MITSUBISHI ELECTRIC

General-Purpose AC Servo

MITSUBISHI SERVO AMPLIFIERS & MOTORS

MELSERVO-J4

Multi-network Interface AC Servo

MODEL

MR-J4-_TM_

SERVO AMPLIFIER
INSTRUCTION MANUAL
(EtherCAT)

B

● Safety Instructions ●

Please read the instructions carefully before using the equipment.

To use the equipment correctly, do not attempt to install, operate, maintain, or inspect the equipment until you have read through this Instruction Manual, Installation guide, and appended documents carefully. Do not use the equipment until you have a full knowledge of the equipment, safety information and instructions.
In this Instruction Manual, the safety instruction levels are classified into "WARNING" and "CAUTION".

⚠ WARNING	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠ CAUTION	Indicates that incorrect handling may cause hazardous conditions, resulting in medium or slight injury to personnel or may cause physical damage.

Note that the CAUTION level may lead to a serious consequence according to conditions.
Please follow the instructions of both levels because they are important to personnel safety.
What must not be done and what must be done are indicated by the following diagrammatic symbols.

⃠	Indicates what must not be done. For example, "No Fire" is indicated by ⃠ .
●	Indicates what must be done. For example, grounding is indicated by ⏚ .

In this Instruction Manual, instructions at a lower level than the above, instructions for other functions, and so on are classified into "POINT".
After reading this Instruction Manual, keep it accessible to the operator.

1. To prevent electric shock, note the following

⚠ WARNING

- Before wiring and inspections, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between P+ and N- is safe with a voltage tester and others. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier.
- Ground the servo amplifier and servo motor securely.
- Any person who is involved in wiring and inspection should be fully competent to do the work.
- Do not attempt to wire the servo amplifier and servo motor until they have been installed. Otherwise, it may cause an electric shock.
- Do not operate switches with wet hands. Otherwise, it may cause an electric shock.
- The cables should not be damaged, stressed, loaded, or pinched. Otherwise, it may cause an electric shock.
- During power-on or operation, do not open the front cover of the servo amplifier. Otherwise, it may cause an electric shock.
- Do not operate the servo amplifier with the front cover removed. High-voltage terminals and charging area are exposed and you may get an electric shock.
- Except for wiring and periodic inspection, do not remove the front cover of the servo amplifier even if the power is off. The servo amplifier is charged and you may get an electric shock.
- To prevent an electric shock, always connect the protective earth (PE) terminal (marked ⏚) of the servo amplifier to the protective earth (PE) of the cabinet.
- To avoid an electric shock, insulate the connections of the power supply terminals.

2. To prevent fire, note the following

⚠ CAUTION

- Install the servo amplifier, servo motor, and regenerative resistor on incombustible material. Installing them directly or close to combustibles will lead to smoke or a fire.
- Always connect a magnetic contactor between the power supply and the main circuit power supply (L1, L2, and L3) of the servo amplifier, in order to configure a circuit that shuts down the power supply on the side of the servo amplifier's power supply. If a magnetic contactor is not connected, continuous flow of a large current may cause smoke or a fire when the servo amplifier malfunctions.
- Always connect a molded-case circuit breaker, or a fuse to each servo amplifier between the power supply and the main circuit power supply (L1, L2, and L3) of the servo amplifier, in order to configure a circuit that shuts down the power supply on the side of the servo amplifier's power supply. If a molded-case circuit breaker or fuse is not connected, continuous flow of a large current may cause smoke or a fire when the servo amplifier malfunctions.
- When using the regenerative resistor, switch power off with the alarm signal. Otherwise, a regenerative transistor malfunction or the like may overheat the regenerative resistor, causing smoke or a fire.
- Provide adequate protection to prevent screws and other conductive matter, oil and other combustible matter from entering the servo amplifier and servo motor.

3. To prevent injury, note the following

⚠ CAUTION

- Only the voltage specified in the Instruction Manual should be applied to each terminal. Otherwise, a burst, damage, etc. may occur.
- Connect cables to the correct terminals. Otherwise, a burst, damage, etc. may occur.

⚠ CAUTION

- ●Ensure that polarity (+/-) is correct. Otherwise, a burst, damage, etc. may occur.
- ●The servo amplifier heat sink, regenerative resistor, servo motor, etc. may be hot while power is on or for some time after power-off. Take safety measures, e.g. provide covers, to prevent accidental contact of hands and parts (cables, etc.) with them.

4. Additional instructions

The following instructions should also be fully noted. Incorrect handling may cause a fault, injury, electric shock, fire, etc.

(1) Transportation and installation

⚠ CAUTION

- ●Transport the products correctly according to their mass.
- ●Stacking in excess of the specified number of product packages is not allowed.
- ●Do not hold the front cover when transporting the servo amplifier. Otherwise, it may drop.
- ●Install the servo amplifier and the servo motor in a load-bearing place in accordance with the Instruction Manual.
- ●Do not get on or put heavy load on the equipment.
- ●The equipment must be installed in the specified direction.
- ●Leave specified clearances between the servo amplifier and the cabinet walls or other equipment.
- ●Do not install or operate the servo amplifier and servo motor which have been damaged or have any parts missing.
- ●Do not block the intake and exhaust areas of the servo amplifier. Otherwise, it may cause a malfunction.
- ●Do not drop or strike the servo amplifier and servo motor. Isolate them from all impact loads.
- ●When you keep or use the equipment, please fulfill the following environment.

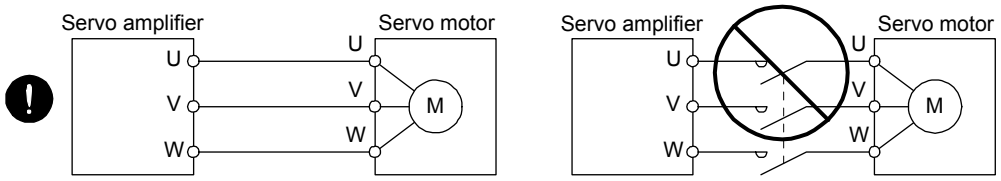
Items		Environment
Ambient temperature	Operation	0 °C to 55 °C (non-freezing)
	Storage	-20 °C to 65 °C (non-freezing)
Ambient humidity	Operation	90 %RH or less (non-condensing)
	Storage	
Ambience		Indoors (no direct sunlight), free from corrosive gas, flammable gas, oil mist, dust, and dirt
Altitude		Max. 2000 m above sea level
Vibration resistance		5.9 m/s^2 at 10 Hz to 55 Hz (directions of X, Y, and Z axes)

- ●When the equipment has been stored for an extended period of time, contact your local sales office.
- ●When handling the servo amplifier, be careful about the edged parts such as corners of the servo amplifier.
- ●The servo amplifier must be installed in the metal cabinet.
- ●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.

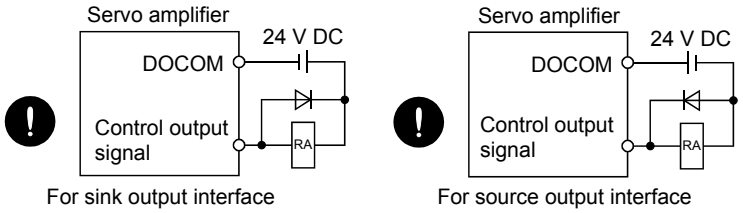
(2) Wiring

⚠ CAUTION

- Wire the equipment correctly and securely. Otherwise, the servo motor may operate unexpectedly.
- Do not install a power capacitor, surge killer, or radio noise filter (FR-BIF(-H) option) on the servo amplifier output side.
- To avoid a malfunction, connect the wires to the correct phase terminals (U, V, and W) of the servo amplifier and servo motor.
- Connect the servo amplifier power output (U, V, and W) to the servo motor power input (U, V, and W) directly. Do not let a magnetic contactor, etc. intervene. Otherwise, it may cause a malfunction.



- The connection diagrams in this instruction manual are shown for sink interfaces, unless stated otherwise.
- The surge absorbing diode installed to the DC relay for control output should be fitted in the specified direction. Otherwise, the emergency stop and other protective circuits may not operate.



- When the cable is not tightened enough to the terminal block, the cable or terminal block may generate heat because of the poor contact. Be sure to tighten the cable with specified torque.
- Connecting a servo motor for different axis to the U, V, W, or CN2 may cause a malfunction.
- Configure a circuit to turn off EM2 or EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.

(3) Test run and adjustment

⚠ CAUTION

- Before operation, check the parameter settings. Improper settings may cause some machines to perform unexpected operation.
- Never adjust or change the parameter values extremely as it will make operation unstable.
- Do not close to moving parts at servo-on status.

(4) Usage

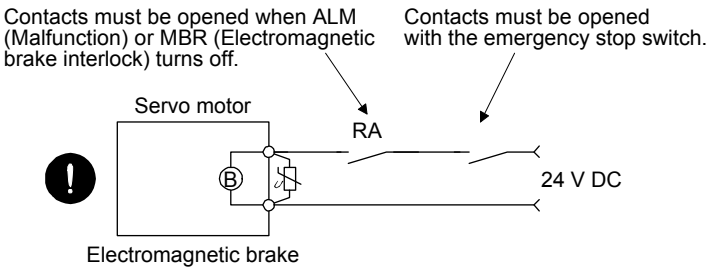
⚠ CAUTION

- ●Provide an external emergency stop circuit to ensure that operation can be stopped and power switched off immediately.
- ●Do not disassemble, repair, or modify the equipment.
- ●Before resetting an alarm, make sure that the run signal of the servo amplifier is off in order to prevent a sudden restart. Otherwise, it may cause an accident.
- ●Use a noise filter, etc. to minimize the influence of electromagnetic interference. Electromagnetic interference may be given to the electronic equipment used near the servo amplifier.
- ●Burning or breaking a servo amplifier may cause a toxic gas. Do not burn or break it.
- ●Use the servo amplifier with the specified servo motor.
- ●The electromagnetic brake on the servo motor is designed to hold the motor shaft and should not be used for ordinary braking.
- ●For such reasons as service life and mechanical structure (e.g. where a ball screw and the servo motor are coupled via a timing belt), the electromagnetic brake may not hold the motor shaft. To ensure safety, install a stopper on the machine side.

(5) Corrective actions

⚠ CAUTION

- ●Ensure safety by confirming the power off, etc. before performing corrective actions. Otherwise, it may cause an accident.
- ●When it is assumed that a hazardous condition may occur due to a power failure or product malfunction, use a servo motor with an electromagnetic brake or external brake to prevent the condition.
- ●Configure an electromagnetic brake circuit so that it is activated also by an external emergency stop switch.



- ●When any alarm has occurred, eliminate its cause, ensure safety, and deactivate the alarm before restarting operation.
- ●Provide an adequate protection to prevent unexpected restart after an instantaneous power failure.

(6) Maintenance, inspection and parts replacement

⚠ CAUTION

- Make sure that the emergency stop circuit operates properly such that an operation can be stopped immediately and a power is shut off by the emergency stop switch.
- It is recommended that the servo amplifier be replaced every 10 years when it is used in general environment.
- When using a servo amplifier whose power has not been turned on for a long time, contact your local sales office.

(7) General instruction

- To illustrate details, the equipment in the diagrams of this Instruction Manual may have been drawn without covers and safety guards. When the equipment is operated, the covers and safety guards must be installed as specified. Operation must be performed in accordance with this Specifications and Instruction Manual.

● DISPOSAL OF WASTE ●

Please dispose a servo amplifier, battery (primary battery) and other options according to your local laws and regulations.

⚠ EEP-ROM life

The number of write times to the EEP-ROM, which stores parameter settings, etc., is limited to 100,000. If the total number of the following operations exceeds 100,000, the servo amplifier may malfunction when the EEP-ROM reaches the end of its useful life.

- Write to the EEP-ROM due to parameter setting changes
- Write to the EEP-ROM due to device changes

STO function of the servo amplifier

When using the STO function of the servo amplifier, refer to chapter 13 of "MR-J4-_TM_ Servo Amplifier Instruction Manual".
For the MR-J3-D05 safety logic unit, refer to app. 5 of "MR-J4-_TM_ Servo Amplifier Instruction Manual".

Compliance with global standards

For the compliance with global standards, refer to app. 4 of "MR-J4-_TM_ Servo Amplifier Instruction Manual".

«About the manuals»

You must have this Instruction Manual and the following manuals to use this servo. Ensure to prepare them to use the servo safely.

Relevant manuals

Manual name	Manual No.
MELSERVO MR-J4-_TM_ SERVO AMPLIFIER INSTRUCTION MANUAL	SH(NA)030193
MELSERVO-J4 SERVO AMPLIFIER INSTRUCTION MANUAL (TROUBLESHOOTING)	SH(NA)030109
MELSERVO MR-D30 INSTRUCTION MANUAL (Note 5)	SH(NA)030132
MELSERVO Servo Motor Instruction Manual (Vol. 3) (Note 1)	SH(NA)030113
MELSERVO Linear Servo Motor Instruction Manual (Note 2)	SH(NA)030110
MELSERVO Direct Drive Motor Instruction Manual (Note 3)	SH(NA)030112
MELSERVO Linear Encoder Instruction Manual (Note 2, 4)	SH(NA)030111
EMC Installation Guidelines	IB(NA)67310

Note 1. It is necessary for using a rotary servo motor.
2. It is necessary for using a linear servo motor.
3. It is necessary for using a direct drive motor.
4. It is necessary for using a fully closed loop system.
5. It is necessary for using an MR-D30 functional safety unit.

«Wiring»

Wires mentioned in this Instruction Manual are selected based on the ambient temperature of 40 °C.

«U.S. customary units»

U.S. customary units are not shown in this manual. Convert the values if necessary according to the following table.

Quantity	SI (metric) unit	U.S. customary unit
Mass	1 [kg]	2.2046 [lb]
Length	1 [mm]	0.03937 [inch]
Torque	1 [N•m]	141.6 [oz•inch]
Moment of inertia	1 [(× 10^{-4} kg•m^2)]	5.4675 [oz•$inch^2$]
Load (thrust load/axial load)	1 [N]	0.2248 [lbf]
Temperature	N [°C] × 9/5 + 32	N [°F]

MEMO

CONTENTS

1. EtherCAT COMMUNICATION

1.1 Summary

EtherCAT is the abbreviation of Ethernet for Control Automation Technology. It is open network communication between a master and slaves developed by Beckhoff Automation that uses real-time Ethernet. ETG (EtherCAT Technology Group) owns EtherCAT.
The EtherCAT communication is available when the EtherCAT network module (ABCC-M40-ECT manufactured by HMS Industrial Networks) is connected to the MR-J4-_TM_ servo amplifier. The MR-J4-_TM_ servo amplifier to which the EtherCAT network module is connected operates as a slave station compliant with CAN application protocol over EtherCAT (CoE) standards. The device type is a power drive system and is compatible with the CiA 402 drive profile.

(1) CiA 402 drive profile compatible
The MR-J4-_TM_ servo amplifier operates as a slave station compliant with CAN application protocol over EtherCAT (CoE) standards. The device type is a power drive system and is compatible with the CiA 402 drive profile.

(2) Various control modes supported
The MR-J4-_TM_ servo amplifier supports the following control modes. In the table below, whether the synchronous mode and asynchronous mode can be used in each control mode. For the synchronous mode and asynchronous mode, refer to (3) of this section.

Control mode	Symbol	Description	Synchronous mode	Asynchronous mode
Cyclic synchronous position mode	csp	This is a position mode where a position command is received at a constant period to drive the servo motor in the synchronous communication with a controller. Use an absolute position address for a command.	Available	Unavailable (Note)
Cyclic synchronous velocity mode	csv	This is a speed mode where a speed command is received at a constant period to drive the servo motor in the synchronous communication with a controller.		
Cyclic synchronous torque mode	cst	This is a torque mode where a torque command is received at a constant period to drive the servo motor in the synchronous communication with a controller.		
Profile position mode	pp	This is a positioning operation mode where an end position command is received to drive the servo motor in the synchronous or asynchronous communication with a controller. Use an absolute position address or relative position address for a command.		Available
Profile velocity mode	pv	This is a mode where a target speed command is received to drive the servo motor in the synchronous or asynchronous communication with a controller.		
Profile torque mode	tq	This is a mode where a target torque command is received to drive the servo motor in the synchronous or asynchronous communication with a controller.		
Homing mode	hm	This is a mode where the servo amplifier performs a home position return operation using the method directed by the controller.		

Note. When the controller sends an operation command in the asynchronous mode, the error code that indicates the state transition is not allowed is notified and the ERROR LED of the EtherCAT network module (ABCC-M40-ECT) may blink. To operate the servo amplifier in the asynchronous mode, set the [Pr. PA01] to Profile mode (_ _ _ 2).

(3) Synchronous mode (DC mode) /asynchronous mode (Free-run mode) in each control mode
Since the cyclic synchronous position mode, cyclic synchronous velocity mode, and cyclic torque mode are designed under the assumption that these modes are used in the cyclic synchronous mode with the DC (Distributed Clock) function specified in the EtherCAT standard, use these modes in the synchronous mode (DC mode). When setting the synchronous mode, set Sync0 and Sync1 as shown in the following table.

	Sync0	Sync1
Cycle time (1C32h: 2)	0.25 ms (When the PDO communication cycle is set to 0.25 ms) 0.5 ms (When the PDO communication cycle is set to 0.5 ms) 1 ms (When the PDO communication cycle is set to 1 ms) 2 ms (When the PDO communication cycle is set to 2 ms)	Unused
Shift time (1C32h: 3)	0	-

The profile position mode, profile velocity mode, profile torque mode, and homing mode can be used in both the synchronous mode and asynchronous mode.

(4) Compliance with standards
MR-J4-_TM_ servo amplifiers comply with the following standards. Refer to the following standards for the description not written in this Instruction Manual.

Standards	Version
ETG.1000.2 EtherCAT Specificaation – Part2 Physical Layer service definition and protocol specification	V1.0.3
ETG.1000.3 EtherCAT Specificaation – Part3 Data Link Layer service definition	V1.0.3
ETG.1000.4 EtherCAT Specificaation – Part4 Data Link Layer protocol specification	V1.0.3
ETG.1000.5 EtherCAT Specificaation – Part5 Application Layer service definition	V1.0.3
ETG.1000.6 EtherCAT Specificaation – Part6 Application Layer protocol specification	V1.0.3
ETG.1020 EtherCAT Protocol Enhancements	V1.1.0
ETG.1300 EtherCAT Indicator and Labeling Specification	V1.1.0
ETG.2000 EtherCAT Slave Information (ESI) Specification	V1.0.7
ETG.6010 Implementation Directive for CiA 402 Drive Profile	V1.1.0
IEC 61800-7-201 Adjustable speed electrical power drive systems – Part 7-201: Generic interface and use of profiles for power drive systems – Profile type 1 specification	Edition 1.0
Adjustable speed electrical power drive systems – Part 7-301: Generic interface and use of profiles for power drive systems – Mapping of profile type 1 to network technologies	Edition 1.0

1.2 Function list

The following table lists the functions available with the MR-J4-_TM_ servo amplifier to which the EtherCAT network module is connected. "MR-J4-_TM_" means "MR-J4-_TM_ Servo Amplifier Instruction Manual".

Function	Description	Reference
Cyclic synchronous position mode (csp)	The position control operation performed by a synchronous sequential position command through network is supported.	Section 5.4
Cyclic synchronous velocity mode (csv)	The speed control operation performed by a synchronous sequential speed command through network is supported.	
Cyclic synchronous torque mode (cst)	The torque control operation performed by a synchronous sequential torque command through network is supported.	
Profile position mode (pp)	The positioning operation performed by an asynchronous end position command through network is supported.	
Profile velocity mode (pv)	The speed control operation performed by an asynchronous speed command through network is supported.	
Profile torque mode (tq)	The torque control operation performed by an asynchronous torque command through network is supported.	
Homing mode (hm)	The home position return operation specified in each network is supported.	
High-resolution encoder	High-resolution encoder of 4194304 pulses/rev is used for the encoder of the rotary servo motor compatible with the MELSERVO-J4 series.	
Absolute position detection system	Setting a home position once makes home position return unnecessary at every power-on.	MR-J4-_TM_ chapter 12
Gain switching function	You can switch gains during rotation/stop, and can use input devices to switch gains during operation.	MR-J4-_TM_ Section 7.2
Advanced vibration suppression control II	This function suppresses vibration at an arm end or residual vibration.	MR-J4-_TM_ Section 7.1.5
Adaptive filter II	The servo amplifier detects mechanical resonance and sets filter characteristics automatically to suppress mechanical vibration.	MR-J4-_TM_ Section 7.1.2
Low-pass filter	Suppresses high-frequency resonance which occurs as the servo system response is increased.	MR-J4-_TM_ Section 7.1.4
Machine analyzer function	This function analyzes the frequency characteristic of the mechanical system by simply connecting an MR Configurator2-installed personal computer and the servo amplifier. MR Configurator2 is necessary for this function.	
Robust filter	For roll feed axis, etc. of which a response level cannot be increased because of the large load to motor inertia ratio, this function improves a disturbance response.	[Pr. PE41]
Slight vibration suppression control	This function suppresses vibration of ±1 pulse generated at a servo motor stop.	[Pr. PB24]
Electronic gear	Positioning control is performed with the value obtained by multiplying the position command from the controller by a set electronic gear ratio.	[Pr. PA06] [Pr. PA07]
S-pattern acceleration/deceleration time constant	Speed can be increased and decreased smoothly.	[Pr. PT51]
Auto tuning	Automatically adjusts the gain to optimum value if load applied to the servo motor shaft varies.	MR-J4-_TM_ Section 6.3
Brake unit	Use the brake unit when the regenerative option cannot provide sufficient regenerative capability. The brake unit can be used for the servo amplifiers of the 5 kW or more.	MR-J4-_TM_ Section 11.3

Function	Description	Reference
Power regeneration converter	Use the power regeneration converter when the regenerative option cannot provide sufficient regenerative capability. The power regeneration converter can be used for the servo amplifiers of the 5 kW or more.	MR-J4-_TM_ Section 11.4
Regenerative option	Use a regenerative option when the built-in regenerative resistor of the servo amplifier does not have sufficient regenerative capacity for a large regenerative power generated.	MR-J4-_TM_ Section 11.2
Alarm history clear	This function clears alarm histories.	[Pr. PC21]
Torque limit	Limits the servo motor torque.	[Pr. PA11] [Pr. PA12]
Speed limit	This function limits the servo motor speed.	[Pr. PT67]
Status display	Shows servo status on the 3-digit, 7-segment LED display	MR-J4-_TM_ Section 4.3
Input signal selection (device settings)	LSP (Forward rotation stroke end), LSN (Reverse rotation stroke end) and other input device can be assigned to any pins.	[Pr. PD03] to [Pr. PD05]
Output signal selection (device settings)	The output devices including ALM (Malfunction) can be assigned to specified pins of the CN3 connector.	[Pr. PD07] to [Pr. PD09]
Output signal (DO) forced output	Turns on/off the output signals forcibly independently of the servo status. Use this function for checking output signal wiring, etc.	MR-J4-_TM_ Section 4.5.1(1) (d)
Test operation mode	Jog operation, positioning operation, motor-less operation, DO forced output, and program operation MR Configurator2 is necessary for this function.	MR-J4-_TM_ Section 4.5
Analog monitor output	This function outputs servo status with voltage in real time.	[Pr. PC09] [Pr. PC10]
MR Configurator2	Using a personal computer, you can perform the parameter setting, test operation, monitoring, and others.	MR-J4-_TM_ Section 11.7
Linear servo system	Linear servo system can be configured using a linear servo motor and linear encoder.	MR-J4-_TM_ chapter 14
Direct drive servo system	The direct drive servo system can be configured to drive a direct drive motor.	MR-J4-_TM_ chapter 15
Fully closed loop system	Fully closed loop system can be configured using the load-side encoder.	MR-J4-_TM_ chapter 16
Latch function (Touch probe)	This function latches the current position at the rising edge of the external latch input signal.	Section 5.5 MR-J4-_TM_ Section 3.5 [Pr. PD37]
One-touch tuning	Gain adjustment is performed just by one click a certain button on MR Configurator2. Also, one-touch tuning can be performed via a network. One-touch tuning via a network is available with servo amplifiers with software version B0 or later.	Section 6.7 MR-J4-_TM_ Section 6.2

Function	Description	Reference
SEMI-F47 function	This function enables to avoid triggering [AL. 10 Undervoltage] using the electrical energy charged in the capacitor in case that an instantaneous power failure occurs during operation. Use a 3-phase for the input power supply of the servo amplifier. Using a 1-phase 100 V AC/200 V AC for the input power supply will not comply with SEMI-F47 standard.	MR-J4-_TM_ Section 7.4 [Pr. PA20] [Pr. PF25]
Tough drive function	This function makes the equipment continue operating even under the condition that an alarm occurs. The tough drive function includes two types: the vibration tough drive and the instantaneous power failure tough drive.	MR-J4-_TM_ Section 7.3
Drive recorder function	This function continuously monitors the servo status and records the status transition before and after an alarm for a fixed period of time. You can check the recorded data on the drive recorder window on MR Configurator2 by clicking the "Graph" button.	[Pr. PA23]
STO function	This amplifier complies with the STO function as functional safety of IEC/EN 61800-5-2. You can create a safety system for the equipment easily.	MR-J4-_TM_ chapter 13
Servo amplifier life diagnosis function	You can check the cumulative energization time and the number of on/off times of the inrush relay. This function gives an indication of the replacement time for parts of the servo amplifier including a capacitor and a relay before they malfunction. This function is available with MR Configurator2 or via a network. The servo amplifier life diagnosis function via a network is available with servo amplifiers with software version B0 or later.	Section 6.9
Power monitoring function	This function calculates the power running energy and the regenerative power from the data in the servo amplifier such as speed and current. Power consumption and others are displayed on MR Configurator2. Also, the power monitoring function can be used via a network.	Section 6.1
Machine diagnosis function	From the data in the servo amplifier, this function estimates the friction and vibrational component of the drive system in the equipment and recognizes an error in the machine parts, including a ball screw and bearing. This function is available with MR Configurator2 or via a network. The machine diagnosis function via a network is available with servo amplifiers with software version B0 or later.	Section 6.8
Scale measurement function	The function transmits position information of a scale measurement encoder to the controller by connecting the scale measurement encoder in semi closed loop control. This is used with servo amplifiers with software version B0 or later.	Section 6.6 MR-J4-_TM_ Section 17.1
Model adaptive control disabled	This function drives the servo motor with PID control without using the model adaptive control.	
Lost motion compensation function	This function improves the response delay occurred when the machine moving direction is reversed.	MR-J4-_TM_ Section 7.6
Super trace control	This function sets constant and uniform acceleration/deceleration droop pulses to almost 0.	MR-J4-_TM_ Section 7.7
Limit switch	Travel intervals can be limited with the limit switch using LSP (Forward rotation stroke end) and LSN (Reverse rotation stroke end)	
Software limit	Limits travel intervals by address using parameters. The same function with the limit switch is enabled by setting parameters.	Section 5.8 MR-J4-_TM_ Section 5.3 [Pr. PT15] to [Pr. PT18]

1.3 Communication specifications

The following table shows the communication specifications.

Item	Description	Remark
EtherCAT communication specifications	IEC 61158 Type121 CAN application protocol over EtherCAT (CoE), IEC 61800-7 CiA 402 Drive Profile	
Physical layer	100BASE-TX (IEEE802.3)	
Communication connector	RJ45, 2 ports (IN port, OUT port)	
Communication cable	CAT5e, shielded twisted pair (4 pair) straight cable	Double-shielded type recommended
Network topology	Line, Tree, Star, or a connection topology where the topologies are used together	
Variable communication speed	100 Mbps (Full duplex)	
Transmission speed between stations	Max. 100 m	
Number of nodes	Max. 65535	The number of connection nodes for actual use varies depending on the specifications of the master controller used.
SDO communication	Asynchronous Sending/Receiving: 1 channel each	
PDO communication	Cycle time: Select from 0.25 ms, 0.5 ms, 1 ms, and 2 ms. Receive (RxPDO): 1 channel Send (TxPDO): 1 channel	Data size at PDO default mapping RxPDO: 29 bytes TxPDO: 41 bytes
PDO mapping	Variable PDO mapping supported	Maximum size of RxPDO and TxPDO: 64 bytes each Maximum number of object mapping: 32 each
Distributed clock (DC)	The DC mode and Free-run mode can be selected. (The DC mode is required in the csp, csv, and cst mode.)	Sync0: Set the same cycle as the PDO communication cycle. Sync1: Not used
Explicit Device Identification	Supported	
LED display	RUN, ERROR, LINK/Activity (IN, OUT)	

1.4 EtherCAT State Machine (ESM)

The communication status of MR-J4-_TM_ servo amplifiers is classified and managed by EtherCAT State Machine (ESM) that the EtherCAT standard specifies.

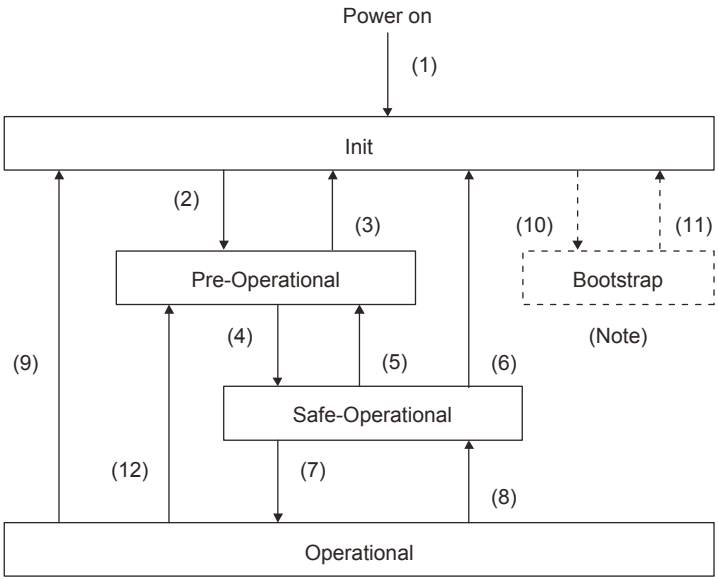
1.4.1 Communication status

The following table shows the classification of the communication status. Two communication types are provided: One is the PDO (process data object) communication where command data and feedback data are sent and received at a constant period. Another is the SDO (service data object) communication where object data is sent and received asynchronously. Refer to chapter 3 for details of the PDO communication. Refer to chapter 4 for details of the SDO communication.

ESM status	Description
Init	After the power is on, the communication status is the init state. The SDO communication and PDO communication cannot be performed. The master accesses the DL-Information register and initializes communication.
Pre-Operational	The SDO communication can be performed. The PDO communication cannot be performed. The initial setting for network and initial transfer of parameters can be performed in this state.
Safe-Operational	The SDO communication can be performed. Though the PDO communication also can be performed, all operations (commands) such as servo motor drive are invalid. When the DC mode is selected, synchronization is established in this state.
Operational	Both the SDO communication and PDO communication can be performed. Commands using the PDO communication are valid and the servo motor can be driven.
Bootstrap	This is not supported by MR-J4-_TM_ servo amplifiers. The mailbox communication with the FoE protocol can be performed. Firmware can be updated through EtherCAT in this state.

1.4.2 EtherCAT state

EtherCAT states shift under the conditions shown in figure 1.1 and table 1.1.
When the state shifts from the Init state through the Pre-Operational and Safe-Operational state to the Operational state, the servo amplifier can be operated. When the Operational state shifts to another state, the servo amplifier executes initialization to clear the internal status.



Note. This is not supported by MR-J4-_TM_ servo amplifiers.

Fig. 1.1

Table. 1.1 EtherCAT state transition

Transition No.	Description
(1)	Power on
(2)	SDO communication configuration (a) The master sets the registers of the slaves. The following shows the registers to be set. • DL Address register • Sync Manager channel for SDO communication (b) The master requests the slaves to shift to the Pre-Operational state. (c) The state shifts to the Pre-Operational state.
(4)	PDO communication configuration (a) Set the configuration parameter of the master (such as PDO mapping) using the SDO communication. (b) The master sets the Sync Manager channel and FMMU channel for the PDO communication of the slaves. FMMU (Fieldbus Memory Management Unit) is a mechanism to manage the relationship between the global address area and the local address area in the EtherCAT communication. The global address area is used for the PDO communication. The local address area stores object data for each station. (c) The master requests the slave to shifts to the Safe-Operational state. (d) The state shifts to the Safe-Operational state.
(7)	Synchronous (a) The master and slave use Distributed Clocks to synchronize. (b) The master starts to output a valid command value. (c) The master requests the slave to shift to the Operational state. (d) The state shifts to the Operational state.
(5), (12)	When the master requests the slave to shifts to the Pre-Operational state, the state shifts to the Pre-Operational state.
(8)	When the master requests the slave to shifts to the Safe-Operational state, the state shifts to the Safe-Operational state.
(3), (6), (9)	In the following case, the state shifts to the init state. • When the master requests the slave to shifts to the Init state.
(10), (11)	These are not supported by MR-J4-_TM_ servo amplifiers.

1.4.3 Startup

The following describes the setting and startup of the EtherCAT communication. Refer to section 4.1 of "MR-J4-_TM_ Servo Amplifier Instruction Manual" for the startup procedure other than the network setting.

(1) Connection with the controller
Set up the controller following the manual of the controller used. For the setup, the EtherCAT Slave Information (ESI) file listing the information about the communication setting of devices is available. Store the ESI file in the controller to use it. The controller configures the setting for the slave connected to the master according to the contents of the ESI file corresponding to the slave connected.

(2) Parameter setting
Set the control mode with [Pr. PA01 Operation mode]. Refer to section 5.2.1 of "MR-J4-_TM_ Servo Amplifier Instruction Manual" for the parameter setting.

(3) Node address setting

POINT
- The node address of MR-J4-_TM_ servo amplifiers complies with the specifications of Explicit Device Identification. Configure the setting of Set Explicit Device Identification for the controller.
- Do not connect multiple devices with the same node address setting.

Set the node address of EtherCAT with the axis selection rotary switch (SW2/SW3) on the display or [Pr. PN01 Node address setting] as necessary. The node address is set with the setting value of the axis selection rotary switch (SW2/SW3) and a parameter as shown in the following table. After the node address setting is changed, cycle the power.

Axis selection rotary switch (SW2/SW3)	Pr. PN01	Node address setting value
00h	0000h	The node address is not used.
00h	0001h to FFFFh	The value of [Pr. PN01] is set as the node address.
01h to FFh	0000h to FFFFh	The setting value of the axis selection rotary switch (SW2/SW3) is set as the node address.

1.4.4 Network disconnection procedure

To disconnect the network by stopping device operation or other means, follow the procedure shown below. If the network is disconnected without following the procedure, [AL. 86.1 Network communication error 1] may occur.

(1) Stop the servo motor.

(2) Set the shutdown command for Controlword (6040h) to establish the servo-off status.

(3) Shift the state to the Pre-Operational state.

(4) Shut off the power of the servo amplifier and controller.

1.5 Summary of object dictionary (OD)

POINT
●Refer to chapter 7 for details of the object dictionary.

Each data set that CAN application protocol over EtherCAT (CoE) devices have such as control parameters, command values, and feedback values is handled as an object composed of an Index value, object name, object type, R/W attribute, and other elements. The object data can be exchanged between the master and slave devices. The aggregate of these objects is called object dictionary (OD).

1.5.1 Section definition of object dictionary

In the CAN application protocol over EtherCAT (CoE) standard, objects of the object dictionary are categorized by Index depending on the area type as shown in the following table. Refer to the Reference column for the chapters and the section where the details of each object are described.

Index	Description	Reference
0000h to 0FFFh	Data type area	
1000h to 1FFFh	CoE communication area	Chapter 1, Chapter 3, Chapter 4, Chapter 7
2000h to 25FFh	Parameter area (Vendor-specific)	Section 6.5, Chapter 7
2A00h to 2FFFh	Servo control command/monitor area (Vendor-specific)	Chapter 6, Chapter 7
6000h to 6FFFh	CiA 402 Drive profile area	Chapter 5, Chapter 7

1.5.2 Saving object dictionary data to EEP-ROM

There are two types of object dictionary data: One is saved to EEP-ROM and another is not saved. Refer to Section 7.3 for the availability and details of save for each object.

2. EtherCAT NETWORK MODULE (ABCC-M40-ECT)

POINT

- For EtherCAT Network module, be sure to use ABCC-M40-ECT which is a dedicated model for Mitsubishi MELSERVO. For purchasing, contact your local sales office.
- Refer to "MR-J4-_TM_ Servo Amplifier Instruction Manual" for how to mount the EtherCAT Network module (ABCC-M40-ECT) to the MR-J4-_TM_ servo amplifier.
- For the quality assurance on the EtherCAT Network module (ABCC-M40-ECT), contact HMS Industrial Networks.

The EtherCAT communication with an MR-J4-_TM_ servo amplifier requires the EtherCAT Network module (ABCC-M40-ECT). The following shows the details.

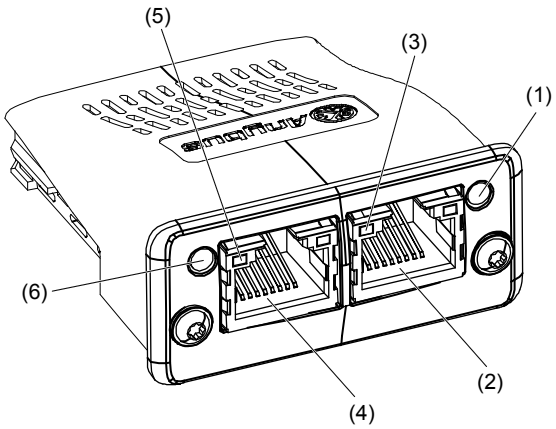
2.1 Specifications

Item	Description
Product name	ABCC-M40-ECT (Anybus Compact Com M40 ECT)
Model	AB6916-C (Note)
Manufacturer	HMS Industrial Networks
External interface	MR-J4-_TM_ servo amplifier connecting interface: Compact flash connector with standard 50 pins EtherCAT communication port interface: RJ45 connector
Dimensions	52 (W) × 50 (D) × 20 (H) (Except the protrusion of the EtherCAT communication port connector)
Mass	Approx. 30 g

Note. AB6916-B and AB6916-C are available. However, when using servo amplifiers with software version B0 or later in combination with the network modules with software version 1.11.01 or earlier, use EtherCAT Slave Information (ESI). Without ESI, the controller does not recognize the 711th and later objects because Get OD List can read only object information of 710 sets.

2.2 Parts identification

This section describes the EtherCAT Network module (ABCC-M40-ECT) only. Refer to section 1.7 of "MR-J4-_TM_ Servo Amplifier Instruction Manual" for the MR-J4-_TM_ servo amplifier.



No.	Name/Application	Detailed explanation
(1)	ERROR LED Indicates an error of the EtherCAT communication.	Section 2.3.2 (2)
(2)	RJ45 EtherCAT communication port (OUT port) Used to connect the next axis servo amplifier.	Section 2.4
(3)	Link/Activity (OUT port) LED Indicates the link status of each EtherCAT communication port.	Section 2.3.2 (3)
(4)	RJ45 EtherCAT communication port (IN port) Used to connect the EtherCAT master controller or the previous axis servo amplifier.	Section 2.4
(5)	Link/Activity (IN port) LED Indicates the link status of each EtherCAT communication port.	Section 2.3.2 (3)
(6)	RUN LED Indicates the EtherCAT communication status (ESM).	Section 2.3.2 (1)

2.3 LED indication

The LEDs of the EtherCAT Network module (ABCC-M40-ECT) function according to the regulations of the EtherCAT standard (ETG.1300 EtherCAT Indicator and Labeling Specification). Under certain condition, such as when a fatal error occurs, the EtherCAT Network module (ABCC-M40-ECT) indicates its status by its own specifications.

2.3.1 LED indication definition

The following shows the LED indication definitions.

LED status	Definition
Lit	An LED remains lit.
Extinguished	An LED remains extinguished.
Flickering	An LED is switching between lit and extinguished at 10 Hz cycles (every 50 ms).
Blinking	An LED is switching between lit and extinguished at 2.5 Hz cycles (every 200 ms).
Single flash	An LED is lit for 200 ms and extinguished 1000 ms repeatedly.
Double flash	An LED is lit for 200 ms, extinguished for 200 ms, lit for 200 ms, and extinguished for 1000 ms repeatedly.

2.3.2 LED indication list

(1) RUN LED

The RUN LED indicates the EtherCAT communication status (ESM status). Refer to section 1.4 for the communication status (ESM status).

LED		Description
Status	Color	
Extinguished		Indicates that the power supply is shut off or the Init state.
Blinking	Green	Indicates the Pre-Operational state.
Single flash		Indicates the Safe-Operational state.
Lit		Indicates the Operational state.
Lit	Red	Indicates that a fatal error has occurred. This indication is specific to the EtherCAT Network module (ABCC-M40-ECT).

(2) ERROR LED

The ERROR LED indicates an error of the EtherCAT communication. If the servo amplifier indicates an alarm, follow the remedy of the alarm number.

LED		Description
Status	Color	
Extinguished		No error
Blinking	Red	Indicates that the EtherCAT state cannot be changed according to the master command.
Single flash		Indicates that the EtherCAT state has been changed autonomously due to an internal error.
Double flash		Indicates a watchdog error in the Sync manager.
Lit		Indicates the EXCEPTION state, which is an error state of the EtherCAT Network module (ABCC-M40-ECT).
Flickering		Indicates an error at start-up of the EtherCAT Network module (ABCC-M40-ECT).

(3) Link/Activity LED (OUT port/IN port)

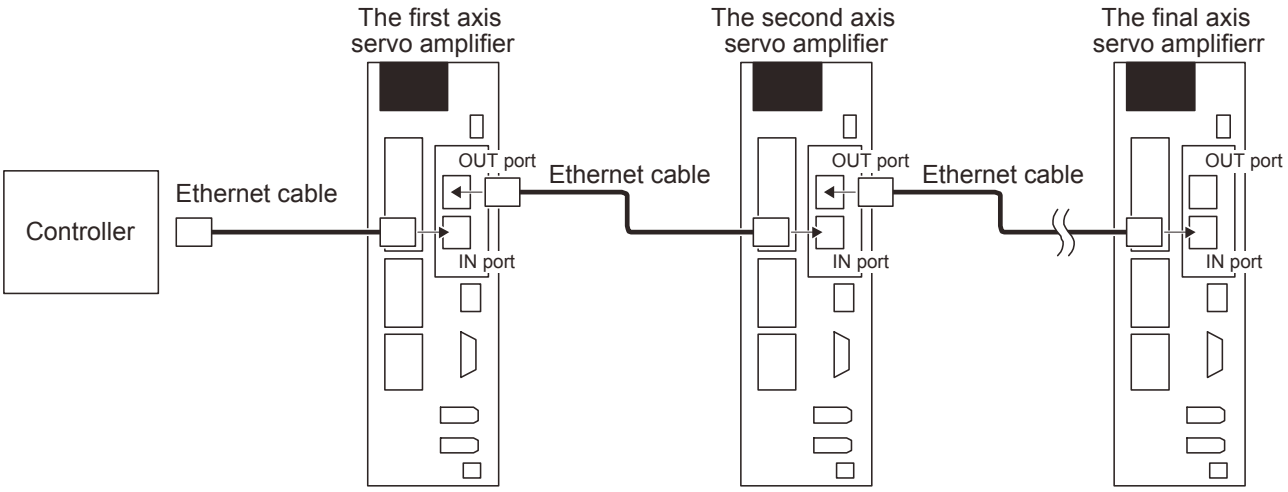
The Link/Activity LEDs indicate the link status of each EtherCAT communication port.

LED		Description
Status	Color	
Extinguished		Indicates that the power supply is shut off or the link-unestablished state.
Lit	Green	Indicates that the link is established without traffic.
Flickering		Indicates that the link is established with traffic.

2.4 Connecting Ethernet cable

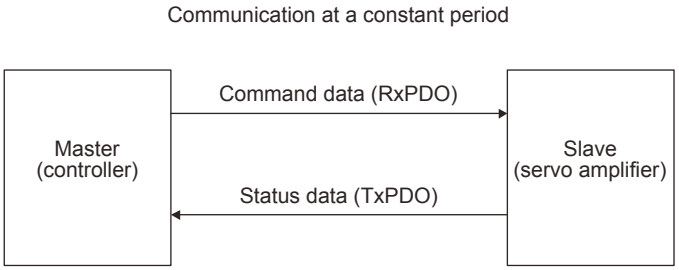
POINT
●Use a twisted pair cable (double shielded) with Ethernet Category 5e (100BASE-TX) or higher as the Ethernet cable. The maximum cable length between nodes is 100 m. ●When connecting an Ethernet cable to an EtherCAT network port, ensure that the connection destination (OUT port (upper side) or IN port (lower side)) is correct.

To the RJ45 EtherCAT communication port (IN port), connect the Ethernet cable connected to the controller or the previous axis servo amplifier. To the RJ45 EtherCAT communication port (OUT port), connect the Ethernet cable connected to the next axis servo amplifier. When the RJ45 EtherCAT communication port (OUT port) is not used, leave this port open.
When the node address is not used, an incorrect connection destination sets node addresses that do not correspond to the actual connection order and may cause a malfunction, such as an unintended axis operation.



3. PDO (PROCESS DATA OBJECT) COMMUNICATION

The PDO (process data object) communication can transfer command data and feedback data between a master (controller) and slaves (servo amplifier) at a constant cycle. PDOs include RxPDOs, which are used by the slaves to receive data from the controller, and TxPDOs, which are used by the slaves to send data to the controller.



The variable PDO mapping function enables the PDO communication to transfer multiple PDOs in any array.

3.1 PDO communication cycle

The same cycle is applied to communication of RxPDOs and TxPDOs of the MR-J4-_TM_ servo amplifier. The communication cycle can be changed via a network through rewriting the subobject Cycle time (Sub index = 2) of SM output parameter (1C32h) with SDO download in the Pre Operational state.

3.2 PDO setting-related object

The following table lists the objects related to the PDO setting.

Index	Sub	Object	Name	Data Type	Access	Default	Description
1C32h	0	RECORD	SM output parameter	U8	ro	12	Refer to section 7.3.3 (4).
	1		Synchronization type	U16	rw	0	
	2		Cycle time	U32	rw	4000000	
	3		Shift time	U32	ro	222222	
	4		Synchronization types supported	U16	ro	0025h	
	5		Minimum cycle time	U32	ro	100000	
	6		Calc and copy time	U32	ro	222722	
	9		Delay time	U32	ro	0	
	12		Cycle time too small	U16	ro	0	
1C33h	0	RECORD	SM input parameter	U8	ro	12	Refer to section 7.3.3 (5).
	1		Synchronization type	U16	rw	0	
	2		Cycle time	U32	ro	4000000	
	3		Shift time	U32	ro	27778	
	4		Synchronization types supported	U16	ro	0025h	
	5		Minimum cycle time	U32	ro	100000	
	6		Calc and copy time	U32	ro	306055	
	9		Delay time	U32	ro	0	
	12		Cycle time too small	U16	ro	0	

3.3 PDO default mapping

> POINT
>
> ●The MR-J4-_TM_ servo amplifier supports the variable PDO mapping function, which can select objects transferred in the PDO communication. Refer to section 3.4 for changing the PDO mapping.

