MITSUBISHI ELECTRIC

General-Purpose AC Servo

MITSUBISHI SERVO AMPLIFIERS & MOTORS
MELSERVO

Functional safety unit
MODEL

MR-D30

INSTRUCTION MANUAL

D

● Safety Instructions ●

Please read the instructions carefully before using the equipment.

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

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

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

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

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

1. To prevent electric shock, note the following

⚠ WARNING

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

2. To prevent fire, note the following

⚠ CAUTION

- ●Install the servo amplifier, servo motor, and regenerative resistor on incombustible material. Installing them directly or close to combustibles will lead to smoke or a fire.
- ●Always connect a magnetic contactor between the power supply and the main circuit power supply (L1/L2/L3) of the servo amplifier, in order to configure a circuit that shuts down the power supply on the side of the servo amplifier's power supply. If a magnetic contactor is not connected, continuous flow of a large current may cause smoke or a fire when the converter unit or servo amplifier malfunctions.
- ●Always connect a molded-case circuit breaker, or a fuse to each servo amplifier between the power supply and the main circuit power supply (L1/L2/L3) of the servo amplifier, in order to configure a circuit that shuts down the power supply on the side of the servo amplifier's power supply. If a molded-case circuit breaker or fuse is not connected, continuous flow of a large current may cause smoke or a fire when the servo amplifier malfunctions.
- ●When using the regenerative resistor, switch power off with the alarm signal. Otherwise, a regenerative transistor malfunction or the like may overheat the regenerative resistor, causing smoke or a fire.
- ●Provide adequate protection to prevent screws and other conductive matter, oil and other combustible matter from entering the servo amplifier, servo motor, and MR-D30.

3. To prevent injury, note the following

⚠ CAUTION

- ●Only the voltage specified in the Instruction Manual should be applied to each terminal. Otherwise, a burst, damage, etc. may occur.
- ●Connect cables to the correct terminals. Otherwise, a burst, damage, etc. may occur.
- ●Ensure that polarity (+/-) is correct. Otherwise, a burst, damage, etc. may occur.
- ●The servo amplifier heat sink, regenerative resistor, servo motor, etc., may be hot while the power is on and for some time after power-off. Take safety measures such as providing covers to avoid accidentally touching them by hands and parts such as cables.

4. Additional instructions

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

(1) Transportation and installation

⚠ CAUTION

- ●Transport the products correctly according to their mass.
- ●Stacking in excess of the specified number of product packages is not allowed.
- ●Do not hold the front cover when transporting the servo amplifier. Otherwise, it may drop.
- ●Install the servo amplifier and the servo motor in a load-bearing place in accordance with the Instruction Manual.
- ●Do not get on or put heavy load on the equipment. Otherwise, it may cause injury.
- ●The equipment must be installed in the specified direction.
- ●Leave specified clearances between the servo amplifier and the cabinet walls or other equipment.
- ●Do not install or operate the servo amplifier and MR-D30 which have been damaged or have any parts missing.
- ●Do not block the intake and exhaust areas of the servo amplifier and MR-D30. Otherwise, it may cause a malfunction.
- ●Do not drop or strike the servo amplifier, servo motor, and MR-D30. Isolate them from all impact loads.
- ●When you keep or use the equipment, please fulfill the following environment.

Item		Environment
Ambient temperature	Operation	0 °C to 55 °C (non-freezing)
	Storage	-20 °C to 65 °C (non-freezing)
Ambient humidity	Operation	5 %RH to 90 %RH (non-condensing)
	Storage	
Ambience		Indoors (no direct sunlight), free from corrosive gas, flammable gas, oil mist, dust, and dirt
Altitude		2000 m or less above sea level
Vibration resistance		5.9 m/s^2, at 10 Hz to 55 Hz (directions of X, Y and Z axes)

- ●When the product has been stored for an extended period of time, contact your local sales office.
- ●When handling the servo amplifier and MR-D30, be careful about the edged parts such as corners of them.

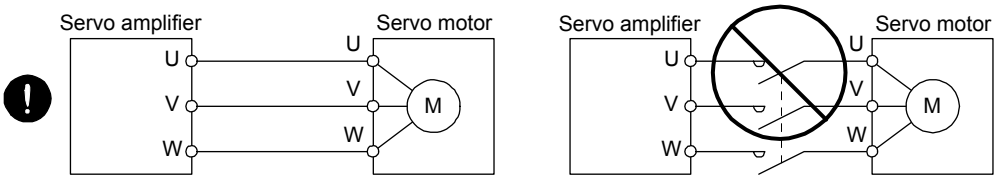
⚠ CAUTION

- The servo amplifier and MR-D30 must be installed in a metal cabinet.
- When fumigants that contain halogen materials such as fluorine, chlorine, bromine, and iodine are used for disinfecting and protecting wooden packaging from insects, they cause malfunction when entering our products. Please take necessary precautions to ensure that remaining materials from fumigant do not enter our products, or treat packaging with methods other than fumigation (heat method). Additionally, disinfect and protect wood from insects before packing products.

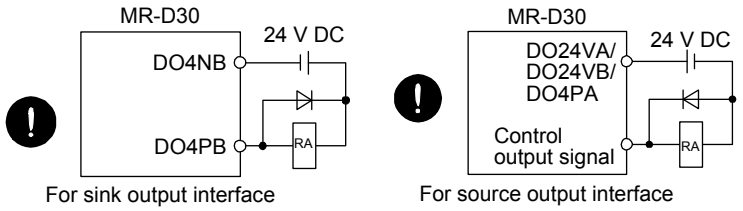
(2) Wiring

⚠ CAUTION

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



- The surge absorbing diode installed to the DC relay for control output signals should be fitted in the specified direction. Otherwise, the emergency stop and other protective circuits may not operate.



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

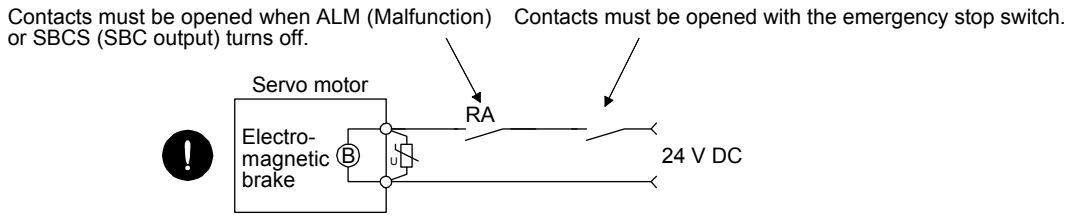
(3) Test run and adjustment

⚠ CAUTION
●Before operation, check the parameter settings. Improper settings may cause some machines to operate unexpectedly. ●Never make a drastic adjustment or change to the parameter values as doing so will make the operation unstable. ●Do not get close to moving parts during the servo-on status.

(4) Usage

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

(5) Corrective actions

⚠ CAUTION
●Ensure safety by confirming the power off, etc. before performing corrective actions. Otherwise, it may cause an accident. ●When it is assumed that a hazardous condition may occur due to a power failure or product malfunction, use a servo motor with an electromagnetic brake or external brake to prevent the condition. ●Configure an electromagnetic brake circuit which is interlocked with an external emergency stop switch.    ●When any alarm has occurred, eliminate its cause, ensure safety, and deactivate the alarm before restarting operation. ●Provide an adequate protection to prevent unexpected restart after an instantaneous power failure.

(6) Maintenance, inspection and parts replacement

⚠ CAUTION

- Make sure that the emergency stop circuit operates properly such that an operation can be stopped immediately and a power is shut off by the emergency stop switch.
- It is recommended that the servo amplifier be replaced every 10 years when it is used in general environment.
- When using a servo amplifier whose power has not been turned on for a long time, contact your local sales office.
- Do not touch the lead sections such as ICs or the connector contacts.
- Do not place the unit on metal that may cause a power leakage or wood, plastic or vinyl that may cause static electricity buildup.
- The parameters of MR-D30 are protected by passwords to prevent incorrect settings. The parameters of MR-D30 which are returned for fixing/investigation will be initialized. The parameters and other settings need to be set again.

(7) General instruction

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

(8) Conditions of use for the product

- MR-D30 complies with a safety standard, but this fact does not guarantee that MR-D30 will be free from any malfunction or failure. The user of this product shall comply with any and all applicable safety standard, regulation or law and take appropriate safety measures for the system in which the product is installed or used and shall take the second or third safety measures other than the product. Our company is not liable for damages that could have been prevented by compliance with any applicable safety standard, regulation or law.
- Our company prohibits the use of Products with or in any application involving, and we shall not be liable for a default, a liability for defect warranty, a quality assurance, negligence or other tort and a product liability in these applications.
  (1) Power plants
  (2) Trains, railway systems, airplanes, airline operations, and other transportation systems
  (3) Hospitals, medical care, dialysis and life support facilities or equipment
  (4) Amusement equipment
  (5) Incineration and fuel devices
  (6) Handling of nuclear or hazardous materials or chemicals
  (7) Mining and drilling
  (8) Other applications where the level of risk to human life, health or property are elevated.

● DISPOSAL OF WASTE ●

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

⚠ EEP-ROM life

The number of write times to the EEP-ROM, which stores parameter settings, etc., is limited to 100,000. If the total number of the following operations exceeds 100,000, MR-D30 may malfunction when the EEP-ROM reaches the end of its useful life.

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

«About the manual»

You must have this Instruction Manual and the following manuals to use this servo. Ensure to prepare them to use the servo safely.
Servo amplifiers and drive units are written as servo amplifiers in this Instruction Manual under certain circumstances, unless otherwise stated.

Relevant manuals

Manual name	Manual No.
MELSERVO MR-J4-_B_(-RJ) Servo Amplifier Instruction Manual (Note 5)	SH(NA)030106ENG
MELSERVO MR-J4-_A_(-RJ) Servo Amplifier Instruction Manual (Note 6)	SH(NA)030107ENG
MELSERVO MR-J4-_GF_(-RJ) Servo Amplifier Instruction Manual (Motion Mode) (Note 8, 9)	SH(NA)030218ENG
MELSERVO MR-J4-_GF_(-RJ) SERVO Amplifier Instruction Manual (I/O Mode) (Note 9)	SH(NA)030221ENG
MELSERVO MR-CV_/MR-CR55K_/MR-J4-DU_(-RJ) Amplifier Instruction Manual (Note 7)	SH(NA)030153ENG
MR-J4 Servo Amplifier Instruction Manual (Troubleshooting)	SH(NA)030109ENG
MELSERVO Servo Motor Instruction Manual (Vol. 3) (Note 1)	SH(NA)030113ENG
MELSERVO Linear Servo Motor Instruction Manual (Note 2)	SH(NA)030110ENG
MELSERVO Direct Drive Motor Instruction Manual (Note 3)	SH(NA)030112ENG
MELSERVO Linear Encoder Instruction Manual (Note 2, 4)	SH(NA)030111ENG
EMC Installation Guidelines	IB(NA)67310ENG

Note 1. It is necessary for using a rotary servo motor.
2. It is necessary for using a linear servo motor.
3. It is necessary for using a direct drive motor.
4. It is necessary for using a fully closed loop system.
5. It is necessary for using an MR-J4-_B_(-RJ) servo amplifier.
6. It is necessary for using an MR-J4-_A_(-RJ) servo amplifier.
7. It is necessary for using an MR-J4-DU_-RJ drive unit.
8. It is necessary for using an MR-J4-_GF_-RJ servo amplifier in the motion mode.
9. It is necessary for using an MR-J4-_GF_-RJ servo amplifier in the I/O mode.

«Cables used for wiring»

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

MEMO

CONTENTS

MEMO

1. FUNCTIONS AND CONFIGURATION

1.1 Summary

POINT
●Servo amplifiers and drive units are written as servo amplifiers in this Instruction Manual under certain circumstances, unless otherwise stated. ●If the combination of MR-D30 and servo amplifier is wrong, "ERROR" will turn on. ●The simple cam function cannot be used with a servo amplifier on which MR-D30 is mounted. ●When replacing MR-D30 with one having a different software version, check that the software version of MR-D30 supports the safety observation functions to prevent them from operating unintentionally. As necessary, disable the safety observation function.

This Instruction Manual only describes the functions of MR-D30. For servo amplifiers, refer to each servo amplifier instruction manual.
You can extend the safety observation function by using MR-D30 with a compatible servo amplifier or drive unit. However, which extension you can use depends on software version. The safety observation function cannot be used other than the following combinations. "ERROR" on the MR-D30 display will turn on with other combinations.

(1) Compatibility of servo amplifiers

(a) MR-J4-_GF_-RJ

1) Safety observation function control by input device

MR-D30 software version	Servo amplifier software version	Safety observation function	Servo motor with functional safety	Servo amplifier
A1 or later	A3 or later	STO/SS1/SBC/SLS/SSM/SOS/ SS2/SM	HG-KR_W0C HG-SR_W0C HG-JR_W0C	MR-J4-_GF_-RJ

2) Safety observation function control by network

MR-D30 software version	Servo amplifier software version	Safety observation function	Servo motor with functional safety	Servo amplifier
A2 or later	A3 or later	STO/SS1/SBC/SLS/SSM/SOS/ SS2/SM	HG-KR_W0C HG-SR_W0C HG-JR_W0C	MR-J4-_GF_-RJ

(b) MR-J4-(DU)B_-RJ/MR-J4-(DU)A_-RJ

MR-D30 software version	Servo amplifier software version	Safety observation function	Servo motor with functional safety	Servo amplifier
A0	B3 or later	STO/SS1/SBC/SLS/SSM/SM	Not compatible	MR-J4-_B_-RJ
A1 or later	B3/B4	STO/SS1/SBC/SLS/SSM	Not compatible	MR-J4-_B_-RJ
	B5 or later	STO/SS1/SBC/SLS/SSM/SOS/ SS2/SM	HG-KR_W0C HG-SR_W0C HG-JR_W0C	MR-J4-_B_-RJ MR-J4-_A_-RJ (Note) MR-J4-DU_B_-RJ MR-J4-DU_A_-RJ (Note)

Note. MR-J4-_A_-RJ manufactured in November, 2014 or later is supported.

(2) Characteristics of functions

(a) When using the safety observation function with wiring to the CN10_ connector of MR-D30 (Safety observation function control by input device)

By combination of MR-D30 functional safety unit, servo amplifier compatible with MR-D30, and servo motor with functional safety, the safety observation functions (STO/SS1/SBC/SLS/SSM/SOS/SS2) compatible with Category 4, PL e, SIL 3 can be used. When a servo motor with functional safety is not used, the SOS/SS2 functions are not available. The SLS/SSM functions are compatible with Category 3, PL d, SIL 2.

(b) When using the safety observation function through SSCNET III/H or CC-Link IE Field (Safety observation function control by network)

The safety observation function is available by combining MR-D30 with MR-J4-B_-RJ through SSCNET III/H, or with MR-J4-GF_-RJ through CC-Link IE Field. This ensures reduced wiring. (Refer to table 1.1.)

Table 1.1 Compatibility of safety observation function

<table>
<tr><th></th><th>Safety observation function control by network (CC-Link IE Field)</th><th>Safety observation function control by network (SSCNET III/H)</th><th>Safety observation function control by input device</th></tr>
<tr><td>Compatible controller</td><td>Safety Programmable Controller
R_SFCPU (Note 5)
+
Safety function module
R6SFM
+
Simple motion module
RD77GF_ (Note 6)</td><td>Drive safety integrated motion controller
Q173DSCPU
Q172DSCPU
+
Safety signal module
Q173DSXY</td><td></td></tr>
<tr><td>STO</td><td rowspan="3">Category 4, PL e, SIL 3</td><td rowspan="6">Category 3, PL d, SIL 2</td><td rowspan="3">Category 4, PL e, SIL 3 (Note 1)</td></tr>
<tr><td>SS1</td></tr>
<tr><td>SBC</td></tr>
<tr><td>SLS (Note 2)</td><td rowspan="2">Category 3, PL d, SIL 2
Category 4, PL e, SIL 3 (Note 3)</td><td rowspan="2">Category 3, PL d, SIL 2
Category 4, PL e, SIL 3 (Note 3)</td></tr>
<tr><td>SSM (Note 2)</td></tr>
<tr><td>SS2 (Note 2, 4)</td><td rowspan="2">Category 4, PL e, SIL 3</td><td rowspan="2">Category 4, PL e, SIL 3 (Note 1)</td></tr>
<tr><td>SOS (Note 2, 4)</td></tr>
</table>

Note 1. To meet Category 4, PL e, SIL 3 for input signals, a diagnosis using test pulses is required. Refer to section 4.1 for detailed conditions.

2. Linear servo system, direct drive servo system, and fully closed loop system are not compatible with SLS, SSM, SS2, and SOS. Table 1.2 shows safety observation functions compatible with each system.
3. To meet Category 4, PL e, SIL 3, a servo motor with functional safety is required.
4. To enable SS2 and SOS, a servo motor with functional safety is required.
5. A safety programmable controller with software version 07 or later is necessary.
6. A simple Motion module with software version 05 or later is necessary.

Table 1.2 Safety observation functions compatible with each system.

	System (Note)				
	Servo motor with functional safety	Servo motor	Full.	Lin.	DD
STO	○	○	○	○	○
SS1	○	○	○	○	○
SBC	○	○	○	○	○
SLS	○	○			
SSM	○	○			
SS2	○				
SOS	○				

○: Usable

Note. The systems indicate the following.

Servo motor with functional safety: Semi closed loop system using the servo motor with functional safety

Servo motor: Semi closed loop system using the servo motor

Full.: Fully closed loop system using the servo motor or servo motor with functional safety

Lin.: Linear servo motor system

DD: Direct drive motor system

1.2 Outline of safety observation function

The following functions can be used by MR-D30 functional safety unit.

(1) STO (Safe torque off)
Shuts off servo motor drive energy electronically with based on an input signal from an external device (secondary-side output shut-off). This corresponds to stop category 0 of IEC/EN 60204-1.

(2) SS1 (Safe stop 1)
Starts deceleration based on an input signal from an external device (EM2). After a specified time for the check of stop, the STO function will be activated (SS1). This corresponds to stop category 1 of IEC/EN 60204-1.

(3) SS2 (Safe stop 2)
Starts deceleration based on an input signal from an external device (EM2). After a specified time for the check of stop, the SOS function will be activated (SS2). This corresponds to stop category 2 of IEC/EN 60204-1.

(4) SOS (Safe operating stop)
Monitors whether the servo motor stops within the prescribed range for the stop position. The power is supplied to the servo motor.

(5) SLS (Safely-limited speed)
Observes whether the speed is within a regulated speed limit value. When the speed is over a specified speed, energy will be shut off by STO.

(6) SSM (Safe speed monitor)
Outputs a signal when the servo motor speed is within a regulated speed.

(7) SBC (Safe brake control)
Outputs a signal for an external brake control.

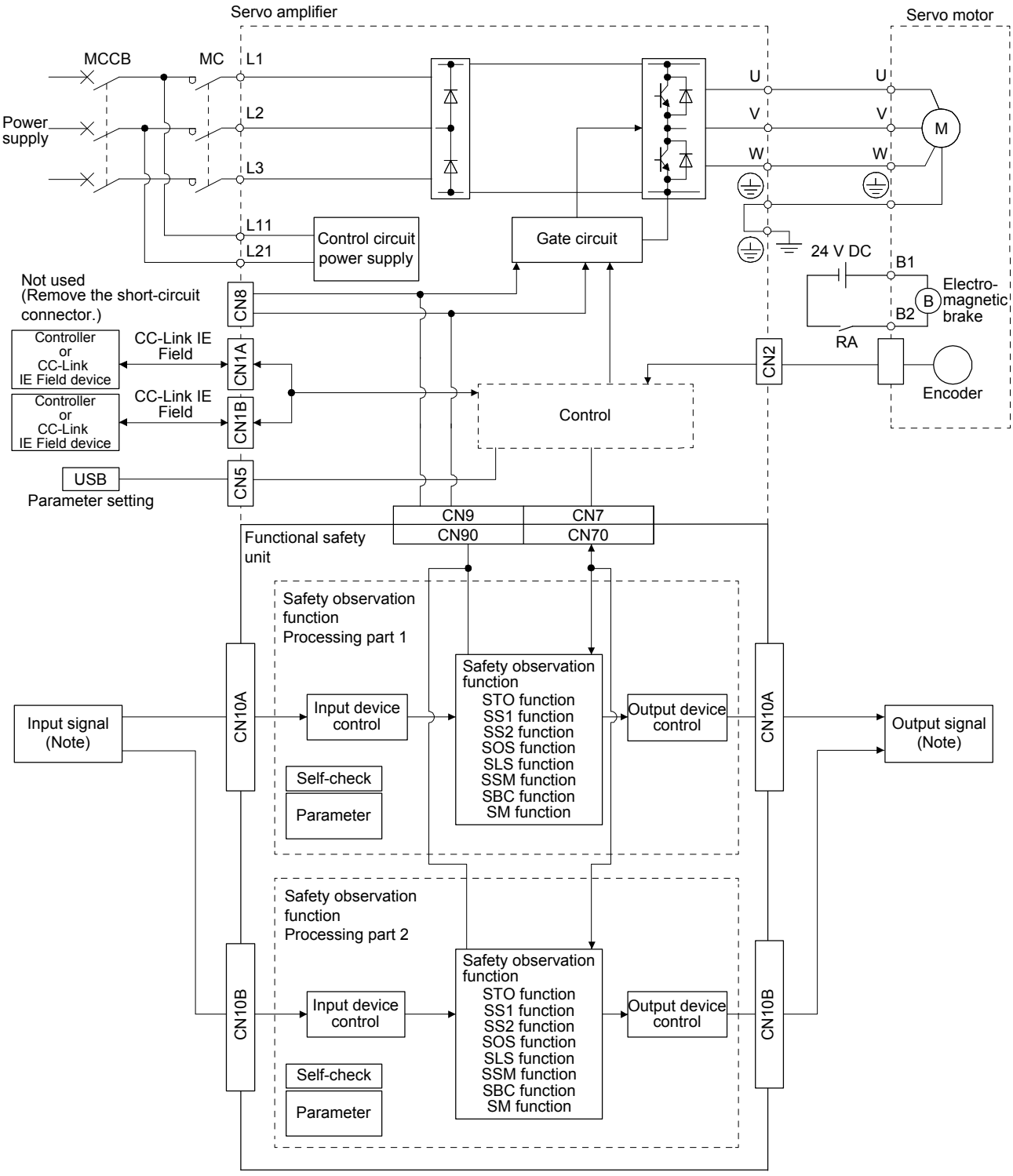
(8) Status monitor (SM: Status monitor)
Outputs a signal for the safety observation function status. This is an original function of the functional safety unit, not the one defined in IEC/EN 61800-5-2.

1.3 Function block diagram

1.3.1 MR-J4-_GF_-RJ

(1) Safety observation function control by input device

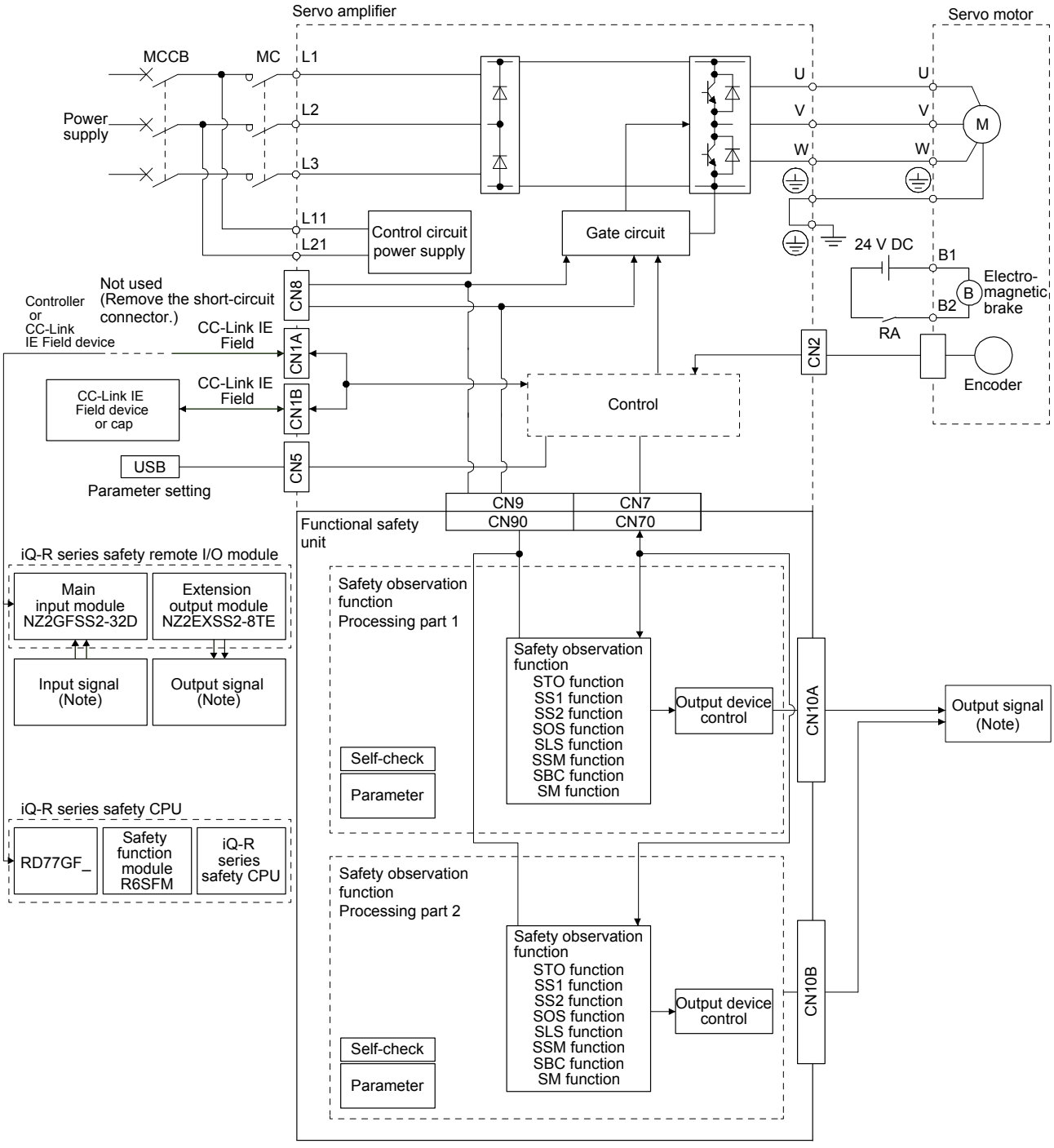
The following block diagram shows an operation of the safety observation function using input devices assigned to pins of the CN10A and CN10B connectors. By diagnosis of input signals, the servo amplifier complies with safety level Category 4, PL e, SIL 3.



Note. Safety switch, safety relay, etc.

(2) Safety observation function control by network

The following block diagram shows an operation of the safety observation function through CC-Link IE Field. The electric wiring can be omitted.

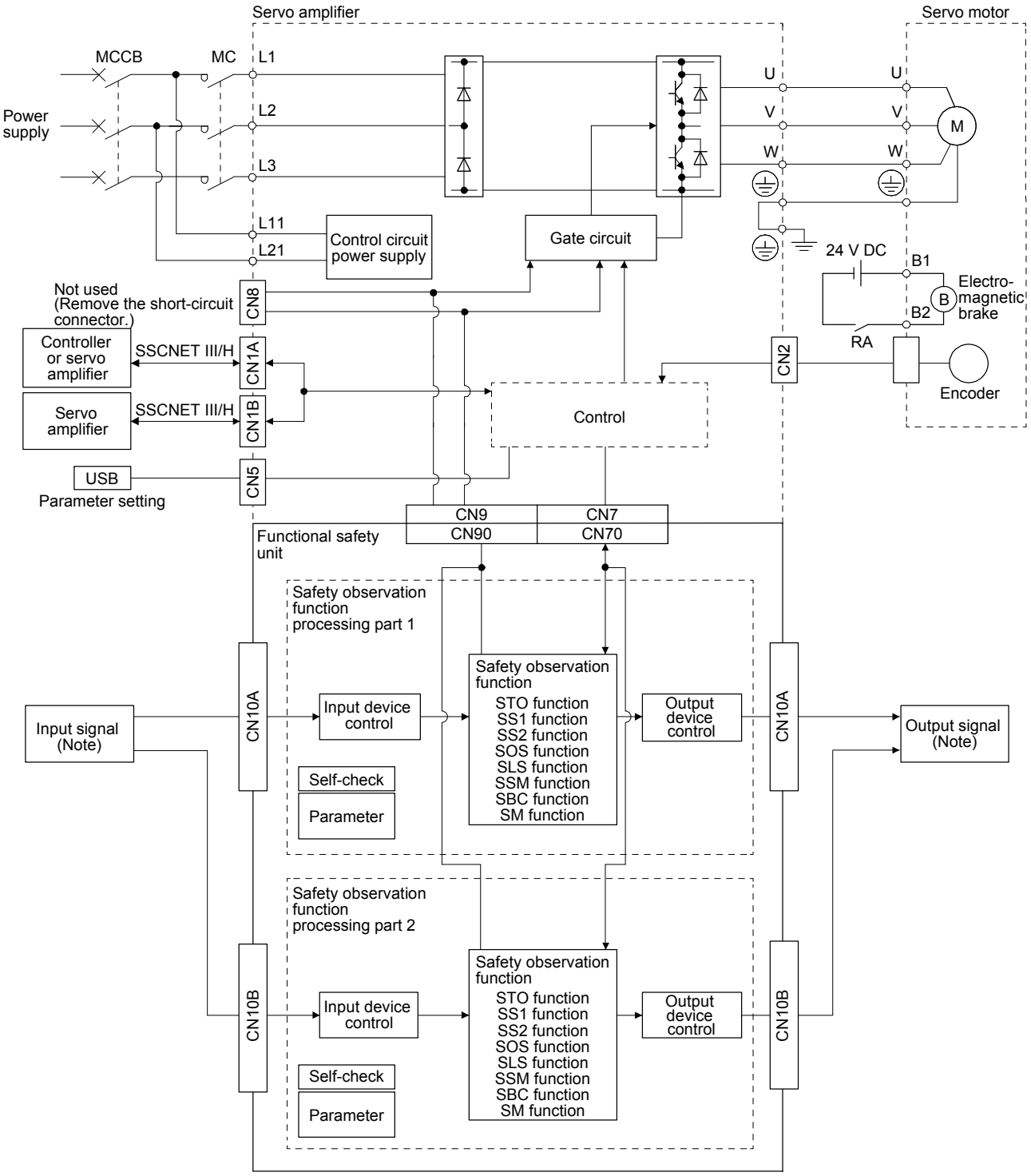


Note. Safety switch, safety relay, etc.

1.3.2 MR-J4-_B_-RJ

(1) Safety observation function control by input device

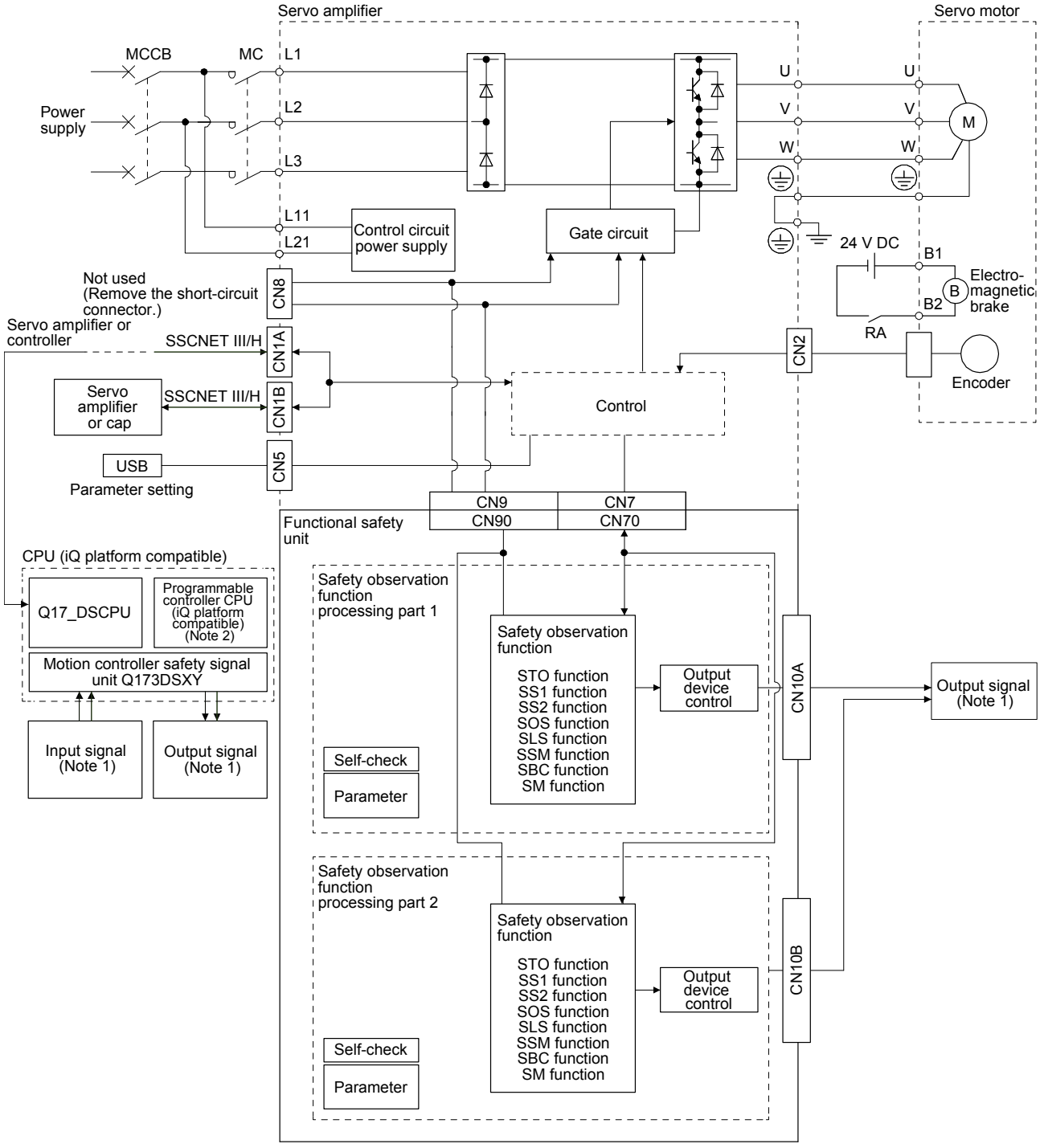
The following block diagram shows an operation of the safety observation function using input devices assigned to pins of the CN10A and CN10B connectors. By diagnosis of input signals, the servo amplifier complies with safety level Category 4, PL e, SIL 3.



Note. Safety switch, safety relay, etc.

(2) Safety observation function control by network

The following block diagram shows an operation of the safety observation function through SSCNET III/H. The electric wiring can be omitted.

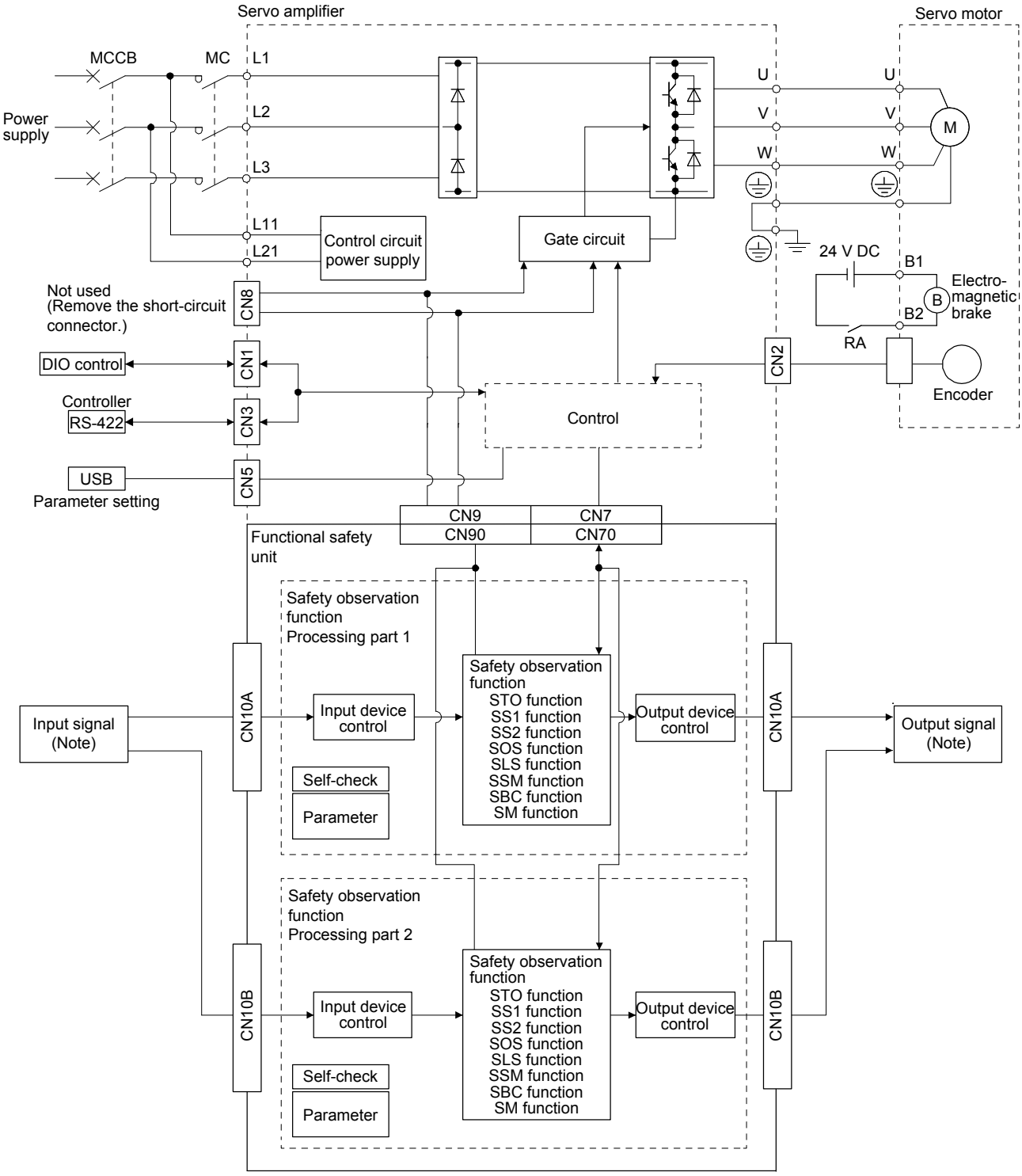


Note 1. Safety switch, safety relay, etc.

2. The safety observation function is certified by Certification Body only by combination of Q17_DSCPU/Q17_DSXY and QnUD(E)(H)CPU programmable controller.

1.3.3 MR-J4-_A_-RJ

The following block diagram shows an operation of the safety observation function using input devices assigned to pins of the CN10A and CN10B connectors. By diagnosis of input signals, the servo amplifier complies with safety level Category 4, PL e, SIL 3.

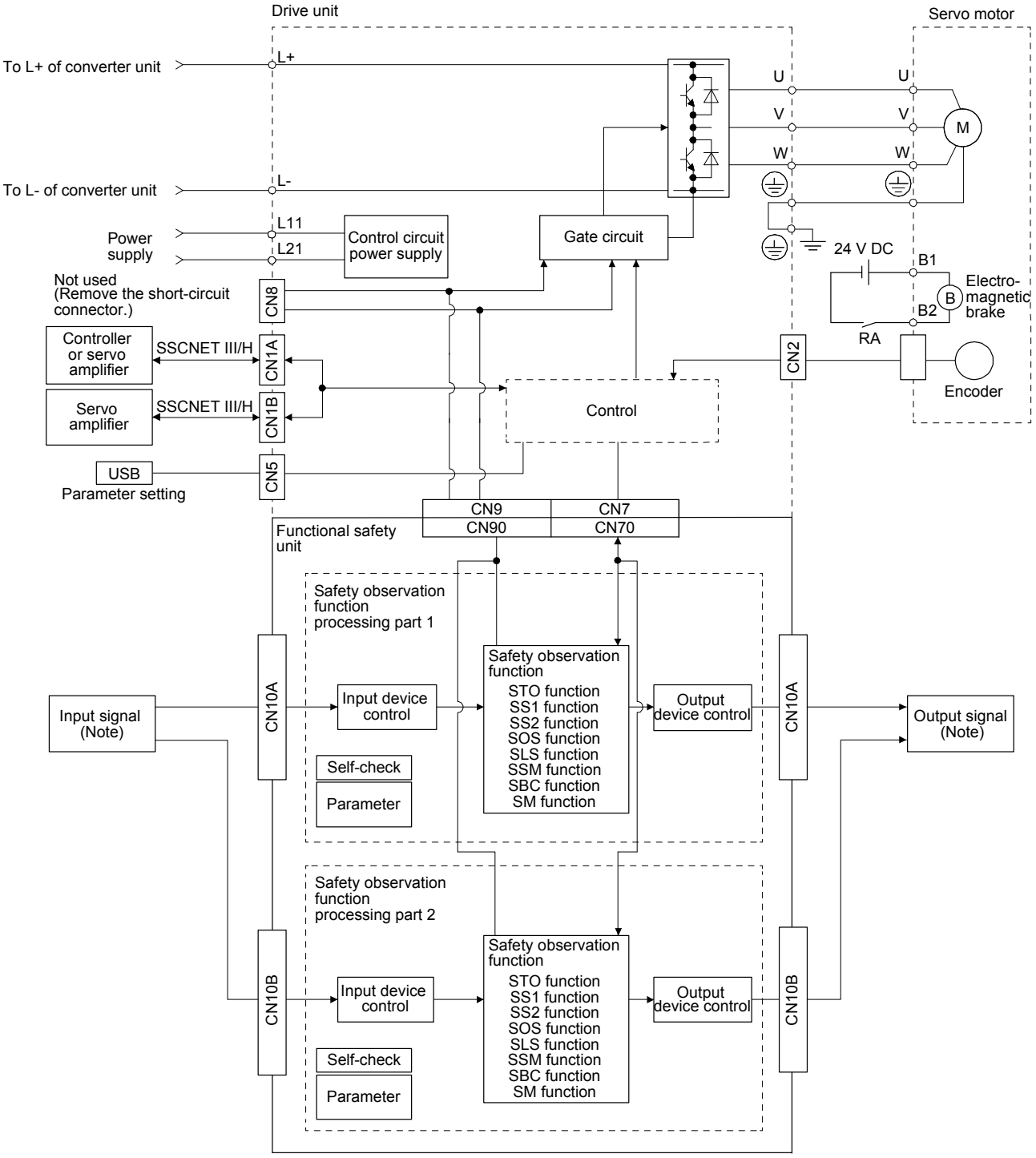


Note. Safety switch, safety relay, etc.

1.3.4 MR-J4-DU_B-RJ

(1) Safety observation function control by input device

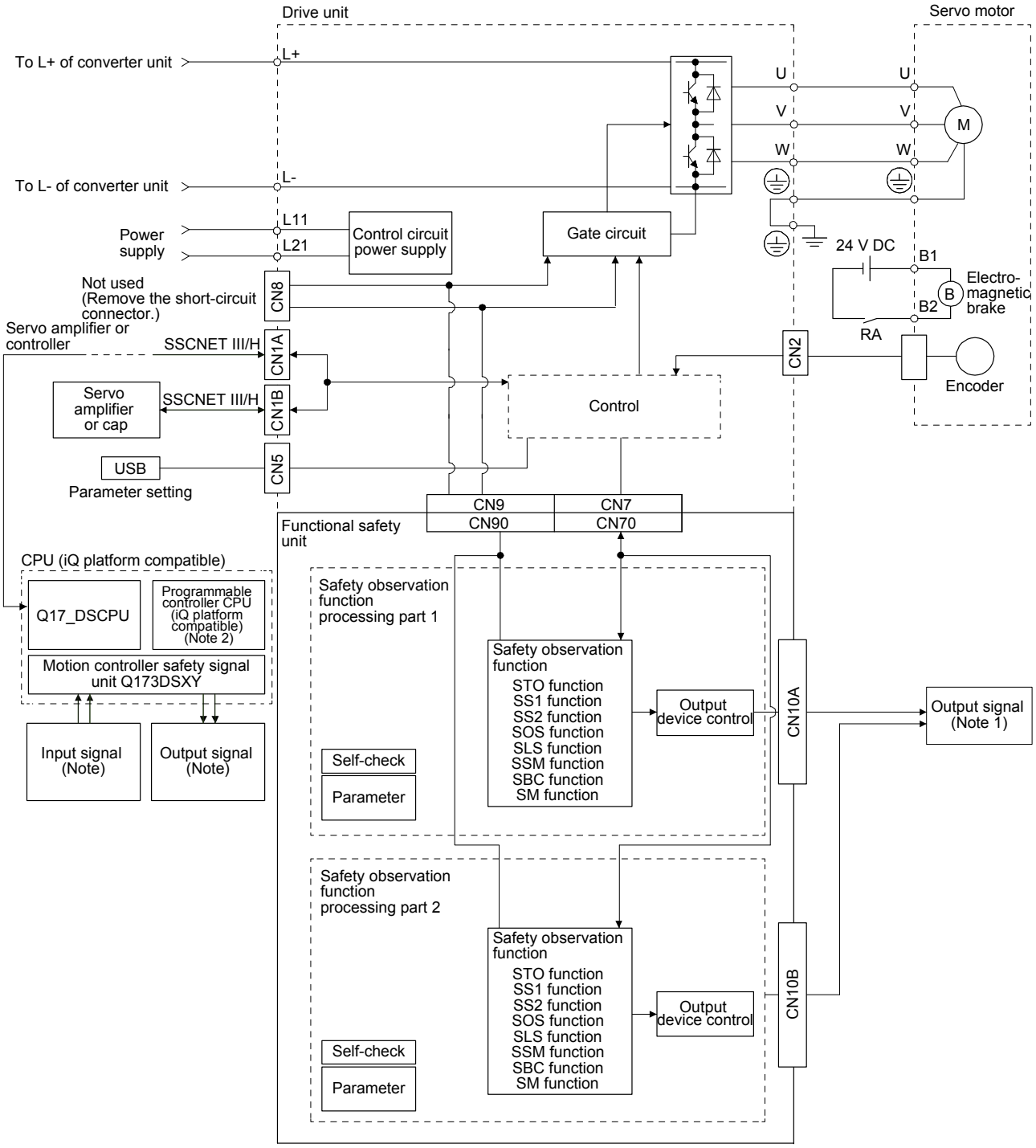
The following block diagram shows an operation of the safety observation function using input devices assigned to pins of the CN10A and CN10B connectors. By diagnosis of input signals, the servo amplifier complies with safety level Category 4, PL e, SIL 3.



Note. Safety switch, safety relay, etc.

(2) Safety observation function control by network

The following block diagram shows an operation of the safety observation function through SSCNET III/H. The electric wiring can be omitted.

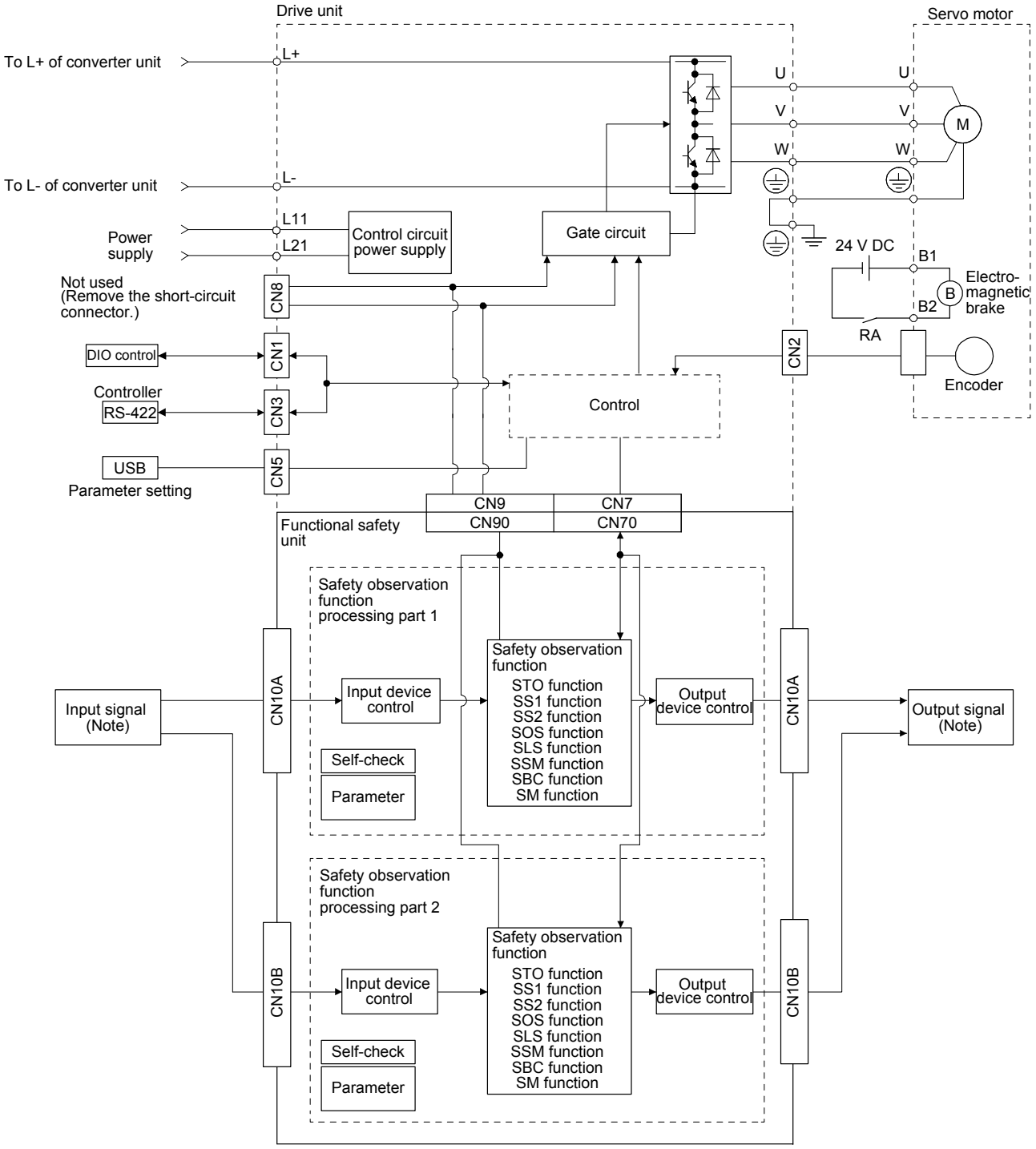


Note 1. Safety switch, safety relay, etc.

