8 |
| 2 | Number of pulses per rotary table revolution (ND) | | Must be not set. It is controlled with the fixed parameter. |
| 3 | Permissible droop pulse value | 6553500 | 1 to 1073741824 [pulse] |
| 4 | Upper stroke limit value | 0 | 0 to 359.99999 [degree] |
| 5 | Lower stroke limit value | 0 | 0 to 359.99999 [degree] |
| 6 | Speed limit value (VL) | 0 | 0.001 to 2147483.647 [degree/min] ^(Note-1) |
| 7 | Torque limit value setting device (1 word) | — | -(300[%]) / word device (D, W, #, U□\G) |
| 8 | Comment | None | 32 characters |
| 9 | Current value within 1 virtual axis revolution storage device (Main shaft side) (2 words) | — | - / word device (D, W, #, U□\G) |
| 10 | Current value within 1 virtual axis revolution storage device (Auxiliary input axis side) (2 words) | — | - / word device (D, W, #, U□\G) |

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

(1) Number of pulses per rotary table revolution (ND)

- (a) The number of pulses per rotary table connected to the servomotor revolution is displayed.



Number of pulses per rotary table revolution (Nd)

| Displayed items | Displayed range |
|---|--|
| Number of pulses per rotary table revolution (ND) | Must be not set. It is controlled with the fixed parameter. $ND = AP[\text{pulse}] \times \frac{360[\text{degree}]}{AL [\text{degree}]}$ AP : Number of pulses value per revolution of fixed parameter AL : Travel value per revolution of fixed parameter |

- (b) The travel value per pulse is calculated from the number of pulses per rotary table revolution in accordance with the following formula:

$$[\text{Travel value per pulse}] = \frac{360}{N_D} [\text{degree}]$$

POINT

"Number of pulses per rotary table revolution" is used for only the cycle speed monitor of servomotor, and it is not related to the rotation speed/travel value of servomotor.

(2) Permissible droop pulse value

- (a) This device is used to set the permissible droop pulse value of deviation counter.
- (b) The deviation counter value is continually checked, and if it becomes larger than the permissible droop pulse value, the error detection signal (M2407+20n) turns on.
However, since the rotary table axis operation continues, execute the error processing by user side.

(3) Upper/lower stroke limit value

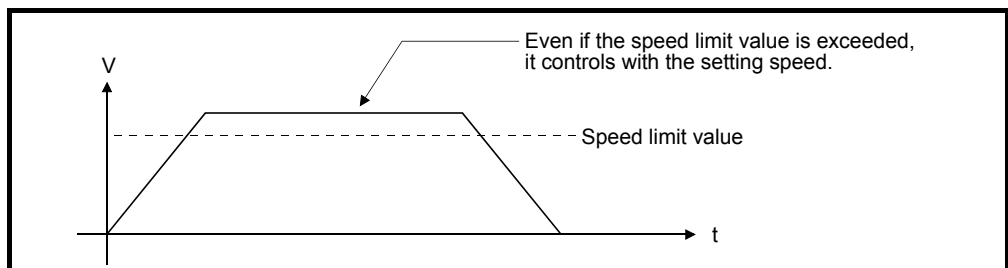
- (a) This device is used to set the stroke range in the virtual mode.
The upper/lower stroke limit setting determines whether the stroke limit is valid or not. If the upper stroke limit value is equal to the lower stroke limit value, the stroke limit is invalid.
- (b) When it exceeds the stroke range during operation, the error detection signal (M2407+20n) turns on.
However, a stop processing of rotary table axis is not executed.

(4) Speed limit value (VL)

- (a) This device is used to set the maximum speed of rotary table axis.
- (b) Set the speed limit value within the following range.

$$1 \leq \frac{V_L \times 10^5 \times N_D}{60 \times 360 \times 10^5} \leq 2147483647[\text{pulse/s}]$$

- (c) When the rotary table axis speed exceeds the speed limit value, the error detection signal (M2407+20n) turns on.
However, the rotary table axis speed is not clamped.



(5) Torque limit value setting device (1 word)

- (a) This device is used to set the torque limit value of rotary table axis.
When the device is set, the torque control is executed with the preset device value.
In the virtual mode, the torque limit setting is always valid.
If the device is not set, the torque limit is set at 300[%].
- (b) The following devices can be set as the torque limit value setting device.

| Name | Setting range |
|--------------------------|--|
| Data register | D0 to D8191 ^(Note-1) |
| Link register | W0 to W1FFF |
| Motion register | #0 to #7999 |
| Multiple CPU area device | U□\G10000 to U□\G(10000+p-1) ^(Note-2) |

(Note-1): D800 to D1559 are dedicated devices of virtual servomotor axis, synchronous encoder axis and output module "Cam" in the virtual mode. Unused areas of virtual servomotor axis and cam axis can be used as a user device.
 (Note-2): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

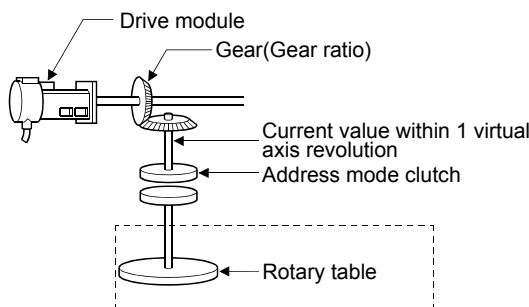
- (c) The setting range for torque limit value is 1 to 1000[%].

(6) Comment

- (a) This device is used to create a comment such as purpose of rotary table axis.
Made comment can be displayed at monitoring using MT Developer2.
- (b) Comments up to 32 characters long can be created.

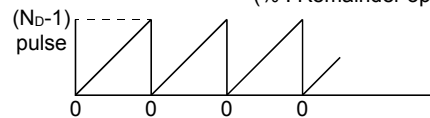
(7) Current value within 1 virtual axis revolution storage device (Main shaft side) (2 words)

This parameter is set when the address mode clutch is set at the rotary table main shaft side.



$$\text{Current value within 1 virtual axis revolution} = (\text{Drive module travel value} \times \text{gear}) \% N_d$$

(% : Remainder operator)



The reference position (0) for the current value within 1 virtual axis revolution is set with the address clutch reference setting command (M3213+20n).

- (a) The current value within 1 virtual axis revolution of rotary table main shaft side is stored in the preset device.

- (b) The following devices can be set as the current value within 1 virtual axis revolution storage device.

| Name | Setting range ^(Note-1) |
|--------------------------|---|
| Data register | D0 to D8191 ^(Note-2) |
| Link register | W0 to W1FFF |
| Motion register | #0 to #7999 |
| Multiple CPU area device | U□\G10000 to U□\G(10000+p-1) ^{(Note-3), (Note-4)} |

(Note-1): Set an even number at the first device.

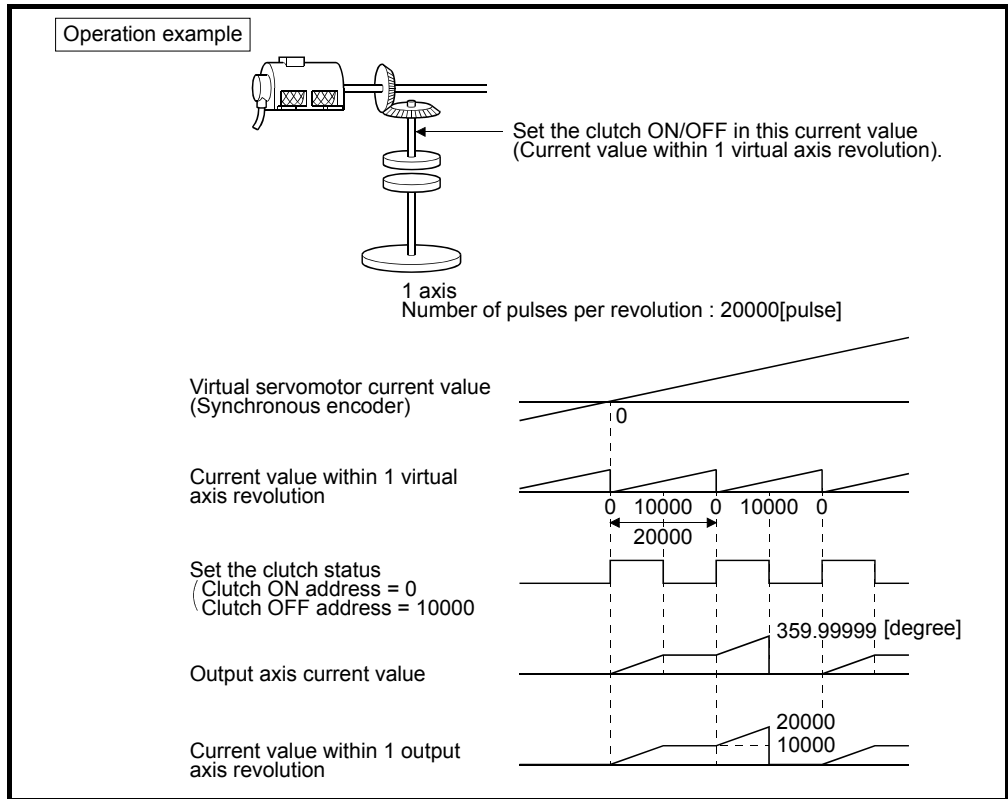
(Note-2): D800 to D1559 are dedicated devices of virtual servomotor axis, synchronous encoder axis and output module "Cam" in the virtual mode. Unused areas of virtual servomotor axis and cam axis can be used as a user device.

(Note-3): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

(Note-4): Only device of the self-CPU can be used.

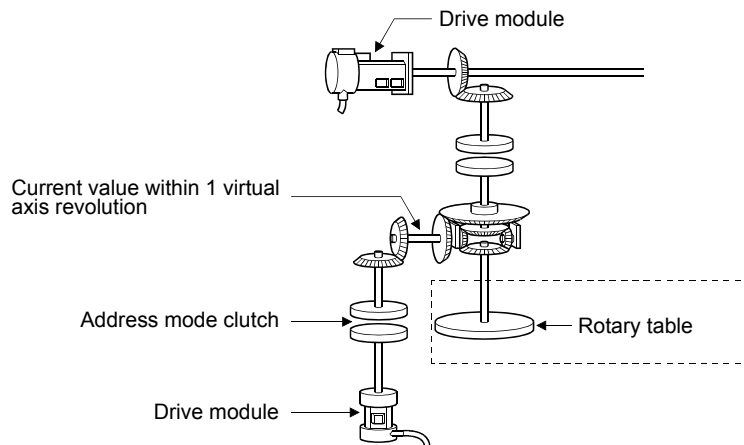
- (c) The current value within 1 virtual axis revolution is the range of 0 to (ND-1) [pulse].
(ND: Number of pulses per rotary table revolution)
- (d) The address mode clutch is turned on/off with the specified address of the current value within 1 virtual axis revolution range of 0 to (ND-1) [pulse]. Therefore, set the address value within the range of 0 to (ND-1) [pulse] in the clutch ON/OFF address setting device.
- (e) The current value within 1 virtual axis revolution reference position "0" is set by turning the address clutch reference setting command (M3213+20n) on and switching to the virtual mode.
The current values within 1 virtual axis revolution for both the main shaft and the auxiliary input axis is set to "0" at this time.
If the address clutch reference setting command (M3213+20n) is turned off and it switches to the virtual mode, the following processing is executed depending on the drive module.
- If the drive module is a virtual servomotor or an incremental synchronous encoder, operation will be continued from the current value within 1 virtual axis revolution for the main shaft and auxiliary input axis in the previous virtual mode.
 - If the drive module is an absolute synchronous encoder, operation will be continued from the current value within 1 virtual axis revolution for the main shaft and auxiliary input axis calculated from the current value of synchronous encoder.

(f) An example of an address mode clutch operation is shown below.



(8) Current value within 1 virtual axis revolution storage device
(Auxiliary input axis side) (2 words)

This parameter is set when the address mode clutch is set at the rotary table auxiliary input axis side.



(a) By setting the current value within 1 virtual axis revolution of rotary table auxiliary input axis side for the current value within 1 virtual axis revolution is stored in the preset device.

| | | | | |
|---|---|--|---|--|
| Current value within 1 virtual axis revolution of auxiliary input axis side | = | Drive module travel value of auxiliary input axis side | × | Gear ratio |
| | | | | Number of pulses per rotary table revolution |

(Note): Current value within 1 virtual axis revolution of auxiliary input axis side is updated regardless of clutch ON/OFF.

- (b) The following devices can be set as the current value within 1 virtual axis revolution storage device.

| Name | Setting range ^(Note-1) |
|--------------------------|---|
| Data register | D0 to D8191 ^(Note-2) |
| Link register | W0 to W1FFF |
| Motion register | #0 to #7999 |
| Multiple CPU area device | U□\G10000 to U□\G(10000+p-1) ^{(Note-3), (Note-4)} |

(Note-1): Set an even number at the first device.

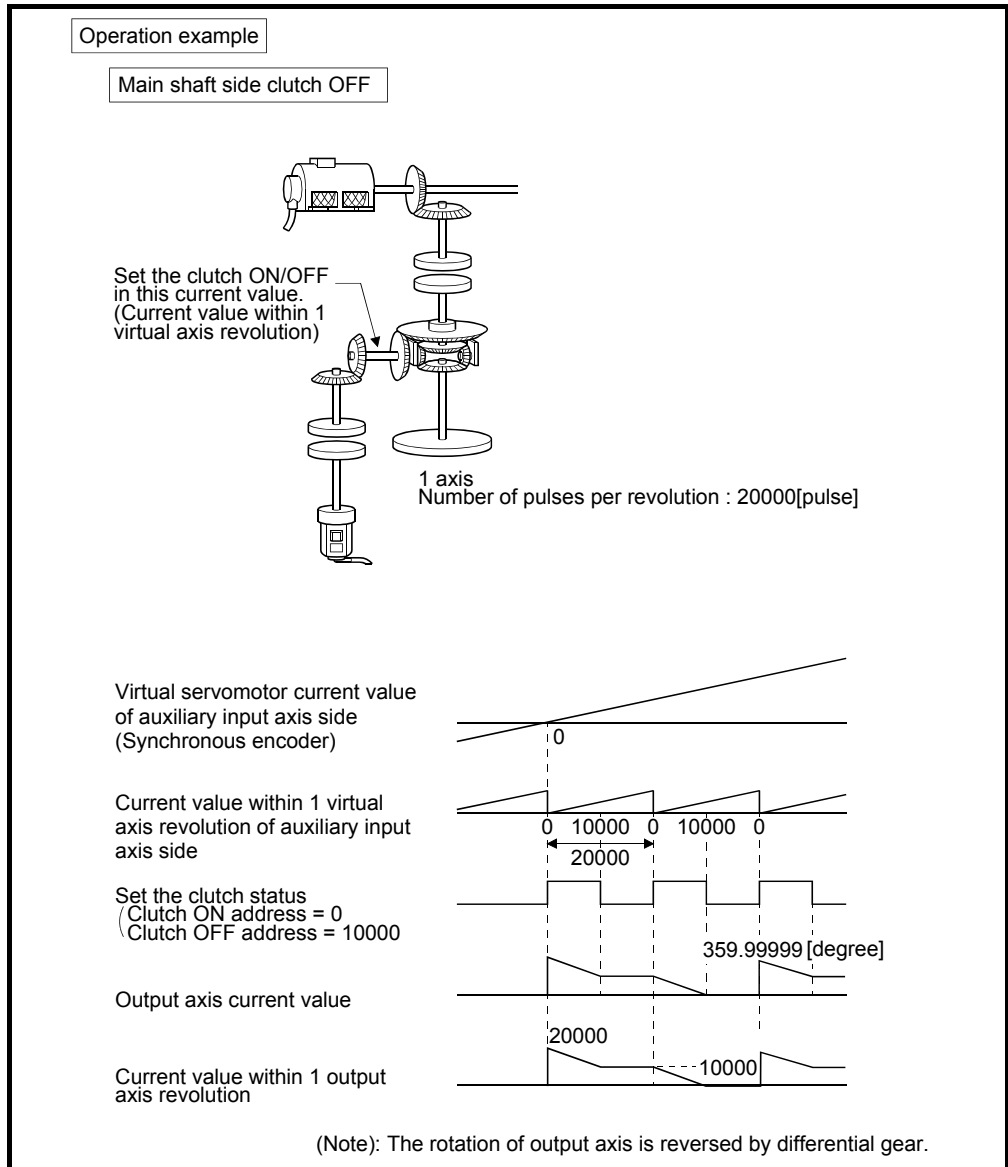
(Note-2): D800 to D1559 are dedicated devices of virtual servomotor axis, synchronous encoder axis and output module "Cam" in the virtual mode. Unused areas of virtual servomotor axis and cam axis can be used as a user device.

(Note-3): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

(Note-4): Only device of the self CPU can be used.

- (c) The current value within 1 virtual axis revolution is the range of 0 to (ND-1) [pulse].
(ND: Number of pulses per rotary table revolution)
- (d) The address mode clutch is turned on/off with the specified address of the current value within 1 virtual axis revolution range of 0 to (ND-1) [pulse]. Therefore, set the address value within the range of 0 to (ND-1) [pulse] in the clutch ON/OFF address setting device.
- (e) The current value within 1 virtual axis revolution reference position "0" is set by turning the address clutch reference setting command (M3213+20n) on and switching to the virtual mode.
The current values within 1 virtual axis revolution for both the main shaft and the auxiliary input axis is set to "0" at this time.
If the address clutch reference setting command (M3213+20n) is turned off and it switches to the virtual mode, the following processing is executed depending on the drive module.
- If the drive module is a virtual servomotor or an incremental synchronous encoder, operation will be continued from the current value within 1 virtual axis revolution for the main shaft and auxiliary input axis in the previous virtual mode.
 - If the drive module is an absolute synchronous encoder, operation will be continued from the current value within 1 virtual axis revolution for the main shaft and auxiliary input axis calculated from the current value of synchronous encoder.

(f) An example of an address mode clutch operation is shown below.



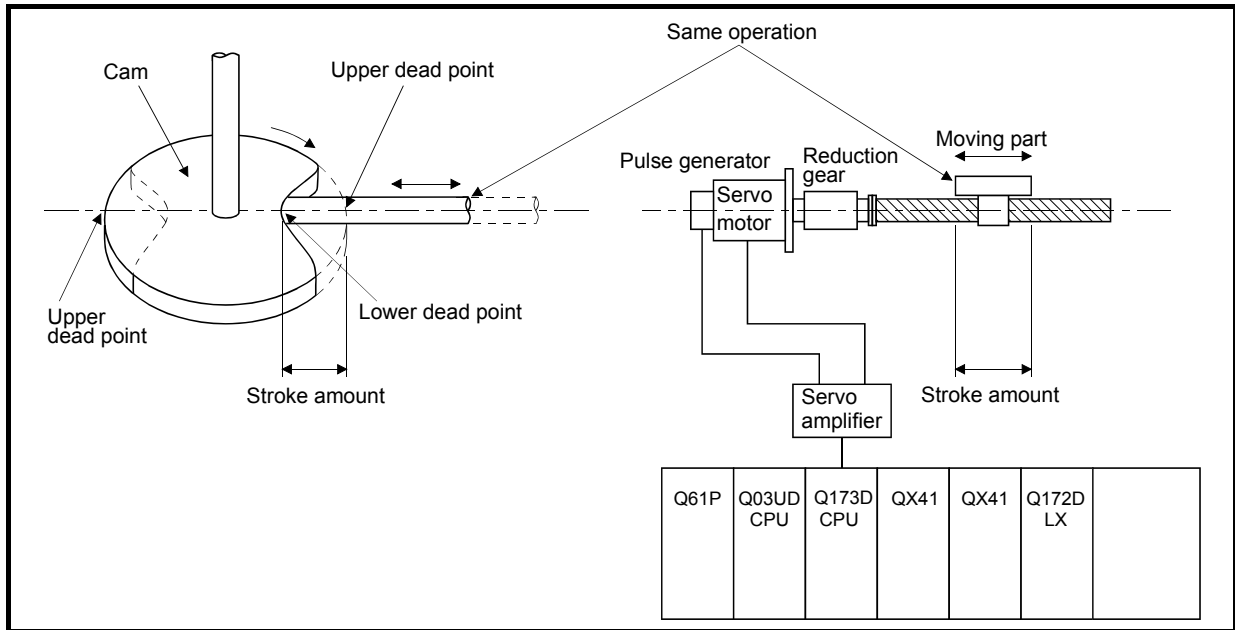
POINT

When the number of pulses per virtual axis revolution is not an integer value, a virtual axis revolution may not become a rotary table revolution.

8.4 Cam

Cam is used to make a machine connected to servomotor operate according to the preset cam pattern.

- (1) For axes at which the cam is set as the output module, the same operation as a cam is executed using a ball screw as shown in the example below.



- (2) The following two types data required to use a cam.

- Settings item at cam data creation.

It is set at cam data (cam curve) creation using the MT Developer2.

(Refer to Section 8.4.2)

- Cam parameters

These are the parameters used to set to cam in the output module at mechanical system program creation.

(Refer to Section 8.4.3)

8.4.1 Operation

This section describes the cam operation.

(1) Procedure for switching from the real mode to virtual mode

Set the devices by the following procedure using the Motion SFC program at the switching from real mode to virtual mode.

(a) Set the following details.

- Set the cam No. and stroke amount in the "cam No. setting device" and "stroke amount setting device" set in each cam shaft parameters.
- Turn the cam reference position setting command (M3214+20n) on/off as required.

(Refer to Section 4.1.2 (4))

↓

(b) Execute the real mode/virtual mode switching request.

(M2043: OFF → ON)

↓

(c) Start operation based on the cam pattern, stroke amount and cam reference setting command set in each cam shaft.

(2) Processing at the switching from the real mode to virtual mode

The current value within 1 cam shaft revolution is indexed based on the cam reference position setting command (M3214+20n), feed current value, lower stroke limit value, stroke amount and cam No. (cam pattern) at the switching from real mode to virtual mode.

(3) Operation

A value calculated by the stroke ratio of cam data table based on the current value within 1 cam shaft revolution is output.

$$[\text{Feed current value}] = [\text{Lower stroke limit value}] + [\text{Stroke amount}] \times [\text{Stroke ratio}]$$

The current value within 1 cam shaft revolution is set by the travel value that the travel value of drive module multiplied by a gear ratio of transmission module. Number of pulses per stroke amount is controlled based on the travel value per pulse set in the fixed parameter in the real mode.

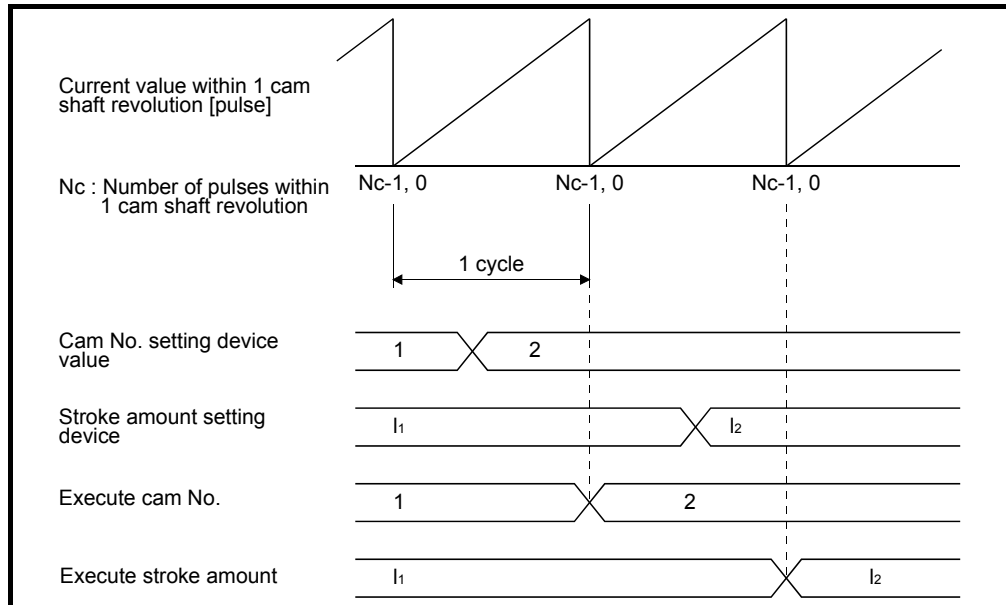
(4) Switching the stroke amount and cam No. during operation

(a) The cam stroke amount and execute cam No. can be changed using the Motion SFC program during cam operation.

(b) The stroke amount and cam No. are changed by the address set in the "stroke amount, cam No. change point" at the creating cam data.

When the "stroke amount, cam No. change point" is passed, the stroke amount/cam No. is changed based on the value of the stroke amount setting device and cam No. setting device set in the cam parameters.

< Example > Switching between cam No.1 and No.2, and switching timing between stroke amount l1 and l2 when the stroke amount/cam No. change point is set as "0".



(c) Error causes at the changing stroke amount/cam No. during operation

- 1) The cam No. and stroke amount are always input at the switching from real mode to virtual mode and in the virtual mode.

A relative check is executed at the time of input. An error occurs in the following cases, the error detection signal (M2407+20n) turns on and the error code is stored in the minor error code storage register.

- The stroke amount is outside the range of 1 to 2147483647 ($2^{31}-1$).
"Lower stroke limit value + Stroke amount" \leq "2147483647 ($2^{31}-1$)" is not satisfied in the two-way cam mode.
- The control mode of cam No. is not same.

2) Processing for the cam No./stroke amount error

- If the error occurs at switching from the real mode to virtual mode, it does not switch to the virtual mode.
- If the error occurs at reaching the preset "stroke amount, cam No. change point" (during cam operation), operation continues without switching to the preset stroke amount/cam No.

Reset the error detection signal and minor error code storage register by the error reset command (M3207+20n).

3) Processing for the error

- a) If the error occurs at switching from the real mode to virtual mode, correct by the following procedure.
 - Turn the real mode/virtual mode switching request flag (M2043) off.
 - Correct the cam No. and stroke amount.
 - Turn the real mode/virtual mode switching request flag on, and switch to virtual mode.
- b) If the error occurs during cam operation, correct the cam No. and stroke amount.

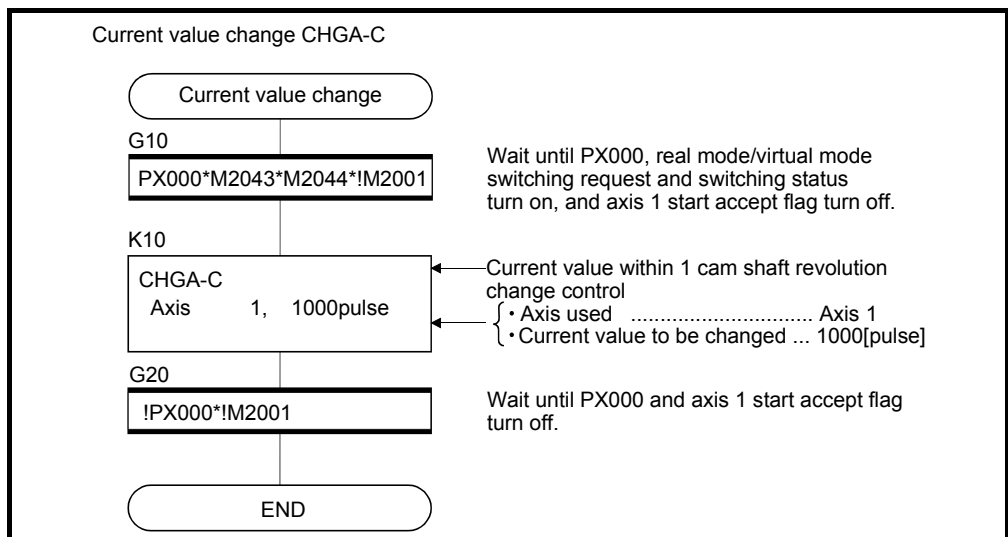
(5) Control details

- (a) The cam feed current value is continued at switching from the real mode to virtual mode/from the virtual mode to real mode.
- (b) Backlash compensation processing is continued with the settings value of fixed parameters, even if switches the real mode/virtual mode.
- (c) Upper/lower stroke limit value and speed limit value are not checked.

(6) Control change

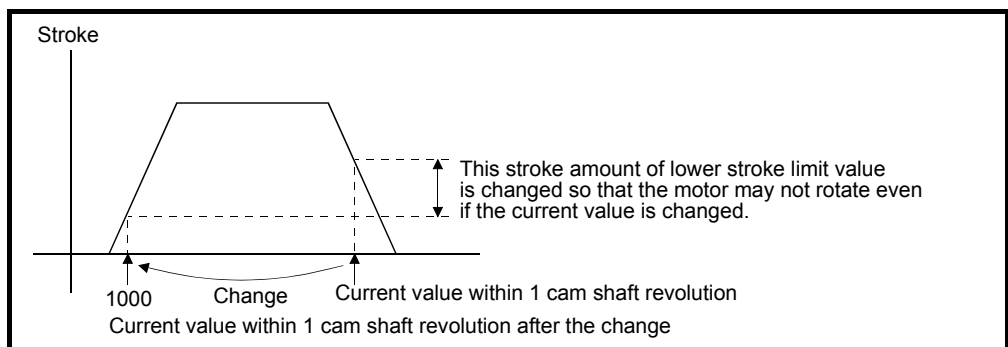
The current value within 1 cam shaft revolution can be changed to optional value for the cam as the control change during the virtual mode operation. Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (Motion SFC)" for details of current value change.

Motion SFC program for which executes the current value change (CHGA-C) is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

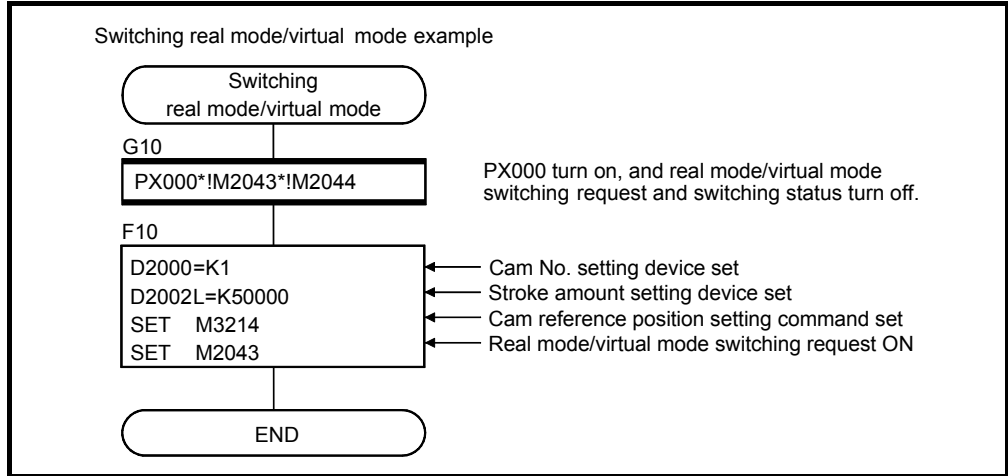
[Operation]



(7) Program example

[Switching real mode/virtual mode]

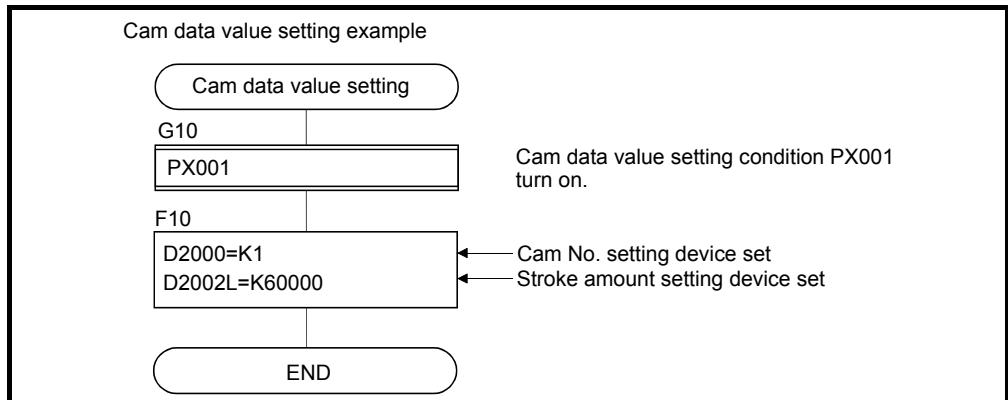
Motion SFC program for switching real mode/virtual mode is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

[Switching cam No./stroke amount during operation]

Motion SFC program for switching cam No. or stroke amount is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

8.4.2 Settings items at cam data creating

This section describes the setting items at cam data creating using MT Developer2.

Table 8.4 Table of Settings Items at cam Data Creating

| No. | Setting item | Default | Setting range |
|-----|--|------------------|---|
| 1 | Cam No. | — | Refer to (1) |
| 2 | Resolution | 256 | 256, 512, 1024, 2048 |
| 3 | Stroke amount/ Cam No. change point | 0 | 0 to (resolution-1) |
| 4 | Operation mode | Two-way cam mode | <ul style="list-style-type: none"> • Two-way cam mode • Feed cam mode |
| 5 | Cam data table | 0 | 0 to 32767 |

(1) Cam No.

This device is used to set the number allocated in created cam data.

The number of cam data is set "1 to 64" for each machine.

A cam No. is used with the number which offset value attached by the machine name sequence registered on mechanical system editing screen in the mechanical system program.

| Machine name sequence | Setting cam No. |
|-----------------------|-----------------|
| 1 | 1 to 64 |
| 2 | 101 to 164 |
| 3 | 201 to 264 |
| 4 | 301 to 364 |

(2) Resolution

(a) This device is used to set the number of index divisions in one cam cycle.

(b) The following conditions need to be satisfied in order to output the all point data of resolution correctly.

- Number of pulses per cam revolution (Nc) ≥ Resolution
- Time required per cam revolution ≥ Operation cycle × Resolution

(3) Stroke amount/cam No. change point

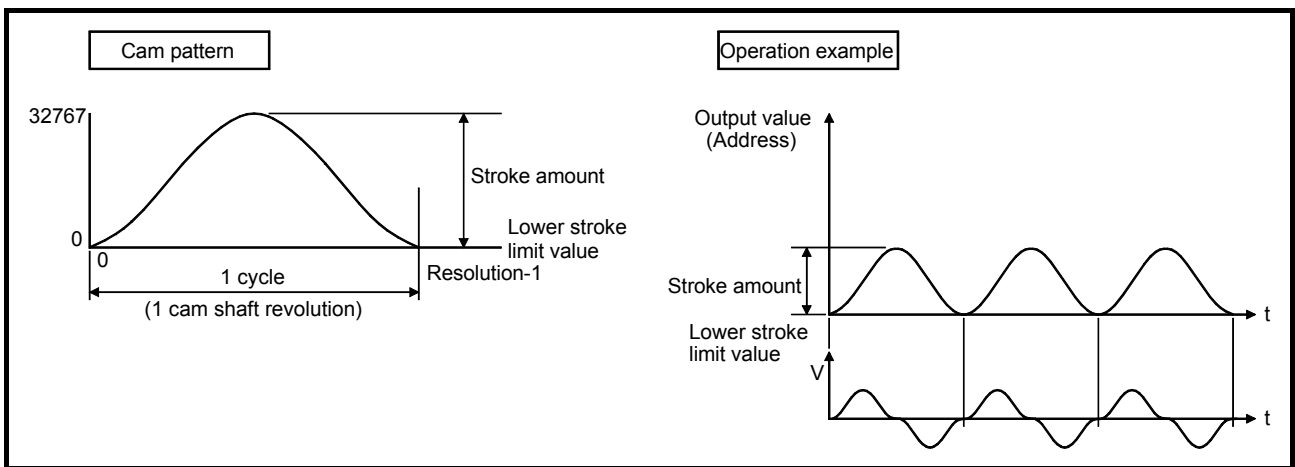
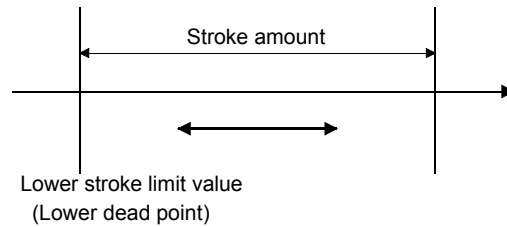
(a) This device is used to set a position at which the stroke amount/cam No. is switched during operation.

(b) When the set switching position [range: 0 to (resolution -1)] is reached, if the stroke amount/cam No. is normal, it is switched to the setting stroke amount and cam No.

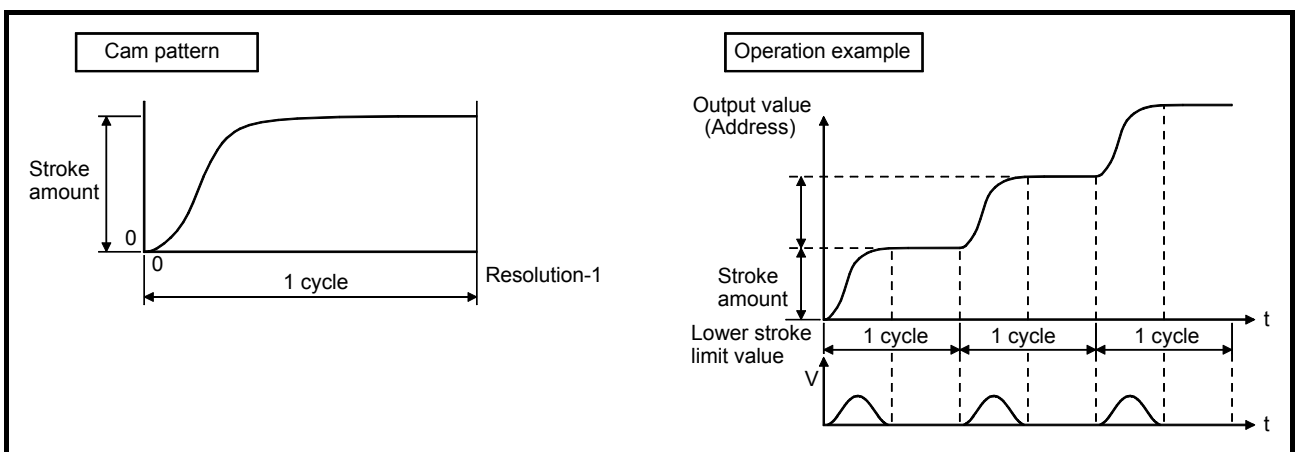
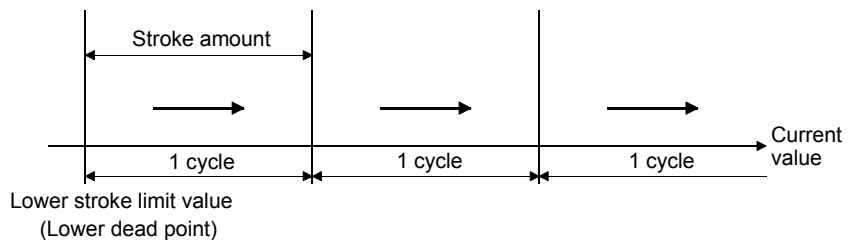
(4) Operation mode

(a) This device is used to set the two-way cam mode/feed cam mode.

1) Two-way cam mode A two-way operation is repeated between the lower stroke limit value (lower dead point) and the range set in the stroke amount.

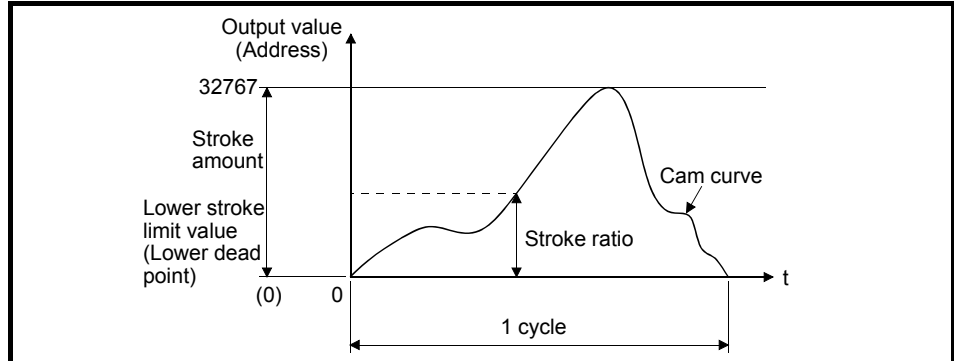


2) Feed cam modeWith the lower stroke limit value (lower dead point) as the operation start position, positioning is executed by feeding one stroke amount per cycle in a fixed direction.



(5) Cam data table

(a) This device is used to set each point stroke ratio (when the stroke amount is divided into 32767 divisions) in the set resolution.



(b) The cam data table is automatically created by creating the cam curve using MT Developer2.

The cam curves which can be used in the Motion CPU are shown in Section 8.4.4.

8 OUTPUT MODULE

8.4.3 Parameter list

The cam parameters are shown in Table 8.5 and the parameters No.2 to No.12 shown in this table are explained in items (1) to (11) below.

Refer to the help of MT Developer2 for the cam parameter setting method.

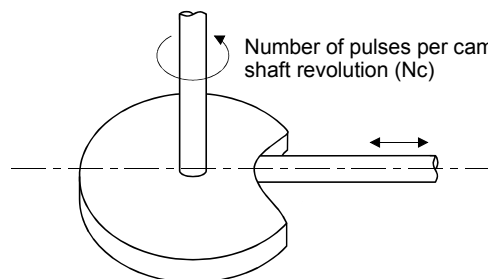
Table 8.5 Cam Parameter List

| No. | Setting item | Default value | Setting range |
|-----|--|---------------|---|
| 1 | Output axis No. | 0 | Q173DSCPU/Q173DCPU(-S1): 1 to 32 Q172DSCPU : 1 to 16 Q172DCPU(-S1) : 1 to 8 |
| 2 | Number of pulses per cam shaft revolution (Nc) (2 words) | 0 | 1 to 1073741824 [pulse]/ Word device (D, W, #, U□\G) QDSK |
| 3 | Cam No. setting device (1 word) | — | Word device (D, W, #, U□\G) |
| 4 | Permissible droop pulse value | 6553500 | 1 to 1073741824 [pulse] |
| 5 | Output unit | mm | mm inch degree QDSK pulse |
| 6 | Stroke amount setting device (2 words) | — | Word device (D, W, #, U□\G) |
| 7 | Torque limit value setting device (1 word) | — | -(300[%]) / word device (D, W, #, U□\G) |
| 8 | Comment | None | 32 characters |
| 9 | Lower stroke limit value storage device (2 words) | — | - / word device (D, W, #, U□\G) |
| 10 | Current value within 1 virtual axis revolution storage device (Main shaft side, 2 words) | — | - / word device (D, W, #, U□\G) |
| 11 | Current value within 1 virtual axis revolution storage device (Auxiliary input axis side, 2 words) | — | - / word device (D, W, #, U□\G) |
| 12 | Cam/ball screw switching command device | — | - / bit device ^(Note-1) |

(Note-1): The devices set in other parameter cannot be used.

(1) Number of pulses per cam shaft revolution (Nc) (2 word)

(a) The number of pulses required to rotate the cam one cycle is set.



(b) The setting for the number of pulses per cam shaft revolution is not related to the travel value per pulse (fixed parameter setting).

- (c) Set cam reference position after setting the number of pulses per cam shaft revolution. If not setting, the positioning is executed at the position before change.
- (d) The following devices can be set as the number of pulses per cam shaft revolution. **QDS**

| Name | Setting range ^(Note-1) |
|--------------------------|--|
| Data register | D0 to D8191 ^(Note-2) |
| Link register | W0 to W1FFF |
| Motion register | #0 to #7999 |
| Multiple CPU area device | U□\G10000 to U□\G(10000+p-1) ^(Note-3) |

(Note-1): Set an even number at the first device.

(Note-2): D800 to D1559 are dedicated devices of virtual servomotor axis, synchronous encoder axis and output module "Cam" in the virtual mode. Unused areas of virtual servomotor axis and cam axis can be used as a user device.

(Note-3): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

(2) Cam No. setting device (1 word)

- (a) This device is used to set the device that sets in the Motion SFC program by which the cam No. to control.
- (b) The following devices can be set as the cam No. setting device.

| Name | Setting range |
|--------------------------|--|
| Data register | D0 to D8191 ^(Note-1) |
| Link register | W0 to W1FFF |
| Motion register | #0 to #7999 |
| Multiple CPU area device | U□\G10000 to U□\G(10000+p-1) ^(Note-2) |

(Note-1): D800 to D1559 are dedicated devices of virtual servomotor axis, synchronous encoder axis and output module "Cam" in the virtual mode. Unused areas of virtual servomotor axis and cam axis can be used as a user device.

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

- (c) When the cam No. setting device value is changed during operation, it changes to the cam No. changed in the "stroke amount/cam No. switching position" set at the cam creating.

(3) Permissible droop pulse value

- (a) This device is used to set the permissible droop pulse value of deviation counter.
- (b) The deviation counter value is continually checked, and if it becomes larger than the permissible droop pulse value, the error detection signal (M2407+20n) turns on. However, since the cam shaft operation continues, execute the error processing by user side.

(4) Output unit

- (a) This device is used to set the unit ([mm]/[inch]/[degree]^{QDS}/[pulse]) of cam.
- (b) Set the same unit as used in the real mode (unit in the fixed parameters) for the cam shaft.

(5) Stroke amount setting device (2 words)

- (a) This device is used to set the cam stroke amount.
- (b) The following devices can be set as the stroke amount setting device.

| Name | Setting range ^(Note--1) |
|--------------------------|--|
| Data register | D0 to D8191 ^(Note--2) |
| Link register | W0 to W1FFF |
| Motion register | #0 to #7999 |
| Multiple CPU area device | U□\G10000 to U□\G(10000+p-1) ^(Note-3) |

(Note-1): Set an even number at the first device.

(Note-2): D800 to D1559 are dedicated devices of virtual servomotor axis, synchronous encoder axis and output module "Cam" in the virtual mode. Unused areas of virtual servomotor axis and cam axis can be used as a user device.

(Note-3): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

- (c) Set the stroke amount within the following range.

- Setting range in the two-way cam mode

| Unit | Setting range |
|-----------------------|---|
| mm | Lower stroke limit value + Stroke amount $\leq 2147483647 \times 10^{-1}$ [μm] |
| inch | Lower stroke limit value + Stroke amount $\leq 2147483647 \times 10^{-5}$ [inch] |
| degree ^{QDS} | Lower stroke limit value + Stroke amount $\leq 2147483647 \times 10^{-5}$ [degree] |
| pulse | Lower stroke limit value + Stroke amount ≤ 2147483647 [pulse] |

- Setting range in the feed cam mode

| Unit | Setting range |
|-----------------------|--|
| mm | 0 < Stroke amount $\leq 2147483647 \times 10^{-1}$ [μm] |
| inch | 0 < Stroke amount $\leq 2147483647 \times 10^{-5}$ [inch] |
| degree ^{QDS} | 0 < Stroke amount $\leq 2147483647 \times 10^{-5}$ [degree] |
| pulse | 0 < Stroke amount ≤ 2147483647 [pulse] |

| POINT |
|--|
| <p>When the cam reference position setting command (M3214+20n) is OFF, a position of cam axis is restored in the range of 0 to 359.99999[degree]. If the cam stroke amount is larger than 360.00000[degree], the current value within 1 cam shaft revolution different from the previous virtual mode might be restored.</p> <p>(Example) When cam position is restored by switching to virtual mode in the following conditions, the current value within 1 cam shaft revolution corresponding to "current feed value: 80[degree]" is restored.</p> <ul style="list-style-type: none"> • Stroke amount : 720[degree] • Lower stroke limit value: 0[degree] • Current value : Lower stroke limit value + 440[degree] (Current feed value: 80[degree]) |

(6) Torque limit value setting device (1 word)

(a) This device is used to set the torque limit value for cam shaft.

When the device is set, the torque control is executed with the preset device value.

In the virtual mode, the torque limit setting is always valid.

If the device is not set, the torque limit is set at 300[%].

(b) The following devices can be set as the torque limit value setting device.

| Name | Setting range |
|--------------------------|--|
| Data register | D0 to D8191 ^(Note-1) |
| Link register | W0 to W1FFF |
| Motion register | #0 to #7999 |
| Multiple CPU area device | U□\G10000 to U□\G(10000+p-1) ^(Note-2) |

(Note-1): D800 to D1559 are dedicated devices of virtual servomotor axis, synchronous encoder axis and output module "Cam" in the virtual mode. Unused areas of virtual servomotor axis and cam axis can be used as a user device.

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

(c) The setting range for torque limit value is 1 to 1000[%].

(7) Comment

(a) This device is used to create a comment such as purpose of cam shaft. Made comment can be displayed at monitoring using MT Developer2.

(b) Comments up to 32 characters long can be created.

(8) Lower stroke limit value storage device (2 words)

(a) This device is used to store the cam lower stroke limit value.
The current lower stroke limit value is stored.