(1) RxPDO default mapping

In the default mapping setting, command data is sent from the master (controller) to slaves (servo amplifier) with RxPDO in the following array. In the MR-J4-_TM_ servo amplifier, the mapping objects of 1600h to 1603h can be used as the RxPDO default mapping table.

Map number	Mapping initial setting	Expected application of the initial map
1st RxPDO map (1600h)	Modes of operation (6060h) Controlword (6040h) Control DI 1 (2D01h) Control DI 2 (2D02h) Control DI 3 (2D03h) Target position (607Ah) Target velocity (60FFh) Velocity limit value (2D20h) (Note1) Target torque (6071h) Positive torque limit value (60E0h) (Note2) Negative torque limit value (60E1h) (Note2) Touch probe function (60B8h)	Cyclic synchronous position mode (csp) Cyclic synchronous velocity mode (csv) Cyclic synchronous torque mode (cst) Homing mode (hm) Mapping for an application in which the modes above are switched The following functions can be used together. ▪ Speed limit function (in cst) ▪ Torque limit function ▪ Touch probe function Map size: 29 bytes
2nd RxPDO map (1601h)	Modes of operation (6060h) Controlword (6040h) Control DI 1 (2D01h) Control DI 2 (2D02h) Control DI 3 (2D03h) Target position (607Ah) Target velocity (60FFh) Velocity limit value (2D20h) (Note1) Target torque (6071h) Profile velocity (6081h) Profile acceleration (6083h) Profile deceleration (6084h) Torque slope (6087h) Positive torque limit value (60E0h) (Note2) Negative torque limit value (60E1h) (Note2) Touch probe function (60B8h)	Profile position mode (pp) Profile velocity mode (pv) Profile torque mode (tq) Homing mode (hm) Mapping for an application in which the modes above are switched The following functions can be used together. ▪ Speed limit function (in tq) ▪ Torque limit function ▪ Touch probe function Map size: 45 bytes
3rd RxPDO map (1602h)	Unassigned	
4th RxPDO map (1603h)	Unassigned	

Note 1. The Velocity limit value (2D20h) is a speed limit value for the torque control. Be sure to set a correct value because setting 0 will limit the speed to 0.

2. Positive torque limit value (60E0h)/Negative torque limit value (60E1h) are torque limit values of forward/reverse rotation. Setting 0 will not generate torque. Be sure to set a correct value.

(2) TxPDO default mapping

In the default mapping setting, status data of the MR-J4-_TM_ servo amplifier is sent to the master (controller) with TxPDO in the following array. In the MR-J4-_TM_ servo amplifier, the mapping objects of 1A00h to 1A03h can be used as the TxPDO default mapping table.

Map number	Mapping initial setting	Expected application of the initial map
1st TxPDO map (1A00h)	Modes of operation display (6061h) Statusword (6041h) Status DO 1 (2D11h) Status DO 2 (2D12h) Status DO 3 (2D13h) Position actual value (6064h) Velocity actual value (606Ch) Following error actual value (60F4h) Torque actual value (6077h) Touch probe status (60B9h) Touch probe pos1 pos value (60BAh) Touch probe pos1 neg value (60BBh) Touch probe pos2 pos value (60BCh) Touch probe pos2 neg value (60BDh)	Cyclic synchronous position mode (csp) Cyclic synchronous velocity mode (csv) Cyclic synchronous torque mode (cst) Homing mode (hm) Mapping for an application in which the modes above are switched Mapping for an application in which the modes below are switched ▪ Profile position mode (pp) ▪ Profile velocity mode (pv) ▪ Profile torque mode (tq) ▪ Homing mode (hm) The latched position by the touch probe function can be monitored. Map size: 41 bytes
2nd TxPDO map (1A01h)	Unassigned	
3rd TxPDO map (1A02h)	Unassigned	
4th TxPDO map (1A03h)	Unassigned	

3.4 PDO variable mapping

POINT
●The PDO mapping can be changed only in the Pre Operational state.

The MR-J4-_TM_ servo amplifier supports the variable PDO mapping function, which can arrange objects in any array for the data transferred with RxPDO or TxPDO.
The following table shows the specifications of the PDO variable mapping.

Communication	Maximum number of objects	Maximum size [byte]	Number of mapping settings
RxPDO	32	64	4 (1600h to 1603h)
TxPDO			4 (1A00h to 1A03h)

The following table lists the PDO mapping objects.

Index	Sub	Object	Name	Data Type	Access	Default	Description
1600h	0	ARRAY	Receive PDO Mapping	U8	rw	12	Refer to section 7.3.2 (1).
	1 to 32		Mapped Object 001 to Mapped Object 032	U32	rw	60600008h to 00000000h	
1601h	0	ARRAY	Receive PDO Mapping	U8	rw	16	Refer to section 7.3.2 (2).
	1 to 32		Mapped Object 001 to Mapped Object 032	U32	rw	60600008h to 00000000h	
1602h	0	ARRAY	Receive PDO Mapping	U8	rw	0	Refer to section 7.3.2 (3).
	1 to 32		Mapped Object 001 to Mapped Object 032	U32	rw		
1603h	0	ARRAY	Receive PDO Mapping	U8	rw	0	Refer to section 7.3.2 (4).
	1 to 32		Mapped Object 001 to Mapped Object 032	U32	rw		
1A00h	0	ARRAY	Transmit PDO Mapping	U8	rw	14	Refer to section 7.3.2 (5).
	1 to 32		Mapped Object 001 to Mapped Object 032	U32	rw	60610008h to 00000000h	
1A01h	0	ARRAY	Transmit PDO Mapping	U8	rw	0	Refer to section 7.3.2 (6).
	1 to 32		Mapped Object 001 to Mapped Object 032	U32	rw		
1A02h	0	ARRAY	Transmit PDO Mapping	U8	rw	0	Refer to section 7.3.2 (7).
	1 to 32		Mapped Object 001 to Mapped Object 032	U32	rw		

Index	Sub	Object	Name	Data Type	Access	Default	Description
1A03h	0	ARRAY	Transmit PDO Mapping	U8	rw	0	Refer to section 7.3.2 (8).
	1 to 32		Mapped Object 001 to Mapped Object 032	U32	rw		
1C12h	0	ARRAY	Sync Manager 2 PDO Assignment	U8	ro	1	Refer to section 7.3.3 (2).
	1		PDO Mapping object index of assigned RxPDO	U16	rw	1600h	
1C13h	0	ARRAY	Sync Manager 3 PDO Assignment	U8	ro	1	Refer to section 7.3.3 (3).
	1		PDO Mapping object index of assigned TxPDO	U16	rw	1A00h	

3.5 Mapping-necessary objects

The following table lists the objects which are required for each mode.

(1) RxPDO

Object name (Index)	Mode (Note)							Function (Note)
	csp	csv	cst	pp	pv	tq	hm	Touch probe
Controlword (6040h)	◎	◎	◎	◎	◎	◎	◎	
Control DI 1 (2D01h) Gain switching	○	○	-	○	○	-	-	
Control DI 2 (2D02h) Proportional control	○	-	-	○	-	-	○	
Control DI 3 (2D03h)	-	-	-	-	-	-	-	
Target position (607Ah)	◎	-	-	◎	-	-	-	
Target velocity (60FFh)	-	◎	-	-	◎	-	-	
Target torque (6071h)	-	-	◎	-	-	◎	-	
Profile velocity (6081h)	-	-	-	○	-	-	-	
Profile acceleration (6083h)	-	-	-	○	○	-	-	
Profile deceleration (6084h)	-	-	-	○	○	-	-	
Torque slope (6087h)	-	-	-	-	-	○	-	
Velocity limit value (2D20h)	-	-	○	-	-	○	-	
Positive torque limit value (60E0h)	○	○	○	○	○	○	○	
Negative torque limit value (60E1h)	○	○	○	○	○	○	○	
Touch probe function (60B8h)								◎
Watch dog counter DL (2D23h)	○	○	○	-	-	-	-	-

Note. ◎: Mapping required
○: Mapping recommended
-: Mapping not required

(2) TxPDO

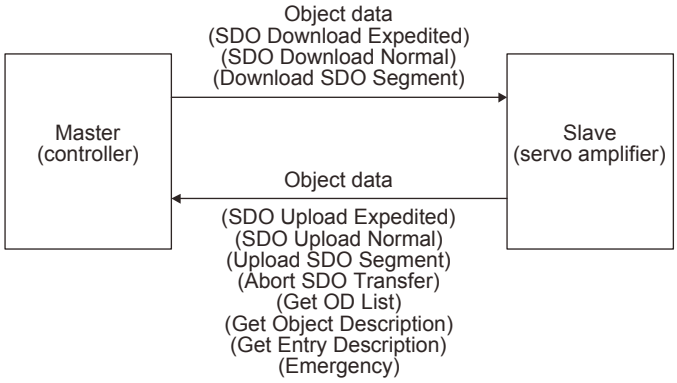
Object name (Index)	Mode (Note)							Function (Note)
	csp	csv	cst	pp	pv	tq	hm	Touch probe
Statusword (6041h)	◎	◎	◎	◎	◎	◎	◎	
Status DI 1 (2D11h)	○	○	○	○	○	○	○	
Status DI 2 (2D12h)	○	○	○	○	○	○	○	
Status DI 3 (2D13h)	○	○	○	○	○	○	○	
Position actual value (6064h)	○	○	○	○	○	○	○	
Following error actual value (60F4h)	○	-	-	○	-	-	-	
Velocity actual value (606Ch)	○	○	○	○	○	○	○	
Torque actual value (6077h)	○	○	○	○	○	○	○	
Touch probe status (60B9h)								◎
Touch probe pos1 pos value (60BAh)								○
Touch probe pos1 neg value (60BBh)								○
Touch probe pos2 pos value (60BCh)								○
Touch probe pos2 neg value (60BDh)								○
Watch dog counter UL (2D24h)	○	○	○	-	-	-	-	-

Note. ◎: Mapping required
○: Mapping recommended
-: Mapping not required

MEMO

4. SDO (SERVICE DATA OBJECT) COMMUNICATION

The SDO (service data object) communication can transfer object data between a master (controller) and slaves (servo amplifier) asynchronously.



4.1 SDO communication-related service

The MR-J4-_TM_ servo amplifier supports the following services relating to the SDO communication.

Service	Description
SDO Download Expedited	Writes data of up to 4 bytes to a slave.
SDO Download Normal	Writes data of the specified bytes to a slave.
Download SDO Segment	Writes additional data when the object size is larger than the specified byte size.
SDO Upload Expedited	Reads data of up to 4 bytes from a slave.
SDO Upload Normal (Note)	Reads data of the specified bytes from a slave.
Upload SDO Segment	Reads additional data when the object size is larger than the specified number of octets.
Abort SDO Transfer	Sends SDO Abort Code when an error occurs in a service.
Get OD List	Reads a list of available object indexes.
Get Object Description	Reads the detail of an index.
Get Entry Description	Reads the detail of Sub Index.
Emergency	Notifies an alarm.

Note. Complete Access is not supported.

4.2 SDO Abort Code

When an error occurs in the SDO communication, the following error messages are returned with the Abort SDO Transfer service.

SDO Abort Code	Meaning	Cause
0504 0005h	Out of memory.	The memory is out of the range.
0601 0001h	Attempt to read to a write only object	Reading is attempted to a write-only object.
0601 0002h	Attempt to write to a read only object	Writing is attempted to a read-only object.
0601 0006h	Object mapped to RxPDO, SDO download blocked.	SDO Download is executed to an object mapped to RxPDO.
0602 0000h	The object does not exist in the object dictionary	A non-existent index is specified.
0604 0043h	General parameter incompatibility reason.	An unsupported command is issued.
0607 0012h	Data type does not match, length of service parameter too high	The data type does not match. The data length is too long.
0607 0013h	Data type does not match ength of service parameter too short.	The data type does not match. The data length is too short.
0609 0011h	Subindex does not exist	A non-existent Sub Index is specified.
0609 0030h	Value range of parameter exceeded	A parameter value outside the range is specified.
0609 0031h	Value of parameter written too high	The value of the parameter written is too large.
0609 0032h	Value of parameter written too low	The value of the parameter written is too small.
0800 0000h	Generic error.	General error
0800 0022h	Data cannot be transferred or stored to the application because of the present device state.	Data cannot be read or written due to the current device status.

5. CiA 402 DRIVE PROFILE

5.1 FSA state

The inside state of the MR-J4-_TM_ servo amplifier is controlled based on the FSA state, defined in the CiA 402 drive profile standard. Figure 5.1 and Table 5.1 show the transition conditions between the FSA states. The states are switched when the master sends a command following the table (sets Controlword) with the PDO communication established (the AL state Operational reached). When the state has transitioned from Not ready to switch on, which is right after the power on, to Operation enabled with the predetermined procedure, the servo motor becomes ready to operate.

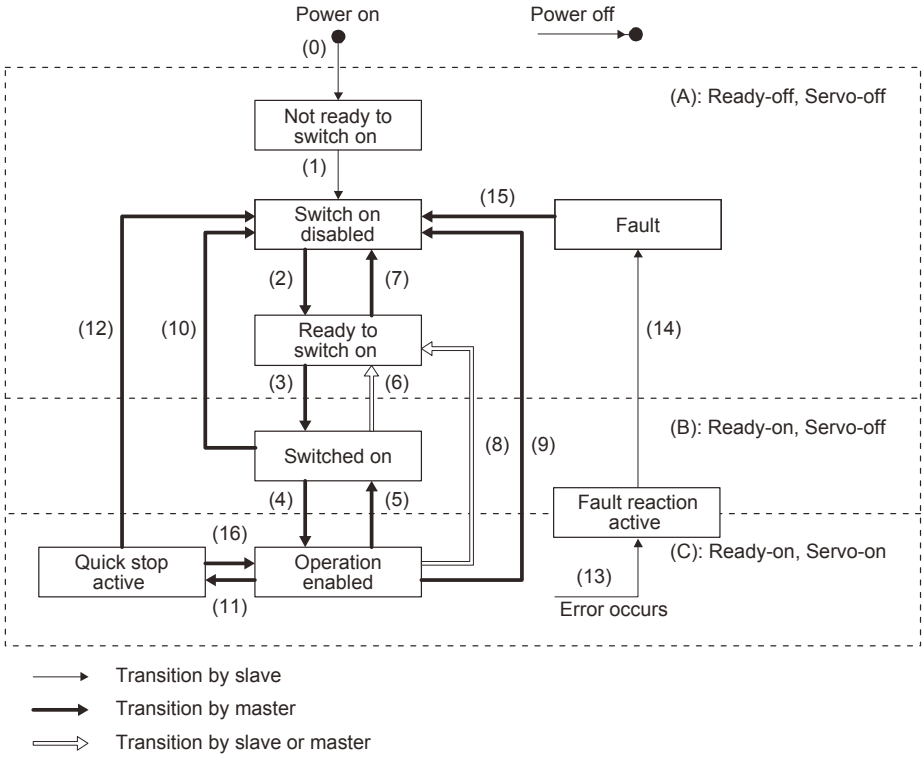


Figure 5.1 Transition between the FSA states

Table 5.1 State transition

Transition No.	Event	Remark
(0)	The control circuit power supply is turned on.	Initialization
(1)	The state automatically transitions when the control circuit power supply is turned on.	Communication setting
(2)	The state transitions with the Shutdown command from the master.	
(3)	The state transitions with the Switch on command from the master.	RA turns on.
(4)	The state transitions with the Enable operation command from the master.	The operation becomes ready after servo-on.
(5)	The state transitions with the Disable operation command from the master.	The operation is disabled after servo-off.
(6)	The state transitions with the Shutdown command from the master.	RA turns off.
(7)	The state transitions with the Disable Voltage command or Quick Stop command from the master.	
(8)	(a) The state transitions with the Shutdown command from the master. (b) The state transitions when the main circuit power supply is turned off.	Operation is disabled after servo-off or RA-off.
(9)	The state transitions with the Disable Voltage command from the master.	Operation is disabled after servo-off or RA-off.
(10)	The state transitions with the Disable Voltage command or Quick Stop command from the master.	RA turns off.
(11)	The state transitions with the Quick Stop command from the master.	Quick Stop starts.
(12)	(a) The state automatically transitions after Quick Stop is completed. (If the Quick Stop option code is 1, 2, 3, or 4) (b) The state transitions with the Disable Voltage command from the master.	Operation is disabled after servo-off or RA-off.
(13)	Alarm occurrence	Processing against the alarm is executed.

Transition No.	Event	Remark
(14)	Automatic transition	After processing against the alarm has been completed, servo-off or RA-off is performed and the operation is disabled.
(15)	The state transitions with the Fault Reset command from the master.	Alarms are reset. Alarms that can be reset are reset.
(16) (Not supported) (Note)	The state transitions with the Enable Operation command from the master. (If the Quick Stop option code is 5, 6, 7, or 8)	The operation becomes ready.

Note. This is not supported by the MR-J4-_TM_ servo amplifier.

The following table lists the commands issued to the servo amplifier. Turn on the bits according to the command.

Command	Command bit setting of Controlword					Transition No.
	Bit 7 Fault Reset	Bit 3 Enable Operation	Bit 2 Quick Stop	Bit 1 Enable Voltage	Bit 0 Switch On	
Shutdown	0		1	1	0	(2)/(6)/(8)
Switch On	0	0	1	1	1	(3)
Disable Voltage	0			0		(7)/(9)/(10)/(12)
Quick Stop	0		0	1		(7)/(10)/(11)
Disable Operation	0	0	1	1	1	(5)
Enable Operation	0	1	1	1	1	(4)/(16)
Fault Reset	0 → 1 (Note)					(15)

Note. In faulty communication, hold the state of Bit 7 = 1 for at least 10 ms for the Fault Reset command to prevent the command from failing to be recognized.

Figure 5.1 and Table 5.1 show the FSA state transition conditions of the EtherCAT standard. The transition from the Switch on disabled state to the Operation enabled state requires Shutdown, Switch on, and Enable operation to be issued in this order. However, with the MR-J4-_TM_ servo amplifier, transition to the target state skipping the states in between is possible.

Current state	Command	State after transition
Switch on disabled	Switch on	Switched on
Switch on disabled	Enable operation	Operation enabled
Ready to switch on	Enable operation	Operation enabled

5.2 Controlword/Control DI

The FSA state can be switched and control commands for the functions of the drive can be issued by rewriting the objects of Controlword (6040h) and Control DI (2D01h to 2D03h) from the master (controller). Use 6040h to issue control commands defined with CiA 402. Use 2D01h to 2D03h to issue control commands of the other manufacturer functions.

Index	Sub	Object	Name	Data Type	Access	Description
6040h		VAR	Controlword	U16	rw	
2D01h		VAR	Control DI 1	U16	rw	Control commands to control the servo amplifier can be set.
2D02h			Control DI 2			
2D03h			Control DI 3			

5.2.1 Bit definition of Controlword

Controlword (6040h) can control the FSA state and issue control commands. Use Bit 0 to Bit 3 and Bit 7 for the FSA state. The following table shows the bit definition of Controlword (6040h).

Bit	Symbol	Description
0	SO	Switch-on
1	EV	Enable voltage
2	QS	Quick stop
3	EO	Enable operation
4	OMS	Differs depending on Modes of operation (6060h). (Refer to section 5.4.)
5		
6		
7	FR	Fault reset
8	HALT	0: Operation ready 1: Temporary stop
9	OMS	Differs depending on Modes of operation (6060h). (Refer to section 5.4.)
10		The value at reading is undefined. Set "0" at writing.
11		
12		
13		
14		
15		

5.2.2 Bit definition of Control DI

Control DI can control the FSA state and issue control commands. The following table shows the bit definition of Control DI.

(1) Control DI 1

Bit	Symbol	Description
0		The value at reading is undefined. Set "0" at writing.
1		
2		
3		
4	C_CDP	Gain switching Turn on C_CDP to use the values of [Pr. PB29] to [Pr. PB36] and [Pr. PB56] to [Pr. PB60] as the load to motor inertia ratio and gain values.
5	C_CLD	Fully closed loop control switching Use this bit when the semi closed loop control/fully closed loop control switching is enabled with [Pr. PE01]. Turn off C_CLD to select the semi closed loop control, and turn on C_CLD to select the fully closed loop control.
6		The value at reading is undefined. Set "0" at writing.
7		
8		
9		
10		
11		
12		
13		
14		
15		

(2) Control DI 2

Bit	Symbol	Description
0		The value at reading is undefined. Set "0" at writing.
1		
2		
3		
4		
5		
6		
7		
8	C_PC	Proportional control Turn C_PC on to switch the speed amplifier from the proportional integral type to the proportional type. If the servo motor at a stop is rotated even one pulse due to any external factor, it generates torque to compensate for a position mismatch. When the servo motor shaft is to be locked mechanically after positioning completion (stop), switching on the C_PC upon positioning completion will suppress the unnecessary torque generated to compensate for a position mismatch. When the shaft is to be locked for a long time, use the C_PC and torque limit at the same time to make the torque less than the rated torque.
9		The value at reading is undefined. Set "0" at writing.
10		
11		
12		
13		
14		
15	C_ORST	Operation alarm reset Turn on C_ORST from off to reset [AL. F4 Positioning warning].

(3) Control DI 3

Bit	Symbol	Description
0		The value at reading is undefined. Set "0" at writing.
1		
2		
3		
4		
5		
6		
7		
8	C_ABS2	Home position return completion (for scale measurement) When C_ABS2 is turned on with the scale measurement function, the absolute position erased status of a scale measurement encoder can be canceled. S_ABSV2 turns off. This is used with servo amplifiers with software version B0 or later.
9		The value at reading is undefined. Set "0" at writing.
10		
11		
12		
13		
14		
15		

5.3 Statusword/Status DO

The objects of Statusword or Status DO notify the master (controller) of the FSA state of the MR-J4-_TM_ servo amplifier and other drive status. Use 6041h to notify the status defined with CiA 402. Use 2D11h to 2D13h and 2D15h for the other Vendor-specific statuses.

Index	Sub	Object	Name	Data Type	Access	Description
6041h		VAR	Statusword	U16	ro	
2D11h		VAR	Status DO 1	U16	ro	The servo status is returned.
2D12h			Status DO 2			
2D13h			Status DO 3			
2D15h			Status DO 5			

5.3.1 Bit definition of Statusword

The following table shows the bit definition of Statusword.

Bit	Symbol	Description
0	RTSO	Ready-to-switch-on
1	SO	Switch-on
2	OE	Operation-enabled
3	F	Fault
4	VE	Voltage-enabled 0: The bus voltage is lower than the certain (RA) level. 1: The bus voltage is equal to or higher than the certain level.
5	QS	Quick stop 0: During a quick stop 1: No during a quick stop (including during the test mode)
6	SOD	Switch on disabled
7	W	Warning 0: No warning has been occurred. 1: A warning has occurred.
8		The value at reading is undefined.
9	RM	Remote 0: Not following the Controlword command 1: In operation following the Controlword command
10	TR	Target reached Differs depending on Modes of operation (6060h). (Refer to section 5.4.)
11	ILA	Internal limit active 0: The forward rotation stroke end, reverse rotation stroke end, and software position limit have not been reached 1: The forward rotation stroke end, reverse rotation stroke end, or software position limit has been reached. (Enabled in the csp, csv, pp, pv, or hm mode)
12	OMS	Differs depending on Modes of operation (6060h). (Refer to section 5.4.)
13		
14		The value at reading is undefined.
15		

Bit 0 to Bit 3, Bit 5, and Bit 6 are switched depending on the FSA state (internal state of the MR-J4-_TM_ servo amplifier). Refer to the following table for details.

Statusword (bin)	FSA state
x0xx xxx0 x0xx 0000	Not ready to switch on (Note)
x0xx xxx0 x1xx 0000	Switch on disabled
x0xx xxx0 x01x 0001	Ready to switch on
x0xx xxx0 x01x 0011	Switched on
x0xx xxx0 x01x 0111	Operation enabled
x0xx xxx0 x00x 0111	Quick stop active
x0xx xxx0 x0xx 1111	Fault reaction active
x0xx xxx0 x0xx 1000	Fault

Note. Statusword is not sent in the Not ready to switch on state.

5.3.2 Bit definition of Status DO

The following table shows the bit definition of Status DO.

(1) Status DO 1

Bit	Symbol	Description
0		The value at reading is undefined.
1		
2	S_SA	Speed reached S_SA turns off during servo-off. When the servo motor speed reaches the following range, S_SA turns on. Preset speed ± ((Preset speed × 0.05) + 20) r/min When the preset speed is 20 r/min or slower, S_SA always turns on.
3	S_MBR	Electromagnetic brake interlock When a servo-off status or alarm occurs, S_MBR turns off.
4	S_CDPS	Variable gain selection S_CDPS will turn on during variable gain.
5	S_CLD	During fully closed loop control switching S_CLD turns on during fully closed loop control.
6		The value at reading is undefined.
7		
8		
9		
10		
11		
12	S_INP	In-position When the number of droop pulses is in the in-position range, S_INP turns on. The in-position range can be changed with [Pr. PA10]. When the in-position range is increased, S_INP may be always on during low-speed rotation. The Status DO cannot be used in the velocity mode or torque mode.
13	S_TLC	Limiting torque When the torque reaches the torque limit value during torque generation, S_TLC turns on. When the servo is off, S_TLC will be turned off. This Status DO cannot be used in the torque mode.
14	S_ABSV	Absolute position undetermined When the absolute position is erased, S_ABSV turns on. The Status DO cannot be used in the velocity mode or torque mode.
15	S_BWNG	Battery warning When [AL. 92 Battery cable disconnection warning] or [AL. 9F Battery warning] has occurred, S_BWNG turns on. When the battery warning is not occurring, turning on the power will turn off S_BWNG after 2.5 s to 3.5 s.

(2) Status DO 2

Bit	Symbol	Description
0	S_ZPAS	Z-phase already passed 0: Z-phase unpassed after start-up 1: Z-phase passed once or more after start-up
1		The value at reading is undefined.
2		
3	S_ZSP	Under zero speed When the servo motor speed is at zero speed or slower, S_ZSP turns on. Zero speed can be changed with [Pr. PC07].
4	S_VLC	Limiting speed When the speed reaches the speed limit value in the torque mode, S_VLC turns on. When the servo is off, S_TLC will be turned off. The Status DO cannot be used in the position mode or velocity mode.
5		The value at reading is undefined.
6	S_IPF	During IPF S_IPF turns on during an instantaneous power failure.
7		
8	S_PC	Under proportional control S_PC turns on under proportional control.
9		The value at reading is undefined.
10	S_DB	External dynamic brake output When the dynamic brake needs to operate, S_DB turns off.
11		The value at reading is undefined.
12		
13		
14		
15	S_ZP2	Home position return completion 2 When a home position return completes normally, S_ZP2 turns on. S_ZP2 is always on unless the home position is erased. In the incremental system, it turns off with one of the following conditions. 1) [AL. 69 Command error] occurs. 2) Home position return is not being executed. 3) Home position return is in progress. If a home position return completes once in the absolute position detection system, S_ZP2 is always on. However, it will be off with one of the conditions 1) to 3) or the following. 4) The home position return is not performed after [AL. 25 Absolute position erased] or [AL. E3 Absolute position counter warning] occurred. 5) The home position return is not performed after the electronic gear ([Pr. PA06] or [Pr. PA07]) was changed. 6) The home position return is not performed after the setting of [Pr. PA03 Absolute position detection system selection] was changed from "Disabled" to "Enabled". 7) [Pr. PA14 Rotation direction selection/travel direction selection] was changed. 8) [Pr. PA01 Operation mode] was changed.

(3) Status DO 3

Bit	Symbol	Description
0		The value at reading is undefined.
1		
2		
3		
4		
5	S_STO	During STO S_STO turns on during STO.
6		The value at reading is undefined.
7		
8	S_ABSV2	Absolute position undetermined 2 (for scale measurement) When the absolute position is erased from a scale measurement encoder with the scale measurement function, S_ABSV2 turns on. This is used with servo amplifiers with software version B0 or later.
9		The value at reading is undefined.
10		
11	S_MTTR	Transition to tough drive mode in process When a tough drive is "Enabled" in [Pr. PA20], activating the instantaneous power failure tough drive will turn on S_MTTR.
12		The value at reading is undefined.
13		
14		
15		

(4) Status DO 5

Bit	Symbol	Description
0		The value at reading is undefined.
1		
2		
3		
4		
5		
6	S_MEND	Travel completion When the droop pulses are within the in-position output range set with [Pr. PA10] and the command remaining distance is "0", S_MEND will be on. S_MEND turns on with servo-on. S_MEND is off at servo-off status. This is used with servo amplifiers with software version B0 or later.
7		The value at reading is undefined.
8		
9		
10		
11		
12		
13		
14		
15		

5.4 Control mode

5.4.1 Selecting control mode (Modes of operation)

Specify a control mode with Modes of operation (6060h). Modes of operation (6060h) can be rewritten with PDO or SDO. Note that usable control modes are limited depending on the setting of [Pr. PA01], as shown in the following table.

Pr. PA01 setting value	pp	pv	tq	hm	csp	csv	cst	6060h/6061h Default value
_ _ _ 0: Automatic selection by each network _ _ _ 1: Cyclic synchronous mode				○	○	○	○	8 (csp)
_ _ _ 2: Profile mode	○	○	○	○				1 (pp)

The following table shows the objects selected for control modes.

Index	Sub	Object	Name	Data Type	Access	Default	Description
6060h		VAR	Modes of operation	I8	rw	Differs depending on [Pr. PA01].	Refer to section 7.3.8 (6).
6061h		VAR	Modes of operation display	I8	ro	Differs depending on [Pr. PA01].	Refer to section 7.3.8 (7).
6502h		VAR	Supported drive mode	U32	ro	000003A1h	Refer to section 7.3.8 (8).

5.4.2 Control switching

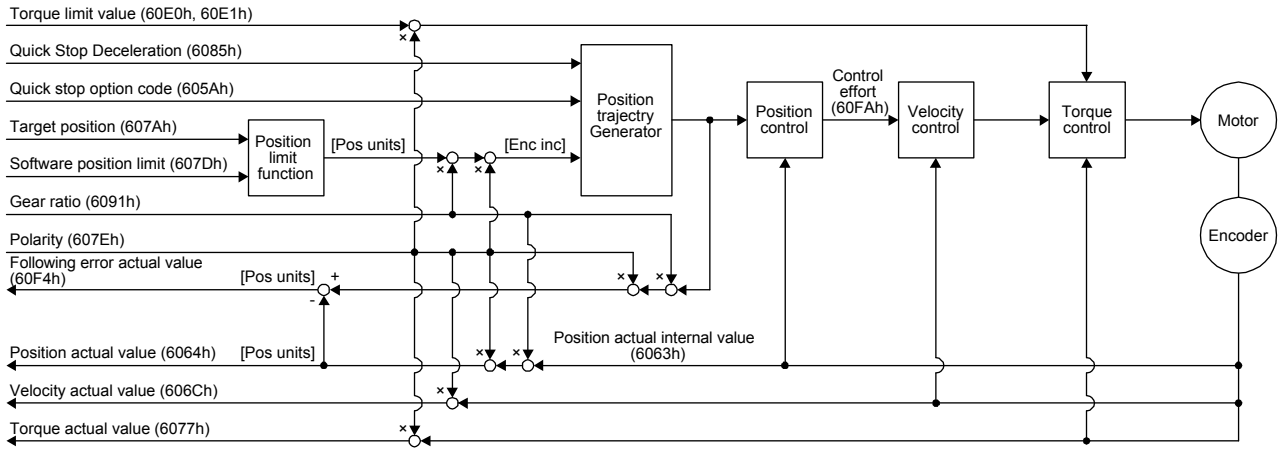
POINT

●Changes to the OMS bit of Controlword (6040h) are not accepted until control switching is completed. Before inputting commands, check that the control mode has been switched referring to Modes of operation display (6061h).

Because control switching has a delay, the controller must keep sending command values corresponding to the control mode before and after the switching. After the completion of control switching has been checked with Modes of operation display (6061h), update of the command value before the switching can be stopped. Before switching the mode from or to the position mode, check that the servo motor speed is zero speed. Zero speed can be obtained with Bit 3 (S_ZSP) of Status DO 2 (2D12h). If the servo motor speed is not zero speed, the control will not be switched and Modes of operation display (6061h) will not change.

5.4.3 Cyclic synchronous position mode (csp)

The following shows the functions and related objects of the cyclic synchronous position mode (csp).



(1) Related object

Index	Sub	Object	Name	Data Type	Access	Default	Description
607Ah		VAR	Target position	I32	rw		Command position (Pos units)
607Bh (Note 2)	0	ARRAY	Position range limit	U8	ro	2	Number of entries
	1		Min position range limit	I32	rw		Minimum value of the position range limit The value is automatically set according to the setting of "Position data unit" in [Pr. PT01]. pulse: -2147483648 degree: 0 The cyclic synchronous mode supports pulses only.
	2		Max position range limit	I32	rw		Maximum value of the position range limit The value is automatically set according to the setting of "Position data unit" in [Pr. PT01]. pulse: 2147483647 degree: 359999 The cyclic synchronous mode supports pulses only.
607Dh	0	ARRAY	Software position limit	U8	ro	2	Number of entries
	1		Min position limit	I32	rw	0	Minimum position address (Pos units)
	2		Max position limit	I32	rw	0	Maximum position address (Pos units)
6085h		VAR	Quick stop deceleration	U32	rw	100	Deceleration at deceleration to a stop by Quick stop Unit: ms
605Ah		VAR	Quick stop option code	I16	rw	2	Operation setting for Quick stop Refer to section 5.6.
6080h		VAR	Max motor speed	U32	rw	Refer to chapter 7.	Servo motor maximum speed Unit: r/min
6063h		VAR	Position actual internal value	I32	ro		Current position (after electronic gear)
6064h		VAR	Position actual value	I32	ro		Current position (command unit)
606Ch		VAR	Velocity actual value	I32	ro		Current speed Unit: 0.01 r/min or 0.01 mm/s (linear)
6077h		VAR	Torque actual value	I32	ro		Current torque Unit: 0.1% (rated torque of 100%)

Index	Sub	Object	Name	Data Type	Access	Default	Description
6092h (Note 2)	0	ARRAY	Feed constant	U8	ro	2	Travel distance per revolution of an output shaft
	1		Feed	U32	rw		Travel distance Refer to section 7.3.14 (4).
	2		Shaft revolutions				Number of servo motor shaft revolutions Refer to section 7.3.14 (4).
60F4h		VAR	Following error actual value	I32	ro		Droop pulses (Pos units)
60FAh		VAR	Control effort	I32	ro		Position control loop output (speed command) Unit: Vel unit (0.01 r/min or 0.01 mm/s)
60E0h		VAR	Positive torque limit value	U16	rw	10000	Torque limit value (forward) Unit: 0.1% (rated torque of 100%)
60E1h		VAR	Negative torque limit value	U16	rw	10000	Torque limit value (reverse) Unit: 0.1% (rated torque of 100%)
6091h	0	ARRAY	Gear ratio	U8	ro	2	Gear ratio
	1		Motor revolutions	U32	rw	1	Number of revolutions of the servo motor axis (numerator) (Note 1)
	2		Shaft revolutions			1	Number of revolutions of the drive axis (denominator) (Note 1)
607Eh		VAR	Polarity	U8	rw	0	Polarity selection Bit 7: Position POL Bit 6: Velocity POL Bit 5: Torque POL (Note 2) Refer to section 5.10.
60A8h (Note 2)		VAR	SI unit position	U32	rw	0	SI unit position The value is automatically set according to the setting of "Position data unit" of [Pr. PT01]. Refer to section 7.3.14 (5).
60A9h (Note 2)		VAR	SI unit velocity	U32	rw	0	SI unit velocity 0.01 r/min or 0.01 mm/s FB010300h (0.01 mm/s) FEB44700h (0.01 r/min)

Note 1. In the cyclic synchronous mode, setting Motor revolutions (6091h: 1) or Shaft revolutions (6091h: 2) to anything other than "1" will trigger [AL. 37].
2. This is used with servo amplifiers with software version B0 or later.

(2) Electronic gear function (unit conversion for position data)

The unit system of position data used inside and outside the MR-J4-_TM_ servo amplifier can be mutually converted with the Gear ratio value used as a coefficient.

Outside/inside	Applicable object example	Unit notation
External position information (position information exchanged with the controller)	Current position (Position actual value (6064h)) Command position (Target position (607Ah))	Pos units
Internal position information (position information in the servo amplifier)	Internal current position (Position actual internal value (6063h))	Enc inc

The following shows the equation.

$$\text{Position actual value (6064h)} = \text{Position actual internal value (6063h)} \times \frac{\text{Shaft revolutions (6091h: 2)}}{\text{Motor revolutions (6091h: 1)}}$$

(3) OMS bit of Controlword (csp mode)

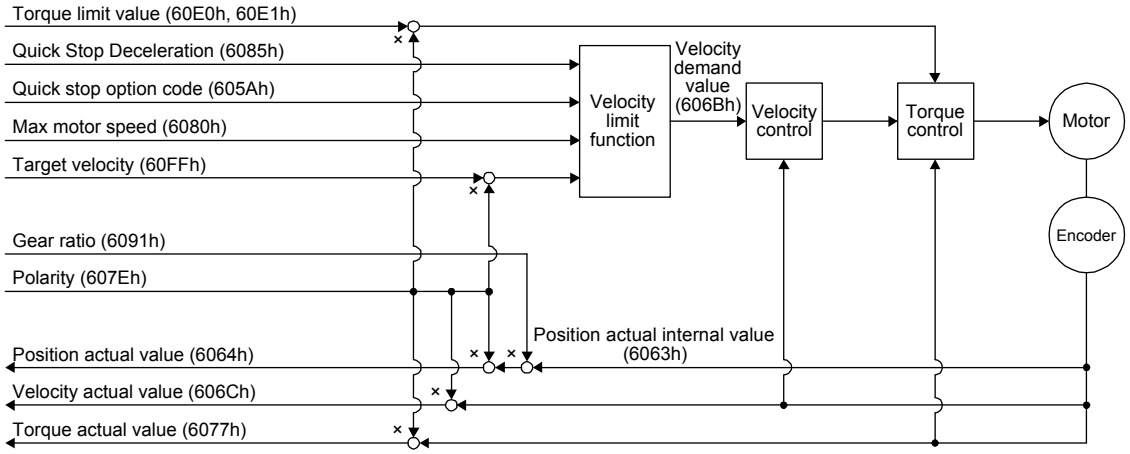
Bit	Symbol	Description
4	(reserved)	The value at reading is undefined. Set "0" at writing.
5	(reserved)	
6	(reserved)	
8	(reserved)	
9	(reserved)	

(4) OMS bit of Statusword (csp mode)

Bit	Symbol	Description
10	(reserved)	The value at reading is undefined.
12	Target position ignored	0: Target position (607Ah) is being discarded. 1: Target position (607Ah) is being used as a position control loop input.
13	Following error	0: No following error 1: Following error If Following error actual value (60F4h) is equal to or larger than Following error window (6065h) for the time (unit: ms) set in the Following error time out (6066h) or more, "1" is set.

5.4.4 Cyclic synchronous velocity mode (csv)

The following shows the functions and related objects of the cyclic synchronous velocity mode (csv).



(1) Related object

Index	Sub	Object	Name	Data Type	Access	Default	Description
60FFh		VAR	Target velocity	I32	rw		Command speed Unit: Vel unit (0.01 r/min or 0.01 mm/s)
6085h		VAR	Quick stop deceleration	U32	rw	100	Deceleration at deceleration to a stop by Quick stop Unit: ms
605Ah		VAR	Quick stop option code	I16	rw	2	Operation setting for Quick stop Refer to section 5.6.
6080h		VAR	Max motor speed	U32	rw		Servo motor maximum speed Unit: r/min
606Bh		VAR	Velocity demand value	I32	ro		Command speed (after limit)
6063h		VAR	Position actual internal value	I32	ro		Current position (after electronic gear)
6064h		VAR	Position actual value	I32	ro		Current position (command unit)
606Ch		VAR	Velocity actual value	I32	ro		Current speed Unit: 0.01 r/min or 0.01 mm/s (linear)
6077h		VAR	Torque actual value	I32	ro		Current torque Unit: 0.1% (rated torque of 100%)
6092h (Note 2)	0	ARRAY	Feed constant	U8	ro	2	Travel distance per revolution of an output shaft
	1		Feed	U32	rw		Travel distance Refer to section 7.3.14 (4).
	2		Shaft revolutions				Number of servo motor shaft revolutions Refer to section 7.3.14 (4).
60E0h		VAR	Positive torque limit value	U16	rw	10000	Torque limit value (forward) Unit: 0.1% (rated torque of 100%)
60E1h		VAR	Negative torque limit value	U16	rw	10000	Torque limit value (reverse) Unit: 0.1% (rated torque of 100%)

Index	Sub	Object	Name	Data Type	Access	Default	Description
6091h	0	ARRAY	Gear ratio	U8	ro	2	Gear ratio
	1		Motor revolutions	U32	rw	1	Number of revolutions of the servo motor axis (numerator) (Note 1)
	2		Shaft revolutions			1	Number of revolutions of the drive axis (denominator) (Note 1)
607Eh		VAR	Polarity	U8	rw	0	Polarity selection Bit 7: Position POL Bit 6: Velocity POL Bit 5: Torque POL (Note 2) Refer to section 5.10.
60A8h (Note 2)		VAR	SI unit position	U32	rw	0	SI unit position The value is automatically set according to the setting of "Position data unit" of [Pr. PT01]. Refer to section 7.3.14 (5).
60A9h (Note 2)		VAR	SI unit velocity	U32	rw	0	SI unit velocity 0.01 r/min or 0.01 mm/s FB010300h (0.01 mm/s) FEB44700h (0.01 r/min)

Note 1. In the cyclic synchronous mode, setting Motor revolutions (6091h: 1) or Shaft revolutions (6091h: 2) to anything other than "1" will trigger [AL. 37].

2. This is used with servo amplifiers with software version B0 or later.

(2) OMS bit of Controlword (csv mode)

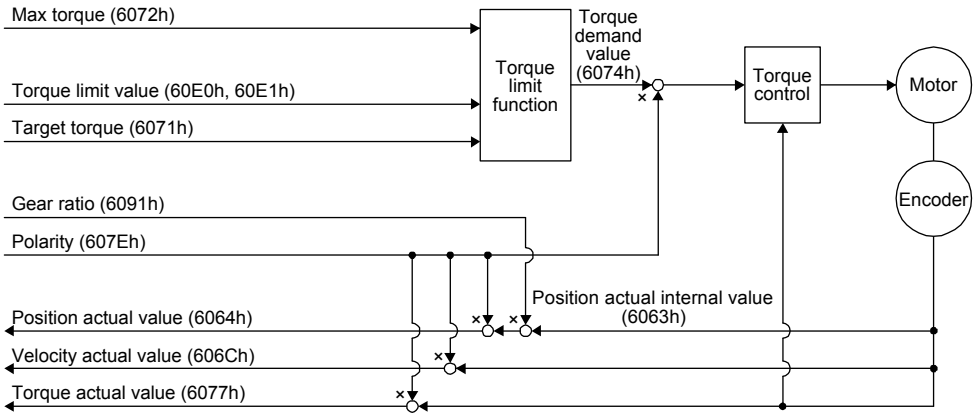
Bit	Symbol	Description
4	(reserved)	The value at reading is undefined. Set "0" at writing.
5	(reserved)	
6	(reserved)	
8	(reserved)	
9	(reserved)	

(3) OMS bit of Statusword (csv mode)

Bit	Symbol	Description
10	(reserved)	The value at reading is undefined.
12	Target velocity ignored	0: Target velocity (60FFh) is being discarded. 1: Target velocity (60FFh) is being used as a speed control loop input.
13	(reserved)	The value at reading is undefined.

5.4.5 Cyclic synchronous torque mode (cst)

The following shows the functions and related objects of the cyclic synchronous torque mode (cst).



(1) Related object

Index	Sub	Object	Name	Data Type	Access	Default	Description
6071h		VAR	Target torque	I16	rw		Command torque Unit: 0.1% (rated torque of 100%)
6072h		VAR	Max torque	U16	rw		Maximum torque Unit: 0.1% (rated torque of 100%)
6074h		VAR	Torque demand	I16	ro		Command torque (after limit) Unit: 0.1% (rated torque of 100%)
6063h		VAR	Position actual internal value	I32	ro		Current position (Enc inc)
6064h		VAR	Position actual value	I32	ro		Current position (Pos units)
606Ch		VAR	Velocity actual value	I32	ro		Current speed Unit: Vel unit (0.01 r/min or 0.01 mm/s)
6077h		VAR	Torque actual value	I32	ro		Current torque Unit: 0.1% (rated torque of 100%)
6092h (Note 2)	0	ARRAY	Feed constant	U8	ro	2	Travel distance per revolution of an output shaft
	1		Feed	U32	rw		Travel distance Refer to section 7.3.14 (4).
	2		Shaft revolutions				Number of servo motor shaft revolutions Refer to section 7.3.14 (4).
60E0h		VAR	Positive torque limit value	U16	rw	10000	Torque limit value (forward) Unit: 0.1% (rated torque of 100%)
60E1h		VAR	Negative torque limit value	U16	rw	10000	Torque limit value (reverse) Unit: 0.1% (rated torque of 100%)
6091h	0	ARRAY	Gear ratio	U8	ro	2	Gear ratio
	1		Motor revolutions	U32	rw	1	Number of revolutions of the servo motor axis (numerator) (Note 1)
	2		Shaft revolutions			1	Number of revolutions of the drive axis (denominator) (Note 1)
607Eh		VAR	Polarity	U8	rw	0	Polarity selection Bit 7: Position POL Bit 6: Velocity POL Bit 5: Torque POL (Note 2) Refer to section 5.10.

Index	Sub	Object	Name	Data Type	Access	Default	Description
2D20h		VAR	Velocity limit value	I32	rw	50000	Speed limit value Unit: Vel unit (0.01 r/min or 0.01 mm/s)
60A8h (Note 2)		VAR	SI unit position	U32	rw	0	SI unit position The value is automatically set according to the setting of "Position data unit" of [Pr. PT01]. Refer to section 7.3.14 (5).
60A9h (Note 2)		VAR	SI unit velocity	U32	rw	0	SI unit velocity 0.01 r/min or 0.01 mm/s FB010300h (0.01 mm/s) FEB44700h (0.01 r/min)

Note 1. In the cyclic synchronous mode, setting Motor revolutions (6091h: 1) or Shaft revolutions (6091h: 2) to anything other than "1" will trigger [AL. 37].
2. This is used with servo amplifiers with software version B0 or later.