2. The safety observation function is certified by Certification Body only by combination of Q17_DSCPU/Q17_DSXY and QnUD(E)(H)CPU programmable controller.

1.3.5 MR-J4-DU_A-RJ

The following block diagram shows an operation of the safety observation function using input devices assigned to pins of the CN10A and CN10B connectors. By diagnosis of input signals, the servo amplifier complies with safety level Category 4, PL e, SIL 3.



Note. Safety switch, safety relay, etc.

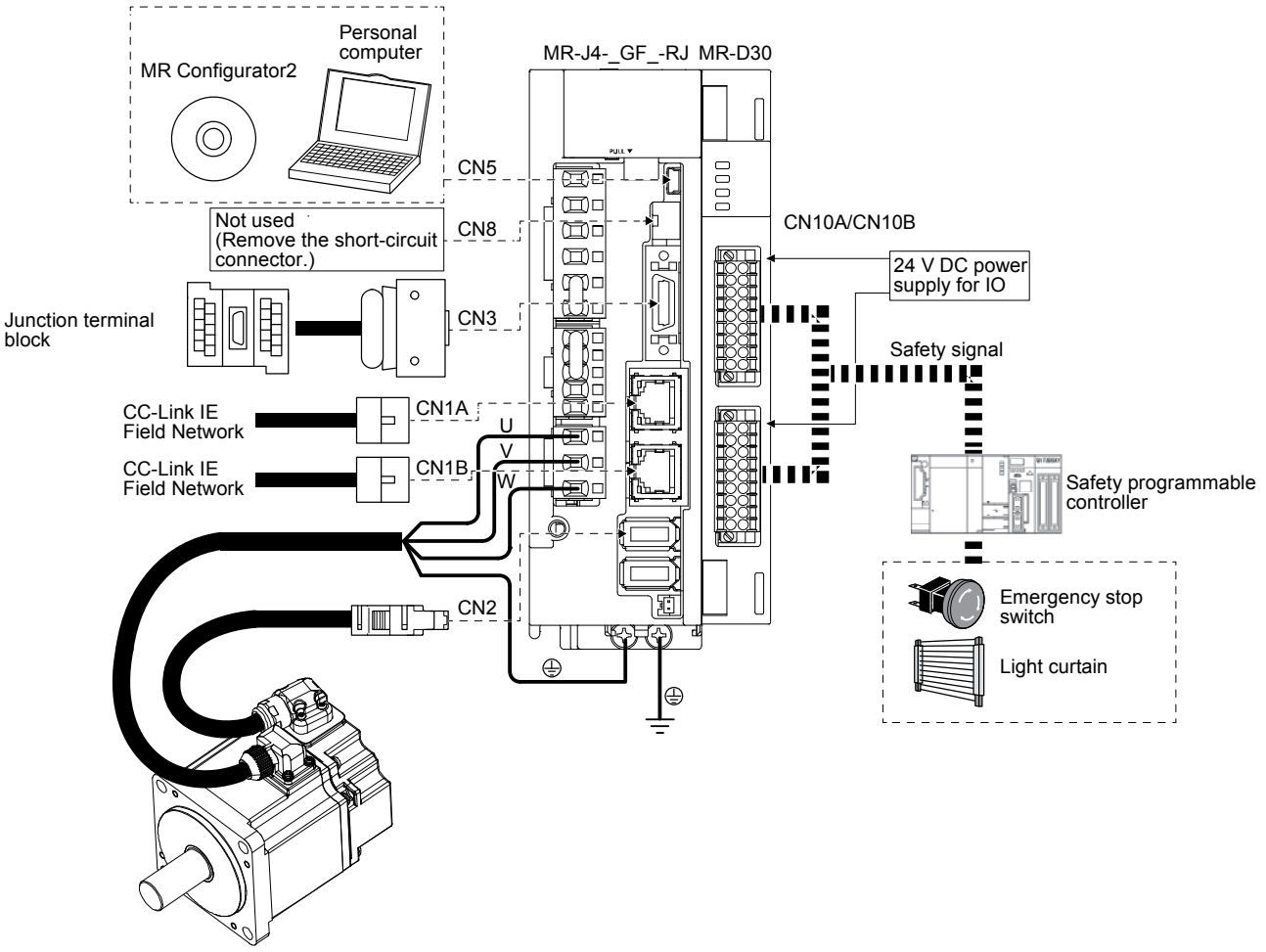
1.4 System configuration

For wirings other than in diagram, refer to each servo amplifier instruction manual.

1.4.1 MR-J4-_GF_-RJ

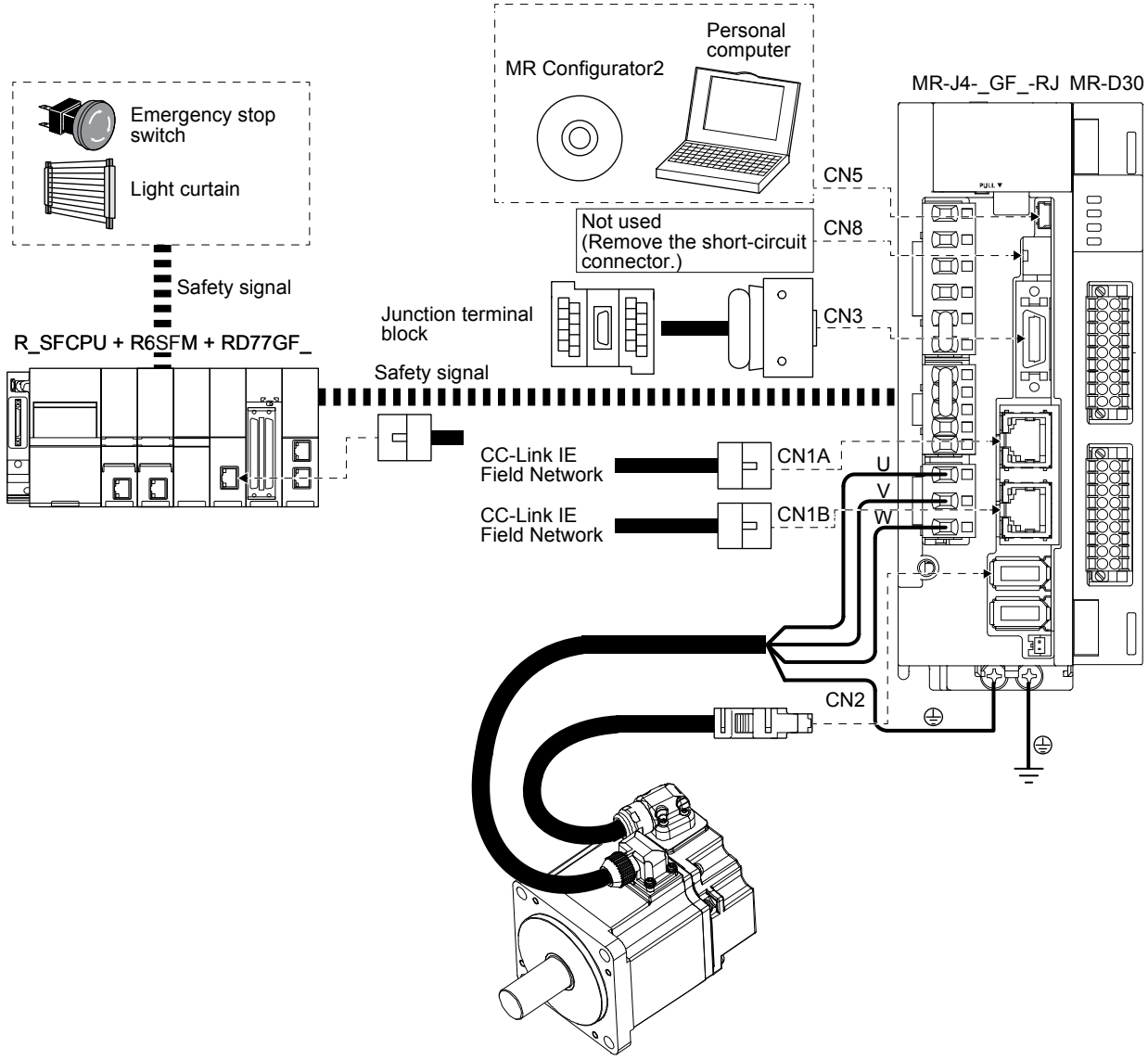
(1) Safety observation function control by input device

POINT
●Remove the short-circuit connector on CN8.



(2) Safety observation function control by network

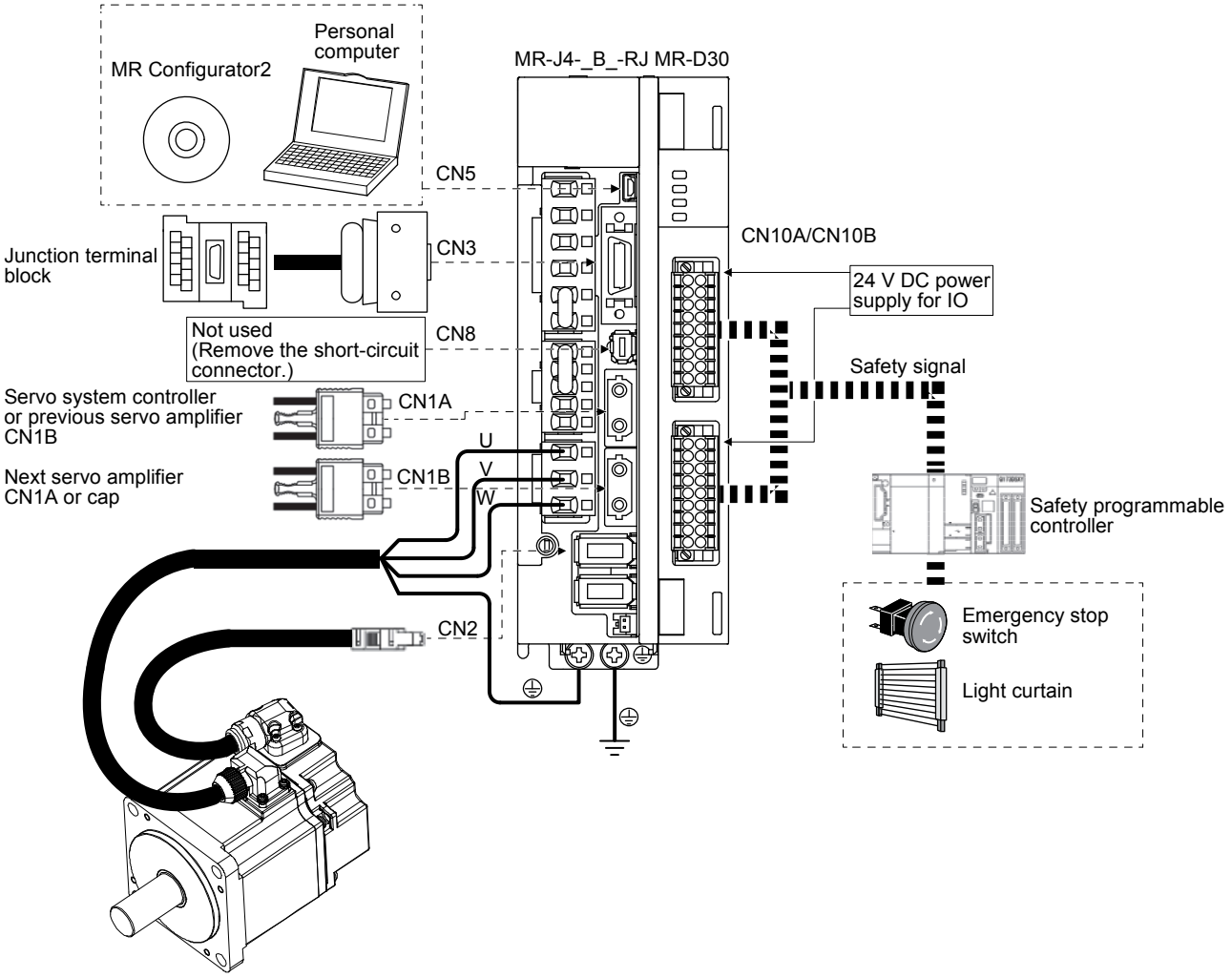
POINT
●Remove the short-circuit connector on CN8.



1.4.2 MR-J4-_B_-RJ/MR-J4-DU_B-RJ

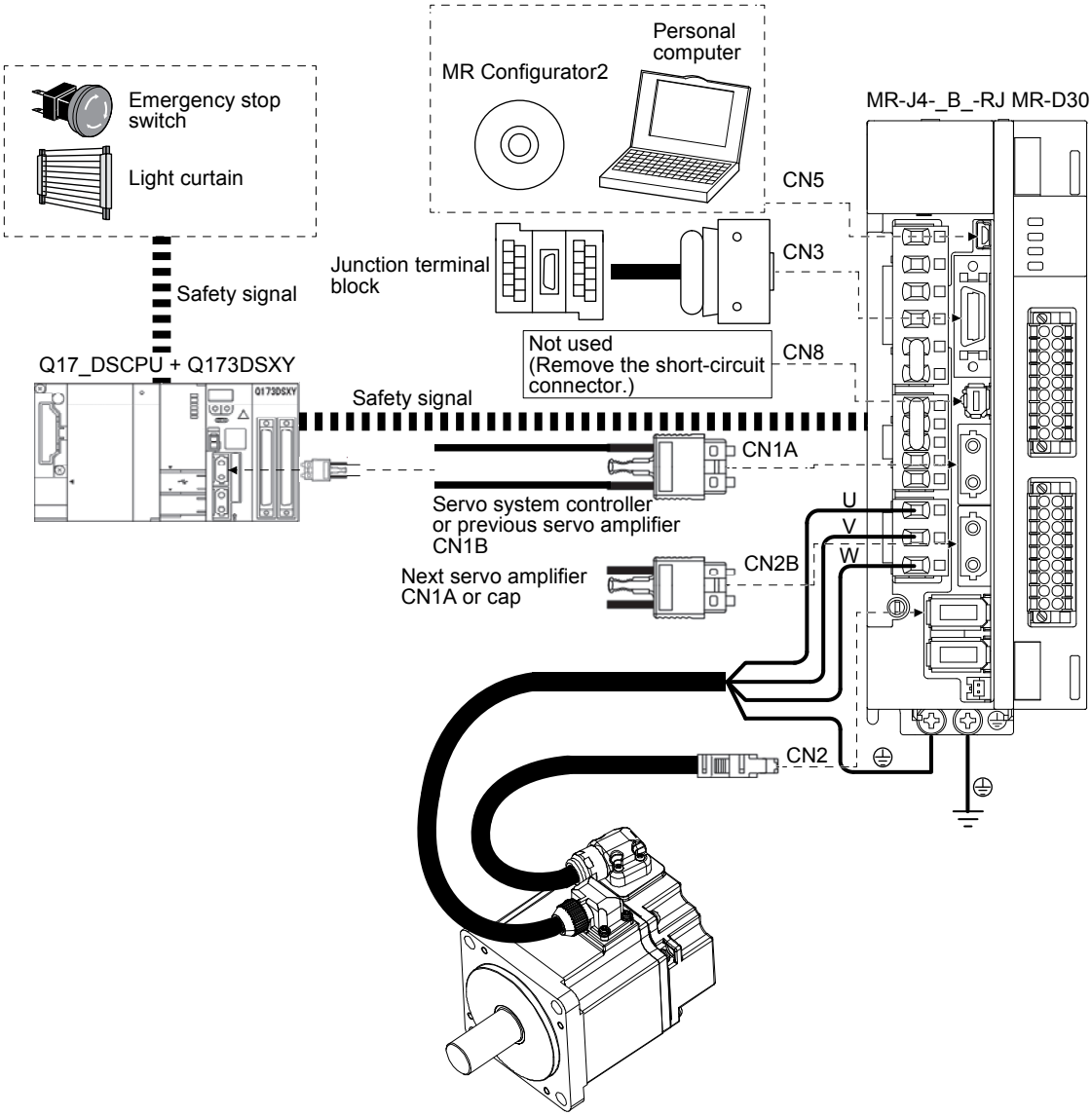
(1) Safety observation function control by input device

POINT
●Remove the short-circuit connector on CN8.



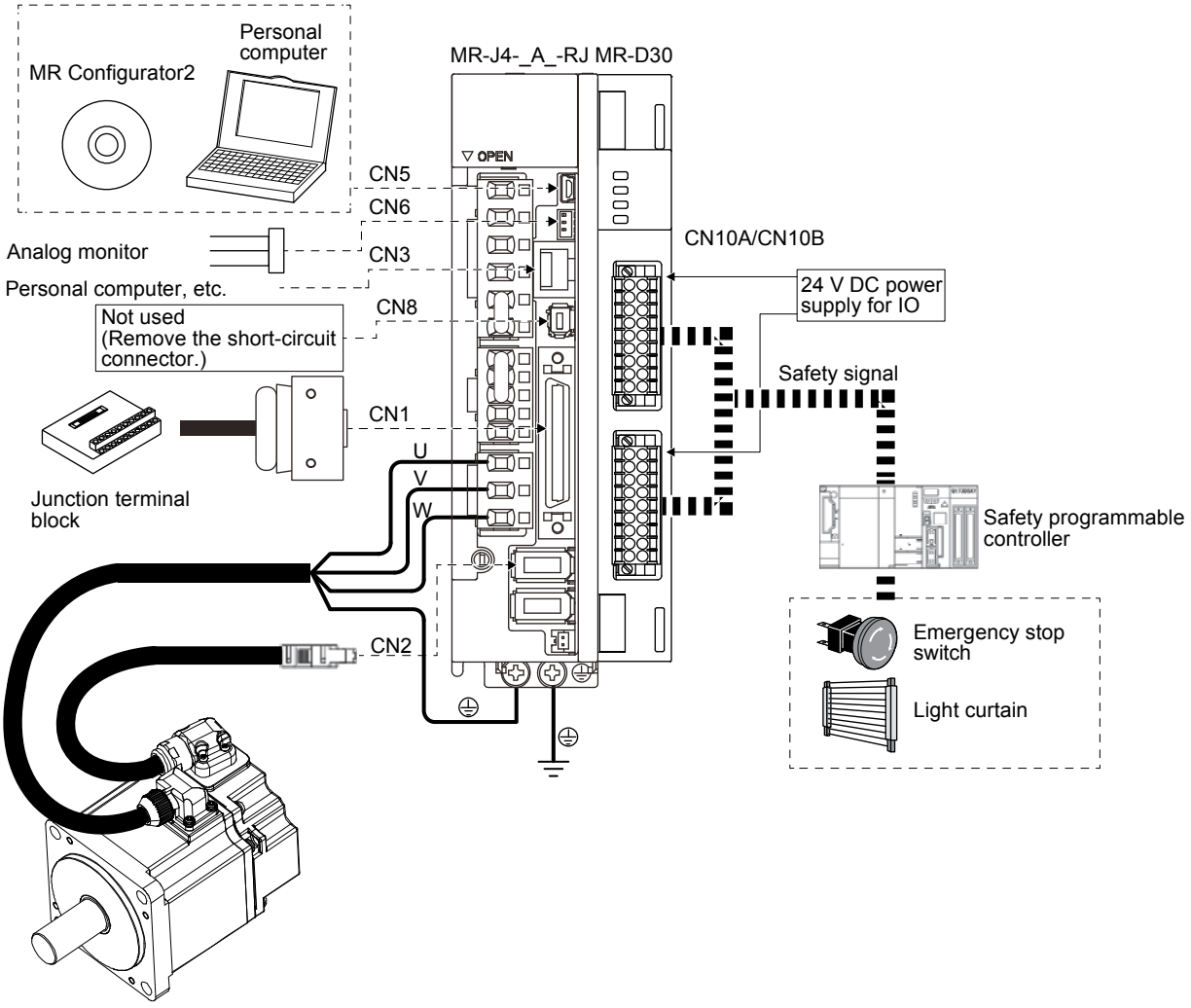
(2) Safety observation function control by network

POINT
●Remove the short-circuit connector on CN8.



1.4.3 MR-J4-_A_-RJ/MR-J4-DU_A-RJ

POINT
●Remove the short-circuit connector on CN8.



1.5 Standard specifications

Model		MR-D30
Output	Rated voltage	24 V DC
	Rated current [A]	0.3
Interface power supply	Voltage	24 V DC ± 10%
	Power supply capacity [A]	0.8 (Note 1)
Safety performance	Standards certified by CB	EN ISO 13849-1 Category 4, PL e and Category 3, PL d IEC 61508 SIL 2 and SIL 3 EN 62061 SIL CL 2 and SIL CL 3 EN 61800-5-2
	Mean time to dangerous failure	MTTFd ≥ 100 [years] (313a)
	Effectiveness of fault monitoring of a system or subsystem	DC = High, 97.6 [%]
	Average probability of dangerous failures per hour	PFH = 6.57×10^{-9} [1/h]
	Mission time	TM = 20 [years]
	Response performance (Note 2)	Using input device: 15 ms or less Using drive safety integrated motion controller: 60 ms or less Using drive safety integrated programmable controller: 65 ms or less
	Speed observation resolution	Depends on a command resolution (22 bit position command: 0.1 r/min or less)
	Position observation resolution	1/32 rev
	Safety position data resolution	32 pulses/rev (5 bits)
	Input device	6 points × 2 systems (source/sink)
	Output device	Source: 3 points × 2 systems and 1 point × 1 system Sink: 1 point × 1 system
Safety observation function (IEC/EN 61800-5-2)	Safe torque off (STO)	Category 4, PL e, SIL 3 (Note 3)/Category 3, PL d, SIL 2
	Safe stop 1 (SS1)	Category 4, PL e, SIL 3 (Note 3)/Category 3, PL d, SIL 2
	Safely-limited speed (SLS) (Note 7)	Category 4, PL e, SIL 3 (Note 3, 4)/Category 3, PL d, SIL 2
	Safe speed monitor (SSM) (Note 7)	Category 4, PL e, SIL 3 (Note 3, 4)/Category 3, PL d, SIL 2
	Safe brake control (SBC)	Category 4, PL e, SIL 3 (Note 3)/Category 3, PL d, SIL 2
	Safe operating stop (SOS) (Note 5, 7)	Category 4, PL e, SIL 3 (Note 3)/Category 3, PL d, SIL 2
	Safe stop 2 (SS2) (Note 5, 7)	Category 4, PL e, SIL 3 (Note 3)/Category 3, PL d, SIL 2
Safety observation function	Status monitor (STO/SOS)	Category 4, PL e, SIL 3/Category 3 PL d, SIL 2 (Note 6)
Compliance with global standards	CE marking	EMC: EN 61800-3 MD: EN ISO 13849-1, EN 61800-5-2, EN 62061
Structure (IP rating)		Natural cooling, open (mounted on a servo amplifier: IP20, MR-D30 (single): IP00)
Environment	Ambient temperature	Operation: 0 °C to 55 °C (non-freezing), storage: -20 °C to 65 °C (non-freezing)
	Ambient humidity	Operation: 5 %RH to 90 %RH (non-condensing), storage: 5 %RH to 90 %RH (non-condensing)
	Ambience	Indoors (no direct sunlight); no corrosive gas, inflammable gas, oil mist or dust
	Altitude	2000 m or less above sea level
	Vibration resistance	5.9 m/s^2, 10 Hz to 57 Hz
Mass [g]		150

Note 1. This is the value applicable when all I/O signals are used. The current capacity can be decreased by reducing the number of I/O points.
2. Time from STO input off to energy shut off
3. To meet Category 4, PL e, SIL 3 for input signals, a diagnosis using test pulses is required.
4. To meet Category 4, PL e, SIL 3, using with an HG-KR_W0C, HG-SR_W0C, or HG-JR_W0C servo motor is required.
5. To enable SS2 and SOS, using with an HG-KR_W0C, HG-SR_W0C, or HG-JR_W0C servo motor is required.
6. For the safety level which can be enabled, refer to the section of "Safety observation function (IEC/EN 61800-5-2)".
7. Linear servo system, direct drive servo system, and fully closed loop system are not compatible with SLS, SSM, SS2, and SOS.

1.6 Function list

Function			Description
Safety observation function	STO	Shut-off response time	15 ms or less (using input device) 60 ms or less (using SSCNET III/H) (Note 1) 65 ms or less (Using CC-Link IE Field) (Note 2)
	SS1	Deceleration delay time	0 ms to 60000 ms (parameter setting)
	SBC	Shut-off response time	15 ms or less (using input device) 60 ms or less (using SSCNET III/H) (Note 1) 65 ms or less (Using CC-Link IE Field) (Note 2)
	SLS1/SLS2/SLS3/SLS4	Observation speed	0 r/min to 10000 r/min (parameter setting) (Note 3)
	SSM	Observation speed	0 r/min to 10000 r/min (parameter setting)
	SS2	Deceleration delay time	0 ms to 60000 ms (parameter setting)
	SOS	Observation position	0 rev to 100 rev (parameter setting)
	Status monitor (SM)	Response time	200 μs
Input/output function	Input device	Number of inputs	6 points × 2 systems
		Mismatch permissible time of duplication input mismatch detection	1 ms to 60000 ms (parameter setting)
		Test pulse off time	0.444 ms to 1.77 ms (parameter setting)
		Test pulse interval	1 s or less
		Noise rejection filter	0.888 ms to 28.4 ms (parameter setting)
	Output device	Number of outputs	4 points × 2 systems (Note 4)
		Test pulse off time	0.444 ms to 1.77 ms (parameter setting)
		Test pulse interval	1 s or less
Parameter setting			Failure diagnosis by duplication parameter, writing protection by password
Safety communication function		Safety communication cycle	14.2 ms to 28.4 ms (parameter setting) (Using SSCNET III/H) 4.0 ms to 32.0 ms (parameter setting) (Using CC-Link IE Field)
		Safety communication delay time	60 ms or less (Note 1) 65 ms or less (Using CC-Link IE Field) (Note 2)

Note 1. This is when the safety communication cycle is 14.2 ms.
2. This is when the safety communication cycle is 16.0 ms. For details on how to calculate the response time, refer to the MELSEC iQ-R Safety Application Guide.
3. Each observation speed can be set separately.
4. MR-D30 manufactured in September, 2014 or earlier has three output points. Connecting a circuit to DO4NA or DO4PB of MR-D30 manufactured in September, 2014 or earlier may cause a malfunction of MR-D30. Connecting MR-D30 manufactured in September, 2014 or earlier to the servo amplifier will deactivate displays about DO4_ of MR Configurator2.

1.7 Combinations with servo amplifiers and servo motors

POINT

- MR-D30 supported by with MR-J4-(DU)_A_-RJ with software version B5 or later, MR-J4-(DU)_B_-RJ with software version B5 or later, or MR-J4-_GF_-RJ with software version A3 or later.
- When you use a servo motor with functional safety, MR-BT6VCASE battery case cannot be used.

Servo amplifiers and servo motors that can be used with MR-D30 are listed as follows. The usable safety observation function and achievable safety performance level vary depending on each servo motor to be used. Refer to section 4.1 for details.

(1) 200 V class

(a) Combinations with MR-J4-_ servo amplifiers

Servo amplifier	Rotary servo motor		Linear servo motor (primary side)	Direct drive motor
	Servo motor	Servo motor with functional safety		
MR-J4-10B-RJ MR-J4-10A-RJ MR-J4-10GF-RJ	HG-KR053 HG-KR13 HG-MR053 HG-MR13	HG-KR053W0C HG-KR13W0C		
MR-J4-20B-RJ MR-J4-20A-RJ MR-J4-20GF-RJ	HG-KR23 HG-MR23	HG-KR23W0C	LM-U2PAB-05M-0SS0 LM-U2PBB-07M-1SS0	TM-RFM002C20
MR-J4-40B-RJ MR-J4-40A-RJ MR-J4-40GF-RJ	HG-KR43 HG-MR43	HG-KR43W0C	LM-H3P2A-07P-BSS0 LM-H3P3A-12P-CSS0 LM-K2P1A-01M-2SS1 LM-U2PAD-10M-0SS0 LM-U2PAF-15M-0SS0	TM-RFM004C20
MR-J4-60B-RJ MR-J4-60A-RJ MR-J4-60GF-RJ	HG-SR51 HG-SR52 HG-JR53	HG-SR51W0C HG-SR52W0C HG-JR53W0C	LM-U2PBD-15M-1SS0	TM-RFM006C20 TM-RFM006E20
MR-J4-70B-RJ MR-J4-70A-RJ MR-J4-70GF-RJ	HG-KR73 HG-MR73 HG-JR73 HG-UR72	HG-KR73W0C HG-JR73W0C	LM-H3P3B-24P-CSS0 LM-H3P3C-36P-CSS0 LM-H3P7A-24P-ASS0 LM-K2P2A-02M-1SS1 LM-U2PBF-22M-1SS0	TM-RFM012E20 TM-RFM012G20 TM-RFM040J10
MR-J4-100B-RJ MR-J4-100A-RJ MR-J4-100GF-RJ	HG-SR81 HG-SR102 HG-JR53 (Note) HG-JR103	HG-SR81W0C HG-SR102W0C HG-JR53W0C (Note) HG-JR103W0C		TM-RFM018E20
MR-J4-200B-RJ MR-J4-200A-RJ MR-J4-200GF-RJ	HG-SR121 HG-SR201 HG-SR152 HG-SR202 HG-JR73 (Note) HG-JR103 (Note) HG-JR153 HG-JR203 HG-RR103 HG-RR153 HG-UR152	HG-SR121W0C HG-SR201W0C HG-SR152W0C HG-SR202W0C HG-JR73W0C (Note) HG-JR103W0C (Note) HG-JR153W0C HG-JR203W0C	LM-H3P3D-48P-CSS0 LM-H3P7B-48P-ASS0 LM-H3P7C-72P-ASS0 LM-FP2B-06M-1SS0 LM-K2P1C-03M-2SS1 LM-U2P2B-40M-2SS0	
MR-J4-350B-RJ MR-J4-350A-RJ MR-J4-350GF-RJ	HG-SR301 HG-SR352 HG-JR153 (Note) HG-JR203 (Note) HG-JR353 HG-RR203 HG-UR202	HG-SR301W0C HG-SR352W0C HG-JR153W0C (Note) HG-JR203W0C (Note) HG-JR353W0C	LM-H3P7D-96P-ASS0 LM-K2P2C-07M-1SS1 LM-K2P3C-14M-1SS1 LM-U2P2C-60M-2SS0	TM-RFM048G20 TM-RFM072G20 TM-RFM120J10
MR-J4-500B-RJ MR-J4-500A-RJ MR-J4-500GF-RJ	HG-SR421 HG-SR502 HG-JR353 (Note) HG-JR503 HG-RR353 HG-RR503 HG-UR352 HG-UR502	HG-SR421W0C HG-SR502W0C HG-JR353W0C (Note) HG-JR503W0C	LM-FP2D-12M-1SS0 LM-FP4B-12M-1SS0 LM-K2P2E-12M-1SS1 LM-K2P3E-24M-1SS1 LM-U2P2D-80M-2SS0	TM-RFM240J10
MR-J4-700B-RJ MR-J4-700A-RJ MR-J4-700GF-RJ	HG-SR702 HG-JR703 HG-JR503 (Note) HG-JR601 HG-JR701M	HG-SR702W0C HG-JR703W0C HG-JR503W0C (Note) HG-JR601W0C HG-JR701MW0C	LM-FP2F-18M-1SS0 LM-FP4D-24M-1SS0	

Servo amplifier	Rotary servo motor		Linear servo motor (primary side)	Direct drive motor
	Servo motor	Servo motor with functional safety		
MR-J4-11KB-RJ MR-J4-11KA-RJ MR-J4-11KGF-RJ	HG-JR903 HG-JR801 HG-JR12K1 HG-JR11K1M	HG-JR903W0C HG-JR801W0C HG-JR12K1W0C HG-JR11K1MW0C	LM-FP4F-36M-1SS0	
MR-J4-15KB-RJ MR-J4-15KA-RJ MR-J4-15KGF-RJ	HG-JR15K1 HG-JR15K1M	HG-JR15K1W0C HG-JR15K1MW0C	LM-FP4F-48M-1SS0	
MR-J4-22KB-RJ MR-J4-22KA-RJ MR-J4-22KGF-RJ	HG-JR20K1 HG-JR25K1 HG-JR22K1M	HG-JR20K1W0C HG-JR25K1W0C HG-JR22K1MW0C		

Note. The maximum torque can be increased to 400% of the rated torque.

(b) Combinations with MR-J4-DU_ drive units

Drive unit	Rotary servo motor		Linear servo motor (primary side)
	Servo motor	Servo motor with functional safety	
MR-J4-DU900B-RJ	HG-SR702 (Note 2) HG-JR601 HG-JR801 HG-JR701M (Note 2) HG-JR503 (Note 1) HG-JR703 (Note 2) HG-JR903	HG-SR702W0C (Note 2) HG-JR601W0C HG-JR801W0C HG-JR701MW0C (Note 2) HG-JR503W0C (Note 1) HG-JR703W0C (Note 2) HG-JR903W0C	LM-FP2F-18M-1SS0 LM-FP4D-24M-1SS0
MR-J4-DU11KB-RJ	HG-JR12K1 HG-JR11K1M	HG-JR801W0C HG-JR12K1W0C HG-JR11K1MW0C	LM-FP4F-36M-1SS0
MR-J4-DU15KB-RJ	HG-JR15K1 HG-JR15K1M	HG-JR15K1W0C HG-JR15K1MW0C	LM-FP4H-48M-1SS0
MR-J4-DU22KB-RJ	HG-JR20K1 HG-JR25K1 HG-JR22K1M	HG-JR20K1W0C HG-JR25K1W0C HG-JR22K1MW0C	
MR-J4-DU30KB-RJ MR-J4-DU30KA-RJ	HG-JR30K1 HG-JR30K1M	HG-JR30K1W0C HG-JR30K1MW0C	
MR-J4-DU37KB-RJ MR-J4-DU37KA-RJ	HG-JR37K1 HG-JR37K1M	HG-JR37K1W0C HG-JR37K1MW0C	

Note 1. The maximum torque can be increased to 400% of the rated torque.
2. By enabling the maximally increased torque function when drive unit is connected, the maximum torque can be increased.

(2) 400 V class

(a) Combinations with MR-J4-_ servo amplifiers

Servo amplifier	Rotary servo motor		Linear servo motor (primary side)
	Servo motor	Servo motor with functional safety	
MR-J4-60B4-RJ MR-J4-60A4-RJ MR-J4-60GF4-RJ	HG-SR524 HG-JR534	HG-SR524W0C HG-JR534W0C	
MR-J4-100B4-RJ MR-J4-100A4-RJ MR-J4-100GF4-RJ	HG-SR1024 HG-JR534 (Note) HG-JR734 HG-JR1034	HG-SR1024W0C HG-JR534W0C (Note) HG-JR734W0C HG-JR1034W0C	
MR-J4-200B4-RJ MR-J4-200A4-RJ MR-J4-200GF4-RJ	HG-SR1524 HG-SR2024 HG-JR734 (Note) HG-JR1034 (Note) HG-JR1534 HG-JR2034	HG-SR1524W0C HG-SR2024W0C HG-JR734W0C (Note) HG-JR1034W0C (Note) HG-JR1534W0C HG-JR2034W0C	
MR-J4-350B4-RJ MR-J4-350A4-RJ MR-J4-350GF4-RJ	HG-SR3524 HG-JR1534 (Note) HG-JR2034 (Note) HG-JR3534	HG-SR3524W0C HG-JR1534W0C (Note) HG-JR2034W0C (Note) HG-JR3534W0C	
MR-J4-500B4-RJ MR-J4-500A4-RJ MR-J4-500GF4-RJ	HG-SR5024 HG-JR3534 (Note) HG-JR5034	HG-SR5024W0C HG-JR3534W0C (Note) HG-JR5034W0C	
MR-J4-700B4-RJ MR-J4-700A4-RJ MR-J4-700GF4-RJ	HG-SR7024 HG-JR5034 (Note) HG-JR6014 HG-JR701M4 HG-JR7034	HG-SR7024W0C HG-JR5034W0C (Note) HG-JR6014W0C HG-JR7034W0C HG-JR701M4W0C	
MR-J4-11KB4-RJ MR-J4-11KA4-RJ MR-J4-11KGF4-RJ	HG-JR8014 HG-JR12K14 HG-JR11K1M4 HG-JR9034	HG-JR8014W0C HG-JR12K14W0C HG-JR11K1M4W0C HG-JR9034W0C	
MR-J4-15KB4-RJ MR-J4-15KA4-RJ MR-J4-15KGF4-RJ	HG-JR15K14 HG-JR15K1M4	HG-JR15K14W0C HG-JR15K1M4W0C	
MR-J4-22KB4-RJ MR-J4-22KA4-RJ MR-J4-22KGF4-RJ	HG-JR20K14 HG-JR25K14 HG-JR22K1M4	HG-JR20K14W0C HG-JR25K14W0C HG-JR22K1M4W0C	LM-FP5H-60M-1SS0

Note. The maximum torque can be increased to 400% of the rated torque.

(b) Combinations with MR-J4-DU_ drive units

Drive unit	Rotary servo motor		Linear servo motor (primary side)
	Servo motor	Servo motor with functional safety	
MR-J4-DU900B4-RJ	HG-SR7024 (Note 2) HG-JR6014 HG-JR8014 HG-JR701M4 (Note 2) HG-JR5034 (Note 1) HG-JR7034 (Note 2) HG-JR9034	HG-SR7024W0C (Note 2) HG-JR6014W0C HG-JR8014W0C HG-JR701M4W0C (Note 2) HG-JR5034W0C (Note 1) HG-JR7034W0C (Note 2) HG-JR9034W0C	
MR-J4-DU11KB4-RJ	HG-JR12K14 HG-JR11K1M4	HG-JR12K14W0C HG-JR11K1M4W0C	
MR-J4-DU15KB4-RJ	HG-JR15K14 HG-JR15K1M4	HG-JR15K14W0C HG-JR15K1M4W0C	
MR-J4-DU22KB4-RJ	HG-JR20K14 HG-JR22K1M4 HG-JR25K14	HG-JR20K14W0C HG-JR22K1M4W0C HG-JR25K14W0C	LM-FP5H-60M-1SS0
MR-J4-DU30KB4-RJ MR-J4-DU30KA4-RJ	HG-JR30K14 HG-JR30K1M4	HG-JR30K14W0C HG-JR30K1M4W0C	
MR-J4-DU37KB4-RJ MR-J4-DU37KA4-RJ	HG-JR37K14 HG-JR37K1M4	HG-JR37K14W0C HG-JR37K1M4W0C	
MR-J4-DU45KB4-RJ MR-J4-DU45KA4-RJ	HG-JR45K1M4	HG-JR45K1M4W0C	
MR-J4-DU55KB4-RJ MR-J4-DU55KA4-RJ	HG-JR55K1M4	HG-JR55K1M4W0C	

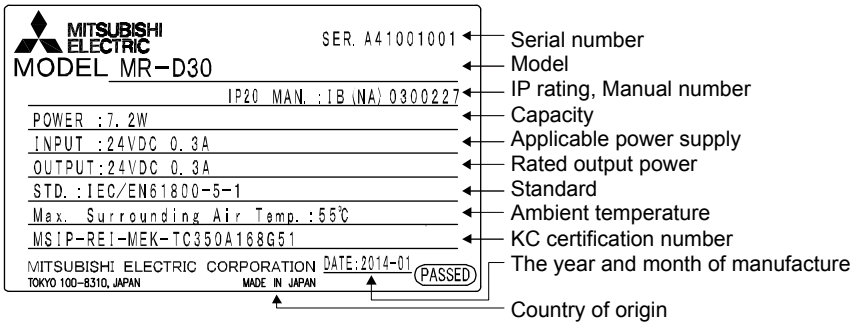
Note 1. The maximum torque can be increased to 400% of the rated torque.
2. By enabling the maximally increased torque function when drive unit is connected, the maximum torque can be increased.

(3) 100 V class

Servo amplifier	Rotary servo motor		Linear servo motor (primary side)	Direct drive motor
	Servo motor	Servo motor with functional safety		
MR-J4-10B1-RJ MR-J4-10A1-RJ	HG-KR053 HG-KR13 HG-MR053 HG-MR13	HG-KR053W0C HG-KR13W0C		
MR-J4-20B1-RJ MR-J4-20A1-RJ	HG-KR23 HG-MR23	HG-KR23W0C	LM-U2PAB-05M-0SS0 LM-U2PBB-07M-1SS0	TM-RFM002C20
MR-J4-40B1-RJ MR-J4-40A1-RJ	HG-KR43 HG-MR43	HG-KR43W0C	LM-H3P2A-07P-BSS0 LM-H3P3A-12P-CSS0 LM-K2P1A-01M-2SS1 LM-U2PAD-10M-0SS0 LM-U2PAF-15M-0SS0	TM-RFM004C20

1.8 Rating plate

The following shows an example of rating plate for explanation of each item.



1.9 Risk assessments

To ensure safety, users should decide all the risk assessments and residual risks in the entire machine equipment. A company and individual who constructed the safety related system must take full responsibility for installation and commissioning of the system. Additionally, when complying with a European machinery directive, the system must acquire safety standards certification as a whole.
Perform all risk assessments and safe level certification to the machine or the system as a whole. It is recommended that a Certification Body final safety certification of the system be used.
The following shows residual risks concerning the safety observation function of this product.

1.9.1 Common residual risks in each function

(1) At the shipment to end-users, check the settings of safety related components with programming tools and monitored/displayed contents on display and record and save the setting data concerning the safety observation function and the programming tools you used. Perform them using a check sheet, etc.

(2) The safety will not be ensured such as in assembling machine until installing, wiring, and adjustment are completed properly. Install, wire, and adjust your system referring to installation guide for each unit.

(3) Only qualified personnel are authorized to install, start-up, repair or adjust the machines in which these components are installed. Only trained engineers should install and operate the equipment. (ISO 13849-1 Table F.1 No. 5)

(4) Separate the wiring for safety observation function from other signal wiring.
(ISO 13849-1 Table F.1 No. 1)

(5) Protect the cables with appropriate ways (routing them in a cabinet, using a cable guard, etc.).

(6) We recommend using a switch, relay, sensor, etc. which comply with safety standards. When using a switch, relay, sensor, etc. which do not comply with safety standards, perform a safety confirmation.

(7) Keep the required clearance/creepage distance depending on voltage you use.

(8) The time to a safety observation error depends on parameter settings.

1.9.2 Residual risks in each function

(1) Speed monitoring (SLS)

(a) Speed monitoring function guarantees the servo motor speed, but it does not guarantee the actual machine safety speed. Set parameters so that the safe speed of the machine is the same as the safety speed of the specified motor.

(b) Check if the speed of the monitored servo axis is the same as the actual speed by using a tachometer, etc. considering the speed includes an error caused by the command and encoder resolution.

(c) The defect of the mechanical section such as slid of shaft and wanting of a timing belt, etc. is not covered. Be sure to eliminate the risk of mechanical section before operation.

(d) Speed monitoring error detection time is set to 1 ms. Error in shorter than this time is not detected.

(e) After speed is over the limit, safety observation error (shut-off signal off) does not occur during the speed error detection time set by the parameter. Make sure that safety can be ensured during this period.

(2) Safe speed monitor (SSM)

When SSM is used as a restart trigger, perform it according to IEC/EN 60204-1.

(3) Safe brake control (SBC)

This function guarantees only that power to mechanic break is properly supplied and abrasion of the brake cannot be detected. Check this function regularly that the mechanic brake can operate.

2. INSTALLATION

⚠WARNING ●To prevent electric shock, ground each equipment securely.

⚠CAUTION

- ●Stacking in excess of the specified number of product packages is not allowed.
- ●Install the equipment on incombustible material. Installing them directly or close to combustibles will lead to a fire.
- ●Install the servo amplifier and the servo motor in a load-bearing place in accordance with the Instruction Manual.
- ●Do not get on or put heavy load on the equipment. Otherwise, it may cause injury.
- ●Use the equipment within the specified environment. For the environment, refer to section 1.5.
- ●Provide adequate protection to prevent screws and other conductive matter, oil and other combustible matter from entering the servo amplifier and MR-D30.
- ●Do not block the intake and exhaust areas of the servo amplifier and MR-D30. Otherwise, it may cause a malfunction.
- ●Do not drop or strike the servo amplifier and MR-D30. Isolate them from all impact loads.
- ●Do not install or operate the servo amplifier and MR-D30 which have been damaged or have any parts missing.
- ●When the product has been stored for an extended period of time, contact your local sales office.
- ●When handling the servo amplifier and MR-D30, be careful about the edged parts such as corners of them.
- ●The servo amplifier and MR-D30 must be installed in a metal cabinet.
- ●When fumigants that contain halogen materials such as fluorine, chlorine, bromine, and iodine are used for disinfecting and protecting wooden packaging from insects, they cause malfunction when entering our products. Please take necessary precautions to ensure that remaining materials from fumigant do not enter our products, or treat packaging with methods other than fumigation (heat method). Additionally, disinfect and protect wood from insects before packing products.

POINT

●When pulling out CNP1, CNP2, and CNP3 connectors of 200 V/100 V class servo amplifiers of 600 W or lower, pull out the CN3 connector beforehand.

2. INSTALLATION

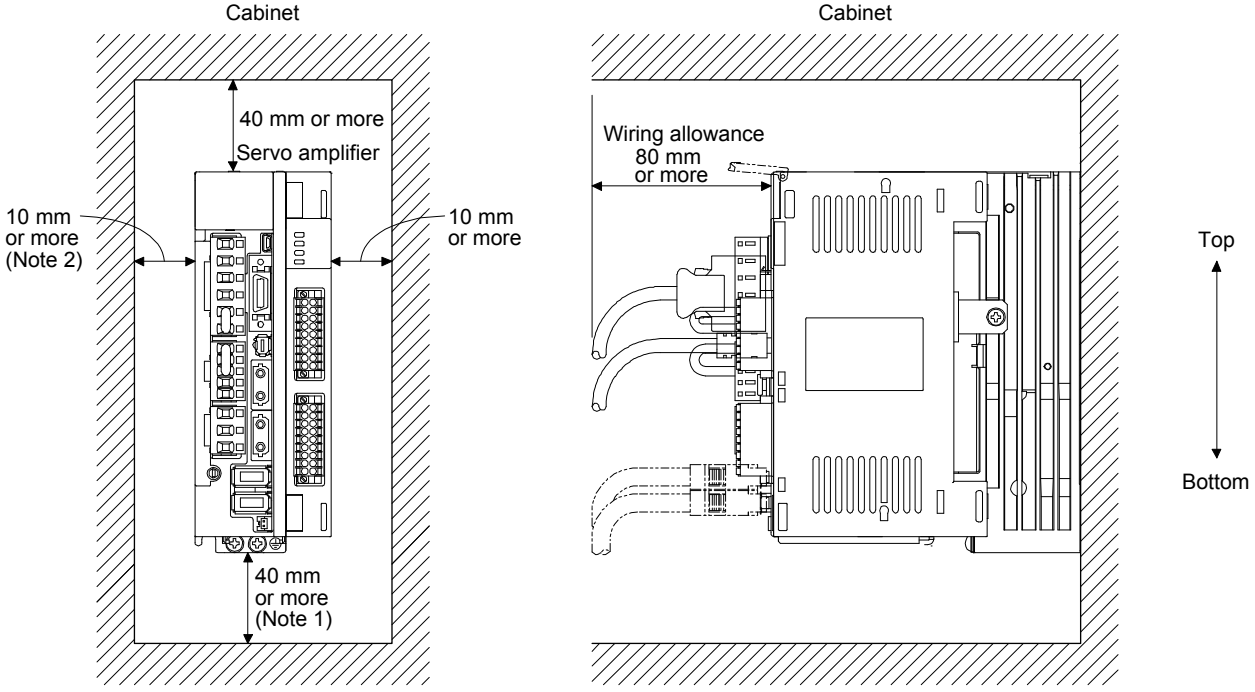
2.1 Installation direction and clearances

CAUTION	●The equipment must be installed in the specified direction. Otherwise, it may cause a malfunction. ●Leave specified clearances between the servo amplifier/MR-D30 and the cabinet walls or other equipment. Otherwise, it may cause a malfunction.

POINT
●For the installation direction and clearances of the MR-J4-DU_-RJ, refer to "MR-CV_/MR-CR55K_/MR-J4DU_(-RJ) Instruction Manual".