(b) The following devices can be set as the lower stroke limit value storage device.

| Name | Setting range ^(Note-1) |
|--------------------------|---|
| Data register | D0 to D8191 ^(Note-2) |
| Link register | W0 to W1FFF |
| Motion register | #0 to #7999 |
| Multiple CPU area device | U□\G10000 to U□\G(10000+p-1) ^{(Note-3), (Note-4)} |

(Note-1): Set an even number at the first device.


(Note-2): D800 to D1559 are dedicated devices of the virtual servomotor axis, synchronous encoder axis and output module "Cam" in the virtual mode.
The unused areas of the virtual servomotor axis and cam axis can be used as a user device.

(Note-3): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

(Note-4): Only device of the self CPU can be used.

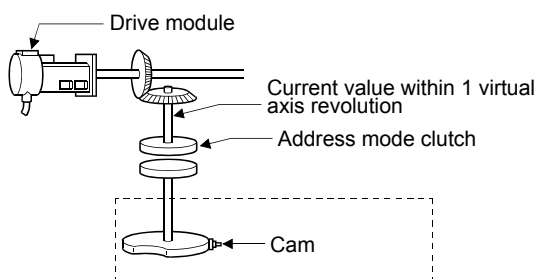
(c) The lower stroke limit value is range of -2147483648 (-2^{31}) to 2147483647 ($2^{31}-1$).

• The lower stroke limit value is determined as follows for each unit setting.

| Unit | Setting range |
|--|---|
| mm | Lower stroke limit value $\times 10^{-1}$ [μm] |
| inch | Lower stroke limit value $\times 10^{-5}$ [inch] |
| degree  | Lower stroke limit value $\times 10^{-5}$ [degree] |
| pulse | Lower stroke limit value $\times 1$ [pulse] |

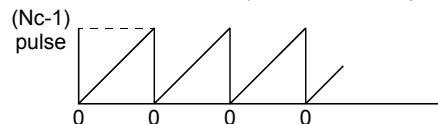
(9) Current value within 1 virtual axis revolution storage device (Main shaft side) (2 words)

This parameter is set when the address mode clutch is set at the cam main shaft side.



$$\text{Current value within 1 virtual axis revolution} = (\text{Drive module travel value} \times \text{gear}) \% N_c$$

(% : Remainder operator)



(a) The current value within 1 virtual axis revolution of cam main shaft side is stored in the preset device.

- (b) The following devices can be set as the current value within 1 virtual axis revolution storage device.

| Name | Setting range ^(Note-1) |
|--------------------------|---|
| Data register | D0 to D8191 ^(Note-2) |
| Link register | W0 to W1FFF |
| Motion register | #0 to #7999 |
| Multiple CPU area device | U□\G10000 to U□\G(10000+p-1) ^{(Note-3), (Note-4)} |

(Note-1): Set an even number at the first device.

(Note-2): D800 to D1559 are dedicated devices of the virtual servomotor axis, synchronous encoder axis and output module "Cam" in the virtual mode. The unused areas of the virtual servomotor axis and cam axis can be used as a user device.

(Note-3): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

(Note-4): Only device of the self CPU can be used.

- (c) The current value within 1 virtual axis revolution is the range of 0 to (NC-1) [pulse].

(NC: Number of pulses per cam shaft revolution)

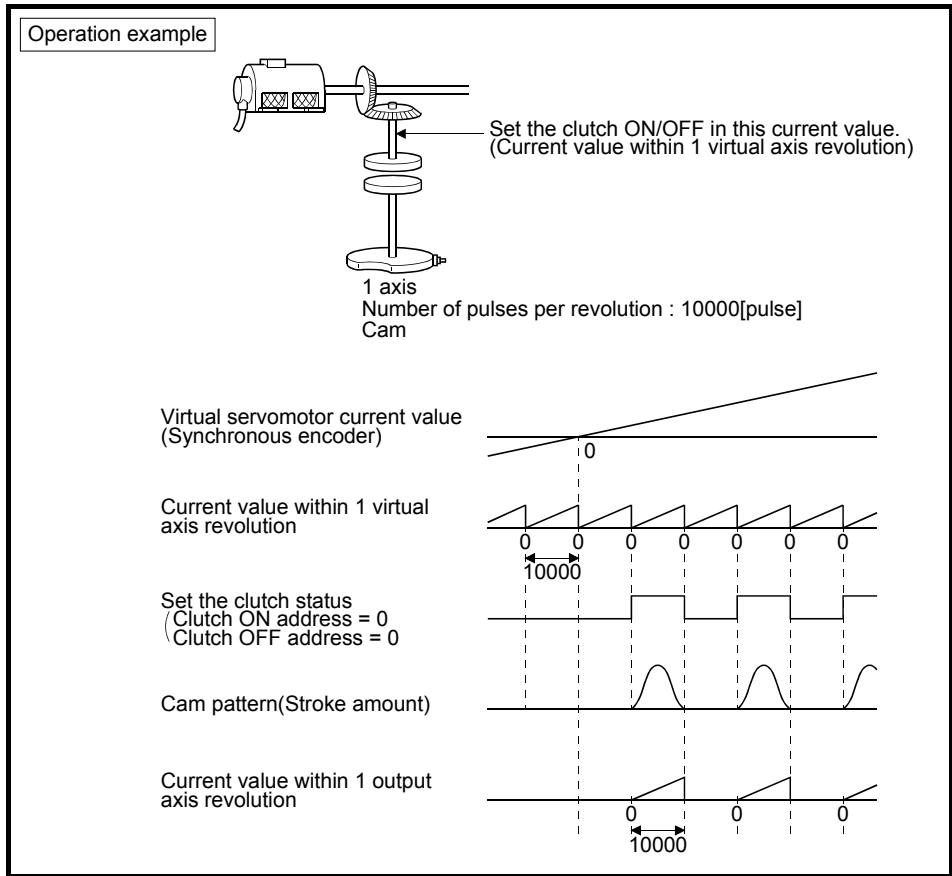
- (d) The address mode clutch is turned on/off with the specified address of the current value within 1 virtual axis revolution range of 0 to (NC-1) [pulse]. Therefore, set the address value within the range of 0 to (NC-1) [pulse] in the clutch ON/OFF address setting device.

- (e) The current value within 1 virtual axis revolution reference position "0" is set by turning the address clutch reference setting command (M3213+20n) on and switching to the virtual mode. The current values within 1 virtual axis revolution for both the main shaft and the auxiliary input axis is set to "0" at this time.

If the address clutch reference setting command (M3213+20n) is turned off and it switches to the virtual mode, the following processing is executed depending on the drive module.

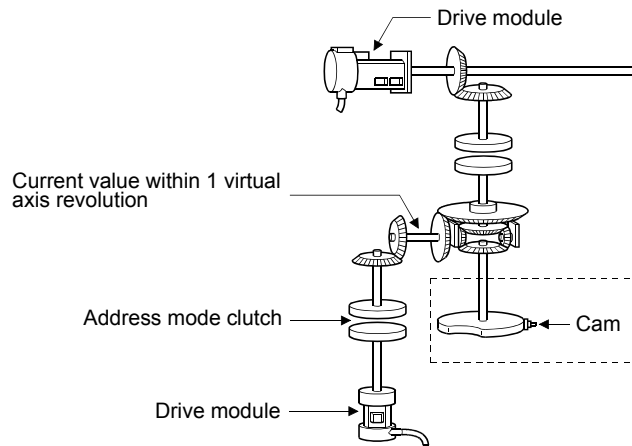
- If the drive module is a virtual servomotor or an incremental synchronous encoder, operation will be continued from the current value within 1 virtual axis revolution for the main shaft and auxiliary input axis in the previous virtual mode.
- If the drive module is an absolute synchronous encoder, operation will be continued from the current value within 1 virtual axis revolution for the main shaft and auxiliary input axis calculated from the current value of synchronous encoder.

(f) An example of an address mode clutch operation is shown below.



(10) Current value within 1 virtual axis revolution storage device (Auxiliary input axis side) (2 words)

This parameter is set when the address mode clutch is set at the cam auxiliary input axis side.



- (a) By setting the current value within 1 virtual axis revolution of auxiliary input axis side, for the current value within 1 virtual axis revolution is stored in the preset device.

| | | | | |
|---|---|--|---|--|
| Current value within 1 virtual axis revolution of auxiliary input axis side | = | Drive module travel value of auxiliary input axis side | × | $\frac{\text{Gear ratio}}{\text{Number of pulses per cam revolution}}$ |
|---|---|--|---|--|

(Note): Current value within 1 virtual axis revolution of auxiliary input axis side is updated regardless of clutch ON/OFF.

- (b) The following devices can be set as the current value within 1 virtual axis revolution storage device.

| Name | Setting range ^(Note-1) |
|--------------------------|---|
| Data register | D0 to D8191 ^(Note-2) |
| Link register | W0 to W1FFF |
| Motion register | #0 to #7999 |
| Multiple CPU area device | U□\G10000 to U□\G(10000+p-1) ^{(Note-3), (Note-4)} |

(Note-1): Set an even number at the first device.

(Note-2): D800 to D1559 are dedicated devices of the virtual servomotor axis, synchronous encoder axis and output module "Cam" in the virtual mode. The unused areas of the virtual servomotor axis and cam axis can be used as a user device.

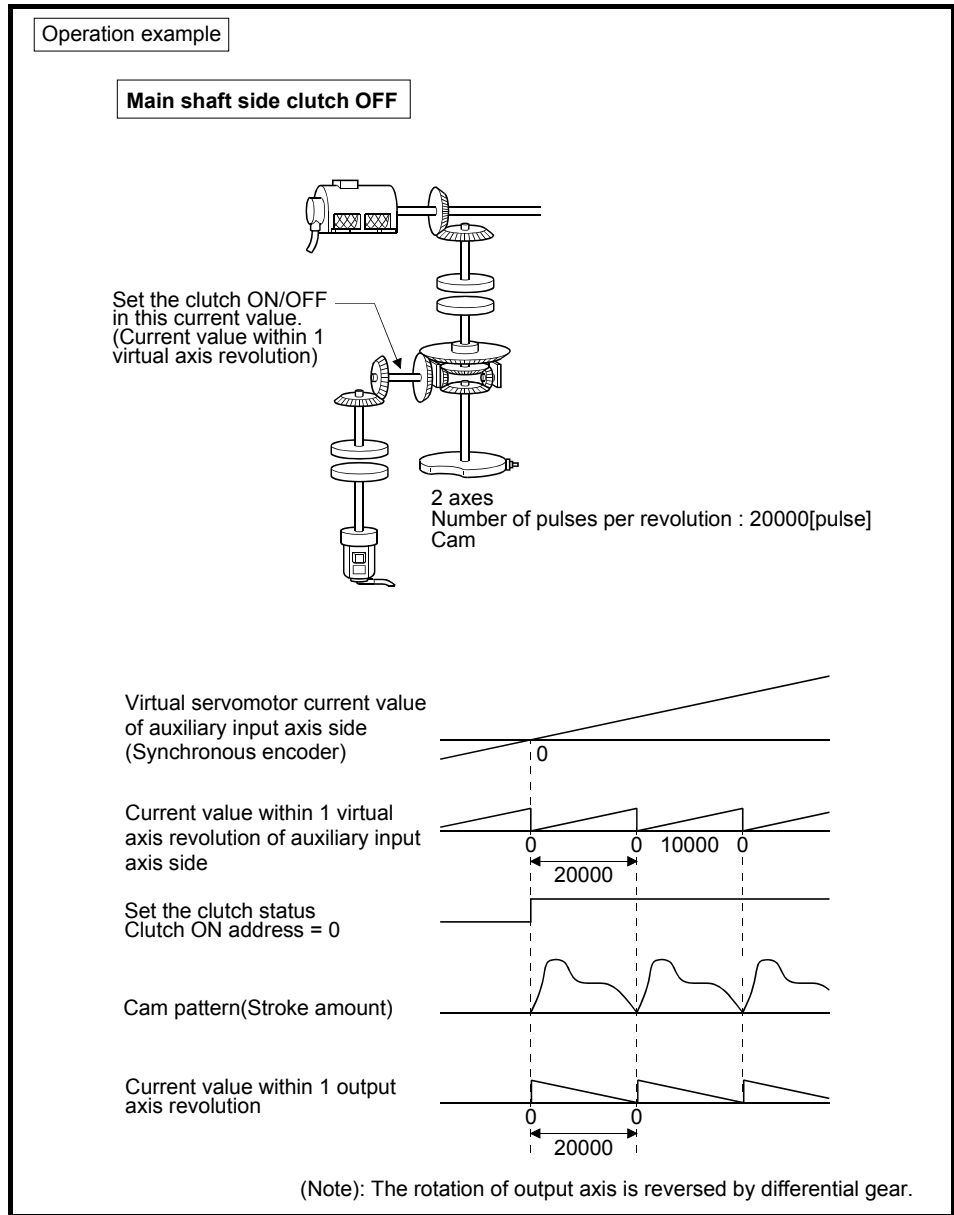
(Note-3): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

(Note-4): Only device of the self CPU can be used.

- (c) The current value within 1 virtual axis revolution is the range of 0 to (Nc-1) [pulse].

- (d) The address mode clutch is turned on/off with the specified address of the current value within 1 virtual axis revolution range of 0 to (Nc-1) [pulse]. Therefore, set the address value within the range of 0 to (Nc-1) [pulse] in the clutch ON/OFF address setting device.
- (e) The current value within 1 virtual axis revolution reference position "0" is set by turning the address clutch reference setting command (M3213+20n) on and switching to the virtual mode.
The current values within 1 virtual axis revolution for both the main shaft and the auxiliary input axis is set to "0" at this time.
If the address clutch reference setting command (M3213+20n) is turned off and it switches to the virtual mode, the following processing is executed depending on the drive module.
- If the drive module is a virtual servomotor or an incremental synchronous encoder, operation will be continued from the current value within 1 virtual axis revolution for the main shaft and auxiliary input axis in the previous virtual mode.
 - If the drive module is an absolute synchronous encoder, operation will be continued from the current value within 1 virtual axis revolution for the main shaft and auxiliary input axis calculated from the current value of synchronous encoder.

(f) An example of an address mode clutch operation is shown below.



8 OUTPUT MODULE

(11) Cam/ball screw switching command device

(a) This parameter is used to set cam operation.

(b) The following devices can be used as the cam/ball screw switching command device.

| Name | Setting range |
|--------------------------|--|
| Input | X0 to X1FFF ^(Note-1) |
| Output | Y0 to Y1FFF |
| Internal relay | M0 to M8191 ^{(Note-2), (Note-3)} |
| Link relay | B0 to B1FFF |
| Annunciator | F0 to F2047 |
| Multiple CPU area device | U□\G10000.0 to U□\G(10000+p-1).F ^(Note-4) |

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

(Note-2): "M4000 to M4639 and M4800 to M5439" are the dedicated devices of virtual servomotor axis in the virtual mode.

Unused area of virtual servomotor axis can be used as a user side.

(Note-3): Use these parameters to use the device (M5488 to M5519) allocated to Q17□CPUN/Q17□HCPU.

(Note-4): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

(c) The following operation is executed depending on the setting unit by turning the cam/ball screw switching command on corresponding to each output axis No.

mm : Same operation as ball screw.

inch : Same operation as ball screw.

degree : Same operation as rotary table. **QDS**

pulse : Same operation as ball screw.

(d) Operation of output axis by cam/ball screw switching command is shown below.

| Items | Operation details |
|--|---|
| Cam/ball screw switching command : OFF | Specified cam pattern operation |
| Cam/ball screw switching command : ON | <ul style="list-style-type: none"> Unit: mm, inch, pulse Same operation as ball screw. Unit: degree QDS Same operation as rotary table. <div style="border: 1px solid black; padding: 5px; margin: 5px 0;"> $\text{Command to servo amplifier} = \text{Preset command to servo amplifier} + \text{Drive module travel value}[\text{pulse}] \times \text{Gear ratio}$ </div> <p>(Note): Feed current value is calculated based on the travel value per pulse set in the fixed parameter.</p> |

- (e) The current value within 1 cam shaft revolution is calculated based on the feed current value, lower stroke limit value, stroke amount and cam No. (cam pattern) by turning off the cam/ball screw switching command. If the cam/ball screw switching command is turned off outside the range of "lower stroke limit value to stroke amount" for cam, a minor error (error code: 5000) will occur.
- (f) "Continue Virtual Mode" is set for operation on servo error, if the feed current value of output axis is outside the range of cam operation ("Lower stroke limit value to Stroke amount") by servo error for two-way cam, return the output axis to within cam operation range.
- 1) Remove servo error cause.
↓
 - 2) Turn the cam/ball screw switching command ON.
↓
 - 3) Execute the servo error reset (M3208+20n).
↓
 - 4) Return the output axis position within cam operation range to within stroke range by JOG operation, etc.
↓
 - 5) Turn the cam/ball screw switching command OFF.
↓
 - 6) Re-start virtual mode.












8.4.4 Cam curve list

This section describes the cam curves which can be used in the virtual mode.

(1) Cam curve characteristics comparison

The cam curve characteristics comparison is shown below.

Table 8.6 Cam Curve Characteristics Comparison Table

| Class | | Cam curve name | Acceleration curve shape | Vm | Am | (A · V)m | (V · V)m | (S · V)m | Remark |
|----------------------|---------------------|--------------------------|---|------|------------------|------------------|----------|----------|---------------------------|
| Discontinuity curves | | Constant - speed |  | 1.00 | | | 1.00 | 1.00 | |
| | | Constant-acceleration |  | 2.00 | ± 4.00 | ± 8.00 | 4.00 | 1.09 | |
| Two-dwelling curve | Symmetrical curves | 5 th curve |  | 1.88 | ± 5.77 | ± 6.69 | 3.52 | 1.19 | |
| | | Cycloid |  | 2.00 | ± 6.28 | ± 8.16 | 4.00 | 1.26 | |
| | | Distorted trapezoid |  | 2.00 | ± 4.89 | ± 8.09 | 4.00 | 1.20 | Ta = 1 / 8 |
| | | Distorted sine |  | 1.76 | ± 5.53 | ± 5.46 | 3.10 | 1.13 | Ta = 1 / 8 |
| | | Distorted constant-speed |  | 1.28 | ± 8.01 | ± 5.73 | 1.63 | 1.07 | Ta = 1 / 16 Ta = 1 / 4 |
| | Asymmetrical curves | Trapezoid |  | 2.18 | ± 6.17 | ± 10.84 | 4.76 | 1.28 | m = 1 |
| | | Reverse trapezoid |  | 2.18 | ± 6.17 | ± 10.84 | 4.76 | 1.28 | m = 1 |
| One-dwelling curve | | Double hypotenuse |  | 2.04 | + 5.55 - 9.87 | + 7.75 - 9.89 | 4.16 | 1.39 | |
| Non-dwelling curve | | Single hypotenuse |  | 1.57 | ± 4.93 | ± 3.88 | 2.47 | 1.02 | |

(2) Free-form curve

The spline interpolation function can be used to create free-form cam curves.

8.5 Phase Compensation Function

When carrying out a position follow-up control (synchronous operation) by synchronous encoder, delays in the progresses, etc. cause the phase to deviate at servomotor shaft end in respect to the synchronous encoder. The phase compensation function compensates in this case so that the phase does not deviate.

(1) Parameter list

Set the following devices for axes to execute the phase compensation function.
(Set in the output module parameter.)

Table 8.7 Phase Compensation Function Parameter List

| No. | Item | Number of device words | Device setting range | Setting range |
|-----|--|------------------------|---|-------------------------------|
| 1 | Phase advance time | 2 | D0 to D8191 ^{(Note-1), (Note-2)} W0 to W1FFF ^(Note-2) U□\G10000 to U□\G(10000+p-1) ^{(Note-2), (Note-3)} | -2147483648 to 2147483647[μs] |
| 2 | Phase compensation time constant | 1 | D0 to D8191 ^(Note-1) W0 to W1FFF U□\G10000 to U□\G(10000+p-1) ^(Note-3) | 0 to 32767[times] |
| 3 | Phase compensation processing valid flag | Bit | X0 to X1FFF ^(Note-4) Y0 to Y1FFF M0 to M8191 ^(Note-5) F0 to F2047 B0 to B1FFF U□\G10000.0 to U□\G(10000+p-1).F ^(Note-3) | — |
| 4 | Compensation amount monitor device | 2 | D0 to D8191 ^{(Note-1), (Note-2)} W0 to W1FFF ^(Note-2) U□\G10000 to U□\G(10000+p-1) ^{(Note-2), (Note-3), (Note-6)} | — |

(Note-1): D800 to D1559 are dedicated devices of virtual servomotor axis, synchronous encoder axis and output module "Cam" in the virtual mode.

Unused areas of virtual servomotor axis and cam axis can be used as a user device.

(Note-2): Set an even number at the first device.

(Note-3): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

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

(Note-5): "M4000 to M4639 and M4800 to M5439" are the dedicated devices of virtual servomotor axis in the virtual mode.

Unused area of virtual servomotor axis can be used as a user side.

(Note-6): Only device of the self CPU can be used.

(a) Phase advance time

It is used to set whether a phase is advanced/delayed.
Phase advance time is calculated in the formula below.

$$\text{Phase advance time} = \text{Delay time peculiar to system [s]} + \frac{1}{\text{PG1 [rad/s]}} \left(\begin{array}{l} \text{Delay time peculiar to system [t] : Refer to Table 8.8} \\ \text{: Model control gain} \end{array} \right)$$

"Command speed[pulse/s] × Phase advance time[s]" is added to the servo command value as an amount of compensation.

Table 8.8 Delay time peculiar to system

| Operation cycle [ms] | Incremental synchronous encoder use [μs] | Q171ENC-W8/Q170ENC use [μs] |
|-------------------------|---|--------------------------------|
| 0.22 QDS | 681 | 612 |
| 0.44 | 1088 | 1271 |
| 0.88 | 2376 | 2611 |
| 1.77 | 4165 | 4388 |
| 3.55 | 7715 | 7943 |
| 7.11 | 18378 | 18608 |
| 14.2 QD | 32613 | 32829 |

(b) Phase compensation time constant

It is used to set to execute leading edge/trailing edge smoothly so that a servomotor does not make rapid acceleration/deceleration at phase compensation.

Set the number of operation cycles as setting unit.

<Example>

For operation cycle is 0.88[ms] and phase compensation time constant is 50[times].

The phase compensation time constant becomes "0.88 × 50 = 44[ms]"

Phase compensation time constant is input at the phase compensation processing valid flag ON.

(c) Phase compensation processing valid flag

It is used to set whether the phase compensation function is "Valid/Invalid".

- ON.....Phase compensation function "Valid"
- OFF.... Phase compensation function "Invalid"

(d) Compensation amount monitor

The compensation amount under compensating is stored to the preset register.

- Except cam axis...Compensation amount of servomotor shaft [pulse]
- Cam axis.....Compensation amount of current value within 1 virtual axis revolution [pulse]

(2) Operating method

Operating method for phase compensation function is shown below.

(a) Set a phase advance time.

↓

(b) Set a suitable time constant as a phase compensation time constant.

↓

(c) Turn the phase compensation processing valid flag on for every axis before the servomotor start.

↓

(d) For cam axis, make a gain adjustment in the servo amplifier side to improve the flatness for cam pattern. In this case, advance to the phase of cam axis compared with axis of other roller or rotary table, etc.

Therefore, if the phase of cam axis is delayed in the phase advance time setting, a phase with the axis of a roller or rotation table, etc. can be set.

(3) Errors at phase compensation

(a) When the phase compensation time constant is outside the setting range, a minor error [6300] will occur for applicable axis, a phase compensation is executed without soothing processing.

| POINT |
|---|
| <p>(1) It must be reduced a phase compensation time constant to use for delay compensation of synchronous encoder.</p> <p>(2) When driving 2 axes synchronizing with virtual servomotor, even if the position control gains 1 of each axis differ, it can be compensated to eliminate a phase discrepancy by the following setting.</p> <p><Example> For Axis 1: PG1= 50[rad/s] and Axis 2: PG1=100[rad/s], Phase advance time = $1/50 - 1/100$ $= 0.01[s]$ (=10000[μs])</p> <p>Therefore, -10000[μs] is set as a phase advance time of axis 2, a phase of axis 2 can be set with a phase of axis 1.</p> <p>(3) For cam axis, if it switches from the virtual mode to real mode in compensation amount except "0", it switches to the real mode with a phase shifted to other axes for compensation amount of remainder. In this case, switch to the real mode after setting "0" as a compensation amount.</p> |

9. REAL MODE/VIRTUAL MODE SWITCHING AND STOP/RE-START

This section describes the check details and switching method for the real mode/virtual mode switching.

(1) Real mode/virtual mode switching

Real mode/virtual mode switching is executed by turning the real mode/virtual mode switching request flag (M2043) ON/OFF.

- Real mode Switching request to the real mode by turning the M2043 OFF.
- Virtual mode Switching request to the virtual mode by turning the M2043 ON.

(2) Real mode/virtual mode confirmation

The current control mode state (real or virtual) can be confirmed by turning the real mode/virtual mode switching status flag (M2044) ON/OFF.

- M2044 : OFF Real mode state
- M2044 : ON Virtual mode state

9.1 Switching from the Real Mode to Virtual Mode

When the real mode to virtual mode switching is requested (M2043 OFF→ON), the following check is executed. (Confirm the check items in Table 9.1 to 9.3 for switching from real mode to virtual mode, and execute with all normal state.)

- Check to determine if switching to the virtual mode is possible.... Refer to Table 9.1
- Output module check Refer to Table 9.2
- Synchronous encoder axis check Refer to Table 9.3

9 REAL MODE/VIRTUAL MODE SWITCHING AND STOP/RE-START

- (1) Check to determine if switching to the virtual mode is possible
- (a) The items in Table 9.1 are checked to determine if switching to the virtual mode is possible.
When all check items of Table 9.1 are normal, switching to the virtual mode is executed.
- (b) If an error of at least one item of Table 9.1, the real mode/virtual mode switching error detection flag (M2045) turns on, and the error code is stored in the real mode/virtual mode switching error information storage register (SD504 to SD506).
Refer to APPENDIX 1.7 for the error codes which are stored in the SD504 to SD506.

Table 9.1 Check Items List for Real Mode to Virtual Mode Switching

| Check sequence | Check item | Applicable output module | | | | | Normal condition | Abnormal condition |
|----------------|---|--------------------------|------------|--------------|-----|-------------------------|------------------|--------------------|
| | | Roller | Ball screw | Rotary table | Cam | Real mode axis (Note-1) | | |
| 1 | • Are PLC ready flag (M2000) and PCPU READY complete flag (SM500) ON ? | ○ | ○ | ○ | ○ | ○ | ON | OFF |
| 2 | • Have all axes stopped ? (M2001 to M2032 : OFF) | ○ | ○ | ○ | ○ | ○ | YES | NO |
| 3 | • Has cam data using the Motion SFC program changed ? | — | — | — | ○ | — | NO | YES |
| 4 | • Has the mechanical system program been registered ? | ○ | ○ | ○ | ○ | ○ | YES | NO |
| | • Does the axis No. set in the system settings match the output axis set in the mechanical system program ? | ○ | ○ | ○ | ○ | ○ | YES | NO |
| 5 | • Is the all axes servo ON command (M2042) ON ? | ○ | ○ | ○ | ○ | ○ | ON | OFF |
| 6 | • Does not the servo start processing by the servo error reset executed at the servo amplifier (axis used) ? | ○ | ○ | ○ | ○ | ○ | Completion | During processing |
| 7 | • Is the external encoder normal ? | ○ | ○ | ○ | ○ | ○ | YES | NO |
| 8 | • Is the external forced stop inputted ? | ○ | ○ | ○ | ○ | ○ | NO | YES |
| 9 | • Are the all axes servo error detection signal (M2408+20n) ON ? | ○ | ○ | ○ | ○ | ○ | OFF | ON even if 1 axis |
| 10 | • Are the home position return request flag (M2409+20n) OFF ? (Excluding roller axis) | — | ○ | ○ | ○ | — | OFF | ON even if 1 axis |
| 11 | • Does the units set in the fixed parameters match that set in the output module ? | — | ○ | ○ | ○ | — | YES | NO |
| 12 | • Has the cam data been registered? | — | — | — | ○ | — | YES | NO |
| 13 | • Has the cam No. been set at the "cam No. setting device" set in the cam parameter ? | — | — | — | ○ | — | YES | NO |
| 14 | • Has the stroke amount (1 to 2147483647) been set at the "stroke amount setting device" set in the cam parameter ? | — | — | — | ○ | — | YES | NO |
| 15 | • Is the cam "stroke amount setting device" an even number ? | — | — | — | ○ | — | YES | NO |

(Note-1): It is not check target for the operating system software version "00H or later".

9 REAL MODE/VIRTUAL MODE SWITCHING AND STOP/RE-START

(2) Output module check

- (a) The items in Table 9.2 below are checked to determine the output module state.

If an error is detected, it switches to the virtual mode, but the applicable system cannot be started. Correct the error cause in the real mode, and switch to virtual mode again.

- (b) When an error is detected, the error detection signal (M2407+20n) of applicable output module turns on, and the error code is stored in the minor/major error code storage register.

Table 9.2 Check Items List for Output Module

| Check sequence | Check item | Applicable output module | | | | Normal condition | Abnormal condition |
|----------------|---|--------------------------|------------|--------------|-----|------------------|------------------------------------|
| | | Roller | Ball screw | Rotary table | Cam | | |
| 1 | • Is the feed current value within the stroke limit range ? | — | ○ | ○ | — | YES | NO |
| | • Is the feed current value within the range of "[lower stroke limit value] to [stroke amount]" ? | — | — | — | ○ | | |
| 2 | • Does not "[lower stroke limit value] + [stroke amount]" exceed 2147483647 ($2^{31}-1$) in the two-way cam mode ? | — | — | — | ○ | YES | NO |
| 3 | • When the clutch connected to between the drive module and synchronous encoder is "external input mode", are the clutch ON/OFF device the same device ? | ○ | ○ | ○ | ○ | YES | NO |
| | • When the clutch connected to between the drive module and synchronous encoder is "external input mode", are the encoder I/F the manual pulse generator input ? | ○ | ○ | ○ | ○ | YES | NO (Serial encoder (ABS) input) |
| 4 | • Is the output module where either a "no clutch" or "clutch ON command" in effect for the virtual main shaft or the virtual auxiliary input axis the servo ready (M2415+20n : ON)? | ○ | ○ | ○ | ○ | ON | OFF |
| | • Is the external input signal "STOP" of output module where either a "no clutch" or "clutch ON command" in effect for the main shaft or the auxiliary input axis OFF ? | ○ | ○ | ○ | ○ | OFF | ON |
| 5 | • Can the current value within 1 cam revolution be calculated in the two-way cam mode ? | — | — | — | ○ | YES | NO |
| 6 | • Is the clutch ON/ OFF address setting device for address mode clutch an even number ? | ○ | ○ | ○ | ○ | YES | NO |

(3) Synchronous encoder axis check

(a) The items in Table 9.3 below are checked to determine the synchronous encoder state.

If an error is detected, it switches to the virtual mode, but the applicable system cannot be started. Correct the error cause in the real mode, and switch to virtual mode again.

(b) When an error is detected, the error detection signal (M2407+20n) of the applicable output module turns on, and the error code is stored in the minor/major error code storage register.

Table 9.3 Check Items List for Synchronous Encoder Axis

| Check sequence | Check item | Applicable synchronous encoder | | Normal condition | Abnormal condition |
|----------------|---|--------------------------------|---------------|------------------|------------------------------|
| | | External synchronous encoder | Output module | | |
| 1 | • Is the synchronous encoder connected to the Q172DEX ? | ○ | — | Connected | Not connected Cable break |

9.2 Switching from the Virtual Mode to Real Mode

There are following methods for switching from the virtual mode to real mode.

- Switching by user
- Switching automatically by the operating system software

9.2.1 Switching by user

- (1) When the virtual mode to real mode switching is requested (M2043 ON → OFF), the item in Table 9.4 is checked. If normal, it switches to the real mode. (Confirm the check items in Table 9.4 for the switching from virtual mode to real mode, and execute with all normal state.)
- (2) The real mode/virtual mode switching error detection flag (M2045) turns on at the error detection, and the error code is stored in the real mode/virtual mode switching error information (SD504 to SD506). (Refer to APPENDIX 1.7)

Table 9.4 Check Items for VIRTUAL Mode to REAL Mode Switching

| Check item | Normal condition | Abnormal condition |
|---|---------------------|-----------------------------------|
| • Is the virtual axis stopped? (M2001 to M2032 of virtual axis: OFF) | Virtual axis OFF | Virtual axis ON even if 1 axis |
| • Virtual axis and real mode axis stopped? (M2001 to M2032 : OFF) (Operating system software version "00G" or before in the Q17□DCPU(-S1)) | OFF | ON even if 1 axis |

9.2.2 Switching by the operating system software

- (1) If the following items are detected in the virtual mode operation, the operating system software automatically switches back to the real mode.
 - The forced stop is input.
 - PLC ready flag (M2000) turns off.
 - When "Return to Real Mode" is set as an operation on servo error, the servo error detection signal (M2408+20n) turns on even if 1 axis.
- (2) The error code is stored in the real mode/virtual mode switching error information (SD504 to SD506) at the switching back from virtual mode to real mode. However, the real mode/virtual mode switching error detection flag (M2045) does not turn on.

9 REAL MODE/VIRTUAL MODE SWITCHING AND STOP/RE-START

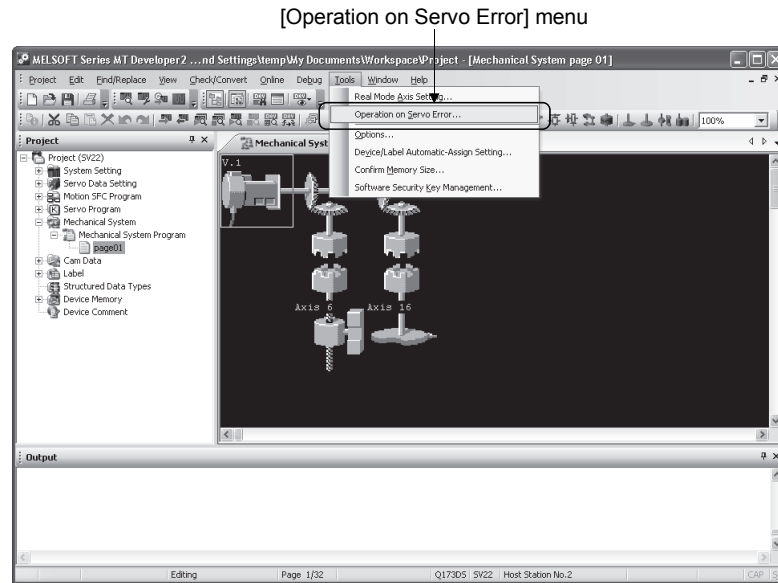
9.2.3 Continuous operation on servo error in virtual mode

Set the processing on servo error in virtual mode on the mechanical system screen of MT Developer2.

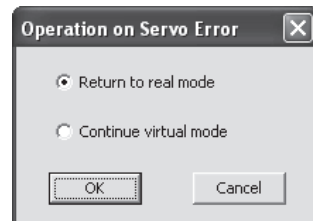
(Default: "Return to real mode")

Refer to the help of MT Developer2 for the setting method.

- Mechanical system screen



- Operation on servo error setting screen



Operation conditions for continuous operation on servo error in virtual mode are shown below.

| Operation mode | Details | Operation on servo error | Operation for other axes | Return condition to virtual mode |
|-----------------------|-----------------------------------|---|--------------------------|-------------------------------------|
| Return to real mode | Motion CPU switches to real mode. | Only axis on servo error is servo OFF, and servomotor coasts. | Rapid stop | After error release in real mode |
| Continue virtual mode | Virtual mode continues. | | Operation continues | After error release in virtual mode |

POINT

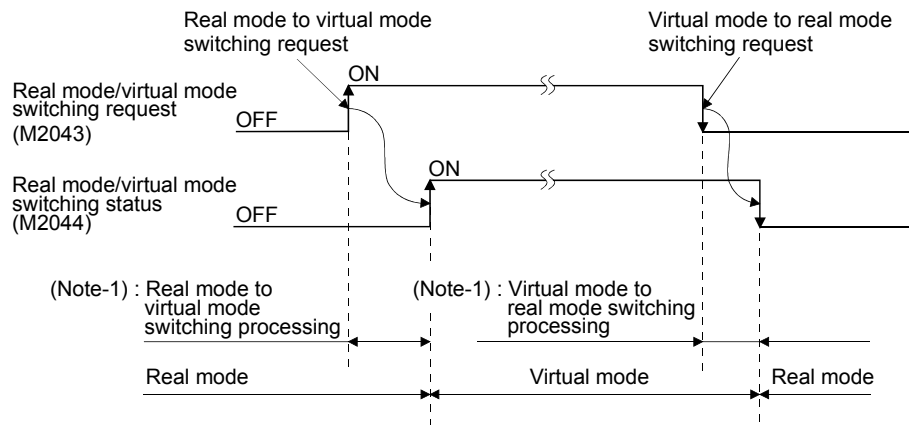
When "Continue virtual mode" is selected, be sure to use a clutch in the mechanical system program.
In addition, the drive module connected to output axis on servo error is also continuing operation. Be sure to release a servo error after clutch OFF.

9.3 Precautions at Real Mode/Virtual Mode Switching

This section describes the precautions at real mode/virtual mode switching.

- (1) The motion control step and the torque limit value change instruction/speed change instruction during mode switching processing execution impossible
 The motion control step and the torque limit value change instruction/speed change instruction during the from real mode to virtual mode/from virtual mode to real mode switching processing (part of timing chart (Note-1)) cannot execute.
 The real mode/virtual mode switching request flag (M2043) and real mode/virtual mode switching status flag (M2044) should be used as an interlock.

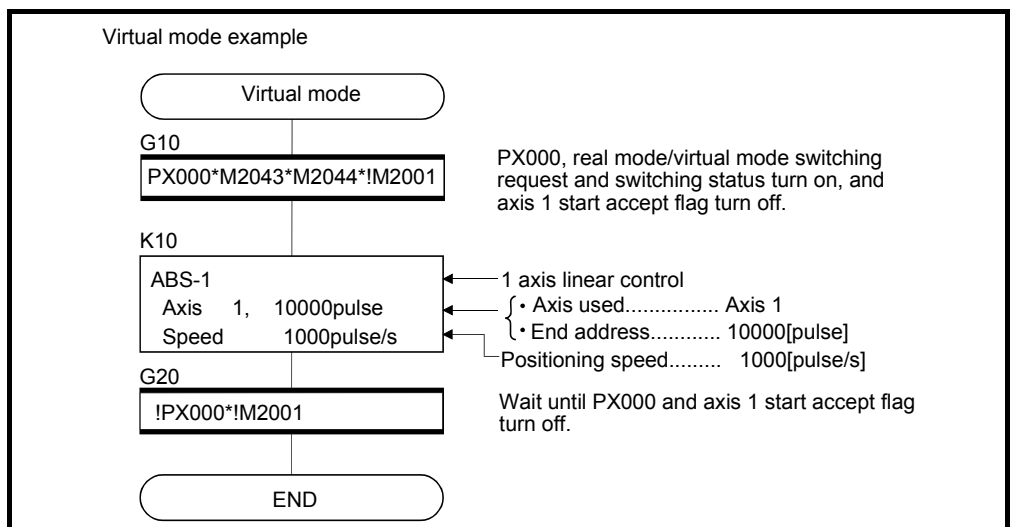
[Timing Chart]



Motion SFC program for which executes the motion control step of real mode and virtual mode is shown below.

[Program Example]

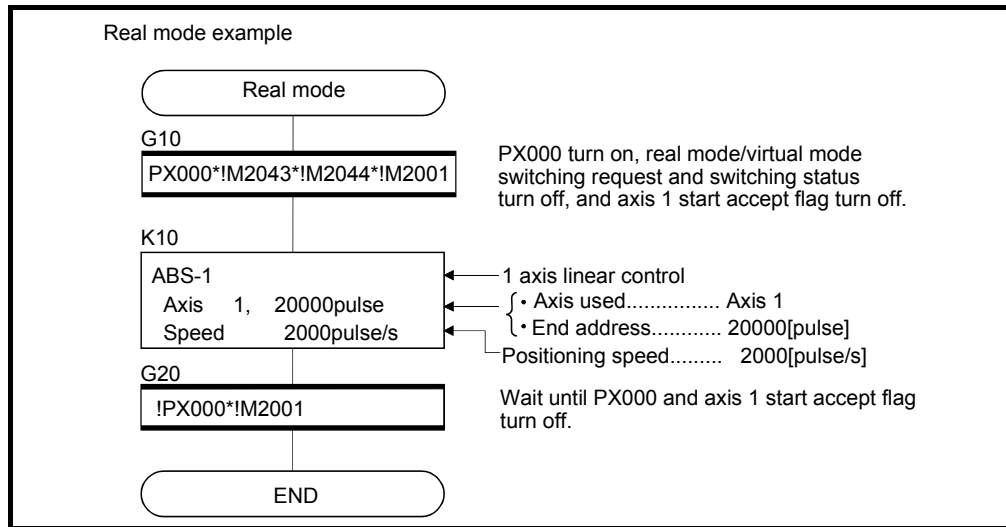
- (a) Motion control step in the virtual mode
 Example of Motion SFC program is shown below.



(Note) : Example of the above Motion SFC program is started using the automatic start or sequence program.

(b) Motion control step in the real mode

Example of Motion SFC program is shown below.



(Note) : Example of the above Motion SFC program is started using the automatic start or sequence program.

(2) M2043 processing during the TEST mode using MT Developer2

M2043 ON/OFF (Real mode/virtual mode switching request) is ignored during the test mode using MT Developer2.

Real mode/virtual mode switching can be executed using MT Developer2, during TEST mode operation using MT Developer2.
The real mode/virtual mode switching status flag (M2044) is turned off/on with the real mode/virtual mode.

REMARK

The same check as the "M2043 (OFF → ON/ON → OFF)" is also executed at the real mode/virtual mode switching using MT Developer2.
(Refer to Sections 9.1 and 9.2)

9.4 Stop and Re-start

The basic method for stopping the system (output module) in the virtual mode operation is to stop the main shaft. If an auxiliary input axis is used, also stop the auxiliary input axis.

(1) Virtual axis stop

The stop operation or causes of virtual axis, the stop processing and re-start after stop are shown below. The following three methods for the virtual servomotor axis stop processing. This processing is also valid for interpolation axes during the interpolation operation.

- Deceleration stop Deceleration stop based on the "stop deceleration time" of parameter block.
- Rapid stop Deceleration stop based on the "rapid stop deceleration time" of parameter block.
- Immediate stop Immediate stop without deceleration.

Because the synchronous encoder axis becomes the input immediate stop, operation should be executed after the synchronous encoder axis has been stopped from the external input, except for abnormal stops such as the forced stop or a servo error occurrence, etc.

(Example : M2000 is OFF, All axes servo OFF command, etc.)

(The servo error occurs by the immediate stop of output module connected to the synchronous encoder axis, and the synchronization discrepancy may occurs.)

When the synchronization discrepancy occurs by the stop cause, the synchronization discrepancy warning (M2046) turns on. In this case, re-align the axes in the real mode, turn M2046 off, then continue the virtual mode operation.

The stop operation/stop causes during operation and re-starting operation after stop are shown in the next page.

9 REAL MODE/VIRTUAL MODE SWITCHING AND STOP/RE-START

9.4.1 Stop operation/stop causes during operation and re-starting operation list

Table 9.5 Stop Operation/stop Causes during Operation and Re-starting Operation List

| No. | Stop operation or stop causes during operation | Affected virtual axis | | | Stop processing | | Return to Real mode by operating system software after all virtual axes stop completion | Synchronization discrepancy warning (M2046) set | |
|-----|--|-------------------------|--------------------------|----------------|-------------------------|-------------------------------|---|---|--|
| | | Virtual servomotor axis | Synchronous encoder axis | All axes batch | Virtual servomotor axis | Synchronous encoder axis | | | |
| 1 | Stop command ON | ○ (Applicable axis) | — | — | Deceleration stop | — | — | — | |
| 2 | Rapid stop command ON | ○ (Applicable axis) | — | — | Rapid stop | — | — | — | |
| 3 | All-axes servo OFF command (M2042 OFF, Command using MT Developer2 in the TEST mode) | — | — | ○ | Deceleration stop | Immediate input stop (Note-1) | — | — | |
| 4 | PLC ready flag (M2000) OFF | — | — | ○ | Deceleration stop | Immediate input stop (Note-1) | ○ | — | |
| 5 | Motion CPU stop | — | — | ○ | Deceleration stop | Immediate input stop (Note-1) | ○ | — | |
| 6 | All-axes rapid stop from MT Developer2 | — | — | ○ | Rapid stop | Immediate input stop (Note-1) | — | — | |
| 7 | Stop from MT Developer2 in the TEST mode | ○ (All axes) | — | — | Deceleration stop | — | — | — | |
| 8 | Forced stop | — | — | ○ | Rapid stop | Immediate input stop (Note-1) | ○ | ○ | |
| 9 | Servo error at output module even if 1 axis | — | — | ○ | Rapid stop | Immediate input stop (Note-1) | ○ | ○ | |
| 10 | Motion CPU WDT error | — | — | ○ | Immediate stop | Immediate input stop | — | — | |
| 11 | Multiple CPU system reset | — | — | ○ | Immediate stop | Immediate input stop | — | — | |
| 12 | Multiple CPU system power OFF | — | — | ○ | Immediate stop | Immediate input stop | — | — | |
| 13 | Other errors during virtual axis operation | ○ | — | — | Deceleration stop | — | — | — | |
| 14 | Error detection at absolute synchronous encoder axis | — | ○ | — | — | Immediate input stop | — | — | |

9 REAL MODE/VIRTUAL MODE SWITCHING AND STOP/RE-START

| Error set | Output module operation | Operation continuation enabled (○)/ disabled (×) | Re-start operation after stop |
|--|---|--|--|
| — | • Deceleration stop based on the smoothing time constant. | ○ | • Continuous operation is possible by turning the stop command off (not necessary when on) and starting. |
| — | • Deceleration stop based on the smoothing time constant. | ○ | • Continuous operation is possible by turning the stop command off (not necessary when on) and starting. |
| — | • Servo OFF state after deceleration stop based on the smoothing time constant. | ○ | • Continuous operation is possible by turning the all clutch off → all axes servo on → clutch on. (However, when the servomotor does not operate during the servo OFF. Also, the clutch OFF/ON is switched as required by the user side.) • For synchronous encoder axes, switch to the real mode, then back to the virtual mode to resume inputs. ^(Note-1) |
| Minor error (200) set (virtual axis) | • Deceleration stop based on the smoothing time constant. | ○ | • Operation is possible by executing the real mode to virtual mode switching request (M2043 ON), after turning the PLC ready flag (M2000) on. |
| Minor error (200) set (virtual axis) | • Deceleration stop based on the smoothing time constant. | ○ | • Operation is possible by executing the real mode to virtual mode switching request (M2043 ON), after starting the Motion CPU. |
| — | • Deceleration stop based on the smoothing time constant. | ○ | • Continuous operation is possible by starting after stop. • For synchronous encoder axes, switch to the real mode, then back to the virtual mode to resume inputs. ^(Note-1) |
| — | • Deceleration stop based on the smoothing time constant. | ○ | • Continuous operation is possible by starting after stop. |
| — | • Servo OFF state after immediate stop. | × | • Continuous operation is not possible due to a synchronization discrepancy between the virtual axis and output module, and stop. • After release the forced stop, re-align the output module in the real mode, switch the synchronization discrepancy warning (M2046) OFF, then switch back to the virtual mode to resume operation. |
| Applicable output module (Servo error, Servo error code set) | • Servo OFF state after immediate stop for error axis only. • Operation is different according to the setting at error occurrence. | × | • After executing a servo error reset in the real mode, re-align the axes, switch the synchronization discrepancy warning (M2046) OFF, then switch back to the virtual mode to resume operation. |
| SM512 (Motion CPU WDT error flag) ON | • Servo OFF state after immediate stop. | × | • Continuous operation is not possible due to a synchronization discrepancy between the virtual axis and output module, and stop. • After resetting the Multiple CPU system, re-align the output module, then switch to the virtual mode to resume operation. |
| — | • Servo OFF state after immediate stop. | × | • Continuous operation is not possible due to a synchronization discrepancy between the virtual axis and output module, and stop. • After resetting the Multiple CPU system, re-align the output module, then switch to the virtual mode to resume operation. |
| — | • Servo OFF state after immediate stop. | × | • Continuous operation is not possible due to a synchronization discrepancy between the virtual axis and output module, and stop. • After resetting the Multiple CPU system, re-align the output module, then switch to the virtual mode to resume operation. |
| Applicable error set | • Deceleration stop based on the smoothing time constant. | ○ | • Operation is possible by release the error cause. |
| Applicable error set | • Deceleration stop based on the smoothing time constant. | × | • Return to the real mode, re-align the axes, then switch to the virtual mode to resume operation. |

(Note-1): It is input continuously for the version (Refer to Section 1.4) that supports "synchronous encoder current value monitor in real mode".