(2) OMS bit of Controlword (csv mode)

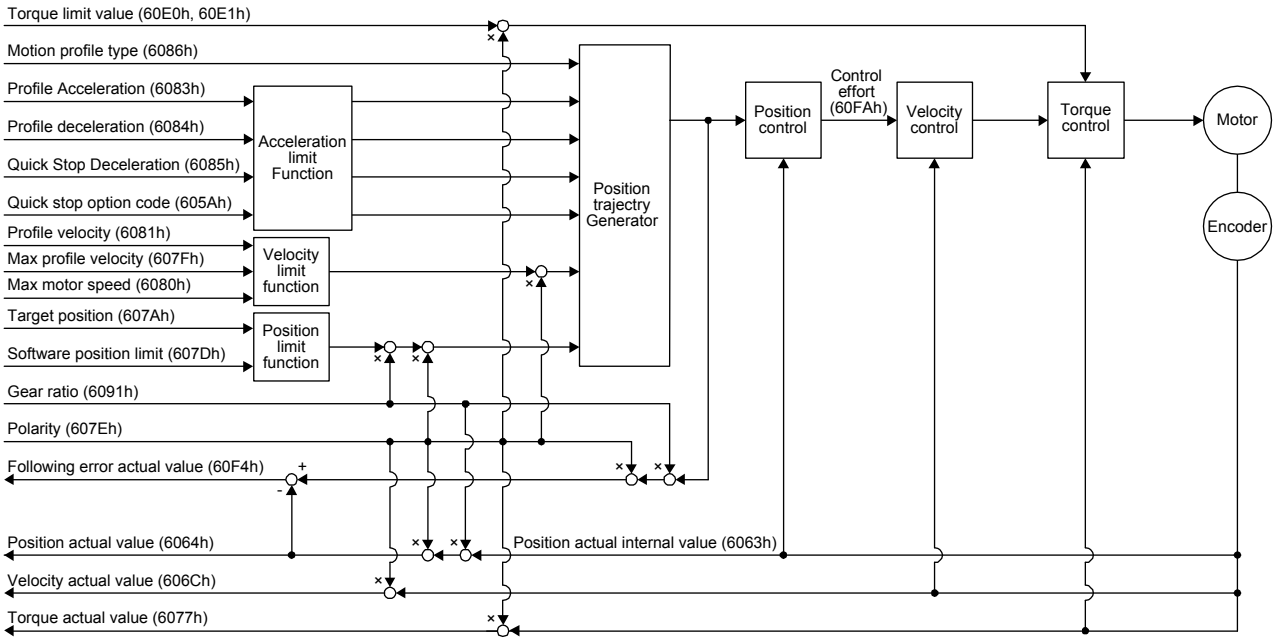
Bit	Symbol	Description
4	(reserved)	The value at reading is undefined. Set "0" at writing.
5	(reserved)	
6	(reserved)	
8	(reserved)	
9	(reserved)	

(3) OMS bit of Statusword (csv mode)

Bit	Symbol	Description
10	(reserved)	The value at reading is undefined.
12	Target torque ignored	0: Target torque is being discarded. 1: Target torque is being used as a torque control loop input.
13	(reserved)	The value at reading is undefined.

5.4.6 Profile position mode (pp)

The following shows the functions and related objects of the profile position mode (pp).



(1) Related object

Index	Sub	Object	Name	Data Type	Access	Default	Description
607Ah		VAR	Target position	I32	rw		Command position (Pos units)
607Bh (Note 2)	0	ARRAY	Position range limit	U8	ro	2	Number of entries
	1		Min position range limit	I32	rw		Minimum value of the position range limit The value is automatically set according to the setting of "Position data unit" in [Pr. PT01]. pulse: -2147483648 degree: 0 The cyclic synchronous mode supports pulses only.
	2		Max position range limit	I32	rw		Maximum value of the position range limit The value is automatically set according to the setting of "Position data unit" in [Pr. PT01]. pulse: 2147483647 degree: 359999 The cyclic synchronous mode supports pulses only.
607Dh	0	ARRAY	Software position limit	U8	ro	2	Number of entries
	1		Min position limit	I32	rw	0	Minimum position address (Pos units)
	2		Max position limit	I32	rw	0	Maximum position address (Pos units)
607Fh		VAR	Max profile velocity	U32	rw	2000000	maximum speed Unit: Vel unit (0.01 r/min or 0.01 mm/s)
6080h		VAR	Max motor speed	U32	rw		Servo motor maximum speed Unit: r/min

Index	Sub	Object	Name	Data Type	Access	Default	Description
6081h		VAR	Profile velocity	U32	rw		Speed after acceleration completed Unit: Vel unit (0.01 r/min or 0.01 mm/s)
6083h		VAR	Profile Acceleration	U32	rw	0	Acceleration at start of movement to target position Unit: ms
6084h		VAR	Profile deceleration	U32	rw	0	Deceleration at arrival at target position Unit: ms
6085h		VAR	Quick stop deceleration	U32	rw	100	Deceleration at deceleration to a stop by Quick stop Unit: ms
6086h		VAR	Motion profile type	I16	rw	0	Acceleration/deceleration type selection -1: S-pattern 0: Linear ramp (not supported) (Note 1) 1: Sin^2 ramp (not supported) (Note 1) 2: Jerk-free ramp (not supported) (Note 1) 3: Jerk-limited ramp (not supported) (Note 1)
605Ah		VAR	Quick stop option code	I16	rw	2	Operation setting for Quick stop Refer to section 5.6.
6063h		VAR	Position actual internal value	I32	ro		Current position (Enc inc)
6064h		VAR	Position actual value	I32	ro		Current position (Pos units)
606Ch		VAR	Velocity actual value	I32	ro		Current speed Unit: Vel unit (0.01 r/min or 0.01 mm/s)
6077h		VAR	Torque actual value	I32	ro		Current torque Unit: 0.1% (rated torque of 100%)
6092h (Note 2)	0	ARRAY	Feed constant	U8	ro	2	Travel distance per revolution of an output shaft
	1		Feed	U32	rw		Travel distance Refer to section 7.3.14 (4).
	2		Shaft revolutions				Number of servo motor shaft revolutions Refer to section 7.3.14 (4).
60F4h		VAR	Following error actual value	I32	ro		Droop pulses (Pos units)
60FAh		VAR	Control effort	I32	ro		Position control loop output (speed command) Unit: Vel unit (0.01 r/min or 0.01 mm/s)
60E0h		VAR	Positive torque limit value	U16	rw	10000	Torque limit value (forward) Unit: 0.1% (rated torque of 100%)
60E1h		VAR	Negative torque limit value	U16	rw	10000	Torque limit value (reverse) Unit: 0.1% (rated torque of 100%)
6091h	0	ARRAY	Gear ratio	U8	ro	2	Gear ratio
	1		Motor revolutions	U32	rw	1	Number of revolutions of the servo motor axis (numerator)
	2		Shaft revolutions			1	Number of revolutions of the drive axis (denominator)

Index	Sub	Object	Name	Data Type	Access	Default	Description
607Eh		VAR	Polarity	U8	rw	0	Polarity selection Bit 7: Position POL Bit 6: Velocity POL Bit 5: Torque POL (Note 2) Refer to section 5.10.
60A8h (Note 2)		VAR	SI unit position	U32	rw	0	SI unit position The value is automatically set according to the setting of "Position data unit" of [Pr. PT01]. Refer to section 7.3.14 (5).
60A9h (Note 2)		VAR	SI unit velocity	U32	rw	0	SI unit velocity 0.01 r/min or 0.01 mm/s FB010300h (0.01 mm/s) FEB44700h (0.01 r/min)

Note 1. This is not supported by the MR-J4-_TM_ servo amplifier.
2. This is used with servo amplifiers with software version B0 or later.

(2) Details on the OMS bit of Controlword (pp mode)

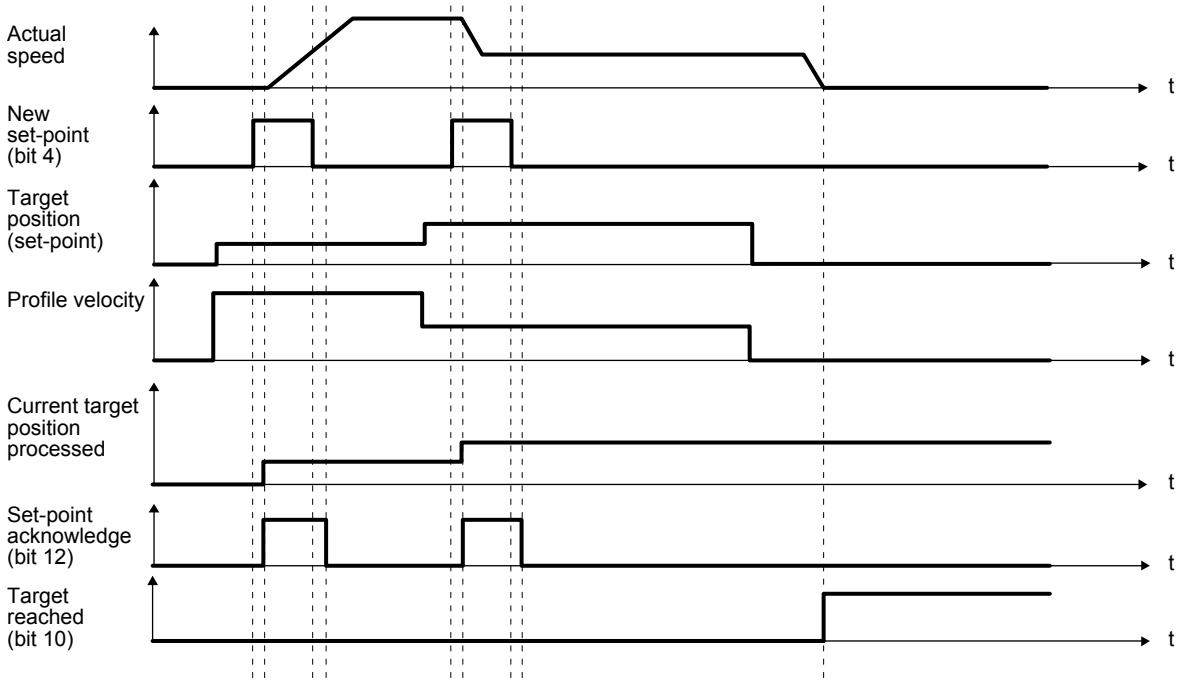
Bit	Symbol	Description
4	New set-point	New positioning parameters are obtained when this bit turns on.
5	Change set immediately	0: Set of set-points 1: Single set-point
6	abs/rel	0: Absolute position command 1: Relative position command When the unit is set to degree, relative position commands are disabled. When the relative position command is specified and positioning is started, [AL. F4.8] occurs and positioning cannot be started.
8	HALT	0: Positioning is executed. 1: The servo motor stops according to Halt option code (605Dh).
9	Change on set-point	Enabled only for Set of set-points (Bit 5 = 0). 0: The next positioning starts after the current positioning is completed (stopped). (black line (Refer to (5) of this section.)). 1: The next positioning starts after positioning is executed with Profile velocity (6081h) held up to the current set-point. (gray line (Refer to (5) of this section.)).

(3) Details on the OMS bit of Statusword (pp mode)

Bit	Symbol	Description
10	Target reached	0 (Halt (Bit 8) = 0): Target position not reached. 0 (Halt (Bit 8) = 1): Axis decelerates 1 (Halt (Bit 8) = 0): Target position reached. 1 (Halt (Bit 8) = 1): Velocity of axis is 0 judgement condition for Target position reached If the error between Actual position and Target position (607Ah) has stayed within Position window (6067h) for Position window time (6068h) or more, Target position reached is stored.
12	Set-point acknowledge	0: Positioning completed (wait for next command) 1: Positioning being executed (The set-point can be overwritten.)
13	Following error	0: No following error 1: Following error

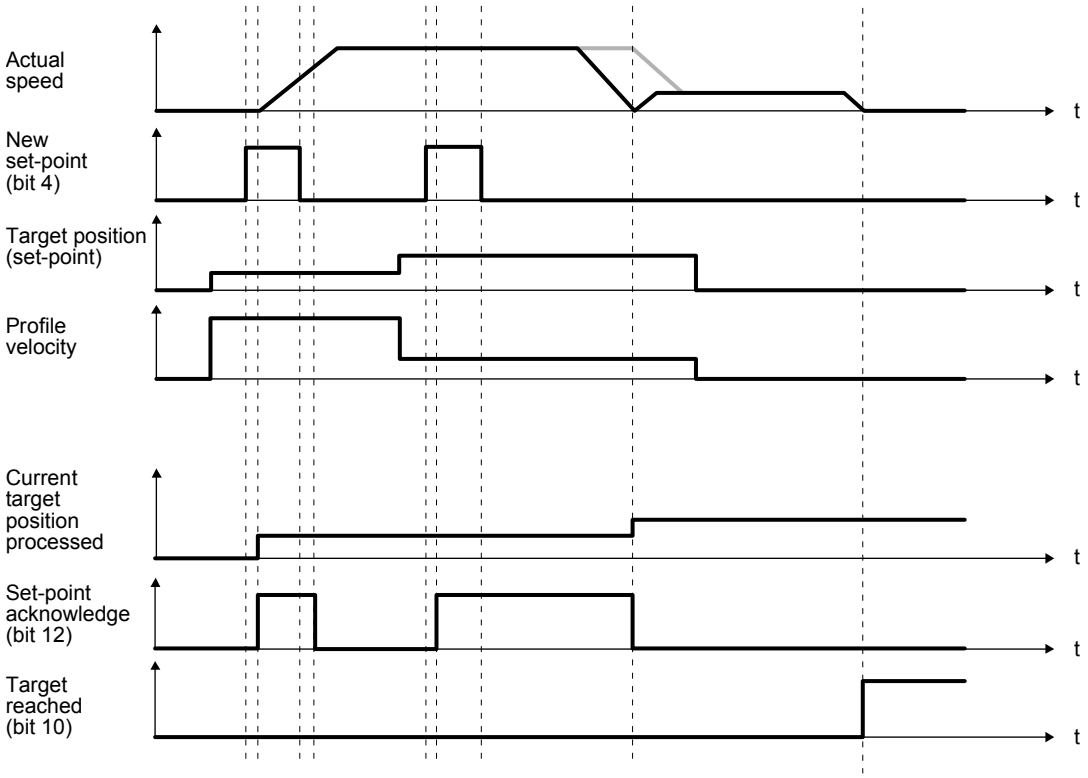
(4) Single Set-point

Update of positioning parameters during a positioning operation is immediately accepted. (The current positioning operation is cancelled and the next positioning is started.)



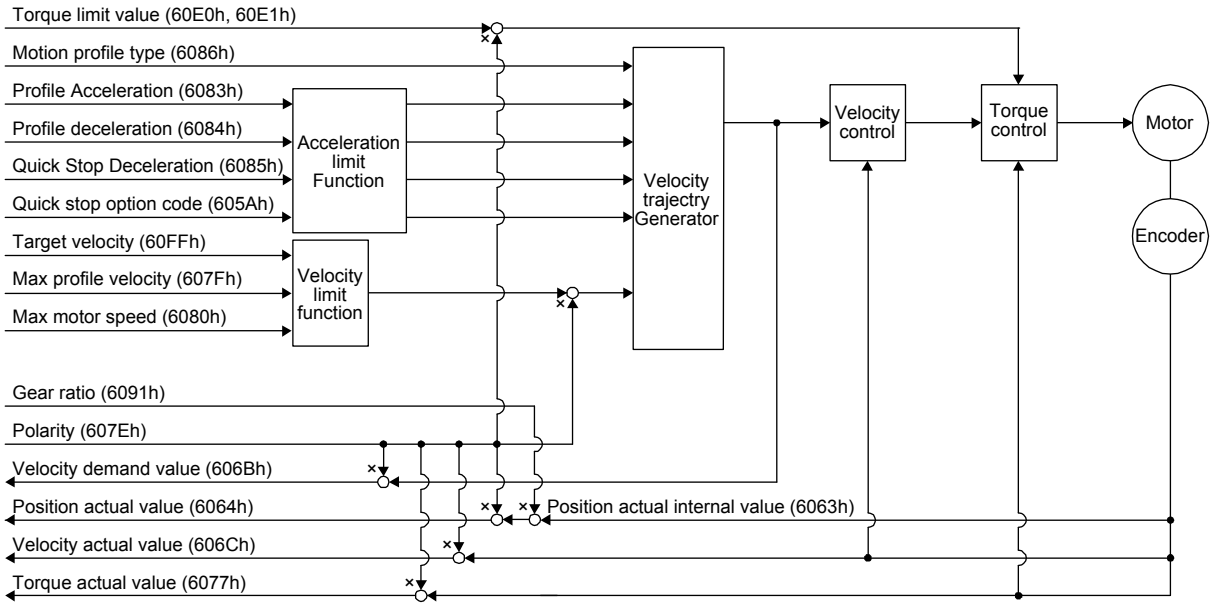
(5) Set of set-points

After the current positioning operation is completed, the next positioning is started. Whether positioning is stopped at the first positioning point when at an update of the positioning parameter before completion of the positioning can be switched. To switch the setting, use Change on set-point (Bit 9 of Controlword).



5.4.7 Profile velocity mode (pv)

The following shows the functions and related objects of the profile velocity mode (pv).



(1) Related object

Index	Sub	Object	Name	Data Type	Access	Default	Description
60FFh		VAR	Target velocity	I32	rw		Command speed Unit: Vel unit (0.01 r/min or 0.01 mm/s)
607Fh		VAR	Max profile velocity	U32	rw	2000000	maximum speed Unit: Vel unit (0.01 r/min or 0.01 mm/s)
6080h		VAR	Max motor speed	U32	rw		Servo motor maximum speed Unit: r/min
6083h		VAR	Profile Acceleration	U32	rw	0	Acceleration at start of movement to target position Unit: ms
6084h		VAR	Profile deceleration	U32	rw	0	Deceleration at arrival at target position Unit: ms
6085h		VAR	Quick stop deceleration	U32	rw	100	Deceleration at deceleration to a stop by Quick stop Unit: ms
6086h		VAR	Motion profile type	I16	rw	0	Acceleration/deceleration type selection -1: S-pattern 0: Linear ramp (not supported) (Note 1) 1: Sin^2 ramp (not supported) (Note 1) 2: Jerk-free ramp (not supported) (Note 1) 3: Jerk-limited ramp (not supported) (Note 1)
605Ah		VAR	Quick stop option code	I16	rw	2	Operation setting for Quick stop Refer to section 5.6.
6063h		VAR	Position actual internal value	I32	ro		Current position (Enc inc)
6064h		VAR	Position actual value	I32	ro		Current position (Pos units)

Index	Sub	Object	Name	Data Type	Access	Default	Description
606Bh		VAR	Velocity demand value	I32	ro		Speed command (after trajectory generation)
606Ch		VAR	Velocity actual value	I32	ro		Current speed Unit: Vel unit (0.01 r/min or 0.01 mm/s)
6077h		VAR	Torque actual value	I32	ro		Current torque Unit: 0.1% (rated torque of 100%)
6092h (Note 2)	0	ARRAY	Feed constant	U8	ro	2	Travel distance per revolution of an output shaft
	1		Feed	U32	rw		Travel distance Refer to section 7.3.14 (4).
	2		Shaft revolutions				Number of servo motor shaft revolutions Refer to section 7.3.14 (4).
60E0h		VAR	Positive torque limit value	U16	rw	10000	Torque limit value (forward) Unit: 0.1% (rated torque of 100%)
60E1h		VAR	Negative torque limit value	U16	rw	10000	Torque limit value (reverse) Unit: 0.1% (rated torque of 100%)
6091h	0	ARRAY	Gear ratio	U8	ro	2	Gear ratio
	1		Motor revolutions	U32	rw	1	Number of revolutions of the servo motor axis (numerator)
	2		Shaft revolutions			1	Number of revolutions of the drive axis (denominator)
607Eh		VAR	Polarity	U8	rw	0	Polarity selection Bit 7: Position POL Bit 6: Velocity POL Bit 5: Torque POL (Note 2) Refer to section 5.10.
606Dh		VAR	Velocity window	U16	rw	2000	Speed error threshold for judging Target reached Unit: 0.01 r/min or 0.01 mm/s
606Eh		VAR	Velocity window time	U16	rw	0	Target reached judgement time Unit: ms
606Fh		VAR	Velocity threshold	U16	rw	5000	Zero speed threshold for judging Speed Unit: 0.01 r/min or 0.01 mm/s
6070h		VAR	Velocity threshold time	U16	rw	10	Speed judgement time Unit: ms
60A8h (Note 2)		VAR	SI unit position	U32	rw	0	SI unit position The value is automatically set according to the setting of "Position data unit" of [Pr. PT01]. Refer to section 7.3.14 (5).
60A9h (Note 2)		VAR	SI unit velocity	U32	rw	0	SI unit velocity 0.01 r/min or 0.01 mm/s FB010300h (0.01 mm/s) FEB44700h (0.01 r/min)

Note 1. This is not supported by the MR-J4-_TM_ servo amplifier.
2. This is used with servo amplifiers with software version B0 or later.

(2) Details on the OMS bit of Controlword (pv mode)

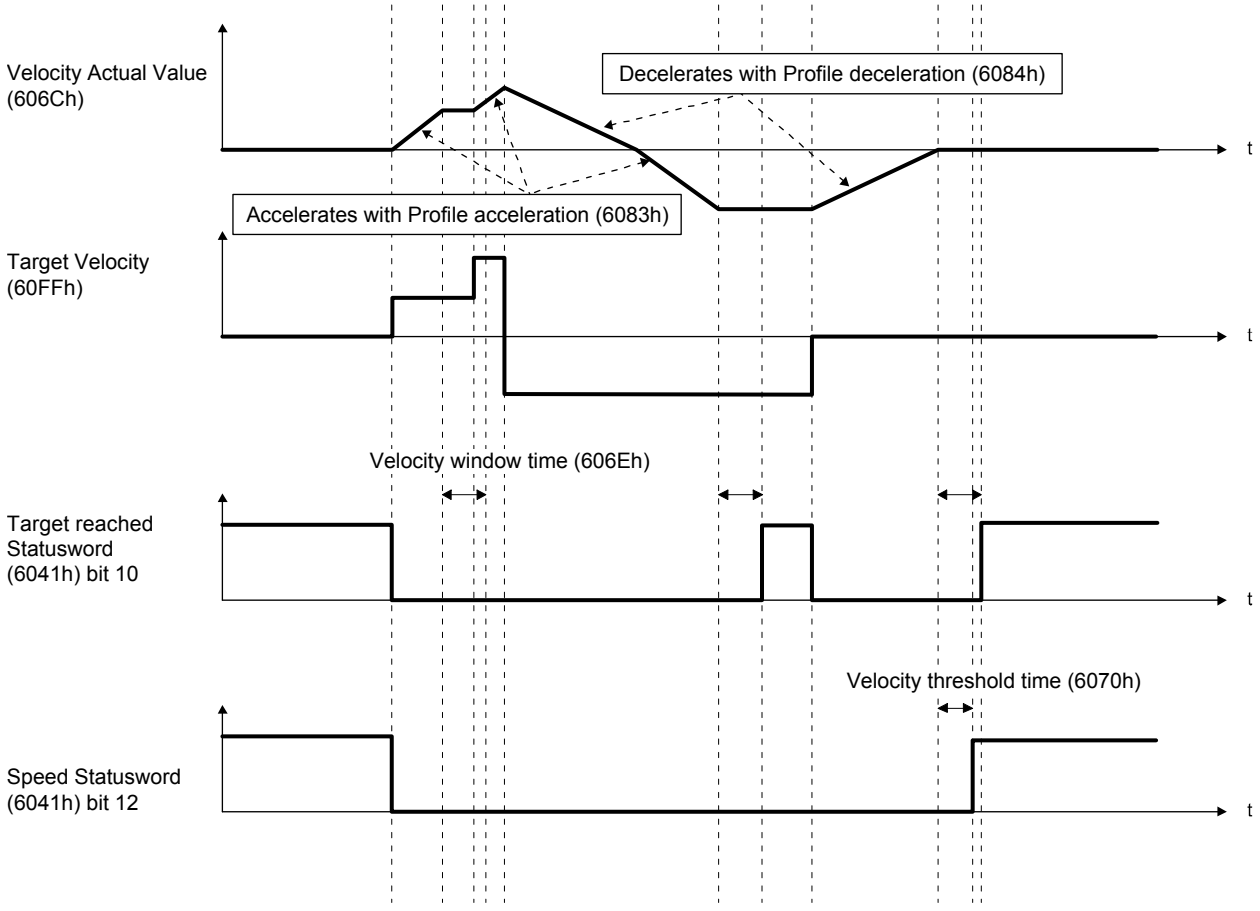
Bit	Symbol	Description
4	(reserved)	The value at reading is undefined. Set "0" at writing.
5	(reserved)	
6	(reserved)	
8	HALT	0: The servo motor is driven. 1: The servo motor is stopped according to Halt option code (605Dh).
9	(reserved)	The value at reading is undefined. Set "0" at writing.

(3) Details on the OMS bit of Statusword (pv mode)

Bit	Symbol	Description
10	Target reached	0 (Halt (Bit 8) = 0): Target velocity not reached. 0 (Halt (Bit 8) = 1): Axis decelerates 1 (Halt (Bit 8) = 0): Target velocity reached. 1 (Halt (Bit 8) = 1): Velocity of axis is 0 judgement condition for Target velocity reached If the error between Actual velocity and Target velocity (60FFh) has stayed within Velocity window (606Dh) for Velocity window time (606Eh) or more, Target velocity reached is stored.
12	Speed	0: Speed is not equal 0 1: Speed is equal 0 judgement condition for Speed is not equal 0 If the absolute value of Actual velocity has exceeded Velocity threshold (606Fh) for Velocity threshold time (6070h) or more, Speed is not equal 0 is stored.
13	Max slippage error	0: Maximum slippage not reached 1: Maximum slippage reached (not supported) (Note) Max slippage is a maximum slippage of the asynchronous servo motor.

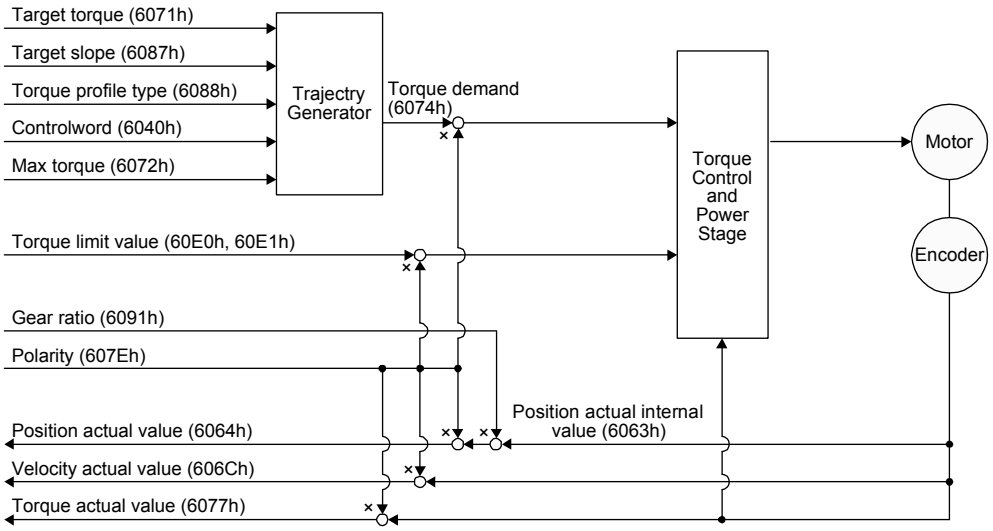
Note. This is not supported by the MR-J4-_TM_ servo amplifier.

(4) pv mode operation sequence



5.4.8 Profile torque mode (tq)

The following shows the functions and related objects of the profile torque mode (tq).



(1) Related object

Index	Sub	Object	Name	Data Type	Access	Default	Description
6040h		VAR	Controlword	U16	rw		Common control command
6071h		VAR	Target torque	I16	rw		Command torque Unit: 0.1% (rated torque of 100%)
6072h		VAR	Max torque	U16	rw		Maximum torque Unit: 0.1% (rated torque of 100%)
6074h		VAR	Torque demand	I16	ro		Command torque (after limit) Unit: 0.1% (rated torque of 100%)
6087h		VAR	Torque slope	U32	rw	0	Torque variation Unit: 0.1%/s (rated torque of 100%)
6088h		VAR	Torque profile type	U32	rw	0	Torque variation pattern 0000h: Linear ramp 0001h: Sin^2 ramp (not supported) (Note 1) 0002h to 7FFFh: reserved 8000h to FFFFh: Manufacturer specific
6063h		VAR	Position actual internal value	I32	ro		Current position (Enc inc)
6064h		VAR	Position actual value	I32	ro		Current position (Pos units)
606Ch		VAR	Velocity actual value	I32	ro		Current speed Unit: Vel unit (0.01 r/min or 0.01 mm/s)
6077h		VAR	Torque actual value	I32	ro		Current torque Unit: 0.1% (rated torque of 100%)
6092h (Note 2)	0	ARRAY	Feed constant	U8	ro	2	Travel distance per revolution of an output shaft
	1		Feed	U32	rw		Travel distance Refer to section 7.3.14 (4).
	2		Shaft revolutions				Number of servo motor shaft revolutions Refer to section 7.3.14 (4).

Index	Sub	Object	Name	Data Type	Access	Default	Description
60E0h		VAR	Positive torque limit value	U16	rw	10000	Torque limit value (forward) Unit: 0.1% (rated torque of 100%)
60E1h		VAR	Negative torque limit value	U16	rw	10000	Torque limit value (reverse) Unit: 0.1% (rated torque of 100%)
6091h	0	ARRAY	Gear ratio	U8	ro	2	Gear ratio
	1		Motor revolutions	U32	rw	1	Number of revolutions of the servo motor axis (numerator)
	2		Shaft revolutions			1	Number of revolutions of the drive axis (denominator)
607Eh		VAR	Polarity	U8	rw	0	Polarity selection Bit 7: Position POL Bit 6: Velocity POL Bit 5: Torque POL (Note 2) Refer to section 5.10.
2D20h		VAR	Velocity limit value	I32	rw	5000	Speed limit value Unit: Vel unit (0.01 r/min or 0.01 mm/s)
60A8h (Note 2)		VAR	SI unit position	U32	rw	0	SI unit position The value is automatically set according to the setting of "Position data unit" of [Pr. PT01]. Refer to section 7.3.14 (5).
60A9h (Note 2)		VAR	SI unit velocity	U32	rw	0	SI unit velocity 0.01 r/min or 0.01 mm/s FB010300h (0.01 mm/s) FEB44700h (0.01 r/min)

Note 1. This is not supported by the MR-J4-_TM_ servo amplifier.
2. This is used with servo amplifiers with software version B0 or later.

(2) Details on the OMS bit of Controlword (tq mode)

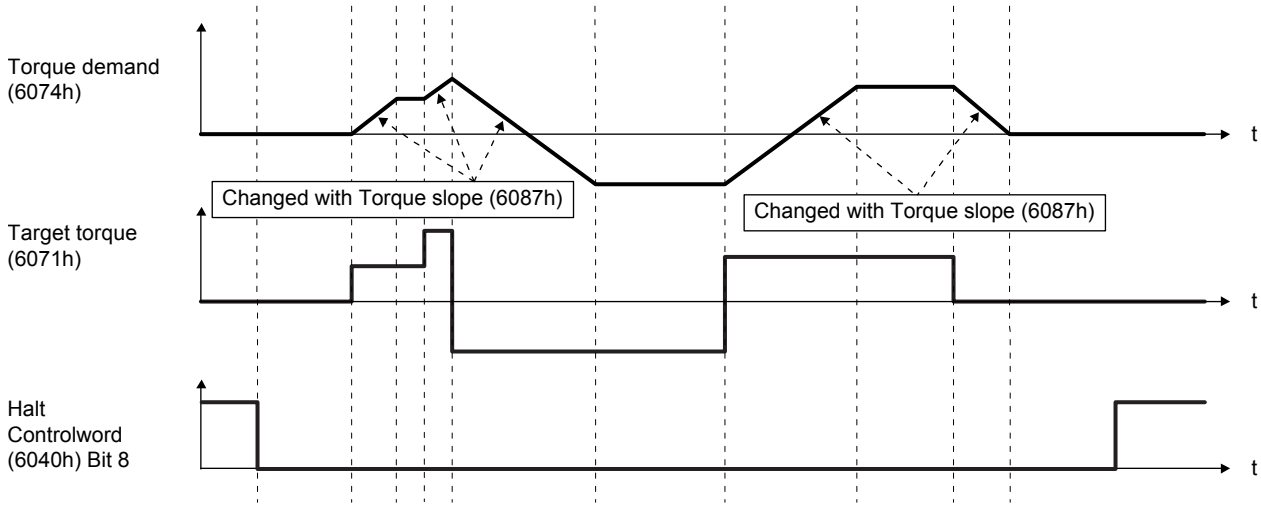
Bit	Symbol	Description
4	(reserved)	The value at reading is undefined. Set "0" at writing.
5	(reserved)	
6	(reserved)	
8	HALT	0: The servo motor is driven. 1: The servo motor is stopped according to Halt option code (605Dh).
9	(reserved)	The value at reading is undefined.

(3) Details on the OMS bit of Statusword (tq mode)

Bit	Symbol	Description
10	Target reached (not supported) (Note)	0 (Halt (Bit 8) = 0): Target torque not reached. 0 (Halt (Bit 8) = 1): Axis decelerates 1 (Halt (Bit 8) = 0): Target torque reached. 1 (Halt (Bit 8) = 1): Velocity of axis is 0 judgement condition for Target torque reached If the error between Auctual torque and Target torque (6071h) has stayed within Torque window for Torque window time or more, Target torque reached is stored.
12	(reserved)	The value at reading is undefined.
13	(reserved)	

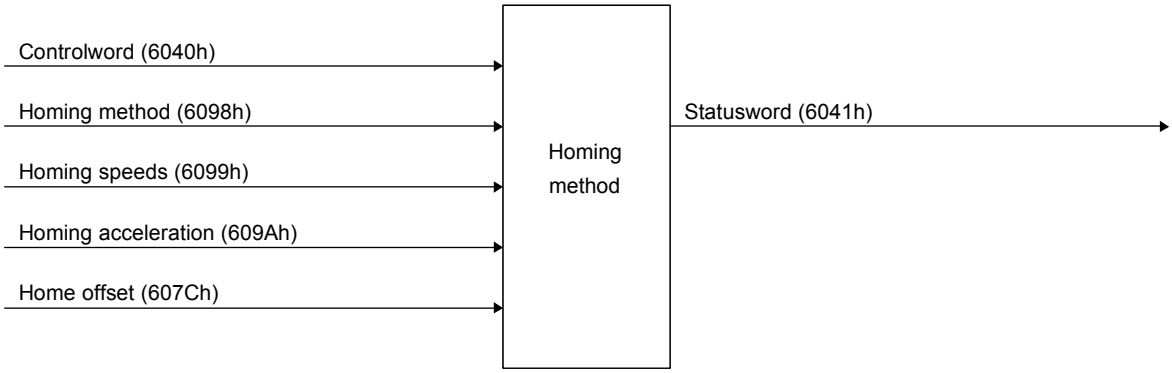
Note. This is not supported by the MR-J4-_TM_ servo amplifier.

(4) tq mode operation sequence



5.4.9 Homing mode (hm)

The following shows the function and related objects of the homing mode (hm).



(1) Related object

Index	Sub	Object	Name	Data Type	Access	Default	Description
607Ch	0	VAR	Home offset	I32	ro		The home position saved in EEP-ROM is stored at power-on. If a home position return is executed in the homing mode (hm), the home position will be updated. If [Pr. PA03 Absolute position detection system] is disabled, 0 is always stored.
6098h	0	VAR	Homing Method	I8	rw	-1	Specify a home position return type. Refer to (4) in this section for supported home position return types.
6099h	0	ARRAY	Homing Speeds	U8	rw	2	Number of entries of the home position return speed
	1		Speed during search for switch	U32	rw	10000	Specify the travel speed until dog detection. Unit: Vel unit (0.01 r/min or 0.01 mm/s) Range: 0 to servo motor maximum speed
	2		Speed during search for zero	U32	rw	1000	Specify the travel speed up to the home position after dog detection. (Note) Unit: Vel unit (0.01 r/min or 0.01 mm/s) Range: 0 to servo motor maximum speed
609Ah	0	VAR	Homing acceleration	U32	rw	0	Acceleration/deceleration time constant at home position return Unit: ms
60E3h	0	ARRAY	Supported Homing Method	U8	ro	39	Number of entries of the supported home position return type
	1		1st supported homing method	I8	ro	37	The home position return type that uses the current position as a home position is supported.
	to						
	39		39th supported homing method	I8	ro	-43	The dogless Z-phase reference home position return type (reverse rotation) is supported.

Note. In the homing mode (hm), the servo motor is brought to a sudden stop according to the deceleration time constant when the stroke end is detected. Set the home position return speed carefully.

(2) Details on the OMS bit of Controlword (hm mode)

Bit	Symbol	Description
4	HOS	Homing operation start 0: Do not start homing procedure 1: Start or continue homing procedure
5	(reserved)	The value at reading is undefined. Set "0" at writing.
6	(reserved)	
8	HALT	Halt 0: Bit 4 enable 1: Stop axis according to halt option code (605Dh)
9	(reserved)	The value at reading is undefined. Set "0" at writing.

(3) Details on the OMS bit of Statusword (hm mode)

POINT

●When the mode is switched to the hm mode after home position return completion, Statusword is "Homing procedure is completed successfully" unless "0" is set in Bit 12. The following shows the conditions when "0" is set in Bit 12.
For incremental system
・At power-on
・At communication shut-off by controller reset
・At home position return start
・At home position erasure
for absolute position detection system
・At home position return start
・At home position erasure

●To check the home position return status with Statusword, note the following. (when the communication cycle of 4 ms or less is set)
・When the mode is switched to the hm mode, Modes of operation display is changed to 6 (hm) and Statusword changes at the same time.
・The status change of Statusword may take 50 ms at a maximum after Bit 4 of Controlword (Homing operation start) is set. To obtain the status of Statusword without any fault, wait 50 ms or more.

●Before updating the position after a home position return completion, check that both Bit 12 and Bit 10 of Statusword are changed to "1" and then wait 8 ms. If 8 ms has not elapsed, the position information may not be updated correctly depending on the communication cycle setting.

Bit	Symbol	Description
10	Target reached	Refer to the following table for the definition.
12	Homing attained	
13	Homing error	

The following shows the definition of Bit 10, Bit 12, and Bit 13 of Statusword in the hm mode.

Bit 13	Bit 12	Bit 10	Definition
0	0	0	Homing procedure is in progress
0	0	1	Homing procedure is interrupted or not started
0	1	0	Homing is attained, but target is not reached
0	1	1	Homing procedure is completed successfully
1	0	0	Homing error occurred, velocity is not 0
1	0	1	Homing error occurred, velocity is 0
1	1		reserved

(4) List of Homing method

POINT

●In the following cases, make sure that the Z-phase has been passed through once before the home position return.
- When using an incremental linear encoder in the linear servo motor control mode
- When using an incremental external encoder in the fully closed loop control mode
- For the use in the DD motor control mode

Z-phase unpassed will trigger [AL. 90.5 Z-phase unpassed].

●To execute a home position return securely, start a home position return after moving the servo motor to the opposite stroke end with csv or pv from the controller and others. Whether the servo motor has reached the stroke end can be checked with Digital inputs (60FDh).

●When changing the mode after the home position return completion, set 0 to the Target position (607Ah) and change the control mode.

To specify the home position return type in the homing mode (hm), use Homing Method (6098h). The MR-J4-_TM_ servo amplifier supports Homing method in the following table.

Method No.	Home position return type	Rotation direction	Description
-1	Dog type (Rear end detection, Z-phase reference)	Forward rotation	Deceleration starts at the front end of the proximity dog. After the rear end is passed, the position specified by the first Z-phase signal, or the position of the first Z-phase signal shifted by the specified home position shift distance is used as the home position.
-33		Reverse rotation	
-3	Data set type home position return		The current position is set as the home position.
-4	Stopper type (Stopper position reference)	Forward rotation	A workpiece is pressed against a mechanical stopper, and the position where it is stopped is set as the home position.
-36		Reverse rotation	
-2	Count type (Front end detection, Z-phase reference)	Forward rotation	At the front end of the proximity dog, deceleration starts. After the front end is passed, the position specified by the first Z-phase signal after the set distance or the position of the Z-phase signal shifted by the set home position shift distance is set as a home position.
-34		Reverse rotation	
-6	Dog type (Rear end detection, rear end reference)	Forward rotation	Deceleration starts from the front end of the proximity dog. After the rear end is passed, the position is shifted by the travel distance after proximity dog and the home position shift distance. The position after the shifts is set as the home position.
-38		Reverse rotation	
-7	Count type (Front end detection, front end reference)	Forward rotation	Deceleration starts from the front end of the proximity dog. The position is shifted by the travel distance after proximity dog and the home position shift distance. The position after the shifts is set as the home position.
-39		Reverse rotation	
-8	Dog cradle type	Forward rotation	A position, which is specified by the first Z-phase signal after the front end of the proximity dog is detected, is set as the home position.
-40		Reverse rotation	
-9	Dog type last Z-phase reference	Forward rotation	After the front end of the proximity dog is detected, the position is shifted away from the proximity dog in the reverse direction. Then, the position specified by the first Z-phase signal or the position of the first Z-phase signal shifted by the home position shift distance is used as the home position.
-41		Reverse rotation	
-10	Dog type front end reference	Forward rotation	Starting from the front end of the proximity dog, the position is shifted by the travel distance after proximity dog and the home position shift distance. The position after the shifts is set as the home position.
-42		Reverse rotation	
-11	Dogless Z-phase reference	Forward rotation	The position specified by the first Z-phase signal, or the position of the first Z-phase signal shifted by the home position shift distance is used as the home position.
-43		Reverse rotation	

Method No.	Home position return type	Rotation direction	Description
3	Homing on positive home switch and index pulse	Forward rotation	Same as the dog type last Z-phase reference home position return. Note that if the stroke end is detected during home position return, [AL. 90 Home position return incomplete warning] occurs.
4	Homing on positive home switch and index pulse	Forward rotation	Same as the dog cradle type home position return. Note that if the stroke end is detected during home position return, [AL. 90 Home position return incomplete warning] occurs.
5	Homing on negative home switch and index pulse	Reverse rotation	Same as the dog type last Z-phase reference home position return. Note that if the stroke end is detected during home position return, [AL. 90 Home position return incomplete warning] occurs.
6	Homing on negative home switch and index pulse	Reverse rotation	Same as the dog cradle type home position return. Note that if the stroke end is detected during home position return, [AL. 90 Home position return incomplete warning] occurs.
7	Homing on home switch and index pulse	Forward rotation	Same as the dog type last Z-phase reference home position return.
8	Homing on home switch and index pulse	Forward rotation	Same as the dog cradle type home position return.
11	Homing on home switch and index pulse	Reverse rotation	Same as the dog type last Z-phase reference home position return.
12	Homing on home switch and index pulse	Reverse rotation	Same as the dog cradle type home position return.
19	Homing without index pulse	Forward rotation	Same as the dog type front end reference home position return. Note that if the stroke end is detected during home position return, [AL. 90 Home position return incomplete warning] occurs.
20	Homing without index pulse	Forward rotation	Although this type is the same as the dog cradle type home position return, the stop position is not on the Z-phase. Starting from the front end of the dog, the position is shifted by the travel distance after proximity dog and the home position shift distance. The position after the shifts is set as the home position. If the stroke end is detected during home position return, [AL. 90 Home position return incomplete warning] occurs.
21	Homing without index pulse	Reverse rotation	Same as the dog type front end reference home position return. Note that if the stroke end is detected during home position return, [AL. 90 Home position return incomplete warning] occurs.
22	Homing without index pulse	Reverse rotation	Although this type is the same as the dog cradle type home position return, the stop position is not on the Z-phase. Starting from the front end of the dog, the position is shifted by the travel distance after proximity dog and the home position shift distance. The position after the shifts is set as the home position. If the stroke end is detected during home position return, [AL. 90 Home position return incomplete warning] occurs.
23	Homing without index pulse	Forward rotation	Same as the dog type front end reference home position return.
24	Homing without index pulse	Forward rotation	Although this type is the same as the dog cradle type home position return, the stop position is not on the Z-phase. Starting from the front end of the dog, the position is shifted by the travel distance after proximity dog and the home position shift distance. The position after the shifts is set as the home position.
27	Homing without index pulse	Reverse rotation	Same as the dog type front end reference home position return.
28	Homing without index pulse	Reverse rotation	Although this type is the same as the dog cradle type home position return, the stop position is not on the Z-phase. Starting from the front end of the dog, the position is shifted by the travel distance after proximity dog and the home position shift distance. The position after the shifts is set as the home position.
33	Homing on index pulse	Reverse rotation	Although this type is the same as the dogless Z-phase reference home position return, the creep speed is applied as the movement start speed.
34	Homing on index pulse	Forward rotation	Although this type is the same as the dogless Z-phase reference home position return, the creep speed is applied as the movement start speed.
35	Homing on current position		The current position is set as the home position. This type can be executed not in the Operational enabled state.
37	Homing on current position		The current position is set as the home position. This type can be executed not in the Operational enabled state.

(5) CiA 402-type homing method

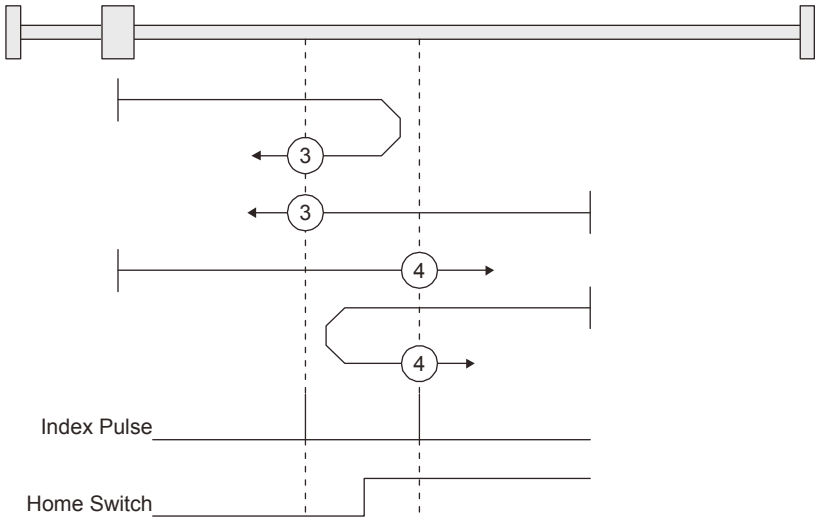
(a) Home position return type in CiA 402 type

The following shows the CiA 402-type home position return.

1) Method 3 and 4: Homing on positive home switch and index pulse

These home position return types use the front end of the proximity dog as reference and set the Z-phase right before and right after the dog as a home position.

