MITSUBISHI ELECTRIC

AC Servo System

MITSUBISHI ELECTRIC SERVO SYSTEM
MELSERVO-J5

MR-J5-G-N1/MR-J5W-G-N1 User's Manual (Communication Function)

-MR-J5-_G_-_N1
-MR-J5W_-_G-_N1
-MR-J5D_-_G_-_N1
-MR-MD333G-N1

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 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 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.

Note that the CAUTION level may lead to a serious consequence depending on conditions.
Please follow the instructions of both levels because they are important to personnel safety.
Forbidden actions and required actions are indicated by the following diagrammatic symbols.

	Indicates a forbidden action. For example, "No Fire" is indicated by .
	Indicates a required action. For example, grounding is indicated by .

In this manual, precautions for hazards that can lead to property damage, instructions for other functions, and other information are shown separately in the "Point" area.
After reading this manual, keep it accessible to the operator.

[Installation/wiring]

⚠WARNING

- To prevent an electric shock, turn off the power and wait for 15 minutes or more (20 minutes or more for a converter unit/drive unit) before starting wiring and/or inspection.
- To prevent an electric shock, ground the servo amplifier.
- To prevent an electric shock, any person who is involved in wiring should be fully competent to do the work.
- To prevent an electric shock, mount the servo amplifier before wiring.
- To prevent an electric shock, connect the protective earth (PE) terminal of the servo amplifier to the protective earth (PE) of the cabinet, then connect the grounding lead wire to the ground.
- To prevent an electric shock, do not touch the conductive parts.

[Setting/adjustment]

⚠WARNING

- To prevent an electric shock, do not operate the switches with wet hands.

[Operation]

⚠WARNING

- To prevent an electric shock, do not operate the switches with wet hands.

[Maintenance]

⚠WARNING

- To prevent an electric shock, any person who is involved in inspection should be fully competent to do the work.
- To prevent an electric shock, do not operate the switches with wet hands.

ABOUT THE MANUAL

If using the servo for the first time, prepare and use the related manuals as needed to ensure safe operation of the servo. For the related manuals, refer to the User's Manual (Introduction) or MR-MD3 User's Manual.
When reading this manual to use a drive unit, substitute "drive unit" for "servo amplifier".

Global standards and regulations

Compliance with the indicated global standards and regulations is current as of the release date of this manual. Some standards and regulations may have been modified or withdrawn.

Network and function availability

For information on available networks (EtherCAT, EtherNet/IP, and PROFINET) and servo amplifier functions, refer to "FUNCTION" in the User's Manual (Introduction) or MR-MD3 User's Manual.

DIFFERENCES IN FIRMWARE VERSIONS AND SERVO PARAMETER INITIAL VALUES FOR MR-MD333G_

When the supported firmware versions and servo parameter initial values differ between the MR-J5_-G_ and MR-MD333G_, the abbreviation for the MR-MD333G_ (MD333G) and the differences are shown in parentheses.

Ex.
Available on servo amplifiers with firmware version D8 (MD333G: A6) or later.

Ex.
Initial value: 25600 [pulse] (MD333G: 1600 [pulse])

OBJECT UNITS

This section explains the pos units, vel units, and acc units used in this manual.
The degree unit is available on servo amplifiers with firmware version B6 (MD333G: A2) or later.
The mm unit and inch unit are available on servo amplifiers with firmware version B8 (MD333G: A2) or later in the positioning mode (point table method).

pos units

The standard unit can be changed using [Pr. PT01.2 Unit for position data] as shown in the following table.

Setting value	Standard unit
0	mm
1	inch
2	degree
3	pulse

vel units

The speed unit can be changed using [Pr. PT01.1 Speed/acceleration/deceleration unit selection] as shown in the following table. The command unit can be changed to "0.001 mm", "0.0001 inch", "0.001 degree", or "pulse" using [Pr. PT01.2].

Setting value	Unit
0	0.01 r/min, 0.01 mm/s *1
1	Command unit/s

*1 0.01 mm/s is used in the linear servo motor control mode.

acc units

The acceleration unit can be changed using [Pr. PT01.1] as shown in the following table. The command unit can be changed to "0.001 mm", "0.0001 inch", "0.001 degree", or "pulse" using [Pr. PT01.2].

Setting value	Unit
0	ms
1	Command unit/s^2

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

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PART 1 EtherCAT

1 FUNCTIONS AND CONFIGURATION

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6 SYNCHRONIZATION

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1 FUNCTIONS AND CONFIGURATION

1.1 Outline

EtherCAT is an abbreviation of Ethernet for Control Automation Technology. It is open network communication between a master station and slave stations via real-time Ethernet developed by Beckhoff Automation. ETG (EtherCAT Technology Group) manages EtherCAT.
The servo amplifiers operate as slave stations which support the CAN application protocol over EtherCAT (CoE). The device type corresponds to the power drive system and supports the CiA 402 drive profile.

CiA 402 drive profile

The servo amplifiers operate as slave stations which support the CAN application protocol over EtherCAT (CoE). The device type corresponds to a power drive system, and supports the CiA 402 drive profile.

Control mode

The servo amplifier supports the following control modes.

Control mode	Symbol	Description
Cyclic synchronous position mode	csp	This is a control mode to drive servo motors by receiving a position command cyclically via either synchronous or asynchronous communication with a controller. Use an absolute position address for the command.
Cyclic synchronous velocity mode	csv	This is a control mode to drive servo motors by receiving a speed command cyclically via either synchronous or asynchronous communication with a controller.
Cyclic synchronous torque mode	cst	This is a control mode to drive servo motors by receiving a torque command cyclically via either synchronous or asynchronous communication with a controller.
Profile position mode	pp	This is a positioning mode to drive servo motors by receiving an end position command via either synchronous or asynchronous communication with a controller. Use an absolute position address or a relative position address for the command.
Profile velocity mode	pv	This is a control mode to drive servo motors by receiving a target speed command via either synchronous or asynchronous communication with a controller.
Profile torque mode	tq	This is a control mode to drive servo motors by receiving a target torque command via either synchronous or asynchronous communication with a controller.
Point table mode	pt	This is a control mode to drive servo motors according to commands such as travel distance and speed which are stored in the point table number specified via either synchronous or asynchronous communication with a controller. This control mode is not in CiA 402 standard (Mitsubishi Electric original).
JOG operation mode	jg	This is a control mode where the servo motor speed is set to drive the servo motor manually via either synchronous or asynchronous communication with a controller. This control mode is not in CiA 402 standard (Mitsubishi Electric original).
Homing mode	hm	This is a control mode to perform homing with the method specified by the controller.

Satisfied standards

The servo amplifiers comply with the standards shown below. For the descriptions which are not in this manual, refer to the following standards.

Standards	Version
ETG.1000.2 EtherCAT Specification - Part2 Physical Layer service definition and protocol specification	V1.0.4
ETG.1000.3 EtherCAT Specification - Part3 Data Link Layer service definition	V1.0.4
ETG.1000.4 EtherCAT Specification - Part4 Data Link Layer protocol specification	V1.0.4
ETG.1000.5 EtherCAT Specification - Part5 Application Layer service definition	V1.0.4
ETG.1000.6 EtherCAT Specification - Part6 Application Layer protocol specification	V1.0.4
ETG.1020 EtherCAT Protocol Enhancements	V1.2.0
ETG.1300 EtherCAT Indicator and Labeling Specification	V1.1.1
ETG.2000 EtherCAT Slave Information (ESI) Specification	V1.0.10
ETG.6010 Implementation Directive for CiA 402 Drive Profile	V1.1.0
ETG.5003.1 Semiconductor Device Profile - part1 CommonDeviceProfile*1	V1.1.0
ETG.5003.2 Semiconductor Device Profile - part2 Firmware Update	V1.0.1
ETG.5001.4 EtherCAT Modular Device Profile - part4 Safety Modules Specification	V1.1.0
ETG.5100 Safety over EtherCAT Protocol Specification	V1.2.0
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 2.0
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 2.0

*1 It complies with the items in CDP (CommonDeviceProfile) in the standards for servo amplifiers with firmware version D4 (MD333G: A4) or later.

1.2 Function list

This list explains the EtherCAT related functions for devices and the whole system.

Category	Subcategory	Function	Description	Detailed explanation
Network	Open network	EtherCAT protocol	This protocol supports EtherCAT.	☞ Page 18 Communication specifications
		EtherCAT communication setting	This setting specifies the control mode and network communication.	☞ Page 58 STARTUP
	Remote maintenance	File access over EtherCAT (FoE)	This protocol enables a firmware upload to devices via a network. For details, contact your local sales office.	—
		Ethernet over EtherCAT (EoE)	This protocol transmits the Ethernet communication data via the EtherCAT segment.	☞ Page 16 Connection via a controller
	Profile	ESI	This is a setting file on which the information specific to each slave station (vendor information, product information, profiles, objects, and other information) is written. Store the ESI file on a controller to use it.	—
Application function	Functional safety	Safety communication function (FSoE)	Connecting the servo amplifier to a controller compliant with functional safety enables the use of safety sub-functions.	☞ Page 69 FSoE
	Synchronization	Distributed clock (DC)	This function enables DC mode.	☞ Page 36 SYNCHRONIZATION

1.3 Engineering software

The following explains the main purposes of the engineering software used in communication. For specific usages, refer to the manuals of the engineering software and controller.

Engineering software list

This list shows engineering software to be used.

Engineering software	Detailed explanation
MR Configurator2	This software has the following functions: servo amplifier adjustment, monitor display, diagnosis, reading/writing of servo parameters, and test operation. These functions are performed using a personal computer. Parameter settings and test operation can also be performed via a controller. Settings, such as a stroke limit, absolute position detection system, and communication error detection time, are configured with this software.

Connection via a controller

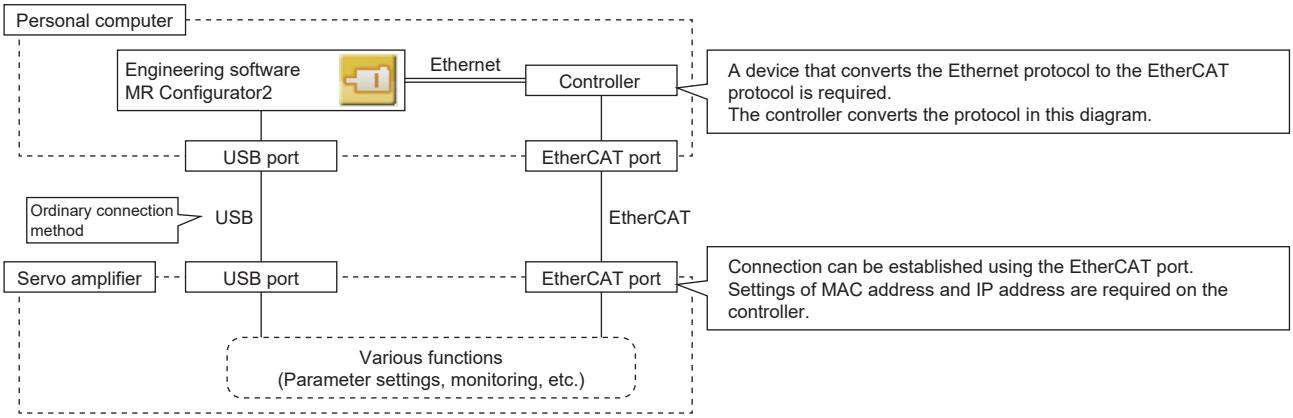
For the MR-J5_-_G_-_N1, connection via a controller is available on servo amplifiers with firmware version C4 or later and MR Configurator2 with software version 1.130L or later.

For the MR-MD333G-N1, connection via a controller is available on servo amplifiers with firmware version A8 or later and MR Configurator2 with software version 1.170C or later.

The Ethernet over EtherCAT (EoE) function of EtherCAT network allows the engineering software to be connected with the servo amplifier via a controller.

A controller that supports the EoE function (EtherCAT master) is required.

For the usage of the EoE function, refer to the manual for the controller to be used.


Personal computer
Engineering software
MR Configurator2
Ethernet
Controller
A device that converts the Ethernet protocol to the EtherCAT protocol is required.
The controller converts the protocol in this diagram.
USB port
EtherCAT port
Ordinary connection method
USB
EtherCAT
Servo amplifier
USB port
EtherCAT port
Connection can be established using the EtherCAT port.
Settings of MAC address and IP address are required on the controller.
Various functions
(Parameter settings, monitoring, etc.)

2 EtherCAT COMMUNICATION

2.1 Communication specifications

The communication specifications are shown in the following table.

Item		Description	Remarks
EtherCAT communication specifications		IEC 61158 Type12 CAN application protocol over EtherCAT (CoE), IEC 61800-7 CiA 402 Drive Profile	—
Physical layer		100BASE-TX (IEEE802.3)	—
Communication connector		Two RJ45 ports (IN port and OUT port)	—
Communication cable	Cable type	Category 5e or higher, (double shielded/STP) straight cable	—
	Standard	One of the following standards must be met. • IEEE802.3 100BASE-TX • ANSI/TIA/EIA-568-B (Category 5e)	
	Connector	RJ-45 shielded connector	
Network topology		Line, tree, star, or hybrid of these three topology types	—
Communication speed		100 Mbps (Full duplex)	—
Transmission distance between stations		Max. 100 m	—
Number of connection nodes		Max. 65535	The number of connection nodes for actual use varies depending on the specifications of the master controller.
SDO (Mailbox) communication		Asynchronous communication Sending/Receiving: 1 channel each	Maximum data size in sending/receiving: 1486 bytes per channel
PDO (Process Data) communication *1		Cycle time: Select from 0.125 ms, 0.25 ms, 0.5 ms, 1 ms, 2 ms, 4 ms, or 8 ms. Receive PDO (RxPDO): 1 channel Send PDO (TxPDO): 1 channel	Multi-axis servo amplifiers do not support a communication cycle of 0.125 ms.
PDO mapping		The servo amplifiers support variable PDO mapping.	• Maximum sizes of RxPDO and TxPDO ☞ Page 31 Variable PDO mapping • Maximum number of object mappings MR-J5-_G_-_N1: 32 MR-J5W2-_G-N1: 64 MR-J5W3-_G-N1: 96 MR-J5D1-_G_-N1: 32 MR-J5D2-_G_-N1: 64 MR-J5D3-_G_-N1: 96 MR-MD333G_-N1: 96 • Maximum number of object mappings (safety PDO when the safety communication function is used) MR-J5-_G_-_N1: 36 MR-J5W2-_G-N1: 70 MR-J5W3-_G-N1: 104 MR-J5D1-_G_-N1: 36 MR-J5D2-_G_-N1: 70 MR-J5D3-_G_-N1: 104 MR-MD333G_-N1: 104
Distributed clock (DC)		DC mode or Free-run mode can be selected.	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 There are restrictions on the communication cycle depending on the function used. For details, refer to "Restrictions on the MR-J5_-_G_" and "Restrictions on the MR-MD3" in the following manual.
MR-J5-G-N1/MR-J5W-G-N1 User's Manual (Introduction)
MR-J5D-G-N1 User's Manual (Introduction)
MR-MD3 User's Manual

2.2 EtherCAT State Machine (ESM)

The communication states of the MR-J5-G-N1/MR-J5W-G-N1 servo amplifier are classified and managed by EtherCAT State Machine (ESM) which is defined in the EtherCAT standard.
For multi-axis servo amplifiers, the communication state transitions in the whole station (common to all the axes).

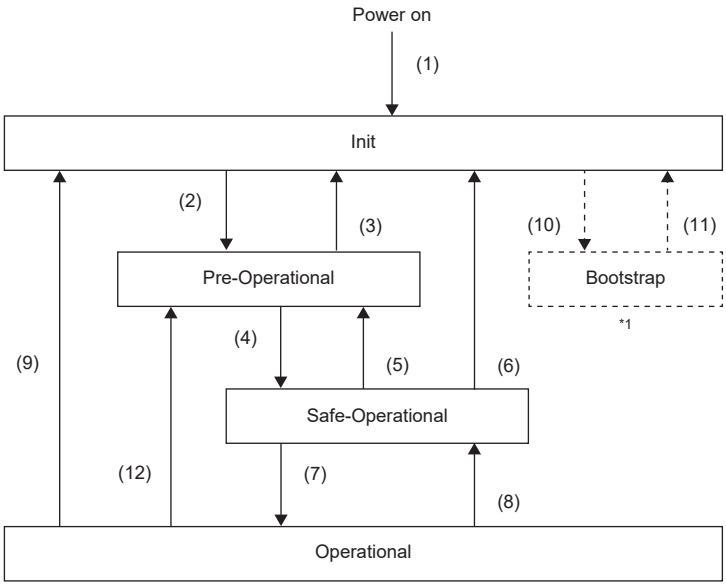
Communication state

Communication states are classified as shown in the table below. There are two types of communications: PDO (Process Data Object) communication in which command data and feedback data are transmitted and received cyclically, and SDO (Service Data Object) communication in which object data is transmitted and received asynchronously.
☞ Page 24 PDO (Process Data Object) COMMUNICATION
☞ Page 34 SDO (Service Data Object) COMMUNICATION

ESM state	Description
Init	The ESM state after turning on the power is the Init state. No SDO communication or PDO communication is possible. The master station accesses the DL-Information registers and initializes the communication.
Pre-Operational	SDO communication is possible. PDO communication is not possible. Initial network settings are configured and the initial transfer of parameters are made in this state.
Safe-Operational	SDO communication is possible. PDO communication is also possible although all the operations (commands) such as driving servo motors are disabled. When the DC mode is selected, synchronization is established in this state.
Operational	Both the SDO communication and the PDO communication are possible. Commanding via PDO communication is enabled, and servo motors can be driven.
Bootstrap	Mailbox communication via the FoE protocol is possible. This is a state in which the firmware is updated via EtherCAT. (For manufacturer setting)

EtherCAT state

The servo amplifier can be operated once the state transitions from the Init state through the Pre-Operational and Safe-Operational state to the Operational state. When the Operational state transitions to other states, initialization of the servo amplifier is executed to clear internal statuses.



*1 This state is for manufacturer's settings.

Transition No.	Description
(1)	Power-on
(2)	SDO communication configuration • The master station sets Sync Manager channels for SDO communication and DL Address registers of the slave station. • The master station requests the slave station to transition to the Pre-Operational state. • The state transitions to the Pre-Operational state.
(4)	PDO communication configuration • The master station sets configuration parameters (such as PDO mapping) using SDO communication. • The master station sets Sync Manager channels for PDO communication and FMMU channels of the slave station. FMMU (Fieldbus Memory Management Unit) is a mechanism to manage the relationship between the global address space and the local address space in EtherCAT communication. The global address space is used for PDO communication, and the local address space in each slave station stores object data. • The master station requests the slave station to transition to the Safe-Operational state. • The state transitions to the Safe-Operational state.
(7)	Synchronization • The master station and the slave station synchronize with each other by using Distributed Clocks. • The master station starts to output a valid command value. • The master station requests the slave station to transition to the Operational state. • The state transitions to the Operational state.
(5), (12)	When the master station requests the slave station to transition to the Pre-Operational state, the state transitions to the Pre-Operational state.
(8)	When the master station requests the slave station to transition to the Safe-Operational state, the state transitions to the Safe-Operational state.
(3), (6), (9), (11)	In the following case, the state transitions to the init state. When the master station requests the slave station to transition to the Init state.
(10)	When the master station requests the slave station to transition to the Bootstrap state, the state transitions to the Bootstrap state.

3 SUMMARY OF OBJECT DICTIONARY (OD)

Point

For details of the object dictionary, refer to the following manual.
MR-J5-G-N1/MR-J5W-G-N1 User's Manual (Object Dictionary)

The data that a CAN application protocol over EtherCAT (CoE) device holds, 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 data is exchanged between the master and slave devices. The collection of these objects is called an object dictionary (OD).

3.1 Section definition of object dictionary

With the CoE protocol (CAN application protocol over EtherCAT), objects of an object dictionary are categorized by Index depending on the descriptions as shown in the following table. Refer to the Reference column for the details of each object.
A multi-axis servo amplifier uses one ESI file for objects of all axes. Therefore, from the second axis onward, the object addresses (Index) differ from those of the first axis. Indexes 1000h to 1FFFh are used for common objects for all axes, and Indexes 2000h onward are used for objects for individual axes. An individual axis can be specified by adding offsets to objects addresses (Index).
The objects of the Semiconductor device profile (Index F000h to F0FFh) are available on servo amplifiers with firmware version D4 (MD333G: A4) or later. Specify the objects for individual axes with Sub Index for Indexes F000h onward.

Index	Description
1000h to 1FFFh	Communication profile
2000h to 4FFFh	Objects group defined by Mitsubishi Electric
6000h to 77FFh	CiA 402 drive profile
F000h to F0FFh	Semiconductor device profile

The following shows the section definition of object dictionary when the safety communication function is used.
The following definitions are added to the section definition (CAN application protocol over EtherCAT (CoE)).
Indexes F000h to FFFFh change to the objects of the FSoE device profile when the safety communication function is used. They can only have either of the FSoE device profile definition and the Semiconductor device profile definition.

Index	Description
1608h 1A08h	Communication profile
E600h E700h E900h to E9FFh F601h to F6FFh F700h to F7FFh	FSoE CiA 402 drive profile
F000h to FFFFh	Modular device profile

All objects of an object dictionary follow the definitions specified in the standards. The correspondence between indexes and the object contents is shown in the following table.
Refer to the Reference column for the details of each object.

Index	Description	Reference
0000h to 0FFFh	Data type area	—
1000h to 1FFFh	CoE communication area	☞ Page 24 PDO (Process Data Object) COMMUNICATION ☞ Page 34 SDO (Service Data Object) COMMUNICATION 📖MR-J5-G-N1/MR-J5W-G-N1 User's Manual (Object Dictionary)
2000h to 25FFh	Servo parameter area (manufacturer specific) (A-axis)	📖MR-J5-G-N1/MR-J5W-G-N1 User's Manual (Object Dictionary)
2A00h to 2FFFh	Servo control command/monitor area (manufacturer specific) (A-axis)	
3000h to 35FFh	Servo parameter area (manufacturer specific) (B-axis)	
3A00h to 3FFFh	Servo control command/monitor area (manufacturer specific) (B-axis)	
4000h to 45FFh	Servo parameter area (manufacturer specific) (C-axis)	
4A00h to 4FFFh	Servo control command/monitor area (manufacturer specific) (C-axis)	
6000h to 67FFh	CiA 402 drive profile area (A-axis)	
6800h to 6FFFh	CiA 402 drive profile area (B-axis)	
7000h to 77FFh	CiA 402 drive profile area (C-axis)	
F000h to F0FFh	Semiconductor device profile area	

The correspondence between indexes and the object contents when the safety communication function is used is shown in the following table. The following definitions are added.
Indexes F000h to FFFFh change to the objects of the FSoE device profile when the safety communication function is used. They can only have either of the FSoE device profile definition and the Semiconductor device profile definition.
Refer to the Reference column for the details of each object.

Index	Description	Reference
1608h 1A08h	CoE communication area	☞ Page 24 PDO (Process Data Object) COMMUNICATION ☞ Page 34 SDO (Service Data Object) COMMUNICATION 📖MR-J5-G-N1/MR-J5W-G-N1 User's Manual (Object Dictionary)
E600h	FSoE CiA402 drive profile area (FSoE Input area)	📖MR-J5-G-N1/MR-J5W-G-N1 User's Manual (Object Dictionary)
E700h	FSoE CiA402 drive profile area (FSoE Output area)	
E900h to E90Fh	FSoE CiA402 drive profile area (FSoEInformation area) (A-axis)	
E910h to E91Fh	FSoE CiA402 drive profile area (FSoEInformation area) (B-axis)	
E920h to E92Fh	FSoE CiA402 drive profile area (FSoEInformation area) (C-axis)	
F601h to F60Fh	FSoE CiA402 drive profile area (FSoE Input area) (A-axis)	
F611h to F61Fh	FSoE CiA402 drive profile area (FSoE Input area) (B-axis)	
F621h to F62Fh	FSoE CiA402 drive profile area (FSoE Input area) (C-axis)	
F701h to F70Fh	FSoE CiA402 drive profile area (FSoE Output area) (A-axis)	
F711h to F71Fh	FSoE CiA402 drive profile area (FSoE Output area) (B-axis)	
F721h to F72Fh	FSoE CiA402 drive profile area (FSoE Output area) (C-axis)	
F000h to FFFFh	Modular device profile area	

3.2 Saving object dictionary data

Some of the object dictionary data is saved in non-volatile memory, while other data is not. Use [Store Parameters (Obj. 1010h)] to save the object dictionary data in non-volatile memory.
For details about objects that can be saved in the non-volatile memory, refer to the following manual.
📖MR-J5-G-N1/MR-J5W-G-N1 User's Manual (Object Dictionary)

Store parameters

Writing "65766173h" (= "save" in reverse ASCII byte order) to [Save all parameters (Obj. 1010h: 01h)] saves the object settings to the non-volatile memory of the servo amplifier.
It may take approximately 25 s for [Save all parameters (Obj. 1010h: 01h)] to save all parameters. Do not turn off the power supply 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.

When [Save all parameters (PNU4112: 1)] is read, the values shown below are returned. Bit 0 is 0 during the save operation and 1 when the save operation is not in progress.

Bit	Description
0	0: Objects cannot be saved by the command (save operation in progress) 1: Objects can be saved by the command (save operation not in progress)
1	0: Not automatically saved

Precautions

To turn off the power supply after executing Store Parameters, make sure that the save operation is not in progress (Bit 0 is 1), and then turn off the power supply.

Restore default parameters

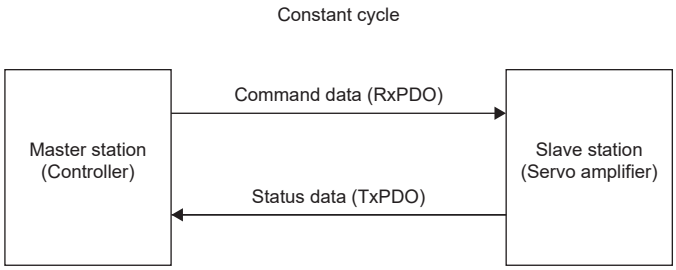
Objects can be reset to the factory setting.
To initialize objects, write "64616F6Ch" (= reverse order of the ASCII code "load") to [Restore all default parameters (Obj. 1011h: 01h)], then cycle the power. Writing a value other than "load" (= 64616F6Ch) triggers an error. Initialization can take up to around 25 s.

Index	Sub	Object	Name	Data Type	Access	Description
1011h	0	ARRAY	Restore default parameters	U8	ro	Number of entries
	1		Restore all default parameters	U32	rw	All parameter initialization

Reading [Restore all default parameters (Obj. 1011h: 01h)] will display "00000001h" (command valid).

4 PDO (Process Data Object) COMMUNICATION

In PDO (Process Data Object) communication, command data and feedback data can be transmitted and received cyclically between a master station (controller) and a slave station (servo amplifier). PDOs are distinguished into RxPDOs and TxPDOs. An RxPDO is used when the slave station receives command data from the controller, and a TxPDO is used when the slave station transmits status data to the controller.



The variable PDO mapping function enables PDO communication to transmit and receive multiple PDOs in any array at a time.

4.1 PDO communication cycle

RxPDO communication and TxPDO communication are performed at the same cycle on the servo amplifier.
To change the communication cycle time, rewrite [Cycle Time (Obj. 1C32h: 02h)] with SDO download in the Pre-Operational state via a network.

4.2 PDO setting-related objects

Objects related to PDO settings are shown in the following table.

Index	Sub	Object	Name	Data Type	Access	Description
1C32h	0	RECORD	SM output parameter	U8	ro	MR-J5-G-N1/MR-J5W-G-N1 User's Manual (Object Dictionary)
	1		Synchronization Type	U16	rw	
	2		Cycle time	U32	rw	
	4		Synchronization types supported	U16	ro	
	5		Minimum cycle time	U32	ro	
	6		Calc and copy time	U32	ro	
	9		Delay time	U32	ro	
	11		SM-Event Missed	U16	ro	
	12		Cycle time too small	U16	ro	
	13		Shift Time Too Short	U16	ro	
	32		Sync Error	BOOL	ro	
1C33h	0	RECORD	SM input parameter	U8	ro	
	1		Synchronization type	U16	rw	
	2		Cycle time	U32	rw	
	4		Synchronization types supported	U16	ro	
	5		Minimum cycle time	U32	ro	
	6		Calc and copy time	U32	ro	
	9		Delay time	U32	ro	
	11		SM-Event Missed	U16	ro	
	12		Cycle time too small	U16	ro	
	13		Shift Time Too Short	U16	ro	
	32		Sync Error	BOOL	ro	

4.3 PDO default mapping

Point

The servo amplifier supports the variable PDO mapping function, which can select objects transmitted and received in PDO communication. For changing the PDO mapping, refer to the following.

☞ Page 31 Variable PDO mapping

RxPDO default mapping

With the RxPDO default mapping, a master station (controller) transmits command data to a slave station (servo amplifier) using an RxPDO in the array shown in the following table. When the safety communication function is used, the safety PDO mapping ([9th Receive PDO Mapping (Obj. 1608h)]) is available. For the safety communication function, refer to the following.

☞ Page 31 Variable PDO mapping

Map No.	Initial mapping settings	Applications expected to be used for initial mapping
1st RxPDO map A-axis: 1600h B-axis: 1610h C-axis: 1620h	Modes of operation (Obj. 6060h) Padding (1 byte) Controlword (Obj. 6040h) Control DI 1 (Obj. 2D01h) Control DI 2 (Obj. 2D02h) Control DI 3 (Obj. 2D03h) Target position (Obj. 607Ah) Target velocity (Obj. 60FFh) Velocity limit value (Obj. 2D20h) Target torque (Obj. 6071h)	Cyclic synchronous position mode (csp) Cyclic synchronous velocity mode (csv) Cyclic synchronous torque mode (cst) Homing mode (hm) This initial mapping is for an application in which the modes above are switched and used. The following function can be used together. • Speed limit function (in cst) Map size: 24 bytes
2nd RxPDO map A-axis: 1601h B-axis: 1611h C-axis: 1621h	Modes of operation (Obj. 6060h) Padding (1 byte) Controlword (Obj. 6040h) Control DI 1 (Obj. 2D01h) Control DI 2 (Obj. 2D02h) Control DI 3 (Obj. 2D03h) Target position (Obj. 607Ah) Target velocity (Obj. 60FFh) Velocity limit value (Obj. 2D20h) Target torque (Obj. 6071h) Profile velocity (Obj. 6081h) Profile acceleration (Obj. 6083h) Profile deceleration (Obj. 6084h) Torque slope (Obj. 6087h)	Profile position mode (pp) Profile velocity mode (pv) Profile torque mode (tq) Homing mode (hm) This initial mapping is for an application in which the modes above are switched and used. The following function can be used together. • Speed limit function (in tq) Map size: 42 bytes
3rd RxPDO map A-axis: 1602h B-axis: 1612h C-axis: 1622h	Modes of operation (Obj. 6060h) Padding (1 byte) Controlword (Obj. 6040h) Control DI 1 (Obj. 2D01h) Control DI 2 (Obj. 2D02h) Control DI 3 (Obj. 2D03h) Target point table (Obj. 2D60h) Profile velocity (Obj. 6081h) Profile acceleration (Obj. 6083h) Profile deceleration (Obj. 6084h)	Point table mode (pt) JOG operation mode (jg) Homing mode (hm) This initial mapping is for an application in which the modes above are switched and used. Map size: 24 bytes
4th RxPDO map A-axis: 1603h B-axis: 1613h C-axis: 1623h	Unassigned	—

Map No.	Initial mapping settings	Applications expected to be used for initial mapping
9th RxPDO map 1608h	FSoE Master Command (Obj. E700h: 01h) STO Command (Obj. F701h: 01h) SS1 Command (Obj. F701h: 02h) SS2 Command (Obj. F701h: 03h) Padding (2 bit) SDIP Command (Obj. F701h: 04h) SDIN Command (Obj.F701h: 05h) Error Ack (Obj. F701h: 06h) SLS1 Command (Obj. F701h: 07h) SLS2 Command (Obj. F701h: 08h) SLS3 Command (Obj. F701h: 09h) SLS4 Command (Obj. F701h: 0Ah) SLI Command (Obj. F701h: 0Bh) SLT1 Command (Obj. F701h: 0Ch) SLT2 Command (Obj. F701h: 0Dh) SLT3 Command (Obj. F701h: 0Eh) FSoE Master CRC_0 (Obj. E700h: 03h) SLT4 Command (Obj. F701h: 0Fh) Padding (15 bit) FSoE Master CRC_1 (Obj. E700h: 04h) STO Command (Obj. F711h: 01h) *1 SS1 Command (Obj. F711h: 02h) *1 SS2 Command (Obj. F711h: 03h) *1 Padding (2 bit) *1 SDIP Command (Obj. F711h: 04h) *1 SDIN Command (Obj.F711h: 05h) *1 Error Ack (Obj. F711h: 06h) *1 SLS1 Command (Obj. F711h: 07h) *1 SLS2 Command (Obj. F711h: 08h) *1 SLS3 Command (Obj. F711h: 09h) *2 SLS4 Command (Obj. F711h: 0Ah) *1 SLI Command (Obj. F711h: 0Bh) *1 SLT1 Command (Obj. F711h: 0Ch) *1 SLT2 Command (Obj. F711h: 0Dh) *1 SLT3 Command (Obj. F711h: 0Eh) *1 FSoE Master CRC_2 (Obj. E700h: 05h) *1 SLT4 Command (Obj. F711h: 0Fh) *1 Padding (15 bit) *1 FSoE Master CRC_3 (Obj. E700h: 06h) *1 STO Command (Obj. F721h: 01h) *2 SS1 Command (Obj. F721h: 02h) *2 SS2 Command (Obj. F721h: 03h) *2 Padding (2 bit) *2 SDIP Command (Obj. F721h: 04h) *2 SDIN Command (Obj.F721h: 05h) *2 Error Ack (Obj. F721h: 06h) *2 SLS1 Command (Obj. F721h: 07h) *2 SLS2 Command (Obj. F721h: 08h) *2 SLS3 Command (Obj. F721h: 09h) *2 SLS4 Command (Obj. F721h: 0Ah) *2 SLI Command (Obj. F721h: 0Bh) *2 SLT1 Command (Obj. F721h: 0Ch) *2 SLT2 Command (Obj. F721h: 0Dh) *2 SLT3 Command (Obj. F721h: 0Eh) *2 FSoE Master CRC_4 (Obj. E700h: 07h) *2 SLT4 Command (Obj. F701h: 0Fh) *2 Padding (15 bit) *2 FSoE Master CRC_5 (Obj. E700h: 08h) *2 FSoE Master ConnectionID (Obj. E700h: 02h)	This mapping is for an application in which the safety communication function is used. Map size: 11 bytes (1-axis servo amplifier), 19 bytes (2-axis servo amplifier), 27 bytes (3-axis servo amplifier)

*1 For the 2-axis servo amplifier and 3-axis servo amplifier

*2 For the 3-axis servo amplifier

TxPDO default mapping

With the TxPDO default mapping, status data is transmitted to a master station (controller) using a TxPDO in the array shown in the following table. When the safety communication function is used, the safety PDO mapping ([9th Transmit PDO Mapping (Obj. 1A08h)]) is available. For the safety communication function, refer to the following.

☞ Page 69 Safety communication function

Map No.	Initial mapping settings	Applications expected to be used for initial mapping
1st TxPDO map A-axis: 1A00h B-axis: 1A10h C-axis: 1A20h	Modes of operation display (Obj. 6061h) Padding (1 byte) Statusword (Obj. 6041h) Status DO 1 (Obj. 2D11h) Status DO 2 (Obj. 2D12h) Status DO 3 (Obj. 2D13h) Position actual value (Obj. 6064h) Velocity actual value (Obj. 606Ch) Following error actual value (Obj. 60F4h) Torque actual value (Obj. 6077h)	Cyclic synchronous position mode (csp) Cyclic synchronous velocity mode (csv) Cyclic synchronous torque mode (cst) Homing mode (hm) This initial mapping is for an application in which the modes above are switched and used. This mapping is also for an application in which the following modes are switched and used. • Profile position mode (pp) • Profile velocity mode (pv) • Profile torque mode (tq) • Homing mode (hm) Map size: 24 bytes
2nd TxPDO map A-axis: 1A01h B-axis: 1A11h C-axis: 1A21h	Modes of operation (Obj. 6060h) Padding (1 byte) Statusword (Obj. 6041h) Status DO 1 (Obj. 2D11h) Status DO 2 (Obj. 2D12h) Status DO 3 (Obj. 2D13h) Status DO 5 (Obj. 2D15h) Status DO 7 (Obj. 2D17h) Position actual value (Obj. 6064h) Velocity actual value (Obj. 606Ch) Following error actual value (Obj. 60F4h) Torque actual value (Obj. 6077h) M code actual value (Obj. 2D6Ah) Padding (1 byte) Point demand value (Obj. 2D68h) Point actual value (Obj. 2D69h)	Point table mode (pt) JOG operation mode (jg) Homing mode (hm) This initial mapping is for an application in which the modes above are switched and used. Map size: 34 bytes
3rd TxPDO map A-axis: 1A02h B-axis: 1A12h C-axis: 1A22h	Unassigned	—
4th TxPDO map A-axis: 1A03h B-axis: 1A13h C-axis: 1A23h	Unassigned	—

Map No.	Initial mapping settings	Applications expected to be used for initial mapping
9th TxPDO map 1A08h	FSoE Slave Command (Obj. E600h: 01h) STO Status (Obj. F601h: 01h) SSM Status (Obj. F601h: 02h) Padding (1 bit) SOS Status (Obj. F601h: 03h) Padding (3 bit) Error (Obj. F601h: 04h) SS1 Status (Obj. F601h: 05h) SS2 Status (Obj. F601h: 06h) SDIP Status (Obj. F601h: 07h) SDIN Status (Obj. F601h: 08h) SLS1 Status (Obj. F601h: 09h) SLS2 Status (Obj. F601h: 0Ah) SLS3 Status (Obj. F601h: 0Bh) SLS4 Status (Obj. F601h: 0Ch) FSoE Slave CRC_0 (Obj. E600h: 03h) SBC Status (Obj. F601h: 0Dh) SLI Status (Obj. F601h: 0Eh) SLT1 Status (Obj. F601h: 0Fh) SLT2 Status (Obj. F601h: 10h) SLT3 Status (Obj. F601h: 11h) SLT4 Status (Obj. F601h: 12h) Padding (10 bit) FSoE Slave CRC_1 (Obj. E600h: 04h) STO Status (Obj. F611h: 01h) *1 SSM Status (Obj. F611h: 02h) *1 Padding (1 bit) *1 SOS Status (Obj. F611h: 03h) *1 Padding (3 bit) *1 Error (Obj. F611h: 04h) *1 SS1 Status (Obj. F611h: 05h) *1 SS2 Status (Obj. F611h: 06h) *1 SDIP Status (Obj. F611h: 07h) *1 SDIN Status (Obj. F611h: 08h) *1 SLS1 Status (Obj. F611h: 09h) *1 SLS2 Status (Obj. F611h: 0Ah) *1 SLS3 Status (Obj. F611h: 0Bh) *1 SLS4 Status (Obj. F611h: 0Ch) *1 FSoE Slave CRC_2 (Obj. E600h: 05h) *1 SBC Status (Obj. F611h: 0Dh) *1 SLI Status (Obj. F611h: 0Eh) *1 SLT1 Status (Obj. F611h: 0Fh) *1 SLT2 Status (Obj. F611h: 10h) *1 SLT3 Status (Obj. F611h: 11h) *1 SLT4 Status (Obj. F611h: 12h) *1 Padding (10 bit) *1 FSoE Slave CRC_3 (Obj. E600h: 06h) *1 STO Status (Obj. F621h: 01h) *2 SSM Status (Obj. F621h: 02h) *2 Padding (1 bit) *2 SOS Status (Obj. F621h: 03h) *2 Padding (3 bit) *2 Error (Obj. F621h: 04h) *2 SS1 Status (Obj. F621h: 05h) *2 SS2 Status (Obj. F621h: 06h) *2 SDIP Status (Obj. F621h: 07h) *2 SDIN Status (Obj. F621h: 08h) *2 SLS1 Status (Obj. F621h: 09h) *2 SLS2 Status (Obj. F621h: 0Ah) *2 SLS3 Status (Obj. F621h: 0Bh) *2 SLS4 Status (Obj. F621h: 0Ch) *2 FSoE Slave CRC_4 (Obj. E600h: 07h) *2 SBC Status (Obj. F621h: 0Dh) *2 SLI Status (Obj. F621h: 0Eh) *2 SLT1 Status (Obj. F621h: 0Fh) *2 SLT2 Status (Obj. F621h: 10h) *2 SLT3 Status (Obj. F621h: 11h) *2 SLT4 Status (Obj. F621h: 12h) *2 Padding (10 bit) *2	This mapping is for an application in which the safety communication function is used. Map size: 11 bytes (1-axis servo amplifier), 19 bytes (2-axis servo amplifier), 27 bytes (3-axis servo amplifier)

Map No.	Initial mapping settings	Applications expected to be used for initial mapping
9th TxPDO map 1A08h	FSoE Slave CRC_5 (Obj. E600h: 08h) *2 FSoE Slave ConnectionID (Obj. E600h: 02h)	This mapping is for an application in which the safety communication function is used. Map size: 11 bytes (1-axis servo amplifier), 19 bytes (2-axis servo amplifier), 27 bytes (3-axis servo amplifier)

*1 For the 2-axis servo amplifier and 3-axis servo amplifier

*2 For the 3-axis servo amplifier

4.4 Variable PDO mapping

Point

PDO mappings can be changed in the Pre-Operational state.

The servo amplifier supports the variable PDO mapping function, which can arrange desired objects in any array for the data transmitted and received with RxPDO and TxPDO.

Variable PDO mapping specifications are shown in the following table.

Communication	Maximum number of objects	Maximum size [byte]	Number of mapping settings
RxPDO	1-axis servo amplifier: 32 2-axis servo amplifier: 64 3-axis servo amplifier: 96	Refer to the following.	4 (1600h to 1603h/1610h to 1613h/1620h to 1623h)
TxPDO			4 (1A00h to 1A03h/1A10h to 1A13h/1A20h to 1A23h)

The total bytes of objects that can be assigned to PDOs are limited depending on the communication cycle. The table below shows the relations between the communication cycles and PDO sizes.

Communication cycle [ms]	1-axis servo amplifier		2-axis servo amplifier		3-axis servo amplifier	
	RxPDO [byte]	TxPDO [byte]	RxPDO [byte]	TxPDO [byte]	RxPDO [byte]	TxPDO [byte]
0.125	64	64	—	—	—	—
0.25	64	64	108	120	120	120
0.5 to 8	64	64	108	120	144	162

PDO mapping objects are shown in the following table.

Index	Sub	Object	Name	Data Type	Access	Description
1600h	0	RECORD	1st Receive PDO Mapping	U8	rw	MR-J5-G-N1/MR-J5W-G-N1 User's Manual (Object Dictionary)
	1 to 32		Mapped Object 001 to Mapped Object 032	U32	rw	
1601h	0	RECORD	2nd Receive PDO Mapping	U8	rw	
	1 to 32		Mapped Object 001 to Mapped Object 032	U32	rw	
1602h	0	RECORD	3rd Receive PDO Mapping	U8	rw	
	1 to 32		Mapped Object 001 to Mapped Object 032	U32	rw	
1603h	0	RECORD	4th Receive PDO Mapping	U8	rw	
	1 to 32		Mapped Object 001 to Mapped Object 032	U32	rw	
1A00h	0	RECORD	1st Transmit PDO Mapping	U8	rw	
	1 to 32		Mapped Object 001 to Mapped Object 032	U32	rw	
1A01h	0	RECORD	2nd Transmit PDO Mapping	U8	rw	
	1 to 32		Mapped Object 001 to Mapped Object 032	U32	rw	
1A02h	0	RECORD	3rd Transmit PDO Mapping	U8	rw	
	1 to 32		Mapped Object 001 to Mapped Object 032	U32	rw	
1A03h	0	RECORD	4th Transmit PDO Mapping	U8	rw	
	1 to 32		Mapped Object 001 to Mapped Object 032	U32	rw	
1C12h	0	ARRAY	Sync Manager 2 PDO Assignment	U8	rw	
	1		PDO Mapping object index of assigned RxPDO	U16	rw	
	2					
	3					
1C13h	0	ARRAY	Sync Manager 3 PDO Assignment	U8	rw	
	1		PDO Mapping object index of assigned TxPDO	U16	rw	
	2					
	3					

When the safety communication function is used

Variable PDO mapping specifications are shown in the following table. The maximum number of RxPDO and TxPDO objects is the same as that when the safety communication function is not used. The safety RxPDO ([Obj. 1608h]) and safety TxPDO ([Obj. 1A08h]) are fixed values.

Communication	Number of objects	Maximum size [byte]	Number of mapping settings
Safety RxPDO	1-axis servo amplifier: 36 2-axis servo amplifier: 70 3-axis servo amplifier: 104	Refer to the following.	4 (1600h to 1603h/1610h to 1613h/1620h to 1623h, 1608h)
Safety TxPDO			4 (1A00h to 1A03h/1A10h to 1A13h/1A20h to 1A23h, 1A08h)

The total bytes of objects that can be assigned to PDOs are limited depending on the communication cycle. The table below shows the relations between the communication cycles and PDO sizes. The total bytes of RxPDO and TxPDO are the same as those when the safety communication function is not used. The total bytes of safety RxPDO ([Obj. 1608h]) and safety TxPDO ([Obj. 1A08h]) are fixed values.

Communication cycle [ms]	1-axis servo amplifier		2-axis servo amplifier		3-axis servo amplifier	
	RxPDO [byte]	TxPDO [byte]	RxPDO [byte]	TxPDO [byte]	RxPDO [byte]	TxPDO [byte]
0.25	11	11	—	—	—	—
0.5 to 8	11	11	19	19	27	27

PDO mapping objects are shown in the following table.

Index	Sub	Object	Name	Data Type	Access	Description
1608h	0	RECORD	9th Receive PDO Mapping	U8	ro	MR-J5-G-N1/MR-J5W-G-N1 User's Manual (Object Dictionary)
	1 to 104		Mapped Object 001 to Mapped Object 104	U32	ro	
1A08h	0	RECORD	9th Transmit PDO Mapping	U8	ro	
	1 to 104		Mapped Object 001 to Mapped Object 104	U32	ro	
1C12h	0	ARRAY	Sync Manager 2 PDO Assignment	U8	rw	
	1		PDO Mapping object index of assigned RxPDO	U16	rw	
	2					
	3					
1C13h	0	ARRAY	Sync Manager 3 PDO Assignment	U8	rw	
	1		PDO Mapping object index of assigned TxPDO	U16	rw	
	2					
	3					

4.5 Objects that require mapping

Objects required for each mode are shown in the following table.

RxPDO

◎: PDO mapping required ○: PDO mapping recommended —: PDO mapping not required

Object name (Index)	Mode								
	csp	csv	cst	pp	pv	tq	pt	jg	hm
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)	—	—	○	—	—	○	—	—	—
Target point table (2D60h)	—	—	—	—	—	—	◎	—	—

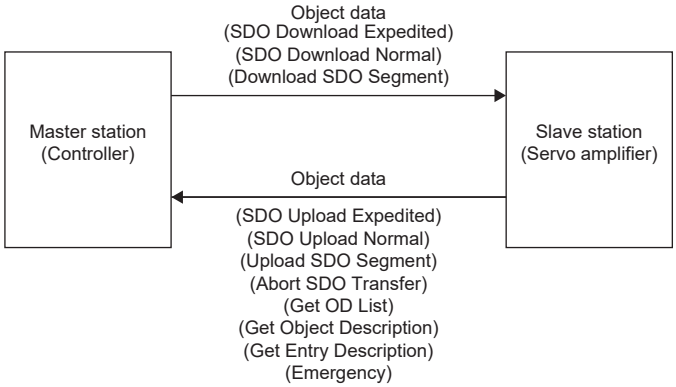
TxPDO

◎: PDO mapping required ○: PDO mapping recommended —: PDO mapping not required

Object name (Index)	Mode								
	csp	csv	cst	pp	pv	tq	pt	jg	hm
Statusword (6041h)	◎	◎	◎	◎	◎	◎	◎	◎	◎
Status DO 1 (2D11h)	○	○	○	○	○	○	○	○	○
Status DO 2 (2D12h)	○	○	○	○	○	○	○	○	○
Status DO 3 (2D13h)	○	○	○	○	○	○	○	○	○
Status DO 5 (2D15h)	—	—	—	—	—	—	○	○	—
Status DO 7 (2D17h)	—	—	—	—	—	—	○	○	—
Position actual value (6064h)	○	○	○	○	○	○	○	○	○
Following error actual value (60F4h)	○	—	—	○	—	—	○	○	—
Velocity actual value (606Ch)	○	○	○	○	○	○	○	○	○
Torque actual value (6077h)	○	○	○	○	○	○	○	○	○
Point actual value (2D69h)	—	—	—	—	—	—	○	○	—
M code actual value (2D6Ah)	—	—	—	—	—	—	○	○	—
Point demand value (2D68h)	—	—	—	—	—	—	○	○	—

5 SDO (Service Data Object) COMMUNICATION

In SDO (Service Data Object) communication, object data can be transmitted and received asynchronously between a master station (controller) and a slave station (servo amplifier).



5.1 SDO communication-related services

The servo amplifier supports the following services related with SDO communication.

Services	Description
SDO Download Expedited	This service writes data of up to 4 bytes to the slave station.
SDO Download Normal	This service writes data of the specified bytes to the slave station.
Download SDO Segment	This service writes additional data when the object size is larger than the specified byte size.
SDO Upload Expedited	This service reads data of up to 4 bytes from the slave station.
SDO Upload Normal	This service reads data of the specified bytes from the slave station.
Upload SDO Segment	This service reads additional data when the object size is larger than the specified number of octets.
Abort SDO Transfer	This service notifies the SDO Abort Code when an error occurs in either of the services.
Get OD List	This service reads a list of available object indexes.
Get Object Description	This service reads the detail of indexes.
Get Entry Description	This service reads the detail of Sub Indexes.
Emergency	This service notifies an alarm occurrence.

5.2 SDO Abort Code

When an error occurs in SDO communication, the Abort SDO Transfer service returns the following error messages.

SDO Abort Code	Meaning
0504 0005h	Out of memory.
0601 0001h	Attempt to read to a write only object
0601 0002h	Attempt to write to a read only object
0601 0006h	Object mapped to RxPDO, SDO download blocked.
0602 0000h	The object does not exist in the object dictionary
0604 0043h	General parameter incompatibility reason.
0607 0012h	Data type does not match, length of service parameter too high.
0607 0013h	Data type does not match, length of service parameter too short.
0609 0011h	Sub Index does not exist
0609 0030h	Value range of parameter exceeded
0609 0031h	Value of parameter written too high
0609 0032h	Value of parameter written too low
0800 0000h	Generic error.
0800 0021h	Data cannot be transferred or stored to the application because of local control
0800 0022h	Data cannot be transferred or stored to the application because of the present device state.

6 SYNCHRONIZATION

6.1 Availability of synchronous mode in control mode

Availability of synchronous mode (DC mode) and asynchronous mode (Free-run mode) in each mode is shown in the following table.

Control mode	Synchronous mode	Asynchronous mode
Cyclic synchronous position mode (csp)	○	○ *1
Cyclic synchronous velocity mode (csv)	○	○ *1
Cyclic synchronous torque mode (cst)	○	○ *1
Profile position mode (pp)	○	○
Profile velocity mode (pv)	○	○
Profile torque mode (tq)	○	○
Point table mode (pt)	○	○
Jog mode (jg)	○	○
Homing mode (hm)	○	○

*1 For MR-J5_-_G_-_N1 with firmware versions earlier than B6, if a servo motor is driven with this combination, [AL. 09E.9 Control mode setting warning] will occur.

6.2 Synchronous mode (DC mode)

In the synchronous mode, the synchronous jitter needs to be kept less than 2 μs. If the synchronous jitter is 2 μs or more, an error may be detected and an alarm may occur.

—	Sync0	Sync1
[Cycle Time (Obj. 1C32h: 02h)] *1	0.125 ms (when the PDO communication cycle is set to 0.125 ms) 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) 4 ms (when the PDO communication cycle is set to 4 ms) 8 ms (when the PDO communication cycle is set to 8 ms)	Unused

*1 There are restrictions on the communication cycle depending on the function used. For details, refer to "Restrictions on the MR-J5_-_G_" and "Restrictions on the MR-MD3" in the following manual.
MR-J5-G-N1/MR-J5W-G-N1 User's Manual (Introduction)
MR-J5D-G-N1 User's Manual (Introduction)
MR-MD3 User's Manual

6.3 Asynchronous mode (Free-run mode)

When using the cyclic synchronous position mode, cyclic synchronous velocity mode, or cyclic synchronous torque mode in the asynchronous mode (Free-run mode), set them as shown in the table in this section. Enter a command value for each communication cycle set in [Cycle Time (Obj. 1C32h: 02h)]. If the command values are not entered for the communication cycles, the previously entered commands are maintained.
Setting this object is not required when using the profile position mode, profile velocity mode, or profile torque mode. Operation can be performed in any communication cycle.