10. AUXILIARY AND APPLIED FUNCTIONS

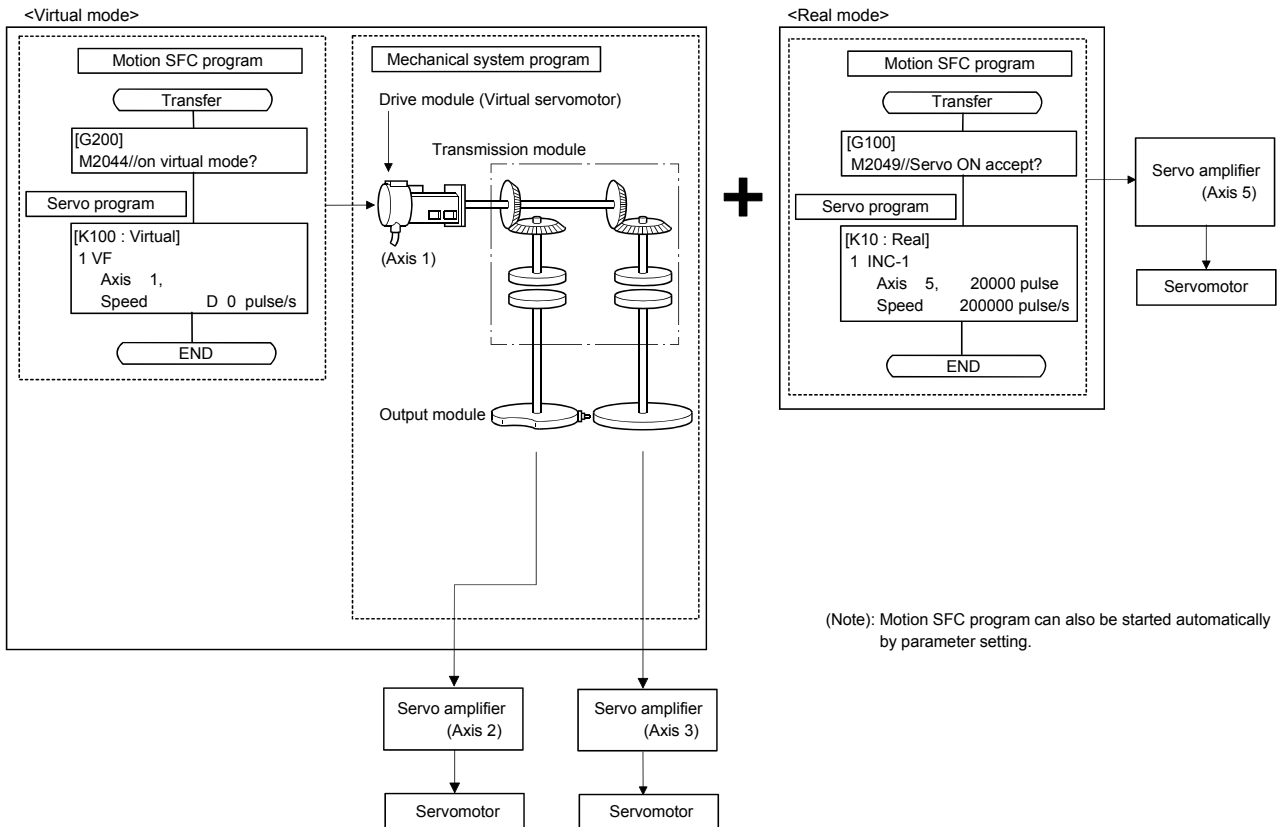
This section describes the auxiliary and applied functions for positioning control in the Multiple CPU system.

| Items | Details | Applications |
|--|--|---|
| Mixed function of virtual mode/real mode | Positioning control for preset axis is executed during synchronous control/cam control in the mechanical system program. | It is used in the system for which conveys while executing synchronous control. |

10.1 Mixed Function of Virtual Mode/Real Mode

When the output axis No. to execute positioning control directly is selected in the mixed function of virtual mode/real mode, a positioning control of axis which is not used in the mechanical system program can be executed simultaneously during the mechanical system program.

Example of program is shown below.

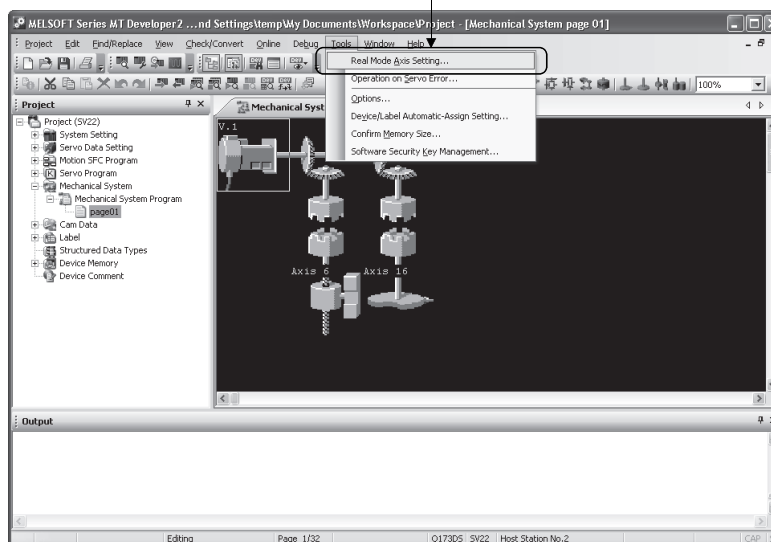


Set the axis to control as real mode axis on the mechanical system screen of MT Developer2.

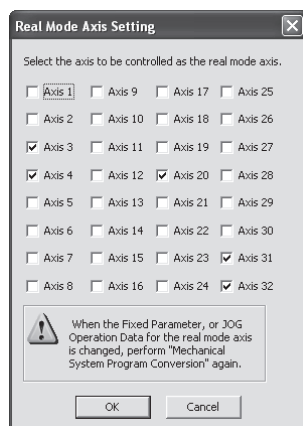
Refer to the help of MT Developer2 for the setting method.

- Mechanical system screen

[Real Mode Axis Setting] menu






- Real mode axis setting screen



POINT

- (1) Execute "Mechanical System Program Conversion" after setting "Real mode axis setting" in the mechanical system program editor.
- (2) When a fixed parameter of each axis is changed, be sure to execute "Mechanical System Program Conversion".
- (3) Axis No. set in the "Real mode axis setting" cannot be set as virtual servomotor axis No. And, the output axis No. set in the mechanical system program cannot be also set as real mode axis No.
- (4) Operation cycle over may occur for default operation cycle depending on the number of axes for real mode axis. In this case, change an operation cycle to a large value in the system setting.

(1) Usable instructions and controls




| Items | | Usable/unusable | Remarks |
|---|--|-----------------|--|
| Servo instructions | Linear positioning control | ○ | Positioning control with the torque limit value set in the servo program (parameter block) |
| | Linear interpolation control | | |
| | Circular interpolation control | | |
| | Helical interpolation control | | |
| | Fixed-pitch feed control | | |
| | Speed control (I) | | |
| | Speed control (II) | | |
| | Speed-position switching control | | |
| | Position follow-up control | | |
| | Constant-speed control | | |
| | Simultaneous start | | |
| | Speed control with fixed position stop | | |
| | Home position return (ZERO) | | |
| | High-speed oscillation (OSC) | ○ Ver.! | |
| JOG operation | | ○ | Control with JOG operation data |
| Speed-torque control  | | | Control with speed-torque control data |
| Manual pulse generator operation | | ○ Ver.! | |
| Current value change (D(P).CHGA J _n ^(Note) , CHGA) | | ○ | |
| Speed change (D(P).CHGV, CHGV) | | | |
| Torque limit value change (D(P).CHGT, CHGT) | | | |
| Torque limit value individual change (D(P).CHGT2, CHGT2)  | | | |
| Target position change (CHGP)  | | | |

○ : Usable × : Unusable

(Note): "n" shows the numerical value (axis No. 1 to 32) correspond to axis No.

 : Refer to Section 1.4 for the software version that supports this function.

(2) Control methods

| Items | Control method | Remarks |
|--|--|---|
| Servo program start | <ul style="list-style-type: none"> • Use a Motion SFC program start or D(P).SVST instruction • Set a real mode axis No. as axis No. | <ul style="list-style-type: none"> • When the real mode axis is set to the virtual servo program and it starts, "Servo program setting error" (error code: 906) occurs. • When the real mode axis and virtual axis are set together to the interpolation axis if it starts, "Servo program setting error" (error code: 906) occurs. |
| Stop | <ul style="list-style-type: none"> • Turn the stop command (M3200+20n) or rapid stop command (M3201+20n) ON in real mode. • Turn the external signal (STOP) ON. • Use the deceleration stop or all axes rapid stop (Test mode ON) from MT Developer2. • Change speed to "0". | Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)" for details. |
| JOG operation | Use the forward rotation JOG start command (M3202+20n) or reverse rotation JOG start command (M3203+20n). | Control with parameter JOG operation data. |
| Speed-torque control  | <ul style="list-style-type: none"> • Set the parameter required at Motion SFC program to switch the mode. • Set a real mode axis No. as axis No. for parameter setting. | Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)" for details. |
| Current value change | <ul style="list-style-type: none"> • Use D(P).CHGA Jn ^(Note), CHGA instruction. • Set a real mode axis No. as axis No. | <ul style="list-style-type: none"> • When the D(P).CHGA Cn ^(Note) instruction is executed, the instruction is ignored. • When the CHGA-C instruction is executed to real mode axis, the instruction is ignored. |
| Speed change | <ul style="list-style-type: none"> • Use D(P).CHGV, CHGV instruction. • Set a real mode axis No. as axis No. | |
| Torque limit value change | <ul style="list-style-type: none"> • Use D(P).CHGT, CHGT instruction. • Set a real mode axis No. as axis No. | Torque limit value of real mode axis at switching from real mode to virtual mode continues the state in real mode. |
| Torque limit value individual change  | <ul style="list-style-type: none"> • Use D(P).CHGT2, CHGT2 instruction. • Set a real mode axis No. as axis No. | |
| Target position change  | <ul style="list-style-type: none"> • Use CHGP instruction. • Set a real mode axis No. as axis No. | |

(Note): "n" shows the numerical value (axis No. 1 to 32) correspond to axis No.

(3) Error codes in real mode axis

Error codes at positioning control in the mixed function of virtual mode with real mode are shown below.



(a) Minor error (1 to 999)

(b) Major error (1000 to 1299)

Minor error (4000 to 9990)/major error (10000 to 12990) code of output module in virtual mode are not set in minor/major error code storage register (D6+20n/D7+20n).

(4) Difference for operation between the output axis of mechanical system program and real mode axis

Operation details for "output axis of mechanical system program" and "real mode axis" on error are shown below.

| Items | Operation for output axis of mechanical system program | Operation for real mode axis |
|---|---|---|
| Feed current value exceeds the stroke limit range at switching from real mode to virtual mode. | <ul style="list-style-type: none"> Minor error (error code: 5000) occurs. Related system cannot be started. | <ul style="list-style-type: none"> Minor error (error code: 105) occurs at servo program start, and operation does not start. |
| Feed current value exceeds the stroke limit range during operation. | <ul style="list-style-type: none"> Minor error (error code: 6030) occurs. Operation continues. | <ul style="list-style-type: none"> Minor error (error code: 207) occurs, and deceleration stop is executed. |
| Output speed exceeds the speed limit value. | <ul style="list-style-type: none"> Minor error (error code: 6010) occurs. Speed clamp does not process by speed limit value. | <ul style="list-style-type: none"> Servo program setting error or minor error occurs. Speed is controlled by speed limit value. |
| Stop signal (STOP) is ON. | <ul style="list-style-type: none"> Major error (error code: 11020) occurs. Operation continues for axis without clutch. Operation is controlled based on the operation mode on error for axis with clutch. | <ul style="list-style-type: none"> Major error (error code: 1000) occurs by turning the stop signal (STOP) on at start, and operation does not start. Operation stops based on "deceleration processing at stop" of parameter block by turning the stop signal (STOP) on during operation. |
| External upper LS signal (FLS) turns off during travel to forward direction (address increase direction). | <ul style="list-style-type: none"> Major error (error code: 11030) occurs. Operation continues for axis without clutch. Operation is controlled based on the operation mode on error for axis with clutch. | <ul style="list-style-type: none"> Major error (error code: 1001) occurs by turning the external upper LS signal (FLS) off at start to forward direction, and operation does not start. Major error (error code: 1101) occurs by turning the external upper LS signal (FLS) off during start to forward direction, operation stops based on "deceleration processing at stop" of parameter block. |
| External lower LS signal (RLS) turns off during travel to reverse direction (address decrease direction). | <ul style="list-style-type: none"> Major error (error code: 11040) occurs. Operation continues for axis without clutch. Operation is controlled based on the operation mode on error for axis with clutch. | <ul style="list-style-type: none"> Major error (error code: 1002) occurs by turning the external lower LS signal (RLS) off at start to reverse direction, and operation does not start. Major error (error code: 1102) occurs by turning the external lower LS signal (RLS) off during start to reverse direction, operation stops based on "deceleration processing at stop" of parameter block. |
| Change the torque limit value. | <ul style="list-style-type: none"> Any time valid by setting the torque limit value setting device of output axis and changing preset value. Torque limit value individual change request instructions (D(P).CHGT2, CHGT2) are valid.  | <ul style="list-style-type: none"> Torque limit value change request instructions (D(P).CHGT, CHGT) and torque limit value individual change request instructions (D(P).CHGT2, CHGT2)  are valid. |

(5) Difference for operation between the real mode axis in virtual mode and real mode

When the servo OFF command (M3215+20n) turns on at using the mixed function of virtual mode with real mode in virtual mode, positioning control stops.

| Items | Operation for real mode axis in virtual mode | Operation for axis in real mode |
|-------------------------------|---|-------------------------------------|
| Servo OFF command (M3215+20n) | Invalid during positioning control. | Invalid during positioning control. |
| | Any time valid. (Operating system software version "00G" or before in the Q17□DCPU(-S1)) | |

(6) Cautions

- (a) For the operating system software version "00G or before" in the Q17□DCPU(-S1), axis operation, current value, speed and torque limit value cannot be changed for all axes during mode switching.
- (b) When the feed current value of real mode axis is outside the stroke limit range at virtual mode switching, an error will occur at start of real mode axis. Use the JOG operation to reverse within the stroke limit range.

| | |
|--------------|--|
| POINT | For the operating system software version "00G or before" in the Q17□DCPU(-S1), switching from virtual mode to real mode cannot be executed during positioning control of real mode axis. Switch a mode after stop the real mode axis. |
|--------------|--|

10.2 Speed-Torque Control

Control mode can be switched for output axis of mechanical system and real mode axis during virtual mode.

(1) Speed-torque control in output axis of mechanical system

- (a) The speed-torque control can be executed for output axis of roller, ball screw and rotary table as output module. When the control mode switching is executed for output axis of cam, a minor error (error code: 6240) will occur, and the control mode is not switched. When switching the mode to speed control mode or torque control mode, the control mode switching is possible during motor stop. When the motor is operating at control mode switching request, a minor error (error code: 6200) will occur, and the control mode is not switched. The mode can be switched to continuous operation to torque control mode even when the motor is operating.
- (b) In the speed-torque control in output axis of mechanical system, the setting value of "Speed command device" is not referred, and the command speed to output axis is the value of command speed. Command speed acceleration time, command speed deceleration time and initial speed selection at control mode switching are also invalid. (For speed limit value, the value set in each output axis module is valid.)
- (c) Control the command torque by setting torque command value in the torque command device set in speed-torque control data same as real mode. Torque limit value change request (D(P).CHGT, CHGT) is invalid (no operation), and the torque limit value to servo amplifier can be changed within the range of torque limit value at speed-torque control by the value of torque limit value setting device. (If the value is outside the range, a minor error (error code: 6250) will occur.)
Only when the torque limit value setting device of output module is not set, the torque limit value to servo amplifier can be changed within the range of torque limit value at speed-torque control by the torque limit value individual change request (D(P).CHGT2, CHGT2). If the value exceeds the torque limit value at speed-torque control is set in positive direction torque limit value or negative direction torque limit value, a minor error (error code: 6250) will occur, and the torque limit value is not changed.

(2) Cautions at control mode switching

- (a) When using continuous operation to torque control mode, use servo amplifiers that support continuous operation to torque control. When using servo amplifiers that do not support continuous operation to torque control, a major error (error code: 11050) will occur at switching to continuous operation to torque control mode request, and the operation continues based on the parameter settings at major error occurrence, or the clutch is OFF.

10 AUXILIARY AND APPLIED FUNCTIONS

- (b) When the mode is switched from virtual mode to real mode, return all output axes to position control mode. If output axis except position control mode exists when the mode is switched from virtual mode to real mode, an error at real mode/virtual mode switching (error code: 256) will occur, and the mode is not switched to real mode.

(3) Stop causes during virtual mode

Operations of stop causes during "speed-torque control" in the output module during virtual mode are shown below.

| Item | Operation during speed-torque control mode |
|--|---|
| The stop command (M3200+20n) turned ON. The rapid stop command (M3201+20n) turned ON. | Command is ignored, and operation continues. |
| The external stop input turned ON. | <ul style="list-style-type: none"> A major error (error code: 10030) will occur, and related system cannot be started at virtual servo motor start A major error (error code: 11020) will occur, and operation continues for axis without clutch during command. Operation is controlled based on the operation mode on error for axis with clutch. |
| The all axes servo ON command (M2042) turned OFF. | During virtual mode, OFF of the all axes servo ON command is not accepted, and the command is ignored. When the mode is returned to position control mode and switched to real mode, command status at the time is valid. |
| Servo OFF command (M3215+20n) turned ON. | <ul style="list-style-type: none"> During no-clutch/clutch ON/clutch status ON, a minor error (error code: 6000) will occur. When the control mode is speed control, torque control or continuous operation to torque control during clutch OFF, servo OFF is not executed. When the mode is switched to position control mode, command status at the time is valid. |
| The current value reached to software stroke limit. | A minor error (error code: 6030) will occur. |
| The position of motor reached to hardware stroke limit | A major error (error code: 11030, 11040) will occur, and operation continues for axis without clutch. Operation is controlled based on the operation mode on error for axis with clutch. |
| The PLC ready flag (M2000) turned OFF. | An error at real mode/virtual mode switching (error code: -4094(F002)) will occur, and the mode is returned to real mode. After that, the control mode is switched to position control mode, and the operation immediately stops. |
| The forced stop input to Motion CPU. | An error at real mode/virtual mode switching (error code: -4096(F000)) will occur, and the mode is returned to real mode. The control mode switches to position control mode at servo OFF. |
| The forced stop input to servo amplifier. | <ul style="list-style-type: none"> During no-clutch/clutch ON/clutch status ON, a major error (error code: 11010) will occur, and operation continues for axis without clutch. Operation is controlled based on the operation mode on error for axis with clutch. When the control mode is speed control, torque control or continuous operation to torque control during clutch OFF, the mode is switched to position control mode at servo OFF. |
| The servo error occurred. | An error at real mode/virtual mode switching (error code: -4095(F001)) will occur, and the mode is returned to real mode. The control mode switches to position control mode at servo OFF. |
| The servo amplifier's power supply turned OFF. | <ul style="list-style-type: none"> During no-clutch/clutch ON/clutch status ON, a major error (error code: 11010) will occur, and operation continues for axis without clutch. Operation is controlled based on the operation mode on error for axis with clutch. When the control mode is speed control, torque control, or continuous operation to torque control during clutch OFF, the mode switches to position control mode at the servo amplifier's power supply ON again. |

(4) Speed-torque control in the real mode axis

The speed-torque control can be executed in the real mode axis.

In this case, the control follows the control during real mode.

The real mode axis can be switched from virtual to real mode during speed-torque control.

Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22)

Programming Manual (REAL MODE)" for details of operation during real mode.

APPENDICES

APPENDIX 1 Error Codes Stored Using the Motion CPU

The following errors are detected in the Motion CPU.

- Servo program setting error
- Positioning error
- Control mode switching error
- Motion SFC error ^(Note-1)
- Motion SFC parameter error ^(Note-1)
- Multiple CPU related error ^(Note-2)

(Note-1): Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (Motion SFC)" for details.

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

(1) Servo program setting errors

These are positioning data errors set in the servo program, and it checks at the start of each servo program.

They are errors that occur when the positioning data is set indirectly.

The operations at the error occurrence are shown below.

- The servo program setting error flag (SM516) turns on.
- The erroneous servo program is stored in the error program No. storage register (SD516).
- The error code is stored in the error item information register (SD517).

(2) Positioning error

(a) Positioning errors occurs at the positioning start or during positioning control. There are minor errors, major errors and servo errors.

1) Minor errors These errors occur in the Motion SFC program or servo program, and the error codes (drive module : 1 to 999, output module : 4000 to 9990) are used.

Check the error code, and remove the error cause by correcting the Motion SFC program or servo program.

2) Major errors These errors occur in the external input signals or control commands from the Motion SFC program, and the error codes (drive module : 1 to 1999, output module : 10000 to 11990) are used.

Check the error code, and remove the error cause of the external input signal state or Motion SFC program.

3) Servo errors..... These errors detected in the servo amplifier, and the error codes 2000 to 2999 are used.

Check the error code, and remove the error cause of the servo amplifier side.

APPENDICES

The error applicable range for each error class are shown below.

| Error class | Erroneous category | Error module | |
|-------------|-------------------------------------|--------------|---|
| | | Drive module | Output module |
| Minor error | Setting data | 1 to 99 | 4000 to 4990 |
| | At start | 100 to 199 | 5000 to 5990 |
| | During operation | 200 to 299 | 6000 to 6990 |
| | At control change | 300 to 399 | — |
| Major error | At start | 1000 to 1099 | 10000 to 10990 |
| | During operation | 1100 to 1199 | 11000 to 11990 |
| | System | — | 15000 to 15990 |
| Servo error | Servo amplifier | — | 2000 to 2799 (2100 to 2499 : warning) |
| | Servo amplifier power supply module | | 2800 to 2999 (2900 or later : warning) |

(b) The error detection signal of the erroneous axis turns on at the error occurrence, and the error codes are stored in the minor error code, major error code or servo error code storage register.

| Device Error class | | Error code storage register | | | | | | | | | | | |
|-----------------------|------------------|-----------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis10 | Axis11 | Axis12 |
| Virtual servomotor | Minor error code | D802 | D812 | D822 | D832 | D842 | D852 | D862 | D872 | D882 | D892 | D902 | D912 |
| | Major error code | D803 | D813 | D823 | D833 | D843 | D853 | D863 | D873 | D883 | D893 | D903 | D913 |
| Synchronous encoder | Minor error code | D1122 | D1132 | D1142 | D1152 | D1162 | D1172 | D1182 | D1192 | D1202 | D1212 | D1222 | D1232 |
| | Major error code | D1123 | D1133 | D1143 | D1153 | D1163 | D1173 | D1183 | D1193 | D1203 | D1213 | D1223 | D1233 |
| Output module | Minor error code | D6 | D26 | D46 | D66 | D86 | D106 | D126 | D146 | D166 | D186 | D206 | D226 |
| | Major error code | D7 | D27 | D47 | D67 | D87 | D107 | D127 | D147 | D167 | D187 | D207 | D227 |
| | Servo error code | D8 | D28 | D48 | D68 | D88 | D108 | D128 | D148 | D168 | D188 | D208 | D228 |

| Device Error class | | Error code storage register | | | | | | | | | | | |
|-----------------------|------------------|-----------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | | Axis13 | Axis14 | Axis15 | Axis16 | Axis17 | Axis18 | Axis19 | Axis20 | Axis21 | Axis22 | Axis23 | Axis24 |
| Virtual servomotor | Minor error code | D922 | D932 | D942 | D952 | D962 | D972 | D982 | D992 | D1002 | D1012 | D1022 | D1032 |
| | Major error code | D923 | D933 | D943 | D953 | D963 | D973 | D983 | D993 | D1003 | D1013 | D1023 | D1033 |
| Synchronous encoder | Minor error code | | | | | | | | | | | | |
| | Major error code | | | | | | | | | | | | |
| Output module | Minor error code | D246 | D266 | D286 | D306 | D326 | D346 | D366 | D386 | D406 | D426 | D446 | D466 |
| | Major error code | D247 | D267 | D287 | D307 | D327 | D347 | D367 | D387 | D407 | D427 | D447 | D467 |
| | Servo error code | D248 | D268 | D288 | D308 | D328 | D348 | D368 | D388 | D408 | D428 | D448 | D468 |

| Device Error class | | Error code storage register | | | | | | | Error detection signal | Error reset command | |
|-----------------------|------------------|-----------------------------|--------|--------|--------|--------|--------|--------|------------------------|---------------------|-----------|
| | | Axis25 | Axis26 | Axis27 | Axis28 | Axis29 | Axis30 | Axis31 | | | Axis32 |
| Virtual servomotor | Minor error code | D1042 | D1052 | D1062 | D1072 | D1082 | D1092 | D1102 | D1112 | M4007+20n | M4807+20n |
| | Major error code | D1043 | D1053 | D1063 | D1073 | D1083 | D1093 | D1103 | D1113 | | |
| Synchronous encoder | Minor error code | | | | | | | | M4640+4n | M5440+4n | |
| | Major error code | | | | | | | | | | |
| Output module | Minor error code | D486 | D506 | D526 | D546 | D566 | D586 | D606 | D626 | M2407+20n | M3207+20n |
| | Major error code | D487 | D507 | D527 | D547 | D567 | D587 | D607 | D627 | | |
| | Servo error code | D488 | D508 | D528 | D548 | D568 | D588 | D608 | D628 | M2408+20n | M3208+20n |

- (c) If another error occurs after an error code has been stored, the existing error code is overwritten, deleting it.
However, the error history can be checked using MT Developer2.
- (d) Error detection signals and error codes are held until the error reset command (M3207+20n) or servo error reset command (M3208+20n) turns on.

| | |
|--------------|--|
| POINT | <p>(1) Even if the servo error reset (M3208+20n) turns on at the servo error occurrence, the same error code might be stored again.</p> <p>(2) Reset the servo error after removing the error cause of the servo amplifier side at the servo error occurrence.</p> |
|--------------|--|

(3) Error at the real mode/virtual mode switching

These errors are checked when the real mode/virtual mode switching request flag (M2043) turns off to on/on to off.

When the check shown in Section 9.1 and 9.2 is executed, and if error is detected, it is as follows.

- It remains the current mode without the real mode/virtual mode switching.
- The real mode/virtual mode switching error detection flag (M2045) turns on.
- The error codes are stored in the real mode/virtual mode switching error information (SD504 to SD506).

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--------------|--|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--|----|-------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|-------|---------|---------|---------|---------|---------|---------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| POINT | <p>• The axis error code among the error codes stored in the SD504 to SD506 is shown below.</p> <div style="text-align: center;"> <table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="width: 10%;"></td> <td style="width: 10%; text-align: center;">b15</td> <td colspan="14" style="text-align: center;">Error</td> <td style="width: 10%; text-align: center;">b0</td> </tr> <tr> <td style="text-align: right;">SD504</td> <td colspan="15"></td> </tr> <tr> <td style="text-align: right;">SD505</td> <td style="text-align: center;">Axis 16</td><td style="text-align: center;">Axis 15</td><td style="text-align: center;">Axis 14</td><td style="text-align: center;">Axis 13</td><td style="text-align: center;">Axis 12</td><td style="text-align: center;">Axis 11</td><td style="text-align: center;">Axis 10</td><td style="text-align: center;">Axis 9</td><td style="text-align: center;">Axis 8</td><td style="text-align: center;">Axis 7</td><td style="text-align: center;">Axis 6</td><td style="text-align: center;">Axis 5</td><td style="text-align: center;">Axis 4</td><td style="text-align: center;">Axis 3</td><td style="text-align: center;">Axis 2</td><td style="text-align: center;">Axis 1</td> </tr> <tr> <td style="text-align: right;">SD506</td> <td style="text-align: center;">Axis 32</td><td style="text-align: center;">Axis 31</td><td style="text-align: center;">Axis 30</td><td style="text-align: center;">Axis 29</td><td style="text-align: center;">Axis 28</td><td style="text-align: center;">Axis 27</td><td style="text-align: center;">Axis 26</td><td style="text-align: center;">Axis 25</td><td style="text-align: center;">Axis 24</td><td style="text-align: center;">Axis 23</td><td style="text-align: center;">Axis 22</td><td style="text-align: center;">Axis 21</td><td style="text-align: center;">Axis 20</td><td style="text-align: center;">Axis 19</td><td style="text-align: center;">Axis 18</td><td style="text-align: center;">Axis 17</td> </tr> </table> </div> <div style="margin-top: 10px;"> <p style="text-align: center;">} → Erroneous axis bit "1"</p> <p style="text-align: center;"><Example> For 8 axes error (Decimal) "128" and (Hexadecimal) "0080H" is stored in the SD505, (Decimal) "0" and (Hexadecimal) "0000H" is stored in the SD506, and the error code is stored in the SD504.</p> </div> | | b15 | Error | | | | | | | | | | | | | | b0 | SD504 | | | | | | | | | | | | | | | | SD505 | 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 | SD506 | 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 |
| | b15 | Error | | | | | | | | | | | | | | b0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SD504 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SD505 | 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 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SD506 | 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 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

APPENDICES

APPENDIX 1.1 Expression method for word data axis No.

The axis No. may be expressed to correspond to each bit of word data for the positioning dedicated signal.

Example of the TEST mode request error information (SD510, SD511) is shown below.

| | b15 | b14 | b13 | b12 | b11 | b10 | b9 | b8 | b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 |
|-------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| SD510 | Axis 16 | Axis 15 | Axis 14 | Axis 13 | Axis 12 | Axis 11 | Axis 10 | Axis 9 | Axis 8 | Axis 7 | Axis 6 | Axis 5 | Axis 4 | Axis 3 | Axis 2 | Axis 1 |
| SD511 | Axis 32 | Axis 31 | Axis 30 | Axis 29 | Axis 28 | Axis 27 | Axis 26 | Axis 25 | Axis 24 | Axis 23 | Axis 22 | Axis 21 | Axis 20 | Axis 19 | Axis 18 | Axis 17 |

Stores the during operation/stop data of each axis

- 0 : During stop
- 1 : During operation

(Note): The following range is valid.

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

(1) Axis 8 : Test mode request error

The controlling signal "1" is stored in SD510 "b7 (axis 8)".

| | b15 | b14 | b13 | b12 | b11 | b10 | b9 | b8 | b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 | Decimal | Hexadecimal | |
|-------|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|----|----|---------|-------------|-------|
| SD510 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | SD510 | 128 | 0080H |
| SD511 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | SD511 | 0 | 0000H |

(2) Axis 12, 20 : Test mode request error

The controlling signal "1" is stored in SD510 "b11 (axis 12)" and SD511 "b3 (axis 20)".

| | b15 | b14 | b13 | b12 | b11 | b10 | b9 | b8 | b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 | Decimal | Hexadecimal | |
|-------|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|----|----|---------|-------------|-------|
| SD510 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | SD510 | 2048 | 0800H |
| SD511 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | SD511 | 8 | 0008H |

(3) Axis 4, 10 : Test mode request error

The controlling signal "1" is stored in SD510 "b3 (axis 4)" and SD511 "b9 (axis 10)".

| | b15 | b14 | b13 | b12 | b11 | b10 | b9 | b8 | b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 | Decimal | Hexadecimal | |
|-------|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|----|----|---------|-------------|-------|
| SD510 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | SD510 | 520 | 0208H |
| SD511 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | SD511 | 0 | 0000H |

APPENDIX 1.2 Related systems and error processing

There are following 2 types for the related systems of virtual mode.

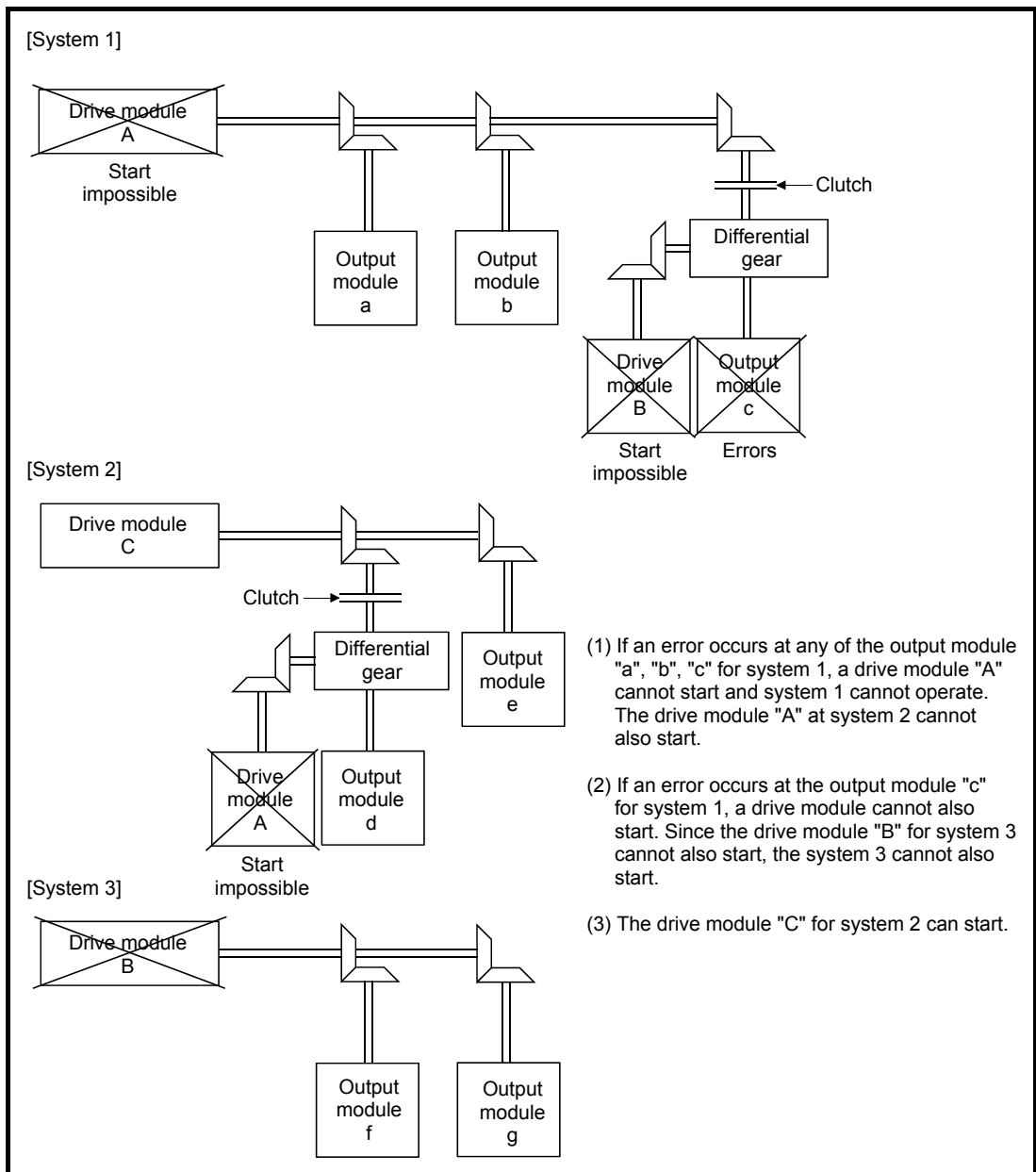
- System consisting of a drive module and output module.
- Multiple systems used the same drive module.

The following processing occurs, when the error is detected at an output module.

- If an error is detected at least one output module, a drive module cannot start and that system cannot be operate.

The auxiliary input axis operation for the erroneous output module also cannot operate.

- Other systems which use the drive module which could not start by the output module error also cannot operate.



APPENDIX 1.3 Servo program setting errors (Stored in SD517)

The error codes, error contents and corrective actions for servo program setting errors are shown in Table 1.1.

In the error codes marked with "Note" indicates the axis No. (1 to 32).

Table 1.1 Servo program setting error list

| Error code stored in SD517 | Error name | Error contents | Error processing | Corrective action | | | | | | | | | | | | | | | |
|----------------------------|---|---|--|---|--|--------|----------------|---------------------------|--|--|-----------------------------|--------|-----------------|---|-------|-----------------|-----------|---|---|
| 1 | Parameter block No. setting error | The parameter block No. is outside the range of 1 to 64. | Execute the servo program with the default value "1" of parameter block. | Set the parameter block No. within the range of 1 to 64. | | | | | | | | | | | | | | | |
| n03 (Note) | Address (travel value) setting error (Except the speed control and speed/position control.) (Setting error for linear axis at the helical-interpolation.) | <p>(1) The address is outside the setting range at the positioning start for absolute data method.</p> <table border="1"> <thead> <tr> <th>Unit</th> <th colspan="2">Address setting range</th> </tr> </thead> <tbody> <tr> <td>degree</td> <td>0 to 35999999</td> <td>$\times 10^{-5}$ [degree]</td> </tr> </tbody> </table> <p>(2) The travel value is set to -2147483648 (H80000000) at the positioning start for incremental data method.</p> | Unit | Address setting range | | degree | 0 to 35999999 | $\times 10^{-5}$ [degree] | <p>(1) Positioning control does not start. (All interpolation control at the interpolation control.)</p> <p>(2) If the error is detected during the speed-switching control or constant-speed control, a deceleration stop is made.</p> <p>(3) If an error occurs in one servo program, all servo programs do not execute during the simultaneous start.</p> | <p>(1) If the control unit is [degree], set the address within the range of 0 to 35999999.</p> <p>(2) Set the travel value within the range of "0 to $\pm (2^{31}-1)$".</p> | | | | | | | | | |
| Unit | Address setting range | | | | | | | | | | | | | | | | | | |
| degree | 0 to 35999999 | $\times 10^{-5}$ [degree] | | | | | | | | | | | | | | | | | |
| 4 | Command speed error | <p>(1) The command speed is outside the range of 1 to the speed limit value.</p> <p>(2) The command speed is outside the setting range.</p> <table border="1"> <thead> <tr> <th>Unit</th> <th colspan="2">Speed setting range</th> </tr> </thead> <tbody> <tr> <td>mm</td> <td>1 to 600000000</td> <td>$\times 10^{-2}$ [mm/min]</td> </tr> <tr> <td>inch</td> <td>1 to 600000000</td> <td>$\times 10^{-3}$ [inch/min]</td> </tr> <tr> <td>degree</td> <td>1 to 2147483647</td> <td>$\times 10^{-3}$ [degree /min] (Note-1)</td> </tr> <tr> <td>pulse</td> <td>1 to 2147483647</td> <td>[pulse/s]</td> </tr> </tbody> </table> | Unit | Speed setting range | | mm | 1 to 600000000 | $\times 10^{-2}$ [mm/min] | inch | 1 to 600000000 | $\times 10^{-3}$ [inch/min] | degree | 1 to 2147483647 | $\times 10^{-3}$ [degree /min] (Note-1) | pulse | 1 to 2147483647 | [pulse/s] | <p>(1) Positioning control does not start if the command speed is "0" or less.</p> <p>(2) If the command speed exceeds the speed limit value, control with the speed limit value.</p> | Set the command speed within the range of 1 to the speed limit value. |
| Unit | Speed setting range | | | | | | | | | | | | | | | | | | |
| mm | 1 to 600000000 | $\times 10^{-2}$ [mm/min] | | | | | | | | | | | | | | | | | |
| inch | 1 to 600000000 | $\times 10^{-3}$ [inch/min] | | | | | | | | | | | | | | | | | |
| degree | 1 to 2147483647 | $\times 10^{-3}$ [degree /min] (Note-1) | | | | | | | | | | | | | | | | | |
| pulse | 1 to 2147483647 | [pulse/s] | | | | | | | | | | | | | | | | | |
| 5 | Dwell time setting error | The dwell time is outside the range of 0 to 5000. | Control with the default value "0". | Set the dwell time within the range of 0 to 5000. | | | | | | | | | | | | | | | |
| 6 | M-code setting error | The M-code is outside the range of 0 to 32767. | | Set the M-code within the range of 0 to 32767. | | | | | | | | | | | | | | | |
| 7 | Torque limit value setting error | The torque limit value is outside the range of 1 to 1000. | Control with the torque limit value of the specified parameter block. | Set the torque limit value within the range of 1 to 1000. | | | | | | | | | | | | | | | |

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

Table 1.1 Servo program setting error list (Continued)

| Error code stored in SD517 | Error name | Error contents | Error processing | Corrective action | | | | | | |
|---|--|---|---|--|--|--------|---------------|---------------------------|-------------------------------------|---|
| n08 (Note) | Auxiliary point setting error (At the auxiliary point-specified circular interpolation.) (At the auxiliary point-specified helical interpolation.) | (1) The auxiliary point address is outside the setting range at the positioning start for absolute data method. <table border="1" style="margin-left: 20px;"> <tr> <th>Unit</th> <th colspan="2">Address setting range</th> </tr> <tr> <td>degree</td> <td>0 to 35999999</td> <td>$\times 10^{-5}$ [degree]</td> </tr> </table> | Unit | Address setting range | | degree | 0 to 35999999 | $\times 10^{-5}$ [degree] | Positioning control does not start. | (1) If the control unit is [degree], set the auxiliary point address within the range of 0 to 35999999. |
| | | Unit | Address setting range | | | | | | | |
| degree | 0 to 35999999 | $\times 10^{-5}$ [degree] | | | | | | | | |
| (2) The auxiliary point address is set to -2147483648 (H80000000) at the positioning start for incremental data method. | (2) Set the auxiliary point address within the range of 0 to $\pm(2^{31}-1)$. | | | | | | | | | |
| n09 (Note) | Radius setting error (At the radius-specified circular interpolation.) (At the radius-specified helical interpolation.) | (1) The radius is outside the setting range at the positioning control for absolute data method. <table border="1" style="margin-left: 20px;"> <tr> <th>Unit</th> <th colspan="2">Address setting range</th> </tr> <tr> <td>degree</td> <td>0 to 35999999</td> <td>$\times 10^{-5}$ [degree]</td> </tr> </table> | Unit | Address setting range | | degree | 0 to 35999999 | $\times 10^{-5}$ [degree] | | (1) If the control unit is [degree], set the radius within the range of 0 to 35999999. |
| | | Unit | Address setting range | | | | | | | |
| degree | 0 to 35999999 | $\times 10^{-5}$ [degree] | | | | | | | | |
| (2) The radius is set to "0" or negative setting at the positioning start for incremental data method. | (2) Set the radius within the range of 1 to $(2^{31}-1)$. | | | | | | | | | |
| n10 (Note) | Central point setting error (At the central point-specified circular interpolation.) (At the central point-specified helical interpolation.) | (1) The central point address is outside the setting range at the positioning start for absolute data method. <table border="1" style="margin-left: 20px;"> <tr> <th>Unit</th> <th colspan="2">Address setting range</th> </tr> <tr> <td>degree</td> <td>0 to 35999999</td> <td>$\times 10^{-5}$ [degree]</td> </tr> </table> | Unit | Address setting range | | degree | 0 to 35999999 | $\times 10^{-5}$ [degree] | | (1) If the control unit is [degree], set the central point address within the range of 0 to 35999999. |
| | | Unit | Address setting range | | | | | | | |
| degree | 0 to 35999999 | $\times 10^{-5}$ [degree] | | | | | | | | |
| (2) The central point is set to -2147483648 (H80000000) at the positioning start for incremental data method. | (2) Set the central point address within the range of 0 to $\pm(2^{31}-1)$. | | | | | | | | | |
| 11 | Interpolation control unit setting error | The interpolation control unit is set outside the range of 0 to 3. | Control with the default value "3". | Set the interpolation control unit within the range of 0 to 3. | | | | | | |
| 12 | Speed limit value setting error | The speed limit value is set outside the setting range. | Control with the default value 200000[pulse/s]. | Set the speed limit value within the setting range. [For pulse] 1 to 2147483647[pulse/s] | | | | | | |
| 13 | Acceleration time setting error | The acceleration time is set to "0". | Control with the default value "1000". | Set the acceleration time within the range of 1 to 65535. | | | | | | |
| | FIN acceleration/ deceleration setting error | The FIN acceleration/deceleration time is set except 1 to 5000. | | The FIN acceleration/ deceleration time within the range of 1 to 5000. | | | | | | |
| | Fixed position stop acceleration/ deceleration time setting error | The fixed position stop acceleration/deceleration time is set to "0". | | Set the fixed position stop acceleration/deceleration time within the range of 1 to 65535. | | | | | | |
| 14 | Deceleration time setting error | The deceleration time is set to "0". | | Set the deceleration time within the range of 1 to 65535. | | | | | | |

Table 1.1 Servo program setting error list (Continued)

| Error code stored in SD517 | Error name | Error contents | Error processing | Corrective action | | | | | | | | | | |
|----------------------------|--|---|--|--|----|---|------|---------------------------|--------|-----------------------------|-------|---------|--|--|
| 15 | Rapid stop deceleration time setting error | The rapid stop deceleration time is set to "0". | Control with the default value "1000". | Set the rapid stop deceleration time within the range of 1 to 65535. | | | | | | | | | | |
| 16 | Torque limit value setting error | The torque limit value is outside the range of 1 to 1000. | Control with the default value "300[%]". | Set the torque limit value within the range of 1 to 1000. | | | | | | | | | | |
| 17 | Allowable error range for circular interpolation setting error | The allowable error range for circular interpolation is outside the setting range. <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Unit</th> <th>Address setting range</th> </tr> </thead> <tbody> <tr> <td>mm</td> <td>0 to 100000 × 10⁻¹ [μm]</td> </tr> <tr> <td>inch</td> <td>× 10⁻⁵ [inch]</td> </tr> <tr> <td>degree</td> <td>× 10⁻⁵ [degree]</td> </tr> <tr> <td>pulse</td> <td>[pulse]</td> </tr> </tbody> </table> | Unit | Address setting range | mm | 0 to 100000 × 10 ⁻¹ [μ m] | inch | × 10 ⁻⁵ [inch] | degree | × 10 ⁻⁵ [degree] | pulse | [pulse] | Control with the default value "100[pulse]". | Set the allowable error range for circular interpolation within the setting range. |
| Unit | Address setting range | | | | | | | | | | | | | |
| mm | 0 to 100000 × 10 ⁻¹ [μ m] | | | | | | | | | | | | | |
| inch | × 10 ⁻⁵ [inch] | | | | | | | | | | | | | |
| degree | × 10 ⁻⁵ [degree] | | | | | | | | | | | | | |
| pulse | [pulse] | | | | | | | | | | | | | |
| 18 | Repeat count error | The repeat count is outside the range of 1 to 32767. | Control the repeat count with "1". | Set the repeat count within the range of 1 to 32767. | | | | | | | | | | |
| 19 | START instruction setting error | (1) The servo program specified with the START instruction does not exist. | Positioning control does not start. | (1) Create the servo program specified with the START instruction. | | | | | | | | | | |
| | | (2) There is a START instruction in the specified servo program. | | (2) Delete the servo program specified with the START instruction. | | | | | | | | | | |
| | | (3) The starting axis of the specified servo program overlap. | | (3) Do not overlap the starting axis. | | | | | | | | | | |
| | | (4) The real mode program and virtual mode program are mixed. | | (4) Do not allow mixture of the real mode program and virtual mode program. | | | | | | | | | | |
| | | (5) The real axis program and command generation axis program are mixed. | | (5) Do not allow mixture of the real axis program and command generation axis program. | | | | | | | | | | |
| 20 | Point setting error | Point is not specified in the instruction at the constant-speed control. | | Set a point between CPSTART and CPEND. | | | | | | | | | | |
| 21 | Reference axis speed setting error | The axis except interpolation axis is set as the reference axis at the linear interpolation of the reference axis speed-specified method. | | Set one of the interpolation axes as the reference axis. | | | | | | | | | | |
| 22 | S-curve ratio setting error | S-curve ratio is set outside the range of 0 to 100[%] at the S-curve acceleration/deceleration. | Control the S-curve ratio with 0[%] (Trapezoidal acceleration/deceleration). | Set the S-curve ratio within the range of 0 to 100[%]. | | | | | | | | | | |
| 23 | VSTART setting error | Not even one speed-switching point has been set between a VSTART and VEND instruction, or between FOR and NEXT instruction. | Positioning control does not start. | Set the speed switching point between the VSTART and VEND instructions or the FOR and NEXT instructions. | | | | | | | | | | |
| 24 | Cancel function start program No. error | The start program No. for the cancel function is set outside the range 0 to 4095. | | Start after set the start program No. within the range of 0 to 4095. | | | | | | | | | | |