(1) Installation clearances of the servo amplifier

(a) Installation of one servo amplifier



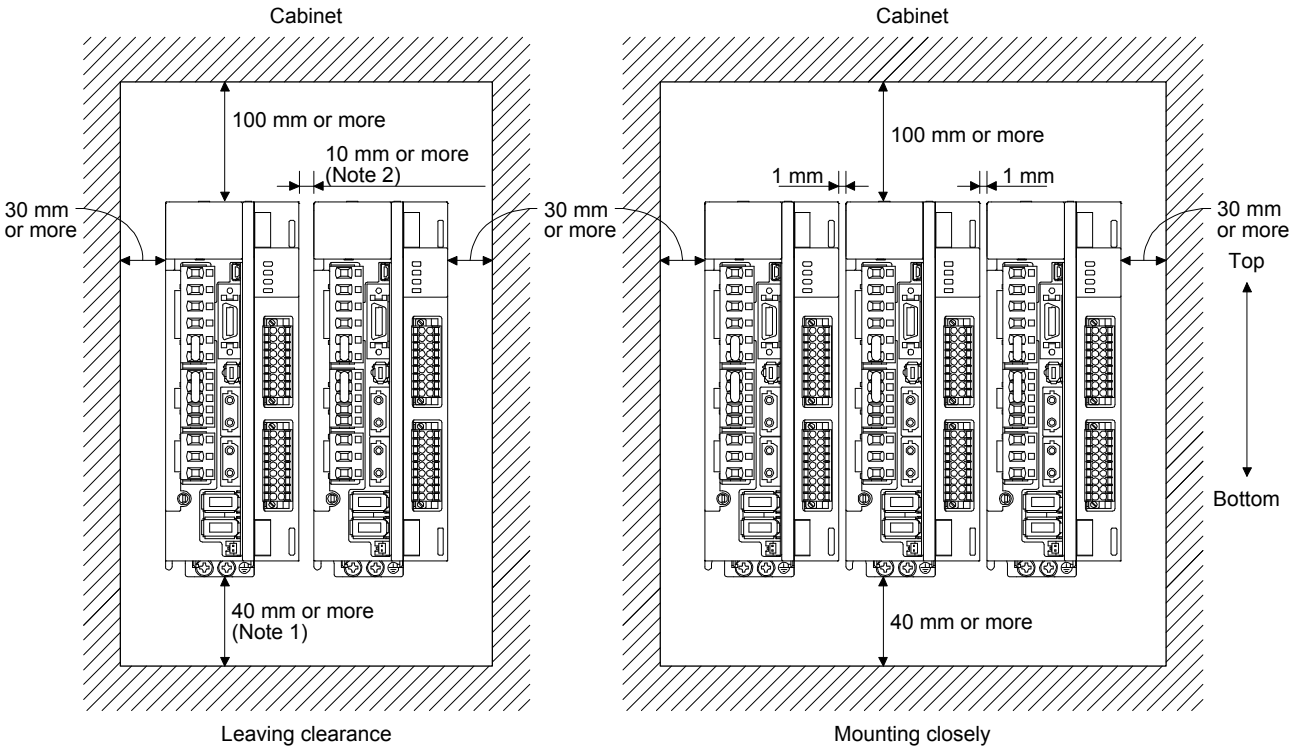
Note 1. For the 11 kW to 22 kW servo amplifiers, the clearance between the bottom and the ground will be 120 mm or more.

2. When mounting MR-J4-500_-RJ, maintain a minimum clearance of 25 mm on the left side.

(b) Installation of two or more servo amplifiers

POINT
●Close mounting is possible depending on the capacity of the servo amplifier. For the possibility of close mounting, refer to each servo amplifier instruction manual. ●When closely mounting multiple servo amplifiers, the servo amplifier on the right must have a larger depth than that on the left. Otherwise, the CNP1, CNP2, and CNP3 connectors cannot be removed.

Leave a large clearance between the top of the servo amplifier and the cabinet walls, and install a cooling fan to prevent the internal temperature of the cabinet from exceeding the environment. When mounting the servo amplifiers closely, leave a clearance of 1 mm between the adjacent servo amplifiers in consideration of mounting tolerances. In this case, keep the ambient temperature within 0 ˚C to 45 ˚C or use the servo amplifier with 75% or less of the effective load ratio.



Note 1. For the 11 kW to 22 kW servo amplifiers, the clearance between the bottom and the ground will be 120 mm or more.
2. When mounting MR-J4-500_-RJ, maintain a minimum clearance of 25 mm between the MR-J4-500GF(-RJ) and a servo amplifier mounted on the left side.

(2) Others

When using heat generating equipment such as the regenerative option, install them with full consideration of heat generation so that the servo amplifier is not affected.

Install the servo amplifier on a perpendicular wall in the correct vertical direction.

2.2 Keep out foreign materials

(1) When drilling in the cabinet, prevent drill chips and wire fragments from entering MR-D30 and servo amplifier.

(2) Prevent oil, water, metallic dust, etc. from entering the servo amplifier through openings in the cabinet or a cooling fan installed on the ceiling.

(3) When installing the cabinet in a place where toxic gas, dirt and dust exist, conduct an air purge (force clean air into the cabinet from outside to make the internal pressure higher than the external pressure) to prevent such materials from entering the cabinet.

2.3 Inspection items

⚠CAUTION ●Do not disassemble and/or repair the equipment on customer side.

It is recommended that the following points periodically be checked.

(1) Check for loose terminal block screws. Retighten any loose screws.

(2) Check the cables and the like for scratches or cracks. Inspect them periodically according to operating conditions especially when the servo motor is movable.

(3) Check that the connector is securely connected to the servo amplifier.

(4) Check that the wires are not coming out from the connector.

(5) Check for dust accumulation on the servo amplifier.

(6) Check for unusual noise generated from the servo amplifier.

(7) Make sure that the emergency stop circuit operates properly such that an operation can be stopped immediately and a power is shut off by the emergency stop switch.

2.4 Parts having service life

MR-D30 has no parts for replacement.

2.5 Maintenance

POINT
●When you order a repair, please return the MR-D30 with a note of No. of occurred alarm.

The parameters of MR-D30 are protected by passwords to prevent incorrect settings. The parameters of MR-D30 which are returned for fixing/investigation will be initialized. The parameters and other settings need to be set again.
Changing the combination of MR-D30 and MR-J4 servo amplifier will trigger [AL. 7A.4 Functional safety unit combination error (safety observation function)], and the safety observation function you set will not operate.

2.6 Attachment and detachment of MR-D30

⚠WARNING

- Before attaching and detaching MR-D30, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between P+ and N- is safe with a voltage tester and others. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier.

⚠CAUTION

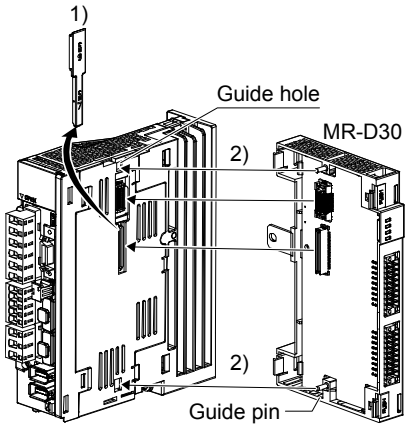
- Do not repeatedly attach and detach MR-D30. Otherwise, a contact failure may be caused in the connector.
- To protect the connectors from dusts and dirt, do not unpack MR-D30 until it is ready to be attached. When storing MR-D30, be sure to cover the unit with a packing bag in which the unit had been covered prior to shipping.
- Do not use MR-D30 if its fixing hook or clips are broken. Otherwise, a contact failure may be caused in the connector.
- When attaching/detaching MR-D30 to/from MR-J4-500_-RJ to MR-J4-22K_-RJ and MR-J4-350_4-RJ to MR-J4-22K_4-RJ servo amplifiers, be careful not to drop the mounting screw in the servo amplifiers. Otherwise, it may cause a malfunction to the servo amplifiers.
- When mounting MR-D30 to MR-J4-500_-RJ to MR-J4-22K_-RJ and MR-J4-350_4-RJ to MR-J4-22K_4-RJ servo amplifiers, be careful not to damage the board in the servo amplifier by the fixing plate. Otherwise, it may cause a malfunction to the servo amplifiers.
- Make sure to tighten MR-D30 with the enclosed mounting screw when installing.

POINT

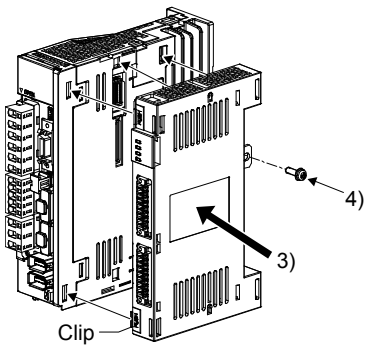
- For attaching/detaching MR-D30 to/from the MR-J4-DU_-RJ drive unit, refer to "MR-CV_/MR-CR55K_/MR-J4-DU_(-RJ) Instruction Manual".
- The internal circuits of the servo amplifier and MR-D30 may be damaged by static electricity. Always take the following precautions.
  - Ground human body and work bench.
  - Do not touch the conductive areas, such as connector pins and electrical parts, directly by hand.

(1) MR-J4-200_(4)-RJ or less and MR-J4-350_-RJ

(a) Attachment of MR-D30

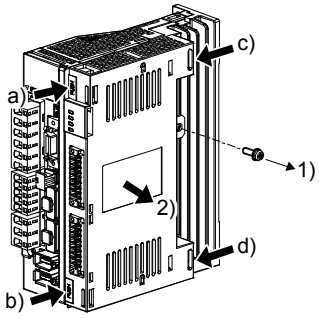


1) Remove the covers of CN7 and CN9 connectors.
   Use caution not to lose the removed covers.
2) Insert the guide pins of the MR-D30 in the guide holes located on the side of the servo amplifier.

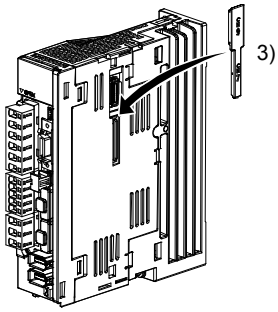


3) To connect the CN7 and CN9 connectors straight, push the four corners of the MR-D30 against the servo amplifier simultaneously, and keep pushing until the clips click into place.
4) Tighten the unit with the enclosed mounting screw (M4).

(b) Detachment of MR-D30



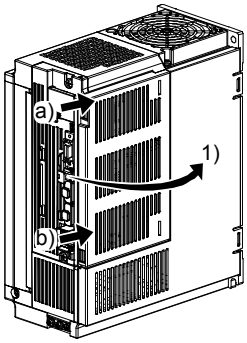
1) Remove the mounting screw.
2) While pushing the clips (a) ,b), c), d)), pull out the MR-D30 to the arrow direction. Do not pull the MR-D30 without removing the mounting screw.



3) When the MR-D30 is detached, be sure to cover the CN7 and CN9 connectors to protect from dust and dirt.

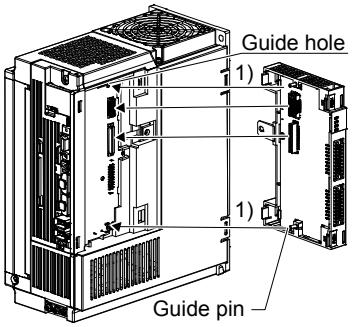
(2) MR-J4-500_-RJ to MR-J4-700_-RJ and MR-J4-350_4-RJ to MR-J4-700_4-RJ

(a) Detachment of the side cover

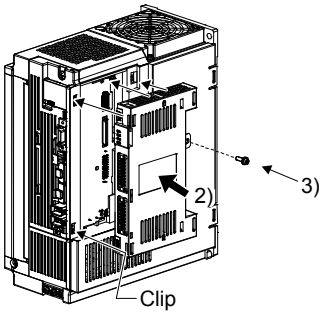


1) While pushing the clips (a) , b)), and pull out the side cover to the arrow direction.

(b) Attachment of MR-D30

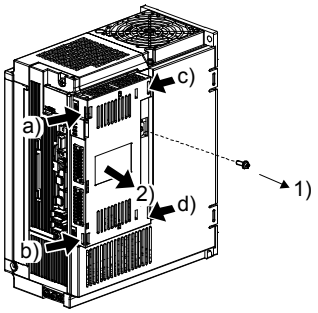


1) Insert the guide pins of the MR-D30 in the guide holes located on the side of the servo amplifier.



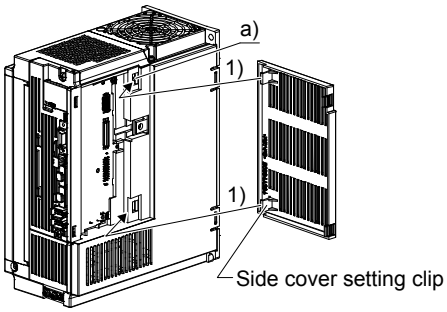
2) To connect the CN7 and CN9 connectors straight, push the four corners of the MR-D30 against the servo amplifier simultaneously, and keep pushing until the clips click into place.
3) Tighten the unit with the enclosed mounting screw (M4).

(c) Detachment of MR-D30

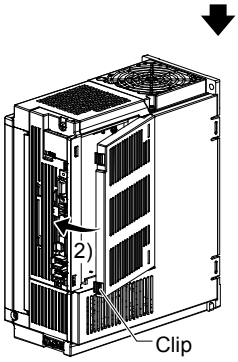


1) Remove the mounting screw.
2) While pushing the clips (a) ,b), c), d)), pull out MR-D30 to the arrow direction. Do not pull the MR-D30 without removing the mounting screw.

(d) Attachment of the side cover



1) Insert the side cover setting clips into the recesses a) of the servo amplifier.

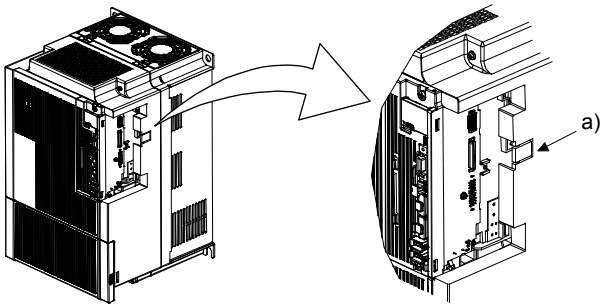


2) Push the side cover at the supporting point a) in procedure 1) until the clips clip into place.

(3) MR-J4-11K_(4)-RJ to MR-J4-22K_(4)-RJ

⚠CAUTION ●Avoid touching burr remained after the part a) being cut off from the case shown in the figure below. Otherwise, it may cause injury.

The mounting screw hole on these servo amplifiers are covered and not shown at shipping. When attaching the unit for the first time, cut off the part a) from the case after removing the side cover.
When cutting off the part a), be careful not to damage the case of the servo amplifier. After the part a) is cut off, inside of the servo amplifier will be exposed even after the side cover or the unit is attached. Prevent foreign materials from entering through the opened area into the servo amplifier.
For attaching and detaching the unit, refer to (2) in this section. Attachment and detachment of the cover is in the same manner as the unit.



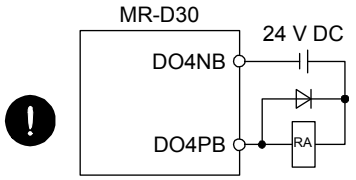
3. SIGNALS AND WIRING

⚠WARNING

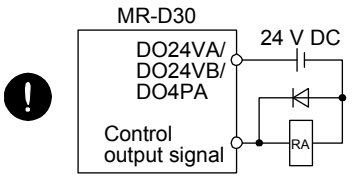
- Any person who is involved in wiring should be fully competent to do the work.
- Before wiring, turn off the power and wait for 15 minutes or more until the charge lamp of the servo amplifier turns off. Then, confirm that the voltage between P+ and N- is safe with a voltage tester and others. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier.
- Ground the servo amplifier and servo motor securely.
- Do not attempt to wire the servo amplifier and servo motor until they have been installed. Otherwise, it may cause an electric shock.
- The cables should not be damaged, stressed, loaded, or pinched. Otherwise, it may cause an electric shock.
- To avoid an electric shock, insulate the connections of the power supply terminals.

⚠CAUTION

- Wire the equipment correctly and securely. Otherwise, the servo motor may operate unexpectedly, resulting in injury.
- Connect cables to the correct terminals. Otherwise, a burst, damage, etc. may occur.
- Ensure that polarity (+/-) is correct. Otherwise, a burst, damage, etc. may occur.
- The surge absorbing diode installed to the DC relay for control output should be fitted in the specified direction. Otherwise, the emergency stop and other protective circuits may not operate.

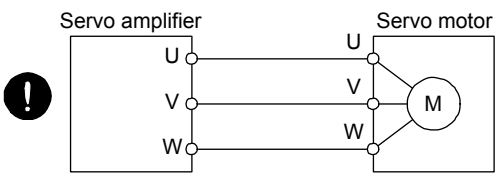


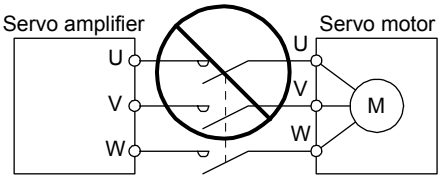
For sink output interface



For source output interface

- Use a noise filter, etc. to minimize the influence of electromagnetic interference. Electromagnetic interference may be given to the electronic equipment used near the servo amplifier.
- Do not install a power capacitor, surge killer or radio noise filter (optional FR-BIF(-H)) with the power line of the servo motor.
- When using a regenerative resistor, switch power off with the alarm signal. Otherwise, a transistor fault or the like may overheat the regenerative resistor, causing a fire.
- Do not modify the equipment.
- Connect the servo amplifier power output (U/V/W) to the servo motor power input (U/V/W) directly. Do not let a magnetic contactor, etc. intervene. Otherwise, it may cause a malfunction.





- Connecting a servo motor of the wrong axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.

POINT

●The following indicate hardware abbreviations (H/W abbreviation) of the connector pin No., not functions.

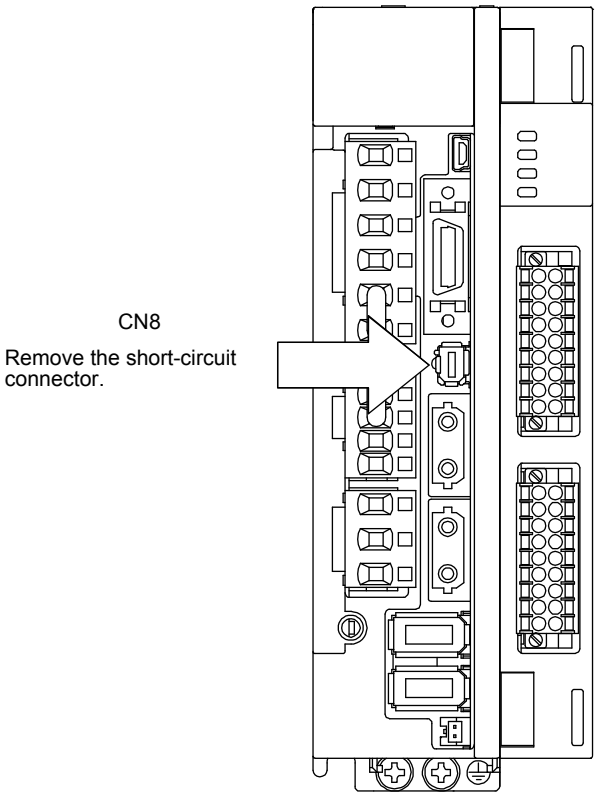
H/W abbreviation	Pin No.
DI1A	CN10A-4
DI2A	CN10A-13
DI3A	CN10A-5
DI4A	CN10A-14
DI5A	CN10A-6
DI6A	CN10A-15
DI1B	CN10B-4
DI2B	CN10B-13
DI3B	CN10B-5
DI4B	CN10B-14
DI5B	CN10B-6
DI6B	CN10B-15

H/W abbreviation	Pin No.
DO1A	CN10A-8
DO2A	CN10A-17
DO3A	CN10A-9
DO4NA	CN10A-18
DO1B	CN10B-8
DO2B	CN10B-17
DO3B	CN10B-9
DO4PB	CN10B-16

For signals and wiring of servo amplifiers, refer to each servo amplifier instruction manual.

3.1 Connectors and pin assignment

The servo amplifier front view shown is an example of the MR-J4-20B-RJ or less. Refer to section 4.4.1 for functions that can be assigned to DI1_ to DI6_, and section 4.4.2 for DO1_ to DO4_.
For connectors other than CN10A/CN10B, refer to each servo amplifier instruction manual.



CN10A (Note)

No.	Symbol	Symbol	No.
10	DC24VA	DC24VA	1
11	DICOMA	DICOMA	2
12	PLSA		3
13	DI2A	DI1A	4
14	DI4A	DI3A	5
15	DI6A	DI5A	6
16	DO4PA	DO24VA	7
17	DO2A	DO1A	8
18	DO4NA	DO3A	9

CN10B (Note)

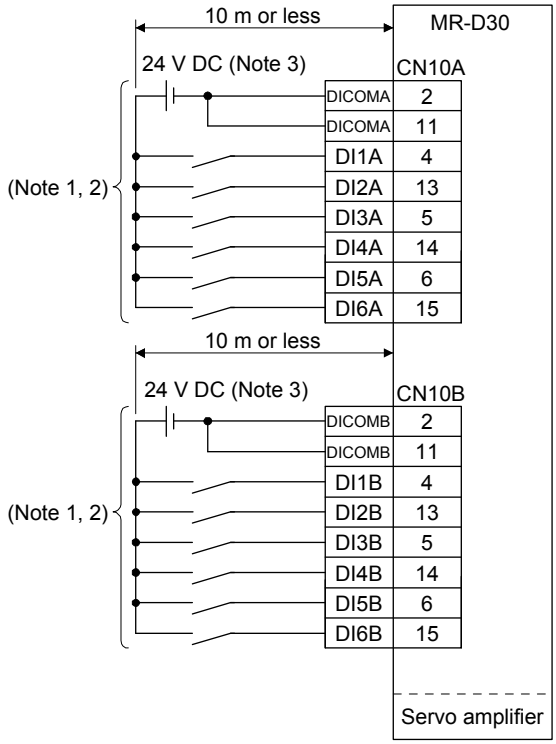
No.	Symbol	Symbol	No.
10	DC24VB	DC24VB	1
11	DICOMB	DICOMB	2
12	PLSB		3
13	DI2B	DI1B	4
14	DI4B	DI3B	5
15	DI6B	DI5B	6
16	DO4PB	DO24VB	7
17	DO2B	DO1B	8
18	DO4NB	DO3B	9

Note. DO4PA (CN10A-16), DO4NA (CN10A-18), DO4PB (CN10B-16), and DO4NB (CN10B-18) are not supported by MR-D30 manufactured in September, 2014 or earlier. Do not connect anything to the pins.

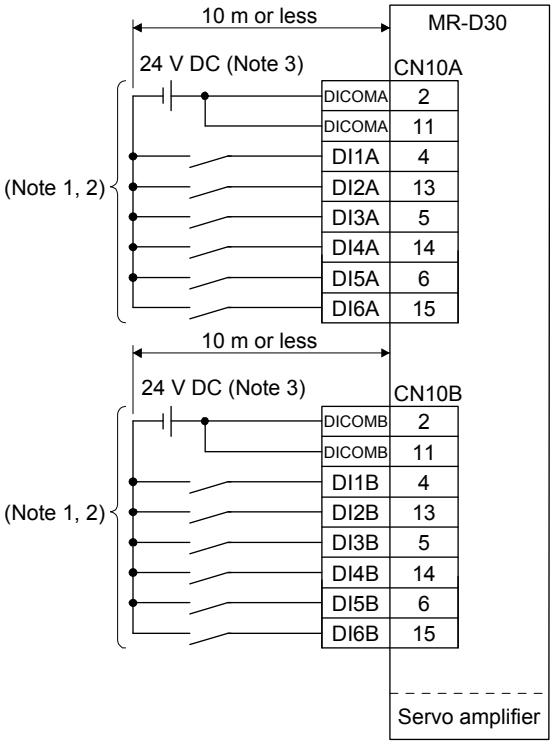
3.2 I/O signal connection example

Consider 15 ms or shorter delay time from input (DI1A to DI6A and DI1B to DI6B) to output (DO1A to DO4A and DO1B to DO4B) when connecting cascade.
For connection examples of servo amplifiers, refer to each servo amplifier instruction manual.

3.2.1 Input signal



For source input interface



For sink input interface

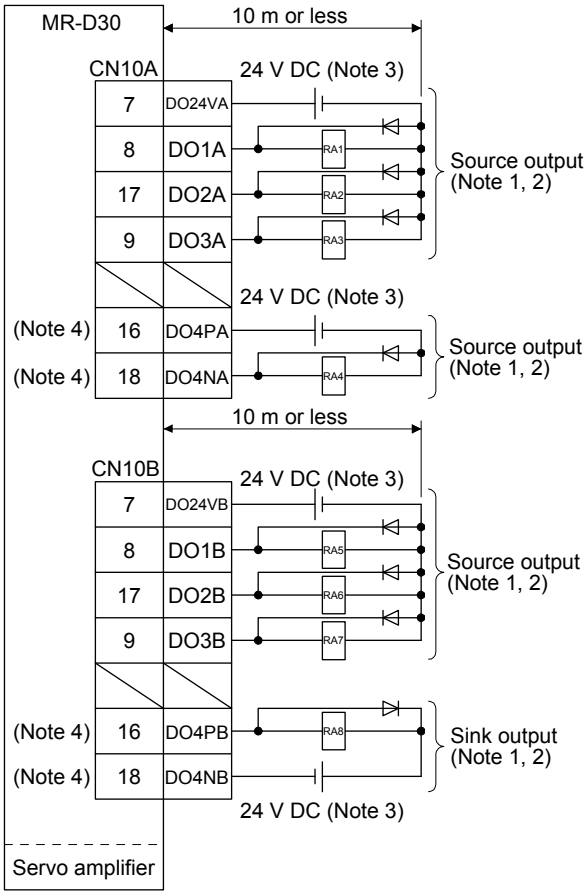
Note 1. Separate all the external wires by two types, CN10A and CN10B.
2. Assign each input device to the following combinations of connector and pin. For details of each device, refer to section 4.4.1 and 4.4.2.

Combination of connector and pin for input
DI1A (CN10A-4)/DI1B (CN10B-4)
DI2A (CN10A-13)/DI2B (CN10B-13)
DI3A (CN10A-5)/DI3B (CN10B-5)
DI4A (CN10A-14)/DI4B (CN10B-14)
DI5A (CN10A-6)/DI5B (CN10B-6)
DI6A (CN10A-15)/DI6B (CN10B-15)

3. Supply 24 V DC ± 10% to interfaces from outside. When all the I/O points are used, the required current capacity is 0.8 A in total. The current capacity can be decreased by reducing the number of I/O points. Refer to section 3.3 that gives the current value necessary for the interface. The illustration of the 24 V DC power supply is divided between input signal and output signal for convenience. However, they can be configured by one.

3.2.2 Output signal

DO1A to DO3A, DO1B to DO3B, and DO4NA can be used as source output. DO4PB can be used as sink output.



Note 1. Separate all the external wires by two types, CN10A and CN10B. Be sure to wire them separately by the two types for power supply for IO (24 V DC, 0 V common). Do not mix them when wiring.

2. Assign each output device to the following combinations of connector and pin. For details of each device, refer to section 4.4.1 and 4.4.2.

Combination of connector and pin for output
DO1A (CN10A-8)/DO1B (CN10B-8)
DO2A (CN10A-17)/DO2B (CN10B-17)
DO3A (CN10A-9)/DO3B (CN10B-9)
DO4NA (CN10A-18)/DO4PB (CN10B-16)

3. Supply 24 V DC ± 10% to interfaces from outside. When all the I/O points are used, the required current capacity is 0.8 A in total. The current capacity can be decreased by reducing the number of I/O points. Refer to section 3.3 that gives the current value necessary for the interface. The illustration of the 24 V DC power supply is divided between input signal and output signal for convenience. However, they can be configured by one.
4. DO4PA (CN10A-16), DO4NA (CN10A-18), DO4PB (CN10B-16), and DO4NB (CN10B-18) are not supported by MR-D30 manufactured in September, 2014 or earlier. Do not connect anything to the pins.

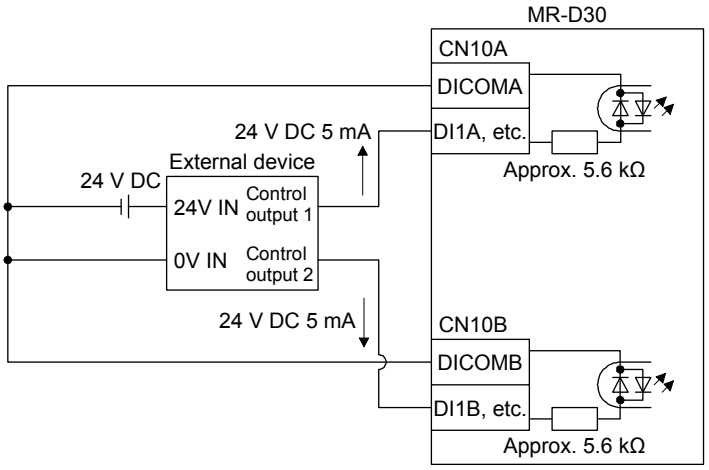
3.3 Connection of I/O interface

The following shows a connection of I/O interface. Refer to this section and make connection with an external device.

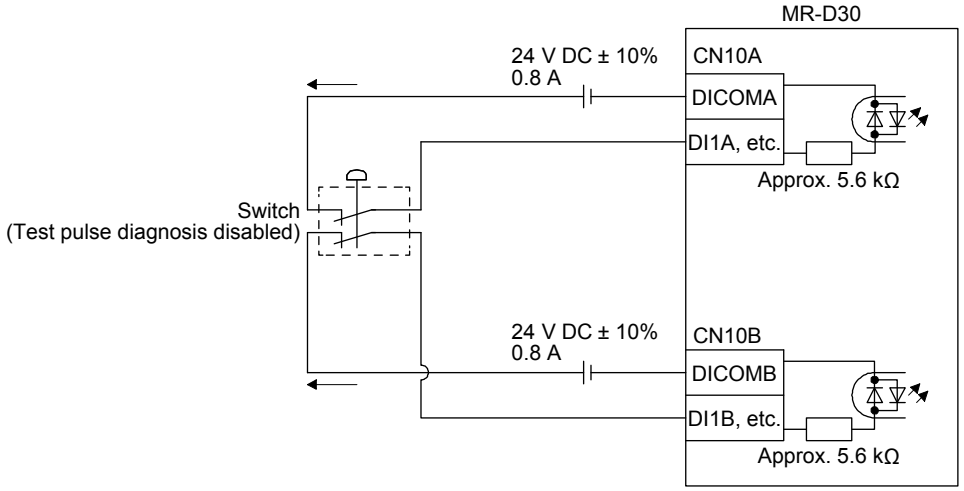
3.3.1 Source output

This is an input circuit in which the anode of the photocoupler is the input terminal. Transmit signals from source (open collector) type transistor output, relay switch, etc.
The wiring differs depending on a device to be connected, and on whether or not a test pulse diagnosis is executed. Refer to section 4.4.1 for the test pulse diagnosis. (Rated current: 5 mA, maximum current: 10 mA)

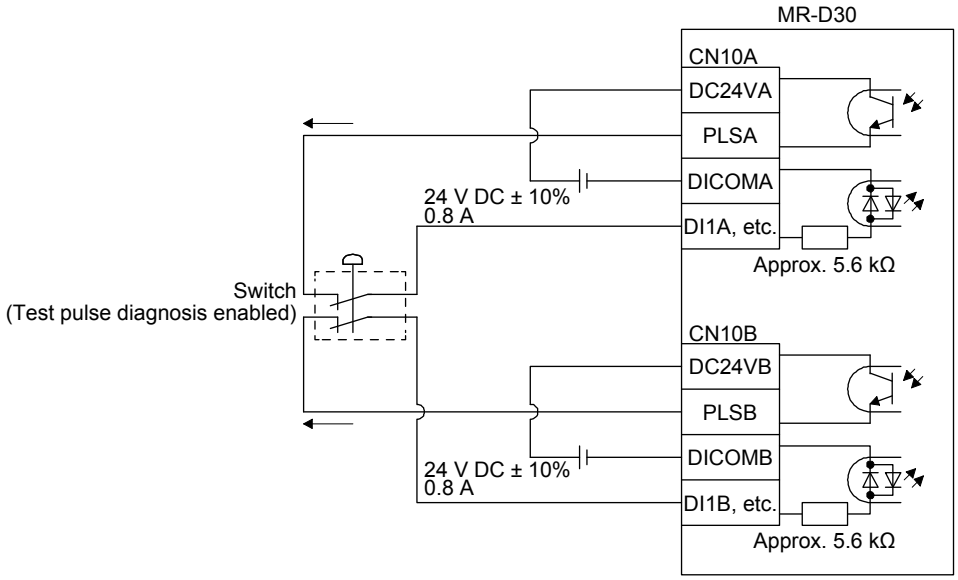
(1) Connection of external device
Connect the output signal of external device to DI _ _.



(2) Switch connection (not when executing a test pulse diagnosis)
Wire without using PLSA and PLSB.



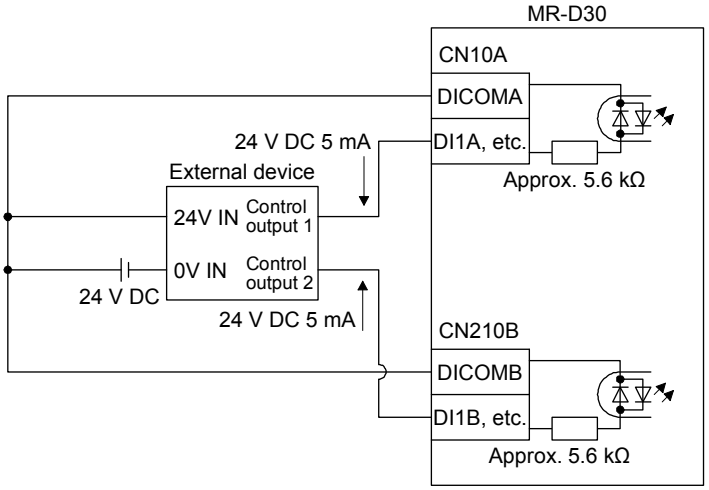
(3) Switch connection (when executing a test pulse diagnosis)
The pulses for diagnosis will be outputted from PLSA and PLSB. Wire so that the pulse signals outputted from PLSA and PLSB pass through the switch.



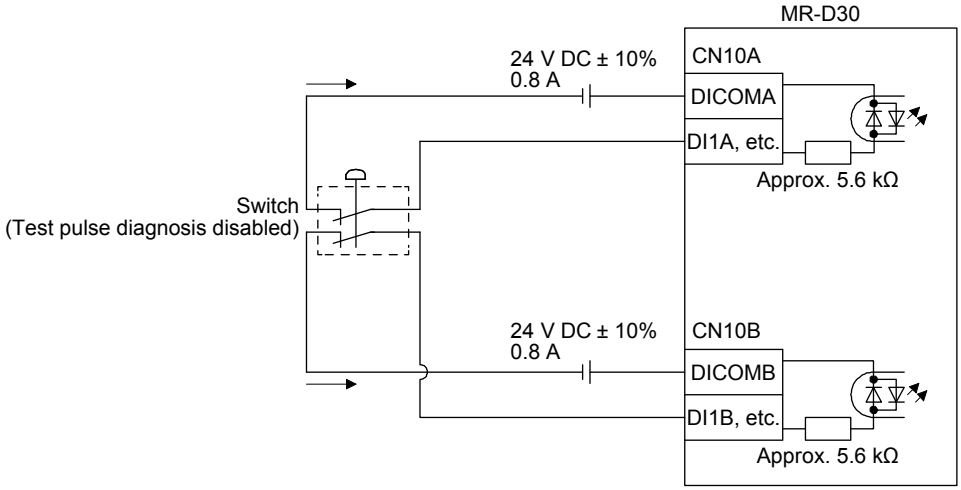
3.3.2 Sink input

This is an input circuit whose photocoupler cathode side is input terminal. Transmit signals from sink (open collector) type transistor output, relay switch, etc.
The wiring differs depending on a device to be connected, and on whether or not a test pulse diagnosis is executed. Refer to section 4.4.1 for the test pulse diagnosis. (Rated current: 5 mA, maximum current: 10 mA)

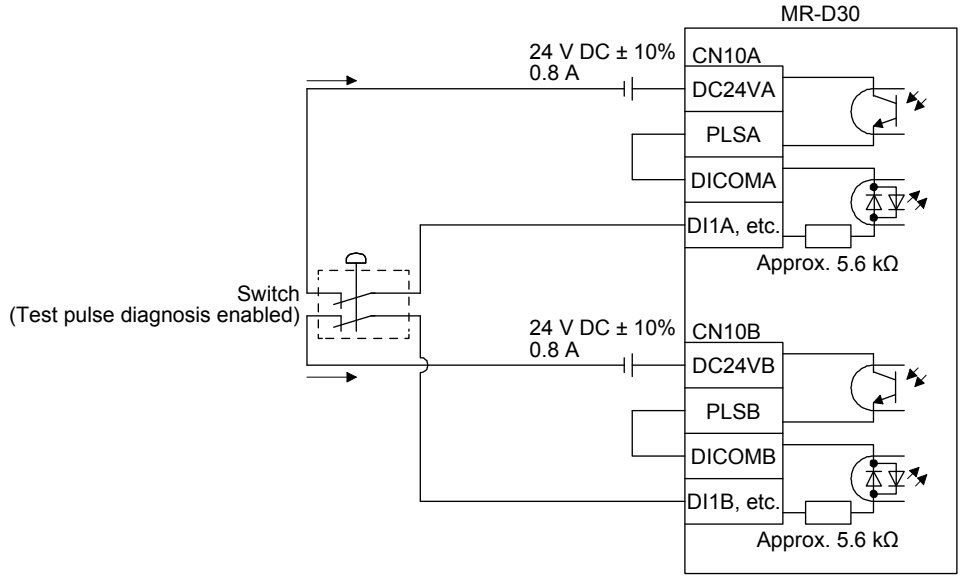
(1) Connection of external device
Connect the output signal of external device to DI _ _.



(2) Switch connection (not when executing a test pulse diagnosis)
Wire without using PLSA and PLSB.

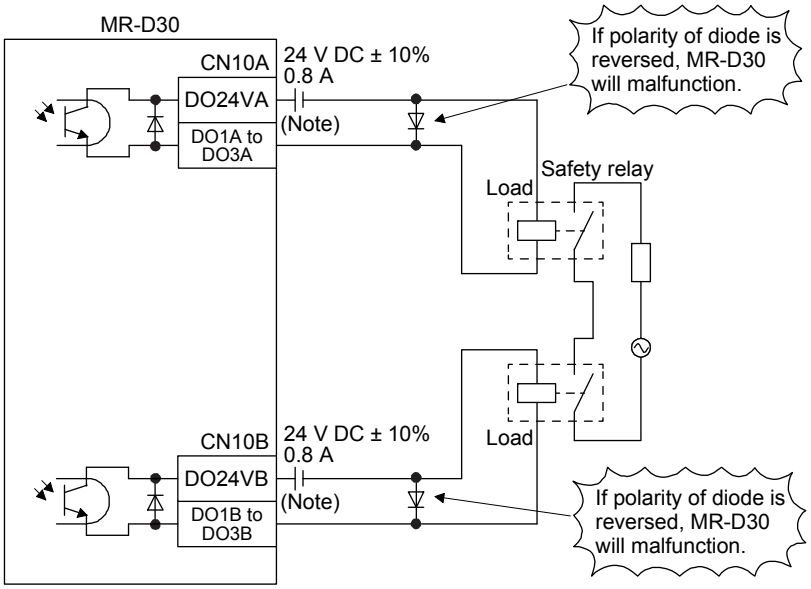


(3) Switch connection (when executing a test pulse diagnosis)
The pulses for diagnosis will be outputted from PLSA and PLSB. Wire so that the pulse signals outputted from PLSA and PLSB pass through the switch.



3.3.3 DO1_ to DO3_ source output

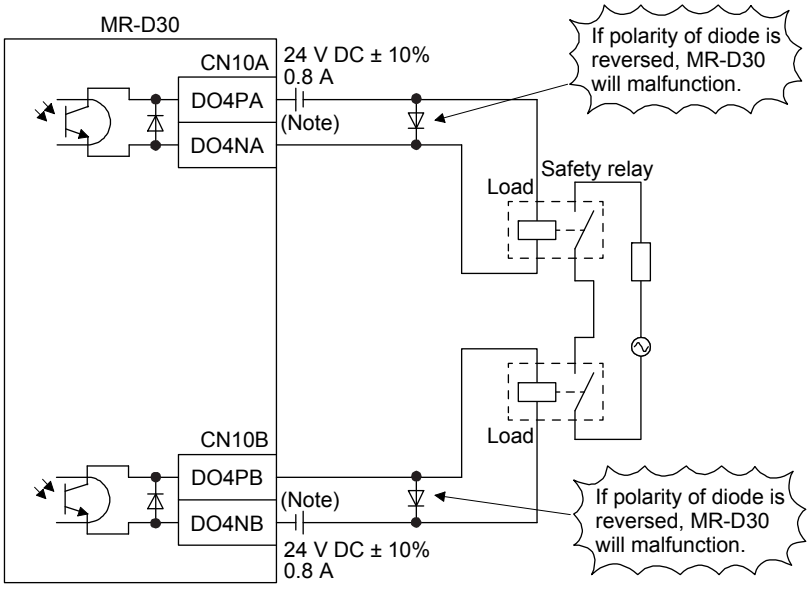
When the output transistor is turned on, the current will flow to the output terminal to a load. A lamp, relay, or photocoupler can be driven. Install a diode (D) for an inductive load, or install an inrush current suppressing resistor (R) for a lamp load. (Rated current: 5 mA to 40 mA, maximum current: 50 mA, inrush current: 100 mA or less) A maximum of 2.4 V voltage drop occurs in MR-D30.



Note. If polarity of power is reversed, the safety relay may malfunction.

3.3.4 DO4NA source output and DO4NB sink output

DO4NA as source output and DO4PB as sink output can be combined to use. As for DO4NA, when the output transistor is turned on, the current will flow from the output terminal to a load. As for DO4PB, when the output transistor is turned on, the current will flow from a load to the output terminal. A lamp, relay, or photocoupler can be driven. Install a diode (D) for an inductive load, or install an inrush current suppressing resistor (R) for a lamp load. (Rated current: 5 mA to 40 mA, maximum current: 50 mA, inrush current: 100 mA or less) A maximum of 2.4 V voltage drop occurs in MR-D30.

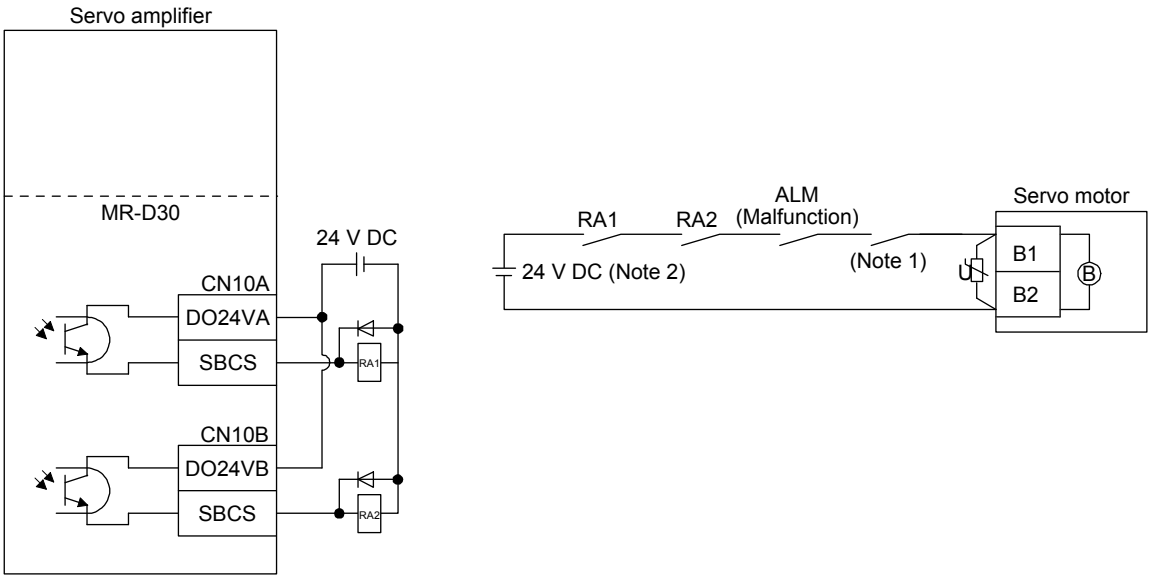


Note. If polarity of power is reversed, the safety relay may malfunction.

3.4 Wiring for SBC output

POINT
●This function guarantees only that power to mechanical brake is properly supplied, and abrasion of the brake cannot be detected. Check this function regularly that the mechanical brake can operate.

SBCS (SBC output) can be used by being connected to the electromagnetic brake on the servo motor. Wire it so that the electromagnetic brake operates when SBCS (SBC output) turns off. Using MBR of servo amplifier (electromagnetic brake interlock) is not necessary.
Refer to section 4.5.6 for the operation sequence for when using SBC function.



Note 1. Create the circuit in order to shut off by being interlocked with the emergency stop switch.
2. Do not use the 24 V DC interface power supply for the electromagnetic brake.

3.5 Noise reduction techniques

(1) Grounding shield of shielded cable

The following show measures against malfunctions of MR-D30 and servo amplifier for when the MR-D30 is installed near a device which generates excessive noise.

Ground a shield of the shielded cable near the MR-D30, and be careful that the cable after grounding should not be affected by electromagnetic induction of the cable before grounding.

Partly remove the insulator of the shielded cable, and ground the exposed shielded part by making contact in a large area with the cabinet. You can also use clamp metal parts as shown in figure 3.2. Mask the painted internal wall of the cabinet that touches the clamp metal parts.

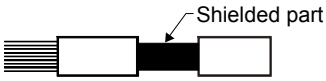


Figure 3.1 The shielded part to be exposed

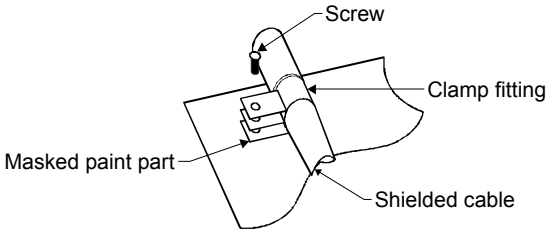
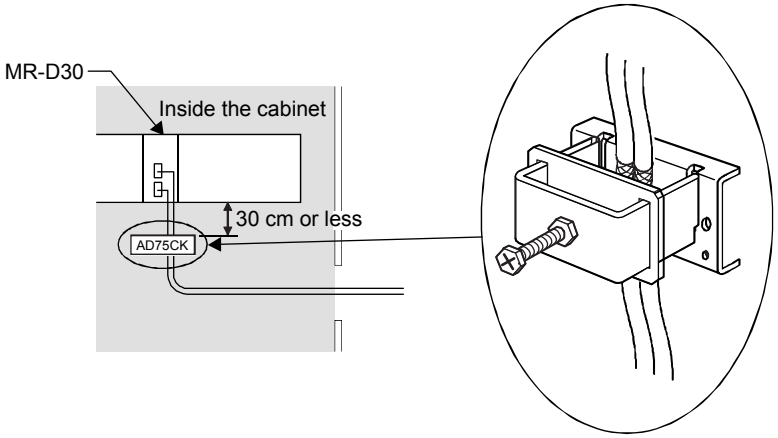


Figure 3.2 Grounding shields

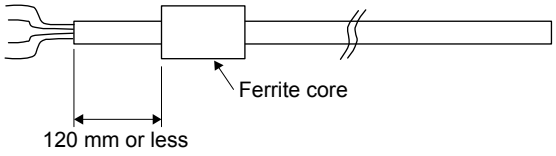
Ground the shield of the signal input cable as close as possible (30 cm or less) to the MR-D30.



(2) Ferrite core

A ferrite core has the effect of reducing conduction noise in the band around 10 MHz and radiated noise in the bands between 30 MHz to 100 MHz. When the shield effect of the shielded cable drawn out form the cabinet is not obtained enough or when emission of conduction noise from a power supply line should be suppressed, we recommend that you install the ferrite core.

Install the ferrite core at the position of the cable shown in the following figure. If the installation position is incorrect, the ferrite core will not be effective.



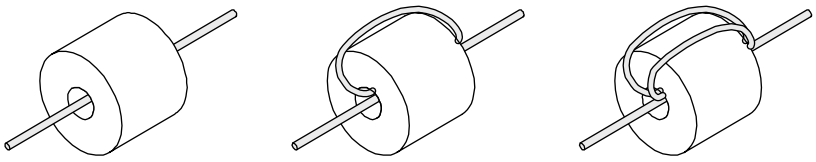
Installing ferrite cores to the signal input wires and cables will suppress more noise. The following table lists a ferrite core as an example.

Model	Impedance [Ω] (Note)	
ZCAT3035-1330 (TDK)	10 MHz to 100 MHz	100 MHz to 500 MHz
	80	150

Note. The values include wires (reference values) and are not guaranteed values.

ESD-SR-250 (NEC TOKIN), E04SRM563218 (SEIWA ELECTRIC) can also be used.

The effect of noise suppression rises as the number of passes though the ferrite core increases. Two or more passes are recommended.



One pass　　Two passes　　Three passes

3.6 Signal explanations

3.6.1 Input device

Assign the devices to DI1_ to DI6_ with [Pr. PSD02 Input device selection DI1] to [Pr. PSD07 Input device selection DI6]. Refer to section 4.4.1 for details.
For the safety observation function control by network, you can input through network.

Device	Symbol	Connector and pin No.	Function	Status of input pin when the function is enabled
STO command	STOC	CN10A-4 CN10A-5 CN10A-6 CN10A-13 CN10A-14 CN10A-15 CN10B-4 CN10B-5 CN10B-6 CN10B-13 CN10B-14 CN10B-15	The STO function operates by the STO command. Refer to section 4.5.1 for details of the STO function.	Open
SS1 command	SS1C		The SS1 function operates by the SS1 command. Refer to section 4.5.2 for details of the SS1 function.	Open
SS2 command	SS2C		The SS2/SOS functions operate by the SS2 command. Refer to section 4.5.3 for details of the SS1 function.	Open
SLS1 command	SLS1C		The SLS function 1 operates by the SLS1 command. [Pr. PSA07 SLS deceleration monitoring time 1] and [Pr. PSA11 SLS speed 1] are used. Refer to section 4.5.4 for details of the SLS function.	Open
SLS2 command	SLS2C		The SLS function 2 operates by the SLS2 command. [Pr. PSA08 SLS deceleration monitoring time 2] and [Pr. PSA12 SLS speed 2] are used. Refer to section 4.5.4 for details of the SLS function.	Open
SLS3 command	SLS3C		The SLS function 3 operates by the SLS3 command. [Pr. PSA09 SLS deceleration monitoring time 3] and [Pr. PSA13 SLS speed 3] are used. Refer to section 4.5.4 for details of the SLS function.	Open
SLS4 command	SLS4C		The SLS function 4 operates by the SLS4 command. [Pr. PSA10 SLS deceleration monitoring time 4] and [Pr. PSA14 SLS speed 4] are used. Refer to section 4.5.4 for details of the SLS function.	Open
Test pulse output A	PLSA	CN10A-12	Outputs test pulses for external wiring diagnosis.	
Test pulse output B	PLSB	CN10B-12	Outputs test pulses for external wiring diagnosis.	