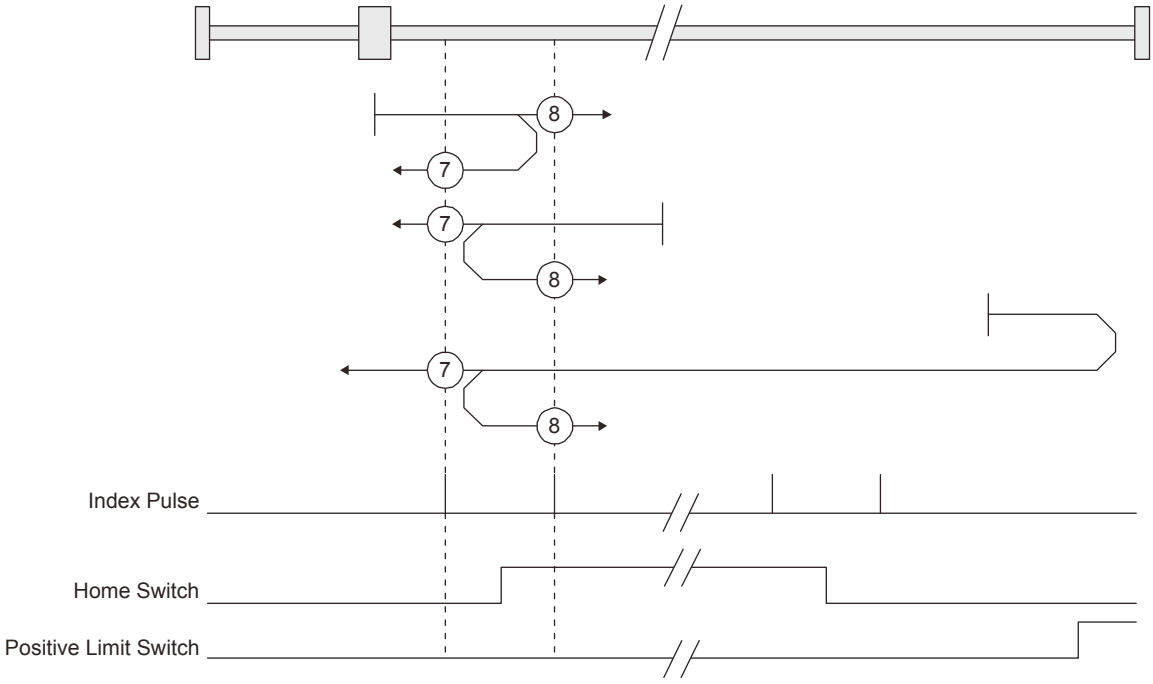
Method 3 has the operation of the dog type last Z-phase reference home position return, and Method 4 has the operation of the dog cradle type home position return at a forward rotation start. However, if the stroke end is detected during home position return, [AL. 90] occurs.



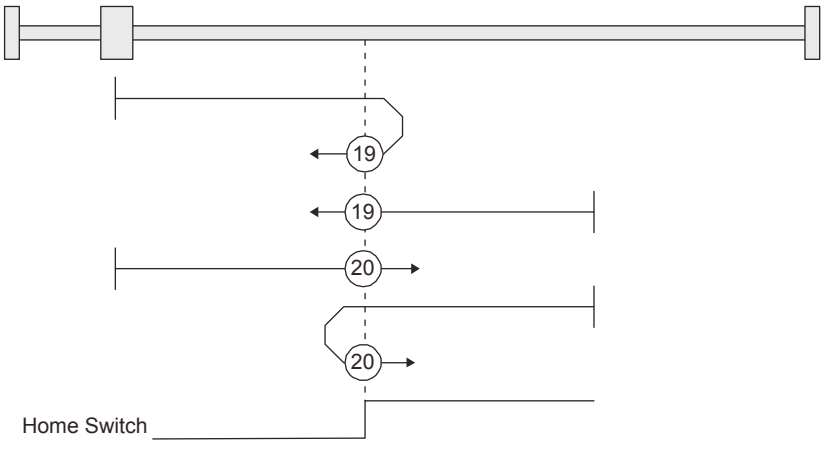
2) Method 5 and 6: Homing on negative home switch and index pulse

These home position return types use the front end of the proximity dog as reference and set the Z-phase right before and right after the dog as a home position. Method 5 and 6 differ from Method 3 and Method 4 in the starting direction: the starting direction of Method 5 and 6 is the reversed direction.

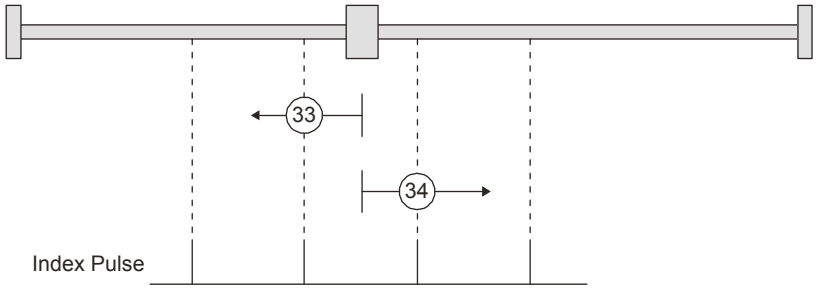
3) Method 7, 8, 11, 12: Homing on home switch and index pulse
These types include the operation at stroke end detection in addition to the operation of Method 3 to Method 6. Thus, the home position is the same as that of Method 3 to Method 6. Method 7 has the operation of the dog type last Z-phase reference home position return. Method 8 has the operation of the dog cradle type home position return at a forward rotation start. Method 11 and 12 differ from Method 7 and Method 8 only in the starting direction: the starting direction of Method 11 and 12 is the reversed direction.



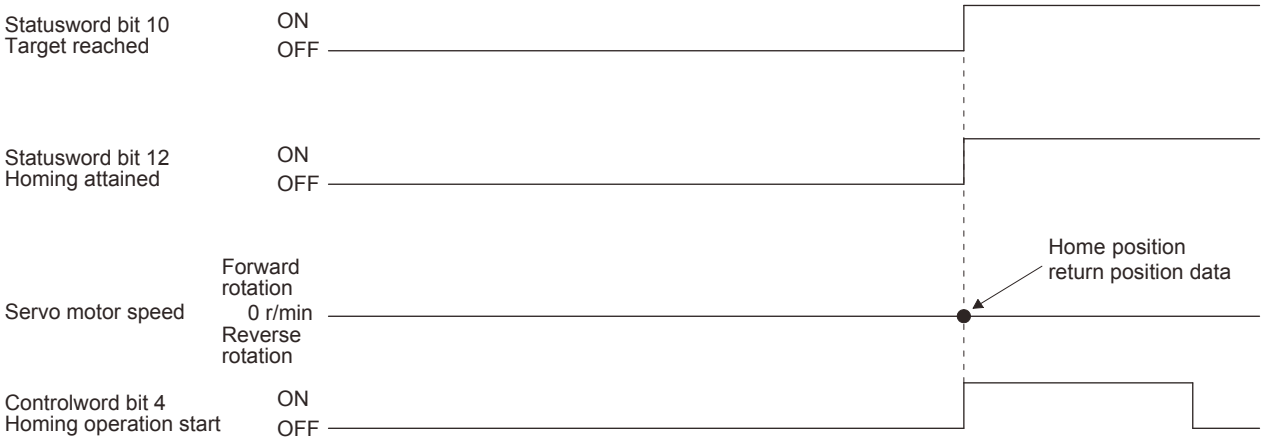
4) Method 17 to 30: Homing without index pulse
Method 17 to 30 have the operation of Method 1 to Method 14; however, these types set the home position not on the Z-phase but on the dog. Method 17 to 30 have the operation of Method 1 to Method 14; however, these types set the home position not on the Z-phase but on the dog. The following figure shows the operation of the home position return type of Method 19 and Method 20. Method 19 and Method 20 have the operation of Method 3 and Method 4; however, these types set the home position not on the Z-phase but on the dog Method 19 has the operation of the dog type front end reference home position return. Method 20 has the operation of the dog cradle type home position return; however, the stop position is not on the Z-phase but on the dog.



5) Method 33 and 34: Homing on index pulse
These home position return types set the Z-phase detected first as a home position. The operation is the same as that of the dogless Z-phase reference home position return except that the creep speed is applied at the start.



6) Method 35 and 37: Homing on current position
These home position return types set the current position as a home position. The operation is the same as that of the data set type home position return; however, these types can be executed even during servo-off.

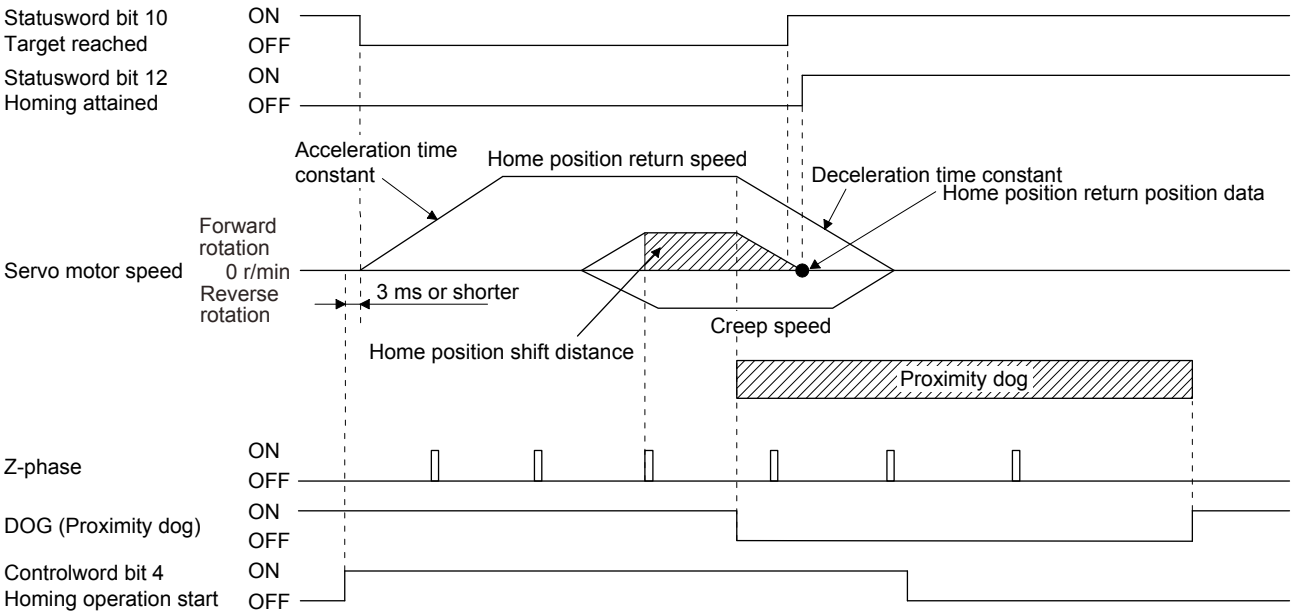


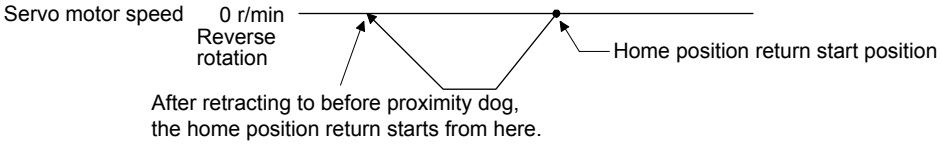
(b) Operation example of the CiA 402-type Homing method

The following shows an operation example of the home position return in the CiA 402-type Homing method.

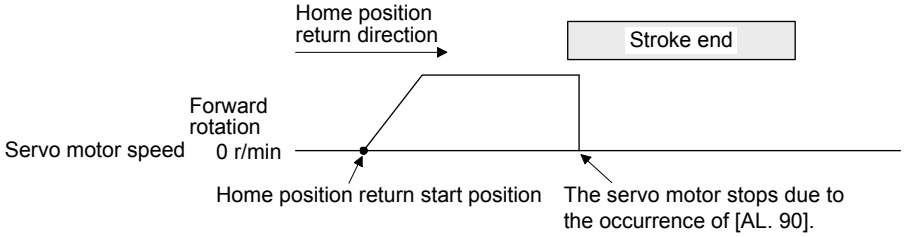
1) Method 3 (Homing on positive home switch and index pulse) and Method 5 (Homing on negative home switch and index pulse)

The following figure shows the operation of Homing method 3. The operation direction of Homing method 5 is opposite to that of Homing method 3.



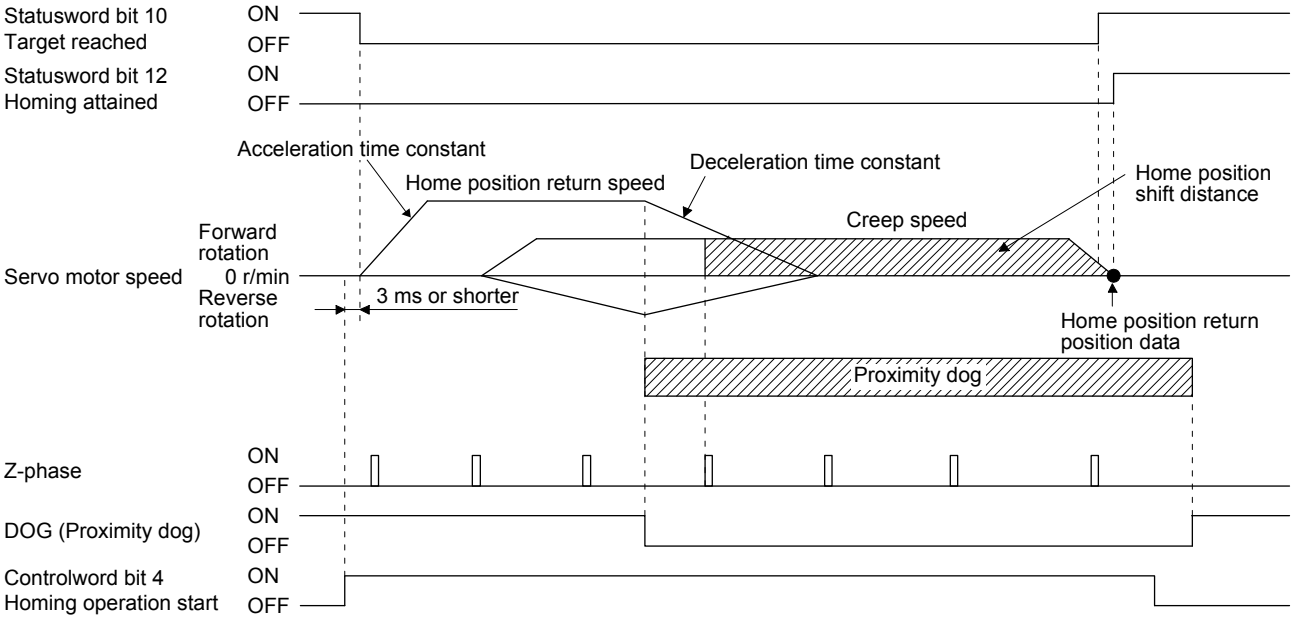


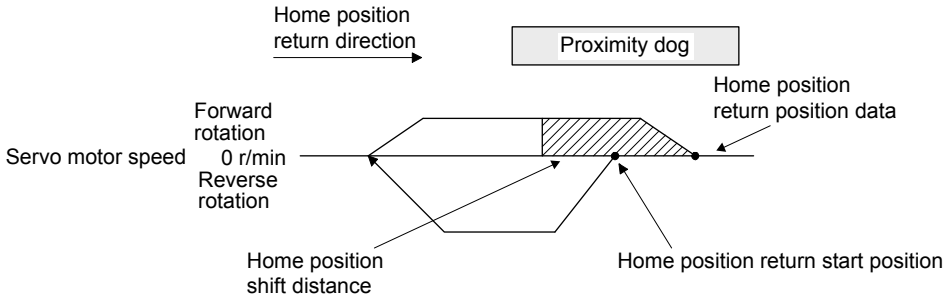
When a home position return is started from the proximity dog



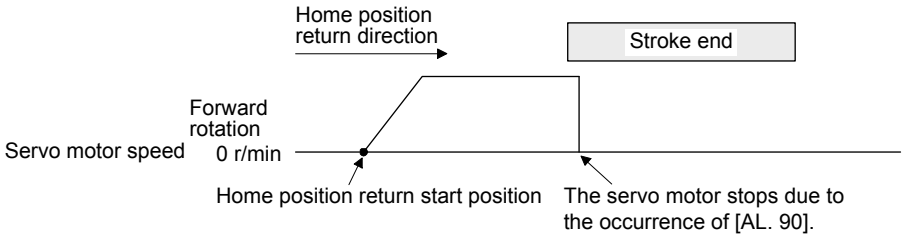
When the stroke end is detected

2) Method 4 (Homing on positive home switch and index pulse) and Method 6 (Homing on negative home switch and index pulse)
The following figure shows the operation of Homing method 4. The operation direction of Homing method 6 is opposite to that of Homing method 4.



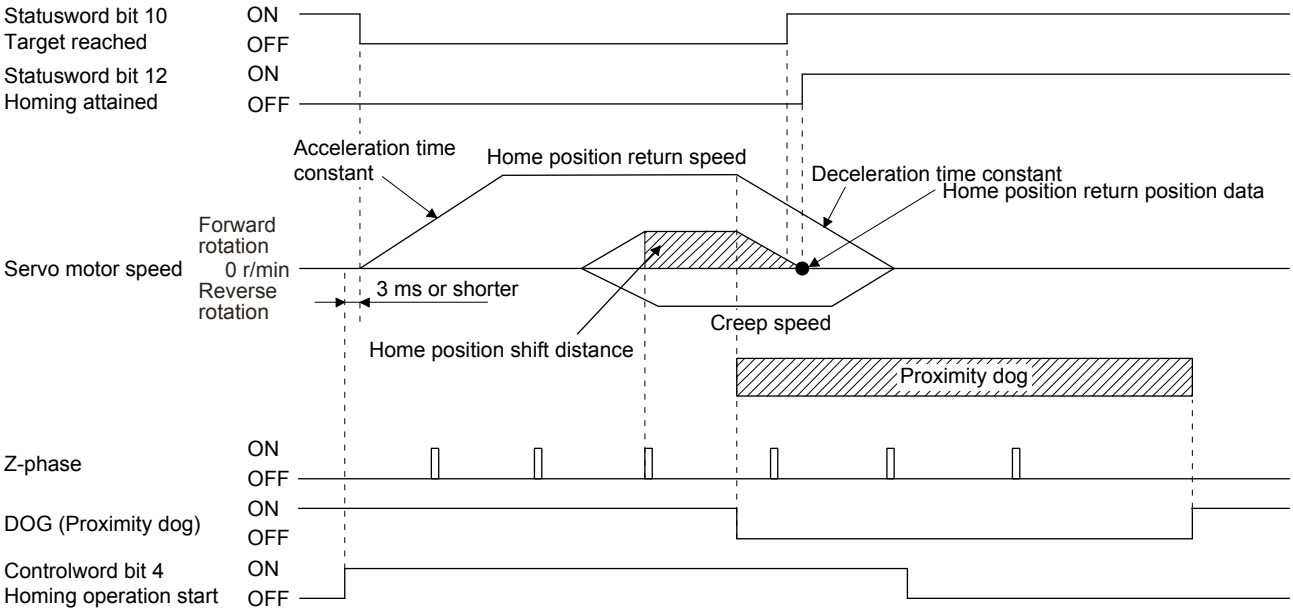


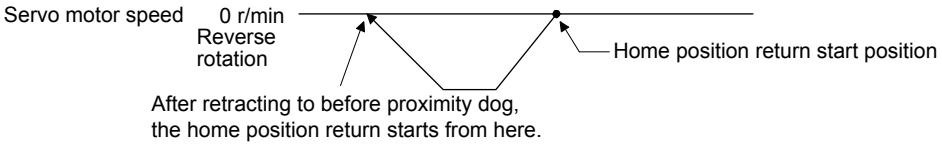
When a home position return is started from the proximity dog



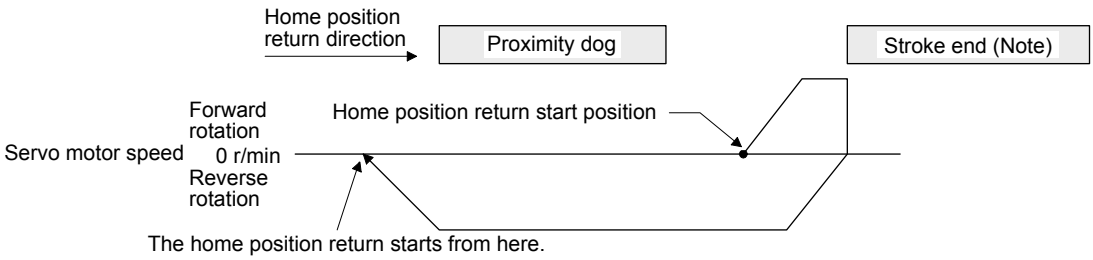
When the stroke end is detected

3) Method 7 and Method 11 (Homing on home switch and index pulse)
The following figure shows the operation of Homing method 7. The operation direction of Homing method 11 is opposite to that of Homing method 7.





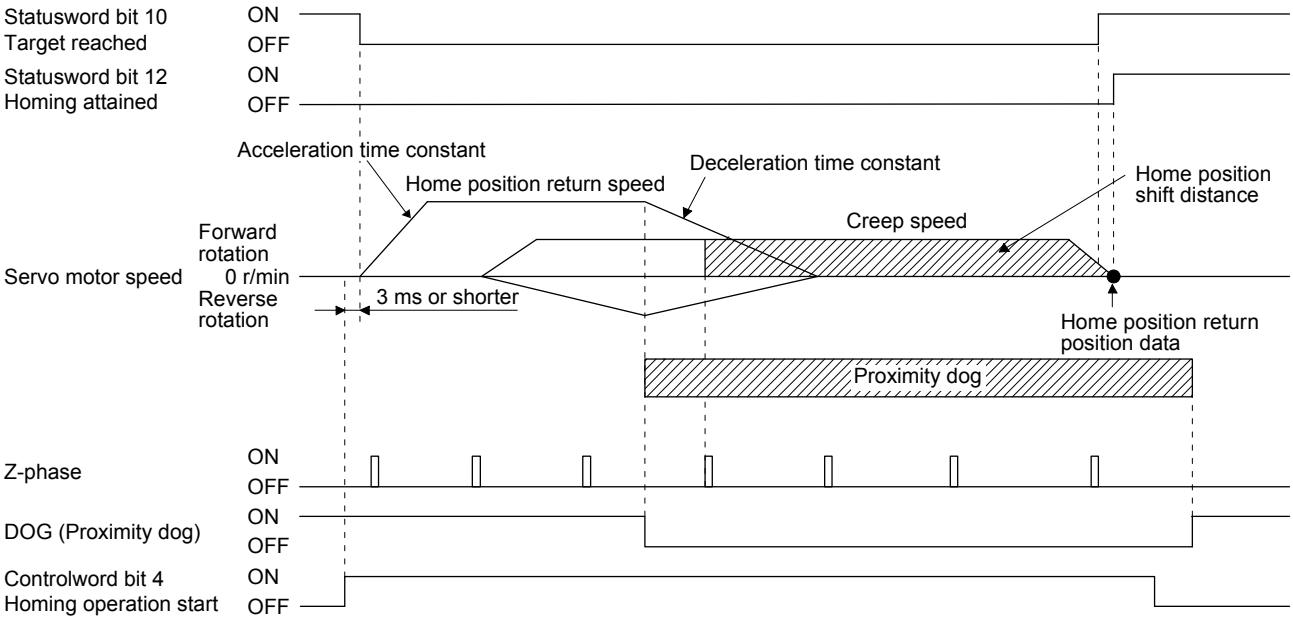
When a home position return is started from the proximity dog

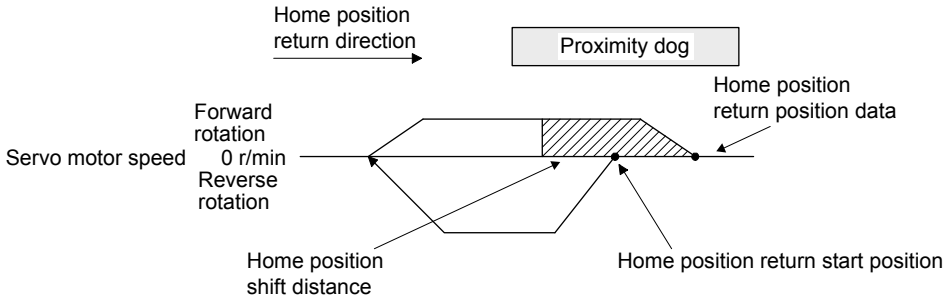


Note. The software limit cannot be used with these functions.

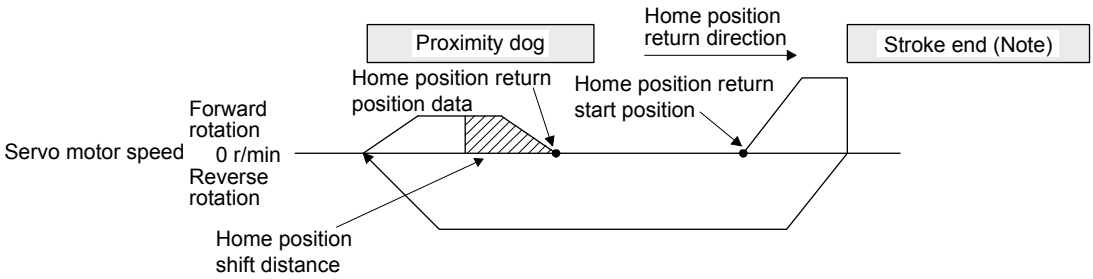
When the movement is returned at the stroke end

4) Method 8 and Method 12 (Homing on home switch and index pulse)
The following figure shows the operation of Homing method 8. The operation direction of Homing method 12 is opposite to that of Homing method 8.





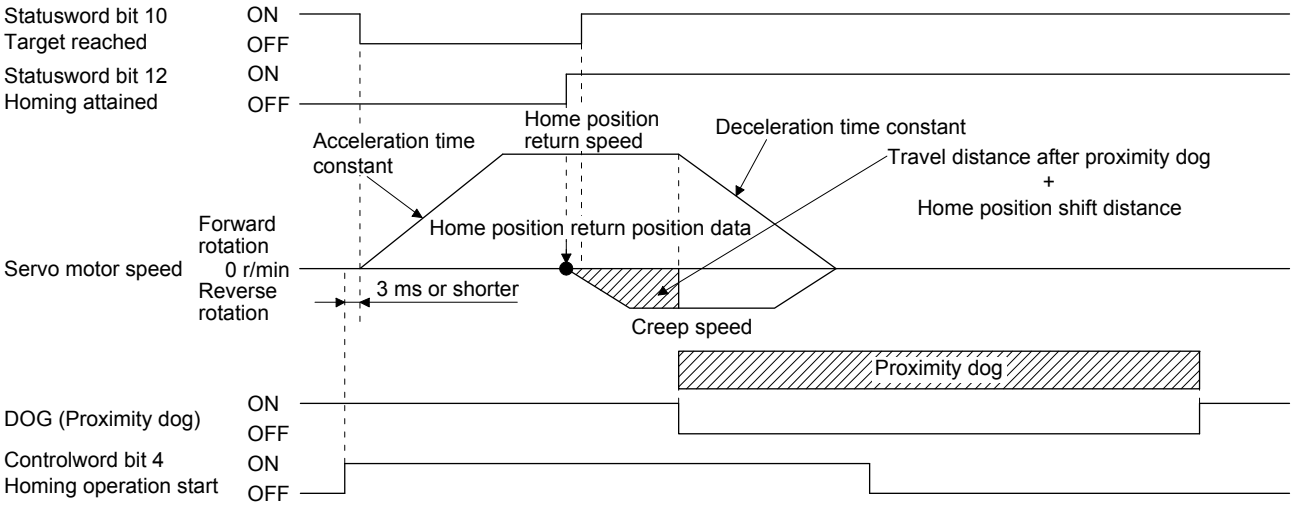
When a home position return is started from the proximity dog

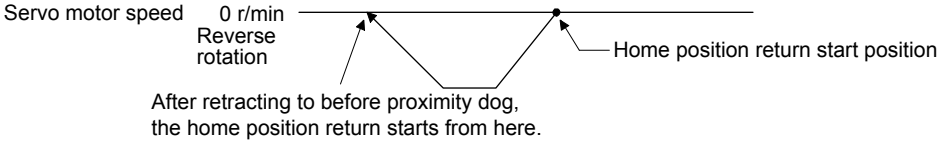


Note. The software limit cannot be used with these functions.

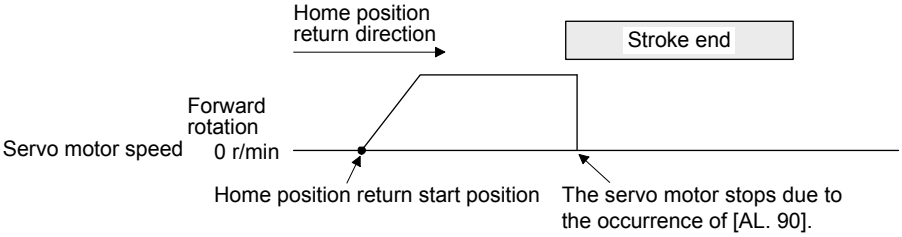
When the movement is returned at the stroke end

5) Method 19 and Method 21 (Homing without index pulse)
The following figure shows the operation of Homing method 19. The operation direction of Homing method 21 is opposite to that of Homing method 19.



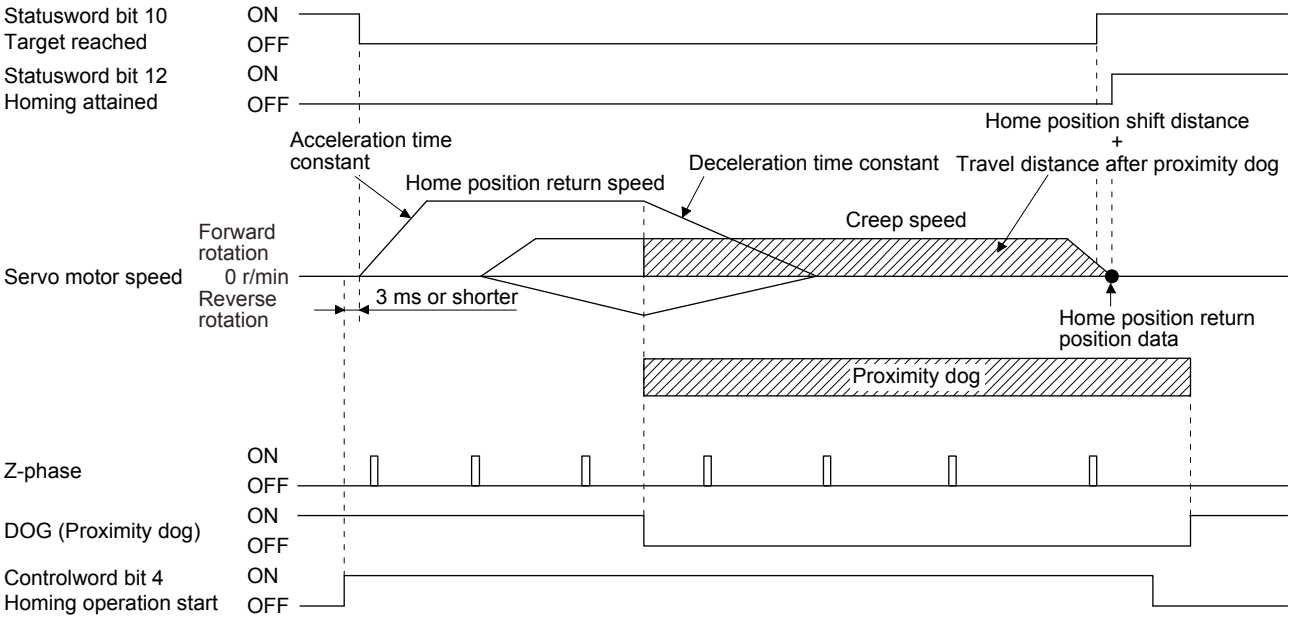


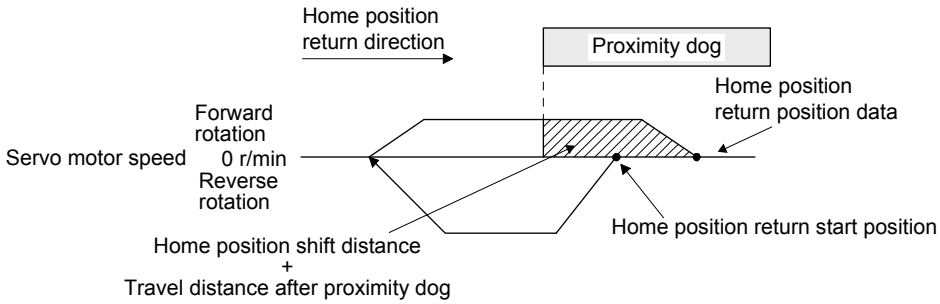
When a home position return is started from the proximity dog



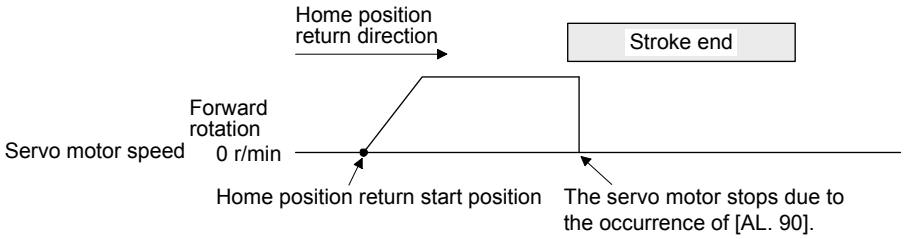
When the stroke end is detected

6) Method 20 and Method 22 (Homing without index pulse)
The following figure shows the operation of Homing method 20. The operation direction of Homing method 22 is opposite to that of Homing method 20.



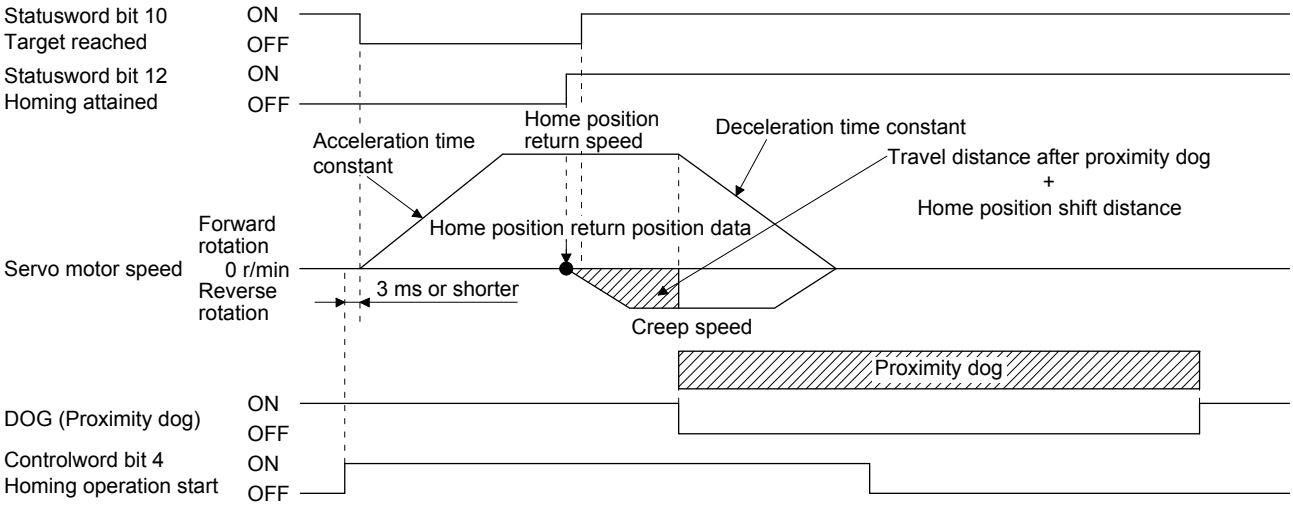


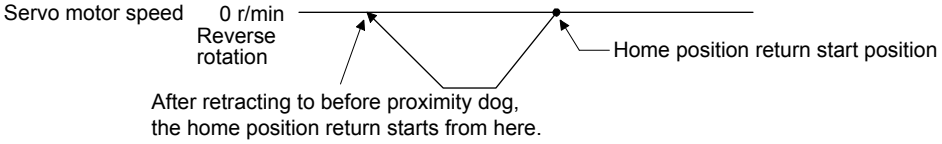
When a home position return is started from the proximity dog



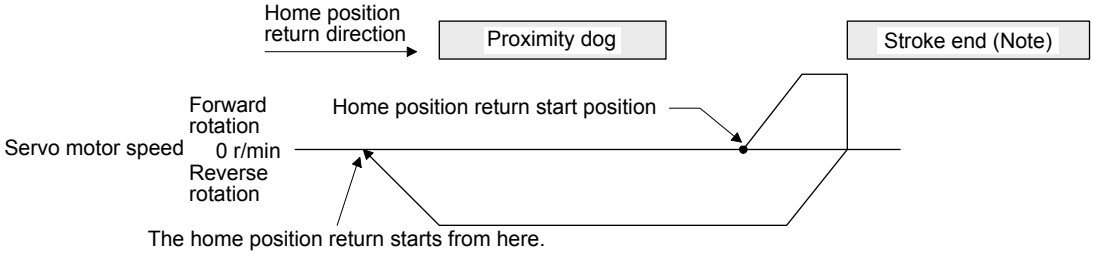
When the stroke end is detected

7) Method 23 and Method 27 (Homing without index pulse)
The following figure shows the operation of Homing method 23. The operation direction of Homing method 27 is opposite to that of Homing method 23.





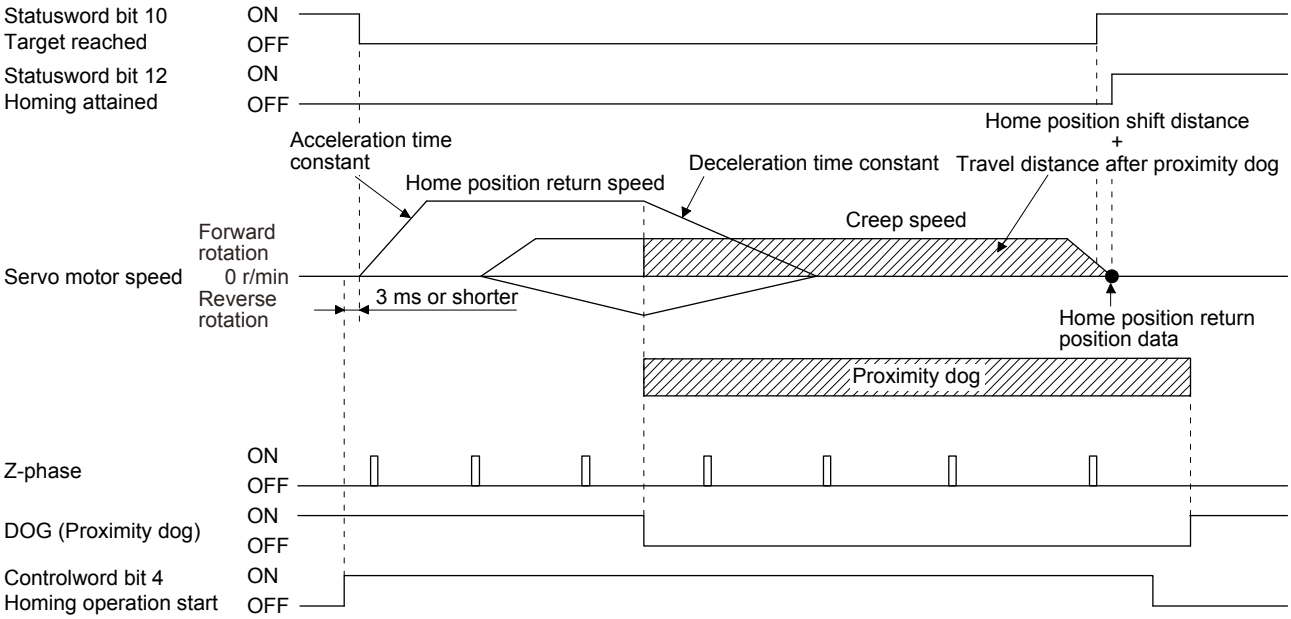
When a home position return is started from the proximity dog

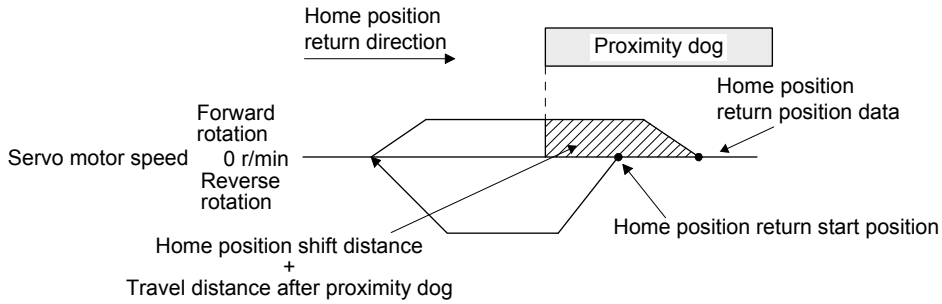


Note. The software limit cannot be used with these functions.

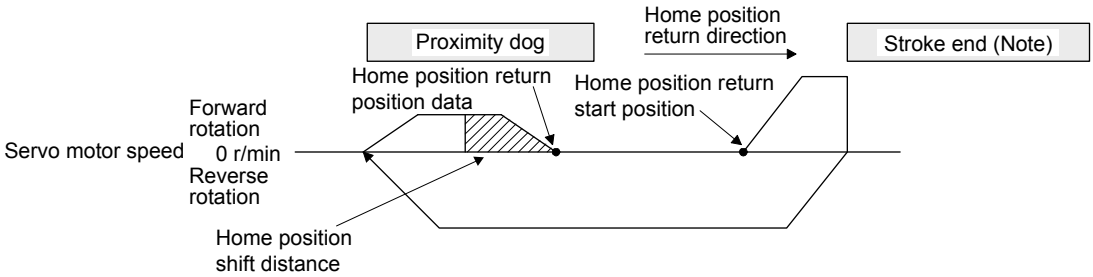
When the movement is returned at the stroke end

8) Method 24 and Method 28 (Homing without index pulse)
The following figure shows the operation of Homing method 24. The operation direction of Homing method 28 is opposite to that of Homing method 24.





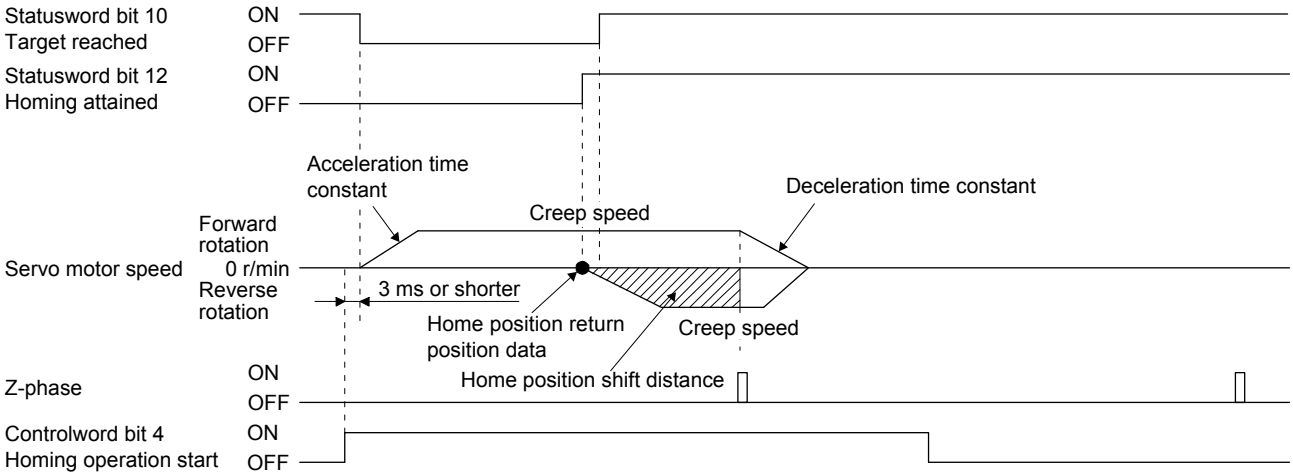
When a home position return is started from the proximity dog

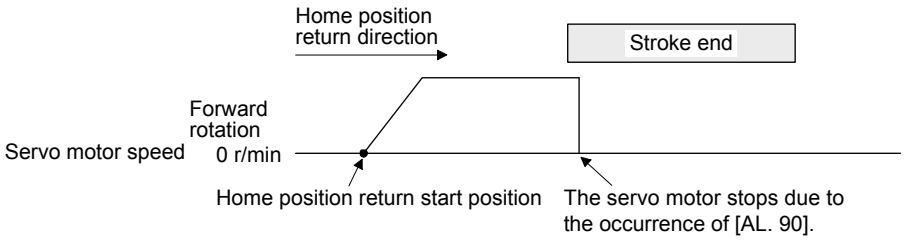


Note. The software limit cannot be used with these functions.

When the movement is returned at the stroke end

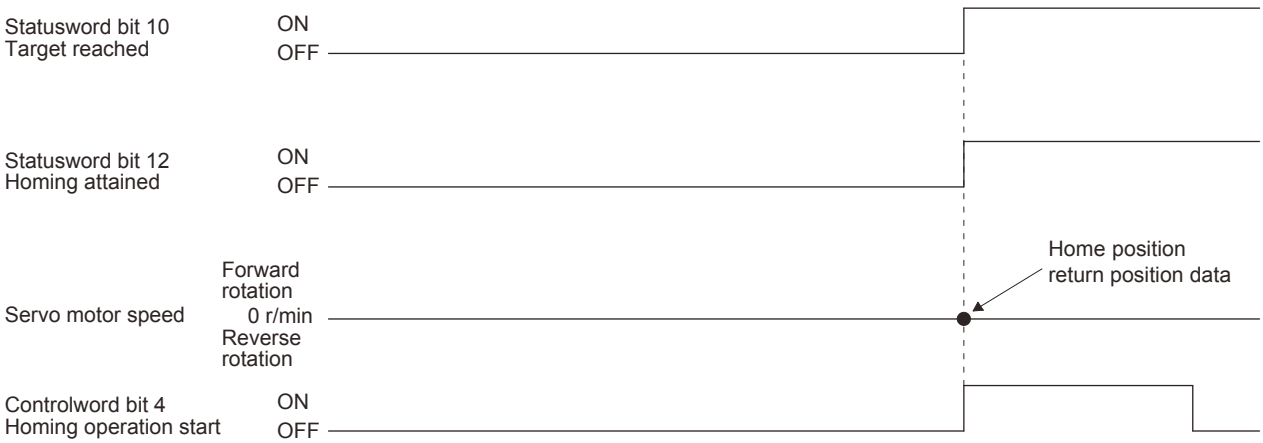
9) Method 33 and Method 34 (Homing on index pulse)
The following figure shows the operation of Homing method 34. The operation direction of Homing method 33 is opposite to that of Homing method 34.





When the stroke end is detected

10) Method 35 and Method 37 (Homing on current position)
The following figure shows the operation of Homing method 35 and Homing method 37. These methods can be performed in the servo-off status.