Table 1.1 Servo program setting error list (Continued)

| Error code stored in SD517 | Error name | Error contents | Error processing | Corrective action |
|----------------------------|--|---|---|--|
| 25 | High-Speed oscillation command amplitude error | Operation cannot be started because the amplitude specified with the high-speed oscillation function is outside the range 1 to 2147483647. | Positioning control does not start. | Start after set the command amplitude within the range of 1 to 214783647. |
| 26 | High-Speed oscillation command starting angle error | Operation cannot be started because the starting angle specified with the high-speed oscillation function is outside the range of 0 to 3599 ($\times 0.1$ [degree]). | | Start after set the starting angle within the range of 0 to 3599 ($\times 0.1$ [degree]). |
| 27 | High-Speed oscillation command frequency error | Operation cannot be started because the frequency specified with the high-speed oscillation function is outside the range of 1 to 5000[CPM]. | | Start after set the frequency within the range of 1 to 5000[CPM]. |
| 28 | Number of helical interpolation pitches error | The specified number of pitches of helical interpolation is outside the range of 0 to 999. | | Set the specified number of pitches within the range of 0 to 999. |
| 41 | Device error of the home position return data for indirect setting | Any unauthorized devices are set in the home position return data for indirect setting. | Positioning control does not start. | Review the devices of home position return data for indirect setting. |
| 45 | Advanced S-curve acceleration/ deceleration setting error | The acceleration section 1 ratio is outside the range of 0.0 to 100.0[%]. | Control with acceleration section 1 ratio = 0.0 acceleration section 2 ratio = 0.0 deceleration section 1 ratio = 0.0 deceleration section 2 ratio = 0.0 | Set the each ratio within the range of 0.0 to 100.0[%]. |
| 46 | | The acceleration section 2 ratio is outside the range of 0.0 to 100.0[%]. | | |
| 47 | | The deceleration section 1 ratio is outside the range of 0.0 to 100.0[%]. | | |
| 48 | | The deceleration section 2 ratio is outside the range of 0.0 to 100.0[%]. | | |
| 49 | | (Acceleration section 1 + Acceleration section 2) > 100.0[%] | | |
| 50 | | (Deceleration section 1 + Deceleration section 2) > 100.0[%] | | |
| 51 | Rapid stop deceleration time setting error | The rapid stop deceleration time is bigger than the setting value of deceleration time. | Control the rapid stop deceleration time with the setting value of deceleration time. | Set the rapid stop deceleration time within the range of 1 to deceleration time setting value. |
| 900 | START instruction setting error | The servo program specified with the servo program start does not exist. | Positioning control does not start. | Set the correct servo program No. |
| 901 | START instruction setting error | The axis No. set in the servo program start is different from the axis No. set in the servo program. | | Set the correct axis No. |
| 902 | Servo program instruction code error | The instruction code cannot be decoded. (A non-existent instruction code has been specified.) | | Set the correct instruction code |

Table 1.1 Servo program setting error list (Continued)

| Error code stored in SD517 | Error name | Error contents | Error processing | Corrective action |
|----------------------------|------------------------|---|--|--|
| 903 | Start error | A virtual mode program was started in the real mode. | Positioning control does not start. | Check the program mode allocation. |
| 905 | Start error | (1) Operation disable instructions (VPF, VPR, VPSTART, PVF, PVR, ZERO, VVF, VVR, OSC) was started in virtual mode. | | Correct the servo program. |
| | | (2) Operation disable instructions (ZERO, OSC, CHGA-C) was started in real mode axis. | | |
| | | (3) Operation disable instructions (VPF, VPR, VPSTART, VSTART, ZERO, VVF, VVR, OSC) was started in command generation axis. | | |
| | | (4) Operation disable instructions (CHGA-C, CHGA-E) from the D(P).SVST instruction of Motion dedicated instruction was started. | | |
| 906 | Axis No. setting error | (1) Unused axis of the system setting is set in the servo program start. | | Set the axis No. set in the system setting or mechanical system program. |
| | | (2) It was started by setting the real mode axis in the virtual servo program. | | |
| | | (3) It was started in the condition that the real mode axis had been mixed with virtual axis in the interpolation axis. | | |
| | | (4) It was started by setting the virtual axis in the real mode program in virtual mode. | | |
| 907 | Start error | It was started during processing for switching from real mode to virtual mode. | Use M2043 (real mode/virtual mode switching request), M2044 (real mode/virtual mode switching status) as interlocks for start. | |
| 908 | Start error | It was stated during processing for switching from virtual mode to real mode. | | |

APPENDIX 1.4 Drive module errors

Table 1.2 Drive module error (100 to 1199) list

| Error class | Error code | Control mode of virtual servo axis | | | | | | | | | Error cause | Error processing | Corrective action |
|-------------|---------------|------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|-----------------------|-----------------------|---|-------------------------------------|--|
| | | Positioning | Fixed-pitch feed | Speed | Speed switching | Constant-speed | JOG | Manual pulse generator | Synchronous encoder | Position follow-up | | | |
| Minor error | 100 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <ul style="list-style-type: none"> The PLC ready flag (M2000) or PCPU READY complete flag (SM500) is OFF. | Positioning control does not start. | <ul style="list-style-type: none"> Set the Motion CPU to RUN. Turn the PLC ready flag (M2000) on. |
| | 101 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <ul style="list-style-type: none"> The start accept flag (M2001 to M2032) for applicable axis is ON. | | <ul style="list-style-type: none"> Take an interlock in the program not to start the starting axis. (Use the start accept flag OFF of the applicable axis as the starting condition). |
| | 103 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <ul style="list-style-type: none"> The stop command (M4800+20n) for applicable axis is ON. | | <ul style="list-style-type: none"> Turn the stop command (M4800+20n) off and start. |
| | 104 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <ul style="list-style-type: none"> The rapid stop command (M4801+20n) for applicable axis is ON. | | <ul style="list-style-type: none"> Turn the rapid stop command (M4801+20n) off and start. |
| | 105 (Note) | <input type="radio"/> | | | <input type="radio"/> | <input type="radio"/> | | | | <input type="radio"/> | <ul style="list-style-type: none"> The feed current value is outside the range of stroke limit at the start. | | <ul style="list-style-type: none"> Set within the stroke limit range by the JOG operation. Set within the stroke limit range by the home position return or current value change. |
| | 106 (Note) | <input type="radio"/> | <input type="radio"/> | | <input type="radio"/> | <input type="radio"/> | | | | <input type="radio"/> | <ul style="list-style-type: none"> Positioning is outside the range of stroke limit. When absolute position system is enabled for stepping driver, and software stroke limit is valid with control units as degree, the following instructions were started. <ol style="list-style-type: none"> Absolute system instructions in constant-speed control Position follow-up control Absolute system instructions in speed-switching control | | <ul style="list-style-type: none"> Perform the positioning within the range of stroke limit. When absolute position system is enabled for stepping driver, if software stroke limit is valid and control units are degree, do not use the following instructions. <ol style="list-style-type: none"> Absolute system instructions in constant-speed control Position follow-up control Absolute system instructions in speed-switching control |
| | 107 (Note) | <input type="radio"/> | | | | <input type="radio"/> | | | | | <ul style="list-style-type: none"> The address that does not generate an arc is set at auxiliary point-specified circular interpolation or auxiliary point-specified helical interpolation. (Relationship between the start point, auxiliary point and end point.) The auxiliary point-specified circular interpolation or auxiliary point-specified helical interpolation was started in the control unit degree axis which is "stroke limit invalid". The auxiliary point-specified circular interpolation or auxiliary point-specified helical interpolation was started in the axis which is "stroke limit invalid". | | <ul style="list-style-type: none"> Correct the addresses of the servo program. Make the stroke limit valid for the control unit degree axis starts the auxiliary point-specified circular interpolation or auxiliary point-specified helical interpolation. Make the stroke limit valid for the axis starts the auxiliary point-specified circular interpolation or auxiliary point-specified helical interpolation. |

(Note): This error code is stored at all relevant interpolation axis storage areas at the interpolation operation.

Table 1.2 Drive module error (100 to 1199) list (Continued)

| Error class | Error code | Control mode of virtual servo axis | | | | | | | | | Error cause | Error processing | Corrective action |
|-------------|---------------|------------------------------------|------------------|-------|-----------------|----------------|-----|------------------------|---------------------|---|--|-------------------------------------|---|
| | | Positioning | Fixed-pitch feed | Speed | Speed switching | Constant-speed | JOG | Manual pulse generator | Synchronous encoder | Position follow-up | | | |
| Minor error | 108 (Note) | ○ | | | | ○ | | | | | <ul style="list-style-type: none"> The address that does not generate an arc is set at R(radius) specified circular interpolation or R(radius) specified helical interpolation. (Relationship between the start point, radius and end point.) The radius-specified circular interpolation or radius-specified helical interpolation was started in the control unit degree axis which is "stroke limit invalid". The radius-specified circular interpolation or radius-specified helical interpolation was started in the axis which is "stroke limit invalid". | Positioning control does not start. | <ul style="list-style-type: none"> Correct the addresses of the servo program. |
| | 109 (Note) | ○ | | | | ○ | | | | <ul style="list-style-type: none"> The address that does not generate an arc is set at central point-specified circular interpolation or central point-specified helical interpolation. (Relationship between the start point, central point and end point.) The central point-specified circular interpolation or central point-specified helical interpolation was started in the control unit degree axis which is "stroke limit invalid". The central point-specified circular interpolation or central point-specified helical interpolation was started in the axis which is "stroke limit invalid". | <ul style="list-style-type: none"> Correct the addresses of the servo program. Make the stroke limit valid for the control unit degree axis starts the central point-specified circular interpolation or central point-specified helical interpolation. Make the stroke limit valid for the axis starts the central point-specified circular interpolation or central point-specified helical interpolation. | | |
| | 110 (Note) | ○ | | | | ○ | | | | | <ul style="list-style-type: none"> The difference between the end point address and ideal end point is outside the allowable error range for circular interpolation at the circular interpolation. | | <ul style="list-style-type: none"> Correct the addresses of the servo program. |
| | 116 | | | | | | ○ | | | | <ul style="list-style-type: none"> The setting JOG speed is "0". The setting JOG speed exceeded the JOG speed limit value. The setting JOG speed limit value exceeded the setting range. | | <ul style="list-style-type: none"> Control with the JOG speed limit value. Control with the maximum setting range of each control unit. |

(Note): This error code is stored at all relevant interpolation axis storage areas at the interpolation operation.

Table 1.2 Drive module error (100 to 1199) list (Continued)

| Error class | Error code | Control mode of virtual servo axis | | | | | | | | | Error cause | Error processing | Corrective action | | | |
|-------------|------------|------------------------------------|------------------|-------|-----------------|----------------|-----|------------------------|---------------------|--------------------|-------------|--|---|---|--|---|
| | | Positioning | Fixed-pitch feed | Speed | Speed switching | Constant-speed | JOG | Manual pulse generator | Synchronous encoder | Position follow-up | | | | | | |
| Minor error | 117 | | | | | | | | | | ○ | <ul style="list-style-type: none"> Both of forward and reverse rotation were set at the simultaneous start for the JOG operation. | Only the applicable axis set to the forward direction starts. | <ul style="list-style-type: none"> Set a correct data. | | |
| | 119 | | | | | | | | | | | <ul style="list-style-type: none"> In the real mode or at the real mode axis, the instruction to specify the end point address by absolute data method in speed switching control was executed for the axis with unit [pulse/mm/inch] where the stroke limit is disabled. | Positioning control does not start. | <ul style="list-style-type: none"> When specifying the end point address by absolute data method in speed switching control, make the stroke limit valid. | | |
| | 136 | | | | | | | | | | | <ul style="list-style-type: none"> An unusable instruction (VVF/VVR) was started in an axis that does not support VVF/VVR instruction. | | <ul style="list-style-type: none"> Cannot start VVF/VVR instruction in an axis that does not support VVF/VVR instruction. | | |
| | 140 | | | | | | | | | | ○ | <ul style="list-style-type: none"> The travel value of the reference axis is set at "0" in the linear interpolation for reference axis specification. | | <ul style="list-style-type: none"> Do not set axis of travel value "0" as the reference axis. | | |
| | 141 | | | | | | | | | | | ○ | | <ul style="list-style-type: none"> The position command device of position follow-up control is set the odd number. | <ul style="list-style-type: none"> Set the even number for the position command device of position follow-up control. | |
| | 151 | | | | | | | | | | ○ | ○ | | <ul style="list-style-type: none"> Not allowed axis started in the virtual mode. (It cannot be started with error at real mode/virtual mode switching.) | <ul style="list-style-type: none"> Start in the virtual mode again after correct the error cause in the real mode. | |
| | 152 | | | | | | | | | | ○ | ○ | | <ul style="list-style-type: none"> It started at the virtual mode and during deceleration by all axes servo OFF (M2042 OFF). | | |
| | 153 | | | | | | | | | | ○ | ○ | | <ul style="list-style-type: none"> It started at the virtual mode and during deceleration by occurrence of the output module servo error. | | |
| | 200 | | | | | | | | | | ○ | ○ | | <ul style="list-style-type: none"> The PLC ready flag (M2000) turned off during the control by the servo program. | Deceleration stop | <ul style="list-style-type: none"> Turn the PLC ready flag (M2000) on after all axes have stopped. |
| | 204 | | | | | | | | | | ○ | ○ | | <ul style="list-style-type: none"> The PLC ready flag (M2000) turned off to on again during deceleration by turning off the PLC ready flag (M2000). | No operation | <ul style="list-style-type: none"> Turn the PLC ready flag (M2000) off to on after all axes have stopped. (Turn the PLC ready flag (M2000) off to on during deceleration is "no operation".) |
| 207 | | | | | | | | | | ○ | ○ | <ul style="list-style-type: none"> The feed current value exceeded the stroke limit range during positioning control. Only the axis exceed the stroke limit range is stored at the circular/helical interpolation. All interpolation axes are stored in the linear interpolation. | Deceleration stop | <ul style="list-style-type: none"> Correct the stroke limit range or travel value setting so that positioning control is within the range of the stroke limit. | | |

Table 1.2 Drive module error (100 to 1199) list (Continued)

| Error class | Error code | Control mode of virtual servo axis | | | | | | | | | Error cause | Error processing | Corrective action | |
|-------------|------------|------------------------------------|------------------|-------|-----------------|----------------|-----|------------------------|---------------------|--------------------|---|--|---|---|
| | | Positioning | Fixed-pitch feed | Speed | Speed switching | Constant-speed | JOG | Manual pulse generator | Synchronous encoder | Position follow-up | | | | |
| Minor error | 208 | ○ | | | ○ | ○ | | | | ○ | <ul style="list-style-type: none"> The feed current value of another axis exceeded the stroke limit value during the circular/helical interpolation control or simultaneous manual pulse generator operation. (For detection of other axis errors). | Deceleration stop | <ul style="list-style-type: none"> Correct the stroke limit range or travel value setting so that positioning control is within the range of the stroke limit. | |
| | 211 | | | | | ○ | | | | | <ul style="list-style-type: none"> During positioning control, an overrun occurred because the deceleration distance for the output speed is not attained at the point where the final positioning address was detected. | | <ul style="list-style-type: none"> Set the speed setting so that overrun does not occur. Set the travel value so that overrun does not occur. | |
| | 214 | | | | | | | | | ○ | <ul style="list-style-type: none"> The manual pulse generator was enabled during the start of the applicable axis, the manual pulse generator operation was executed. | Manual pulse generator input is ignored until the axis stops. | <ul style="list-style-type: none"> Execute the manual pulse generator operation after the applicable axis stopped. | |
| | 215 | | | | | ○ | | | | | | <ul style="list-style-type: none"> The speed switching point address exceed the end point address. The positioning address in the reverse direction was set during the speed switching control. The same servo program was executed again. | Rapid stop | <ul style="list-style-type: none"> Set the speed-switching point between the previous speed switching point address and the end point address. |
| | | | | | | | | | | | | <ul style="list-style-type: none"> Correct the Motion SFC program. | | |
| | 220 | | | | | | | | | | ○ | <ul style="list-style-type: none"> When the control unit is "degree" during the position follow-up control, the command address exceeded the range of 0 to 35999999. The command address for the position follow-up control exceeded the stroke limit range. | Deceleration stop | <ul style="list-style-type: none"> When the control unit is "degree", set the command address within the range of 0 to 35999999. |
| | | | | | | | | | | | | | | <ul style="list-style-type: none"> Set the address within the stroke limit range. |
| 225 | | | | | | ○ | | | | | <ul style="list-style-type: none"> The speed at the pass point exceeded the speed limit value during constant-speed control. The speed at the pass point is 0 or less. | Control with the speed limit value. | <ul style="list-style-type: none"> Set the speed command value within the range of 1 to speed limit value. | |
| | | | | | | | | | | | | Control with the speed of last pass point | | |
| 230 | | | | | | | | | | | <ul style="list-style-type: none"> When the skip is executed in the constant-speed control, the next interpolation instruction is an absolute circular interpolation or absolute helical interpolation. | Immediate stop | <ul style="list-style-type: none"> If absolute circular interpolation or absolute helical interpolation is designated at a point after the skip designation point, set an absolute linear interpolation in the interval. | |
| | | | | | | ○ | | | | | <ul style="list-style-type: none"> After the skip is executed in the constant-speed control, an absolute circular interpolation or absolute helical interpolation is executed while passing through only the positioning point for incremental method. | Deceleration stop | | |

Table 1.2 Drive module error (100 to 1199) list (Continued)

| Error class | Error code | Control mode of virtual servo axis | | | | | | | | | Error cause | Error processing | Corrective action |
|-------------|------------|------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|-----------------------|-----------------------|--|-------------------------------------|--|
| | | Positioning | Fixed-pitch feed | Speed | Speed switching | Constant-speed | JOG | Manual pulse generator | Synchronous encoder | Position follow-up | | | |
| Minor error | 260 | <input type="radio"/> | <input type="radio"/> | | | <input type="radio"/> | | | | | <ul style="list-style-type: none"> The target position change request (CHGP) specifying the address where the target position is outside the range of 0 to 35999999 is executed to the axis whose unit is [degree]. | Deceleration stop | <ul style="list-style-type: none"> When executing the target position change request specifying the address to the axis whose unit is [degree], set the target position within the range of 0 to 35999999. |
| | 261 | <input type="radio"/> | <input type="radio"/> | | | <input type="radio"/> | | | | | <ul style="list-style-type: none"> At the target position change request (CHGP), since the travel to the target position after the change was shorter than the deceleration distance, an overrun occurred. | | <ul style="list-style-type: none"> Set the speed so that an overrun will not occur. Set the target position so that an overrun will not occur. |
| | 262 | <input type="radio"/> | <input type="radio"/> | | | <input type="radio"/> | | | | | <ul style="list-style-type: none"> At the target position change request (CHGP), the target position after the change exceeds the range of the stroke limit. | | <ul style="list-style-type: none"> Set the stroke limit range or the target position after the change so that the positioning control is performed within the stroke limit range. |
| | 263 | <input type="radio"/> | <input type="radio"/> | | | <input type="radio"/> | | | | | <ul style="list-style-type: none"> The target position change request (CHGP) is executed to the program where the following acceleration/deceleration system is set. (1) FIN acceleration/deceleration (2) Advanced S-curve acceleration/deceleration | | <ul style="list-style-type: none"> Do not execute the target position change to the program where the FIN acceleration/deceleration or the advanced S-curve acceleration/deceleration is set. Set the acceleration/deceleration system of the parameter block or the servo program to the trapezoid/S-curve acceleration/deceleration. |
| | 264 | <input type="radio"/> | | | | | | | | | <ul style="list-style-type: none"> In reference axis-specified linear interpolation or the long axis-specified linear interpolation, the travel of the reference axis or the long axis after the target position change request (CHGP) is 0. | | <ul style="list-style-type: none"> Set a target position so that the travel of the reference axis or the long axis after the target position change is not 0. |
| | 300 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <ul style="list-style-type: none"> The current value was changed during positioning control of the applicable axis. The current value was changed for the axis that had not been started. The current value was changed for the servo OFF axis. | | Current value is not changed. |
| | 305 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | | <input type="radio"/> | | <ul style="list-style-type: none"> The speed after speed change is set outside the range of 0 to speed limit value. The absolute value of speed after speed change is set outside the range of 0 to speed limit value. | Control with the speed limit value. | <ul style="list-style-type: none"> Set the speed after speed change within the range of 0 to speed limit value. Set the absolute value of speed after speed change within the range of 0 to speed limit value. |

Table 1.2 Drive module error (100 to 1199) list (Continued)

| Error class | Error code | Control mode of virtual servo axis | | | | | | | | | Error cause | Error processing | Corrective action | |
|-------------|------------|------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|---------------------|-----------------------|---|--|---|---|
| | | Positioning | Fixed-pitch feed | Speed | Speed switching | Constant-speed | JOG | Manual pulse generator | Synchronous encoder | Position follow-up | | | | |
| Minor error | 310 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | | | <input type="radio"/> | • Change speed to negative speed in the invalid axis of stroke limit. | Speed is not changed. | • Do not change speed to negative speed in the invalid axis of stroke limit. | |
| | 330 | | | <input type="radio"/> | <input type="radio"/> | | <input type="radio"/> | <input type="radio"/> | | | • The target position change request (CHGP) was executed for the axis which was executing a servo instruction which was not compatible with target position change. | Target position is not changed. | • Change the target position for the axes operated by the following servo instructions. (1) Linear interpolation control (2) Fixed-pitch feed operation (3) Constant-speed control | |
| Major error | 1151 | | | | | | | | | <input type="radio"/> | • Q172DEX or encoder hardware error. | Immediate input stop | • Check (replace) the Q172DEX or encoder. | |
| | | | | | | | | | | <input type="radio"/> | • Disconnected encoder cable | | • Check the encoder cable | |
| | | | | | | | | | | | <input type="radio"/> | • A synchronous encoder set in the system setting differs from a synchronous encoder actually connected. | Input from synchronous encoder does not accept. | • Set a synchronous encoder actually connected in the system setting. |
| | | | | | | | | | | | <input type="radio"/> | • No battery or disconnected battery at Q172DEX. | Immediate input stop | • Replace the battery and turn ON the Multiple CPU system power supply a few minutes later. |
| | 1152 | | | | | | | | | | <input type="radio"/> | • Low voltage at Q172DEX. | Operation is continued. | • Replace the battery. |
| | 1153 | | | | | | | | | <input type="radio"/> | • No battery or disconnected battery at Q172DEX. | • Replace the battery or check (replace) the Q172DEX. | | |

APPENDIX 1.5 Servo errors


(1) Servo errors (2000 to 2999)


These errors are detected by the servo amplifier, and the error codes are [2000] to [2999].

The servo error detection signal (M2408+20n) turns on at the servo error occurrence. Eliminate the error cause, reset the servo amplifier error by turning on the servo error reset command (M3208+20n) and perform re-start. (The servo error detection signal does not turn on because the codes [2100] to [2599] are for warnings.)

(Note-1): As for the regenerative alarm (error code [2030]) or overload 1 or 2 (error codes [2050], [2051]), the state at the operation is held also for after the protection circuit operation in the servo amplifier. The memory contents are cleared with the external power supply off, but are not cleared by the reset signal.

(Note-2): If resetting by turning off the external power supply is repeated at the occurrence of error code [2030], [2050] or [2051], it may cause devices to be destroyed by overheating. Re-start operation after eliminating the cause of the error certainly.

The hexadecimal display of servo amplifier display servo error code (#8008+20n) is the same as the LED of servo amplifier. 

 CAUTION

- If a controller, servo amplifier self-diagnosis error occurs, check the points stated in this manual and clear the error.

List of servo errors are shown in next page or later.
Refer to the "Servo amplifier Instruction Manual" for details.

| Servo amplifier type | Instruction manual name |
|----------------------|---|
| MR-J4-□B | SSCNETⅢ/H Interface AC Servo MR-J4-_B_(-RJ) Servo amplifier Instruction Manual (SH-030106) |
| MR-J4W-□B | SSCNETⅢ/H Interface Multi-axis AC Servo MR-J4W2-_B_/MR-J4W3-_B_/MR-J4W2-0303B6 Servo amplifier Instruction Manual (SH-030105) |
| MR-J3-□B | SSCNETⅢ interface MR-J3-□B Servo amplifier Instruction Manual (SH-030051) |
| MR-J3W-□B | SSCNETⅢ interface 2-axis AC Servo Amplifier MR-J3W-0303BN6/MR-J3W-□B Servo amplifier Instruction Manual (SH-030073) |
| MR-J3-□B-RJ004 | SSCNETⅢ Compatible Linear Servo MR-J3-□B-RJ004U□ Instruction Manual (SH-030054) |
| MR-J3-□B-RJ006 | SSCNETⅢ Compatible Fully Closed Loop Control MR-J3-□B-RJ006 Servo amplifier Instruction Manual (SH-030056) |
| MR-J3-□B-RJ080 | SSCNETⅢ interface Direct Drive Servo MR-J3-□B-RJ080W Instruction Manual (SH-030079) |
| MR-J3-□B Safety | SSCNETⅢ interface Drive Safety integrated MR-J3-□B Safety Servo amplifier Instruction Manual (SH-030084) |

: Refer to Section 1.4 for the software version that supports this function.

(a) MR-J4(W)-□B

Table 1.3 Servo error (2000 to 2999) list (MR-J4(W)-□B)

| Error code | Servo amplifier LED display | Name | Details name | Remarks |
|------------|---|---------------------------------------|---|---------|
| 2010 | 10.1 | Undervoltage | Voltage drop in the control power | |
| | 10.2 | | Voltage drop in the main circuit power | |
| 2011 | 11.1 | Switch setting error | Axis number setting error/Station number setting error | |
| | 11.2 | | Disabling control axis setting error | |
| 2012 | 12.1 | Memory error 1 (RAM) | RAM error 1 | |
| | 12.2 | | RAM error 2 | |
| | 12.3 | | RAM error 3 | |
| | 12.4 | | RAM error 4 | |
| | 12.5 | | RAM error 5 | |
| | 12.6 | | RAM error 6 | |
| 2013 | 13.1 | Clock error | Clock error 1 | |
| | 13.2 | | Clock error 2 | |
| 2014 | 14.1 | Control process error | Control process error 1 | |
| | 14.2 | | Control process error 2 | |
| | 14.3 | | Control process error 3 | |
| | 14.4 | | Control process error 4 | |
| | 14.5 | | Control process error 5 | |
| | 14.6 | | Control process error 6 | |
| | 14.7 | | Control process error 7 | |
| | 14.8 | | Control process error 8 | |
| | 14.9 | | Control process error 9 | |
| | 14.A | | Control process error 10 | |
| | 14.B | | Control process error 11 | |
| 2015 | 15.1 | Memory error 2 (EEP-ROM) | EEP-ROM error at power on | |
| | 15.2 | | EEP-ROM error during operation | |
| | 15.4 | | Home position information read error | |
| 2016 | 16.1 | Encoder initial communication error 1 | Encoder initial communication - Receive data error 1 | |
| | 16.2 | | Encoder initial communication - Receive data error 2 | |
| | 16.3 | | Encoder initial communication - Receive data error 3 | |
| | 16.5 | | Encoder initial communication - Transmission data error 1 | |
| | 16.6 | | Encoder initial communication - Transmission data error 2 | |
| | 16.7 | | Encoder initial communication - Transmission data error 3 | |
| | 16.A | | Encoder initial communication - Process error 1 | |
| | 16.B | | Encoder initial communication - Process error 2 | |
| | 16.C | | Encoder initial communication - Process error 3 | |
| | 16.D | | Encoder initial communication - Process error 4 | |
| | 16.E | | Encoder initial communication - Process error 5 | |
| 16.F | Encoder initial communication - Process error 6 | | | |
| 2017 | 17.1 | Board error | Board error 1 | |
| | 17.3 | | Board error 2 | |
| | 17.4 | | Board error 3 | |
| | 17.5 | | Board error 4 | |
| | 17.6 | | Board error 5 | |
| | 17.8 | | Board error 6 | |
| | 17.9 | | Board error 8 | |

APPENDICES

Table 1.3 Servo error (2000 to 2999) list (MR-J4(W)-□B) (Continued)

| Error code | Servo amplifier LED display | Name | Details name | Remarks |
|------------|-----------------------------|---------------------------------------|--|---------|
| 2019 | 19.1 | Memory error 3 (Flash-ROM) | Flash-ROM error 1 | |
| | 19.2 | | Flash-ROM error 2 | |
| | 19.3 | | Flash-ROM error 3 | |
| 2020 | 20.1 | Encoder normal communication error 1 | Encoder normal communication - Receive data error 1 | |
| | 20.2 | | Encoder normal communication - Receive data error 2 | |
| | 20.3 | | Encoder normal communication - Receive data error 3 | |
| | 20.5 | | Encoder normal communication - Transmission data error 1 | |
| | 20.6 | | Encoder normal communication - Transmission data error 2 | |
| | 20.7 | | Encoder normal communication - Transmission data error 3 | |
| | 20.9 | | Encoder normal communication - Receive data error 4 | |
| | 20.A | | Encoder normal communication - Receive data error 5 | |
| 2021 | 21.1 | Encoder normal communication error 2 | Encoder error 1 | |
| | 21.2 | | Encoder data update error | |
| | 21.3 | | Encoder data waveform error | |
| | 21.4 | | Encoder non-signal error | |
| | 21.5 | | Encoder hardware error 1 | |
| | 21.6 | | Encoder hardware error 2 | |
| | 21.9 | | Encoder error 2 | |
| 2024 | 24.1 | Main circuit error | Ground fault detected at hardware detection circuit | |
| | 24.2 | | Ground fault detected at software detection function | |
| 2025 | 25.1 | Absolute position erased | Servo motor encoder - Absolute position erased | |
| | 25.2 | | Scale measurement encoder - Absolute position erased. | |
| 2027 | 27.1 | Initial magnetic pole detection error | Magnetic pole detection - Abnormal termination | |
| | 27.2 | | Magnetic pole detection - Time out error | |
| | 27.3 | | Magnetic pole detection - Limit switch error | |
| | 27.4 | | Magnetic pole detection - Estimated error | |
| | 27.5 | | Magnetic pole detection - Position deviation error | |
| | 27.6 | | Magnetic pole detection - Speed deviation error | |
| | 27.7 | | Magnetic pole detection - Current error | |
| 2028 | 28.1 | Linear encoder error 2 | Linear encoder - Environment error | |
| 2030 | 30.1 | Regenerative error | Regeneration heat error | |
| | 30.2 | | Regeneration signal error | |
| | 30.3 | | Regeneration feedback signal error | |
| 2031 | 31.1 | Overspeed | Abnormal motor speed | |
| 2032 | 32.1 | Overcurrent | Overcurrent detected at hardware detection circuit (during operation) | |
| | 32.2 | | Overcurrent detected at software detection function (during operation) | |
| | 32.3 | | Overcurrent detected at hardware detection circuit (during a stop) | |
| | 32.4 | | Overcurrent detected at software detection function (during a stop) | |
| 2033 | 33.1 | Overvoltage | Main circuit voltage error | |

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Table 1.3 Servo error (2000 to 2999) list (MR-J4(W)-□B) (Continued)

| Error code | Servo amplifier LED display | Name | Details name | Remarks |
|---------------|-----------------------------|---------------------------------|---|---------|
| 2034 | 34.1 | SSCNET receive error 1 | SSCNET receive data error | |
| | 34.2 | | SSCNET connector connection error | |
| | 34.3 | | SSCNET communication data error | |
| | 34.4 | | Hardware error signal detection | |
| | 34.5 | | SSCNET receive data error (safety observation function) | |
| | 34.6 | | SSCNET communication data error (safety observation function) | |
| 2035 | 35.1 | Command frequency error | Command frequency error | |
| 2036 | 36.1 | SSCNET receive error 2 | Continuous communication data error | |
| | 36.2 | | Continuous communication data error (safety observation function) | |
| 2037 (Note-1) | 37.1 | Parameter error | Parameter setting range error | |
| | 37.2 | | Parameter combination error | |
| | 37.3 | | Point table setting error | |
| 2042 | 42.1 | Servo control error | Servo control error by position deviation | |
| | 42.2 | | Servo control error by speed deviation | |
| | 42.3 | | Servo control error by torque/thrust deviation | |
| | 42.8 | Fully closed loop control error | Fully closed loop control error by position deviation | |
| | 42.9 | | Fully closed loop control error by speed deviation | |
| | 42.A | | Fully closed loop control error by position deviation (during command stop) | |
| 2045 | 45.1 | Main circuit device overheat | Main circuit device overheat error 1 | |
| | 45.2 | | Main circuit device overheat error 2 | |
| 2046 | 46.1 | Servo motor overheat | Abnormal temperature of servo motor 1 | |
| | 46.2 | | Abnormal temperature of servo motor 2 | |
| | 46.3 | | Thermistor disconnected error | |
| | 46.4 | | Thermistor circuit error | |
| | 46.5 | | Abnormal temperature of servo motor 3 | |
| | 46.6 | | Abnormal temperature of servo motor 4 | |
| 2047 | 47.1 | Cooling fan error | Cooling fan stop error | |
| | 47.2 | | Cooling fan speed reduction error | |
| 2050 | 50.1 | Overload 1 | Thermal overload error 1 during operation | |
| | 50.2 | | Thermal overload error 2 during operation | |
| | 50.3 | | Thermal overload error 4 during operation | |
| | 50.4 | | Thermal overload error 1 during a stop | |
| | 50.5 | | Thermal overload error 2 during a stop | |
| | 50.6 | | Thermal overload error 4 during a stop | |
| 2051 | 51.1 | Overload 2 | Thermal overload error 3 during operation | |
| | 51.2 | | Thermal overload error 3 during a stop | |
| 2052 | 52.1 | Error excessive | Excess droop pulse 1 | |
| | 52.3 | | Excess droop pulse 2 | |
| | 52.4 | | Error excessive during 0 torque limit | |
| | 52.5 | | Excess droop pulse 3 | |
| 2054 | 54.1 | Oscillation detection | Oscillation detection error | |
| 2056 | 56.2 | Forced stop error | Over speed during forced stop | |
| | 56.3 | | Estimated distance over during forced stop | |

(Note-1): Refer to the parameter No. stored in the parameter error No. (#8009+20n) for details of the erroneous parameter.

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Table 1.3 Servo error (2000 to 2999) list (MR-J4(W)-□B) (Continued)

| Error code | Servo amplifier LED display | Name | Details name | Remarks |
|------------|-------------------------------|--|---|---------|
| 2060 | 1A.1 | Servo motor combination error | Servo motor combination error | |
| | 1A.2 | | Servo motor control mode combination error | |
| | 1A.4 | | Servo motor combination error 2 | |
| 2061 | 2A.1 | Linear encoder error 1 | Linear encoder error 1-1 | |
| | 2A.2 | | Linear encoder error 1-2 | |
| | 2A.3 | | Linear encoder error 1-3 | |
| | 2A.4 | | Linear encoder error 1-4 | |
| | 2A.5 | | Linear encoder error 1-5 | |
| | 2A.6 | | Linear encoder error 1-6 | |
| | 2A.7 | | Linear encoder error 1-7 | |
| | 2A.8 | | Linear encoder error 1-8 | |
| 2063 | 63.1 | STO timing error | STO1 off | |
| | 63.2 | | STO2 off | |
| | 63.5 | | STO by functional safety unit | |
| | 1E.1 | Encoder initial communication error 2 | Encoder malfunction | |
| 1E.2 | Load-side encoder malfunction | | | |
| 2064 | 64.1 | Functional safety unit setting error | STO input error | |
| | 64.2 | | Compatibility mode setting error | |
| | 64.3 | | Operation mode setting error | |
| | 1F.1 | Encoder initial communication error 3 | Incompatible encoder | |
| | 1F.2 | | Incompatible load-side encoder | |
| 2065 | 65.1 | Functional safety unit connection error | Functional safety unit communication error 1 | |
| | 65.2 | | Functional safety unit communication error 2 | |
| | 65.3 | | Functional safety unit communication error 3 | |
| | 65.4 | | Functional safety unit communication error 4 | |
| | 65.5 | | Functional safety unit communication error 5 | |
| | 65.6 | | Functional safety unit communication error 6 | |
| | 65.7 | | Functional safety unit communication error 7 | |
| | 65.8 | | Functional safety unit shut-off signal error 1 | |
| | 65.9 | | Functional safety unit shut-off signal error 2 | |
| 2066 | 66.1 | Encoder initial communication error (safety observation function) | Encoder initial communication - Receive data error 1 (safety observation function) | |
| | 66.2 | | Encoder initial communication - Receive data error 2 (safety observation function) | |
| | 66.3 | | Encoder initial communication - Receive data error 3 (safety observation function) | |
| | 66.7 | | Encoder initial communication - Transmission data error 1 (safety observation function) | |
| | 66.9 | | Encoder initial communication - Process error 1 (safety observation function) | |
| 2067 | 67.1 | Encoder normal communication error 1 (safety observation function) | Encoder normal communication - Receive data error 1 (safety observation function) | |
| | 67.2 | | Encoder normal communication - Receive data error 2 (safety observation function) | |
| | 67.3 | | Encoder normal communication - Receive data error 3 (safety observation function) | |
| | 67.4 | | Encoder normal communication - Receive data error 4 (safety observation function) | |
| | 67.7 | | Encoder normal communication - Transmission data error 1 (safety observation function) | |

APPENDICES

Table 1.3 Servo error (2000 to 2999) list (MR-J4(W)-□B) (Continued)

| Error code | Servo amplifier LED display | Name | Details name | Remarks |
|------------|---|---|---|---------|
| 2068 | 68.1 | STO diagnosis error | Mismatched STO signal error | |
| 2070 | 70.1 | Load-side encoder initial communication error 1 | Load-side encoder initial communication - Receive data error 1 | |
| | 70.2 | | Load-side encoder initial communication - Receive data error 2 | |
| | 70.3 | | Load-side encoder initial communication - Receive data error 3 | |
| | 70.5 | | Load-side encoder initial communication - Transmission data error 1 | |
| | 70.6 | | Load-side encoder initial communication - Transmission data error 2 | |
| | 70.7 | | Load-side encoder initial communication - Transmission data error 3 | |
| | 70.A | | Load-side encoder initial communication - Process error 1 | |
| | 70.B | | Load-side encoder initial communication - Process error 2 | |
| | 70.C | | Load-side encoder initial communication - Process error 3 | |
| | 70.D | | Load-side encoder initial communication - Process error 4 | |
| | 70.E | | Load-side encoder initial communication - Process error 5 | |
| 70.F | Load-side encoder initial communication - Process error 6 | | | |
| 2071 | 71.1 | Load-side encoder normal communication error 1 | Load-side encoder communication - Receive data error 1 | |
| | 71.2 | | Load-side encoder communication - Receive data error 2 | |
| | 71.3 | | Load-side encoder communication - Receive data error 3 | |
| | 71.5 | | Load-side encoder communication - Transmission data error 1 | |
| | 71.6 | | Load-side encoder communication - Transmission data error 2 | |
| | 71.7 | | Load-side encoder communication - Transmission data error 3 | |
| | 71.9 | | Load-side encoder communication - Transmission data error 4 | |
| | 71.A | | Load-side encoder communication - Transmission data error 5 | |
| 2072 | 72.1 | Load-side encoder normal communication error 2 | Load-side encoder data error 1 | |
| | 72.2 | | Load-side encoder data update error | |
| | 72.3 | | Load-side encoder data waveform error | |
| | 72.4 | | Load-side encoder non-signal error | |
| | 72.5 | | Load-side encoder hardware error 1 | |
| | 72.6 | | Load-side encoder hardware error 2 | |
| | 72.9 | | Load-side encoder data error 2 | |

APPENDICES

Table 1.3 Servo error (2000 to 2999) list (MR-J4(W)-□B) (Continued)

| Error code | Servo amplifier LED display | Name | Details name | Remarks |
|--------------------------|-----------------------------|--|---|---------|
| 2079 | 79.1 | Functional safety unit diagnosis error | Functional safety unit power voltage error | |
| | 79.2 | | Functional safety unit internal error | |
| | 79.3 | | Abnormal temperature of functional safety unit | |
| | 79.4 | | Servo amplifier error | |
| | 79.5 | | Input device error | |
| | 79.6 | | Output device error | |
| | 79.7 | | Mismatched input signal error | |
| | 79.8 | | Position feedback fixing error | |
| 2082 | 82.1 | Master-slave operation error 1 | Master-slave operation error 1 | |
| 2088 | 888 | Watchdog | Watchdog | |
| 2091 | 91.1 | Servo amplifier overheat warning | Main circuit device overheat warning | |
| 2095 | 95.1 | STO warning | STO1 off detection | |
| | 95.2 | | STO2 off detection | |
| | 95.3 | | STO warning 1 (safety observation function) | |
| | 95.4 | | STO warning 2 (safety observation function) | |
| | 95.5 | | STO warning 3 (safety observation function) | |
| 2102 | 92.1 | Battery cable disconnection warning | Encoder battery cable disconnection warning | |
| | 92.3 | | Battery degradation | |
| 2106 | 96.1 | Home position setting warning | In-position warning at home positioning | |
| | 96.2 | | Command input warning at home positioning | |
| | 96.3 | | Servo off warning at home positioning | |
| | 96.4 | | Home positioning warning during magnetic pole detection | |
| 2116 | 9F.1 | Battery warning | Low battery | |
| | 9F.2 | | Battery degradation warning | |
| 2140 | E0.1 | Excessive regeneration warning | Excessive regeneration warning | |
| 2141 | E1.1 | Overload warning 1 | Thermal overload warning 1 during operation | |
| | E1.2 | | Thermal overload warning 2 during operation | |
| | E1.3 | | Thermal overload warning 3 during operation | |
| | E1.4 | | Thermal overload warning 4 during operation | |
| | E1.5 | | Thermal overload error 1 during a stop | |
| | E1.6 | | Thermal overload error 2 during a stop | |
| | E1.7 | | Thermal overload error 3 during a stop | |
| | E1.8 | | Thermal overload error 4 during a stop | |
| 2142 | E2.1 | Servo motor overheat warning | Servo motor temperature warning | |
| 2143 | E3.1 | Absolute position counter warning | Multi-revolution counter travel distance excess warning | |
| | E3.2 | | Absolute position counter warning | |
| | E3.4 | | Absolute positioning counter EEPROM writing frequency warning | |
| | E3.5 | | Encoder absolute positioning counter warning | |
| 2144 ^(Note-1) | E4.1 | Parameter warning | Parameter setting range error warning | |

(Note-1): Refer to the parameter No. stored in the parameter error No. (#8009+20n) for details of the erroneous parameter.

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Table 1.3 Servo error (2000 to 2999) list (MR-J4(W)-□B) (Continued)

| Error code | Servo amplifier LED display | Name | Details name | Remarks |
|------------|-----------------------------|---|--|---------|
| 2146 | E6.1 | Servo forced stop warning | Forced stop warning | |
| | E6.2 | | SS1 forced stop warning 1 (safety observation function) | |
| | E6.3 | | SS1 forced stop warning 2 (safety observation function) | |
| 2147 | E7.1 | Controller forced stop warning | Controller forced stop warning | |
| 2148 | E8.1 | Cooling fan speed reduction warning | Decreased cooling fan speed warning | |
| | E8.2 | | Cooling fan stop | |
| 2149 | E9.1 | Main circuit off warning | Servo-on signal on during main circuit off | |
| | E9.2 | | Bus voltage drop during low speed operation | |
| | E9.3 | | Ready-on signal on during main circuit off | |
| | E9.4 | | Converter unit forced stop | |
| 2151 | EB.1 | The other axis error warning | The other axis error warning | |
| 2152 | EC.1 | Overload warning 2 | Overload warning 2 | |
| 2153 | ED.1 | Output watt excess warning | Output watt excess warning | |
| 2160 | F0.1 | Tough drive warning | Instantaneous power failure tough drive warning | |
| | F0.3 | | Vibration tough drive warning | |
| 2162 | F2.1 | Drive recorder - Miswriting warning | Drive recorder - Area writing time-out warning | |
| | F2.2 | | Drive recorder - Data miswriting warning | |
| 2163 | F3.1 | Oscillation detection warning | Oscillation detection warning | |
| 2907 | 1B.1 | Converter error | Converter unit error | |
| 2913 | 2B.1 | Encoder counter error | Encoder counter error 1 | |
| | 2B.2 | | Encoder counter error 2 | |
| 2918 | 3A.1 | Inrush current suppression circuit error | Inrush current suppression circuit error | |
| 2921 | 3D.1 | Parameter setting error for driver communication | Parameter combination error for driver communication on slave | |
| | 3D.2 | | Parameter combination error for driver communication on master | |
| 2922 | 3E.1 | Operation mode error | Operation mode error | |
| | 3E.6 | | Operation mode switch error | |
| 2942 | 7A.1 | Parameter setting error (safety observation function) | Parameter verification error (safety observation function) | |
| | 7A.2 | | Parameter setting range error (safety observation function) | |
| | 7A.3 | | Parameter combination error (safety observation function) | |
| | 7A.4 | | Functional safety unit combination error (safety observation function) | |

Table 1.3 Servo error (2000 to 2999) list (MR-J4(W)-□B) (Continued)

| Error code | Servo amplifier LED display | Name | Details name | Remarks |
|------------|-----------------------------|--|--|---------|
| 2943 | 7B.1 | Encoder diagnosis error (safety observation function) | Encoder diagnosis error 1 (safety observation function) | |
| | 7B.2 | | Encoder diagnosis error 2 (safety observation function) | |
| | 7B.3 | | Encoder diagnosis error 3 (safety observation function) | |
| | 7B.4 | | Encoder diagnosis error 4 (safety observation function) | |
| 2944 | 7C.1 | Functional safety unit communication diagnosis error (safety observation function) | Functional safety unit communication cycle error (safety observation function) | |
| | 7C.2 | | Functional safety unit communication data error (safety observation function) | |
| 2945 | 7D.1 | Safety observation error | Stop observation error | |
| | 7D.2 | | Speed observation error | |
| 2948 | 8A.1 | USB communication time-out error/serial communication time-out error/Modbus-RTU communication time-out error | USB communication time-out error/serial communication time-out error | |
| | 8A.2 | | Modbus-RTU communication time-out error | |
| 2952 | 8E.1 | USB communication error/serial communication error/Modbus-RTU communication error | USB communication receive error/serial communication receive error | |
| | 8E.2 | | USB communication checksum error/serial communication checksum error | |
| | 8E.3 | | USB communication character error/serial communication character error | |
| | 8E.4 | | USB communication command error/serial communication command error | |
| | 8E.5 | | USB communication data number error/serial communication data number error | |
| | 8E.6 | | Modbus-RTU communication receive error | |
| | 8E.7 | | Modbus-RTU communication message frame error | |
| | 8E.8 | | Modbus-RTU communication CRC error | |
| 2955 | 9B.1 | Error excessive warning | Excess droop pulse 1 warning | |
| | 9B.3 | | Excess droop pulse 2 warning | |
| | 9B.4 | | Error excessive warning during 0 torque limit | |
| 2956 | 9C.1 | Converter error | Converter unit error | |

APPENDICES

(b) MR-J3-□B

Table 1.4 Servo error (2000 to 2999) list (MR-J3-□B)

| Error code | Servo amplifier LED display | Name | Remarks |
|--------------|-----------------------------|--|---------|
| 2010 | 10 | Undervoltage | |
| 2012 | 12 | Memory error 1 (RAM) | |
| 2013 | 13 | Clock error | |
| 2015 | 15 | Memory error 2 (EEP-ROM) | |
| 2016 | 16 | Encoder error 1 (At power on) | |
| 2017 | 17 | Board error | |
| 2019 | 19 | Memory error 3 (Flash ROM) | |
| 2020 | 20 | Encoder error 2 (During runtime) | |
| 2021 | 21 | Encoder error 3 (During runtime) | |
| 2024 | 24 | Main circuit error | |
| 2025 | 25 | Absolute position erase | |
| 2030 | 30 | Regenerative error | |
| 2031 | 31 | Overspeed | |
| 2032 | 32 | Overcurrent | |
| 2033 | 33 | Overvoltage | |
| 2034 | 34 | Receive error 1 | |
| 2035 | 35 | Command frequency error | |
| 2036 | 36 | Receive error 2 | |
| 2045 | 45 | Main circuit device overheat | |
| 2046 | 46 | Servo motor overheat | |
| 2047 | 47 | Cooling fan error | |
| 2050 | 50 | Overload 1 | |
| 2051 | 51 | Overload 2 | |
| 2052 | 52 | Error excessive | |
| 2060 | 1A | Motor combination error | |
| 2082 | 82 | Master/slave operation error 1 | |
| 2088 | 888 | Watchdog | |
| 2102 | 92 | Battery cable disconnection warning | |
| 2106 | 96 | Home position setting warning | |
| 2116 | 9F | Battery warning | |
| 2140 | E0 | Excessive regeneration warning | |
| 2141 | E1 | Overload warning 1 | |
| 2143 | E3 | Absolute position counter warning | |
| 2146 | E6 | Servo forced stop warning | |
| 2147 | E7 | Controller forced stop warning | |
| 2148 | E8 | Cooling fan speed reduction warning | |
| 2149 | E9 | Main circuit off warning | |
| 2152 | EC | Overload warning 2 | |
| 2153 | ED | Output watt excess warning | |
| 2301 to 2599 | E4 | Parameter warning (Refer to the table 1.5) | |
| 2601 to 2899 | 37 | Parameter error (Refer to the table 1.5) | |
| 2907 | 1B | Converter alarm | |
| 2921 | 3D | Driver communication parameter setting error | |
| 2948 | 8A | USB communication time-out error | |
| 2952 | 8E | USB communication error | |
| 2956 | 9C | Converter warning | |

(Note): The LED display is different when using the servo amplifiers with a large capacity. Refer to the "Servo amplifier Instruction Manual" for details.