3.6.2 Output device

The status monitor (SM) of the safety observation function is outputted from the devices of DO1_ to DO4_. The devices can be assigned to DO1_ to DO4_ with [Pr. PSD08 Output device selection DO1] to [Pr. PSD11 Output device selection DO4]. Refer to section 4.4.2 for details. For the safety observation function control by network, you can output through network. Then, DO1_ to DO4_ can be used simultaneously.

Device	Symbol	Connector and pin No.	Function	Status of output pin during operation
SSM output	SSMS	CN10A-8 CN10A-9 CN10A-17 CN10A-18 CN10B-8 CN10B-9 CN10B-17 CN10B-16	Indicates that the servo motor speed is at SLS speed or less while speed observation is operating by SLS function. Refer to section 4.5.5 for details.	Closed
SBC output	SBCS		Outputs a control signal of the electromagnetic brake. Refer to section 4.5.6 for details.	Open
STO output	STOS		This is a monitor output signal meaning that the STO function is operating. Refer to section 4.5.1 for details.	Open
SOS output	SOSS		This is a monitor output signal meaning that the servo motor in stop state is being monitored with the SS2/SOS functions. Refer to section 4.5.3 for details.	Open
SS1 output	SS1S		This is a monitor output signal meaning that the SS1 function is operating. Refer to section 4.5.2 for details.	Open
SS2 output	SS2S		This is a monitor output signal meaning that the SS2/SOS function is operating. Refer to section 4.5.3 for details.	Open
SLS1 output	SLS1S		This is a monitor output signal meaning that the SLS function 1 is operating. Refer to section 4.5.4 for details.	Open
SLS2 output	SLS2S		This is a monitor output signal meaning that the SLS function 2 is operating. Refer to section 4.5.4 for details.	Open
SLS3 output	SLS3S		This is a monitor output signal meaning that the SLS function 3 is operating. Refer to section 4.5.4 for details.	Open
SLS4 output	SLS4S		This is a monitor output signal meaning that the SLS function 4 is operating. Refer to section 4.5.4 for details.	Open

3.6.3 Power supply

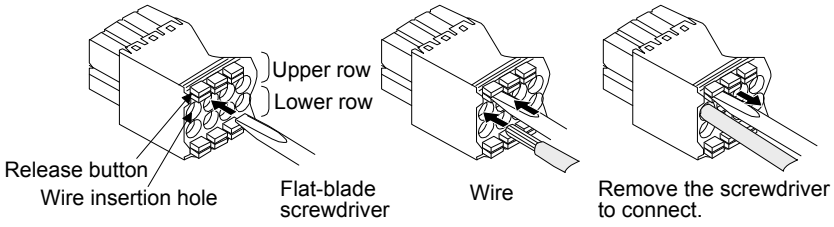
Name	Symbol	Connector and pin No.	Function and application
Digital input I/F common A	DICOMA	CN10A-2 CN10A-11	This is a common terminal for input signal. Input 24 V DC (24 V DC ± 10% 0.8 A) for I/O interface. The power supply capacity varies depending on the number of I/O interface points to be used. For sink interface, connect + of 24 V DC external power supply. For source interface, connect - of 24 V DC external power supply.
Test pulse power supply input A	DC24VA	CN10A-1 CN10A-10	Input a power supply to output test pulses for external wiring diagnosis. Connect + of the 24 V DC external power supply.
Digital output I/F common A	DO24VA	CN10A-7	This is a common terminal for output signal. For source interface, connect + of the 24 V DC external power supply.
Digital output I/F DO4A power supply	DO4PA	CN10A-16	This is a power supply terminal of DO4A output signal. Connect + of 24 V DC external power supply.
Digital input I/F common B	DICOMB	CN10B-2 CN10B-11	This is a common terminal for input signal. Input 24 V DC (24 V DC ± 10% 0.8 A) for I/O interface. The power supply capacity varies depending on the number of I/O interface points to be used. For sink interface, connect + of 24 V DC external power supply. For source interface, connect - of 24 V DC external power supply.
Test pulse power supply input B	DC24VB	CN10B-1 CN10B-10	Input a power supply to output test pulses for external wiring diagnosis. Connect + of the 24 V DC external power supply.
Digital output I/F common B	DO24VB	CN10B-7	This is a common terminal for output signal. For source interface, connect + of the 24 V DC external power supply.
Digital output I/F DO4B power supply	DO4NB	CN10B-18	This is a power supply terminal of DO4B output signal. Connect - of the 24 V DC external power supply.

3.7 Wiring method of CN10A/CN10B connectors

When wiring to CN10 and CN10B, use the connector DFMC 1,5/9-STF-3,5 (Phoenix Contact) packed with the servo amplifier.

(1) Fabricating wire insulator
Use a wire with AWG 24 to 16, and strip the wire end to make the stripped length 10 mm ± 0.5 mm.

(2) Inserting wire
Insert the wire while pressing the release button with a flat-blade screwdriver with a blade width of 2.0 mm to 2.5 mm. When the wire is inserted all the way, remove the screw driver.
It is recommended using the following screwdriver manufactured by Phoenix Contact: model: SZS 0,4X2,5, product No.: 1205037



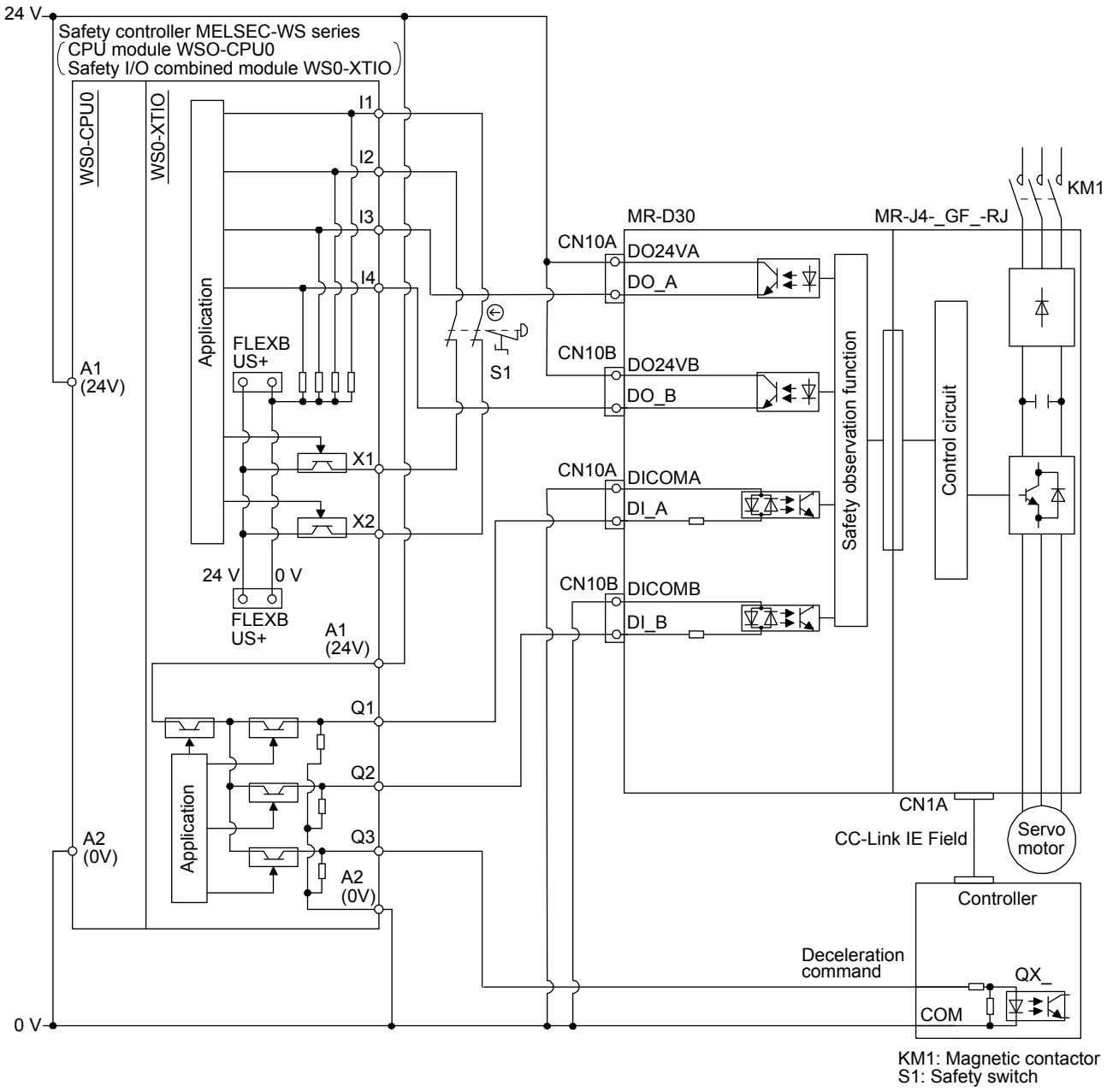
(3) Removing wire
Pull out the wire while pressing the release button with the flat-blade screwdriver.

3.8 Connection example with other devices

3.8.1 MR-J4-_GF_-RJ

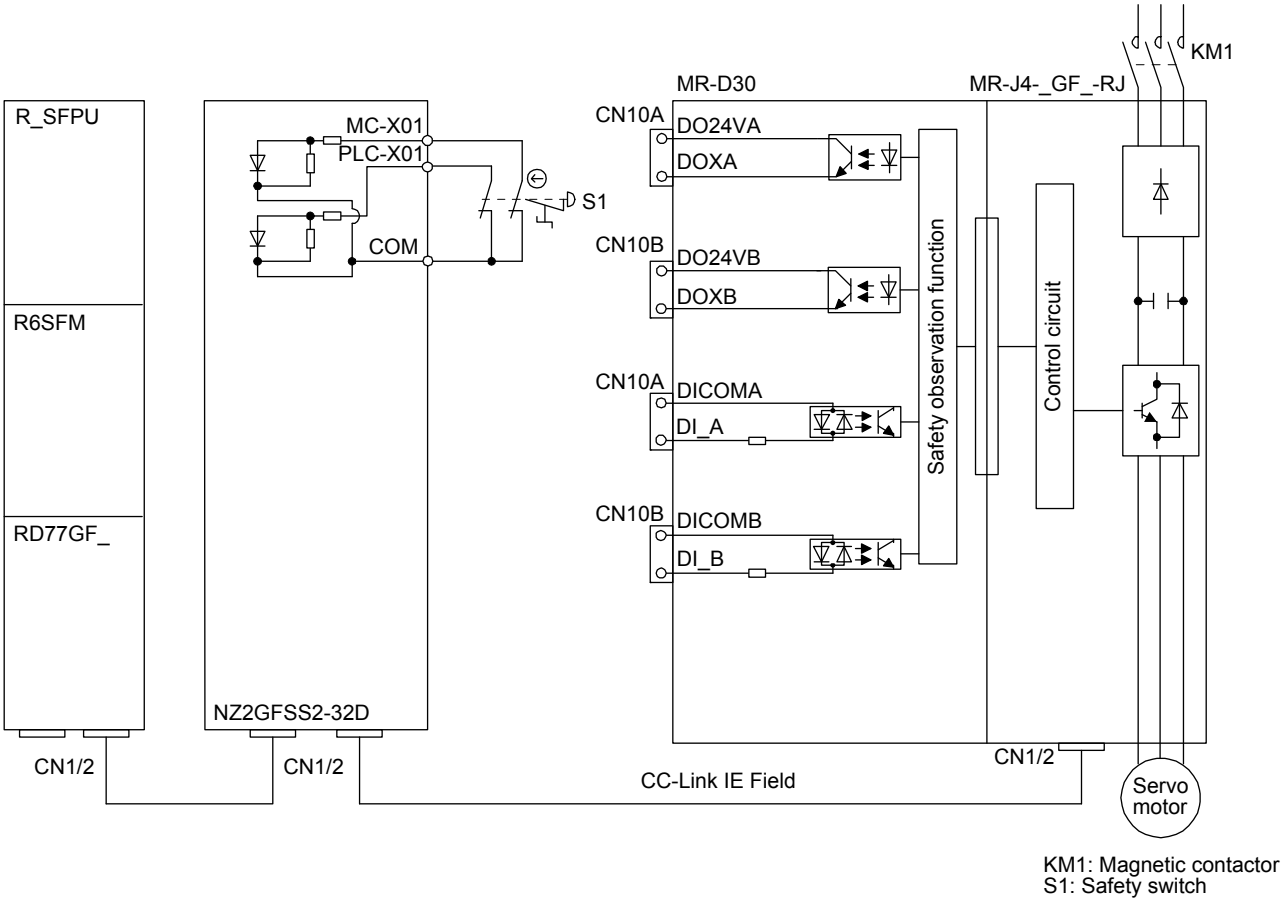
(1) Safety observation function control by input device

The following connection diagram shows an operation of the safety observation function using input devices assigned to pins of the CN10A and CN10B connectors with a safety controller. By diagnosis of input signals, the servo amplifier complies with safety level Category 4, PL e, SIL 3.



(2) Safety observation function control by network

The following connection diagram shows an operation of the safety observation function through CC-Link IE Field. The electric wiring can be omitted.

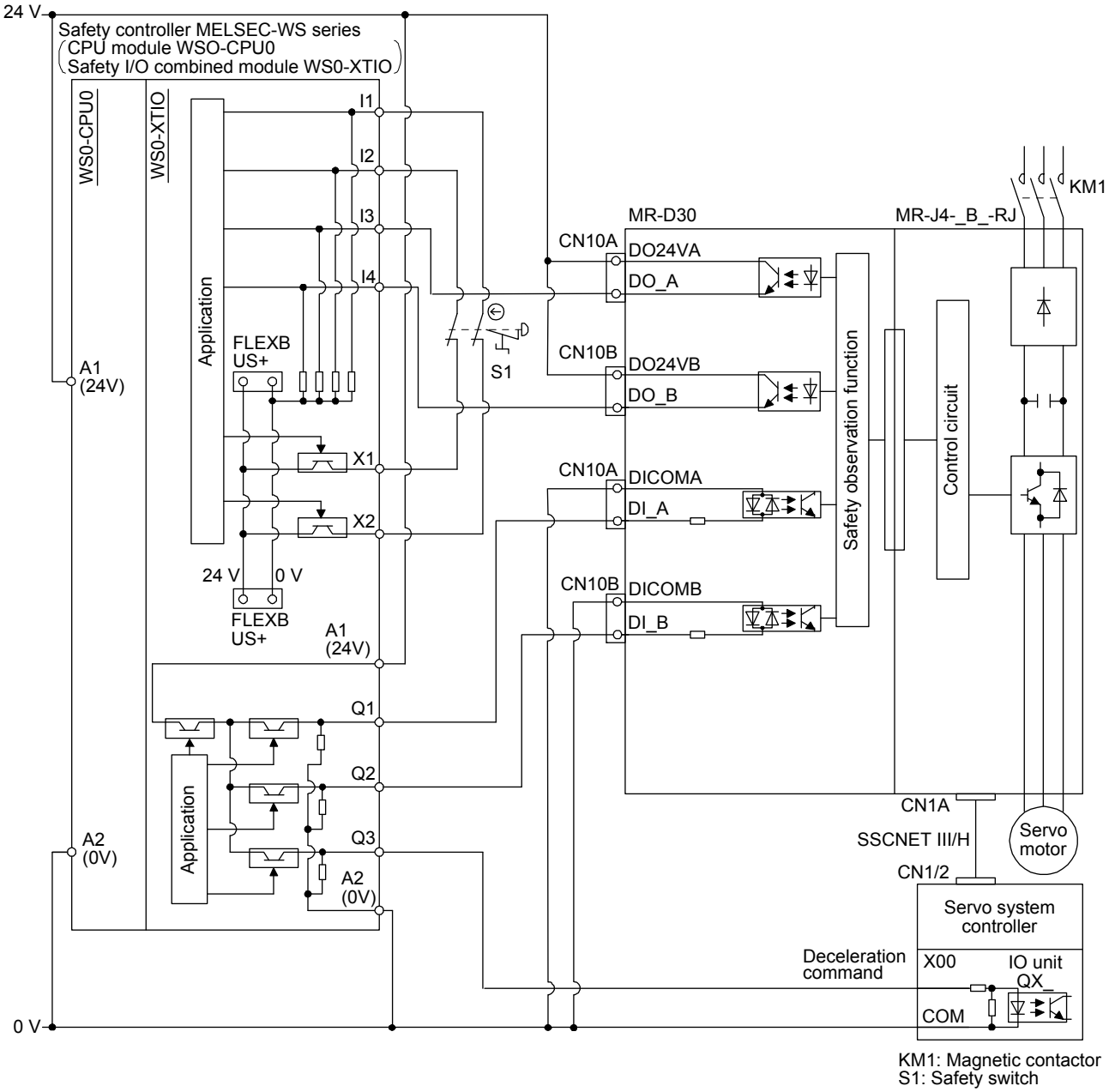


KM1: Magnetic contactor
S1: Safety switch

3.8.2 MR-J4-_B_-RJ

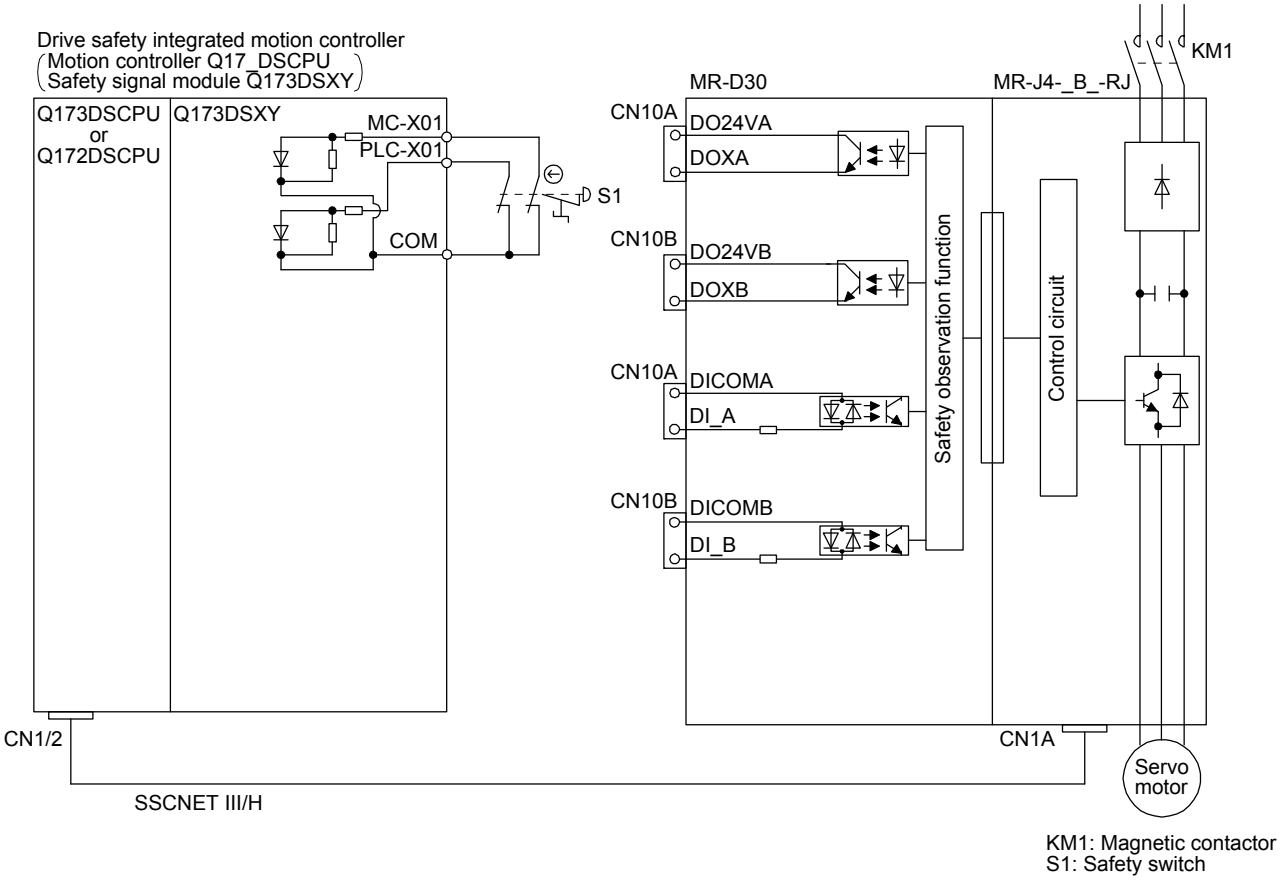
(1) Safety observation function control by input device

The following connection diagram shows an operation of the safety observation function using input devices assigned to pins of the CN10A and CN10B connectors with a safety controller. By diagnosis of input signals, the servo amplifier complies with safety level Category 4, PL e, SIL 3.



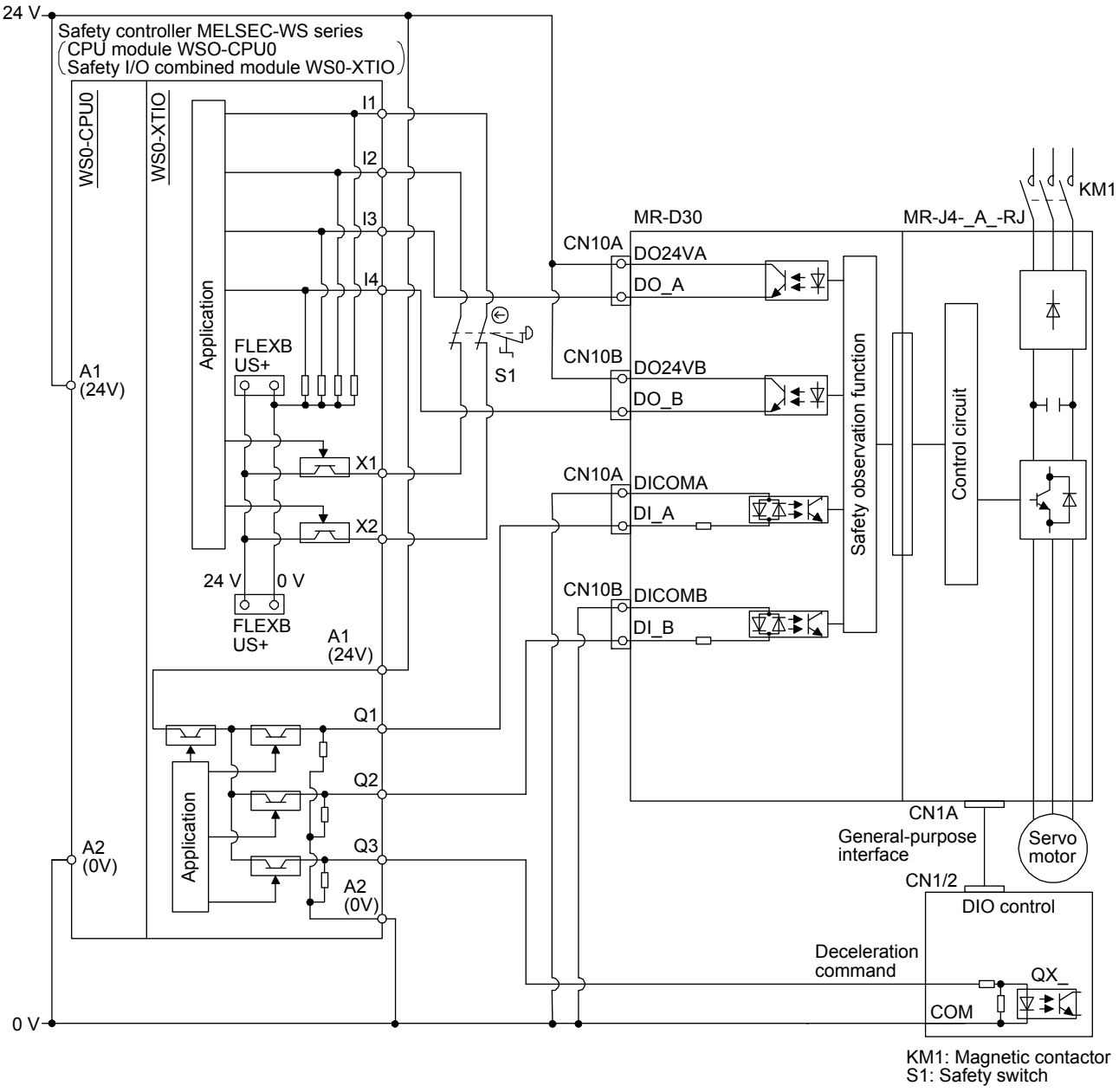
(2) Safety observation function control by network

The following connection diagram shows an operation of the safety observation function through SSCNET III/H. The electric wiring can be omitted.



3.8.3 MR-J4-_A_-RJ

The following connection diagram shows an operation of the safety observation function using input devices assigned to pins of the CN10A and CN10B connectors with a safety controller. By diagnosis of input signals, the servo amplifier complies with safety level Category 4, PL e, SIL 3.



3.9 Power-on sequence

Maintain about 0.5 s to 2 s in addition to the startup time of the servo amplifier in the system using MR-D30 and servo motor with functional safety for the initial diagnosis of the encoder.

4. SAFETY OBSERVATION FUNCTION

POINT

●The following indicate hardware abbreviations (H/W abbreviation) of the connector pin No., not functions.

H/W abbreviation	Pin No.
DI1A	CN10A-4
DI2A	CN10A-13
DI3A	CN10A-5
DI4A	CN10A-14
DI5A	CN10A-6
DI6A	CN10A-15
DI1B	CN10B-4
DI2B	CN10B-13
DI3B	CN10B-5
DI4B	CN10B-14
DI5B	CN10B-6
DI6B	CN10B-15

H/W abbreviation	Pin No.
DO1A	CN10A-8
DO2A	CN10A-17
DO3A	CN10A-9
DO4NA	CN10A-18
DO1B	CN10B-8
DO2B	CN10B-17
DO3B	CN10B-9
DO4PB	CN10B-16

4. SAFETY OBSERVATION FUNCTION

4.1 Achievable safety level

The achievable safety level and usable safety observation function depend on devices to be connected. Note that parameters need to be set according to the devices connected. The following shows servo motors and parameter settings required to meet each functional safety level.

(1) Shut off/Observation function

(a) Safety observation function control by network (CC-Link IE Field)

Safety observation function			Connected device	Parameter setting
STO function SS1 function	SLS function	SS2/SOS function	Servo motor with functional safety	Position/speed observation Pr. PSA02
Category 4, PL e, SIL 3	Category 3, PL d, SIL 2		Not required	_ _ 0 1 (no execution)
Category 4, PL e, SIL 3	Category 4, PL e, SIL 3	Category 4, PL e, SIL 3	Required	_ _ 1 1 (execution)

(b) Safety observation function control by network (SSCNETIII/H)

Safety observation function			Connected device	Parameter setting
STO function SS1 function	SLS function	SS2/SOS function	Servo motor with functional safety	Position/speed observation Pr. PSA02
Category 3, PL d, SIL 2	Category 3, PL d, SIL 2		Not required	_ _ 0 1 (no execution)
Category 3, PL d, SIL 2	Category 3, PL d, SIL 2	Category 3, PL d, SIL 2	Required	_ _ 1 1 (execution)

(c) Safety observation function control by input device

Safety observation function			Connected device		Parameter setting		
STO function SS1 function	SLS function	SS2/SOS function	Device to be connected to the input devices (DI1_ to DI6_) (example)	Servo motor with functional safety	Position/speed observation Pr. PSA02	Built-in test pulse diagnosis Pr. PSD24 Pr. PSD25	Fixing-diagnosis at start-up Pr. PSD27 Pr. PSD28
Category 3, PL d, SIL 2			Emergency stop push button, safety switch, enable switch	Not required	_ _ 0 0 (no execution)	0 (no execution)	1 (execution)
			Safety programmable controller (Note 1), safety controller (Note 1)	Not required	_ _ 0 0 (no execution)	0 (no execution)	1 (execution)
Category 4, PL e, SIL 3			Emergency stop push button, safety switch, enable switch	Not required	_ _ 0 0 (no execution)	1 (execution)	1 (execution)
			Safety programmable controller (Note 2), safety controller (Note 2)	Not required	_ _ 0 0 (no execution)	0 (no execution)	0 (no execution)
Category 3, PL d, SIL 2	Category 3, PL d, SIL 2		Emergency stop push button, safety switch, enable switch	Not required	_ _ 2 0 (execution)	0 (no execution)	1 (execution)
			Safety programmable controller (Note 1), safety controller (Note 1)	Not required	_ _ 2 0 (execution)	0 (no execution)	1 (execution)
Category 4, PL e, SIL 3			Emergency stop push button, safety switch, enable switch	Not required	_ _ 2 0 (execution)	1 (execution)	1 (execution)
			Safety programmable controller (Note 2), safety controller (Note 2)	Not required	_ _ 2 0 (execution)	0 (no execution)	0 (no execution)
Category 3, PL d, SIL 2	Category 3, PL d, SIL 2	Category 3, PL d, SIL 2	Emergency stop push button, safety switch, enable switch	Required	_ _ 1 0 (execution)	0 (no execution)	1 (execution)
			Safety programmable controller (Note 1), safety controller (Note 1)	Required	_ _ 1 0 (execution)	0 (no execution)	1 (execution)
Category 4, PL e, SIL 3	Category 4, PL e, SIL 3	Category 4, PL e, SIL 3	Emergency stop push button, safety switch, enable switch	Required	_ _ 1 0 (execution)	1 (execution)	1 (execution)
			Safety programmable controller (Note 2), safety controller (Note 2)	Required	_ _ 1 0 (execution)	0 (no execution)	0 (no execution)

Note 1. Set the IO diagnosis pulses of the controller to disabled (not use).

2. Set the IO diagnosis pulses of the controller to enabled (use). The controller needs to be compatible with SIL 3.

(2) Output function

<table>
<tr><th colspan="4">Safety observation function</th><th rowspan="2">Connected device</th><th rowspan="2">Servo motor with functional safety</th><th>Parameter setting</th><th>Parameter setting</th></tr>
<tr><th rowspan="2">SSM function</th><th colspan="3" rowspan="2">Status monitor function (STO/SS1/SBC)</th><th>Position/speed observation</th><th>Built-in test pulse diagnosis</th></tr>
<tr><th>SSMS</th><th>STOS/SS1S/ SBCS</th><th>SLS1S/SLS2S/ SLS3S/SLS4S</th><th>SOSS/SS2S</th><th>Device to be connected to the output devices (DO1_ to DO4_) (example)</th><th>Pr. PSA02</th><th>Pr. PSD29</th></tr>
<tr><td rowspan="4"></td><td rowspan="2">Category 3, PL d, SIL 2</td><td rowspan="4"></td><td rowspan="4"></td><td>Magnetic contactor, safety relay</td><td>Not required</td><td>_ _ 0 0 (no execution)</td><td>0 (no execution) (Note 3)</td></tr>
<tr><td>Drive safety integrated motion controller, magnetic contactor, safety relay</td><td>Not required</td><td>_ _ 0 1 (no execution)</td><td>0 (no execution) (Note 3)</td></tr>
<tr><td rowspan="2">Category 4, PL e, SIL 3</td><td>Safety programmable controller (Note 1), safety controller (Note 1)</td><td>Not required</td><td>_ _ 0 0 (no execution)</td><td>1 (execution)</td></tr>
<tr><td>Safety programmable controller (Note 2), safety controller (Note 2)</td><td>Not required</td><td>_ _ 0 0 (no execution)</td><td>0 (no execution) (Note 3)</td></tr>
<tr><td rowspan="4">Category 3, PL d, SIL 2</td><td rowspan="2">Category 3, PL d, SIL 2</td><td rowspan="4">Category 3, PL d, SIL 2</td><td rowspan="4"></td><td>Magnetic contactor, safety relay</td><td>Not required</td><td>_ _ 2 0 (execution)</td><td>0 (no execution) (Note 3)</td></tr>
<tr><td>Drive safety integrated motion controller, magnetic contactor, safety relay</td><td>Not required</td><td>_ _ 2 1 (execution)</td><td>0 (no execution) (Note 3)</td></tr>
<tr><td rowspan="2">Category 4, PL e, SIL 3</td><td>Safety programmable controller (Note 1), safety controller (Note 1)</td><td>Not required</td><td>_ _ 2 0 (execution)</td><td>1 (execution)</td></tr>
<tr><td>Safety programmable controller (Note 2), safety controller (Note 2)</td><td>Not required</td><td>_ _ 2 0 (execution)</td><td>0 (no execution) (Note 3)</td></tr>
<tr><td>Category 3, PL d, SIL 2</td><td>Category 3, PL d, SIL 2</td><td>Category 3, PL d, SIL 2</td><td>Category 3, PL d, SIL 2</td><td>Magnetic contactor, safety relay</td><td>Required</td><td>_ _ 1 0 (execution)</td><td>0 (no execution) (Note 3)</td></tr>
<tr><td rowspan="2">Category 4, PL e, SIL 3</td><td rowspan="2">Category 4, PL e, SIL 3</td><td rowspan="2">Category 4, PL e, SIL 3</td><td rowspan="2">Category 4, PL e, SIL 3</td><td>Safety programmable controller (Note 1), safety controller (Note 1)</td><td>Required</td><td>_ _ 1 0 (execution)</td><td>1 (execution)</td></tr>
<tr><td>Safety programmable controller (Note 2), safety controller (Note 2)</td><td>Required</td><td>_ _ 1 0 (execution)</td><td>0 (no execution)</td></tr>
</table>

Note 1. Set the IO diagnosis pulses on the controller side (compatible with SIL 3) to disabled (not use).
2. Set the IO diagnosis pulses on the controller side (compatible with SIL 3) to enabled (use).
3. It is recommended checking (diagnosing) if the output devices operates correctly at least once in 24 hours.

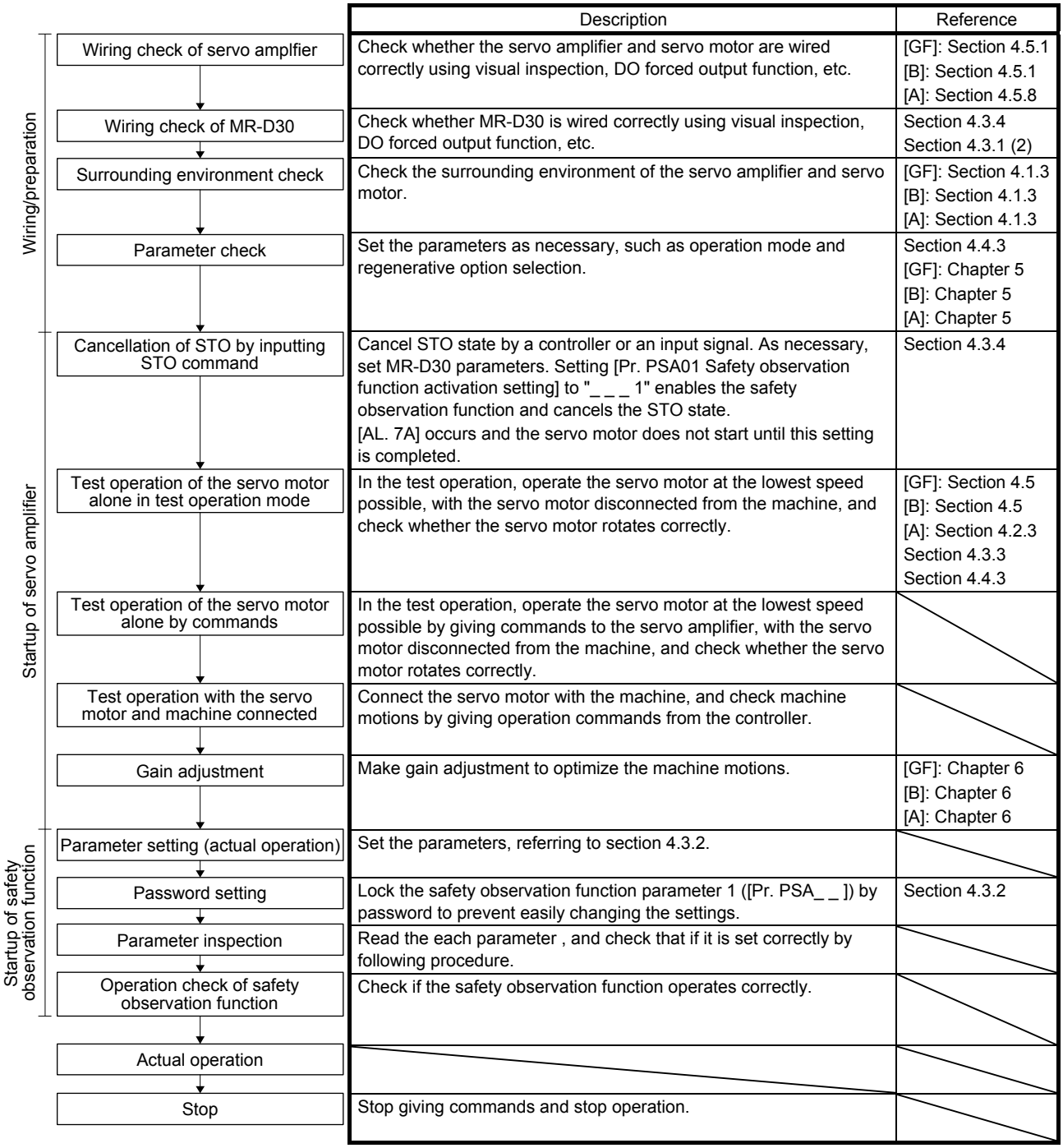
4.2 Safety diagnosis function list

Diagnosis item		Description
I/O device	Duplication input mismatch detection	This function diagnoses that the duplicated input device states are matched.
	Input device test pulse diagnosis	This function diagnoses that the input circuit and the externally connected machine are not fixed to on.
	Output device test pulse diagnosis	This function diagnoses that the output circuit and the externally connected machine are not fixed to on.
	Safety device fixing diagnosis at start-up	This function diagnoses that input devices are not fixed by repeatedly turning the devices on and off individually when the power to MR-D30 is switched on.

4.3 Startup

4.3.1 Switching power on for the first time

When switching power on for the first time, follow this section to make a startup.
"[GF]" means "MR-J4-_GF_(-RJ) Servo Amplifier Instruction Manual (Motion Mode)". "[B]" means "MR-J4-_B_(-RJ) Servo Amplifier Instruction Manual". "[A]" means "MR-J4-_A_(-RJ) Servo Amplifier Instruction Manual".



Description	Reference
Check whether the servo amplifier and servo motor are wired correctly using visual inspection, DO forced output function, etc.	[GF]: Section 4.5.1 [B]: Section 4.5.1 [A]: Section 4.5.8
Check whether MR-D30 is wired correctly using visual inspection, DO forced output function, etc.	Section 4.3.4 Section 4.3.1 (2)
Check the surrounding environment of the servo amplifier and servo motor.	[GF]: Section 4.1.3 [B]: Section 4.1.3 [A]: Section 4.1.3
Set the parameters as necessary, such as operation mode and regenerative option selection.	Section 4.4.3 [GF]: Chapter 5 [B]: Chapter 5 [A]: Chapter 5
Cancel STO state by a controller or an input signal. As necessary, set MR-D30 parameters. Setting [Pr. PSA01 Safety observation function activation setting] to "_ _ _ 1" enables the safety observation function and cancels the STO state. [AL. 7A] occurs and the servo motor does not start until this setting is completed.	Section 4.3.4
In the test operation, operate the servo motor at the lowest speed possible, with the servo motor disconnected from the machine, and check whether the servo motor rotates correctly.	[GF]: Section 4.5 [B]: Section 4.5 [A]: Section 4.2.3 Section 4.3.3 Section 4.4.3
In the test operation, operate the servo motor at the lowest speed possible by giving commands to the servo amplifier, with the servo motor disconnected from the machine, and check whether the servo motor rotates correctly.	
Connect the servo motor with the machine, and check machine motions by giving operation commands from the controller.	
Make gain adjustment to optimize the machine motions.	[GF]: Chapter 6 [B]: Chapter 6 [A]: Chapter 6
Set the parameters, referring to section 4.3.2.	
Lock the safety observation function parameter 1 ([Pr. PSA_ _]) by password to prevent easily changing the settings.	Section 4.3.2
Read the each parameter , and check that if it is set correctly by following procedure.	
Check if the safety observation function operates correctly.	
Stop giving commands and stop operation.	

4.3.2 Parameter

When using MR-D30, the safety observation function parameters 1 ([Pr. PSA_ _]), network parameters ([Pr. PSC_ _]) and I/O device parameters ([Pr. PSD_ _]) can be set by using MR Configurator2. Execute the setting that involves safety observation function by these parameter groups. The following shows the difference between these and other parameter groups. The password is set to MR-D30 to prevent changing the parameters. The default password is "000000".

(a) Set a password to prevent easily changing the parameter settings of MR-D30.

(b) After the settings are changed, the power needs to be cycled.

(c) After changing the settings, follow the procedure to check if the parameters are correct.

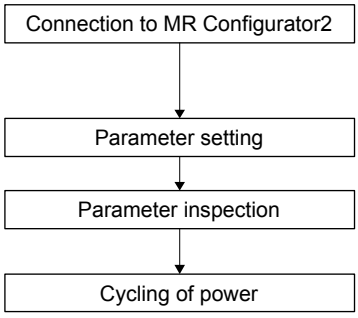
(d) The parameter settings of MR-D30 cannot be stored in the Motion controller or safety programmable controller.

(e) Set the parameters of MR-D30 with MR Configurator2.

(f) The parameters of MR-D30 cannot be set with the parameter unit.

(1) Parameter setting procedure

Set the parameter by the procedure as follows.



Set the parameter with MR Configurator2 connected. When the parameter protection is set, input the password.

Set the each parameter.

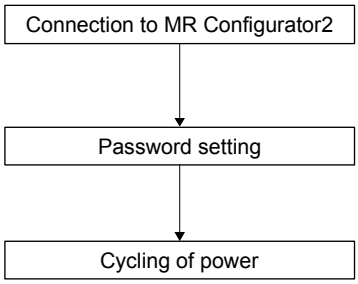
Read the each parameter and check if the parameter is set correctly.

The set parameter will be enabled after the power is cycled.

(2) Protection by password.

Set a password to the safety observation function parameters 1 ([Pr. PSA_ _]), network parameters ([Pr. PSC_ _]), and I/O device parameters ([Pr. PSD_ _]) to prevent changing them easily. There are no restrictions for reading parameters when a password is set. However, changing parameter is restricted until the password is confirmed.

(a) Setting and changing password



To set and change a password, connect MR Configurator2. When the parameter protection is set, input the password.

Set a password with MR Configurator2. Set a password using one to six digits alphanumeric. The password is case sensitive and letter case matters.

The set password will be valid after the power is cycled.

(b) If password is forgotten
The password is forgotten, you can reconfigure the parameter settings by initializing MR-D30. Initialize the password by the password initializing function of MR Configurator2. When the password is initialized, all the parameter setting values will be initialized. [AL. 7A Parameter setting error (safety observation function)] occurs until the parameter is set again.

4.3.3 Mandatory parameter setting

The following parameters must be set.

Parameter	Name
PSA01	Safety observation function activation setting
PSA02	Functional safety unit setting
PSA03	SS1/SS2 monitoring deceleration time

(1) [Pr. PSA01 Safety observation function activation setting]
Check the contents of [Pr. PSA _ _], [Pr. PSC _ _], and [Pr. PSD _ _] and set [Pr. PSA01 Safety observation function activation setting] to "_ _ _ 1". Until this parameter is set, STO cannot be canceled due to [AL. 7A Parameter setting error (safety observation function)] occurrence.

(2) [Pr. PSA02 Functional safety unit setting]
Set the items according to your system configuration. The recommended parameter settings and achievable safety level differ by the system structure. Refer to section 4.1 for details.

(3) [Pr. PSA03 SS1/SS2 monitoring deceleration time]
The parameter for SS1 function must be set because the function will be used when an error is detected by self-diagnosis. Set a proper value referring to section 4.5.2.

4.3.4 Test operation

(1) Summary
When using MR-D30, parameter setting is necessary for using the test operation. Set [Pr. PSA02 Functional safety unit setting] to "_ _ _ 2". The diagnosis function and safety observation function are partially disabled in the test operation mode. The mode can be used for the JOG operation, positioning operation, machine analyzer, etc. for when the startup of safety devices is not complete. Note the following for test operation mode.

(a) Set the test operation mode. For details of the test operation mode, refer to each servo amplifier instruction manual.

(b) I/O will not be diagnosed.

(c) Operate with great care because the safety observation function is disabled.

(d) If the servo motor operates abnormally, use EM2 (Forced stop 2) to stop it.

For details of the test operation, refer to each servo amplifier instruction manual.
To stop the test operation, set [Pr. PSA02 Functional safety unit setting] to "_ _ _ 0" or "_ _ _ 1" according to your system configuration, and cycle the power.

(2) DO forced output
Output signals of DO1_ to DO4_ can be switched on/off forcibly and independently regardless of servo status. This function is used to check the wirings of signal output, etc. Exercise control on the DO forced output screen of MR Configurator2.
This function can be used only when [Pr. PSA02 Functional safety unit setting] is set to "_ _ _ 2" (test operation mode).

4.3.5 Unit replacement

When an MR-D30 that has already been attached to MR-J4-_-RJ servo amplifier once is attached to the other MR-J4-_-RJ servo amplifier, [AL. 7A Parameter setting error (safety observation function)] will occur. To use the MR-D30 with other MR-J4-_-RJ servo amplifier, initialize the password by the password initializing function of MR Configurator2. When the password is initialized, all the parameters will be initialized. [AL. 7A Parameter setting error (safety observation function)] occurs until the parameters are set again.

4.4 I/O function

4.4.1 Input device

(1) Summary
For the safety observation function control by network, input devices cannot be used. The input devices of MR-D30 have the following characteristics.

(a) Input device selection
Any device can be assigned to DI1_ to DI6_ with parameters.

(b) Duplication of the input wiring
The input error will be detected immediately by verifying input signals with duplicated wirings.

(c) Fixing-diagnosis at start-up
The input devices including the external wiring are diagnosed for failure by individually being turned on and off repeatedly when the power is switched on.

(d) Diagnosis with test pulses
The input devices including the external wiring are diagnosed for failure by using pulse signals that temporarily turns off the input signals when the input signals are on. Enabled/disabled can be selected with [Pr. PSD24] and [Pr. PSD25].
Set any test pulse width considering the wiring length of the external circuit, impedance of the circuit, etc. If the pulse width is not enough, change the test pulse off-time with [Pr. PSD26 Input device - Test pulse off time].

(e) Noise rejection filter
This function is to reduce the noise to input signals.

(2) Input device selection

(a) Input device selection

The input devices can be assigned to DI1_ to DI6_ with [Pr. PSD02 Input device selection DI1] to [Pr. PSD07 Input device selection DI6].

CN10A		CN10B		Parameter
Pin No.	H/W abbreviation	Pin No.	H/W abbreviation	
4	DI1A	4	DI1B	[Pr. PSD02 Input device selection DI1]
13	DI2A	13	DI2B	[Pr. PSD03 Input device selection DI2]
5	DI3A	5	DI3B	[Pr. PSD04 Input device selection DI3]
14	DI4A	14	DI4B	[Pr. PSD05 Input device selection DI4]
6	DI5A	6	DI5B	[Pr. PSD06 Input device selection DI5]
15	DI6A	15	DI6B	[Pr. PSD07 Input device selection DI6]

For details of each input device, refer to the following section. Note that one input device cannot be assigned to multiple connector pins of the same connector.

Input signal	Reference
STOC (STO command)	Section 4.5.1
SS1C (SS1 command)	Section 4.5.2
SS2C (SS2 command)	Section 4.5.3
SLS1C (SLS1 command)	Section 4.5.4
SLS2C (SLS2 command)	
SLS3C (SLS3 command)	
SLS4C (SLS4 command)	

(b) Input device automatic activation selection

Setting [Pr. PSD01 Input device automatic activation selection] activates operation command of each function automatically. The automatically activated input device will be enabled regardless of input device condition, and the corresponding function will operate automatically.

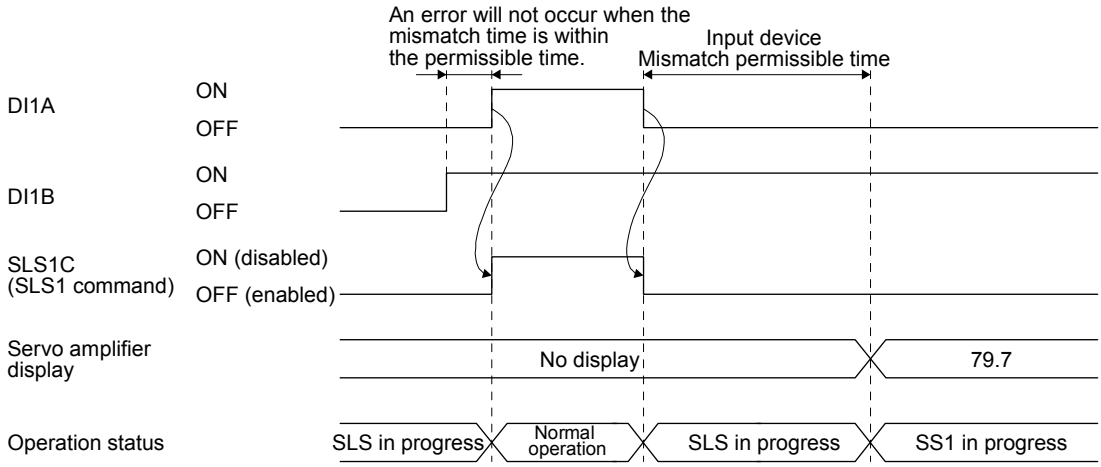
SLS1C (SLS1 command), SLS2C (SLS2 command), SLS3C (SLS3 command), and SLS4C (SLS4 command) can be automatically activated.