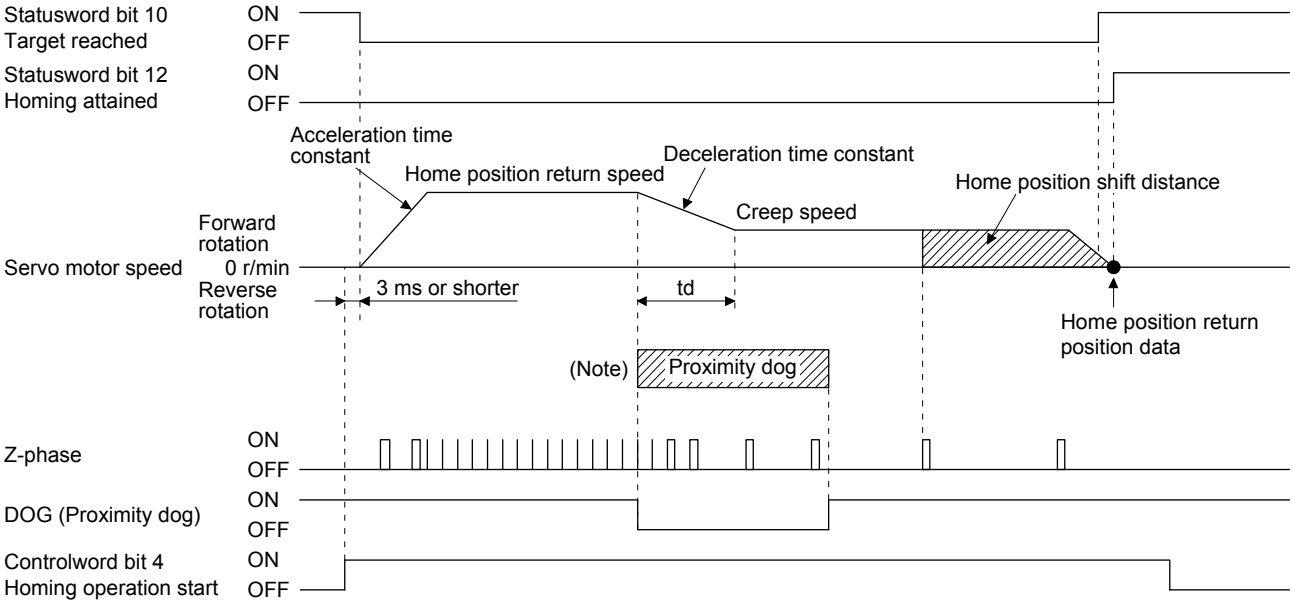


(6) Operation example of Manufacturer-specific Homing method

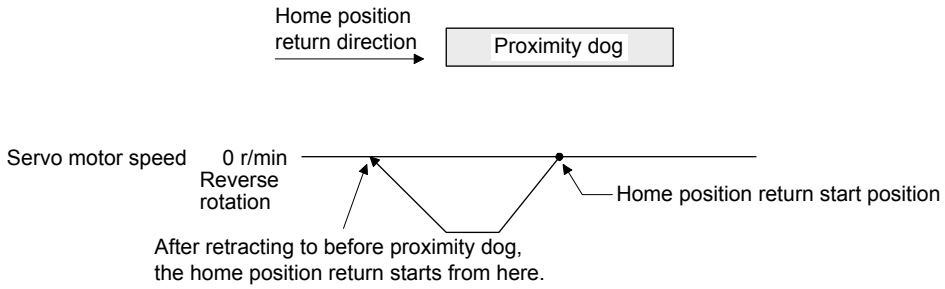
The following shows an operation example of the Manufacturer-specific home return.

(a) Method -1 and -33 (Dog type home position return)

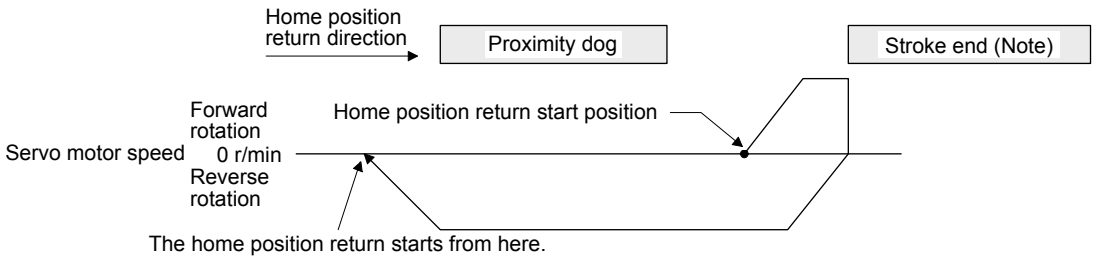
The following figure shows the operation of Homing method -1. The operation direction of Homing method -33 is opposite to that of Homing method -1.



Note. After the front end of the proximity dog is detected, if the distance after proximity dog is traveled without reaching the creep speed, [AL. 90] occurs. Set the travel distance after proximity dog enough for deceleration from the home position return speed to the creep speed.



When a home position return is started from the proximity dog



Note. The software limit cannot be used with these functions.

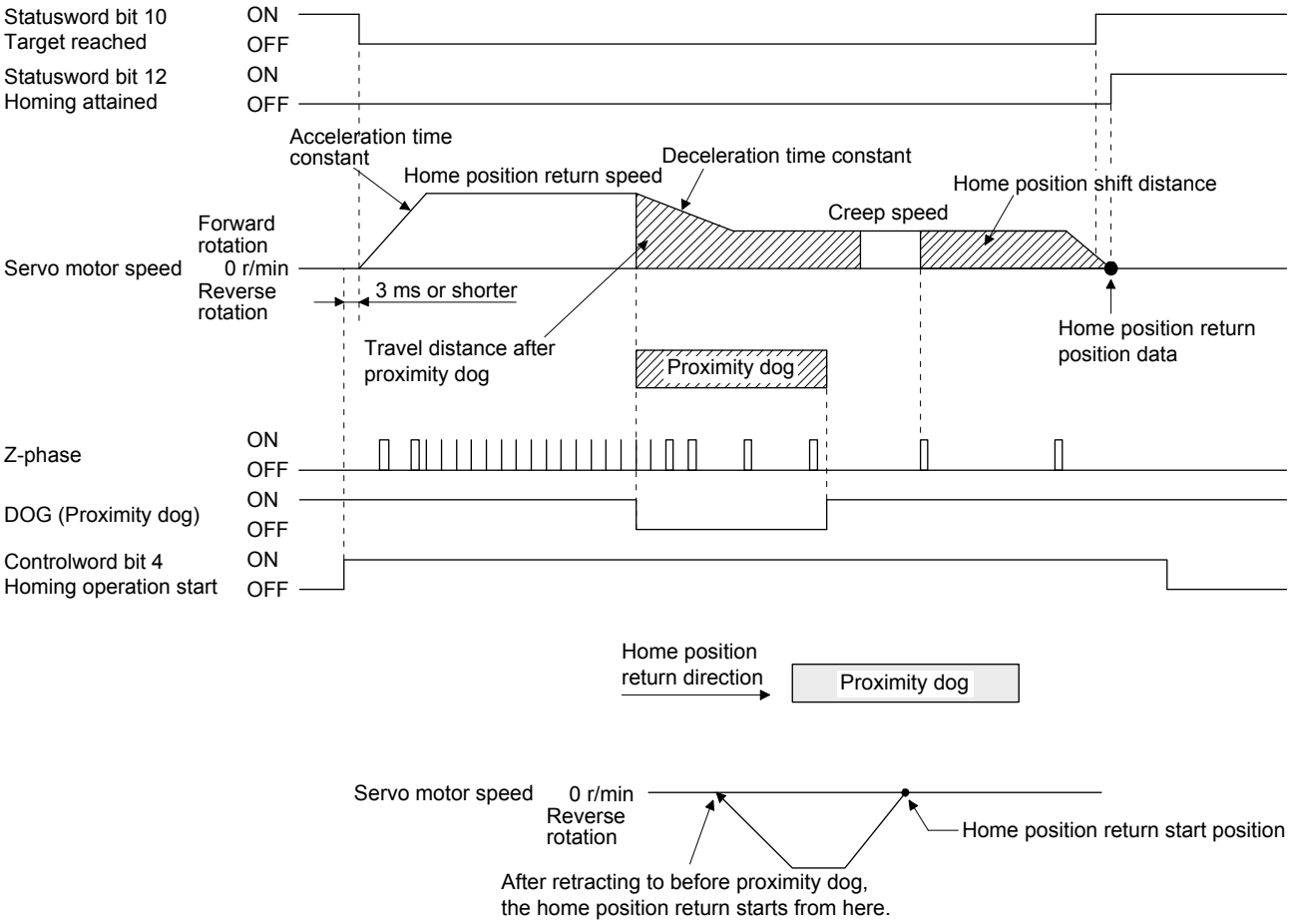
When the movement is returned at the stroke end

(b) Method -2 and -34 (Count type home position return)

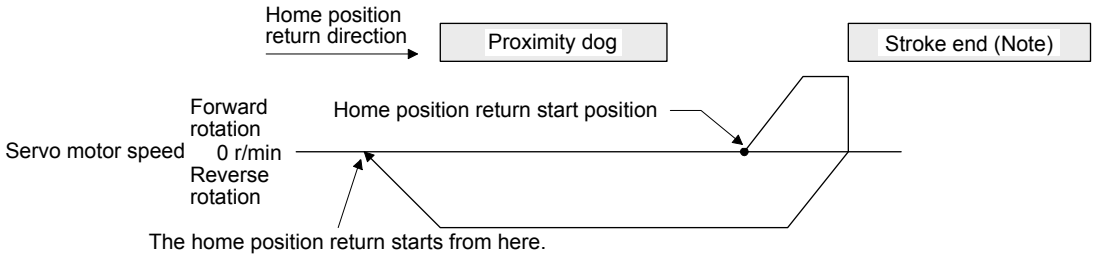
POINT

●For the count type home position return, after the front end of the proximity dog is detected, the position is shifted by the distance set in the travel distance after proximity dog. Then, the first Z-phase is set as the home position. Therefore, when the on-time of the proximity dog is 10 ms or more, the length of the proximity dog has no restrictions. Use this home position return type when the dog type home position return cannot be used because the length of the proximity dog cannot be reserved or other cases.

The following figure shows the operation of Homing method -2. The operation direction of Homing method -34 is opposite to that of Homing method -2. After the front end of the proximity dog is detected, if the distance after proximity dog is traveled without reaching the creep speed, [AL. 90] occurs. Set the travel distance after proximity dog enough for deceleration from the home position return speed to the creep speed.



When a home position return is started from the proximity dog

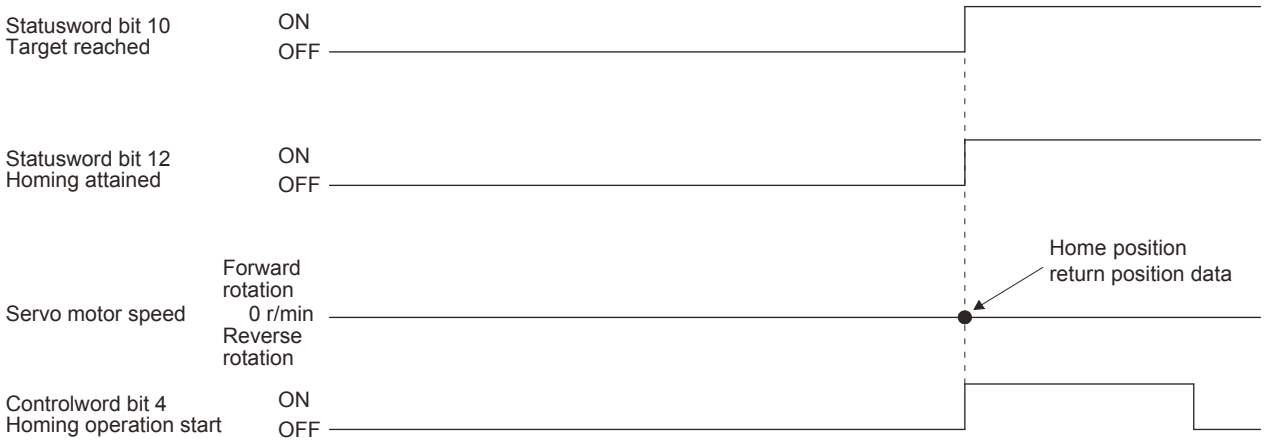


Note. The software limit cannot be used with these functions.

When the movement is returned at the stroke end

(c) Method -3 (Data set type home position return)

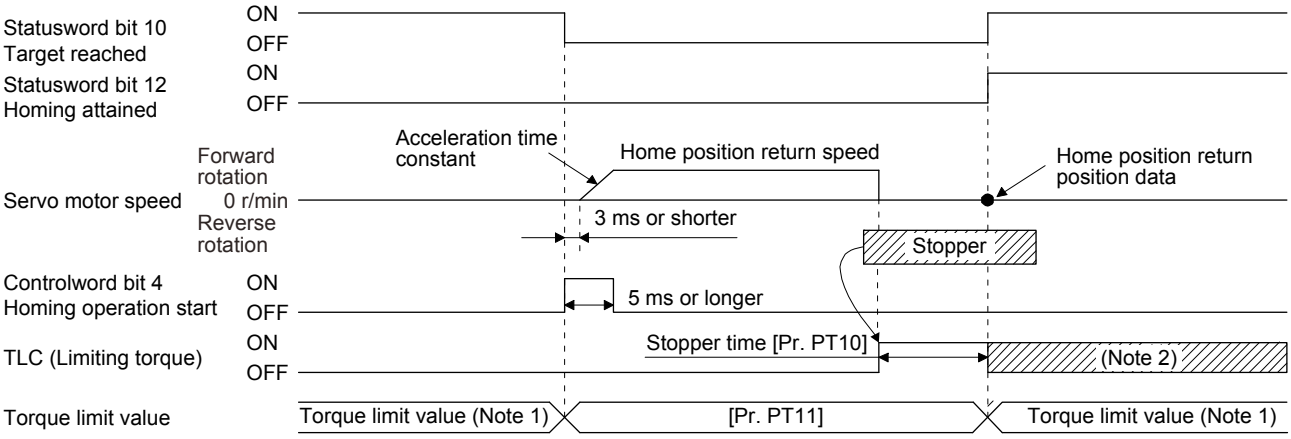
The following figure shows the operation of Homing method -3. This type cannot be executed during servo-off.



(d) Method -4 and -36 (stopper type home position return)

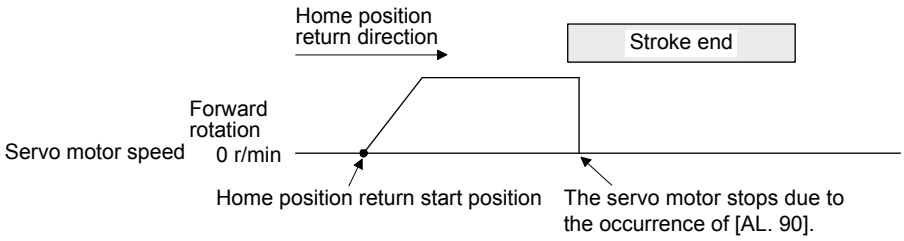
POINT
●Since the workpiece collides with the mechanical stopper, the home position return speed must be low enough.

The following figure shows the operation of Homing method -4. The operation direction of Homing method -36 is opposite to that of Homing method -4.



Note 1. When Method -4 is set, the torque limit value of Positive torque limit value (60E0h) is applied. When Method -36 is set, the torque limit value of Negative torque limit value (60E1h) is applied.

2. If the torque limit value is reached, TLC remains on after the home position return is completed.



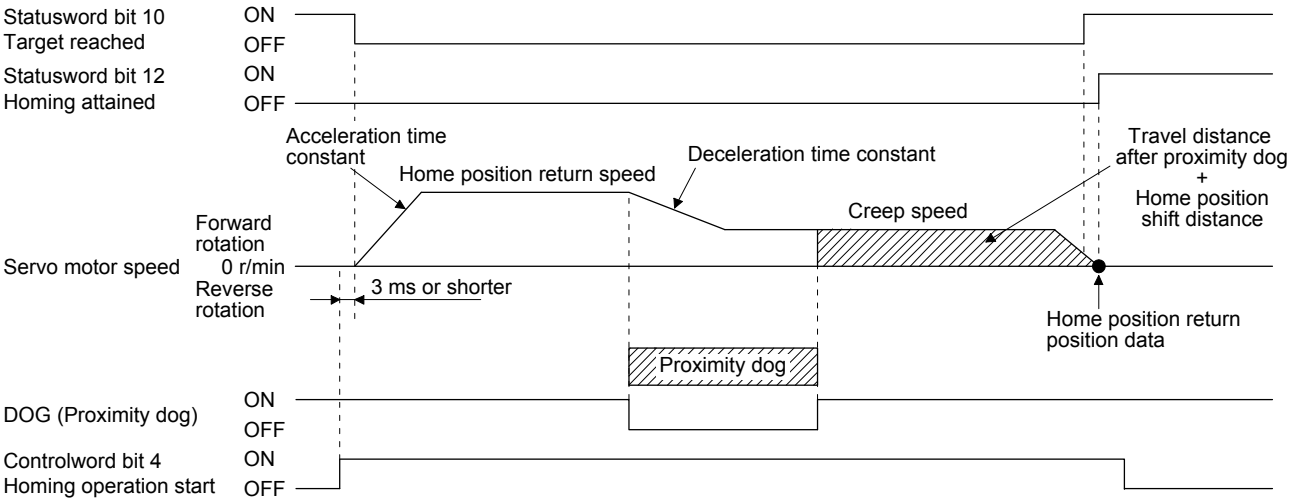
When the stroke end is detected

(e) Method -6 and -38 (dog type rear end reference home position return)

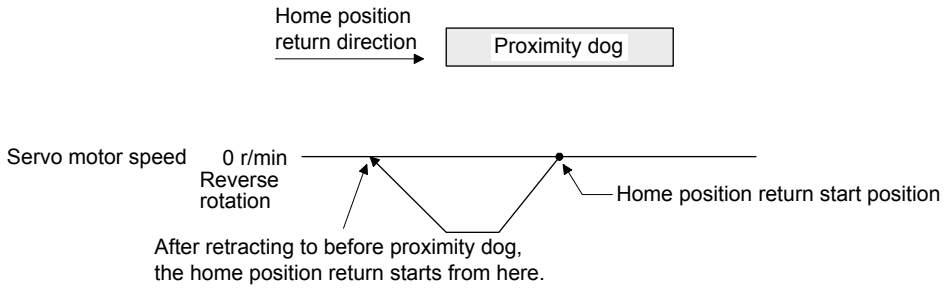
POINT

●This home position return type depends on the timing of reading DOG (Proximity dog) that has detected the rear end of the proximity dog. Therefore, when the creep speed is set to 100 r/min and a home position return is performed, the home position has an error of ± (Encoder resolution) × 100/65536 [pulse]. The higher the creep speed, the greater the error of the home position.

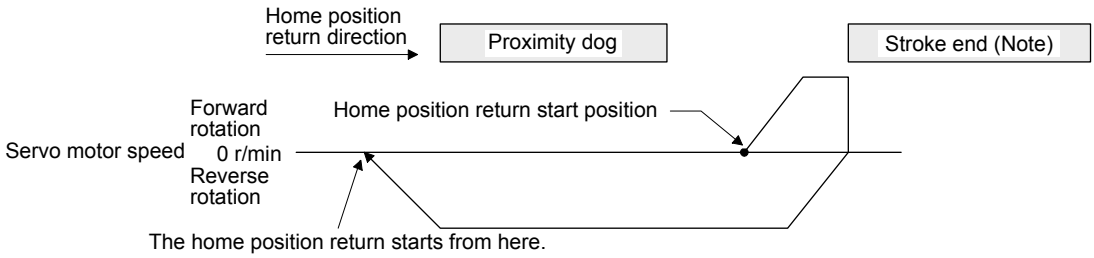
The following figure shows the operation of Homing method -6. The operation direction of Homing method -38 is opposite to that of Homing method -6.



Note. After the front end of the proximity dog is detected, if the rear end of the proximity dog is detected without reaching the creep speed, [AL. 90] occurs. Check the length of the proximity dog or check the home position return speed and creep speed.



When a home position return is started from the proximity dog



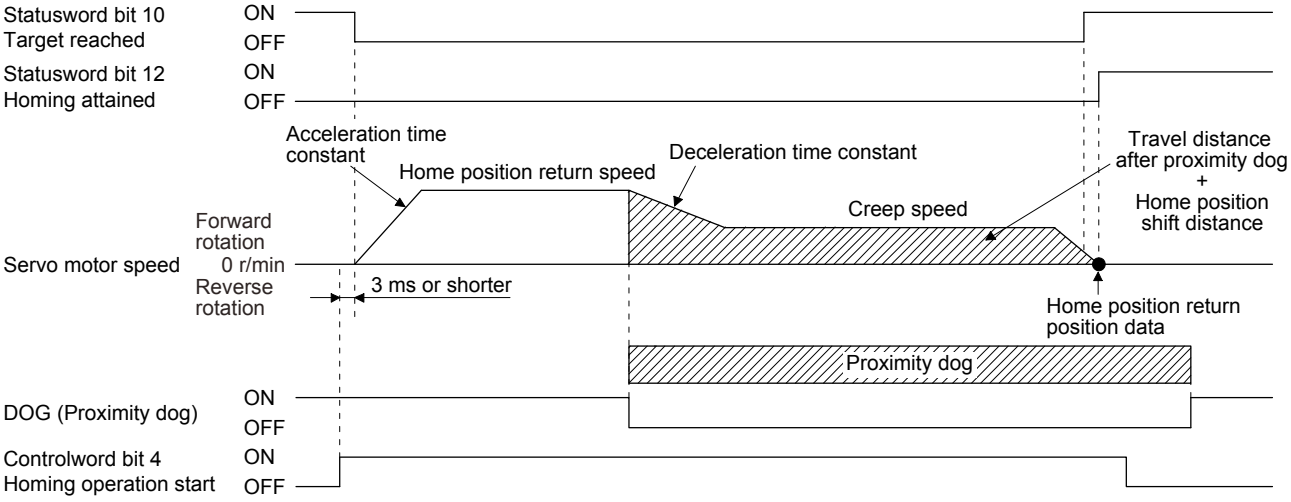
Note. The software limit cannot be used with these functions.

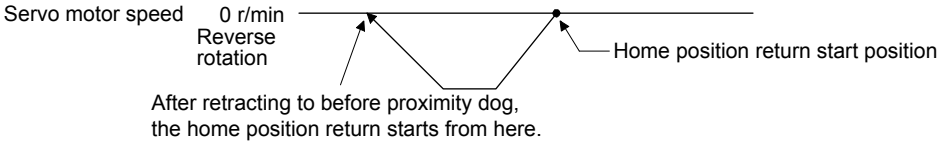
When the movement is returned at the stroke end

(f) Method -7 and -39 (count type front end reference home position return)

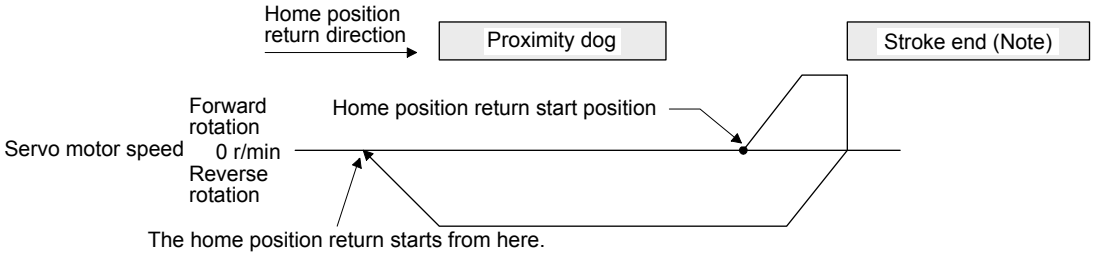
> POINT
>
> ●This home position return type depends on the timing of reading DOG (Proximity dog) that has detected the front end of the proximity dog. Therefore, when the creep speed is set to 100 r/min and a home position return is performed, the home position has an error of ± (Encoder resolution) × 100/65536 [pulse]. The faster home position return speed sets a larger error in the home position.

The following figure shows the operation of Homing method -7. The operation direction of Homing method -39 is opposite to that of Homing method -7.





When a home position return is started from the proximity dog

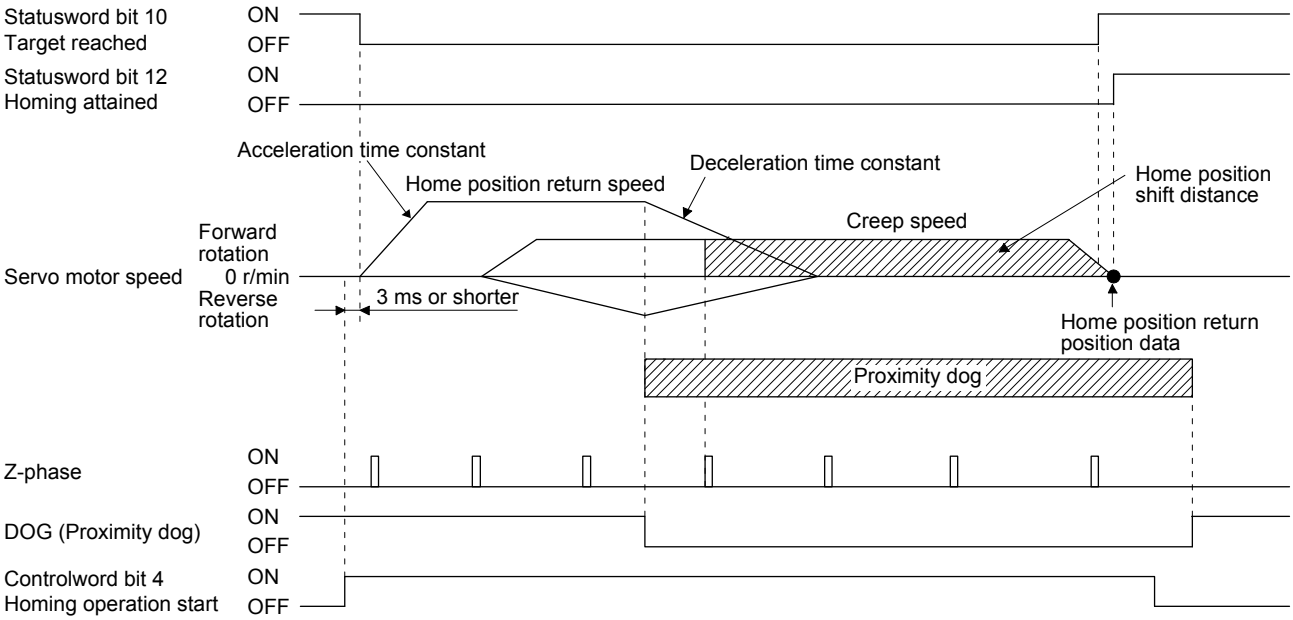


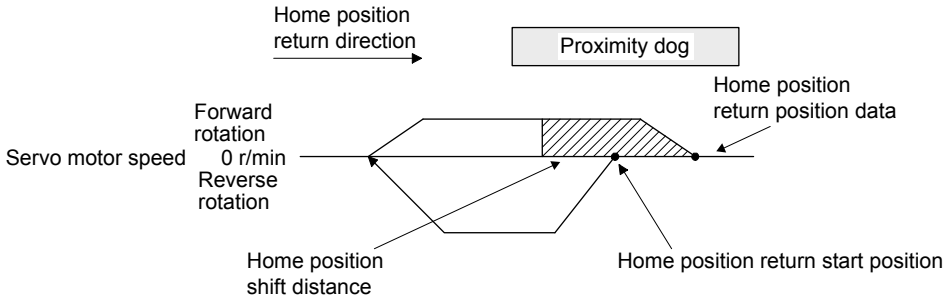
Note. The software limit cannot be used with these functions.

When the movement is returned at the stroke end

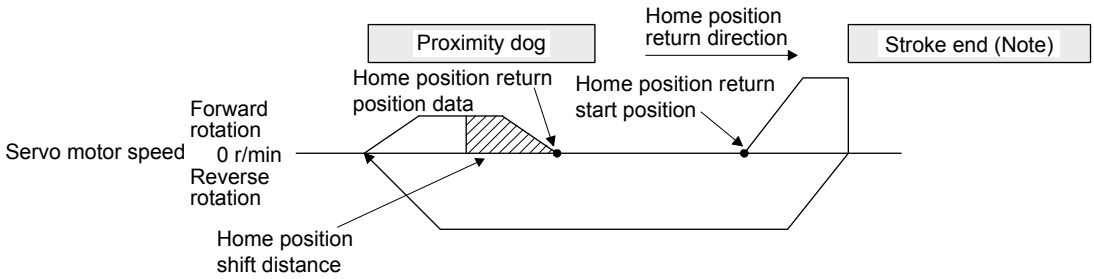
(g) Method -8 and -40 (dog cradle type home position return)

The following figure shows the operation of Homing method -8. The operation direction of Homing method -40 is opposite to that of Homing method -8.





When a home position return is started from the proximity dog

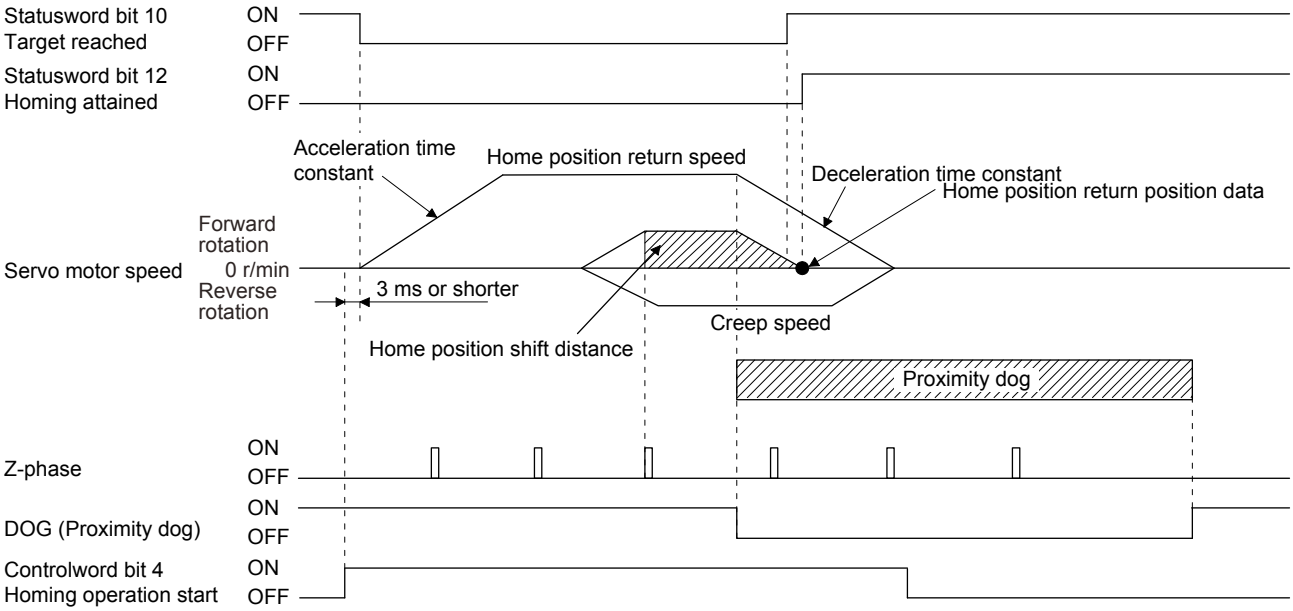


Note. The software limit cannot be used with these functions.

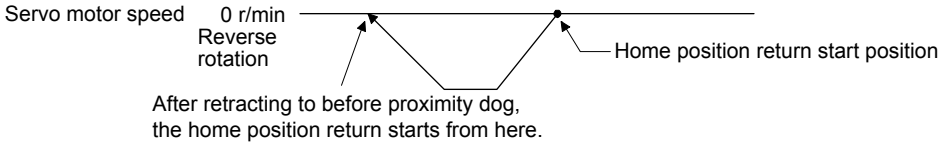
When the movement is returned at the stroke end

(h) Method -9 and -41 (dog type last Z-phase reference home position return)

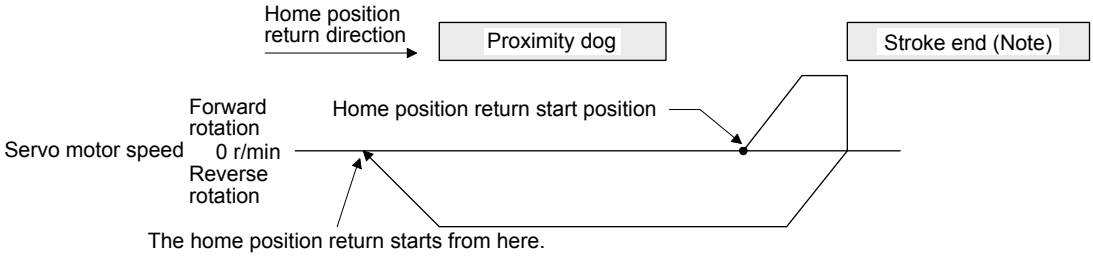
The following figure shows the operation of Homing method -9. The operation direction of Homing method -41 is opposite to that of Homing method -9.



Note. After the front end of the proximity dog is detected, if the rear end of the proximity dog is detected without stop, [AL. 90] occurs. Check the length of the proximity dog or check the home position return speed and creep speed.



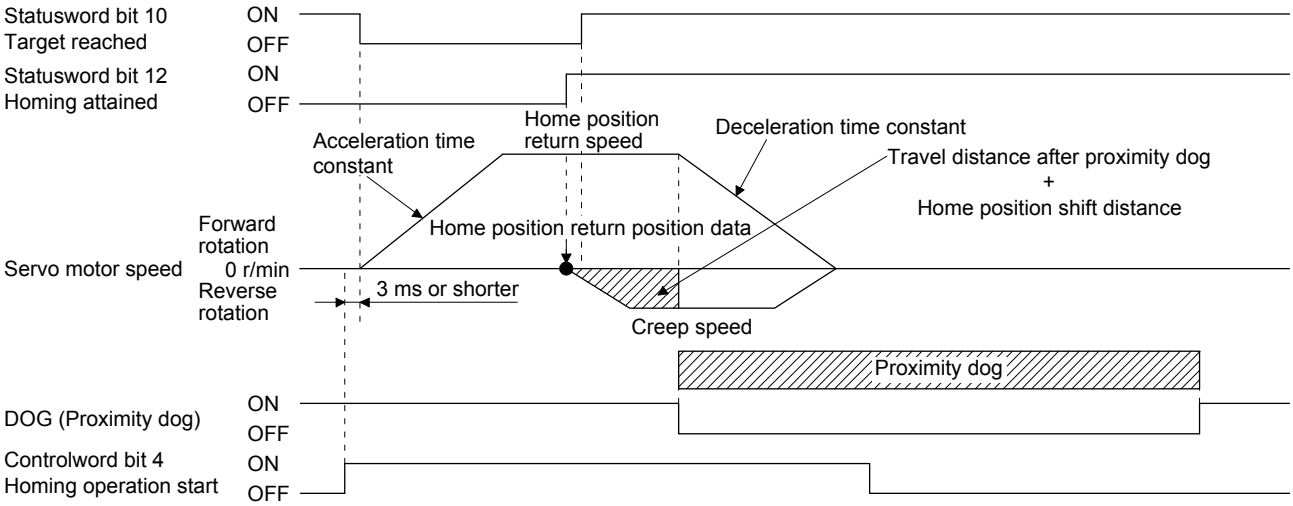
When a home position return is started from the proximity dog



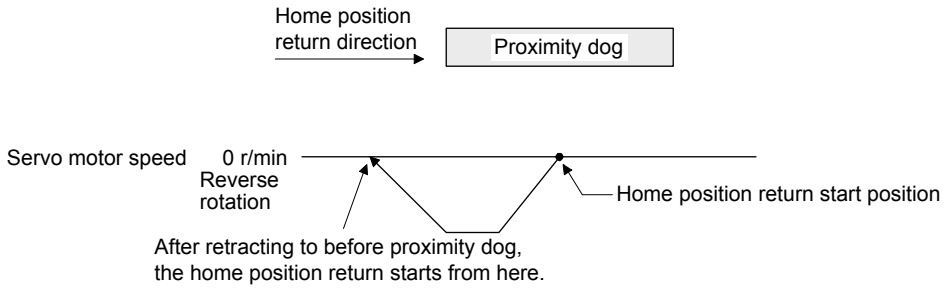
Note. The software limit cannot be used with these functions.

When the movement is returned at the stroke end

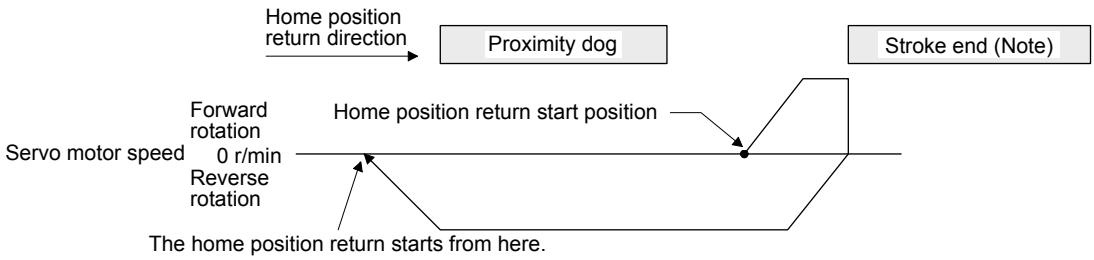
(i) Method -10 and -42 (dog type front end reference home position return)
The following figure shows the operation of Homing method -10. The operation direction of Homing method -42 is opposite to that of Homing method -10.



Note. After the front end of the proximity dog is detected, if the rear end of the proximity dog is detected without reaching the creep speed, [AL. 90] occurs. Check the length of the proximity dog or check the home position return speed and creep speed.



When a home position return is started from the proximity dog

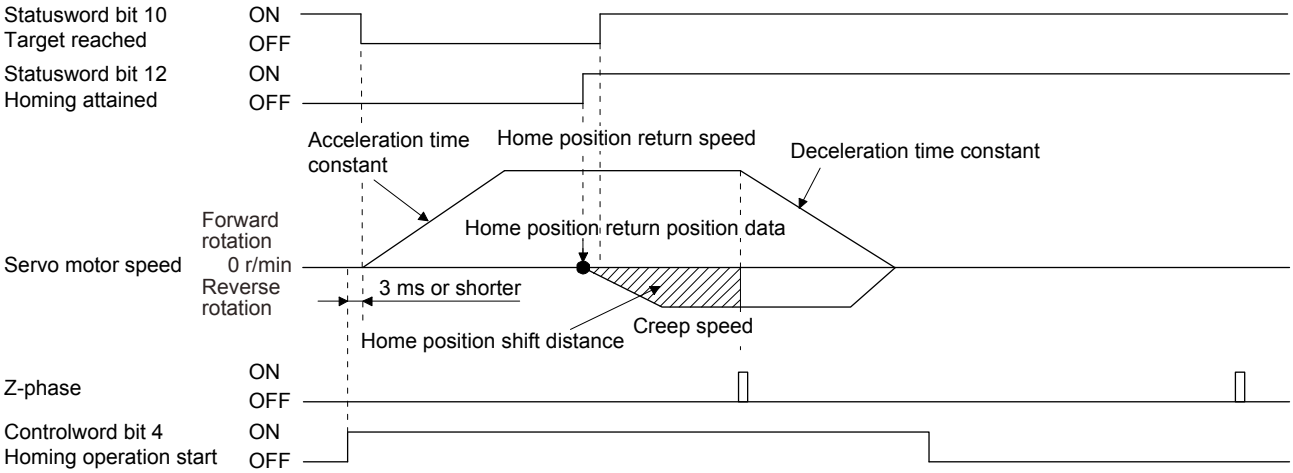


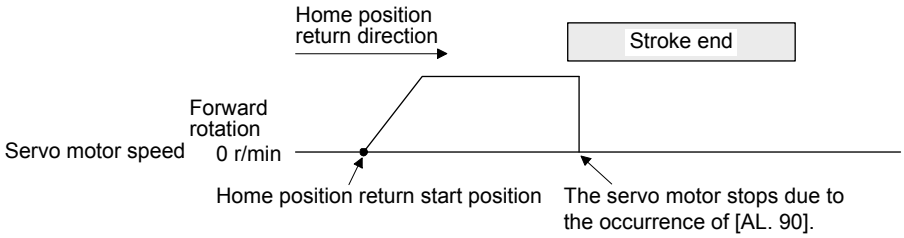
Note. The software limit cannot be used with these functions.

When the movement is returned at the stroke end

(j) Method -11 and -43 (dogless Z-phase reference home position return)

The following figure shows the operation of Homing method -11. The operation direction of Homing method -43 is opposite to that of Homing method -11.





When the stroke end is detected

5.5 Touch probe

The touch probe function that executes current position latch by sensor input can be used.
With this function, the position feedback of the rising edge and falling edge of TPR1 (touch probe 1) and TPR2 (touch probe 2) can be memorized and stored into each object of 60BAh to 60BDh according to the conditions specified in Touch probe function (60B8h).
The following shows the touch probe detection resolution. Enabling the high precision touch probe will disable the encoder output pulses.

		Touch probe1	Touch probe2
Input terminal		TPR1	TPR2
Encoder resolution	[Pr. PD37] = _ _ _ 0 (Selection of high-precision touch probe is disabled)	55 µs	55 µs
	[Pr. PD37] = _ _ _ 1 (Selection of high-precision touch probe is enabled)	55 µs	Rising: 2 µs Falling: 55 µs

(1) Related object

Index	Sub	Object	Name	Data Type	Access	Default	Description
60B8h		VAR	Touch probe function	U16	rw		Settings such as enabling/disabling of the touch probe function and trigger conditions
60B9h		VAR	Touch probe status	U16	ro	0	Status information of the touch probe function
60BAh		VAR	Touch probe pos1 pos value	I32	ro	0	Shows the rising edge position of TPR1 (touch probe 1). (Pos units)
60BBh		VAR	Touch probe pos1 neg value	I32	ro	0	Shows the falling edge position of TPR1 (touch probe 1). (Pos units)
60BCh		VAR	Touch probe pos2 pos value	I32	ro	0	Shows the rising edge position of TPR2 (touch probe 2). (Pos units)
60BDh		VAR	Touch probe pos2 neg value	I32	ro	0	Shows the falling edge position of TPR2 (touch probe 2). (Pos units)

(a) Details of Touch probe function (60B8h)

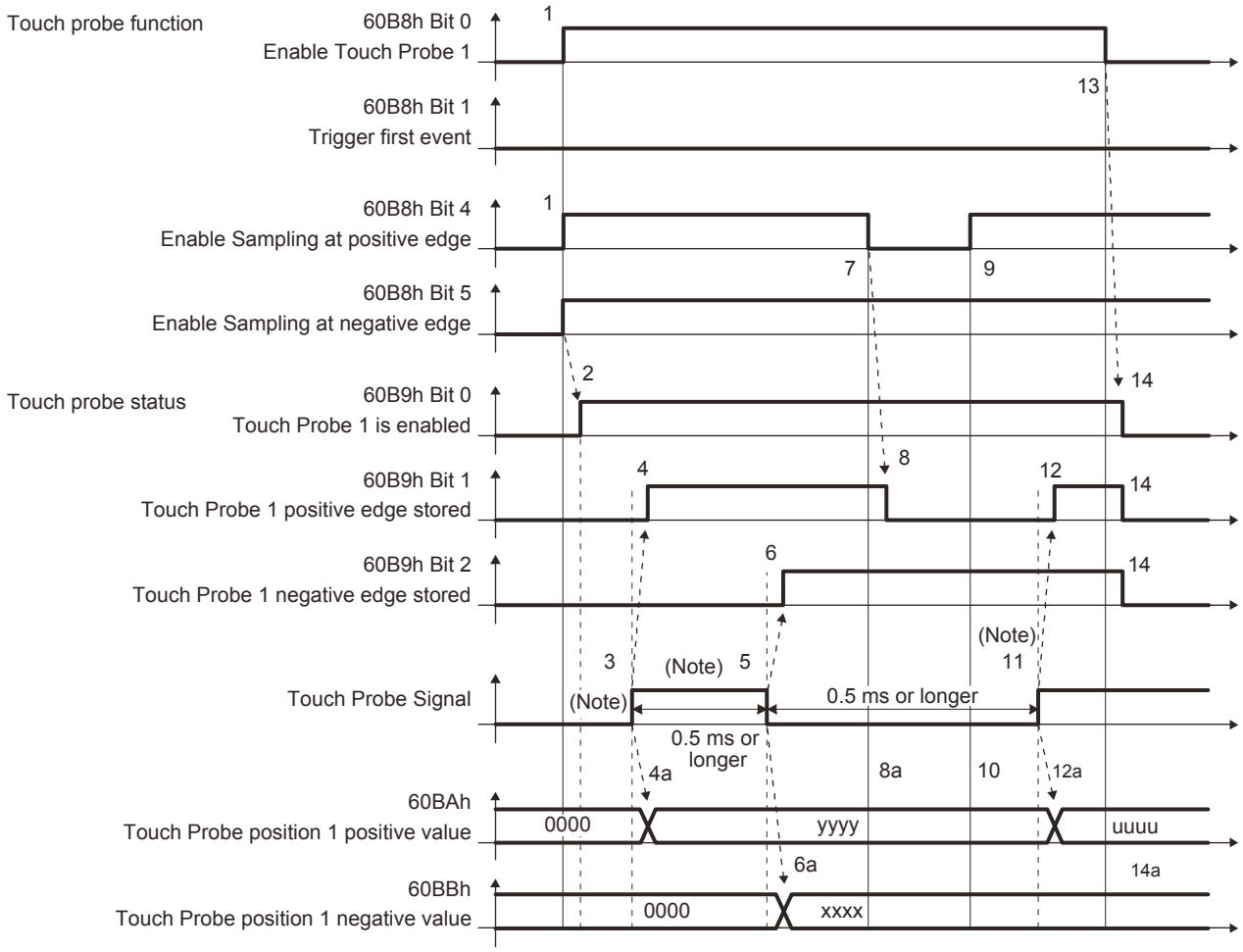
Bit	Definition
0	0: Touch probe 1 disabled 1: Touch probe 1 enabled
1	0: Single trigger mode 1: Continuous trigger mode
2	0: Set input of touch probe 1 as a trigger 1: Set 0 point of the encoder as a trigger (Unsupported) (Note)
3	(Reserved) The value at reading is undefined. Set "0" at writing.
4	0: Stop sampling at the rising edge of touch probe 1 1: Start sampling at the rising edge of touch probe 1
5	0: Stop sampling at the falling edge of touch probe 1 1: Start sampling at the falling edge of touch probe 1
6	(Reserved) The value at reading is undefined. Set "0" at writing.
7	
8	0: Touch probe 2 disabled 1: Touch probe 2 enabled
9	0: Single trigger mode 1: Continuous trigger mode
10	0: Set input of touch probe 2 as a trigger 1: Set 0 point of the encoder as a trigger (Unsupported) (Note)
11	(Reserved) The value at reading is undefined. Set "0" at writing.
12	0: Stop sampling at the rising edge of touch probe 2 1: Start sampling at the rising edge of touch probe 2
13	0: Stop sampling at the falling edge of touch probe 2 1: Start sampling at the falling edge of touch probe 2
14	(Reserved) The value at reading is undefined. Set "0" at writing.
15	

Note. This is not supported by the MR-J4-_TM_ servo amplifier.

(b) Details of Touch probe status (60B9h)

Bit	Definition
0	0: Touch probe 1 disabled 1: Touch probe 1 enabled
1	0: The rising edge position of touch probe 1 has not been stored. 1: The rising edge position of touch probe 1 has been stored.
2	0: The falling edge position of touch probe 1 has not been stored. 1: The falling edge position of touch probe 1 has been stored.
3	(Reserved) The value at reading is undefined. Set "0" at writing.
4	
5	
6	
7	
8	0: Touch probe 2 disabled 1: Touch probe 2 enabled
9	0: The rising edge position of touch probe 2 has not been stored. 1: The rising edge position of touch probe 2 has been stored.
10	0: The falling edge position of touch probe 2 has not been stored. 1: The falling edge position of touch probe 2 has been stored.
11	(Reserved) The value at reading is undefined. Set "0" at writing.
12	
13	
14	
15	

(2) Timing chart



Note. Turn on and off Touch Probe Signal so that both the on time and off time are 0.5 ms or longer.