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Table 1.5 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail

| Error code | Parameter No. | Name | Error code | Parameter No. | Name | | |
|------------|---------------|------|--|---------------|------|------|--|
| 2301 | 2601 | PA01 | Control mode | 2340 | 2640 | PB21 | For manufacturer setting |
| 2302 | 2602 | PA02 | Regenerative option | 2341 | 2641 | PB22 | |
| 2303 | 2603 | PA03 | Absolute position detection system | 2342 | 2642 | PB23 | Low-pass filter selection |
| 2304 | 2604 | PA04 | Function selection A-1 | 2343 | 2643 | PB24 | Slight vibration suppression control selection |
| 2305 | 2605 | PA05 | For manufacturer setting | 2344 | 2644 | PB25 | For manufacturer setting |
| 2306 | 2606 | PA06 | | 2345 | 2645 | PB26 | Gain changing selection |
| 2307 | 2607 | PA07 | | 2346 | 2646 | PB27 | Gain changing condition |
| 2308 | 2608 | PA08 | Auto tuning mode | 2347 | 2647 | PB28 | Gain changing time constant |
| 2309 | 2609 | PA09 | Auto tuning response | 2348 | 2648 | PB29 | Gain changing ratio of load inertia moment to servo motor inertia moment |
| 2310 | 2610 | PA10 | In-position range | 2349 | 2649 | PB30 | Gain changing position loop gain |
| 2311 | 2611 | PA11 | For manufacturer setting | 2350 | 2650 | PB31 | Gain changing speed loop gain |
| 2312 | 2612 | PA12 | | 2351 | 2651 | PB32 | Gain changing speed integral compensation |
| 2313 | 2613 | PA13 | | 2352 | 2652 | PB33 | Gain changing vibration suppression control vibration frequency setting |
| 2314 | 2614 | PA14 | Rotation direction selection | 2353 | 2653 | PB34 | Gain changing vibration suppression control resonance frequency setting |
| 2315 | 2615 | PA15 | Encoder output pulse | 2354 | 2654 | PB35 | For manufacturer setting |
| 2316 | 2616 | PA16 | For manufacturer setting | 2355 | 2655 | PB36 | |
| 2317 | 2617 | PA17 | | 2356 | 2656 | PB37 | |
| 2318 | 2618 | PA18 | | 2357 | 2657 | PB38 | |
| 2319 | 2619 | PA19 | Parameter write inhibit | 2358 | 2658 | PB39 | |
| 2320 | 2620 | PB01 | Adaptive tuning mode (adaptive filter II) | 2359 | 2659 | PB40 | |
| 2321 | 2621 | PB02 | Vibration suppression control tuning mode (advanced vibration suppression control) | 2360 | 2660 | PB41 | |
| 2322 | 2622 | PB03 | For manufacturer setting | 2361 | 2661 | PB42 | |
| 2323 | 2623 | PB04 | Feed forward gain | 2362 | 2662 | PB43 | |
| 2324 | 2624 | PB05 | For manufacturer setting | 2363 | 2663 | PB44 | |
| 2325 | 2625 | PB06 | Ratio of load inertia moment to servo motor inertia moment | 2364 | 2664 | PB45 | Vibration suppression control filter 2 |
| 2326 | 2626 | PB07 | Model loop gain | 2365 | 2665 | PC01 | Error excessive alarm level |
| 2327 | 2627 | PB08 | Position loop gain | 2366 | 2666 | PC02 | Electromagnetic brake sequence output |
| 2328 | 2628 | PB09 | Speed loop gain | 2367 | 2667 | PC03 | Encoder output pulse selection |
| 2329 | 2629 | PB10 | Speed integral compensation | 2368 | 2668 | PC04 | Function selection C-1 |
| 2330 | 2630 | PB11 | Speed differential compensation | 2369 | 2669 | PC05 | Function selection C-2 |
| 2331 | 2631 | PB12 | Overshoot amount compensation | 2370 | 2670 | PC06 | Function selection C-3 |
| 2332 | 2632 | PB13 | Machine resonance suppression filter 1 | 2371 | 2671 | PC07 | Zero speed |
| 2333 | 2633 | PB14 | Notch shape selection 1 | 2372 | 2672 | PC08 | For manufacturer setting |
| 2334 | 2634 | PB15 | Machine resonance suppression filter 2 | 2373 | 2673 | PC09 | Analog monitor 1 output |
| 2335 | 2635 | PB16 | Notch shape selection 2 | 2374 | 2674 | PC10 | Analog monitor 2 output |
| 2336 | 2636 | PB17 | Automatic setting parameter | 2375 | 2675 | PC11 | Analog monitor 1 offset |
| 2337 | 2637 | PB18 | Low-pass filter setting | 2376 | 2676 | PC12 | Analog monitor 2 offset |
| 2338 | 2638 | PB19 | Vibration suppression control vibration frequency setting | 2377 | 2677 | PC13 | Analog monitor feedback position output standard data Low |
| 2339 | 2639 | PB20 | Vibration suppression control resonance frequency setting | 2378 | 2678 | PC14 | Analog monitor feedback position output standard data High |

(Note): The details are different when using the servo amplifiers with a large capacity. Refer to the "Servo amplifier Instruction Manual" for details.

APPENDICES

Table 1.5 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail (Continued)

| Error code | Parameter No. | Name | Error code | Parameter No. | Name | |
|------------|---------------|---|------------|---------------|--|--|
| 2377 | 2677 | PC13 | 2416 | 2716 | PD20 | |
| | | Analog monitor feedback position output standard data Low | | | Driver communication setting Master axis No. selection1 for slave | |
| 2378 | 2678 | PC14 | 2417 | 2717 | PD21 | |
| | | Analog monitor feedback position output standard data High | | | For manufacturer setting | |
| 2379 | 2679 | PC15 | 2418 | 2718 | | PD22 |
| | | For manufacturer setting | 2419 | 2719 | | PD23 |
| 2380 | 2680 | PC16 | 2420 | 2720 | | PD24 |
| | | Function selection C-3A | 2421 | 2721 | | PD25 |
| 2381 | 2681 | PC17 | 2422 | 2722 | | PD26 |
| | | Function selection C-4 | 2423 | 2723 | | PD27 |
| 2382 | 2682 | PC18 | 2424 | 2724 | | PD28 |
| | | For manufacturer setting | 2425 | 2725 | | PD29 |
| 2383 | 2683 | PC19 | | | | |
| | | Function selection C-7 | 2426 | 2726 | PD30 | |
| 2384 | 2684 | PC20 | | | Master-slave operation - Torque command coefficient on slave | |
| | | Alarm history clear | 2427 | 2727 | PD31 | |
| 2385 | 2685 | PC21 | | | Master-slave operation - Speed limit coefficient on slave | |
| | | For manufacturer setting | 2428 | 2728 | PD32 | |
| 2386 | 2686 | | PC22 | | | Master-slave operation - Speed limit adjustment value on slave |
| | | | | 2429 | 2729 | PE01 |
| 2387 | 2687 | | PC23 | 2430 | 2730 | PE02 |
| | | | | 2431 | 2731 | PE03 |
| 2388 | 2688 | | PC24 | 2432 | 2732 | PE04 |
| | | | | 2433 | 2733 | PE05 |
| 2389 | 2689 | | PC25 | 2434 | 2734 | PE06 |
| | | | | 2435 | 2735 | PE07 |
| 2390 | 2690 | | PC26 | 2436 | 2736 | PE08 |
| | | | | 2437 | 2737 | PE09 |
| 2391 | 2691 | | PC27 | 2438 | 2738 | PE10 |
| | | | | 2439 | 2739 | PE11 |
| 2392 | 2692 | | PC28 | 2440 | 2740 | PE12 |
| | | | | 2441 | 2741 | PE13 |
| 2393 | 2693 | | PC29 | 2442 | 2742 | PE14 |
| | | | | 2443 | 2743 | PE15 |
| 2394 | 2694 | | PC30 | 2444 | 2744 | PE16 |
| | | | 2445 | 2745 | PE17 | |
| 2395 | 2695 | PC31 | 2446 | 2746 | PE18 | |
| | | | 2447 | 2747 | PE19 | |
| 2396 | 2696 | PC32 | 2448 | 2748 | PE20 | |
| | | | 2449 | 2749 | PE21 | |
| 2397 | 2697 | PD01 | 2450 | 2750 | PE22 | |
| | | | | | For manufacturer setting | |
| 2398 | 2698 | PD02 | 2451 | 2751 | | PE23 |
| | | | | | | |
| 2399 | 2699 | PD03 | 2452 | 2752 | | PE24 |
| | | | | | | |
| 2400 | 2700 | PD04 | 2453 | 2753 | | PE25 |
| | | | | | | |
| 2401 | 2701 | PD05 | 2454 | 2754 | | PE26 |
| | | | | | | |
| 2402 | 2702 | PD06 | | | | |
| | | | | | | |
| 2403 | 2703 | PD07 | | | | |
| | | Output signal device selection 1 (CN3-13) | | | | |
| 2404 | 2704 | PD08 | | | | |
| | | Output signal device selection 2 (CN3-9) | | | | |
| 2405 | 2705 | PD09 | | | | |
| | | Output signal device selection 3 (CN3-15) | | | | |
| 2406 | 2706 | PD10 | | | | |
| | | For manufacturer setting | | | | |
| 2407 | 2707 | PD11 | | | | |
| | | Input filter setting | | | | |
| 2408 | 2708 | PD12 | | | | |
| | | For manufacturer setting | | | | |
| 2409 | 2709 | PD13 | | | | |
| | | For manufacturer setting | | | | |
| 2410 | 2710 | PD14 | | | | |
| | | Function selection D-3 | | | | |
| 2411 | 2711 | PD15 | | | | |
| | | Driver communication setting | | | | |
| 2412 | 2712 | PD16 | | | | |
| | | Driver communication setting Master transmit data selection1 | | | | |
| 2413 | 2713 | PD17 | | | | |
| | | Driver communication setting Master transmit data selection2 | | | | |
| 2414 | 2714 | PD18 | | | | |
| | | For manufacturer setting | | | | |
| 2415 | 2715 | PD19 | | | | |
| | | For manufacturer setting | | | | |
| | | | | | Filter coefficient 2-1 | |

(Note): The details are different when using the servo amplifiers with a large capacity. Refer to the "Servo amplifier Instruction Manual" for details.

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Table 1.5 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail (Continued)

| Error code | Parameter No. | Name | |
|------------|---------------|------|------------------------|
| 2455 | 2755 | PE27 | Filter coefficient 2-2 |
| 2456 | 2756 | PE28 | Filter coefficient 2-3 |
| 2457 | 2757 | PE29 | Filter coefficient 2-4 |
| 2458 | 2758 | PE30 | Filter coefficient 2-5 |
| 2459 | 2759 | PE31 | Filter coefficient 2-6 |
| 2460 | 2760 | PE32 | Filter coefficient 2-7 |
| 2461 | 2761 | PE33 | Filter coefficient 2-8 |

| Error code | Parameter No. | Name | |
|------------|---------------|------|--------------------------|
| 2462 | 2762 | PE34 | For manufacturer setting |
| 2463 | 2763 | PE35 | |
| 2464 | 2764 | PE36 | |
| 2465 | 2765 | PE37 | |
| 2466 | 2766 | PE38 | |
| 2467 | 2767 | PE39 | |
| 2468 | 2768 | PE40 | |

(Note): The details are different when using the servo amplifiers with a large capacity. Refer to the "Servo amplifier Instruction Manual" for details.

(c) MR-J3W-□B

Table 1.6 Servo error (2000 to 2999) list (MR-J3W-□B)

| Error code | Servo amplifier LED display | Name | Details name | Remarks |
|------------|-----------------------------|---------------------------------------|--|------------------------|
| 2010 | 10.1 | Undervoltage | Voltage drop in the control circuit power supply | |
| | 10.2 | | Voltage drop in the main circuit power | |
| 2011 | 11.1 | Switch setting error | Rotary switch setting error | |
| | 11.2 | | DIP switch setting error | |
| | 11.3 | | Servo motor selection switch setting error | |
| | 11.4 | | Servo motor selection switch setting error 2 | |
| 2012 | 12.1 | Memory error 1 (RAM) | CPU built-in RAM error | |
| | 12.2 | | CPU data RAM error | |
| | 12.3 | | Custom IC RAM error | |
| 2013 | 13.1 | Clock error | Clock error | |
| 2015 | 15.1 | Memory error 2 (EEP-ROM) | EEP-ROM error at power on | |
| | 15.2 | | EEP-ROM error during operation | |
| 2016 | 16.1 | Encoder initial communication error 1 | Encoder receive data error 1 | |
| | 16.2 | | Encoder receive data error 2 | |
| | 16.3 | | Encoder receive data error 3 | |
| | 16.5 | | Encoder transmission data error 1 | |
| | 16.6 | | Encoder transmission data error 2 | |
| | 16.7 | | Encoder transmission data error 3 | |
| 2017 | 17.1 | Board error | AD converter error | |
| | 17.2 | | Current feedback data error | |
| | 17.3 | | Custom IC error | |
| | 17.4 | | Amplifier detection signal error | |
| | 17.5 | | Rotary switch error | |
| | 17.6 | | DIP switch error | |
| 2019 | 19.1 | Memory error 3 (Flash ROM) | Flash-ROM error 1 | |
| | 19.2 | | Flash-ROM error 2 | |
| 2020 | 20.1 | Encoder normal communication error 1 | Encoder receive data error 1 | |
| | 20.2 | | Encoder receive data error 2 | |
| | 20.3 | | Encoder receive data error 3 | |
| | 20.5 | | Encoder transmission data error 1 | |
| | 20.6 | | Encoder transmission data error 2 | |
| | 20.7 | | Encoder transmission data error 3 | |
| 2021 | 21.1 | Encoder normal communication error 2 | Encoder data error | |
| | 21.2 | | Encoder data update error | |
| | 21.3 | | Encoder waveform error | Direct drive motor use |
| 2024 | 24.1 | Main circuit error | Ground fault detected at hardware detection circuit | |
| | 24.2 | | Ground fault detected at software detection function | |
| 2025 | 25.1 | Absolute position erase | Absolute position data erase | |

(Note-1): The name is different when using the linear servo motors. Refer to the "Servo amplifier Instruction Manual" for details.

(Note-2): The name is different when using the direct drive motors. Refer to the "Servo amplifier Instruction Manual" for details.

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Table 1.6 Servo error (2000 to 2999) list (MR-J3W-□B) (Continued)

| Error code | Servo amplifier LED display | Name | Details name | Remarks |
|------------|-----------------------------|---------------------------------------|---|---|
| 2027 | 27.1 | Initial magnetic pole detection error | Magnetic pole detection abnormal termination | Linear servo motor/ direct drive motor use |
| | 27.2 | | Magnetic pole detection time out error | |
| | 27.3 | | Magnetic pole detection limit switch error | |
| | 27.4 | | Magnetic pole detection estimated error | |
| | 27.5 | | Magnetic pole detection position deviation error | |
| | 27.6 | | Magnetic pole detection speed deviation error | |
| | 27.7 | | Magnetic pole detection current error | |
| 2028 | 28.1 | Linear encoder error 2 | Linear encoder environment error | Linear servo motor use |
| 2030 | 30.1 | Regenerative error | Regeneration heat error | |
| | 30.2 | | Regenerative transistor error | |
| | 30.3 | | Regenerative transistor feedback data error | |
| 2031 | 31.1 | Overspeed | Abnormal motor speed ^{(Note-1), (Note-2)} | |
| 2032 | 32.1 | Overcurrent | Overcurrent detected at hardware detection circuit (during operation). | |
| | 32.2 | | Overcurrent detected at software detection function (during operation). | |
| | 32.3 | | Overcurrent detected at hardware detection circuit (during a stop). | |
| | 32.4 | | Overcurrent detected at software detection function (during a stop). | |
| 2033 | 33.1 | Overvoltage | Main circuit voltage error | |
| 2034 | 34.1 | SSCNET receive error 1 | SSCNET receive data error | |
| | 34.2 | | SSCNET communication connector connection error | |
| | 34.3 | | Communication data error | |
| | 34.4 | | Hardware error signal detection | |
| 2035 | 35.1 | Command frequency error | Command frequency error | |
| 2036 | 36.1 | SSCNET receive error 2 | Continuous communication data error | |
| 2042 | 42.1 | Linear servo control error | Linear servo control error on the positioning detection | Linear servo motor use |
| | | Servo control error | Servo control error due to position deviation | Direct drive motor use |
| | 42.2 | Linear servo control error | Linear servo control error on the speed detection | Linear servo motor use |
| | | Servo control error | Servo control error due to speed deviation | Direct drive motor use |
| | 42.3 | Linear servo control error | Linear servo control error on the thrust detection | Linear servo motor use |
| | | Servo control error | Servo control error due to torque detection | Direct drive motor use |
| 2045 | 45.1 | Main circuit device overheat | Main circuit abnormal temperature | |
| | 45.2 | | Board temperature error | |

(Note-1): The name is different when using the linear servo motors. Refer to the "Servo amplifier Instruction Manual" for details.

(Note-2): The name is different when using the direct drive motors. Refer to the "Servo amplifier Instruction Manual" for details.

Table 1.6 Servo error (2000 to 2999) list (MR-J3W-□B) (Continued)

| Error code | Servo amplifier LED display | Name | Details name | Remarks |
|------------|-----------------------------|--|---|---|
| 2046 | 46.1 | Servo motor overheat ^(Note-2) | Abnormal temperature of servo motor | |
| | 46.2 | | Linear servo motor thermal sensor error | Linear servo motor use |
| | | | Direct drive motor thermal sensor error | Direct drive motor use |
| | 46.3 | | Thermistor wires are not connected error | Linear servo motor/ direct drive motor use |
| 2047 | 47.1 | Cooling fan error | Cooling fan stop error | |
| | 47.2 | | Decreased cooling fan speed error | |
| 2050 | 50.1 | Overload 1 | Thermal overload error 1 during operation | |
| | 50.2 | | Thermal overload error 2 during operation | |
| | 50.3 | | Thermal overload error 4 during operation | |
| | 50.4 | | Thermal overload error 1 during a stop | |
| | 50.5 | | Thermal overload error 2 during a stop | |
| | 50.6 | | Thermal overload error 4 during a stop | |
| 2051 | 51.1 | Overload 2 | Thermal overload error 3 during operation | |
| | 51.2 | | Thermal overload error 3 during a stop | |
| 2052 | 52.3 | Error excessive | Excess droop pulse ^{(Note-1), (Note-2)} | |
| | 52.4 | | Maximum deviation at 0 torque limit ^{(Note-1), (Note-2)} | |
| 2060 | 1A.1 | Motor combination error | Motor combination error | |
| 2061 | 2A.1 | Linear encoder error 1 | Linear encoder side error 1 | Linear servo motor use |
| | 2A.2 | | Linear encoder side error 2 | |
| | 2A.3 | | Linear encoder side error 3 | |
| | 2A.4 | | Linear encoder side error 4 | |
| | 2A.5 | | Linear encoder side error 5 | |
| | 2A.6 | | Linear encoder side error 6 | |
| | 2A.7 | | Linear encoder side error 7 | |
| | 2A.8 | | Linear encoder side error 8 | |
| 2063 | 1E.1 | Encoder initial communication error 2 | Encoder failure | |
| 2064 | 1F.1 | Encoder initial communication error 3 | Incompatible encoder | |
| 2088 | 888 | Watchdog | — | |
| 2101 | 91.1 | Main circuit device overheat warning | Main circuit device overheat warning | |
| | 91.2 | | Board temperature warning | |
| 2102 | 92.1 | Battery cable disconnection warning | Encoder battery disconnection warning signal detection | |
| 2106 | 96.1 | Home position setting warning | In-position error at home positioning | |
| | 96.2 | | Command input error at home positioning | |
| 2116 | 9F.1 | Battery warning | Low battery | |
| 2140 | E0.1 | Excessive regeneration warning | Excessive regeneration warning | |

(Note-1): The name is different when using the linear servo motors.
Refer to the "Servo amplifier Instruction Manual" for details.

(Note-2): The name is different when using the direct drive motors.
Refer to the "Servo amplifier Instruction Manual" for details.

Table 1.6 Servo error (2000 to 2999) list (MR-J3W-□B) (Continued)

| Error code | Servo amplifier LED display | Name | Details name | Remarks |
|--------------|-----------------------------|--|---|------------------------|
| 2141 | E1.1 | Overload warning 1 | Thermal overload warning 1 during operation | |
| | E1.2 | | Thermal overload warning 2 during operation | |
| | E1.3 | | Thermal overload warning 3 during operation | |
| | E1.4 | | Thermal overload warning 4 during operation | |
| | E1.5 | | Thermal overload warning 1 during a stop | |
| | E1.6 | | Thermal overload warning 2 during a stop | |
| | E1.7 | | Thermal overload warning 3 during a stop | |
| | E1.8 | | Thermal overload warning 4 during a stop | |
| 2142 | E2.1 | Linear servo motor overheat warning | Linear servo motor overheat warning | Linear servo motor use |
| | | Direct drive motor overheat warning | Direct drive motor overheat warning | Direct drive motor use |
| 2143 | E3.1 | Absolute position counter warning | The multi-revolution counter travel distance excess warning | |
| | E3.2 | | Absolute positioning counter error | |
| 2146 | E6.1 | Servo forced stop warning | Servo forced stop warning | |
| 2147 | E7.1 | Controller forced stop warning | Controller forced stop warning | |
| 2148 | E8.1 | Cooling fan speed reduction warning | Decreased cooling fan speed warning | |
| 2149 | E9.1 | Main circuit off warning | Ready-on signal on at main circuit off | |
| | E9.2 | | Bus voltage drop during low speed operation ^(Note-1) | |
| | E9.3 | | Servo-on signal on at main circuit off | |
| 2151 | EB.1 | The other axis fault warning | The other axis fault warning | |
| 2152 | EC.1 | Overload warning 2 | Overload warning 2 | |
| 2153 | ED.1 | Output watt excess warning | Output watt excess | |
| 2301 to 2599 | E4.1 | Parameter warning (Refer to the table 1.7) | Parameter setting range error warning | |
| 2601 to 2899 | 37.1 | Parameter error (Refer to the table 1.7) | Parameter setting range error | |
| | 37.2 | | Parameter combination error | |
| 2913 | 2B.1 | Encoder counter error | Encoder counter error 1 | Direct drive motor use |
| | 2B.2 | | Encoder counter error 2 | |
| 2948 | 8A.1 | USB communication time-out error | USB communication time-out error | |
| 2952 | 8E.1 | USB communication error | USB communication receive error | |
| | 8E.2 | | USB communication checksum error | |
| | 8E.3 | | USB communication character error | |
| | 8E.4 | | USB communication command error | |
| | 8E.5 | | USB communication data No. error | |

(Note-1): The name is different when using the linear servo motors. Refer to the "Servo amplifier Instruction Manual" for details.

(Note-2): The name is different when using the direct drive motors. Refer to the "Servo amplifier Instruction Manual" for details.

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Table 1.7 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail

| Error code | Parameter No. | Name | Error code | Parameter No. | Name | | |
|------------|---------------|------|--|---------------|------|------|--|
| 2301 | 2601 | PA01 | Control mode | 2340 | 2640 | PB21 | For manufacturer setting |
| 2302 | 2602 | PA02 | Regenerative option | 2341 | 2641 | PB22 | |
| 2303 | 2603 | PA03 | Absolute position detection system | 2342 | 2642 | PB23 | Low-pass filter selection |
| 2304 | 2604 | PA04 | Function selection A-1 | 2343 | 2643 | PB24 | Slight vibration suppression control selection |
| 2305 | 2605 | PA05 | For manufacturer setting | 2344 | 2644 | PB25 | For manufacturer setting |
| 2306 | 2606 | PA06 | | | | | |
| 2307 | 2607 | PA07 | | | | | |
| 2308 | 2608 | PA08 | Auto tuning mode | 2345 | 2645 | PB26 | Gain changing selection |
| 2309 | 2609 | PA09 | Auto tuning response | 2346 | 2646 | PB27 | Gain changing condition |
| 2310 | 2610 | PA10 | In-position range | 2347 | 2647 | PB28 | Gain changing time constant |
| 2311 | 2611 | PA11 | For manufacturer setting | 2348 | 2648 | PB29 | Gain changing ratio of load inertia moment to servo motor inertia moment |
| 2312 | 2612 | PA12 | | | | | |
| 2313 | 2613 | PA13 | | | | | |
| 2314 | 2614 | PA14 | Rotation direction selection | 2349 | 2649 | PB30 | Gain changing position loop gain |
| 2315 | 2615 | PA15 | Encoder output pulse | 2350 | 2650 | PB31 | Gain changing speed loop gain |
| 2316 | 2616 | PA16 | Encoder output pulse 2 | 2351 | 2651 | PB32 | Gain changing speed integral compensation |
| 2317 | 2617 | PA17 | For manufacturer setting | 2352 | 2652 | PB33 | Gain changing vibration suppression control vibration frequency setting |
| 2318 | 2618 | PA18 | | | | | |
| 2319 | 2619 | PA19 | Parameter write inhibit | 2353 | 2653 | PB34 | Gain changing vibration suppression control resonance frequency setting |
| 2320 | 2620 | PB01 | Adaptive tuning mode (adaptive filter II) | 2354 | 2654 | PB35 | For manufacturer setting |
| 2321 | 2621 | PB02 | Vibration suppression control tuning mode (advanced vibration suppression control) | 2355 | 2655 | PB36 | |
| 2322 | 2622 | PB03 | For manufacturer setting | 2356 | 2656 | PB37 | |
| 2323 | 2623 | PB04 | Feed forward gain | 2357 | 2657 | PB38 | |
| 2324 | 2624 | PB05 | For manufacturer setting | 2358 | 2658 | PB39 | |
| 2325 | 2625 | PB06 | Ratio of load inertia moment to servo motor inertia moment | 2359 | 2659 | PB40 | |
| 2326 | 2626 | PB07 | Model loop gain | 2360 | 2660 | PB41 | |
| 2327 | 2627 | PB08 | Position loop gain | 2361 | 2661 | PB42 | |
| 2328 | 2628 | PB09 | Speed loop gain | 2362 | 2662 | PB43 | |
| 2329 | 2629 | PB10 | Speed integral compensation | 2363 | 2663 | PB44 | |
| 2330 | 2630 | PB11 | Speed differential compensation | 2364 | 2664 | PB45 | |
| 2331 | 2631 | PB12 | For manufacturer setting | 2365 | 2665 | PC01 | Error excessive alarm level |
| 2332 | 2632 | PB13 | Machine resonance suppression filter 1 | 2366 | 2666 | PC02 | Electromagnetic brake sequence output |
| 2333 | 2633 | PB14 | Notch shape selection 1 | 2367 | 2667 | PC03 | Encoder output pulse selection |
| 2334 | 2634 | PB15 | Machine resonance suppression filter 2 | 2368 | 2668 | PC04 | Function selection C-1 |
| 2335 | 2635 | PB16 | Notch shape selection 2 | 2369 | 2669 | PC05 | Function selection C-2 |
| 2336 | 2636 | PB17 | Automatic setting parameter | 2370 | 2670 | PC06 | Function selection C-3 |
| 2337 | 2637 | PB18 | Low-pass filter setting | 2371 | 2671 | PC07 | Zero speed |
| 2338 | 2638 | PB19 | Vibration suppression control vibration frequency setting | 2372 | 2672 | PC08 | For manufacturer setting |
| 2339 | 2639 | PB20 | Vibration suppression control resonance frequency setting | 2373 | 2673 | PC09 | Analog monitor 1 output |
| | | | | 2374 | 2674 | PC10 | Analog monitor 2 output |
| | | | | 2375 | 2675 | PC11 | Analog monitor 1 offset |
| | | | | 2376 | 2676 | PC12 | Analog monitor 2 offset |
| | | | | 2377 | 2677 | PC13 | For manufacturer setting |
| | | | | 2378 | 2678 | PC14 | |

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Table 1.7 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail (Continued)

| Error code | Parameter No. | Name | Error code | Parameter No. | Name | | |
|------------|---------------|------|--------------------------|---------------------|------|--|------|
| 2379 | 2679 | PC15 | Station number selection | 2412 | 2712 | PD16 | |
| 2380 | 2680 | PC16 | For manufacturer setting | 2413 | 2713 | PD17 | |
| 2381 | 2681 | PC17 | Function selection C-4 | 2414 | 2714 | PD18 | |
| 2382 | 2682 | PC18 | For manufacturer setting | 2415 | 2715 | PD19 | |
| 2383 | 2683 | PC19 | | 2416 | 2716 | PD20 | |
| 2384 | 2684 | PC20 | For manufacturer setting | 2417 | 2717 | PD21 | |
| 2385 | 2685 | PC21 | | Alarm history clear | 2418 | 2718 | PD22 |
| 2386 | 2686 | PC22 | | 2419 | 2719 | PD23 | |
| 2387 | 2687 | PC23 | | 2420 | 2720 | PD24 | |
| 2388 | 2688 | PC24 | | 2421 | 2721 | PD25 | |
| 2389 | 2689 | PC25 | | 2422 | 2722 | PD26 | |
| 2390 | 2690 | PC26 | | 2423 | 2723 | PD27 | |
| 2391 | 2691 | PC27 | | 2424 | 2724 | PD28 | |
| 2392 | 2692 | PC28 | | 2425 | 2725 | PD29 | |
| 2393 | 2693 | PC29 | | 2426 | 2726 | PD30 | |
| 2394 | 2694 | PC30 | | 2427 | 2727 | PD31 | |
| 2395 | 2695 | PC31 | | 2428 | 2728 | PD32 | |
| 2396 | 2696 | PC32 | 2485 | 2785 | Po01 | Function selection O-1 | |
| 2397 | 2697 | PD01 | 2486 | 2786 | Po02 | Axis selection for graphing analog data (MR Configurator) | |
| 2398 | 2698 | PD02 | 2487 | 2787 | Po03 | Axis selection for graphing digital data (MR Configurator) | |
| 2399 | 2699 | PD03 | 2488 | 2788 | Po04 | Function selection O-2 | |
| 2400 | 2700 | PD04 | 2489 | 2789 | Po05 | For manufacturer setting | |
| 2401 | 2701 | PD05 | 2490 | 2790 | Po06 | | |
| 2402 | 2702 | PD06 | 2491 | 2791 | Po07 | | |
| 2403 | 2703 | PD07 | 2492 | 2792 | Po08 | | |
| 2404 | 2704 | PD08 | 2493 | 2793 | Po09 | | |
| 2405 | 2705 | PD09 | 2494 | 2794 | Po10 | | |
| 2406 | 2706 | PD10 | 2495 | 2795 | Po11 | | |
| 2407 | 2707 | PD11 | 2496 | 2796 | Po12 | | |
| 2408 | 2708 | PD12 | 2497 | 2797 | Po13 | | |
| 2409 | 2709 | PD13 | 2498 | 2798 | Po14 | | |
| 2410 | 2710 | PD14 | 2499 | 2799 | Po15 | | |
| 2411 | 2711 | PD15 | 2500 | 2800 | Po16 | | |

(d) MR-J3-□B-RJ004 (For linear servo)

Table 1.8 Servo error (2000 to 2999) list (MR-J3-□B-RJ004)

| Error code | Servo amplifier LED display | Name | Remarks |
|--------------|-----------------------------|--|---------|
| 2010 | 10 | Undervoltage | |
| 2012 | 12 | Memory error 1 (RAM) | |
| 2013 | 13 | Clock error | |
| 2015 | 15 | Memory error 2 (EEP-ROM) | |
| 2016 | 16 | Encoder error 1 (At power on) | |
| 2017 | 17 | Board error | |
| 2019 | 19 | Memory error 3 (Flash ROM) | |
| 2020 | 20 | Encoder error 2 | |
| 2021 | 21 | Encoder error 3 | |
| 2024 | 24 | Main circuit error | |
| 2027 | 27 | Initial magnetic pole detection error | |
| 2028 | 28 | Linear encoder error 2 | |
| 2030 | 30 | Regenerative error | |
| 2031 | 31 | Overspeed | |
| 2032 | 32 | Overcurrent | |
| 2033 | 33 | Overvoltage | |
| 2034 | 34 | Receive error 1 | |
| 2035 | 35 | Command frequency alarm | |
| 2036 | 36 | Receive error 2 | |
| 2042 | 42 | Linear servo control error | |
| 2045 | 45 | Main circuit device overheat | |
| 2046 | 46 | Linear servo motor overheat | |
| 2047 | 47 | Cooling fan alarm | |
| 2050 | 50 | Overload 1 | |
| 2051 | 51 | Overload 2 | |
| 2052 | 52 | Error excessive | |
| 2061 | 2A | Linear encoder error 1 | |
| 2088 | 888 | Watchdog | |
| 2106 | 96 | Home position setting error | |
| 2140 | E0 | Excessive regeneration warning | |
| 2141 | E1 | Overload warning 1 | |
| 2142 | E2 | Linear servo motor overheat warning | |
| 2146 | E6 | Servo forced stop warning | |
| 2147 | E7 | Controller emergency stop warning | |
| 2148 | E8 | Cooling fan speed reduction warning | |
| 2149 | E9 | Main circuit off warning | |
| 2152 | EC | Overload warning 2 | |
| 2153 | ED | Output watt excess warning | |
| 2301 to 2599 | E4 | Parameter warning (Refer to the table 1.9) | |
| 2601 to 2899 | 37 | Parameter error (Refer to the table 1.9) | |
| 2948 | 8A | USB communication time-out error | |
| 2952 | 8E | USB communication error | |

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Table 1.9 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail

| Error code | Parameter No. | Name | Error code | Parameter No. | Name | | |
|------------|---------------|------|--|---------------|------|------|---|
| 2301 | 2601 | PA01 | For manufacturer setting | 2341 | 2641 | PB22 | For manufacturer setting |
| 2302 | 2602 | PA02 | Regenerative option | 2342 | 2642 | PB23 | Low-pass filter selection |
| 2303 | 2603 | PA03 | Absolute position detection system | 2343 | 2643 | PB24 | Slight vibration suppression control selection |
| 2304 | 2604 | PA04 | Function selection A-1 | 2344 | 2644 | PB25 | For manufacturer setting |
| 2305 | 2605 | PA05 | For manufacturer setting | 2345 | 2645 | PB26 | Gain changing selection |
| 2306 | 2606 | PA06 | | 2346 | 2646 | PB27 | Gain changing condition |
| 2307 | 2607 | PA07 | | 2347 | 2647 | PB28 | Gain changing time constant |
| 2308 | 2608 | PA08 | Auto tuning mode | 2348 | 2648 | PB29 | Gain load mass ratio to the linear servo motor primary side (coil) |
| 2309 | 2609 | PA09 | Auto tuning response | 2349 | 2649 | PB30 | Gain changing position loop gain |
| 2310 | 2610 | PA10 | In-position range | 2350 | 2650 | PB31 | Gain changing speed loop gain |
| 2311 | 2611 | PA11 | For manufacturer setting | 2351 | 2651 | PB32 | Gain changing speed integral compensation |
| 2312 | 2612 | PA12 | | 2352 | 2652 | PB33 | Gain changing vibration suppression control vibration frequency setting |
| 2313 | 2613 | PA13 | | 2353 | 2653 | PB34 | Gain changing vibration suppression control resonance frequency setting |
| 2314 | 2614 | PA14 | Moving direction selection | 2354 | 2654 | PB35 | For manufacturer setting |
| 2315 | 2615 | PA15 | Encoder output pulse | 2355 | 2655 | PB36 | |
| 2316 | 2616 | PA16 | Encoder output pulse 2 | 2356 | 2656 | PB37 | |
| 2317 | 2617 | PA17 | For manufacturer setting | 2357 | 2657 | PB38 | |
| 2318 | 2618 | PA18 | | 2358 | 2658 | PB39 | |
| 2319 | 2619 | PA19 | Parameter write inhibit | 2359 | 2659 | PB40 | |
| 2320 | 2620 | PB01 | Adaptive tuning mode (adaptive filter II) | 2360 | 2660 | PB41 | |
| 2321 | 2621 | PB02 | Vibration suppression control tuning mode (advanced vibration suppression control) | 2361 | 2661 | PB42 | |
| 2322 | 2622 | PB03 | For manufacturer setting | 2362 | 2662 | PB43 | |
| 2323 | 2623 | PB04 | Feed forward gain | 2363 | 2663 | PB44 | |
| 2324 | 2624 | PB05 | For manufacturer setting | 2364 | 2664 | PB45 | Vibration suppression control filter 2 |
| 2325 | 2625 | PB06 | Load mass ratio to the linear servo motor primary side (coil) | 2365 | 2665 | PC01 | Error excessive alarm level |
| 2326 | 2626 | PB07 | Model loop gain | 2366 | 2666 | PC02 | Electromagnetic brake sequence output |
| 2327 | 2627 | PB08 | Position loop gain | 2367 | 2667 | PC03 | Encoder output pulse selection |
| 2328 | 2628 | PB09 | Speed loop gain | 2368 | 2668 | PC04 | For manufacturer setting |
| 2329 | 2629 | PB10 | Speed integral compensation | 2369 | 2669 | PC05 | |
| 2330 | 2630 | PB11 | Speed differential compensation | 2370 | 2670 | PC06 | |
| 2331 | 2631 | PB12 | For manufacturer setting | 2371 | 2671 | PC07 | Zero speed |
| 2332 | 2632 | PB13 | Machine resonance suppression filter 1 | 2372 | 2672 | PC08 | For manufacturer setting |
| 2333 | 2633 | PB14 | Notch form selection 1 | 2373 | 2673 | PC09 | Analog monitor 1 output |
| 2334 | 2634 | PB15 | Machine resonance suppression filter 2 | 2374 | 2674 | PC10 | Analog monitor 2 output |
| 2335 | 2635 | PB16 | Notch form selection 2 | 2375 | 2675 | PC11 | Analog monitor 1 offset |
| 2336 | 2636 | PB17 | Automatic setting parameter | 2376 | 2676 | PC12 | Analog monitor 2 offset |
| 2337 | 2637 | PB18 | Low-pass filter setting | 2377 | 2677 | PC13 | For manufacturer setting |
| 2338 | 2638 | PB19 | Vibration suppression control vibration frequency setting | 2378 | 2678 | PC14 | |
| 2339 | 2639 | PB20 | Vibration suppression control resonance frequency setting | 2379 | 2679 | PC15 | |
| 2340 | 2640 | PB21 | For manufacturer setting | 2380 | 2680 | PC16 | |

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Table 1.9 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail (Continued)

| Error code | Parameter No. | Name | Error code | Parameter No. | Name | |
|------------|---------------|------|---|-------------------------------------|--|------|
| 2381 | 2681 | PC17 | Function selection C-4 | 2427 | 2727 | PD31 |
| 2382 | 2682 | PC18 | For manufacturer setting | 2428 | 2728 | PD32 |
| 2383 | 2683 | PC19 | | 2429 | 2729 | PE01 |
| 2384 | 2684 | PC20 | | 2430 | 2730 | PE02 |
| 2385 | 2685 | PC21 | Alarm history clear | 2431 | 2731 | PE03 |
| 2386 | 2686 | PC22 | For manufacturer setting | 2432 | 2732 | PE04 |
| 2387 | 2687 | PC23 | | 2433 | 2733 | PE05 |
| 2388 | 2688 | PC24 | | 2434 | 2734 | PE06 |
| 2389 | 2689 | PC25 | | 2435 | 2735 | PE07 |
| 2390 | 2690 | PC26 | Function selection C-8 | 2436 | 2736 | PE08 |
| 2391 | 2691 | PC27 | Function selection C-9 | 2437 | 2737 | PE09 |
| 2392 | 2692 | PC28 | For manufacturer setting | 2438 | 2738 | PE10 |
| 2393 | 2693 | PC29 | | 2439 | 2739 | PE11 |
| 2394 | 2694 | PC30 | | 2440 | 2740 | PE12 |
| 2395 | 2695 | PC31 | | 2441 | 2741 | PE13 |
| 2396 | 2696 | PC32 | | 2442 | 2742 | PE14 |
| 2397 | 2697 | PD01 | | 2443 | 2743 | PE15 |
| 2398 | 2698 | PD02 | | Input signal automatic ON selection | 2444 | 2744 |
| 2399 | 2699 | PD03 | For manufacturer setting | 2445 | 2745 | PE17 |
| 2400 | 2700 | PD04 | | 2446 | 2746 | PE18 |
| 2401 | 2701 | PD05 | | 2447 | 2747 | PE19 |
| 2402 | 2702 | PD06 | | 2448 | 2748 | PE20 |
| 2403 | 2703 | PD07 | Output signal device selection 1 (CN3-13) | 2449 | 2749 | PE21 |
| 2404 | 2704 | PD08 | Output signal device selection 2 (CN3-9) | 2450 | 2750 | PE22 |
| 2405 | 2705 | PD09 | Output signal device selection 3 (CN3-15) | 2451 | 2751 | PE23 |
| 2406 | 2706 | PD10 | For manufacturer setting | 2452 | 2752 | PE24 |
| 2407 | 2707 | PD11 | Input filter setting | 2453 | 2753 | PE25 |
| 2408 | 2708 | PD12 | For manufacturer setting | 2454 | 2754 | PE26 |
| 2409 | 2709 | PD13 | | 2455 | 2755 | PE27 |
| 2410 | 2710 | PD14 | Function selection D-3 | 2456 | 2756 | PE28 |
| 2411 | 2711 | PD15 | For manufacturer setting | 2457 | 2757 | PE29 |
| 2412 | 2712 | PD16 | | 2458 | 2758 | PE30 |
| 2413 | 2713 | PD17 | | 2459 | 2759 | PE31 |
| 2414 | 2714 | PD18 | | 2460 | 2760 | PE32 |
| 2415 | 2715 | PD19 | | 2461 | 2761 | PE33 |
| 2416 | 2716 | PD20 | | 2462 | 2762 | PE34 |
| 2417 | 2717 | PD21 | | 2463 | 2763 | PE35 |
| 2418 | 2718 | PD22 | | 2464 | 2764 | PE36 |
| 2419 | 2719 | PD23 | | 2465 | 2765 | PE37 |
| 2420 | 2720 | PD24 | | 2466 | 2766 | PE38 |
| 2421 | 2721 | PD25 | | 2467 | 2767 | PE39 |
| 2422 | 2722 | PD26 | | 2468 | 2768 | PE40 |
| 2423 | 2723 | PD27 | | 2501 | 2801 | PS01 |
| 2424 | 2724 | PD28 | | 2502 | 2802 | PS02 |
| 2425 | 2725 | PD29 | 2503 | 2803 | PS03 | |
| 2426 | 2726 | PD30 | 2504 | 2804 | PS04 | |
| | | | | | Linear function selection 1 | |
| | | | | | Linear encoder resolution setting Numerator | |
| | | | | | Linear encoder resolution setting Denominator | |
| | | | | | Linear function selection 2 | |

APPENDICES

Table 1.9 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail (Continued)

| Error code | | Parameter No. | Name | Error code | | Parameter No. | Name |
|------------|------|---------------|--|------------|------|---------------|--------------------------|
| 2505 | 2805 | PS05 | Linear servo motor control position deviation error detection level | 2519 | 2819 | PS19 | For manufacturer setting |
| 2506 | 2806 | PS06 | Linear servo motor control speed deviation error detection level | 2520 | 2820 | PS20 | |
| 2507 | 2807 | PS07 | Linear servo motor control thrust deviation error detection level | 2521 | 2821 | PS21 | |
| 2508 | 2808 | PS08 | Linear function selection 3 | 2522 | 2822 | PS22 | |
| 2509 | 2809 | PS09 | Magnetic pole detection voltage level | 2523 | 2823 | PS23 | |
| 2510 | 2810 | PS10 | At magnetic pole detection current detection method Identification signal frequency | 2524 | 2824 | PS24 | |
| 2511 | 2811 | PS11 | At magnetic pole detection current detection method Identification signal amplitude | 2525 | 2825 | PS25 | |
| 2512 | 2812 | PS12 | For manufacturer setting | 2526 | 2826 | PS26 | |
| 2513 | 2813 | PS13 | | 2527 | 2827 | PS27 | |
| 2514 | 2814 | PS14 | | 2528 | 2828 | PS28 | |
| 2515 | 2815 | PS15 | | 2529 | 2829 | PS29 | |
| 2516 | 2816 | PS16 | | 2530 | 2830 | PS30 | |
| 2517 | 2817 | PS17 | | 2531 | 2831 | PS31 | |
| 2518 | 2818 | PS18 | | 2532 | 2832 | PS32 | |

(e) MR-J3-□B-RJ006 (For fully closed control)

Table 1.10 Servo error (2000 to 2999) list (MR-J3-□B-RJ006)

| Error code | Servo amplifier LED display | Name | Remarks |
|--------------|-----------------------------|---|---------|
| 2010 | 10 | Undervoltage | |
| 2012 | 12 | Memory error 1 (RAM) | |
| 2013 | 13 | Clock error | |
| 2015 | 15 | Memory error 2 (EEP-ROM) | |
| 2016 | 16 | Encoder error 1 (At power on) | |
| 2017 | 17 | Board error | |
| 2019 | 19 | Memory error 3 (Flash ROM) | |
| 2020 | 20 | Encoder error 2 (During runtime) | |
| 2021 | 21 | Encoder error 3 (During runtime) | |
| 2024 | 24 | Main circuit error | |
| 2028 | 28 | Linear encoder error 2 | |
| 2030 | 30 | Regenerative error | |
| 2031 | 31 | Overspeed | |
| 2032 | 32 | Overcurrent | |
| 2033 | 33 | Overvoltage | |
| 2034 | 34 | Receive error 1 | |
| 2035 | 35 | Command frequency alarm | |
| 2036 | 36 | Receive error 2 | |
| 2042 | 42 | Fully closed control error detection | |
| 2045 | 45 | Main circuit device overheat | |
| 2046 | 46 | Servo motor overheat | |
| 2047 | 47 | Cooling fan alarm | |
| 2050 | 50 | Overload 1 | |
| 2051 | 51 | Overload 2 | |
| 2052 | 52 | Error excessive | |
| 2060 | 1A | Motor combination error | |
| 2061 | 2A | Linear encoder error 1 | |
| 2070 | 70 | Load side encoder error 1 | |
| 2071 | 71 | Load side encoder error 2 | |
| 2088 | 888 | Watchdog | |
| 2106 | 96 | Home position setting error | |
| 2140 | E0 | Excessive regeneration warning | |
| 2141 | E1 | Overload warning 1 | |
| 2146 | E6 | Servo forced stop warning | |
| 2147 | E7 | Controller emergency stop warning | |
| 2148 | E8 | Cooling fan speed reduction warning | |
| 2149 | E9 | Main circuit off warning | |
| 2152 | EC | Overload warning 2 | |
| 2153 | ED | Output watt excess warning | |
| 2301 to 2599 | E4 | Parameter warning (Refer to the table 1.11) | |
| 2601 to 2899 | 37 | Parameter error (Refer to the table 1.11) | |
| 2948 | 8A | USB communication time-out error | |
| 2952 | 8E | USB communication error | |