(3) Duplication of the input wiring

(a) Duplication of the input wiring

Switch DI_A and DI_B within the mismatch permissible time.

This function continuously monitors whether signals of duplicated input are matched. The corresponding input device will be processed as off when a mismatch is detected. The following shows the operation sequence when SLS1C (SLS1 command) is assigned to DI1. SLS1C (SLS1 command) is off while DI1A and DI1B are mismatched. SLS1C (SLS1 command) is on when both DI1A and DI1B turn on. When the mismatch continues exceeding the mismatch permissible time specified by the parameter, [AL. 79.7 Mismatched input signal error] occurs and SS1 function operates.



(b) Parameter setting

For the input devices that are assigned by [Pr. PSD02 Input device selection DI1] to [Pr. PSD07 Input device selection DI6], set the following parameters. Setting the mismatch permissible time to 0 disables the diagnosis.

Parameter	Name
PSD18	Mismatch permissible time DI1
PSD19	Mismatch permissible time DI2
PSD20	Mismatch permissible time DI3
PSD21	Mismatch permissible time DI4
PSD22	Mismatch permissible time DI5
PSD23	Mismatch permissible time DI6

(4) Fixing-diagnosis at start-up

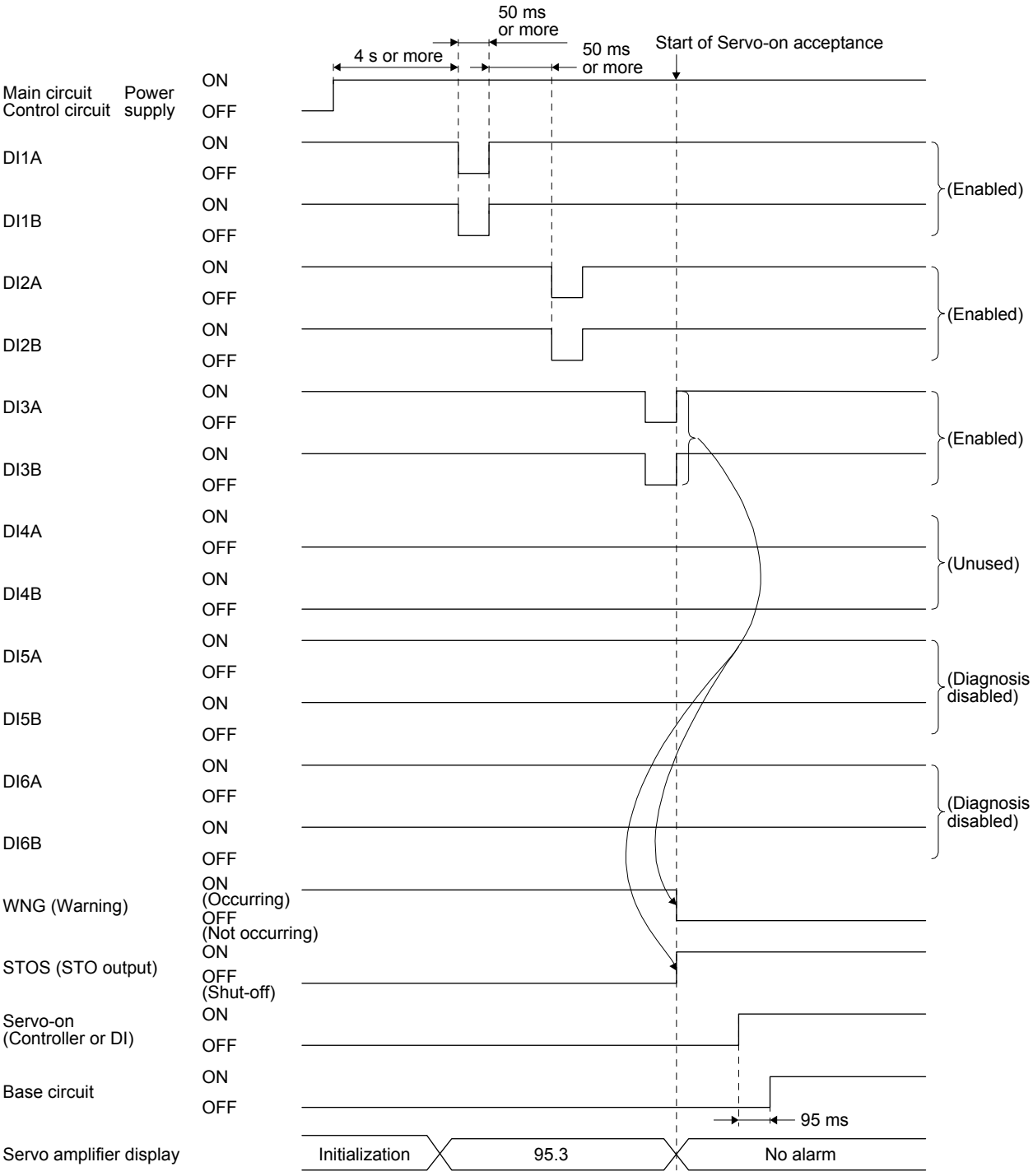
This function diagnoses that each input pin has no failure by repeatedly turning the signals on and off when the power to MR-D30 is switched on.

(a) Executing fixing-diagnosis at start-up

This function diagnoses a fixing by turning each of DI1_ to DI6_ on, off and on one by one. When all diagnoses are completed, a warning will be reset, and STO state will be canceled. Keep the pins not to be diagnosed to on.

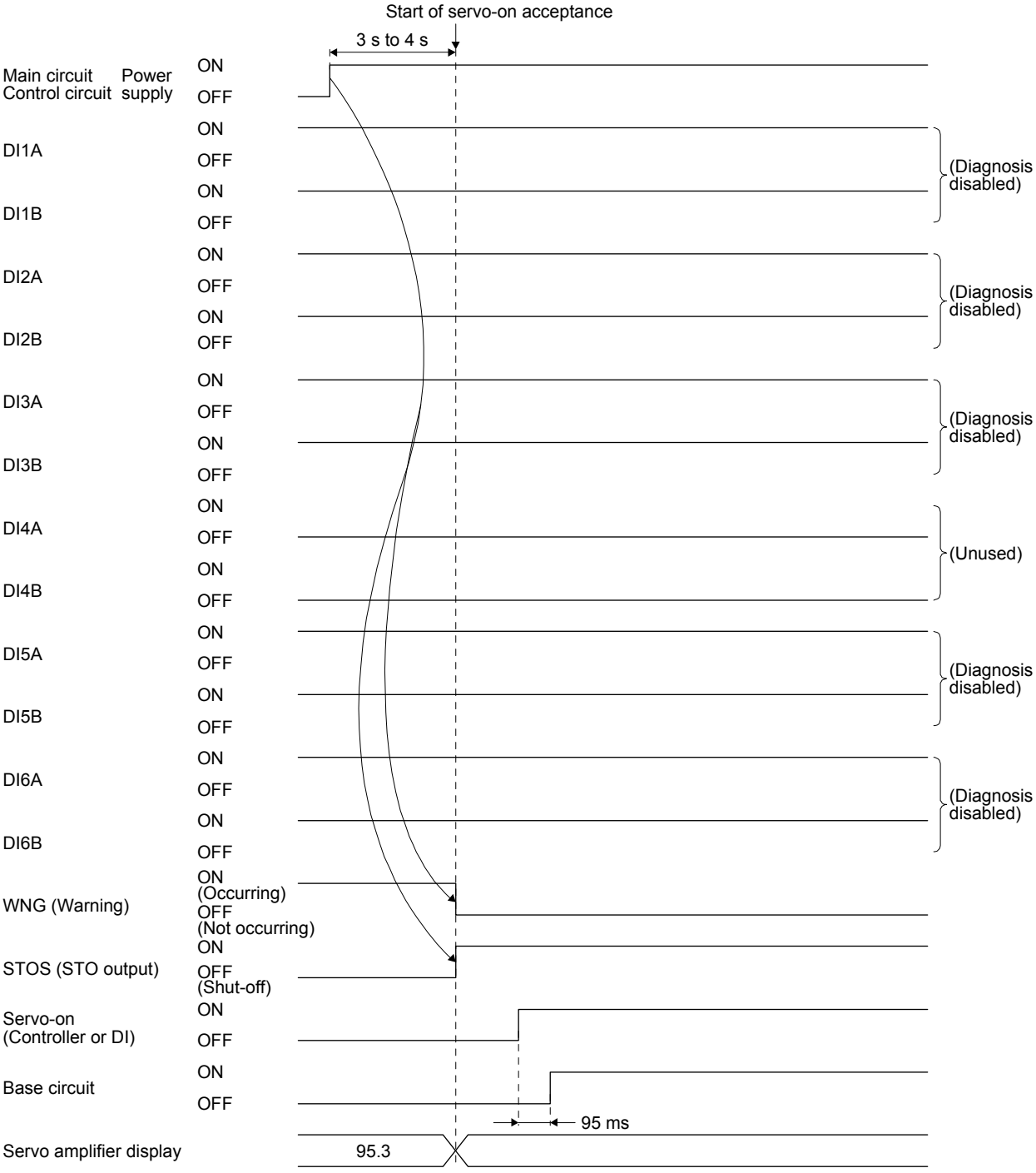
The following pins are diagnosed: pins to which functions are assigned with [Pr. PSD02 Input device selection DI1] to [Pr. PSD07 Input device selection DI6], and in which [Pr. PSD27 Input device - Fixing-diagnosis execution selection 1 at start-up] and [Pr. PSD28 Input device - Fixing-diagnosis execution selection 2 at start-up] are set to "execute".

Additionally, the diagnosis will not be executed to the pin (unused pin) to which an input device is not assigned with [Pr. PSD02 Input device selection DI1] to [Pr. PSD07 Input device selection DI6].



(b) Not executing fixing-diagnosis at start-up

If there is no device for the fixing-diagnosis at start-up, an internal diagnosis is executed after power-on. Then, the warning will be reset when all input devices turn on, and the STO state will be canceled.



(c) Parameter setting

For the pins to which input devices are assigned with [Pr. PSD02 Input device selection DI1] to [Pr. PSD07 Input device selection DI6] , set whether or not to execute the fixing-diagnosis at start-up with [Pr. PSD27 Input device - Fixing-diagnosis execution selection 1 at start-up] and [Pr. PSD28 Input device - Fixing-diagnosis execution selection 2 at start-up].

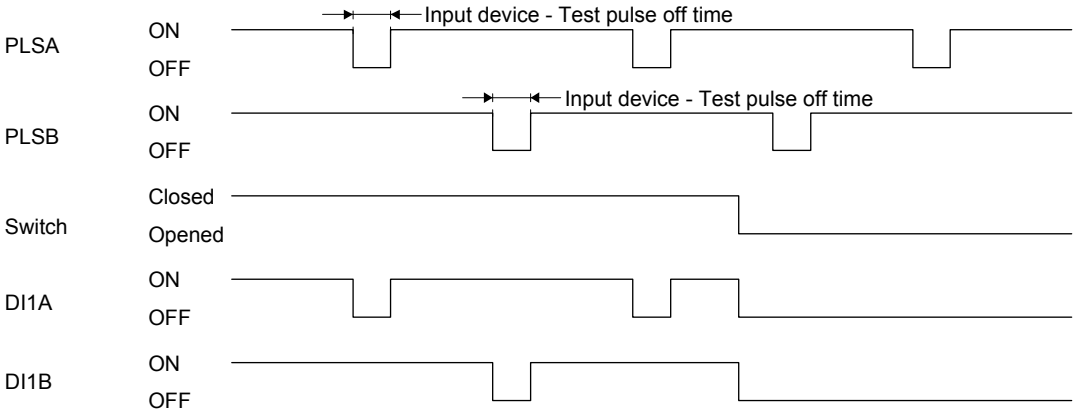
The achievable safety level will depend on the settings of [Pr. PSD27] and [Pr. PSD28]. Refer to section 4.1 for details.

(5) Diagnosis with test pulses

(a) When connecting a device which does not have a diagnosis function (such as switch)

The external wirings can be diagnosed by using the pulse signals outputted from PLSA and PLSB. Refer to section 3.3, and check that the wiring is properly connected to execute the test pulse diagnosis.

The following shows the operation sequence to execute the test pulse diagnosis by the switch connected to DI1A and DI1B. The off-pulses are outputted from PLSA/PLSB periodically. PLSA and PLSB output the off-pulses at different timing, not the same time. The width of off-pulses can be set with [Pr. PSD26 Input device test pulse off time]. Set the parameter so that external devices such as switches are affected by the output pulses.



[AL. 79.5 Input device error] occurs when an error is detected by the test pulse diagnosis.

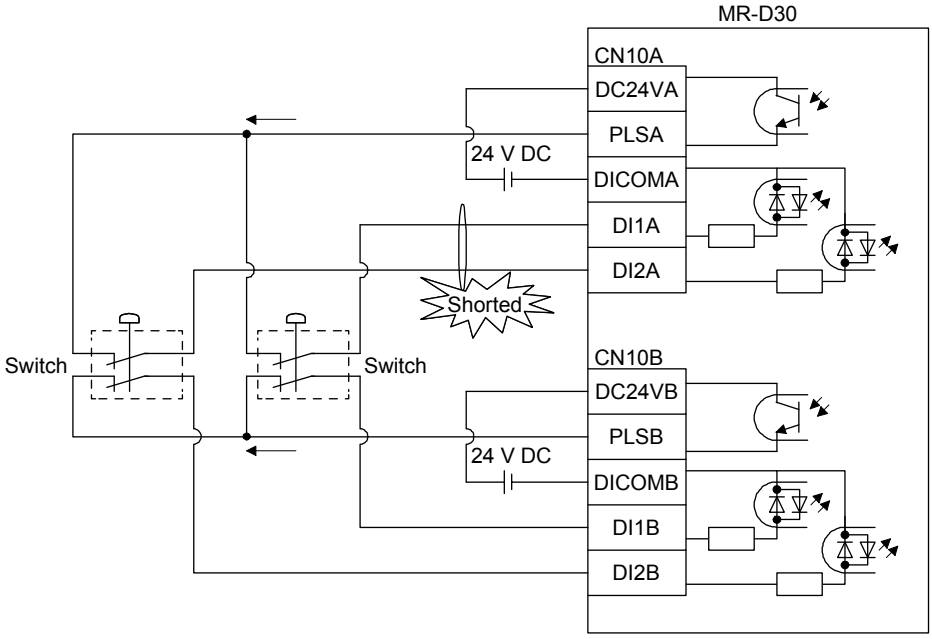
Whether or not the test pulse diagnosis is executed to each input device can be set with [Pr. PSD24 Input device - Test pulse diagnosis execution selection 1] and [Pr. PSD25 Input device - Test pulse diagnosis execution selection 2].

(b) When connecting a device which has a diagnosis function (such as safety controller)

To diagnose external wiring, use diagnosis function of the device. The test pulse diagnosis of MR-D30 cannot be used. Set the relevant device settings to "0" (not diagnose) with [Pr. PSD24 Input device - Test pulse diagnosis execution selection 1] and [Pr. PSD25 Input device - Test pulse diagnosis execution selection 2].

(c) Cautions for executing test pulse diagnosis by multiple devices.

When there are multiple input devices for the test pulse diagnosis, share PLSA/PLSB with those input devices. A short-circuit failure between wirings sharing PLSA/PLSB cannot be detected with the test pulse diagnosis. Execute the input device fixing-diagnosis at start-up (refer to section 4.4.1 (4)) in addition.



(d) Parameter setting

Set the following parameters for DI1_ to DI6_ which input devices are assigned to with [Pr. PSD02 Input device selection DI1] to [Pr. PSD07 Input device selection DI6].

Parameter	Name
PSD24	Input device - Test pulse diagnosis execution selection 1
PSD25	Input device - Test pulse diagnosis execution selection 2
PSD26	Input device - Test pulse off time

Select whether or not to execute the test pulse diagnosis with [Pr. PSD24 Input device - Test pulse diagnosis execution selection 1] and [Pr. PSD25 Input device - Test pulse diagnosis execution selection 2]. Set the off-time of test pulses outputted from PLSA and PLSB to [Pr. PSD26 Input device - Test pulse off time].

The achievable safety level depends on the input devices you use and parameter settings of this function. Refer to section 4.1 for details.

(6) Noise rejection filter

(a) Summary

The noise rejection filter is a function to set a filtering time to reduce the noise of input signals. Set the filtering time of the noise rejection filter with [Pr. PSD12 Input device - Noise rejection filtering time DI1] to [Pr. PSD17 Input device - Noise rejection filtering time DI6].

The longer the noise rejection filtering time, the higher the tolerance to chattering or noise, but the response to the input signals will be lower. The shorter the noise rejection filtering time, the higher the response to the input signals, but the tolerance to chattering or noise will be lower.

When the test pulses are in superposition in the input signals, the noise rejection filtering time needs to be set considering the test pulse off-time. The following shows the specific settings of the noise rejection filtering time.

Structure		Noise rejection filtering time
Using a switch	Executing a test pulse diagnosis	Set 0.888 ms or longer time than set time in [Pr. PSD26 Input device - Test pulse off time].
	Not executing a test pulse diagnosis	Set 0.888 ms or longer time.
Using a device	Test pulses are in superposition in the output signal of the device.	Set 0.888 ms or longer time than the test pulse off-time outputted from the device.
	Test pulses are not in superposition in the output signal of the device.	Set 0.888 ms or longer time.

(b) Parameter setting

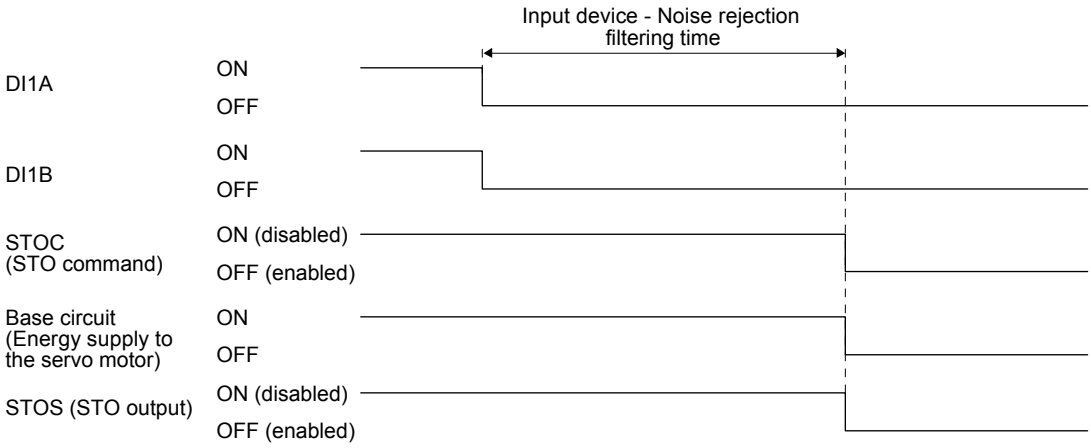
With the following parameters, set the noise rejection filtering time to each input device to which function is assigned with [Pr. PSD02 Input device selection DI1] to [Pr. PSD07 Input device selection DI6]. In addition, refer to section 4.4.1 (7) because the response time of the input device changes depending on the noise rejection filtering time.

Parameter	Name
PSD12	Input device - Noise rejection filtering time DI1
PSD13	Input device - Noise rejection filtering time DI2
PSD14	Input device - Noise rejection filtering time DI3
PSD15	Input device - Noise rejection filtering time DI4
PSD16	Input device - Noise rejection filtering time DI5
PSD17	Input device - Noise rejection filtering time DI6

(7) Response time of input device

The response time of input devices changes depending on noise rejection filtering time set with [Pr. PSD12 Input device - Noise rejection filtering time DI1] to [Pr. PSD17 Input device - Noise rejection filtering time DI6].

The following example shows a sequence for when STOC (STO command) is assigned to DI1_. A delay equal to the input device noise rejection filtering time occurs in the response time from signals are inputted to input devices until the corresponding functions switch to enabled/disabled.



4.4.2 Output device

(1) Summary

The output device of the status monitor function (SM) of MR-D30 has following characteristics.

(a) Output device selection

Any device can be assigned to DO1_ to DO4_ with parameters.

(b) Duplication of the output

Same signal is duplicately outputted by duplicated wiring. With this, a function will not be lost even if an error occurs in one output device.

DO4_ can be configured with source output and sink output in combination.

(c) Diagnosis with test pulses

The output devices including the external wiring are diagnosed for failure by using pulse signals that temporarily turns off the output signals when the output signals are on. Enabled/disabled can be selected with [Pr. PSD29 Output device - Test pulse execution selection].

(2) Output device selection

The devices can be assigned to DO1_ to DO4_ with [Pr. PSD08 Output device selection DO1] to [Pr. PSD11 Output device selection DO4].

CN10A		CN10B		Parameter
Pin No.	H/W abbreviation	Pin No.	H/W abbreviation	
8	DO1A	8	DO1B	[Pr. PSD08 Output device selection DO1]
17	DO2A	17	DO2B	[Pr. PSD09 Output device selection DO2]
9	DO3A	9	DO3B	[Pr. PSD10 Output device selection DO3]
18	DO4NA	16	DO4PB	[Pr. PSD11 Output device selection DO4]

For details of each output device, refer to the following section. For output devices, the same signal can be assigned to different terminal.

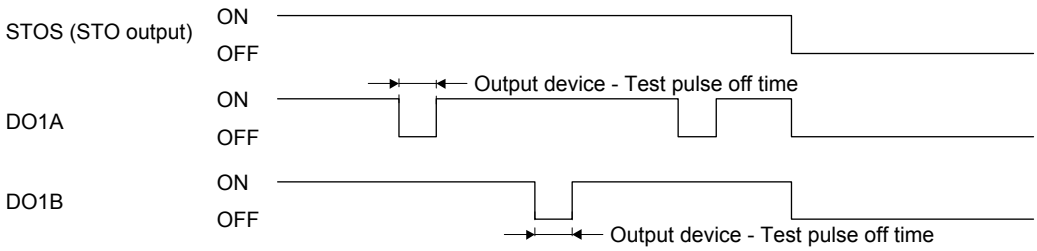
Output signal	Reference
STOS (STO output)	Section 4.5.1
SS1S (SS1 output)	Section 4.5.2
SS2S (SS2 output)	Section 4.5.3
SLS1S (SLS1 output)	Section 4.5.4
SLS2S (SLS2 output)	Section 4.5.4
SLS3S (SLS3 output)	Section 4.5.4
SLS4S (SLS4 output)	Section 4.5.4
SSMS (SSM output)	Section 4.5.5
SOSS (SOS output)	Section 4.5.3
SBCS (SBC output)	Section 4.5.6

(3) Diagnosis with test pulses

(a) Test pulse diagnosis function

This function diagnoses the wiring by periodically outputting the off-pulses when DO1_ to DO4_ are on.

The following shows the operation sequence for when STOS (STO output) is assigned to DO1_. The off-pulses are outputted to DO1A and DO1B periodically when STOS (STO output) is on. DO1A and DO1B output the off-pulses at different timing, not the same time. The width of off-pulses can be set with [Pr. PSD30 Output device - Test pulse off time]. Set the parameter so that external devices are not affected by the outputted off-pulses.



[AL. 79.6 Output device error] occurs when an error is detected by the test pulse diagnosis. Whether or not the test pulse diagnosis is executed to each output device can be set with [Pr. PSD29 Output device - Test pulse execution selection].

(b) Parameter setting

For the output device that is assigned by [Pr. PSD08 Output device selection DO1] to [Pr. PSD11 Output device selection DO4], set the following parameters.

Parameter	Name
PSD29	Output device - Test pulse execution selection
PSD30	Output device - Test pulse off time

Set whether or not to execute the test pulse diagnosis to each output device with [Pr. PSD29 Output device - Test pulse execution selection]. Set the off-time of test pulses outputted from the output devices to [Pr. PSD30 Output device - Test pulse off time].

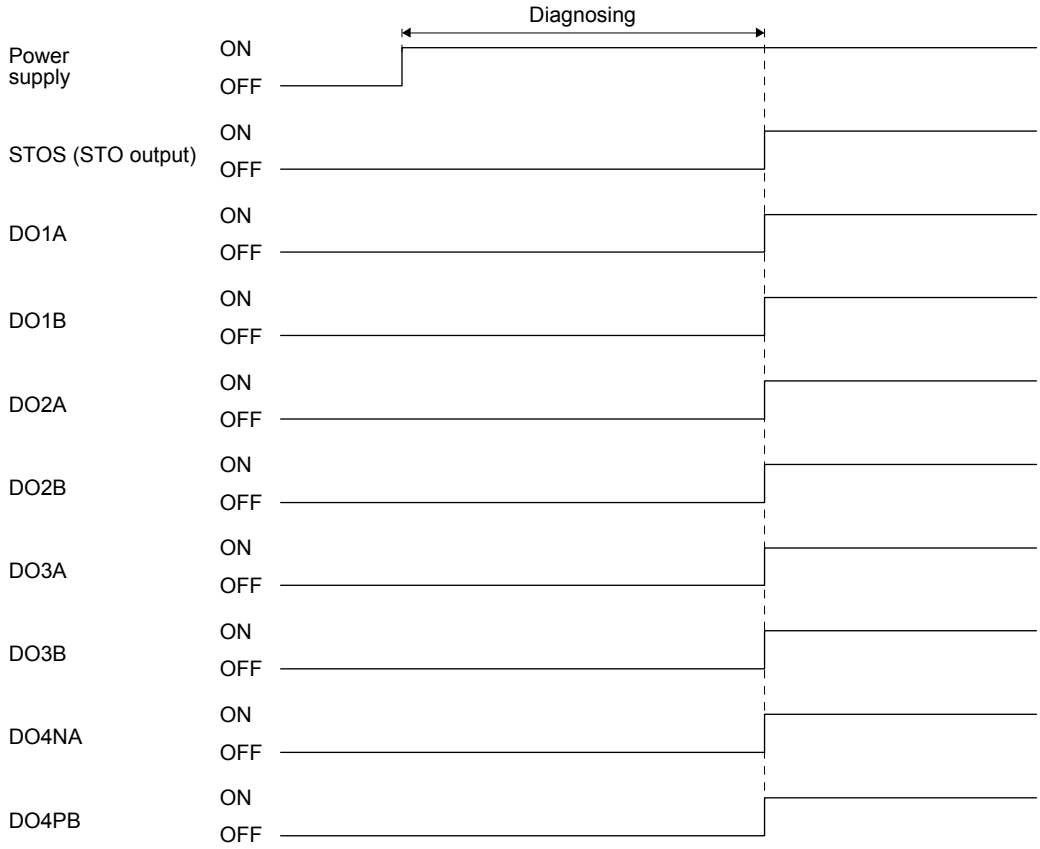
The achievable safety level depends on the device you use and parameter settings of this function. Refer to section 4.1 for details.

(4) Input signal conditions at start-up/error detection

(a) At start-up

The each output device remains off until the diagnosis completes after the MR-D30 is turned on. After the diagnosis is completed, devices assigned with [Pr. PSD08 Output device selection DO1] to [Pr. PSD11 Output device selection DO4] will be activated.

The diagnosis completion time differs depending on the safety observation function control by input device or by network. For the safety observation function control by input device, refer to section 4.4.1 (4). For the safety observation function control by network, refer to section 4.4.3.



(b) At error detection

If MR-D30 detects an error and an alarm which disables SSM occurs, the each device turns off. Refer to chapter 7 for corresponding alarm Nos. If a non-corresponding alarm occurs, assigned devices will be outputted continuously.

4.4.3 Safety observation function control by input device

(1) Summary

For the safety observation function control by network, input devices cannot be used. The safety observation function control by network has the following characteristics.

(a) Transmitting each function command input through network

STOC (STO command), SS1C (SS1 command), SS2C (SS2 command), SLS1C (SLS1 command), SLS2C (SLS2 command), SLS3C (SLS3 command), and SLS4C (SLS4 command) can be transmitted through network.

The following shows function inputs for each bit of the safety data storage device in MR-J4-_GF_-RJ.

Master station → Servo amplifier (SA\n)		
Bit	Function input	Description
0	STO command	When the STO command is turned off, the STO function of the servo amplifier operates, and the power is shut off.
1	SS1 command	When the SS1 command is turned off, the SS1 function operates.
2	SS2 command	When the SS2 command is turned off, the SS2 function operates.
3	Unavailable	
4		
5		
6		
7		
8	SLS1 command	When the SLS1 command is turned off, the SLS1 function operates.
9	SLS2 command	When the SLS2 command is turned off, the SLS2 function operates.
10	SLS3 command	When the SLS3 command is turned off, the SLS3 function operates.
11	SLS4 command	When the SLS4 command is turned off, the SLS4 function operates.
12	Unavailable	
13		
14		
15		
16		
17		
18		
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(b) Feedback for each function output through network

Safety position data of servo motor with functional safety, STOS (STO output), SOSS (SOS output), SSMS (SSM output), etc. can be transmitted through network.

The following shows function outputs for each bit of the safety data storage device in MR-J4-_GF_-RJ.

Servo amplifier → Master station (SA\n)		
Bit	Function output	Description
0	STO status	When the STO function operates and the power is shut off, the status turns on. The status is off under other conditions.
1	SSM status	When the servo motor rotates at the set SSM speed or less, the status turns on. When the SSM function is disabled, the status is always off.
2	Unavailable	
3	SOS status	When the SS2 function activates the SOS function, the status turns on. The status is off under other conditions.
4	Unavailable	
5		
6		
7	Error status	If an error related to the safety communication occurs, the status turns on. The status is off under other conditions.
8	SLS1 status	When the SLS1 function operates, the status turns on. The status is off under other conditions.
9	SLS2 status	When the SLS2 function operates, the status turns on. The status is off under other conditions.
10	SLS3 status	When the SLS3 function operates, the status turns on. The status is off under other conditions.
11	SLS4 status	When the SLS4 function operates, the status turns on. The status is off under other conditions.
12	SS1 status	When the SS1 function operates, the status turns on. The status is off under other conditions.
13	SS2 status	When the SS2 function operates, the status turns on. The status is off under other conditions.
14	Unavailable	
15		
16		
17	Error status 2	In [Pr. PSA02 Functional safety unit setting], when a command signal is inputted for an unavailable safety observation function, the status turns on. The status is off under other conditions.
18	SBC status	This is a status signal for the servo motor holding brake. When the STO function operates and a power supplied to the electromagnetic brake is shut off, the status turns off. The status is on under other conditions.
19	Unavailable	
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		
31		

(2) Parameter setting

Set a communication cycle for network with the following parameter. For MR-J4-_B_-RJ, set the same value as of the controller to "Safety communication - Communication cycle". When a different value is set, [AL. 7C.1 Functional safety unit communication setting error (safety observation function)] will occur.

Parameter	Name
PSC01	Safety communication - Communication cycle

When connecting an MR-J4-_GF_-RJ, set the network number of CC-Link IE Field with the following parameter.
Match the network number of the master station with that of MR-J4_-GF_-RJ.
Otherwise, [AL. 95.4 STO warning 2 (safety observation function)] will occur.

Parameter	Name
PSC04	Safety communication - Network communication selection

(3) Setting method for MR-J4-_GF_-RJ

For the safety observation function control by network, calculate the transmission interval monitoring time between MR-D30 and CC-Link IE Field master module according to the Safety Application Guide. Use the following values for safety remote station refresh response time (SRef).

	Motion mode	I/O mode
Safety remote station refresh response time	8.0 ms	16.0 ms

Set the safety communication communication cycle according to the following transmission interval monitoring time. For MR-J4-_GF_-RJ, do not select "_ _ 0 6" (14.2 ms) or "_ _ 0 7" (28.4 ms). Otherwise, [AL. 7C.1 Functional safety unit communication setting error (safety observation function)] will occur.

Calculated transmission interval monitoring time	Safety communication communication cycle	[Pr. PSC01]
16 ms to 24 ms	16 ms	"_ _ 1 6"
24 ms to 48 ms	32 ms	"_ _ 1 7"

The following shows another value used for calculating safety response time.

Name	Value
Transmission interval monitoring time of MR-D30	Safety communication communication cycle × 1.5

Calculate the safety refresh monitoring time. For MR-J4-_GF_-RJ, set the safety refresh monitoring time so that the following equation is satisfied.

Safety refresh monitoring time [ms] ≥ TMact + TMpas + (LS × 2) + SCmst + (SRef/2)

TMact: Transmission interval monitoring time of CC-Link IE Field master module [ms]
TMpas: Transmission interval monitoring time of MR-D30 [ms] (= Safety communication communication cycle [ms] × 1.5)
LS: Link scan time of CC-Link IE Field Network [ms], or the calculation cycle of the simple Motion module [ms] when a simple Motion module is used as the master module.
SCmst: Safety cycle time of CC-Link IE Field master module
SRef: Safety remote station refresh response time [ms]

Set the calculated transmission interval monitoring time of CC-Link IE Field master module and the safety refresh monitoring time to the master module.

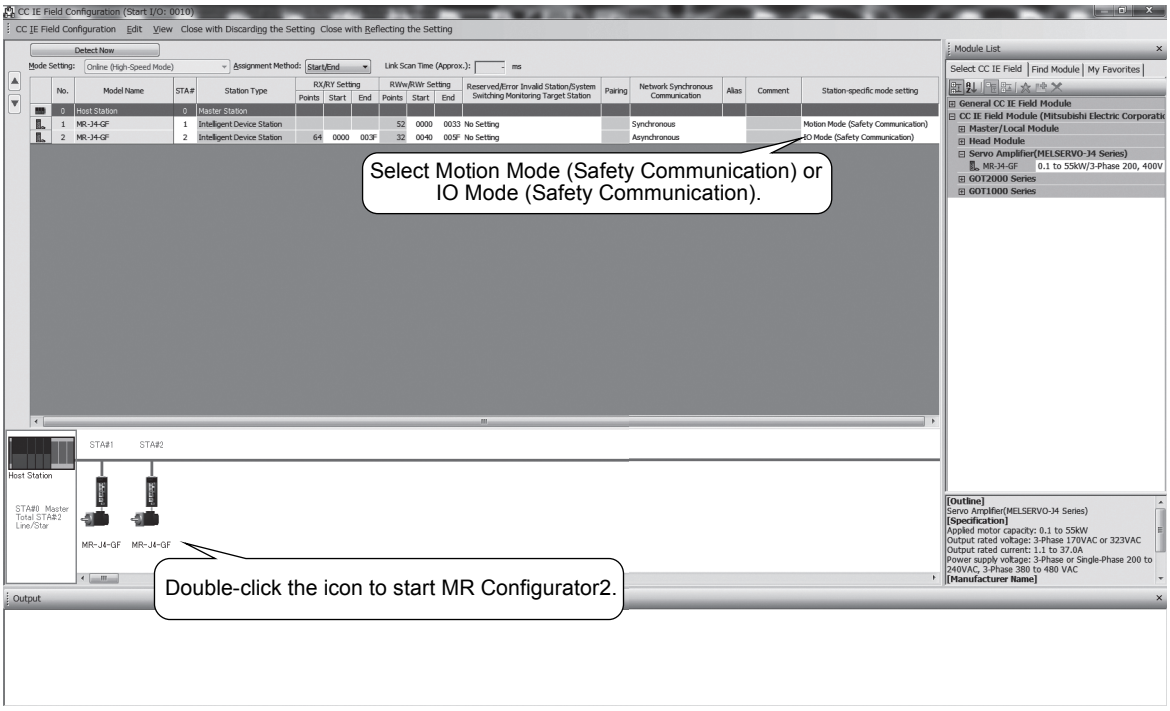
(4) Setting method of CC-Link IE Field Network for MR-J4-GF

Configure the CC-Link IE Field Network and safety communication settings according to the Safety Application Guide. This section provides descriptions not mentioned in the Safety Application Guide.

(a) Basic settings (network configuration settings)

To perform the safety communication, select "Motion Mode (Safety Communication)" or "IO Mode (Safety Communication)" for the station-specific mode setting. Set the number of devices for the RWw/RWr setting as follows:

Motion mode: 52 points I/O mode: 32 points



When the I/O mode is used in the safety communication, the first 16 points in the cyclic RWw/RWr frame are used for the safety communication.

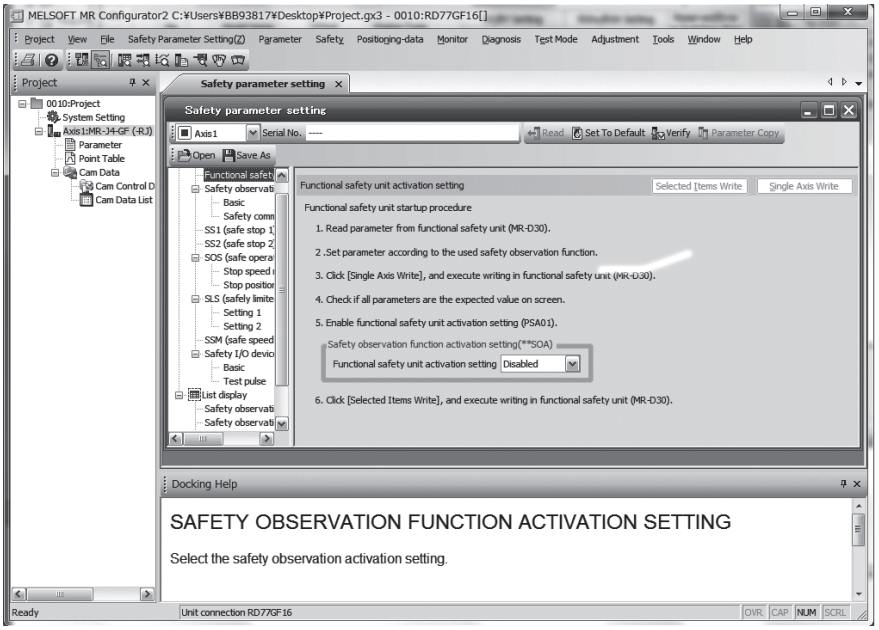
Thus, to assign link device RWwn/RWrn, consider 16 points for offsets.

For RWwn6 (point table No. selection/next station No. selection), add 16 points as offsets and set a value to RWw (n + 1) 6.

The following shows the number of offsets necessary for each frame.

Frame name	Offsets for safety communication
RWw	16 points
RWr	16 points
RX	0 points
RY	0 points

Use MR Configurator2 to set the parameters of slave stations.
To start MR Configurator2, double-click the icon of a servo amplifier for parameter settings while the icon is being selected.
For parameters of MR-J4-_GF_-RJ, refer to "MR-J4-_GF_(-RJ) Servo Amplifier Instruction Manual".For parameters of MR-D30, refer to "MR-D30 Instruction Manual".



(b) Position check of safety slave station
The MR-J4-_GF_-RJ and MR-D30 do not support the position check start function for the safety slave station. Visually check the station number displayed on the 7-segment LED display of each servo amplifier to ensure that the safety slave station is installed as designed and intended.

(c) Check of parameters
Read each parameter and check that the parameters are set correctly.

(d) Safety unit activation
Activate MR-D30 by setting parameters. Refer to section 4.3.3 for details.

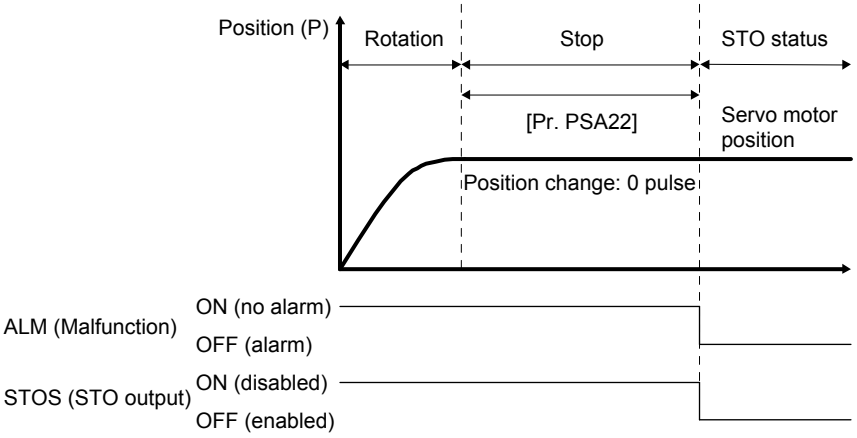
4.4.4 Servo motor with functional safety

Using a servo motor with functional safety enables you to use speed monitoring functions and position monitoring functions without external encoders for duplication of encoders.
When using a servo motor with functional safety, set [Pr. PSA02 Functional safety unit setting] to "_ _ 1 _". When not using it, set [Pr. PSA02] to "_ _ 0 _". Refer to section 4.1 for details.

4.4.5 Position feedback fixing diagnosis function

(1) Summary
The position feedback fixing diagnosis function generates [AL. 79.8 Position feedback fixing error] to make the servo amplifier STO state when position data from the encoder is fixed.

(2) Operation summary
The position feedback fixing diagnosis function will be enabled when the safety observation function is enabled and moreover the servo amplifier is not in STO state. When a position feedback does not change for the time set with [Pr. PSA22 Position feedback fixing error detection time], [AL. 79.8 Position feedback fixing error] occurs and the STO function operates.



4.5 Safety observation function

4.5.1 STO function

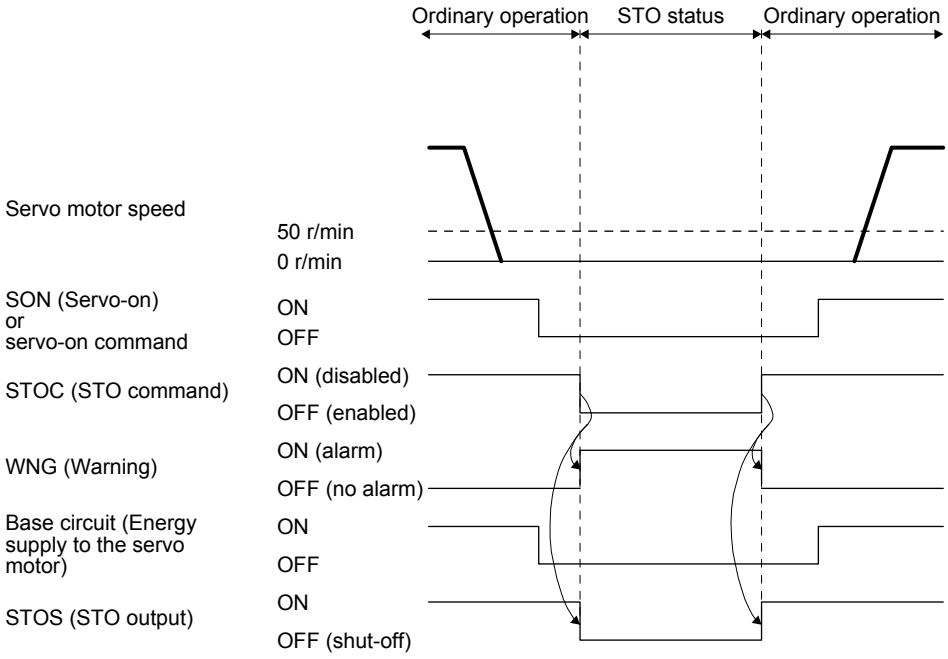
(1) Summary

This function electronically shuts off power to the servo motor based on an input signal from an external device (secondary-side output shut-off). This corresponds to stop category 0 of IEC/EN 60204-1. The STO function is also used for an emergency stop when an error is detected in an internal diagnosis. Use the STO function while the servo motor stops.

(2) Operation sequence

(a) STOC (STO command)

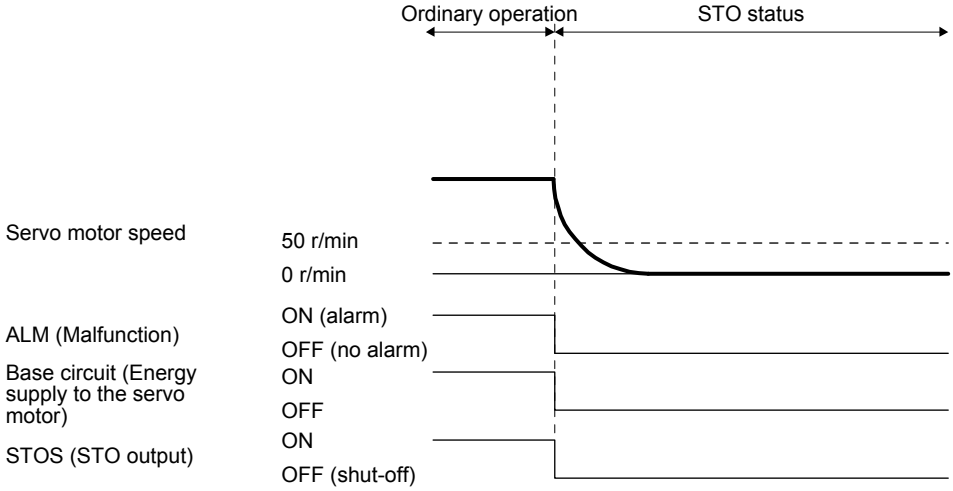
Turn off STOC (STO command) only when the servo motor stops after servo off. The STO function will operate when STOC (STO command) is turned off. While STO is in operation, the power to the servo motor is shut off and the dynamic brake activates. Turning STOC (STO command) back to on will return to normal operation.



(b) Alarm occurrence

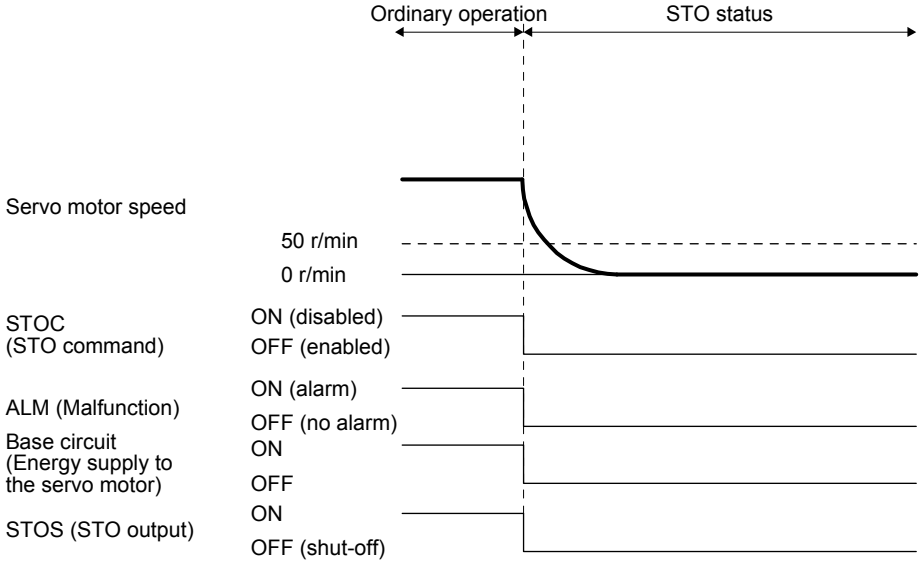
The STO function operates also during alarm occurrence. While STO is in operation, power to the servo motor is shut off and the dynamic brake activates. For alarms which activate STO, refer to chapter 7. For returning to normal operation, refer to section 4.5.10.

The timing chart is for STO/DB stop method.



(c) STO shut-off during servo motor operation

Turn off STOC (STO command) only when the servo motor stops after servo off. [AL. 63 STO timing error] occurs if STOC (STO command) is turned off during operation. Use the SS1 function when decelerating at the same time.



(3) Parameter setting

To set the parameters, refer to section 4.3.3. Set the parameters referring to section 4.4.1 when using the STO function with input devices, and section 4.4.3 when using the STO function in the safety observation function control by network.

Additionally, when using STOS (STO output) with output devices, refer to 4.4.2 to set parameters.

4.5.2 SS1 function

(1) Summary

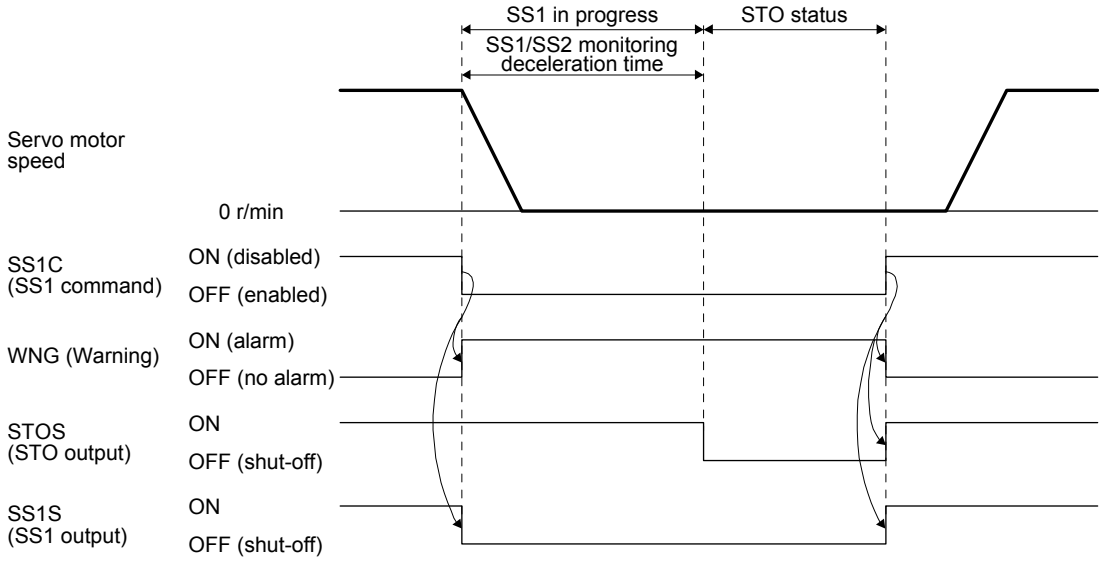
This function starts deceleration based on an input signal from an external device (EM2). After a specified time for the check of stop, the STO function will be activated (SS1). This corresponds to stop category 1 of IEC/EN 60204-1.

Be sure to set parameters because the SS1 function is also used for an emergency stop when an error is detected in an internal diagnosis.