—	**Local Cycle time**
[Cycle Time (Obj. 1C32h: 02h)] *1*2	0.125 ms (when the PDO communication cycle is set to 0.125 ms) 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) 4 ms (when the PDO communication cycle is set to 4 ms) 8 ms (when the PDO communication cycle is set to 8 ms)

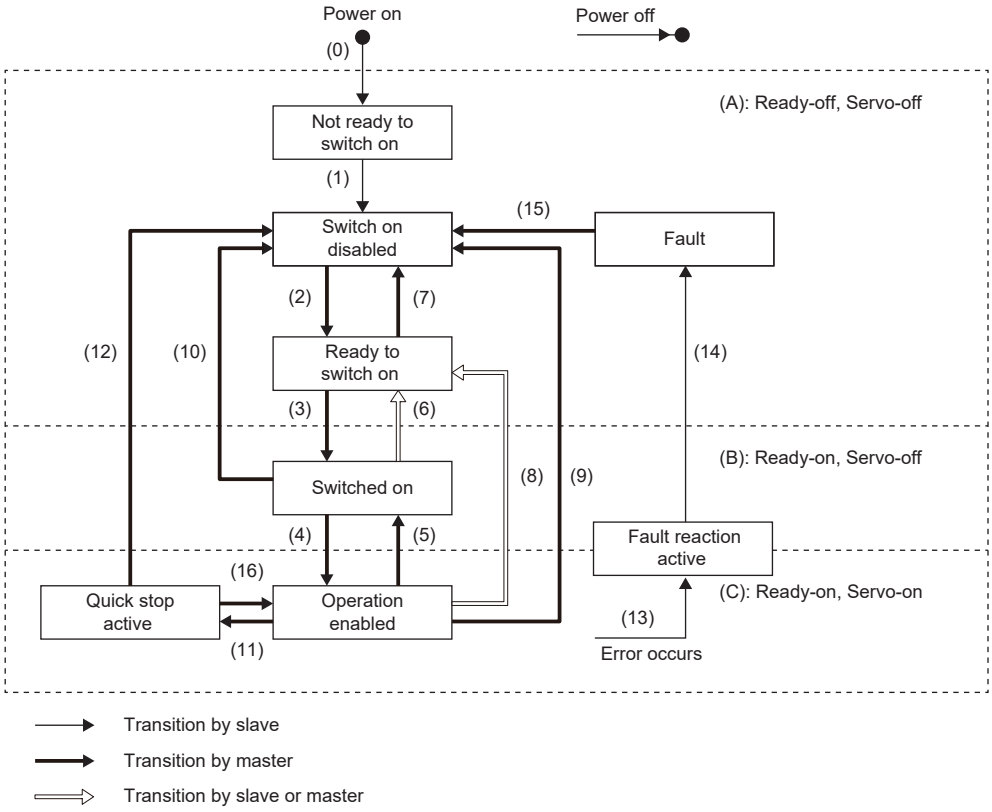
*1 When no value is set in Cycle time, the communication cycle is 0.25 ms (initial value). The initial value can be changed with [Pr. PN07 Communication cycle initial setting].

*2 There are restrictions on the communication cycle depending on the function used. For details, refer to "Restrictions on the MR-J5_-_G_" and "Restrictions on the MR-MD3" in the following manual.
MR-J5-G-N1/MR-J5W-G-N1 User's Manual (Introduction)
MR-J5D-G-N1 User's Manual (Introduction)
MR-MD3 User's Manual

7 CiA 402 DRIVE PROFILE

7.1 PDS state transitions

The internal state of the servo amplifier is managed by the PDS state defined in the CiA 402 drive profile specification. After the PDO communication is established (after the AL state has reached "Operational"), the status is controlled by the master station transmitting commands (by setting Controlword) in accordance with the following table. Once the state transitions from "Not ready to switch on", which is right after turning on the power supply, to "Operation enabled", the servo motor becomes ready to operate.



Transition No.	Event	Description
(0)	Control circuit power supply is turned on	Initialization
(1)	Transitions automatically when the control circuit power supply is turned on	Communication setting
(2)	Transitions with the "Shutdown" command from the master station	—
(3)	Transitions with the "Switch On" command from the master station	The dynamic brake is released.
(4)	Transitions with the "Enable Operation" command from the master station	The operation becomes ready after servo-on.
(5)	Transitions with the "Disable Operation" command from the master station Transitions when RD (Ready) is turned off	The operation is disabled after servo-off.
(6)	Transitions with the "Shutdown" command from the master station	The dynamic brake operates.
(7)	Transitions with the "Disable Voltage" command or "Quick Stop" command from the master station	—
(8)	(A) Transitions with the "Shutdown" command from the master station (B) Transitions when the main circuit power supply is turned off (C) Transitions after becoming servo-off (see the transition No. (5) if RD is turned off at the same time)	The operation is disabled after servo-off and dynamic braking.
(9)	Transitions with the "Disable Voltage" command from the master station	The operation is disabled after servo-off and dynamic braking.
(10)	Transitions with the "Disable Voltage" command or "Quick Stop" command from the master station	The dynamic brake operates.
(11)	(A) Transitions with the "Quick Stop" command from the master station (B) Transitions when the forced stop signal is turned off *1	Quick Stop starts.
(12) *2	(A) Transitions automatically after the completion of Quick Stop (when the value of [Quick stop option code (Obj. 605Ah)] is any of "1", "2", "3", or "4") (B) Transitions with the "Disable Voltage" command from the master station after completion of "Quick Stop" (C) Transitions when the main circuit power supply is turned off (when the value of [Quick stop option code (Obj. 605Ah)] is any of "5", "6", "7", or "8")	The operation is disabled after servo-off and dynamic braking.
(13)	Alarm occurrence	The processing at the alarm occurrence is executed.
(14)	Automatic transition	After the completion of the alarm occurrence processing, the operation is disabled by servo-off or the dynamic brake.
(15)	Transitions with the "Fault Reset" command from the master station	An alarm reset is performed. Resettable alarms are reset.

Transition No.	Event	Description
(16) *3	Transitions with the "Enable Operation" command from the master station (when the value of [Quick stop option code (Obj. 605Ah)] is any of "5", "6", "7", or "8")	The operation becomes ready after Quick Stop is canceled.

*1 This event occurs when "1" (Quick stop active) is selected in [Pr. PF29.1 State selection with forced stop in progress].
*2 (C) is available on servo amplifiers with firmware version D0 (MD333G: A4) or later.
*3 Available on servo amplifiers with firmware version D0 (MD333G: A4) or later.

The commands issued to the servo amplifier are shown in the table below. Turn on the bits relative to the command.

0: Off 1: On —: Either on/off can be used

Command	Bit setting of Controlword command					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 *1	—	—	—	—	(15)

*1 To prevent commands from being missed during communication errors, keep the Fault Reset command with bit 7 set to "1" for at least 10 ms when the communication cycle is 4 ms or less, or at least 20 ms when the communication cycle is 8 ms or less.

To transition from the "Switch on disabled" state to the "Operation enabled" state, give the commands "Shutdown", "Switch On", and "Enable Operation" sequentially. If using an MR-J5 servo amplifier, however, it is possible to transition directly from the current state to the target state with one command.

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

7.2 Controlword/Control DI

By rewriting the Controlword and Control DI x objects from the master station, commands can be issued to switch PDS states and control other functions provided by the drive. [Obj. 6040h] is used for the control commands defined by CiA 402, and [Obj. 2D01h] and other objects are used for other control commands defined by Mitsubishi Electric.

Index	Sub	Object	Name	Data Type	Access	Description
6040h	—	VAR	Controlword	U16	rw	—
2D01h	—	VAR	Control DI 1	U16	rw	Object defined by Mitsubishi Electric
2D02h	—	VAR	Control DI 2	U16	rw	Object defined by Mitsubishi Electric
:	:	:	:	:	:	:

Bit definition of Controlword

Bit	Symbol	Description
0	SO	Switch On
1	EV	Enable Voltage
2	QS	Quick Stop
3	EO	Enable Operation
4	OMS	The contents differ depending on the setting of [Modes of operation (Obj. 6060h)]. Refer to "Control mode [G]" in the following manual. MR-J5 User's Manual (Function)
5		
6		
7	FR	Fault Reset
8	HALT	0: Operation ready 1: Temporary stop
9	OMS	The contents differ depending on the setting of [Modes of operation]. Refer to "Control mode [G]" in the following manual. MR-J5 User's Manual (Function)
10	—	The value at reading is undefined. Set "0" when writing.
11	CPTL	Positive Torque Limit switching ☞ Page 66 Torque limit selection
12	CNTL	Negative Torque Limit switching ☞ Page 66 Torque limit selection
13	—	The value at reading is undefined. Set "0" when writing.
14		
15		

Bit definition of Control DI

• Control DI 1

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined. Set "0" when writing.	—
1	—		—
2	—		—
3	—		—
4	C_CDP	Gain switching	Refer to "Signal (device) explanation" in the following manuals. MR-J5 User's Manual (Hardware) MR-J5D User's Manual (Hardware)
5	C_CLD	Fully closed loop selection	
6	—	The value at reading is undefined. Set "0" when writing.	—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Control DI 2

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined. Set "0" when writing.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	C_PC	Proportional control	Refer to "Signal (device) explanation" in the following manuals. MR-J5 User's Manual (Hardware) MR-J5D User's Manual (Hardware) MR-MD3 User's Manual
9	—	The value at reading is undefined. Set "0" when writing.	—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	C_ORST	Operation alarm reset Turning on C_ORST resets [AL. 0F4 Positioning warning].	—

• Control DI 3

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined. Set "0" when writing.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	C_ABS2	Homing completion (for scale measurement) The state "absolute position erased" of a scale measurement encoder can be canceled by turning on C_ABS2 with the scale measurement function. At this time, S_ABSV2 will turn off.	—
9	—	The value at reading is undefined. Set "0" when writing.	—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Control DI 4

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined. Set "0" when writing.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Control DI 5

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined. Set "0" when writing.	—
1	—		—
2	—		—
3	—		—
4	C_CDP2	Gain switching 2	Refer to "Signal (device) explanations" in the following manual. MR-J5 User's Manual (Hardware) MR-J5D User's Manual (Hardware) MR-MD3 User's Manual
5	—	The value at reading is undefined. Set "0" when writing.	—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Control DI 6

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined. Set "0" when writing.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Control DI 7

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined. Set "0" when writing.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	C_OVR*1	Override selection	Refer to "Override function" in the following manual. 📖MR-J5 User's Manual (Function)
8	—	The value at reading is undefined. Set "0" when writing.	—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

*1 Available on servo amplifiers with firmware version D4 (MD333G: A4) or later.

• Control DI 8

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined. Set "0" when writing.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Control DI 9

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined. Set "0" when writing.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Control DI 10

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined. Set "0" when writing.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

7.3 Statusword/Status DO

The Statusword objects and the Status DO x objects notify the master station of the PDS state and other drive states. States defined by CiA 402 are notified by using [Obj. 6041h], and states defined by Mitsubishi Electric are notified by using [Obj. 2D11h].

Index	Sub	Object	Name	Data Type	Access	Description
6041h	—	VAR	Statusword	U16	ro	—
2D11h	—	VAR	Status DO 1	U16	ro	Object defined by Mitsubishi Electric
2D02h	—	VAR	Status DO 2	U16	ro	Object defined by Mitsubishi Electric
:	:	:	:	:	:	:

Bit definition of Statusword

Bit	Symbol	Description
0	RTSO	Ready To Switch On
1	SO	Switched On
2	OE	Operation Enabled
3	F	Fault
4	VE	Voltage-enabled 0: The bus voltage is lower than the specified (RA) level. 1: The bus voltage is equal to or higher than the specified level.
5	QS	Quick stop 0: In a Quick stop 1: Not in a Quick stop (including in the test mode)
6	SOD	Switch On Disabled
7	W	Warning 0: No warning has occurred. 1: A warning has occurred.
8	—	Reserved The value at reading is undefined.
9	RM	Remote 0: Not following the Controlword command. 1: Operating in accordance with the Controlword command.
10	OMS	Operation Mode Specific The contents differ depending on the setting of [Modes of operation (Obj. 6060h)]. Refer to "Control mode [G]" in the following manual. MR-J5 User's Manual (Function)
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 csp, csv, pp, pv, hm, pt, or jg mode)
12 13	OMS	Operation Mode Specific The contents differ depending on the setting of [Modes of operation (Obj. 6060h)]. Refer to "Control mode [G]" in the following manual. MR-J5 User's Manual (Function)
14 15	—	Reserved The value at reading is undefined.

Bit 0 to Bit 3, Bit 5, and Bit 6 are switched depending on the PDS state (servo amplifier internal state). Refer to the following table for details.

Statusword (bin)	PDS state
x0xx xxx0 x0xx 0000	Not ready to switch on *1
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

*1 Statusword is not sent when in the "Not ready to switch on" state.

Bit definition of Status DO

• Status DO 1

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined.	—
1	—		—
2	S_SA	Speed reached	Refer to "Signal (device) explanation" in the following manuals. MR-J5 User's Manual (Hardware) MR-J5D User's Manual (Hardware) MR-MD3 User's Manual
3	S_MBR	Electromagnetic brake interlock	
4	S_CDPS	Variable gain enabled	
5	S_CLDS	Fully closed loop control in progress	
6	—	The value at reading is undefined.	—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	S_INP	In-position	Refer to "Signal (device) explanation" in the following manuals. MR-J5 User's Manual (Hardware) MR-J5D User's Manual (Hardware) MR-MD3 User's Manual
13	S_TLC	Limiting torque	
14	S_ABSV	Absolute position erased	
15	S_BWNG	Battery warning	

• Status DO 2

Bit	Symbol	Description	Reference
0	S_ZPASS	Z-phase already passed After the Z-phase is passed, S_ZPASS turns on.	—
1	—	The value at reading is undefined.	—
2	—		—
3	S_ZSP	Zero speed detection	Refer to "Signal (device) explanation" in the following manuals. MR-J5 User's Manual (Hardware) MR-J5D User's Manual (Hardware) MR-MD3 User's Manual
4	S_VLC	Limiting speed	
5	—	The value at reading is undefined.	—
6	S_IPF	In IPF During instantaneous power failure, S_IPF is on.	—
7	—	The value at reading is undefined.	—
8	S_PC	Proportional control in progress S_PC is turned on under proportional control.	—
9	—	The value at reading is undefined.	—
10	S_DB	External dynamic brake output	—
11	—	The value at reading is undefined.	—
12	—		—
13	—		—
14	—		—
15	S_ZP2	Homing completion 2 When homing finishes successfully, S_ZP2 turns on.	—

• Status DO 3

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	S_STO	In the STO state S_STO turns on in the STO state.	Refer to "Monitor signal (digital) [G]" in the following manual. MR-J5 User's Manual (Function)
6	—	The value at reading is undefined.	—
7	—		—
8	—		—
9	—		—
10	—		—
11	S_MTTR	Tough drive in progress	Refer to "Tough drive function" in the following manual. MR-J5 User's Manual (Function)
12	—	The value at reading is undefined.	—
13	—		—
14	—		—
15	—		—

• Status DO 4

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Status DO 5

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined.	—
1	—		—
2	—		—
3	—		—
4	S_CDPS2	Variable gain enabled 2	Refer to "GAIN SWITCHING FUNCTION" in the following manual. MR-J5 User's Manual (Adjustment)
5	S_CPO	Rough match When the command remaining distance is less than the value of the rough match output range set in [Pr. PT12], S_CPO is on. This is not output during base circuit shut-off. When the servo amplifier is switched to the servo-on state, S_CPO switches on.	—
6	S_MEND *1	Traveling completion If droop pulses are within the in-position output range set in [Pr. PA10] and the command remaining distance is "0", S_MEND turns on. S_MEND turns on at servo-on. S_MEND is off in the servo-off state.	—
7	—	The value at reading is undefined.	—
8	—		—
9	—		—
10	S_PNLT *2	Open phase condition	Refer to "Disconnection/incorrect wiring detection function" in the following manual. MR-J5 User's Manual (Function)
11	—	The value at reading is undefined.	—
12	—		—
13	—		—
14	—		—
15	—		—

*1 Available on servo amplifiers with firmware version B8 (MD333G: A2) or later.

*2 Available on MR-J5_-_G_-_N1 with firmware version C4 or later.

• Status DO 6

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Status DO 7

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined.	—
1	—		—
2	S_POT	Position range When the actual current position is within the range set in [Pr. PT19] and [Pr. PT21], S_POT is on. When homing is not complete or base circuit shut-off is in progress, S_POT is off.	—
3	—	The value at reading is undefined.	—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Status DO 8

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Status DO 9

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Status DO 10

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

7.4 Control mode

Point

- The control mode is set to the cyclic synchronous position mode as a default. When using the cyclic synchronous position mode, perform position follow-up with the upper controller at servo-on.
- To use the profile mode, switch to the mode in the servo-off state. After the control mode is switched, turn on the servo-on.
- If the control mode is switched without performing position follow-up, unexpected movements such as sudden acceleration of the servo motor may occur.

Selecting control mode (Modes of operation)

Specify a control mode with [Modes of operation (Obj. 6060h)]. [Modes of operation] can be rewritten with a PDO or an SDO.
The available control modes are limited as follows depending on the setting value of [Pr. PT01.2].
○: Supported, —: Not supported

[Pr. PA01.0]	[Pr. PT01.2]	pp	pv	tq	hm	csp	csv	cst	jg	pt	6061h initial value
0	2 (degree)	○	○	○	○	—	—	—	—	—	1 (pp)
	3 (pulse)	○	○	○	○	○	○	○	—	—	8 (csp)
6	0 (mm)	—	—	—	○	—	—	—	○	○	-101 (pt)
	1 (inch)										
	2 (degree)										
	3 (pulse)										

Index	Sub	Object	Name	Data Type	Access	Description
6060h	—	VAR	Modes of operation	I8	rw	0: No mode change/No mode assigned 1: Profile position mode (pp) 3: Profile velocity mode (pv) 4: Profile torque mode (tq) 6: Homing mode (hm) 8: Cyclic sync position mode (csp) 9: Cyclic sync velocity mode (csv) 10: Cyclic sync torque mode (cst) -100: Jog mode (jg) -101: Point table Mode (pt)
6061h	—	VAR	Modes of operation display	I8	ro	0: No mode assigned 1: Profile position mode (pp) 3: Profile velocity mode (pv) 4: Profile torque mode (tq) 6: Homing mode (hm) 8: Cyclic sync position mode (csp) 9: Cyclic sync velocity mode (csv) 10: Cyclic sync torque mode (cst) -100: Jog mode (jg) -101: Point table Mode (pt)
6502h	—	VAR	Supported drive modes	U32	ro	Bit = 1 for the following modes bit 0: Profile position mode bit 2: Profile velocity mode bit 3: Profile torque mode bit 5: Homing mode bit 7: Cyclic sync position mode bit 8: Cyclic sync velocity mode bit 9: Cyclic sync torque mode bit 16: Jog mode (jg) bit 17: Point table Mode (pt)

Control switching

Point

- Changes to the OMS Bit of [Controlword (Obj. 6040h)] are not accepted until control switching finishes. Before inputting a command, check that the control mode has been switched by referring to [Modes of operation display (Obj. 6061h)].
- Update [Target position (Obj. 607Ah)] and [Position offset (Obj. 60B0h)] to [Position actual value (Obj. 6064h)] when changing the control mode from the mode other than the cyclic synchronous position mode (csp) to the cyclic synchronous position mode (csp).

Control switching between position/speed/torque modes

As there is a time lag in the control mode switching processing, the controller must keep sending the command value corresponding to the control mode until the mode is completely switched. After the completion of the control mode switching is confirmed by [Modes of operation display], the controller can stop updating the command value before switching.
Before switching to or from the position mode, check that the servo motor is in zero speed state. Whether the servo motor is in the zero speed state can be obtained by Bit 3 (S_ZSP) of [Status DO 2 (Obj. 2D12h)]. If the motor is not in the zero speed state, the control will not be switched and therefore [Modes of operation display (Obj. 6061h)] will not change. To switch the control mode regardless of the zero speed state, set [Pr. PC76.1 ZSP disabled selection at control switching] to "1" to disable the monitoring of zero speed state. When the monitoring of zero speed state is disabled, a shock may occur at control switching.

Control switching between cyclic mode (csp, csv, and cst) and profile mode (pp, pv, and tq)

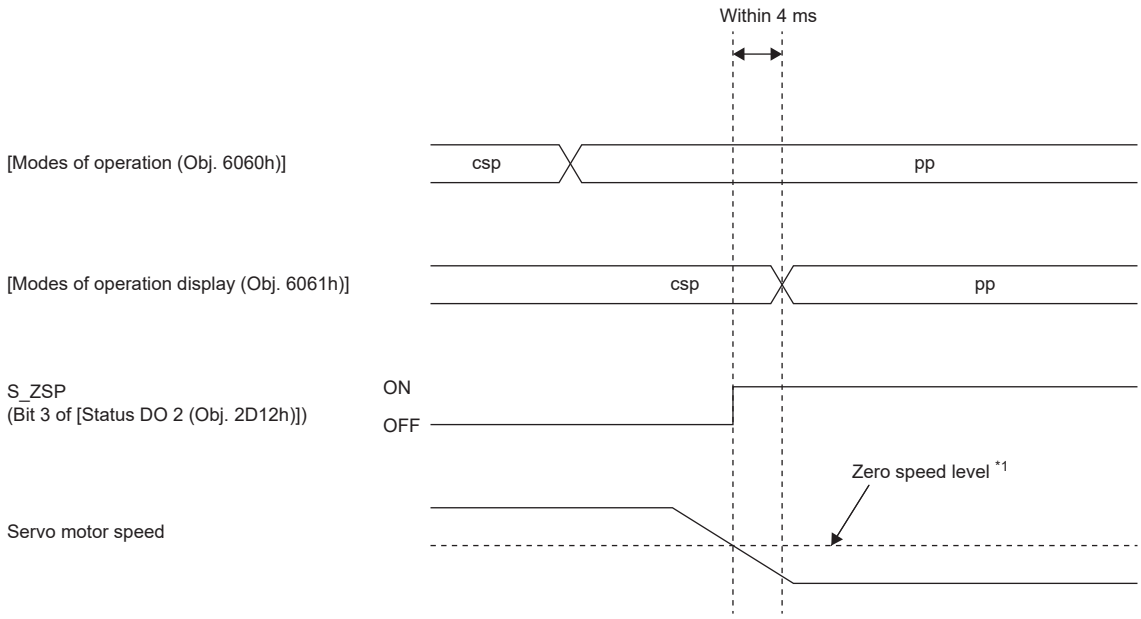
The control mode is switched between the cyclic mode (csp, csv, and cst) and the profile mode (pp, pv, and tq) only if the condition for control switching is met, following which [Modes of operation display (Obj. 6061h)] is changed. If the condition for control switching is not met, the control mode will not be switched and the value in [Modes of operation display (Obj. 6061h)] will not be changed. The condition for control switching is "Motor being stopped".

"Motor being stopped" means that S_ZSP (Bit 3 of [Status DO 2 (Obj. 2D12h)]) is on.

(Servo motor speed being less than zero speed set in [Pr. PC07])

Setting "1" (Disabled (Control switching is performed regardless of the range of ZSP)) to [Pr. PC76.1] enables the control mode to be switched without checking the condition "Motor being stopped" on the servo amplifier. Set "1" to [Pr. PC76.1] only if switching the control mode without waiting for the motor to stop. Switching the control mode without waiting for the motor to stop may cause a shock.

The following shows a timing chart of control switching between the cyclic mode (csp, csv, and cst) and the profile mode (pp, pv, and tq).



*1 Switching from the profile position mode (pp) can only be performed when the servo motor speed is zero or below and the command output has been completed. Completion of the command output can be checked with bit 12 (S_INP) of [Status DO 1 (Obj. 2D11h)] by setting [Pr. PD13.2 INP output signal ON condition selection] to "1" (within the in-position range and at the completion of command output).

Control switching in positioning mode

Refer to "Control switching in positioning mode" in the following manual.

📖MR-J5 User's Manual (Function)

8 STARTUP

For the startup procedures other than the network settings, refer to the following user's manual.
MR-J5-G-N1/MR-J5W-G-N1 User's Manual (Introduction)
MR-J5D-G-N1 User's Manual (Introduction)

Precautions

To ensure the safety of the system against unauthorized network access, take security measures such as using a firewall.

Point

Switching SW3-1 "OFF (down)" and SW3-2 "ON (up)" of the DIP switch (SW3) triggers [AL. 011.2 Disabled axis setting error] when using the 1-axis servo amplifier.
For servo amplifiers with firmware version D4 (MD333G: A4) or later, the PDO Mapping attribute of the objects has been changed. To use the PDO Mapping attribute before the change, set "1" in [Pr. PN03.3 Object attribute selection]. For details, refer to "[Pr. PN03.3_Object attribute selection]" in the following manual.
MR-J5-G/MR-J5W-G User's Manual (Parameters)
When setting "1" in [Pr. PN03.3], contact the sales representative for available ESI files.

The MR-J5_-_G_-_N1 with firmware version D8 or later supports ESI files in both Device and Module formats. When using the safety communication function, use ESI files in Module format. If the controller to be used cannot read ESI files that support the Module format, use ESI files created only in the conventional Device format. However, the safety communication function cannot be used with ESI files created only in Device format.

8.1 Absolute position detection system configuration

Summary

Controllers not using homing mode with the servo amplifier manage the home position via the controller, so setting of a home position is not performed for the servo amplifier. Refer to this section for information about how to configure the absolute position detection system for controllers not using homing mode with the servo amplifier.
When using homing mode with the servo amplifier, refer to "Control mode [G]" in the following manual.
MR-J5 User's Manual (Function)

Precautions and restrictions

- [Pr. PC41.0 [AL. 090.1 Homing incomplete] detection selection] can only be used in the cyclic synchronous position mode (csp).
- Setting of a home position is not performed for the servo amplifier, so the software limit function ([Software position limit (Obj. 607Dh)]) cannot be used.
- When [AL. 025 Absolute position erased] occurs, perform homing again via the controller to prevent an unexpected operation.
- Do not rotate the servo motor in excess of 2147483647 pulses without an EtherCAT communication established. Doing so causes the controller to be unable to correctly restore to the current position when the EtherCAT communication is established.
- Once the relevant settings for the absolute position detection system have been performed, the absolute position cannot be managed with the servo amplifier. To prevent unexpected operation, perform management of the absolute position via the controller.

Startup procedure

Battery installation

If using a servo motor that requires installation of a battery in order to configure the absolute position detection system, install the battery as necessary.

Parameter setting

■Absolute position detection system selection

To enable the absolute position detection system, set [Pr. PA03.0] to "1" (enabled (absolute position detection system)).

■[AL. 0E3 Absolute position counter warning] selection

If the travel distance from the home position is 32768 rev or more, [AL. 0E3.1] occurs.

To disable [AL. 0E3], set [Pr. PC29.5 [AL. 0E3 Absolute position counter warning] selection] to "0" (disabled).

■[AL. 090.1 Homing incomplete] detection selection

[AL. 090.1] occurs at servo-on if a home position has not been set for the servo amplifier.

To disable [AL. 090.1], set [Pr. PC41.0 [AL. 090.1 Homing incomplete] detection selection] to "1" (disabled).

[AL. 025.1 Servo motor encoder absolute position erased] deactivation

[AL. 025.1 Servo motor encoder absolute position erased] occurs when initial settings for the absolute position detection system are performed.

Wait for 5 seconds, then cycle the power to deactivate the alarm.

Homing

Be sure to perform homing before performing positioning operation.

8.2 Connecting Ethernet cables

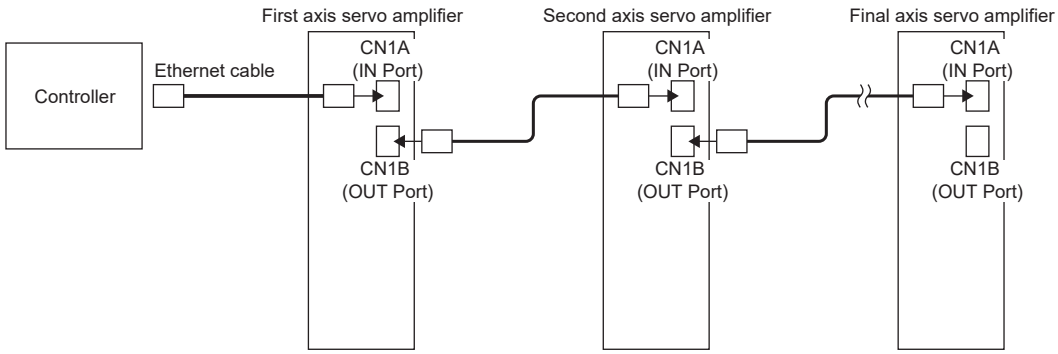
Point

- Use a twisted pair cable (double shielded) compliant with Ethernet Category 5e (100BASE-TX) or higher as an Ethernet cable. The maximum cable length between nodes is 100 m.
- When connecting Ethernet cables to servo amplifiers, be aware that CN1A is the IN port and CN1B is the OUT port.

Connect the Ethernet cable connected to the controller or the preceding servo amplifier to CN1A (IN port). Connect the Ethernet cable connected with the succeeding servo amplifier to CN1B (OUT port). Leave CN1B (OUT port) open if not using it.

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 operation of an unintended axis.

The following figure shows a connection example.



8.3 Example set-up procedure

Set up the controller by following its manual. An example set-up procedure is shown below.

Controller settings

ESI file installation

Point

Use the latest ESI file when setting up a controller. If the ESI file is old, newly added objects may not be usable. For the ESI files usable with your servo amplifier, contact your local sales office.

Store the EtherCAT Slave Information (ESI) file, which lists information about the communication settings of devices, on the controller. The controller configures settings of connected slave stations in accordance with their ESI files.
In addition, the ENI file is generated from the online information that is read from the object dictionary or the EEP-ROM in the slave station (or both). For details, refer to the manual for the controller to be used.

Node address setting

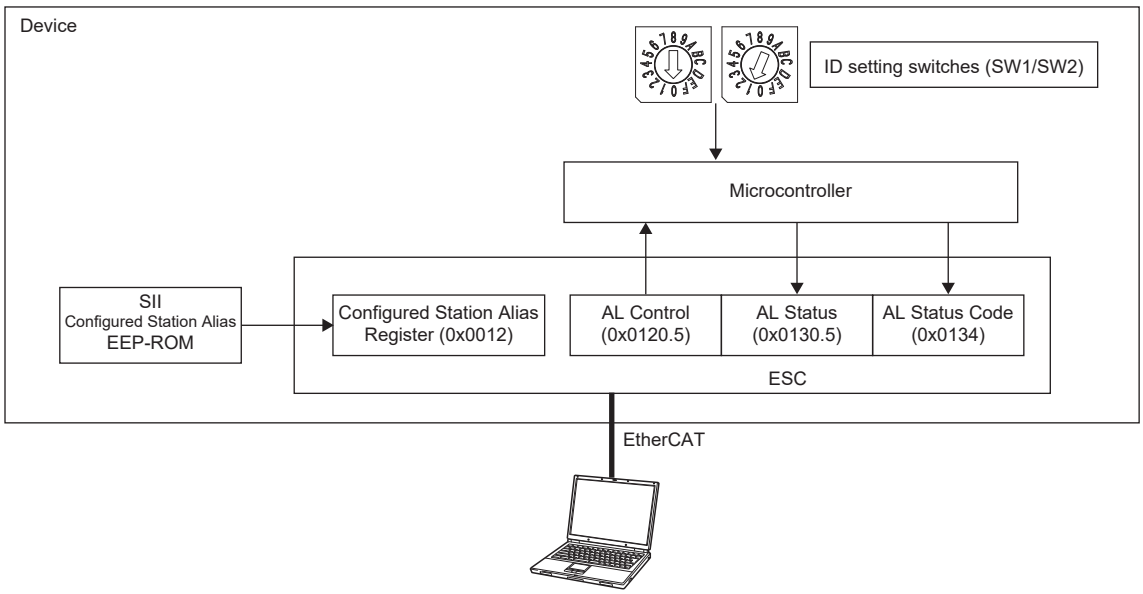
Point

The node address of a servo amplifier is set according to Explicit Device Identification. Configure the settings complied with Explicit Device Identification to the controller.
Do not connect several devices which have the same node address setting.

Set a node address in EtherCAT as necessary with ID setting switches (SW1/SW2) on the display, [Pr. NPA09 Node address setting], or with SII Configured Station Alias. After the node address settings are changed, cycle the power.

■Identifying slave stations with node addresses

The controller can identify slave stations by the node address using AL Status Code (ESC register: 0134h) or Configured Station Alias (ESC register: 0012h). Identify the slave stations by using either code.



• Identifying with AL Status Code (ESC register: 0134h)

Set the node address with the ID setting switches (SW1/SW2) or [Pr. NPA09] by referring to the following table. Set the master station using AL Status Code (ESC register: 0134h) so that the node address is recognized.

The set node address will be displayed on the 7-segment LED.

When using [Pr. NPA09] for the node address, set the ID setting switches (SW1/SW2) to "00h".

When using the ID setting switches (SW1/SW2) for the node address, the setting value of [Pr. NPA09] is not reflected in the node address.

ID setting switches (SW1/SW2)	[Pr. NPA09]	Node address	7-segment LED
00h	00000000h to 0000FFFFh	The setting value of [Pr. NPA09] is the node address.	Displays the lower two digits of the setting value of [Pr. NPA09].
01h to FFh	—	The node address comprises of the setting values of ID setting switches (SW1/SW2).	Displays the setting values of the ID setting switches (SW1/SW2).

• Identifying with Configured Station Alias (ESC register: 0012h)

Write the value of the node address to SII Configured Station Alias (ESC register: 0012h) from the master station (controller). The node address is saved on EEP-ROM. Set the master station so that SII Configured Station Alias (ESC register: 0012h) is recognized as a node address.

The setting values of the ID setting switches (SW1/SW2) or [Pr. NPA09] will be displayed on the 7-segment LED. For the value displayed on the 7-segment LED, refer to the table in "Identifying with AL Status Code (ESC register: 0134h)".

Mapping settings

When mapping objects that transmit command data and feedback data using PDO communication, perform the settings via the controller.

For information regarding the default mappings of the servo amplifier, refer to the following section.

☞ Page 26 PDO default mapping

Communication setting

For settings related to communication between the controller and servo amplifier, perform the settings via the controller. For information regarding settable communication cycles, refer to the following section.

☞ Page 18 Communication specifications

For the servo amplifier, synchronous mode (DC mode) and asynchronous mode (FreeRun mode) can be set. Set the mode that is appropriate for the application.

Establishing the communication

Point

- It is recommended that you change the setting value of [Pr. PN18 Counter level for communication error detection] according to the system configuration.
- If the communication error counter increases, change the communication cycle of the controller and check the wiring of the Ethernet cable.
- When [Pr. PN18] is set to "0", the servo motor does not stop at occurrence of a communication error. In addition, setting a larger value for [Pr. PN18] as the setting value increases the time it takes to stop the servo motor when there is a communication error. Set [Pr. PN18] carefully as there is a danger of collision.
- When [AL. 086.1 Network communication error 1] occurs, the communication error counter is clamped at the setting value of [Pr. PN18]. When [Pr. PN18] is set to "0", the communication error counter does not increase.

Start communication with the controller, then confirm that the 7-segment LED display is correct. (For example, "r01" is displayed if the first axis is used.)

For the MR-MD333G-N1, confirm that RD_ of each status display LED blinks and AL_ turns off.

Follow the manual for the controller to be used when starting communication.

If [AL. 086.1 Network receive data error (Network communication error 1)] occurs, set a threshold in [Pr. PN18 Counter level for communication error detection] or [Sync Error Counter Limit (Obj. 10F1h: 02h)] that is appropriate for the controller to be used.

The communication error counter can be checked with the graph function "EtherCAT communication error counter" of MR Configurator2.

Operating the servo motor

An example procedure for operating in cyclic synchronous position mode (csp) is shown below.

Homing mode settings

To operate in cyclic synchronous position mode (csp), first perform homing. Set [Modes of operation (Obj. 6060h)] to "6" (Homing mode), then confirm that [Modes of operation display (Obj. 6061h)] has changed to "6" (Homing mode). For information regarding the settings of other control modes, refer to the following section.

☞ Page 54 Control mode

If performing homing via the controller without using homing mode, refer to the following section.

☞ Page 59 Absolute position detection system configuration

Servo-on

Set the control command issued from the controller to [Controlword (Obj. 6040h)], then change the internal state of the servo amplifier to the "servo-on" state.

For details regarding servo amplifier internal states, refer to the following section.

☞ Page 38 PDS state transitions

Homing

Set a homing method in [Homing method (Obj. 6098h)], then perform homing.

For details regarding homing, refer to "Homing mode (hm) and homing" in the following manual.

MR-J5 User's Manual (Function)

Starting servo motor operation

Confirm that homing is complete, then change the control mode to the cyclic synchronous position mode. The servo motor is driven by giving commands to [Target position (Obj. 607Ah)], etc. in accordance with the desired operation pattern.

Disconnecting the communication

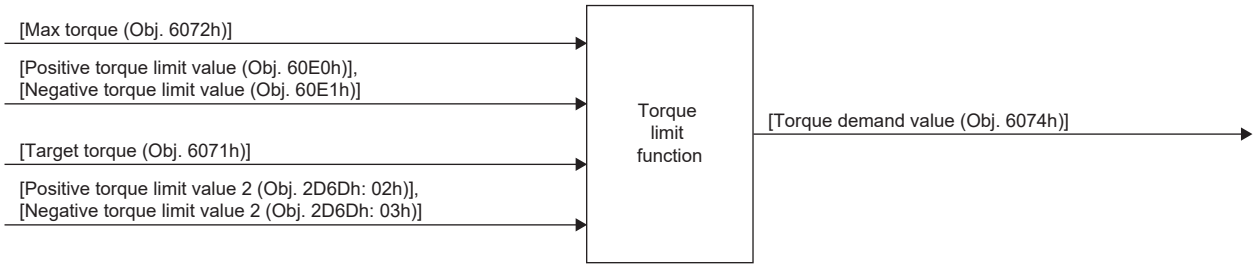
To disconnect the network when stopping the operation of equipment, follow the procedure shown below. Failure to follow this procedure exactly may result in [AL. 086.1 Network communication error 1].

1. Stop the servo motor.
2. Set the Shutdown command for [Controlword (Obj. 6040h)] to establish the servo-off state.
3. Switch the state to the Pre-Operational state.
4. Shut off the power of the servo amplifier and the controller.

9 MANUFACTURER-SPECIFIC FUNCTION

9.1 Torque limit selection

The torque limit selection function is a function that switches the torque limit value by using Bit 11 (CPTL) and Bit 12 (CNTL) of [Controlword (Obj. 6040h)].
The settings of the torque limit selection ([Obj. 2D6Dh]) are as follows.



Torque limit

Index	Sub	Name	Data Type	Access	PDO Mapping
2D6Dh	0	Positive/Negative torque limit 2 setting	U8	ro	Impossible
	1	Positive/Negative torque limit 2 select	U16	rw	
	2	Positive torque limit value 2			
	3	Negative torque limit value 2			

Index	Sub	Default	Range	Units	Save	Parameter
2D6Dh	0	3	3h to 3h (3)	—	Impossible	—
	1	0	0000h to 0001h (1)	—	Possible	[Pr. PC42]
	2	10000	0 to 10000	per thousand of rated torque		POL disabled: [Pr. PC43 Forward rotation torque limit 2] POL enabled: [Pr. PC44 Reverse rotation torque limit 2]
	3	10000				POL disabled: [Pr. PC44 Reverse rotation torque limit 2] POL enabled: [Pr. PC43 Forward rotation torque limit 2]

For the combinations of servo parameters and objects that are switched by CPTL/CNTL, refer to the following table.

[Pr. PC42.0]/ [Positive/Negative torque limit 2 select (Obj. 2D6Dh: 01h)]	Forward rotation torque limit value		Reverse rotation torque limit value	
	CPTL: 0	CPTL: 1	CNTL: 0	CNTL: 1
0h/ 0000h	[Pr. PA11]/ [Positive torque limit value (Obj. 60E0h)]	[Pr. PA11]/ [Positive torque limit value (Obj. 60E0h)]	[Pr. PA12]/ [Negative torque limit value (Obj. 60E1h)]	[Pr. PA12]/ [Negative torque limit value (Obj. 60E1h)]
1h/ 0001h	[Pr. PA11]/ [Positive torque limit value (Obj. 60E0h)]	[Pr. PC43]/ [Positive torque limit value2 (Obj. 2D6Dh: 02h)]	[Pr. PA12]/ [Negative torque limit value (Obj. 60E1h)]	[Pr. PC44]/ [Negative torque limit value2 (Obj. 2D6Dh: 03h)]

9.2 Infinite feed function

Outline

When this function is used in an absolute position detection system, even if the servo motor rotates 32768 rev or more in the same direction, [AL. 0E3.1 Multi-revolution counter travel distance exceeded warning] will not occur and the home position will not be erased. Therefore, the current position will be restored after the power is cycled. When this function is not used, if the servo motor rotates 32768 rev or more in the same direction, [AL. 0E3.1] will occur and the home position will be erased.

Setting method

Set [Pr. PT85.0 Infinite feed function selection] to "1".

Servo parameter	Name	Description
PT85.0	Infinite feed function selection	0: Disabled 1: Enabled

When the servo motor rotates 32768 rev or more

The following table shows whether [AL. 0E3.1] will occur, the home position will be erased, and the current position will be restored when the servo motor rotates 32768 rev or more.

Control mode	Unit for position data	[AL. 0E3.1]	Home position	Current position
Cyclic synchronous mode	pulse	Will not occur	Will not be erased	Will be restored
Profile mode	degree	Will not occur *1	Will not be erased	Will be restored
	pulse	Will occur *1	Will be erased	Will not be restored
Positioning mode (point table method)	mm	Will occur *1	Will be erased	Will not be restored
	inch	Will occur *1	Will be erased	Will not be restored
	degree	Will not occur *1	Will not be erased	Will be restored
	pulse	Will occur *1	Will be erased	Will not be restored

*1 When [Pr. PC29.5 Absolute position counter warning [AL. 0E3.1] selection] is set to "0" (disabled), [AL. 0E3.1] will not occur and the home position will not be erased. However, if "0" is set while the unit is other than "degree", the current position will not be restored correctly after the power is cycled. As this will result in an incorrect current position value, set [Pr. PC29.5] to "1" (enabled).

Restrictions

The following shows restrictions on when [Pr. PT85.0] is set to "1".

- This function cannot be used in the linear servo motor control mode, direct drive motor control mode, or fully closed loop control mode. Setting [Pr. PT85.0] to "1" in these modes triggers [AL. 037 Parameter error].
- The scale measurement function cannot be used. When the scale measurement function is enabled, setting [Pr. PT85.0] to "1" triggers [AL. 037 Parameter error].
- This function can be used only in the cyclic position mode (csp) and homing mode (hm). The mode cannot be switched to other control modes.
- Set values in [Pr. PA06 Electronic gear numerator] and [Pr. PA07 Electronic gear denominator] so that the numerator (m) after reducing the following equation is less than 16384. If "m" is 16384 or more, [AL. 037 Parameter error] will occur.

$$\frac{\text{Unit} \times \text{cmx}}{\text{fbpm} \times \text{cdv}} = \frac{m}{n} \quad m < 16384$$

Unit: 2^{32} (4294967296)
cmx: Electronic gear numerator ([Pr. PA06])
cdv: Electronic gear denominator ([Pr. PA07])
fbpm: Servo motor encoder resolution

Ex.
Setting 2^{26} (67108864) for the encoder resolution and 48:1 for the electronic gear

$$\frac{4294967296 \times 48}{67108864 \times 1} = \frac{3072}{1} \quad 3072 < 16384$$

- When [Pr. PT85.0] is changed while the absolute position detection system is enabled, perform homing again. If homing is not performed, [AL. 090.5 Homing incomplete warning] occurs at the start of an operation.
- Do not rotate the motor 2^{32} (4294967296) [pos units] or more in the forward or reverse rotation direction during power-off. Doing so will cause inaccurate absolute position restoration after the power is turned on.
- LSP (Forward rotation stroke end) and LSN (Reverse rotation stroke end) cannot be used. When the infinite feed function is enabled, LSP and LSN will turn on automatically.
- When the infinite feed function is enabled, the home position will be updated automatically. When the home position is updated, [Position actual value (Obj. 6064h)] will not change, but ABS data in MR Configurator2 will show values after the home position has been updated.

10 FSoE

10.1 Safety communication function

Point

When using the safety communication function, use ESI files in Module format.

Safety communication performed via EtherCAT is called FSoE (Safety Over EtherCAT), and the safety sub-function can be used by connecting to a controller that supports functional safety.

For details of the safety sub-function, refer to "FUNCTIONAL SAFETY" in the following manual.

MR-J5 User's Manual (Function)

Safety PDO mapping

When using the safety communication function, use safety PDO ([Obj. 1608h]/ [Obj. 1A08h]).

The safety communication function can be used by adding safety PDO to [Sync Manager RxPDO assign (Obj. 1C12h)] and [Sync Manager TxPDO assign (Obj. 1C13h)].

The configuration of safety PDO is as follows. Refer to the following for details of mapping.

Page 24 PDO (Process Data Object) COMMUNICATION

1-axis servo amplifier

Index	Sub Index	Description
1608h	00h	Number of entries (24h)
	01h	FSoE Master Command
	02h to 09h	SafeData[0]
	0Ah to 11h	SafeData[1]
	12h	FSoE Master CRC_0
	13h to 1Ah	SafeData[2]
	1Bh to 22h	SafeData[3]
	23h	FSoE Master CRC_1
	24h	FSoE Master ConnectionID
1A08h	00h	Number of entries (24h)
	01h	FSoE Slave Command
	02h to 09h	SafeData[0]
	0Ah to 11h	SafeData[1]
	12h	FSoE Slave CRC_0
	13h to 1Ah	SafeData[2]
	1Bh to 22h	SafeData[3]
	23h	FSoE Slave CRC_1
	24h	FSoE Slave ConnectionID

2-axis servo amplifier

Index	Sub Index	Description
1608h	00h	Number of entries (46h)
	01h	FSoE Master Command
	02h to 09h	SafeData[0]
	0Ah to 11h	SafeData[1]
	12h	FSoE Master CRC_0
	13h to 1Ah	SafeData[2]
	1Bh to 22h	SafeData[3]
	23h	FSoE Master CRC_1
	24h to 2Bh	SafeData[4]
	2Ch to 33h	SafeData[5]
	34h	FSoE Master CRC_2
	35h to 3Ch	SafeData[6]
	3Dh to 44h	SafeData[7]
	45h	FSoE Master CRC_3
	46h	FSoE Master ConnectionID
1A08h	00h	Number of entries (46h)
	01h	FSoE Slave Command
	02h to 09h	SafeData[0]
	0Ah to 11h	SafeData[1]
	12h	FSoE Slave CRC_0
	13h to 1Ah	SafeData[2]
	1Bh to 22h	SafeData[3]
	23h	FSoE Slave CRC_1
	24h to 2Bh	SafeData[4]
	2Ch to 33h	SafeData[5]
	34h	FSoE Slave CRC_2
	35h to 3Ch	SafeData[6]
	3Dh to 44h	SafeData[7]
	45h	FSoE Slave CRC_3
	46h	FSoE Slave ConnectionID

3-axis servo amplifier

Index	Sub Index	Description
1608h	00h	Number of entries (68h)
	01h	FSoE Master Command
	02h to 09h	SafeData[0]
	0Ah to 11h	SafeData[1]
	12h	FSoE Master CRC_0
	13h to 1Ah	SafeData[2]
	1Bh to 22h	SafeData[3]
	23h	FSoE Master CRC_1
	24h to 2Bh	SafeData[4]
	2Ch to 33h	SafeData[5]
	34h	FSoE Master CRC_2
	35h to 3Ch	SafeData[6]
	3Dh to 44h	SafeData[7]
	45h	FSoE Master CRC_3
	46h to 4Dh	SafeData[8]
	4Eh to 55h	SafeData[9]
	56h	FSoE Master CRC_4
	57h to 5Eh	SafeData[10]
	5Fh to 66h	SafeData[11]
	67h	FSoE Master CRC_5
	68h	FSoE Master ConnectionID
1A08h	00h	Number of entries (68h)
	01h	FSoE Slave Command
	02h to 09h	SafeData[0]
	0Ah to 11h	SafeData[1]
	12h	FSoE Slave CRC_0
	13h to 1Ah	SafeData[2]
	1Bh to 22h	SafeData[3]
	23h	FSoE Slave CRC_1
	24h to 2Bh	SafeData[4]
	2Ch to 33h	SafeData[5]
	34h	FSoE Slave CRC_2
	35h to 3Ch	SafeData[6]
	3Dh to 44h	SafeData[7]
	45h	FSoE Slave CRC_3
	46h to 4Dh	SafeData[8]
	4Eh to 55h	SafeData[9]
	56h	FSoE Slave CRC_4
	57h to 5Eh	SafeData[10]
	5Fh to 66h	SafeData[11]
	67h	FSoE Slave CRC_5
	68h	FSoE Slave ConnectionID

Safety parameter set

The safety communication function performs a parameter set (FSoE Connection Parameter Set) during the initial sequence of communication, and the parameters related to the safety communication are transferred from the controller to the slave. For details, refer to the following manual.

MR-J5-G-N1/MR-J5W-G-N1 User's Manual (Object Dictionary)

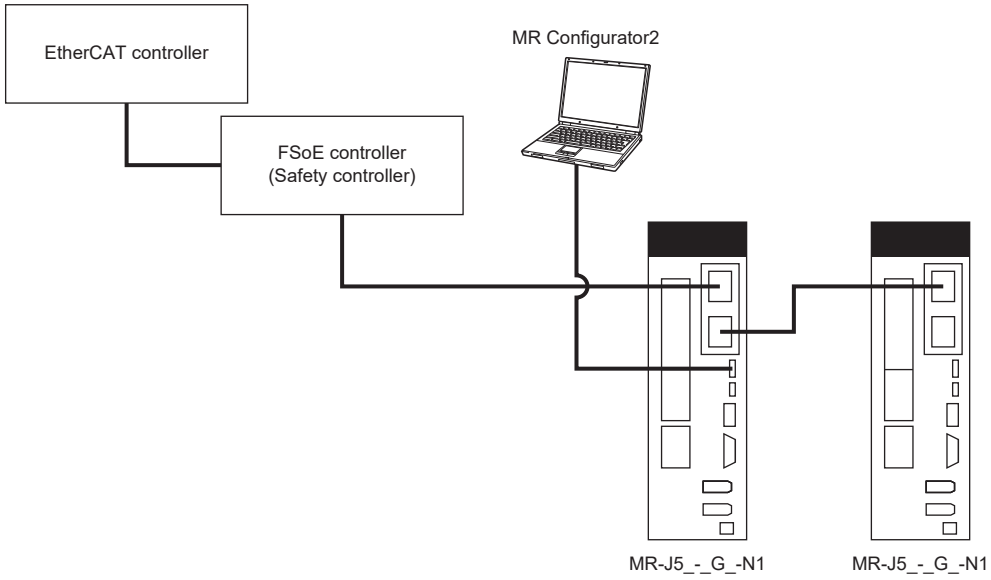
The following shows the data to be transferred by the parameter set.

Description	Supported object
Length of Communication Parameter	Communication Parameter Length (Obj. E901h:07h)
Watchdog Time	Watchdog Time (Obj. E901h:04h)
Length of Application Parameter	Application Parameter Length (Obj. E901h:08h)

Startup

Configuration

The following figure shows a configuration example.



Startup procedure

Point

- Use ESI files that support the Module format.
- Before connecting with the controller, set the functional safety parameters of the servo amplifier. If a network is automatically detected when [Pr. PSA01.1 Input mode selection] is set to "0" (safety sub-function control by input device), FSoE may not be properly configured on the controller side.

■Parameter settings

• [Pr. PSA01.0 Safety sub-function activation setting]

Set "1" (enabled) after checking the setting of each functional safety parameter and confirming that there are no errors.

• [Pr. PSA01.1 Input mode selection]

Set "1" (safety sub-function control by network).

• [Pr. PSC07 FSoE Address setting]

Set the FSoE Address of FSoE Slave within the range of 1 to 65355. If [Pr. PSC07] is set to "0" when [Pr. PSA01.0] is "1" and [Pr. PSA01.1] is "1", [AL. 537.2 Parameter combination error A (safety sub-function)] occurs.

■EtherCAT controller settings

1. ESI file installation

Refer to the following.

☞ Page 62 ESI file installation

2. Node address setting

Refer to the following.

☞ Page 62 Node address setting

3. Communication setting

Refer to the following.

☞ Page 64 Communication setting

4. Mapping settings

Refer to the following. Set the safety PDO mapping in addition to the normal PDO mapping.

☞ Page 64 Mapping settings

Safety sub-function control by network

■Outline

Input devices cannot be used for safety sub-function control by network.

The following shows the configuration of process data for safety communication via EtherCAT communication. The safety sub-function can be controlled using the dedicated input/output signal assigned to SafeData[n].



To use the safety communication function through EtherCAT communication, assign [9th Receive PDO Mapping (Obj. 1608h)] and [9th Transmit PDO Mapping (Obj. 1A08h)] to [Sync Manager RxPDO assign (Obj. 1C12h)] and [Sync Manager TxPDO assign (Obj. 1C13h)]. For details of each object, refer to the following manual.

📖MR-J5-G-N1/MR-J5W-G-N1 User's Manual (Object Dictionary)

Safety sub-function control by network has the following characteristics.

• Transmission of various function command inputs via a network (for the MR-J5-_G_-RJN1 and MR-J5-_G_-HSN1)

The following commands can be transmitted via a network.