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Table 1.11 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail

| Error code | Parameter No. | Name | Error code | Parameter No. | Name | | |
|------------|---------------|------|--|---------------|------|------|--|
| 2301 | 2601 | PA01 | Control mode | 2341 | 2641 | PB22 | For manufacturer setting |
| 2302 | 2602 | PA02 | Regenerative option | 2342 | 2642 | PB23 | Low-pass filter selection |
| 2303 | 2603 | PA03 | Absolute position detection system | 2343 | 2643 | PB24 | Slight vibration suppression control selection |
| 2304 | 2604 | PA04 | Function selection A-1 | 2344 | 2644 | PB25 | For manufacturer setting |
| 2305 | 2605 | PA05 | For manufacturer setting | 2345 | 2645 | PB26 | Gain changing selection |
| 2306 | 2606 | PA06 | | 2346 | 2646 | PB27 | Gain changing condition |
| 2307 | 2607 | PA07 | | 2347 | 2647 | PB28 | Gain changing time constant |
| 2308 | 2608 | PA08 | Auto tuning mode | 2348 | 2648 | PB29 | Gain changing ratio of load inertia moment to servo motor inertia moment |
| 2309 | 2609 | PA09 | Auto tuning response | 2349 | 2649 | PB30 | Gain changing position loop gain |
| 2310 | 2610 | PA10 | In-position range | 2350 | 2650 | PB31 | Gain changing speed loop gain |
| 2311 | 2611 | PA11 | For manufacturer setting | 2351 | 2651 | PB32 | Gain changing speed integral compensation |
| 2312 | 2612 | PA12 | | 2352 | 2652 | PB33 | Gain changing vibration suppression control vibration frequency setting |
| 2313 | 2613 | PA13 | | 2353 | 2653 | PB34 | Gain changing vibration suppression control resonance frequency setting |
| 2314 | 2614 | PA14 | Rotation direction selection | 2354 | 2654 | PB35 | For manufacturer setting |
| 2315 | 2615 | PA15 | Encoder output pulse | 2355 | 2655 | PB36 | |
| 2316 | 2616 | PA16 | Encoder output pulse 2 | 2356 | 2656 | PB37 | |
| 2317 | 2617 | PA17 | For manufacturer setting | 2357 | 2657 | PB38 | |
| 2318 | 2618 | PA18 | | 2358 | 2658 | PB39 | |
| 2319 | 2619 | PA19 | Parameter write inhibit | 2359 | 2659 | PB40 | |
| 2320 | 2620 | PB01 | Adaptive tuning mode (adaptive filter II) | 2360 | 2660 | PB41 | |
| 2321 | 2621 | PB02 | Vibration suppression control tuning mode (advanced vibration suppression control) | 2361 | 2661 | PB42 | |
| 2322 | 2622 | PB03 | For manufacturer setting | 2362 | 2662 | PB43 | |
| 2323 | 2623 | PB04 | Feed forward gain | 2363 | 2663 | PB44 | |
| 2324 | 2624 | PB05 | For manufacturer setting | 2364 | 2664 | PB45 | Vibration suppression control filter 2 |
| 2325 | 2625 | PB06 | Ratio of load inertia moment to servo motor inertia moment | 2365 | 2665 | PC01 | Error excessive alarm level |
| 2326 | 2626 | PB07 | Model loop gain | 2366 | 2666 | PC02 | Electromagnetic brake sequence output |
| 2327 | 2627 | PB08 | Position loop gain | 2367 | 2667 | PC03 | Encoder output pulse selection |
| 2328 | 2628 | PB09 | Speed loop gain | 2368 | 2668 | PC04 | Function selection C-1 |
| 2329 | 2629 | PB10 | Speed integral compensation | 2369 | 2669 | PC05 | Function selection C-2 |
| 2330 | 2630 | PB11 | Speed differential compensation | 2370 | 2670 | PC06 | Function selection C-3 |
| 2331 | 2631 | PB12 | Overshoot amount compensation | 2371 | 2671 | PC07 | Zero speed |
| 2332 | 2632 | PB13 | Machine resonance suppression filter 1 | 2372 | 2672 | PC08 | For manufacturer setting |
| 2333 | 2633 | PB14 | Notch shape selection 1 | 2373 | 2673 | PC09 | Analog monitor 1 output |
| 2334 | 2634 | PB15 | Machine resonance suppression filter 2 | 2374 | 2674 | PC10 | Analog monitor 2 output |
| 2335 | 2635 | PB16 | Notch shape selection 2 | 2375 | 2675 | PC11 | Analog monitor 1 offset |
| 2336 | 2636 | PB17 | Automatic setting parameter | 2376 | 2676 | PC12 | Analog monitor 2 offset |
| 2337 | 2637 | PB18 | Low-pass filter setting | 2377 | 2677 | PC13 | For manufacturer setting |
| 2338 | 2638 | PB19 | Vibration suppression control vibration frequency setting | 2378 | 2678 | PC14 | |
| 2339 | 2639 | PB20 | Vibration suppression control resonance frequency setting | 2379 | 2679 | PC15 | |
| 2340 | 2640 | PB21 | For manufacturer setting | 2380 | 2680 | PC16 | Function selection C-3A |

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Table 1.11 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail (Continued)

| Error code | | Parameter No. | Name | Error code | | Parameter No. | Name |
|------------|------|---------------|--|------------|------|---------------|--------------------------|
| 2463 | 2763 | PE35 | Fully closed loop feedback pulse electronic gear 2 denominator | 2466 | 2766 | PE38 | For manufacturer setting |
| 2464 | 2764 | PE36 | For manufacturer setting | 2467 | 2767 | PE39 | |
| 2465 | 2765 | PE37 | | 2468 | 2768 | PE40 | |

(f) MR-J3-□B-RJ080W (For direct drive motor)

Table 1.12 Servo error (2000 to 2999) list (MR-J3-□B-RJ080W)

| Error code | Servo amplifier LED display | Name | Remarks |
|--------------|-----------------------------|---|---------|
| 2010 | 10 | Undervoltage | |
| 2012 | 12 | Memory error 1 (RAM) | |
| 2013 | 13 | Clock error | |
| 2015 | 15 | Memory error 2 (EEP-ROM) | |
| 2016 | 16 | Encoder error 1 | |
| 2017 | 17 | Board error | |
| 2019 | 19 | Memory error 3 (Flash ROM) | |
| 2020 | 20 | Encoder error 2 | |
| 2021 | 21 | Encoder error 3 | |
| 2024 | 24 | Main circuit error | |
| 2025 | 25 | Absolute position erase | |
| 2027 | 27 | Initial magnetic pole detection error | |
| 2030 | 30 | Regenerative error | |
| 2031 | 31 | Overspeed | |
| 2032 | 32 | Overcurrent | |
| 2033 | 33 | Overvoltage | |
| 2034 | 34 | Receive error 1 | |
| 2035 | 35 | Command frequency alarm | |
| 2036 | 36 | Receive error 2 | |
| 2042 | 42 | Servo control error | |
| 2045 | 45 | Main circuit device overheat | |
| 2046 | 46 | Direct drive motor overheat | |
| 2047 | 47 | Cooling fan alarm | |
| 2050 | 50 | Overload 1 | |
| 2051 | 51 | Overload 2 | |
| 2052 | 52 | Error excessive | |
| 2060 | 1A | Motor combination error | |
| 2064 | 1F | Encoder combination error | |
| 2088 | 888 | Watchdog | |
| 2102 | 92 | Battery cable disconnection warning | |
| 2106 | 96 | Home position setting error | |
| 2116 | 9F | Battery warning | |
| 2140 | E0 | Excessive regeneration warning | |
| 2141 | E1 | Overload warning 1 | |
| 2142 | E2 | Direct drive motor overheat warning | |
| 2143 | E3 | Absolute position counter warning | |
| 2146 | E6 | Servo forced stop warning | |
| 2147 | E7 | Controller emergency stop warning | |
| 2148 | E8 | Cooling fan speed reduction warning | |
| 2149 | E9 | Main circuit off warning | |
| 2152 | EC | Overload warning 2 | |
| 2153 | ED | Output watt excess warning | |
| 2301 to 2599 | E4 | Parameter warning (Refer to the table 1.13) | |
| 2601 to 2899 | 37 | Parameter error (Refer to the table 1.13) | |
| 2913 | 2B | Encoder counter error | |
| 2948 | 8A | USB communication time-out error | |
| 2952 | 8E | USB communication error | |

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Table 1.13 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail

| Error code | Parameter No. | Name | Error code | Parameter No. | Name | | |
|------------|---------------|------|--|---------------|------|------|---|
| 2301 | 2601 | PA01 | For manufacturer setting | 2340 | 2640 | PB21 | For manufacturer setting |
| 2302 | 2602 | PA02 | Regenerative option | 2341 | 2641 | PB22 | |
| 2303 | 2603 | PA03 | Absolute position detection system | 2342 | 2642 | PB23 | Low-pass filter selection |
| 2304 | 2604 | PA04 | Function selection A-1 | 2343 | 2643 | PB24 | Slight vibration suppression control selection |
| 2305 | 2605 | PA05 | For manufacturer setting | 2344 | 2644 | PB25 | For manufacturer setting |
| 2306 | 2606 | PA06 | | | | | |
| 2307 | 2607 | PA07 | | | | | |
| 2308 | 2608 | PA08 | Auto tuning mode | 2346 | 2646 | PB27 | Gain changing condition |
| 2309 | 2609 | PA09 | Auto tuning response | 2347 | 2647 | PB28 | Gain changing time constant |
| 2310 | 2610 | PA10 | In-position range | 2348 | 2648 | PB29 | Gain changing ratio of load inertia moment to direct drive motor inertia moment |
| 2311 | 2611 | PA11 | For manufacturer setting | 2349 | 2649 | PB30 | Gain changing position loop gain |
| 2312 | 2612 | PA12 | | | | | |
| 2313 | 2613 | PA13 | | | | | |
| 2314 | 2614 | PA14 | Rotation direction selection | 2350 | 2650 | PB31 | Gain changing speed loop gain |
| 2315 | 2615 | PA15 | Encoder output pulse | 2351 | 2651 | PB32 | Gain changing speed integral compensation |
| 2316 | 2616 | PA16 | For manufacturer setting | 2352 | 2652 | PB33 | Gain changing vibration suppression control vibration frequency setting |
| 2317 | 2617 | PA17 | | | | | |
| 2318 | 2618 | PA18 | | | | | |
| 2319 | 2619 | PA19 | Parameter write inhibit | 2353 | 2653 | PB34 | Gain changing vibration suppression control resonance frequency setting |
| 2320 | 2620 | PB01 | Adaptive tuning mode (adaptive filter II) | 2354 | 2654 | PB35 | For manufacturer setting |
| 2321 | 2621 | PB02 | Vibration suppression control tuning mode (advanced vibration suppression control) | 2355 | 2655 | PB36 | |
| 2322 | 2622 | PB03 | For manufacturer setting | 2356 | 2656 | PB37 | |
| 2323 | 2623 | PB04 | Feed forward gain | 2357 | 2657 | PB38 | |
| 2324 | 2624 | PB05 | For manufacturer setting | 2358 | 2658 | PB39 | |
| 2325 | 2625 | PB06 | Ratio of load inertia moment to direct drive motor inertia moment | 2359 | 2659 | PB40 | |
| 2326 | 2626 | PB07 | Model loop gain | 2360 | 2660 | PB41 | |
| 2327 | 2627 | PB08 | Position loop gain | 2361 | 2661 | PB42 | |
| 2328 | 2628 | PB09 | Speed loop gain | 2362 | 2662 | PB43 | |
| 2329 | 2629 | PB10 | Speed integral compensation | 2363 | 2663 | PB44 | |
| 2330 | 2630 | PB11 | Speed differential compensation | 2364 | 2664 | PB45 | Vibration suppression control filter 2 |
| 2331 | 2631 | PB12 | For manufacturer setting | 2365 | 2665 | PC01 | Error excessive alarm level |
| 2332 | 2632 | PB13 | Machine resonance suppression filter 1 | 2366 | 2666 | PC02 | Electromagnetic brake sequence output |
| 2333 | 2633 | PB14 | Notch shape selection 1 | 2367 | 2667 | PC03 | Encoder output pulse selection |
| 2334 | 2634 | PB15 | Machine resonance suppression filter 2 | 2368 | 2668 | PC04 | Function selection C-1 |
| 2335 | 2635 | PB16 | Notch shape selection 2 | 2369 | 2669 | PC05 | For manufacturer setting |
| 2336 | 2636 | PB17 | Automatic setting parameter | 2370 | 2670 | PC06 | Function selection C-3 |
| 2337 | 2637 | PB18 | Low-pass filter setting | 2371 | 2671 | PC07 | Zero speed |
| 2338 | 2638 | PB19 | Vibration suppression control vibration frequency setting | 2372 | 2672 | PC08 | For manufacturer setting |
| 2339 | 2639 | PB20 | Vibration suppression control resonance frequency setting | 2373 | 2673 | PC09 | Analog monitor 1 output |
| | | | | 2374 | 2674 | PC10 | Analog monitor 2 output |
| | | | | 2375 | 2675 | PC11 | Analog monitor 1 offset |
| | | | | 2376 | 2676 | PC12 | Analog monitor 2 offset |
| | | | | 2377 | 2677 | PC13 | Analog monitor feedback position output standard data Low |
| | | | | 2378 | 2678 | PC14 | Analog monitor feedback position output standard data High |

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Table 1.13 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail (Continued)

| Error code | Parameter No. | Name | Error code | Parameter No. | Name | | | |
|------------|---------------|------|------------|---------------|------|------|------|------|
| 2379 | 2679 | PC15 | 2426 | 2726 | PD30 | | | |
| 2380 | 2680 | PC16 | | | | | | |
| 2381 | 2681 | PC17 | | | | 2427 | 2727 | PD31 |
| 2382 | 2682 | PC18 | | | | 2428 | 2728 | PD32 |
| 2383 | 2683 | PC19 | | | | 2429 | 2729 | PE01 |
| 2384 | 2684 | PC20 | | | | 2430 | 2730 | PE02 |
| 2385 | 2685 | PC21 | | | | 2431 | 2731 | PE03 |
| 2386 | 2686 | PC22 | | | | 2432 | 2732 | PE04 |
| 2387 | 2687 | PC23 | | | | 2433 | 2733 | PE05 |
| 2388 | 2688 | PC24 | | | | 2434 | 2734 | PE06 |
| 2389 | 2689 | PC25 | | | | 2435 | 2735 | PE07 |
| 2390 | 2690 | PC26 | | | | 2436 | 2736 | PE08 |
| 2391 | 2691 | PC27 | | | | 2437 | 2737 | PE09 |
| 2392 | 2692 | PC28 | | | | 2438 | 2738 | PE10 |
| 2393 | 2693 | PC29 | | | | 2439 | 2739 | PE11 |
| 2394 | 2694 | PC30 | | | | 2440 | 2740 | PE12 |
| 2395 | 2695 | PC31 | | | | 2441 | 2741 | PE13 |
| 2396 | 2696 | PC32 | | | | 2442 | 2742 | PE14 |
| 2397 | 2697 | PD01 | | | | 2443 | 2743 | PE15 |
| 2398 | 2698 | PD02 | | | | 2444 | 2744 | PE16 |
| 2399 | 2699 | PD03 | | | | 2445 | 2745 | PE17 |
| 2400 | 2700 | PD04 | | | | 2446 | 2746 | PE18 |
| 2401 | 2701 | PD05 | | | | 2447 | 2747 | PE19 |
| 2402 | 2702 | PD06 | | | | 2448 | 2748 | PE20 |
| 2403 | 2703 | PD07 | | | | 2449 | 2749 | PE21 |
| 2404 | 2704 | PD08 | | | | 2450 | 2750 | PE22 |
| 2405 | 2705 | PD09 | | | | 2451 | 2751 | PE23 |
| 2406 | 2706 | PD10 | | | | 2452 | 2752 | PE24 |
| 2407 | 2707 | PD11 | | | | 2453 | 2753 | PE25 |
| 2408 | 2708 | PD12 | 2454 | 2754 | PE26 | | | |
| 2409 | 2709 | PD13 | 2455 | 2755 | PE27 | | | |
| 2410 | 2710 | PD14 | 2456 | 2756 | PE28 | | | |
| 2411 | 2711 | PD15 | 2457 | 2757 | PE29 | | | |
| 2412 | 2712 | PD16 | 2458 | 2758 | PE30 | | | |
| 2413 | 2713 | PD17 | 2459 | 2759 | PE31 | | | |
| 2414 | 2714 | PD18 | 2460 | 2760 | PE32 | | | |
| 2415 | 2715 | PD19 | 2461 | 2761 | PE33 | | | |
| 2416 | 2716 | PD20 | 2462 | 2762 | PE34 | | | |
| 2417 | 2717 | PD21 | 2463 | 2763 | PE35 | | | |
| 2418 | 2718 | PD22 | 2464 | 2764 | PE36 | | | |
| 2419 | 2719 | PD23 | 2465 | 2765 | PE37 | | | |
| 2420 | 2720 | PD24 | 2466 | 2766 | PE38 | | | |
| 2421 | 2721 | PD25 | 2467 | 2767 | PE39 | | | |
| 2422 | 2722 | PD26 | 2468 | 2768 | PE40 | | | |
| 2423 | 2723 | PD27 | 2501 | 2801 | PS01 | | | |
| 2424 | 2724 | PD28 | 2502 | 2802 | PS02 | | | |
| 2425 | 2725 | PD29 | 2503 | 2803 | PS03 | | | |
| | | | 2504 | 2804 | PS04 | | | |

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Table 1.13 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail (Continued)

| Error code | | Parameter No. | Name | Error code | | Parameter No. | Name |
|------------|------|---------------|---|------------|------|---------------|--------------------------|
| 2505 | 2805 | PS05 | Servo control position deviation error detection level | 2519 | 2819 | PS19 | For manufacturer setting |
| 2506 | 2806 | PS06 | Servo control speed deviation error detection level | 2520 | 2820 | PS20 | |
| 2507 | 2807 | PS07 | Servo control torque deviation error detection level | 2521 | 2821 | PS21 | |
| 2508 | 2808 | PS08 | Special function selection 3 | 2522 | 2822 | PS22 | |
| 2509 | 2809 | PS09 | Magnetic pole detection voltage level | 2523 | 2823 | PS23 | |
| 2510 | 2810 | PS10 | For manufacturer setting | 2524 | 2824 | PS24 | |
| 2511 | 2811 | PS11 | | | | | |
| 2512 | 2812 | PS12 | | | | | |
| 2513 | 2813 | PS13 | | | | | |
| 2514 | 2814 | PS14 | | | | | |
| 2515 | 2815 | PS15 | | | | | |
| 2516 | 2816 | PS16 | | | | | |
| 2517 | 2817 | PS17 | Minimal position detection method function selection | 2525 | 2825 | PS25 | |
| 2518 | 2818 | PS18 | Minimal position detection method identification signal amplitude | 2526 | 2826 | PS26 | |
| | | | | 2527 | 2827 | PS27 | |
| | | | | 2528 | 2828 | PS28 | |
| | | | | 2529 | 2829 | PS29 | |
| | | | | 2530 | 2830 | PS30 | |
| | | | | 2531 | 2831 | PS31 | |
| | | | | 2532 | 2832 | PS32 | |

(g) MR-J3-□B Safety (For safety servo)

Table 1.14 Servo error (2000 to 2999) list (MR-J3-□B Safety)

| Error code | Servo amplifier LED display | Name | Remarks |
|--------------|-----------------------------|---|---------|
| 2010 | 10 | Undervoltage | |
| 2012 | 12 | Memory error 1 (RAM) | |
| 2013 | 13 | Clock error | |
| 2015 | 15 | Memory error 2 (EEP-ROM) | |
| 2016 | 16 | Encoder error 1 (At power on) | |
| 2017 | 17 | Board error | |
| 2019 | 19 | Memory error 3 (Flash ROM) | |
| 2020 | 20 | Encoder error 2 (during runtime) | |
| 2021 | 21 | Encoder error 3 (during runtime) | |
| 2024 | 24 | Main circuit error | |
| 2025 | 25 | Absolute position erase | |
| 2028 | 28 | Linear encoder error 2 | |
| 2030 | 30 | Regenerative error | |
| 2031 | 31 | Overspeed | |
| 2032 | 32 | Overcurrent | |
| 2033 | 33 | Overvoltage | |
| 2034 | 34 | Receive error 1 | |
| 2035 | 35 | Command frequency error | |
| 2036 | 36 | Receive error 2 | |
| 2042 | 42 | Fully closed control error detection | |
| 2045 | 45 | Main circuit device overheat | |
| 2046 | 46 | Servo motor overheat | |
| 2047 | 47 | Cooling fan error | |
| 2050 | 50 | Overload 1 | |
| 2051 | 51 | Overload 2 | |
| 2052 | 52 | Error excessive | |
| 2056 | 56 | Forced stop error | |
| 2070 | 70 | Load side encoder error 1 | |
| 2071 | 71 | Load side encoder error 2 | |
| 2060 | 1A | Motor combination error | |
| 2061 | 2A | Linear encoder error 1 | |
| 2063 | 63 | STO timing error | |
| 2088 | 888 | Watchdog | |
| 2095 | 95 | STO warning | |
| 2102 | 92 | Battery cable disconnection warning | |
| 2106 | 96 | Home position setting warning | |
| 2116 | 9F | Battery warning | |
| 2140 | E0 | Excessive regeneration warning | |
| 2141 | E1 | Overload warning 1 | |
| 2143 | E3 | Absolute position counter warning | |
| 2146 | E6 | Servo forced stop warning | |
| 2147 | E7 | Controller forced stop warning | |
| 2148 | E8 | Cooling fan speed reduction warning | |
| 2149 | E9 | Main circuit off warning | |
| 2152 | EC | Overload warning 2 | |
| 2153 | ED | Output watt excess warning | |
| 2301 to 2599 | E4 | Parameter warning (Refer to the table 1.15) | |

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Table 1.14 Servo error (2000 to 2999) list (MR-J3-□B Safety) (Continued)

| Error code | Servo amplifier LED display | Name | Remarks |
|--------------|--------------------------------|---|---------|
| 2601 to 2899 | 37 | Parameter error (Refer to the table 1.15) | |
| 2948 | 8A | USB communication time-out error | |
| 2952 | 8E | USB communication error | |

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Table 1.15 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail

| Error code | Parameter No. | Name | Error code | Parameter No. | Name | | |
|------------|---------------|------|--|---------------|------|------|--|
| 2301 | 2601 | PA01 | Control mode | 2340 | 2640 | PB21 | For manufacturer setting |
| 2302 | 2602 | PA02 | Regenerative option | 2341 | 2641 | PB22 | |
| 2303 | 2603 | PA03 | Absolute position detection system | 2342 | 2642 | PB23 | Low-pass filter selection |
| 2304 | 2604 | PA04 | Function selection A-1 | 2343 | 2643 | PB24 | Slight vibration suppression control selection |
| 2305 | 2605 | PA05 | For manufacturer setting | 2344 | 2644 | PB25 | For manufacturer setting |
| 2306 | 2606 | PA06 | | | | | |
| 2307 | 2607 | PA07 | | | | | |
| 2308 | 2608 | PA08 | Auto tuning mode | 2345 | 2645 | PB26 | Gain changing selection |
| 2309 | 2609 | PA09 | Auto tuning response | 2346 | 2646 | PB27 | Gain changing condition |
| 2310 | 2610 | PA10 | In-position range | 2347 | 2647 | PB28 | Gain changing time constant |
| 2311 | 2611 | PA11 | For manufacturer setting | 2348 | 2648 | PB29 | Gain changing ratio of load inertia moment to servo motor inertia moment |
| 2312 | 2612 | PA12 | | | | | |
| 2313 | 2613 | PA13 | | | | | |
| 2314 | 2614 | PA14 | Rotation direction selection | 2349 | 2649 | PB30 | Gain changing position loop gain |
| 2315 | 2615 | PA15 | Encoder output pulse | 2350 | 2650 | PB31 | Gain changing speed loop gain |
| 2316 | 2616 | PA16 | Encoder output pulse 2 | 2351 | 2651 | PB32 | Gain changing speed integral compensation |
| 2317 | 2617 | PA17 | For manufacturer setting | 2352 | 2652 | PB33 | Gain changing vibration suppression control vibration frequency setting |
| 2318 | 2618 | PA18 | | | | | |
| 2319 | 2619 | PA19 | Parameter write inhibit | 2353 | 2653 | PB34 | Gain changing vibration suppression control resonance frequency setting |
| 2320 | 2620 | PB01 | Adaptive tuning mode (adaptive filter II) | 2354 | 2654 | PB35 | For manufacturer setting |
| 2321 | 2621 | PB02 | Vibration suppression control tuning mode (advanced vibration suppression control) | 2355 | 2655 | PB36 | |
| 2322 | 2622 | PB03 | For manufacturer setting | 2356 | 2656 | PB37 | |
| 2323 | 2623 | PB04 | Feed forward gain | 2357 | 2657 | PB38 | |
| 2324 | 2624 | PB05 | For manufacturer setting | 2358 | 2658 | PB39 | |
| 2325 | 2625 | PB06 | Ratio of load inertia moment to servo motor inertia moment | 2359 | 2659 | PB40 | |
| 2326 | 2626 | PB07 | Model loop gain | 2360 | 2660 | PB41 | |
| 2327 | 2627 | PB08 | Position loop gain | 2361 | 2661 | PB42 | |
| 2328 | 2628 | PB09 | Speed loop gain | 2362 | 2662 | PB43 | |
| 2329 | 2629 | PB10 | Speed integral compensation | 2363 | 2663 | PB44 | |
| 2330 | 2630 | PB11 | Speed differential compensation | 2364 | 2664 | PB45 | Vibration suppression control filter 2 |
| 2331 | 2631 | PB12 | Overshoot amount compensation | 2365 | 2665 | PC01 | Error excessive alarm level |
| 2332 | 2632 | PB13 | Machine resonance suppression filter 1 | 2366 | 2666 | PC02 | Electromagnetic brake sequence output |
| 2333 | 2633 | PB14 | Notch shape selection 1 | 2367 | 2667 | PC03 | Encoder output pulse selection |
| 2334 | 2634 | PB15 | Machine resonance suppression filter 2 | 2368 | 2668 | PC04 | Function selection C-1 |
| 2335 | 2635 | PB16 | Notch shape selection 2 | 2369 | 2669 | PC05 | Function selection C-2 |
| 2336 | 2636 | PB17 | Automatic setting parameter | 2370 | 2670 | PC06 | Function selection C-3 |
| 2337 | 2637 | PB18 | Low-pass filter setting | 2371 | 2671 | PC07 | Zero speed |
| 2338 | 2638 | PB19 | Vibration suppression control vibration frequency setting | 2372 | 2672 | PC08 | For manufacturer setting |
| 2339 | 2639 | PB20 | Vibration suppression control resonance frequency setting | 2373 | 2673 | PC09 | Analog monitor 1 output |
| | | | | 2374 | 2674 | PC10 | Analog monitor 2 output |
| | | | | 2375 | 2675 | PC11 | Analog monitor 1 offset |
| | | | | 2376 | 2676 | PC12 | Analog monitor 2 offset |
| | | | | 2377 | 2677 | PC13 | Analog monitor feedback position output standard data Low |
| | | | | 2378 | 2678 | PC14 | Analog monitor feedback position output standard data High |

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Table 1.15 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail (Continued)

| Error code | Parameter No. | Name | Error code | Parameter No. | Name | |
|------------|---------------|------|---|---------------|------|--|
| 2379 | 2679 | PC15 | For manufacturer setting | 2421 | 2721 | PD25 |
| 2380 | 2680 | PC16 | Function selection C-3A | 2422 | 2722 | PD26 |
| 2381 | 2681 | PC17 | Function selection C-4 | 2423 | 2723 | PD27 |
| 2382 | 2682 | PC18 | For manufacturer setting | 2424 | 2724 | PD28 |
| 2383 | 2683 | PC19 | | 2425 | 2725 | PD29 |
| 2384 | 2684 | PC20 | Function selection C-7 | 2426 | 2726 | PD30 |
| 2385 | 2685 | PC21 | Alarm history clear | 2427 | 2727 | PD31 |
| 2386 | 2686 | PC22 | For manufacturer setting | 2428 | 2728 | PD32 |
| 2387 | 2687 | PC23 | | 2429 | 2729 | PE01 |
| 2388 | 2688 | PC24 | Forced stop deceleration time constant | 2430 | 2730 | PE02 |
| 2389 | 2689 | PC25 | For manufacturer setting | 2431 | 2731 | PE03 |
| 2390 | 2690 | PC26 | Function selection C-8 | 2432 | 2732 | PE04 |
| 2391 | 2691 | PC27 | Function selection C-9 | 2433 | 2733 | PE05 |
| 2392 | 2692 | PC28 | For manufacturer setting | 2434 | 2734 | PE06 |
| 2393 | 2693 | PC29 | | 2435 | 2735 | PE07 |
| 2394 | 2694 | PC30 | | 2436 | 2736 | PE08 |
| 2395 | 2695 | PC31 | Vertical axis freefall prevention compensation amount | 2437 | 2737 | PE09 |
| 2396 | 2696 | PC32 | For manufacturer setting | 2438 | 2738 | PE10 |
| 2397 | 2697 | PD01 | | 2439 | 2739 | PE11 |
| 2398 | 2698 | PD02 | | 2440 | 2740 | PE12 |
| 2399 | 2699 | PD03 | | 2441 | 2741 | PE13 |
| 2400 | 2700 | PD04 | | 2442 | 2742 | PE14 |
| 2401 | 2701 | PD05 | | 2443 | 2743 | PE15 |
| 2402 | 2702 | PD06 | | 2444 | 2744 | PE16 |
| 2403 | 2703 | PD07 | Output signal device selection 1 (CN3-13) | 2445 | 2745 | PE17 |
| 2404 | 2704 | PD08 | Output signal device selection 2 (CN3-9) | 2446 | 2746 | PE18 |
| 2405 | 2705 | PD09 | Output signal device selection 3 (CN3-15) | 2447 | 2747 | PE19 |
| 2406 | 2706 | PD10 | For manufacturer setting | 2448 | 2748 | PE20 |
| 2407 | 2707 | PD11 | Input filter setting | 2449 | 2749 | PE21 |
| 2408 | 2708 | PD12 | For manufacturer setting | 2450 | 2750 | PE22 |
| 2409 | 2709 | PD13 | | 2451 | 2751 | PE23 |
| 2410 | 2710 | PD14 | Function selection D-3 | 2452 | 2752 | PE24 |
| 2411 | 2711 | PD15 | For manufacturer setting | 2453 | 2753 | PE25 |
| 2412 | 2712 | PD16 | | 2454 | 2754 | PE26 |
| 2413 | 2713 | PD17 | | 2455 | 2755 | PE27 |
| 2414 | 2714 | PD18 | | 2456 | 2756 | PE28 |
| 2415 | 2715 | PD19 | | 2457 | 2757 | PE29 |
| 2416 | 2716 | PD20 | | 2458 | 2758 | PE30 |
| 2417 | 2717 | PD21 | | 2459 | 2759 | PE31 |
| 2418 | 2718 | PD22 | | 2460 | 2760 | PE32 |
| 2419 | 2719 | PD23 | | 2461 | 2761 | PE33 |
| 2420 | 2720 | PD24 | | 2462 | 2762 | PE34 |
| | | | | | | Fully closed loop feedback pulse electronic gear 2 numerator |
| | | | | | | Fully closed loop selection 3 |
| | | | | | | For manufacturer setting |
| | | | | | | Fully closed loop dual feedback filter |
| | | | | | | Fully closed loop position deviation error detection level |
| | | | | | | Fully closed loop speed deviation error detection level |
| | | | | | | Fully closed loop feedback pulse electronic gear 1 denominator |
| | | | | | | Fully closed loop feedback pulse electronic gear 1 numerator |
| | | | | | | Fully closed loop selection 2 |
| | | | | | | For manufacturer setting |
| | | | | | | Fully closed loop selection 1 |

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Table 1.15 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail (Continued)

| Error code | | Parameter No. | Name |
|------------|------|---------------|--|
| 2463 | 2763 | PE35 | Fully closed loop feedback pulse electronic gear 2 denominator |
| 2464 | 2764 | PE36 | For manufacturer setting |
| 2465 | 2765 | PE37 | |

| Error code | | Parameter No. | Name |
|------------|------|---------------|--------------------------|
| 2466 | 2766 | PE38 | For manufacturer setting |
| 2467 | 2767 | PE39 | |
| 2468 | 2768 | PE40 | |

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APPENDIX 1.6 Output module errors

(1) Output module errors at real mode/virtual mode switching (4000 to 5990)

Table 1.16 Output Module Error List (4000 to 5990)

| Error class | Error code | Output module | | | | Error cause | Processing | Corrective action | |
|-------------|------------|---------------|------------|--------------|-----|--|-----------------------------------|--|--|
| | | Roller | Ball screw | Rotary table | Cam | | | | |
| Minor error | 4050 | | | | ○ | <ul style="list-style-type: none"> The "lower stroke limit setting device value + stroke amount setting device value" exceeded "2147483647 (setting unit)". (At the two-way cam mode.) | Related system cannot be started. | <ul style="list-style-type: none"> Since the current value within 1 cam shaft revolution cannot be calculated, return to the real mode and set the correct No. in the device. | |
| | 4060 | ○ | ○ | ○ | ○ | <ul style="list-style-type: none"> When the drive module is the synchronous encoder connected to the manual pulse generator inputs, and the connected clutch is the "external input mode", multiple ON/OFF command bit devices are set. Or, the external input mode clutch setting is fault. | | <ul style="list-style-type: none"> Set a one-to-one setting for the external input mode clutch and synchronous encoder. Return to the real mode, turn the PLC ready flag off, then correct and write the clutch setting. | |
| | 4070 | ○ | ○ | ○ | ○ | <ul style="list-style-type: none"> The clutch of the external input mode is set at the Q173DPX or Q172DEX set for high-speed reading. | | <ul style="list-style-type: none"> Do not use the clutch of the external input mode at the Q173DPX or Q172DEX set for high-speed reading. | |
| | 5000 | | ○ | ○ | ○ | <ul style="list-style-type: none"> The "feed current value" is outside the stroke limit range. For cam, the feed current value is outside the range of "lower stroke limit value to stroke amount", when the cam/ball screw switching command device is turned ON to OFF at real/virtual mode switching or in virtual mode. (The current value within 1 cam shaft revolution cannot be calculated at the two-way cam mode.) For cam, the feed current value is outside the range of "lower stroke limit value to stroke amount" at the servo amplifier's power supply ON. (In this case, the servo amplifier does not change into servo ON status.) | | <ul style="list-style-type: none"> Return to the real mode and position within the stroke limit range. | |
| | 5060 | | | | ○ | <ul style="list-style-type: none"> The "feed current value" is within the stroke limit range, but the current value within 1 cam shaft revolution cannot be calculated. (Cam table fault) | | <ul style="list-style-type: none"> Correct the cam table. Set the cam table by the stroke ratio "0 to 7FFFH" of lower stroke value and stroke amount. | |
| | 5080 | ○ | ○ | ○ | ○ | <ul style="list-style-type: none"> Torque limit value setting outside range error. | | Control with the default value "300[%]". | <ul style="list-style-type: none"> Set the torque limit value within the setting range. |
| | 5200 | | | | ○ | <ul style="list-style-type: none"> The first lower stroke limit value storage device is an odd number. | | Operation is possible, but monitoring is impossible. | <ul style="list-style-type: none"> Set an even numbered the first device. |
| | 5210 | ○ | ○ | ○ | ○ | <ul style="list-style-type: none"> The first clutch ON address setting device is an odd number. | | Related system cannot be started. | |

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Table 1.16 Output Module Error List (4000 to 5990) (Continued)

| Error class | Error code | Output module | | | | Error cause | Processing | Corrective action |
|-------------|------------|---------------|------------|--------------|---|--|---|---|
| | | Roller | Ball screw | Rotary table | Cam | | | |
| Minor error | 5220 | ○ | ○ | ○ | ○ | • The first clutch OFF address setting device is an odd number. | Related system cannot be started. | • Set an even numbered the first device. |
| | 5230 | | | ○ | ○ | • The first current value within 1 virtual axis revolution storage device (main shaft side) is an odd number. | Operation is possible, but monitoring is impossible. | |
| | 5240 | | | ○ | ○ | • The first current value within 1 virtual axis revolution storage device (auxiliary input shaft side) is an odd number. | | |
| | 5250 | ○ | ○ | ○ | ○ | • When the amount of slip is set as the clutch smoothing method, the amount of slip setting device value is outside the range (0 to 2147483647). | Amount of slip = 0 (control as the direct clutch). | • Set a value within the range of 0 to 2147483647. |
| | 5260 | | | | ○ | • The device set to "Stroke amount setting device" is outside the range. | Related system cannot be started. | • Correct the device set to "Stroke amount setting device". |
| | 5270 | | | | ○ | • The device set to "Cam No. setting device" is outside the range. | | • Correct the device set to Cam No. |
| | 5280 | ○ | ○ | ○ | ○ | • The device set to "Clutch mode setting device" is outside the range. | | • Correct the device set to clutch mode. |
| | 5290 | ○ | ○ | ○ | ○ | • The device set to "Clutch ON address setting device" is outside the range. | | • Correct the device set to clutch ON address. |
| | 5300 | ○ | ○ | ○ | ○ | • The device set to "Clutch OFF address setting device" is outside the range. | | • Correct the device set to clutch OFF address. |
| | 5310 | ○ | ○ | ○ | ○ | • The device set to "Clutch ON/OFF command setting device" is outside the range. | | • Correct the device set to clutch ON/OFF command. |
| | 5320 | ○ | ○ | ○ | ○ | • The device set to "Speed change ratio setting device" is outside the range. | | • Correct the device set to speed change ratio. |
| | 5330 | ○ | ○ | ○ | ○ | • The device set to "Amount of slip setting device" is outside the range. | Amount of slip = 0 (control as the direct clutch). | • Correct the device set to amount of slip. |
| | 5340 | ○ | ○ | ○ | ○ | • The device set to "Torque limit value setting device" is outside the range. | Related system cannot be started | • Correct the device set to torque limit value. |
| | 5350 | | | ○ | ○ | • The device set to "Current value within 1 virtual axis revolution storage device (main shaft side)" is outside the range. | Current value within 1 virtual axis revolution (main shaft side) cannot be monitored. | • Correct the device set to current value within 1 virtual axis revolution (main shaft side). |
| | 5360 | | | ○ | ○ | • The device set to "Current value within 1 virtual axis revolution storage device (auxiliary input axis side) storage device" is outside the range. | Current value within 1 virtual axis revolution (auxiliary input axis side) cannot be monitored. | • Correct the device set to current value within 1 virtual axis revolution (auxiliary input axis side). |
| | 5370 | | | | ○ | • The device set to "Lower stroke limit value storage device" is outside the range. | Lower stroke limit value cannot be monitored. | • Correct the device set to lower stroke limit value. |
| 5380 | ○ | ○ | ○ | ○ | • The device set to "Number of input axis side gear tooth count setting device" is outside the range. | Related system cannot be started. | • Correct the device set to number of input axis side gear tooth count. | |

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Table 1.16 Output Module Error List (4000 to 5990) (Continued)

| Error class | Error code | Output module | | | | Error cause | Processing | Corrective action |
|-------------|------------|---------------|------------|--------------|--|--|---|---|
| | | Roller | Ball screw | Rotary table | Cam | | | |
| Minor error | 5390 | ○ | ○ | ○ | ○ | • The device set to "Number of output axis side gear tooth count setting device" is outside the range. | Related system cannot be started. | • Correct the device set to number of output axis side gear tooth count. |
| | 5400 | ○ | ○ | ○ | ○ | • Number of input axis side gear tooth count setting device is set to "0". | | • Correct the number of input axis side gear tooth count. |
| | 5410 | ○ | ○ | ○ | ○ | • Number of output axis side gear tooth count setting device is set to "0". | | • Correct the number of output axis side gear tooth count. |
| | 5420 | ○ | ○ | ○ | ○ | • The device set to "Slippage in-position range setting device" is outside the range. | | • Correct the device set to slippage in-position range setting device. |
| | 5430 | ○ | ○ | ○ | ○ | • Slippage in-position range setting device is outside the range (0 to 2147483647). | Control with the setting value "0". | |
| | 5440 | ○ | ○ | ○ | ○ | • Either of "phase advance time" of "phase compensation processing valid flag" or "phase compensation time constant" of the phase compensation setting devices is outside the setting range. | Control as the phase compensation processing invalid. | <ul style="list-style-type: none"> • Correct the phase advance time. • Correct the phase compensation processing valid flag. • Correct the phase compensation time constant. |
| | 5450 | ○ | ○ | ○ | ○ | • The device set to "Smoothing clutch complete signal device" is outside the range. | Related system cannot be started. | • Correct the device set to "Smoothing clutch complete signal device". |
| | 5460 | ○ | ○ | ○ | ○ | • The device set to "Clutch status device" is outside the range. | | • Correct the device set to "Clutch status device". |
| | 5480 | | | | ○ | • The device set to "Cam/ball screw switching command device" is outside the range. | | • Correct the device set to "Cam/ball screw switching command device". |
| | 5490 | | | ○ | ○ | • When the address mode clutch control system is the current value within 1 virtual axis revolution, the setting value set to "Clutch ON address setting device" is outside the range of "0 to number of pulses within 1 output axis revolution -1[pulse]". | | • Correct the setting value set to "Clutch ON address setting device" with in the range of "0 to number of pulses within 1 output axis revolution - 1[pulse]". |
| | 5500 | | | ○ | ○ | • When the address mode clutch control system is the current value within 1 virtual axis revolution, the setting value set to "Clutch OFF address setting device" is outside the range of "0 to number of pulses within 1 output axis revolution -1[pulse]". | | • Correct the setting value set to "Clutch OFF address setting device" with in the range of "0 to number of pulses within 1 output axis revolution - 1[pulse]". |
| | 5510 | | | | ○ | • The device set to "Number of pulses per cam shaft revolution" is outside the range. | | • Correct the device set to "Number of pulses per cam shaft revolution". |
| 5520 | | | | ○ | • The value of "Number of pulses per cam shaft revolution" is outside the range. | • Correct the setting of "Number of pulses per cam shaft revolution". | | |

APPENDICES

(2) Output module errors (6000 to 6990)

Table 1.17 Output Module Error List (6000 to 6990)

| Error class | Error code | Output module | | | | Error cause | Processing | Corrective action |
|-------------|------------|---------------|------------|--------------|-----|--|---|--|
| | | Roller | Ball screw | Rotary table | Cam | | | |
| Minor error | 6000 | ○ | ○ | ○ | ○ | <ul style="list-style-type: none"> The servo OFF command (M3215+20n) turned ON during operation. The servo amplifier's power supply is turned ON during operation. | Operation continues. | <ul style="list-style-type: none"> Execute the servo OFF after clutch OFF command. |
| | 6010 | ○ | ○ | ○ | | <ul style="list-style-type: none"> The output speed exceeded the speed limit value during operation. (Speed clamp processing by the speed limit value is not executed.) | | <ul style="list-style-type: none"> Correct the speed, gear ratio and speed change ratio of drive module within the speed limit value. |
| | 6020 | ○ | ○ | ○ | ○ | <ul style="list-style-type: none"> The deviation counter value exceeded the permissible droop pulse value during operation. | | <ul style="list-style-type: none"> Correct the speed, gear ratio and speed change ratio of drive module within the permissible droop pulse value after stopping the drive module. |
| | 6030 | | ○ | ○ | | <ul style="list-style-type: none"> The feed current value exceeded the stroke limit range during operation. | | <ul style="list-style-type: none"> Control within the stroke limit value. |
| | 6040 | | | | ○ | <ul style="list-style-type: none"> The cam No. setting device value is outside the "used cam No." range. (Operation continues with the current cam No.) | | <ul style="list-style-type: none"> Correct the cam No. setting. |
| | 6050 | | | | ○ | <ul style="list-style-type: none"> The stroke amount setting device value is outside the range of "1 to 2147483647". "Lower stroke limit value + stroke amount ≤ 2147483647" is outside the range. (Operation continues with the current stroke amount.) | Operation continues with the current cam No. and stroke amount. | <ul style="list-style-type: none"> Correct the stroke amount setting. |
| | 6060 | | | | ○ | <ul style="list-style-type: none"> A control mode (feed/two-way) does not match at cam No. switching. | Operation continues. | <ul style="list-style-type: none"> Correct the control mode after stopping the drive module. |
| | 6080 | ○ | ○ | ○ | ○ | <ul style="list-style-type: none"> The torque limit value setting device is outside the range. | Control with the default value "300[%]". | <ul style="list-style-type: none"> Set the torque limit value within the setting range. |
| | 6090 | ○ | ○ | ○ | ○ | <ul style="list-style-type: none"> The servo OFF command (M3215+20n) turned on at servo OFF in operation. The servo ON is executed by turning ON the servo amplifier's power supply in operation. | Servo ON is not executed. | <ul style="list-style-type: none"> Execute the servo ON after clutch OFF command. |
| | 6120 | | | | ○ | <ul style="list-style-type: none"> The current value within 1 cam axis revolution was changed to the outside the range. | The current value is not changed. | <ul style="list-style-type: none"> Set a value within the range of 1 to "number of pulses 1 cam shaft revolution - 1". |
| | 6130 | ○ | ○ | ○ | ○ | <ul style="list-style-type: none"> Number of input axis side gear tooth count is set by indirect device setting, and the current value for the drive module was changed to the device value "0". | The gear ratio of applicable gear is not changed. | <ul style="list-style-type: none"> Set the value within the range of 1 to 65535. |
| | 6140 | ○ | ○ | ○ | ○ | <ul style="list-style-type: none"> Number of output axis side gear tooth count is set by indirect device setting, and the current value for the drive module was changed to the device value "0". | | |

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Table 1.17 Output Module Error List (6000 to 6990) (Continued)

| Error class | Error code | Output module | | | | Error cause | Processing | Corrective action |
|-------------|------------|---------------|------------|--------------|-----|--|--|--|
| | | Roller | Ball screw | Rotary table | Cam | | | |
| Minor error | 6160 | | | | ○ | <ul style="list-style-type: none"> Current value was changed for the axis that had not been started. Or, the current value within 1 cam shaft revolution was changed for the servo OFF axis. The current value within 1 cam shaft revolution was changed during cam/ball screw switching processing. | Do not change the current value within 1 cam shaft revolution. | <ul style="list-style-type: none"> Use the following device as interlock not to change the current value within 1 cam shaft revolution for applicable axis. (Servo READY signal (M2415+20) ON) Do not change the current value within 1 cam shaft revolution during cam/ball screw switching or cam/ball screw switching command ON. |
| | 6170 | ○ | ○ | ○ | ○ | Slippage in-position range setting device value is outside the range (0 to 2147483647). | Control with the setting value "0". | Set the device value within the range of 0 to 2147483647. |
| | 6180 | ○ | ○ | ○ | | One of the devices set in the speed-torque control operation data is outside the range. | Operation continues without switching the control mode. | Correct the speed-torque control operation data device. |
| | 6190 | ○ | ○ | ○ | | The control mode switching was executed with an invalid value specified in the control mode setting device. | | <ul style="list-style-type: none"> Correct the value of the control mode setting device. When switching the mode from the continuous operation to torque control mode to another, return the mode to the previous one. |
| | 6200 | ○ | ○ | ○ | | The control mode switching request was executed during the zero speed was OFF. | | <ul style="list-style-type: none"> Switch the control mode while the output axis is stopped and the zero speed is turned on. Make "Invalid selection during zero speed at control mode switching" valid when not waiting for the stop of the servo motor. |
| | 6210 | ○ | ○ | ○ | | At the control mode switching, a value set to the torque limit value at speed-torque control is outside the range. | Control with the default value "300[%]". | Set the torque limit value to 0.1 to 1000.0[%]. |
| | 6220 | ○ | ○ | ○ | | During torque control or continuous operation to torque control, the absolute value of the command torque is outside the range of 0 to the torque limit value at speed-torque control. | Control with the torque limit value at speed-torque control. | Set the torque after torque change within the range of 0 to the torque limit value at speed-torque control. |
| | 6230 | ○ | ○ | ○ | | The control mode switching request of speed/torque control was executed for the axis that connects to the stepping driver which do not support the control mode switching. | The control mode is not switched. | Do not switch the control mode switching request of speed/torque control for the axis that connects to the stepping driver which does not support the control mode switching. |
| | 6240 | | | | ○ | The control mode switching request of speed-torque control was executed to the cam axis. | | Do not execute the speed-torque control mode switching request to the cam axis. |