Transition No.	Object	Description
1	60B8h Bit 0, 4, 5 = 1	Enables Touch Probe1. The rising edge and falling edge are enabled.
2	→ 60B9h Bit 0 = 1	Turns on the Touch Probe1 enable status.
3		Turns on Touch Probe Signal (TPR1).
4	→ 60B9h Bit 1 = 1	Turns on the Touch Probe1 positive edge stored status.
4a	→ 60BAh	Sets the latched position feedback for Touch probe position1 positive value.
5		Turns off Touch Probe Signal (TPR1).
6	→ 60B9h Bit 2 = 1	Turns on the Touch Probe1 negative edge stored status.
6a	→ 60BBh	Sets the latched position feedback for Touch probe position1 negative value.
7	60B8h Bit 4 = 0	Turns off Sample positive edge. Rising edge detection is disabled.
8	→ 60B9h Bit 1 = 0	Turns off Touch Probe1 positive edge stored status.
8a	→ 60BAh	Touch probe position1 positive value does not change.
9	60B8h Bit 4 = 1	Turns on Sample positive edge. Rising edge detection is enabled.
10	→ 60BAh	Touch probe position1 positive value does not change.
11		Turns on Touch Probe Signal (TPR1).
12	→ 60B9h Bit 1 = 1	Turns on the Touch Probe1 negative edge stored status.
12a	→ 60BAh	Sets the latched position feedback for Touch probe position1 negative value.
13	60B8h Bit 0 = 0	Disables Touch Probe1.
14	→ 60B9h Bit 0, 1, 2 = 0	Clears all the status Bit.
14a	→ 60BAh, 60BBh	Touch probe position1 positive/negative value does not change.

(3) High-precision touch probe

TPR2 (touch probe 2) supports high-precision touch probe. The normal touch probe has the latch function with precision of 55 μs. On the other hand, the high-precision touch probe latches precisely startup of TPR2 (touch probe 2) with precision of 2 μs. To use the high-precision touch probe, set [Pr. PD37] to "_ _ _ 1". While the high-precision touch probe is being used, the encoder pulse output function cannot be used. The precision of rising edge is 55 μs in this case as well.

5.6 Quick stop

Decelerate the servo motor to a stop with the Quick stop command of Controlword (6040h). The following table shows the related objects.

Index	Sub	Object	Name	Data Type	Access	Default	Description
6085h		VAR	Quick stop deceleration	U32	rw	100	Deceleration at deceleration to a stop by Quick stop Unit: ms
605Ah		VAR	Quick stop option code	I16	rw	2	Refer to table 5.2 for details.

The operation method of deceleration to a stop can be specified with Quick stop option code (605Ah). The following table shows the supported methods and the operations.

Table 5.2 Quick stop option code

Setting value	Description
1 (Not supported) (Note)	csp/csv: The servo motor decelerates to a stop with Quick stop deceleration (6085h) and the state shifts to the Switch On Disabled state. cst/tq: The state immediately shifts to the Switch on disabled state and the servo motor is stopped with the dynamic brake. pp/pv: The servo motor decelerates to a stop with Profile deceleration (6084h) and the state shifts to the Switch On Disabled state. hm: The servo motor decelerates to a stop with Homing acceleration (609Ah) and the state shifts to the Switch On Disabled state.
2	In the cyclic synchronous mode (csp/csv), profile position mode (pp/pv), and homing mode (hm), the servo motor decelerates to a stop with Quick stop deceleration (6085h) and the state shifts to the Switch On Disabled state. In the cyclic synchronous torque mode (cst) and profile torque mode (tq), the state immediately shifts to the Switch On Disabled state and the servo motor stops with the dynamic brake.
3 (Not supported) (Note)	The current is limited and the servo motor decelerates to a stop. Then, the state shifts to the Switch On Disabled state.
4 (Not supported) (Note)	The voltage is limited and the servo motor decelerates to a stop. Then, the state shifts to the Switch On Disabled state.
5 (Not supported) (Note)	The servo motor decelerates to a stop. The state does not change from the Quick Stop Active state (servo-on).
6 (Not supported) (Note)	The servo motor decelerates to a stop with Quick stop deceleration (6085h). The state does not change from the Quick Stop Active state (servo-on).
7 (Not supported) (Note)	The current is limited and the servo motor decelerates to a stop. The state does not change from the Quick Stop Active state (servo-on).
8 (Not supported) (Note)	The voltage is limited and the servo motor decelerates to a stop. The state does not change from the Quick Stop Active state (servo-on).

Note. This is not supported by the MR-J4-_TM_ servo amplifier.

5.7 Halt

When Halt Bit (Bit 8 of Controlword) is set to 1, the servo motor decelerates to a stop with the deceleration time constant of Homing acceleration (609Ah) or Profile deceleration (6084h) according to the setting of Halt option code (605Dh). The halt function can be used in the profile mode (pp/pv/tq) and homing mode (hm). Operation in other modes can be performed regardless of the Halt Bit status. When Halt Bit is set to 0 at deceleration stop operation, the servo motor decelerates to a stop and returns to the operable state. The following table shows the related object.

Index	Sub	Object	Name	Data Type	Access	Default	Description
605Dh		VAR	Halt option code	I16	rw	1	Setting for executing the Halt function Refer to table 5.3 for details.

The following table shows descriptions of Halt option code (605Dh). However, in the profile torque mode (tq), Torque demand value (6074h) is set to 0 regardless of Halt option code (605Dh). The amount of torque change at this time can be set using Torque slope (6087h).

Table 5.3 Halt option code

Setting value	Description
1	For Profile deceleration (6084h) and the homing mode (hm), the servo motor decelerates to a stop according to Homing acceleration (609Ah) and the state does not change from the Operation Enabled state (servo-on).
2 (Not supported) (Note)	The servo motor decelerates to a stop with Quick stop deceleration (6085h). The state does not change from the Operation Enabled state (servo-on).
3 (Not supported) (Note)	The current is limited and the servo motor decelerates to a stop. The state does not change from the Operation Enabled (servo-on).
4 (Not supported) (Note)	The voltage is limited and the servo motor decelerates to a stop. The state does not change from the Operation Enabled (servo-on).

Note. This is not supported by the MR-J4-_TM_ servo amplifier.

5.8 Software position limit

Specify the upper and lower limits of the command position and current position. If a command position exceeding the limit position is specified, the command position is clamped at the limit position. Specify a relative position from the machine home point (position address = 0) as the limit position.
This function is enabled when the home position is not erased in the cyclic synchronous position mode (csp) or profile position mode (pp). While the clamp processing is being performed with the command position exceeding the limit value, [AL. 98 Software limit warning] occurs and not cleared. When the position command of the direction opposite to reached Software position limit (607Dh) is given, the operation can be restarted.
In the cyclic synchronous position mode (csp), stop a command when the software position limit is detected. When the command position exceeds 32 bits (-2147483648 to 2147483647), [AL. 69 Command error] occurs. When the command position exceeds the limit range by 30 bits (-536870912 to 536870911), [AL. 69 Command error] also occurs.
When [AL. 69 Command error] has occurred, the home position is erased. Perform a home position return again. The following table lists the related objects.

Index	Sub	Object	Name	Data Type	Access	Default	Description
607Dh	0	ARRAY	Software position limit	U8	ro	2	Number of entries
	1		Min position limit (Note)	I32	rw	0	Specify a relative position from the machine home point (position address = 0) as the minimum value of the command position and current position. When the value falls below the minimum value, it is clamped and processed as the minimum value.
	2		Max position limit (Note)	I32	rw	0	Specify a relative position from the machine home point (position address = 0) as the maximum value of the command position and current position. When the value exceeds the maximum value, it is clamped and processed as the maximum value.

Note. When the set value of Min position limit is equal to or greater than the set value of Max position limit, the function of Software position limit (607Dh) is disabled.

5.9 Torque limit

Generated torque can be limited with the values of Positive torque limit value (60E0h) and Negative torque limit value (60E1h). When "0" is set, torque (thrust) is not generated. The following table lists the related objects.

Index	Sub	Object	Name	Data Type	Access	Default	Description
60E0h		VAR	Positive torque limit value	U16	rw	10000	[Pr. PA11 Forward rotation torque limit/positive direction thrust limit] Torque limit value in CCW power running/CW regeneration Unit: 0.1% (rated torque of 100%) Range: 0 to 10000
60E1h		VAR	Negative torque limit value	U16	rw	10000	[Pr. PA12 Reverse rotation torque limit/negative direction thrust limit] Torque limit value in CW power running/CCW regeneration Unit: 0.1% (rated torque of 100%) Range: 0 to 10000

5.10 Polarity

The rotation direction of a servo motor to position commands, speed commands, and torque commands can be set with Polarity (607Eh). For the Polarity (607Eh) setting to position commands and speed commands, use [Pr. PA14]. For the Polarity (607Eh) setting to torque commands, use [Pr. PA14] and "POL reflection selection at torque mode" of [Pr. PC29]. A change in the setting of Polarity (607Eh) is not applied without enabling the change. Refer to section 6.5.2 for the procedure of enabling parameters.

(1) Object definition

Bit	Description
0	(reserved) The value at reading is undefined. Set "0" at writing.
1	
2	
3	
4	
5 (Note)	Torque POL The polarity is reversed when this bit is turned on.
6	Velocity POL The polarity is reversed when this bit is turned on.
7	Position POL The polarity is reversed when this bit is turned on.

Note. This is available with servo amplifiers with software version B0 or later.

(2) Target object

The following shows objects whose polarity is reversed according to the setting of Polarity (607Eh).

Object name (Index)	Remark
Target position (607Ah)	
Target velocity (60FFh)	
Target torque (6071h)	
Position actual value (6064h)	
Velocity demand value (606Bh)	Whether to reverse the polarity using Polarity (607Eh) can be switched with "Internal command speed POL reflection selection" of [Pr. PC76]. [Pr. PC76] = _ 0 _ _ (Automatic setting): Automatically set depending on the type of the network in use. [Pr. PC76] = _ 1 _ _ (POL setting enabled): The polarity is reversed using Polarity. [Pr. PC76] = _ 2 _ _ (POL setting disabled): The polarity is not reversed using Polarity.
Velocity actual value (606Ch)	
Torque demand (6074h)	
Torque actual value (6077h)	
Positive torque limit value (60E0h)	The corresponding parameters are changed according to "POL reflection selection at torque mode" in [Pr. PA14] and [Pr. PC29] as follows. [Pr. PA14] = 0, [Pr. PC29] = 1 _ _ _ (Disabled): Written to [Pr. PA11 Forward rotation torque limit/positive direction thrust limit]. [Pr. PA14] = 1, [Pr. PC29] = 1 _ _ _ (Disabled): Written to [Pr. PA11 Forward rotation torque limit/positive direction thrust limit]. [Pr. PA14] = 0, [Pr. PC29] = 0 _ _ _ (Enabled): Written to [Pr. PA11 Forward rotation torque limit/positive direction thrust limit]. [Pr. PA14] = 1, [Pr. PC29] = 0 _ _ _ (Enabled): Written to [Pr. PA12 Reverse rotation torque limit/negative direction thrust limit].
Negative torque limit value (60E1h)	The corresponding parameters are changed according to "POL reflection selection at torque mode" in [Pr. PA14] and [Pr. PC29] as follows. [Pr. PA14] = 0, [Pr. PC29] = 1 _ _ _ (Disabled): Written to [Pr. PA12 Reverse rotation torque limit/negative direction thrust limit]. [Pr. PA14] = 1, [Pr. PC29] = 1 _ _ _ (Disabled): Written to [Pr. PA12 Reverse rotation torque limit/negative direction thrust limit]. [Pr. PA14] = 0, [Pr. PC29] = 0 _ _ _ (Enabled): Written to [Pr. PA12 Reverse rotation torque limit/negative direction thrust limit]. [Pr. PA14] = 1, [Pr. PC29] = 0 _ _ _ (Enabled): Written to [Pr. PA11 Forward rotation torque limit/positive direction thrust limit].
Digital inputs (60FDh)	The corresponding status is changed according to the setting of [Pr. PA14] as follows. [Pr. PA14] = 0: The status of LSN (reverse rotation stroke end) is applied to Negative limit switch (bit 0). The status of LSP (forward rotation stroke end) is applied to Positive limit switch (bit 1). [Pr. PA14] = 1: The status of LSP (forward rotation stroke end) is applied to Negative limit switch (bit 0). The status of LSN (reverse rotation stroke end) is applied to Positive limit switch (bit 1).

5.11 degree function

POINT
●This is available with servo amplifiers with software version B0 or later.

(1) Summary

Selecting "degree (_ 2 _ _)" in "Position data unit" of [Pr. PT01] allows for positioning with module coordinates (axis of rotation). The following shows the differences when "degree" is selected.

Item	Description
Target position (607Ah)	The range -360.000° to 360.000° is newly applied.
Position actual value (6064h)	The range 0° to 359.999° is newly applied.
Software position limit (607Dh)	The range 0° to 359.999° is newly applied. A value outside the range is clamped within the range 0° to 359.999°.
Position range limit (607Bh)	The range 0° to 359.999° is newly applied.
Touch probe pos1 pos value (60BAh)	The range 0° to 359.999° is newly applied.
Touch probe pos1 neg value (60BBh)	The range 0° to 359.999° is newly applied.
Touch probe pos2 pos value (60BCh)	The range 0° to 359.999° is newly applied.
Touch probe pos2 neg value (60BDh)	The range 0° to 359.999° is newly applied.
Home offset (607Ch)	The range 0° to 359.999° is newly applied.

(2) Setting of the operation pattern

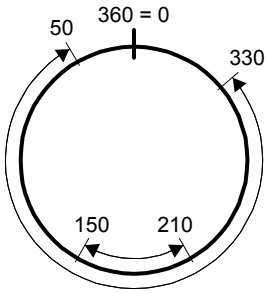
Positioning operation patterns can be changed with Positioning option code (60F2h) or [Pr. PT03]. Change the setting while the servo motor is stopped (Target reached is on). If the setting is changed while the servo motor is rotating (Target reached is off), the setting value is not applied immediately. The new value is applied at a positioning start (Bit 4 of Controlword is turned on) after Target reached is once turned on. The following table shows the bit of Positioning option code (60F2h) and the setting of [Pr. PT03].

Bit 7	Bit 6	[Pr. PT03]	Rotation direction definition for the axis of rotation
0	0	_ 0 _ _	The servo motor rotates to the target position in a direction specified with a sign of the position data.
0	1	_ 2 _ _	The servo motor rotates in the address decreasing direction regardless of the sign of the position data.
1	0	_ 3 _ _	The servo motor rotates in the address increasing direction regardless of the sign of the position data.
1	1	_ 1 _ _	The servo motor rotates from the current position to the target position in the shorter direction. If the distances from the current position to the target position are the same for CCW and CW, the servo motor rotates in the CCW direction.

(3) Sequence

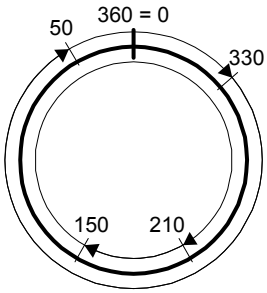
The following shows the operation patterns corresponding to the settings of Positioning option code (60F2h).

(a) When POL is disabled ([Pr. PA14] = 0)



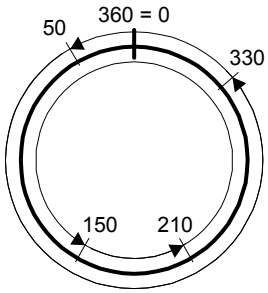
Bit 7: 0
Bit 6: 0

The servo motor rotates in a direction specified with a sign of the position data.



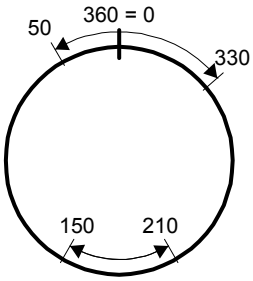
Bit 7: 0
Bit 6: 1

The servo motor rotates only in the address decreasing direction.



Bit 7: 1
Bit 6: 0

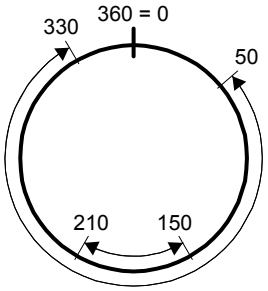
The servo motor rotates only in the address increasing direction.



Bit 7: 1
Bit 6: 1

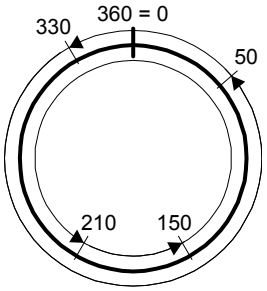
The servo motor rotates in the shorter direction.

(b) When POL is enabled ([Pr. PA14] = 1)



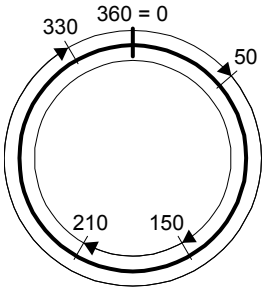
Bit 7: 0
Bit 6: 0

The servo motor rotates in a direction specified with a sign of the position data.



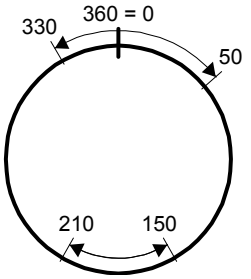
Bit 7: 0
Bit 6: 1

The servo motor rotates only in the address decreasing direction.



Bit 7: 1
Bit 6: 0

The servo motor rotates only in the address increasing direction.



Bit 7: 1
Bit 6: 1

The servo motor rotates in the shorter direction.

MEMO

6. MANUFACTURER FUNCTIONS

6.1 Object for status monitor

The monitor data as the manufacturer functions can be checked with the objects in the following table.

Index	Sub	Object	Name	Data Type	Access	Default	Description
2B01h		VAR	Monitor 1 Cumulative feedback pulses	I32	rw		Cumulative feedback pulses (Unit: pulse) Cleared by writing "00001EA5h".
2B02h		VAR	Monitor 2 Servo motor speed	I32	ro		Servo motor speed (Unit: r/min)
2B03h		VAR	Monitor 3 Droop pulse	I32	ro		Droop pulses (Unit: pulse)
2B04h		VAR	Monitor 4 Cumulative command pulses	I32	ro		Cumulative command pulses (Unit: pulse) Cleared by writing "00001EA5h".
2B05h		VAR	Monitor 5 Command pulse frequency	I32	ro		Command pulse frequency (Unit: kpulse/s)
2B08h		VAR	Monitor 8 Regenerative load ratio	U16	ro		Regenerative load ratio (Unit: %)
2B09h		VAR	Monitor 9 Effective load ratio	U16	ro		Effective load ratio (Unit: %)
2B0Ah		VAR	Monitor 10 Peak load ratio	U16	ro		Peak load ratio (Unit: %)
2B0Bh		VAR	Monitor 11 Instantaneous torque	I16	ro		Instantaneous torque (Unit: %)
2B0Ch		VAR	Monitor 12 Within one-revolution position	I32	ro		Position within one-revolution (Unit: pulse)
2B0Dh		VAR	Monitor 13 ABS counter	I32	ro		ABS counter (Unit: rev)
2B0Eh		VAR	Monitor 14 Load to motor inertia ratio	U16	ro		Load to motor inertia ratio (Unit: 0.1 times)
2B0Fh		VAR	Monitor 15 Bus voltage	U16	ro		Bus voltage (Unit: V)
2B10h		VAR	Monitor 16 Load side encoder cumulative feedback pulses	I32	ro		Load-side encoder cumulative feedback pulses (Unit: pulse)
2B11h		VAR	Monitor 17 Load side encoder droop pulses	I32	ro		Load-side encoder droop pulses (Unit: pulse)
2B12h		VAR	Monitor 18 Load side encoder information 1	I32	ro		Load-side encoder information 1 (Unit: pulse)
2B13h		VAR	Monitor 19 Load side encoder information 2	I32	ro		Load-side encoder information 2 (Unit: rev)
2B17h		VAR	Monitor 23 Temperature of motor thermistor	I16	ro		Temperature of servo motor thermistor (Unit: °C)
2B18h		VAR	Monitor 24 Motor side cumulative F/B pulses (Before Gear)	I32	ro		Servo motor-side cumulative feedback pulses (before gear) (Unit: pulse)
2B19h		VAR	Monitor 25 Electrical angle	I32	ro		Electrical angle (Unit: pulse)
2B23h		VAR	Monitor 35 Motor/load side position deviation	I32	ro		Servo motor-side/load-side position deviation (Unit: pulse)
2B24h		VAR	Monitor 36 Motor/load side speed deviation	I32	ro		Servo motor-side/load-side speed deviation (Unit: r/min)

Index	Sub	Object	Name	Data Type	Access	Default	Description
2B25h		VAR	Monitor 37 Internal temperature of encoder	I16	ro		Internal temperature of encoder (Unit: °C)
2B26h		VAR	Monitor 38 Settling time	I16	ro		Settling time (Unit: ms)
2B27h		VAR	Monitor 39 Oscillation detection frequency	I16	ro		Oscillation detection frequency (Unit: Hz)
2B28h		VAR	Monitor 40 Number of tough drive operations	U32	ro		Number of tough drive operations (Unit: time)
2B2Dh		VAR	Monitor 45 Unit power consumption	I16	ro		Unit power consumption (Unit: W)
2B2Eh		VAR	Monitor 46 Unit total power consumption	I32	ro		Unit total power consumption (Unit: Wh)

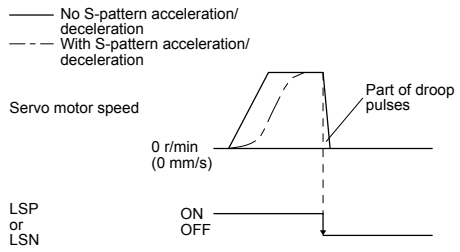
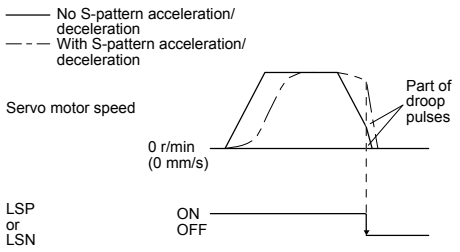
6.2 Incremental counter

To protect the operation when a PDO communication error occurs, the incremental counter can be used in the DC mode. When an incremental counter object has been mapped in the PDO communication, the detection of [AL. 86.2 Network communication error 2] is enabled. Increment the incremental counter (download) on the master (controller) per communication cycle. When incremental counter objects are mapped to RxPDO and TxPDO, the slave (servo amplifier) sends the sum of the received incremental counter value and 1. Detect an incremental counter update error on the master side (controller) as necessary.
The incremental counter value is an unsigned integer from 0 to 255 and added per send/receive of the PDO communication. The value returns to 0 when exceeding 255.

Index	Sub	Object	Name	Data Type	Default	Description
2D23h		VAR	Watch dog counter DL	U8		Incremental counter (download)
2D24h		VAR	Watch dog counter UL	U8		Incremental counter (upload)

6.3 Stroke end

When LSP (Forward rotation stroke end) or LSN (Reverse rotation stroke end) is turned off, a slow stop is performed by either of the following stop methods.
In the cyclic synchronous position mode (csp), stop the command when the stroke end is detected. When the command position exceeds by 30 bits from the position where the stroke end is detected, [AL. 69 Command error] occurs.
When [AL. 69 Command error] has occurred, the home position is erased. Perform a home position return again.

Operation status		Remark
During rotation at constant speed	During deceleration to a stop	
		Travels for the droop pulse portion and stops the servo motor. A difference will be generated between the command position and the current position. Perform a home position return again.

Perform a return as follows when the stroke end is detected.

Mode	Return method
Cyclic synchronous position mode (csp)	After following up Target position (607Ah) with Position actual value (6061h), change the direction opposite to the limit. Check that Bit 12 of Statusword (6041h) is 0 before performing the return.
Cyclic synchronous velocity mode (csv)	Input the speed command of the direction opposite to the limit to Target velocity (60FFh). Check that Bit 12 of Statusword (6041h) is 0 before performing the return.
Profile position mode (pp)	Input the position command of the direction opposite to the limit to Target position (607Ah).
Profile velocity mode (pv)	Input the speed command of the direction opposite to the limit to Target velocity (60FFh).

6.4 Definition of alarm-related objects

Whether an alarm occurs or not in the slave (servo amplifier) can be detected on the master (controller) with Bit 3 and Bit 7 of Statusword in the PDO communication. The alarm history of the latest alarm and 15 alarms that have occurred can be referred to by acquiring the following related object values in the SDO communication.

Index	Sub	Object	Name	Data Type	Access	Description
2A00h	0	ARRAY	Alarm history newest	U8	ro	Refer to section 7.3.5 (1).
	1		Alarm No.	U32	ro	
	2		Alarm time (Hour)	U32	ro	
2A01h	0	ARRAY	Alarm history 1	U8	ro	Refer to section 7.3.5 (2).
	1		Alarm No.	U32	ro	
	2		Alarm time (Hour)	U32	ro	
:	:	:	:	:	:	
2A0Fh	0	ARRAY	Alarm history 15	U8	ro	
	1		Alarm No.	U32	ro	
	2		Alarm time (Hour)	U32	ro	
2A40h		VAR	Clear alarm history	U16	wo	Refer to section 7.3.5 (3).
2A41h		VAR	Current alarm	U32	ro	Refer to section 7.3.5 (4).
2A44h	0	VAR	Parameter error number	U16	ro	Refer to section 7.3.5 (5).
2A45h	0	ARRAY	Parameter error list	U8	ro	Refer to section 7.3.5 (6).
	1		(No.1)	U16	ro	
	:		:	:	:	
	254		(No.254)	U16	ro	

6.5 Parameter object

6.5.1 Definition of parameter objects

The parameter of the servo amplifier can be changed on the master (controller) by writing values to the following objects in the SDO communication. However, once the power supply is shut off, the changed setting is not held at the next startup. To hold the changed setting even after the power supply is shut-off, save the parameter setting value to EEP-ROM using Store Parameters (1010h).
To change the setting of the parameters where the changes are reflected by cycling the power (parameters whose symbols are preceded by **), change the value of the corresponding object and execute Store Parameters (1010h) before cycling the power. Refer to chapter 5 of "MR-J4-_TM_ Servo Amplifier Instruction Manual" for "**" of the parameter symbol. The following table lists the related objects.

Index	Sub	Object	Name	Data Type	Access	Description
2001h		VAR	PA01	I32	rw	[Pr. PA_ _] group
:	:	:	:	:	:	
2020h		VAR	PA32	I32	rw	
2081h		VAR	PB01	I32	rw	[Pr. PB_ _] group
:	:	:	:	:	:	
20C0h		VAR	PB64	I32	rw	
2101h		VAR	PC01	I32	rw	[Pr. PC_ _] group
:	:	:	:	:	:	
2150h		VAR	PC80	I32	rw	
2181h		VAR	PD01	I32	rw	[Pr. PD_ _] group
:	:	:	:	:	:	
21B0h		VAR	PD48	I32	rw	
2201h		VAR	PE01	I32	rw	[Pr. PE_ _] group
:	:	:	:	:	:	
2240h		VAR	PE64	I32	rw	
2281h		VAR	PF01	I32	rw	[Pr. PF_ _] group
:	:	:	:	:	:	
22C0h		VAR	PF48	I32	rw	
2401h		VAR	PL01	I32	rw	[Pr. PL_ _] group
:	:	:	:	:	:	
2430h		VAR	PL48	I32	rw	
2481h		VAR	PT01	I32	rw	[Pr. PT_ _] group
:	:	:	:	:	:	
24D0h		VAR	PT80	I32	rw	
2581h		VAR	PN01	I32	rw	[Pr. PN_ _] group
:	:	:	:	:	:	
25A0h		VAR	PN32	I32	rw	

6.5.2 Enabling parameters

The parameters whose symbols are preceded by "*" are enabled by the following operations. Refer to chapter 5 in "MR-J4-_TM_ Servo Amplifier Instruction Manual" for the parameters with "*". Refer to chapter 5 of "MR-J4-_TM_ Servo Amplifier Instruction Manual" for "*" of the parameter symbol.

(1) Network communication reset
A parameter is enabled when the EtherCAT state shifts from the Operational state to another state. Refer to section 1.4.4 for the procedure of network disconnection.

(2) Enabling a parameter with a parameter enabling object
A parameter is enabled by writing "1EA5h" to User parameter configuration (2D34h). This operation can be performed only when the EtherCAT state is the Pre-Operational state. The parameter enabling processing requires a maximum of about 100 ms. The following table shows the read values of User parameter configuration (2D34h). By checking the read value, the completion of the parameter enabling processing can be checked.

Value	Description
0	Parameter enabling processing is being executed.
1	Parameter enabling processing is not being executed. (The processing is completed.)

6.6 Scale measurement function

POINT
●This is available with servo amplifiers with software version B0 or later.

Refer to section 17.1 of "MR-J4-_TM_ Servo Amplifier Instruction Manual" for the scale measurement function. Position information of a scale measurement encoder can be obtained with the following objects.

(1) Related object

Index	Sub	Object	Name	Data Type	Access	Default	Description
2D38h	0	VAR	Scale measurement encoder resolution	U32	ro		Refer to section 7.3.7 (31).
2D36h	0	VAR	Scale cycle counter	U32	ro		Refer to section 7.3.7 (29).
2D37h	0	VAR	Scale ABS counter	I32	ro		Refer to section 7.3.7 (30).
2D3Ch	0	VAR	Scale measurement encoder alarm	U32	ro		Refer to section 7.3.7 (32).
2D35h	0	ARRAY	Encoder status	U8	ro	2	Refer to section 7.3.7 (28).
	1		Encoder status1	U32	ro		
	2		Encoder status2				

(2) Method for calculating a scale measurement encoder position
Calculate the position of a scale measurement encoder in the following formula.

Scale position = (2D37h (Scale ABS counter) × 2D38h (Scale measurement encoder resolution)) + 2D36h (Scale cycle counter)

6.7 One-touch tuning

> POINT
>
> ●One-touch tuning via a network is available with servo amplifiers with software version B0 or later.

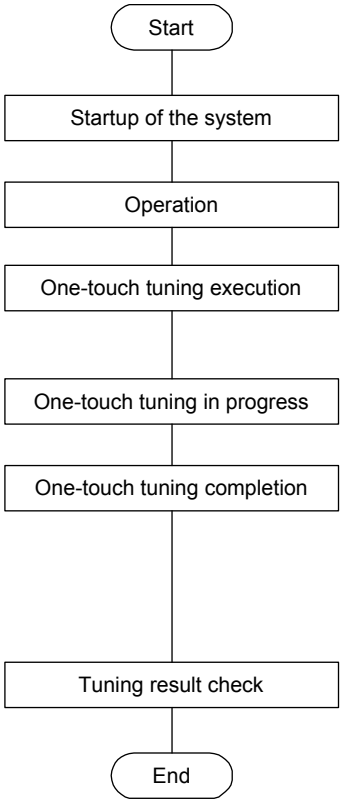
Refer to section 6.2 of "MR-J4-_TM_ Servo Amplifier Instruction Manual" for one-touch tuning. Using One-touch tuning mode (2D50h) allows one-touch tuning from a controller.

(1) Related object

Index	Sub	Object	Name	Data Type	Access	Default	Description
2D50h		VAR	One-touch tuning mode	U8	rw	0	One-touch tuning command Setting a value of "1" to "3" starts one-touch tuning. After one-touch tuning is completed, the setting value automatically changes to "0". 0: During one-touch tuning stop 1: Basic mode 2: High mode 3: Low mode
2D51h		VAR	One-touch tuning status	I8	ro	0	One-touch tuning status Regardless of whether one-touch tuning is properly completed or not, the setting value changes to 100% at the completion. Unit: %
2D52h		VAR	One-touch tuning Stop	U16	wo	0	One-touch tuning stop command Writing "1EA5h" stops one-touch tuning. Writing a value other than "1EA5h" sets 0609 0030h Value range of parameter exceeded in SDO Abort Code.
2D53h		VAR	One-touch tuning Clear	U16	wo	0	The parameter changed in one-touch tuning can be returned to the value before the change. 0000h: Restores the initial value. 0001h: Restores the value before one-touch tuning. The setting value of the restored parameter is stored to the EEP-ROM.
2D54h		VAR	One-touch tuning Error Code	U16	ro	0	One-touch tuning error code 0000h: Finished normally C000h: Tuning canceled C001h: Overshoot exceeded C002h: Servo-off during tuning C003h: Control mode error C004h: Time-out C005h: Load to motor inertia ratio misestimated C00Fh: One-touch tuning disabled

(2) Procedure of one-touch tuning via a network

Perform one-touch tuning via a network in the following procedure.



Refer to chapter 4 of "MR-J4-_TM_ Servo Amplifier Instruction Manual" to start the system.

Rotate the servo motor with a controller. (One-touch tuning cannot be performed if the servo motor is not operating.)

Write a value corresponding to the response mode (High mode, basic mode, or Low mode) to perform in One-touch tuning mode (2D50h) during servo motor driving to perform one-touch tuning.

Gains and filters will be adjusted automatically. During one-touch tuning, the progress can be checked with One-touch tuning status (2D51h).

Check whether one-touch tuning is completed normally with One-touch tuning Error Code (2D54h). When one-touch tuning is completed normally, the parameters will be set automatically. Refer to section 6.2 of "MR-J4-_TM_ Servo Amplifier Instruction Manual" for the parameters that are set automatically.

After a tuning error is returned, take the appropriate action according to section 6.2.2 (4) of "MR-J4-_TM_ Servo Amplifier Instruction Manual".

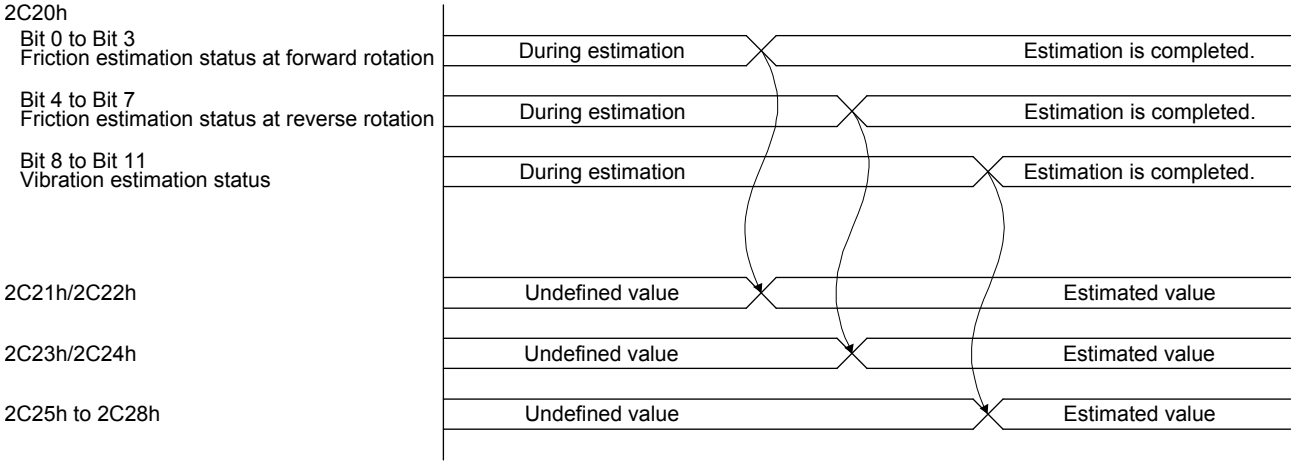
Check the tuning result.

If the tuning result is not satisfactory, you can return the parameter to the value before the one-touch tuning or the initial value using One-touch tuning Clear (2D53h).

6.8 Machine diagnosis function

POINT
●The machine diagnosis function via a network is available with servo amplifiers with software version B0 or later.

This function estimates the friction and vibrational component of the drive system in the equipment based on the data in the servo amplifier, and recognizes an error in the machine parts, including a ball screw and bearing. The information of the machine diagnosis function can be obtained with the following objects.



Index	Sub	Object	Name	Data Type	Access	Default	Description
2C20h		VAR	Machine diagnostic status	U16	ro		Machine diagnostic status Refer to section 7.3.7 (3).
2C21h		VAR	Coulomb friction torque in positive direction	I16	ro		Static friction at forward rotation torque Static friction at forward rotation torque is returned in increments of 0.1%.
2C22h		VAR	Friction torque at rated speed in positive direction	I16	ro		Kinetic friction at forward rotation torque (at rated speed) Kinetic friction at forward rotation torque at the rated speed is returned in increments of 0.1%.
2C23h		VAR	Coulomb friction torque in negative direction	I16	ro		Static friction at reverse rotation torque Static friction at reverse rotation torque is returned in increments of 0.1%.
2C24h		VAR	Friction torque at rated speed in negative direction	I16	ro		Kinetic friction at reverse rotation torque (at rated speed) Kinetic friction at reverse rotation torque at the rated speed is returned in increments of 0.1%.
2C25h		VAR	Oscillation frequency during motor stop	I16	ro		Vibration frequency at stop/servo-lock Vibration frequency during stop/servo-lock is returned in increments of 1 Hz.
2C26h		VAR	Vibration level during motor stop	I16	ro		Vibration level at stop/servo-lock Vibration level during stop/servo-lock is returned in increments of 0.1%.
2C27h		VAR	Oscillation frequency during motor operating	I16	ro		Vibration frequency during operation Vibration frequency during operation is returned in increments of 1 Hz.
2C28h		VAR	Vibration level during motor operating	I16	ro		Vibration level during operation Vibration level during operation is returned in increments of 0.1%.

6.9 Servo amplifier life diagnosis function

> POINT
>
> ●The servo amplifier life diagnosis function via a network is available with servo amplifiers with software version B0 or later.

You can check the cumulative energization time and the number of on/off times of the inrush relay based on the data in the servo amplifier. This function gives an indication of the replacement time for parts of the servo amplifier including a capacitor and a relay before they malfunction. The information of the servo amplifier life diagnosis function can be obtained with the following objects.

Index	Sub	Object	Name	Data Type	Access	Default	Description
2C18h		VAR	Power ON cumulative time	U32	ro		The cumulative energization time of the servo amplifier is returned.
2C19h		VAR	Inrush relay ON/OFF number	U32	ro		The number of on/off times of the inrush relay of the servo amplifier is returned.

7. OBJECT DICTIONARY

7.1 Store Parameters

POINT
●Before shutting off the power after executing Store Parameters, always check that parameters are not being saved (bit 0 is on).

For the objects that can be saved, write "65766173h" (= reverse order of the ASCII code of "save") to the corresponding sub object of Store Parameters (1010h) to store the object in the EEP-ROM of the servo amplifier.
The value saved in the EEP-ROM is set to the object at the next power-on. For the parameters, the setting can also be changed through the object dictionary. However the new setting is not automatically written to the EEP-ROM. To write the new setting, use the Store Parameters (1010h).
Executing Store Parameters (1010h) takes about a maximum of 10s because all parameters are written at the same time. Be careful not to shut off the power during writing.

Index	Sub	Object	Name	Data Type	Access	Description
1010h	0	ARRAY	Store Parameters	U8	ro	Number of entries
	1		Save all parameters	U32	rw	Saves all parameters. Writing "save" (= 65766173h) saves all the objects which can be stored in EEP-ROM.
	2 (Not supported) (Note)		Save communication parameters	U32	rw	Saves communication parameters. Writing "save" (= 65766173h) saves the communication objects (objects in the 1000s) in EEP-ROM.
	3 (Not supported) (Note)		Save application parameters	U32	rw	Saves application parameters. Writing "save" (= 65766173h) saves the objects which can be saved in EEP-ROM except for the communication objects (objects in the 1000s).

Note. This is not supported by the MR-J4-_TM_ servo amplifier.

The following values are read from this object. When a parameter is being saved, "0" is read. When no parameter is being saved, "1" is read.

Bit	Description
0	0: The parameter cannot be saved with the command. (A parameter is being saved.) 1: The parameter can be saved with the command. (No parameter is being saved.)
1	0: The parameter is not automatically saved.

7.2 Supported object dictionary list

Group	Name	Index
General Objects	Device Type	1000h
	Error Register	1001h
	Pre-defined error field	1003h
	Manufacturer Device Name	1008h
	Manufacturer Hardware Version	1009h
	Manufacturer Software Version	100Ah
	Store parameters	1010h
	Restore default parameters	1011h
	Identity Object	1018h
	Error Settings	10F1h
PDO Mapping Objects	Receive PDO Mapping	1600h to 1603h
	Transmit PDO Mapping	1A00h to 1A03h
Sync Manager Communication Objects	Sync Manager Communication Type	1C00h
	Sync Manager RxPDO assign	1C12h
	Sync Manager TxPDO assign	1C13h
	SM output parameter	1C32h
	SM input parameter	1C33h
Parameter Objects	PA_ _	2001h to 2020h
	PB_ _	2081h to 20C0h
	PC_ _	2101h to 2150h
	PD_ _	2181h to 21B0h
	PE_ _	2201h to 2240h
	PF_ _	2281h to 22C0h
	PL_ _	2401h to 2430h
	PT_ _	2481h to 24D0h
	PN_ _	2581h to 25A0h
Alarm Objects	Alarm history newest	2A00h
	Alarm history _	2A01h to 2A0Fh
	Clear alarm history	2A40h
	Current alarm	2A41h
	Parameter error number	2A44h
	Parameter error list	2A45h
Monitor Objects	Cumulative feedback pulses	2B01h
	Servo motor speed	2B02h
	Droop pulses	2B03h
	Cumulative command pulses	2B04h
	Command pulse frequency	2B05h
	Regenerative load ratio	2B08h
	Effective load ratio	2B09h
	Peak load ratio	2B0Ah
	Instantaneous torque	2B0Bh
	Within one-revolution position	2B0Ch
	ABS counter	2B0Dh
	Load inertia moment ratio	2B0Eh
	Bus voltage	2B0Fh
	Load-side cumulative feedback pulses	2B10h
	Load-side droop pulses	2B11h
	Load-side encoder information 1 Z-phase counter	2B12h
	Load-side encoder information 2	2B13h
	Temperature of motor thermistor	2B17h
	Motor-side cumu. feedback pulses (before gear)	2B18h
	Electrical angle	2B19h

Group	Name	Index
Monitor Objects	Motor-side/load-side position deviation	2B23h
	Motor-side/load-side speed deviation	2B24h
	Internal temperature of encoder	2B25h
	Settling time	2B26h
	Oscillation detection frequency	2B27h
	Number of tough drive operations	2B28h
	Unit power consumption	2B2Dh
	Unit total power consumption	2B2Eh
	Alarm Monitor 1 Cumulative feedback pulses	2B81h
	Alarm Monitor 2 Servo motor speed	2B82h
	Alarm Monitor 3 Droop pulses	2B83h
	Alarm Monitor 4 Cumulative command pulses	2B84h
	Alarm Monitor 5 Command pulse frequency	2B85h
	Alarm Monitor 8 Regenerative load ratio	2B88h
	Alarm Monitor 9 Effective load ratio	2B89h
	Alarm Monitor 10 Peak load ratio	2B8Ah
	Alarm Monitor 11 Instantaneous torque	2B8Bh
	Alarm Monitor 12 Within one-revolution position	2B8Ch
	Alarm Monitor 13 ABS counter	2B8Dh
	Alarm Monitor 14 Load inertia moment ratio	2B8Eh
	Alarm Monitor 15 Bus voltage	2B8Fh
	Alarm Monitor 16 Load-side cumulative feedback pulses	2B90h
	Alarm Monitor 17 Load-side droop pulses	2B91h
	Alarm Monitor 18 Load-side encoder information 1 Z-phase counter	2B92h
	Alarm Monitor 19 Load-side encoder information 2	2B93h
	Alarm Monitor 23 Temperature of motor thermistor	2B97h
	Alarm Monitor 24 Motor-side cumu. feedback pulses (before gear)	2B98h
	Alarm Monitor 25 Electrical angle	2B99h
	Alarm Monitor 35 Motor-side/load-side position deviation	2BA3h
	Alarm Monitor 36 Motor-side/load-side speed deviation	2BA4h
	Alarm Monitor 37 Internal temperature of encoder	2BA5h
	Alarm Monitor 38 Settling time	2BA6h
	Alarm Monitor 39 Oscillation detection frequency	2BA7h
	Alarm Monitor 40 Number of tough drive operations	2BA8h
	Alarm Monitor 45 Unit power consumption	2BADh
	Alarm Monitor 46 Unit total power consumption	2BAEh
Manufacturer Specific Control Objects	Power ON cumulative time	2C18h
	Inrush relay ON/OFF number	2C19h
	Machine diagnostic status	2C20h
	Coulomb friction torque in positive direction	2C21h
	Friction torque at rated speed in positive direction	2C22h
	Coulomb friction torque in negative direction	2C23h
	Friction torque at rated speed in negative direction	2C24h
	Oscillation frequency during motor stop	2C25h
	Vibration level during motor stop	2C26h
	Oscillation frequency during motor operating	2C27h
	Vibration level during motor operating	2C28h
	Control DI 1	2D01h
	Control DI 2	2D02h
	Control DI 3	2D03h
	Status DO 1	2D11h
	Status DO 2	2D12h

Group	Name	Index
Manufacturer Specific Control Objects	Status DO 3	2D13h
	Status DO 5	2D15h
	Velocity limit value	2D20h
	Watch dog counter DL	2D23h
	Watch dog counter UL	2D24h
	Motor rated speed	2D28h
	Manufacturer Device Name 2	2D30h
	Manufacturer Hardware Version 2	2D31h
	Manufacturer Software Version 2	2D32h
	Serial Number 2	2D33h
	User parameter configuration	2D34h
	Encoder status	2D35h
	Scale cycle counter	2D36h
	Scale ABS counter	2D37h
	Scale measurement encoder resolution	2D38h
	Scale measurement encoder alarm	2D3Ch
	One-touch tuning mode	2D50h
	One-touch tuning status	2D51h
	One-touch tuning Stop	2D52h
	One-touch tuning Clear	2D53h
	One-touch tuning Error Code	2D54h
PDS Control Objects	Error code	603Fh
	Controlword	6040h
	Statusword	6041h
	Quick stop option code	605Ah
	Halt option code	605Dh
	Modes of operation	6060h
	Modes of operation display	6061h
	Supported drive modes	6502h
Position Control Function Objects	Position actual internal value	6063h
	Position actual value	6064h
	Following error window	6065h
	Following error time out	6066h
	Position window	6067h
	Position window time	6068h
	Positioning option code	60F2h
	Following error actual value	60F4h
	Control effort	60FAh
Profile Velocity Mode Objects	Velocity demand value	606Bh
	Velocity actual value	606Ch
	Velocity window	606Dh
	Velocity window time	606Eh
	Velocity threshold	606Fh
	Velocity threshold time	6070h
	Target velocity	60FFh
Profile Torque Mode Objects	Target torque	6071h
	Max torque	6072h
	Torque demand value	6074h
	Torque actual value	6077h
	Torque slope	6087h
	Torque profile type	6088h
	Positive torque limit value	60E0h
	Negative torque limit value	60E1h

Group	Name	Index
Profile Position Mode Objects	Target position	607Ah
	Position range limit	607Bh
	Software position limit	607Dh
	Max profile velocity	607Fh
	Max motor speed	6080h
	Profile velocity	6081h
	Profile acceleration	6083h
	Profile deceleration	6084h
	Quick stop deceleration	6085h
	Motion profile type	6086h
Homing Mode Objects	Home offset	607Ch
	Homing method	6098h
	Homing speeds	6099h
	Homing acceleration	609Ah
	Supported homing method	60E3h
Factor Group Objects	Polarity	607Eh
	Position encoder resolution	608Fh
	Gear ratio	6091h
	Feed constant	6092h
	SI unit position	60A8h
	SI unit velocity	60A9h
Touch Probe Function Objects	Touch probe function	60B8h
	Touch probe status	60B9h
	Touch probe pos1 pos value	60BAh
	Touch probe pos1 neg value	60BBh
	Touch probe pos2 pos value	60BCh
	Touch probe pos2 neg value	60BDh
Optional application FE Objects	Digital inputs	60FDh

7.3 Object dictionary

This section describes the details of the object dictionary for each group.
The following is shown in the "Access" column.
"ro": Only reading is available.
"rw": Reading and writing are available.