Controller to servo amplifier			
SafeData[n]	**Bit**	**Input command**	**Description**
SafeData[0]	0	STOC (STO command)	0: The STO function of the servo amplifier is activated and the energy supply is shut off. 1: The STO status is canceled and normal operation resumes.
	1	SS1C (SS1 command)	0: The SS1 function is activated. 1: The SS1 function is canceled.
	2	SS2C (SS2 command)	0: The SS2 function is activated. 1: The SS2 function is canceled.
	3	Not used	Set to "0".
	4		
	5	SDIPC (SDIP command)	0: The SDIP function is activated. 1: The SDIP function is canceled.
	6	SDINC (SDIN command)	0: The SDIN function is activated. 1: The SDIN function is canceled.
	7	Error Ack (error clear command)	0 → 1: Cancellation of errors is requested.
SafeData[1]	0	SLS1C (SLS1 command)	0: The SLS1 function is activated. 1: The SLS1 function is canceled.
	1	SLS2C (SLS2 command)	0: The SLS2 function is activated. 1: The SLS2 function is canceled.
	2	SLS3C (SLS3 command)	0: The SLS3 function is activated. 1: The SLS3 function is canceled.
	3	SLS4C (SLS4 command)	0: The SLS4 function is activated. 1: The SLS4 function is canceled.
	4	SLIC (SLI command)	0: The SLI function is activated. 1: The SLI function is canceled.
	5	SLT1C (SLT1 command)	0: The SLT1 function is activated. 1: The SLT1 function is canceled.
	6	SLT2C (SLT2 command)	0: The SLT2 function is activated. 1: The SLT2 function is canceled.
	7	SLT3C (SLT3 command)	0: The SLT3 function is activated. 1: The SLT3 function is canceled.

Controller to servo amplifier			
SafeData[n]	**Bit**	**Input command**	**Description**
SafeData[2]	0	SLT4C (SLT4 command)	0: The SLT4 function is activated. 1: The SLT4 function is canceled.
	1	Not used	Set to "0".
	2		
	3		
	4		
	5		
	6		
	7		
SafeData[3]	0	Not used	Set to "0".
	1		
	2		
	3		
	4		
	5		
	6		
	7		

• Transmission of various function command inputs via a network (for the MR-J5W2-_G_-N1)

The following commands can be transmitted via a network.

Controller to servo amplifier				
SafeData[n]	**Bit**	**Input command**	**Axis**	**Description**
SafeData[0]	0	STOC (STO command)	A-axis	0: The STO function of the servo amplifier is activated and the energy supply is shut off. 1: The STO status is canceled and normal operation resumes.
	1	SS1C (SS1 command)		0: The SS1 function is activated. 1: The SS1 function is canceled.
	2	SS2C (SS2 command)		0: The SS2 function is activated. 1: The SS2 function is canceled.
	3	Not used		Set to "0".
	4			
	5	SDIPC (SDIP command)		0: The SDIP function is activated. 1: The SDIP function is canceled.
	6	SDINC (SDIN command)		0: The SDIN function is activated. 1: The SDIN function is canceled.
	7	Error Ack (Error clear command)		0 → 1: Cancellation of errors is requested.
SafeData[1]	0	SLS1C (SLS1 command)		0: The SLS1 function is activated. 1: The SLS1 function is canceled.
	1	SLS2C (SLS2 command)		0: The SLS2 function is activated. 1: The SLS2 function is canceled.
	2	SLS3C (SLS3 command)		0: The SLS3 function is activated. 1: The SLS3 function is canceled.
	3	SLS4C (SLS4 command)		0: The SLS4 function is activated. 1: The SLS4 function is canceled.
	4	SLIC (SLI command)		0: The SLI function is activated. 1: The SLI function is canceled.
	5	SLT1C (SLT1 command)		0: The SLT1 function is activated. 1: The SLT1 function is canceled.
	6	SLT2C (SLT2 command)		0: The SLT2 function is activated. 1: The SLT2 function is canceled.
	7	SLT3C (SLT3 command)		0: The SLT3 function is activated. 1: The SLT3 function is canceled.
SafeData[2]	0	SLT4C (SLT4 command)		0: The SLT4 function is activated. 1: The SLT4 function is canceled.
	1	Not used		Set to "0".
	2			
	3			
	4			
	5			
	6			
	7			
SafeData[3]	0	Not used		Set to "0".
	1			
	2			
	3			
	4			
	5			
	6			
	7			

Controller to servo amplifier				
SafeData[n]	**Bit**	**Input command**	**Axis**	**Description**
SafeData[4]	0	STOC (STO command)	B-axis	0: The STO function of the servo amplifier is activated and the energy supply is shut off. 1: The STO status is canceled and normal operation resumes.
	1	SS1C (SS1 command)		0: The SS1 function is activated. 1: The SS1 function is canceled.
	2	SS2C (SS2 command)		0: The SS2 function is activated. 1: The SS2 function is canceled.
	3	Not used		Set to "0".
	4			
	5	SDIPC (SDIP command)		0: The SDIP function is activated. 1: The SDIP function is canceled.
	6	SDINC (SDIN command)		0: The SDIN function is activated. 1: The SDIN function is canceled.
	7	Error Ack (Error clear command)		0 → 1: Cancellation of errors is requested.
SafeData[5]	0	SLS1C (SLS1 command)		0: The SLS1 function is activated. 1: The SLS1 function is canceled.
	1	SLS2C (SLS2 command)		0: The SLS2 function is activated. 1: The SLS2 function is canceled.
	2	SLS3C (SLS3 command)		0: The SLS3 function is activated. 1: The SLS3 function is canceled.
	3	SLS4C (SLS4 command)		0: The SLS4 function is activated. 1: The SLS4 function is canceled.
	4	SLIC (SLI command)		0: The SLI function is activated. 1: The SLI function is canceled.
	5	SLT1C (SLT1 command)		0: The SLT1 function is activated. 1: The SLT1 function is canceled.
	6	SLT2C (SLT2 command)		0: The SLT2 function is activated. 1: The SLT2 function is canceled.
	7	SLT3C (SLT3 command)		0: The SLT3 function is activated. 1: The SLT3 function is canceled.
SafeData[6]	0	SLT4C (SLT4 command)		0: The SLT4 function is activated. 1: The SLT4 function is canceled.
	1	Not used		Set to "0".
	2			
	3			
	4			
	5			
	6			
	7			
SafeData[7]	0	Not used		Set to "0".
	1			
	2			
	3			
	4			
	5			
	6			
	7			

• Transmission of various function command inputs via a network (for the MR-J5W3-_G_-N1)

The following commands can be transmitted via a network.

Controller to servo amplifier				
SafeData[n]	**Bit**	**Input command**	**Axis**	**Description**
SafeData[0]	0	STOC (STO command)	A-axis	0: The STO function of the servo amplifier is activated and the energy supply is shut off. 1: The STO status is canceled and normal operation resumes.
	1	SS1C (SS1 command)		0: The SS1 function is activated. 1: The SS1 function is canceled.
	2	SS2C (SS2 command)		0: The SS2 function is activated. 1: The SS2 function is canceled.
	3	Not used		Set to "0".
	4			
	5	SDIPC (SDIP command)		0: The SDIP function is activated. 1: The SDIP function is canceled.
	6	SDINC (SDIN command)		0: The SDIN function is activated. 1: The SDIN function is canceled.
	7	Error Ack (Error clear command)		0 → 1: Cancellation of errors is requested.
SafeData[1]	0	SLS1C (SLS1 command)		0: The SLS1 function is activated. 1: The SLS1 function is canceled.
	1	SLS2C (SLS2 command)		0: The SLS2 function is activated. 1: The SLS2 function is canceled.
	2	SLS3C (SLS3 command)		0: The SLS3 function is activated. 1: The SLS3 function is canceled.
	3	SLS4C (SLS4 command)		0: The SLS4 function is activated. 1: The SLS4 function is canceled.
	4	SLIC (SLI command)		0: The SLI function is activated. 1: The SLI function is canceled.
	5	SLT1C (SLT1 command)		0: The SLT1 function is activated. 1: The SLT1 function is canceled.
	6	SLT2C (SLT2 command)		0: The SLT2 function is activated. 1: The SLT2 function is canceled.
	7	SLT3C (SLT3 command)		0: The SLT3 function is activated. 1: The SLT3 function is canceled.
SafeData[2]	0	SLT4C (SLT4 command)		0: The SLT4 function is activated. 1: The SLT4 function is canceled.
	1	Not used		Set to "0".
	2			
	3			
	4			
	5			
	6			
	7			
SafeData[3]	0	Not used		Set to "0".
	1			
	2			
	3			
	4			
	5			
	6			
	7			

Controller to servo amplifier				
SafeData[n]	**Bit**	**Input command**	**Axis**	**Description**
SafeData[4]	0	STOC (STO command)	B-axis	0: The STO function of the servo amplifier is activated and the energy supply is shut off. 1: The STO status is canceled and normal operation resumes.
	1	SS1C (SS1 command)		0: The SS1 function is activated. 1: The SS1 function is canceled.
	2	SS2C (SS2 command)		0: The SS2 function is activated. 1: The SS2 function is canceled.
	3	Not used		Set to "0".
	4			
	5	SDIPC (SDIP command)		0: The SDIP function is activated. 1: The SDIP function is canceled.
	6	SDINC (SDIN command)		0: The SDIN function is activated. 1: The SDIN function is canceled.
	7	Error Ack (Error clear command)		0 → 1: Cancellation of errors is requested.
SafeData[5]	0	SLS1C (SLS1 command)		0: The SLS1 function is activated. 1: The SLS1 function is canceled.
	1	SLS2C (SLS2 command)		0: The SLS2 function is activated. 1: The SLS2 function is canceled.
	2	SLS3C (SLS3 command)		0: The SLS3 function is activated. 1: The SLS3 function is canceled.
	3	SLS4C (SLS4 command)		0: The SLS4 function is activated. 1: The SLS4 function is canceled.
	4	SLIC (SLI command)		0: The SLI function is activated. 1: The SLI function is canceled.
	5	SLT1C (SLT1 command)		0: The SLT1 function is activated. 1: The SLT1 function is canceled.
	6	SLT2C (SLT2 command)		0: The SLT2 function is activated. 1: The SLT2 function is canceled.
	7	SLT3C (SLT3 command)		0: The SLT3 function is activated. 1: The SLT3 function is canceled.
SafeData[6]	0	SLT4C (SLT4 command)		0: The SLT4 function is activated. 1: The SLT4 function is canceled.
	1	Not used		Set to "0".
	2			
	3			
	4			
	5			
	6			
	7			
SafeData[7]	0	Not used		Set to "0".
	1			
	2			
	3			
	4			
	5			
	6			
	7			

Controller to servo amplifier				
SafeData[n]	**Bit**	**Input command**	**Axis**	**Description**
SafeData[8]	0	STOC (STO command)	C-axis	0: The STO function of the servo amplifier is activated and the energy supply is shut off. 1: The STO status is canceled and normal operation resumes.
	1	SS1C (SS1 command)		0: The SS1 function is activated. 1: The SS1 function is canceled.
	2	SS2C (SS2 command)		0: The SS2 function is activated. 1: The SS2 function is canceled.
	3	Not used		Set to "0".
	4			
	5	SDIPC (SDIP command)		0: The SDIP function is activated. 1: The SDIP function is canceled.
	6	SDINC (SDIN command)		0: The SDIN function is activated. 1: The SDIN function is canceled.
	7	Error Ack (Error clear command)		0 → 1: Cancellation of errors is requested.
SafeData[9]	0	SLS1C (SLS1 command)		0: The SLS1 function is activated. 1: The SLS1 function is canceled.
	1	SLS2C (SLS2 command)		0: The SLS2 function is activated. 1: The SLS2 function is canceled.
	2	SLS3C (SLS3 command)		0: The SLS3 function is activated. 1: The SLS3 function is canceled.
	3	SLS4C (SLS4 command)		0: The SLS4 function is activated. 1: The SLS4 function is canceled.
	4	SLIC (SLI command)		0: The SLI function is activated. 1: The SLI function is canceled.
	5	SLT1C (SLT1 command)		0: The SLT1 function is activated. 1: The SLT1 function is canceled.
	6	SLT2C (SLT2 command)		0: The SLT2 function is activated. 1: The SLT2 function is canceled.
	7	SLT3C (SLT3 command)		0: The SLT3 function is activated. 1: The SLT3 function is canceled.
SafeData[10]	0	SLT4C (SLT4 command)		0: The SLT4 function is activated. 1: The SLT4 function is canceled.
	1	Not used		Set to "0".
	2			
	3			
	4			
	5			
	6			
	7			
SafeData[11]	0	Not used		Set to "0".
	1			
	2			
	3			
	4			
	5			
	6			
	7			

• Transmission of various function command inputs via a network (for the MR-J5D1-_G-N1)

The following commands can be transmitted via a network.

Controller to servo amplifier			
SafeData[n]	**Bit**	**Input command**	**Description**
SafeData[0]	0	STOC (STO command)	0: The STO function of the servo amplifier is activated and the energy supply is shut off. 1: The STO status is canceled and normal operation resumes.
	1	SS1C (SS1 command)	0: The SS1 function is activated. 1: The SS1 function is canceled.
	2	SS2C (SS2 command)	0: The SS2 function is activated. 1: The SS2 function is canceled.
	3	Not used	Set to "0".
	4		
	5	SDIPC (SDIP command)	0: The SDIP function is activated. 1: The SDIP function is canceled.
	6	SDINC (SDIN command)	0: The SDIN function is activated. 1: The SDIN function is canceled.
	7	Error Ack (Error clear command)	0 → 1: Cancellation of errors is requested.
SafeData[1]	0	SLS1C (SLS1 command)	0: The SLS1 function is activated. 1: The SLS1 function is canceled.
	1	SLS2C (SLS2 command)	0: The SLS2 function is activated. 1: The SLS2 function is canceled.
	2	SLS3C (SLS3 command)	0: The SLS3 function is activated. 1: The SLS3 function is canceled.
	3	SLS4C (SLS4 command)	0: The SLS4 function is activated. 1: The SLS4 function is canceled.
	4	SLIC (SLI command)	0: The SLI function is activated. 1: The SLI function is canceled.
	5	SLT1C (SLT1 command)	0: The SLT1 function is activated. 1: The SLT1 function is canceled.
	6	SLT2C (SLT2 command)	0: The SLT2 function is activated. 1: The SLT2 function is canceled.
	7	SLT3C (SLT3 command)	0: The SLT3 function is activated. 1: The SLT3 function is canceled.
SafeData[2]	0	SLT4C (SLT4 command)	0: The SLT4 function is activated. 1: The SLT4 function is canceled.
	1	Not used	Set to "0".
	2		
	3		
	4		
	5		
	6		
	7		
SafeData[3]	0	Not used	Set to "0".
	1		
	2		
	3		
	4		
	5		
	6		
	7		

• Transmission of various function command inputs via a network (for the MR-J5D2-_G-N1)

The following commands can be transmitted via a network.

Controller to servo amplifier				
SafeData[n]	**Bit**	**Input command**	**Axis**	**Description**
SafeData[0]	0	STOC (STO command)	A-axis	0: The STO function of the servo amplifier is activated and the energy supply is shut off. 1: The STO status is canceled and normal operation resumes.
	1	SS1C (SS1 command)		0: The SS1 function is activated. 1: The SS1 function is canceled.
	2	SS2C (SS2 command)		0: The SS2 function is activated. 1: The SS2 function is canceled.
	3	Not used		Set to "0".
	4			
	5	SDIPC (SDIP command)		0: The SDIP function is activated. 1: The SDIP function is canceled.
	6	SDINC (SDIN command)		0: The SDIN function is activated. 1: The SDIN function is canceled.
	7	Error Ack (Error clear command)		0 → 1: Cancellation of errors is requested.
SafeData[1]	0	SLS1C (SLS1 command)		0: The SLS1 function is activated. 1: The SLS1 function is canceled.
	1	SLS2C (SLS2 command)		0: The SLS2 function is activated. 1: The SLS2 function is canceled.
	2	SLS3C (SLS3 command)		0: The SLS3 function is activated. 1: The SLS3 function is canceled.
	3	SLS4C (SLS4 command)		0: The SLS4 function is activated. 1: The SLS4 function is canceled.
	4	SLIC (SLI command)		0: The SLI function is activated. 1: The SLI function is canceled.
	5	SLT1C (SLT1 command)		0: The SLT1 function is activated. 1: The SLT1 function is canceled.
	6	SLT2C (SLT2 command)		0: The SLT2 function is activated. 1: The SLT2 function is canceled.
	7	SLT3C (SLT3 command)		0: The SLT3 function is activated. 1: The SLT3 function is canceled.
SafeData[2]	0	SLT4C (SLT4 command)		0: The SLT4 function is activated. 1: The SLT4 function is canceled.
	1	Not used		Set to "0".
	2			
	3			
	4			
	5			
	6			
	7			
SafeData[3]	0	Not used		Set to "0".
	1			
	2			
	3			
	4			
	5			
	6			
	7			

Controller to servo amplifier				
SafeData[n]	**Bit**	**Input command**	**Axis**	**Description**
SafeData[4]	0	STOC (STO command)	B-axis	0: The STO function of the servo amplifier is activated and the energy supply is shut off. 1: The STO status is canceled and normal operation resumes.
	1	SS1C (SS1 command)		0: The SS1 function is activated. 1: The SS1 function is canceled.
	2	SS2C (SS2 command)		0: The SS2 function is activated. 1: The SS2 function is canceled.
	3	Not used		Set to "0".
	4			
	5	SDIPC (SDIP command)		0: The SDIP function is activated. 1: The SDIP function is canceled.
	6	SDINC (SDIN command)		0: The SDIN function is activated. 1: The SDIN function is canceled.
	7	Error Ack (Error clear command)		0 → 1: Cancellation of errors is requested.
SafeData[5]	0	SLS1C (SLS1 command)		0: The SLS1 function is activated. 1: The SLS1 function is canceled.
	1	SLS2C (SLS2 command)		0: The SLS2 function is activated. 1: The SLS2 function is canceled.
	2	SLS3C (SLS3 command)		0: The SLS3 function is activated. 1: The SLS3 function is canceled.
	3	SLS4C (SLS4 command)		0: The SLS4 function is activated. 1: The SLS4 function is canceled.
	4	SLIC (SLI command)		0: The SLI function is activated. 1: The SLI function is canceled.
	5	SLT1C (SLT1 command)		0: The SLT1 function is activated. 1: The SLT1 function is canceled.
	6	SLT2C (SLT2 command)		0: The SLT2 function is activated. 1: The SLT2 function is canceled.
	7	SLT3C (SLT3 command)		0: The SLT3 function is activated. 1: The SLT3 function is canceled.
SafeData[6]	0	SLT4C (SLT4 command)		0: The SLT4 function is activated. 1: The SLT4 function is canceled.
	1	Not used		Set to "0".
	2			
	3			
	4			
	5			
	6			
	7			
SafeData[7]	0	Not used		Set to "0".
	1			
	2			
	3			
	4			
	5			
	6			
	7			

• Transmission of various function command inputs via a network (for the MR-J5D3-_G-N1)

The following commands can be transmitted via a network.

Controller to servo amplifier				
SafeData[n]	**Bit**	**Input command**	**Axis**	**Description**
SafeData[0]	0	STOC (STO command)	A-axis	0: The STO function of the servo amplifier is activated and the energy supply is shut off. 1: The STO status is canceled and normal operation resumes.
	1	SS1C (SS1 command)		0: The SS1 function is activated. 1: The SS1 function is canceled.
	2	SS2C (SS2 command)		0: The SS2 function is activated. 1: The SS2 function is canceled.
	3	Not used		Set to "0".
	4			
	5	SDIPC (SDIP command)		0: The SDIP function is activated. 1: The SDIP function is canceled.
	6	SDINC (SDIN command)		0: The SDIN function is activated. 1: The SDIN function is canceled.
	7	Error Ack (Error clear command)		0 → 1: Cancellation of errors is requested.
SafeData[1]	0	SLS1C (SLS1 command)		0: The SLS1 function is activated. 1: The SLS1 function is canceled.
	1	SLS2C (SLS2 command)		0: The SLS2 function is activated. 1: The SLS2 function is canceled.
	2	SLS3C (SLS3 command)		0: The SLS3 function is activated. 1: The SLS3 function is canceled.
	3	SLS4C (SLS4 command)		0: The SLS4 function is activated. 1: The SLS4 function is canceled.
	4	SLIC (SLI command)		0: The SLI function is activated. 1: The SLI function is canceled.
	5	SLT1C (SLT1 command)		0: The SLT1 function is activated. 1: The SLT1 function is canceled.
	6	SLT2C (SLT2 command)		0: The SLT2 function is activated. 1: The SLT2 function is canceled.
	7	SLT3C (SLT3 command)		0: The SLT3 function is activated. 1: The SLT3 function is canceled.
SafeData[2]	0	SLT4C (SLT4 command)		0: The SLT4 function is activated. 1: The SLT4 function is canceled.
	1	Not used		Set to "0".
	2			
	3			
	4			
	5			
	6			
	7			
SafeData[3]	0	Not used		Set to "0".
	1			
	2			
	3			
	4			
	5			
	6			
	7			

Controller to servo amplifier				
SafeData[n]	**Bit**	**Input command**	**Axis**	**Description**
SafeData[4]	0	STOC (STO command)	B-axis	0: The STO function of the servo amplifier is activated and the energy supply is shut off. 1: The STO status is canceled and normal operation resumes.
	1	SS1C (SS1 command)		0: The SS1 function is activated. 1: The SS1 function is canceled.
	2	SS2C (SS2 command)		0: The SS2 function is activated. 1: The SS2 function is canceled.
	3	Not used		Set to "0".
	4			
	5	SDIPC (SDIP command)		0: The SDIP function is activated. 1: The SDIP function is canceled.
	6	SDINC (SDIN command)		0: The SDIN function is activated. 1: The SDIN function is canceled.
	7	Error Ack (Error clear command)		0 → 1: Cancellation of errors is requested.
SafeData[5]	0	SLS1C (SLS1 command)		0: The SLS1 function is activated. 1: The SLS1 function is canceled.
	1	SLS2C (SLS2 command)		0: The SLS2 function is activated. 1: The SLS2 function is canceled.
	2	SLS3C (SLS3 command)		0: The SLS3 function is activated. 1: The SLS3 function is canceled.
	3	SLS4C (SLS4 command)		0: The SLS4 function is activated. 1: The SLS4 function is canceled.
	4	SLIC (SLI command)		0: The SLI function is activated. 1: The SLI function is canceled.
	5	SLT1C (SLT1 command)		0: The SLT1 function is activated. 1: The SLT1 function is canceled.
	6	SLT2C (SLT2 command)		0: The SLT2 function is activated. 1: The SLT2 function is canceled.
	7	SLT3C (SLT3 command)		0: The SLT3 function is activated. 1: The SLT3 function is canceled.
SafeData[6]	0	SLT4C (SLT4 command)		0: The SLT4 function is activated. 1: The SLT4 function is canceled.
	1	Not used		Set to "0".
	2			
	3			
	4			
	5			
	6			
	7			
SafeData[7]	0	Not used		Set to "0".
	1			
	2			
	3			
	4			
	5			
	6			
	7			

Controller to servo amplifier				
SafeData[n]	**Bit**	**Input command**	**Axis**	**Description**
SafeData[8]	0	STOC (STO command)	C-axis	0: The STO function of the servo amplifier is activated and the energy supply is shut off. 1: The STO status is canceled and normal operation resumes.
	1	SS1C (SS1 command)		0: The SS1 function is activated. 1: The SS1 function is canceled.
	2	SS2C (SS2 command)		0: The SS2 function is activated. 1: The SS2 function is canceled.
	3	Not used		Set to "0".
	4			
	5	SDIPC (SDIP command)		0: The SDIP function is activated. 1: The SDIP function is canceled.
	6	SDINC (SDIN command)		0: The SDIN function is activated. 1: The SDIN function is canceled.
	7	Error Ack (Error clear command)		0 → 1: Cancellation of errors is requested.
SafeData[9]	0	SLS1C (SLS1 command)		0: The SLS1 function is activated. 1: The SLS1 function is canceled.
	1	SLS2C (SLS2 command)		0: The SLS2 function is activated. 1: The SLS2 function is canceled.
	2	SLS3C (SLS3 command)		0: The SLS3 function is activated. 1: The SLS3 function is canceled.
	3	SLS4C (SLS4 command)		0: The SLS4 function is activated. 1: The SLS4 function is canceled.
	4	SLIC (SLI command)		0: The SLI function is activated. 1: The SLI function is canceled.
	5	SLT1C (SLT1 command)		0: The SLT1 function is activated. 1: The SLT1 function is canceled.
	6	SLT2C (SLT2 command)		0: The SLT2 function is activated. 1: The SLT2 function is canceled.
	7	SLT3C (SLT3 command)		0: The SLT3 function is activated. 1: The SLT3 function is canceled.
SafeData[10]	0	SLT4C (SLT4 command)		0: The SLT4 function is activated. 1: The SLT4 function is canceled.
	1	Not used		Set to "0".
	2			
	3			
	4			
	5			
	6			
	7			
SafeData[11]	0	Not used		Set to "0".
	1			
	2			
	3			
	4			
	5			
	6			
	7			

• Feedback of various function outputs via a network (for the MR-J5-_G_-RJN1 and MR-J5-_G_-HSN1)

STOS (STO output), SOSS (SOS output), SSMS (SSM output), etc., can be transmitted through the network.

Servo amplifier to controller			
SafeData[n]	**Bit**	**Function output**	**Description**
SafeData[0]	0	STOS (STO output)	0: Indicates that the STO status has been canceled. 1: Indicates that the STO function is activated and the energy supply has been shut off.
	1	SSMS (SSM output)	0: Indicates that the servo motor speed exceeds the set SSM speed. (Off when the SSM function is disabled.) 1: Indicates that the servo motor speed is equal to or less than the set SSM speed.
	2	Not used	—
	3	SOSS (SOS output)	0: Indicates that the SOS function is not activated. 1: Indicates that the SOS function is activated by the SS2 function.
	4	Not used	—
	5		
	6		
	7	Error (Error status)	0: Indicates that no error is occurring. 1: Indicates that an error is occurring.
SafeData[1]	0	SS1S (SS1 output)	0: Indicates that the SS1 function is not activated. 1: Indicates that the SS1 function is activated.
	1	SS2S (SS2 output)	0: Indicates that the SS2 function is not activated. 1: Indicates that the SS2 function is activated.
	2	SDIPS (SDIP output)	0: Indicates that the SDIP function is not activated. 1: Indicates that the SDIP function is activated.
	3	SDINS (SDIN output)	0: Indicates that the SDIN function is not activated. 1: Indicates that the SDIN function is activated.
	4	SLS1S (SLS1 output)	0: Indicates that the SLS1 function is not activated. 1: Indicates that the SLS1 function is activated.
	5	SLS2S (SLS2 output)	0: Indicates that the SLS2 function is not activated. 1: Indicates that the SLS2 function is activated.
	6	SLS3S (SLS3 output)	0: Indicates that the SLS3 function is not activated. 1: Indicates that the SLS3 function is activated.
	7	SLS4S (SLS4 output)	0: Indicates that the SLS4 function is not activated. 1: Indicates that the SLS4 function is activated.
SafeData[2]	0	SBCS (SBC output)	0: Indicates that the STO status has been canceled and the energy supply to the electromagnetic brake has not been shut off. 1: Indicates that the STO function is activated and the energy supply to the electromagnetic brake has been shut off.
	1	SLIS (SLI output)	0: Indicates that the SLI function is not activated. 1: Indicates that the SLI function is activated.
	2	SLT1S (SLT1 output)	0: Indicates that the SLT1 function is not activated. 1: Indicates that the SLT1 function is activated.
	3	SLT2S (SLT2 output)	0: Indicates that the SLT2 function is not activated. 1: Indicates that the SLT2 function is activated.
	4	SLT3S (SLT3 output)	0: Indicates that the SLT3 function is not activated. 1: Indicates that the SLT3 function is activated.
	5	SLT4S (SLT4 output)	0: Indicates that the SLT4 function is not activated. 1: Indicates that the SLT4 function is activated.
	6	Not used	—
	7		
SafeData[3]	0	Not used	—
	1		
	2		
	3		
	4		
	5		
	6		
	7		

• Feedback of various function outputs via a network (for the MR-J5W2-_G_-N1)

STOS (STO output), SOSS (SOS output), SSMS (SSM output), etc., can be transmitted through the network.

Servo amplifier to controller				
SafeData[n]	**Bit**	**Function output**	**Axis**	**Description**
SafeData[0]	0	STOS (STO output)	A-axis	0: Indicates that the STO status has been canceled. 1: Indicates that the STO function is activated and the energy supply has been shut off.
	1	SSMS (SSM output)		0: Indicates that the servo motor speed exceeds the set SSM speed. (Off when the SSM function is disabled.) 1: Indicates that the servo motor speed is equal to or less than the set SSM speed.
	2	Not used		—
	3	SOSS (SOS output)		0: Indicates that the SOS function is not activated. 1: Indicates that the SOS function is activated by the SS2 function.
	4	Not used		—
	5			
	6			
	7	Error (Error status)		0: Indicates that no error is occurring. 1: Indicates that an error is occurring.
SafeData[1]	0	SS1S (SS1 output)		0: Indicates that the SS1 function is not activated. 1: Indicates that the SS1 function is activated.
	1	SS2S (SS2 output)		0: Indicates that the SS2 function is not activated. 1: Indicates that the SS2 function is activated.
	2	SDIPS (SDIP output)		0: Indicates that the SDIP function is not activated. 1: Indicates that the SDIP function is activated.
	3	SDINS (SDIN output)		0: Indicates that the SDIN function is not activated. 1: Indicates that the SDIN function is activated.
	4	SLS1S (SLS1 output)		0: Indicates that the SLS1 function is not activated. 1: Indicates that the SLS1 function is activated.
	5	SLS2S (SLS2 output)		0: Indicates that the SLS2 function is not activated. 1: Indicates that the SLS2 function is activated.
	6	SLS3S (SLS3 output)		0: Indicates that the SLS3 function is not activated. 1: Indicates that the SLS3 function is activated.
	7	SLS4S (SLS4 output)		0: Indicates that the SLS4 function is not activated. 1: Indicates that the SLS4 function is activated.
SafeData[2]	0	SBCS (SBC output)		0: Indicates that the STO status has been canceled and the energy supply to the electromagnetic brake has not been shut off. 1: Indicates that the STO function is activated and the energy supply to the electromagnetic brake has been shut off.
	1	SLIS (SLI output)		0: Indicates that the SLI function is not activated. 1: Indicates that the SLI function is activated.
	2	SLT1S (SLT1 output)		0: Indicates that the SLT1 function is not activated. 1: Indicates that the SLT1 function is activated.
	3	SLT2S (SLT2 output)		0: Indicates that the SLT2 function is not activated. 1: Indicates that the SLT2 function is activated.
	4	SLT3S (SLT3 output)		0: Indicates that the SLT3 function is not activated. 1: Indicates that the SLT3 function is activated.
	5	SLT4S (SLT4 output)		0: Indicates that the SLT4 function is not activated. 1: Indicates that the SLT4 function is activated.
	6	Not used		—
	7			
SafeData[3]	0	Not used		—
	1			
	2			
	3			
	4			
	5			
	6			
	7			

Servo amplifier to controller				
SafeData[n]	**Bit**	**Function output**	**Axis**	**Description**
SafeData[4]	0	STOS (STO output)	B-axis	0: Indicates that the STO status has been canceled. 1: Indicates that the STO function is activated and the energy supply has been shut off.
	1	SSMS (SSM output)		0: Indicates that the servo motor speed exceeds the set SSM speed. (Off when the SSM function is disabled.) 1: Indicates that the servo motor speed is equal to or less than the set SSM speed.
	2	Not used		—
	3	SOSS (SOS output)		0: Indicates that the SOS function is not activated. 1: Indicates that the SOS function is activated by the SS2 function.
	4	Not used		—
	5			
	6			
	7	Error (Error status)		0: Indicates that no error is occurring. 1: Indicates that an error is occurring.
SafeData[5]	0	SS1S (SS1 output)		0: Indicates that the SS1 function is not activated. 1: Indicates that the SS1 function is activated.
	1	SS2S (SS2 output)		0: Indicates that the SS2 function is not activated. 1: Indicates that the SS2 function is activated.
	2	SDIPS (SDIP output)		0: Indicates that the SDIP function is not activated. 1: Indicates that the SDIP function is activated.
	3	SDINS (SDIN output)		0: Indicates that the SDIN function is not activated. 1: Indicates that the SDIN function is activated.
	4	SLS1S (SLS1 output)		0: Indicates that the SLS1 function is not activated. 1: Indicates that the SLS1 function is activated.
	5	SLS2S (SLS2 output)		0: Indicates that the SLS2 function is not activated. 1: Indicates that the SLS2 function is activated.
	6	SLS3S (SLS3 output)		0: Indicates that the SLS3 function is not activated. 1: Indicates that the SLS3 function is activated.
	7	SLS4S (SLS4 output)		0: Indicates that the SLS4 function is not activated. 1: Indicates that the SLS4 function is activated.
SafeData[6]	0	SBCS (SBC output)		0: Indicates that the STO status has been canceled and the energy supply to the electromagnetic brake has not been shut off. 1: Indicates that the STO function is activated and the energy supply to the electromagnetic brake has been shut off.
	1	SLIS (SLI output)		0: Indicates that the SLI function is not activated. 1: Indicates that the SLI function is activated.
	2	SLT1S (SLT1 output)		0: Indicates that the SLT1 function is not activated. 1: Indicates that the SLT1 function is activated.
	3	SLT2S (SLT2 output)		0: Indicates that the SLT2 function is not activated. 1: Indicates that the SLT2 function is activated.
	4	SLT3S (SLT3 output)		0: Indicates that the SLT3 function is not activated. 1: Indicates that the SLT3 function is activated.
	5	SLT4S (SLT4 output)		0: Indicates that the SLT4 function is not activated. 1: Indicates that the SLT4 function is activated.
	6	Not used		—
	7			
SafeData[7]	0	Not used		—
	1			
	2			
	3			
	4			
	5			
	6			
	7			

• Feedback of various function outputs via a network (for the MR-J5W3-_G_-N1)

STOS (STO output), SOSS (SOS output), SSMS (SSM output), etc., can be transmitted through the network.

Servo amplifier to controller				
SafeData[n]	**Bit**	**Function output**	**Axis**	**Description**
SafeData[0]	0	STOS (STO output)	A-axis	0: Indicates that the STO status has been canceled. 1: Indicates that the STO function is activated and the energy supply has been shut off.
	1	SSMS (SSM output)		0: Indicates that the servo motor speed exceeds the set SSM speed. (Off when the SSM function is disabled.) 1: Indicates that the servo motor speed is equal to or less than the set SSM speed.
	2	Not used		—
	3	SOSS (SOS output)		0: Indicates that the SOS function is not activated. 1: Indicates that the SOS function is activated by the SS2 function.
	4	Not used		—
	5			
	6			
	7	Error (Error status)		0: Indicates that no error is occurring. 1: Indicates that an error is occurring.
SafeData[1]	0	SS1S (SS1 output)		0: Indicates that the SS1 function is not activated. 1: Indicates that the SS1 function is activated.
	1	SS2S (SS2 output)		0: Indicates that the SS2 function is not activated. 1: Indicates that the SS2 function is activated.
	2	SDIPS (SDIP output)		0: Indicates that the SDIP function is not activated. 1: Indicates that the SDIP function is activated.
	3	SDINS (SDIN output)		0: Indicates that the SDIN function is not activated. 1: Indicates that the SDIN function is activated.
	4	SLS1S (SLS1 output)		0: Indicates that the SLS1 function is not activated. 1: Indicates that the SLS1 function is activated.
	5	SLS2S (SLS2 output)		0: Indicates that the SLS2 function is not activated. 1: Indicates that the SLS2 function is activated.
	6	SLS3S (SLS3 output)		0: Indicates that the SLS3 function is not activated. 1: Indicates that the SLS3 function is activated.
	7	SLS4S (SLS4 output)		0: Indicates that the SLS4 function is not activated. 1: Indicates that the SLS4 function is activated.
SafeData[2]	0	SBCS (SBC output)		0: Indicates that the STO status has been canceled and the energy supply to the electromagnetic brake has not been shut off. 1: Indicates that the STO function is activated and the energy supply to the electromagnetic brake has been shut off.
	1	SLIS (SLI output)		0: Indicates that the SLI function is not activated. 1: Indicates that the SLI function is activated.
	2	SLT1S (SLT1 output)		0: Indicates that the SLT1 function is not activated. 1: Indicates that the SLT1 function is activated.
	3	SLT2S (SLT2 output)		0: Indicates that the SLT2 function is not activated. 1: Indicates that the SLT2 function is activated.
	4	SLT3S (SLT3 output)		0: Indicates that the SLT3 function is not activated. 1: Indicates that the SLT3 function is activated.
	5	SLT4S (SLT4 output)		0: Indicates that the SLT4 function is not activated. 1: Indicates that the SLT4 function is activated.
	6	Not used		—
	7			
SafeData[3]	0	Not used		—
	1			
	2			
	3			
	4			
	5			
	6			
	7			

Servo amplifier to controller				
SafeData[n]	**Bit**	**Function output**	**Axis**	**Description**
SafeData[4]	0	STOS (STO output)	B-axis	0: Indicates that the STO status has been canceled. 1: Indicates that the STO function is activated and the energy supply has been shut off.
	1	SSMS (SSM output)		0: Indicates that the servo motor speed exceeds the set SSM speed. (Off when the SSM function is disabled.) 1: Indicates that the servo motor speed is equal to or less than the set SSM speed.
	2	Not used		—
	3	SOSS (SOS output)		0: Indicates that the SOS function is not activated. 1: Indicates that the SOS function is activated by the SS2 function.
	4	Not used		—
	5			
	6			
	7	Error (Error status)		0: Indicates that no error is occurring. 1: Indicates that an error is occurring.
SafeData[5]	0	SS1S (SS1 output)		0: Indicates that the SS1 function is not activated. 1: Indicates that the SS1 function is activated.
	1	SS2S (SS2 output)		0: Indicates that the SS2 function is not activated. 1: Indicates that the SS2 function is activated.
	2	SDIPS (SDIP output)		0: Indicates that the SDIP function is not activated. 1: Indicates that the SDIP function is activated.
	3	SDINS (SDIN output)		0: Indicates that the SDIN function is not activated. 1: Indicates that the SDIN function is activated.
	4	SLS1S (SLS1 output)		0: Indicates that the SLS1 function is not activated. 1: Indicates that the SLS1 function is activated.
	5	SLS2S (SLS2 output)		0: Indicates that the SLS2 function is not activated. 1: Indicates that the SLS2 function is activated.
	6	SLS3S (SLS3 output)		0: Indicates that the SLS3 function is not activated. 1: Indicates that the SLS3 function is activated.
	7	SLS4S (SLS4 output)		0: Indicates that the SLS4 function is not activated. 1: Indicates that the SLS4 function is activated.
SafeData[6]	0	SBCS (SBC output)		0: Indicates that the STO status has been canceled and the energy supply to the electromagnetic brake has not been shut off. 1: Indicates that the STO function is activated and the energy supply to the electromagnetic brake has been shut off.
	1	SLIS (SLI output)		0: Indicates that the SLI function is not activated. 1: Indicates that the SLI function is activated.
	2	SLT1S (SLT1 output)		0: Indicates that the SLT1 function is not activated. 1: Indicates that the SLT1 function is activated.
	3	SLT2S (SLT2 output)		0: Indicates that the SLT2 function is not activated. 1: Indicates that the SLT2 function is activated.
	4	SLT3S (SLT3 output)		0: Indicates that the SLT3 function is not activated. 1: Indicates that the SLT3 function is activated.
	5	SLT4S (SLT4 output)		0: Indicates that the SLT4 function is not activated. 1: Indicates that the SLT4 function is activated.
	6	Not used		—
	7			
SafeData[7]	0	Not used		—
	1			
	2			
	3			
	4			
	5			
	6			
	7			

Servo amplifier to controller				
SafeData[n]	**Bit**	**Function output**	**Axis**	**Description**
SafeData[8]	0	STOS (STO output)	C-axis	0: Indicates that the STO status has been canceled. 1: Indicates that the STO function is activated and the energy supply has been shut off.
	1	SSMS (SSM output)		0: Indicates that the servo motor speed exceeds the set SSM speed. (Off when the SSM function is disabled.) 1: Indicates that the servo motor speed is equal to or less than the set SSM speed.
	2	Not used		—
	3	SOSS (SOS output)		0: Indicates that the SOS function is not activated. 1: Indicates that the SOS function is activated by the SS2 function.
	4	Not used		—
	5			
	6			
	7	Error (Error status)		0: Indicates that no error is occurring. 1: Indicates that an error is occurring.
SafeData[9]	0	SS1S (SS1 output)		0: Indicates that the SS1 function is not activated. 1: Indicates that the SS1 function is activated.
	1	SS2S (SS2 output)		0: Indicates that the SS2 function is not activated. 1: Indicates that the SS2 function is activated.
	2	SDIPS (SDIP output)		0: Indicates that the SDIP function is not activated. 1: Indicates that the SDIP function is activated.
	3	SDINS (SDIN output)		0: Indicates that the SDIN function is not activated. 1: Indicates that the SDIN function is activated.
	4	SLS1S (SLS1 output)		0: Indicates that the SLS1 function is not activated. 1: Indicates that the SLS1 function is activated.
	5	SLS2S (SLS2 output)		0: Indicates that the SLS2 function is not activated. 1: Indicates that the SLS2 function is activated.
	6	SLS3S (SLS3 output)		0: Indicates that the SLS3 function is not activated. 1: Indicates that the SLS3 function is activated.
	7	SLS4S (SLS4 output)		0: Indicates that the SLS4 function is not activated. 1: Indicates that the SLS4 function is activated.
SafeData[10]	0	SBCS (SBC output)		0: Indicates that the STO status has been canceled and the energy supply to the electromagnetic brake has not been shut off. 1: Indicates that the STO function is activated and the energy supply to the electromagnetic brake has been shut off.
	1	SLIS (SLI output)		0: Indicates that the SLI function is not activated. 1: Indicates that the SLI function is activated.
	2	SLT1S (SLT1 output)		0: Indicates that the SLT1 function is not activated. 1: Indicates that the SLT1 function is activated.
	3	SLT2S (SLT2 output)		0: Indicates that the SLT2 function is not activated. 1: Indicates that the SLT2 function is activated.
	4	SLT3S (SLT3 output)		0: Indicates that the SLT3 function is not activated. 1: Indicates that the SLT3 function is activated.
	5	SLT4S (SLT4 output)		0: Indicates that the SLT4 function is not activated. 1: Indicates that the SLT4 function is activated.
	6	Not used		—
	7			
SafeData[11]	0	Not used		—
	1			
	2			
	3			
	4			
	5			
	6			
	7			

• Feedback of various function outputs via a network (for the MR-J5D1-_G-N1)

STOS (STO output), SOSS (SOS output), SSMS (SSM output), etc., can be transmitted through the network.

Servo amplifier to controller			
SafeData[n]	**Bit**	**Function output**	**Description**
SafeData[0]	0	STOS (STO output)	0: Indicates that the STO status has been canceled. 1: Indicates that the STO function is activated and the energy supply has been shut off.
	1	SSMS (SSM output)	0: Indicates that the servo motor speed exceeds the set SSM speed. (Off when the SSM function is disabled.) 1: Indicates that the servo motor speed is equal to or less than the set SSM speed.
	2	Not used	—
	3	SOSS (SOS output)	0: Indicates that the SOS function is not activated. 1: Indicates that the SOS function is activated by the SS2 function.
	4	Not used	—
	5		
	6		
	7	Error (Error status)	0: Indicates that no error is occurring. 1: Indicates that an error is occurring.
SafeData[1]	0	SS1S (SS1 output)	0: Indicates that the SS1 function is not activated. 1: Indicates that the SS1 function is activated.
	1	SS2S (SS2 output)	0: Indicates that the SS2 function is not activated. 1: Indicates that the SS2 function is activated.
	2	SDIPS (SDIP output)	0: Indicates that the SDIP function is not activated. 1: Indicates that the SDIP function is activated.
	3	SDINS (SDIN output)	0: Indicates that the SDIN function is not activated. 1: Indicates that the SDIN function is activated.
	4	SLS1S (SLS1 output)	0: Indicates that the SLS1 function is not activated. 1: Indicates that the SLS1 function is activated.
	5	SLS2S (SLS2 output)	0: Indicates that the SLS2 function is not activated. 1: Indicates that the SLS2 function is activated.
	6	SLS3S (SLS3 output)	0: Indicates that the SLS3 function is not activated. 1: Indicates that the SLS3 function is activated.
	7	SLS4S (SLS4 output)	0: Indicates that the SLS4 function is not activated. 1: Indicates that the SLS4 function is activated.
SafeData[2]	0	SBCS (SBC output)	0: Indicates that the STO status has been canceled and the energy supply to the electromagnetic brake has not been shut off. 1: Indicates that the STO function is activated and the energy supply to the electromagnetic brake has been shut off.
	1	SLIS (SLI output)	0: Indicates that the SLI function is not activated. 1: Indicates that the SLI function is activated.
	2	SLT1S (SLT1 output)	0: Indicates that the SLT1 function is not activated. 1: Indicates that the SLT1 function is activated.
	3	SLT2S (SLT2 output)	0: Indicates that the SLT2 function is not activated. 1: Indicates that the SLT2 function is activated.
	4	SLT3S (SLT3 output)	0: Indicates that the SLT3 function is not activated. 1: Indicates that the SLT3 function is activated.
	5	SLT4S (SLT4 output)	0: Indicates that the SLT4 function is not activated. 1: Indicates that the SLT4 function is activated.
	6	Not used	—
	7		
SafeData[3]	0	Not used	—
	1		
	2		
	3		
	4		
	5		
	6		
	7		

• Feedback of various function outputs via a network (for the MR-J5D2-_G-N1)

STOS (STO output), SOSS (SOS output), SSMS (SSM output), etc., can be transmitted through the network.

Servo amplifier to controller				
SafeData[n]	**Bit**	**Function output**	**Axis**	**Description**
SafeData[0]	0	STOS (STO output)	A-axis	0: Indicates that the STO status has been canceled. 1: Indicates that the STO function is activated and the energy supply has been shut off.
	1	SSMS (SSM output)		0: Indicates that the servo motor speed exceeds the set SSM speed. (Off when the SSM function is disabled.) 1: Indicates that the servo motor speed is equal to or less than the set SSM speed.
	2	Not used		—
	3	SOSS (SOS output)		0: Indicates that the SOS function is not activated. 1: Indicates that the SOS function is activated by the SS2 function.
	4	Not used		—
	5			
	6			
	7	Error (Error status)		0: Indicates that no error is occurring. 1: Indicates that an error is occurring.
SafeData[1]	0	SS1S (SS1 output)		0: Indicates that the SS1 function is not activated. 1: Indicates that the SS1 function is activated.
	1	SS2S (SS2 output)		0: Indicates that the SS2 function is not activated. 1: Indicates that the SS2 function is activated.
	2	SDIPS (SDIP output)		0: Indicates that the SDIP function is not activated. 1: Indicates that the SDIP function is activated.
	3	SDINS (SDIN output)		0: Indicates that the SDIN function is not activated. 1: Indicates that the SDIN function is activated.
	4	SLS1S (SLS1 output)		0: Indicates that the SLS1 function is not activated. 1: Indicates that the SLS1 function is activated.
	5	SLS2S (SLS2 output)		0: Indicates that the SLS2 function is not activated. 1: Indicates that the SLS2 function is activated.
	6	SLS3S (SLS3 output)		0: Indicates that the SLS3 function is not activated. 1: Indicates that the SLS3 function is activated.
	7	SLS4S (SLS4 output)		0: Indicates that the SLS4 function is not activated. 1: Indicates that the SLS4 function is activated.
SafeData[2]	0	SBCS (SBC output)		0: Indicates that the STO status has been canceled and the energy supply to the electromagnetic brake has not been shut off. 1: Indicates that the STO function is activated and the energy supply to the electromagnetic brake has been shut off.
	1	SLIS (SLI output)		0: Indicates that the SLI function is not activated. 1: Indicates that the SLI function is activated.
	2	SLT1S (SLT1 output)		0: Indicates that the SLT1 function is not activated. 1: Indicates that the SLT1 function is activated.
	3	SLT2S (SLT2 output)		0: Indicates that the SLT2 function is not activated. 1: Indicates that the SLT2 function is activated.
	4	SLT3S (SLT3 output)		0: Indicates that the SLT3 function is not activated. 1: Indicates that the SLT3 function is activated.
	5	SLT4S (SLT4 output)		0: Indicates that the SLT4 function is not activated. 1: Indicates that the SLT4 function is activated.
	6	Not used		—
	7			
SafeData[3]	0	Not used		—
	1			
	2			
	3			
	4			
	5			
	6			
	7			

Servo amplifier to controller				
SafeData[n]	**Bit**	**Function output**	**Axis**	**Description**
SafeData[4]	0	STOS (STO output)	B-axis	0: Indicates that the STO status has been canceled. 1: Indicates that the STO function is activated and the energy supply has been shut off.
	1	SSMS (SSM output)		0: Indicates that the servo motor speed exceeds the set SSM speed. (Off when the SSM function is disabled.) 1: Indicates that the servo motor speed is equal to or less than the set SSM speed.
	2	Not used		—
	3	SOSS (SOS output)		0: Indicates that the SOS function is not activated. 1: Indicates that the SOS function is activated by the SS2 function.
	4	Not used		—
	5			
	6			
	7	Error (Error status)		0: Indicates that no error is occurring. 1: Indicates that an error is occurring.
SafeData[5]	0	SS1S (SS1 output)		0: Indicates that the SS1 function is not activated. 1: Indicates that the SS1 function is activated.
	1	SS2S (SS2 output)		0: Indicates that the SS2 function is not activated. 1: Indicates that the SS2 function is activated.
	2	SDIPS (SDIP output)		0: Indicates that the SDIP function is not activated. 1: Indicates that the SDIP function is activated.
	3	SDINS (SDIN output)		0: Indicates that the SDIN function is not activated. 1: Indicates that the SDIN function is activated.
	4	SLS1S (SLS1 output)		0: Indicates that the SLS1 function is not activated. 1: Indicates that the SLS1 function is activated.
	5	SLS2S (SLS2 output)		0: Indicates that the SLS2 function is not activated. 1: Indicates that the SLS2 function is activated.
	6	SLS3S (SLS3 output)		0: Indicates that the SLS3 function is not activated. 1: Indicates that the SLS3 function is activated.
	7	SLS4S (SLS4 output)		0: Indicates that the SLS4 function is not activated. 1: Indicates that the SLS4 function is activated.
SafeData[6]	0	SBCS (SBC output)		0: Indicates that the STO status has been canceled and the energy supply to the electromagnetic brake has not been shut off. 1: Indicates that the STO function is activated and the energy supply to the electromagnetic brake has been shut off.
	1	SLIS (SLI output)		0: Indicates that the SLI function is not activated. 1: Indicates that the SLI function is activated.
	2	SLT1S (SLT1 output)		0: Indicates that the SLT1 function is not activated. 1: Indicates that the SLT1 function is activated.
	3	SLT2S (SLT2 output)		0: Indicates that the SLT2 function is not activated. 1: Indicates that the SLT2 function is activated.
	4	SLT3S (SLT3 output)		0: Indicates that the SLT3 function is not activated. 1: Indicates that the SLT3 function is activated.
	5	SLT4S (SLT4 output)		0: Indicates that the SLT4 function is not activated. 1: Indicates that the SLT4 function is activated.
	6	Not used		—
	7			
SafeData[7]	0	Not used		—
	1			
	2			
	3			
	4			
	5			
	6			
	7			

• Feedback of various function outputs via a network (for the MR-J5D3-_G-N1)

STOS (STO output), SOSS (SOS output), SSMS (SSM output), etc., can be transmitted through the network.