(2) Summary of sequence

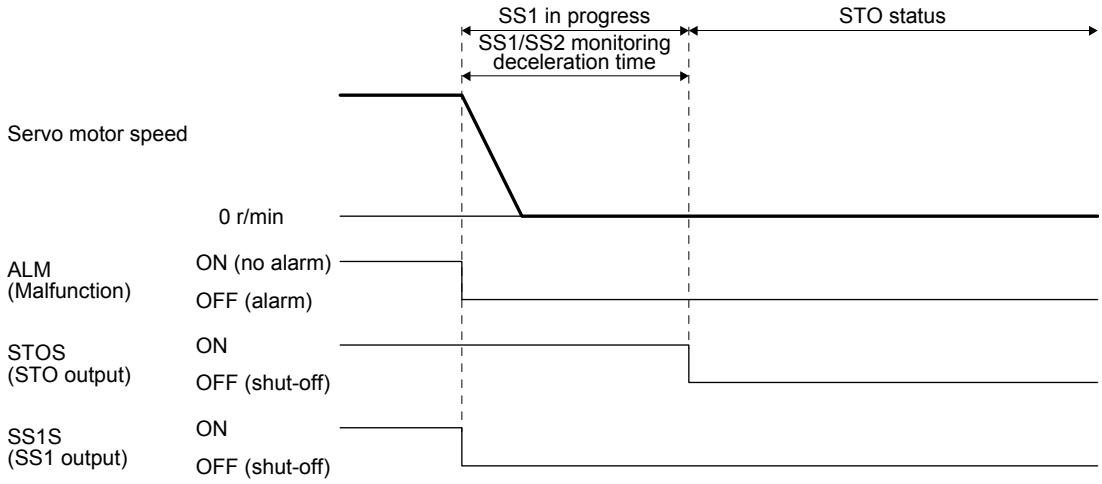
(a) SS1C (SS1 command)

The following shows operation sequence of the SS1 function. The SS1 function will operate when SS1C (SS1 command) is turned off. The servo motor decelerates with the dynamic brake, electronic dynamic brake, or forced stop. Simultaneously, the time from activation of the SS1 function is calculated, and the STO function will operate when the time specified with [PSA03 SS1/SS2 monitoring deceleration time] has passed. Turning SS1C (SS1 command) back to on will return to normal operation.



(b) Alarm occurrence

The SS1 function operates also during alarm occurrence. After the alarm occurrence, the servo motor decelerates with the dynamic brake, electronic dynamic brake, or forced stop. Simultaneously, the time from activation of the SS1 function is calculated, and the STO function will operate when the time specified with [PSA03 SS1/SS2 monitoring deceleration time] has passed. For alarms which activate the SS1 function, refer to chapter 7. For returning to normal operation, refer to section 4.5.10.



(3) Stop method

(a) Category of stop method

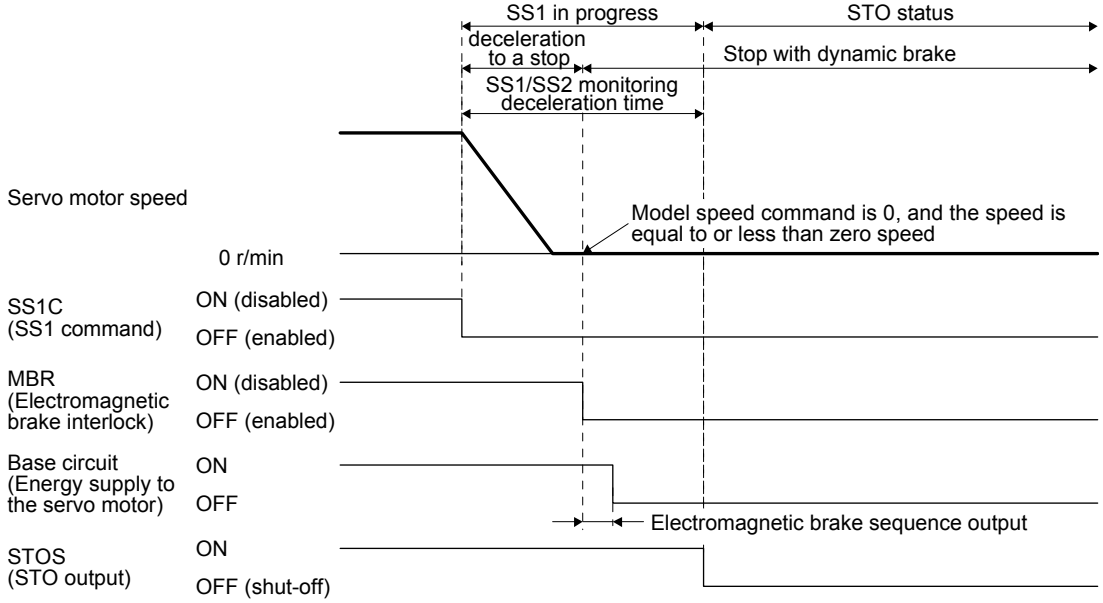
The stop method of the servo motor is determined depending on the parameter setting or a cause of activating the SS1 function. The following table shows stop method of the servo motor during SS1 function operation. For the operation sequence of the each stop method, refer to (b) to (d).

Servo amplifier parameter		Servo amplifier capacity	Control mode during SS1 function operation	Stop method (Note 1)		
				Activated by SS1C (SS1 command)	Activated by alarm occurrence (Note 2)	
[Pr. PA04] Forced stop deceleration function selection	[Pr. PF06] Electronic dynamic brake selection				When the stop method of alarm is SS1/SD	When the stop method of alarm is SS1/EDB
Enabled	Automatic	600 W or less	Torque control mode	EDB	EDB	EDB
			Other than torque control mode	SD	SD	EDB
		700 W or more	Torque control mode	DB	DB	DB
			Other than torque control mode	SD	SD	DB
	Disabled		Torque control mode	DB	DB	DB
			Other than torque control mode	SD	SD	DB
Disabled	Automatic	600 W or less		EDB	EDB	EDB
		700 W or more		DB	DB	DB
	Disabled			DB	DB	DB

Note 1. The following shows three stop methods of DB, EDB, and SD.
DB: Stops with dynamic brake. (Coasts for the servo amplifier without dynamic brake.)
EDB: Electronic dynamic brake stop
SD: Forced stop deceleration
2. The stop method varies depending on the stop method of alarm. For the stop method of each alarm, refer to chapter 7.

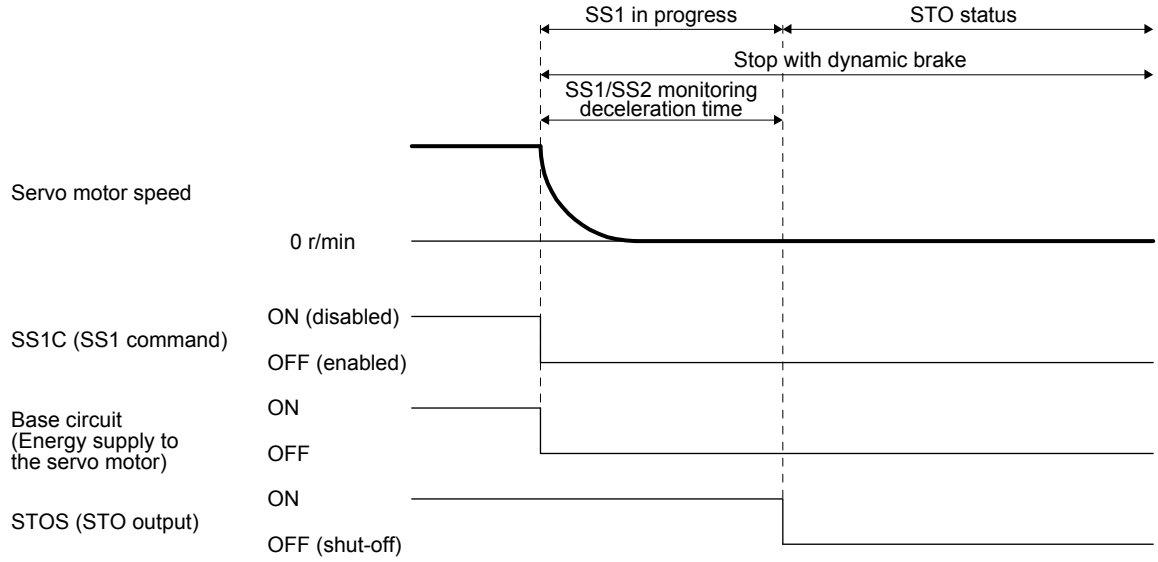
(b) Stop with forced stop deceleration

For the operation of forced stop deceleration, refer to each servo amplifier instruction manual. When the SS1 function operates, the servo motor will decelerate according to [Pr. PC24 Forced stop deceleration time constant]. When the deceleration command is completed and the servo motor speed is decreased to the setting of [Pr. PC07 Zero speed] or less, the base circuit will be shut off and the dynamic brake will be activated after the delay time specified with [Pr. PC02 Electromagnetic brake sequence output] has passed. When SS1/SS2 monitoring deceleration time is shorter than the actual deceleration time to a stop, the STO function operates during the deceleration.



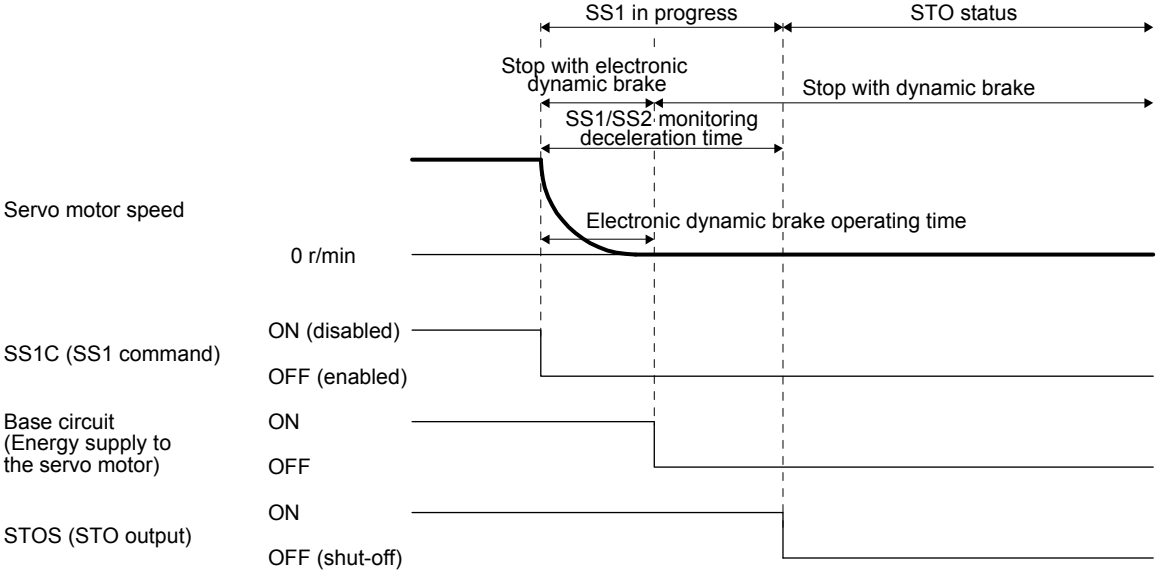
(c) Stop with dynamic brake

When the SS1 function operates, the servo motor will be stopped with the dynamic brake. For operation of the dynamic brake, also refer to each servo amplifier instruction manual.



(d) Stop with electronic dynamic brake

When the SS1 function operates, the servo motor will be stopped with the electric dynamic brake. When the time has passed after the SS1 function start reaches the setting of [Pr. PF12 Electronic dynamic brake operating time], the dynamic brake will be activated. If the setting of [Pr. PSA03 SS1/SS2 monitoring deceleration time] is shorter than that of [Pr. PF12 Electronic dynamic brake operating time], the dynamic brake will be activated at the moment of reaching the set value of [Pr. PSA03 SS1/SS2 monitoring deceleration time].



(4) Parameter setting

To set the parameters, refer to section 4.3.3. Set the parameters referring to section 4.4.1 when using the SS1 function in the safety observation function control by input device, and section 4.4.3 when using the SS1 function in the safety observation function control by network. Additionally, when using SS1S (SS1 output) with output devices, refer to 4.4.2 to set parameters.

The SS1 function is used for an emergency stop when an error is detected in internal diagnosis. Therefore, be sure to set [Pr. PSA03 SS1/SS2 monitoring deceleration time] to a time required for the servo motor to stop.

4.5.3 SS2/SOS function

(1) Summary

When SS2C (SS2 command) turns off, the SS2/SOS function executes the stop observation (SOS) after a delay time set in advance or after standby until the servo motor stop is detected (SS2).

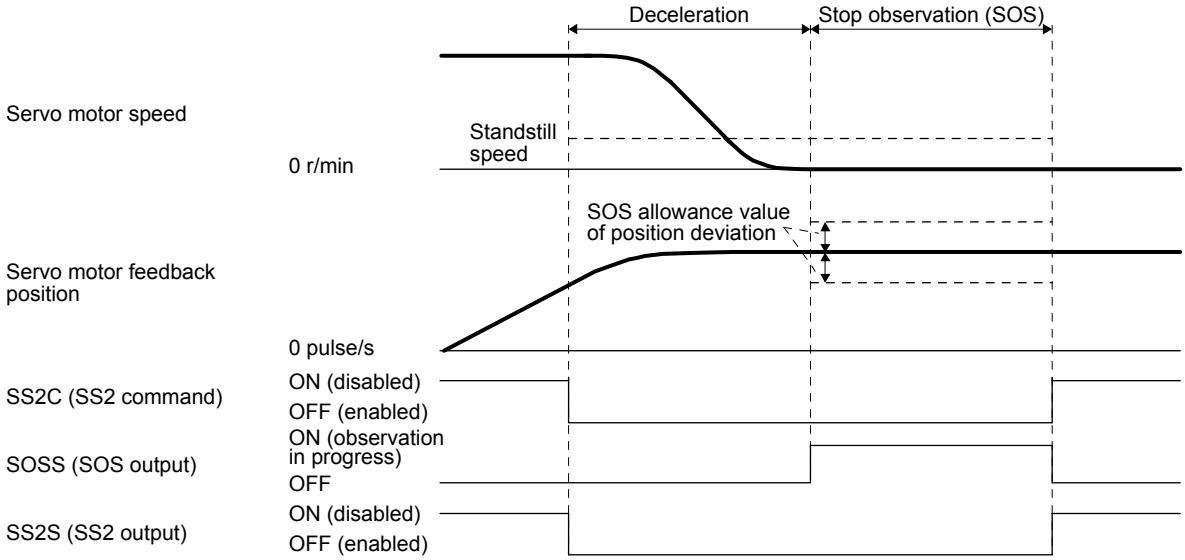
(2) Summary of sequence

The SS2/SOS function will operate when SS2C (SS2 command) is turned off.

The SS2/SOS function executes monitoring deceleration at first. Next, it will wait until the speed decelerates to a fixed speed or until a specified time passes. During this time, execute deceleration with the controller. Refer to (3) in this section for details of speed observation and delay time observation during deceleration.

After the deceleration is completed, the stop observation starts. The stop observation monitors the speed command, speed feedback, and position feedback. Refer to (4) in this section for details of these observations. SOSS (SOS output) outputs on during the stop observation.

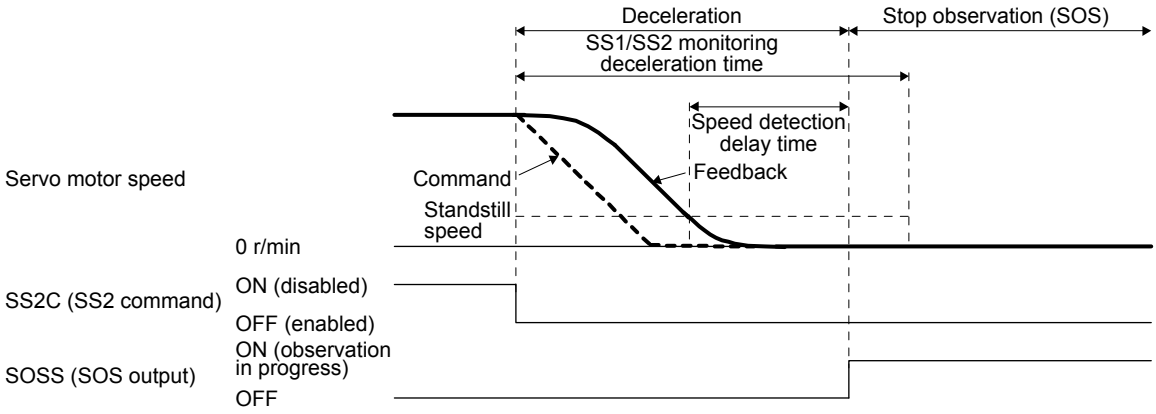
The SS2/SOS function ends when SS2C (SS2 command) is turned back to on.



(3) Deceleration observation

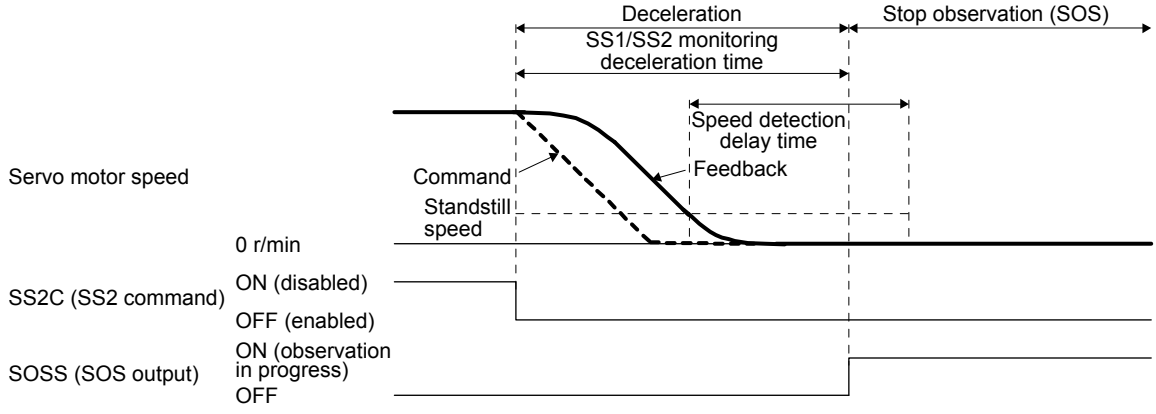
(a) Speed observation at deceleration

When both absolute values of the speed command and the speed feedback reach the set value of [Pr. PSA04 SS2/SOS standstill speed] or lower during deceleration, the deceleration will be assumed as completion and the stop observation (SOS) will start. The time to start the stop observation after the speed reaching the standstill speed will be delayed by the set time of [Pr. PSA15 SLS/SS2/SOS speed detection delay time].



(b) Delay time observation during deceleration

When the time after starting SS2/SOS function reaches the set time of [Pr. PSA03 SS1/SS2 Deceleration observation time], the deceleration will be assumed as completion and the stop observation (SOS) will start.

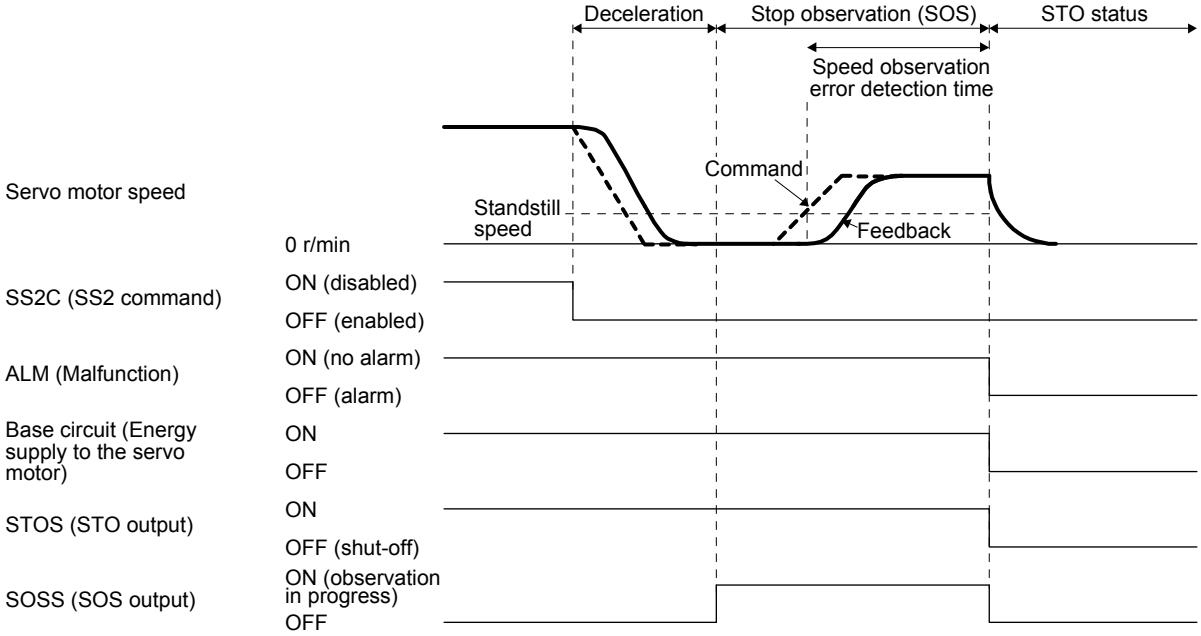


(4) Stop observation

The SOS function observes both command speed and feedback speed.

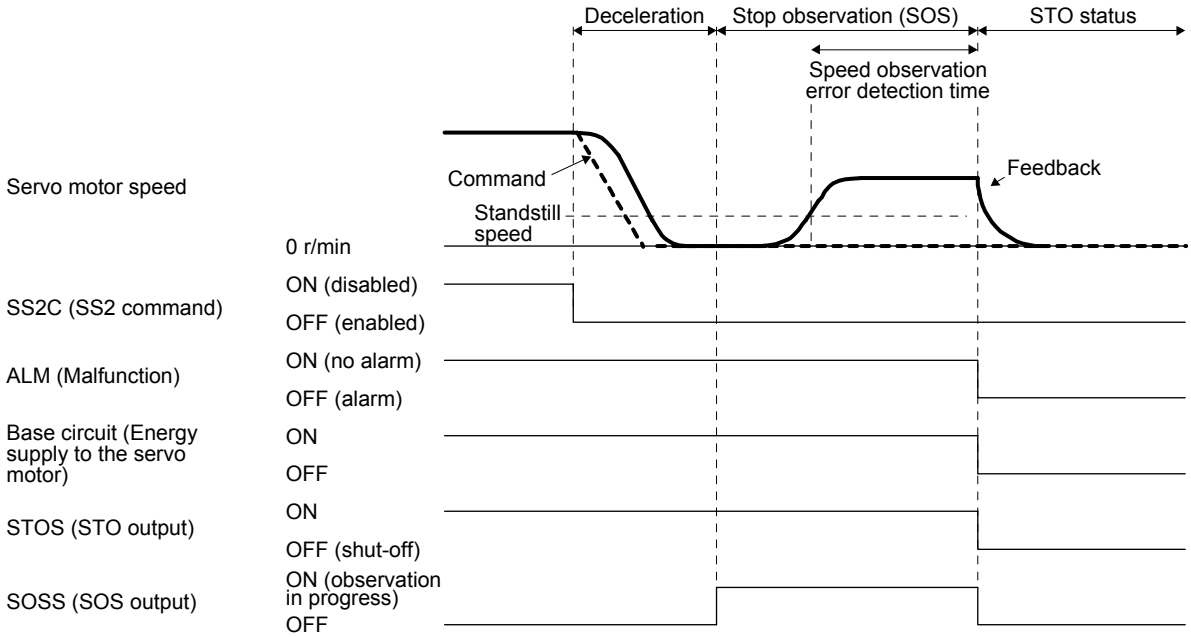
(a) Speed command observation

This observes that an absolute value of the command speed does not exceed the set value of [Pr. PSA04 SS2/SOS standstill speed] during the stop observation. When an excess of command speed continues for the set value of [Pr. PSA15 SLS/SS2/SOS speed detection delay time], the STO function will start.



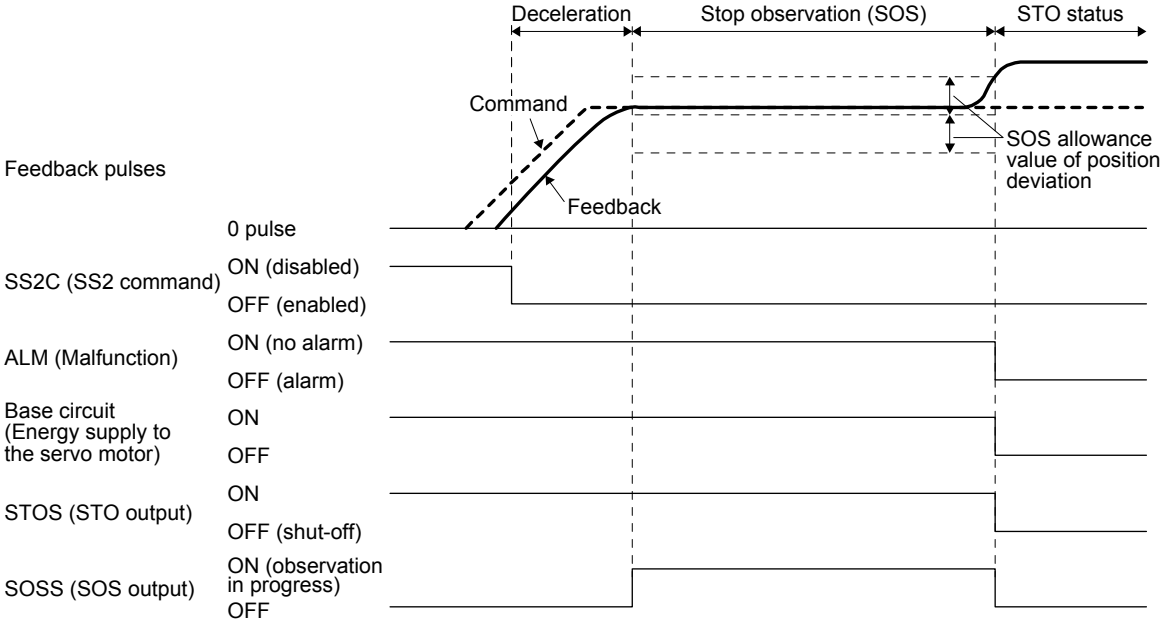
(b) Speed feedback observation

This observes that an absolute value of the speed feedback does not exceed the set value of [Pr. PSA04 SS2/SOS standstill speed] during the stop observation. When an excess of speed feedback continues for the set value of [Pr. PSA15 SLS/SS2/SOS speed detection delay time], the STO function will start.



(c) Position feedback observation during a stop

This observes that an absolute value of the position feedback variation from the start of the stop observation (SOS) is within the set value of [Pr. PSA05 SOS allowance value of position deviation] during stop observation. When the travel distance exceeding the set value of [Pr. PSA05 SOS allowance value of position deviation] is detected, the STO function will start.



(5) Parameter setting

To set the parameters, refer section 4.3.3. When using the SS2/SOS function in the safety observation function control by input device, refer to 4.4.1 to set parameters. When using the SS2/SOS function in the safety observation function control by network, refer to 4.4.3 to set parameters. Additionally, when using SS2S (SS2 output) and SOSS (SOS output) with output devices, refer to 4.4.2 to set parameters. To use the SS2/SOS function, a servo motor with functional safety is required. Refer to section 4.4.4 for servo motors with functional safety. When using the SS2/SOS function, set the parameters as follows.

Parameter	Name
PSA03	SS1/SS2 monitoring deceleration time
PSA04	SS2/SOS standstill speed
PSA05	SOS allowance value of position deviation
PSA06	SOS allowance value of position deviation unit selection
PSA15	SLS/SS2/SOS speed detection delay time
PSA17	SOS position detection delay time

(a) SS1/SS2 monitoring deceleration time

Set enough time for the servo motor to stop referring to operation sequence.

(b) SS2/SOS standstill speed

Set servo motor speed which the servo motor is assumed as stopped referring to operation sequence.

(c) SOS allowance value of position deviation, SOS allowance value of position deviation unit selection

Set an allowance value of position deviation during stop observation referring to the operation sequence.

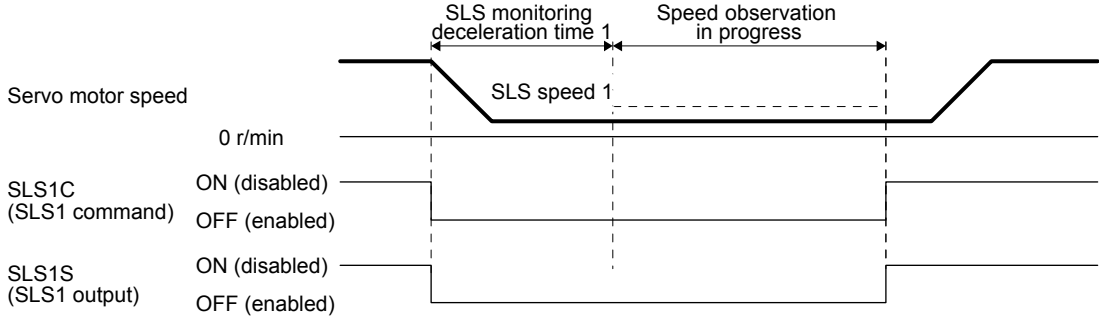
(d) SLS/SS2/SOS speed detection delay time
You can set a delay time for from when the speed decelerates lower than the standstill speed until the start of the stop observation and for from when the speed accelerates higher than the standstill speed during stop observation until the start of the STO function by using [Pr. PSA15 SLS/SS2/SOS speed detection delay time].

(e) SOS position detection delay time
You can set a delay time for from when the travel distance exceeds a threshold until the start of the STO function by using [Pr. PSA17 SOS position detection delay time].

4.5.4 SLS function

(1) Summary
This is a function to observe whether the speed is within a regulated speed limit value. When a specified speed is exceeded, energy will be shut off by STO. The STO function operates when the servo motor speed exceeding the SLS speed is detected. The SLS function observes both command speed and feedback speed.

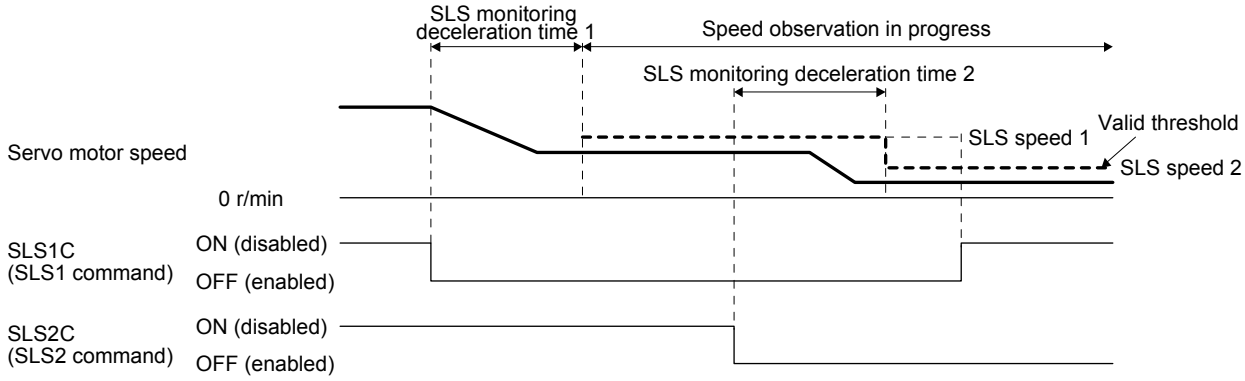
(2) Summary of sequence
The SLS function starts when SLS_C (SLS command) is turned off. Speed observation will be started when the delay time specified with the parameter has passed after SLS_C (SLS command) is turned off. During the speed observation, the servo motor speed is observed to be equal to or less than the SLS speed specified with the parameter. The speed observation will be terminated by turning on SLS_C (SLS command).



(3) Parameter switching
With the SLS function, four patterns of SLS speed and SLS deceleration monitoring time can be set. The following table shows SLS deceleration monitoring time and SLS speed enabled with each command of SLS1, SLS2, SLS3, and SLS4.

SLS command	SLS deceleration monitoring time	SLS speed
SLS1 command	[Pr. PSA07 SLS deceleration monitoring time 1]	[Pr. PSA11 SLS speed 1]
SLS2 command	[Pr. PSA08 SLS deceleration monitoring time 2]	[Pr. PSA12 SLS speed 2]
SLS3 command	[Pr. PSA09 SLS deceleration monitoring time 3]	[Pr. PSA13 SLS speed 3]
SLS4 command	[Pr. PSA10 SLS deceleration monitoring time 4]	[Pr. PSA14 SLS speed 4]

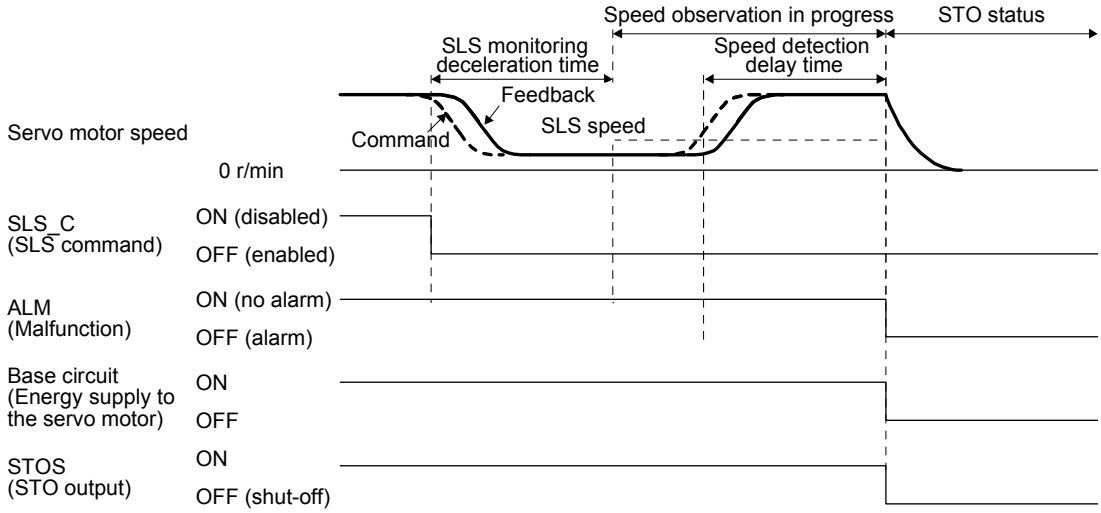
The following shows a sequence for when SLS1 and SLS2 commands are simultaneously turned off. Multiple speed observations are executed simultaneously. However, a valid threshold for speed would be the smallest SLS speed. In the following sequence, the value of SLS speed 2 is smaller than that of SLS speed 1. Thus, observation will be executed by SLS speed 2 while both SLS1 and SLS2 commands are enabled.



(4) Speed observation

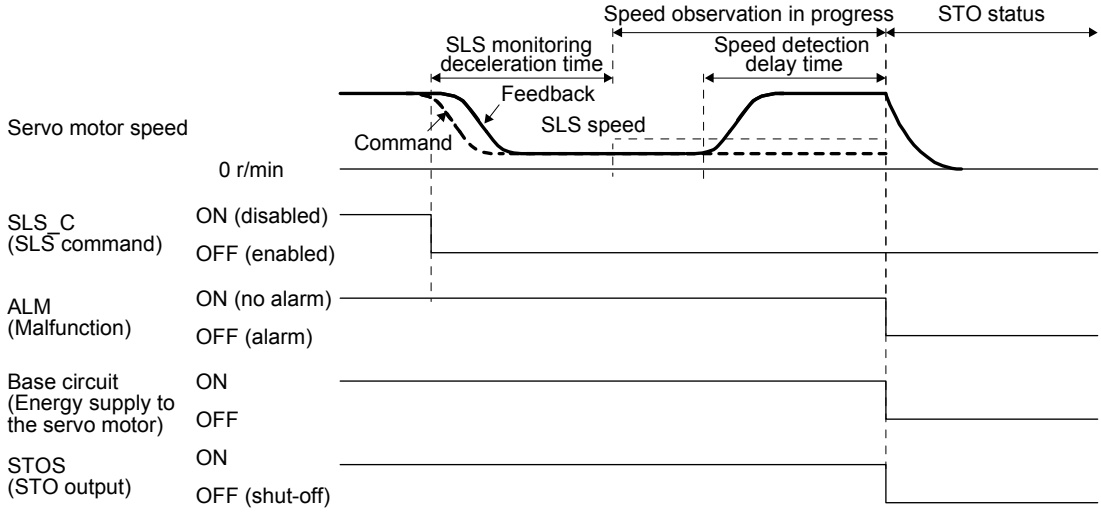
(a) Speed command observation

During the speed observation, an absolute value of the speed command is observed not to exceed the SLS speed. The STO function operates when the speed command exceeding the SLS speed is detected. However, when the speed is higher than the SLS speed, the STO function will start after the setting time of [Pr. PSA15 SLS/SS2/SOS speed detection delay time].



(b) Speed feedback observation

During the speed observation, an absolute value of the speed feedback is observed not to exceed the SLS speed. When an excess of speed feedback continues for the set value of [Pr. PSA15 SLS/SS2/SOS speed detection delay time], the STO function will start.



(5) Parameter setting

To set the parameters, refer to section 4.3.3. Set the parameters referring to section 4.4.1 when using the SLS function in the safety observation function control by input device, and section 4.4.3 when using the SLS function in the safety observation function control by network.

When using the SLS function, set the parameters as follows.

Parameter	Name
PSA07	SLS deceleration monitoring time 1
PSA08	SLS deceleration monitoring time 2
PSA09	SLS deceleration monitoring time 3
PSA10	SLS deceleration monitoring time 4
PSA11	SLS speed 1
PSA12	SLS speed 2
PSA13	SLS speed 3
PSA14	SLS speed 4
PSA15	SLS/SS2/SOS speed detection delay time

(a) SLS deceleration monitoring time 1 to SLS deceleration monitoring time 4

Set a time from SLS_C (SLS command) off to the speed observation start referring to the operation sequence. Set enough time for the servo motor to decelerate to the SLS speed or less. Four parameters are available for SLS1C (SLS1 command) to SLS4C (SLS4 command). However, it is not necessary to set a parameter with no possibility to be enabled.

(b) SLS speed 1 to SLS speed 4

Set a speed threshold for the speed observation referring to the operation sequence. Four parameters are available for SLS1C (SLS1 command) to SLS4C (SLS4 command). However, it is not necessary to set a parameter with no possibility to be enabled.

(c) SLS speed detection delay time

Set an error detection time for the time detected. This parameter changes the delay time to activate the STO function after the speed exceeds the SLS speed during the speed observation.

4.5.5 SSM function

(1) Summary

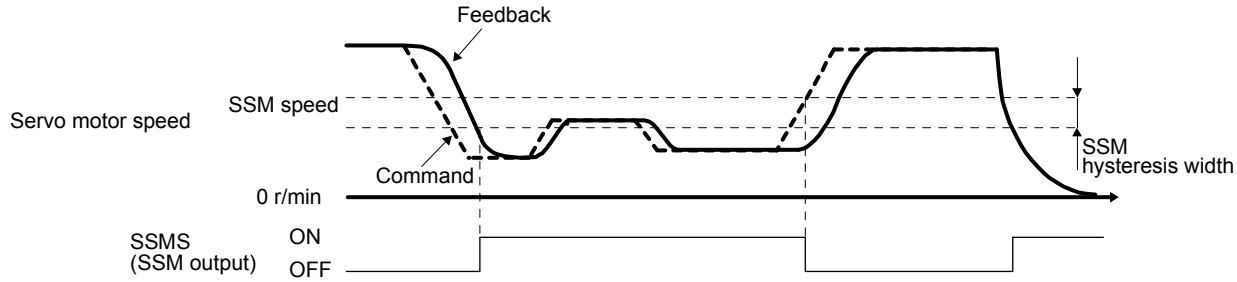
This function outputs a signal when the servo motor speed is within a regulated speed.

(2) Operation sequence

(a) SSMS (SSM output)

In the SSM function, SSMS (SSM output) is on when both the speed command and the speed feedback are equal to or lower than the setting of [Pr. PSA18 SSM speed]. Absolute values of the speed command and the speed feedback are observed not to exceed the SSM speed. SSMS (SSM output) is off when the either one exceeding the SSM speed is detected.

SSMS (SSM output) is on when the absolute values of both the speed command and the speed feedback are decreased, exceeding the setting value of [Pr. PSA19 SSM hysteresis width] from the SSM speed. Setting [Pr. PSA19 SSM hysteresis width] properly prevents chattering of SSMS (SSM output) at the time of the servo motor speed change around the SSM speed.



(3) Parameter setting

When using the SSM function, set the parameters as follows.

Parameter	Name
PSA18	SSM speed
PSA19	SSM hysteresis width

(a) SSM speed

Set a speed threshold for the speed observation referring to the operation sequence.

(b) SSM hysteresis width

Set a hysteresis width necessary to prevent chattering of SSMS (SSM output) referring to the operation sequence.

4.5.6 SBC function

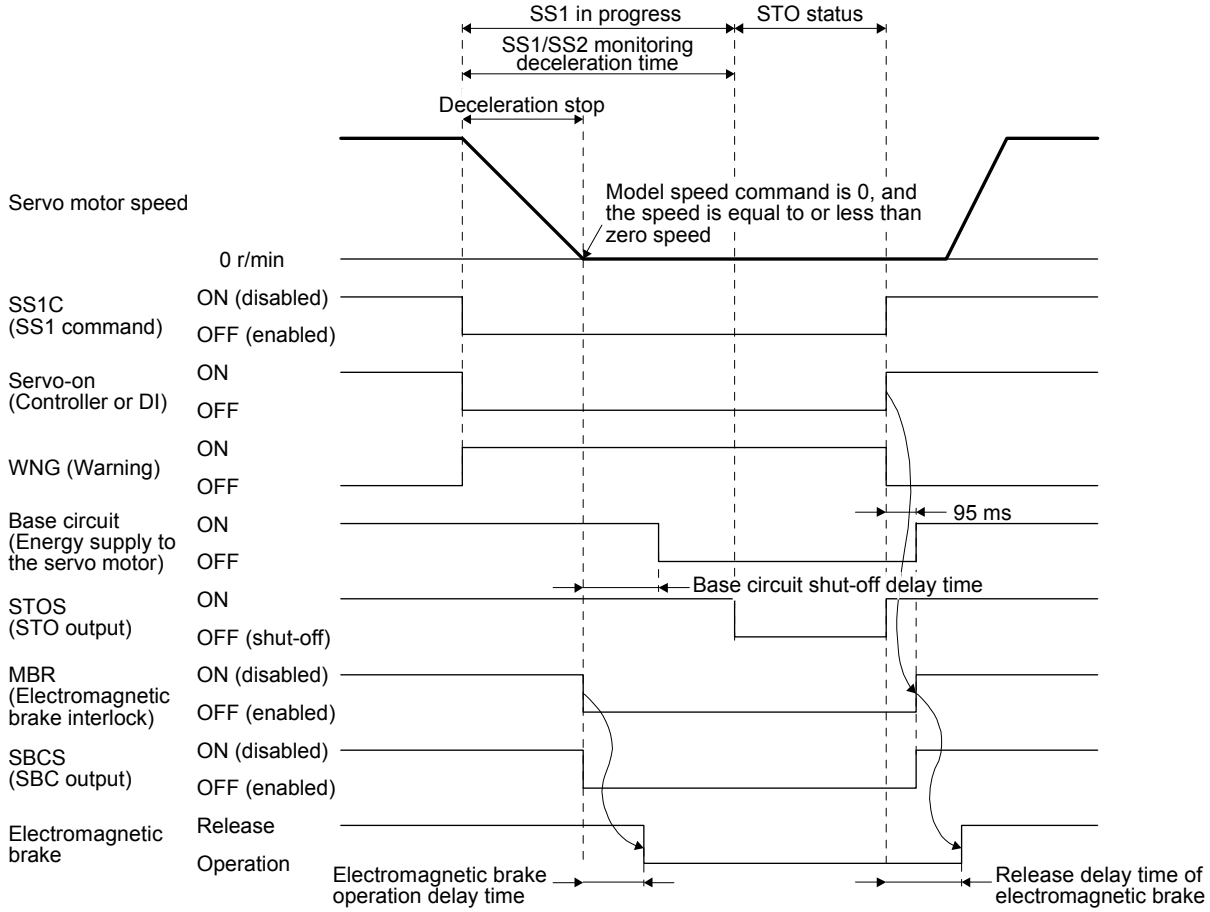
POINT
●Use SBCS (SBC output) for activating the electromagnetic brake. There is no need to use MBR (Electromagnetic brake interlock).

(1) Summary

This function outputs a signal for an external brake control.

(2) Operation sequence

The following shows an operation sequence during an operation of SS1 and a return from STO state. The configuration shows that the electromagnetic brake operates when SBCS (SBC output) is off. By setting [Pr. PC02 Base circuit shut-off delay time] and [Pr. PSA03 SS1/SS2 monitoring deceleration time] properly, the electromagnetic brake operates preventing dropping of vertical axis. Vertical axis freefall prevention function is also available.



Note. When the power is shut off by STO, the dynamic brake operates from the start of the STO function until an activation of the electromagnetic brake.

(3) Parameter setting

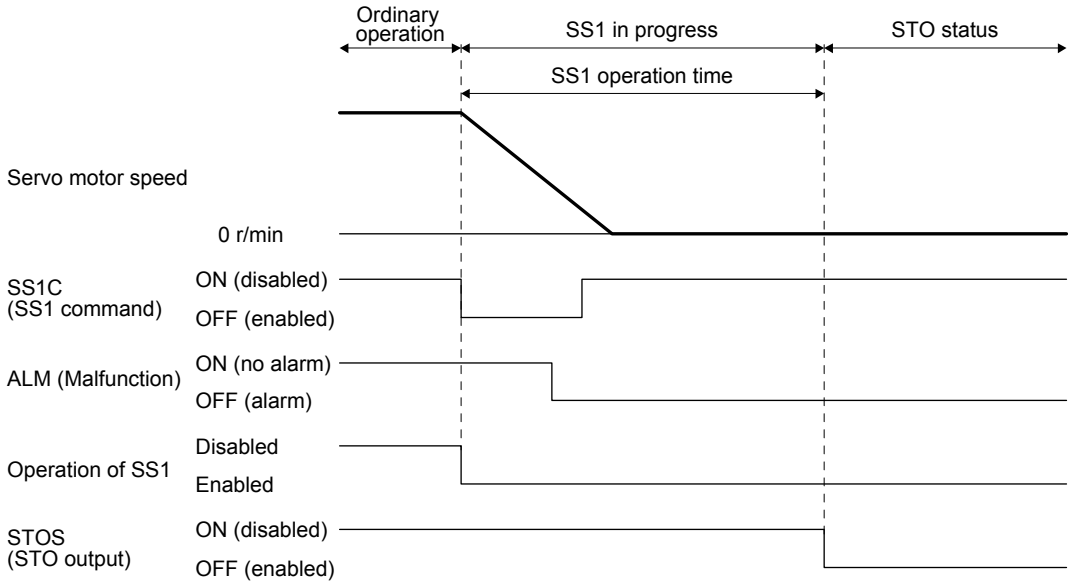
To set the parameters, refer to section 4.3.3. Set the parameters for the output devices referring to section 4.4.2.

4.5.7 Status monitor (SM) function

Each function state of SSM, SBC, STO, SOS, SS1, SS2, and SLS will be outputted by signals. This function is not the one defined in IEC/EN 61800-5-2. The function is an original function of the functional safety unit. For details of device, refer to section 3.6.2.

4.5.8 Multiple inputs of safety observation functional operation commands

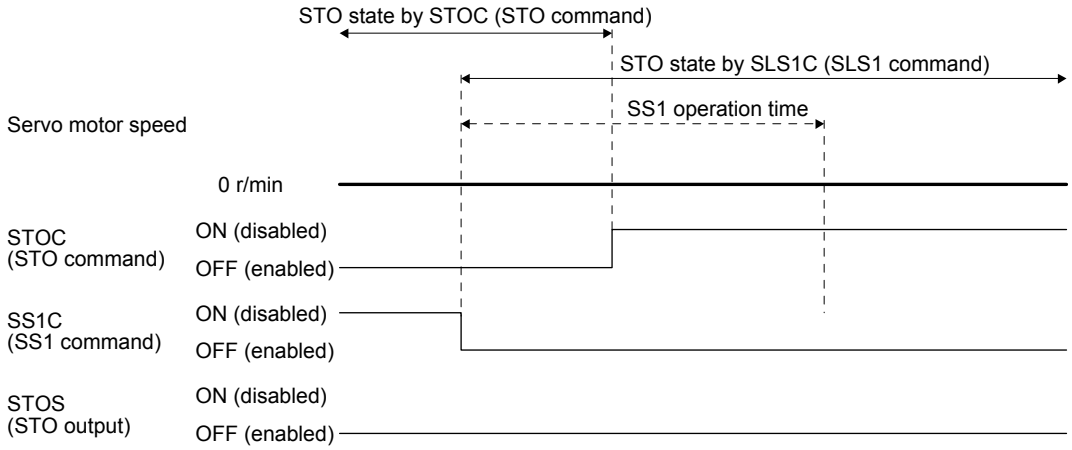
Operation commands which have the same function may be inputted simultaneously for operation commands of the safety observation function. For example, SS1C (SS1 command) input and SS1 input due to an alarm occurrence can occur simultaneously.
When there are multiple operation triggers for a function and at least one of them is valid, the function will start. The following shows an operation sequence for when an alarm occurs during the operation of SS1 by SS1C (SS1 command) as an example.



As triggers of the SS1 function, SS1C (SS1 command) and ALM (Malfunction) are inputted. However, a timer counting the SS1/SS2 monitoring deceleration time is the only one counting from SS1C (SS1 command) which was started first. At the moment of SS1C (SS1 command) returning to on, the SS1 function is being enabled by ALM (Malfunction), thus, the SS1 function continues the operation.