"Impossible": The data is not saved to the EEP-ROM. The value of the data written from the controller returns to the value of "Default" when the power is shut off.
"Possible": The data can be saved to the EEP-ROM with Store Parameters (1010h). The data is saved in the parameter corresponding to the object. For the corresponding parameters, refer to "Parameter".

7.3.1 General Objects

(1) Device Type (1000h)

Index	Sub	Name	Data Type	Access	PDO Mapping
1000h	0	Device Type	UNSIGNED32	ro	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
1000h	0	00020192h	00020192h to 00020192h		Impossible	

The value "00020192h", which indicates a servo drive defined with the CiA 402 profile, is returned.

(2) Error Register (1001h)

Index	Sub	Name	Data Type	Access	PDO Mapping
1001h	0	Error Register	UNSIGNED8	ro	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
1001h	0		00h to 01h		Impossible	

The error occurrence is returned.

bit	Description
0	Turns on when an alarm has occurred.
1	Unused
2	Unused
3	Unused
4	Unused
5	Unused
6	Unused
7	Unused

(3) Pre-defined error field (1003h)

Index	Sub	Name	Data Type	Access	PDO Mapping
1003h	0	Pre-defined error field	UNSIGNED8	rw	Impossible
	1	Standard error field 1	UNSIGNED32	ro	
	2	Standard error field 2			
	3	Standard error field 3			
	4	Standard error field 4			
	5	Standard error field 5			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
1003h	0	0	00h to 05h		Impossible	
	1		00000000h or 00001000h			
	2					
	3					
	4					
	5					

The error history that occurred after the power-on is returned. Up to five errors can be stored. Standard error field 1 is the latest error, and Standard error field 5 is the oldest error. The error number is as follows.

Error number	Description
00001000h	Generic error

(4) Manufacturer Device Name (1008h)

Index	Sub	Name	Data Type	Access	PDO Mapping
1008h	0	Manufacturer Device Name	VISIBLE STRING	ro	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
1008h	0				Impossible	

The model name of the MR-J4-_TM_ servo amplifier is returned.

(5) Manufacturer Hardware Version (1009h)

Index	Sub	Name	Data Type	Access	PDO Mapping
1009h	0	Manufacturer Hardware Version	VISIBLE STRING	ro	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
1009h	0				Impossible	

The hardware version of the EtherCAT network module is returned. Refer to Manufacturer Hardware Version 2 (2D31h) for the hardware version of the MR-J4-_TM_ servo amplifier.

(6) Manufacturer Software Version (100Ah)

Index	Sub	Name	Data Type	Access	PDO Mapping
100Ah	0	Manufacturer Software Version	VISIBLE STRING	ro	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
100Ah	0				Impossible	

The software version of the EtherCAT network module is returned. Refer to Manufacturer Software Version 2 (2D32h) for the software version of the MR-J4-_TM_ servo amplifier.

(7) Store parameters (1010h)

Index	Sub	Name	Data Type	Access	PDO Mapping
1010h	0	Store parameters	UNSIGNED8	ro	Impossible
	1	Save all parameters	UNSIGNED32	rw	
	2 (Not supported) (Note)	Save communication parameters			
	3 (Not supported) (Note)	Save application parameters			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
1010h	0	3	03h		Impossible	
	1	00000001h	Refer to the following table.			
	2 (Not supported) (Note)					
	3 (Not supported) (Note)					

Note. This is not supported by the MR-J4-_TM_ servo amplifier.

Writing "65766173h" (= reverse order of ASCII code of "save") to the corresponding sub object saves an object value in EEP-ROM. The relationship between Sub Index and the saved object is shown below.

Sub	Saved object
1	All objects

Whether saving a parameter has been completed can be checked by reading this object. The read values are as follows.

bit	Description
0	0: The parameter cannot be saved with the command. (A parameter is being saved.) 1: The parameter can be saved with the command. (No parameter is being saved.)
1	0: The parameter is not automatically saved.
2 to 31	Unused

(8) Restore default parameters (1011h)

Index	Sub	Name	Data Type	Access	PDO Mapping
1011h	0	Restore default parameters	UNSIGNED8	ro	Impossible
	1	Restore all default parameters	UNSIGNED32	rw	

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
1011h	0	1	01h		Impossible	
	1	00000001h	Refer to the text.			

The parameter of the servo amplifier can be rewritten with the factory setting. When "64616F6Ch" (= reverse order of ASCII code of "load") is written to Restore all default parameters (1011h: 1) and the power is cycled, the parameter is initialized.

(9) Identity Object (1018h)

Index	Sub	Name	Data Type	Access	PDO Mapping
1018h	0	Identity Object	UNSIGNED8	ro	Impossible
	1	Vendor ID	UNSIGNED32		
	2	Product Code			
	3	Revision Number			
	4	Serial Number			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
1018h	0	4	04h		Impossible	
	1	00000A1Eh	00000A1Eh			
	2	00000201h	00000201h			
	3		00000000h to FFFFFFFFh			
	4					

The following values are returned for each Sub Index.

Sub Index	Description
1	Vendor ID of the MR-J4-_TM_ servo amplifier
2	Model code of the MR-J4-_TM_ servo amplifier
3	Revision number of the MR-J4-_TM_ servo amplifier
4	Serial number of the EtherCAT Network module Refer to Serial Number 2 (2D33h) for the serial number of the MR-J4-_TM_ servo amplifier.

(10) Error Settings (10F1h)

Index	Sub	Name	Data Type	Access	PDO Mapping
10F1h	0	Error Settings	UNSIGNED8	ro	Impossible
	1	Reserved	UNSIGNED32	rw	
	2	Sync Error Counter Limit			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
10F1h	0		02h		Impossible	
	1		00000000h			
	2		00000000h to FFFFFFFFh			

The threshold at which [AL. 86.1] is detected is returned from Sync Error Counter Limit (10F1h: 2). The error counter increments by 3 each time a data loss error occurs at reception. When the error counter exceeds the value of Sync Error Counter Limit (10F1h: 2), an alarm is detected. The value of this object cannot be changed from the controller.

7.3.2 PDO Mapping Objects

(1) Receive PDO Mapping (1600h)

Index	Sub	Name	Data Type	Access	PDO Mapping
1600h	0	Receive PDO Mapping	UNSIGNED8	rw	Impossible
	1	Mapped Object 001	UNSIGNED32		
	▪ ▪ ▪	▪ ▪ ▪			
	32	Mapped Object 032			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
1600h	0	8	00h to 20h (32)		Impossible	
	1	60600008h	00000000h to FFFFFFFFh			
	▪ ▪ ▪	▪ ▪ ▪				
	32	00000000h				

The object to be mapped for RxPDO can be set. Set the number of objects to be mapped for Receive PDO Mapping (1600h: 0). Set the objects to be mapped for Mapped Object 001 (1600h: 1) to Mapped Object 032 (1600h: 32). The following shows the description of Mapped Object 001 (1600h: 1) to Mapped Object 032 (1600h: 32).

Bit	Description
0 to 7	Length of the object to be mapped (Bit unit) (For the gap in PDO, the bit length of the gap)
8 to 15	Sub Index of the object to be mapped (For the gap in PDO, 0)
16 to 31	The index of the object to be mapped (For the gap in PDO, 0)

(2) Receive PDO Mapping (1601h)

Index	Sub	Name	Data Type	Access	PDO Mapping
1601h	0	Receive PDO Mapping	UNSIGNED8	rw	Impossible
	1	Mapped Object 001	UNSIGNED32		
	▪ ▪ ▪	▪ ▪ ▪			
	32	Mapped Object 032			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
1601h	0	0	00h to 20h (32)		Impossible	
	1	00000000h	00000000h to FFFFFFFFh			
	▪ ▪ ▪	▪ ▪ ▪				
	32	00000000h				

The details are the same as those of (1) of this section. Refer to (1) of this section.

(3) Receive PDO Mapping (1602h)

Index	Sub	Name	Data Type	Access	PDO Mapping
1602h	0	Receive PDO Mapping	UNSIGNED8	rw	Impossible
	1	Mapped Object 001	UNSIGNED32		
	▪ ▪ ▪	▪ ▪ ▪			
	32	Mapped Object 032			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
1602h	0	0	00h to 20h (32)		Impossible	
	1	00000000h	00000000h to FFFFFFFFh			
	▪ ▪ ▪	▪ ▪ ▪				
	32	00000000h				

The details are the same as those of (1) of this section. Refer to (1) of this section.

(4) Receive PDO Mapping (1603h)

Index	Sub	Name	Data Type	Access	PDO Mapping
1603h	0	Receive PDO Mapping	UNSIGNED8	rw	Impossible
	1	Mapped Object 001	UNSIGNED32		
	▪ ▪ ▪	▪ ▪ ▪			
	32	Mapped Object 032			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
1603h	0	0	00h to 20h (32)		Impossible	
	1	00000000h	00000000h to FFFFFFFFh			
	▪ ▪ ▪	▪ ▪ ▪				
	32	00000000h				

The details are the same as those of (1) of this section. Refer to (1) of this section.

(5) Transmit PDO Mapping (1A00h)

Index	Sub	Name	Data Type	Access	PDO Mapping
1A00h	0	Transmit PDO Mapping	UNSIGNED8	rw	Impossible
	1	Mapped Object 001	UNSIGNED32		
	▪ ▪ ▪	▪ ▪ ▪			
	32	Mapped Object 032			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
1A00h	0	9	00h to 20h (32)		Impossible	
	1	60610008h	00000000h to FFFFFFFFh			
	▪ ▪ ▪	▪ ▪ ▪				
	32	00000000h				

The object to be mapped for TxPDO can be set. Set the number of objects to be mapped for Transmit PDO Mapping (1A00h: 0). Set the objects to be mapped for Mapped Object 001 (1A00h: 1) to Mapped Object 032 (1A00h: 32). The following shows the description of Mapped Object 001 (1A00h: 1) to Mapped Object 032 (1A00h: 32).

Bit	Description
0 to 7	Length of the object to be mapped (Bit unit) (For the gap in PDO, the bit length of the gap)
8 to 15	Sub Index of the object to be mapped (For the gap in PDO, 0)
16 to 31	The index of the object to be mapped (For the gap in PDO, 0)

(6) Transmit PDO Mapping (1A01h)

Index	Sub	Name	Data Type	Access	PDO Mapping
1A01h	0	Transmit PDO Mapping	UNSIGNED8	rw	Impossible
	1	Mapped Object 001	UNSIGNED32		
	▪ ▪ ▪	▪ ▪ ▪			
	32	Mapped Object 032			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
1A01h	0	0	00h to 20h (32)		Impossible	
	1	00000000h	00000000h to FFFFFFFFh			
	▪ ▪ ▪	▪ ▪ ▪				
	32	00000000h				

The details are the same as those of (5) of this section. Refer to (5) of this section.

(7) Transmit PDO Mapping (1A02h)

Index	Sub	Name	Data Type	Access	PDO Mapping
1A02h	0	Transmit PDO Mapping	UNSIGNED8	rw	Impossible
	1	Mapped Object 001	UNSIGNED32		
	▪ ▪ ▪	▪ ▪ ▪			
	32	Mapped Object 032			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
1A02h	0	0	00h to 20h (32)		Impossible	
	1	00000000h	00000000h to FFFFFFFFh			
	▪ ▪ ▪	▪ ▪ ▪				
	32	00000000h				

The details are the same as those of (5) of this section. Refer to (5) of this section.

(8) Transmit PDO Mapping (1A03h)

Index	Sub	Name	Data Type	Access	PDO Mapping
1A03h	0	Transmit PDO Mapping	UNSIGNED8	rw	Impossible
	1	Mapped Object 001	UNSIGNED32		
	▪ ▪ ▪	▪ ▪ ▪			
	32	Mapped Object 032			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
1A03h	0	0	00h to 20h (32)		Impossible	
	1	00000000h	00000000h to FFFFFFFFh			
	▪ ▪ ▪	▪ ▪ ▪				
	32	00000000h				

The details are the same as those of (5) of this section. Refer to (5) of this section.

7.3.3 Sync Manager Communication Objects

(1) Sync Manager Communication Type (1C00h)

Index	Sub	Name	Data Type	Access	PDO Mapping
1C00h	0	Sync Manager Communication Type	UNSIGNED8	ro	Impossible
	1	Sync Manager 0			
	2	Sync Manager 1			
	3	Sync Manager 2			
	4	Sync Manager 3			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
1C00h	0	4	04h		Impossible	
	1	1	01h			
	2	2	02h			
	3	3	03h			
	4	4	04h			

The information of each Sync Manager is returned. The following shows the description of Sync Manager 0 (1C00h: 1) to Sync Manager 3 (1C00h: 4).

Value	Description
00h	Unused
01h	Received in the mail box (master → slave)
02h	Received in the mail box (slave → master)
03h	Process data output (master → slave)
04h	Process data input (slave → master)

(2) Sync Manager RxPDO assign (1C12h)

Index	Sub	Name	Data Type	Access	PDO Mapping
1C12h	0	Sync Manager RxPDO assign	UNSIGNED8	rw	Impossible
	1	Assigned PDO 001	UNSIGNED16		
	2	Assigned PDO 002			
	3	Assigned PDO 003			
	4	Assigned PDO 004			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
1C12h	0	1	00h to 04h		Impossible	
	1	1600h	1600h to 1603h			
	2					
	3					
	4					

Set the mapping table to be assigned to Sync Manager 2 (RxPDO). Select an object from Receive PDO Mapping (1600h) to Receive PDO Mapping (1603h).

(3) Sync Manager TxPDO assign (1C13h)

Index	Sub	Name	Data Type	Access	PDO Mapping
1C13h	0	Sync Manager TxPDO assign	UNSIGNED8	rw	Impossible
	1	Assigned PDO 001	UNSIGNED16		
	2	Assigned PDO 002			
	3	Assigned PDO 003			
	4	Assigned PDO 004			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
1C13h	0	1	00h to 04h		Impossible	
	1	1A00h	1A00h to 1A03h			
	2					
	3					
	4					

Set the mapping table to be assigned to Sync Manager 3 (TxPDO). Select an object from Transmit PDO Mapping (1A00h) to Transmit PDO Mapping (1A03h).

(4) SM output parameter (1C32h)

Index	Sub	Name	Data Type	Access	PDO Mapping
1C32h	0	SM output parameter	UNSIGNED8	ro	Impossible
	1	Synchronization Type	UNSIGNED16	rw	
	2	Cycle Time	UNSIGNED32		
	3	Shift Time			
	4	Synchronization Types supported	UNSIGNED16	ro	
	5	Minimum Cycle Time	UNSIGNED32		
	6	Calc and Copy Time			
	9	Delay Time			
	12	Cycle Time Too Small	UNSIGNED16		

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
1C32h	0	12	0Ch (12)		Impossible	
	1	0	0000h or 0002h			
	2	4000000	0003D090h (250000) 0007A120h (500000) 000F4240h (1000000) 001E8480h (2000000) 003D0900h (4000000)	ns		
	3	222222	00000000h to FFFFFFFFh			
	4	0025h	0025h (35)			
	5	100000	000186A0h (100000)	ns		
	6	222722	00000000h to FFFFFFFFh			
	9	0	00000000h			
	12	0	0000h			

Set Sync Manager 2 (RxPDO). The description of each Sub Index is as follows.

Sub	Name	Description
0	SM output parameter	The number of entries is returned.
1	Synchronization Type	Set the synchronous mode. 0000h: Free Run (Note 1) 0001h: Synchronous (Not supported) (Note 2) 0002h: DC Sync0 0003h: DC Sync1 (Not supported) (Note 2) The value can be changed in the Pre Operational state. If the value of 1C33h: 1 is changed, the same value as that of 1C33h: 1 is automatically set to this sub index.
2	Cycle Time	Set the RxPDO communication cycle. 250000: 0.25 ms 500000: 0.5 ms 1000000: 1 ms 2000000: 2 ms The PDO communication cycle can be changed by changing the value in the Pre Operational state. Communication cycles other than the above cannot be set. If the value of 1C33h: 2 is changed, the same value as that of 1C33h: 2 is automatically set to this sub index.
3	Shift Time	The delay time from SYNC0 to output is returned. Unit: [ns]
4	Synchronization Types supported	The supported synchronous type is returned. Bit 0: Free Run supported (Note 1) Bit 1: Synchronous supported (Not supported) (Note 2) Bit 4 to Bit 2: DC Type supported 000 = No DC (Not supported) (Note 2) 001 = DC Sync0 010 = DC Sync1 (Not supported) (Note 2) 100 = Subordinated Application with fixed Sync0 (Not supported) (Note 2) Bit 6 to Bit 5: Shift settings 00 = No Output Shift supported (Not supported) (Note 2) 01 = Output Shift with local time 10 = Output Shift with Sync1 (Not supported) (Note 2) Bit 9 to Bit 7: Reserved Bit 10: Delay Time should be measured (Not supported) (Note 2) Bit 11: Delay Time is fix. (Not supported) (Note 2) Bit 13 to Bit 11: Reserved Bit 14: Dynamic Cycle Times (Not supported) (Note 2) Bit 15: Reserved
5	Minimum Cycle Time	The minimum communication cycle is returned. Unit: [ns]
6	Calc and Copy Time	The minimum value of the delay time from data reception to output is returned. The value varies according to the communication cycle setting. Unit: [ns]
9	Delay Time	Not supported (Note 2)
12	Cycle Time Too Small	Not supported (Note 2)

Note 1. If [Pr. PA01] is set to the cyclic synchronous mode (_ _ _ 0 or _ _ _ 1), Free Run cannot be used. Use DC Sync0.
2. This is not supported by the MR-J4-_TM_ servo amplifier.

(5) SM input parameter (1C33h)

Index	Sub	Name	Data Type	Access	PDO Mapping
1C33h	0	SM input parameter	UNSIGNED8	ro	Impossible
	1	Synchronization Type	UNSIGNED16	rw	
	2	Cycle Time	UNSIGNED32		
	3	Shift Time			
	4	Synchronization Types supported	UNSIGNED16	ro	
	5	Minimum Cycle Time	UNSIGNED32		
	6	Calc and Copy Time			
	9	Delay Time			
	12	Cycle Time Too Small	UNSIGNED16		

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
1C33h	0	12	0Ch (12)		Impossible	
	1	0	0000h or 0002h			
	2	4000000	0003D090h (250000) 0007A120h (500000) 000F4240h (1000000) 001E8480h (2000000) 003D0900h (4000000)	ns		
	3	27778	00000000h to FFFFFFFFh			
	4	0025h	0025h (35)			
	5	100000	000186A0h (100000)	ns		
	6	306055	00000000h to FFFFFFFFh			
	9	0	00000000h			
	12	0	0000h			

Set Sync Manager 3 (TxPDO). The description of each Sub Index is as follows.

Sub	Name	Description
0	SM output parameter	The number of entries is returned.
1	Synchronization Type	Set the synchronous mode. 0000h: Free Run (Note 1) 0001h: Synchronous (Not supported) (Note 2) 0002h: DC Sync0 0003h: DC Sync1 (Not supported) (Note 2) The value can be changed in the Pre Operational state. If the value of 1C32h: 1 is changed, the same value as that of 1C32h: 1 is automatically set to this sub index.
2	Cycle Time	Set the TxPDO communication cycle. 250000: 0.25 ms 500000: 0.5 ms 1000000: 1 ms 2000000: 2 ms The PDO communication cycle can be changed by changing the value in the Pre Operational state. Communication cycles other than the above cannot be set. If the value of 1C32h: 2 is changed, the same value as that of 1C32h: 2 is automatically set to this sub index.
3	Shift Time	The delay time from SYNC0 to input is returned. Unit: [ns]
4	Synchronization Types supported	The supported synchronous type is returned. Bit 0: Free Run supported (Note 1) Bit 1: Synchronous supported (Not supported) (Note 2) Bit 4 to Bit 2: DC Type supported 000 = No DC (Not supported) (Note 2) 001 = DC Sync0 010 = DC Sync1 (Not supported) (Note 2) 100 = Subordinated Application with fixed Sync0 (Not supported) (Note 2) Bit 6 to Bit 5: Shift settings 00 = No Output Shift supported (Not supported) (Note 2) 01 = Output Shift with local time 10 = Output Shift with Sync1 (Not supported) (Note 2) Bit 9 to Bit 7: Reserved Bit 10: Delay Time should be measured (Not supported) (Note 2) Bit 11: Delay Time is fix. (Not supported) (Note 2) Bit 13 to Bit 11: Reserved Bit 14: Dynamic Cycle Times (Not supported) (Note 2) Bit 15: Reserved
5	Minimum Cycle Time	The minimum communication cycle is returned. Unit: [ns]
6	Calc and Copy Time	The minimum value of the delay time from input to sending is returned. The value varies according to the communication cycle setting. Unit: [ns]
9	Delay Time	Not supported (Note 2)
12	Cycle Time Too Small	Not supported (Note 2)

Note 1. If [Pr. PA01] is set to the cyclic synchronous mode (_ _ _ 0 or _ _ _ 1), Free Run cannot be used. Use DC Sync0.
2. This is not supported by the MR-J4-_TM_ servo amplifier.

7.3.4 Parameter Objects

(1) Parameter Objects PA (2001h to 2020h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2001h	0	PA01	INTEGER32	rw	Impossible
▪ ▪ ▪		▪ ▪ ▪			
2020h		PA32			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2001h	0		Refer to "MR-J4-_TM_ Servo Amplifier Instruction Manual".		Possible	PA01
▪ ▪ ▪		▪ ▪ ▪				▪ ▪ ▪
2020h						PA32

The value of the basic setting parameters ([Pr. PA_ _]) can be obtained and set.

(2) Parameter Objects PB (2081h to 20C0h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2081h	0	PB01	INTEGER32	rw	Impossible
▪ ▪ ▪		▪ ▪ ▪			
20C0h		PB64			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2081h	0		Refer to "MR-J4-_TM_ Servo Amplifier Instruction Manual".		Possible	PB01
▪ ▪ ▪		▪ ▪ ▪				▪ ▪ ▪
20C0h						PB64

The value of the gain/filter setting parameters ([Pr. PB_ _]) can be obtained and set.

(3) Parameter Objects PC (2101h to 2150h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2101h	0	PC01	INTEGER32	rw	Impossible
▪ ▪ ▪		▪ ▪ ▪			
2150h		PC80			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2101h	0		Refer to "MR-J4-_TM_ Servo Amplifier Instruction Manual".		Possible	PC01
▪ ▪ ▪		▪ ▪ ▪				▪ ▪ ▪
2150h						PC80

The value of the extension setting parameters ([Pr. PC_ _]) can be obtained and set.

(4) Parameter Objects PD (2181h to 21B0h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2181h	0	PD01	INTEGER32	rw	Impossible
▪ ▪ ▪		▪ ▪ ▪			
21B0h		PD48			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2181h	0		Refer to "MR-J4-_TM_ Servo Amplifier Instruction Manual".		Possible	PD01
▪ ▪ ▪		▪ ▪ ▪				▪ ▪ ▪
21B0h						PD48

The value of the I/O setting parameters ([Pr. PD_ _]) can be obtained and set.

(5) Parameter Objects PE (2201h to 2240h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2201h	0	PE01	INTEGER32	rw	Impossible
▪ ▪ ▪		▪ ▪ ▪			
2240h		PE64			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2201h	0		Refer to "MR-J4-_TM_ Servo Amplifier Instruction Manual".		Possible	PE01
▪ ▪ ▪		▪ ▪ ▪				▪ ▪ ▪
2240h						PE64

The value of the extension setting 2 parameters ([Pr. PE_ _]) can be obtained and set.

(6) Parameter Objects PF (2281h to 22C0h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2281h	0	PF01	INTEGER32	rw	Impossible
▪ ▪ ▪		▪ ▪ ▪			
22C0h		PF64			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2281h	0		Refer to "MR-J4-_TM_ Servo Amplifier Instruction Manual".		Possible	PF01
▪ ▪ ▪		▪ ▪ ▪				▪ ▪ ▪
22C0h						PF64

The value of the extension setting 3 parameters ([Pr. PF_ _]) can be obtained and set.

(7) Parameter Objects PL (2401h to 2430h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2401h	0	PL01	INTEGER32	rw	Impossible
▪ ▪ ▪		▪ ▪ ▪			
2430h		PL48			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2401h	0		Refer to "MR-J4-_TM_ Servo Amplifier Instruction Manual".		Possible	PL01
▪ ▪ ▪		▪ ▪ ▪				▪ ▪ ▪
2430h						PL48

The value of the linear servo motor/DD motor setting parameters ([Pr. PL_ _]) can be obtained and set.

(8) Parameter Objects PT (2481h to 24D0h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2481h	0	PT01	INTEGER32	rw	Impossible
▪ ▪ ▪		▪ ▪ ▪			
24D0h		PT80			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2481h	0		Refer to "MR-J4-_TM_ Servo Amplifier Instruction Manual".		Possible	PT01
▪ ▪ ▪		▪ ▪ ▪				▪ ▪ ▪
24D0h						PT80

The value of the positioning control parameters ([Pr. PT_ _]) can be obtained and set.

(9) Parameter Objects PN (2581h to 25A0h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2581h	0	PN01	INTEGER32	rw	Impossible
▪ ▪ ▪		▪ ▪ ▪			
25A0h		PN32			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2581h	0		Refer to "MR-J4-_TM_ Servo Amplifier Instruction Manual".		Possible	PN01
▪ ▪ ▪		▪ ▪ ▪				▪ ▪ ▪
25A0h						PN32

The value of the network setting parameters ([Pr. PN_ _]) can be obtained and set.

7.3.5 Alarm Objects

(1) Alarm history newest (2A00h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2A00h	0	Alarm history newest	UNSIGNED8	ro	Impossible
	1	Alarm No.	UNSIGNED32		
	2	Alarm time (Hour)			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2A00h	0	2	02h to 02h		Possible	
	1	0	00000000h to FFFFFFFFh			
	2	0	00000000h to FFFFFFFFh	hour		

The latest alarm information of the alarm history is returned. The description of each Sub Index is as follows.

Sub	Name	Description
0	Alarm history newest	The number of entries is returned.
1	Alarm No.	The number of the alarm that has occurred is returned. The description is as follows. When no history exists, 0 is returned. Bit 0 to Bit 15: Alarm detail No. Bit 16 to Bit 31: Alarm No. If [AL. 16.3] occurs, 00160003h is returned.
2	Alarm time (Hour)	Alarm occurrence time is returned. When no history exists, 0 is returned. Unit: [hour]

(2) Alarm history 1 (2A01h) to Alarm history 15 (2A0Fh)

Index	Sub	Name	Data Type	Access	PDO Mapping
2A01h to 2A0Fh	0	Alarm history 1 to Alarm history 15	UNSIGNED8	ro	Impossible
	1	Alarm No.	UNSIGNED32		
	2	Alarm time (Hour)			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2A01h to 2A0Fh	0	2	02h to 02h		Possible	
	1	0	00000000h to FFFFFFFFh			
	2	0	00000000h to FFFFFFFFh	hour		

The second (2A01h) to 16th (2A0Fh) latest alarm information of the alarm history is returned. The description of each Sub Index is the same as that of (1) of this section.

(3) Clear alarm history (2A40h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2A40h	0	Clear alarm history	UNSIGNED16	wo	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2A40h	0		Refer to the text.		Impossible	

Writing "1EA5h" clears the alarm history.

(4) Current alarm (2A41h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2A41h	0	Current alarm	UNSIGNED32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2A41h	0		00000000h to FFFFFFFFh		Impossible	

The number of the current alarm is returned. When no alarm has occurred, "00000000h" is returned. The description of the values is as follows. If [AL. 16.3] occurs, "00160003h" is returned.

Bit	Description
0 to 15	Alarm detail No.
16 to 31	Alarm No.

(5) Parameter error number (2A44h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2A44h	0	Parameter error number	UNSIGNED16	ro	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2A44h	0		0000h to 01F4h (500)		Impossible	

When [AL. 37 Parameter error] has occurred, the number of the parameters which cause the error is returned. Refer to Parameter error list (2A45h) for the number of each parameter which causes the error.

(6) Parameter error list (2A45h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2A45h	0	Parameter error list	UNSIGNED8	ro	Impossible
	1	No.1	UNSIGNED16		
	▪ ▪ ▪	▪ ▪ ▪			
	254	No.254			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2A45h	0		FEh to FEh (254)		Impossible	
	1		0000h to FFFFh			
	▪ ▪ ▪	▪ ▪ ▪				
	254					

When [AL. 37 Parameter error] has occurred, the number of the parameter which causes the error is returned. The description of No.1 (2A45h: 1) to No.254 (2A45h: 254) is as follows. If [Pr. PC01] is an error factor, 0201h is returned.

Bit	Description
0 to 7	Parameter number
8 to 15	Parameter group number 00: [Pr. PA _ _] 01: [Pr. PB _ _] 02: [Pr. PC _ _] 03: [Pr. PD _ _] 04: [Pr. PE _ _] 05: [Pr. PF _ _] 06: Parameter for manufacturer setting 07: Parameter for manufacturer setting 08: Parameter for manufacturer setting 09: Parameter for manufacturer setting 0A: Parameter for manufacturer setting 0B: [Pr. PL _ _] 0C: [Pr. PT _ _] 0E: [Pr. PN _ _]

7.3.6 Monitor Objects

(1) Cumulative feedback pulses (2B01h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B01h	0	Cumulative feedback pulses	INTEGER32	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B01h	0		80000000h to FFFFFFFFh	pulse	Impossible	

The cumulative feedback pulses are returned. Writing "00001EA5h" clears the cumulative feedback pulses.

(2) Servo motor speed (2B02h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B02h	0	Servo motor speed	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B02h	0		80000000h to 7FFFFFFFh	Refer to the text.	Impossible	

The servo motor speed is returned.
Unit: [r/min] ([mm/s] when a linear servo motor is used)

(3) Droop pulses (2B03h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B03h	0	Droop pulses	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B03h	0		80000000h to 7FFFFFFFh	pulse	Impossible	

The droop pulses (encoder unit) are returned.

(4) Cumulative command pulses (2B04h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B04h	0	Cumulative command pulses	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B04h	0		80000000h to 7FFFFFFFh	pulse	Impossible	

The cumulative command pulses are returned.

(5) Command pulse frequency (2B05h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B05h	0	Command pulse frequency	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B05h	0		80000000h to 7FFFFFFFh	kpulse/s	Impossible	

The command pulse frequency is returned.

(6) Regenerative load ratio (2B08h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B08h	0	Regenerative load ratio	UNSIGNED16	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B08h	0		0000h to FFFFh	%	Impossible	

The regenerative load ratio is returned.

(7) Effective load ratio (2B09h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B09h	0	Effective load ratio	UNSIGNED16	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B09h	0		0000h to FFFFh	%	Impossible	

The effective load ratio is returned.

(8) Peak load ratio (2B0Ah)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B0Ah	0	Peak load ratio	UNSIGNED16	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B0Ah	0		0000h to FFFFh	%	Impossible	

The peak load ratio is returned.

(9) Instantaneous torque (2B0Bh)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B0Bh	0	Instantaneous torque	INTEGER16	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B0Bh	0		8000h to 7FFFh	%	Impossible	

The instantaneous torque is returned.

(10) Within one-revolution position (2B0Ch)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B0Ch	0	Within one-revolution position	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B0Ch	0		80000000h to 7FFFFFFFh	pulse	Impossible	

The position within one-revolution is returned.

(11) ABS counter (2B0Dh)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B0Dh	0	ABS counter	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B0Dh	0		80000000h to 7FFFFFFFh	rev	Impossible	

The ABS counter is returned.

(12) Load inertia moment ratio (2B0Eh)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B0Eh	0	Load inertia moment ratio	UNSIGNED16	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B0Eh	0		0000h to FFFFh	0.01 times	Impossible	

The load to motor inertia ratio is returned.

(13) Bus voltage (2B0Fh)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B0Fh	0	Bus voltage	UNSIGNED16	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B0Fh	0		0000h to FFFFh	V	Impossible	

The bus voltage is returned.

(14) Load-side cumulative feedback pulses (2B10h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B10h	0	Load-side cumulative feedback pulses	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B10h	0		80000000h to 7FFFFFFFh	pulse	Impossible	

The load-side cumulative feedback pulses (load-side encoder unit) are returned.

(15) Load-side droop pulses (2B11h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B11h	0	Load-side droop pulses	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B11h	0		80000000h to 7FFFFFFFh	pulse	Impossible	

The load-side droop pulses are returned.

(16) Load-side encoder information 1 Z-phase counter (2B12h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B12h	0	Load-side encoder information 1 Z-phase counter	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B12h	0		80000000h to 7FFFFFFFh	pulse	Impossible	

The load-side encoder information 1 is returned.

(17) Load-side encoder information 2 (2B13h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B13h	0	Load-side encoder information 2	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B13h	0		80000000h to 7FFFFFFFh	rev	Impossible	

The load-side encoder information 2 is returned.

(18) Temperature of motor thermistor (2B17h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B17h	0	Temperature of motor thermistor	INTEGER16	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B17h	0		8000h to 7FFFh	°C	Impossible	

The temperature of servo motor thermistor is returned.

(19) Motor-side cumu. feedback pulses (before gear) (2B18h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B18h	0	Motor-side cumu. feedback pulses (before gear)	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B18h	0		80000000h to 7FFFFFFFh	pulse	Impossible	

The cumulative feedback pulses are returned.

(20) Electrical angle (2B19h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B19h	0	Electrical angle	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B19h	0		80000000h to 7FFFFFFFh	pulse	Impossible	

The electrical angle is returned.

(21) Motor-side/load-side position deviation (2B23h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B23h	0	Motor-side/load-side position deviation	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B23h	0		80000000h to 7FFFFFFFh	pulse	Impossible	

The servo motor-side/load-side position deviation is returned.

(22) Motor-side/load-side speed deviation (2B24h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B24h	0	Motor-side/load-side speed deviation	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B24h	0		80000000h to 7FFFFFFFh	r/min	Impossible	

The servo motor-side/load-side speed deviation is returned.

(23) Internal temperature of encoder (2B25h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B25h	0	Internal temperature of encoder	INTEGER16	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B25h	0		8000h to 7FFFh	°C	Impossible	

The internal temperature of encoder is returned.

(24) Settling time (2B26h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B26h	0	Settling time	INTEGER16	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B26h	0		8000h to 7FFFh	ms	Impossible	

The settling time is returned.

(25) Oscillation detection frequency (2B27h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B27h	0	Oscillation detection frequency	INTEGER16	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B27h	0		8000h to 7FFFh	Hz	Impossible	

The oscillation detection frequency is returned.

(26) Number of tough drive operations (2B28h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B28h	0	Number of tough drive operations	UNSIGNED16	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B28h	0		0000h to FFFFh	number of times	Impossible	

The number of tough drive operations is returned.

(27) Unit power consumption (2B2Dh)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B2Dh	0	Unit power consumption	INTEGER16	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B2Dh	0		8000h to 7FFFh	W	Impossible	

The unit power consumption is returned.

(28) Unit total power consumption (2B2Eh)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B2Eh	0	Unit total power consumption	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B2Eh	0		80000000h to 7FFFFFFFh	Wh	Impossible	

The unit total power consumption is returned.

(29) Alarm Monitor 1 Cumulative feedback pulses (2B81h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B81h	0	Alarm Monitor 1 Cumulative feedback pulses	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B81h	0		80000000h to 7FFFFFFFh	pulse	Impossible	

The cumulative feedback pulses at alarm occurrence are returned.

(30) Alarm Monitor 2 Servo motor speed (2B82h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B82h	0	Alarm Monitor 2 Servo motor speed	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B82h	0		80000000h to 7FFFFFFFh	Refer to the text.	Impossible	

The servo motor speed at alarm occurrence is returned.
Unit: [r/min] ([mm/s] when a linear servo motor is used)

(31) Alarm Monitor 3 Droop pulses (2B83h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B83h	0	Alarm Monitor 3 Droop pulses	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B83h	0		80000000h to 7FFFFFFFh	pulse	Impossible	

The droop pulses at alarm occurrence are returned.

(32) Alarm Monitor 4 Cumulative command pulses (2B84h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B84h	0	Alarm Monitor 4 Cumulative command pulses	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B84h	0		80000000h to 7FFFFFFFh	pulse	Impossible	

The cumulative command pulses (encoder unit) at alarm occurrence are returned.

(33) Alarm Monitor 5 Command pulse frequency (2B85h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B85h	0	Alarm Monitor 5 Command pulse frequency	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B85h	0		80000000h to 7FFFFFFFh	kpulse/s	Impossible	

The command pulse frequency at alarm occurrence is returned.

(34) Alarm Monitor 8 Regenerative load ratio (2B88h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B88h	0	Alarm Monitor 8 Regenerative load ratio	UNSIGNED16	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B88h	0		0000h to FFFFh	%	Impossible	

The regenerative load ratio at alarm occurrence is returned.

(35) Alarm Monitor 9 Effective load ratio (2B89h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B89h	0	Alarm Monitor 9 Effective load ratio	UNSIGNED16	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B89h	0		0000h to FFFFh	%	Impossible	

The effective load ratio at alarm occurrence is returned.

(36) Alarm Monitor 10 Peak load ratio (2B8Ah)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B8Ah	0	Alarm Monitor 10 Peak load ratio	UNSIGNED16	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B8Ah	0		0000h to FFFFh	%	Impossible	

The peak load ratio at alarm occurrence is returned.

(37) Alarm Monitor 11 Instantaneous torque (2B8Bh)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B8Bh	0	Alarm Monitor 11 Instantaneous torque	INTEGER16	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B8Bh	0		8000h to 7FFFh	%	Impossible	

The instantaneous torque at alarm occurrence is returned.

(38) Alarm Monitor 12 Within one-revolution position (2B8Ch)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B8Ch	0	Alarm Monitor 12 Within one-revolution position	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B8Ch	0		80000000h to 7FFFFFFFh	pulse	Impossible	

The position within one-revolution at alarm occurrence is returned.

(39) Alarm Monitor 13 ABS counter (2B8Dh)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B8Dh	0	Alarm Monitor 13 ABS counter	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B8Dh	0		80000000h to 7FFFFFFFh	rev	Impossible	

The ABS counter at alarm occurrence is returned.

(40) Alarm Monitor 14 Load inertia moment ratio (2B8Eh)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B8Eh	0	Alarm Monitor 14 Load inertia moment ratio	UNSIGNED16	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B8Eh	0		0000h to FFFFh	0.1 times	Impossible	

The load to motor inertia ratio at alarm occurrence is returned.

(41) Alarm Monitor 15 Bus voltage (2B8Fh)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B8Fh	0	Alarm Monitor 15 Bus voltage	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B8Fh	0		80000000h to 7FFFFFFFh	V	Impossible	

The bus voltage at alarm occurrence is returned.

(42) Alarm Monitor 16 Load-side cumulative feedback pulses (2B90h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B90h	0	Alarm Monitor 16 Load-side cumulative feedback pulses	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B90h	0		80000000h to 7FFFFFFFh	pulse	Impossible	

The load-side cumulative feedback pulses at alarm occurrence are returned.

(43) Alarm Monitor 17 Load-side droop pulses (2B91h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B91h	0	Alarm Monitor 17 Load-side droop pulses	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B91h	0		80000000h to 7FFFFFFFh	pulse	Impossible	

The load-side droop pulses (load-side encoder unit) at alarm occurrence are returned.

(44) Alarm Monitor 18 Load-side encoder information 1 Z-phase counter (2B92h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B92h	0	Alarm Monitor 18 Load-side encoder information 1 Z-phase counter	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B92h	0		80000000h to 7FFFFFFFh	pulse	Impossible	

The load-side encoder information 1 at alarm occurrence is returned.

(45) Alarm Monitor 19 Load-side encoder information 2 (2B93h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B93h	0	Alarm Monitor 19 Load-side encoder information 2	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B93h	0		80000000h to 7FFFFFFFh	rev	Impossible	

The load-side encoder information 2 at alarm occurrence is returned.

(46) Alarm Monitor 23 Temperature of motor thermistor (2B97h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B97h	0	Alarm Monitor 23 Temperature of motor thermistor	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B97h	0		80000000h to 7FFFFFFFh	°C	Impossible	

The temperature of servo motor thermistor at alarm occurrence is returned.

(47) Alarm Monitor 24 Motor-side cumu. feedback pulses (before gear) (2B98h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B98h	0	Alarm Monitor 24 Motor-side cumu. feedback pulses (before gear)	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B98h	0		80000000h to 7FFFFFFFh	pulse	Impossible	

The cumulative feedback pulses (servo motor-side unit) at alarm occurrence are returned.

(48) Alarm Monitor 25 Electrical angle (2B99h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2B99h	0	Alarm Monitor 25 Electrical angle	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2B99h	0		80000000h to 7FFFFFFFh	pulse	Impossible	

The electrical angle at alarm occurrence is returned.

(49) Alarm Monitor 35 Motor-side/load-side position deviation (2BA3h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2BA3h	0	Alarm Monitor 35 Motor-side/load-side position deviation	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2BA3h	0		80000000h to 7FFFFFFFh	pulse	Impossible	

The motor-side/load-side position deviation at alarm occurrence is returned.

(50) Alarm Monitor 36 Motor-side/load-side speed deviation (2BA4h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2BA4h	0	Alarm Monitor 36 Motor-side/load-side speed deviation	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2BA4h	0		80000000h to 7FFFFFFFh	r/min	Impossible	

The motor-side/load-side speed deviation at alarm occurrence is returned.

(51) Alarm Monitor 37 Internal temperature of encoder (2BA5h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2BA5h	0	Alarm Monitor 37 Internal temperature of encoder	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2BA5h	0		80000000h to 7FFFFFFFh	°C	Impossible	

The internal temperature of encoder at alarm occurrence is returned.

(52) Alarm Monitor 38 Settling time (2BA6h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2BA6h	0	Alarm Monitor 38 Settling time	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2BA6h	0		80000000h to 7FFFFFFFh	ms	Impossible	

The settling time at alarm occurrence is returned.

(53) Alarm Monitor 39 Oscillation detection frequency (2BA7h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2BA7h	0	Alarm Monitor 39 Oscillation detection frequency	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2BA7h	0		80000000h to 7FFFFFFFh	Hz	Impossible	

The oscillation detection frequency at alarm occurrence is returned.

(54) Alarm Monitor 40 Number of tough drive operations (2BA8h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2BA8h	0	Alarm Monitor 40 Number of tough drive operations	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2BA8h	0		80000000h to 7FFFFFFFh	number of times	Impossible	

The number of tough drive operations at alarm occurrence is returned.

(55) Alarm Monitor 45 Unit power consumption (2BADh)

Index	Sub	Name	Data Type	Access	PDO Mapping
2BADh	0	Alarm Monitor 45 Unit power consumption	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2BADh	0		80000000h to 7FFFFFFFh	W	Impossible	

The unit power consumption at alarm occurrence is returned.

(56) Alarm Monitor 46 Unit total power consumption (2BAEh)

Index	Sub	Name	Data Type	Access	PDO Mapping
2BAEh	0	Alarm Monitor 46 Unit total power consumption	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2BAEh	0		80000000h to 7FFFFFFFh	Wh	Impossible	

The unit total power consumption at alarm occurrence is returned.

7.3.7 Manufacturer Specific Control Objects

(1) Power ON cumulative time (2C18h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2C18h	0	Power ON cumulative time	UNSIGNED32	ro	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2C18h	0		00000000h to FFFFFFFFh	hour	Impossible	

The cumulative energization time of the servo amplifier is returned.
This object is available with servo amplifiers with software version B0 or later.

(2) Inrush relay ON/OFF number (2C19h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2C19h	0	Inrush relay ON/OFF number	UNSIGNED32	ro	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2C19h	0		00000000h to FFFFFFFFh	number of times	Impossible	

The number of on/off times of the inrush relay of the servo amplifier is returned.
This object is available with servo amplifiers with software version B0 or later.

(3) Machine diagnostic status (2C20h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2C20h	0	Machine diagnostic status	UNSIGNED16	ro	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2C20h	0		Refer to the text.		Impossible	

The machine diagnostic status is returned. The description is as follows.
This object is available with servo amplifiers with software version B0 or later.

Bit	Description
0 to 3	Friction estimation status at forward rotation 0: Friction is being estimated. (normal) 1: Estimation is completed. (normal) 2: The servo motor may rotate in one direction too frequently. (warning) 3: The servo motor speed may too slow for friction estimation. (warning) 4: The change in the servo motor speed may be small for friction estimation. (warning) 5: The acceleration/deceleration time constants may be too short for friction estimation. (warning) 6: The operation time may not be enough. (warning) When warning conditions for 2 to 6 are met at the same time, the smaller number is returned. When an estimation is completed even though a warning has once occurred, the status changes to Estimation is completed.
4 to 7	Friction estimation status at reverse rotation 0: Friction is being estimated. (normal) 1: Estimation is completed. (normal) 2: The servo motor may rotate in one direction too frequently. (warning) 3: The servo motor speed may too slow for friction estimation. (warning) 4: The change in the servo motor speed may be small for friction estimation. (warning) 5: The acceleration/deceleration time constants may be too short for friction estimation. (warning) 6: The operation time may not be enough. (warning) When warning conditions for 2 to 6 are met at the same time, the smaller number is returned. When an estimation is completed even though a warning has once occurred, the status changes to Estimation is completed.
8 to 11	Vibration estimation status 0: During estimation 1: Estimation is completed.
12 to 15	(reserved) The value at reading is undefined.

(4) Coulomb friction torque in positive direction (2C21h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2C21h	0	Coulomb friction torque in positive direction	INTEGER16	ro	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2C21h	0		8000h to 7FFFh	0.1%	Impossible	

Static friction at forward rotation torque is returned in increments of 0.1%.
This object is available with servo amplifiers with software version B0 or later.

(5) Friction torque at rated speed in positive direction (2C22h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2C22h	0	Friction torque at rated speed in positive direction	INTEGER16	ro	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2C22h	0		8000h to 7FFFh	0.1%	Impossible	

Kinetic friction at forward rotation torque at the rated speed is returned in increments of 0.1%.
This object is available with servo amplifiers with software version B0 or later.

(6) Coulomb friction torque in negative direction (2C23h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2C23h	0	Coulomb friction torque in negative direction	INTEGER16	ro	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2C23h	0		8000h to 7FFFh	0.1%	Impossible	

Static friction at reverse rotation torque is returned in increments of 0.1%.
This object is available with servo amplifiers with software version B0 or later.