Servo amplifier to controller				
SafeData[n]	**Bit**	**Function output**	**Axis**	**Description**
SafeData[0]	0	STOS (STO output)	A-axis	0: Indicates that the STO status has been canceled. 1: Indicates that the STO function is activated and the energy supply has been shut off.
	1	SSMS (SSM output)		0: Indicates that the servo motor speed exceeds the set SSM speed. (Off when the SSM function is disabled.) 1: Indicates that the servo motor speed is equal to or less than the set SSM speed.
	2	Not used		—
	3	SOSS (SOS output)		0: Indicates that the SOS function is not activated. 1: Indicates that the SOS function is activated by the SS2 function.
	4	Not used		—
	5			
	6			
	7	Error (Error status)		0: Indicates that no error is occurring. 1: Indicates that an error is occurring.
SafeData[1]	0	SS1S (SS1 output)		0: Indicates that the SS1 function is not activated. 1: Indicates that the SS1 function is activated.
	1	SS2S (SS2 output)		0: Indicates that the SS2 function is not activated. 1: Indicates that the SS2 function is activated.
	2	SDIPS (SDIP output)		0: Indicates that the SDIP function is not activated. 1: Indicates that the SDIP function is activated.
	3	SDINS (SDIN output)		0: Indicates that the SDIN function is not activated. 1: Indicates that the SDIN function is activated.
	4	SLS1S (SLS1 output)		0: Indicates that the SLS1 function is not activated. 1: Indicates that the SLS1 function is activated.
	5	SLS2S (SLS2 output)		0: Indicates that the SLS2 function is not activated. 1: Indicates that the SLS2 function is activated.
	6	SLS3S (SLS3 output)		0: Indicates that the SLS3 function is not activated. 1: Indicates that the SLS3 function is activated.
	7	SLS4S (SLS4 output)		0: Indicates that the SLS4 function is not activated. 1: Indicates that the SLS4 function is activated.
SafeData[2]	0	SBCS (SBC output)		0: Indicates that the STO status has been canceled and the energy supply to the electromagnetic brake has not been shut off. 1: Indicates that the STO function is activated and the energy supply to the electromagnetic brake has been shut off.
	1	SLIS (SLI output)		0: Indicates that the SLI function is not activated. 1: Indicates that the SLI function is activated.
	2	SLT1S (SLT1 output)		0: Indicates that the SLT1 function is not activated. 1: Indicates that the SLT1 function is activated.
	3	SLT2S (SLT2 output)		0: Indicates that the SLT2 function is not activated. 1: Indicates that the SLT2 function is activated.
	4	SLT3S (SLT3 output)		0: Indicates that the SLT3 function is not activated. 1: Indicates that the SLT3 function is activated.
	5	SLT4S (SLT4 output)		0: Indicates that the SLT4 function is not activated. 1: Indicates that the SLT4 function is activated.
	6	Not used		—
	7			
SafeData[3]	0	Not used		—
	1			
	2			
	3			
	4			
	5			
	6			
	7			

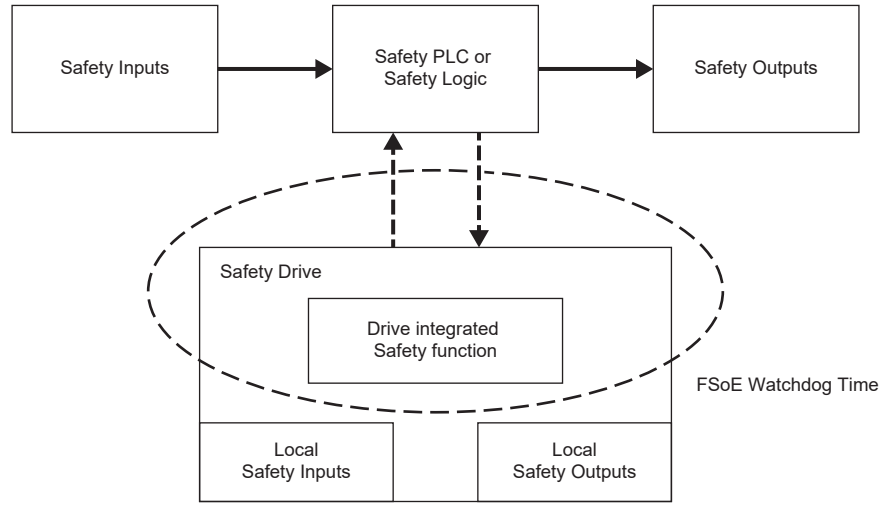
Servo amplifier to controller				
SafeData[n]	**Bit**	**Function output**	**Axis**	**Description**
SafeData[4]	0	STOS (STO output)	B-axis	0: Indicates that the STO status has been canceled. 1: Indicates that the STO function is activated and the energy supply has been shut off.
	1	SSMS (SSM output)		0: Indicates that the servo motor speed exceeds the set SSM speed. (Off when the SSM function is disabled.) 1: Indicates that the servo motor speed is equal to or less than the set SSM speed.
	2	Not used		—
	3	SOSS (SOS output)		0: Indicates that the SOS function is not activated. 1: Indicates that the SOS function is activated by the SS2 function.
	4	Not used		—
	5			
	6			
	7	Error (Error status)		0: Indicates that no error is occurring. 1: Indicates that an error is occurring.
SafeData[5]	0	SS1S (SS1 output)		0: Indicates that the SS1 function is not activated. 1: Indicates that the SS1 function is activated.
	1	SS2S (SS2 output)		0: Indicates that the SS2 function is not activated. 1: Indicates that the SS2 function is activated.
	2	SDIPS (SDIP output)		0: Indicates that the SDIP function is not activated. 1: Indicates that the SDIP function is activated.
	3	SDINS (SDIN output)		0: Indicates that the SDIN function is not activated. 1: Indicates that the SDIN function is activated.
	4	SLS1S (SLS1 output)		0: Indicates that the SLS1 function is not activated. 1: Indicates that the SLS1 function is activated.
	5	SLS2S (SLS2 output)		0: Indicates that the SLS2 function is not activated. 1: Indicates that the SLS2 function is activated.
	6	SLS3S (SLS3 output)		0: Indicates that the SLS3 function is not activated. 1: Indicates that the SLS3 function is activated.
	7	SLS4S (SLS4 output)		0: Indicates that the SLS4 function is not activated. 1: Indicates that the SLS4 function is activated.
SafeData[6]	0	SBCS (SBC output)		0: Indicates that the STO status has been canceled and the energy supply to the electromagnetic brake has not been shut off. 1: Indicates that the STO function is activated and the energy supply to the electromagnetic brake has been shut off.
	1	SLIS (SLI output)		0: Indicates that the SLI function is not activated. 1: Indicates that the SLI function is activated.
	2	SLT1S (SLT1 output)		0: Indicates that the SLT1 function is not activated. 1: Indicates that the SLT1 function is activated.
	3	SLT2S (SLT2 output)		0: Indicates that the SLT2 function is not activated. 1: Indicates that the SLT2 function is activated.
	4	SLT3S (SLT3 output)		0: Indicates that the SLT3 function is not activated. 1: Indicates that the SLT3 function is activated.
	5	SLT4S (SLT4 output)		0: Indicates that the SLT4 function is not activated. 1: Indicates that the SLT4 function is activated.
	6	Not used		—
	7			
SafeData[7]	0	Not used		—
	1			
	2			
	3			
	4			
	5			
	6			
	7			

Servo amplifier to controller				
SafeData[n]	**Bit**	**Function output**	**Axis**	**Description**
SafeData[8]	0	STOS (STO output)	C-axis	0: Indicates that the STO status has been canceled. 1: Indicates that the STO function is activated and the energy supply has been shut off.
	1	SSMS (SSM output)		0: Indicates that the servo motor speed exceeds the set SSM speed. (Off when the SSM function is disabled.) 1: Indicates that the servo motor speed is equal to or less than the set SSM speed.
	2	Not used		—
	3	SOSS (SOS output)		0: Indicates that the SOS function is not activated. 1: Indicates that the SOS function is activated by the SS2 function.
	4	Not used		—
	5			
	6			
	7	Error (Error status)		0: Indicates that no error is occurring. 1: Indicates that an error is occurring.
SafeData[9]	0	SS1S (SS1 output)		0: Indicates that the SS1 function is not activated. 1: Indicates that the SS1 function is activated.
	1	SS2S (SS2 output)		0: Indicates that the SS2 function is not activated. 1: Indicates that the SS2 function is activated.
	2	SDIPS (SDIP output)		0: Indicates that the SDIP function is not activated. 1: Indicates that the SDIP function is activated.
	3	SDINS (SDIN output)		0: Indicates that the SDIN function is not activated. 1: Indicates that the SDIN function is activated.
	4	SLS1S (SLS1 output)		0: Indicates that the SLS1 function is not activated. 1: Indicates that the SLS1 function is activated.
	5	SLS2S (SLS2 output)		0: Indicates that the SLS2 function is not activated. 1: Indicates that the SLS2 function is activated.
	6	SLS3S (SLS3 output)		0: Indicates that the SLS3 function is not activated. 1: Indicates that the SLS3 function is activated.
	7	SLS4S (SLS4 output)		0: Indicates that the SLS4 function is not activated. 1: Indicates that the SLS4 function is activated.
SafeData[10]	0	SBCS (SBC output)		0: Indicates that the STO status has been canceled and the energy supply to the electromagnetic brake has not been shut off. 1: Indicates that the STO function is activated and the energy supply to the electromagnetic brake has been shut off.
	1	SLIS (SLI output)		0: Indicates that the SLI function is not activated. 1: Indicates that the SLI function is activated.
	2	SLT1S (SLT1 output)		0: Indicates that the SLT1 function is not activated. 1: Indicates that the SLT1 function is activated.
	3	SLT2S (SLT2 output)		0: Indicates that the SLT2 function is not activated. 1: Indicates that the SLT2 function is activated.
	4	SLT3S (SLT3 output)		0: Indicates that the SLT3 function is not activated. 1: Indicates that the SLT3 function is activated.
	5	SLT4S (SLT4 output)		0: Indicates that the SLT4 function is not activated. 1: Indicates that the SLT4 function is activated.
	6	Not used		—
	7			
SafeData[11]	0	Not used		—
	1			
	2			
	3			
	4			
	5			
	6			
	7			

■FSoE Watchdog Time

For safety sub-function control by network, set FSoE Watchdog Time.

FSoE Watchdog Time is a time-out value for safety process data and it affects the determination of the safety reaction time. By increasing the value, communication timeouts are less likely to occur.



TRef + TCom × 4 = 16 (Unit: ms) is the minimum configurable value for FSoE Watchdog Time.

Set the FSoE Watchdog Time on the controller, taking into account the response time of the controller used.

Element	Explanation
TRef	Safety refresh response processing time 15.0 ms
TCom	Network response time Communication cycle (1-axis servo amplifier): 250 μs or longer. Communication cycle (2-axis servo amplifier, 3-axis servo amplifier): 500 μs or longer.

FSoE Watchdog Time set in [Watchdog Time (Obj. E901h: 04h)] can be checked on the servo amplifier.

■Functional safety parameter setting

To perform safety monitoring using safety communications, set the following functional safety parameter.

Functional safety parameter	Name
PSC07	FSoE Address setting

- FSoE Address setting

Set the value used to identify FSoE Slave. Ensure that FSoE Slave has a unique value.

Match the value of FSoE Master with this functional safety parameter. If it is set to a non-matching value, [AL. 584.1 FSoE Address mismatch error (safety sub-function)] occurs.

MEMO

PART 2 EtherNet/IP

11 FUNCTIONS AND CONFIGURATION

12 OVERVIEW OF OBJECT LIBRARY

13 I/O COMMUNICATION

14 Explicit Message COMMUNICATION

15 DRIVE PROFILE

16 MANUFACTURER-SPECIFIC FUNCTION

17 CIP Safety

18 OBJECT LIBRARY

11 FUNCTIONS AND CONFIGURATION

11.1 Outline

Point

• When using EtherNet/IP, set [Pr. PN13.0-3 Network protocol setting] to "0800h".

EtherNet/IP is an abbreviation of Ethernet Industrial Protocol. It is an open industrial network that uses the TCP/IP protocol and implements CIP (Common Industrial Protocol) as the control protocol in the application layer, and is controlled by ODVA (Open DeviceNet Vendor Association, Inc.).

Control mode

The servo amplifier supports the following control modes.

Control mode	Symbol	Remarks
Profile position mode	pp	This is a positioning mode to drive servo motors by receiving an end position command in the communication with a controller. Use an absolute position address or a relative position address for the command.
Profile velocity mode	pv	This is a control mode to drive servo motors by receiving a target speed command in the communication with a controller.
Profile torque mode	tq	This is a control mode to drive servo motors by receiving a target torque command in the communication with a controller.
Homing mode	hm	This is a control mode to perform homing with the method specified by the controller.

Applicable standards

The servo amplifiers comply with the standards shown below. For the descriptions which are not in this manual, refer to the following standards.

Standards	Version
THE CIP NETWORKS LIBRARY Volume 1 Common Industrial Protocol (CIPTM)	Edition 3.34
THE CIP NETWORKS LIBRARY Volume 2 EtherNet/IP Adaptation of CIP	Edition 1.32
CANopen Device Profile Drives and Motion Control	Version 3.0

11.2 Function list

This list explains the EtherNet/IP communication related functions for devices and the whole system.

Category	Subcategory	Function	Description	Detailed explanation
Network	Open network	EtherNet/IP protocol	This protocol supports EtherNet/IP.	☞ Page 104 Communication specifications
		EtherNet/IP communication setting	This setting specifies the control mode and network communication.	☞ Page 106 Startup
	Remote maintenance	Firmware update	This function allows devices to update their firmware via a network. For details, contact your local sales office.	—
	Profile	EDS	This is a setting file on which the information specific to each server (vendor information, product information, objects, and other information) is written. Store the EDS file on the controller to use it.	☞ Page 106 Controller setting
Application function	Functional safety	Safety communication function (CIPSafety)	Connecting the servo amplifier to a controller compliant with functional safety enables the use of safety sub-functions.	☞ Page 157 CIP Safety
	File transfer	FTP server function	This function can read/write/delete data on a per-file basis using the FTP commands.	—

11.3 Communication specifications

The communication specifications are shown in the following table.

Item	Description	Remarks
EtherNet/IP communication specifications	THE CIP NETWORKS LIBRARY Volume 1 Common Industrial Protocol (CIP™) THE CIP NETWORKS LIBRARY Volume 2 EtherNet/IP Adaptation of CIP	—
Physical layer	10BASE-T, 100BASE-TX	—
Communication connector	Two RJ45 ports (port 1, port 2)	—
Communication cable	CAT5e shielded twisted pair (4 pairs) straight cable	The double shielded type is recommended.
Network topology	Line, star, ring, or hybrid of these three topology types	For the ring topology, use in the system configuration with less than 50 ring nodes is recommended.
Communication speed	10 Mbps/100 Mbps (Full duplex/half duplex)	—
Port No.	44818 (TCP, UDP) 2222 (UDP) 5010 (For manufacturer setting) 45237 (For manufacturer setting) 45239 (For manufacturer setting) 61451 (For manufacturer setting)	—
Transmission distance between stations	Max. 100 m	—
Number of nodes	Compliance with the standard Ethernet specifications	—
Explicit message	Class 3 communication/Unconnected Message Manager Number of simultaneous connections: 20	10 connections can be established for each T → O and O → T connection.
I/O message	Class 1 communication Cycle time: Select from 1 ms to 100 ms. Number of simultaneous connections: 4	Exclusive Owner, Input Only, Listen Only Up to four connections can be established.
LED display	Network Status, Module Status, LINK/Activity (port1, port2)	—

11.4 Establishment and disconnection of the communication

Communication state

Communication states are classified as shown in the table below. There are two types of communications: I/O communication in which command data and feedback data are transmitted and received cyclically, and Explicit Message communication in which object data is transmitted and received asynchronously.

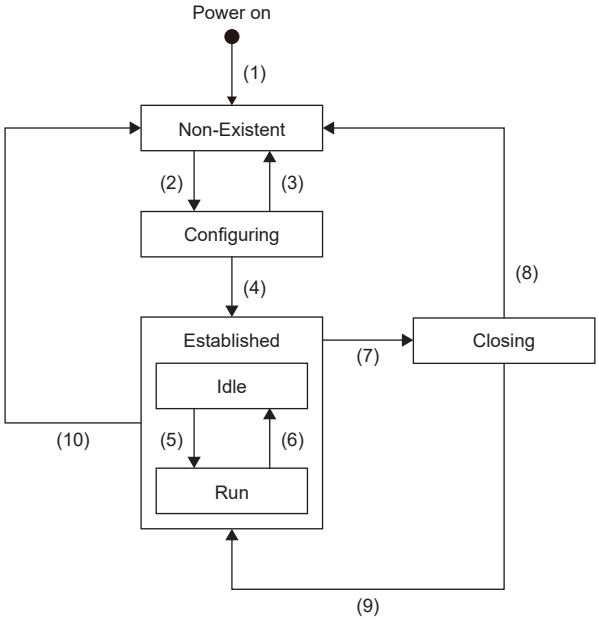
☞ Page 113 I/O COMMUNICATION

☞ Page 130 Explicit Message COMMUNICATION

When the I/O connection is established and the Run mode is set, the servo amplifier allows the servo motor to drive.

The communication state can be checked with Class 01h, Instance 1h, and Attribute 5 Status. Refer to the following for details.

☞ Page 178 Class 01h Instance 1h Attribute5 (Status)



Transition No.	Description
(1)	Power-on
(2)	Transitions when Connection Manager Object receives a Forward_Open or Large_Forward_Open request.
(3)	Transitions when Connection Manager Object fails to establish the connection by the Forward_Open or Large_Forward_Open request.
(4)	Transitions when a connection is successfully established by the Forward_Open or Large_Forward_Open request. Immediately after the connection is established, it enters the Idle state. In this state, the servo motor cannot be driven by communication.
(5)	When the Run notification is received from the client, the server transitions from the Idle state to the Run state. The servo motor can be driven by communication.
(6)	When the Idle notification is received from the client, the server transitions from the Run state to the Idle state. It enters the Quick Stop state and the servo motor stops.
(7)	Transitions when the Forward_Close request is received from the master.
(8)	Transitions when the connection is successfully disconnected by the Forward_Close request. When the connection is disconnected, the servo amplifier performs the initialization process.
(9)	If connection disconnection by the Forward_Close request fails, it transitions from the Closing state to the Establish state.
(10)	Transitions when a connection time-out occurs. When a connection time-out occurs, the servo amplifier performs the initialization process. When a connection time-out occurs, [AL. 086.1] is detected.

Startup

For the startup procedures other than the network settings, refer to the following manuals.
MR-J5-G-N1/MR-J5W-G-N1 User's Manual (Introduction)
MR-J5D-G-N1 User's Manual (Introduction)

Point

[Pr. PN13.0-3 Network protocol setting] is set to "0100h" (EtherCAT) by default. When using Ethernet/IP, change [Pr. PN13.0-3] to "0800h" (EtherNet/IP).
The setting value of [Pr.PN13.0-3] can be automatically changed by setting the servo amplifier to the network switching mode to detect EtherNet/IP communication automatically. For details, refer to "Network protocol switching methods" in the following manuals.
MR-J5-G-N1/MR-J5W-G-N1 User's Manual (Introduction)
MR-J5D-G-N1 User's Manual (Introduction)

Controller setting

Point

When using the MR-J5-_G_-HSN1, use the "EDS file for MR-J5-G-RJN1".

Set up the controller by following its manual. At this time, the Electronic Data Sheets (EDS) file, which lists information about the communication settings of devices is written, is available. Install the EDS file in the configuration tool to be used.
The EDS file uses the following module definitions.

Item	Setting					
	MR-J5-G-RJN1	MR-J5W2-G-N1	MR-J5W3-G-N1	MR-J5D1-G-N1	MR-J5D2-G-N1	MR-J5D3-G-N1
Vendor ID	161					
Vendor Name	Mitsubishi Electric Corporation					
Product Type	150					
Product Code	20	21	22	23	24	25
Product Name	MR-J5-G-RJN1	MR-J5W2-G-N1	MR-J5W3-G-N1	MR-J5D1-G-N1	MR-J5D2-G-N1	MR-J5D3-G-N1
Major Revision/ Minor Revision	Major Revision and Minor Revision may be updated through software updates. Therefore, if the Major and Minor Revision identity check for the controller to be used is enabled, connection to servo amplifiers with a newer firmware version may not be established. If the identity check is not required, it is recommended that you do not enable the Major and Minor Revision identity check for the controller to be used. ☞ Page 106 Major Revision/Minor Revision					

For how to use the EDS file, refer to the manual of each configuration tool.
When not using the EDS file, set the request data of the Forward_Open service by referring to the following.
☞ Page 113 Communication cycle setting-related objects

■Major Revision/Minor Revision

Major Revision	Minor Revision	Firmware version of the servo amplifier	Remarks
1	1	E8 or later	—
2	1	F4 or later *1	For CIP Safety

*1 For the MR-J5W_-_G_, MR-J5D2-_G_, and MR-J5D3-_G_, servo amplifiers with firmware version F5 or later support Major Revision: 2.

IP address setting

Point

- [Pr. NPC01 Configuration Control] supports [Configuration Control (Class ID: F5h, Ins ID: 01h, Attr ID: 03h)] of "TCP/IP Interface Object".
- [Pr. NPC02 IP Address] supports [Interface Configuration (Class ID: F5h, Ins ID: 01h, Attr ID: 05h)] of "TCP/IP Interface Object".

The DHCP function can be used as the IP address setting method. When not using the DHCP function, set the IP address of the device with MR Configurator2 or the rotary switches on the servo amplifier display area. The IP address range is between 0.0.0.1 and 223.255.255.254.

The IP address is changed with the rotary switches only at the startup of the servo amplifier.

The set IP address can be checked on "System Configuration" of MR Configurator2.

Regardless of the rotary switch setting, the IP address can be set in the "Change IP Address of Servo Amplifiers" window of MR Configurator2, however, cycling the power enables the following settings with the rotary switch settings after the startup.

Rotary switch	IP address setting value
00h	The DHCP function is enabled and the IP address set from the DHCP server is used.
01h	At the factory setting, the DHCP function is enabled and the IP address set from the DHCP server is used. To specify and use the IP address, it can be set with MR Configurator2. When the IP address is changed in the "Change IP Address of Servo Amplifiers" window of MR Configurator2, the setting value of [Pr. NPC01 Configuration Control] changes to "0" (The parameter is used), which disables the DHCP function. To use the DHCP function again, change [Pr. NPC01] to "2" (DHCP is used).
02H to FEh	The fourth octet of the IP address set in [Pr. NPC02 IP Address] changes to the rotary switch setting value. In addition, the DHCP function is disabled. When setting the IP address with rotary switches, set it in hexadecimal. The hexadecimal setting value is converted to decimal and set in the fourth octet.
FFh	For manufacturer setting

Parameter setting

Setting [Pr. PN13.0-3 Network protocol setting] to "0800h" (EtherNet/IP) switches the network protocol to EtherNet/IP.

If necessary, set the following parameters in accordance with the controller settings.

Servo parameter	Name
PN13	Network protocol setting

Network parameter	Name
NPC01	Configuration Control
NPC02	IP Address
NPC03	Network Mask

Connecting the controller

Set up the controller by following its manual.

Provision of AOI (Add-On Instruction)

AOI can shorten the start-up period for users.

AOI is developed and provided by MITSUBISHI ELECTRIC AUTOMATION, INC. For details of AOI, refer to the website of MITSUBISHI ELECTRIC AUTOMATION, INC.

Network disconnection procedure

To disconnect the network when stopping the operation of equipment, follow the procedure shown below.

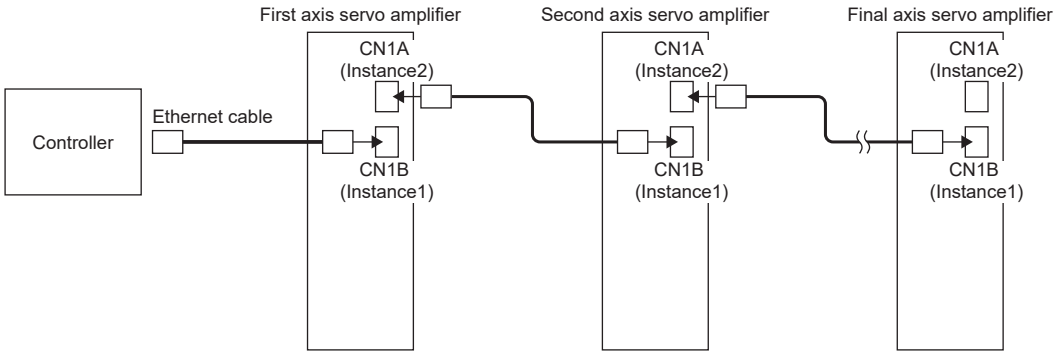
1. Stop the servo motor.
2. Set the shutdown command for [Controlword (Class 64h, Instance 6040h, Attribute 0)] to establish the servo-off state.
3. Issue the Forward_Close service from the controller to disconnect the I/O communication.
4. Shut off the power of the servo amplifier and the controller.

11.5 Connecting Ethernet cables

Point

- Use a twisted pair cable (double shielded) compliant with Ethernet Category 5e (100BASE-TX) or higher as an Ethernet cable. The maximum cable length between nodes is 100 m.
- CN1B indicates port 1 (Instance1). CN1A indicates port 2 (Instance2).

It is recommended to connect an Ethernet cable leading to the controller or servo amplifier of the front axis to CN1B and an Ethernet cable leading to the servo amplifier of the rear axis to CN1A, respectively. When not using CN1A, do not connect anything.



11.6 Engineering software

The following explains the main purposes of the engineering software used in communication. For specific usages, refer to the manuals of the engineering software and controller.

Engineering software list

This list shows engineering software to be used.

Engineering software	Description
MR Configurator2	This software has the following functions: servo amplifier adjustment, monitor display, diagnosis, reading/writing of servo parameters, and test operation. These functions are performed using a personal computer. Parameter settings and test operation can also be performed via a controller. Settings, such as an IP address, stroke limit, absolute position detection system, and communication error detection time, are configured with this software.

12 OVERVIEW OF OBJECT LIBRARY

Point

For details of the object library, refer to the following.

☞ Page 175 OBJECT LIBRARY

Each data such as control parameters, command values, and feedback values which is held by EtherNet/IP devices is handled as an object composed of a Class ID, object name, data type, access rule, and other elements. The object data can be exchanged between the client and the server device. The collection of these objects is called an object library.

The MR-J5_-_G-_N1 servo amplifier supports the following objects. For details of each object, refer to the reference column.

Class ID	Object name	Reference
01h	Identity Object	☞ Page 176 Identity Object (Class ID: 01h)
02h	Message Router Object	☞ Page 179 Message Router object (Class ID: 02h)
04h	Assembly Object	☞ Page 180 Assembly Object (Class ID: 04h)
06h	Connection Manager Object	☞ Page 181 Connection Manager Object (Class ID: 06h)
47h	Device Level Ring (DLR) Object	☞ Page 182 Device Level Ring (DLR) Object (Class ID: 47h)
48h	QoS Object	☞ Page 183 QoS Object (Class ID: 48h)
F5h	TCP/IP Interface Object	☞ Page 184 TCP/IP Interface Object (Class ID: F5h)
F6h	Ethernet Link Object	☞ Page 187 Ethernet Link Object (Class ID: F6h)
64h	Drive Configuration Object	MR-J5-G-N1/MR-J5W-G-N1 User's Manual (Object Dictionary)
109h	LLDP Management	☞ Page 190 LLDP Management Object (Class ID: 109h)
10Ah	LLDP Data Table	☞ Page 191 LLDP Data Table Object (Class ID: 10Ah)

12.1 Section definition of Drive Configuration Object (64h)

Clients can control the server by sending or receiving commands/feedbacks via Drive Configuration Object. Each Instance of Drive Configuration Object is classified in accordance with the CiA 402 standard as shown in the following table. Instance IDs 1000h to 1FFFh support objects for all axes, and Instance ID 2000h and later support objects for each axis. Each axis can be specified by giving an offset to the address (Instance ID) of the object.

For objects not described in this manual, refer to the following manual.

MR-J5-G-N1/MR-J5W-G-N1 User's Manual (Object Dictionary)

- 1-axis servo amplifier

Class ID	Instance ID	Description	Reference
64h	1000h to 1FFFh	Communication profile	MR-J5-G-N1/MR-J5W-G-N1 User's Manual (Object Dictionary)
	2000h to 27FFh	Parameter area (Vendor-Specific)	
	2A00h to 2FFFh	Servo control command/monitor area (Vendor-specific)	
	6000h to 77FFh	CiA 402 drive profile area	

- Multi-axis servo amplifier

Class ID	Instance ID	Description	Reference
64h	1000h to 1FFFh	Communication profile	MR-J5-G-N1/MR-J5W-G-N1 User's Manual (Object Dictionary)
	2000h to 27FFh	Servo parameter area (Vendor-Specific) (A-axis)	
	2A00h to 2FFFh	Servo control command/monitor area (Vendor-specific) (A-axis)	
	3000h to 37FFh	Servo parameter area (Vendor-Specific) (B-axis)	
	3A00h to 3FFFh	Servo control command/monitor area (Vendor-specific) (B-axis)	
	4000h to 47FFh	Servo parameter area (Vendor-Specific) (C-axis)	
	4A00h to 4FFFh	Servo control command/monitor area (Vendor-specific) (C-axis)	
	6000h to 67FFh	CiA 402 drive profile area (A-axis)	
	6800h to 6FFFh	CiA 402 drive profile area (B-axis)	
	7000h to 77FFh	CiA 402 drive profile area (C-axis)	

12.2 Alternative reading of user's manual

Use the alternative reading for the contents of the user's manual as follows.

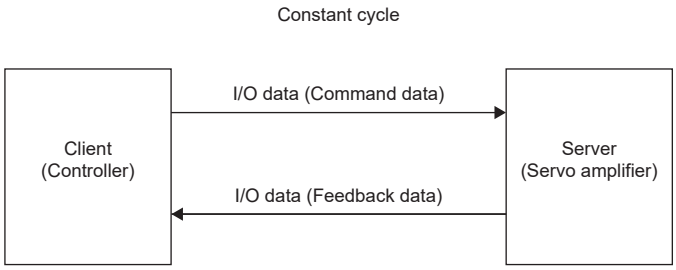
For details of alternative reading, refer to "Notation related to objects for each communication type" in the following manual.

MR-J5-G-N1/MR-J5W-G-N1 User's Manual (Object Dictionary)

Command interface	Instance ID	Attribute ID	Access	Data Type
EtherNet/IP	Ins ID	Attr ID	Set/Get	SINT
Other than EtherNet/IP	Index	Sub	R/W	I8

13 I/O COMMUNICATION

In the I/O communication, command data and feedback data can be transmitted and received cyclically between a client (controller) and a server (servo amplifier).



13.1 I/O communication cycle

To specify the I/O communication cycle, use the Forward_Open or Large_Forward_Open service of "Class 06h Connection Manager Object" via the Explicit message communication. Refer to the following for details.

☞ Page 113 Communication cycle setting-related objects

Communication cycle setting-related objects

Point

- At the time of connection establishment, set the communication time-out time to an appropriate value according to the equipment configuration. If the communication time-out time is set to a value longer than necessary, it takes longer for the servo motor to stop at occurrence of a communication error.

For "Class 06h Connection Manager Object", establish the Explicit Messaging connection and I/O Message connection using Forward_Open or Large_Forward_Open.

For the I/O Message connection, use "Transport Class 1". For the Explicit Message connection, use "Transport Class 3". For the description of "Transport Class", refer to "THE CIP NETWORKS LIBRARY Volume 1 Common Industrial Protocol (CIP^{TM})".

To set the EtherNet/IP client, set the following parameters using Forward_Open or Large_Forward_Open.

When data is frequently exchanged by Explicit Messaging, establish the Explicit Message connection using Forward_Open or Large_Forward_Open. If data is rarely exchanged by Explicit Message, the connection establishment is optional.

No	Parameter	Data type	Description	I/O connection	Explicit Message connection
1	Priority/Time_tick	BYTE	Used to calculate the time-out information of the request.	Refer to the following.	Refer to the following.
	Setting value breakdown				
	Tick Time	BIT0 to BIT3	Unit of the time specified by the "Time-out_ticks" parameter.	0 to 15	0 to 15
	Priority	BIT4	Priority of non-connection type message	0: Normal	0: Normal
	Reserved	BIT5 to BIT7	Reserved	0	0
2	Time-out_ticks	USINT	Used to calculate the time-out information of the request.	0 to 255	0 to 255
3	O->T Network Connection ID	UDINT	Network connection ID to be used for the local link from the originator to the target. This is the CIP transmission connection ID on the originator side.	00000000h to FFFFFFFFh	00000000h to FFFFFFFFh
4	T->O Network Connection ID	UDINT	Network connection ID to be used for the local link from the target to the originator. This is the CIP receiving connection ID on the originator side.	00000000h to FFFFFFFFh	00000000h to FFFFFFFFh

No	Parameter	Data type	Description	I/O connection	Explicit Message connection
5	Connection Serial Number	UINT	The connection serial number is a unique 16-bit value which is selected by the Connection Manager object in the originator of the connection.	0000h to FFFFh	0000h to FFFFh
6	Originator Vendor ID	UINT	Vender ID of the originator node	Value of Identity object instance attribute 1	Value of Identity object instance attribute 1
7	Originator Serial Number	UDINT	Serial number of the originator node	Value of Identity object instance attribute 6	Value of Identity object instance attribute 6
8	Connection Timeout Multiplier	USINT	The connection time-out multiplier is a value to be multiplied by RPI to acquire the connection time-out value.	0 to 7	0 to 7
9	Reserved	Octet	Reserved	0	0
		Octet		0	0
		Octet		0	0
10	O->T RPI	UDINT	Transmission speed of the request packet from the originator to the target [µs]	1000 to 100000	100000 to 10000000
11	O->T Network Connection Parameters	WORD/DWORD *1	Size of the connection Set whether the size is fixed or variable.	☞ Page 115 Network Connection Parameters format	☞ Page 115 Network Connection Parameters format
12	T->O RPI	UDINT	Transmission speed of the request packet from the target to the originator [µs]	1000 to 100000	100000 to 10000000
13	T->O Network Connection Parameters	WORD/DWORD *1	Size of the connection Set whether the size is fixed or variable.	☞ Page 115 Network Connection Parameters format	☞ Page 115 Network Connection Parameters format
14	Transport Type/Trigger	BYTE	—	Refer to the following.	Refer to the following.
	Setting value breakdown				
	Transport Class	BIT0 to BIT3	Set Transport Class to be used for sending and receiving.	1	3
	Production Trigger	BIT4 to BIT6	Set the condition that triggers data transmission.	0: Cyclic 1: Change of state	2: Trigger by the Application object
	Direction	BIT7	Indicates whether the end-point acts as a client or server on this connection.	0: Client	0: Client
15	Connection_Path_Size	USINT	Number of 16-bit words in the Connection_Path field	0 to 255	0 to 255
16	Connection_Path	Padded EPATH	Indicates the path to the remote target device.	Set the IP address and host name of the connection destination.	Set the IP address and host name of the connection destination.

*1 The data type is WORD for Foward_Open and DWORD for LArge_Foward_Open.

*2 Muticast is not supported.

Network Connection Parameters format

Forward_Open service

■O->T Network Connection Parameters

Setting value breakdown	BIT	Description	I/O connection	Explicit Message connection
Connection Size	BIT0 to BIT8	Set the connection size.	Set a value according to the I/O connection size.	0000h to 01FFh
Fixed/Variable	BIT9	Set the transmission data size. When "Fix" is selected, the size of the transmission data is the one specified in Connection Size.	0: Fix	0: Fix 1: Variable
Priority	BIT10 to BIT11	Set the priority of the connection.	2: Scheduled	
Reserved	BIT12	Reserved	00h	
Connection Type	BIT13 to BIT14	Set the connection type.	1: Point to Point	
Redundant owner	BIT15	Enable or disable the redundant owner connection.	0: Non Redundant	

■T->O Network Connection Parameters

Setting value breakdown	BIT	Description	I/O connection	Explicit Message connection
Connection Size	BIT0 to BIT8	Set the connection size.	Set a value according to the I/O connection size.	0000h to 01FFh
Fixed/Variable	BIT9	Set the transmission data size. When "Fix" is selected, the size of the transmission data is the one specified in Connection Size.	0: Fix	0: Fix 1: Variable
Priority	BIT10 to BIT11	Set the priority of the connection.	2: Scheduled	
Reserved	BIT12	Reserved	00h	
Connection Type	BIT13 to BIT14	Set the connection type.	1: Point to Point 2: Multicast	
Redundant owner	BIT15	Enable or disable the redundant owner connection.	0: Non Redundant	

Large_Forward_Open service

■O->T Network Connection Parameters

Setting value breakdown	BIT	Description	I/O connection	Explicit Message connection
Connection Size	BIT0 to BIT15	Set the connection size.	Set a value according to the I/O connection size.	0000h to 05DCh
Reserved	BIT16 to BIT24	Reserved	00h	
Fixed/Variable	BIT25	Set the transmission data size. When "Fix" is selected, the size of the transmission data is the one specified in Connection Size.	0: Fix	0: Fix 1: Variable
Priority	BIT26 to BIT27	Set the priority of the connection.	2: Scheduled	
Reserved	BIT28	Reserved	00h	
Connection Type	BIT29 to BIT30	Set the connection type.	1: Point to Point	
Redundant owner	BIT31	Enable or disable the redundant owner connection.	0: Non Redundant	

■T->O Network Connection Parameters

Setting value breakdown	BIT	Description	I/O connection	Explicit Message connection
Connection Size	BIT0 to BIT15	Set the connection size.	Set a value according to the I/O connection size.	0000h to 05DCh
Reserved	BIT16 to BIT24	Reserved	00h	
Fixed/Variable	BIT25	Set the transmission data size. When "Fix" is selected, the size of the transmission data is the one specified in Connection Size.	0: Fix	0: Fix 1: Variable
Priority	BIT26 to BIT27	Set the priority of the connection.	2: Scheduled	
Reserved	BIT28	Reserved	00h	
Connection Type	BIT29 to BIT30	Set the connection type.	1: Point to Point 2: Multicast	
Redundant owner	BIT31	Enable or disable the redundant owner connection.	0: Non Redundant	

13.2 I/O communication mapping

I/O communication format (Input)

This section shows the format of the communication data from the client (controller) to the server (servo amplifier).
The Instance No. column in the list indicates the Instance No. of "Assembly object".
The Instance Nos. to be specified differ between 1-axis, 2-axis, and 3-axis servo amplifiers. The following table lists the Instance Nos. to be specified. Specify the Instance No. according to the number of the axes.

Number of axes	Instance No.
1-axis servo amplifier	150
2-axis servo amplifier	160
3-axis servo amplifier	170

For 1-axis servo amplifiers

Specify "150" as the Instance No.

Map No.	Initial mapping settings	Applications expected to be used for initial mapping
1st Output data For 1-axis servo amplifiers (Instance 150)	1 byte: Modes of operation (6060h) 1 byte: Reserved 2 bytes: Controlword (6040h) 4 bytes: Target position (607Ah) 4 bytes: Target velocity (60FFh) 2 bytes: Target torque (6071h) 2 bytes: Reserved 4 bytes: Profile velocity (6081h) 4 bytes: Profile acceleration (6083h) 4 bytes: Profile deceleration (6084h) 4 bytes: Torque slope (6087h) 4 bytes: Instruction code (2DB1h, 1) 4 bytes: Writing data (2DB1h, 2) 2 bytes: Control DI 10 (2D0Ah) 2 bytes: User defined output data 0 (2E00h, 1) (Initial value: Control DI 1 (2D01h)) *1 2 bytes: User defined output data 1 (2E00h, 2) (Initial value: Control DI 2 (2D02h)) *1 2 bytes: User defined output data 2 (2E00h, 3) (Initial value: Control DI 3 (2D03h)) *1 4 bytes: User defined output data 3 (2E00h, 4) (Initial value: Velocity limit value (2D20h)) *1 4 bytes: User defined output data 4 (2E00h, 4) (Initial value: Not assigned) *1 4 bytes: User defined output data 5 (2E00h, 5) (Initial value: Not assigned) *1 4 bytes: User defined output data 6 (2E00h, 6) (Initial value: Not assigned) *1	• Profile position mode (pp) • Profile velocity mode (pv) • Profile torque mode (tq) • Homing mode (hm) This initial mapping is for an application in which the modes above are switched and used. Map size: 64 bytes

*1 User defined output data 0 to User defined output data 6 are variable objects.

The I/O communication mapping (input) can be read.

Class ID	Ins ID	Attr ID	Name	Default
64h	1600h	00h	1st Receive PDO Mapping	15h
		01h	Mapped Object 001	60600008h
		02h	Mapped Object 002	00000008h
		03h	Mapped Object 003	60400010h
		04h	Mapped Object 004	607A0020h
		05h	Mapped Object 005	60FF0020h
		06h	Mapped Object 006	60710010h
		07h	Mapped Object 007	00000010h
		08h	Mapped Object 008	60810020h
		09h	Mapped Object 009	60830020h
		0Ah	Mapped Object 010	60840020h
		0Bh	Mapped Object 011	60870020h
		0Ch	Mapped Object 012	2DB10120h
		0Dh	Mapped Object 013	2DB10220h
		0Eh	Mapped Object 014	2D0A0010h
		0Fh	Mapped Object 015	2E000110h
		10h	Mapped Object 016	2E000210h
		11h	Mapped Object 017	2E000310h
		12h	Mapped Object 018	2E000420h
		13h	Mapped Object 019	2E000520h
		14h	Mapped Object 020	2E000620h
		15h	Mapped Object 021	2E000720h
		16h	Mapped Object 022	00000000h
		17h	Mapped Object 023	00000000h
		18h	Mapped Object 024	00000000h
		19h	Mapped Object 025	00000000h
		1Ah	Mapped Object 026	00000000h
		1Bh	Mapped Object 027	00000000h
		1Ch	Mapped Object 028	00000000h
		1Dh	Mapped Object 029	00000000h
		1Eh	Mapped Object 030	00000000h
		1Fh	Mapped Object 031	00000000h
		20h	Mapped Object 032	00000000h

For 2-axis servo amplifiers

Specify "160" as the Instance No.

Map No.	Initial mapping settings	Applications expected to be used for initial mapping
1st Output data For 2-axis servo amplifiers (Instance 160)	1 byte: Modes of operation (6060h) 1 byte: Reserved 2 bytes: Controlword (6040h) 4 bytes: Target position (607Ah) 4 bytes: Target velocity (60FFh) 2 bytes: Target torque (6071h) 2 bytes: Reserved 4 bytes: Profile velocity (6081h) 4 bytes: Profile acceleration (6083h) 4 bytes: Profile deceleration (6084h) 4 bytes: Torque slope (6087h) 4 bytes: Instruction code (2DB1h, 1) 4 bytes: Writing data (2DB1h, 2) 2 bytes: Control DI 10 (2D0Ah) 2 bytes: User defined output data 0 (2E00h, 1) (Initial value: Control DI 1 (2D01h)) *1 2 bytes: User defined output data 1 (2E00h, 2) (Initial value: Control DI 2 (2D02h)) *1 2 bytes: User defined output data 2 (2E00h, 3) (Initial value: Control DI 3 (2D03h)) *1 4 bytes: User defined output data 3 (2E00h, 4) (Initial value: Velocity limit value (2D20h)) *1 4 bytes: User defined output data 4 (2E00h, 5) (Initial value: Not assigned) *1 4 bytes: User defined output data 5 (2E00h, 6) (Initial value: Not assigned) *1 4 bytes: User defined output data 6 (2E00h, 7) (Initial value: Not assigned) *1 1 byte: Modes of operation (6870h) 1 byte: Reserved 2 bytes: Controlword (6840h) 4 bytes: Target position (687Ah) 4 bytes: Target velocity (68FFh) 2 bytes: Target torque (6871h) 2 bytes: Reserved 4 bytes: Profile velocity (6881h) 4 bytes: Profile acceleration (6883h) 4 bytes: Profile deceleration (6884h) 4 bytes: Torque slope (6887h) 4 bytes: Instruction code (3DB1h, 1) 4 bytes: Writing data (3DB1h, 2) 2 bytes: Control DI 10 (3D0Ah) 2 bytes: User defined output data 0 (3E00h, 1) (Initial value: Control DI 1 (3D01h)) *1 2 bytes: User defined output data 1 (3E00h, 2) (Initial value: Control DI 2 (3D02h)) *1 2 bytes: User defined output data 2 (3E00h, 3) (Initial value: Control DI 3 (3D03h)) *1 4 bytes: User defined output data 3 (3E00h, 4) (Initial value: Velocity limit value (3D20h)) *1 4 bytes: User defined output data 4 (3E00h, 5) (Initial value: Not assigned) *1 4 bytes: User defined output data 5 (3E00h, 6) (Initial value: Not assigned) *1 4 bytes: User defined output data 6 (3E00h, 7) (Initial value: Not assigned) *1	• Profile position mode (pp) • Profile velocity mode (pv) • Profile torque mode (tq) • Homing mode (hm) This initial mapping is for an application in which the modes above are switched and used. Map size: 128 bytes

*1 User defined output data 0 to User defined output data 6 are variable objects.

The I/O communication mapping (input) can be read. The mapping of the B-axis is shown in the following table.
The I/O communication mapping (input) of the A-axis can be read with "Class ID: 64h, Ins ID: 1600h". For the descriptions, refer to the following.
☞ Page 117 For 1-axis servo amplifiers

Class ID	Ins ID	Attr ID	Name	Default
64h	1610h	00h	1st Receive PDO Mapping	15h
		01h	Mapped Object 001	68600008h
		02h	Mapped Object 002	00000008h
		03h	Mapped Object 003	68400010h
		04h	Mapped Object 004	687A0020h
		05h	Mapped Object 005	68FF0020h
		06h	Mapped Object 006	68710010h
		07h	Mapped Object 007	00000010h
		08h	Mapped Object 008	68810020h
		09h	Mapped Object 009	68830020h
		0Ah	Mapped Object 010	68840020h
		0Bh	Mapped Object 011	68870020h
		0Ch	Mapped Object 012	3DB10120h
		0Dh	Mapped Object 013	3DB10220h
		0Eh	Mapped Object 014	3D0A0010h
		0Fh	Mapped Object 015	3E000110h
		10h	Mapped Object 016	3E000210h
		11h	Mapped Object 017	3E000310h
		12h	Mapped Object 018	3E000420h
		13h	Mapped Object 019	3E000520h
		14h	Mapped Object 020	3E000620h
		15h	Mapped Object 021	3E000720h
		16h	Mapped Object 022	00000000h
		17h	Mapped Object 023	00000000h
		18h	Mapped Object 024	00000000h
		19h	Mapped Object 025	00000000h
		1Ah	Mapped Object 026	00000000h
		1Bh	Mapped Object 027	00000000h
		1Ch	Mapped Object 028	00000000h
		1Dh	Mapped Object 029	00000000h
		1Eh	Mapped Object 030	00000000h
		1Fh	Mapped Object 031	00000000h
		20h	Mapped Object 032	00000000h

For 3-axis servo amplifiers

Specify "170" as the Instance No.

Map No.	Initial mapping settings	Applications expected to be used for initial mapping
1st Output data For 3-axis servo amplifiers (Instance 170)	1 byte: Modes of operation (6060h) 1 byte: Reserved 2 bytes: Controlword (6040h) 4 bytes: Target position (607Ah) 4 bytes: Target velocity (60FFh) 2 bytes: Target torque (6071h) 2 bytes: Reserved 4 bytes: Profile velocity (6081h) 4 bytes: Profile acceleration (6083h) 4 bytes: Profile deceleration (6084h) 4 bytes: Torque slope (6087h) 4 bytes: Instruction code (2DB1h, 1) 4 bytes: Writing data (2DB1h, 2) 2 bytes: Control DI 10 (2D0Ah) 2 bytes: User defined output data 0 (2E00h, 1) (Initial value: Control DI 1 (2D01h)) *1 2 bytes: User defined output data 1 (2E00h, 2) (Initial value: Control DI 2 (2D02h)) *1 2 bytes: User defined output data 2 (2E00h, 3) (Initial value: Control DI 3 (2D03h)) *1 4 bytes: User defined output data 3 (2E00h, 4) (Initial value: Velocity limit value (2D20h)) *1 4 bytes: User defined output data 4 (2E00h, 5) (Initial value: Not assigned) *1 4 bytes: User defined output data 5 (2E00h, 6) (Initial value: Not assigned) *1 4 bytes: User defined output data 6 (2E00h, 7) (Initial value: Not assigned) *1 1 byte: Modes of operation (6870h) 1 byte: Reserved 2 bytes: Controlword (6840h) 4 bytes: Target position (687Ah) 4 bytes: Target velocity (68FFh) 2 bytes: Target torque (6871h) 2 bytes: Reserved 4 bytes: Profile velocity (6881h) 4 bytes: Profile acceleration (6883h) 4 bytes: Profile deceleration (6884h) 4 bytes: Torque slope (6887h) 4 bytes: Instruction code (3DB1h, 1) 4 bytes: Writing data (3DB1h, 2) 2 bytes: Control DI 10 (3D0Ah) 2 bytes: User defined output data 0 (3E00h, 1) (Initial value: Control DI 1 (3D01h)) *1 2 bytes: User defined output data 1 (3E00h, 2) (Initial value: Control DI 2 (3D02h)) *1 2 bytes: User defined output data 2 (3E00h, 3) (Initial value: Control DI 3 (3D03h)) *1 4 bytes: User defined output data 3 (3E00h, 4) (Initial value: Velocity limit value (3D20h)) *1 4 bytes: User defined output data 4 (3E00h, 5) (Initial value: Not assigned) *1 4 bytes: User defined output data 5 (3E00h, 6) (Initial value: Not assigned) *1 4 bytes: User defined output data 6 (3E00h, 7) (Initial value: Not assigned) *1 1 byte: Modes of operation (7060h) 1 byte: Reserved 2 bytes: Controlword (7040h) 4 bytes: Target position (707Ah) 4 bytes: Target velocity (70FFh) 2 bytes: Target torque (7071h) 2 bytes: Reserved 4 bytes: Profile velocity (7081h) 4 bytes: Profile acceleration (7083h) 4 bytes: Profile deceleration (7084h) 4 bytes: Torque slope (7087h) 4 bytes: Instruction code (4DB1h, 1) 4 bytes: Writing data (4DB1h, 2) 2 bytes: Control DI 10 (4D0Ah) 2 bytes: User defined output data 0 (4E00h, 1) (Initial value: Control DI 1 (4D01h)) *1 2 bytes: User defined output data 1 (4E00h, 2) (Initial value: Control DI 2 (4D02h)) *1 2 bytes: User defined output data 2 (4E00h, 3) (Initial value: Control DI 3 (4D03h)) *1 4 bytes: User defined output data 3 (4E00h, 4) (Initial value: Velocity limit value (4D20h)) *1 4 bytes: User defined output data 4 (4E00h, 5) (Initial value: Not assigned) *1 4 bytes: User defined output data 5 (4E00h, 6) (Initial value: Not assigned) *1 4 bytes: User defined output data 6 (4E00h, 7) (Initial value: Not assigned) *1	• Profile position mode (pp) • Profile velocity mode (pv) • Profile torque mode (tq) • Homing mode (hm) This initial mapping is for an application in which the modes above are switched and used. Map size: 192 bytes

*1 User defined output data 0 to User defined output data 6 are variable objects.

The I/O communication mapping (input) can be read. The mapping of the C-axis is shown in the following table.

The I/O communication mapping (input) of the A-axis can be read with "Class ID: 64h, Ins ID: 1600h". For the descriptions, refer to the following.

☞ Page 117 For 1-axis servo amplifiers

The I/O communication mapping (1nput) of the B-axis can be read with "Class ID: 64h, Ins ID: 1610h". For the descriptions, refer to the following.

☞ Page 119 For 2-axis servo amplifiers

Class ID	Ins ID	Attr ID	Name	Default
64h	1620h	00h	1st Receive PDO Mapping	15h
		01h	Mapped Object 001	70600008h
		02h	Mapped Object 002	00000008h
		03h	Mapped Object 003	70400010h
		04h	Mapped Object 004	707A0020h
		05h	Mapped Object 005	70FF0020h
		06h	Mapped Object 006	70710010h
		07h	Mapped Object 007	00000010h
		08h	Mapped Object 008	70810020h
		09h	Mapped Object 009	70830020h
		0Ah	Mapped Object 010	70840020h
		0Bh	Mapped Object 011	70870020h
		0Ch	Mapped Object 012	4DB10120h
		0Dh	Mapped Object 013	4DB10220h
		0Eh	Mapped Object 014	4D0A0010h
		0Fh	Mapped Object 015	4E000110h
		10h	Mapped Object 016	4E000210h
		11h	Mapped Object 017	4E000310h
		12h	Mapped Object 018	4E000410h
		13h	Mapped Object 019	4E000520h
		14h	Mapped Object 020	4E000620h
		15h	Mapped Object 021	4E000720h
		16h	Mapped Object 022	00000000h
		17h	Mapped Object 023	00000000h
		18h	Mapped Object 024	00000000h
		19h	Mapped Object 025	00000000h
		1Ah	Mapped Object 026	00000000h
		1Bh	Mapped Object 027	00000000h
		1Ch	Mapped Object 028	00000000h
		1Dh	Mapped Object 029	00000000h
		1Eh	Mapped Object 030	00000000h
		1Fh	Mapped Object 031	00000000h
		20h	Mapped Object 032	00000000h

I/O communication format (Output)

This section shows the format of the communication data from the server (servo amplifier) to the client (controller).
The Instance No. column in the list indicates the Instance No. of "Assembly object".
The Instance Nos. to be specified differ between 1-axis, 2-axis, and 3-axis servo amplifiers. The following table lists the Instance Nos. to be specified. Specify the Instance No. according to the number of the axes.

Number of axes	Instance No.
1-axis servo amplifier	100
2-axis servo amplifier	110
3-axis servo amplifier	120

For 1-axis servo amplifiers

Specify "100" as the Instance No.

Map No.	Initial mapping settings	Applications expected to be used for initial mapping
1st Input data For 1-axis servo amplifiers (Instance 100)	1 byte: Modes of operation display (6061h) 1 byte: Reserved 2 bytes: Statusword (6041h) 4 bytes: Position actual value (6064h) 4 bytes: Velocity actual value (606Ch) 2 bytes: Torque actual value (6077h) 2 bytes: Reserved 4 bytes: Reading data (2DB1h, 4) 2 bytes: Respond code (2DB1h, 3) 2 bytes: Status DO 10 (2D1Ah) 2 bytes: User defined input data 0 (2E01h, 1) (Initial value: Status DO 1 (2D11h)) *1 2 bytes: User defined input data 1 (2E01h, 2) (Initial value: Status DO 2 (2D12h)) *1 2 bytes: User defined input data 2 (2E01h, 3) (Initial value: Status DO 3 (2D13h)) *1 2 bytes: Reserved 4 bytes: User defined input data 3 (2E01h, 4) (Initial value: Following error actual value (60F4h)) *1 4 bytes: User defined input data 4 (2E01h, 5) (Initial value: Digital Input (60FDh)) *1 4 bytes: User defined input data 5 (2E01h, 6) (Initial value: Not assigned) *1 4 bytes: User defined input data 6 (2E01h, 7) (Initial value: Not assigned) *1 16 bytes: Reserved	• Profile position mode (pp) • Profile velocity mode (pv) • Profile torque mode (tq) • Homing mode (hm) This initial mapping is for an application in which the modes above are switched and used. Map size: 64 bytes

*1 User defined output data 0 to User defined output data 6 are variable objects.

The I/O communication mapping (output) can be read.