4.5.9 Simultaneous operation of STO and SS1 functions

When SS1C (SS1 command) turns off during the operation of the STO function, deceleration and time count by the SS1 function will not be executed and the STO function continues the operation.
As the following sequence, time count of the SS1 function will not executed if SS1C (SS1 command) turns off during the STO state by STOC (STO command). Even if STOC (STO command) is turned on, the STO state by SS1C (SS1 command) continues without being canceled.



Similarly, when STOC (STO command) is turned off during the operation of the SS1 function, both deceleration of SS1 and time count will be canceled.

4.5.10 At alarm occurrence

When an error occurs during operation, the corresponding alarm or warning is displayed. If any alarm or warning has occurred, refer to section 7 and take the appropriate action.

(1) Summary

(a) Stop method

The following stop methods are available when MR-D30 is used.

Stop method	Explanation
DB	Stops with dynamic brake. (Coasts for the servo amplifier without dynamic brake.)
EDB	600 W or less servo amplifiers: Stops with electronic dynamic brake. 700 W or more servo amplifiers: Stops with dynamic brake.
SD	The forced stop deceleration is performed.
STO/DB	Stops with dynamic brake by activating the STO function. For the operation sequence of this stop method, refer to 4.5.1.
SS1/EDB	Activates the SS1 function. 600 W or less servo amplifiers: Stops with electronic dynamic brake. 700 W or more servo amplifiers: Stops with dynamic brake. For the operation sequence of this stop method, refer to 4.5.2.
SS1/SD	Activates the SS1 function. The forced stop deceleration is performed. For the operation sequence of this stop method, refer to 4.5.2.

STO/DB, SS1/EDB, and SS1/ED are mainly an internal alarm of MR-D30. The STO state continues until the power is cycled or reset.

(b) Safety observation function stop

If a serious error is detected in MR-D30, the SLS and SSM functions will stop. For the alarms which stop these functions, refer to chapter 7. When the function stops, output devices will output off.

(c) Alarm reset

After a cause of the alarm is removed, the alarm can be canceled with one of the following methods.

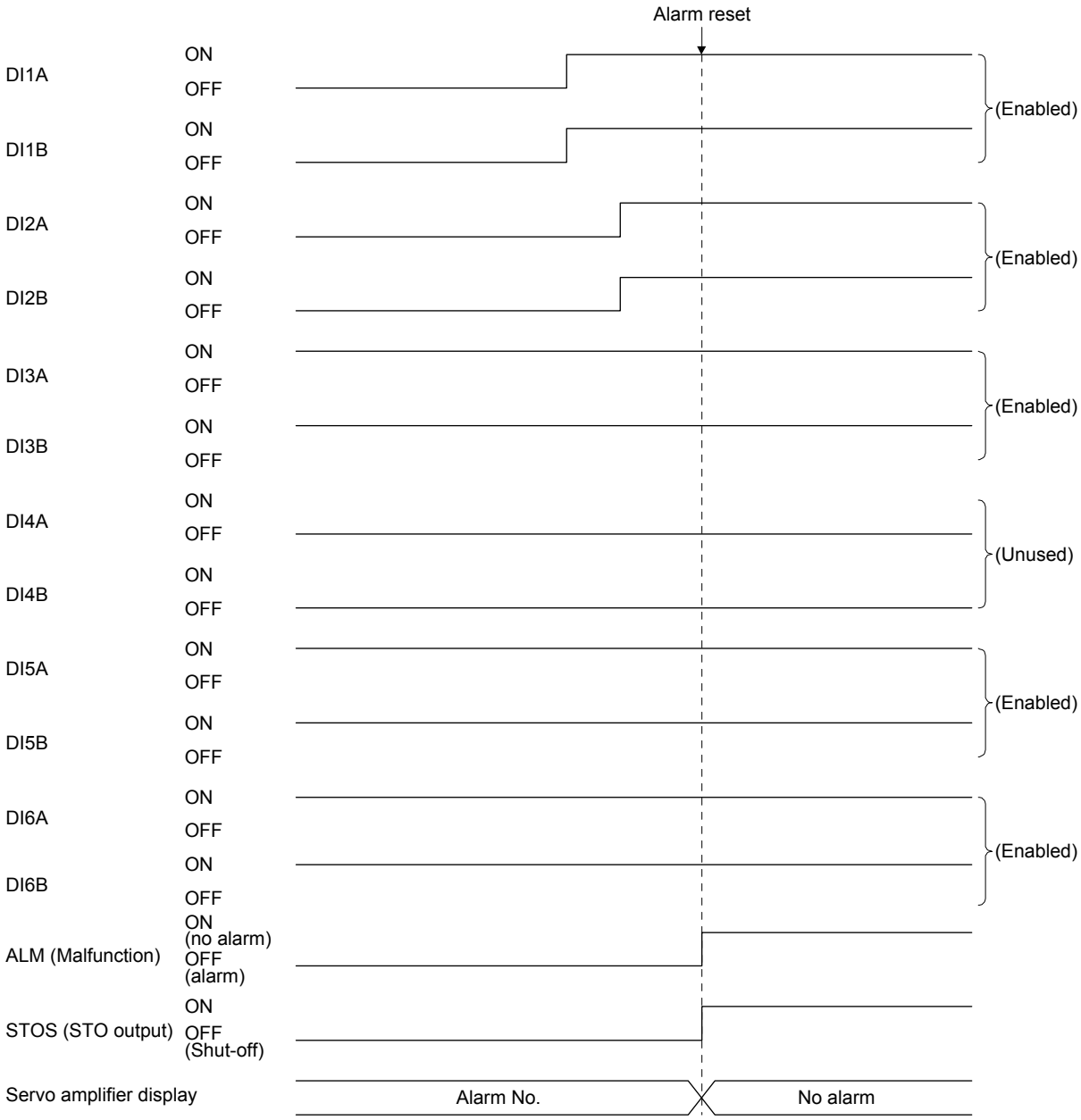
- Error reset
- CPU reset
- Power off to on

(2) How to reset alarm of safety observation function

(a) Safety observation function control by input device

Refer to chapter 7 for the list of alarms supporting reset operation in the alarms of safety observation function.

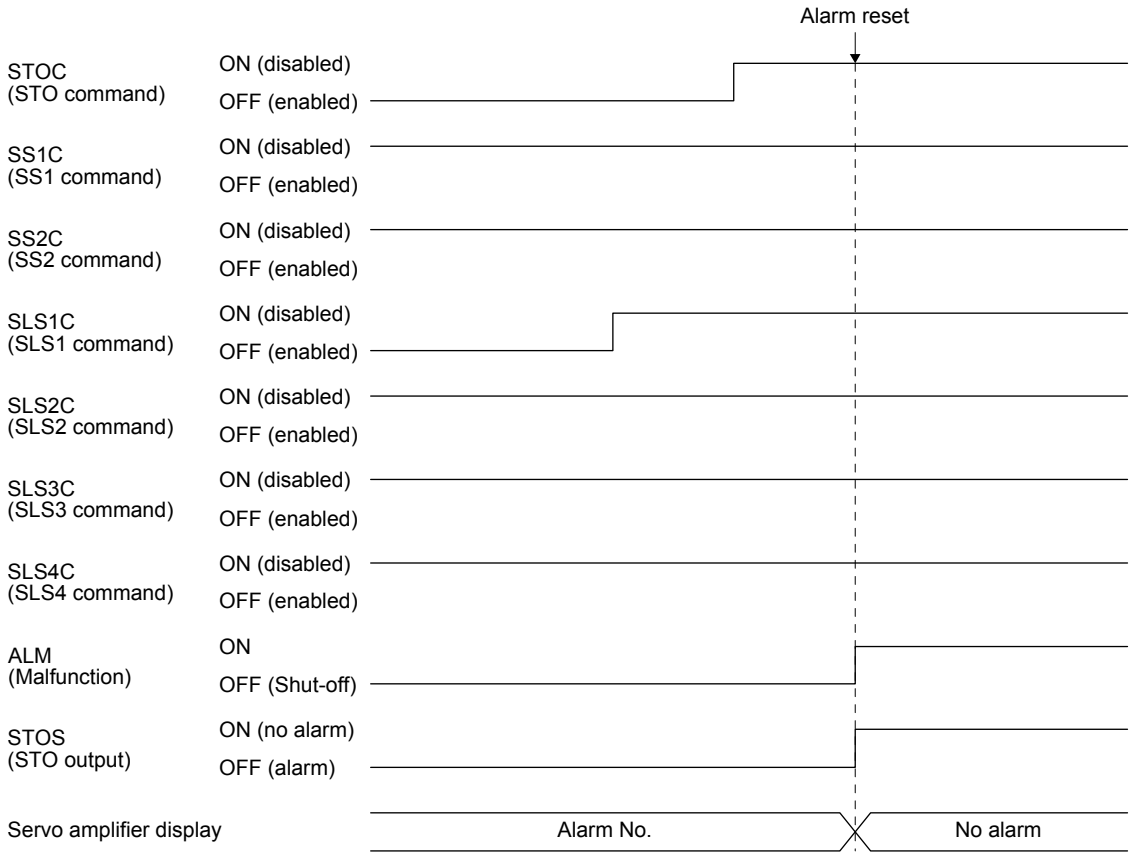
When the cause of an alarm occurrence is removed and alarm reset is executed with all the enabled input devices on, STO will be canceled, returning to a normal operation. It is no problem if the pin (unused pin) to which an input device is not assigned with [Pr. PSD02 Input device selection DI1] to [Pr. PSD07 Input device selection DI6] is off.



(b) Safety observation function control by network

Refer to chapter 7 for the list of alarms supporting reset operation in the alarms of safety observation function.

When the cause of the alarm occurrence is removed and alarm reset is executed with all commands on: STOC (STO command), SS1C (SS1 command), SS2C (SS2 command), SLS1C (SLS1 command), SLS2C (SLS2 command), SLS3C (SLS3 command), and SLS4C (SLS4 command), STO will be canceled, returning to a normal operation.



MEMO

5. PARAMETERS

⚠CAUTION	●Never make a drastic adjustment or change to the parameter values as doing so will make the operation unstable. ●Do not change the parameter settings as described below. Doing so may cause an unexpected condition such as failing to start up the servo amplifier. ・Changing the values of the parameters for manufacturer setting. ・A value out of the range is set. ・Changing the fixed values in the digits of a parameter.

POINT

●For parameters of servo amplifiers, refer to each servo amplifier instruction manual.

5.1 Parameter list

POINT

●The parameter whose symbol is preceded by * is enabled with the following conditions:
*: After setting the parameter, cycle the power or reset the controller.
**: After setting the parameter, cycle the power.

●Abbreviations of operation modes indicate the followings.
Servo motor: Standard (semi closed loop system) use of the servo motor
Servo motor with functional safety: Standard (semi closed loop system) use of the servo motor with functional safety
Full.: Fully closed loop system use of the servo motor or servo motor with functional safety
Lin.: Linear servo motor use
DD: Direct drive (DD) motor use

5.1.1 Safety observation function parameters 1 ([Pr. PSA_ _])

No.	Symbol	Name	Initial value	Unit	Password protection	Input mode		Operation mode				
						Safety observation function control by network	Safety observation function control by input device	Servo motor	Servo motor with functional safety	Lin.	Full.	DD
PSA01	**SOA	Safety observation function activation setting	0000h		○	○	○	○	○	○	○	○
PSA02	**SMD	Functional safety unit setting	0000h		○	○	○	○	○	○	○	○
PSA03	**SST	SS1/SS2 monitoring deceleration time	1000	[ms]	○	○	○	○	○	○	○	○
PSA04	**SSS	SS2/SOS standstill speed	50	[r/min]	○	○	○		○			
PSA05	**SSDP	SOS allowance value of position deviation	3		○	○	○		○			
PSA06	**SAOP1	SOS allowance value of position deviation unit selection	0		○	○	○		○			
PSA07	**SLSDT1	SLS deceleration monitoring time 1	1000	[ms]	○	○	○	○	○			
PSA08	**SLSDT2	SLS deceleration monitoring time 2	1000	[ms]	○	○	○	○	○			
PSA09	**SLSDT3	SLS deceleration monitoring time 3	1000	[ms]	○	○	○	○	○			
PSA10	**SLSDT4	SLS deceleration monitoring time 4	1000	[ms]	○	○	○	○	○			
PSA11	**SLSS1	SLS speed 1	50	[r/min]	○	○	○	○	○			
PSA12	**SLSS2	SLS speed 2	50	[r/min]	○	○	○	○	○			
PSA13	**SLSS3	SLS speed 3	50	[r/min]	○	○	○	○	○			
PSA14	**SLSS4	SLS speed 4	50	[r/min]	○	○	○	○	○			
PSA15	**SLST	SLS/SS2/SOS speed detection delay time	10	[ms]	○	○	○	○	○			
PSA16		For manufacturer setting	0000h									
PSA17	**SOSPT	SOS position detection delay time	0	[ms]	○	○	○		○			
PSA18	**SSMS	SSM speed	50	[r/min]	○	○	○	○	○			
PSA19	**SSMHW	SSM hysteresis width	20	[r/min]	○	○	○	○	○			
PSA20	**SMERL	Servo motor encoder resolution - Lower	4304	[pulse/rev]	○	○	○	○	○			
PSA21	**SMERH	Servo motor encoder resolution - Upper	419	[×10000 pulses/rev]	○	○	○	○	○			
PSA22	**SAADT	Position feedback fixing error detection time	60	[min]	○	○	○	○				
PSA23		For manufacturer setting	0000h									
PSA24			0000h									
PSA25			0000h									
PSA26			0000h									
PSA27			0000h									
PSA28			0000h									
PSA29			0000h									
PSA30			0000h									
PSA31			0000h									
PSA32			0000h									
PSA33			0000h									
PSA34			0000h									
PSA35			0000h									
PSA36			0000h									
PSA37			0000h									
PSA38			0000h									
PSA39			0000h									
PSA40			0000h									
PSA41			0000h									
PSA42			0000h									
PSA43			0000h									
PSA44			0000h									
PSA45			0000h									
PSA46			0000h									
PSA47			0000h									
PSA48			0000h									
PSA49			0000h									

No.	Symbol	Name	Initial value	Unit	Password protection	Input mode		Operation mode				
						Safety observation function control by network	Safety observation function control by input device	Servo motor	Servo motor with functional safety	Lin.	Full.	DD
PSA50		For manufacturer setting	0000h									
PSA51			0000h									
PSA52			0000h									
PSA53			0000h									
PSA54			0000h									
PSA55			0000h									
PSA56			0000h									
PSA57			0000h									
PSA58			0000h									
PSA59			0000h									
PSA60			0000h									
PSA61			0000h									
PSA62			0000h									
PSA63			0000h									
PSA64			0000h									

5.1.2 Network parameters ([Pr. PSC_ _])

No.	Symbol	Name	Initial value	Unit	Password protection	Input mode		Operation mode				
						Safety observation function control by network	Safety observation function control by input device	Servo motor	Servo motor with functional safety	Lin.	Full.	DD
PSC01	**SNC	Safety communication - Communication cycle	0006h		○	○		○	○	○	○	○
PSC02	**SNAS	Safety communication - Axis number selection	0000h		○	○		○	○	○	○	○
PSC03	**SNPOL	Safety communication - Servo motor rotation direction selection with functional safety	0000h		○	○			○	○	○	○
PSC04	**SNNO	Safety communication - Network communication selection	0000h		○	○		○	○	○	○	○
PSC05		For manufacturer setting	0000h									
PSC06			0000h									
PSC07			0000h									
PSC08			0000h									
PSC09			0000h									
PSC10			0000h									
PSC11			0000h									
PSC12			0000h									
PSC13			0000h									
PSC14			0000h									
PSC15			0000h									
PSC16			0000h									
PSC17			0000h									
PSC18			0000h									
PSC19			0000h									
PSC20			0000h									
PSC21			0000h									
PSC22			0000h									

No.	Symbol	Name	Initial value	Unit	Password protection	Input mode		Operation mode				
						Safety observation function control by network	Safety observation function control by input device	Servo motor	Servo motor with functional safety	Lin.	Full.	DD
PSC23		For manufacturer setting	0000h									
PSC24			0000h									
PSC25			0000h									
PSC26			0000h									
PSC27			0000h									
PSC28			0000h									
PSC29			0000h									
PSC30			0000h									
PSC31			0000h									
PSC32			0000h									
PSC33			0000h									
PSC34			0000h									
PSC35			0000h									
PSC36			0000h									
PSC37			0000h									
PSC38			0000h									
PSC39			0000h									
PSC40			0000h									
PSC41			0000h									
PSC42			0000h									
PSC43			0000h									
PSC44			0000h									
PSC45			0000h									
PSC46			0000h									
PSC47			0000h									
PSC48			0000h									
PSC49			0000h									
PSC50			0000h									
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PSC59			0000h									
PSC60			0000h									
PSC61			0000h									
PSC62			0000h									
PSC63			0000h									
PSC64			0000h									

5.1.3 Safety I/O device parameters ([Pr. PSD_ _])

No.	Symbol	Name	Initial value	Unit	Password protection	Input mode		Operation mode				
						Safety observation function control by network	Safety observation function control by input device	Servo motor	Servo motor with functional safety	Lin.	Full.	DD
PSD01	**SDIA	Input device automatic activation selection	0000h		○		○	○	○	○	○	○
PSD02	**SDI1	Input device selection DI1	0000h		○		○	○	○	○	○	○
PSD03	**SDI2	Input device selection DI2	0000h		○		○	○	○	○	○	○
PSD04	**SDI3	Input device selection DI3	0000h		○		○	○	○	○	○	○
PSD05	**SDI4	Input device selection DI4	0000h		○		○	○	○	○	○	○
PSD06	**SDI5	Input device selection DI5	0000h		○		○	○	○	○	○	○
PSD07	**SDI6	Input device selection DI6	0000h		○		○	○	○	○	○	○
PSD08	**SDO1	Output device selection DO1	0000h		○	○	○	○	○	○	○	○
PSD09	**SDO2	Output device selection DO2	0000h		○	○	○	○	○	○	○	○
PSD10	**SDO3	Output device selection DO3	0000h		○	○	○	○	○	○	○	○
PSD11	**SDO4	Output device selection DO4	0000h		○	○	○	○	○	○	○	○
PSD12	**SDIF1	Input device - Noise rejection filtering time DI1	0001h		○		○	○	○	○	○	○
PSD13	**SDIF2	Input device - Noise rejection filtering time DI2	0001h		○		○	○	○	○	○	○
PSD14	**SDIF3	Input device - Noise rejection filtering time DI3	0001h		○		○	○	○	○	○	○
PSD15	**SDIF4	Input device - Noise rejection filtering time DI4	0001h		○		○	○	○	○	○	○
PSD16	**SDIF5	Input device - Noise rejection filtering time DI5	0001h		○		○	○	○	○	○	○
PSD17	**SDIF6	Input device - Noise rejection filtering time DI6	0001h		○		○	○	○	○	○	○
PSD18	**SDIDT1	Mismatch permissible time DI1	20	[ms]	○		○	○	○	○	○	○
PSD19	**SDIDT2	Mismatch permissible time DI2	20	[ms]	○		○	○	○	○	○	○
PSD20	**SDIDT3	Mismatch permissible time DI3	20	[ms]	○		○	○	○	○	○	○
PSD21	**SDIDT4	Mismatch permissible time DI4	20	[ms]	○		○	○	○	○	○	○
PSD22	**SDIDT5	Mismatch permissible time DI5	20	[ms]	○		○	○	○	○	○	○
PSD23	**SDIDT6	Mismatch permissible time DI6	20	[ms]	○		○	○	○	○	○	○
PSD24	**SDIP1	Input device - Test pulse diagnosis execution selection 1	1111h		○		○	○	○	○	○	○
PSD25	**SDIP2	Input device - Test pulse diagnosis execution selection 2	0011h		○		○	○	○	○	○	○
PSD26	**SDIPW	Input device - Test pulse off time	0001h		○		○	○	○	○	○	○
PSD27	**SDID1	Input device - Fixing-diagnosis execution selection 1 at start-up	1111h		○		○	○	○	○	○	○
PSD28	**SDID2	Input device - Fixing-diagnosis execution selection 2 at start-up	0011h		○		○	○	○	○	○	○
PSD29	**SDOP	Output device - Test pulse execution selection	1111h		○	○	○	○	○	○	○	○
PSD30	**SDOPW	Output device - Test pulse off time	0000h		○	○	○	○	○	○	○	○
PSD31		For manufacturer setting	0000h									
PSD32			0000h									
PSD33			0000h									
PSD34			0000h									
PSD35			0000h									
PSD36			0000h									
PSD37			0000h									
PSD38			0000h									
PSD39			0000h									
PSD40			0000h									
PSD41			0000h									
PSD42			0000h									
PSD43			0000h									
PSD44			0000h									
PSD45			0000h									
PSD46			0000h									
PSD47			0000h									
PSD48			0000h									
PSD49			0000h									

No.	Symbol	Name	Initial value	Unit	Password protection	Input mode		Operation mode				
						Safety observation function control by network	Safety observation function control by input device	Servo motor	Servo motor with functional safety	Lin.	Full.	DD
PSD50		For manufacturer setting	0000h									
PSD51			0000h									
PSD52			0000h									
PSD53			0000h									
PSD54			0000h									
PSD55			0000h									
PSD56			0000h									
PSD57			0000h									
PSD58			0000h									
PSD59			0000h									
PSD60			0000h									
PSD61			0000h									
PSD62			0000h									
PSD63			0000h									
PSD64			0000h									

5.2 Detailed list of parameters

POINT
●Set a value to each "x" in the "Setting digit" columns. ●This parameter cannot be used in the J3 compatibility mode.

5.2.1 Safety observation function parameters 1 ([Pr. PSA_ _])

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PSA01</td><td>**SOA</td><td>Safety observation function activation setting
Select enabled/disabled of MR-D30 parameter settings.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th><th>Setting range</th></tr>
<tr><td>_ _ _ x</td><td>Functional safety unit activation setting
0: Disabled
1: Enabled
While this parameter is disabled, STO cannot be canceled due to [AL. 7A.2 Parameter setting range error (safety observation function)] occurrence. Before enabling this parameter, check the setting of each parameter that they have no problem.</td><td>0h</td><td>0h
to
1h</td></tr>
<tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td><td></td></tr>
<tr><td>_ x _ _</td><td>0h</td><td></td></tr>
<tr><td>x _ _ _</td><td>0h</td><td></td></tr>
</table></td><td></td><td></td></tr>
<tr><td>PSA02</td><td>**SMD</td><td>Functional safety unit setting
Make basic settings of MR-D30 functions.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th><th>Setting range</th></tr>
<tr><td>_ _ _ x</td><td>Input mode selection
0: Safety observation function control by input device
1: Safety observation function control by network
2: Test operation
Please note that the safety observation function will not operate while test operation is selected. For the test operation, refer to each servo amplifier instruction manual.</td><td>0h</td><td>0h
to
2h</td></tr>
<tr><td>_ _ x _</td><td>Safety observation function - Position/speed observation setting
0: Using STO/SS1/SBC without executing position/speed observation (SLS/SSM/SOS/SS2)
1: Executing position/speed observation with the servo motor with functional safety (This setting value can be used with MR-D30 with software version A1 or later. This setting value can be used with MR-J4-_A_-RJ and MR-J4-_B_-RJ servo amplifiers with software version B5 or later.)
2: Executing position/speed observation without the servo motor with functional safety</td><td>0h</td><td>0h
to
2h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td><td></td></tr>
<tr><td>x _ _ _</td><td>0h</td><td></td></tr>
</table>Incorrect setting of this parameter will trigger [AL. 7A.3]. Refer to section 7.2 for details.</td><td></td><td></td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PSA03</td><td>**SST</td><td>SS1/SS2 monitoring deceleration time
Set a deceleration time of the SS1 function and SS2/SOS function. This parameter is used for the following two functions.
(1) When setting time passes during deceleration of the SS1 function, the STO function will operate.
(2) When setting time passes during deceleration of the SS2/SOS function, the stop observation (SOS) will operate. (This function is available with MR-D30 with software version A1 or later. For MR-J4-_A_-RJ and MR-J4-_B_-RJ, this parameter is available with the servo amplifiers with software version B5 or later.</td><td>1000
[ms]</td><td>0
to
60000</td></tr>
<tr><td>PSA04</td><td>**SSS</td><td>SS2/SOS standstill speed
Set a standstill speed. When an absolute value of the servo motor speed is lower than the set value of this parameter, the servo motor will be assumed as stopped.
Concretely, this parameter is used for the following two functions.
(1) When the speed becomes slower than the set value of this parameter during deceleration of the SS2/SOS function, the stop observation (SOS) will operate.
(2) When the speed becomes higher than the set value of this parameter during stop observation (SOS) of the SS2/SOS function, the STO function will operate.
This parameter is available with MR-D30 with software version A1 or later. For MR-J4-_A_-RJ and MR-J4-_B_-RJ, this parameter is available with the servo amplifiers with software version B5 or later.</td><td>50
[r/min]</td><td>0
to
10000</td></tr>
<tr><td>PSA05</td><td>**SSDP</td><td>SOS allowance value of position deviation
Specify an allowance value of a position deviation during stop observation (SOS) of the SS2/SOS function. When the position travels equal to or more than the specified value in this parameter after the stop observation has started, the STO function will operate.
The SOS allowance value of the position deviation will be clamped at 100 rev when [Pr. PSA06 SOS allowance value of position deviation unit selection] is set to "0".
This parameter is available with MR-D30 with software version A1 or later. For MR-J4-_A_-RJ and MR-J4-_B_-RJ, this parameter is available with the servo amplifiers with software version B5 or later.
Note. Setting unit can be changed in [Pr. PSA06].</td><td>3
[rev]
(Note)</td><td>0
to
1000</td></tr>
<tr><td>PSA06</td><td>**SAOP1</td><td>SOS allowance value of position deviation unit selection
Select a setting unit of the SOS allowance value of the position deviation set in [Pr. PSA05].
This parameter is available with MR-D30 with software version A1 or later. For MR-J4-_A_-RJ and MR-J4-_B_-RJ, this parameter is available with the servo amplifiers with software version B5 or later.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th><th>Setting range</th></tr>
<tr><td>_ _ _ x</td><td>SOS allowance value of position deviation unit selection
0: 1 rev
1: 0.1 rev
2: 0.01 rev</td><td>0h</td><td>0h
to
2h</td></tr>
<tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td><td></td></tr>
<tr><td>_ x _ _</td><td>0h</td><td></td></tr>
<tr><td>x _ _ _</td><td>0h</td><td></td></tr>
</table></td><td></td><td></td></tr>
<tr><td>PSA07</td><td>**SLSDT1</td><td>SLS deceleration monitoring time 1
Set a threshold of the time from when the SLS1 command is enabled to when the speed observation starts. Specify enough time for deceleration to a safety speed from the enabled SLS1 command. As necessary, execute such as deceleration control with the controller during the delay time.</td><td>1000
[ms]</td><td>0
to
60000</td></tr>
<tr><td>PSA08</td><td>**SLSDT2</td><td>SLS deceleration monitoring time 2
Set a threshold of the time from when the SLS2 command is enabled to when the speed observation starts. Specify enough time for deceleration to a safety speed from the enabled SLS2 command. As necessary, execute such as deceleration control with the controller during the delay time.</td><td>1000
[ms]</td><td>0
to
60000</td></tr>
<tr><td>PSA09</td><td>**SLSDT3</td><td>SLS deceleration monitoring time 3
Set a threshold of the time from when the SLS3 command is enabled to when the speed observation starts. Specify enough time for deceleration to a safety speed from the enabled SLS3 command. As necessary, execute such as deceleration control with the controller during the delay time.</td><td>1000
[ms]</td><td>0
to
60000</td></tr>
</table>

No.	Symbol	Name and function	Initial value [unit]	Setting range
PSA10	**SLSDT4	SLS deceleration monitoring time 4 Set a threshold of the time from when the SLS4 command is enabled to when the speed observation start. Specify enough time for deceleration to a safety speed from the enabled SLS4 command. As necessary, execute such as deceleration control with the controller during the delay time.	1000 [ms]	0 to 60000
PSA11	**SLSS1	SLS speed 1 Set a threshold of a safety speed for when the SLS function operates by the SLS1 command. When an absolute value of the servo motor speed exceeds this value during the speed observation of the SLS function, the STO function will operate.	50 [r/min]	0 to 10000
PSA12	**SLSS2	SLS speed 2 Set a threshold of a safety speed for when the SLS function operates by the SLS2 command. When an absolute value of the servo motor speed exceeds this value during the speed observation of the SLS function, the STO function will operate.	50 [r/min]	0 to 10000
PSA13	**SLSS3	SLS speed 3 Set a threshold of a safety speed for when the SLS function operates by the SLS3 command. When an absolute value of the servo motor speed exceeds this value during the speed observation of the SLS function, the STO function will operate.	50 [r/min]	0 to 10000
PSA14	**SLSS4	SLS speed 4 Set a threshold of a safety speed for when the SLS function operates by the SLS4 command. When an absolute value of the servo motor speed exceeds this value during the speed observation of the SLS function, the STO function will operate.	50 [r/min]	0 to 10000
PSA15	**SLST	SLS/SS2/SOS speed detection delay time Specify filtering time of the delay filter which determines whether a servo motor speed is over or below the threshold during the speed observation. Response time of the speed observation will be affected by this parameter setting. This parameter affects the following response time. ・Time after the speed exceeds during the speed observation of the SLS function until the STO function starts ・Time after the speed decelerates lower than the standstill speed during the speed observation of the SS2/SOS function until the stop observation (SOS) starts (This function is available with MR-D30 with software version A1 or later. For MR-J4-_A_-RJ and MR-J4-_B_-RJ, this parameter is available with the servo amplifiers with software version B5 or later. ・Time after the speed accelerates higher than standstill speed during the stop observation (SOS) of the SS2/SOS function until the STO function starts (This function is available with MR-D30 with software version A1 or later. For MR-J4-_A_-RJ and MR-J4-_B_-RJ, this parameter is available with the servo amplifiers with software version B5 or later.	0 [ms]	0 to 2000
PSA17	**SOSPT	SOS position detection delay time Set a filtering time of the delay filter which determines that motor position exceeds the threshold at position observation. Response time of position observation will be affected by this parameter setting. This parameter affects the following response time. ・Time after the position deviation of position feedback becomes out of the allowance value of the position deviation during the stop observation of the SS2/SOS function until the STO function starts This parameter is available with MR-D30 with software version A1 or later. For MR-J4-_A_-RJ and MR-J4-_B_-RJ, this parameter is available with the servo amplifiers with software version B5 or later.	0 [ms]	0 to 2000
PSA18	**SSMS	SSM speed Set a threshold of a safety speed for when the SSM function operates. SSMS (SSM output) will turn off when an absolute value of the servo motor speed exceeds this speed and will turn on when the value is below this speed. However, these determinations include hysteresis specified with [Pr. PSA19]. When an alarm which disables SSM occurs, SSMS (SSM output) will turn off. Incorrect setting of this parameter will trigger [AL. 7A.3]. Refer to section 7.2 for details.	50 [r/min]	0 to 10000
PSA19	**SSMHW	SSM hysteresis width Set a threshold of a hysteresis width for the SSM function speed decision. Be sure to specify a value lower than [Pr. PSA18]. Setting a value of [Pr. PSA18] or more will trigger [AL. 7A.3 Parameter combination error (safety observation function)]. Incorrect setting of this parameter will trigger [AL. 7A.3]. Refer to section 7.2 for details.	20 [r/min]	0 to 10000

No.	Symbol	Name and function	Initial value [unit]	Setting range
PSA20	**SMERL	Servo motor encoder resolution - Lower Set an encoder resolution of the servo motor. Set lower four digits in decimal numbers with this parameter.	4304 [pulse/ rev]	0 to 9999
PSA21	**SMERH	Servo motor encoder resolution - Upper Set an encoder resolution of the servo motor. Set upper four digits in decimal numbers with this parameter. Do not set "0" for the servo motor encoder resolution ("0" for both [Pr. PSA20] and [Pr. PSA21]). Setting "0" will trigger [AL. 7A.3 Parameter combination error (safety observation function)]. When the values set for the servo motor encoder resolution ([Pr. PSA20] and [Pr. PSA21]) do not match with the resolution of the actually connected encoder, [AL. 7A.3 Parameter combination error (safety observation function)] will occur. Incorrect setting of this parameter will trigger [AL. 7A.3]. Refer to section 7.2 for details.	419 [×10000 pulses/ rev]	0 to 9999
PSA22	**SAADT	Position feedback fixing error detection time Set a time until [AL. 79.8 Position feedback fixing error] is detected. Setting "0" will disable a diagnosis for [AL. 79.8 Position feedback fixing error].	60 [min]	0 to 65535

5.2.2 Network parameters ([Pr. PSC_ _])

No.	Symbol	Name and function	Initial value [unit]	Setting range
PSC01	**SNC	Safety communication - Communication cycle Select a communication cycle for the safety communication. Set the same value as of the controller to "Safety communication - Communication cycle". When a different value is set, [AL. 7C.1 Functional safety unit communication setting error (safety observation function)] will occur.		

Setting digit	Explanation	Initial value	Setting range
_ _ x x	Safety communication - Communication cycle 06: 14.2 ms 07: 28.4 ms 16: 16.0 ms (Note) 17: 32.0 ms (Note)	06h	06h 07h 14h to 17h
_ x _ _	For manufacturer setting	0h	
x _ _ _		0h	

Note. This setting value can be used with MR-D30 with software version A2 or later.

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PSC02</td><td>**SNAS</td><td>
Safety communication - Axis number selection
Set an axis No. for the safety communication.
This parameter is available with MR-D30 with software version A1 or later. For MR-J4-_B_-RJ, this parameter is available with the servo amplifiers with software version B5 or later.
For MR-J4-_A_-RJ, this parameter is disabled.
For MR-J4-_GF_-RJ, replace "axis number" to "station number".
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th><th>Setting range</th></tr>
<tr><td>_ _ x x</td><td>Safety communication - Axis number selection
Refer to table 5.1 for settings.
Set the same axis No. as the setting of servo amplifier. Setting a different No. will trigger [AL. 7A.3 Parameter combination error (safety observation function)]. For axis No. selection of servo amplifiers, refer to each servo amplifier instruction manual.</td><td>00h</td><td>00h
to
77h</td></tr>
<tr><td>_ x _ _</td><td>For manufacturer setting</td><td>0h</td><td></td></tr>
<tr><td>x _ _ _</td><td>Safety communication - Enabling axis number selection
0: Disabled (using the axis selection rotary switch)
1: Enabled (using the first digit of the setting of [Pr. PSD02])</td><td>0h</td><td>0h
to
1h</td></tr>
</table>
Table 5.1 Axis No. selection
<table>
<tr><th>Setting value</th><th>Axis No.</th></tr>
<tr><td>_ _ 0 0</td><td>1</td></tr>
<tr><td>_ _ 0 1</td><td>2</td></tr>
<tr><td>_ _ 0 2</td><td>3</td></tr>
<tr><td>_ _ 0 3</td><td>4</td></tr>
<tr><td>_ _ 0 4</td><td>5</td></tr>
<tr><td>_ _ 0 5</td><td>6</td></tr>
<tr><td>_ _ 0 6</td><td>7</td></tr>
<tr><td>_ _ 0 7</td><td>8</td></tr>
<tr><td>.
.
.</td><td>.
.
.</td></tr>
<tr><td>_ _ 7 0</td><td>113</td></tr>
<tr><td>_ _ 7 1</td><td>114</td></tr>
<tr><td>_ _ 7 2</td><td>115</td></tr>
<tr><td>_ _ 7 3</td><td>116</td></tr>
<tr><td>_ _ 7 4</td><td>117</td></tr>
<tr><td>_ _ 7 5</td><td>118</td></tr>
<tr><td>_ _ 7 6</td><td>119</td></tr>
<tr><td>_ _ 7 7</td><td>120</td></tr>
</table>
</td><td></td><td></td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PSC03</td><td>**SNPOL</td><td>Safety communication - Servo motor rotation direction selection with functional safety
When a safety controller is used with a servo motor with functional safety, set the same value as the servo motor rotation direction set by the servo amplifier ([Pr. PA14 Rotation direction selection/travel direction selection]). For the setting of servo motor rotation direction of servo amplifiers, refer to each servo amplifier instruction manual.
This parameter is available with MR-D30 with software version A1 or later. For MR-J4-_A_-RJ and MR-J4-_B_-RJ, this parameter is available with the servo amplifiers with software version B5 or later.
For MR-J4-_A_-RJ, this parameter is disabled.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th><th>Setting range</th></tr>
<tr><td>_ _ _ x</td><td>Safety communication - Servo motor rotation direction selection with functional safety
Refer to table 5.2 for settings.</td><td>0h</td><td>0h
to
1h</td></tr>
<tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td><td></td></tr>
<tr><td>_ x _ _</td><td>0h</td><td></td></tr>
<tr><td>x _ _ _</td><td>0h</td><td></td></tr>
</table>
Table 5.2 Servo motor rotation direction selection with functional safety
<table>
<tr><th rowspan="2">Setting value</th><th colspan="2">Servo motor rotation direction with functional safety</th></tr>
<tr><th>When forward rotation pulse is inputted</th><th>When reverse rotation pulse is inputted</th></tr>
<tr><td>_ _ _ 0</td><td>CCW</td><td>CW</td></tr>
<tr><td>_ _ _ 1</td><td>CW</td><td>CCW</td></tr>
</table>
Incorrect setting of this parameter will trigger [AL. 7A.3]. Refer to section 7.2 for details.</td><td></td><td></td></tr>
<tr><td>PSC04</td><td>**SNNO</td><td>Safety communication - Network communication selection
Set a network number for the safety communication.
For MR-J4-_A_-RJ, this parameter is disabled.
For MR-J4-_B_-RJ, set "0". Setting a value other than "0" will trigger [AL. 95.4 STO warning 2 (safety observation function)].
For MR-J4_-GF-RJ, match the network number of the master station with that of MR-J4_-GF_-RJ. Otherwise, [AL. 95.4 STO warning 2 (safety observation function)] will occur.
When "0" is set, network No. 1 is assigned. For details of the network number for the MR-J4_-GF-RJ, refer to [Pr. PN04 CC-Link IE communication network number] in chapter 5 of "MR-J4-_GF_(-RJ) Servo Amplifier Instruction Manual (Motion Mode)".</td><td>0</td><td>0
to
239</td></tr>
</table>

5.2.3 Safety I/O device parameters ([Pr. PSD_ _])

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PSD01</td><td>**SDIA</td><td>Input device automatic activation selection
This setting is enabled only when an input device is used. The SLS function can be activated automatically with this setting. A command set to automatic activation with this setting will be off (the function enabled) at a system start-up , and a corresponding function will start automatically. Specifically, the speed observation by the SLS function will be always enabled when SLS1C to SL41C is set to automatic activation.
<table>
<tr><th colspan="2">Setting digit</th><th rowspan="2">Explanation</th><th rowspan="2">Initial value</th><th rowspan="2">Setting range</th></tr>
<tr><th>HEX</th><th>BIN</th></tr>
<tr><td rowspan="4">_ _ _ x</td><td>_ _ _ x</td><td>SLS1C (SLS1 command)
0: Disable automatic activation
1: Enable automatic activation</td><td rowspan="4">0h</td><td rowspan="4">0h
to
Fh</td></tr>
<tr><td>_ _ x _</td><td>SLS2C (SLS2 command)
0: Disable automatic activation
1: Enable automatic activation</td></tr>
<tr><td>_ x _ _</td><td>SLS3C (SLS3 command)
0: Disable automatic activation
1: Enable automatic activation</td></tr>
<tr><td>x _ _ _</td><td>SLS4C (SLS4 command)
0: Disable automatic activation
1: Enable automatic activation</td></tr>
<tr><td>_ _ x _</td><td rowspan="3"></td><td rowspan="3">For manufacturer setting</td><td>0h</td><td></td></tr>
<tr><td>_ x _ _</td><td>0h</td><td></td></tr>
<tr><td>x _ _ _</td><td>0h</td><td></td></tr>
</table>
Incorrect setting of this parameter will trigger [AL. 7A.3]. Refer to section 7.2 for details.</td></tr>
<tr><td>PSD02</td><td>**SDI1</td><td>Input device selection DI1
Select an input device to assign to DI1A (CN10A-4) and DI1B (CN10B-4). When you set "Safety observation function control by input device" with [Pr. PSA02], be sure to assign one or more device to [Pr. PSD02] to [Pr. PSD07]. When no device is set, [AL. 7A.3 Parameter combination error (safety observation function)] will occur. Additionally, the same input device cannot be assigned to multiple connector pins. When a device is assigned to multiple connector pins, [AL. 7A.3 Parameter combination error (safety observation function)] will occur.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th><th>Setting range</th></tr>
<tr><td>_ _ x x</td><td>Input device selection DI1
Refer to table 5.3 for setting.</td><td>00h</td><td>00h
to
07h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td><td></td></tr>
<tr><td>x _ _ _</td><td>0h</td><td></td></tr>
</table>
Table 5.3 Input device selection
<table>
<tr><th>Setting value</th><th>Input device</th></tr>
<tr><td>_ _ 0 0</td><td>None</td></tr>
<tr><td>_ _ 0 1</td><td>STOC (STO command)</td></tr>
<tr><td>_ _ 0 2</td><td>SS1C (SS1 command)</td></tr>
<tr><td>_ _ 0 3</td><td>SS2C (SS2 command)</td></tr>
<tr><td>_ _ 0 4</td><td>SLS1C (SLS1 command)</td></tr>
<tr><td>_ _ 0 5</td><td>SLS2C (SLS2 command)</td></tr>
<tr><td>_ _ 0 6</td><td>SLS3C (SLS3 command)</td></tr>
<tr><td>_ _ 0 7</td><td>SLS4C (SLS4 command)</td></tr>
</table>
Incorrect setting of this parameter will trigger [AL. 7A.3]. Refer to section 7.2 for details.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PSD03</td><td>**SDI2</td><td>Input device selection DI2
Select an input device to assign to DI2A (CN10A-13) and DI2B (CN10B-13). Setting method is the same as [Pr. PSD02].
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th><th>Setting range</th></tr><tr><td>_ _ x x</td><td>Input device selection DI2
Refer to table 5.3 for setting.</td><td>00h</td><td>00h
to
07h</td></tr><tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td><td></td></tr><tr><td>x _ _ _</td><td>0h</td><td></td></tr></table>Incorrect setting of this parameter will trigger [AL. 7A.3]. Refer to section 7.2 for details.</td><td></td><td></td></tr>
<tr><td>PSD04</td><td>**SDI3</td><td>Input device selection DI3
Select an input device to assign to DI3A (CN10A-5) and DI3B (CN10B-5). Setting method is the same as [Pr. PSD02].
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th><th>Setting range</th></tr><tr><td>_ _ x x</td><td>Input device selection DI3
Refer to table 5.3 for setting.</td><td>00h</td><td>00h
to
07h</td></tr><tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td><td></td></tr><tr><td>x _ _ _</td><td>0h</td><td></td></tr></table>Incorrect setting of this parameter will trigger [AL. 7A.3]. Refer to section 7.2 for details.</td><td></td><td></td></tr>
<tr><td>PSD05</td><td>**SDI4</td><td>Input device selection DI4
Select an input device to assign to DI4A (CN10A-14) and DI4B (CN10B-14). Setting method is the same as [Pr. PSD02].
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th><th>Setting range</th></tr><tr><td>_ _ x x</td><td>Input device selection DI4
Refer to table 5.3 for setting.</td><td>00h</td><td>00h
to
07h</td></tr><tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td><td></td></tr><tr><td>x _ _ _</td><td>0h</td><td></td></tr></table>Incorrect setting of this parameter will trigger [AL. 7A.3]. Refer to section 7.2 for details.</td><td></td><td></td></tr>
<tr><td>PSD06</td><td>**SDI5</td><td>Input device selection DI5
Select an input device to assign to DI5A (CN10A-6) and DI5B (CN10B-6). Setting method is the same as [Pr. PSD02].
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th><th>Setting range</th></tr><tr><td>_ _ x x</td><td>Input device selection DI5
Refer to table 5.3 for setting.</td><td>00h</td><td>00h
to
07h</td></tr><tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td><td></td></tr><tr><td>x _ _ _</td><td>0h</td><td></td></tr></table>Incorrect setting of this parameter will trigger [AL. 7A.3]. Refer to section 7.2 for details.</td><td></td><td></td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PSD07</td><td>**SDI6</td><td>Input device selection DI6
Select an input device to assign to DI6A (CN10A-15) and DI6B (CN10B-15). Setting method is the same as [Pr. PSD02].

<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th><th>Setting range</th></tr>
<tr><td>_ _ x x</td><td>Input device selection DI6
Refer to table 5.3 for setting.</td><td>00h</td><td>00h
to
07h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td><td></td></tr>
<tr><td>x _ _ _</td><td>0h</td><td></td></tr>
</table>
Incorrect setting of this parameter will trigger [AL. 7A.3]. Refer to section 7.2 for details.</td><td></td><td></td></tr>
<tr><td>PSD08</td><td>**SDO1</td><td>Output device selection DO1
Select an input device to assign to DO1A (CN10A-8) and DO1B (CN10B-8).

<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th><th>Setting range</th></tr>
<tr><td>_ _ x x</td><td>Output device selection DO1
Refer to table 5.4 for setting.</td><td>00h</td><td>00h
to
0Ah</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td><td></td></tr>
<tr><td>x _ _ _</td><td>0h</td><td></td></tr>
</table>
Table 5.4 Output device selection
<table>
<tr><th>Setting value</th><th>Output device</th></tr>
<tr><td>_ _ 0 0</td><td>None</td></tr>
<tr><td>_ _ 0 1</td><td>STOS (STO output)</td></tr>
<tr><td>_ _ 0 2</td><td>SS1S (SS1 output)</td></tr>
<tr><td>_ _ 0 3</td><td>SS2S (SS2 output)</td></tr>
<tr><td>_ _ 0 4</td><td>SLS1S (SLS1 output)</td></tr>
<tr><td>_ _ 0 5</td><td>SLS2S (SLS2 output)</td></tr>
<tr><td>_ _ 0 6</td><td>SLS3S (SLS3 output)</td></tr>
<tr><td>_ _ 0 7</td><td>SLS4S (SLS4 output)</td></tr>
<tr><td>_ _ 0 8</td><td>SSMS (SSM output)</td></tr>
<tr><td>_ _ 0 9</td><td>SOSS (SOS output)</td></tr>
<tr><td>_ _ 0 A</td><td>SBCS (SBC output)</td></tr>
</table>
Incorrect setting of this parameter will trigger [AL. 7A.3]. Refer to section 7.2 for details.</td><td></td><td></td></tr>
<tr><td>PSD09</td><td>**SDO2</td><td>Output device selection DO2
Select an input device to assign to DO2A (CN10A-17) and DO2B (CN10B-17). Setting method is the same as [Pr. PSD08].

<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th><th>Setting range</th></tr>
<tr><td>_ _ x x</td><td>Output device selection DO2
Refer to table 5.4 for setting.</td><td>00h</td><td>00h
to
0Ah</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td><td></td></tr>
<tr><td>x _ _ _</td><td>0h</td><td></td></tr>
</table>
Incorrect setting of this parameter will trigger [AL. 7A.3]. Refer to section 7.2 for details.</td><td></td><td></td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PSD10</td><td>**SDO3</td><td>Output device selection DO3
Select an input device to assign to DO3A (CN10A-9) and DO3B (CN10B-9). Setting method is the same as [Pr. PSD08].
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th><th>Setting range</th></tr><tr><td>_ _ x x</td><td>Output device selection DO3
Refer to table 5.4 for setting.</td><td>00h</td><td>00h
to
0Ah</td></tr><tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td><td></td></tr><tr><td>x _ _ _</td><td>0h</td><td></td></tr></table>Incorrect setting of this parameter will trigger [AL. 7A.3]. Refer to section 7.2 for details.</td><td></td><td></td></tr>
<tr><td>PSD11</td><td>**SDO4</td><td>Output device selection DO4
Select an output device to assign to DO4NA (CN10A-18) and DO4PB (CN10B-16). Setting method is the same as [Pr. PSD08].
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th><th>Setting range</th></tr><tr><td>_ _ x x</td><td>Output device selection DO4
Refer to table 5.4 for setting.</td><td>00h</td><td>00h
to
0Ah</td></tr><tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td><td></td></tr><tr><td>x _ _ _</td><td>0h</td><td></td></tr></table>Incorrect setting of this parameter will trigger [AL. 7A.3]. Refer to section 7.2 for details.</td><td></td><td></td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PSD12</td><td>**SDIF1</td><td>
Input device - Noise rejection filtering time DI1
Select a filtering time to reduce noise of DI1A (CN10A-4) and DI1B (CN10B-4).
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th><th>Setting range</th></tr>
<tr><td>_ _ x x</td><td>Noise rejection filtering time DI1
Refer to table 5.5 for setting.</td><td>01h</td><td>00h
to
05h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td><td></td></tr>
<tr><td>x _ _ _</td><td>0h</td><td></td></tr>
</table>
Table 5.5 Filtering time selection
<table>
<tr><th>Setting value</th><th>Filtering time [ms]</th></tr>
<tr><td>_ _ 0 0</td><td>0.888</td></tr>
<tr><td>_ _ 0 1</td><td>1.777</td></tr>
<tr><td>_ _ 0 2</td><td>3.555</td></tr>
<tr><td>_ _ 0 3</td><td>7.111</td></tr>
<tr><td>_ _ 0 4</td><td>14.22</td></tr>
<tr><td>_ _ 0 5</td><td>28.44</td></tr>
</table>
Set a proper value referring to the following table.
<table>
<tr><th colspan="2">Configuration</th><th>Noise rejection filtering time</th></tr>
<tr><td rowspan="2">Using a switch</td><td>Executing a test pulse diagnosis</td><td>Set 0.888 ms or longer time than the setting time in [Pr. PSD26 Input device - Test pulse off time].</td></tr>
<tr><td>Not executing a test pulse diagnosis</td><td>Set 0.888 ms or longer time.</td></tr>
<tr><td rowspan="2">Using a device which has diagnosis function</td><td>Test pulses are in superposition at output signal of the device.</td><td>Set 0.888 ms or longer time than the test pulse off-time outputted from the device.</td></tr>
<tr><td>Test pulses are not in superposition at output signal of the device.</td><td>Set 0.888 ms or longer time.</td></tr>
</table>
Incorrect setting of this parameter will trigger [AL. 7A.3]. Refer to section 7.2 for details.
</td></tr>
<tr><td>PSD13</td><td>**SDIF2</td><td>
Input device - Noise rejection filtering time DI2
Select a filtering time to reduce noise of DI2A (CN10A-13) and DI2B (CN10B-13).
Setting method is the same as [Pr. PSD12].
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th><th>Setting range</th></tr>
<tr><td>_ _ x x</td><td>Noise rejection filtering time DI2
Refer to table 5.5 for setting.</td><td>01h</td><td>00h
to
05h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td><td></td></tr>
<tr><td>x _ _ _</td><td>0h</td><td></td></tr>
</table>
Incorrect setting of this parameter will trigger [AL. 7A.3]. Refer to section 7.2 for details.
</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PSD14</td><td>**SDIF3</td><td>Input device - Noise rejection filtering time DI3
Select a filtering time to reduce noise of DI3A (CN10A-5) and DI3B (CN10B-5).
Setting method is the same as [Pr. PSD12].