APPENDICES

Table 1.17 Output Module Error List (6000 to 6990) (Continued)

| Error class | Error code | Output module | | | | Error cause | Processing | Corrective action |
|-------------|------------|---------------|------------|--------------|-----|---|--|---|
| | | Roller | Ball screw | Rotary table | Cam | | | |
| Minor error | 6250 | ○ | ○ | ○ | | <ul style="list-style-type: none"> During the speed-torque control, the change value by the torque limit value setting device exceeds the torque limit value at speed-torque control. During the speed-torque control, the change value by the torque limit value individual change request (D(P).CHGT2, CHGT2) exceeds the torque limit value at speed-torque control. | <ul style="list-style-type: none"> Control with the torque limit value at speed-torque control. The torque limit value by the torque limit value individual change request (D(P).CHGT2, CHGT2) is not changed. | <ul style="list-style-type: none"> Set the torque limit value after torque change within the range of 1 to the torque limit value at speed-torque control. |
| | 6260 | ○ | ○ | ○ | ○ | <ul style="list-style-type: none"> The torque limit value individual change request (D(P).CHGT2, CHGT2) was executed with the setting of the torque limit value setting device of the mechanical system output module. | | <ul style="list-style-type: none"> When executing the torque limit value individual change request (D(P).CHGT2, CHGT2), do not set the torque limit value setting device of the mechanical system output module. |
| | 6270 | ○ | ○ | ○ | ○ | <ul style="list-style-type: none"> The positive direction torque limit value or the negative direction torque limit value outside the range of 0.1 to 1000.0[%] was set in the torque limit value individual change request (CHGT2). | The torque limit value is not changed. | <ul style="list-style-type: none"> Set the change request within the range of 0.1 to 1000.0[%] for the positive direction torque limit value or the negative direction torque limit value. |
| | 6280 | ○ | ○ | ○ | ○ | <ul style="list-style-type: none"> The torque limit value individual change request (D(P).CHGT2, CHGT2) was made for the axis that had not been started. | | <ul style="list-style-type: none"> Request the torque limit value individual change for the starting axis. |
| | 6300 | ○ | ○ | ○ | ○ | <ul style="list-style-type: none"> Phase compensation time constant is outside the range. | Control with the phase compensation time constant "0". | <ul style="list-style-type: none"> Set the phase compensation time constant within the range of 0 to 32767 (times). |
| | 6500 | ○ | ○ | ○ | ○ | <ul style="list-style-type: none"> A servo OFF state at a clutch ON command. | Clutch remains OFF. | <ul style="list-style-type: none"> Return to the clutch OFF command, and repeat the clutch ON command after executing a servo ON command. |
| | 6530 | | ○ | ○ | ○ | <ul style="list-style-type: none"> The home position return request signal (M2409+20n) is turning on at a clutch ON command. (Incremental axis servo amplifier power from off to ON.) | | <ul style="list-style-type: none"> Return to the real mode, back to the virtual mode after home position return. |
| | 6540 | | | | ○ | <ul style="list-style-type: none"> Although the feed current value is within the stroke limit value, the current value within 1 cam shaft revolution cannot be calculated. (Cam table error) | Servo remains ON. | <ul style="list-style-type: none"> Return to the real mode, correct the cam data settings. Set the cam table by the stroke ratio "0 to 7FFFH" of lower stroke value and stroke amount. |

APPENDICES

(3) System errors (9000 to 9990)

Table 1.18 Output Module Error List (9000 to 9990)

| Error class | Error code | Output module | | | | Error cause | Processing | Corrective action |
|-------------|------------|---------------|------------|--------------|-----|---|---|--|
| | | Roller | Ball screw | Rotary table | Cam | | | |
| Minor error | 9010 | ○ | ○ | ○ | ○ | <ul style="list-style-type: none"> The motor travel value while the power is off exceeded the "System setting mode-allowable travel value during power off" set in the system settings at the turning on of the servo amplifier. | Virtual mode continuation operation disable warning signal turns on. Further operation is possible. | <ul style="list-style-type: none"> Check the position. Check the battery of encoder. |

(4) Output module errors at virtual servomotor axis start (10000 to 10990)

Table 1.19 Output Module Error List (10000 to 10990)

| Error class | Error code | Output module | | | | Error cause | Processing | Corrective action |
|-------------|------------|---------------|------------|--------------|-----|---|---------------------------------|--|
| | | Roller | Ball screw | Rotary table | Cam | | | |
| Major error | 10000 | | ○ | ○ | ○ | <ul style="list-style-type: none"> The home position return request signal (M2409+20n) is ON. | Related system cannot be start. | <ul style="list-style-type: none"> Return to the real mode and execute a home position return. If position is not established after executing a home position return at all axes, the virtual mode operation cannot be executed. |
| | 10010 | ○ | ○ | ○ | ○ | <ul style="list-style-type: none"> The servo error detection signal (M2408+20n) is ON. | | <ul style="list-style-type: none"> Execute a servo error reset in the real mode. |
| | 10020 | ○ | ○ | ○ | ○ | <ul style="list-style-type: none"> A servo OFF (M2415+20n OFF) status exists at an output module where a "clutch ON" or "no clutch" setting is set at either the main shaft or auxiliary input axis. | | <ul style="list-style-type: none"> Turn the servo on after clutch OFF command. |
| | 10030 | ○ | ○ | ○ | ○ | <ul style="list-style-type: none"> An external input signal (STOP) is turning on at an output module where a "clutch ON" or "no clutch" setting is set at either the main shaft or auxiliary input axis. | | <ul style="list-style-type: none"> Turn the stop signal (STOP) off. |

APPENDICES

(5) "No-clutch/clutch ON/clutch status ON" output module errors (11000 to 11990)

Table 1.20 Output Module Error List (11000 to 11990)

| Error class | Error code | Output module | | | | Error cause | Processing | Corrective action |
|-------------|------------|---------------|------------|--------------|-----|--|--|--|
| | | Roller | Ball screw | Rotary table | Cam | | | |
| Major error | 11000 | ○ | ○ | ○ | ○ | • The servo error detection signal (M2408+20n) turned on during operation. | After an immediate stop at the applicable output module, and the servo OFF state. | • Release the servo error causes. (Refer to APPENDIX 1.5). |
| | 11010 | ○ | ○ | ○ | ○ | • A servo OFF state (M2415+20n OFF) during operation. • Servo amplifier power supply was OFF. | <ul style="list-style-type: none"> • Operation continues at "no-clutch" axes. • At axes with clutches, control is executed based on the operation mode at the time of the error. <div style="border-left: 1px solid black; border-right: 1px solid black; padding: 2px;"> <ul style="list-style-type: none"> • Operation continues. • All clutches turns off at the applicable systems. </div> | • When the "operation continuation" setting is set, execute the stop processing using the user's Motion SFC program. |
| | 11020 | ○ | ○ | ○ | ○ | • The stop signal (STOP) turned on. | | |
| | 11030 | ○ | ○ | ○ | ○ | • The upper limit switch signal (FLS) turned off during forward (address increase direction) travel. | | |
| | 11040 | ○ | ○ | ○ | ○ | • The lower limit switch signal (RLS) turned off during reverse (address decrease direction) travel. | | |
| | 11050 | ○ | ○ | ○ | ○ | • At the switching request to the continuous operation to torque control, the servo amplifier is not compatible with the continuous operation to torque control. | | |

(6) Errors when using an absolute position system (12000 to 12990)

Table 1.21 Output Module Error List (12000 to 12990)

| Error class | Error code | Output module | | | | Error cause | Processing | Corrective action |
|-------------|------------|---------------|------------|--------------|-----|---|---|---|
| | | Roller | Ball screw | Rotary table | Cam | | | |
| Major error | 12010 | ○ | ○ | ○ | ○ | <ul style="list-style-type: none"> The error causes why the home position return is required in the absolute position system are as follows: <ol style="list-style-type: none"> The home position return has never been executed after the system start. The home position return is started, but not completed correctly. Absolute data in the Motion CPU is erased due to causes such as a battery error. Servo error [2025], [2143], or [2913] occurred. Major error [1202], [1203], [1204], [12020], [12030] or [12040] occurred. "Rotation direction selection" of the servo parameter is changed. | Home position return signal turns ON. | <ul style="list-style-type: none"> Execute the home position return in real mode after checking the batteries of the Motion CPU module and servo amplifier. |
| | 12020 | ○ | ○ | ○ | ○ | <ul style="list-style-type: none"> A communication error between the servo amplifier and encoder occurred at the servo amplifier power supply on. | Depending on the version of operating system and servo amplifier, home position return signal turns ON. | <ul style="list-style-type: none"> Check the motor and encoder cables. If the home position return request signal is turning ON, execute a home position return in the real mode. |
| | 12030 | ○ | ○ | ○ | ○ | <ul style="list-style-type: none"> The amount of change in encoder current value during operation holds the following expression: "Amount of change in encoder current value / 3.5[ms] > 180° of motor revolution" It is always checked after the servo amplifier power supply on (in both servo ON and OFF states). (Q17□DCPU(-S1) use) | Home position return signal turns ON. | <ul style="list-style-type: none"> Check the motor and encoder cables. |
| | 12040 | ○ | ○ | ○ | ○ | <ul style="list-style-type: none"> During operation, the following expression holds: "Encoder current value [pulse] ≠ feedback current value [pulse] (number of bits in encoder enable range)". It is always checked after the servo amplifier power supply on (in both servo ON and OFF states). (Q17□DCPU(-S1) use) | | |

APPENDICES

Table 1.21 Output Module Error List (12000 to 12990) (Continued)

| Error class | Error code | Output module | | | | Error cause | Processing | Corrective action |
|-------------|------------|---------------|------------|--------------|-----|--|---|---|
| | | Roller | Ball screw | Rotary table | Cam | | | |
| Major error | 12050 | ○ | ○ | ○ | ○ | <ul style="list-style-type: none"> During operation, the following expression holds: "Encoder current value [pulse] ≠ feedback current value [pulse] (number of bits in encoder enable range)". It is always checked after the servo amplifier power supply on (in both servo ON and OFF states). | <p>Operation continues. (Home position return signal does not turn ON.)</p> | <ul style="list-style-type: none"> Check the motor and encoder cables. |

APPENDICES

APPENDIX 1.7 Errors at real mode/virtual mode switching

Table 1.22 Real Mode/Virtual Mode Switching Error Code List

| Error codes stored in SD504 | | Error description | Corrective action |
|-----------------------------|---------------------|--|---|
| Decimal display | Hexadecimal display | | |
| 1 | 0001 | <ul style="list-style-type: none"> Real mode/virtual mode switching request flag (M2043) turned OFF → ON in the state which all axes have not stopped. (Operation system software version "00G" or before) | <ul style="list-style-type: none"> Turn real mode/virtual mode switching request flag (M2043) OFF → ON when start accept flag (M2001 to M2032) are all OFF. (Operation system software version "00G" or before) |
| | | <ul style="list-style-type: none"> Real mode/virtual mode switching request flag (M2043) turned OFF → ON in the state which output axis set in the mechanical system program has not stopped. (Operation system software version "00H" or later) | <ul style="list-style-type: none"> Turn real mode/virtual mode switching request flag (M2043) OFF → ON when start accept flag (M2001 to M2032) of output axis set in the mechanical system program are all OFF. (The real mode axis can be switched in even operation.) (Operation system software version "00H" or later) |
| 256 | 0100 | <ul style="list-style-type: none"> Real mode/virtual mode switching request flag (M2043) turned ON → OFF in the state which all axes have not stopped. (Operation system software version "00G" or before) | <ul style="list-style-type: none"> Turn real mode/virtual mode switching request flag (M2043) ON → OFF when start accept flag (M2001 to M2032) are all OFF. (Operation system software version "00G" or before) |
| | | <ul style="list-style-type: none"> Real mode/virtual mode switching request flag (M2043) turned ON → OFF in the state which virtual axis has not stopped. (Operation system software version "00H" or later) | <ul style="list-style-type: none"> Turn real mode/virtual mode switching request flag (M2043) ON → OFF when start accept flag (M2001 to M2032) of virtual axis are all OFF. (The real mode axis can be switched in even operation.) (Operation system software version "00H" or later) |
| | | <ul style="list-style-type: none"> Real mode/virtual mode switching request flag (M2043) turned ON → OFF in the state which virtual axis has not stopped. Real mode/virtual mode switching request flag (M2043) turned ON → OFF in the state which output module is speed-torque control". | <ul style="list-style-type: none"> Turn real mode/virtual mode switching request flag (M2043) ON → OFF when start accept flag (M2001 to M2032) of output axis set in the mechanical system program are all OFF. (The real mode axis can be switched in even operation.) Turn real/virtual mode switching request flag (M2043) ON → OFF when all output modules are in the position control. |
| 512 | 0200 | <ul style="list-style-type: none"> Real mode/virtual mode switching request flag (M2043) turned OFF → ON in the state which mechanical system program has not registered. | <ul style="list-style-type: none"> Write the mechanical system program to the Motion CPU. |
| | | <ul style="list-style-type: none"> Real mode/virtual mode switching request flag (M2043) turned OFF → ON in the state which the axis No. set in the system setting does not match the output axis No. set in the mechanical system program. | <ul style="list-style-type: none"> Set the same axis No. at both the system settings and mechanical system program, then write the data to the Motion CPU. |
| 513 ^(Note) | 0201 | <ul style="list-style-type: none"> Real mode/virtual mode switching request flag (M2043) turned OFF → ON in the state which the PLC ready flag (M2000) or PCPU READY complete flag (SM500) is OFF. | <ul style="list-style-type: none"> After turning the PLC ready flag and PCPU READY flags on, turn real mode/virtual mode switching request flag (M2043) OFF → ON. |
| 514 ^(Note) | 0202 | <ul style="list-style-type: none"> Real mode/virtual mode switching request flag (M2043) turned OFF → ON in the state which the all-axes servo ON command (M2042) is OFF. | <ul style="list-style-type: none"> Turn all axes servo ON command (M2042) on, turn the all-axes servo ON accept flag on, then turn real mode/virtual mode switching request flag (M2043) OFF → ON. |

(Note): Error axis No. information is not set to SD505, SD506 in this error.

APPENDICES

Table 1.22 Real Mode/Virtual Mode Switching Error Code List (Continued)

| Error codes stored in SD504 | | Error description | Corrective action |
|-----------------------------|---------------------|---|--|
| Decimal display | Hexadecimal display | | |
| 515 ^(Note) | 0203 | • Real mode/virtual mode switching request flag (M2043) turned OFF → ON in the state which the external forced stop input signal (EMG) is ON. | • Turn the external forced stop signal off, then turn real mode/virtual mode switching request flag (M2043) OFF → ON switching. |
| 516 ^(Note) | 0204 | • Real mode/virtual mode switching request flag (M2043) turned OFF → ON during the servo start processing by the servo error reset command (M3208+20n). | • When the servo error reset is executed by turning servo error reset command (M3208+20n) on, turn the servo error detection signal (M2408+20n) off, then turn real mode/virtual mode switching request flag (M2043) OFF → ON. |
| 768 | 0300 | • Real mode/virtual mode switching request flag (M2043) turned OFF → ON in the state which the home position return signal is turning on for the output module is other than the roller. | • Execute the home position return (execute ZERO in the servo program), and turn real mode/virtual mode switching request flag (M2043) OFF → ON after home position return request signal (M2409+20n) has turned OFF. |
| 1024 | 0400 | • Real mode/virtual mode switching request flag (M2043) turned OFF → ON in the state (M2408+20n ON) of the servo error. | • Check the servo amplifier, servomotor and wiring, etc. |
| 1280 | 0500 | • Real mode/virtual mode switching request flag (M2043) turned OFF → ON in the state which the units set in the fixed parameter and output module are different for the output module is other than the roller. | • Correct the setting unit of the fixed parameter or output module, and write to the Motion CPU. |
| 1536 | 0600 | • Real mode/virtual mode switching request flag (M2043) turned OFF → ON in the state which cam data has not registered although the cam is set to the output module. | • Write the cam data to the Motion CPU. |
| 2048 | 0800 | • Real mode/virtual mode switching request flag (M2043) turned OFF → ON without the cam No. setting to the cam No. setting device. (Cam No. setting device is "0"). | • Turn real mode/virtual mode switching request flag (M2043) OFF → ON after writing the cam No. set in the cam No. used of cam parameter to the cam No. setting device. |
| 2304 | 0900 | • The setting value of cam stroke amount setting device is outside the range of 1 to $(2^{31}-1)$. | • Turn real mode/virtual mode switching request flag (M2043) OFF → ON after setting the value within the range of 1 to $(2^{31}-1)$ to the cam stroke amount setting device. |
| 2816 | 0B00 | • The cam stroke amount setting device is not an even number. | • Set an even number to the cam stroke amount setting device. |
| 3072 | 0C00 | • Setting for real mode axis is not correct. | • Execute "conversion and save" after setting real mode axis setting in the mechanical system program editor. |
| 3328 | 0D00 | • The number of pulses per revolution of the rotary table is outside the range of 1 to 1073741824. | • Correct the number of pulses per revolution and the travel value per revolution in the fixed parameter within the range of 1 to 1073741824 to the number of pulses per revolution of the rotary table. |
| -4094 ^(Note) | F002 | • The PLC ready flag (M2000) turned off, and the system returned to the real mode during virtual mode operation. • The Motion CPU stopped during virtual mode operation. | • Turn PLC ready flag (M2000) on. • Set the Motion CPU "RUN" state. |
| -4095 ^(Note) | F001 | • The servo error detection signal (M2408+20n) turned off, and the system returned to the real mode during virtual mode operation. | • Check the servo error code register to determine the error cause at the axis in question, then release the error cause (Refer to APPENDIX 1.5). |
| -4096 ^(Note) | F000 | • The forced stop signal (EMG) turned on, and the system returned to the real mode. | • Turn the forced stop signal off. |

(Note): Error axis No. information is not set to SD505, SD506 in this error.

APPENDICES

APPENDIX 2 Setting Range for Indirect Setting Devices

Positioning address, command speed or M-code, etc. (excluding the axis No.) set in the servo program can be set indirectly by the word.

(1) Device range


The number of device words and device range at indirect setting are shown below.

| | Item | Number of device words | Device setting range | Remarks | | | | | | | | | | | | | | |
|--|--|--|--|---------|-------|---|----------------------------------|---|--------------|---|-------------------------------|------|--|---|-----------|------|--|--|
| Common | Parameter block No. | 1 | <table border="1"> <thead> <tr> <th>Device</th> <th>Range</th> </tr> </thead> <tbody> <tr> <td>D</td> <td>0 to 8191 ^(Note-1)</td> </tr> <tr> <td>W</td> <td>0000 to 1FFF</td> </tr> <tr> <td>#</td> <td>0 to 7999</td> </tr> <tr> <td>U□\G</td> <td>10000 to (10000+p-1) ^(Note-2)</td> </tr> </tbody> </table> | Device | Range | D | 0 to 8191 ^(Note-1) | W | 0000 to 1FFF | # | 0 to 7999 | U□\G | 10000 to (10000+p-1) ^(Note-2) | | | | | |
| | Device | Range | | | | | | | | | | | | | | | | |
| | D | 0 to 8191 ^(Note-1) | | | | | | | | | | | | | | | | |
| | W | 0000 to 1FFF | | | | | | | | | | | | | | | | |
| | # | 0 to 7999 | | | | | | | | | | | | | | | | |
| | U□\G | 10000 to (10000+p-1) ^(Note-2) | | | | | | | | | | | | | | | | |
| Address (travel value) | 2 | | | | | | | | | | | | | | | | | |
| Command speed | 2 | | | | | | | | | | | | | | | | | |
| Dwell time | 1 | | | | | | | | | | | | | | | | | |
| M-code | 1 | | | | | | | | | | | | | | | | | |
| Torque limit value | 1 | | | | | | | | | | | | | | | | | |
| Arc | Auxiliary point | 2 | | | | | | | | | | | | | | | | |
| | Radius | 2 | | | | | | | | | | | | | | | | |
| | Central point | 2 | | | | | | | | | | | | | | | | |
| | Pitch | 1 | | | | | | | | | | | | | | | | |
| Parameter block | Control unit | 1 | | | | | | | | | | | | | | | | |
| | Speed limit value | 2 | | | | | | | | | | | | | | | | |
| | Acceleration time | 1 | | | | | | | | | | | | | | | | |
| | Deceleration time | 1 | | | | | | | | | | | | | | | | |
| | Rapid stop deceleration time | 1 | | | | | | | | | | | | | | | | |
| | S-curve ratio | 1 | | | | | | | | | | | | | | | | |
| | Advanced S-curve acceleration/ deceleration | Acceleration/deceleration system | | 1 | | | | | | | | | | | | | | |
| | | Acceleration section 1 ratio | | 1 | | | | | | | | | | | | | | |
| | | Acceleration section 2 ratio | | 1 | | | | | | | | | | | | | | |
| | | Deceleration section 1 ratio | 1 | | | | | | | | | | | | | | | |
| | Deceleration section 2 ratio | 1 | | | | | | | | | | | | | | | | |
| | Torque limit value | 1 | | | | | | | | | | | | | | | | |
| | Deceleration processing on STOP input | 1 | | | | | | | | | | | | | | | | |
| Allowable error range for circular interpolation | 2 | | | | | | | | | | | | | | | | | |
| Others | Command speed (Constant speed) | 2 | <table border="1"> <thead> <tr> <th>Device</th> <th>Range</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>0000 to 1FFF ^(Note-3)</td> </tr> <tr> <td>Y</td> <td>0000 to 1FFF</td> </tr> <tr> <td>M</td> <td>0 to 8191 ^(Note-1)</td> </tr> <tr> <td>B</td> <td>0000 to 1FFF</td> </tr> <tr> <td>F</td> <td>0 to 2047</td> </tr> <tr> <td>U□\G</td> <td>10000.0 to (10000+p-1).F ^(Note-2)</td> </tr> </tbody> </table> | Device | Range | X | 0000 to 1FFF ^(Note-3) | Y | 0000 to 1FFF | M | 0 to 8191 ^(Note-1) | B | 0000 to 1FFF | F | 0 to 2047 | U□\G | 10000.0 to (10000+p-1).F ^(Note-2) | |
| | Device | Range | | | | | | | | | | | | | | | | |
| | X | 0000 to 1FFF ^(Note-3) | | | | | | | | | | | | | | | | |
| | Y | 0000 to 1FFF | | | | | | | | | | | | | | | | |
| | M | 0 to 8191 ^(Note-1) | | | | | | | | | | | | | | | | |
| | B | 0000 to 1FFF | | | | | | | | | | | | | | | | |
| | F | 0 to 2047 | | | | | | | | | | | | | | | | |
| | U□\G | 10000.0 to (10000+p-1).F ^(Note-2) | | | | | | | | | | | | | | | | |
| | FIN acceleration/deceleration | 1 | | | | | | | | | | | | | | | | |
| | Fixed position stop acceleration/deceleration time | 1 | | | | | | | | | | | | | | | | |
| Repetition condition (Number of repetitions) | 1 | | | | | | | | | | | | | | | | | |
| Repetition condition (ON/OFF) | Bit | | | | | | | | | | | | | | | | | |
| Cancel | | | | | | | | | | | | | | | | | | |
| Skip | | | | | | | | | | | | | | | | | | |
| WAIT ON/OFF | | | | | | | | | | | | | | | | | | |
| Fixed position stop | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |

(Note-1): Synchronous encoder axis area cannot be set.

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

(Note-3): The range of "PXn+4 to PXn+F" cannot be used (fixed at 0) for the input device (PXn+0 to PXn+F)

allocated to the built-in interface in Motion CPU (DI). (n: First input No.) 

APPENDICES

| POINT |
|--|
| <p>(1) Be sure to set even-numbered devices of the items set as 2-word. Be sure to set as 32-bit integer type when the data is set in these devices using the Motion SFC programs. (Example : #0L, D0L)</p> <p>(2) Refer to Chapter 2 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for the user setting area points of the Multiple CPU high speed transmission area.</p> |

(2) Inputting device data

Indirect setting device data is inputted by the Motion CPU at the servo program start.

Do not change the applicable device before setting to device and start completion.

The procedures by start method for setting data to devices and cautions are shown below.

| Start method | Setting method | Notes |
|---|--|---|
| Start by the servo program | Set data in indirect setting devices. ↓ Start the servo program. | Do not change the indirect setting device before the "positioning start complete signal" of the starting axis turns on. |
| Set the loop (FOR - NEXT) point data for CPSTART instruction indirectly | Set initial command data in the indirect setting device. ↓ Start using the servo program (or turn the cancel command device on). ↓ Read the value of "data set pointer for constant-speed control" of the start axis, and update the data input by Motion CPU. | Refer to the positioning signal data register "Monitoring data area" for details. |

APPENDICES

APPENDIX 3 Processing Times of the Motion CPU

The processing time of each signal and each instruction for positioning control in the Multiple CPU system is shown below.

(1) Motion operation cycle [ms] (Default)

(a) Q173DSCPU/Q172DSCPU

| | Q173DSCPU | | | Q172DSCPU | |
|-------------------------------|-----------|---------|----------|-----------|---------|
| | 1 to 6 | 7 to 16 | 17 to 32 | 1 to 6 | 7 to 16 |
| Number of setting axes (SV22) | 1 to 6 | 7 to 16 | 17 to 32 | 1 to 6 | 7 to 16 |
| Operation cycle [ms] | 0.44 | 0.88 | 1.77 | 0.44 | 0.88 |

(b) Q173DCPU(-S1)/Q172DCPU(-S1)

| | Q173DCPU(-S1) | | | | Q172DCPU(-S1) | |
|-------------------------------|---------------|---------|----------|----------|---------------|--------|
| | 1 to 4 | 5 to 12 | 13 to 28 | 29 to 32 | 1 to 4 | 5 to 8 |
| Number of setting axes (SV22) | 1 to 4 | 5 to 12 | 13 to 28 | 29 to 32 | 1 to 4 | 5 to 8 |
| Operation cycle [ms] | 0.44 | 0.88 | 1.77 | 3.55 | 0.44 | 0.88 |

(2) CPU processing time [ms]

The instruction processing time means the time until the content is reflected to servo amplifier side after each instruction is executed.

(Including the transmission time between Motion controller and servo amplifier.)

(a) Q173DSCPU/Q172DSCPU

| | | Q173DSCPU/Q172DSCPU | | | | | |
|--|---|---------------------|------------|------------|------------|------------|--------------|
| Operation cycle [ms] | | 0.22 | 0.44 | 0.88 | 1.77 | 3.55 | 7.11 |
| Servo program start processing time (Note-1) | "WAIT ON/OFF" + Motion control step | 0.44 | 0.88 | 1.77 | 2.66 | 4.44 | 7.99 |
| | Only Motion control step | 0.6 to 0.9 | 1.0 to 1.4 | 1.9 to 2.8 | 2.8 to 4.6 | 4.6 to 8.2 | 8.1 to 15.2 |
| | Dedicated instruction (D(P).SVST) from the PLC CPU | 1.4 to 2.3 | 2.2 to 3.1 | 3.5 to 4.4 | 5.3 to 6.2 | 8.8 to 9.7 | 16.0 to 16.9 |
| Speed change response time | Instruction (CHGV) from the Motion SFC | 0.4 to 0.9 | 0.8 to 1.3 | 1.7 to 2.6 | 2.6 to 4.4 | 4.4 to 8.0 | 8.0 to 15.1 |
| | Dedicated instruction (D(P).CHGV) from the PLC CPU | 1.4 to 2.3 | 1.7 to 2.6 | 2.6 to 3.5 | 3.5 to 4.4 | 5.3 to 6.2 | 8.9 to 9.8 |
| Torque limit value change response time | Instruction (CHGT) from the Motion SFC | 0.4 to 0.9 | 0.8 to 1.3 | 1.7 to 2.6 | 2.6 to 4.4 | 4.4 to 8.0 | 4.4 to 11.5 |
| | Dedicated instruction (D(P).CHGT) from the PLC CPU | 1.4 to 2.3 | 1.7 to 2.6 | 2.6 to 3.5 | 3.5 to 4.4 | 5.3 to 6.2 | 5.3 to 9.7 |
| Torque limit value individual change response time | Instruction (CHGT2) from the Motion SFC | 0.4 to 0.9 | 0.8 to 1.3 | 1.7 to 2.6 | 2.6 to 4.4 | 4.4 to 8.0 | 4.4 to 11.5 |
| | Dedicated instruction (D(P).CHGT2) from the PLC CPU | 1.4 to 2.3 | 1.7 to 2.6 | 2.6 to 3.5 | 3.5 to 4.4 | 5.3 to 6.2 | 5.3 to 9.7 |
| Target position change response time | Instruction (CHGP) from the Motion SFC | 0.4 to 0.9 | 0.8 to 1.3 | 1.7 to 2.6 | 2.6 to 4.4 | 4.4 to 8.0 | 8.0 to 15.1 |
| Time from PLC ready flag (M2000) ON to PCPU READY complete flag (SM500) ON | | 44 to 60 | | | | | |

(Note-1): FEED instruction varies greatly depending on the condition (whether other axes are operating).

APPENDICES

(b) Q173DCPU(-S1)/Q172DCPU(-S1)

| | | Q173DCPU(-S1)/Q172DCPU(-S1) | | | | | |
|--|--|-----------------------------|------------|------------|------------|--------------|--------------|
| Operation cycle [ms] | | 0.44 | 0.88 | 1.77 | 3.55 | 7.11 | 14.2 |
| Servo program start processing time ^(Note-1) | "WAIT ON/OFF" + Motion control step | 0.88 | 1.77 | 2.66 | 4.44 | 7.99 | 15.11 |
| | Only Motion control step | 1.0 to 1.4 | 1.9 to 2.8 | 2.8 to 4.6 | 4.6 to 8.2 | 8.1 to 15.2 | 15.2 to 29.4 |
| | Dedicated instruction (D(P).SVST) from the PLC CPU | 2.2 to 3.1 | 3.5 to 4.4 | 5.3 to 6.2 | 8.8 to 9.7 | 16.0 to 16.9 | 30.2 to 31.1 |
| Speed change response time | Instruction (CHGV) from the Motion SFC | 0.8 to 1.3 | 1.7 to 2.6 | 2.6 to 4.4 | 4.4 to 8.0 | 8.0 to 15.1 | 15.1 to 29.3 |
| | Dedicated instruction (D(P).CHGV) from the PLC CPU | 1.7 to 2.6 | 2.6 to 3.5 | 3.5 to 4.4 | 5.3 to 6.2 | 8.9 to 9.8 | 16.0 to 16.9 |
| Torque limit value change response time | Instruction (CHGT) from the Motion SFC | 0.8 to 1.3 | 1.7 to 2.6 | 2.6 to 4.4 | 4.4 to 8.0 | 4.4 to 11.5 | 4.4 to 18.6 |
| | Dedicated instruction (D(P).CHGT) from the PLC CPU | 1.7 to 2.6 | 2.6 to 3.5 | 3.5 to 4.4 | 5.3 to 6.2 | 5.3 to 9.7 | 5.3 to 16.0 |
| Time from PLC ready flag (M2000) ON to PCPU READY complete flag (SM500) ON | | 22 to 28 | | | | | |

(Note-1): FEED instruction varies greatly depending on the condition (whether other axes are operating).

(3) Virtual servomotor axis/synchronous encoder axis operation cycle [ms] (Default)

(a) Q173DSCPU/Q172DSCPU

| | Q173DSCPU | | | Q172DSCPU | |
|-------------------------------|-----------|---------|----------|-----------|---------|
| Number of setting axes (SV22) | 1 to 6 | 7 to 16 | 17 to 32 | 1 to 6 | 7 to 16 |
| Virtual servomotor [ms] | 0.44 | 0.88 | 1.77 | 0.44 | 0.88 |
| Synchronous encoder [ms] | 0.44 | 0.88 | 1.77 | 0.44 | 0.88 |

(b) Q173DCPU(-S1)/Q172DCPU(-S1)

| | Q173DCPU(-S1) | | | | Q172DCPU(-S1) | |
|-------------------------------|---------------|---------|----------|----------|---------------|--------|
| Number of setting axes (SV22) | 1 to 4 | 5 to 12 | 13 to 28 | 29 to 32 | 1 to 4 | 5 to 8 |
| Virtual servomotor [ms] | 0.44 | 0.88 | 1.77 | 3.55 | 0.44 | 0.88 |
| Synchronous encoder [ms] | 0.44 | 0.88 | 1.77 | 3.55 | 0.44 | 0.88 |

APPENDICES

APPENDIX 4 Device List

(1) Axis status list

| Axis No. | Device No. | Signal name | | | | | | | | | |
|----------|----------------|-------------|------|---------|------------|--------------|-----|----------------|-----------------|-------------|------------------|
| | | Signal name | Real | Virtual | | | | Real Mode axis | Refresh cycle | Fetch cycle | Signal direction |
| | | | | Roller | Ball screw | Rotary table | Cam | | | | |
| 1 | M2400 to M2419 | | | | | | | | | | |
| 2 | M2420 to M2439 | | | | | | | | | | |
| 3 | M2440 to M2459 | | | | | | | | | | |
| 4 | M2460 to M2479 | | | | | | | | | | |
| 5 | M2480 to M2499 | | | | | | | | | | |
| 6 | M2500 to M2519 | 0 | ○ | OFF | | | | ○ | Operation cycle | Immediately | Status signal |
| 7 | M2520 to M2539 | 1 | | OFF | | | | | | | |
| 8 | M2540 to M2559 | 2 | | ○ | | | | | | | |
| 9 | M2560 to M2579 | 3 | | OFF | | | | | | | |
| 10 | M2580 to M2599 | 4 | | OFF | | | | | | | |
| 11 | M2600 to M2619 | 5 | | OFF | | | | | | | |
| 12 | M2620 to M2639 | 6 | | OFF | | | | | | | |
| 13 | M2640 to M2659 | 7 | | OFF | | | | | | | |
| 14 | M2660 to M2679 | 8 | | OFF | | | | | | | |
| 15 | M2680 to M2699 | 9 | | OFF | | | | | | | |
| 16 | M2700 to M2719 | 10 | | OFF | | | | | | | |
| 17 | M2720 to M2739 | 11 | | OFF | | | | | | | |
| 18 | M2740 to M2759 | 12 | | OFF | | | | | | | |
| 19 | M2760 to M2779 | 13 | | OFF | | | | | | | |
| 20 | M2780 to M2799 | 14 | | OFF | | | | | | | |
| 21 | M2800 to M2819 | 15 | | OFF | | | | | | | |
| 22 | M2820 to M2839 | 16 | | OFF | | | | | | | |
| 23 | M2840 to M2859 | 17 | OFF | | | | | | | | |
| 24 | M2860 to M2879 | 18 | OFF | | | | | | | | |
| 25 | M2880 to M2899 | 19 | OFF | | | | | | | | |
| 26 | M2900 to M2919 | 20 | OFF | | | | | | | | |
| 27 | M2920 to M2939 | 21 | OFF | | | | | | | | |
| 28 | M2940 to M2959 | 22 | OFF | | | | | | | | |
| 29 | M2960 to M2979 | 23 | OFF | | | | | | | | |
| 30 | M2980 to M2999 | 24 | OFF | | | | | | | | |
| 31 | M3000 to M3019 | 25 | OFF | | | | | | | | |
| 32 | M3020 to M3039 | 26 | OFF | | | | | | | | |
| | | 27 | OFF | | | | | | | | |
| | | 28 | OFF | | | | | | | | |
| | | 29 | OFF | | | | | | | | |
| | | 30 | OFF | | | | | | | | |
| | | 31 | OFF | | | | | | | | |
| | | 32 | OFF | | | | | | | | |
| | | 33 | OFF | | | | | | | | |
| | | 34 | OFF | | | | | | | | |
| | | 35 | OFF | | | | | | | | |
| | | 36 | OFF | | | | | | | | |
| | | 37 | OFF | | | | | | | | |
| | | 38 | OFF | | | | | | | | |
| | | 39 | OFF | | | | | | | | |
| | | 40 | OFF | | | | | | | | |
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| | | 43 | OFF | | | | | | | | |
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| | | 90 | OFF | | | | | | | | |
| | | 91 | OFF | | | | | | | | |
| | | 92 | OFF | | | | | | | | |
| | | 93 | OFF | | | | | | | | |
| | | 94 | OFF | | | | | | | | |
| | | 95 | OFF | | | | | | | | |
| | | 96 | OFF | | | | | | | | |
| | | 97 | OFF | | | | | | | | |
| | | 98 | OFF | | | | | | | | |
| | | 99 | OFF | | | | | | | | |
| | | 100 | OFF | | | | | | | | |

○ : Valid

(Note-1): It is unusable in the SV22 real mode.

| POINT |
|---|
| (1) The following range is valid. <ul style="list-style-type: none"> • Q172DSCPU : Axis No.1 to 16 • Q172DCPU(-S1): Axis No.1 to 8 |
| (2) The following device area can be used as a user device. <ul style="list-style-type: none"> • Q172DSCPU : 17 axes or more • Q172DCPU(-S1): 9 axes or more <p>However, when the project of Q172DSCPU/Q172DCPU(-S1) is replaced with Q173DSCPU/Q173DCPU(-S1), this area cannot be used as a user device.</p> |

APPENDICES

(2) Axis command signal list

| Axis No. | Device No. | Signal name | | | | | | | | | | |
|----------|----------------|-------------|--------|------------|--------------|-----|----------------|-----------------|----------------------------|------------------|------------|-----------------|
| | | Signal name | Real | Virtual | | | | Refresh cycle | Fetch cycle | Signal direction | | |
| | | | Roller | Ball screw | Rotary table | Cam | Real mode axis | | | | | |
| 1 | M3200 to M3219 | 0 | | | | | | | Operation cycle | Command signal | | |
| 2 | M3220 to M3239 | 1 | | | | | | | Main cycle | | | |
| 3 | M3240 to M3259 | 2 | | | | | | Operation cycle | | | | |
| 4 | M3260 to M3279 | 3 | ○ | | × | | ○ | | | | Main cycle | |
| 5 | M3280 to M3299 | 4 | | | | | | | | | | Operation cycle |
| 6 | M3300 to M3319 | 5 | | | | | | | | | | |
| 7 | M3320 to M3339 | 6 | — | | — | | — | — | — | | | |
| 8 | M3340 to M3359 | 7 | | | | | | | Main cycle | Command signal | | |
| 9 | M3360 to M3379 | 8 | ○ | | ○ | | ○ | | At start | | | |
| 10 | M3380 to M3399 | 9 | | | × | | | | | | | |
| 11 | M3400 to M3419 | 10 | — | | — | | — | — | — | — | | |
| 12 | M3420 to M3439 | 11 | | | | | | | | Command signal | | |
| 13 | M3440 to M3459 | 12 | ○ | | × | | ○ | | At start | | | |
| 14 | M3460 to M3479 | 13 | | × | | ○ | | | At virtual mode transition | | | |
| 15 | M3480 to M3499 | 14 | × | | × | | × | | | | | |
| 16 | M3500 to M3519 | 15 | | | | | | | Operation cycle | | | |
| 17 | M3520 to M3539 | 16 | | | | | | | Operation cycle (Note-2) | | | |
| 18 | M3540 to M3559 | 17 | ○ | | ○ | | ○ | | | | | |
| 19 | M3560 to M3579 | 18 | | | | | | | | | | |
| 20 | M3580 to M3599 | 19 | | | × | | | | Operation cycle | | | |
| 21 | M3600 to M3619 | 20 | | | | | | | | | | |
| 22 | M3620 to M3639 | 21 | | | | | | | | | | |
| 23 | M3640 to M3659 | 22 | | | | | | | | | | |
| 24 | M3660 to M3679 | 23 | | | | | | | | | | |
| 25 | M3680 to M3699 | 24 | | | | | | | | | | |
| 26 | M3700 to M3719 | 25 | | | | | | | | | | |
| 27 | M3720 to M3739 | 26 | | | | | | | | | | |
| 28 | M3740 to M3759 | 27 | | | | | | | | | | |
| 29 | M3760 to M3779 | 28 | | | | | | | | | | |
| 30 | M3780 to M3799 | 29 | | | | | | | | | | |
| 31 | M3800 to M3819 | 30 | | | | | | | | | | |
| 32 | M3820 to M3839 | 31 | | | | | | | | | | |
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APPENDICES

(3) Virtual servomotor axis status list

| Axis No. | Device No. | Signal name | | | | | | | | | |
|----------|----------------|-------------|----------------------------|--------------|-----|----------------|--|---------------|-----------------|------------------|---------------|
| | | Signal name | Real | Virtual | | | | Refresh cycle | Fetch cycle | Signal direction | |
| Roller | Ball screw | | | Rotary table | Cam | Real mode axis | | | | | |
| 1 | M4000 to M4019 | | | | | | | | | | |
| 2 | M4020 to M4039 | | | | | | | | | | |
| 3 | M4040 to M4059 | | | | | | | | | | |
| 4 | M4060 to M4079 | | | | | | | | | | |
| 5 | M4080 to M4099 | | | | | | | | | | |
| 6 | M4100 to M4119 | 0 | Positioning start complete | Backup | | ○ | | × | Operation cycle | / | Status signal |
| 7 | M4120 to M4139 | 1 | Positioning complete | | | | | | | | |
| 8 | M4140 to M4159 | 2 | Unusable | — | | — | | — | — | — | — |
| 9 | M4160 to M4179 | 3 | Command in-position | | | | | | | | |
| 10 | M4180 to M4199 | 4 | Speed controlling | Backup | | ○ | | × | Operation cycle | / | Status signal |
| 11 | M4200 to M4219 | 5 | | | | | | | | | |
| 12 | M4220 to M4239 | 6 | Unusable | — | | — | | — | — | — | — |
| 13 | M4240 to M4259 | 7 | Error detection | Backup | | ○ | | × | Immediately | / | Status signal |
| 14 | M4260 to M4279 | 8 | | | | | | | | | |
| 15 | M4280 to M4299 | 9 | | | | | | | | | |
| 16 | M4300 to M4319 | 10 | | | | | | | | | |
| 17 | M4320 to M4339 | 11 | | | | | | | | | |
| 18 | M4340 to M4359 | 12 | | | | | | | | | |
| 19 | M4360 to M4379 | 13 | Unusable | — | | — | | — | — | — | — |
| 20 | M4380 to M4399 | 14 | | | | | | | | | |
| 21 | M4400 to M4419 | 15 | | | | | | | | | |
| 22 | M4420 to M4439 | 16 | | | | | | | | | |
| 23 | M4440 to M4459 | 17 | | | | | | | | | |
| 24 | M4460 to M4479 | 18 | | | | | | | | | |
| 25 | M4480 to M4499 | 19 | M-code outputting | Backup | | ○ | | × | Operation cycle | / | Status signal |
| 26 | M4500 to M4519 | | | | | | | | | | |
| 27 | M4520 to M4539 | | | | | | | | | | |
| 28 | M4540 to M4559 | | | | | | | | | | |
| 29 | M4560 to M4579 | | | | | | | | | | |
| 30 | M4580 to M4599 | | | | | | | | | | |
| 31 | M4600 to M4619 | | | | | | | | | | |
| 32 | M4620 to M4639 | | | | | | | | | | |

○ : Valid, × : Invalid

POINT

- (1) The following range is valid.
 - Q172DSCPU : Axis No.1 to 16
 - Q172DCPU(-S1) : Axis No.1 to 8
- (2) The unused axis areas in the mechanical system program can be used as a user device.

APPENDICES

(4) Virtual servomotor axis command signal list

| Axis No. | Device No. | Signal name | | | | | | | | | |
|----------|----------------|-------------|--|--------------|-----|----------------|--|-----------------|-----------------|------------------|--|
| | | Signal name | Real | Virtual | | | | Refresh cycle | Fetch cycle | Signal direction | |
| Roller | Ball screw | | | Rotary table | Cam | Real mode axis | | | | | |
| 1 | M4800 to M4819 | | | | | | | | | | |
| 2 | M4820 to M4839 | | | | | | | | | | |
| 3 | M4840 to M4859 | | | | | | | | | | |
| 4 | M4860 to M4879 | | | | | | | | | | |
| 5 | M4880 to M4899 | | | | | | | | | | |
| 6 | M4900 to M4919 | 0 | Stop command | | | | | | Main cycle | Command signal | |
| 7 | M4920 to M4939 | 1 | Rapid stop command | | | | | Operation cycle | | | |
| 8 | M4940 to M4959 | 2 | Forward rotation JOG start command | | | | | | | | |
| 9 | M4960 to M4979 | 3 | Reverse rotation JOG start command | × | | ○ | | | | | |
| 10 | M4980 to M4999 | 4 | Complete signal OFF command | | | | | | | | |
| 11 | M5000 to M5019 | 5 | Unusable | — | | | | | | | |
| 12 | M5020 to M5039 | 6 | Unusable | — | | | | | | | |
| 13 | M5040 to M5059 | 7 | Error reset command | × | | | | | Main cycle | Command signal | |
| 14 | M5060 to M5079 | 8 | Unusable | — | | | | | | | |
| 15 | M5080 to M5099 | 9 | External stop input disable at start command | × | | | | | At start | Command signal | |
| 16 | M5100 to M5119 | 10 | Unusable | — | | | | | | | |
| 17 | M5120 to M5139 | 11 | | | | | | | | | |
| 18 | M5140 to M5159 | 12 | | | | | | | | | |
| 19 | M5160 to M5179 | 13 | | | | | | | | | |
| 20 | M5180 to M5199 | 14 | | | | | | | | | |
| 21 | M5200 to M5219 | 15 | | | | | | | | | |
| 22 | M5220 to M5239 | 16 | | | | | | | | | |
| 23 | M5240 to M5259 | 17 | | | | | | | | | |
| 24 | M5260 to M5279 | 18 | | | | | | | | | |
| 25 | M5280 to M5299 | 19 | FIN signal | × | | | | | Operation cycle | Command signal | |
| 26 | M5300 to M5319 | | | | | | | | | | |
| 27 | M5320 to M5339 | | | | | | | | | | |
| 28 | M5340 to M5359 | | | | | | | | | | |
| 29 | M5360 to M5379 | | | | | | | | | | |
| 30 | M5380 to M5399 | | | | | | | | | | |
| 31 | M5400 to M5419 | | | | | | | | | | |
| 32 | M5420 to M5439 | | | | | | | | | | |

○ : Valid, × : Invalid

POINT

- (1) The following range is valid.
 - Q172DSCPU : Axis No.1 to 16
 - Q172DCPU(-S1) : Axis No.1 to 8
- (2) The unused axis areas in the mechanical system program can be used as a user device.

APPENDICES

(5) Synchronous encoder axis status list

| Axis No. | Device No. | Signal name | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|----------------|--|--|--|--|--|-------------|---------------|-------------|------------------|-------------|------------------|-------------------|--|--|-------------|---|---------------|------------------------|---|---|------------|---|--|--|------------|---|---|---|---|---|
| 1 | M4640 to M4643 | <table border="1"> <thead> <tr> <th>Signal name</th> <th>Real</th> <th>Virtual</th> <th>Refresh cycle</th> <th>Fetch cycle</th> <th>Signal direction</th> </tr> </thead> <tbody> <tr> <td>0 Error detection</td> <td></td> <td></td> <td>Immediately</td> <td rowspan="3" style="text-align: center;">/</td> <td rowspan="3">Status signal</td> </tr> <tr> <td>1 External signal TREN</td> <td>○</td> <td>○</td> <td rowspan="2">Main cycle</td> </tr> <tr> <td>2 Virtual mode continuation operation disable warning</td> <td></td> <td></td> </tr> <tr> <td>3 Unusable</td> <td>—</td> <td>—</td> <td>—</td> <td>—</td> <td>—</td> </tr> </tbody> </table> | | | | | Signal name | Real | Virtual | Refresh cycle | Fetch cycle | Signal direction | 0 Error detection | | | Immediately | / | Status signal | 1 External signal TREN | ○ | ○ | Main cycle | 2 Virtual mode continuation operation disable warning | | | 3 Unusable | — | — | — | — | — |
| Signal name | Real | | | | | | Virtual | Refresh cycle | Fetch cycle | Signal direction | | | | | | | | | | | | | | | | | | | | | |
| 0 Error detection | | | | | | | | Immediately | / | Status signal | | | | | | | | | | | | | | | | | | | | | |
| 1 External signal TREN | ○ | | | | | | ○ | Main cycle | | | | | | | | | | | | | | | | | | | | | | | |
| 2 Virtual mode continuation operation disable warning | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 Unusable | — | | | | | | — | — | — | — | | | | | | | | | | | | | | | | | | | | | |
| 2 | M4644 to M4647 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | M4648 to M4651 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | M4652 to M4655 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | M4656 to M4659 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | M4660 to M4663 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | M4664 to M4667 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | M4668 to M4671 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | M4672 to M4675 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | M4676 to M4679 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | M4680 to M4683 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | M4684 to M4687 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

○ : Valid

POINT

- (1) The range of axis No.1 to 8 is valid in the Q172DCPU(-S1).
- (2) The device area of 9 axes or more can be used as a user device in the Q172DCPU(-S1).
However, when the project of Q172DCPU(-S1) is replaced with Q173DSCPU/Q172DSCPU/Q173DCPU(-S1), this area cannot be used.