Class ID	Ins ID	Attr ID	Name	Default
64h	1A00h	00h	1st Transmit PDO Mapping	13h
		01h	Mapped Object 001	60610008h
		02h	Mapped Object 002	00000008h
		03h	Mapped Object 003	60410010h
		04h	Mapped Object 004	60640020h
		05h	Mapped Object 005	606C0020h
		06h	Mapped Object 006	60770010h
		07h	Mapped Object 007	00000010h
		08h	Mapped Object 008	2DB10420h
		09h	Mapped Object 009	2DB10310h
		0Ah	Mapped Object 010	2D1A0010h
		0Bh	Mapped Object 011	2E010110h
		0Ch	Mapped Object 012	2E010210h
		0Dh	Mapped Object 013	2E010310h
		0Eh	Mapped Object 014	00000010h
		0Fh	Mapped Object 015	2E010420h
		10h	Mapped Object 016	2E010520h
		11h	Mapped Object 017	2E010620h
		12h	Mapped Object 018	2E010720h
		13h	Mapped Object 019	00000080h
		14h	Mapped Object 020	00000000h
		15h	Mapped Object 021	00000000h
		16h	Mapped Object 022	00000000h
		17h	Mapped Object 023	00000000h
		18h	Mapped Object 024	00000000h
		19h	Mapped Object 025	00000000h
		1Ah	Mapped Object 026	00000000h
		1Bh	Mapped Object 027	00000000h
		1Ch	Mapped Object 028	00000000h
		1Dh	Mapped Object 029	00000000h
		1Eh	Mapped Object 030	00000000h
		1Fh	Mapped Object 031	00000000h
		20h	Mapped Object 032	00000000h

For 2-axis servo amplifiers

Specify "110" as the Instance No.

Map No.	Initial mapping settings	Applications expected to be used for initial mapping
1st Input data For 2-axis servo amplifiers (Instance 110)	1 byte: Modes of operation display (6061h) 1 byte: Reserved 2 bytes: Statusword (6041h) 4 bytes: Position actual value (6064h) 4 bytes: Velocity actual value (606Ch) 2 bytes: Torque actual value (6077h) 2 bytes: Reserved 4 bytes: Reading data (2DB1h, 4) 2 bytes: Respond code (2DB1h, 3) 2 bytes: Status DO 10 (2D1Ah) 2 bytes: User defined input data 0 (2E01h, 1) (Initial value: Status DO 1 (2D11h)) *1 2 bytes: User defined input data 1 (2E01h, 2) (Initial value: Status DO 2 (2D12h)) *1 2 bytes: User defined input data 2 (2E01h, 3) (Initial value: Status DO 3 (2D13h)) *1 2 bytes: Reserved 4 bytes: User defined input data 3 (2E01h, 4) (Initial value: Following error actual value (60F4h)) *1 4 bytes: User defined input data 4 (2E01h, 5) (Initial value: Digital Input (60FDh)) *1 4 bytes: User defined input data 5 (2E01h, 6) (Initial value: Not assigned) *1 4 bytes: User defined input data 6 (2E01h, 7) (Initial value: Not assigned) *1 16 bytes: Reserved 1 byte: Modes of operation display (6861h) 1 byte: Reserved 2 bytes: Statusword (6841h) 4 bytes: Position actual value (6864h) 4 bytes: Velocity actual value (686Ch) 2 bytes: Torque actual value (6877h) 2 bytes: Reserved 4 bytes: Reading data (3DB1h, 4) 2 bytes: Respond code (3DB1h, 3) 2 bytes: Status DO 10 (3D1Ah) 2 bytes: User defined input data 0 (3E01h, 1) (Initial value: Status DO 1 (3D11h)) *1 2 bytes: User defined input data 1 (3E01h, 2) (Initial value: Status DO 2 (3D12h)) *1 2 bytes: User defined input data 2 (3E01h, 3) (Initial value: Status DO 3 (3D13h)) *1 2 bytes: Reserved 4 bytes: User defined input data 3 (2E01h, 4) (Initial value: Following error actual value (60F4h)) *1 4 bytes: User defined input data 4 (3E01h, 5) (Initial value: Digital Input (68FDh)) *1 4 bytes: User defined input data 5 (3E01h, 6) (Initial value: Not assigned) *1 4 bytes: User defined input data 6 (3E01h, 7) (Initial value: Not assigned) *1 16 bytes: Reserved	• Profile position mode (pp) • Profile velocity mode (pv) • Profile torque mode (tq) • Homing mode (hm) This initial mapping is for an application in which the modes above are switched and used. Map size: 128 bytes

*1 User defined output data 0 to User defined output data 6 are variable objects.

The I/O communication mapping (output) can be read. The mapping of the B-axis is shown in the following table.
The I/O communication mapping (output) of the A-axis can be read with "Class ID: 64h, Ins ID: 1A00h". For the descriptions, refer to the following.
☞ Page 123 For 1-axis servo amplifiers

Class ID	Ins ID	Attr ID	Name	Default
64h	1A10h	00h	1st Transmit PDO Mapping	14h
		01h	Mapped Object 001	68610008h
		02h	Mapped Object 002	00000008h
		03h	Mapped Object 003	68410010h
		04h	Mapped Object 004	68640020h
		05h	Mapped Object 005	686C0020h
		06h	Mapped Object 006	68770010h
		07h	Mapped Object 007	00000010h
		08h	Mapped Object 008	3DB10420h
		09h	Mapped Object 009	3DB10310h
		0Ah	Mapped Object 010	3D1A0010h
		0Bh	Mapped Object 011	3E010110h
		0Ch	Mapped Object 012	3E010210h
		0Dh	Mapped Object 013	3E010310h
		0Eh	Mapped Object 014	00000010h
		0Fh	Mapped Object 015	3E010420h
		10h	Mapped Object 016	3E010520h
		11h	Mapped Object 017	3E010620h
		12h	Mapped Object 018	3E010720h
		13h	Mapped Object 019	00000080h
		14h	Mapped Object 020	00000000h
		15h	Mapped Object 021	00000000h
		16h	Mapped Object 022	00000000h
		17h	Mapped Object 023	00000000h
		18h	Mapped Object 024	00000000h
		19h	Mapped Object 025	00000000h
		1Ah	Mapped Object 026	00000000h
		1Bh	Mapped Object 027	00000000h
		1Ch	Mapped Object 028	00000000h
		1Dh	Mapped Object 029	00000000h
		1Eh	Mapped Object 030	00000000h
		1Fh	Mapped Object 031	00000000h
		20h	Mapped Object 032	00000000h

For 3-axis servo amplifiers

Specify "120" as the Instance No.

Map No.	Initial mapping settings	Applications expected to be used for initial mapping
1st Input data For 3-axis servo amplifiers (Instance 120)	1 byte: Modes of operation display (6061h) 1 byte: Reserved 2 bytes: Statusword (6041h) 4 bytes: Position actual value (6064h) 4 bytes: Velocity actual value (606Ch) 2 bytes: Torque actual value (6077h) 2 bytes: Reserved 4 bytes: Reading data (2DB1h, 4) 2 bytes: Respond code (2DB1h, 3) 2 bytes: Status DO 10 (2D1Ah) 2 bytes: User defined input data 0 (2E01h, 1) (Initial value: Status DO 1 (2D11h)) *1 2 bytes: User defined input data 1 (2E01h, 2) (Initial value: Status DO 2 (2D12h)) *1 2 bytes: User defined input data 2 (2E01h, 3) (Initial value: Status DO 3 (2D13h)) *1 2 bytes: Reserved 4 bytes: User defined input data 3 (2E01h, 4) (Initial value: Following error actual value (60F4h)) *1 4 bytes: User defined input data 4 (2E01h, 5) (Initial value: Digital Input (60FDh)) *1 4 bytes: User defined input data 5 (2E01h, 6) (Initial value: Not assigned) *1 4 bytes: User defined input data 6 (2E01h, 7) (Initial value: Not assigned) *1 16 bytes: Reserved 1 byte: Modes of operation display (6861h) 1 byte: Reserved 2 bytes: Statusword (6841h) 4 bytes: Position actual value (6864h) 4 bytes: Velocity actual value (686Ch) 2 bytes: Torque actual value (6877h) 2 bytes: Reserved 4 bytes: Reading data (3DB1h, 4) 2 bytes: Respond code (3DB1h, 3) 2 bytes: Status DO 10 (3D1Ah) 2 bytes: User defined input data 0 (3E01h, 1) (Initial value: Status DO 1 (3D11h)) *1 2 bytes: User defined input data 1 (3E01h, 2) (Initial value: Status DO 2 (3D12h)) *1 2 bytes: User defined input data 2 (3E01h, 3) (Initial value: Status DO 3 (3D13h)) *1 2 bytes: Reserved 4 bytes: User defined input data 3 (3E01h, 4) (Initial value: Following error actual value (60F4h)) *1 4 bytes: User defined input data 4 (3E01h, 5) (Initial value: Digital Input (68FDh)) *1 4 bytes: User defined input data 5 (3E01h, 6) (Initial value: Not assigned) *1 4 bytes: User defined input data 6 (3E01h, 7) (Initial value: Not assigned) *1 16 bytes: Reserved 1 byte: Modes of operation display (7061h) 1 byte: Reserved 2 bytes: Statusword (7041h) 4 bytes: Position actual value (7064h) 4 bytes: Velocity actual value (706Ch) 2 bytes: Torque actual value (7077h) 2 bytes: Reserved 4 bytes: Reading data (4DB1h, 4) 2 bytes: Respond code (4DB1h, 3) 2 bytes: Status DO 10 (4D1Ah) 2 bytes: User defined input data 0 (4E01h, 1) (Initial value: Status DO 1 (4D11h)) *1 2 bytes: User defined input data 1 (4E01h, 2) (Initial value: Status DO 2 (4D12h)) *1 2 bytes: User defined input data 2 (4E01h, 3) (Initial value: Status DO 3 (4D13h)) *1 2 bytes: Reserved 4 bytes: User defined input data 3 (4E01h, 4) (Initial value: Following error actual value (70F4h)) *1 4 bytes: User defined input data 4 (4E01h, 5) (Initial value: Digital Input (70FDh)) *1 4 bytes: User defined input data 5 (4E01h, 6) (Initial value: Not assigned) *1 4 bytes: User defined input data 6 (4E01h, 7) (Initial value: Not assigned) *1 16 bytes: Reserved	• Profile position mode (pp) • Profile velocity mode (pv) • Profile torque mode (tq) • Homing mode (hm) This initial mapping is for an application in which the modes above are switched and used. Map size: 192 bytes

*1 User defined output data 0 to User defined output data 6 are variable objects.

The I/O communication mapping (output) can be read. The mapping of the C-axis is shown in the following table.
The I/O communication mapping (output) of the A-axis can be read with "Class ID: 64h, Ins ID: 1A00h". For the descriptions, refer to the following.
☞ Page 123 For 1-axis servo amplifiers
The I/O communication mapping (output) of the B-axis can be read with "Class ID: 64h, Ins ID: 1A10h". For the descriptions, refer to the following.
☞ Page 125 For 2-axis servo amplifiers

Class ID	Ins ID	Attr ID	Name	Default
64h	1A20h	00h	1st Transmit PDO Mapping	13h
		01h	Mapped Object 001	70610008h
		02h	Mapped Object 002	00000008h
		03h	Mapped Object 003	70410010h
		04h	Mapped Object 004	70640020h
		05h	Mapped Object 005	706C0020h
		06h	Mapped Object 006	70770010h
		07h	Mapped Object 007	00000010h
		08h	Mapped Object 008	4DB10420h
		09h	Mapped Object 009	4DB10310h
		0Ah	Mapped Object 010	4D1A0010h
		0Bh	Mapped Object 011	4E010110h
		0Ch	Mapped Object 012	4E010210h
		0Dh	Mapped Object 013	4E010310h
		0Eh	Mapped Object 014	00000010h
		0Fh	Mapped Object 015	4E010420h
		10h	Mapped Object 016	4E010520h
		11h	Mapped Object 017	4E010620h
		12h	Mapped Object 018	4E010720h
		13h	Mapped Object 019	00000080h
		14h	Mapped Object 020	00000000h
		15h	Mapped Object 021	00000000h
		16h	Mapped Object 022	00000000h
		17h	Mapped Object 023	00000000h
		18h	Mapped Object 024	00000000h
		19h	Mapped Object 025	00000000h
		1Ah	Mapped Object 026	00000000h
		1Bh	Mapped Object 027	00000000h
		1Ch	Mapped Object 028	00000000h
		1Dh	Mapped Object 029	00000000h
		1Eh	Mapped Object 030	00000000h
		1Fh	Mapped Object 031	00000000h
		20h	Mapped Object 032	00000000h

Variable mapping function

The instance defined in User defined data_ can be switched dynamically to any sending or receiving instance. Use an instruction code for switching. Refer to the following for details.

☞ Page 152 Instruction code

14 Explicit Message COMMUNICATION

The Explicit Message communication is used to send and receive object data asynchronously between the client (controller) and the server (servo amplifier).
The services that are available for the Explicit Message communication are different for each class or instance. For the supported services of each class or instance, refer to the following.
☞ Page 175 OBJECT LIBRARY
For details of each service, refer to "THE CIP NETWORKS LIBRARY Volume 1 Common Industrial Protocol (CIP™) Appendix A".

14.1 Explicit Message communication related service

The MR-J5_-_G-_N1 servo amplifier supports the following common services and object specific services related to the Explicit Message communication.

Common service

For the common services, refer to the following.
☞ Page 131 Common service

Service	Description
Set_Attribute_Single	Writing values to the specified attribute
Get_Attribute_Single	Reading values from the specified attribute
Get_Attributes_All	Reading values from all attributes
Reset	Calling the Reset service of the specified class/object

Object specific service

For the object specific services, refer to the following.
☞ Page 175 OBJECT LIBRARY

Service	Description
Large_Forward_Open	Used in Connection Manager Object
Forward_Open	Used in Connection Manager Object
Forward_Close	Used in Connection Manager Object
Get_And_Clear	Used in Ethernet Link Object

14.2 Common service

The following shows an example of general status codes which are returned by the common service supported by the MR-J5_-_G-_N1 servo amplifier. For other general status codes, refer to "General Status Codes" in "THE CIP NETWORKS LIBRARY Volume 1 Common Industrial Protocol (CIP™) Appendix B".

Set_Attribute_Single

When a Set_Attribute_Single request is given from the client (controller), the specified value is written to the attribute corresponding to Class ID, Instance ID, or Attribute ID to be specified at the same time.
This service returns any of the following general status codes according to the condition.

General status code	Meaning	Generation condition
05h	Path destination unknown	A non-existent object or instance was specified.
14h	Attribute not supported	A non-existent attribute was specified.
0Eh	Attribute not settable	The value was written to an unchangeable attribute.
09h	Invalid attribute value	A value outside the parameter range was written.
08h	Service not supported	A request was issued to a class or instance that does not support the Set_Attribute_Single service.

Get_Attribute_Single

When a Get_Attribute_Single request is given from the client (controller), the value of the attribute corresponding to Class ID, Instance ID, or Attribute ID to be specified at the same time is returned.
This service returns any of the following general status codes according to the condition.

General status code	Meaning	Generation condition
05h	Path destination unknown	A non-existent object or instance was specified.
14h	Attribute not supported	A non-existent attribute was specified.
08h	Service not supported	A request was issued to a class or instance that does not support the Get_Attribute_Single service.

Get_Attributes_All

When a Get_Attribute_All request is given from the client (controller), the values of all the attributes belonging to Class ID and Instance ID to be specified at the same time are returned.
This service returns any of the following general status codes according to the condition.

General status code	Meaning	Generation condition
05h	Path destination unknown	A non-existent object or instance was specified.
14h	Attribute not supported	A non-existent attribute was specified.
08h	Service not supported	A request was issued to a class or instance that does not support the Get_Attribute_All service.

Reset

When a Reset request is given from the client (controller), the reset process specified by Class ID, Instance ID, and object specific parameters to be specified at the same time is performed. The process upon receipt of the Reset request differs depending on the object. Refer to the following for details.

☞ Page 179 Reset

This service returns any of the following general status codes according to the condition.

General status code	Meaning	Generation condition
20h	Invalid parameter	An unsupported reset type was specified.
08h	Service not supported	A request was issued to a class or instance that does not support the Reset service.
10h	Device state conflict	The Reset service was executed during the I/O communication.

15 DRIVE PROFILE

Point

- The speed unit is set to "command unit/s" in the factory setting. To change the speed unit to "r/min", set [Pr. PT01.1 Speed/acceleration/deceleration unit selection] to "0" (r/min).

15.1 Outline

The MR-J5_-_G-_N1 servo amplifier performs control in accordance with the CiA 402 drive profile. The operations related to the CiA 402 drive profile are performed by using "Class 64 Drive Configuration Object". This chapter describes the CiA 402 drive profile standards and subsets for the functions unique to the MR-J5_-_G-_N1 servo amplifier. Each function can be controlled by using the object dictionary via the network. For the basic functions and advanced functions of the MR-J5_-_G-_N1 servo amplifier, refer to the following manuals.

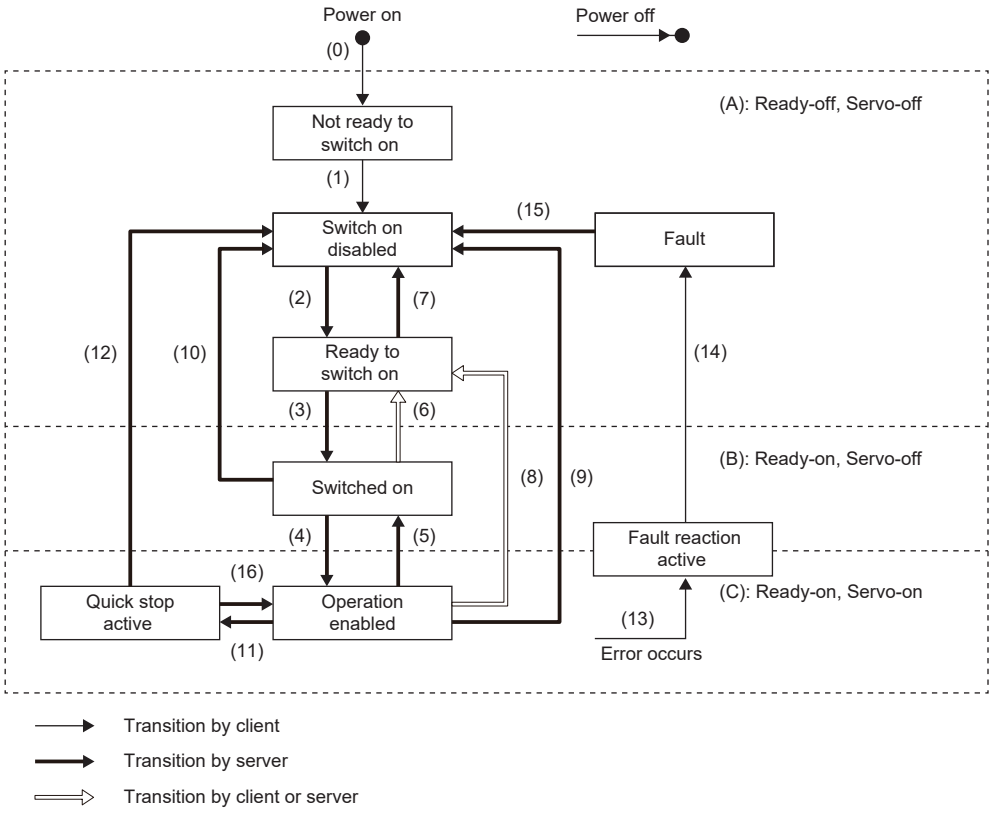
MR-J5 User's Manual (Function)

The following table lists specifications of the drive profile for the MR-J5_-_G-_N1 servo amplifier.

Function name	Description	Reference
Control mode	Control of the modes such as the position mode, speed mode, and torque mode	☞ Page 150 Control mode
PDS state transition	Control method until the servo motor is ready to operate.	☞ Page 134 PDS state transition
Controlword/Control DI	Control of the functions of the MR-J5-_G_-N1 servo amplifier.	☞ Page 137 Controlword/ Control DI
Statusword/Status DO	Monitoring of the functions of the MR-J5-_G_-N1 servo amplifier.	☞ Page 143 Statusword/Status DO

15.2 PDS state transition

The internal state of the servo amplifier is managed by the PDS state defined in the CiA 402 drive profile specification. The transition conditions of the PDS states are as follows. After the PDO communication is established (after the AL state has reached "Operational"), the status is controlled by the client transmitting commands (by setting Controlword) in accordance with the following table. Once the state transitions from "Not ready to switch on", which is right after turning on the power supply, to "Operation enabled", the servo motor becomes ready to operate.



Setting Controlword enables control of the state transitions.

The PDS state is supported in each axis of multi-axis servo amplifiers. On multi-axis servo amplifiers, RA turns on when any one of the axes becomes "Switch on" and RA turns off when all the axes become a state other than "Switch on", "Operation Enabled", or "Quick stop Active".

The following shows the PDS state transition events and operations.

Transition No.	Event	Operation
(0)	Control circuit power supply is turned on	Initialization
(1)	Transitions automatically when the control circuit power supply is turned on	Communication setting
(2)	Transitions with the "Shutdown" command from the client	-
(3)	Transitions with the "Switch On" command from the client	The dynamic brake is released.
(4)	Transitions with the "Enable Operation" command from the client	The operation becomes ready after servo-on.
(5)	Transitions with the "Disable Operation" command from the client Transitions when RD (Ready) is turned off	The operation is disabled after servo-off.
(6)	Transitions with the "Shutdown" command from the client	The dynamic brake operates.
(7)	Transitions with the "Disable Voltage" command or "Quick Stop" command from the client	-
(8)	(A) Transitions with the "Shutdown" command from the client (B) Transitions when the main circuit power supply is turned off (C) Transitions after becoming servo-off (see the transition No. (5) if RD is turned off at the same time)	The operation is disabled after servo-off and dynamic braking.
(9)	Transitions with the "Disable Voltage" command from the client	The operation is disabled after servo-off and dynamic braking.
(10)	Transitions with the "Disable Voltage" command or "Quick Stop" command from the client	The dynamic brake operates.
(11)	(A) Transitions with the "Quick Stop" command from the client (B) Transitions when the forced stop signal is turned off *1	Quick Stop starts.
(12)	(A) Transitions automatically after the completion of Quick Stop (when the value of [Quick stop option code (Class ID: 64h, Ins ID: 605Ah, Attr ID: 0)] is any of "1", "2", "3", or "4") (B) Transitions with the "Disable Voltage" command from the client after completion of "Quick Stop" (C) Transitions when the main circuit power supply is turned off (when the value of [Quick stop option code] is any of "5", "6", "7", or "8")	The operation is disabled after servo-off and dynamic braking.
(13)	Alarm occurrence	The processing at the alarm occurrence is executed.
(14)	Automatic transition	After the completion of the alarm occurrence processing, the operation is disabled by servo-off or the dynamic brake.
(15)	Transitions with the "Fault Reset" command from the client	An alarm reset is performed. Resettable alarms are reset.
(16)	Transitions with the "Enable Operation" command from the client (when the value of [Quick stop option code] is any of "5", "6", "7", or "8")	The operation becomes ready after Quick Stop is canceled.

*1 This event occurs when "1" (Quick stop active) is selected in [Pr. PF29.1 State selection with forced stop in progress].

Correspondence between the command bit setting and the PDS state

0: Off 1: On —: Either on/off can be used

Command	Bit setting of Controlword command					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)
Fault Reset	0 → 1	—	—	—	—	(15)

To prevent commands from being missed during communication errors, keep the Fault Reset command with bit 7 set to "1" for the time specified below according to the communication cycle.

- When twice the communication cycle is less than 10 ms: 10 ms
- When twice the communication cycle is 10 ms or more: Period which is twice the communication cycle

The above periods are specified to prevent the Fault Reset command from being missed if a communication loss occurs. Because communication losses occur frequently depending on the machine usage environment, adjust the period based on the environment.

To transition from the "Switch on disabled" state to the "Operation enabled" state, give the commands "Shutdown", "Switch On", and "Enable operation" sequentially. If using an MR-J5 servo amplifier, however, it is possible to transition directly from the current state to the target state with one command.

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

15.3 Controlword/Control DI

By rewriting the Controlword and Control DI x objects from the client (controller), commands can be issued to switch PDS states and control other functions provided by the drive.

Class ID	Ins ID	Attr ID	Name	Type	Access	Description
64h	6040h	0	Controlword	UINT	Get/Set	
	2D01h	0	Control DI 1	UINT	Get/Set	Objects defined by Mitsubishi Electric
	2D02h	0	Control DI 2	UINT	Get/Set	Objects defined by Mitsubishi Electric
	:	:	:	:	:	:

Bit definition of Controlword

Bit	Symbol	Description
0	SO	Switch On
1	EV	Enable Voltage
2	QS	Quick Stop
3	EO	Enable Operation
4	OMS	The contents differ depending on the setting of [Modes of operation (Class ID: 64h, Ins ID: 6060h, Attr ID: 0)]. Refer to "Control mode [G]" in the following manual. MR-J5 User's Manual (Function)
5		
6		
7	FR	Fault Reset
8	HALT	0: Operation ready 1: Temporary stop
9	OMS	The contents differ depending on the setting of [Modes of operation (Class ID: 64h, Ins ID: 6060h, Attr ID: 0)]. Refer to "Control mode [G]" in the following manual. MR-J5 User's Manual (Function)
10	—	The value at reading is undefined. Set "0" when writing.
11	—	
12	—	
13	—	
14	—	
15	—	

Bit definition of Control DI

• Control DI 1

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined. Set "0" when writing.	—
1	—		—
2	—		—
3	—		—
4	C_CDP	Gain switching	Refer to "Signal (device) explanation" in the following manuals. MR-J5 User's Manual (Hardware) MR-J5D User's Manual (Hardware)
5	C_CLD	Fully closed loop selection	
6	—	The value at reading is undefined. Set "0" when writing.	—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Control DI 2

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined. Set "0" when writing.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	C_PC	Proportional control	Refer to "Signal (device) explanation" in the following manuals. MR-J5 User's Manual (Hardware) MR-J5D User's Manual (Hardware)
9	—	The value at reading is undefined. Set "0" when writing.	—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	C_ORST	Operation alarm reset Turning on C_ORST resets [AL. 0F4 Positioning warning].	—

• Control DI 3

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined. Set "0" when writing.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	C_ABS2	Homing completion (for scale measurement) The state "absolute position erased" of a scale measurement encoder can be canceled by turning on C_ABS2 with the scale measurement function. At this time, S_ABSV2 will turn off.	—
9	—	The value at reading is undefined. Set "0" when writing.	—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Control DI 4

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined. Set "0" when writing.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Control DI 5

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined. Set "0" when writing.	—
1	—		—
2	—		—
3	—		—
4	C_CDP2	Gain switching 2	Refer to "Signal (device) explanation" in the following manuals. MR-J5 User's Manual (Hardware) MR-J5D User's Manual (Hardware)
5	—	The value at reading is undefined. Set "0" when writing.	—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Control DI 6

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined. Set "0" when writing.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Control DI 7

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined. Set "0" when writing.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	C_OVR	Override selection	Refer to "Override function" in the following manual. MR-J5 User's Manual (Function)
8	—	The value at reading is undefined. Set "0" when writing.	—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Control DI 8

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined. Set "0" when writing.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Control DI 9

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined. Set "0" when writing.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Control DI 10

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined. Set "0" when writing.	—
1	C_SPR	Instruction code request The set instruction code is executed by turning on C_SPR.	☞ Page 152 Instruction code
2	—	The value at reading is undefined. Set "0" when writing.	—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

15.4 Statusword/Status DO

The Statusword objects and the Status DO x objects notify the client (controller) of the PDS state and other drive states.

Class ID	Ins ID	Attr ID	Name	Type	Access	Description
64h	6041h	0	Statusword	UINT	Get	
	2D11h	0	Status DO 1	UINT	Get	Objects defined by Mitsubishi Electric
	2D12h	0	Status DO 2	UINT	Get	Objects defined by Mitsubishi Electric
	:	:	:	:	:	:

Bit definition of Statusword

Bit	Symbol	Description
0	RTSO	Ready To Switch On
1	SO	Switched On
2	OE	Operation Enabled
3	F	Fault
4	VE	Voltage-enabled 0: The bus voltage is lower than the specified (RA) level. 1: The bus voltage is equal to or higher than the specified level.
5	QS	Quick stop 0: In a Quick stop 1: Not in a Quick stop (including in the test mode)
6	SOD	Switch On Disabled
7	W	Warning 0: No warning has occurred. 1: A warning has occurred.
8	—	Reserved The value at reading is undefined.
9	RM	Remote 0: Not following the Controlword command. 1: Operating in accordance with the Controlword command.
10	OMS	Operation Mode Specific The contents differ depending on the setting of [Modes of operation (Class ID: 64h, Ins ID: 6060h, Attr ID: 0)]. Refer to "Control mode [G]" in the following manual. MR-J5 User's Manual (Function)
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 pp, pv, hm, or jg mode)
12	OMS	Operation Mode Specific The contents differ depending on the setting of [Modes of operation (Class ID: 64h, Ins ID: 6060h, Attr ID: 0)]. Refer to "Control mode [G]" in the following manual. MR-J5 User's Manual (Function) "0" is set when in the test operation mode.
13		
14	—	Reserved The value at reading is undefined.
15		

State coding

Bit 0 to Bit 3, Bit 5, and Bit 6 are switched depending on the PDS state (servo amplifier internal state). Refer to the following table for details.

Statusword (bin)	PDS state
x0xx xxx0 x0xx 0000	Not ready to switch on [*1]
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

*1 Statusword is not sent when in the "Not ready to switch on" state.

Bit definition of Status DO

• Status DO 1

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined.	—
1	—		—
2	S_SA	Speed reached	Refer to "Signal (device) explanation" in the following manuals. MR-J5 User's Manual (Hardware) MR-J5D User's Manual (Hardware)
3	S_MBR	Electromagnetic brake interlock	
4	S_CDPS	Variable gain enabled	
5	S_CLDS	Fully closed loop control in progress	
6	—	The value at reading is undefined.	—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	S_INP	In-position	Refer to "Signal (device) explanation" in the following manuals. MR-J5 User's Manual (Hardware) MR-J5D User's Manual (Hardware)
13	S_TLC	Limiting torque	
14	S_ABSV	Absolute position erased	
15	S_BWNG	Battery warning	

• Status DO 2

Bit	Symbol	Description	Reference
0	S_ZPASS	Z-phase already passed After the Z-phase is passed, S_ZPASS turns on.	—
1	—	The value at reading is undefined.	—
2	—		—
3	S_ZSP	Zero speed detection	Refer to "Signal (device) explanation" in the following manuals. MR-J5 User's Manual (Hardware) MR-J5D User's Manual (Hardware)
4	S_VLC	Limiting speed	
5	—	The value at reading is undefined.	—
6	S_IPF	In IPF During instantaneous power failure, S_IPF is on.	—
7	—	The value at reading is undefined.	—
8	S_PC	Proportional control in progress S_PC is turned on under proportional control.	—
9	—	The value at reading is undefined.	—
10	S_DB	External dynamic brake output	—
11	—	The value at reading is undefined.	—
12	—		—
13	—		—
14	—		—
15	S_ZP2	Homing completion 2 When homing finishes successfully, S_ZP2 turns on.	—

• Status DO 3

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	S_STO	In the STO state S_STO turns on in the STO state.	Refer to "monitor signal (digital) [G]" in the following manual. MR-J5 User's Manual (Function)
6	—	The value at reading is undefined.	—
7	—		—
8	S_ABSV2	Absolute position erased 2 (for scale measurement) When the absolute position of the scale measurement encoder is erased in the scale measurement function, S_ABSV2 turns on.	—
9	—	The value at reading is undefined.	—
10	—		—
11	S_MTTR	Tough drive in progress	Refer to "Tough drive function" in the following manual. MR-J5 User's Manual (Function)
12	—	The value at reading is undefined.	—
13	—		—
14	—		—
15	—		—

• Status DO 4

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Status DO 5

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined.	—
1	—		—
2	—		—
3	—		—
4	S_CDPS2	Variable gain enabled 2	Refer to "GAIN SWITCHING FUNCTION" in the following manual. MR-J5 User's Manual (Adjustment)
5	S_CPO	Rough match When the command remaining distance is less than the value of the rough match output range set in [Pr. PT12], S_CPO is on. This is not output during base circuit shut-off. When the servo amplifier is switched to the servo-on state, S_CPO switches on.	—
6	S_MEND	Traveling completion If droop pulses are within the in-position output range set in [Pr. PA10] and the command remaining distance is "0", S_MEND turns on. S_MEND turns on at servo-on. S_MEND is off in the servo-off state.	—
7	—	The value at reading is undefined.	—
8	—		—
9	—		—
10	S_PNLT	Open phase condition	Refer to "Disconnection/incorrect wiring detection function" in the following manual. MR-J5 User's Manual (Function)
11	—	The value at reading is undefined.	—
12	—		—
13	—		—
14	—		—
15	—		—

• Status DO 6

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Status DO 7

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined.	—
1	—		—
2	S_POT	Position range When the actual current position is within the range set in [Pr. PT19] and [Pr. PT21], S_POT is on. When homing is not complete or base circuit shut-off is in progress, S_POT is off.	—
3	—	The value at reading is undefined.	—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Status DO 8

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Status DO 9

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Status DO 10

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined.	—
1	S_COF	Instruction code execution completion When the instruction code is executed, S_COF turns on.	☞ Page 152 Instruction code
2	—	The value at reading is undefined.	—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

15.5 Control mode

Selecting control mode (Modes of operation)

Specify a control mode with [Modes of operation (Class: 64h, Instance: 6060h, Attribute: 0)]. [Modes of operation] can be rewritten via the I/O communication or Explicit message communication. The available control modes are limited as follows depending on the setting value of [Pr. PT01.2].

○: Supported, —: Not supported

[Pr. PA01.0]	[Pr. PT01.2]	pp	pv	tq	hm	6061h Initial value
0 (Network standard mode)	2 (degree) 3 (pulse)	○	○	○	○	1 (pp)

Class ID	Ins ID	Attr ID	Name	Type	Aceess	Default value	Description
64h	6060h	0	Modes of operation	SINT	Get/Set	Varies depending on [Pr. PA01] and [Pr. PT01]	0: No mode change/No mode assigned 1: Profile position mode (pp) 3: Profile velocity mode (pv) 4: Profile torque mode (tq) 6: Homing mode (hm)
	6061h	0	Modes of operation display	SINT	Get	Varies depending on [Pr. PA01] and [Pr. PT01]	0: No mode assigned 1: Profile position mode (pp) 3: Profile velocity mode (pv) 4: Profile torque mode (tq) 6: Homing mode (hm)
	6502h	0	Supported drive modes	UDINT	Get	0000002Dh	Bit = 1 for the following modes bit0: Profile position mode bit2: Profile velocity mode bit3: Profile torque mode bit5: Homing mode

Control switching

Point

- Changes to the OMS Bit of [Controlword (Class ID: 64h, Ins ID: 6040h, Attr ID: 0)] are not accepted until control switching finishes. Before inputting a command, check that the control mode has been switched by referring to [Modes of operation display (Class ID: 64h, Ins ID: 6061h, Attr ID: 0)]. In addition, switch the control modes when the start command is turned off. (For example, when "Homing operation start" is turned off in hm mode.)

As there is a time lag in the control mode switching processing, the controller must keep sending the command value corresponding to the control mode until the mode is completely switched. After the completion of the control mode switching is confirmed by [Modes of operation display], the controller can stop updating the command value before switching.
Before switching to or from the position mode, select whether to perform it within the ZSP (zero speed detection) range in [Pr. PC76.1 ZSP disabled selection at control switching]. Whether the servo motor is in the zero speed state can be obtained by Bit 3 (S_ZSP) of [Status DO 2 (Class ID: 64h, Ins ID: 2D12h, Attr ID: 0)].
If [Pr. PC76.1] is set to "0" (Enabled (control switching is performed within the range of ZSP)), [Modes of operation display] does not change because the control switching can be executed only in the zero speed state.
If [Pr. PC76.1] is set to "1" (Disabled (control switching is performed regardless of the range of ZSP)), a shock may occur at control switching.

16 MANUFACTURER-SPECIFIC FUNCTION

16.1 Instruction code

Outline

The value of parameters and objects of the servo amplifier can be changed and read by using the instruction code object. The following shows the instruction code object. Even after the controller is reset, the code set in Instruction code and object information set in User defined data are maintained.

Class ID	Ins ID	Attr ID	Name	Data Type	Access	Description
64h	2DB1h	1	Instruction code	UDINT	Get/Set	Instruction code
		2	Writing data	DINT	Get/Set	Write data
		3	Respond code	UINT	Get	Response code
		4	Reading data	DINT	Get	Read data

For a multi-axis servo amplifier, specify Instance ID of the object to be operated in Instruction Code corresponding to each axis No. The following shows the corresponding Instruction codes. For details of Instruction code mapping, refer to the following.

☞ Page 117 I/O communication mapping

Axis	Instruction code	Description
A-axis	2DB1h: 01h	Reads/writes data from/to the A-axis.
B-axis	3DB1h: 01h	Reads/writes data from/to the B-axis.
C-axis	4DB1h: 01h	Reads/writes data from/to the C-axis.

Regardless of whether the Ins ID of the object dictionary specified in the code No. is the one for the A-axis, B-axis, or C-axis, data is read/written from/to the axis corresponding to the Ins ID of the instruction code.

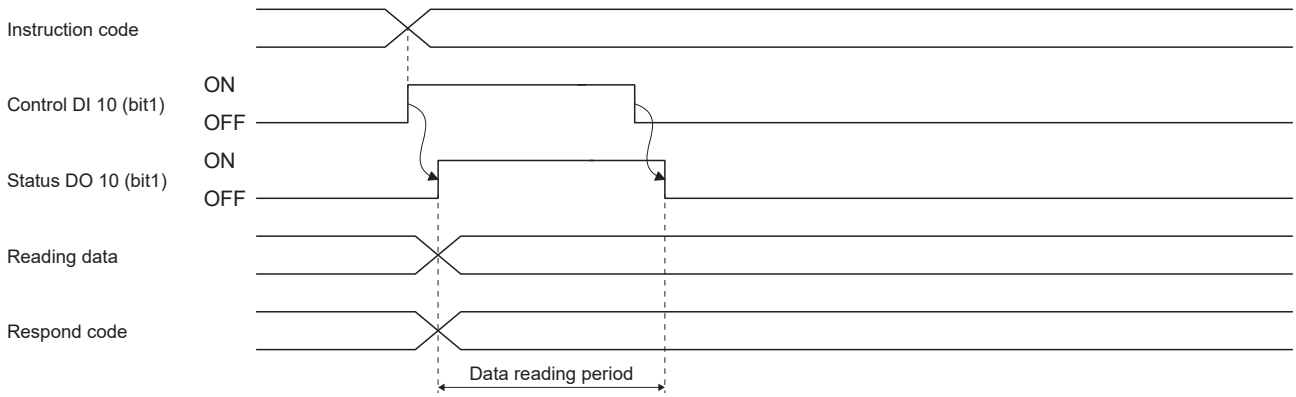
Ex.

If Control DI1 (Instance ID: 3D01h) for the B-axis is read with the instruction code (Instance ID: 2DB1h), Control DI1 (Instance ID: 2D01h) for the A-axis will be read because the instruction code is for the A-axis.

For details of Instance ID of the object for each axis, refer to the following.

☞ Page 111 Section definition of Drive Configuration Object (64h)

Reading instruction code



Set the reading instruction code in Instruction code and turn on the instruction code execution request (Control DI 10, bit1). When the instruction code execution request (Control DI 10, bit1) is turned on, the data corresponding to the set read code is set in Reading data. All data is hexadecimal. At the same time, the instruction code execution completion (Status DO 10, bit1) turns on. Read the data set in Reading data while the instruction code execution request (Control DI 10, bit1) is on. The data set in Reading data is held until the instruction code execution request (Control DI 10, bit1) is turned on with the next reading instruction code set.

Setting an unsupported instruction code in Instruction code sets an error code (_ _ 1 _) in Respond code. At this time, "00000000" will be stored in Reading data.

For details of the response code, refer to the following.

☞ Page 156 Response code

Turn off the instruction code execution request (Control DI 10, bit1) after the data reading processing is completed.

Do not change the instruction code until the instruction code execution completion turns on after the instruction code execution request is turned on.

Check that the data reading processing is completed before turning off the instruction code execution request.

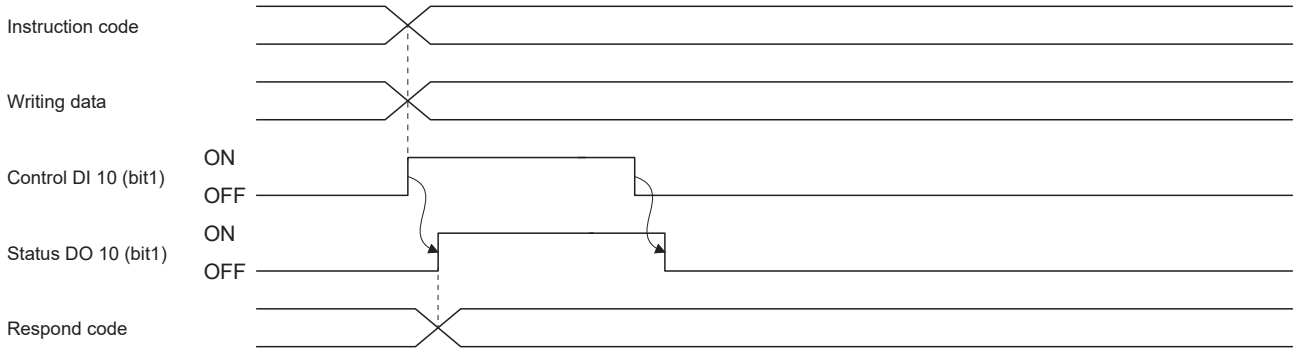
Instruction code

Code No.	Item/function	Read data (Servo amplifier → Client)	
		Lower 16 bits	Upper 16 bits
10XXXXYYh	Setting the Ins ID and Attr ID of an object dictionary supporting object dictionary reading respectively in XXXX and YY reads the value of the corresponding object dictionary. When an unsupported object dictionary is specified, an error code is returned.	The value read from the requested object dictionary is stored.*1*2	The upper 16 bits are stored.*1

*1 When data is read from an object whose size is less than 32 bits, "0" is stored in the area exceeding the size of the reading target object. Objects whose size is 8 bits, 16 bits, and 32 bits can be read.

*2 Communication profile objects (Instance IDs 1000h to1FFFh) excluding Instance ID 1010h are not available.

Writing instruction code



Set the writing instruction code in Instruction code and set the written data (data to be executed) in Writing data in hexadecimal, and then turn on the instruction code execution request (Control DI 10, bit 1).
When the instruction code execution request (Control DI 10, bit 1) is turned on, the data set in Writing data is written to the item corresponding to the writing instruction code. Once the data is written, the instruction code execution completion (Status DO 10, bit 1) turns on.
Setting an unsupported instruction code in Instruction code sets an error code (_ _ 1 _) in Respond code.
Turn off the instruction code execution request (Control DI 10, bit 1) after the instruction code execution completion (Status DO 10, bit 1) turns on.
Do not change the setting values of Instruction code and Writing data until the instruction code execution completion turns on after the instruction code execution request is turned on. Turn off the instruction code execution request when the instruction code execution completion is on.

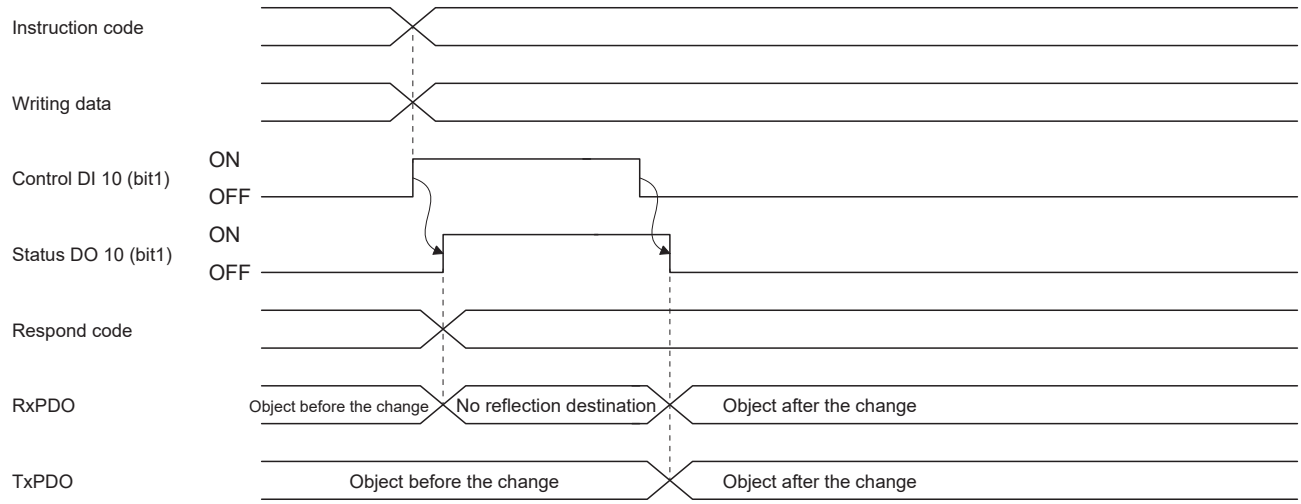
Instruction code

Code No.	Item/function	Write data (Client → Servo amplifier)	
		Lower 16 bits	Upper 16 bits
A0XXXXYYh	Setting the Ins ID and Attr ID of an object dictionary supporting object dictionary writing respectively in XXXX and YY writes a value to the corresponding object dictionary. When an unsupported object dictionary is specified, an error code is returned.	Set the value to be written to the object dictionary.*1*2	Set the upper 16 bits.*1
B0XX0000h	Instruction code for variable mapping It changes the reference object of User defined data defined in the variable mapping for 1st Output data (Instance 150, 160, 170). Specify the object to be changed in the XX part in the instruction code. Refer to the following for details. ☞Page 155 Instruction code for variable mapping	WritingData part format 0 0 Y Y Attribute ID Fixed to 0	WritingData part format X X X X Instance ID
B1XX0000h	Instruction code for variable mapping It changes the reference object of User defined data defined in the variable mapping for 1st Input data (Instance 100, 110, 120). Specify the object to be changed in the XX part in the instruction code. Refer to the following for details. ☞Page 155 Instruction code for variable mapping	WritingData part format 0 0 Y Y Attribute ID Fixed to 0	WritingData part format X X X X Instance ID

*1 When data is written to an object whose size is less than 32 bits, no data is written to the area exceeding the size of the writing target object.
*2 Communication profile objects (Instance IDs 1000h to1FFFh) excluding Instance ID 1010h are not available.

Variable mapping

Set the writing instruction code corresponding to the object to be changed in Instruction code. At the same time, set Ins ID and Attr ID of the object to be changed in Writing data in hexadecimal. Then, turn on the instruction code execution request (Control DI 10, bit 1).
When the instruction code execution request (Control DI 10, bit 1) is turned on, the mapping position where the object corresponding to the writing instruction code is defined operates as the object set in Writing data. Once the data is written, the instruction code execution completion (Status DO 10, bit 1) turns on.
The following shows the reflective timing in the mapping by variable mapping.



From the above timing, for the data sent from the controller, the controller sets the changed object data in User defined data triggered by reception of the instruction code execution completion ON from the servo amplifier. After the setting is completed, the controller turns off the instruction code execution request. User defined data is reflected to the changed object after the instruction code execution completion OFF is received from the servo amplifier.
For the data the controller receives, the changed object value is set in User defined data when the instruction code execution completion OFF is received. The object data before the change is set until the OFF is received.

Instruction code for variable mapping

The following shows the instruction codes and names of the corresponding instances in the I/O communication mapping file.

No	Sending direction	Instruction code	Size	Default	Definition in mapping file
1	Output	B0000000h	2 bytes	Control DI 1 (2D01h)	User defined data 0 (2 bytes)
2	Output	B0010000h	2 bytes	Control DI 2 (2D02h)	User defined data 1 (2 bytes)
3	Output	B0020000h	2 bytes	Control DI 3 (2D03h)	User defined data 2 (2 bytes)
4	Output	B0030000h	4 bytes	Velocity limit value (2D20h)	User defined data 3 (4 bytes)
5	Output	B0040000h	4 bytes	—	User defined data 4 (4 byte)
6	Output	B0050000h	4 bytes	—	User defined data 5 (4 byte)
7	Output	B0060000h	4 bytes	—	User defined data 6 (4 byte)
8	Input	B1000000h	2 bytes	Status DO 1 (2D11h)	User defined data 0 (2 bytes)
9	Input	B1010000h	2 bytes	Status DO 2 (2D12h)	User defined data 1 (2 bytes)
10	Input	B1020000h	2 bytes	Status DO 3 (2D13h)	User defined data 2 (2 bytes)
11	Input	B1030000h	4 bytes	Following error actual value (60F4h)	User defined data 3 (4 bytes)
12	Input	B1040000h	4 bytes	Digital inputs (60FDh)	User defined data 4 (4 bytes)
13	Input	B1050000h	4 bytes	—	User defined data 5 (4 byte)
14	Input	B1060000h	4 bytes	—	User defined data 6 (4 byte)

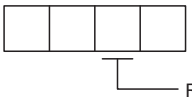
Error condition

The following shows the conditions of normal termination and error occurrences. The code Nos. correspond to the following.
☞ Page 156 Response code

Error name	Generation condition	Code No.
Normal termination	User defined data is switched successfully.	0: Normal answer
Instruction code error	There is no code corresponding to the instruction code.	1: Code error
No mapping definition	The mapping definition is not in the default mapping file definition.	1: Code error
User Defined Data error	The specified instance does not exist.	3: Write data outside the range
Sending/receiving error	The sending direction of the instruction code and User defined data differ.	3: Write data outside the range
Data size error	The size of User defined data exceeds the permissible data size for the instruction code.	3: Write data outside the range
User defined data 0 to 6 assignment error	User defined data 0 to 6 (2E00h, 2E01h) or an object in the mapping to be used is assigned.	3: Write data outside the range

Response code

If the instruction code set in Instruction code is outside the setting range, an error code is set in Respond code. When the instruction code is normal, "_ _ 0 _" is set. The value of "_" at reading is undefined.



Reading instruction code, writing instruction code

Code No.	Error description	Details
0	Normal answer	The execution of the instruction was completed normally.
1	Code error	An inappropriate code No. was specified.
2		
3	Write data outside the range	A value outside the setting range was set.

17 CIP Safety

Safety communication performed via EtherNet/IP is called CIP Safety, and the safety sub-function can be used by connecting to a controller that supports functional safety.
CIP Safety is available for single-axis servo amplifiers with firmware version F4 or later and for multi-axis servo amplifiers with firmware version F5 or later.

17.1 Safety sub-function control by network

Outline

Input devices cannot be used for safety sub-function control by network.
The sent and received data via CIP Safety is defined by the I/O assembly. This I/O assembly has Safety Output and Safety Input, which enable control of the safety sub-function via the safety-specific I/O signals.

Safety communication specifications

The following table shows the safety communication specifications.

Item	Description
Communication method	Class0 communication
Number of connections	Consumer: 1 Producer: 1
Data size per connection	Consumer: 12 bytes Producer: 12 bytes
RPI/EPI	4 ms to 1000 ms (variable in 4 ms increments)

CIP Safety setting procedure

Point

For MR Configurator2 which supports CIP Safety, contact your local sales office.

This section explains the setting procedure of CIP Safety.
For this servo amplifier, configure the settings of the functional safety parameters and CIP Safety parameters using MR Configurator2.
The setting of the functional safety parameters using Safety Network Configuration Tool (SNCT) is not supported.

EtherNet/IP setting

Point

When using CIP Safety, DHCP is not recommended. Set a fixed IP address without using DHCP.

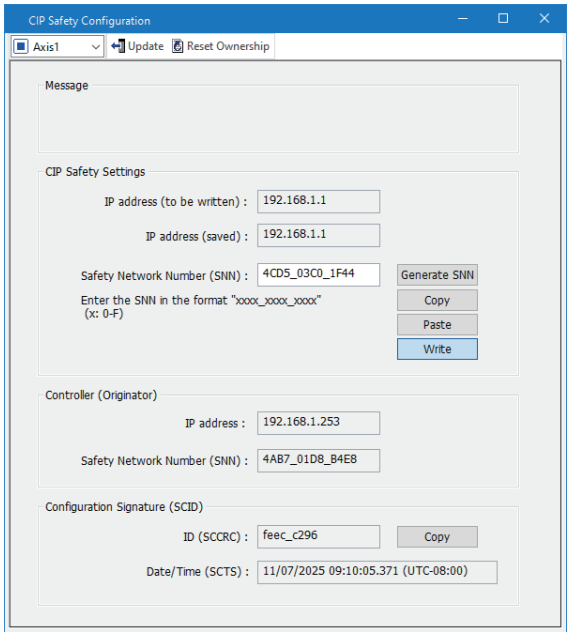
Configure pre-settings such as the IP address of EtherNet/IP.
☞ Page 106 Startup

CIP Safety activation

Start MR Configurator2, and set [Pr. PSA01.1 Input mode selection] of the function safety parameters to "1" (Safety sub-function control by network) in the safety parameter setting window. This activates the safety sub-function control by network.

Setting CIP Safety parameters

Set the CIP Safety parameters in the "CIP Safety Configuration" window of MR Configurator2.



1. SNN (Safety Network Number) setting

Point

SNN must be the same for all devices related to safety in the EtherNet/IP network.
Set the same SNN for the controller and servo amplifiers.

Set the SNN to be assigned to the servo amplifier in "Safety Network Number (SNN)" on "CIP Safety Settings" using one of the following methods.

- Enter the SNN generated by another tool (such as the engineering software of the controller).
- Generate an SNN. (The SNN will be generated on a time basis.)
- Enter an SNN directly. (In this method, you need to understand the correct format of the SNN.)

After setting the SNN, click "Write" to write the SNN to the servo amplifier. After the writing is completed, cycle the power or reset the software. The set SNN is applied to the servo amplifier.

2. Reading CIP Safety parameters

Click "Update" to read the CIP Safety parameters from the servo amplifier. Check that the read SNN matches the written SNN.