<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th><th>Setting range</th></tr>
<tr><td>_ _ x x</td><td>Noise rejection filtering time DI3
Refer to table 5.5 for setting.</td><td>01h</td><td>00h
to
05h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td><td></td></tr>
<tr><td>x _ _ _</td><td>0h</td><td></td></tr>
</table>

Incorrect setting of this parameter will trigger [AL. 7A.3]. Refer to section 7.2 for details.</td><td></td><td></td></tr>
<tr><td>PSD15</td><td>**SDIF4</td><td>Input device - Noise rejection filtering time DI4
Select a filtering time to reduce noise of DI4A (CN10A-14) and DI4B (CN10B-14).
Setting method is the same as [Pr. PSD12].

<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th><th>Setting range</th></tr>
<tr><td>_ _ x x</td><td>Noise rejection filtering time DI4
Refer to table 5.5 for setting.</td><td>01h</td><td>00h
to
05h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td><td></td></tr>
<tr><td>x _ _ _</td><td>0h</td><td></td></tr>
</table>

Incorrect setting of this parameter will trigger [AL. 7A.3]. Refer to section 7.2 for details.</td><td></td><td></td></tr>
<tr><td>PSD16</td><td>**SDIF5</td><td>Input device - Noise rejection filtering time DI5
Select a filtering time to reduce noise of DI5A (CN10A-6) and DI5B (CN10B-6).
Setting method is the same as [Pr. PSD12].

<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th><th>Setting range</th></tr>
<tr><td>_ _ x x</td><td>Noise rejection filtering time DI5
Refer to table 5.5 for setting.</td><td>01h</td><td>00h
to
05h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td><td></td></tr>
<tr><td>x _ _ _</td><td>0h</td><td></td></tr>
</table>

Incorrect setting of this parameter will trigger [AL. 7A.3]. Refer to section 7.2 for details.</td><td></td><td></td></tr>
<tr><td>PSD17</td><td>**SDIF6</td><td>Input device - Noise rejection filtering time DI6
Select a filtering time to reduce noise of DI6A (CN10A-15) and DI6B (CN10B-15).
Setting method is the same as [Pr. PSD12].

<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th><th>Setting range</th></tr>
<tr><td>_ _ x x</td><td>Noise rejection filtering time DI6
Refer to table 5.5 for setting.</td><td>01h</td><td>00h
to
05h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td><td></td></tr>
<tr><td>x _ _ _</td><td>0h</td><td></td></tr>
</table>

Incorrect setting of this parameter will trigger [AL. 7A.3]. Refer to section 7.2 for details.</td><td></td><td></td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PSD18</td><td>**SDIDT1</td><td>Mismatch permissible time DI1
Set a threshold of mismatch time of DI1A (CN10A-4) and DI1B (CN10B-4). When the mismatch time of DI1A and DI1B reaches the setting value, [AL. 79.7 Mismatched input signal error] will occur. Setting "0" disables alarm detections.</td><td>20
[ms]</td><td>0
to
60000</td></tr>
<tr><td>PSD19</td><td>**SDIDT2</td><td>Mismatch permissible time DI2
Set a threshold of mismatch time of DI2A (CN10A-13) and DI2B (CN10B-13). When the mismatch time of DI2A and DI2B reaches the setting value, [AL. 79.7 Mismatched input signal error] will occur. Setting "0" disables alarm detections.</td><td>20
[ms]</td><td>0
to
60000</td></tr>
<tr><td>PSD20</td><td>**SDIDT3</td><td>Mismatch permissible time DI3
Set a threshold of mismatch time of DI3A (CN10A-5) and DI3B (CN10B-5). When the mismatch time of DI3A and DI3B reaches the setting value, [AL. 79.7 Mismatched input signal error] will occur. Setting "0" disables alarm detections.</td><td>20
[ms]</td><td>0
to
60000</td></tr>
<tr><td>PSD21</td><td>**SDIDT4</td><td>Mismatch permissible time DI4
Set a threshold of mismatch time of DI4A (CN10A-14) and DI4B (CN10B-14). When the mismatch time of DI4A and DI4B reaches the setting value, [AL. 79.7 Mismatched input signal error] will occur. Setting "0" disables alarm detections.</td><td>20
[ms]</td><td>0
to
60000</td></tr>
<tr><td>PSD22</td><td>**SDIDT5</td><td>Mismatch permissible time DI5
Set a threshold of mismatch time of DI5A (CN10A-6) and DI5B (CN10B-6). When the mismatch time of DI5A and DI5B reaches the setting value, [AL. 79.7 Mismatched input signal error] will occur. Setting "0" disables alarm detections.</td><td>20
[ms]</td><td>0
to
60000</td></tr>
<tr><td>PSD23</td><td>**SDIDT6</td><td>Mismatch permissible time DI6
Set a threshold of mismatch time of DI6A (CN10A-15) and DI6B (CN10B-15). When the mismatch time of DI6A and DI6B reaches the setting value, [AL. 79.7 Mismatched input signal error] will occur. Setting "0" disables alarm detections.</td><td>20
[ms]</td><td>0
to
60000</td></tr>
<tr><td>PSD24</td><td>**SDIP1</td><td>Input device - Test pulse diagnosis execution selection 1
Select whether or not to diagnose DI1_ to DI4_ by test pulses outputted from PLSA and PLSB.
When executing the test pulse diagnosis with an external device, etc., set "0 (Not diagnose)".
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th><th>Setting range</th></tr>
<tr><td>_ _ _ x</td><td>Test pulse diagnosis execution selection DI1
Select whether diagnose DI1_ or not.
0: Not diagnose
1: Diagnose</td><td>1h</td><td>0h
to
1h</td></tr>
<tr><td>_ _ x _</td><td>Test pulse diagnosis execution selection DI2
Select whether diagnose DI2_ or not.
0: Not diagnose
1: Diagnose</td><td>1h</td><td>0h
to
1h</td></tr>
<tr><td>_ x _ _</td><td>Test pulse diagnosis execution selection DI3
Select whether diagnose DI3_ or not.
0: Not diagnose
1: Diagnose</td><td>1h</td><td>0h
to
1h</td></tr>
<tr><td>x _ _ _</td><td>Test pulse diagnosis execution selection DI4
Select whether diagnose DI4_ or not.
0: Not diagnose
1: Diagnose</td><td>1h</td><td>0h
to
1h</td></tr>
</table></td><td></td><td></td></tr>
</table>

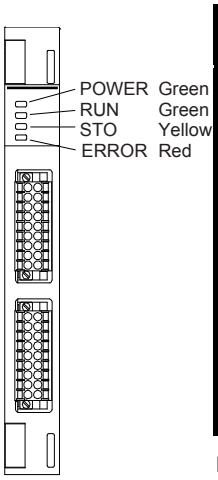
<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PSD25</td><td>**SDIP2</td><td>Input device - Test pulse diagnosis execution selection 2
Select whether or not to diagnose DI5_ and DI6_ by test pulses outputted from PLSA and PLSB.
When executing the test pulse diagnosis with an external device, etc., set "0 (Not diagnose)".
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th><th>Setting range</th></tr>
<tr><td>_ _ _ x</td><td>Test pulse diagnosis execution selection DI5
Select whether or not to diagnose DI5_.
0: Not diagnose
1: Diagnose</td><td>1h</td><td>0h
to
1h</td></tr>
<tr><td>_ _ x _</td><td>Test pulse diagnosis execution selection DI6
Select whether or not to diagnose DI6_.
0: Not diagnose
1: Diagnose</td><td>1h</td><td>0h
to
1h</td></tr>
<tr><td>_ x _ _</td><td>For manufacturer setting</td><td>0h</td><td></td></tr>
<tr><td>x _ _ _</td><td></td><td>0h</td><td></td></tr>
</table></td></tr>
<tr><td>PSD26</td><td>**SDIPW</td><td>Input device - Test pulse off time
Select off-pulse time of test pulses outputted from PLSA and PLSB.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th><th>Setting range</th></tr>
<tr><td>_ _ _ x</td><td>Input device - Test pulse off time
1: 0.888 ms
2: 1.777 ms</td><td>1h</td><td>1h
to
2h</td></tr>
<tr><td>_ _ x _</td><td>For manufacturer setting</td><td>0h</td><td></td></tr>
<tr><td>_ x _ _</td><td></td><td>0h</td><td></td></tr>
<tr><td>x _ _ _</td><td></td><td>0h</td><td></td></tr>
</table>
Incorrect setting of this parameter will trigger [AL. 7A.3]. Refer to section 7.2 for details.</td></tr>
<tr><td>PSD27</td><td>**SDID1</td><td>Input device - Fixing-diagnosis execution selection 1 at start-up
Select whether or not to execute a fixing-diagnosis of DI1_ to DI4_ at start-up.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th><th>Setting range</th></tr>
<tr><td>_ _ _ x</td><td>Fixing-diagnosis execution selection DI1 at start-up
Select whether or not to execute a fixing-diagnosis of DI1_ at start-up.
0: Not diagnose
1: Diagnose</td><td>1h</td><td>0h
to
1h</td></tr>
<tr><td>_ _ x _</td><td>Fixing-diagnosis execution selection DI2 at start-up
Select whether or not to execute a fixing-diagnosis of DI2_ at start-up.
0: Not diagnose
1: Diagnose</td><td>1h</td><td>0h
to
1h</td></tr>
<tr><td>_ x _ _</td><td>Fixing-diagnosis execution selection DI3 at start-up
Select whether or not to execute a fixing-diagnosis of DI3_ at start-up.
0: Not diagnose
1: Diagnose</td><td>1h</td><td>0h
to
1h</td></tr>
<tr><td>x _ _ _</td><td>Fixing-diagnosis execution selection DI4 at start-up
Select whether or not to execute a fixing-diagnosis of DI4_ at start-up.
0: Not diagnose
1: Diagnose</td><td>1h</td><td>0h
to
1h</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PSD28</td><td>**SDID1</td><td>Input device - Fixing-diagnosis execution selection 2 at start-up
Select whether or not to execute a fixing-diagnosis of DI5_ and DI6_ at start-up.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th><th>Setting range</th></tr>
<tr><td>_ _ _ x</td><td>Fixing-diagnosis execution selection DI5 at start-up
Select whether or not to execute a fixing-diagnosis of DI5_ at start-up.
0: Not diagnose
1: Diagnose</td><td>1h</td><td>0h
to
1h</td></tr>
<tr><td>_ _ x _</td><td>Fixing-diagnosis execution selection DI6 at start-up
Select whether or not to execute a fixing-diagnosis of DI6_ at start-up.
0: Not diagnose
1: Diagnose</td><td>1h</td><td>0h
to
1h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td><td></td></tr>
<tr><td>x _ _ _</td><td>0h</td><td></td></tr>
</table></td><td></td><td></td></tr>
<tr><td>PSD29</td><td>**SDOP</td><td>Output device - Test pulse execution selection
Select whether or not to diagnose DO1_ to DO4_ by test pulses. Selecting "0" (Not diagnose) will not transmit the test pulses from DO1_ to DO4_.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th><th>Setting range</th></tr>
<tr><td>_ _ _ x</td><td>Test pulse diagnosis execution selection DO1
Select whether or not to diagnose DO1_ by test pulses.
0: Not diagnose
1: Diagnose</td><td>1h</td><td>0h
to
1h</td></tr>
<tr><td>_ _ x _</td><td>Test pulse diagnosis execution selection DO2
Select whether or not to diagnose DO2_ by test pulses.
0: Not diagnose
1: Diagnose</td><td>1h</td><td>0h
to
1h</td></tr>
<tr><td>_ x _ _</td><td>Test pulse diagnosis execution selection DO3
Select whether or not to diagnose DO3_ by test pulses.
0: Not diagnose
1: Diagnose</td><td>1h</td><td>0h
to
1h</td></tr>
<tr><td>x _ _ _</td><td>Test pulse diagnosis execution selection DO4
Select whether or not to diagnose DO4_ by test pulses.
0: Not diagnose
1: Diagnose
This digit is available with MR-D30 manufactured in October, 2014 or later.</td><td>1h</td><td>0h
to
1h</td></tr>
</table></td><td></td><td></td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PSD30</td><td>**SDOPW</td><td>Output device - Test pulse off time
Select off-pulse time of the test pulses outputted from the devices of DO1_ to DO4_. This setting is enabled for DO1_ to DO4_ in which "1" (Diagnose) is set with [Pr. PSD29].
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th><th>Setting range</th></tr>
<tr><td>_ _ _ x</td><td>Test pulse off time DO1
Select off-pulse time outputted from DO1_.
Refer to table 5.6 for settings.</td><td>0h</td><td>0h
to
2h</td></tr>
<tr><td>_ _ x _</td><td>Test pulse off time DO2
Select off-pulse time outputted from DO2_.
Refer to table 5.6 for settings.</td><td>0h</td><td>0h
to
2h</td></tr>
<tr><td>_ x _ _</td><td>Test pulse off time DO3
Select off-pulse time outputted from DO3_.
Refer to table 5.6 for settings.</td><td>0h</td><td>0h
to
2h</td></tr>
<tr><td>x _ _ _</td><td>Test pulse off time DO4
Select off pulse time outputted from DO4_.
Refer to table 5.6 for settings.
This digit is available with MR-D30 manufactured in October, 2014 or later.</td><td>0h</td><td>0h
to
2h</td></tr>
</table>
Table 5.6 Off time selection
<table>
<tr><th>Setting value</th><th>Off time [ms]</th></tr>
<tr><td>0</td><td>0.444</td></tr>
<tr><td>1</td><td>0.888</td></tr>
<tr><td>2</td><td>1.777</td></tr>
</table>
</td></tr>
</table>

6. DISPLAY

MR-D30 has four LED indications. They indicate the following.



LED	Lighting status	Description
POWER	On	Power is being supplied.
	Off	Power is not supplied.
RUN	On	The safety observation function is in activation. STO, SS1, SS2/SOS, or SLS function is being executed, shutting off normally or observing.
	Off	The safety observation function is not in activation because an operation command of the safety observation function is not inputted or an internal diagnosis error has occurred.
STO	On	STO function is in activation. The power to the motors is shut off.
	Off	STO function is not in activation. The power to the motors is not shut off.
ERROR	On	An error has been detected for MR-D30. (Note)
	Blinking	An error has been detected for MR-D30.
	Off	An error is not detected in MR-D30.

Note. When MR-D30 is attached to a servo amplifier not supporting MR-D30, "ERROR" turns on. Refer to section 1.1 for the software version of a servo amplifier that is compatible with MR-D30.

The following shows indication example of each state.

POWER	RUN	STO	ERROR	Servo amplifier display	Status	Description
●	●	●	●	Normal	Power off	Power is not supplied.
○	●	○	●	95._ or Ab	During diagnosis	For the safety observation function control by input device, execute a fixing-diagnosis at start-up. For the safety observation function control by network, connect networks.
○	●	●	●	Normal	Safety observation function is not in activation.	The safety observation function is not in activation.
○	○	○	●	95._	Safety observation function is in activation. (shut-off)	STO or SS1 functions are in activation.
○	○	●	●	Normal	Safety observation function is in activation. (observation in progress)	SLS or SS2/SOS function is in activation.
○	●/○	○	◎/○	Alarm No.	Error has occurred.	An error has been detected. Refer to chapter 7 for error details. (Note)
○	○	○	○	Alarm No.	Error has occurred (watchdog)	Watchdog is occurring due to parts error, such as the CPU.

(○: On, ◎: Blinking, ●: Off)

Note. When MR-D30 is attached to a servo amplifier not supporting MR-D30, "ERROR" turns on. Refer to section 1.1 for the software version of a servo amplifier that is compatible with MR-D30.

MEMO

7. TROUBLESHOOTING

POINT
●Refer to "MELSERVO-J4 Servo Amplifier Instruction Manual (Troubleshooting)" for details of alarms and warnings. ●This chapter shows alarms and warnings which may occur by using a servo amplifier with MR-D30. For other alarms, refer to each servo amplifier instruction manual. ●As soon as an alarm occurs, make the servo-off status and shut off the main circuit power. ●[AL. 37 Parameter error] and warnings are not recorded in the alarm history.

7.1 Alarm and warning list

The following shows alarms and warnings which are added for the functional safety unit.
When the alarm or the warning occurs, refer to "MELSERVO-J4 Servo Amplifier Instruction Manual (Troubleshooting)" to remove the failure. When an alarm occurs, ALM (Malfunction) will be off.
After its cause has been removed, the alarm can be deactivated in any of the methods marked ○ in the alarm deactivation column in the following table. For the procedures of alarm reset, refer to section 4.5.10.
Warnings are automatically canceled after the cause of occurrence is removed.

(1) Alarms

	No.	Name	Detail No.	Detail name	Stop method (Note 1, 2)	Alarm which SSM is disabled (Note 4)	Alarm reset		
							Error reset	CPU reset	Power off to on
Alarm	34	SSCNET receive error 1	34.5	SSCNET receive data error (safety observation function)	SD		○	○	○
			34.6	SSCNET communication data error (safety observation function)	SD		○	○	○
	36	SSCNET receive error 2	36.2	Continuous communication data error (safety observation function)	SD		○	○	○
	63	STO timing error	63.5	STO by functional safety unit	STO/DB		○	○	○
	64	Functional safety unit setting error	64.1	STO input error	DB				○
			64.2	Compatibility mode setting error	DB				○
			64.3	Operation mode setting error	DB				○
	65	Functional safety unit connection error	65.1	Functional safety unit communication error 1	SD	○			○
			65.2	Functional safety unit communication error 2	SD	○			○
			65.3	Functional safety unit communication error 3	SD	○			○
			65.4	Functional safety unit communication error 4	SD	○			○
			65.5	Functional safety unit communication error 5	SD	○			○
			65.6	Functional safety unit communication error 6	SD	○			○
			65.7	Functional safety unit communication error 7	SD	○			○
			65.8	Functional safety unit shut-off signal error 1	DB	○			○
			65.9	Functional safety unit shut-off signal error 2	DB	○			○
	66	Encoder initial communication error (safety observation function)	66.1	Encoder initial communication - Receive data error 1 (safety observation function)	DB	○			○
			66.2	Encoder initial communication - Receive data error 2 (safety observation function)	DB	○			○
			66.3	Encoder initial communication - Receive data error 3 (safety observation function)	DB	○			○
			66.7	Encoder initial communication - Transmission data error 1 (safety observation function)	DB	○			○
			66.9	Encoder initial communication - Process error (safety observation function)	DB	○			○
	67	Encoder normal communication error 1 (safety observation function)	67.1	Encoder communication - Receive data error 1 (safety observation function)	DB	○			○
			67.2	Encoder communication - Receive data error 2 (safety observation function)	DB	○			○
			67.3	Encoder communication - Receive data error 3 (safety observation function)	DB	○			○
			67.4	Encoder communication - Receive data error 4 (safety observation function)	DB	○			○
			67.7	Encoder communication - Transmission data error 1 (safety observation function)	DB	○			○
	79	Functional safety unit diagnosis error	79.1	Functional safety unit power voltage error	STO/DB	○	○ (Note 3)		○
			79.2	Functional safety unit internal error	STO/DB	○			○
			79.3	Abnormal temperature of functional safety unit	SS1/SD	○	○ (Note 3)		○
			79.4	Servo amplifier error	SS1/SD	○			○
			79.5	Input device error	SS1/SD	○			○
			79.6	Output device error	SS1/SD	○			○
			79.7	Mismatched input signal error	SS1/SD	○			○
			79.8	Position feedback fixing error	STO/DB	○			○
	7A	Parameter setting error (safety observation function)	7A.1	Parameter verification error (safety observation function)	STO/DB	○			○
			7A.2	Parameter setting range error (safety observation function)	STO/DB	○			○
			7A.3	Parameter combination error (safety observation function)	STO/DB	○			○
			7A.4	Functional safety unit combination error (safety observation function)	STO/DB	○			○

	No.	Name	Detail No.	Detail name	Stop method (Note 1, 2)	Alarm which SSM is disabled (Note 4)	Alarm reset		
							Error reset	CPU reset	Power off to on
Alarm	7B	Encoder diagnosis error (safety observation function)	7B.1	Encoder diagnosis error 1 (safety observation function)	SS1/EDB	○			○
			7B.2	Encoder diagnosis error 2 (safety observation function)	SS1/EDB	○			○
			7B.3	Encoder diagnosis error 3 (safety observation function)	SS1/EDB	○			○
			7B.4	Encoder diagnosis error 4 (safety observation function)	SS1/EDB	○			○
	7C	Functional safety unit communication diagnosis error (safety observation function)	7C.1	Functional safety unit communication setting error (safety observation function)	SS1/SD	○	○ (Note 3)	○	○
			7C.2	Functional safety unit communication data error (safety observation function)	SS1/SD	○	○ (Note 3)		○
	7D	Safety observation error	7D.1	Stop observation error	STO/DB	○			○
			7D.2	Speed observation error	STO/DB		○ (Note 3)		○

Note 1. The following shows stop methods. For other stop methods, refer to section 4.5.2 (3) (a).
DB: Stops with dynamic brake. (Coasts for the servo amplifier without dynamic brake.)
SD: Forced stop deceleration
STO/DB: Dynamic brake stop with STO function
SS1/SD: Forced stop deceleration with SS1 function
SS1/EDB: Electronic dynamic brake stop (available with specified servo motors)
Refer to the following table for the specified servo motors. The stop method for other than the specified servo motors is SS1/DB.

Series	Servo motor
HG-KR	HG-KR053/HG-KR13/HG-KR23/HG-KR43
HG-MR	HG-MR053/HG-MR13/HG-MR23/HG-MR43
HG-SR	HG-SR51/HG-SR52

2. This is applicable when [Pr. PA04] is set to the initial value. The stop system of SD can be changed to DB using [Pr. PA04].
3. Reset this while all the safety observation functions are stopped.
4. The SSM function will be disabled and each output device will turn off.

(2) Warnings

	No.	Name	Detail No.	Detail name	Stop method (Note 1, 2)	Alarm which SSM is disabled with (Note 3)
Warning	95	STO warning	95.3	STO warning 1 (safety observation function)	STO/DB	○
			95.4	STO warning 2 (safety observation function)	STO/DB	○
			95.5	STO warning 3 (safety observation function)	STO/DB	
	E6	Servo forced stop warning	E6.2	SS1 forced stop warning 1 (safety observation function)	SS1/SD	
			E6.3	SS1 forced stop warning 2 (safety observation function)	SS1/SD	○

Note 1. The following sho
ws stop methods.
DB: Stops with dynamic brake. (Coasts for the servo amplifier without dynamic brake.)
SD: Forced stop deceleration
STO/DB: Dynamic brake stop operating STO function
2. This is applicable when [Pr. PA04] is set to the initial value. The stop system of SD can be changed to DB using [Pr. PA04].
3. The SSM function will be disabled and each output device will turn off.

7.2 Combinations of the parameters that trigger [AL. 7A.3 Parameter combination error (safety observation function)]

Incorrect setting of the parameters described in this section will trigger [AL. 7A.3].

(1) Parameters related to [Pr. PSA02 Functional safety unit setting]

	Safety observation function control by input device			Safety observation function control by network			Motor-less operation
Safety observation function	STO/SS1/SBC	STO/SS1/SBC/ SLS/SSM/SOS/ SS2	STO/SS1/SBC/ SLS/SSM	STO/SS1/SBC	STO/SS1/SBC/ SLS/SSM/SOS/ SS2	STO/SS1/SBC/ SLS/SSM	
Servo motor with functional safety	Not required	Required	Not required	Not required	Required	Not required	
[Pr. PSA02 Functional safety unit setting]	_ _ 0 0	_ _ 1 0	_ _ 2 0	_ _ 0 1	_ _ 1 1	_ _ 2 1	_ _ _ 2
[Pr. PSD01 Input device automatic activation selection]	_ _ _ 0	_ _ _ 0/_ _ _ 1	_ _ _ 0/_ _ _ 1	_ _ _ 0			
[Pr. PSD02 Input device selection DI1] to [Pr. PSD07 Input device selection DI6] (Note 1)	_ _ 0 0 to _ _ 0 2	_ _ 0 0 to _ _ 0 7	_ _ 0 0 to _ _ 0 2 _ _ 0 4 to _ _ 0 7				
[Pr. PSD08 Output device selection DO1] to [Pr. PSD11 Output device selection DO4] (Note 2)	_ _ 0 0 to _ _ 0 2 _ _ 0 A	_ _ 0 0 to _ _ 0 A	_ _ 0 0 to _ _ 0 2 _ _ 0 4 to _ _ 0 8 _ _ 0 A				
[Pr. PSA20 Servo motor encoder resolution - Lower] [Pr. PSA21 Servo motor encoder resolution - Upper]		Set the servo motor encoder resolution.			Set the servo motor encoder resolution.		
[Pr. PSC03 Safety communication - Servo motor rotation direction selection with functional safety]					Set the same value as that of [Pr. PA14] of the servo amplifier.		
Motor-less operation	Impossible						Possible

Note 1. Set a value other than "00" for at least one of DI1 to DI6. Assign different devices to DI1 to DI6.
2. Set a value other than "00" for at least one of DO1 to DO4.

When [Pr. PSA02 Functional safety unit setting] is set to "_ _ _ 1" and [Pr. PSC03 Safety communication - Servo motor rotation direction selection with functional safety] is set to "1 _ _ _", set the same value in the servo amplifier's station number setting or rotary switch axis No. and the [Pr. PSC02 Safety communication - Axis number selection] (_ _ x x).

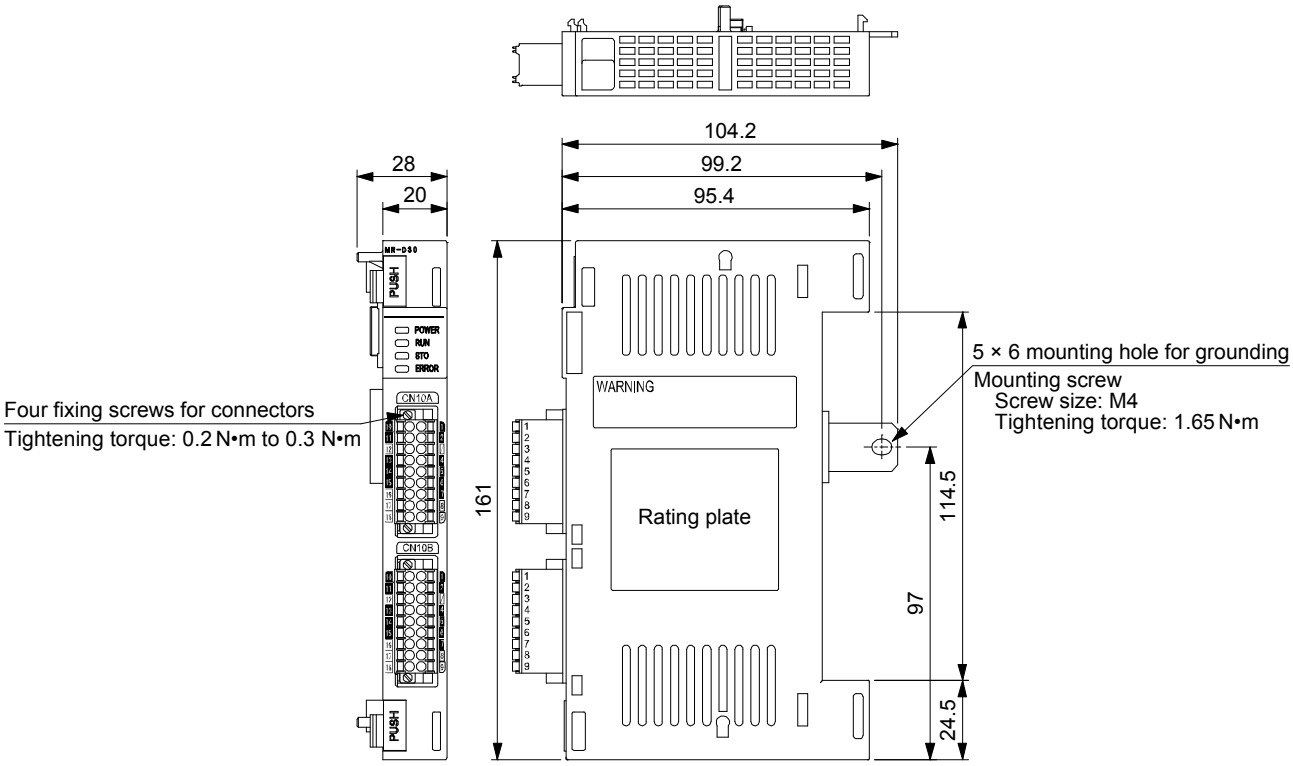
(2) Parameters related to [Pr. PSA18 SSM speed]
Set [Pr. PSA18 SSM speed] to a value larger than the SSM hysteresis width ([Pr. PSA19 SSM hysteresis width]).

(3) Parameters related to [Pr. PSD12 Input device - Noise rejection filtering time DI1] to [Pr. PSD17 Input device - Noise rejection filtering time DI6].
Set [Pr. PSD12 Input device - Noise rejection filtering time DI1] to [Pr. PSD17 Input device - Noise rejection filtering time DI6] to a value smaller than that of [Pr. PSD26 Input device - Test pulse off time].

8. DIMENSIONS

8.1 MR-D30 functional safety unit

[Unit: mm]

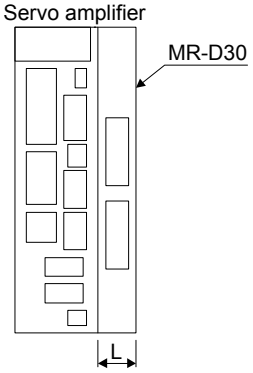


Mass: 0.15 kg

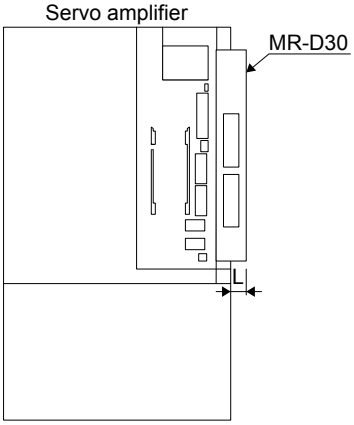
8.2 When an MR-D30 is attached to a servo amplifier

POINT
●For MR-J4-DU900_-RJ to MR-J4-DU22K_-RJ servo amplifiers, the dimensions remain the same because MR-D30 is attached inside the drive unit.

100 V/200 V 0.1 kW to 3.5 kW
400 V 0.6 kW to 2 kW
Servo amplifier



200 V 5 kW/7 kW
400 V 3.5 kW to 7 kW
Servo amplifier

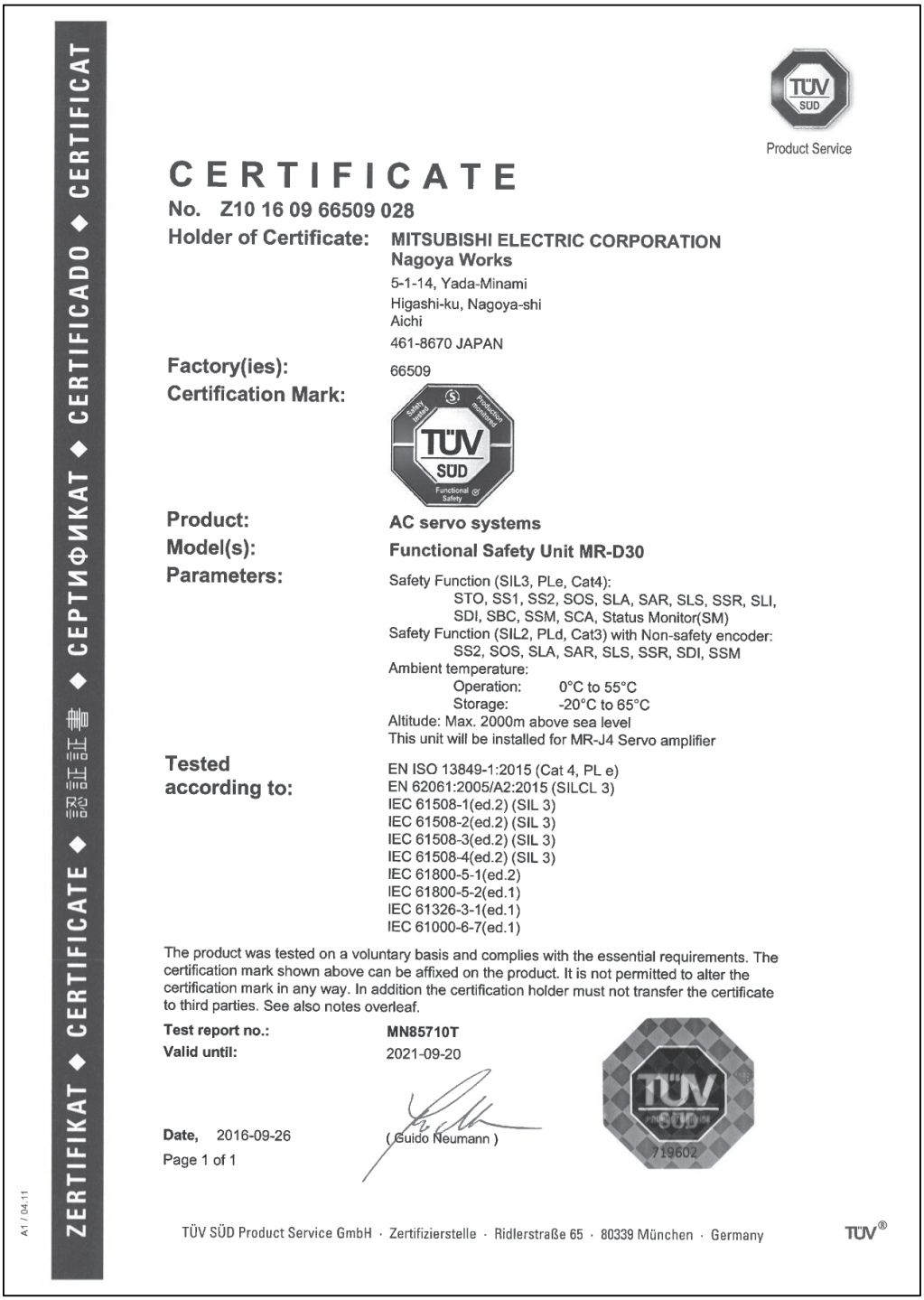


Servo amplifier	L [mm]
MR-J4-10_1-RJ to MR-J4-40_1-RJ MR-J4-10_-RJ to MR-J4-100_-RJ MR-J4-60_4-RJ to MR-J4-100_4-RJ	20
MR-J4-200_-RJ/MR-J4-350_-RJ MR-J4-200_4-RJ	15
MR-J4-500_-RJ/MR-J4-700_-RJ MR-J4-350_4-RJ to MR-J4-700_4-RJ	10
MR-J4-11K_-RJ to MR-J4-22K_-RJ MR-J4-11K_4-RJ to MR-J4-22K_4-RJ MR-J4-DU30K_-RJ to MR-J4-DU37K_-RJ MR-J4-DU30K_4-RJ to MR-J4-DU55K_4-RJ	0

APPENDIX

App. 1 EC declaration of conformity

MR-D30 complies with the safety components laid down in the machinery directive.
When the servo motor with functional safety is not used, some functions are rated SIL 2, PL d, category 3 (indicated with "with Non-safety encoder" in the certificate).
The functions described in the certificate are unusable, unless otherwise explained in this instruction manual.



ZERTIFIKAT ◆ CERTIFICATE ◆ 認証証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

Product Service

CERTIFICATE

No. Z10 16 09 66509 028

Holder of Certificate: **MITSUBISHI ELECTRIC CORPORATION**
Nagoya Works
5-1-14, Yada-Minami
Higashi-ku, Nagoya-shi
Aichi
461-8670 JAPAN

Factory(ies): 66509

Certification Mark:

Product: **AC servo systems**

Model(s): **Functional Safety Unit MR-D30**

Parameters:
Safety Function (SIL3, PLe, Cat4):
STO, SS1, SS2, SOS, SLA, SAR, SLS, SSR, SLI, SDI, SBC, SSM, SCA, Status Monitor(SM)
Safety Function (SIL2, PLd, Cat3) with Non-safety encoder:
SS2, SOS, SLA, SAR, SLS, SSR, SDI, SSM
Ambient temperature:
Operation: 0°C to 55°C
Storage: -20°C to 65°C
Altitude: Max. 2000m above sea level
This unit will be installed for MR-J4 Servo amplifier

Tested according to:
EN ISO 13849-1:2015 (Cat 4, PL e)
EN 62061:2005/A2:2015 (SILCL 3)
IEC 61508-1(ed.2) (SIL 3)
IEC 61508-2(ed.2) (SIL 3)
IEC 61508-3(ed.2) (SIL 3)
IEC 61508-4(ed.2) (SIL 3)
IEC 61800-5-1(ed.2)
IEC 61800-5-2(ed.1)
IEC 61326-3-1(ed.1)
IEC 61000-6-7(ed.1)

The product was tested on a voluntary basis and complies with the essential requirements. The certification mark shown above can be affixed on the product. It is not permitted to alter the certification mark in any way. In addition the certification holder must not transfer the certificate to third parties. See also notes overleaf.

Test report no.: **MN85710T**
Valid until: 2021-09-20

Date, 2016-09-26
Page 1 of 1

(Guido Neumann)

719602

TÜV SÜD Product Service GmbH · Zertifizierstelle · Ridlerstraße 65 · 80339 München · Germany

TÜV®

A1 / 04.11

REVISION

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

Revision Date	*Manual Number	Revision	
Apr. 2014	SH(NA)030132ENG-A	First edition	
Jan. 2015	SH(NA)030132ENG-B	Servo motors with functional safety are added.	
		SS2/SOS/SM functions are added.	
		DO4_ is added.	
		The status monitor function is added.	
		MR-J4-_A_-RJ is added.	
		Safety Instructions	
		(2) Wiring	The diagram is added.
		Section 1.1	The table is changed.
		Section 1.1 (1)	The sentences are changed.
		Section 1.1 (2)	The table is changed.
		Section 1.2	Added.
		Section 1.3.1	The diagram is changed.
		Section 1.3.2	Added.
		Section 1.4.1	POINT is added.
		Section 1.4.2	Added.
		Section 1.5	The table is changed.
		Section 1.6	The table is changed.
		Section 1.7	Sentences of POINT and table are changed.
		Section 1.9.1 (8)	The sentences are changed.
		Section 1.9.2 (2), (3)	The sentences are changed.
		Section 2.1 (1) (b)	The sentences in POINT are changed.
		Section 2.6	The sentences of Note are changed.
		Section 2.6 (1)	The diagram is changed.
		Chapter 3	The diagram of CAUTION and POINT are changed.
		Section 3.1	The sentences and diagram are changed. Note is added.
		Section 3.2.1	The diagram is changed.
		Section 3.2.2	The diagram is changed.
		Section 3.3.1 (1)	The diagram is changed.
		Section 3.3.2 (1)	The diagram is changed.
		Section 3.3.3	The sentences and diagram are changed.
		Section 3.3.4	Added.
		Section 3.5	Item name and sentences are changed.
		Section 3.6.1	The table is changed.
		Section 3.6.2	The sentences and table are changed.
		Section 3.6.3	The table is changed.
		Section 3.8.1 (1)	The sentences are added and diagram is changed.
		Section 3.8.1 (2)	The sentences are added and diagram is changed.
		Section 3.8.2	Added.
		Section 3.9	Added.
		Chapter 4	POINT is changed.
		Section 4.1	Added.
		Section 4.1 (1)	The table is changed.
		Section 4.1 (2)	The table is changed.
		Section 4.1 (3)	The table is changed.
		Section 4.3.1	The table is changed.
		Section 4.3.2 (e)	Added.
		Section 4.3.3	The table is changed.
		Section 4.3.3 (3)	The item name is changed.
		Section 4.3.4 (1)	The sentences are changed.
		Section 4.3.4 (2)	The sentences are changed.
		Section 4.4.1 (1) (d)	The sentences are added.
		Section 4.4.1 (2) (a)	The table is changed.

Revision Date	*Manual Number	Revision	
Jan. 2015	SH(NA)030132ENG-B	Section 4.4.1 (3) (a)	The sentences are added.
		Section 4.4.1 (4) (a)	The diagram is changed.
		Section 4.4.1 (4) (b)	The diagram is changed.
		Section 4.4.1 (5) (a)	The sentences are added.
		Section 4.4.1 (5) (b)	The sentences are added.
		Section 4.4.1 (6)	The table is changed.
		Section 4.4.2 (1) (a)	The sentences are changed.
		Section 4.4.2 (1) (b)	The sentences are changed.
		Section 4.4.2 (2)	The sentences and table are changed.
		Section 4.4.2 (3) (a)	The sentences are changed.
		Section 4.4.2 (3) (b)	The sentences are changed.
		Section 4.4.2 (4) (a)	The sentences and diagram are changed.
		Section 4.4.3 (1) (b)	The sentences are changed.
		Section 4.4.3 (1) (c)	Deleted.
		Section 4.4.4	Added.
		Section 4.4.5	Added.
		Section 4.5.1 (2) (a)	The sentences and diagram are changed.
		Section 4.5.1 (2) (b)	The sentences and diagram are changed.
		Section 4.5.2 (2) (a)	The sentences and diagram are changed.
		Section 4.5.2 (2) (a)	The sentences and diagram are changed.
		Section 4.5.2 (2) (b)	The sentences and diagram are changed.
		Section 4.5.2 (2) (c)	The sentences and diagram are changed.
		Section 4.5.2 (3) (b)	The sentences and diagram are changed.
		Section 4.5.2 (3) (c)	The sentences and diagram are changed.
		Section 4.5.2 (3) (d)	The sentences and diagram are changed.
		Section 4.5.3	Added.
		Section 4.5.4	The sentences are changed.
		Section 4.5.4 (4) (a)	The sentences are changed.
		Section 4.5.4 (4) (b)	The sentences are changed.
		Section 4.5.4 (5)	The table is changed.
		Section 4.5.5 (2) (a)	The diagram is changed.
		Section 4.5.6 (2)	The sentences and diagram are changed.
		Section 4.5.6 (3)	The sentences are changed.
		Section 4.5.9 (2)	Added.
		Chapter 5	The sentences in POINT are changed.
		Section 5.1	The table is changed.
		Section 5.2.1	The table is changed.
		Section 5.2.2	The table is changed.
		Section 5.2.3	The table is changed.
		Chapter 6	The table and Note are changed.
		Section 7.1 (1)	The table is changed.
		Section 8.1	The diagram is changed.
		Section 8.2	The table is changed.
		APPENDIX	Added.
Dec. 2016	SH(NA)030132ENG-C	MR-J4-DU_-RJ and MR-J4-_GF_-RJ are added.	
		Safety Instructions	
		1. To prevent electric shock, note the following	The sentences are partially deleted.
		4. Additional instructions	
		(1) Transportation and installation	The environment is partially changed.
		(2) Wiring	The sentence is added.
		(5) Corrective actions	The sentences are added.
		(6) Maintenance, inspection and parts replacement	The sentences are added.

Revision Date	*Manual Number	Revision	
Dec. 2016	SH(NA)030132ENG-C	About the manuals	The sentence is added and table is changed.
		Section 1.1	The sentences are added to POINT. The tables are changed. The sentences are changed.
		Section 1.1 (2) (b)	Table 1.1 is changed.
		Section 1.3.1 (1)	Added.
		Section 1.3.4	Added.
		Section 1.3.5	Added.
		Section 1.5	The part of table is changed.
		Section 1.6	The part of table is changed.
		Section 1.7	The part of table is changed.
		Section 2.1	POINT is added.
		Section 2.3	The sentence is added.
		Section 2.6	CAUTION is added. POINT is added.
		Section 3.4	POINT is added.
		Section 3.8.1	Added.
		Section 4.1 (1) (b)	The part of table is changed.
		Section 4.4.3 (1) (a)	The sentence is changed.
		Section 4.4.3 (1) (b)	The sentence is changed.
		Section 4.5.5 (2) (a)	The sentences are changed.
		Section 4.5.9 (2) (b)	The diagram is changed.
		Chapter 5	POINT is changed.
		Section 5.1.2	PSC04 is added.
		Section 5.2.1	PSA02 to PSA06, PSA15, PSA17, PSA19, and PSA21 are partially changed.
		Section 5.2.2	The sentences are added to PSC01 to PSC03. PSC04 is added.
		Section 5.2.3	The sentences are added to PSD01 to PSD17, and PSD26.
		Chapter 6	The notes of the table are changed.
		Section 7.2	Added.
		Section 8.2	POINT is added. The table is changed.
		App. 1	The certificate is updated.
Apr. 2017	SH(NA)030132ENG-D	The description of the safety observation function control by network is added for MR-J4-_GF_-RJ.	
		Section 1.1 (1) (a) 2)	Added.
		Section 1.1 (2) (b)	Added.
		Section 1.3.1 (2)	Added.
		Section 1.4.1 (2)	Added.
		Section 1.5	The part of table is changed.
		Section 1.6	The part of table is changed.
		Section 3.8.1 (2)	Added.
		Section 4.1 (1) (a)	Added.
		Section 4.4.3 (1)	The content is changed.
		Section 4.4.3 (3)	Added.

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Warranty

1. Warranty period and coverage

We will repair any failure or defect hereinafter referred to as "failure" in our FA equipment hereinafter referred to as the "Product" arisen during warranty period at no charge due to causes for which we are responsible through the distributor from which you purchased the Product or our service provider. However, we will charge the actual cost of dispatching our engineer for an on-site repair work on request by customer in Japan or overseas countries. We are not responsible for any on-site readjustment and/or trial run that may be required after a defective unit are repaired or replaced.

[Term]

The term of warranty for Product is twelve (12) months after your purchase or delivery of the Product to a place designated by you or eighteen (18) months from the date of manufacture whichever comes first ("Warranty Period"). Warranty period for repaired Product cannot exceed beyond the original warranty period before any repair work.

[Limitations]

(1) You are requested to conduct an initial failure diagnosis by yourself, as a general rule.
It can also be carried out by us or our service company upon your request and the actual cost will be charged. However, it will not be charged if we are responsible for the cause of the failure.

(2) This limited warranty applies only when the condition, method, environment, etc. of use are in compliance with the terms and conditions and instructions that are set forth in the instruction manual and user manual for the Product and the caution label affixed to the Product.

(3) Even during the term of warranty, the repair cost will be charged on you in the following cases;
- (i) a failure caused by your improper storing or handling, carelessness or negligence, etc., and a failure caused by your hardware or software problem
- (ii) a failure caused by any alteration, etc. to the Product made on your side without our approval
- (iii) a failure which may be regarded as avoidable, if your equipment in which the Product is incorporated is equipped with a safety device required by applicable laws and has any function or structure considered to be indispensable according to a common sense in the industry
- (iv) a failure which may be regarded as avoidable if consumable parts designated in the instruction manual, etc. are duly maintained and replaced
- (v) any replacement of consumable parts (battery, fan, smoothing capacitor, etc.)
- (vi) a failure caused by external factors such as inevitable accidents, including without limitation fire and abnormal fluctuation of voltage, and acts of God, including without limitation earthquake, lightning and natural disasters
- (vii) a failure generated by an unforeseeable cause with a scientific technology that was not available at the time of the shipment of the Product from our company
- (viii) any other failures which we are not responsible for or which you acknowledge we are not responsible for

2. Term of warranty after the stop of production

(1) We may accept the repair at charge for another seven (7) years after the production of the product is discontinued. The announcement of the stop of production for each model can be seen in our Sales and Service, etc.

(2) Please note that the Product (including its spare parts) cannot be ordered after its stop of production.

3. Service in overseas countries

Our regional FA Center in overseas countries will accept the repair work of the Product. However, the terms and conditions of the repair work may differ depending on each FA Center. Please ask your local FA center for details.

4. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to:

(1) Damages caused by any cause found not to be the responsibility of Mitsubishi.

(2) Loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products.

(3) Special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products.

(4) Replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Change of Product specifications

Specifications listed in our catalogs, manuals or technical documents may be changed without notice.

6. Application and use of the Product

(1) For the use of our General-Purpose AC Servo, its applications should be those that may not result in a serious damage even if any failure or malfunction occurs in General-Purpose AC Servo, and a backup or fail-safe function should operate on an external system to General-Purpose AC Servo when any failure or malfunction occurs.

(2) Our General-Purpose AC Servo is designed and manufactured as a general purpose product for use at general industries.
Therefore, applications substantially influential on the public interest for such as atomic power plants and other power plants of electric power companies, and also which require a special quality assurance system, including applications for railway companies and government or public offices are not recommended, and we assume no responsibility for any failure caused by these applications when used
In addition, applications which may be substantially influential to human lives or properties for such as airlines, medical treatments, railway service, incineration and fuel systems, man-operated material handling equipment, entertainment machines, safety machines, etc. are not recommended, and we assume no responsibility for any failure caused by these applications when used.
We will review the acceptability of the abovementioned applications, if you agree not to require a specific quality for a specific application. Please contact us for consultation.

MODEL	MR-D30 INSTRUCTIONMANUAL
MODEL CODE	1CW817

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE: TOKYO BLDG MARUNOUCHI TOKYO 100-8310

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Specifications are subject to change without notice.