(7) Friction torque at rated speed in negative direction (2C24h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2C24h	0	Friction torque at rated speed in negative direction	INTEGER16	ro	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2C24h	0		8000h to 7FFFh	0.1%	Impossible	

Kinetic friction at reverse rotation torque at the rated speed is returned in increments of 0.1%.
This object is available with servo amplifiers with software version B0 or later.

(8) Oscillation frequency during motor stop (2C25h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2C25h	0	Oscillation frequency during motor stop	INTEGER16	ro	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2C25h	0		8000h to 7FFFh	Hz	Impossible	

Vibration frequency during stop/servo-lock is returned in increments of 1 Hz.
This object is available with servo amplifiers with software version B0 or later.

(9) Vibration level during motor stop (2C26h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2C26h	0	Vibration level during motor stop	INTEGER16	ro	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2C26h	0		8000h to 7FFFh	0.1%	Impossible	

Vibration level during stop/servo-lock is returned in increments of 0.1%.
This object is available with servo amplifiers with software version B0 or later.

(10) Oscillation frequency during motor operating (2C27h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2C27h	0	Oscillation frequency during motor operating	INTEGER16	ro	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2C27h	0		8000h to 7FFFh	Hz	Impossible	

Vibration frequency during operation is returned in increments of 1 Hz.
This object is available with servo amplifiers with software version B0 or later.

(11) Vibration level during motor operating (2C28h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2C28h	0	Vibration level during motor operating	INTEGER16	ro	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2C28h	0		8000h to 7FFFh	0.1%	Impossible	

Vibration level during operation is returned in increments of 0.1%.
This object is available with servo amplifiers with software version B0 or later.

(12) Control DI 1 (2D01h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2D01h	0	Control DI 1	UNSIGNED16	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2D01h	0	0	Refer to the text.		Impossible	

Set control commands to control the servo amplifier. Refer to section 5.2.2 (1) for details.

(13) Control DI 2 (2D02h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2D02h	0	Control DI 2	UNSIGNED16	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2D02h	0	0	Refer to the text.		Impossible	

Set control commands to control the servo amplifier. Refer to section 5.2.2 (2) for details.

(14) Control DI 3 (2D03h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2D03h	0	Control DI 3	UNSIGNED16	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2D03h	0	0	Refer to the text.		Impossible	

Set control commands to control the servo amplifier. Refer to section 5.2.2 (3) for details.

(15) Status DO 1 (2D11h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2D11h	0	Status DO 1	UNSIGNED16	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2D11h	0		Refer to the text.		Impossible	

The servo status is returned. Refer to section 5.3.2 (1) for details.

(16) Status DO 2 (2D12h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2D12h	0	Status DO 2	UNSIGNED16	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2D12h	0		Refer to the text.		Impossible	

The servo status is returned. Refer to section 5.3.2 (2) for details.

(17) Status DO 3 (2D13h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2D13h	0	Status DO 3	UNSIGNED16	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2D13h	0		Refer to the text.		Impossible	

The servo status is returned. Refer to section 5.3.2 (3) for details.

(18) Status DO 5 (2D15h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2D15h	0	Status DO 5	UNSIGNED16	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2D15h	0		Refer to the text.		Impossible	

The servo status is returned. Refer to section 5.3.2 (4) for details.

(19) Velocity limit value (2D20h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2D20h	0	Velocity limit value	UNSIGNED32	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2D20h	0	50000	00000000h to permissible instantaneous speed	vel units	Possible	PT67

Set the speed limit value of the cyclic synchronous torque mode (csv) and the profile torque mode (pv).
Unit: [0.01 r/min] ([0.01 mm/s] when a linear servo motor is used)

(20) Watch dog counter DL (2D23h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2D23h	0	Watch dog counter DL	UNSIGNED8	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2D23h	0		00h to FFh		Impossible	

When this object is mapped for RxPDO, set a value so that the counter is incremented by 1 per communication cycle. If the value is not updated correctly in the MR-J4-_TM_ servo amplifier, [AL. 86.2 Network communication error 2] occurs.

(21) Watch dog counter UL (2D24h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2D24h	0	Watch dog counter UL	UNSIGNED8	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2D24h	0		00h to FFh		Impossible	

This counter is incremented by 1 per communication cycle. The sum of the value of Watch dog counter DL (2D23h) and 1 is returned.

(22) Motor rated speed (2D28h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2D28h	0	Motor rated speed	UNSIGNED32	ro	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2D28h	0		00000000h to FFFFFFFFh	r/min	Impossible	

The servo motor rated speed is returned.
Unit: [r/min] ([mm/s] when a linear servo motor is used)

(23) Manufacturer Device Name 2 (2D30h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2D30h	0	Manufacturer Device Name 2	VISIBLE STRING	ro	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2D30h	0				Impossible	

The model name of the MR-J4-_TM_ servo amplifier is returned. The description is the same as that of Manufacturer Device Name (1008h).

(24) Manufacturer Hardware Version 2 (2D31h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2D31h	0	Manufacturer Hardware Version 2	VISIBLE STRING	ro	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2D31h	0				Impossible	

The hardware version of the MR-J4-_TM_ servo amplifier is returned.

(25) Manufacturer Software Version 2 (2D32h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2D32h	0	Manufacturer Software Version 2	VISIBLE STRING	ro	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2D32h	0				Impossible	

The software version of the MR-J4-_TM_ servo amplifier is returned.

(26) Serial Number 2 (2D33h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2D33h	0	Serial Number 2	VISIBLE STRING	ro	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2D33h	0				Impossible	

The serial number of the MR-J4-_TM_ servo amplifier is returned.

(27) User parameter configuration (2D34h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2D34h	0	User parameter configuration	UNSIGNED16	rw	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2D34h	0	1	Refer to the text.		Impossible	

The parameters whose symbols are preceded by * are not automatically enabled. Writing "1EA5h" to this object enables the parameters. This operation can be performed only in the Pre-Operational state.

The read values of this object are as follows. The completion of the parameter enables processing can be checked.

Value	Description
0	Parameter enabling processing is being executed.
1	Parameter enabling processing is not being executed. (The processing is completed.)

(28) Encoder status (2D35h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2D35h	0	Encoder status	UNSIGNED8	ro	Impossible
	1	Encoder status1	UNSIGNED32		
	2	Encoder status2			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2D35h	0	2	02h to 02h		Impossible	
	1		00000000h to 00000001h			
	2		00000000h to 00000007h			

The status of the encoder is returned. The description of each Sub Index is as follows.
This object is available with servo amplifiers with software version B0 or later.

Sub	Name	Description
0	Encoder status	Number of entries
1	Encoder status1	The status of the encoder is returned. For a fully closed loop system, the external encoder status is returned. Bit 0: Whether the servo amplifier is used in an absolute position detection system or not is returned. 0 = Incremental system 1 = Absolute position detection system Bit 1 to Bit 31: Reserved
2	Encoder status2	The status of the scale measurement encoder is returned. Bit 0: Whether the servo amplifier is used in an absolute position detection system or not is returned. 0 = Incremental system 1 = Absolute position detection system Bit 1: Whether the scale measurement function is enabled or disabled is returned. 0 = Disabled 1 = Enabled Bit 2: Whether the connected scale measurement encoder is the absolute position type or not is returned. 0 = Incremental type 1 = Absolute position type Bit 3 to Bit 31: Reserved

(29) Scale cycle counter (2D36h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2D36h	0	Scale cycle counter	UNSIGNED32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2D36h	0		00000000h to FFFFFFFFh	pulse	Impossible	

The position within one-revolution of the scale measurement encoder is returned. Returned values differ depending on the scale measurement encoder type.
This object is available with servo amplifiers with software version B0 or later.

Scale measurement encoder	Description
Rotary encoder	Cycle counter
Linear encoder Absolute position type	ABS counter
Linear encoder Incremental type	Scale coasting counter
Linear encoder A/B/Z-phase differential output type Incremental type	Scale coasting counter

(30) Scale ABS counter (2D37h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2D37h	0	Scale ABS counter	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2D37h	0		80000000h to 7FFFFFFFh	rev	Impossible	

The ABS counter of the scale measurement encoder is returned. Returned values differ depending on the scale measurement encoder type.
This object is available with servo amplifiers with software version B0 or later.

Scale measurement encoder	Description
Rotary encoder	Multi-revolution ABS counter
Linear encoder Absolute position type	Fixed to 0
Linear encoder Incremental type	Fixed to 0
Linear encoder A/B/Z-phase differential output type Incremental type	Fixed to 0

(31) Scale measurement encoder resolution (2D38h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2D38h	0	Scale measurement encoder resolution	UNSIGNED32	ro	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2D38h	0		00000000h to FFFFFFFFh	inc/rev	Impossible	

The resolution of the scale measurement encoder is returned.
This object is available with servo amplifiers with software version B0 or later.

(32) Scale measurement encoder alarm (2D3Ch)

Index	Sub	Name	Data Type	Access	PDO Mapping
2D3Ch	0	Scale measurement encoder alarm	UNSIGNED32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2D3Ch	0		00000000h to FFFFFFFFh		Impossible	

The alarm data of the scale measurement encoder is returned. The value "0" indicates that no error occurs. A value other than "0" indicates that an error occurs.
This object is available with servo amplifiers with software version B0 or later.

(33) One-touch tuning mode (2D50h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2D50h	0	One-touch tuning mode	UNSIGNED8	rw	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2D50h	0		00h to 03h		Impossible	

Setting a value of "1" to "3" starts one-touch tuning. After one-touch tuning is completed, the setting value automatically changes to "0". The description of the setting values is as follows.
This object is available with servo amplifiers with software version B0 or later.

Setting value	Description
0	During one-touch tuning stop
1	Basic setting
2	High setting
3	Low setting

(34) One-touch tuning status (2D51h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2D51h	0	One-touch tuning status	INTEGER8	ro	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2D51h	0		00h to 64h	%	Impossible	

The one-touch tuning progress is returned.
This object is available with servo amplifiers with software version B0 or later.

(35) One-touch tuning Stop (2D52h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2D52h	0	One-touch tuning Stop	UNSIGNED16	wo	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2D52h	0		0000h/1EA5h		Impossible	

Writing "1EA5h" can stop one-touch tuning. Writing a value other than "1EA5h" sets 0609 0030h Value range of parameter exceeded in SDO Abort Code.
This object is available with servo amplifiers with software version B0 or later.

(36) One-touch tuning Clear (2D53h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2D53h	0	One-touch tuning Clear	UNSIGNED16	wo	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2D53h	0		0000h to 0001h		Impossible	

The parameter changed in one-touch tuning can be returned to the value before the change. The description of the setting values is as follows.
This object is available with servo amplifiers with software version B0 or later.

Setting value	Description
0000h	Restores the initial value.
0001h	Restores the value before one-touch tuning.

(37) One-touch tuning Error Code (2D54h)

Index	Sub	Name	Data Type	Access	PDO Mapping
2D54h	0	One-touch tuning Error Code	UNSIGNED16	ro	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
2D54h	0		0000h to C00Fh		Impossible	

An error code of the one-touch tuning is returned. The description of the error codes is as follows.
This object is available with servo amplifiers with software version B0 or later.

Error code	Description
0000h	Finished normally
C000h	Tuning canceled
C001h	Overshoot exceeded
C002h	Servo-off during tuning
C003h	Control mode error
C004h	Time-out
C005h	Load to motor inertia ratio misestimated
C00Fh	One-touch tuning disabled

7.3.8 PDS Control Objects

(1) Error code (603Fh)

Index	Sub	Name	Data Type	Access	PDO Mapping
603Fh	0	Error code	UNSIGNED16	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
603Fh	0	0	0000h to FFFFh		Impossible	

The number of the latest error that occurred after the power on is returned. The description of the error number is the same as that of Pre-defined error field (1003h). Refer to section 7.3.1 (3).

(2) Controlword (6040h)

Index	Sub	Name	Data Type	Access	PDO Mapping
6040h	0	Controlword	UNSIGNED16	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
6040h	0	0	Refer to the text.		Impossible	

Set control commands to control the servo amplifier. Refer to section 5.2.1 for details.

(3) Statusword (6041h)

Index	Sub	Name	Data Type	Access	PDO Mapping
6041h	0	Statusword	UNSIGNED16	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
6041h	0		Refer to the text.		Impossible	

The servo status is returned. Refer to section 5.3.1 for details.

(4) Quick stop option code (605Ah)

Index	Sub	Name	Data Type	Access	PDO Mapping
605Ah	0	Quick stop option code	INTEGER16	rw	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
605Ah	0	2	0002h to 0002h		Possible	PT68

Set how to decelerate the servo motor to a stop at QuickStop reception. The description of the setting values is as follows.

Setting value	Description
1	
2	In the cyclic synchronous mode (csp/csv), profile mode (pp/pv), and homing mode (hm), the servo motor decelerates to a stop with Quick stop deceleration (6085h) and the state shifts to the Switch On Disabled state. In the cyclic synchronous torque mode (cst) and profile torque mode (tq), the state immediately shifts to the Switch On Disabled state and the servo motor stops with the dynamic brake.
3	
4	
5	
6	
7	
8	

(5) Halt option code (605Dh)

Index	Sub	Name	Data Type	Access	PDO Mapping
605Dh	0	Halt option code	INTEGER16	rw	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
605Dh	0	1	0001h to 0001h		Possible	PT68

Set how to decelerate the servo motor to a stop at Halt reception. The description of the setting values is as follows.

Setting value	Description
1	For Profile deceleration (6084h) and the homing mode (hm), the servo motor decelerates to a stop according to Homing acceleration (609Ah) and the state does not change from the Operation Enabled state (servo-on).
2	
3	
4	

(6) Modes of operation (6060h)

Index	Sub	Name	Data Type	Access	PDO Mapping
6060h	0	Modes of operation	INTEGER8	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
6060h	0	0	Refer to the text.		Impossible	

Set the control mode. The setting values are as follows.

Setting value	Description
0	No mode change/No mode assinged
1	Profile position mode (pp)
3	Profile velocity mode (pv)
4	Profile torque mode (tq)
6	Homing mode (hm)
8	Cyclic synchronous position mode (csp)
9	Cyclic synchronous velocity mode (csv)
10	Cyclic synchronous torque mode (cst)

The settable values are limited depending on the setting of [Pr. PA01]. Refer to section 5.4.1 for details.

(7) Modes of operation display (6061h)

Index	Sub	Name	Data Type	Access	PDO Mapping
6061h	0	Modes of operation display	INTEGER8	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
6061h	0	0	Refer to the text.		Impossible	

The current control mode is returned. The description is as follows.

Setting value	Description
0	No mode assinged
1	Profile position mode (pp)
3	Profile velocity mode (pv)
4	Profile torque mode (tq)
6	Homing mode (hm)
8	Cyclic synchronous position mode (csp)
9	Cyclic synchronous velocity mode (csv)
10	Cyclic synchronous torque mode (cst)

The default values vary depending on the setting value of [Pr. PA01].

Setting value of [Pr. PA01]	Default value
_ _ _ 0 _ _ _ 1	8 (csp)
_ _ _ 2	1 (pp)

(8) Supported drive modes (6502h)

Index	Sub	Name	Data Type	Access	PDO Mapping
6502h	0	Supported drive modes	UNSIGNED32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
6502h	0	000003ADh	000003ADh to 000003ADh		Impossible	

The supported control mode is returned. The description is as follows.

Bit	Description	Defined value
0	Profile position mode (pp)	1: Supported
1	Velocity mode (vl)	0
2	Profile velocity mode (pv)	1: Supported
3	Profile torque mode (tq)	1: Supported
4	Reserved	0
5	Homing mode (hm)	1: Supported
6	Interpolated position mode (ip)	0
7	Cyclic synchronous position mode (csp)	1: Supported
8	Cyclic synchronous velocity mode (csv)	1: Supported
9	Cyclic synchronous torque mode (cst)	1: Supported
10	Cyclic synchronous torque mode with communication angle (cstca)	0
11 to 31	Reserved	0

The fixed value "000003ADh" is returned regardless of the setting of [Pr. PA01]. However, the usable control modes are limited depending on the setting of [Pr. PA01]. Refer to section 5.4.1 for details.

7.3.9 Position Control Function Objects

(1) Position actual internal value (6063h)

Index	Sub	Name	Data Type	Access	PDO Mapping
6063h	0	Position actual internal value	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
6063h	0		80000000h to 7FFFFFFFh	inc	Impossible	

The current position is returned.

(2) Position actual value (6064h)

Index	Sub	Name	Data Type	Access	PDO Mapping
6064h	0	Position actual value	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
6064h	0		80000000h to 7FFFFFFFh	pos units	Impossible	

The current position in the command unit is returned.

(3) Following error window (6065h)

Index	Sub	Name	Data Type	Access	PDO Mapping
6065h	0	Following error window	UNSIGNED32	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
6065h	0	00C00000h	00000000h to FFFFFFFFh	pos units	Possible	PC67/PC68

In the profile position mode (pp) or cyclic synchronous position mode (csp), when the time set with Following error time out (6066h) has elapsed with the number of droop pulses exceeding the setting value of this object, Bit 13 of Statusword (6041h) is turned on. When "FFFFFFFFh" is set, Bit 13 of Statusword (6041h) is always off.

(4) Following error time out (6066h)

Index	Sub	Name	Data Type	Access	PDO Mapping
6066h	0	Following error time out	UNSIGNED16	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
6066h	0	10	0000h to FFFFh	ms	Possible	PC69

Refer to Following error window (6065h).

(5) Position window (6067h)

Index	Sub	Name	Data Type	Access	PDO Mapping
6067h	0	Position window	UNSIGNED32	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
6067h	0	100	Refer to the text.	pos units	Possible	PC70

The description of this object is as follows.

Setting value	Description
00000000h to 0000FFFEh	In the profile position mode (pp), when the time set with Position windows time (6068h) has elapsed with the number of droop pulses equal to or lower than the setting value of this object, Bit 10 of Statusword (6041h) is turned on.
0000FFFFh to FFFFFFFEh	Unsettable
FFFFFFFFh	Bit 10 of Statusword (6041h) is always on in the profile position mode (pp).

(6) Position window time (6068h)

Index	Sub	Name	Data Type	Access	PDO Mapping
6068h	0	Position window time	UNSIGNED16	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
6068h	0	10	0000h to FFFFh	ms	Possible	PC71

Refer to Position window (6067h).

(7) Positioning option code (60F2h)

Index	Sub	Name	Data Type	Access	PDO Mapping
60F2h	0	Positioning option code	UNSIGNED16	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
60F2h	0	0000h	0000h to 00C0h		Possible	PT03

Set the profile position mode. The description of this object is as follows.

Bit	Description	Defined value
0 to 1	00b: The positioning is performed with the relative position from the internal absolute target position. 01b: The positioning is performed with the relative position from Position demand actual value (60FCh). (Not supported) (Note 1) 10b: The positioning is performed with the relative position from Position actual value (6064h). 11b: reserved	00b
1 to 2	00b: New values of Target position (607Ah), Profile velocity (6081h), and Acceleration are promptly reflected. 01b: The current positioning continues to reach the target position. Then a new setting of Target position (607Ah), Profile velocity (6081h), and Acceleration is applied. 10b: reserved 11b: reserved	00b
3 to 5	Reserved	0
6 to 7 (Note 2)	00b: The servo motor rotates to the target position in a direction specified with a sign of the position data. 01b: The servo motor rotates in the address decreasing direction regardless of the sign of the position data. 10b: The servo motor rotates in the address increasing direction regardless of the sign of the position data. 11b: The servo motor rotates from the current position to the target position in the shorter direction. If the distances from the current position to the target position are the same for CCW and CW, the servo motor rotates in the CCW direction.	00b
8 to 15	Reserved	0

Note 1. This is not supported by the MR-J4-_TM_ servo amplifier.
2. This is available with servo amplifiers with software version B0 or later.

(8) Following error actual value (60F4h)

Index	Sub	Name	Data Type	Access	PDO Mapping
60F4h	0	Following error actual value	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
60F4h	0		80000000h to 7FFFFFFFh	pos units	Impossible	

The droop pulses are returned.

(9) Control effort (60FAh)

Index	Sub	Name	Data Type	Access	PDO Mapping
60FAh	0	Control effort	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
60FAh	0		80000000h to 7FFFFFFFh	vel units	Impossible	

The speed command is returned.
Unit: [0.01 r/min] ([0.01 mm/s] when a linear servo motor is used)

7.3.10 Profile Velocity Mode Objects

(1) Velocity demand value (606Bh)

Index	Sub	Name	Data Type	Access	PDO Mapping
606Bh	0	Velocity demand value	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
606Bh	0		80000000h to 7FFFFFFFh	vel units	Impossible	

The speed command is returned.
Unit: [0.01 r/min] ([0.01 mm/s] when a linear servo motor is used)

(2) Velocity actual value (606Ch)

Index	Sub	Name	Data Type	Access	PDO Mapping
606Ch	0	Velocity actual value	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
606Ch	0		80000000h to 7FFFFFFFh	vel units	Impossible	

The current speed is returned.
Unit: [0.01 r/min] ([0.01 mm/s] when a linear servo motor is used)

(3) Velocity window (606Dh)

Index	Sub	Name	Data Type	Access	PDO Mapping
606Dh	0	Velocity window	UNSIGNED16	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
606Dh	0	2000	0000h to FFFFh	vel units	Possible	PC72

In the profile velocity mode (pv), when the time set with Velocity window time (606Eh) has elapsed with the current speed equal to or lower than the setting value of this object, Bit 10 of Statusword (6041h) is turned on.
Unit: [0.01 r/min] ([0.01 mm/s] when a linear servo motor is used)

(4) Velocity window time (606Eh)

Index	Sub	Name	Data Type	Access	PDO Mapping
606Eh	0	Velocity window time	UNSIGNED16	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
606Eh	0	10	0000h to FFFFh	ms	Possible	PC73

Refer to Velocity window (606Dh).

(5) Velocity threshold (606Fh)

Index	Sub	Name	Data Type	Access	PDO Mapping
606Fh	0	Velocity threshold	UNSIGNED16	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
606Fh	0	5000	0000h to FFFFh	vel units	Possible	PC65

In the profile velocity mode (pv), when the time set with Velocity threshold time (6070h) has elapsed with the current speed higher than the setting value of this object, Bit 12 of Statusword (6041h) is turned off.
Unit: [0.01 r/min] ([0.01 mm/s] when a linear servo motor is used)

(6) Velocity threshold time (6070h)

Index	Sub	Name	Data Type	Access	PDO Mapping
6070h	0	Velocity threshold time	UNSIGNED16	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
6070h	0	10	0000h to FFFFh	ms	Possible	PC66

Refer to Velocity threshold (606Fh).

(7) Target velocity (60FFh)

Index	Sub	Name	Data Type	Access	PDO Mapping
60FFh	0	Target velocity	INTEGER32	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
60FFh	0	0	80000000h to 7FFFFFFFh	vel units	Impossible	

Set the speed command used in the cyclic synchronous velocity mode (csv) and the profile velocity mode (pv).
Unit: [0.01 r/min] ([0.01 mm/s] when a linear servo motor is used)

7.3.11 Profile Torque Mode Objects

(1) Target torque (6071h)

Index	Sub	Name	Data Type	Access	PDO Mapping
6071h	0	Target torque	INTEGER16	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
6071h	0	0	8000h to 7FFFh	per thousand of rated torque	Impossible	

Set the torque command used in the cyclic synchronous torque mode (cst) and the profile torque mode (tq).

(2) Max torque (6072h)

Index	Sub	Name	Data Type	Access	PDO Mapping
6072h	0	Max torque	UNSIGNED16	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
6072h	0		0000h to FFFFh	per thousand of rated torque	Impossible	

The maximum torque of the servo motor is returned. The value notified by this object is the maximum current and feedback value and may not match the maximum torque mentioned in "Servo Motor Instruction Manual (Vol. 3)".

(3) Torque demand value (6074h)

Index	Sub	Name	Data Type	Access	PDO Mapping
6074h	0	Torque demand value	INTEGER16	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
6074h	0		8000h to 7FFFh	per thousand of rated torque	Impossible	

The torque command is returned.

(4) Torque actual value (6077h)

Index	Sub	Name	Data Type	Access	PDO Mapping
6077h	0	Torque actual value	INTEGER16	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
6077h	0		8000h to 7FFFh	per thousand of rated torque	Impossible	

The current torque is returned.

(5) Torque slope (6087h)

Index	Sub	Name	Data Type	Access	PDO Mapping
6087h	0	Torque slope	UNSIGNED32	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
6087h	0	00000000h	00000000h to 00989680h (10000000)	per thousand of rated torque per second	Possible	PT53

Set the variation per second of the torque command used in the profile torque mode. When "0" is set, the setting value is invalid and the torque command is input with step input.

(6) Torque profile type (6088h)

Index	Sub	Name	Data Type	Access	PDO Mapping
6088h	0	Torque profile type	INTEGER16	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
6088h	0	0	0000h to 0000h		Impossible	

Set the torque command pattern. The description is as follows.

Setting value	Description
0	Linear ramp
1	sin^2 ramp (Not supported) (Note)

Note. This is not supported by the MR-J4-_TM_ servo amplifier.

Values other than "0" cannot be set.

(7) Positive torque limit value (60E0h)

Index	Sub	Name	Data Type	Access	PDO Mapping
60E0h	0	Positive torque limit value	UNSIGNED16	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
60E0h	0	10000	0000h to 2710h (10000)	per thousand of rated torque	Possible	PA11 (POL disabled) PA12 (POL enabled)

You can limit the torque or thrust generated by the servo motor. Set the limit value of the torque of the servo motor in the CCW power running or CW regeneration, or the limit value of the thrust of the linear servo motor in the positive direction power running or negative direction regeneration. Set this object to "0" to generate no torque or thrust.

(8) Negative torque limit value (60E1h)

Index	Sub	Name	Data Type	Access	PDO Mapping
60E1h	0	Negative torque limit value	UNSIGNED16	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
60E1h	0	10000	0000h to 2710h (10000)	per thousand of rated torque	Possible	PA12 (POL disabled) PA11 (POL enabled)

You can limit the torque or thrust generated by the servo motor. Set the limit value of the torque of the servo motor in the CW power running or CCW regeneration, or the limit value of the thrust of the linear servo motor in the negative direction power running or positive direction regeneration. Set this object to "0" to generate no torque or thrust.

7.3.12 Profile Position Mode Objects

(1) Target position (607Ah)

Index	Sub	Name	Data Type	Access	PDO Mapping
607Ah	0	Target position	INTEGER32	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
607Ah	0	0	Refer to the text.	pos units	Impossible	

Set the position command used in the cyclic synchronous position mode (csp) and the profile position mode (pp). The settable values vary depending on the control mode and the setting of [Pr. PT01].

Control mode	[Pr. PT01] setting	Range
Cyclic synchronous position mode (csp)		-80000000h to 7FFFFFFFh (-2147483648 to 2147483647)
Profile position mode (pp)	_ 2 _ _ (degree)	FFFA81C0h to 00057E40h (-360000 to 360000)
	_ 3 _ _ (pulse)	FFF0BDC1h to 000F423Fh (-999999 to 999999)

Set also Gear ratio (6091h) for the profile position mode (pp).

(2) Position range limit (607Bh)

Index	Sub	Name	Data Type	Access	PDO Mapping
607Bh	0	Position range limit	UNSIGNED8	ro	Impossible
	1	Min position range limit	INTEGER32	rw	Possible
	2	Max position range limit			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
607Bh	0	2	00h to 02h		Impossible	
	1		Refer to the text.	pos units		
	2					

Set the range for limiting the command position. The settable values vary depending on the setting of [Pr. PT01].
This object is available with servo amplifiers with software version B0 or later.

[Pr. PT01] setting	Range
_ 2 _ _ (degree) (Note)	00000000h to 00057E3Fh (0 to 359999)
_ 3 _ _ (pulse)	80000000h to 7FFFFFFFh (-2147483648 to 2147483647)

Note. This setting will be enabled in the profile mode.

(3) Software position limit (607Dh)

Index	Sub	Name	Data Type	Access	PDO Mapping
607Dh	0	Software position limit	UNSIGNED8	ro	Impossible
	1	Min position limit	INTEGER32	rw	Possible
	2	Max position limit			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
607Dh	0	2	02h to 02h		Impossible	
	1	0	80000000h to 7FFFFFFFh	pos units	Possible	PT17/PT18
	2					PT15/PT16

Set the range for limiting the command position. Target position (607Ah) is limited within the range between Min position limit (607Dh: 1) and Max position limit (607Dh: 2). When the set value of Min position limit (607Dh: 1) is equal to or greater than the set value of Max position limit (607Dh: 2), the function of Software position limit (607Dh) is disabled.

(4) Max profile velocity (607Fh)

Index	Sub	Name	Data Type	Access	PDO Mapping
607Fh	0	Max profile velocity	UNSIGNED32	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
607Fh	0	2000000	00000000h to 001E8480h (2000000)	vel units	Possible	PT66

Set the speed limit value for the profile position mode (pp) and profile velocity mode (pv). When a value exceeding this object is set to Target velocity (60FFh) or Profile velocity (6081h), the speed is limited with the value of this object.

(5) Max motor speed (6080h)

Index	Sub	Name	Data Type	Access	PDO Mapping
6080h	0	Max motor speed	UNSIGNED32	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
6080h	0		00000000h to FFFFFFFFh	Refer to the text.	Impossible	

The maximum speed of the servo motor is returned. Operation cannot be performed at a speed exceeding the speed set with this object.
Unit: [r/min] ([mm/s] when a linear servo motor is used)

(6) Profile velocity (6081h)

Index	Sub	Name	Data Type	Access	PDO Mapping
6081h	0	Profile velocity	UNSIGNED32	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
6081h	0	10000	00000000h to permissible instantaneous speed	vel units	Possible	PT65

Set the command speed in the profile position mode (pp). Set a value within the range between "0" and permissible speed.
Unit: [0.01 r/min] ([0.01 mm/s] when a linear servo motor is used)

(7) Profile acceleration (6083h)

Index	Sub	Name	Data Type	Access	PDO Mapping
6083h	0	Profile acceleration	UNSIGNED32	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
6083h	0	0	Refer to the text.	ms	Possible	PT49

Set the acceleration time constant in the profile position mode (pp) and the profile velocity mode (pv). Set a time for the servo motor to reach the rated speed. The settable values vary depending on the control mode.

Control mode	Range
Profile position mode (pp)	0 to 20000
Profile velocity mode (pv)	0 to 50000

(8) Profile deceleration (6084h)

Index	Sub	Name	Data Type	Access	PDO Mapping
6084h	0	Profile deceleration	UNSIGNED32	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
6084h	0	0	Refer to the text.	ms	Possible	PT50

Set the deceleration time constant in the profile position mode (pp) and the profile velocity mode (pv). Set a time for the servo motor to stop from the rated speed. The settable values vary depending on the control mode.

Control mode	Range
Profile position mode (pp)	0 to 20000
Profile velocity mode (pv)	0 to 50000

(9) Quick stop deceleration (6085h)

Index	Sub	Name	Data Type	Access	PDO Mapping
6085h	0	Quick stop deceleration	UNSIGNED32	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
6085h	0	100	0 to 20000	ms	Possible	PC24

Set a deceleration time constant for the Quick stop function. Set a time for the servo motor to stop from the rated speed. When "0" is set, the operation is performed with 100 ms.

(10) Motion profile type (6086h)

Index	Sub	Name	Data Type	Access	PDO Mapping
6086h	0	Motion profile type	INTEGER16	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
6086h	0	-1	FFFFh to FFFFh (-1)		Impossible	

Set the acceleration/deceleration pattern in the profile position mode (pp). The description is as follows.

Setting value	Description
-1	S-pattern
0	Linear ramp (Not supported) (Note)
1	sin^2 ramp (Not supported) (Note)
2	Jerk-free ramp (Not supported) (Note)
3	Jerk-limited ramp (Not supported) (Note)

Note. This is not supported by the MR-J4-_TM_ servo amplifier.

For this object, "-1" is always returned. Values other than "-1" cannot be set.

7.3.13 Homing Mode Objects

(1) Home offset (607Ch)

Index	Sub	Name	Data Type	Access	PDO Mapping
607Ch	0	Home offset	INTEGER32	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
607Ch	0	0	80000000h to 7FFFFFFFh	pos units	Possible	

The home position is returned. Only reading the value is available. Do not perform writing because doing so causes an error.

(2) Homing method (6098h)

Index	Sub	Name	Data Type	Access	PDO Mapping
6098h	0	Homing method	INTEGER8	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
6098h	0	37	D5h (-43) to 25h (37)		Possible	PT45

Set a home position return type. Refer to section 5.4.9 (4) for the settable values.

(3) Homing speeds (6099h)

Index	Sub	Name	Data Type	Access	PDO Mapping
6099h	0	Homing speeds	UNSIGNED8	ro	Impossible
	1	Speed during search for switch	UNSIGNED32	rw	Possible
	2	Speed during search for zero			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
6099h	0	2	02h to 02h		Impossible	
	1	10000	0 to permissible instantaneous speed	vel units	Possible	PT05
	2	1000				PT06

Set the servo motor speed at home position return.

Set the servo motor speed at home position return for Speed during search for switch (6099h: 1).
Unit: [0.01 r/min] ([0.01 mm/s] when a linear servo motor is used)

Set the creep speed after proximity dog at home position return for Speed during search for zero (6099h: 2).
Unit: [0.01 r/min] ([0.01 mm/s] when a linear servo motor is used)

(4) Homing acceleration (609Ah)

Index	Sub	Name	Data Type	Access	PDO Mapping
609Ah	0	Homing acceleration	UNSIGNED32	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
609Ah	0	0	00000000h to 00004E20h (20000)	ms	Possible	PT56

Set the acceleration/deceleration time constants at home position return. Set a time for the servo motor to reach the rated speed.

(5) Supported homing method (60E3h)

Index	Sub	Name	Data Type	Access	PDO Mapping
60E3h	0	Supported homing method	UNSIGNED8	ro	Impossible
	1	1st supported homing method	INTEGER8		
	2	2nd supported homing method			
	3	3rd supported homing method			
	4	4th supported homing method			
	5	5th supported homing method			
	6	6th supported homing method			
	7	7th supported homing method			
	8	8th supported homing method			
	9	9th supported homing method			
	10	10th supported homing method			
	11	11th supported homing method			
	12	12th supported homing method			
	13	13th supported homing method			
	14	14th supported homing method			
	15	15th supported homing method			
	16	16th supported homing method			
	17	17th supported homing method			
	18	18th supported homing method			
	19	19th supported homing method			
	20	20th supported homing method			
	21	21st supported homing method			
	22	22nd supported homing method			
	23	23rd supported homing method			
	24	24th supported homing method			
	25	25th supported homing method			
	26	26th supported homing method			
	27	27th supported homing method			
	28	28th supported homing method			
	29	29th supported homing method			
	30	30th supported homing method			
	31	31st supported homing method			
	32	32nd supported homing method			
	33	33rd supported homing method			
	34	34th supported homing method			
	35	35th supported homing method			
	36	36th supported homing method			
	37	37th supported homing method			
	38	38th supported homing method			
	39	39th supported homing method			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
60E3h	0	39	27h (39)		Impossible	
	1	37	25h (37)			
	2	35	23h (35)			
	3	34	22h (34)			
	4	33	21h (33)			
	5	28	1Ch (28)			
	6	27	1Bh (27)			
	7	24	18h (24)			
	8	23	17h (23)			
	9	22	16h (22)			
	10	21	15h (21)			
	11	20	14h (20)			
	12	19	13h (19)			
	13	12	0Ch (12)			
	14	11	0Bh (11)			
	15	8	08h (8)			
	16	7	07h (7)			
	17	6	06h (6)			
	18	5	05h (5)			
	19	4	04h (4)			
	20	3	03h (3)			
	21	-1	FFh (-1)			
	22	-2	FEh (-2)			
	23	-3	FDh (-3)			
	24	-4	FCh (-4)			
	25	-6	FAh (-6)			
	26	-7	F9h (-7)			
	27	-8	F8h (-8)			
	28	-9	F7h (-9)			
	29	-10	F6h (-10)			
	30	-11	F5h (-11)			
	31	-33	DFh (-33)			
	32	-34	DEh (-34)			
	33	-36	DCh (-36)			
	34	-38	DAh (-38)			
	35	-39	D9h (-39)			
	36	-40	D8h (-40)			
	37	-41	D7h (-41)			
	38	-42	D6h (-42)			
	39	-43	D5h (-43)			

The supported home position return type is returned.

7.3.14 Factor Group Objects

(1) Polarity (607Eh)

Index	Sub	Name	Data Type	Access	PDO Mapping
607Eh	0	Polarity	UNSIGNED8	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
607Eh	0	00h	Refer to the text.		Possible	PA14 PC29

The rotation direction selection can be set.

Bit	Description
0	reserved
1	reserved
2	reserved
3	reserved
4	reserved
5 (Note)	0: Servo motor CCW rotation at positive torque 1: Servo motor CW rotation at positive torque
6	0: Servo motor CCW rotation at positive speed 1: Servo motor CW rotation at positive speed
7	0: Servo motor CCW rotation in positioning address increasing direction 1: Servo motor CW rotation in positioning address increasing direction

Note. This is available with servo amplifiers with software version B0 or later.

For the servo amplifier with software version A0, only "00h" or "C0h" can be set. For the servo amplifier with software version B0 or later, only "00h", "C0h", or "E0h" can be set. Values other than 00h and C0h cannot be set.

(2) Position encoder resolution (608Fh)

Index	Sub	Name	Data Type	Access	PDO Mapping
608Fh	0	Position encoder resolution	UNSIGNED8	ro	Impossible
	1	Encoder increments	UNSIGNED32	rw	Possible
	2	Motor revolutions			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
608Fh	0	2	02h to 02h	inc/rev	Impossible	
	1		00000000h to FFFFFFFFh	inc		
	2	1	00000001h to 00000001h	rev		

Encoder resolution is returned with Encoder increments (608Fh: 1). When a linear servo motor is connected, the virtual resolution per revolution is returned. When a fully closed loop system is used, the number of load-side pulses per servo motor-side revolution is returned.

(3) Gear ratio (6091h)

Index	Sub	Name	Data Type	Access	PDO Mapping
6091h	0	Gear ratio	UNSIGNED8	ro	Impossible
	1	Motor revolutions	UNSIGNED32	rw	Possible
	2	Shaft revolutions			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
6091h	0	2	02h to 02h		Impossible	
	1	1	00000001h to 00FFFFFFh (16777215)	rev	Possible	PA06
	2					PA07

Set the electronic gear. Refer to [Pr. PA06] for the settable values. In the cyclic synchronous mode, always set "1" for Motor revolutions (6091h: 1) and Shaft revolutions (6091h: 2).

(4) Feed constant (6092h)

Index	Sub	Name	Data Type	Access	PDO Mapping
6092h	0	Feed constant	UNSIGNED8	ro	Impossible
	1	Feed	INTEGER32	rw	Possible
	2	Shaft revolutions			

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
6092h	0	2	02h to 02h		Impossible	
	1		Refer to the text.	pos units		
	2	1	00000001h to 00000001h	rev		

No value can be written to Feed (6092h: 2) because it is set automatically with [Pr. PT01]. Writing a value sets 0609 0030h Value range of parameter exceeded in SDO Abort Code.
This object is available with servo amplifiers with software version B0 or later.

[Pr. PT01] setting	Range
_ 2 _ _ (degree) (Note)	360000
_ 3 _ _ (pulse)	Encoder resolution of the servo motor

Note. This setting will be enabled in the profile mode.

Position actual value (6064h) is calculated from Gear ratio (6091h) and Feed constant (6092h), as follows.

$$\text{Position actual value (6064h)} = \frac{\text{Position actual internal value (6063h)} \times \text{Feed constant (6092h)}}{\text{Position encoder resolution (608Fh)} \times \text{Gear ratio (6091h)}}$$

When the unit is degree, the operation result will be limited within 0 to 359999.

(5) SI unit position (60A8h)

Index	Sub	Name	Data Type	Access	PDO Mapping
60A8h	0	SI unit position	UNSIGNED32	rw	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
60A8h	0	0	Refer to the text.	pos units	Impossible	

SI unit position (60A8h) is set automatically with [Pr. PT01].
This object is available with servo amplifiers with software version B0 or later.

[Pr. PT01] setting	Range
_ 2 _ _ (degree) (Note)	FD410000h (0.001 degree)
_ 3 _ _ (pulse)	00000000h (1 pulse)

Note. This setting will be enabled in the profile mode.

(6) SI unit velocity (60A9h)

Index	Sub	Name	Data Type	Access	PDO Mapping
60A9h	0	SI unit velocity	UNSIGNED32	rw	Impossible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
60A9h	0	0	FB010300h (0.01 mm/s) FEB44700h (0.01 r/min)	vel units	Impossible	

The SI unit velocity is returned.
This object is available with servo amplifiers with software version B0 or later.

7.3.15 Touch Probe Function Objects

(1) Touch probe function (60B8h)

Index	Sub	Name	Data Type	Access	PDO Mapping
60B8h	0	Touch probe function	UNSIGNED16	rw	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
60B8h	0	0	0000h to FFFFh		Impossible	

Set the command for the touch probe function. Refer to section 5.5 (1) (a) for details.

(2) Touch probe status (60B9h)

Index	Sub	Name	Data Type	Access	PDO Mapping
60B9h	0	Touch probe status	UNSIGNED16	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
60B9h	0		0000h to FFFFh		Impossible	

The status of the touch probe function is returned. Refer to section 5.5 (1) (b) for details.

(3) Touch probe pos1 pos value (60BAh)

Index	Sub	Name	Data Type	Access	PDO Mapping
60BAh	0	Touch probe pos1 pos value	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
60BAh	0	0	80000000h to 7FFFFFFFh	pos units	Impossible	

The position latched at the rising edge of touch probe 1 is returned.

(4) Touch probe pos1 neg value (60BBh)

Index	Sub	Name	Data Type	Access	PDO Mapping
60BBh	0	Touch probe pos1 neg value	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
60BBh	0	0	80000000h to 7FFFFFFFh	pos units	Impossible	

The position latched at the falling edge of touch probe 1 is returned.

(5) Touch probe pos2 pos value (60BCh)

Index	Sub	Name	Data Type	Access	PDO Mapping
60BCh	0	Touch probe pos2 pos value	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
60BCh	0	0	80000000h to 7FFFFFFFh	pos units	Impossible	

The position latched at the rising edge of touch probe 2 is returned.

(6) Touch probe pos2 neg value (60BDh)

Index	Sub	Name	Data Type	Access	PDO Mapping
60BDh	0	Touch probe pos2 neg value	INTEGER32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
60BDh	0	0	80000000h to 7FFFFFFFh	pos units	Impossible	

The position latched at the falling edge of touch probe 2 is returned.

7.3.16 Optional application FE Objects

(1) Digital inputs (60FDh)

Index	Sub	Name	Data Type	Access	PDO Mapping
60FDh	0	Digital inputs	UNSIGNED32	ro	Possible

Index	Sub	Default	Range	Units	EEP-ROM	Parameter
60FDh	0		00000000h to 03300007h		Impossible	

The on/off states of the input device connected to the servo amplifier are returned.
This object is available with servo amplifiers with software version B0 or later.

Bit	Description
0	Negative limit switch 0: LSN (reverse rotation stroke end) off 1: LSN (reverse rotation stroke end) on
1	Positive limit switch 0: LSP (forward rotation stroke end) off 1: LSP (forward rotation stroke end) on
2	home switch 0: DOG (proximity dog) off 1: DOG (proximity dog) on
3 to 19	(reserved) The value at reading is undefined.
20	DI4 0: TPR1 (touch probe 1) off 1: TPR1 (touch probe 1) on
21	DI5 0: TPR2 (touch probe 2) off 1: TPR2 (touch probe 2) on
22 to 23	(reserved) The value at reading is undefined.
24	Safe torque off 1 0: STO1 off 1: STO1 on
25	Safe torque off 2 0: STO2 off 1: STO2 on
26 to 31	(reserved) The value at reading is undefined.

REVISION

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

Print Data	*Manual Number	Revision
Jun. 2015	SH(NA)030208-A	First edition
Apr. 2016	SH(NA)030208-B	Torque POL is added. The degree function is added. The scale measurement function is added. The one-touch tuning, machine diagnosis function, and servo amplifier life diagnosis function via a network are added. «About the manuals» Partially added. Section 1.2 Partially added. Section 1.5.2 Partially changed. Section 2.1 Partially changed. Section 2.2 Partially changed. Section 3.1 Partially changed. Section 3.2 Partially changed. Section 3.4 Partially changed. Section 5.2.2 Partially added. Section 5.3 Partially added. Section 5.3.2 Partially changed. Section 5.3.2 (2) Newly added. Section 5.4.3 Partially added. Partially changed. Section 5.4.4 Partially added. Partially changed. Section 5.4.5 Partially added. Partially changed. Section 5.4.6 Partially added. Partially changed. Section 5.4.7 Partially added. Partially changed. Section 5.4.8 Partially added. Partially changed. Section 5.4.9 Partially added. Partially changed. Section 5.9 Partially changed. Section 5.10 Newly added. Section 5.11 Newly added. Section 6.1 Partially added. Section 6.3 Partially changed. Section 6.6 Newly added. Section 6.7 Newly added. Section 6.8 Newly added. Section 6.9 Newly added. Section 7.1 Partially changed. Section 7.2 Partially added. Section 7.3 Partially added. Section 7.3.1 Partially changed. Section 7.3.2 Partially changed. Section 7.3.3 Partially changed. Section 7.3.4 Partially changed. Section 7.3.5 Partially changed. Section 7.3.6 Partially changed. Section 7.3.7 Partially added. Partially changed. Section 7.3.8 Partially changed.

Print Data	*Manual Number	Revision	
Apr. 2016	SH(NA)030208-B	Section 7.3.9	Partially changed.
		Section 7.3.10	Partially changed.
		Section 7.3.11	Partially changed.
		Section 7.3.12	Partially added.
			Partially changed.
		Section 7.3.13	Partially changed.
		Section 7.3.14	Partially added.
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Warranty

1. Warranty period and coverage

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 are repaired or replaced.

[Term]

The term of warranty for Product is twelve (12) months after your purchase or delivery of the Product to a place designated by you or eighteen (18) 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.

[Limitations]

(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;
- (i) a failure caused by your improper storing or handling, carelessness or negligence, etc., and a failure caused by your hardware or software problem
- (ii) a failure caused by any alteration, etc. to the Product made on your side without our approval
- (iii) 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
- (iv) a failure which may be regarded as avoidable if consumable parts designated in the instruction manual, etc. are duly maintained and replaced
- (v) any replacement of consumable parts (battery, fan, smoothing capacitor, etc.)
- (vi) 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
- (vii) 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
- (viii) any other failures which we are not responsible for or which you acknowledge we are not responsible for

2. Term of warranty after the stop 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. Application and use of the Product

(1) For the use of our General-Purpose AC Servo, its applications should be those that may not result in a serious damage even if any failure or malfunction occurs in General-Purpose AC Servo, and a backup or fail-safe function should operate on an external system to General-Purpose AC Servo when any failure or malfunction occurs.

(2) Our General-Purpose AC Servo 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.

MODEL	
MODEL CODE	

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE : TOKYO BLDG MARUNOUCHI TOKYO 100-8310

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