3. Obtaining Safety Configuration Identifier (SCID)

Point

The SCID is not checked when the SCID of the controller is set to "0". Therefore, when configuring the safety connections with the SCID set to "0", the user must ensure that the configuration is properly made both in the connection source and the connection destination.
When the functional safety parameters are changed, the SCID is changed. When changing the functional safety parameters, change the SCID of the controller as well.

The generated SCID can be obtained by clicking "Update" and reading the CIP Safety parameters. Set the obtained SCID in the controller. For the setting method in the controller, refer to the manual of the controller to be used.

4. Reset Ownership

When the servo amplifier is connected to the controller, the ownership of the Output connection must be explicitly reset to connect the servo amplifier to another controller. This is because only a single controller can own the connection to the servo amplifier.

To check the controller which has the ownership of the Output connection, read the CIP Safety parameters by clicking "Update" and check "Safety Network Number (SNN)" and "IP address" in the Controller (Originator) section. If the SNN and IP address of the controller to be used do not match them, the ownership needs to be reset.

The connection information with the controller can be reset with one of the following methods.

- Click "Reset Ownership" in the "CIP Safety Configuration" window of MR Configurator2.
- Perform the password initialization from the safety tab of MR Configurator2. This resets all parameters including the functional safety parameters and restores them to the factory settings. Since performing password initialization resets all parameters, configure them again.

After resetting the ownership, reconfigure the CIP Safety parameters from the SNN setting.

Safety connection settings

Point

The safety connection setting can be easily configured by using the EDS file.

After closing the safety connection, shut off or reset the power of the controller. If the power of the controller is shut off or reset before closing the safety connection, [AL. 588 CIP Safety communication error 1 (safety sub-function)] occurs.

After setting the CIP Safety parameters, configure the safety connection in the controller to be used. For the setting method, refer to the manual of the controller to be used.

■Module definition

When using CIP Safety, use the EDS file with Major Revision: 2 and Minor Revision: 1. Other module definitions are the same as when using EtherNet/IP without using CIP Safety.

☞ Page 106 Controller setting

■Connection parameter (assembly data)

In the connection setting, set the following assembly data.

Item	Input Assembly Instance	Output Assembly Instance	Configuration Assembly Instance	Size [byte]
Safety Input	130	196	196	12
Safety Output	196	180	196	12

For details of the assembly data, refer to the following.

☞ Page 161 I/O assembly

■Connection parameter (connection type)

Set the connection parameter to Unicast Connection over EtherNet/IP.

Multicast is not supported. When Multicast is set, a communication error occurs and the safety connection cannot be established.

■Connection parameter (Network Time Expectation)

☞ Page 160 Network Time Expectation

Functional safety parameter setting

To disable the safety reset service ([Safety Reset (Class ID: 39h, Attr ID: 54h)] of "Safety Supervisor Object") defined by CIP Safety, set the following functional safety parameter to "1" (Disables Safety Reset).

Functional safety parameter	Name
PSC05.3	CIP Safety reset condition selection

When [Pr. PSC05.3] is set to "0" (Enables Safety Reset), the CIP Safety parameters can be initialized by the safety reset service. It is recommended to disable the safety reset service after the startup is complete.

Network Time Expectation

Description

Set the allowable time for communication delay of the servo amplifier (Network Time Expectation) in the controller without fail. In the safety connection, when the communication delay exceeding the Network Time Expectation occur, [AL. 588 CIP Safety communication error 1 (safety sub-function)] occurs in the servo amplifier and it transitions to the safety state.
"Network Time Expectation" is the worst-case time until the servo amplifier transitions to the safety state.
Although increasing the value of "Network Time Expectation" reduces the likelihood of communication time-outs, it affects the safe response time. Set an appropriate value considering the safe response time.

Connection parameter settings

Point

Set RPI/EPI in 4 ms increments.

Set the connection parameters related to "Network Time Expectation" in the controller. These connection parameter settings affect the response time of the entire safety functions. Set the connection parameters carefully.

Item	Description
RPI (Requested Packet Interval)/ EPI (Expected Packet Interval)	4 ms to 1000 ms (4 ms increments) Initial value: 16 ms Set the interval for requesting data transmission for RPI and the interval for receiving data packets for EPI. Although setting a smaller value shortens the data sending interval and response time, it also increases the network load and the likelihood of errors. Although setting a larger value reduces the network load and the likelihood of errors, it also increases the response time.
Timeout Multiplier	Initial value: 2 Set the number of messages allowed to be lost before a connection error is detected. The appropriate value varies depending on the network status, required response time, and required system uptime. For example, when "2" is set, the first message loss is allowed. If the second message loss occurs, an error will be detected.
Network Delay Multiplier	Initial value: 200 An appropriate value considering the network latency must be set. The appropriate setting value varies depending on the network complexity (the number of connected devices and the network scale). For a simple network, short buffer time (a smaller value) is enough. For a complex network, longer buffer time (a lager value) is required.

I/O assembly

Cyclic data transmission between the controller and the servo amplifier is performed via Implicit Message.
The servo amplifier supports the following assemblies.

Transmission of various function command inputs via a network

The following shows the safety input commands (controller output is supported).

■Assembly 180: Safety Output (Command from controller to servo amplifier)

The following table shows the contents of the assembly.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	—	SDINC1	SDIPC1	—	—	SS2C1	SS1C1	STOC1
1	SLT3C1	SLT2C1	SLT1C1	SLIC1	SLS4C1	SLS3C1	SLS2C1	SLS1C1
2	—	—	—	—	—	—	—	SLT4C1
3	—	—	—	—	—	—	—	—
4	—	SDINC2	SDIPC2	—	—	SS2C2	SS1C2	STOC2
5	SLT3C2	SLT2C2	SLT1C2	SLIC2	SLS4C2	SLS3C2	SLS2C2	SLS1C2
6	—	—	—	—	—	—	—	SLT4C2
7	—	—	—	—	—	—	—	—
8	—	SDINC3	SDIPC3	—	—	SS2C3	SS1C3	STOC3
9	SLT3C3	SLT2C3	SLT1C3	SLIC3	SLS4C3	SLS3C3	SLS2C3	SLS1C3
10	—	—	—	—	—	—	—	SLT4C3
11	—	—	—	—	—	—	—	—

The last digit of STOC1 or the like indicates the axis number. For example, STOC2 indicates the STO command of the B-axis.

Controller to servo amplifier				
Byte	**Bit**	**Input command**	**Axis**	**Description**
0	0	STOC (STO command)	A-axis	0: The STO function of the servo amplifier is activated and the energy supply is shut off. 1: The STO status is canceled and normal operation resumes.
	1	SS1C (SS1 command)		0: The SS1 function is activated. 1: The SS1 function is canceled.
	2	SS2C (SS2 command)		0: The SS2 function is activated. 1: The SS2 function is canceled.
	3	Not used		Set to "0".
	4			
	5	SDIPC (SDIP command)		0: The SDIP function is activated. 1: The SDIP function is canceled.
	6	SDINC (SDIN command)		0: The SDIN function is activated. 1: The SDIN function is canceled.
	7	Error Ack (Error clear command)		0 → 1: Cancellation of errors is requested.
1	0	SLS1C (SLS1 command)		0: The SLS1 function is activated. 1: The SLS1 function is canceled.
	1	SLS2C (SLS2 command)		0: The SLS2 function is activated. 1: The SLS2 function is canceled.
	2	SLS3C (SLS3 command)		0: The SLS3 function is activated. 1: The SLS3 function is canceled.
	3	SLS4C (SLS4 command)		0: The SLS4 function is activated. 1: The SLS4 function is canceled.
	4	SLIC (SLI command)		0: The SLI function is activated. 1: The SLI function is canceled.
	5	SLT1C (SLT1 command)		0: The SLT1 function is activated. 1: The SLT1 function is canceled.
	6	SLT2C (SLT2 command)		0: The SLT2 function is activated. 1: The SLT2 function is canceled.
	7	SLT3C (SLT3 command)		0: The SLT3 function is activated. 1: The SLT3 function is canceled.
2	0	SLT4C (SLT4 command)		0: The SLT4 function is activated. 1: The SLT4 function is canceled.
	1	Not used		Set to "0".
	2			
	3			
	4			
	5			
	6			
	7			
3	0	Not used		Set to "0".
	1			
	2			
	3			
	4			
	5			
	6			
	7			

Controller to servo amplifier				
Byte	**Bit**	**Input command**	**Axis**	**Description**
4	0	STOC (STO command)	B-axis	0: The STO function of the servo amplifier is activated and the energy supply is shut off. 1: The STO status is canceled and normal operation resumes. For the 1-axis servo amplifier, set 0.
	1	SS1C (SS1 command)		0: The SS1 function is activated. 1: The SS1 function is canceled. For the 1-axis servo amplifier, set 0.
	2	SS2C (SS2 command)		0: The SS2 function is activated. 1: The SS2 function is canceled. For the 1-axis servo amplifier, set 0.
	3	Not used		Set to "0".
	4			
	5	SDIPC (SDIP command)		0: The SDIP function is activated. 1: The SDIP function is canceled. For the 1-axis servo amplifier, set 0.
	6	SDINC (SDIN command)		0: The SDIN function is activated. 1: The SDIN function is canceled. For the 1-axis servo amplifier, set 0.
	7	Error Ack (Error clear command)		0 → 1: Cancellation of errors is requested. For the 1-axis servo amplifier, set 0.
5	0	SLS1C (SLS1 command)		0: The SLS1 function is activated. 1: The SLS1 function is canceled. For the 1-axis servo amplifier, set 0.
	1	SLS2C (SLS2 command)		0: The SLS2 function is activated. 1: The SLS2 function is canceled. For the 1-axis servo amplifier, set 0.
	2	SLS3C (SLS3 command)		0: The SLS3 function is activated. 1: The SLS3 function is canceled. For the 1-axis servo amplifier, set 0.
	3	SLS4C (SLS4 command)		0: The SLS4 function is activated. 1: The SLS4 function is canceled. For the 1-axis servo amplifier, set 0.
	4	SLIC (SLI command)		0: The SLI function is activated. 1: The SLI function is canceled. For the 1-axis servo amplifier, set 0.
	5	SLT1C (SLT1 command)		0: The SLT1 function is activated. 1: The SLT1 function is canceled. For the 1-axis servo amplifier, set 0.
	6	SLT2C (SLT2 command)		0: The SLT2 function is activated. 1: The SLT2 function is canceled. For the 1-axis servo amplifier, set 0.
	7	SLT3C (SLT3 command)		0: The SLT3 function is activated. 1: The SLT3 function is canceled. For the 1-axis servo amplifier, set 0.
6	0	SLT4C (SLT4 command)		0: The SLT4 function is activated. 1: The SLT4 function is canceled. For the 1-axis servo amplifier, set 0.
	1	Not used		Set to "0".
	2			
	3			
	4			
	5			
	6			
	7			

Controller to servo amplifier				
Byte	**Bit**	**Input command**	**Axis**	**Description**
7	0	Not used	B-axis	Set to "0".
	1			
	2			
	3			
	4			
	5			
	6			
	7			
8	0	STOC (STO command)	C-axis	0: The STO function of the servo amplifier is activated and the energy supply is shut off. 1: The STO status is canceled and normal operation resumes. For the 1-axis servo amplifier and 2-axis servo amplifier, set 0.
	1	SS1C (SS1 command)		0: The SS1 function is activated. 1: The SS1 function is canceled. For the 1-axis servo amplifier and 2-axis servo amplifier, set 0.
	2	SS2C (SS2 command)		0: The SS2 function is activated. 1: The SS2 function is canceled. For the 1-axis servo amplifier and 2-axis servo amplifier, set 0.
	3	Not used		Set to "0".
	4			
	5	SDIPC (SDIP command)		0: The SDIP function is activated. 1: The SDIP function is canceled. For the 1-axis servo amplifier and 2-axis servo amplifier, set 0.
	6	SDINC (SDIN command)		0: The SDIN function is activated. 1: The SDIN function is canceled. For the 1-axis servo amplifier and 2-axis servo amplifier, set 0.
	7	Error Ack (Error clear command)		0 → 1: Cancellation of errors is requested. For the 1-axis servo amplifier and 2-axis servo amplifier, set 0.
9	0	SLS1C (SLS1 command)		0: The SLS1 function is activated. 1: The SLS1 function is canceled. For the 1-axis servo amplifier and 2-axis servo amplifier, set 0.
	1	SLS2C (SLS2 command)		0: The SLS2 function is activated. 1: The SLS2 function is canceled. For the 1-axis servo amplifier and 2-axis servo amplifier, set 0.
	2	SLS3C (SLS3 command)		0: The SLS3 function is activated. 1: The SLS3 function is canceled. For the 1-axis servo amplifier and 2-axis servo amplifier, set 0.
	3	SLS4C (SLS4 command)		0: The SLS4 function is activated. 1: The SLS4 function is canceled. For the 1-axis servo amplifier and 2-axis servo amplifier, set 0.
	4	SLIC (SLI command)		0: The SLI function is activated. 1: The SLI function is canceled. For the 1-axis servo amplifier and 2-axis servo amplifier, set 0.
	5	SLT1C (SLT1 command)		0: The SLT1 function is activated. 1: The SLT1 function is canceled. For the 1-axis servo amplifier and 2-axis servo amplifier, set 0.
	6	SLT2C (SLT2 command)		0: The SLT2 function is activated. 1: The SLT2 function is canceled. For the 1-axis servo amplifier and 2-axis servo amplifier, set 0.
	7	SLT3C (SLT3 command)		0: The SLT3 function is activated. 1: The SLT3 function is canceled. For the 1-axis servo amplifier and 2-axis servo amplifier, set 0.

Controller to servo amplifier				
Byte	**Bit**	**Input command**	**Axis**	**Description**
10	0	SLT4C (SLT4 command)	C-axis	0: The SLT4 function is activated. 1: The SLT4 function is canceled. For the 1-axis servo amplifier and 2-axis servo amplifier, set 0.
	1	Not used		Set to "0".
	2			
	3			
	4			
	5			
	6			
	7			
11	0	Not used		Set to "0".
	1			
	2			
	3			
	4			
	5			
	6			
	7			

Feedback of various function outputs via a network

The following shows the safety output status (corresponding to the controller inputs) such as STOS (STO output), SOSS (SOS output), and SSMS (SSM output).

■Assembly 130: Safety Input (Status sent from servo amplifier to controller)

The following table shows the contents of the assembly.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Error1	—	—	—	SOSS1	—	SSMS1	STOS1
1	SLS4S1	SLS3S1	SLS2S1	SLS1S1	SDINS1	SDIPS1	SS2S1	SS1S1
2	—	—	SLT4S1	SLT3S1	SLT2S1	SLT1S1	SLIS1	SBCS1
3	—	—	—	—	—	—	—	—
4	Error2	—	—	—	SOSS2	—	SSMS2	STOS2
5	SLS4S2	SLS3S2	SLS2S2	SLS1S2	SDINS2	SDIPS2	SS2S2	SS1S2
6	—	—	SLT4S2	SLT3S2	SLT2S2	SLT1S2	SLIS2	SBCS2
7	—	—	—	—	—	—	—	—
8	Error3	—	—	—	SOSS3	—	SSMS3	STOS3
9	SLS4S3	SLS3S3	SLS2S3	SLS1S3	SDINS3	SDIPS3	SS2S3	SS1S3
10	—	—	SLT4S3	SLT3S3	SLT2S3	SLT1S3	SLIS3	SBCS3
11	—	—	—	—	—	—	—	—

The last digit of STOC1 or the like indicates the axis number. For example, STOS2 indicates the STO output of the B-axis.

Servo amplifier to controller				
Byte	**Bit**	**Function output**	**Axis**	**Description**
0	0	STOS (STO output)	A-axis	0: Indicates that the STO status has been canceled. 1: Indicates that the STO function is activated and the energy supply has been shut off.
	1	SSMS (SSM output)		0: Indicates that the servo motor speed exceeds the set SSM speed. (Off when the SSM function is disabled.) 1: Indicates that the servo motor speed is equal to or less than the set SSM speed.
	2	Not used		—
	3	SOSS (SOS output)		0: Indicates that the SOS function is not activated. 1: Indicates that the SOS function is activated by the SS2 function.
	4	Not used		—
	5			
	6			
	7	Error (Error status)		0: Indicates that no error is occurring. 1: Indicates that an error is occurring.
1	0	SS1S (SS1 output)		0: Indicates that the SS1 function is not activated. 1: Indicates that the SS1 function is activated.
	1	SS2S (SS2 output)		0: Indicates that the SS2 function is not activated. 1: Indicates that the SS2 function is activated.
	2	SDIPS (SDIP output)		0: Indicates that the SDIP function is not activated. 1: Indicates that the SDIP function is activated.
	3	SDINS (SDIN output)		0: Indicates that the SDIN function is not activated. 1: Indicates that the SDIN function is activated.
	4	SLS1S (SLS1 output)		0: Indicates that the SLS1 function is not activated. 1: Indicates that the SLS1 function is activated.
	5	SLS2S (SLS2 output)		0: Indicates that the SLS2 function is not activated. 1: Indicates that the SLS2 function is activated.
	6	SLS3S (SLS3 output)		0: Indicates that the SLS3 function is not activated. 1: Indicates that the SLS3 function is activated.
	7	SLS4S (SLS4 output)		0: Indicates that the SLS4 function is not activated. 1: Indicates that the SLS4 function is activated.
2	0	SBCS (SBC output)		0: Indicates that the STO status has been canceled and the energy supply to the electromagnetic brake has not been shut off. 1: Indicates that the STO function is activated and the energy supply to the electromagnetic brake has been shut off.
	1	SLIS (SLI output)		0: Indicates that the SLI function is not activated. 1: Indicates that the SLI function is activated.
	2	SLT1S (SLT1 output)		0: Indicates that the SLT1 function is not activated. 1: Indicates that the SLT1 function is activated.
	3	SLT2S (SLT2 output)		0: Indicates that the SLT2 function is not activated. 1: Indicates that the SLT2 function is activated.
	4	SLT3S (SLT3 output)		0: Indicates that the SLT3 function is not activated. 1: Indicates that the SLT3 function is activated.
	5	SLT4S (SLT4 output)		0: Indicates that the SLT4 function is not activated. 1: Indicates that the SLT4 function is activated.
	6	Not used		—
	7			
3	0	Not used		—
	1			
	2			
	3			
	4			
	5			
	6			
	7			

Servo amplifier to controller				
Byte	**Bit**	**Function output**	**Axis**	**Description**
4	0	STOS (STO output)	B-axis	0: Indicates that the STO status has been canceled. 1: Indicates that the STO function is activated and the energy supply has been shut off. The function output cannot be used with the 1-axis servo amplifier.
	1	SSMS (SSM output)		0: Indicates that the servo motor speed exceeds the set SSM speed. (Off when the SSM function is disabled.) 1: Indicates that the servo motor speed is equal to or less than the set SSM speed. The function output cannot be used with the 1-axis servo amplifier.
	2	Not used		—
	3	SOSS (SOS output)		0: Indicates that the SOS function is not activated. 1: Indicates that the SOS function is activated by the SS2 function. The function output cannot be used with the 1-axis servo amplifier.
	4	Not used		—
	5			
	6			
	7	Error (Error status)		0: Indicates that no error is occurring. 1: Indicates that an error is occurring. The function output cannot be used with the 1-axis servo amplifier.
5	0	SS1S (SS1 output)		0: Indicates that the SS1 function is not activated. 1: Indicates that the SS1 function is activated. The function output cannot be used with the 1-axis servo amplifier.
	1	SS2S (SS2 output)		0: Indicates that the SS2 function is not activated. 1: Indicates that the SS2 function is activated. The function output cannot be used with the 1-axis servo amplifier.
	2	SDIPS (SDIP output)		0: Indicates that the SDIP function is not activated. 1: Indicates that the SDIP function is activated. The function output cannot be used with the 1-axis servo amplifier.
	3	SDINS (SDIN output)		0: Indicates that the SDIN function is not activated. 1: Indicates that the SDIN function is activated. The function output cannot be used with the 1-axis servo amplifier.
	4	SLS1S (SLS1 output)		0: Indicates that the SLS1 function is not activated. 1: Indicates that the SLS1 function is activated. The function output cannot be used with the 1-axis servo amplifier.
	5	SLS2S (SLS2 output)		0: Indicates that the SLS2 function is not activated. 1: Indicates that the SLS2 function is activated. The function output cannot be used with the 1-axis servo amplifier.
	6	SLS3S (SLS3 output)		0: Indicates that the SLS3 function is not activated. 1: Indicates that the SLS3 function is activated. The function output cannot be used with the 1-axis servo amplifier.
	7	SLS4S (SLS4 output)		0: Indicates that the SLS4 function is not activated. 1: Indicates that the SLS4 function is activated. The function output cannot be used with the 1-axis servo amplifier.
6	0	SBCS (SBC output)		0: Indicates that the STO status has been canceled and the energy supply to the electromagnetic brake has not been shut off. 1: Indicates that the STO function is activated and the energy supply to the electromagnetic brake has been shut off. The function output cannot be used with the 1-axis servo amplifier.
	1	SLIS (SLI output)		0: Indicates that the SLI function is not activated. 1: Indicates that the SLI function is activated. The function output cannot be used with the 1-axis servo amplifier.
	2	SLT1S (SLT1 output)		0: Indicates that the SLT1 function is not activated. 1: Indicates that the SLT1 function is activated. The function output cannot be used with the 1-axis servo amplifier.
	3	SLT2S (SLT2 output)		0: Indicates that the SLT2 function is not activated. 1: Indicates that the SLT2 function is activated. The function output cannot be used with the 1-axis servo amplifier.
	4	SLT3S (SLT3 output)		0: Indicates that the SLT3 function is not activated. 1: Indicates that the SLT3 function is activated. The function output cannot be used with the 1-axis servo amplifier.

Servo amplifier to controller				
Byte	**Bit**	**Function output**	**Axis**	**Description**
6	5	SLT4S (SLT4 output)	B-axis	0: Indicates that the SLT4 function is not activated. 1: Indicates that the SLT4 function is activated. The function output cannot be used with the 1-axis servo amplifier.
	6	Not used		—
	7			
7	0	Not used		—
	1			
	2			
	3			
	4			
	5			
	6			
	7			
8	0	STOS (STO output)	C-axis	0: Indicates that the STO status has been canceled. 1: Indicates that the STO function is activated and the energy supply has been shut off. The function output cannot be used with the 1-axis servo amplifier and 2-axis servo amplifier.
	1	SSMS (SSM output)		0: Indicates that the servo motor speed exceeds the set SSM speed. (Off when the SSM function is disabled.) 1: Indicates that the servo motor speed is equal to or less than the set SSM speed. The function output cannot be used with the 1-axis servo amplifier and 2-axis servo amplifier.
	2	Not used		—
	3	SOSS (SOS output)		0: Indicates that the SOS function is not activated. 1: Indicates that the SOS function is activated by the SS2 function. The function output cannot be used with the 1-axis servo amplifier and 2-axis servo amplifier.
	4	Not used		—
	5			
	6			
	7	Error (Error status)		0: Indicates that no error is occurring. 1: Indicates that an error is occurring. The function output cannot be used with the 1-axis servo amplifier and 2-axis servo amplifier.
9	0	SS1S (SS1 output)		0: Indicates that the SS1 function is not activated. 1: Indicates that the SS1 function is activated. The function output cannot be used with the 1-axis servo amplifier and 2-axis servo amplifier.
	1	SS2S (SS2 output)		0: Indicates that the SS2 function is not activated. 1: Indicates that the SS2 function is activated. The function output cannot be used with the 1-axis servo amplifier and 2-axis servo amplifier.
	2	SDIPS (SDIP output)		0: Indicates that the SDIP function is not activated. 1: Indicates that the SDIP function is activated. The function output cannot be used with the 1-axis servo amplifier and 2-axis servo amplifier.
	3	SDINS (SDIN output)		0: Indicates that the SDIN function is not activated. 1: Indicates that the SDIN function is activated. The function output cannot be used with the 1-axis servo amplifier and 2-axis servo amplifier.
	4	SLS1S (SLS1 output)		0: Indicates that the SLS1 function is not activated. 1: Indicates that the SLS1 function is activated. The function output cannot be used with the 1-axis servo amplifier and 2-axis servo amplifier.
	5	SLS2S (SLS2 output)		0: Indicates that the SLS2 function is not activated. 1: Indicates that the SLS2 function is activated. The function output cannot be used with the 1-axis servo amplifier and 2-axis servo amplifier.
	6	SLS3S (SLS3 output)		0: Indicates that the SLS3 function is not activated. 1: Indicates that the SLS3 function is activated. The function output cannot be used with the 1-axis servo amplifier and 2-axis servo amplifier.
	7	SLS4S (SLS4 output)		0: Indicates that the SLS4 function is not activated. 1: Indicates that the SLS4 function is activated. The function output cannot be used with the 1-axis servo amplifier and 2-axis servo amplifier.

Servo amplifier to controller				
Byte	**Bit**	**Function output**	**Axis**	**Description**
10	0	SBCS (SBC output)	C-axis	0: Indicates that the STO status has been canceled and the energy supply to the electromagnetic brake has not been shut off. 1: Indicates that the STO function is activated and the energy supply to the electromagnetic brake has been shut off. The function output cannot be used with the 1-axis servo amplifier and 2-axis servo amplifier.
	1	SLIS (SLI output)		0: Indicates that the SLI function is not activated. 1: Indicates that the SLI function is activated. The function output cannot be used with the 1-axis servo amplifier and 2-axis servo amplifier.
	2	SLT1S (SLT1 output)		0: Indicates that the SLT1 function is not activated. 1: Indicates that the SLT1 function is activated. The function output cannot be used with the 1-axis servo amplifier and 2-axis servo amplifier.
	3	SLT2S (SLT2 output)		0: Indicates that the SLT2 function is not activated. 1: Indicates that the SLT2 function is activated. The function output cannot be used with the 1-axis servo amplifier and 2-axis servo amplifier.
	4	SLT3S (SLT3 output)		0: Indicates that the SLT3 function is not activated. 1: Indicates that the SLT3 function is activated. The function output cannot be used with the 1-axis servo amplifier and 2-axis servo amplifier.
	5	SLT4S (SLT4 output)		0: Indicates that the SLT4 function is not activated. 1: Indicates that the SLT4 function is activated. The function output cannot be used with the 1-axis servo amplifier and 2-axis servo amplifier.
	6	Not used		—
	7			
11	0	Not used		—
	1			
	2			
	3			
	4			
	5			
	6			
	7			

Usable data

The servo amplifier provides specific data for diagnosis via Explicit Message.

Specific functions can be called from Explicit Message.

The data consists of CIP objects. The CIP objects that are provided by the servo amplifier are as follows.

- Standard object

Instance No.	Class ID	Name
130, 180	04h	Assembly Object
1	39h	Safety Supervisor Object
1 to 2	3Ah	Safety Validator Object
1	F5h	TCP/IP Object

These CIP objects are available only when CIP Safety is enabled. If CIP Safety is not enabled, an error occurs.

Precautions

- An error occurs when an attempt to use the Reset service of Identity Object is made. For the Reset service, use the Safety Reset service of Safety Supervisor Object.
- When IP addresses or other settings are set using Instance Attribute 5 of TCP/IP Object, the written values will not be applied unless the power is reset. Even if the IP addresses or other settings are read using Instance Attribute 5 of TCP/IP Object before a power reset, the setting values before the written values are applied are read.

Standard object

Contents of the "Access" column indicate the following.

"Get": Only reading is available.

"Set": Only writing is available.

"Get/Set": Reading and writing are available.

Assembly Object (Class ID: 04h)

When CIP Safety is enabled, the following instances are added to Assembly Object.

- Instance ID 130: Safety Input
- Instance ID 180: Safety Output

For details of these instances, refer to the following.

☞ Page 161 I/O assembly

For contents of other attributes, refer to the following.

☞ Page 180 Assembly Object (Class ID: 04h)

Safety Supervisor Object (Class ID: 39h)

- Class attributes

Attr ID	Access	Name	Data Type	Description
1	Get	Revision	UINT	Revision of this object

- Instance Attributes

Attr ID	Access	Name	Data Type
11	Get	Device Status	USINT
12	Get	Exception Status	BYTE
15	Get/Set	Alarm Enable	BOOL
16	Get/Set	Warning Enable	BOOL
25	Get	Configuration UNID	10 octets
26	Get	Safety Configuration Identifier	10 octets
27	Get	Target UNID	10 octets
28	Get	OCPOUNID	STRUCT
29	Get	Proposed TUNID	10 octets

- Services

○: Supported —: Not supported

Service Code	Service Name	Description	Supported service	
			Class	Instance
14	Get_Attribute_Single	Used to read the specified Attribute value.	○	○
16	Set_Attribute_Single	Used to write a value to the specified Attribute.	—	○
84	Safety Reset *1*2	Type 0, 1, and 2 are supported. Type 0: Performs a reset equivalent to a power reset. Type 1: Resets the CIP Safety parameter, and then performs a reset equivalent to a power reset. Type 2: Allows you to select whether to retain or reset the specified CIP Safety parameter, and then performs a reset equivalent to a power reset.	—	○
86	Propose_TUNID	Used to start setting the TUNID. A temporary TUNID is set.	—	○
87	Apply_TUNID *3	Completes the setting operation of the TUNID, and applies the TUNID set using Propose_TUNID to the servo amplifier.	—	○

*1 The Safety Reset service resets only the CIP Safety parameters. It does not affect other servo parameters or function safety parameters.

*2 This servo amplifier does not support the password reset of Soft-set MacId, Soft-set Baud Rate, or Safety Supervisor.

*3 After setting the TUNID using Apply_TUNID, perform Safety Reset, cycle the power of servo amplifier, or perform a software reset.

Safety Validator Object (Class ID: 3Ah)

• Class attributes

Attr ID	Access	Name	Data Type	Description
1	Get	Revision	UINT	Revision of this object
8	Get	Safety Connection Fault Count	UINT	A diagnosis counter for counting Safety Connection Fault during the execution

• Instance Attributes

Attr ID	Access	Name	Data Type
1	Get	Safety Validator State	USINT
2	Get	Safety Validator Type	USINT
3	Get	Ping Interval EPI Multiplier	UINT
4	Get	Time Coord Msg Min Multiplier	STRUCT
5	Get	Network Time Expectation Multiplier	STRUCT
6	Get	Timeout Multiplier	STRUCT
7	Get	Max Consumer Number	USINT
12	Get/Set	Max Data Age	UINT
13	Get	Application Data Path	Packed EPATH
14	Get	Error Code	UINT
15	Get	Producer/Consumer Fault Counters	STRUCT

• Services

○: Supported —: Not supported

Service Code	Service Name	Description	Supported service	
			Class	Instance
14	Get_Attribute_Single	Used to read the specified Attribute value.	○	○
16	Set_Attribute_Single	Used to write a value to the specified Attribute.	—	○
75	Reset all error counters	Used to reset Class Attribute 8 (Safety Connection Fault Count) of all instances.	○	—

TCP/IP Interface Object (Class ID: F5h)

When using CIP Safety, the next Instance Attribute is added to TCP/IP Interface Object.

For contents of other attributes, refer to the following.

☞ Page 184 TCP/IP Interface Object (Class ID: F5h)

• Instance Attributes

Attr ID	Access	Name	Data Type	Description
7	Get	Safety Network Number	6 octets	Safety Network Number (SNN) of the servo amplifier is read.

Status LEDs

Enabling CIP Safety changes the display of RUN MS (Module Status LED) and ERR NS (Network Status LED) as follows. For the definition of the LED display, refer to "LED display (for EtherNet/IP)" in the following manual.

MR-J5-G-N1/MR-J5W-G-N1 User's Manual (Introduction)
MR-J5D-G-N1 User's Manual (Introduction)

Precautions

RUN MS (Module Status LED) and ERR NS (Network Status LED) cannot guarantee accurate information. Use them only for general diagnostic purposes during test operation or troubleshooting. Do not use them as operation indicators.

RUN MS (Module Status LED)

LED		Description
State	Color	
Off	—	Indicates that no voltage is supplied.
On	Green	Indicates that the safety connection is established and operating normally.
Blinking		Indicates that the connection from the controller is being awaited.
Blinking	Red	Indicates that a recoverable error (Major Recoverable Fault) is occurring.
On		Indicates that an unrecoverable error (Major Unrecoverable Fault) is occurring.
Blinking alternately	Green/Red	Indicates the following states. • Self-diagnosis at power-on is in progress • The TUNID of the servo amplifier is not set • The power has not been cycled after setting the TUNID

ERR NS (Network Status LED)

LED		Description
State	Color	
Off	—	Indicates that no voltage is supplied or the IP address is not set.
Blinking	Green	Indicates that the connection is not established even though the IP address is already set.
On		Indicates that the connection is established and operating normally.
Blinking	Red	Indicates that a recoverable network error, such as a connection time-out, is occurring.
On		Indicates that a serious network error, such as duplication of IP addresses has been detected, is occurring.
Blinking alternately	Green/Red	Indicates the following states. • Self-diagnosis at power-on is in progress • The TUNID of the servo amplifier is being set

CIP Safety requirements

- The setting of the functional safety parameters cannot be configured using Safety Network Configuration Tool (SNCT).
- When replacing the servo amplifier, it is necessary to ensure that the new servo amplifier is properly configured and verified to be operating correctly.
- When Safety Configuration ID (SCID) is set to "0" to select the option to set the safety connection, the user must ensure that the settings of the controller and servo amplifier are properly configured.
- For each safety network or safety subnet, a unique SNN through the entire system needs to be set.
- The user test (verification) is a method that verifies all downloads (transmission of settings) to the servo amplifier.
- Signatures should be identified as "verified" (and "configuration locked") only after the user test (verification) is completed.
- When configuring a controller with the connection data and the configuration data for the servo amplifier, download (transmit) the data to the servo amplifier and perform a test to verify it. Only then the SCID can be checked from the servo amplifier.
- When there are existing configurations in the servo amplifier, delete these configurations before installing the servo amplifier in the safety network.
- For all safety devices, set the IP addresses (baud rate as necessary) before installing them in the safety network.
- If there is a possibility of devices with different SIL levels coexisting on the network, carefully consider whether the system meets the required SIL level.
- After applying the safety connection configuration to the controller, conduct a test to check whether the connection to the servo amplifier is operating as intended.
- The LEDs are not reliable indicators and cannot guarantee accurate information. Use the LEDs only for general diagnostic purposes during test operation or troubleshooting. Do not use the LEDs as operation indicators.
- Use the functions of the controller equipped with the automatic SNN setting function only when the reliability of the safety system is low.
- All configuration data should be visually checked to ensure that they have been downloaded (transmitted) properly.

18 OBJECT LIBRARY

18.1 List of supported object libraries

Class ID	Name
01h	Identity Object
02h	Message Router Object
04h	Assembly Object
06h	Connection Manager Object
47h	Device Level Ring (DLR) Object
48h	QoS Object
F5h	TCP/IP Interface Object
F6h	Ethernet Link Object
109h	LLDP Manegement Object
10Ah	LLDP Data Table Object
64h	Drive Configuration Object

18.2 Object library

This section describes object libraries for each group.
Contents of the "Access" column indicate the following.
"Get": Only reading is available.
"Set": Only writing is available.
"Get/Set": Reading and writing are available.
Contents of the "Non-volatile memory" column indicate the following.
"Impossible": Data cannot be stored in the non-volatile memory. The value of the data written from the controller returns to the value of "Default" when the power is shut off.
"Possible": Data can be stored in the non-volatile memory with [Store Parameters (Class ID: 64h, Ins ID: 1010h)]. Data is saved in the parameter corresponding to the object. For the corresponding parameters, refer to "Parameter".

Identity Object (Class ID: 01h)

This object provides the device identification information such as Vendor ID and general information such as the device status. Each Attribute is as follows.

Ins ID	Attr ID	Access	Name	Data Type	Description	Default
0	1	Get	Revision	UINT	Revision of this object	0002
	2	Get	Max Instance	UINT	Maximum Instance No.	1
	3	Get	Number of Instances	UINT	Number of Instances	1

Ins ID	Attr ID	Access	Name	Data Type	Description	Default
1	1	Get	Vendor ID	UINT	Identification No. of each vendor	A1h(161)
	2	Get	Device Type	UINT	Device type of the product	0096h (Vendor Specific)
	3	Get	Product Code	UINT	Product code assigned by each vendor	0014h (MR-J5-_G_-RJN1) 0015h (MR-J5W2-_G-N1) 0016h (MR-J5W3-_G-N1) 0017h (MR-J5D1-_G_-N1) 0018h (MR-J5D2-_G_-N1) 0019h (MR-J5D3-_G_-N1)
	4	Get	Revision	Structure including the following	Revision of the item indicated by the Identity object	****h *3
			Major Revision	USINT	Major revision No. (Lower 8 bits)	**h *3
			Minor Revision	USINT	Minor revision No. (Upper 8 bits)	**h *3
	5	Get	Status	WORD	Device status summary Refer to the following for details. ☞ Page 178 Class 01h Instance 1h Attribute5 (Status)	—
	6	Get	Serial Number	UDINT	Device serial No.	********h *3
	7	Get	Product Name	SHORT_STRING	Product name	— *1
	8	Get	State	USINT	Current state of the device shown in the state transition diagram	0 = Nonexistent 1 = Device Self Testing 2 = Standby 3 = Operational 4 = Major Recoverable Fault 5 = Major Unrecoverable Fault 6 - 254 = Reserved 255 = Default Value
	11	Set	Active Language	Structure including the following	Language currently used on the device	eng (English)
				USINT	The language1 field of the STRINGI data type	— *2
				USINT	The language2 field of the STRINGI data type	— *2
				USINT	The language3 field of the STRINGI data type	— *2
	30	Get	Supported Language List 2	Structure including the following	List of languages supported on the device	0100656E67h
				UINT	Number of languages in the list	0001h
				Structure including the following	Supported languages of the device	eng (English)
				USINT	The language1 field of the STRINGI data type	— *2
				USINT	The language2 field of the STRINGI data type	— *2
				USINT	The language3 field of the STRINGI data type	— *2

*1 The model name of the servo amplifier (such as MR-J5-G-RJN1) is returned.

*2 Language to be used and supported languages are stored as follows.
(Example) For English: language1: 65h (e), language2: 6Eh (n), language3: 67h (g)

*3 The initial value of this object is undefined.

Ins ID	Attr ID	Range	Units	Non-volatile memory	Parameter
0	1	0002h to 0002h	—	Impossible	—
	2	0001h to 0001h			
	3	0001h to 0001h			
1	1	00A1h to 00A1h			
	2	002Bh to 002Bh			
	3	0013h to 0013h			
	4	0000h to FFFFh			
	5	0000h to 0F75h			
	6	00000000h to FFFFFFFFh			
	7	—			
	8	00h to FFh			
	11	—		Possible	
	30	—		Impossible	

This instance supports the following services.

- When Ins ID is 0

Service Code	Name	Description
01h	Get_Attributes_All	Reads the values of all attributes.
0Eh	Get_Attribute_Single	Reads the value of the specified attribute.

- When Ins ID is other than 0

Service Code	Name	Description
01h	Get_Attributes_All	Reads the values of all attributes.
03h	Get_Attribute_List	Returns the contents of the specified attributes using a list of attribute IDs.
04h	Set_Attribute_List	Changes the contents of the specified attributes using a list of attribute IDs.
05h	Reset	Calls the Reset service of the specified class/object.
0Eh	Get_Attribute_Single	Reads the value of the specified attribute.
10h	Set_Attribute_Single	Writes the value to the specified attribute.

Class 01h Instance 1h Attribute5 (Status)

bit	Name
0	Module Owned
1	Reserved
2	Configured
3	Reserved
4 to 7	Extended Device Status: 0000b: Unknown 0010b: Faulted I/O Connection 0011b: No I/O connection establish 0100b: Non volatile configuration bad 0101b: Major fault 0110b: Connection in Run mode 0111b: Connection in Idle mode
8	Minor Recoverable Fault *1
9	Minor Unrecoverable Fault *1
10	Major Recoverable Fault *1
11	Major Unrecoverable Fault *1
12 to 15	Reserved

*1 If an alarm occurs, Major Recoverable Fault or Major Unrecoverable Fault turns on. If a warning occurs, the status does not change.

Reset

The available reset types in the Reset service are as follows.

Value	Reset type
0	Emulates the power supply reset as strictly as possible based on the item indicated by Identity Object. When this parameter is omitted, this value is used as the default value. The parameter of the servo amplifier will not be the default value.
1	Restores the state as close as possible to the factory setting and emulates the power supply reset as strictly as possible. All communication settings such as the IP address become the default values. Parameters of the servo amplifier (servo parameters and network parameters) are restored to the factory setting.

Message Router object (Class ID: 02h)

This object sorts messages for the any object classes and object instances in the actual servo amplifier.

There is no available attributes and services for this object.

Assembly Object (Class ID: 04h)

This object specifies the data format of the I/O communication between the client and server.

The servo amplifier uses the data format specified by Instance100, 110, 120, 150, 160, and 170 to exchange instruction and feedback cyclically. For the sending and receiving formats, refer to the following.

☞ Page 117 I/O communication mapping

Each Attribute is as follows.

Ins ID	Attr ID	Access	Name	Data Type	Description	Default
0	1	Get	Revision	UINT	Revision of this object	0002
	2	Get	Max Instance	UINT	Maximum Instance No.	—
100 (1-axis) 110 (2-axis) 120 (3-axis)	3	Set	Data	Array of BYTE	1st Input data	☞ Page 123 I/O communication format (Output)
	4	Get	Size	UINT	Number of bytes in attribute 3	☞ Page 123 I/O communication format (Output)
150 (1-axis) 160 (2-axis) 170 (3-axis)	3	Set	Data	Array of BYTE	1st Output data	☞ Page 117 I/O communication format (Input)
	4	Get	Size	UINT	Number of bytes in attribute 3	☞ Page 117 I/O communication format (Input)

Ins ID	Attr ID	Range	Units	Non-volatile memory	Parameter
0	1	0002h to 0002h	—	—	—
	2	0000h to 009Ch			
100	3	—			
	4	0000 to 0040h			
150	3	—			
	4	0000h to 0040h			

This instance supports the following services.

- When Ins ID is 0

Service Code	Name	Description
0Eh	Get_Attribute_Single	Reads the value of the specified attribute.

- When Ins ID is other than 0

Service Code	Name	Description
0Eh	Get_Attribute_Single	Reads the value of the specified attribute.
10h	Set_Attribute_Single	Writes the value to the specified attribute.

Connection Manager Object (Class ID: 06h)

This object is used to establish a dedicated connection when data is exchanged by I/O connection or frequently by Explicit Message. Each Attribute is as follows.

Ins ID	Attr ID	Access	Name	Data Type	Description	Default
1	1	Set *1	Open Requests	UINT	Number of received Forward_Open service requests	0
	2	Set *1	Open Format Rejects	UINT	Number of Forward_Open service requests rejected due to format incompatibility	0
	3	Set *1	Open Resource Rejects	UINT	Number of Forward_Open service requests rejected due to resource shortage	0
	4	Set *1	Open Other Rejects	UINT	Number of Forward_Open service requests rejected for a reason other than format incompatibility or resource shortage.	0
	5	Set *1	Close Requests	UINT	Number of received Forward_Close service requests	0
	6	Set *1	Close Format Rejects	UINT	Number of Forward_Close service requests rejected due to format incompatibility	0
	7	Set *1	Close Other Rejects	UINT	Number of Forward_Close service requests rejected for a reason other than format incompatibility	0
	8	Set *1	Connection Timeouts	UINT	Total number of connection time-outs that occurred in the connection controlled by this Connection Manager	0

*1 When the transmitted setting value is not zero, the device may reject the setting request to this Attr ID using general status code "0x09" (invalid setting value).

Ins ID	Attr ID	Range	Units	Non-volatile memory	Parameter
1	1	0000h to FFFFh	number of times	Impossible	—
	2				
	3				
	4				
	5				
	6				
	7				
	8				

This instance supports the following services.

Service Code	Name	Description
01h	Get_Attribute_All	Reads the values of all attributes.
0Eh	Get_Attribute_Single	Reads the value of the specified attribute.
10h	Set_Attribute_Single	Writes the value to the specified attribute.
4Eh	Forward_Close	Closes a connection.
54h	Forward_Open	Opens a connection whose data size is up to 511 bytes.
5Bh	Large_Forward_Open	Opens a connection whose data size is up to 1500 bytes.

Device Level Ring (DLR) Object (Class ID: 47h)

This object provides interfaces for the DLR protocol setting and status information. Each Attribute is as follows.

Ins ID	Attr ID	Access	Name	Data Type	Description	Default
0	1	Get	Revision	UINT	Revision of this object	0003h
1	1	Get	Network Topology	USINT	Current network topology	0: Linear 1: Ring
	2	Get	Network Status	USINT	Current network status	0
	10	Get	Active Supervisor Address	Following structures	Either or both of the IP address (IPv4) and MAC address of an active ring supervisor	—
			Supervisor IP Address	UDINT	IP address (IPv4) of an active ring supervisor	—
			Supervisor MAC Address	Array of USINT	MAC address of an active ring supervisor	—
	12	Get	Capability Flags	DWORD	Explanation of DLR function of the device Refer to the following for details. ☞ Page 182 Capability Flags	82h (Beacon-based Ring Node, Flush_Table frame capable)

Ins ID	Attr ID	Range	Units	Non-volatile memory	Parameter
0	1	0003h to 0003h	—	Impossible	—
1	1	00h to 01h			
	2	00h to 04h			
	10	—			
	12	00000000h to 000000E3h			

This instance supports the following services.

- When Ins ID is 0

Service Code	Name	Description
01h	Get_Attribute_All	Reads the values of all attributes.
0Eh	Get_Attribute_Single	Reads the value of the specified attribute.

- When Ins ID is other than 0

Service Code	Name	Description
01h	Get_Attribute_All	Reads the values of all attributes.
0Eh	Get_Attribute_Single	Reads the value of the specified attribute.

Network Status

Network Status value	Description
0	Communication is normally performed in the Ring or Linear network topology mode.
1	Ring Fault (Only in the Ring network topology mode)
2	An unexpected loop is detected in the network connection (Only in the Linear network topology mode)
3	Partial Network Fault (Only in the Ring network topology mode and the node is the Ring supervisor)
4	Rapid Fault/Restore Cycle

Capability Flags

bit	Name	Definition
0	Announce-based Ring Node	This flag is set when the ring node of the device is implemented based on Announce frame.
1	Beacon-based Ring Node	This flag is set when the ring node of the device is implemented based on Beacon frame.
2 to 4	Reserved	Reserved
5	Supervisor Capable	This flag is set when the device can provide the supervisor function.
6	Redundant Gateway Capable	This flag is set when the device can provide the redundant gateway function.
7	Flush_Table frame Capable	This flag is set when the Flush Tables frame can be supported.
8 to 31	Reserved	Reserved

QoS Object (Class ID: 48h)

This object prioritizes each communication type so that no communication delay or stop occurs due to strain of bandwidth.
Each Attribute is as follows.

Ins ID	Attr ID	Access	Name	Data Type	Description	Default
0	1	Get	Revision	UINT	Revision of this object	0001h
1	4	Set	DSCP Urgent	USINT	DSCP value of the urgent priority message in the CIP transport class 0/1	55
	5	Set	DSCP Scheduled	USINT	DSCP value of the schedule priority message in the CIP transport class 0/1	47
	6	Set	DSCP High	USINT	DSCP value of the high priority in the CIP transport class 0/1	43
	7	Set	DSCP Low	USINT	DSCP value of the low priority in the CIP transport class 0/1	31
	8	Set	DSCP Explicit	USINT	DSCP values of the EtherNet/IP encapsulated messages in the CIP explicit message transport class 2/3UCMM and others.	27

Ins ID	Attr ID	Range	Units	Non-volatile memory	Parameter
0	1	00h to FFh	—	Impossible	—
1	4			Possible	
	5				
	6				
	7				
	8				

This instance supports the following services.

- When Ins ID is 0

Service Code	Name	Description
0Eh	Get_Attribute_Single	Reads the value of the specified attribute.

- When Ins ID is other than 0

Service Code	Name	Description
0Eh	Get_Attribute_Single	Reads the value of the specified attribute.
10h	Set_Attribute_Single	Writes the value to the specified attribute.

TCP/IP Interface Object (Class ID: F5h)

This object provides a structure for setting the TCP/IP network interface of the device (such as IP address and network mask). Each Attribute is as follows.

Ins ID	Attr ID	Access	Name	Data Type	Description	Default
0	1	Get	Revision	UINT	Revision of this object	0004h
	2	Get	Max Instance	UINT	Maximum Instance No.	1
	3	Get	Number of Instance	UINT	Number of Instances	1
	6	Get	Maximum ID Number Class Attributes	UINT	The last attribute ID of the class attributes	7
	7	Get	Maximum ID Number Instance Attributes	UINT	The last attribute ID of the instance attributes	13
1	1	Get	Status	DWORD	Status of the interface	—
	2	Get	Configuration Capability	DWORD	Interface capability flag	—
	3	Get/Set	Configuration Control	DWORD	Interface control flag	—
	4	Get	Physical Link Object	Following structures	—	—
				UINT	Path size	0000h
				Padded EPATH	A path to Ethernet Link Object, Instance #1	00h
	5	Get/Set	Interface Configuration	Following structures	—	—
				UDINT	IP address	—
				UDINT	Subnet mask	—
				UDINT	Default gateway	—
				UDINT	Primary DNS	—
				UDINT	Secondary DNS	—
				STRING	Default domain	—
	6	Get/Set	Host Name	STRING	Host name of the servo amplifier	—
	8	Get/Set	TTL Value	USINT	TTL value of the EtherNet/IP multicast packet	1
	9	Get/Set	Mcast Config	Following structures	IP multicast address setting	—
			Alloc Control	USINT	Multicast address assignment control word	—
			Reserved	USINT	—	0
			Num Mcast	UINT	Number of IP multicast addresses to be assigned to EtherNet/IP	—
			Mcast Start Addr	UDINT	First multicast address to be assigned	—
	10	Set	SelectAcd	Bool	Activation of ACD use	—
	11	Set	Last ConflictDetected	Following structures	The last conflict information	—
			AcdActivity	USINT	ACD activation status at the last conflict detection	—
			RemoteMAC	USINT type array	MAC address of the remote node from ARP PDU at conflict detection	—
			ArpPdu	USINT type array	Copy of ARP PDU at conflict detection	—
	13	Set	Encapsulation Inactivity Timeout	UINT	Number of inactive seconds before the TCP connection is closed	120

When the IP address conflict is detected while SelectAcd is set to "1" (enabled), [AL. 09E.6 IP address setting warning] occurs. Review the following settings.

- Configuration Control (Ins ID 1h, Attr ID 3), [Pr. NPC01 Configuration Control], or the rotary switch
- Interface Configuration (Ins ID 1h, Attr ID 5) or [Pr. NPC02 IP Address]

When a conflict of the IP address acquired from the DHCP server is detected, acquire the IP address again.

Ins ID	Attr ID	Range	Units	Non-volatile memory	Parameter
0	1	0004h to 0004h	—	Impossible	—
	2	0001h to 0001h			
	3	0001h to 0001h			
	6	0007h to 0007h			
	7	000Dh to 000Dh			
1	1	0000h to 00D8h			
	2	0000h to 00F4h			
	3	0000h to 0005h		Possible	[Pr. NPC01]
	4	—		Impossible	—
	5			Possible	[Pr. NPC02] [Pr. NPC03] [Pr. NPC04]
	6				—
	8	01h to FFh			
	9	—			
	10	00h to FFh			
	11	—			
	13	00h to E10h	s		

This instance supports the following services.

• When Ins ID is 0

Service Code	Name	Description
01h	Get_Attribute_All	Reads the values of all attributes.
0Eh	Get_Attribute_Single	Reads the value of the specified attribute.

• When Ins ID is other than 0

Service Code	Name	Description
01h	Get_Attribute_All	Reads the values of all attributes.
0Eh	Get_Attribute_Single	Reads the value of the specified attribute.
10h	Set_Attribute_Single	Writes the value to the specified attribute.

Status

bit	Name	Definition
0 to 3	Interface Configuration Status	Indicates the attribute status of Interface Configuration. 0: The Interface Configuration attribute is not set. 1: The Interface Configuration attribute contains any active setting acquired from BOOTP, DHCP, or non-volatile memory. 2: The Interface Configuration attribute contains any active setting acquired from the hardware settings. 3 to 15: Reserved
4	Mcast Pending	Returns the undetermined setting change of the TTL Value and Mcast Config attributes. When the TTL Value or Mcast Config attribute is set, this bit will be cleared at the next device startup.
5	Reserved	Reserved (always 0)
6	AcdStatus	Indicates that duplication of IP addresses was detected by ACD. It becomes "1" after detection of IP address duplication when the ACD is supported and enabled.
7	AcdFault	Indicates whether the IP address conflict was detected or protection was failed by ACD. It becomes "1" when the current interface setting cannot be used due to the conflict.
8 to 31	Reserved	Reserved (always 0)

Configuration Capability

bit	Name	Definition
0	BOOTP Client *1	Becomes "1" when the device can acquire its network setting via BOOTP.
1	DNS Client *1	Becomes "1" when the device contacts the DNS server and can resolve the host name.
2	DHCP Client	Becomes "1" when the device can acquire its network setting via DHCP.
3	DHCP-DNS Update *1	Becomes "1" when the device can transmit its host name in a DHCP request as described in the Internet Draft (draft-ietf-dhcdhcp-dns-12.txt).
4	Configuration Settable	Becomes "1" when the Interface Configuration attribute is settable.
5	Hardware Configurable	Indicates that the IP address setting can be acquired from the hardware settings when this bit is "1". (Pushwheel switch, thumbwheel switch)
6	Interface Configuration Change Requires Reset	Indicates that the device needs to be reset to reflect the setting of the Interface Configuration attribute when this bit is "1". (Always 0)
7	AcdCapable	Indicates that the ACD is available for the device when this bit is "1".
8 to 31	Reserved	Reserved (always 0)

*1 Not supported by this servo amplifier.