(6) Synchronous encoder axis command signal list

| Axis No. | Device No. | Signal name | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------|----------------|--|--|--|--|--|-------------|---------------|-------------|------------------|-------------|------------------|---------------|---------------|---|---|------------|---------------|---|--|--|------------|---|---|---|---|---|--|--|--|--|--|
| 1 | M5440 to M5443 | <table border="1"> <thead> <tr> <th>Signal name</th> <th>Real</th> <th>Virtual</th> <th>Refresh cycle</th> <th>Fetch cycle</th> <th>Signal direction</th> </tr> </thead> <tbody> <tr> <td>0 Error reset</td> <td>× (Note-1)</td> <td>○</td> <td rowspan="3" style="text-align: center;">/</td> <td rowspan="3">Main cycle</td> <td rowspan="3">Status signal</td> </tr> <tr> <td>1</td> <td></td> <td></td> </tr> <tr> <td>2 Unusable</td> <td>—</td> <td>—</td> <td>—</td> <td>—</td> </tr> <tr> <td>3</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> | | | | | Signal name | Real | Virtual | Refresh cycle | Fetch cycle | Signal direction | 0 Error reset | × (Note-1) | ○ | / | Main cycle | Status signal | 1 | | | 2 Unusable | — | — | — | — | 3 | | | | | |
| Signal name | Real | | | | | | Virtual | Refresh cycle | Fetch cycle | Signal direction | | | | | | | | | | | | | | | | | | | | | | |
| 0 Error reset | × (Note-1) | | | | | | ○ | / | Main cycle | Status signal | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 Unusable | — | | | | | | — | | | | — | — | | | | | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | M5444 to M5447 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | M5448 to M5451 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | M5452 to M5455 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | M5456 to M5459 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | M5460 to M5463 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | M5464 to M5467 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | M5468 to M5471 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | M5472 to M5475 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | M5476 to M5479 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | M5480 to M5483 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | M5484 to M5487 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

○ : Valid, × : Invalid

(Note-1): It is valid for the version (Refer to Section 1.4) that supports "synchronous encoder current value monitor in real mode".

POINT

- (1) The range of axis No.1 to 8 is valid in the Q172DCPU(-S1).
- (2) The device area of 9 axes or more can be used as a user device in the Q172DCPU(-S1).
However, when the project of Q172DCPU(-S1) is replaced with Q173DSCPU/Q172DSCPU/Q173DCPU(-S1), this area cannot be used.

APPENDICES

(7) Common device list

| Device No. | Signal name | Refresh cycle | Fetch cycle | Signal direction | Remark (Note-6) | | | | |
|------------|--|--|----------------------------|--|-----------------|--|-----------------|----------------------------------|--|
| M2000 | PLC ready flag | / | Main cycle | Command signal | M3072 | | | | |
| M2001 | Axis 1 | Start accept flag | Operation cycle | Status signal (Note-1), (Note-2), (Note-3), (Note-4) | | | | | |
| M2002 | Axis 2 | | | | | | | | |
| M2003 | Axis 3 | | | | | | | | |
| M2004 | Axis 4 | | | | | | | | |
| M2005 | Axis 5 | | | | | | | | |
| M2006 | Axis 6 | | | | | | | | |
| M2007 | Axis 7 | | | | | | | | |
| M2008 | Axis 8 | | | | | | | | |
| M2009 | Axis 9 | | | | | | | | |
| M2010 | Axis 10 | | | | | | | | |
| M2011 | Axis 11 | | | | | | | | |
| M2012 | Axis 12 | | | | | | | | |
| M2013 | Axis 13 | | | | | | | | |
| M2014 | Axis 14 | | | | | | | | |
| M2015 | Axis 15 | | | | | | | | |
| M2016 | Axis 16 | | | | | | | | |
| M2017 | Axis 17 | | | | | | | | |
| M2018 | Axis 18 | | | | | | | | |
| M2019 | Axis 19 | | | | | | | | |
| M2020 | Axis 20 | | | | | | | | |
| M2021 | Axis 21 | | | | | | | | |
| M2022 | Axis 22 | | | | | | | | |
| M2023 | Axis 23 | | | | | | | | |
| M2024 | Axis 24 | | | | | | | | |
| M2025 | Axis 25 | | | | | | | | |
| M2026 | Axis 26 | | | | | | | | |
| M2027 | Axis 27 | | | | | | | | |
| M2028 | Axis 28 | | | | | | | | |
| M2029 | Axis 29 | | | | | | | | |
| M2030 | Axis 30 | | | | | | | | |
| M2031 | Axis 31 | | | | | | | | |
| M2032 | Axis 32 | | | | | | | | |
| M2033 | Unusable (2 points) | — | — | — | — | | | | |
| M2035 | Motion error history clear request flag | / | Main cycle | Command signal | M3080 | | | | |
| M2036 | Unusable (2 points) | — | — | — | — | | | | |
| M2038 | Motion SFC debugging flag | At debugging mode transition | / | Status signal | | | | | |
| M2039 | Motion error detection flag | Immediate | / | Status signal | | | | | |
| M2040 | Speed switching point specified flag | / | At start | Command signal | M3073 | | | | |
| M2041 | System setting error flag | Operation cycle | / | Status signal | | | | | |
| M2042 | All axes servo ON command | / | Operation cycle | Command signal | M3074 | | | | |
| M2043 | Real mode/virtual mode switching request (SV22) | / | At virtual mode transition | Command signal | M3075 | | | | |
| M2044 | Real mode/virtual mode switching status (SV22) | / | / | Status signal | | | | | |
| M2045 | Real mode/virtual mode switching error detection signal (SV22) | At virtual mode transition | / | Status signal | | | | | |
| M2046 | Out-of-sync warning (SV22) | / | / | Status signal | | | | | |
| M2047 | Motion slot fault detection flag | Operation cycle | / | Status signal | | | | | |
| M2048 | JOG operation simultaneous start command | / | Main cycle | Command signal | M3076 | | | | |
| M2049 | All axes servo ON accept flag | Operation cycle | / | Status signal | | | | | |
| M2050 | Unusable | — | — | — | — | | | | |
| M2051 | Manual pulse generator 1 enable flag | / | Main cycle | Command signal | M3077 | | | | |
| M2052 | Manual pulse generator 2 enable flag | | | | | | | | |
| M2053 | Manual pulse generator 3 enable flag | | | | | | | | |
| M2054 | Operation cycle over flag | Operation cycle | / | Status signal | | | | | |
| M2055 | Unusable (6 points) | — | — | — | — | | | | |
| M2056 | | | | | | | | | |
| M2057 | | | | | | | | | |
| M2058 | | | | | | | | | |
| M2059 | | | | | | | | | |
| M2060 | | | | | | | | | |
| M2061 | Axis 1 | Speed change accepting flag | Operation cycle | Status signal (Note-1), (Note-2), (Note-3), (Note-4) | | | | | |
| M2062 | Axis 2 | | | | | | | | |
| M2063 | Axis 3 | | | | | | | | |
| M2064 | Axis 4 | | | | | | | | |
| M2065 | Axis 5 | | | | | | | | |
| M2066 | Axis 6 | | | | | | | | |
| M2067 | Axis 7 | | | | | | | | |
| M2068 | Axis 8 | | | | | | | | |
| M2069 | Axis 9 | | | | | | | | |
| M2070 | Axis 10 | | | | | | | | |
| M2071 | Axis 11 | | | | | | | | |
| M2072 | Axis 12 | | | | | | | | |
| M2073 | Axis 13 | | | | | | | | |
| M2074 | Axis 14 | | | | | | | | |
| M2075 | Axis 15 | | | | | | | | |
| M2076 | Axis 16 | | | | | | | | |
| M2077 | Axis 17 | | | | | | | | |
| M2078 | Axis 18 | | | | | | | | |
| M2079 | Axis 19 | | | | | | | | |
| M2080 | Axis 20 | | | | | | | | |
| M2081 | Axis 21 | | | | | | | | |
| M2082 | Axis 22 | | | | | | | | |
| M2083 | Axis 23 | | | | | | | | |
| M2084 | Axis 24 | | | | | | | | |
| M2085 | Axis 25 | | | | | | | | |
| M2086 | Axis 26 | | | | | | | | |
| M2087 | Axis 27 | | | | | | | | |
| M2088 | Axis 28 | | | | | | | | |
| M2089 | Axis 29 | | | | | | | | |
| M2090 | Axis 30 | | | | | Synchronous encoder current value changing flag (Note-5) | Operation cycle | Status signal (Note-2), (Note-4) | |
| M2091 | Axis 31 | | | | | | | | |
| M2092 | Axis 32 | | | | | | | | |
| M2093 | Unusable (8 points) | — | — | — | — | | | | |
| M2094 | | | | | | | | | |
| M2095 | | | | | | | | | |
| M2096 | | | | | | | | | |
| M2097 | | | | | | | | | |
| M2098 | | | | | | | | | |
| M2099 | | | | | | | | | |
| M2100 | | | | | | | | | |
| M2101 | Axis 1 | Synchronous encoder current value changing flag (Note-5) | Operation cycle | Status signal (Note-2), (Note-4) | | | | | |
| M2102 | Axis 2 | | | | | | | | |
| M2103 | Axis 3 | | | | | | | | |
| M2104 | Axis 4 | | | | | | | | |
| M2105 | Axis 5 | | | | | | | | |
| M2106 | Axis 6 | | | | | | | | |
| M2107 | Axis 7 | | | | | | | | |
| M2108 | Axis 8 | | | | | | | | |
| M2109 | Axis 9 | | | | | | | | |

APPENDICES

Common device list (Continued)

| Device No. | Signal name | Refresh cycle | Fetch cycle | Signal direction | Remark (Note-6) | Device No. | Signal name | Refresh cycle | Fetch cycle | Signal direction | Remark (Note-6) |
|------------|-------------------------------|--|-----------------|------------------|--|------------|-------------------------------|---------------|-------------|------------------|-----------------|
| M2110 | Axis 10 | Synchronous encoder current value changing flag (Note-5) | Operation cycle | / | Status signal (Note-2), (Note-4) | M2179 | Unusable (45 points) (Note-7) | - | - | - | - |
| M2111 | Axis 11 | | | | | | | | | | |
| M2112 | Axis 12 | | | | | | | | | | |
| M2113 | Unusable (15 points) | - | - | - | - | M2180 | | | | | |
| M2114 | | | | | | | | | | | |
| M2115 | | | | | | | | | | | |
| M2116 | | | | | | | | | | | |
| M2117 | | | | | | | | | | | |
| M2118 | | | | | | | | | | | |
| M2119 | | | | | | | | | | | |
| M2120 | | | | | | | | | | | |
| M2121 | | | | | | | | | | | |
| M2122 | | | | | | | | | | | |
| M2123 | | | | | | | | | | | |
| M2124 | | | | | | | | | | | |
| M2125 | | | | | | | | | | | |
| M2126 | | | | | | | | | | | |
| M2127 | | | | | | | | | | | |
| M2128 | Axis 1 | Automatic decelerating flag | Operation cycle | / | Status signal (Note-1), (Note-2), (Note-3), (Note-4) | M2181 | | | | | |
| M2129 | Axis 2 | | | | | | | | | | |
| M2130 | Axis 3 | | | | | | | | | | |
| M2131 | Axis 4 | | | | | | | | | | |
| M2132 | Axis 5 | | | | | | | | | | |
| M2133 | Axis 6 | | | | | | | | | | |
| M2134 | Axis 7 | | | | | | | | | | |
| M2135 | Axis 8 | | | | | | | | | | |
| M2136 | Axis 9 | | | | | | | | | | |
| M2137 | Axis 10 | | | | | | | | | | |
| M2138 | Axis 11 | | | | | | | | | | |
| M2139 | Axis 12 | | | | | | | | | | |
| M2140 | Axis 13 | | | | | | | | | | |
| M2141 | Axis 14 | | | | | | | | | | |
| M2142 | Axis 15 | | | | | | | | | | |
| M2143 | Axis 16 | | | | | | | | | | |
| M2144 | Axis 17 | | | | | | | | | | |
| M2145 | Axis 18 | | | | | | | | | | |
| M2146 | Axis 19 | | | | | | | | | | |
| M2147 | Axis 20 | | | | | | | | | | |
| M2148 | Axis 21 | | | | | | | | | | |
| M2149 | Axis 22 | | | | | | | | | | |
| M2150 | Axis 23 | | | | | | | | | | |
| M2151 | Axis 24 | | | | | | | | | | |
| M2152 | Axis 25 | | | | | | | | | | |
| M2153 | Axis 26 | | | | | | | | | | |
| M2154 | Axis 27 | | | | | | | | | | |
| M2155 | Axis 28 | | | | | | | | | | |
| M2156 | Axis 29 | | | | | | | | | | |
| M2157 | Axis 30 | | | | | | | | | | |
| M2158 | Axis 31 | | | | | | | | | | |
| M2159 | Axis 32 | | | | | | | | | | |
| M2160 | Unusable (19 points) (Note-7) | - | - | - | - | M2182 | | | | | |
| M2161 | | | | | | | | | | | |
| M2162 | | | | | | | | | | | |
| M2163 | | | | | | | | | | | |
| M2164 | | | | | | | | | | | |
| M2165 | | | | | | | | | | | |
| M2166 | | | | | | | | | | | |
| M2167 | | | | | | | | | | | |
| M2168 | | | | | | | | | | | |
| M2169 | | | | | | | | | | | |
| M2170 | | | | | | | | | | | |
| M2171 | | | | | | | | | | | |
| M2172 | | | | | | | | | | | |
| M2173 | | | | | | | | | | | |
| M2174 | | | | | | | | | | | |
| M2175 | | | | | | | | | | | |
| M2176 | | | | | | | | | | | |
| M2177 | | | | | | | | | | | |
| M2178 | | | | | | | | | | | |
| M2200 | Unusable (16 points) | - | - | - | - | M2183 | | | | | |
| M2201 | | | | | | | | | | | |
| M2202 | | | | | | | | | | | |
| M2203 | | | | | | | | | | | |
| M2204 | | | | | | | | | | | |
| M2205 | | | | | | | | | | | |
| M2206 | | | | | | | | | | | |
| M2207 | | | | | | | | | | | |
| M2208 | | | | | | | | | | | |
| M2209 | | | | | | | | | | | |
| M2210 | | | | | | | | | | | |
| M2211 | | | | | | | | | | | |
| M2212 | | | | | | | | | | | |
| M2213 | | | | | | | | | | | |
| M2214 | | | | | | | | | | | |
| M2215 | | | | | | | | | | | |
| M2216 | | | | | | | | | | | |
| M2217 | | | | | | | | | | | |
| M2218 | | | | | | | | | | | |
| M2219 | | | | | | | | | | | |
| M2220 | | | | | | | | | | | |
| M2221 | | | | | | | | | | | |
| M2222 | | | | | | | | | | | |
| M2223 | | | | | | | | | | | |
| M2224 | | | | | | | | | | | |
| M2225 | | | | | | | | | | | |
| M2226 | | | | | | | | | | | |
| M2227 | | | | | | | | | | | |
| M2228 | | | | | | | | | | | |
| M2229 | | | | | | | | | | | |
| M2230 | | | | | | | | | | | |
| M2231 | | | | | | | | | | | |
| M2232 | | | | | | | | | | | |
| M2233 | | | | | | | | | | | |
| M2234 | | | | | | | | | | | |
| M2235 | | | | | | | | | | | |
| M2236 | | | | | | | | | | | |
| M2237 | | | | | | | | | | | |
| M2238 | | | | | | | | | | | |
| M2239 | | | | | | | | | | | |
| M2240 | Axis 1 | Speed change "0" accepting flag | Operation cycle | / | Status signal (Note-1), (Note-2), (Note-3), (Note-4) | M2240 | | | | | |
| M2241 | Axis 2 | | | | | | | | | | |
| M2242 | Axis 3 | | | | | | | | | | |
| M2243 | Axis 4 | | | | | | | | | | |
| M2244 | Axis 5 | | | | | | | | | | |
| M2245 | Axis 6 | | | | | | | | | | |
| M2246 | Axis 7 | | | | | | | | | | |
| M2247 | Axis 8 | | | | | | | | | | |

APPENDICES

Common device list (Continued)

| Device No. | Signal name | Refresh cycle | Fetch cycle | Signal direction | Remark (Note-6) | Device No. | Signal name | Refresh cycle | Fetch cycle | Signal direction | Remark (Note-6) |
|------------|-------------|-----------------|-------------|------------------|-----------------|------------|-------------|-----------------|-------------|------------------|--|
| M2248 | Axis 9 | Operation cycle | / | ↑ | | M2284 | Axis 13 | Operation cycle | / | ↑ | Status signal (Note-1), (Note-2), (Note-3), (Note-4) |
| M2249 | Axis 10 | | | | | M2285 | Axis 14 | | | | |
| M2250 | Axis 11 | | | | | M2286 | Axis 15 | | | | |
| M2251 | Axis 12 | | | | | M2287 | Axis 16 | | | | |
| M2252 | Axis 13 | | | | | M2288 | Axis 17 | | | | |
| M2253 | Axis 14 | | | | | M2289 | Axis 18 | | | | |
| M2254 | Axis 15 | | | | | M2290 | Axis 19 | | | | |
| M2255 | Axis 16 | | | | | M2291 | Axis 20 | | | | |
| M2256 | Axis 17 | | | | | M2292 | Axis 21 | | | | |
| M2257 | Axis 18 | | | | | M2293 | Axis 22 | | | | |
| M2258 | Axis 19 | | | | | M2294 | Axis 23 | | | | |
| M2259 | Axis 20 | | | | | M2295 | Axis 24 | | | | |
| M2260 | Axis 21 | | | | | M2296 | Axis 25 | | | | |
| M2261 | Axis 22 | | | | | M2297 | Axis 26 | | | | |
| M2262 | Axis 23 | | | | | M2298 | Axis 27 | | | | |
| M2263 | Axis 24 | | | | | M2299 | Axis 28 | | | | |
| M2264 | Axis 25 | | | | | M2300 | Axis 29 | | | | |
| M2265 | Axis 26 | | | | | M2301 | Axis 30 | | | | |
| M2266 | Axis 27 | | | | | M2302 | Axis 31 | | | | |
| M2267 | Axis 28 | | | | | M2303 | Axis 32 | | | | |
| M2268 | Axis 29 | | | | | M2304 | | | | | |
| M2269 | Axis 30 | M2305 | | | | | | | | | |
| M2270 | Axis 31 | M2306 | | | | | | | | | |
| M2271 | Axis 32 | M2307 | | | | | | | | | |
| M2272 | Axis 1 | M2308 | | | | | | | | | |
| M2273 | Axis 2 | M2309 | | | | | | | | | |
| M2274 | Axis 3 | M2310 | | | | | | | | | |
| M2275 | Axis 4 | M2311 | Unusable | | | | | | | | |
| M2276 | Axis 5 | M2312 | (16 points) | | | | | | | | |
| M2277 | Axis 6 | M2313 | | | | | | | | | |
| M2278 | Axis 7 | M2314 | | | | | | | | | |
| M2279 | Axis 8 | M2315 | | | | | | | | | |
| M2280 | Axis 9 | M2316 | | | | | | | | | |
| M2281 | Axis 10 | M2317 | | | | | | | | | |
| M2282 | Axis 11 | M2318 | | | | | | | | | |
| M2283 | Axis 12 | M2319 | | | | | | | | | |

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

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

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

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

(Note-5): It is unusable in the real mode.

(It can be used in the real mode for the version (Refer to Section 1.4) that supports "synchronous encoder current value monitor in real mode".)

(Note-6): It can also be ordered the device of a remark column.

(Note-7): These devices can be used as the clutch statuses.

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

Refer to Section 7.2.2.

APPENDICES

(8) Common device list (Command signal)

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

(Note-1): The state of a device is not in agreement when the device of a remark column is turned ON/OFF directly. In addition, when the request from a data register and the request from the above device are performed simultaneously, the request from the above device becomes effective.

(Note-2): It can also be ordered the device of a remark column.

(Note-3): Do not use it as a user device. It can be used as a device that performs automatic refresh because of area for the reserve of command signal.

POINT

The device of a remark column turns ON by OFF to ON of the above device, and turns OFF by ON to OFF of the above device.
 The command signal cannot be turned ON/OFF by the PLC CPU in the automatic refresh because the statuses and commands are mixed together in M2000 to M2053. Use the above devices in the case.
 And, it can also be turned ON/OFF by the data register. (Refer to Section 4.2.8)

APPENDICES

(9) Axis monitor device list

| Axis No. | Device No. | Signal name | | | | | | | | | | |
|----------|--------------|-------------|---|------|---------|------------|--------------|-----|-----------------|----------------|------------------|----------------|
| 1 | D0 to D19 | | Signal name | Real | Virtual | | | | Refresh cycle | Fetch cycle | Signal direction | |
| 2 | D20 to D39 | | | | Roller | Ball screw | Rotary table | Cam | | | | Real mode axis |
| 3 | D40 to D59 | | | | | | | | | | | |
| 4 | D60 to D79 | | | | | | | | | | | |
| 5 | D80 to D99 | | | | | | | | | | | |
| 6 | D100 to D119 | 0 | Feed current value/roller cycle speed | | | | | | Operation cycle | Monitor device | | |
| 7 | D120 to D139 | 1 | Real current value | | | | | | | | | |
| 8 | D140 to D159 | 2 | Deviation counter value | | | | | | | | | |
| 9 | D160 to D179 | 3 | Minor error code | | | | | | | | | |
| 10 | D180 to D199 | 4 | Major error code | | | | | | | | | |
| 11 | D200 to D219 | 5 | Servo error code | | | | | | | | | |
| 12 | D220 to D239 | 6 | Home position return re-travel value | ○ | | | Backup | | | | | |
| 13 | D240 to D259 | 7 | Travel value after proximity dog ON | | | | | | | | | |
| 14 | D260 to D279 | 8 | Execute program No. | | | | | | | | | |
| 15 | D280 to D299 | 9 | M-code | | | | | | | | | |
| 16 | D300 to D319 | 10 | Torque limit value | | | | | | | | | |
| 17 | D320 to D339 | 11 | Data set pointer for constant-speed control | | | | | | | | | |
| 18 | D340 to D359 | 12 | Unusable (Note-1) | — | | | | | | | | |
| 19 | D360 to D379 | 13 | Real current value at stop input | ○ | | | Backup | | | | | |
| 20 | D380 to D399 | 14 | | | | | | | | | | |
| 21 | D400 to D419 | 15 | | | | | | | | | | |
| 22 | D420 to D439 | 16 | | | | | | | | | | |
| 23 | D440 to D459 | 17 | | | | | | | | | | |
| 24 | D460 to D479 | 18 | | | | | | | | | | |
| 25 | D480 to D499 | 19 | | | | | | | | | | |
| 26 | D500 to D519 | | | | | | | | | | | |
| 27 | D520 to D539 | | | | | | | | | | | |
| 28 | D540 to D559 | | | | | | | | | | | |
| 29 | D560 to D579 | | | | | | | | | | | |
| 30 | D580 to D599 | | | | | | | | | | | |
| 31 | D600 to D619 | | | | | | | | | | | |
| 32 | D620 to D639 | | | | | | | | | | | |

○ : Valid, × : Invalid

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

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

| POINT |
|--|
| (1) The following range is valid. <ul style="list-style-type: none"> • Q172DSCPU : Axis No.1 to 16 • Q172DCPU(-S1) : Axis No.1 to 8 |
| (2) The following device area can be used as a user device. <ul style="list-style-type: none"> • Q172DSCPU : 17 axes or more • Q172DCPU(-S1) : 9 axes or more <p>However, when the project of Q172DSCPU/Q172DCPU(-S1) is replaced with Q173DSCPU/Q173DCPU(-S1), this area cannot be used as a user device.</p> |

APPENDICES

(10) Control change register list

| Axis No. | Device No. | Signal name | | | | | | | | | | | | | | | | | | | |
|----------|-------------------|--|---|---|----------|----------------|------|-------------|---------------|-------------|------------------|-------------|------------------|---|-------------------|---|---|---|----------|----------------|---|
| 1 | D640, D641 | | | | | | | | | | | | | | | | | | | | |
| 2 | D642, D643 | | | | | | | | | | | | | | | | | | | | |
| 3 | D644, D645 | | | | | | | | | | | | | | | | | | | | |
| 4 | D646, D647 | | | | | | | | | | | | | | | | | | | | |
| 5 | D648, D649 | | | | | | | | | | | | | | | | | | | | |
| 6 | D650, D651 | <table border="1"> <thead> <tr> <th></th> <th>Signal name</th> <th>Real</th> <th>Virtual</th> <th>Refresh cycle</th> <th>Fetch cycle</th> <th>Signal direction</th> </tr> </thead> <tbody> <tr> <td>0</td> <td rowspan="2">JOG speed setting</td> <td rowspan="2">○</td> <td rowspan="2">○</td> <td rowspan="2">/</td> <td rowspan="2">At start</td> <td rowspan="2">Command device</td> </tr> <tr> <td>1</td> </tr> </tbody> </table> | | | | | | Signal name | Real | Virtual | Refresh cycle | Fetch cycle | Signal direction | 0 | JOG speed setting | ○ | ○ | / | At start | Command device | 1 |
| | Signal name | | | | | | Real | Virtual | Refresh cycle | Fetch cycle | Signal direction | | | | | | | | | | |
| 0 | JOG speed setting | ○ | ○ | / | At start | Command device | | | | | | | | | | | | | | | |
| 1 | | | | | | | | | | | | | | | | | | | | | |
| 7 | D652, D653 | | | | | | | | | | | | | | | | | | | | |
| 8 | D654, D655 | | | | | | | | | | | | | | | | | | | | |
| 9 | D656, D657 | | | | | | | | | | | | | | | | | | | | |
| 10 | D658, D659 | | | | | | | | | | | | | | | | | | | | |
| 11 | D660, D661 | | | | | | | | | | | | | | | | | | | | |
| 12 | D662, D663 | | | | | | | | | | | | | | | | | | | | |
| 13 | D664, D665 | | | | | | | | | | | | | | | | | | | | |
| 14 | D666, D667 | | | | | | | | | | | | | | | | | | | | |
| 15 | D668, D669 | | | | | | | | | | | | | | | | | | | | |
| 16 | D670, D671 | | | | | | | | | | | | | | | | | | | | |
| 17 | D672, D673 | | | | | | | | | | | | | | | | | | | | |
| 18 | D674, D675 | | | | | | | | | | | | | | | | | | | | |
| 19 | D676, D677 | | | | | | | | | | | | | | | | | | | | |
| 20 | D678, D679 | | | | | | | | | | | | | | | | | | | | |
| 21 | D680, D681 | | | | | | | | | | | | | | | | | | | | |
| 22 | D682, D683 | | | | | | | | | | | | | | | | | | | | |
| 23 | D684, D685 | | | | | | | | | | | | | | | | | | | | |
| 24 | D686, D687 | | | | | | | | | | | | | | | | | | | | |
| 25 | D688, D689 | | | | | | | | | | | | | | | | | | | | |
| 26 | D690, D691 | | | | | | | | | | | | | | | | | | | | |
| 27 | D692, D693 | | | | | | | | | | | | | | | | | | | | |
| 28 | D694, D695 | | | | | | | | | | | | | | | | | | | | |
| 29 | D696, D697 | | | | | | | | | | | | | | | | | | | | |
| 30 | D698, D699 | | | | | | | | | | | | | | | | | | | | |
| 31 | D700, D701 | | | | | | | | | | | | | | | | | | | | |
| 32 | D702, D703 | | | | | | | | | | | | | | | | | | | | |

○ : Valid

POINT

(1) The following range is valid.

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

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

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

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

APPENDICES

(11) Virtual servomotor axis monitor device list

| Axis No. | Device No. | Signal name | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|----------------|---|-------------|------------|--------------|-----|----------------|---|-----------------|----------------|-------------|------------------|---------------|-------------|------------------|-----|----------------|----------------------|--------|---|--|--|--|--|---|-----------------|----------------|---|-------------|--------------------|----------|--------------------|-----------------|-----------------------|----------|--|---|--------------------------------|---|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| 1 | D800 to D809 | <table border="1"> <thead> <tr> <th rowspan="2">Signal name</th> <th rowspan="2">Real</th> <th colspan="5">Virtual</th> <th rowspan="2">Refresh cycle</th> <th rowspan="2">Fetch cycle</th> <th rowspan="2">Signal direction</th> </tr> <tr> <th>Roller</th> <th>Ball screw</th> <th>Rotary table</th> <th>Cam</th> <th>Real mode axis</th> </tr> </thead> <tbody> <tr> <td>0 Feed current value</td> <td rowspan="10">Backup</td> <td rowspan="10">○</td> <td rowspan="10"></td> <td rowspan="10"></td> <td rowspan="10"></td> <td rowspan="10"></td> <td rowspan="10">×</td> <td>Operation cycle</td> <td rowspan="10">Monitor device</td> </tr> <tr> <td>1</td> <td>Immediately</td> </tr> <tr> <td>2 Minor error code</td> <td>At start</td> </tr> <tr> <td>3 Major error code</td> <td rowspan="6">Operation cycle</td> </tr> <tr> <td>4 Execute program No.</td> </tr> <tr> <td>5 M-code</td> </tr> <tr> <td>6 Current value after virtual servomotor axis main shaft's differential gear</td> </tr> <tr> <td>7</td> </tr> <tr> <td>8 Error search output axis No.</td> </tr> <tr> <td>9 Data set pointer for constant-speed control</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> | Signal name | Real | Virtual | | | | | Refresh cycle | Fetch cycle | Signal direction | Roller | Ball screw | Rotary table | Cam | Real mode axis | 0 Feed current value | Backup | ○ | | | | | × | Operation cycle | Monitor device | 1 | Immediately | 2 Minor error code | At start | 3 Major error code | Operation cycle | 4 Execute program No. | 5 M-code | 6 Current value after virtual servomotor axis main shaft's differential gear | 7 | 8 Error search output axis No. | 9 Data set pointer for constant-speed control | | | | | | | | | | | | | | | | |
| Signal name | Real | | | | Virtual | | | | | | | | Refresh cycle | Fetch cycle | Signal direction | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Roller | Ball screw | Rotary table | Cam | Real mode axis | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 Feed current value | Backup | | ○ | | | | | × | Operation cycle | Monitor device | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | | | | | | | | Immediately | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 Minor error code | | | | | | | | | At start | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 Major error code | | | | | | | | | Operation cycle | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 Execute program No. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 M-code | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 Current value after virtual servomotor axis main shaft's differential gear | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 Error search output axis No. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 Data set pointer for constant-speed control | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | D810 to D819 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | D820 to D829 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | D830 to D839 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | D840 to D849 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | D850 to D859 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | D860 to D869 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | D870 to D879 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | D880 to D889 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | D890 to D899 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | D900 to D909 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | D910 to D919 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13 | D920 to D929 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 | D930 to D939 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | D940 to D949 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16 | D950 to D959 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 17 | D960 to D969 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 18 | D970 to D979 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 19 | D980 to D989 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20 | D990 to D999 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 21 | D1000 to D1009 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 22 | D1010 to D1019 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 23 | D1020 to D1029 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 24 | D1030 to D1039 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25 | D1040 to D1049 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 26 | D1050 to D1059 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 27 | D1060 to D1069 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 28 | D1070 to D1079 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 29 | D1080 to D1089 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 30 | D1090 to D1099 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 31 | D1100 to D1109 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 32 | D1100 to D1119 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

○ : Valid, × : Invalid

POINT

- (1) The following range is valid.
- Q172DSCPU : Axis No.1 to 16
 - Q172DCPU(-S1) : Axis No.1 to 8
- (2) The unused axis areas in the mechanical system program can be used as a user device.

APPENDICES

(12) Synchronous encoder axis monitor device list

| Axis No. | Device No. | Signal name | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|----------|------------------|---|---|-------------|-----------------|-----------------|------------------|----------------|------------------|---|---------------|-----------------|---|-----------------|---|----------------|---|-------------|---|------------------|--------|--|--|--|--|---|------------------|---|----------------|----------|---|---|---|---|---|----------------|---|----------------|---|--------|---|-----------------|---|----------------|---|----------------|---|----------------|----------|---|---|---|---|---|----------------|----|----------------|------------------------------|--------|--|--|--|----|----------------|----|----------------|----------|---|---|---|---|
| 1 | D1120 to D1129 | <table border="1"> <thead> <tr> <th></th> <th>Signal name</th> <th>Real</th> <th>Virtual</th> <th>Refresh cycle</th> <th>Fetch cycle</th> <th>Signal direction</th> </tr> </thead> <tbody> <tr> <td>0</td> <td rowspan="2">Current value</td> <td rowspan="2">Backup (Note-1)</td> <td rowspan="2">○</td> <td>Operation cycle</td> <td rowspan="2">/</td> <td rowspan="2">Monitor device</td> </tr> <tr> <td>1</td> <td>Immediately</td> </tr> <tr> <td>2</td> <td>Minor error code</td> <td rowspan="2">Backup</td> <td rowspan="2"></td> <td rowspan="2"></td> <td rowspan="2"></td> <td rowspan="2"></td> </tr> <tr> <td>3</td> <td>Major error code</td> </tr> <tr> <td>4</td> <td>D1150 to D1159</td> <td rowspan="2">Unusable</td> <td rowspan="2">—</td> <td rowspan="2">—</td> <td rowspan="2">—</td> <td rowspan="2">—</td> </tr> <tr> <td>5</td> <td>D1160 to D1169</td> </tr> <tr> <td>6</td> <td>D1170 to D1179</td> <td rowspan="2">Current value after synchronous encoder axis main shaft's differential gear</td> <td rowspan="2">Backup</td> <td rowspan="2">○</td> <td rowspan="2">Operation cycle</td> <td rowspan="2">/</td> <td rowspan="2">Monitor device</td> </tr> <tr> <td>7</td> <td>D1180 to D1189</td> </tr> <tr> <td>8</td> <td>D1190 to D1199</td> <td rowspan="2">Unusable</td> <td rowspan="2">—</td> <td rowspan="2">—</td> <td rowspan="2">—</td> <td rowspan="2">—</td> </tr> <tr> <td>9</td> <td>D1200 to D1209</td> </tr> <tr> <td>10</td> <td>D1210 to D1219</td> <td rowspan="2">Error search output axis No.</td> <td rowspan="2">Backup</td> <td rowspan="2"></td> <td rowspan="2"></td> <td rowspan="2"></td> </tr> <tr> <td>11</td> <td>D1220 to D1229</td> </tr> <tr> <td>12</td> <td>D1230 to D1239</td> <td>Unusable</td> <td>—</td> <td>—</td> <td>—</td> <td>—</td> </tr> </tbody> </table> | | Signal name | Real | Virtual | Refresh cycle | Fetch cycle | Signal direction | 0 | Current value | Backup (Note-1) | ○ | Operation cycle | / | Monitor device | 1 | Immediately | 2 | Minor error code | Backup | | | | | 3 | Major error code | 4 | D1150 to D1159 | Unusable | — | — | — | — | 5 | D1160 to D1169 | 6 | D1170 to D1179 | Current value after synchronous encoder axis main shaft's differential gear | Backup | ○ | Operation cycle | / | Monitor device | 7 | D1180 to D1189 | 8 | D1190 to D1199 | Unusable | — | — | — | — | 9 | D1200 to D1209 | 10 | D1210 to D1219 | Error search output axis No. | Backup | | | | 11 | D1220 to D1229 | 12 | D1230 to D1239 | Unusable | — | — | — | — |
| | Signal name | | Real | Virtual | Refresh cycle | Fetch cycle | Signal direction | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | Current value | | Backup (Note-1) | ○ | Operation cycle | / | Monitor device | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | | | | Immediately | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Minor error code | | Backup | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | Major error code | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | D1150 to D1159 | | Unusable | — | — | — | — | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | D1160 to D1169 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | D1170 to D1179 | | Current value after synchronous encoder axis main shaft's differential gear | Backup | ○ | Operation cycle | / | Monitor device | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | D1180 to D1189 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | D1190 to D1199 | | Unusable | — | — | — | — | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | D1200 to D1209 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | D1210 to D1219 | Error search output axis No. | Backup | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | D1220 to D1229 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | D1230 to D1239 | Unusable | — | — | — | — | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ○ : Valid | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | (Note-1): It is valid for the version (Refer to Section 1.4) that supports "synchronous encoder current value monitor in real mode". | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

POINT

- (1) It is unusable in the SV22 real mode.
- (2) The range of axis No.1 to 8 is valid in the Q172DCPU(-S1).
- (3) The device area of 9 axes or more can be used as a user device.
However, when the project of Q172DCPU(-S1) is replaced with Q173DSCPU/ Q172DSCPU/Q173DCPU(-S1), this area cannot be used.

APPENDICES

(13) Cam axis monitor device list

| Axis No. | Device No. | Signal name | | | | |
|----------|----------------|-------------|-----------------------|--------|---|-----------------|
| 1 | D1240 to D1249 | | | | | |
| 2 | D1250 to D1259 | | | | | |
| 3 | D1260 to D1269 | | | | | |
| 4 | D1270 to D1279 | 0 | Unusable | — | — | — |
| 5 | D1280 to D1289 | 1 | Execute cam No. | Backup | ○ | Operation cycle |
| 6 | D1290 to D1299 | 2 | Execute stroke amount | | | |
| 7 | D1300 to D1309 | 3 | | | | |
| 8 | D1310 to D1319 | 4 | | | | |
| 9 | D1320 to D1329 | 5 | revolution | | | |
| 10 | D1330 to D1339 | 6 | Unusable | — | — | — |
| 11 | D1340 to D1349 | 7 | | | | |
| 12 | D1350 to D1359 | 8 | | | | |
| 13 | D1360 to D1369 | 9 | Unusable | — | — | — |
| 14 | D1370 to D1379 | | | | | |
| 15 | D1380 to D1389 | | | | | |
| 16 | D1390 to D1399 | | | | | |
| 17 | D1400 to D1409 | | | | | |
| 18 | D1410 to D1419 | | | | | |
| 19 | D1420 to D1429 | | | | | |
| 20 | D1430 to D1439 | | | | | |
| 21 | D1440 to D1449 | | | | | |
| 22 | D1450 to D1459 | | | | | |
| 23 | D1460 to D1469 | | | | | |
| 24 | D1470 to D1479 | | | | | |
| 25 | D1480 to D1489 | | | | | |
| 26 | D1490 to D1499 | | | | | |
| 27 | D1500 to D1509 | | | | | |
| 28 | D1510 to D1519 | | | | | |
| 29 | D1520 to D1529 | | | | | |
| 30 | D1530 to D1539 | | | | | |
| 31 | D1540 to D1549 | | | | | |
| 32 | D1550 to D1559 | | | | | |

○ : Valid

POINT

- (1) The following range is valid.
 - Q172DSCPU : Axis No.1 to 16
 - Q172DCPU(-S1) : Axis No.1 to 8
- (2) The unused axis areas in the mechanical system program can be used as a user device.

APPENDICES

(14) Common device list

| Device No. | Signal name | Refresh cycle | Fetch cycle | Signal direction | Device No. | Signal name | Refresh cycle | Fetch cycle | Signal direction | | |
|------------|--|---------------|--|------------------|---|---|---------------|---|------------------|--|------|
| D704 | PLC ready flag request | / | Main cycle | Command device | D752 | Manual pulse generator 1 smoothing magnification setting register | / | At the manual pulse generator enable flag OFF to ON | Command device | | |
| D705 | Speed switching point specified flag request | | | | D753 | Manual pulse generator 2 smoothing magnification setting register | | | | | |
| D706 | All axes servo ON command request | | | | D754 | Manual pulse generator 3 smoothing magnification setting register | | | | | |
| D707 | Real mode/virtual mode switching request (SV22) | | | | D755 | Manual pulse generator 1 enable flag request | | | | | |
| D708 | JOG operation simultaneous start command request | | | | D756 | Manual pulse generator 2 enable flag request | | | | | |
| D709 | Unusable | — | — | — | D757 | Manual pulse generator 3 enable flag request | / | Main cycle | Command device | | |
| D710 | JOG operation simultaneous start axis setting register | / | At start | Command device | D758 | Unusable (42 points) | — | — | — | | |
| D711 | | | Manual pulse generator axis 1 No. setting register | | At the manual pulse generator enable flag OFF to ON | | | | | D759 | |
| D712 | | | | | | | | | | Manual pulse generator axis 2 No. setting register | D760 |
| D713 | | | | | | | | | | | D761 |
| D714 | Manual pulse generator axis 3 No. setting register | | D762 | | | | | | | | |
| D715 | | | D763 | | | | | | | | |
| D716 | Axis 1 | | D764 | | | | | | | | |
| D717 | | | D765 | | | | | | | | |
| D718 | Axis 2 | | D766 | | | | | | | | |
| D719 | | | D767 | | | | | | | | |
| D720 | Axis 3 | D768 | | | | | | | | | |
| D721 | | D769 | | | | | | | | | |
| D722 | Axis 4 | D770 | | | | | | | | | |
| D723 | | D771 | | | | | | | | | |
| D724 | Axis 5 | D772 | | | | | | | | | |
| D725 | | D773 | | | | | | | | | |
| D726 | Axis 6 | D774 | | | | | | | | | |
| D727 | | D775 | | | | | | | | | |
| D728 | Axis 7 | D776 | | | | | | | | | |
| D729 | | D777 | | | | | | | | | |
| D730 | Axis 8 | D778 | | | | | | | | | |
| D731 | | D779 | | | | | | | | | |
| D732 | Axis 9 | D780 | | | | | | | | | |
| D733 | | D781 | | | | | | | | | |
| D734 | Axis 10 | D782 | | | | | | | | | |
| D735 | | D783 | | | | | | | | | |
| D736 | Axis 11 | D784 | | | | | | | | | |
| D737 | | D785 | | | | | | | | | |
| D738 | Axis 12 | D786 | | | | | | | | | |
| D739 | | D787 | | | | | | | | | |
| D740 | Axis 13 | D788 | | | | | | | | | |
| D741 | | D789 | | | | | | | | | |
| D742 | Axis 14 | D790 | | | | | | | | | |
| D743 | | D791 | | | | | | | | | |
| D744 | Axis 15 | D792 | | | | | | | | | |
| D745 | | D793 | | | | | | | | | |
| D746 | Axis 16 | D794 | | | | | | | | | |
| D747 | | D795 | | | | | | | | | |
| D748 | Axis 17 | D796 | | | | | | | | | |
| D749 | | D797 | | | | | | | | | |
| D750 | Axis 18 | D798 | | | | | | | | | |
| D751 | | D799 | | | | | | | | | |

(Note-1): The following range is valid.

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

(Note-2): The following device area is unusable.

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

APPENDICES

(15) Motion register list (#)

| Axis No. | Device No. | Signal name | | |
|----------|----------------|-------------|--|--|
| 1 | #8000 to #8019 | | | |
| 2 | #8020 to #8039 | | | |
| 3 | #8040 to #8059 | | | |
| 4 | #8060 to #8079 | | | |
| 5 | #8080 to #8099 | | | |
| 6 | #8100 to #8119 | | | |
| 7 | #8120 to #8139 | | | |
| 8 | #8140 to #8159 | | | |
| 9 | #8160 to #8179 | | | |
| 10 | #8180 to #8199 | | | |
| 11 | #8200 to #8219 | | | |
| 12 | #8220 to #8239 | | | |
| 13 | #8240 to #8259 | | | |
| 14 | #8260 to #8279 | | | |
| 15 | #8280 to #8299 | | | |
| 16 | #8300 to #8319 | | | |
| 17 | #8320 to #8339 | | | |
| 18 | #8340 to #8359 | | | |
| 19 | #8360 to #8379 | | | |
| 20 | #8380 to #8399 | | | |
| 21 | #8400 to #8419 | | | |
| 22 | #8420 to #8439 | | | |
| 23 | #8440 to #8459 | | | |
| 24 | #8460 to #8479 | | | |
| 25 | #8480 to #8499 | | | |
| 26 | #8500 to #8519 | | | |
| 27 | #8520 to #8539 | | | |
| 28 | #8540 to #8559 | | | |
| 29 | #8560 to #8579 | | | |
| 30 | #8580 to #8599 | | | |
| 31 | #8600 to #8619 | | | |
| 32 | #8620 to #8639 | | | |

| Signal name | Refresh cycle | Signal direction |
|--|--|------------------|
| 0 Servo amplifier type | When the servo amplifier power-on | Monitor device |
| 1 Motor current | Operation cycle 1.7[ms] or less : Operation cycle Operation cycle 3.5[ms] or more : 3.5[ms] | |
| 2 Motor speed | | |
| 3 | | |
| 4 Command speed | Operation cycle | |
| 5 | | |
| 6 Home position return re-travel value | At home position return re-travel | |
| 7 | | |
| 8 Servo amplifier display servo error code | Main cycle | |
| 9 Parameter error No. | | |
| 10 Servo status1 | Operation cycle 1.7[ms] or less : Operation cycle Operation cycle 3.5[ms] or more : 3.5[ms] | |
| 11 Servo status2 | | |
| 12 Servo status3 | | |
| 13 Unusable | — | — |
| 14 | | |
| 15 | | |
| 16 | | |
| 17 | | |
| 18 Servo status7 | Operation cycle 1.7[ms] or less : Operation cycle Operation cycle 3.5[ms] or more : 3.5[ms] | Monitor device |
| 19 Unusable | — | — |


(16) Product information list devices (#8736 to #8751)

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





: Refer to Section 1.4 for the software version that supports this function.

APPENDICES

(17) Special relay list

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

(18) Special register list

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

: Refer to Section 1.4 for the software version that supports this function.

WARRANTY

Please confirm the following product warranty details before using this product.

1. Gratis Warranty Term and Gratis Warranty Range

We will repair any failure or defect hereinafter referred to as "failure" in our FA equipment hereinafter referred to as the "Product" arisen during warranty period at no charge due to causes for which we are responsible through the distributor from which you purchased the Product or our service provider. However, we will charge the actual cost of dispatching our engineer for an on-site repair work on request by customer in Japan or overseas countries. We are not responsible for any on-site readjustment and/or trial run that may be required after a defective unit is repaired or replaced.

[Gratis Warranty Term]

The term of warranty for Product is thirty six (36) months after your purchase or delivery of the Product to a place designated by you or forty two (42) months from the date of manufacture whichever comes first "Warranty Period". Warranty period for repaired Product cannot exceed beyond the original warranty period before any repair work.

[Gratis Warranty Range]

- (1) You are requested to conduct an initial failure diagnosis by yourself, as a general rule.
It can also be carried out by us or our service company upon your request and the actual cost will be charged. However, it will not be charged if we are responsible for the cause of the failure.
- (2) This limited warranty applies only when the condition, method, environment, etc. of use are in compliance with the terms and conditions and instructions that are set forth in the instruction manual and user manual for the Product and the caution label affixed to the Product.
- (3) Even during the term of warranty, the repair cost will be charged on you in the following cases;
 - 1) A failure caused by your improper storing or handling, carelessness or negligence, etc., and a failure caused by your hardware or software problem
 - 2) A failure caused by any alteration, etc. to the Product made on your side without our approval
 - 3) A failure which may be regarded as avoidable, if your equipment in which the Product is incorporated is equipped with a safety device required by applicable laws and has any function or structure considered to be indispensable according to a common sense in the industry
 - 4) A failure which may be regarded as avoidable if consumable parts designated in the instruction manual, etc. are duly maintained and replaced
 - 5) Any replacement of consumable parts (battery, fan, etc.)
 - 6) A failure caused by external factors such as inevitable accidents, including without limitation fire and abnormal fluctuation of voltage, and acts of God, including without limitation earthquake, lightning and natural disasters
 - 7) A failure generated by an unforeseeable cause with a scientific technology that was not available at the time of the shipment of the Product from our company
 - 8) Any other failures which we are not responsible for or which you acknowledge we are not responsible for

2. Onerous Repair Term after Discontinuation of Production

- (1) We may accept the repair at charge for another seven (7) years after the production of the product is discontinued.
The announcement of the stop of production for each model can be seen in our Sales and Service, etc.
- (2) Please note that the Product (including its spare parts) cannot be ordered after its stop of production.

3. Service in overseas countries

Our regional FA Center in overseas countries will accept the repair work of the Product; However, the terms and conditions of the repair work may differ depending on each FA Center. Please ask your local FA center for details.

4. Exclusion of Loss in Opportunity and Secondary Loss from Warranty Liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to:

- (1) Damages caused by any cause found not to be the responsibility of Mitsubishi.
- (2) Loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products.
- (3) Special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products.
- (4) Replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Change of Product specifications

Specifications listed in our catalogs, manuals or technical documents may be changed without notice.

6. Precautions for Choosing the Products

(1) For the use of our Motion controller, its applications should be those that may not result in a serious damage even if any failure or malfunction occurs in Motion controller, and a backup or fail-safe function should operate on an external system to Motion controller when any failure or malfunction occurs.

(2) Our Motion controller is designed and manufactured as a general purpose product for use at general industries. Therefore, applications substantially influential on the public interest for such as atomic power plants and other power plants of electric power companies, and also which require a special quality assurance system, including applications for railway companies and government or public offices are not recommended, and we assume no responsibility for any failure caused by these applications when used.

In addition, applications which may be substantially influential to human lives or properties for such as airlines, medical treatments, railway service, incineration and fuel systems, man-operated material handling equipment, entertainment machines, safety machines, etc. are not recommended, and we assume no responsibility for any failure caused by these applications when used.

We will review the acceptability of the abovementioned applications, if you agree not to require a specific quality for a specific application. Please contact us for consultation.

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IB(NA)-0300137-J(1703)MEE

MODEL: Q173D-P-SV22-KASO-E

MODEL CODE: 1XB931

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Specifications subject to change without notice.