Configuration Control

bit	Name	Definition
0 to 3	Configuration Method	Determines the IP address acquisition method. 0: The device acquires the IP address from the value saved in the non-volatile memory. 1: The device acquires the interface setting via BOOTP. (Not supported) 2: The device acquires the interface setting via DHCP. 3 to 15: Reserved
4	DNS Enable	Becomes "1" when the device can resolve the name by contacting the DNS server. (Not supported)
5 to 31	Reserved	Reserved

Alloc Control

Value	Description
0	Use default allocation algorithm to generate multicast addresses
1	Allocate multicast addresses according to the values in the "Num Mcast" and "Mcast Start Addr" fields.

Ethernet Link Object (Class ID: F6h)

This object retains the status information of the link specific counter and IEEE802.3 communication interface. Each Attribute is as follows.

Ins ID	Attr ID	Access	Name	Data Type	Description	Default
0	1	Get	Revision	UINT	Revision of this object	0004h
	2	Get	Max Instance	UINT	Maximum Instance No.	2
	3	Get	Number of Instance	UINT	Number of Instances	2
	6	Get	Maximum ID Number Class Attributes	UINT	The last attribute ID of the class attributes	7
	7	Get	Maximum ID Number Instance Attributes	UINT	The last attribute ID of the instance attributes	10
1 to 2	1	Get	Interface Speed	UDINT	Speed of the currently used interface (10 Mbps or 100 Mbps)	—
	2	Get	Interface Flags	DWORD	Status flag of the interface Refer to the following for details. ☞Page 189 Interface Flags	—
	3	Get	Physical Address	USINT type array	MAC address	—
	4	Get	Interface Counters	Following structures	—	—
			In Octets	UDINT	Number of octets received on the interface	—
			In Ucast Packets	UDINT	Number of unicast packets received on the interface	—
			In NUcast Packets	UDINT	Number of packets other than unicast received on the interface	—
			In Discards	UDINT	Number of incoming packets received but discarded on the interface	—
			In Errors	UDINT	Number of incoming packets including an error (not included in In Discards)	—
			In Unknown Protos	UDINT	Number of incoming packets including an unknown protocol	—
			Out Octets	UDINT	Number of octets transmitted on the interface	—
			Out Ucast Packets	UDINT	Number of unicast packets transmitted on the interface	—
			Out NUcast Packets	UDINT	Number of packets other than unicast transmitted on the interface	—
			Out Discards	UDINT	Number of discarded transmitted packets	—
			Out Errors	UDINT	Number of outgoing packets	—

Ins ID	Attr ID	Access	Name	Data Type	Description	Default
1 to 2	5	Get	Media Counters	Following structures	Media specific counter	—
			Alignment Errors	UDINT	Number of incoming frames whose length is not an octet integer	—
			FCS Errors	UDINT	Number of incoming frames that does not pass the FCS check	—
			Single Collisions	UDINT	Number of frames successfully transmitted with a single collision	—
			Multiple Collisions	UDINT	Number of frames successfully transmitted with 2 or more collisions	—
			SQE Test Errors	UDINT	Number of times an SQE test error message was generated	—
			Deferred Transmissions	UDINT	Number of frames delayed which the first transmission attempt was delayed because the media was busy	—
			Late collisions	UDINT	Number of collisions detected in a packet transmission later than 512-bit time	—
			Excessive Collisions	UDINT	Number of frames that failed to be transmitted due to excessive collisions	—
			MAC Transmit Errors	UDINT	Number of frames that failed to be transmitted due to an internal MAC sublayer transmission error	—
			Carrier Sense Errors	UDINT	Number of times the career sense condition was lost or not asserted when an attempt to transmit a frame was made	—
			Frame Too Long	UDINT	Number of incoming frames exceeding the maximum frame size	—
			MAC Receive Errors	UDINT	Number of frames that failed to be received on the interface due to an internal MAC sublayer transmission error	—
	6	Get/Set	Interface Control	Following structures	Physical interface setting	—
			Control Bits	WORD	Interface management bit	—
			Forced Interface Speed	UINT	Operation speed forced by the interface	—
	7	Get	Interface Type	USINT	Type of interface: Twisted pair, fiber, inside, or others	—
	8	Get	Interface State	USINT	Current status of interface: In operation, disabled, and others	—
	9	Set *1	Admin State	USINT	Management status: Enabled, disabled	—
	10	Get	Interface Label	SHORT_STRI NG	User-recognizable identifier	—
	11	Get	Interface Capability	Following structures	Interface function	—
			Capability Bits	DWORD	Interface function other than speed/duplex communication	—
			Speed/Duplex Options	Following structures	Speed/duplex communication pair supported by the Interface Control attribute	—
				USINT	Number of elements in the speed/duplex communication array	—
				Array of the following structure	Array of the speed/duplex communication	—
				UINT	Interface speed Unit: Mbps	—
				USINT	Duplex communication interface mode 0: Half-duplex 1: Full-duplex	—

*1 When the Set_Attribute_Single service is executed during the I/O communication, a general status code: 10h (Device state conflict) is returned.

Ins ID	Attr ID	Range	Units	Non-volatile memory	Parameter
0	1	0004h to 0004h	—	Impossible	—
	2	0002h to 0002h			
	3	0002h to 0002h			
	6	0007h to 0007h			
	7	000Ah to 000Ah			
1	1	00000000h to 00000064h	Mbps		
	2	00000000h to 0000007Fh	—		
	3	—			
	4	—			
	5	—			
	6	—		Possible	[Pr. NPC05] [Pr. NPC06]
	7	01h to 02h		Impossible	—
	8	00h to 03h			
	9	00h to 02h			
	10	—			
	11	—			

This instance supports the following services.

• When Ins ID is 0

Service Code	Name	Description
01h	Get_Attribute_All	Reads the values of all attributes.
0Eh	Get_Attribute_Single	Reads the value of the specified attribute.

• When Ins ID is other than 0

Service Code	Name	Description
01h	Get_Attribute_All	Reads the values of all attributes.
0Eh	Get_Attribute_Single	Reads the value of the specified attribute.
10h	Set_Attribute_Single	Writes the value to the specified attribute.
4Ch	Get_And_Clear	Acquires Interface Counters or Media Counters and then clears it. This service supports only the Interface counters attribute and Media counters attribute. After reading the specified attribute value, this service sets the value to "0".

Interface Flags

bit	Name	Definition	
0	Link Status	Indicates whether the IEEE802.3 communication interface is connected to an active network. "0" indicates an inactive link, and "1" indicates an active link.	
1	Half/Full Duplex	Indicates the currently used duplex mode. "0" indicates half-duplex, and "1" indicates full-duplex. When the Link Status flag is "0", this bit is undefined.	
2 to 4	Negotiation Status	0	Auto negotiation in progress
		1	Auto negotiation and speed detection using the default settings of the speed and duplex mode have failed.
		2	Even though auto negotiation using the default value of duplex has failed, the speed has been successfully detected.
		3	Negotiation of speed and duplex mode has succeeded.
		4	Auto negotiation is not attempted. The values of Forced Duplex Mode and Forced Interface Speed are used.
5	Manual Setting Requires Reset	When this bit is "0", it indicates that the change in Interface Control (Attr ID: 6) is automatically enabled, and resetting the device is not required. When this bit is "1", it indicates that resetting the device is required to enable the change.	
6	Local Hardware Fault	When this bit is "0", it indicates that no malfunction of local hardware is detected by the interface. When this bit is "1", it indicates that a malfunction of local hardware is detected.	
7 to 31	Reserved	Reserved (always 0)	

Capability Bits

bit	Name	Definition
0	Manual Setting Requires Reset	When this bit is "0", it indicates that the change in Interface Control (Attr ID: 6) is automatically enabled, and resetting the device is not required. When this bit is "1", it indicates that resetting the device is required to enable the change.
1	Auto-negotiate	When this bit is "0", it indicates that the auto negotiation is not supported. When this bit is "1", it indicates that the auto negotiation is supported.
2	Auto-MDIX	When this bit is "0", it indicates that the operation of Auto-MDIX is not supported. When this bit is "1", it indicates that the operation of Auto-MDIX is supported.
3	Manual speed/duplex	When this bit is "0", it indicates that the manual setting of the speed/duplex communication is not supported. When this bit is "1", it indicates that the manual setting of the speed/duplex communication is supported.
4 to 31	Reserved	Reserved (always 0)

LLDP Management Object (Class ID: 109h)

The LLDP management object includes the management data of the LLDP protocol. Each Attribute is as follows.

Ins ID	Attr ID	Access	Name	Data Type	Description	Default
0	1	Get	Revision	UINT	Revision of this object	0001h
1	1	Set	LLDP Enable	Following structures	—	0
			LLDP Enable Array Length	UINT	Number of bits defined in the LLDP Enable Array member of this structure	—
			LLDP Enable Array	ARRAY of: BYTE	Enables the generation of LLDP frames both globally and for each port and processes the received LLDP frames globally.	—
	2	Set	msgTxInterval	UINT	Transmission intervals of LLDP frames from the device (in seconds)	30
	3	Set	msgTxHold	UINT	Multiplier of msgTxInterval to determine the value of TTL TLV to be sent to the neighboring devices	—
	4	Get	LLDP Datastore	WORD	Displays the acquisition method of the LLDP database supported by the device	1h (Bit: 0 = LLDP Data Table Object1)
	5	Set	Last Change	UDINT	Value of sysUpTime acquired at the time of the latest change in the entry of the local LLDP database (TTL is ignored)	—

Ins ID	Attr ID	Range	Units	Non-volatile memory	Parameter
0	1	0000h to FFFFh	—	Impossible	—
1	1	—		Possible	—
	2	0001h to 0E10h	s		—
	3	0001h to 0064h	—		—
	4	0001h to 0001h		Impossible	—
	5	00000000h to FFFFFFFFh	0.01 s		

This instance supports the following services.

- When Ins ID is 0

Service Code	Name	Description
0Eh	Get_Attribute_Single	Reads the value of the specified attribute.

- When Ins ID is other than 0

Service Code	Name	Description
0Eh	Get_Attribute_Single	Reads the value of the specified attribute.
10h	Set_Attribute_Single	Writes the value to the specified attribute.

LLDP Enable Array Length

bit	Name	Definition
0	Global Enable	0 = LLDP Tx and Rx Disabled, 1 = LLDP Tx and Rx Enabled (Default) When Global Enable (bit 0) is 0, transmission of all ports are stopped (other bits need to be ignored) and the received LLDP frames are ignored. When Global Enable (bit 0) is changed from "1" to "0", all the existing table entries are deleted.
1	Port 1 enable	0 = LLDP Tx Disabled, 1 = LLDP Tx Enabled (Default)
2	Port 2 enable	
3	Internal port (always set to 0)	—

LLDP Data Table Object (Class ID: 10Ah)

The LLDP data table object displays the records of all the adjoining LLDP implemented devices that are currently active according to the receive state machine of the LLDP protocol. Each Attribute is as follows.

Ins ID	Attr ID	Access	Name	Data Type	Description	Default
0	1	Get	Revision	UINT	Revision of this object	0001h
	2	Get	Max Instance	UINT	Maximum number of instances of the object currently being created at this class level of the device	8
	3	Get	Number of Instances	UINT	Number of object instances currently being created at this class level of the device	—

Ins ID	Attr ID	Access	Name	Data Type	Description	Default
1 to 8	1	Get	Ethernet Link Instance Number	UINT	Local instance No. of the Ethernet link object corresponding to the physical Ethernet port that received the LLDP frame to be input to this instance	—
	2	Get	MAC Address	ETH_MAC_ADDR	CIP MAC address, chassis ID, or the adjoining MAC address received from port ID TLV	—
	3	Get	Interface Label	SHORT_STRING	CIP interface label, chassis ID, or the adjoining interface label received from port ID TLV	—
	4	Get	Time to Live	UINT	Number of seconds after which the adjoining information is regarded as enabled	— (0 = Reserved, 1 to 65535 = Time To Live (in seconds))
	5	Get	System Capabilities TLV	Following structures	The system function field includes a bit map of the function that defines the main functions of the adjoining system.	—
			System Capabilities	WORD	Function supported by the adjoining device based on the firmware currently loaded	—
			Enabled Capabilities	WORD	Function currently enabled in the adjoining device	—
	6	Get	IPv4 Management Addresses	Following structures	IPv4 management address of the adjoining device	—
			Management Address Count	USINT	Number of implementation management addresses	—
			Management Address	ARRAY of UDINT	IPv4 management address of the adjoining device	—
	7	Get	CIP Identification	Following structures	CIP identification TLV of the adjoining device (when it exists)	—
			Vendor ID	UINT	—	—
			Device Type	UINT	—	—
			Product Code	UINT	—	—
			Major Revision	BYTE	—	—
			Minor Revision	USINT	—	—
			CIP Serial Number	UDINT	—	—
	8	Get	Additional Ethernet Capabilities	Following structures	TLV of the Ethernet preemption support from the adjoining device	—
			Preemption Support	BOOL	—	—
			Preemption Status	BOOL	—	—
			Preemption Active	BOOL	—	—
			Additional Fragment Size	USINT	—	—
	9	Get	Last Change	UDINT	Value of sysUpTime acquired at the time of the latest change in any of the attributes of this instance	—

Ins ID	Attr ID	Range	Units	Non-volatile memory	Parameter
0	1	0000h to FFFFh	—	Impossible	—
1	1	0001h to 0002h			
	2	—			
	3				
	4	0000h to FFFFh	s		
	5	—	—		
	6				
	7				
	8				
	9	00000000h to FFFFFFFFh	0.01 s		

This instance supports the following services.

• When Ins ID is 0

Service Code	Name	Description
0Eh	Get_Attribute_Single	Returns the contents of the specified attribute.
11h	Find_Next_Object_Instance	The specified class searches for and returns the list of instance IDs of the existing instances in the LLDP data table object.

• When Ins ID is other than 0

Service Code	Name	Description
0Eh	Get_Attribute_Single	Returns the contents of the specified attribute.

Bitmap of Supported Capabilities and Enabled Capabilities

bit	Definition
0	Other
1	Repeater
2	Bridge
3	Access Point
4	Router
5	Telephone
6	DOCSIS Cable Device1
7	End Station
8	C-VLAN component1
9	S-VLAN component1
10	Two-port MAC Relay Component1
11 to 15	Reserved by IEEE

Drive Configuration Object (Class ID: 64h)

For details of objects available in this class, refer to the following manual.

MR-J5-G-N1/MR-J5W-G-N1 User's Manual (Object Dictionary)

• This object supports the following services.

Service Code	Name	Description
0Eh	Get_Attribute_Single	Reads the value of the specified attribute.
10h	Set_Attribute_Single	Writes the value to the specified attribute.

MEMO

PART 3 PROFINET

19 FUNCTIONS AND CONFIGURATION

20 STARTUP

21 PROFINET COMMUNICATION

22 PROFIdrive PROFILE

23 CiA 402 DRIVE PROFILE

24 PROFIdrive Parameter

19 FUNCTIONS AND CONFIGURATION

19.1 Outline

Point

When using PROFINET, set [Pr. PN13.0-3 Network protocol setting] to "1000h".

PROFINET is an automation communication standard defined by PROFIBUS & PROFINET International (PI).
The MR-J5_-_G_-_N1 servo amplifier operates as an IO Device compliant with the PROFINET standard.
It also supports two cyclic communication formats: the PROFIdrive profile and the CiA 402 drive profile.
The supported profiles and control methods are as follows:

PROFIdrive profile

The servo amplifier supports the following operation method of Application Class (AC).

AC	Operation method	Remarks
1	Standard Drive	This is a mode to drive motors by receiving a target speed command or a target torque command in the communication with an IO Controller.

CiA 402 drive profile

The servo amplifier supports the following control modes.

Control mode	Symbol	Remarks
Profile position mode	pp	This is a positioning control mode to drive servo motors by receiving an end position command in the communication with a controller. Use an absolute position address or a relative position address for the command.
Profile velocity mode	pv	This is a control mode to drive servo motors by receiving a target speed command in the communication with a controller.
Profile torque mode	tq	This is a control mode to drive servo motors by receiving a target torque command in the communication with a controller.
Point table mode	pt	This is a control mode to drive servo motors according to commands, such as travel distance and speed, which are stored in the point table number specified via communication with a controller. This control mode is not in CiA 402 standard (Mitsubishi Electric original).
JOG operation mode	jg	This is a control mode where the servo motor speed is set to drive the servo motor manually via communication with a controller. This control mode is not in CiA 402 standard (Mitsubishi Electric original).
Homing mode	hm	This is a control mode to perform homing with the method specified by the controller.

Applicable controllers

When using the MR-J5_-_G_-_N1 servo amplifier with PROFINET, the RJ71PN92 cannot be used. If you are considering using the MR-J5_-_G_-_N1 servo amplifier in combination with the RJ71PN92, contact your local sales office.

19.2 Function list

This list explains the PROFINET- and PROFIdrive-related functions that apply across multiple devices or to the overall system.

Category	Subcategory	Function	Description	Detailed explanation
Network	Open network	PROFINET	This protocol supports the PROFINET communication.	☞ Page 197 Communication specifications
		PROFIdrive	This protocol supports PROFIdrive.	☞ Page 211 Acyclic communication
	Remote maintenance	Firmware update	This function allows devices to update their firmware via a network. For details, contact your local sales office.	—
	Profile	GSDML	A file written in XML format that contains information about the basic functions of the device. It includes communication options and available diagnosis functions.	☞ Page 199 STARTUP
Application function	File transfer	FTP server function	This function can read/write/delete data on a per-file basis using the FTP commands.	—

19.3 Communication specifications

The communication specifications are shown in the following table.

Item		Description	Remarks
PROFINET communication specifications		PROFINET IO V2.4	—
Physical layer		100BASE-TX	—
Communication connector		Two RJ45 ports (port 1, port 2)	—
Communication cable	Cable type	Category 5e or higher, (double shielded/STP) straight cable	—
	Standard	One of the following standards must be met. • IEEE802.3 100BASE-TX • ANSI/TIA/EIA-568-B (Category 5e)	
	Connector	RJ-45 shielded connector	
Network topology		Line, star, ring, or hybrid of these three topology types	—
Communication speed		100 Mbps (Full duplex/half duplex)	—
Transmission distance between stations		Max. 100 m	—
Number of nodes		Compliance with the standard Ethernet specifications	The actual number of connected nodes depends on the IO controller specifications.
Byte order		Big Endian	—
Field bus devices		IO device with real-time (RT)	—
Cyclic Communication (Cyclic frame transmission) Cycle times		1 ms, 2 ms, 4 ms, 8 ms, 16 ms, 32 ms, 64 ms, 128 ms, 256 ms, 512 ms	—
PROFIdrive Parameter Access		Supported	—
Alarm/diagnosis		Supported	—
LED display		Network Status, Module Status, LINK/Activity (port 1, port 2)	—

19.4 Engineering software

The following explains the main purposes of the engineering software used in communication. For specific usages, refer to the manuals of the engineering software and controller.

Engineering software list

This list shows engineering software to be used.

Engineering software	Description
MR Configurator2	This software has the following functions: servo amplifier adjustment, monitor display, diagnosis, reading/writing of servo parameters, and test operation. These functions are performed using a personal computer. Parameter settings and test operation can also be performed via a controller. Settings, such as an IP address, stroke limit, absolute position detection system, and communication error detection time, are configured with this software.

20 STARTUP

For the startup procedures other than the network settings, refer to the following manuals.
MR-J5-G-N1/MR-J5W-G-N1 User's Manual (Introduction)
MR-J5D-G-N1 User's Manual (Introduction)

Point

[Pr. PN13.0-3 Network protocol setting] is set to "0100h" (EtherCAT) by default. When using PROFINET, change [Pr. PN13.0-3] to "1000h" (PROFINET).
The setting value of [Pr. PN13.0-3] can be automatically changed by setting the servo amplifier to the network switching mode to detect PROFINET communication automatically. For details, refer to "Network protocol switching methods" in the following manuals.
MR-J5-G-N1/MR-J5W-G-N1 User's Manual (Introduction)
MR-J5D-G-N1 User's Manual (Introduction)

20.1 Controller setting

Set up the controller by following its manual. An example set-up procedure is shown below.

1. GSDML file installation

Point

Use the latest GSDML file when setting up a controller. If the GSDML file is old, the latest functions may not be available, or control operation may not be performed. For the GSDML files usable with your servo amplifier, contact your local sales office.

Obtain the GSDML file for the servo amplifier and install it into the engineering software for controller project setting. For details on how to install, refer to the manual for the controller or engineering software to be used.
When the GSDML file is installed, the following devices are displayed and can be added to the controller project. Add the device corresponding to the machine model to the controller project and use it.

Device name on the engineering software	Model
MR-J5-G-N1-1Axis	MR-J5-_G_-RJN1 MR-J5-_G_-HSN1 MR-J5D1-_G_-N1
MR-J5-G-N1-2Axis	MR-J5W2-_G-N1 MR-J5D2-_G_-N1
MR-J5-G-N1-3Axis	MR-J5W3-_G-N1 MR-J5D3-_G_-N1

2. Station name setting

Point

- The station name of the servo amplifier is set to " " (empty string) by default. Set a unique station name for the servo amplifier within the PROFINET network to be used.
- When the station name of the servo amplifier is changed, check that it matches the station name set in the controller project. If the station names do not match, connection to the controller cannot be established.

Set the controller project so that the station name of the device added to the controller project matches the station name of the servo amplifier.

• How to set the station name of the servo amplifier

The station name of the servo amplifier can be set using a controller or [Pr. NPD05 Name of Station]. For details on how to set the station name using a controller, refer to the manual for the controller.

For available character strings for the station name of the servo amplifier, refer to "[Pr. NPD05_Name of Station]" in the following manual.

MR-J5-G/MR-J5W-G User's Manual (Parameters)

3. IP address setting

Point

- The IP address of the servo amplifier is set to "0.0.0.0" by default.
- When the IP address of the servo amplifier is changed, check that it matches the IP address set in the controller project. If the IP addresses do not match, connection to the controller cannot be established.
- If the IP address setting is configured in MR Configurator2, cycle the power and then connect to a PROFINET controller.

Set the controller project so that the IP address of the device added to the controller project matches the IP address of the servo amplifier.

• IP address setting of the servo amplifier

The IP address of the servo amplifier is determined by the rotary switch settings on the servo amplifier as follows.

Rotary switch	IP address setting value
00h	For manufacturer setting
01h	The IP address is set to "0.0.0.0" by default. If the IP address is set from either the controller or MR Configuration2, the set IP address is applied. When restored to the factory default settings, the IP address is set to "0.0.0.0".
02h to FEh	The fourth octet of the IP address set in [Pr. NPD02 IP Address] changes to the rotary switch setting value. When setting the IP address with rotary switches, set it in hexadecimal. The hexadecimal setting value is converted to decimal and set in the fourth octet.
FFh	For manufacturer setting

4. Telegram setting

For the device added to the controller project, change the telegram set for the submodule of the Drive Axis module to the telegram to be used.

The relationship between slots and axes is as follows.

Slot	Axis
1	A-axis
2 *1	B-axis
3 *2	C-axis

*1 Available in "MR-J5-G-N1-2Axis" and "MR-J5-G-N1-3Axis". Not available in "MR-J5-G-N1-1Axis".

*2 Available only in "MR-J5-G-N1-3Axis". Not available in "MR-J5-G-N1-1Axis" or "MR-J5-G-N1-2Axis".

The following submodules are set for Drive Axis by default. Set the telegram to be used for the submodule as required.

Slot	Sub Slot	Assigned submodule	Remarks
1 to 3	1	Parameter Access Point	Cannot be changed.
	2	Telegram 1	Set the main telegram. For the supported main telegrams, refer to the following. ☞ Page 205 Supported telegram
	3	Empty submodule	Cannot be changed.
	4	Empty submodule	Cannot be changed.

Establishing the communication

Start communication with the controller, then confirm that "r_ _" (the "_ _" part is the 4th octet of the set IP address) appears on the 7-segment LED display.

Follow the manual for the controller to be used when starting communication.

Operating the servo motor

Operate the servo motor at the lowest speed possible by giving commands to the servo amplifier from the controller, and check whether the servo motor operates correctly.
The following is an example procedure for operation using Standard Telegram 1 and Telegram 202.

Example procedure for operation using Telegram 1

1. Servo parameter setting

Use MR Configurator2 to set [Pr. PT01.1 Speed/acceleration/deceleration unit selection] to "0" (r/min). After the setting, cycle the power of the servo amplifier.

2. Acceleration/deceleration time constant setting

Set the acceleration and deceleration time during the speed control.
Set ample acceleration and deceleration time at first to prevent sudden changes in speed, and check the operation status.
Acceleration and deceleration time can be set in milliseconds using the following servo parameters or via the PNU.

Item	Servo parameter	PNU
Acceleration time constant	[Pr. PT49 Speed acceleration time constant]	[Profile acceleration (PNU24707)]
Deceleration time constant	[Pr. PT50 Speed deceleration time constant]	[Profile deceleration (PNU24708)]

3. Connection to a controller

Set Telegram 1 for the servo amplifier in the controller project. After the setting, write the controller project to the controller.
Connect the controller to the servo amplifier and start communication using Telegram 1.

4. Servo-on

Set the control command issued from the controller in Setpoint PZD1 [STW1 (Controlword1 (PNU1051))], then change the internal state of the servo amplifier to the servo-on state.
For details of the servo amplifier internal states, refer to the following.
☞ Page 216 State transition

5. Servo motor operation start

The servo motor is driven in speed control mode by specifying the desired speed command in Setpoint PZD2 [NSOLL_A (Speed setpoint (PNU1055))].

Example procedure for operation using Telegram 202

1. Connection to a controller

Set Telegram 202 for the servo amplifier in the controller project. After the setting, write the controller project to the controller. Connect the controller to the servo amplifier and start communication using Telegram 202.

2. Homing mode setting

Perform homing to perform operation in the profile position mode (pp). Set Setpoint PZD1 [Modes of operation (PNU24672)] to "6" (Homing mode), then confirm that Actual value PZD1 [Modes of operation display (PNU24673)] has changed to "6" (Homing mode).

3. Servo-on

Set the control command issued from the controller in Setpoint PZD2 [Controlword (PNU24640)], then change the internal state of the servo amplifier to the servo-on state.

For details of the servo amplifier internal states, refer to the following.

☞ Page 225 PDS state transition

4. Homing

Set a homing method in [Homing method (PNU24728)], then perform homing.

For details of homing, refer to "Homing mode (hm) and homing" in the following manual.

📖MR-J5 User's Manual (Function)

5. Profile position mode setting

Confirm that homing is complete, then change the control mode to the profile position mode (pp). Set Setpoint PZD1 [Modes of operation (PNU24672)] to "1" (Profile position mode), then confirm that Actual value PZD1 [Modes of operation display (PNU24673)] has changed to "1" (Profile position mode).

6. Servo motor operation start

The servo motor is driven in position control mode by specifying the position command in Setpoint PZD9.10 [Target position (PNU24698)].

Network disconnection procedure

To disconnect the network when stopping the operation of equipment, follow the procedure shown below.

1. Stop the servo motor.

2. Perform the following procedure to set the servo-off state.

• When using Telegram 1

Set the Off command in Setpoint PZD1 [STW1 (Controlword1 (PNU1051))]. For the Off command, refer to the following.

☞ Page 216 State transition

• When using Telegram 200, Telegram 202, and Telegram 203

Set the Shutdown command in Setpoint PZD2 [Controlword (PNU24640)]. For the Shutdown command, refer to the following.

☞ Page 225 PDS state transition

3. After confirming that the servo amplifier is in the servo-off state, set the controller to the STOP state.

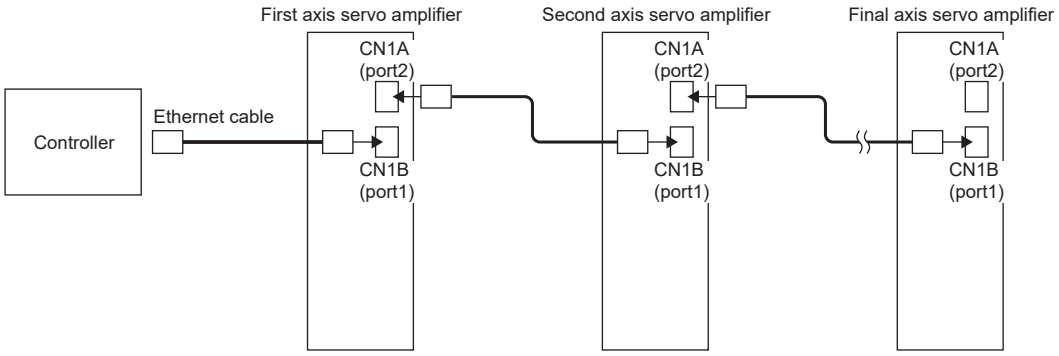
4. Shut off the power of the servo amplifier and the controller.

20.2 Ethernet cable connection

Point

- Use a twisted pair cable (double shielded) compliant with Ethernet Category 5e (100BASE-TX) or higher as an Ethernet cable. The maximum cable length between nodes is 100 m.
- CN1B indicates port 1. CN1A indicates port 2.

It is recommended to connect an Ethernet cable leading to the controller or servo amplifier of the front axis to CN1B and an Ethernet cable leading to the servo amplifier of the rear axis to CN1A, respectively. When not using CN1A, do not connect anything.



21 PROFINET COMMUNICATION

21.1 Cyclic communication

Cyclic communication is used to exchange process data in real time.
In Cyclic communication, command data and feedback data are transmitted and received as process data (PZD) between the controller and the servo amplifier at the specified communication cycle.
For the communication cycle that can be specified by Cyclic communication, refer to the following.
☞ Page 197 Communication specifications
The process data to be transmitted and received is determined by selecting a telegram in the controller. For details of the process data to be transmitted and received in each telegram, refer to the following.
☞ Page 206 Telegram mapping
In addition, for Telegram 202 and 203, users can freely set and use process data. Refer to the following for details.
☞ Page 207 Variable mapping

Supported telegram

For MR-J5_-_G-_N1 servo amplifiers, the following telegrams can be used.
For the process data of each telegram, refer to the following.
☞ Page 206 Telegram mapping
Select a telegram using the controller. For details of the setting method, refer to the manual of each controller.

• Main Telegram

Telegram	AC (ApplicationClass)	Name	Description
1	1	Standard Telegram 1	Telegram for applications that control the drive speed using a 16-bit Speed setpoint
200	—	Telegram 200	Telegram for applications that use torque control based on the CiA 402 drive profile
202	—	Telegram 202	Telegram for applications that switch among position control, speed control, torque control, and homing based on the CiA 402 drive profile. It supports variable mapping.
203	—	Telegram 203	Telegram for applications that use point tables, JOG operation, and homing based on the CiA 402 drive profile. It supports variable mapping.

Telegram mapping

The following shows the process data (PZD) to be mapped to each telegram. For details of the process data, refer to the following.

☞ Page 242 PROFIdrive Parameter

Standard Telegram 1

PZD	Setpoint		Actual value	
	Significance	Abbreviation	Significance	Abbreviation
1	Control word 1	STW1	Status word 1	ZSW1
2	Speed setpoint A	NSOLL_A	Speed actual value A	NIST_A

Telegram 200

PZD	Setpoint	Actual value
1	Controlword	Statusword
2	Target torque	Torque actual value

Telegram 202

PZD	Setpoint	Actual value
1	Modes of operation (8 bit)	Modes of operation display (8 bit)
	Reserved (8 bit)	Reserved (8 bit)
2	Controlword	Statusword
3	Control DI 1	Status DO 1
4	Control DI 2	Status DO 2
5	Control DI 3	Status DO 3
6	Target torque	Torque actual value
7	Torque slope	Digital inputs
8		
9	Target position	Position actual value
10		
11	Target velocity	Velocity actual value
12		
13	Velocity limit value	Following error actual value
14		
15	Profile velocity	Touch probe pos1 pos value
16		
17	Profile acceleration	Touch probe pos1 neg value
18		
19	Profile deceleration	Touch probe pos2 pos value
20		
21	Touch probe function	Touch probe pos2 neg value
22	—	
23	—	Touch probe status
24	—	—

Telegram 203

PZD	Setpoint	Actual value
1	Modes of operation (8 bit)	Modes of operation display (8 bit)
	Reserved (8 bit)	Reserved (8 bit)
2	Control word	Status word
3	Control DI 1	Status DO 1

PZD	Setpoint	Actual value
4	Control DI 2	Status DO 2
5	Control DI 3	Status DO 3
6	Target point table	Status DO 5
7	Profile velocity	Status DO 7
8		Torque actual value
9	Profile acceleration	Digital inputs
10		
11	Profile deceleration	Position actual value
12		
13	—	Velocity actual value
14	—	
15	—	Following error actual value
16	—	
17	—	Point demand value
18	—	Point actual value
19	—	M code actual value
20	—	—
21	—	—
22	—	—
23	—	—
24	—	—
25	—	—
26	—	—
27	—	—
28	—	—
29	—	—
30	—	—

Variable mapping

Telegram 202 and Telegram 203 support variable mapping.
The process data exchanged in the telegram can be customized using variable mapping.

Restrictions

The process data that can be mapped to Telegram 202 and Telegram 203 is the objects defined in the object dictionary. If an invalid Index is specified for mapping, [AL. 09E.B PDO Setting warning] occurs.
Process data is aligned on 2-byte boundaries. When mapping process data after a 1-byte process data item, set 8-bit padding (PNU0, Subindex 8) for alignment.
The maximum number of objects and the maximum number of bytes that can be mapped to Telegram 202 and Telegram 203 are as follows.

Item	Value
Telegram 202 Maximum size	Setpoint: 48 bytes Actual value: 48 bytes
Telegram 202 Maximum number of mappings	Setpoint: 24 Actual value: 24
Telegram 203 Maximum size	Setpoint: 60 bytes Actual value: 60 bytes
Telegram 203 Maximum number of mappings	Setpoint: 30 Actual value: 30

The following restrictions apply to the total number of bytes in the telegrams transmitted and received by the servo amplifier.

1-axis servo amplifier		2-axis servo amplifier		3-axis servo amplifier	
Setpoint [byte]	Actual value [byte]	Setpoint [byte]	Actual value [byte]	Setpoint [byte]	Actual value [byte]
60	60	108	120	144	162

Areas where no process data is mapped are not used. Do not reference areas where Actual value process data is not mapped.

Process data requiring mapping

The process data required for each mode is shown below.

■Setpoint

◎: Mapping required ○: Mapping recommended —: Mapping not required

Process data (PNU)	Mode					
	pp	pv	tq	pt	jg	hm
Controlword (24640)	◎	◎	◎	◎	◎	◎
Control DI 1 (11521) Gain switching	○	○	—	○	○	—
Control DI 2 (11522) Proportional control	○	—	—	○	○	○
Control DI 3 (11523)	○	○	○	○	○	○
Target position (24698)	◎	—	—	—	—	—
Target velocity (24831)	—	◎	—	—	—	—
Target torque (24689)	—	—	◎	—	—	—
Profile velocity (24705)	○	—	—	—	○	—
Profile acceleration (24707)	○	○	—	—	○	—
Profile deceleration (24708)	○	○	—	—	○	—
Torque slope (24711)	—	—	○	—	—	—
Velocity limit value (11552)	—	—	○	—	—	—
Target point table (11616)	—	—	—	◎	—	—

■Actual value

◎: Mapping required ○: Mapping recommended —: Mapping not required

Process data (PNU)	Mode					
	pp	pv	tq	pt	jg	hm
Statusword (24641)	◎	◎	◎	◎	◎	◎
Status DO 1 (11537)	○	○	○	○	○	○
Status DO 2 (11538)	○	○	○	○	○	○
Status DO 3 (11539)	○	○	○	○	○	○
Status DO 5 (11541)	—	—	—	○	○	—
Status DO 7 (11543)	—	—	—	○	○	—
Position actual value (24676)	○	○	○	○	○	○
Following error actual value (24820)	○	—	—	○	○	—
Velocity actual value (24684)	○	○	○	○	○	○
Torque actual value (24695)	○	○	○	○	○	○
Point actual value (11625)	—	—	—	○	○	—
M code actual value (11626)	—	—	—	○	○	—
Point demand value (11624)	—	—	—	○	○	—

Setting method

Set the following items from Device-specific parameters in the telegram setting.

Since the setting screen varies depending on the engineering software, refer to the manual of the engineering software.

The offset of the process data to be mapped is determined by the total size of the preceding process data entries, counted from n = 1.

Setting item *1	Value
PNU IN n	PNU and its Subindex of the process data to be mapped to Setpoint
PNU IN n Subindex	
PNU OUT n	PNU and its Subindex of the process data to be mapped to Actual value
PNU OUT n Subindex	

*1 "n" is an integer greater than or equal to 1.

Setting example

The following shows an example of configuring variable mapping.

Ex.

To add touch probe related objects ((1) to (6)) to Telegram 203, modify the process data as shown in the table below.

PZD	Setpoint	Actual value
1	Modes of operation (8 bit)	Modes of operation display (8 bit)
	Reserved (8 bit)	Reserved (8 bit)
2	Control word	Status word
3	Control DI 1	Status DO 1
4	Control DI 2	Status DO 2
5	Control DI 3	Status DO 3
6	Target point table	Status DO 5
7	Profile velocity	Status DO 7
8		Torque actual value
9	Profile acceleration	Digital inputs
10		
11	Profile deceleration	Position actual value
12		
13	Touch probe function (1)	Velocity actual value
14	—	
15	—	Following error actual value
16	—	
17	—	Point demand value
18	—	Point actual value
19	—	M code actual value
20	—	—
21	—	Touch probe 1 positive edge (2)
22	—	
23	—	Touch probe 1 negative edge (3)
24	—	
25	—	Touch probe 2 positive edge (4)
26	—	
27	—	Touch probe 2 negative edge (5)
28	—	
29	—	Touch probe status (6)
30	—	—

■Setpoint

Set the values for OUT11 and OUT11 Subindex as follows.

Leave the areas to which process data is not mapped unchanged (PNU 0, Subindex 0).

Setting item	Initial value	Setting value	Description
OUT1	24672	24672	PNU24672 and Subindex 0 are mapped (No change) ([Modes of operation (Obj. 6060h: 00h)])
OUT1 Subindex	0	0	
OUT2	0	0	8-bit padding for 2-byte alignment adjustment (No change)
OUT2 Subindex	8	8	
:	:	:	— (No change)
OUT10	24708	24708	PNU24708 and Subindex 0 are mapped (No change) ([Profile deceleration (Obj. 6084h: 00h)])
OUT10 Subindex	0	0	
OUT11	0	24760	PNU24760 and Subindex 0 are mapped (No change) ([Touch probe function (Obj. 60B8h: 00h)])
OUT11 Subindex	0	0	
OUT12	0	0	Empty area (No change)
OUT12 Subindex	0	0	
:	:	:	— (No change)

■Actual value

Set the values for IN17 to IN23 and IN17 Subindex to IN23 Subindex as follows.

Leave the areas to which process data is not mapped unchanged (PNU 0, Subindex 0).

Setting item	Initial value	Setting value	Description
IN1	24673	24673	PNU24673 and Subindex 0 are mapped (No change) ([Modes of operation display (Obj. 6061h: 00h)])
IN1 Subindex	0	0	
IN2	0	0	8-bit padding for 2-byte alignment adjustment (No change)
IN2 Subindex	8	8	
:	:	:	— (No change)
IN16	11626	11626	PNU11626 and Subindex 0 are mapped (No change) ([M code actual value (Obj. 2D6Ah: 00h)])
IN16 Subindex	0	0	
IN17	0	0	8-bit padding for 2-byte alignment adjustment
IN17 Subindex	0	8	
IN18	0	0	16-bit padding *1
IN18 Subindex	0	16	
IN19	0	24762	PNU24762 and Subindex 0 are mapped ([Touch probe 1 positive edge (Obj. 60BAh: 00h)])
IN19 Subindex	0	0	
IN20	0	24763	PNU24763 and Subindex 0 are mapped ([Touch probe 1 negative edge (Obj. 60BBh: 00h)])
IN20 Subindex	0	0	
IN21	0	24764	PNU24764 and Subindex 0 are mapped ([Touch probe 2 positive edge (Obj. 60BCh: 00h)])
IN21 Subindex	0	0	
IN22	0	24765	PNU24765 and Subindex 0 are mapped ([Touch probe 2 negative edge (Obj. 60BDh: 00h)])
IN22 Subindex	0	0	
IN23	0	24761	PNU24761 and Subindex 0 are mapped ([Touch probe status (Obj. 60B9h: 00h)])
IN23 Subindex	0	0	
IN24	0	0	Empty area (No change)
IN24 Subindex	0	0	
:	:	:	— (No change)

*1 This is an example of padding setting and does not need to be configured if padding is not used. Padding can be used, for example, to adjust the offset position of process data. To configure padding, set the PNU to "0" and specify the size in bits in Subindex. The supported sizes are 8 bits, 16 bits, and 32 bits.

21.2 Acyclic communication

Unlike Cyclic communication, Acyclic communication transfers data only when an explicit request, such as a parameter read or write operation, is issued.

PROFIdrive Parameter Access

Acyclic communication allows the controller to access the PROFIdrive parameters of the servo amplifier. For the PROFIdrive parameters of the servo amplifier, refer to the following.

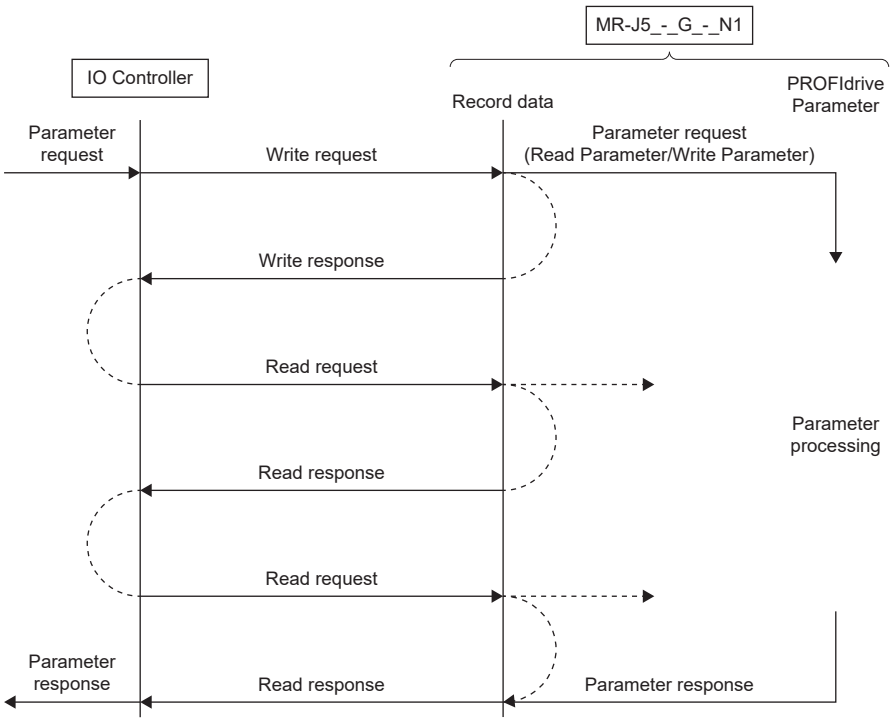
☞ Page 242 PROFIdrive Parameter

PROFIdrive parameter read and write operations are performed via Record data (Index: B02Eh).

First, transmit "Write Request" containing "PROFIdrive Parameter Request" to the target "Record data" from the controller. If "Write Response" indicates an error, send "Write Request" again. If "Write Response" indicates successful completion, transmit "Read Request" to the target "Record data" to receive "Read Response" containing "PROFIdrive Parameter Response". If the servo amplifier is processing the parameter, an error response will be returned. In this case, transmit "Read Request" again.

When transmitting consecutive "PROFIdrive Parameter Request" to the same target, retrieve "PROFIdrive Parameter Response" for the previously sent "PROFIdrive Parameter Request".

For how to transmit and receive "Write Request" and "Read Request", refer to the manual for the controller or engineering software to be used.



PROFIdrive Parameter Request/Response

The following shows the block structure of "PROFIdrive Parameter Request" and "PROFIdrive Parameter Response".
The total size of the "PROFIdrive Parameter Request" and "PROFIdrive Parameter Response" blocks, including Request header/Response header, must not exceed 240 bytes.

■PROFIdrive Parameter Request

The block structure is shown below.
When reading a parameter, set "Request ID" to "0x01" (Request parameter).
When writing a parameter, set "Request ID" to "0x02" (Change parameter).

Block Definition	Field	Size [byte]	Value
Request header	Request reference	1	0x01-0xFF
	Request ID	1	0x01: Request parameter 0x02: Change parameter
	Axis No./DO-ID	1	0x00 *1
	No. of parameters	1	0x01-0x27: number of parameters = i
1st Parameter address	Attribute	1	0x10: Value 0x20: Description
	No. of elements	1	0x00-0xEA: number of elements *3
	Parameter number	2	0x0000-0xFFFF: PROFIdrive Parameter number (PNU)
	Subindex	2	0x0000-0xFFFF: Subindex
i th Parameter address	…	…	…
1st Parameter Value *2	Format	1	☞ Page 213 Format
	No. of values	1	0x00-0xEA: number of values
	Values	—	Write value
i th Parameter Value *2	…	…	…

*1 The value of this field is invalid.
*2 The "Parameter Value" block is used only when Request ID is set to 0x02 (Change parameter).
*3 Specify the number of array elements to be accessed. For non-array parameters, set this value to "0".

■PROFIdrive Parameter Response

The block structure is shown below.
When "Response ID" is set to "0x80" (service not supported), review "Request ID" of Parameter Request.
When "Response ID" is set to "0x81" (Request parameter NG) or "0x82" (Change parameter NG), check each error value and review the contents in Parameter Request.

Block Definition	Field	Size [byte]	Value
Response header	Request reference	1	Request reference mirrored
	Response ID	1	Normal response 0x01: Request parameter OK 0x02: Change parameter OK Error response 0x80: service not supported 0x81: Request parameter NG 0x82: Change parameter NG
	Axis No./DO-ID	1	Axis No./DO-ID mirrored
	No. of parameters	1	0x01-0x27: number of parameters = i
1st Parameter Value *1	Format	1	☞ Page 213 Format
	No. of values	1	0x00-0xEA: number of values
	Values or Error values	1…253	Normal state: Read value Error state: ☞ Page 213 Error number
i th Parameter Value *1	…		…

*1 Use the "Parameter Value" block when Request ID is set to 0x01 (Request parameter) or when an error response with Response ID set to 0x81 or 0x82 is returned.

■Format

The value in the format field to be transmitted and received in "PROFIdrive Parameter Request" and "PROFIdrive Parameter Response" corresponds to the data type of PROFIdrive Parameter to be accessed. The format field values corresponding to each data type are shown below.

Value	Data type
0x01	Boolean
0x02	Signed8
0x03	Signed16
0x04	Signed32
0x05	Unsigned8
0x06	Unsigned16
0x07	Unsigned32
0x08	FloatingPoint32
0x09	VisibleString
0x0A	OctetString
0x37	Signed64
0x38	Unsigned64
0x40	Zero
0x41	Byte
0x42	Word
0x43	Double word
0x44	Error
0x71	N2
0x72	N4
0x73	V2
0x7B	X2
0x7C	X4

■Error number

When "Response ID" of "PROFIdrive Parameter Response" returns an error, store the following "Error No. " (Unsigned16) in the "Values or Error values" field.

Error No.	Name	Description
0x0000	Impermissible parameter number	Access to a non-existent PROFIdrive Parameter
0x0001	Parameter value cannot be changed	Writing to a non-writable PROFIdrive Parameter
0x0002	Low or high limit exceeded	Value out of range
0x0003	Faulty subindex	Access to a non-existent Subindex
0x0004	No array	Access to PROFIdrive Parameter without Subindex
0x0005	Incorrect data type	Data type mismatch
0x0007	Description element cannot be changed	Modification of non-changeable description element
0x000F	No text array available	Text element array does not exist
0x0011	Request cannot be executed because of operating state	Access restrictions depending on operating state
0x0014	Value impermissible	Modification of PROFIdrive Parameter with a value that is not permitted
0x0015	Response too long	The response exceeds the maximum transmission size.
0x0016	Parameter address impermissible	Invalid value, invalid number of elements, or invalid combination of PNU and Subindex
0x0017	Illegal format	Invalid format of PROFIdrive Parameter Request
0x0018	Number of values are not consistent	Mismatch between the numbers of elements in the write request and parameter
0x0019	Axis/DO nonexistent	Access to a non-existent axis
0x0021	Service not supported	Invalid request ID
0x00FF	Attempt to read to a write only parameter	A write-only parameter is read.

Reset To Factory

Point

Executing "Reset To Factory" writes data to the non-volatile memory. The memory area of the servo amplifier has a limited service life. Therefore, do not use this function frequently.

Executing "Reset To Factory" can reset the parameters to the factory default settings. For how to operate "Reset To Factory", refer to the manual for the controller or engineering software to be used.

The factory reset functions supported by the servo amplifier are as follows.

Reset Option	Description
2	Restores the communication settings (station name and IP address-related settings) to the factory default settings. • The station name is changed to " " (an empty string). • The IP address, subnet mask, and default gateway are changed to "0.0.0.0".
8	Restores the communication settings, servo parameters, point table, and network parameters to the factory default settings. • Software reset is performed. • The station name is changed to " " (an empty string). • The IP address, subnet mask, and default gateway are changed to "0.0.0.0". • The servo parameters are initialized. • The point table is initialized. • The network parameters are initialized. • The functional safety parameters are not initialized. *1

*1 Initialization of the functional safety parameters can be performed using "Initialize Password" in MR Configurator2. Refer to "Setting functional safety parameters" in the following manual.
MR-J5 User's Manual (Function)

PROFINET Alarm

Point

Do not use PROFINET Alarm to detect a servo motor stop. When an error occurs in the servo amplifier, an alarm or warning is generated. However, the servo amplifier sends PROFINET Alarm only when an alarm occurs. Therefore, even if the servo motor stops due to a warning, the servo amplifier does not send PROFINET Alarm.

When an error occurs in the servo amplifier, the following PROFINET Alarm is sent to the controller.

Channel Error Type	Meaning	Occurrence condition	Troubleshooting
0x0100	Manufacture specific	An alarm occurred.	Check the alarm number and remove the causes of the alarm or warning according to the following manual. MR-J5 User's Manual (Troubleshooting)

22 PROFIdrive PROFILE

22.1 Outline

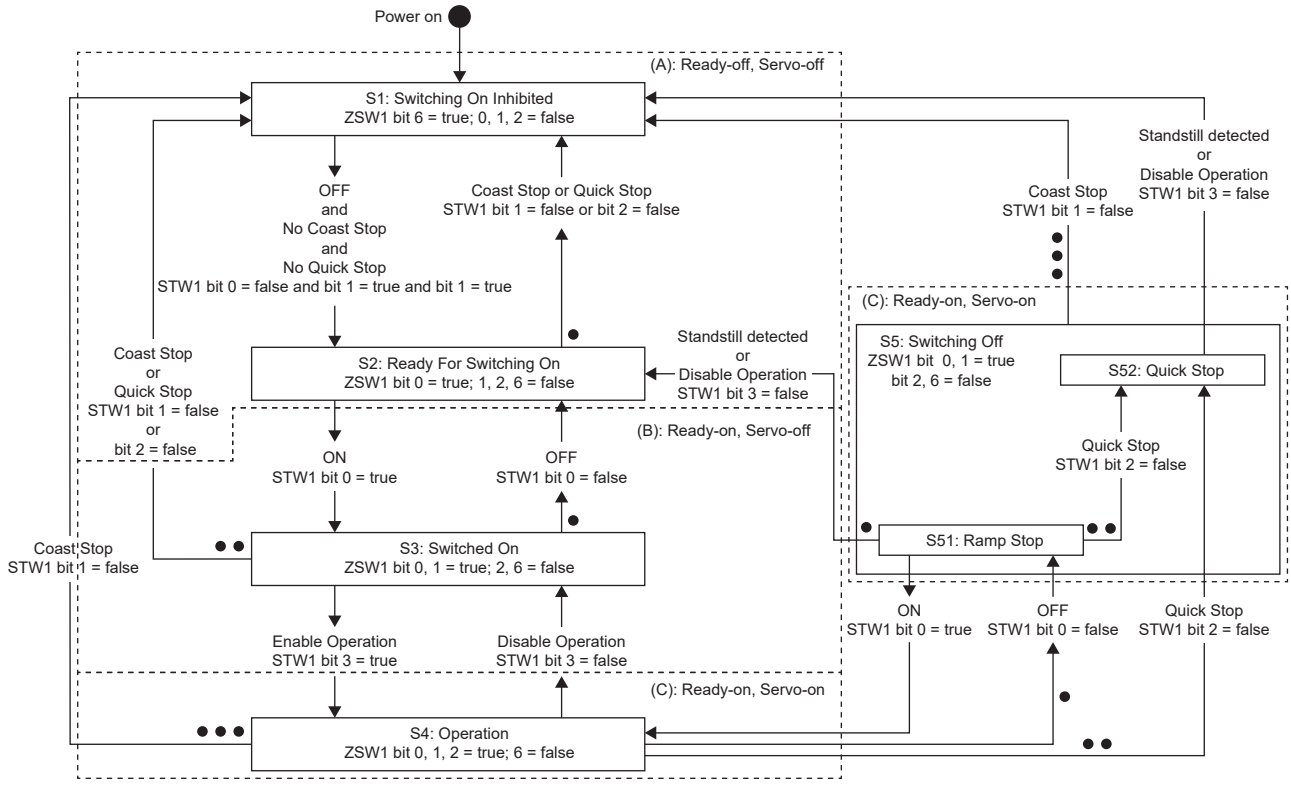
This chapter describes the PROFIdrive Drive Profile standards and subsets for the functions unique to the MR-J5_-_G-_N1 servo amplifier. Each function can be controlled by setting the PROFIdrive parameter via the network. For the basic functions and advanced functions of the MR-J5_-_G-_N1 servo amplifier, refer to the following manual.

📖MR-J5 User's Manual (Function)

22.2 State transition

General State Diagram

The internal state of the servo amplifier is managed by the state transition defined by PROFIdrive.
The transition conditions are shown in the following diagram (General State Diagram). After establishing connection with the controller, set Control word 1 Bit 10 (Control By PLC) to "1" (PLC enabled). The controller will then send commands (set Control word 1) and control the status.
Once the state transitions from "Switching On Inhibited", which is right after turning on the power supply, to "Operation", the servo motor becomes ready to operate.
Setting "Control word 1" enables control of the state transitions.
The state transition is supported in each axis of multi-axis servo amplifiers. On multi-axis servo amplifiers, ready-on is set when any one of the axes becomes "Switched on" and ready-off is set when all the axes become a state other than "Switched on", "Operation", "Ramp Stop", or "Quick Stop".



- ● indicates the priority. A greater number of ● symbols indicates a higher priority.
- "Standstill detected" indicates the motor stop (zero speed) state.
- "coast stop" is "Dynamic brake state after dynamic brake stop" because [Pr. PC37.0] is set to "0" by default. To stop the motor by coasting, set [Pr. PC37.0] to "1" (Coasting state after coasting stop). For details, refer to "Dynamic brake release function" in the following manual.

MR-J5 User's Manual (Function)

When an alarm occurs, bit 3 of Status Word 1 becomes "1" (Fault Present).
When bit 3 of Status Word 1 is "1", the state transition from "Switching On Inhibited" cannot be performed.
To resume operation, eliminate the cause of the alarm, and then either cycle the servo amplifier power supply or set "Fault Present" to "0" using Fault Acknowledge.

Warning

Some warnings cause the state to transition to "S1: Switching On Inhibited", "S2: Ready For Switching On", or "S52: quick stop" when the warning occurs to ensure safety, and the servo motor is automatically stopped. Warnings subject to automatic stop are indicated as "SD", "EDB", or "DB" in the motor stop method column of "List of alarm No./warning No." in the following manual.

📖MR-J5 User's Manual (Troubleshooting)

In this case, Status word 1 Bit 7 (Warning Present) will be "1", however, the servo motor will not follow commands.

To resume operation, eliminate the cause of the warning, and then follow the normal startup procedure.

22.3 Control word

By rewriting Control Word 1 and other parameters from the controller, commands can be given to switch states and control other functions provided by the servo amplifier.

control word 1

Bit	Name	Setting value	Description	Remarks
0	ON/OFF	0	OFF1	Executes ON/OFF. ☞ Page 216 State transition
		1	ON	Brings the servo amplifier into the ready-on state. When bit 3 is set to 1, the servo amplifier enters the servo-on state.
1	Coast Stop	0	Coast Stop (OFF2) enabled	Enables/disables Coast Stop. ☞ Page 216 State transition
		1	Coast Stop (OFF2) disabled	
2	Quick Stop	0	Quick Stop (OFF3) enabled	Enables/disables Quick Stop. ☞ Page 216 State transition
		1	Quick Stop (OFF3) disabled	
3	Enable Operation	0	Disable Operation	Enables/disables Enable Operation. ☞ Page 216 State transition
		1	Enable Operation	
4	The contents differ depending on the telegram type. For details, refer to each telegram.			
5				
6				
7	Fault Acknowledge *1	0 → 1	Fault Acknowledge	Executes "Fault reset" to clear the resettable alarm.
10	Control By PLC	0	Control by PLC disabled	Sets whether to accept the command from PLC.
		1	Control by PLC enabled	
11	The contents differ depending on the telegram type. For details, refer to each telegram.			
12				
13				
14				
15				

*1 To prevent commands from being missed during communication errors, when clearing an alarm, keep Fault Acknowledge with bit 7 set to "1" for the time specified below according to the communication cycle. After turning on bit 7, turn off bit 7.
When the communication cycle is less than 5 ms: 10 ms
When the communication cycle is 5 ms or more: Period which is twice the communication cycle
The above periods are specified to prevent the Fault Acknowledge command from being missed if a communication loss occurs.

22.4 Status word

The servo amplifier state machine and other drive states are notified to the controller through Status word 1 and other signals.

Status word 1

Bit	Name	Setting value	Description	Remarks
0	Ready To Switch On	1	Ready for ready-on	Indicates that preparation for ready-on is complete. ☞ Page 216 State transition
1	Ready To Operate	1	Ready-on	Indicates that the servo amplifier is in the ready-on state. ☞ Page 216 State transition
2	Operation Enabled	1	Motor drive start	Indicates that the motor is operating in response to a command.
3	Fault present	1	Fault detection	The bit turns on when an alarm occurs.
4	Coast Stop Not Activated	1	Coast Stop disabled	Indicates that Coast Stop is disabled. ☞ Page 216 State transition
5	Quick Stop Not Activated	1	Quick Stop disabled	Indicates that Quick Stop is disabled. ☞ Page 216 State transition
6	Switching On Inhibited	1	Switching on inhibited enabled	Indicates that the servo amplifier is in the Switching on inhibited state.
7	Warning Present	1	Warning detection	The bit turns on when a warning is detected.
8	The contents differ depending on the telegram type. For details, refer to each telegram.			
9	Control requested	1	Control by PLC enabled	Indicates that commands from the host controller can be accepted.
10	The contents differ depending on the telegram type. For details, refer to each telegram.			
11				
12				
13				
14				
15				

22.5 Operating mode

The servo amplifier is controlled in the operating mode corresponding to the selected telegram. The correspondence between operating modes and telegrams is shown in the following table.

Operating mode	ApplicationClass	Telegram
PROFIdrive Speed Control Mode	1	1
Manufacturer-specific Control Mode	—	200 *1
	—	202 *1
	—	203 *1

*1 "control word 1" and "status word 1" are not supported.

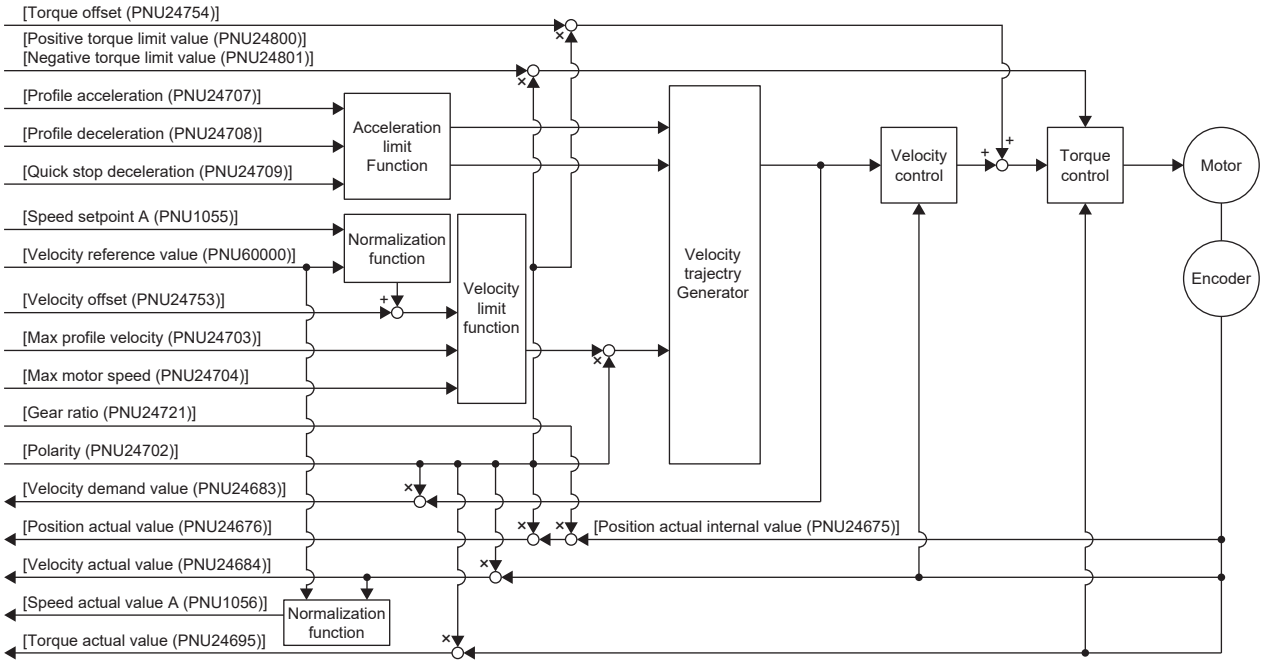
22.6 PROFIdrive Speed Control Mode

The speed is controlled using the PROFINET process data.

Standard Telegram 1

The following diagram shows the PROFIdrive parameters and Control word/Status word related to Standard Telegram 1.
For details of the PROFIdrive parameters other than Control word/Status word, refer to the following.

☞ Page 242 PROFIdrive Parameter



List of related PROFIdrive parameters

For details of the PROFIdrive parameters, refer to the following.

☞ Page 242 PROFIdrive Parameter

If the contents are divided by control mode in the User's Manual (Object Dictionary), refer to the contents for the profile velocity mode (PV).

PNU	Sub	Object	Name	Description
1051	—	VAR	Control word 1	Sets Control word 1.
1052	—	VAR	Status word 1	Returns Status word 1.
1055	—	VAR	Speed setpoint A	Sets the speed setting value A (16 bits).
1056	—	VAR	Speed actual value A	Returns the current speed A (16 bits).
24703	—	VAR	Max profile velocity	Maximum speed Unit: vel units
24704	—	VAR	Max motor speed	Servo motor maximum speed Unit: r/min, mm/s
24707	—	VAR	Profile acceleration	Acceleration at start of movement to target position Unit: acc units
24708	—	VAR	Profile deceleration	Deceleration at arrival to target position Unit: acc units
24709	—	VAR	Quick stop deceleration	Deceleration at deceleration to a stop with Quick stop Unit: acc units
24675	—	VAR	Position actual internal value	Current position Unit: Enc inc
24676	—	VAR	Position actual value	Current position Unit: pos units

PNU	Sub	Object	Name	Description
24683	—	VAR	Velocity demand value	Speed command (after trajectory generation) Unit: vel units
24684	—	VAR	Velocity actual value	Current speed Unit: vel units
24695	—	VAR	Torque actual value	Current torque Unit: 0.1% (with rated torque being 100%)
24722	0	ARRAY	Feed constant	Travel distance per revolution of an output shaft
	1		Feed	Travel distance setting Unit: pos units
	2		Shaft revolutions	Number of servo motor shaft revolutions Unit: rev
24800	—	VAR	Positive torque limit value	Torque limit value (forward) Unit: 0.1% (with rated torque being 100%)
24801	—	VAR	Negative torque limit value	Torque limit value (reverse) Unit: 0.1% (with rated torque being 100%)
24721	0	ARRAY	Gear ratio	Gear ratio
	1		Motor revolutions	Number of revolutions of the servo motor shaft (numerator)
	2		Shaft revolutions	Number of revolutions of the drive shaft (denominator)
24702	—	VAR	Polarity	Polarity selection Bit 7: Position POL Bit 6: Velocity POL Bit 5: Torque POL
24685	—	VAR	Velocity window	Speed error threshold for judging Target reached Unit: vel units
24686	—	VAR	Velocity window time	Target reached judgment time Unit: ms
24687	—	VAR	Velocity threshold	Zero speed threshold for judging Speed Unit: vel units
24688	—	VAR	Velocity threshold time	Speed judgment time Unit: ms
24744	—	VAR	SI unit position	SI unit position It is automatically set in [Pr. PT01.2 Unit for position data].
24745	—	VAR	SI unit velocity	SI unit velocity Returns the SI unit velocity. It is automatically set in [Pr. PT01.2 Unit for position data].
24753	—	VAR	Velocity offset	Velocity offset Unit: Vel units
24754	—	VAR	Torque offset	Torque offset Unit: 0.1% (with rated torque being 100%)
60000	—	VAR	Velocity reference value	Sets the 100% speed value of the N2/N4 normalized speed signals (NIST, NSOLL).

Restrictions

- When using Telegram 1, set [Pr. PT01.1 Acceleration unit selection] to "0". When Telegram 1 is used with [Pr. PT01.1] set to "1", [AL. 09E.C Communication data combination warning] occurs.
- When using Telegram 1, set [Pr. PA01.0 Control mode selection] to "0" (Network standard mode). When Telegram 1 is used with [Pr. PA01.0] set to a value other than "0", [AL. 09E.C Communication data combination warning] occurs.

Control word 1

By changing [Control word 1 (PNU1051)], control commands can be given to the servo amplifier.

Bit	Name	Setting value	Description	Remarks
0	☞ Page 217 Control word			
1				
2				
3				
4	Enable Ramp Generator	0	Reset Ramp Generator	When the setting value is "1", the servo motor operates according to the command. When the setting value is "0", the servo motor decelerates with a deceleration time constant of 0.
		1	Enable Ramp Generator	
5	Unfreeze Ramp Generator	0	Freeze Ramp Generator	When the setting value is "1", the servo motor operates according to the command. When the setting value is "0", the acceleration/deceleration processing is stopped, and the servo motor speed is fixed at the current speed.
		1	Unfreeze Ramp Generator	
6	Enable Setpoint	0	Disable Setpoint	When the setting value is "1", the servo motor operates according to the command. When the setting value is "0", the speed command is set to "0", and the servo motor decelerates according to the deceleration time constant.
		1	Enable Setpoint	
7	☞ Page 217 Control word			
8				
9				
10				
11	Reserved			
12				
13				
14				
15				

When bit 4, 5, and 6 of Control word 1 are all set to "0" simultaneously, they are processed according to the following priority order.

Priority	Bit	Function name
High	Bit 4	Reset Ramp Generator
Medium	Bit 5	Freeze Ramp Generator
Low	Bit 6	Disable Setpoint

Status word 1

The control status can also be checked with [Status word 1 (PNU1052)].

Bit	Name	Setting value	Description	Remarks
0	☞ Page 218 Status word			
1				
2				
3				
4				
5				
6				
7				
8	Speed Error Within Tolerance Range	1	Speed deviation within the tolerance range	The bit is turned on when the deviation between the command data and the feedback value is within the tolerance range.
9	☞ Page 218 Status word			
10	f Or n Reached Or Exceeded	1	Speed command reached	The bit is turned on when the servo motor speed reaches the speed command value.
11	Reserved			
12				
13				
14				
15				

22.7 Manufacturer-specific Control Mode

The servo amplifier is controlled in a manufacturer-specific mode.

Telegram 200

The servo amplifier operates in profile torque mode (tq) of the CiA 402 drive profile.
Set [Pr. PA01.0 Control mode selection] to "0". The control mode at power-on is the profile torque mode (tq).
For the CiA 402 drive profile, refer to the following.
☞ Page 224 CiA 402 DRIVE PROFILE
For the profile torque mode, refer to the following.
☞ Page 241 Control mode

Telegram 202

The servo amplifier operates in profile position mode (pp), profile velocity mode (pv), profile torque mode (tq), and homing mode (hm) of the CiA 402 drive profile. The control mode at power-on is the profile position mode (pp).
Set [Pr. PA01.0 Control mode selection] to "0".
For the CiA 402 drive profile, refer to the following.
☞ Page 224 CiA 402 DRIVE PROFILE
For each control mode, refer to the following.
☞ Page 241 Control mode

Telegram 203

The servo amplifier operates in point table mode (pt), JOG operation mode (jg), and homing mode (hm) of the CiA 402 drive profile.
Set [Pr. PA01.0 Control mode selection] to "6". The control mode at power-on is the point table mode (pt).
For the CiA 402 drive profile, refer to the following.
☞ Page 224 CiA 402 DRIVE PROFILE
For each control mode, refer to the following.
☞ Page 241 Control mode

23 CiA 402 DRIVE PROFILE

Point

- The speed unit is set to "command unit/s" by default. To change the speed unit to "r/min", set [Pr. PT01.1 Speed/acceleration/deceleration unit selection] to "0" (r/min).

23.1 Outline

This chapter describes the CiA 402 drive profile standards and subsets for the functions unique to the MR-J5_-_G-_N1 servo amplifier. Each function can be controlled by using the object dictionary via the network from PROFIdrive Parameter. For the basic functions and applicable functions of the MR-J5_-_G-_N1 servo amplifier, refer to the following manuals.

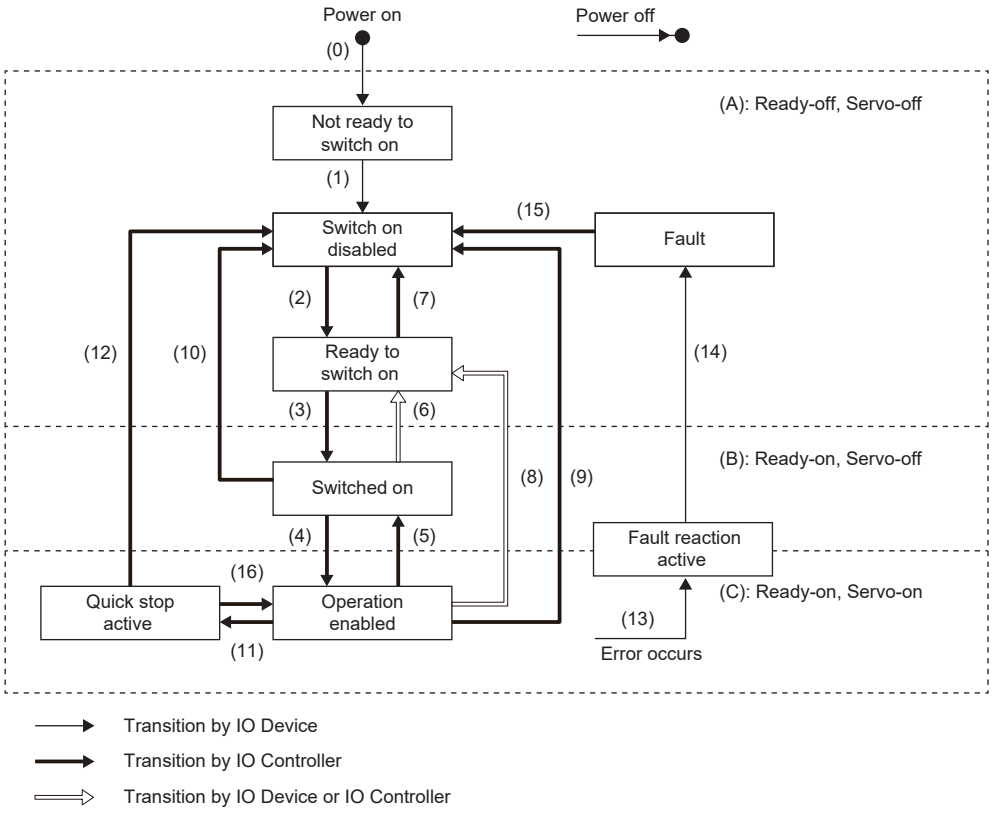
MR-J5 User's Manual (Function)

The following table lists specifications of the drive profile for the MR-J5_-_G-_N1 servo amplifier.

Function name	Description	Reference
Control mode	Control of the modes such as the position mode, speed mode, and torque mode	☞ Page 241 Control mode
PDS state transition	Control method until the servo motor is ready to operate.	☞ Page 225 PDS state transition
Controlword/Control DI	Control of the functions of the MR-J5-_G_-N1 servo amplifier.	☞ Page 228 Controlword/ Control DI
Statusword/Status DO	Monitoring of the functions of the MR-J5-_G_-N1 servo amplifier.	☞ Page 234 Statusword/Status DO

23.2 PDS state transition

The internal state of the servo amplifier is managed by the PDS state defined in the CiA 402 drive profile specification. The transition conditions of the PDS states are as follows. After the connection with the controller is established, the status is controlled by the controller transmitting commands (by setting Controlword) in accordance with the following table. Once the state transitions from "Not ready to switch on", which is right after turning on the power supply, to "Operation enabled", the servo motor becomes ready to operate.



Setting Controlword enables control of the state transitions.

The PDS state is supported in each axis of multi-axis servo amplifiers. On multi-axis servo amplifiers, RA turns on when any one of the axes becomes "Switch on" and RA turns off when all the axes become a state other than "Switch on", "Operation Enabled", or "Quick stop Active".

The following shows the PDS state transition events and operations when the dynamic brake release function is not used.

Transition No.	Event	Operation
(0)	Control circuit power supply is turned on	Initialization
(1)	Transitions automatically when the control circuit power supply is turned on	Communication setting
(2)	Transitions with the "Shutdown" command from the client	-
(3)	Transitions with the "Switch On" command from the client	The dynamic brake is released.
(4)	Transitions with the "Enable Operation" command from the client	The operation becomes ready after servo-on.
(5)	Transitions with the "Disable Operation" command from the client Transitions when RD (Ready) is turned off	The operation is disabled after servo-off.
(6)	Transitions with the "Shutdown" command from the client	The dynamic brake operates.
(7)	Transitions with the "Disable Voltage" command or "Quick Stop" command from the client	-
(8)	(A) Transitions with the "Shutdown" command from the client (B) Transitions when the main circuit power supply is turned off (C) Transitions after becoming servo-off (see the transition No. (5) if RD is turned off at the same time)	The operation is disabled after servo-off and dynamic braking.
(9)	Transitions with the "Disable Voltage" command from the client	The operation is disabled after servo-off and dynamic braking.
(10)	Transitions with the "Disable Voltage" command or "Quick Stop" command from the client	The dynamic brake operates.
(11)	(A) Transitions with the "Quick Stop" command from the client (B) Transitions when the forced stop signal is turned off *1	Quick Stop starts.
(12)	(A) Transitions automatically after the completion of Quick Stop (when the value of [Quick stop option code (PNU24666)] is any of "1", "2", "3", or "4") (B) Transitions with the "Disable Voltage" command from the client after completion of "Quick Stop" (C) Transitions when the main circuit power supply is turned off (when the value of [Quick stop option code] is any of "5", "6", "7", or "8")	The operation is disabled after servo-off and dynamic braking.
(13)	Alarm occurrence	The processing at the alarm occurrence is executed.
(14)	Automatic transition	After the completion of the alarm occurrence processing, the operation is disabled by servo-off or the dynamic brake.
(15)	Transitions with the "Fault Reset" command from the client	An alarm reset is performed. Resettable alarms are reset.
(16)	Transitions with the "Enable Operation" command from the client (when the value of [Quick stop option code] is any of "5", "6", "7", or "8")	The operation becomes ready after Quick Stop is canceled.

*1 This event occurs when "1" (Quick stop active) is selected in [Pr. PF29.1 State selection with forced stop in progress].

Correspondence between the command bit setting and the PDS state

0: Off 1: On —: Either on/off can be used

Command	Bit setting of Controlword command					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)
Fault Reset	0 → 1	—	—	—	—	(15)

To prevent commands from being missed during communication errors, keep the Fault Reset command with bit 7 set to "1" for the time specified below according to the communication cycle.

- When the communication cycle is less than 5 ms: 10 ms
- When the communication cycle is 5 ms or more: Period which is twice the communication cycle

The above periods are specified to prevent the Fault Reset command from being missed if a communication loss occurs once. Because communication losses occur frequently depending on the machine usage environment, adjust the period based on the environment.

To transition from the "Switch on disabled" state to the "Operation enabled" state, give the commands "Shutdown", "Switch On", and "Enable operation" sequentially. It is possible to transition directly from the current state to the target state with one command.

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

23.3 Controlword/Control DI

The PDS states can be switched and control instructions for various driving-related functions can be given by rewriting the Controlword and Control DI x objects from the controller.

Index (PNU)	Sub	Name	Type	Access	Description
6040h (24640)	—	Controlword	Unsigned 16	Read/Write	—
2D01h (11521)	—	Control DI 1	Unsigned 16	Read/Write	Object defined by Mitsubishi Electric
2D02h (11522)	—	Control DI 2	Unsigned 16	Read/Write	Object defined by Mitsubishi Electric
:	:	:	:	:	:

Bit definition of Controlword

Bit	Symbol	Description
0	SO	Switch On
1	EV	Enable Voltage
2	QS	Quick Stop
3	EO	Enable Operation
4	OMS	The contents differ depending on the setting of [Modes of operation (Obj. 6060h (24672))]. Refer to "Control mode [G]" in the following manual. MR-J5 User's Manual (Function)
5		
6		
7	FR	Fault Reset
8	HALT	0: Operation ready 1: Temporary stop
9	OMS	The contents differ depending on the setting of [Modes of operation]. Refer to "Control mode [G]" in the following manual. MR-J5 User's Manual (Function)
10	—	The value at reading is undefined. Set "0" when writing.
11	—	
12	—	
13	—	
14	—	
15	—	

Bit definition of Control DI

• Control DI 1

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined. Set "0" when writing.	—
1	—		—
2	—		—
3	—		—
4	C_CDP	Gain switching	Refer to "Signal (device) explanation" in the following manuals. MR-J5 User's Manual (Hardware) MR-J5D User's Manual (Hardware)
5	C_CLD	Fully closed loop selection	
6	—	The value at reading is undefined. Set "0" when writing.	—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Control DI 2

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined. Set "0" when writing.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	C_PC	Proportional control	Refer to "Signal (device) explanation" in the following manuals. MR-J5 User's Manual (Hardware) MR-J5D User's Manual (Hardware)
9	—	The value at reading is undefined. Set "0" when writing.	—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	C_ORST	Operation alarm reset Turning on C_ORST resets [AL. 0F4 Positioning warning].	—

• Control DI 3

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined. Set "0" when writing.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	C_ABS2	Homing completion (for scale measurement) The state "absolute position erased" of a scale measurement encoder can be canceled by turning on C_ABS2 with the scale measurement function. At this time, S_ABSV2 will turn off.	—
9	—	The value at reading is undefined. Set "0" when writing.	—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Control DI 4

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined. Set "0" when writing.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Control DI 5

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined. Set "0" when writing.	—
1	—		—
2	—		—
3	—		—
4	C_CDP2	Gain switching 2	Refer to "Signal (device) explanation" in the following manuals. MR-J5 User's Manual (Hardware) MR-J5D User's Manual (Hardware)
5	—	The value at reading is undefined. Set "0" when writing.	—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Control DI 6

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined. Set "0" when writing.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Control DI 7

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined. Set "0" when writing.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	C_OVR	Override selection	Refer to "Override function" in the following manual. MR-J5 User's Manual (Function)
8	—	The value at reading is undefined. Set "0" when writing.	—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Control DI 8

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined. Set "0" when writing.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Control DI 9

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined. Set "0" when writing.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Control DI 10

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined. Set "0" when writing.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

23.4 Statusword/Status DO

The Statusword objects and the Status DO x objects notify the controller of the PDS state and other drive states.

Index (PNU)	Sub	Name	Type	Access	Description
6041h (24641)	—	Statusword	Unsigned 16	Read	—
2D11h (11537)	—	Status DO 1	Unsigned 16	Read	Object defined by Mitsubishi Electric
2D12h (11538)	—	Status DO 2	Unsigned 16	Read	Object defined by Mitsubishi Electric
:	:	:	:	:	:

Bit definition of Statusword

Bit	Symbol	Description
0	RTSO	Ready To Switch On
1	SO	Switched On
2	OE	Operation Enabled
3	F	Fault
4	VE	Voltage-enabled 0: The bus voltage is lower than the specified (RA) level. 1: The bus voltage is equal to or higher than the specified level.
5	QS	Quick stop 0: In a Quick stop 1: Not in a Quick stop (including in the test mode)
6	SOD	Switch On Disabled
7	W	Warning 0: No warning has occurred. 1: A warning has occurred.
8	—	Reserved The value at reading is undefined.
9	RM	Remote 0: Not following the Controlword command. 1: Operating in accordance with the Controlword command.
10	OMS	Operation Mode Specific The contents differ depending on the setting of [Modes of operation (Obj. 6060h (24672))]. Refer to "Control mode [G]" in the following manual. MR-J5 User's Manual (Function)
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 pp, pv, hm, pt, or jg mode)
12	OMS	Operation Mode Specific The contents differ depending on the setting of [Modes of operation (Obj. 6060h (24672))]. Refer to "Control mode [G]" in the following manual. MR-J5 User's Manual (Function) "0" is set when in the test operation mode.
13		
14	—	Reserved The value at reading is undefined.
15		

State coding

Bit 0 to Bit 3, Bit 5, and Bit 6 are switched depending on the PDS state (servo amplifier internal state). Refer to the following table for details.

Statusword (bin)	PDS state
x0xx xxx0 x0xx 0000	Not ready to switch on *1
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

*1 Statusword is not sent when in the "Not ready to switch on" state.

Bit definition of Status DO

• Status DO 1

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined.	—
1	—		—
2	S_SA	Speed reached	Refer to "Signal (device) explanation" in the following manuals. MR-J5 User's Manual (Hardware) MR-J5D User's Manual (Hardware)
3	S_MBR	Electromagnetic brake interlock	
4	S_CDPS	Variable gain enabled	
5	S_CLDS	Fully closed loop control in progress	
6	—	The value at reading is undefined.	—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	S_INP	In-position	Refer to "Signal (device) explanation" in the following manuals. MR-J5 User's Manual (Hardware) MR-J5D User's Manual (Hardware)
13	S_TLC	Limiting torque	
14	S_ABSV	Absolute position erased	
15	S_BWNG	Battery warning	

• Status DO 2

Bit	Symbol	Description	Reference
0	S_ZPASS	Z-phase already passed After the Z-phase is passed, S_ZPASS turns on.	—
1	—	The value at reading is undefined.	—
2	—		—
3	S_ZSP	Zero speed detection	Refer to "Signal (device) explanation" in the following manuals. MR-J5 User's Manual (Hardware) MR-J5D User's Manual (Hardware)
4	S_VLC	Limiting speed	
5	—	The value at reading is undefined.	—
6	S_IPF	In IPF During instantaneous power failure, S_IPF is on.	—
7	—	The value at reading is undefined.	—
8	S_PC	Proportional control in progress S_PC is turned on under proportional control.	—
9	—	The value at reading is undefined.	—
10	S_DB	External dynamic brake output	—
11	—	The value at reading is undefined.	—
12	—		—
13	—		—
14	—		—
15	S_ZP2	Homing completion 2 When homing finishes successfully, S_ZP2 turns on.	—

• Status DO 3

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	S_STO	In the STO state S_STO turns on in the STO state.	Refer to "Monitor signal (digital) [G]" in the following manual. MR-J5 User's Manual (Function)
6	—	The value at reading is undefined.	—
7	—		—
8	S_ABSV2	Absolute position erased 2 (for scale measurement) When the absolute position of the scale measurement encoder is erased in the scale measurement function, S_ABSV2 turns on.	—
9	—	The value at reading is undefined.	—
10	—		—
11	S_MTTR	Tough drive in progress	Refer to "Tough drive function" in the following manual. MR-J5 User's Manual (Function)
12	—	The value at reading is undefined.	—
13	—		—
14	—		—
15	—		—

• Status DO 4

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Status DO 5

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined.	—
1	—		—
2	—		—
3	—		—
4	S_CDPS2	Variable gain enabled 2	Refer to "GAIN SWITCHING FUNCTION" in the following manual. MR-J5 User's Manual (Adjustment)
5	S_CPO	Rough match When the command remaining distance is less than the value of the rough match output range set in [Pr. PT12], S_CPO is on. This is not output during base circuit shut-off. When the servo amplifier is switched to the servo-on state, S_CPO switches on.	—
6	S_MEND	Traveling completion If droop pulses are within the in-position output range set in [Pr. PA10] and the command remaining distance is "0", S_MEND turns on. S_MEND turns on at servo-on. S_MEND is off in the servo-off state.	—
7	—	The value at reading is undefined.	—
8	—		—
9	—		—
10	S_PNLT	Open phase condition	Refer to "Disconnection/incorrect wiring detection function" in the following manual. MR-J5 User's Manual (Function)
11	—	The value at reading is undefined.	—
12	—		—
13	—		—
14	—		—
15	—		—

• Status DO 6

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Status DO 7

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined.	—
1	—		—
2	S_POT	Position range When the actual current position is within the range set in [Pr. PT19] and [Pr. PT21], S_POT is on. When homing is not complete or base circuit shut-off is in progress, S_POT is off.	—
3	—	The value at reading is undefined.	—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Status DO 8

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Status DO 9

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

• Status DO 10

Bit	Symbol	Description	Reference
0	—	The value at reading is undefined.	—
1	—		—
2	—		—
3	—		—
4	—		—
5	—		—
6	—		—
7	—		—
8	—		—
9	—		—
10	—		—
11	—		—
12	—		—
13	—		—
14	—		—
15	—		—

23.5 Control mode

Selecting control mode (Modes of operation)

Specify a control mode with [Modes of operation (Obj. 6060h (24672))]. [Modes of operation] can be rewritten with a PDO or an SDO. The available control modes are limited as follows depending on the setting value of [Pr. PT01.2].

○: Supported, —: Not supported

[Pr. PA01.0]	[Pr. PT01.2]	pp	pv	tq	hm	jg	pt	6061h Initial value
0 (Network standard mode)	2 (degree) 3 (pulse)	○	○	○	○	—	—	1 (pp)
6 (Positioning mode (point table method))	0 (mm) 1 (inch) 2 (degree) 3 (pulse)	—	—	—	○	○	○	-101 (pt)

Index (PNU)	Subindex	Name	Type	Access	Default value	Description
6060h (24672)	—	Modes of operation	Integer8	Read/Write	Varies depending on [Pr. PA01] and [Pr. PT01]	0: No mode change/No mode assigned 1: Profile position mode (pp) 3: Profile velocity mode (pv) 4: Profile torque mode (tq) 6: Homing mode (hm)
6061h (24673)	—	Modes of operation display	Integer8	Read	Varies depending on [Pr. PA01] and [Pr. PT01]	0: No mode assigned 1: Profile position mode (pp) 3: Profile velocity mode (pv) 4: Profile torque mode (tq) 6: Homing mode (hm)
6502h (25858)	—	Supported drive mode	Unsigned32	Read	0000002Dh	Bit = 1 for the following modes bit 0: Profile position mode bit 2: Profile velocity mode bit 3: Profile torque mode bit 5: Homing mode

Control switching

Point

Changes to the OMS Bit of [Controlword (Obj. 6040h (24640))] are not accepted until control switching finishes. Before inputting commands, check that the control mode has been switched by referring to [Modes of operation display (Obj. 6061h (24673))]. In addition, switch the control modes when the start command is turned off. (For example, when "Homing operation start" is turned off in hm mode.)

As there is a time lag in the control mode switching processing, the controller must keep sending the command value corresponding to the control mode until the mode is completely switched. After the completion of the control mode switching is confirmed by [Modes of operation display], the controller can stop updating the command value before switching.

Before switching to or from the position mode, select whether to perform it within the ZSP (zero speed detection) range in [Pr. PC76.1 ZSP disabled selection at control switching]. Whether the servo motor is in the zero speed state can be obtained by Bit 3 (S_ZSP) of [Status DO 2 (Obj. 2D12h (11538))].

If [Pr. PC76.1] is set to "0" (Enabled (control switching is performed within the range of ZSP)), [Modes of operation display] does not change because the control switching can be executed only in the zero speed state.

If [Pr. PC76.1] is set to "1" (Disabled (control switching is performed regardless of the range of ZSP)), a shock may occur at control switching.

24 PROFIdrive Parameter

For details of each PROFIdrive parameter, refer to the following according to PNU.

PNU	Index	Reference
0 to 999, 60000	0000h to 0383h, EA60h	☞ Page 242 List of PROFIdrive standard parameters
1000 to 4095	0384h to 0FFFh	☞ Page 246 List of PROFIdrive manufacture parameters
From 4096	From 1000h	☞ Page 248 Object dictionary (OD)

24.1 List of PROFIdrive standard parameters

The supported PROFIdrive standard parameters are as follows.

To read and write PROFIdrive standard parameters, use PROFIdrive Parameter Access.

Refer to the following for details.

☞ Page 211 PROFIdrive Parameter Access

The Mapping column indicates whether each item can be mapped to the transmitted and received data using the variable mapping function available with Telegrams 202 and 203. For details of the variable mapping function, refer to the following.

☞ Page 207 Variable mapping

PNU	PROFIdrive parameter name	Description
922	Telegram selection	Returns the currently used main telegram.
930	Operating mode	Returns the currently used control mode.
944	Fault message counter	Returns the counter value, which is incremented by one whenever the Fault number is updated.
947	Fault number	Returns the number of the current alarm.
964	Drive Unit identification data block	Returns the module information of the servo amplifier.
965	Profile identification number	Returns Profile Number and Version Number of the PROFIdrive.
975	DO identification	Returns the identification information of the drive object.
980	Number list of defined parameters	Returns a list of all supported PROFIdrive parameters.
60000	Velocity reference value	Sets the 100% speed value of the N2/N4 normalized speed signals (NIST, NSOLL).

24.2 Details of PROFIdrive standard parameters

[Telegram selection (PNU922)]

Data Type	Access	Mapping	Default	Range	Save
Unsigned16	Read	Impossible	1	Refer to the following.	Impossible

This parameter returns the currently used main telegram.

Setting value	Description
1	Standard telegram 1
200	Telegram 200
202	Telegram 202
203	Telegram 203

[Operating mode (PNU930)]

Data Type	Access	Mapping	Default	Range	Save
Unsigned16	Read	Impossible	1	Refer to the following.	Impossible

This parameter returns the currently used control mode.

Setting value	Description
1	PROFIdrive Speed Control Mode
32768	Manufacturer-specific mode

[Fault message counter (PNU944)]

Data Type	Access	Mapping	Default	Range	Save
Unsigned16	Read Only	Impossible	0	0 to 65535	Impossible

This parameter returns the counter value, which is incremented by one whenever the Fault number is updated.

[Fault number (PNU947)]

Data Type	Access	Mapping	Default	Range	Save
Array [n] Unsigned16	Read Only	Impossible	0	0 to 65535	Impossible

This parameter returns the number of the current alarm. "n" in Array [n] indicates the Subindex.

If an alarm occurs in the servo amplifier, the alarm number is stored in Array [0].

If no alarm occurs in the servo amplifier, "0" (No error) is set in Array [0].

Value	Description
0x0000	none
Other than 0x0000	Alarm number

Subindex

Subindex	Description
0	unacknowledged faults Indicates the current alarm number.
Other than 0	0 (fixed)

[Drive Unit identification data block (PNU964)]

Data Type	Access	Mapping	Default	Range	Save
Array [n] Unsigned16	Read Only	Impossible	—	—	Impossible

This parameter returns the module information of the servo amplifier. "n" in Array [n] indicates the Subindex.

Subindex

Subindex	Name	Setting value
0	Manufacturer	540 (Mitsubishi Electric Corporation)
1	Drive Unit type	0
2	Version (Software)	— For example, interpret "110" as V1.10.
3	Firmware date (year)	yyyy: year
4	Firmware date (day/month)	ddmm: day/month
5	Number of Drive Objects (DO)	1: 1-axis servo amplifier 2: 2-axis servo amplifier 3: 3-axis servo amplifier

[Profile identification number (PNU965)]

Data Type	Access	Mapping	Default	Range	Save
Octet string [2]	Read Only	Impossible	—	—	Impossible

This parameter returns Profile Number and Version Number of the PROFIdrive.

Octet string [n]	value
0	3 (PROFIdrive Profile)
1	42 (Version 4.2)

[DO identification (PNU975)]

Data Type	Access	Mapping	Default	Range	Save
Array [n] Unsigned16	Read Only	Impossible	—	—	Impossible

This parameter reads the identification information of the drive object. "n" in Array [n] indicates the Subindex.

Subindex

Subindex	Name	Setting value
0	Manufacturer	540 (Mitsubishi Electric Corporation)
1	DO Type	0
2	Version (Software)	— For example, interpret "110" as V1.10.
3	Firmware date (year)	yyyy: year
4	Firmware date (day/month)	ddmm: day/month
5	PROFIdrive DO type class	1 (Axis)
6	PROFIdrive DO sub class 1	1 (Application Class 1 supported)
7	Drive Object ID (DO-ID)	1: A-axis 2: B-axis 3: C-axis

[Number list of defined parameters (PNU980)]

Data Type	Access	Mapping	Default	Range	Save
Array [n] Unsigned16	Read Only	Impossible	—	—	Impossible

This parameter returns a list of all supported PROFIdrive parameters.
The PROFIdrive parameter numbers are assigned to each Subindex in ascending order.
When the displayed value is "0", it indicates that the end of the list has been reached.

[Velocity reference value (PNU60000)]

Data Type	Access	Mapping	Default	Range	Save
float32	Read Only	Impossible	—	—	possible

The setting value of this PNU is the 100% speed value of the N2/N4 normalized speed signals (NIST, NSOLL).
The speed value is in [r/min] when [PA01.1 Operation mode selection] is set to a mode other than the linear servo motor control mode, and is in [m/min] when the linear servo motor control mode is selected.
For details, refer to the following manual.
📖MR-J5-G/MR-J5W-G User's Manual (Parameters)
For the N2/N4 normalized speed signals, refer to the following.
☞ Page 247 [Speed setpoint A (PNU1055)]
☞ Page 247 [Speed actual value A (PNU1056)]
This PNU corresponds to [Pr. PV41 Speed reference value].

24.3 List of PROFIdrive manufacture parameters

The supported PROFIdrive manufacturer parameters are as follows.

To read and write PROFIdrive manufacture parameters, use PROFIdrive Parameter Access.

Refer to the following for details.

☞ Page 211 PROFIdrive Parameter Access

The Mapping column indicates whether each item can be mapped to the transmitted and received data using the variable mapping function available with Telegrams 202 and 203. For details of the variable mapping function, refer to the following.

☞ Page 207 Variable mapping

PNU	PROFIdrive parameter name	Description
1051	Control word 1	Sets Control word 1.
1052	Status word 1	Returns Status word 1.
1055	Speed setpoint A	Sets the speed setting value A (16 bits).
1056	Speed actual value A	Returns the current speed A (16 bits).
2051	f or n Reached Or Exceeded level	Sets the speed level at which "f Or n Reached Or Exceeded" turns on.
2052	f or n Reached Or Exceeded time	Sets the filter time required for "f Or n Reached Or Exceeded" to turn on.
2058	Speed Error Within Tolerance Range value	Sets the speed level for "Speed Error Within Tolerance Range".
2059	Speed Error Within Tolerance Range hysteresis	Sets the hysteresis for "Speed Error Within Tolerance Range".
2060	Speed Error Within Tolerance Range time	Sets the off-delay time for "Speed Error Within Tolerance Range".

24.4 Details of PROFIdrive manufacture parameters

[Control word 1 (PNU1051)]

Data Type	Access	Mapping	Default	Range	Save
Unsigned16	Read/Write	Setpoint	0000h	0000h to FFFFh	Impossible

For details of the PROFIdrive parameter of Control word 1, refer to the following.

☞ Page 217 control word 1

[Status word 1 (PNU1052)]

Data Type	Access	Mapping	Default	Range	Save
Unsigned16	Read	Actual value	0000h	0000h to FFFFh	Impossible

For details of the PROFIdrive parameter of Status word 1, refer to the following.

☞ Page 218 Status word 1

[Speed setpoint A (PNU1055)]

Data Type	Access	Mapping	Default	Range	Save
signed16	Read/Write	Setpoint	0	-32768 to 32767	Impossible

Set the speed setting value A.

When "16384" is set, the setting value is 100% of the speed specified by [Velocity reference value (PNU60000)].

[Speed actual value A (PNU1056)]

Data Type	Access	Mapping	Default	Range	Save
signed16	Read	Actual value	0	-32768 to 32767	Impossible

The current speed A is returned.

When "16384" is set, the speed feedback is 100% of the speed specified by [Velocity reference value (PNU60000)].

[f or n Reached Or Exceeded level (PNU2051)]

Data Type	Access	Mapping	Default	Range	Save
unsigned32	Read/Write	Setpoint	0	0 to 2147483647	possible

Set the speed level for bit 10 (f Or n Reached Or Exceeded) of [Status word 1 (PNU1052)] in units of 0.01 r/min or 0.01 mm/s.

When the absolute value of the servo motor speed is greater than or equal to the value set for this PNU and the time specified by [f Or n Reached Or Exceeded Time (PNU2052)] has elapsed, "f Or n Reached Or Exceeded" turns on. If this PNU is set to "0", "f Or n Reached Or Exceeded" remains on at all times.

This PNU corresponds to [Pr. PV36 f or n Reached Or Exceeded output level].

[f or n Reached Or Exceeded time (PNU2052)]

Data Type	Access	Mapping	Default	Range	Save
unsigned32	Read/Write	Setpoint	0	0 to 65535	possible

Set the filter time for bit 10 (f Or n Reached Or Exceeded) of [Status word 1 (PNU1052)] in milliseconds.

When the absolute value of the servo motor speed exceeds [f or n Reached Or Exceeded level (PNU2051)] and the time specified by this PNU has elapsed, "f Or n Reached Or Exceeded" turns on.

This PNU corresponds to [Pr. PV37 f or n Reached Or Exceeded output filter time].

[Speed Error Within Tolerance Range value (PNU2058)]

Data Type	Access	Mapping	Default	Range	Save
unsigned32	Read/Write	Setpoint	0	0 to 2147483647	possible

Set the speed level for "Speed Error Within Tolerance Range" in units of 0.01 r/min or 0.01 mm/s.
When the difference between the setting value of this PNU and the current speed is greater than or equal to the value set for [Speed Error Within Tolerance Range hysteresis (PNU2059)], and the time specified by [Speed Error Within Tolerance Range time (PNU2060)] has elapsed, Bit 8 (Speed Error Within Tolerance Range) of [Status word 1 (PNU1052)] turns off.
If this PNU is set to "0", the speed level for "Speed Error Within Tolerance Range" is the speed command value.
This PNU corresponds to [Pr. PV38 Speed Error Within Tolerance Range speed].

[Speed Error Within Tolerance Range hysteresis (PNU2059)]

Data Type	Access	Mapping	Default	Range	Save
unsigned32	Read/Write	Setpoint	0	0 to 2147483647	possible

Set the hysteresis for "Speed Error Within Tolerance Range" in units of 0.01 r/min or 0.01 mm/s.
When the difference between the setting value of [Speed Error Within Tolerance Range value (PNU2058)] and the current speed is greater than or equal to the value set for this PNU, and the time specified by [Speed Error Within Tolerance Range time (PNU2060)] has elapsed, Bit 8 (Speed Error Within Tolerance Range) of [Status word 1 (PNU1052)] turns off.
If this PNU is set to "0", "Speed Error Within Tolerance Range" remains on at all times.
This PNU corresponds to [Pr. PV39 Speed Error Within Tolerance Range hysteresis].

[Speed Error Within Tolerance Range time (PNU2060)]

Data Type	Access	Mapping	Default	Range	Save
unsigned32	Read/Write	Setpoint	0	0 to 65535	possible

Set the off-delay time for "Speed Error Within Tolerance Range" in milliseconds.
When the difference between the setting value of [Speed Error Within Tolerance Range value (PNU2058)] and the current speed is greater than or equal to the value set for [Speed Error Within Tolerance Range hysteresis (PNU2059)], and the time specified by this PNU has elapsed, Bit 8 (Speed Error Within Tolerance Range) of [Status word 1 (PNU1052)] turns off.
This PNU corresponds to [Pr. PV40 Speed Error Within Tolerance Range off delay time].

24.5 Object dictionary (OD)

Various data held by the servo amplifier, such as control parameters, command values, and feedback values, is handled as objects composed of an object name, object type, data type, and other elements. The object data can be exchanged with the IO Controller as PROFIdrive parameters. The collection of these objects is called an object dictionary (OD).
The object dictionary also contains objects related to the CiA 402 drive profile.
In the servo amplifier, each object in the object dictionary can be accessed by specifying Number of parameter (PNU) assigned to the object.
For details of the object dictionary, refer to the following manual.
📖MR-J5-G-N1/MR-J5W-G-N1 User's Manual (Object Dictionary)
"Object dictionary" must be replaced with "PROFIdrive Parameter" in the notation. For details of alternative reading, refer to "Notation related to objects for each communication type" in the following manual.
📖MR-J5-G-N1/MR-J5W-G-N1 User's Manual (Object Dictionary)

24.6 Saving PROFIdrive parameters

Some of the PROFIdrive parameter data is saved in non-volatile memory, while other data is not. Use [Store parameters (PNU4112)] to save the PROFIdrive parameter data in non-volatile memory.
Whether each PROFIdrive parameter can be saved in non-volatile memory, refer to the following.
☞ Page 243 Details of PROFIdrive standard parameters
☞ Page 247 Details of PROFIdrive manufacture parameters
📖MR-J5-G-N1/MR-J5W-G-N1 User's Manual (Object Dictionary)

Store parameters

Writing "65766173h" (= "save" in reverse ASCII byte order) to [Save all parameters (PNU4112: 1)] saves the PROFIdrive parameter settings to the non-volatile memory of the servo amplifier.
It may take approximately 25 s for [Save all parameters (PNU4112: 1)] to save all parameters. Do not turn off the power supply during writing.
When [Save all parameters (PNU4112: 1)] is read, the values shown below are returned. Bit 0 is 0 during the save operation and 1 when the save operation is not in progress.

Bit	Description
0	0: Objects cannot be saved by the command (save operation in progress) 1: Objects can be saved by the command (save operation not in progress)
1	0: Not automatically saved

Precautions

To turn off the power supply after executing Store Parameters, make sure that the save operation is not in progress (Bit 0 is 1), and then turn off the power supply.

REVISIONS

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

Revision date	*Manual number	Description
January 2020	SH(NA)-030371ENG-A	First edition
July 2020	SH(NA)-030371ENG-B	■Added/edited: Section 1.3, Chapter 8 ■Deleted: Section 7.5
November 2020	SH(NA)-030371ENG-C	■The following functions are added and changed: Cyclic asynchronous mode, degree unit, identifying slave stations with node addresses ■Added/edited: Section 4.3, Section 6.1, Section 6.3, Section 7.4, Section 8.3
March 2021	SH(NA)-030371ENG-D	■The following function is added: Positioning mode (point table method) ■Edited: Section 1.1, Section 4.3, Section 4.5, Section 6.1, Section 7.3, Section 7.4
June 2021	SH(NA)-030371ENG-E	■The following drive unit is added: MR-J5D_-_G_ ■Edited: Section 2.1, Section 6.2, Section 7.2, Section 8.2
July 2022	SH(NA)-030371ENG-F	■The following functions are added: Ethernet over EtherCAT (EoE), Quick Stop, infinite feed function ■Edited: Section 1.2, Section 1.3, Section 7.3
January 2023	SH(NA)-030371ENG-G	■The following function is added: Override function ■The following function is changed: PDO Mapping ■Added/edited: Section 1.1, Section 3.1, Section 4.2, Section 7.2, Chapter 8, Section 9.2
July 2023	SH(NA)-030371ENG-H	■The following function is added: FSoE ■Added/edited: Section 2.1, Section 3.1, Section 4.3, Section 4.4, Section 9.3
January 2024	SH(NA)-030371ENG-J	■The following servo amplifier is added: MR-J5-_G_-HSN1 ■Added/edited: Section 9.3
January 2025	SH(NA)-030371ENG-K	■The following function is added: EtherNet/IP ■Added/edited: Section 3.1, Chapter 2
July 2025	SH(NA)-030371ENG-L	■Added/edited: Section 8.3, Section 14.3, Section 14.4
February 2026	SH(NA)-030371ENG-M	■The following function is added: CIP Safety ■The chapter structure is changed. ■Added/edited: Chapter 10, Section 11.4, Chapter 16 ■Deleted: Section 9.3
September 2026	SH(NA)-030371ENG-N	■The following function is added: PROFINET ■The following servo amplifier is added: MR-MD333G-N1 ■Added/edited: Differences in firmware versions and servo parameter initial values for MR-MD333G_, Unit of the object, Section 1.2, Section 1.3, Section 2.1, Section 3.1, Section 4.5, Section 6.1, Section 6.2, Section 7.2, Section 7.3, Section 7.4, Chapter 8, Chapter 10, Section 11.1, Section 11.3, Section 11.4, Section 15.1, Section 15.5, Chapter 17, PART 3

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WARRANTY

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 is repaired or replaced.

[Term]

For terms of warranty, please contact your original place of purchase.

[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;

1. a failure caused by your improper storing or handling, carelessness or negligence, etc., and a failure caused by your hardware or software problem
2. a failure caused by any alteration, etc. to the Product made on your side without our approval
3. a failure which may be regarded as avoidable, if your equipment in which the Product is incorporated is equipped with a safety device required by applicable laws and has any function or structure considered to be indispensable according to a common sense in the industry
4. a failure which may be regarded as avoidable if consumable parts designated in the instruction manual, etc. are duly maintained and replaced
5. any replacement of consumable parts (battery, fan, smoothing capacitor, etc.)
6. a failure caused by external factors such as inevitable accidents, including without limitation fire and abnormal fluctuation of voltage, and acts of God, including without limitation earthquake, lightning and natural disasters
7. a failure generated by an unforeseeable cause with a scientific technology that was not available at the time of the shipment of the Product from our company
8. any other failures which we are not responsible for or which you acknowledge we are not responsible for

2. 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 AC Servo, its applications should be those that may not result in a serious damage even if any failure or malfunction occurs in AC Servo, and a backup or fail-safe function should operate on an external system to AC Servo when any failure or malfunction occurs.

(2) Our 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.

(3) Mitsubishi Electric shall have no responsibility or liability for any problems involving programmable controller trouble and system trouble caused by DoS attacks, unauthorized access, computer viruses, and other cyberattacks.

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TRANSLATION OF THE ORIGINAL INSTRUCTIONS

SH(NA)-030371ENG-N(2609)MEE
MODEL:
MODEL CODE:

MITSUBISHI ELECTRIC CORPORATION

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Compliance with the indicated global standards and regulations is current as of the release date of this manual.