MITSUBISHI ELECTRIC

General-Purpose AC Servo

MITSUBISHI SERVO AMPLIFIERS & MOTORS

MELSERVO

Functional safety unit

MR-D30

INSTALLATION GUIDE

B

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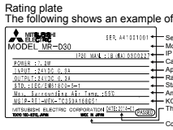
This guide uses recycled paper.
Specifications are subject to change without notice.

Contents of the package

Contents	Quantity
MR-D30 functional safety unit	1
MR-D30 Installation Guide (this guide)	1

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



Warning plate

1. About the manuals

1.1 MELSERVO MR-J4 relevant manuals

This installation guide explains how to mount MR-J4 servo amplifiers. You can also check it with our website for free.
http://www.mitsubishielectric.com/fa/
If you have any questions about the operation or programming of the equipment described in this guide, contact your local sales office.
In addition, when you mount a protective device, specific technical skills which are not detailed in the guide will be required.

1.2 Purpose of this guide

This installation guide explains the safe operation of MR-J4 servo amplifiers for engineers of machinery manufacturers and machine operators. For detailed information of the products, refer to "MR-D30 Instruction Manual". This installation guide does not explain how to operate equipment in which MR-D30 and MR-J4 servo amplifier are integrated.

1.3 Terms related to safety

(1) STO (Safe torque off)
Shuts off servo motor drive energy electronically based on an input signal from an external device (secondary-side output shut-off). This corresponds to stop category 0 of IEC 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, STO function will be activated (SS1). This corresponds to stop category 1 of IEC 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 60204-1.

(4) SOS (Safe operating stop)
This is a function to monitor 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)
This is a function to observe 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 safety output signal when the servo motor speed is within a regulated speed.

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

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

2. About safety

This chapter explains safety of users and machine operators. Please read the chapter carefully before mounting the equipment. In this installation guide, the specific warnings and cautions levels are classified as follows.

⚠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.

2.1 Professional engineer

Only professional engineers should mount this to MR-J4 servo amplifiers.
Here, professional engineers should meet the all conditions below.

(1) Persons who took a proper engineering training or qualified persons who are engaged in electrical equipment. Check if applicable technical training is available at your local Mitsubishi Electric office. Contact your local sales office for schedules and locations.

(2) A person who can access to operating manuals for the protective devices (e.g. light curtain) connected to the safety control system. A person who have read and familiarized himself/herself with the manuals.

2.2 Applications of the devices

MR-D30 has a control system whose configuration is possible to be for safety.
This product complies with the following standards. (Declaration of conformity No. BCN-B61008-076)

- EN ISO 13849-1 Category 3 PL d and Category 4 PL e)
- IEC 61508 SIL 2 and SIL 3
- EN 62061 SIL CL 2 and SIL CL 3
- EN 61800-5-2 SIL 2 and SIL 3

An achieved safety level depends on external circuit, wiring conditions, parameter settings, sensor selections, and mounting position on the machine.
A photoelectric and contact sensor such as light curtain, laser scanner, safety switch, sensor, and push button for emergency stop can be used with programs. The power of an actuator mounted on the machine or system can be shut off safely using switching output of the safety control system.

2.3 Correct use

⚠CAUTION	●MR-D30 complies with basic specifications concerning radiation electromagnetic immunity and fulfills requirements of industrial uses. Threrefore, MR-D30 is only for use in industrial environment, not for general use.

MR-D30 can be used only within specifications. (Refer to section 6.2 and section 6.3.) Only professional engineer can use the control system in which MR-D30 is integrated. Additionally, only when a professional engineer installed, performed test operations, and adjusted a machine following "MR-D30 Instruction Manual", an operator can use the machine.

2.3.1 EU compliance

The combination of MR-J4 servo amplifier and MR-D30 is designed to comply with the following directions to meet requirements for mounting, using, and periodic technical inspections: Machinery directive (2006/42/EC), EMC directive (2004/108/EC), and Low-voltage directive (2006/95/EC).

(1) EMC requirement
The combination of MR-J4 servo amplifier and MR-D30 complies with category C3 in accordance with EN 61800-3. As for I/O wires (max. length 10 m) and encoder cables (max. length 50 m), use shielded wires and ground the shields.
Use an EMC filter and surge protector on the primary side. The following shows recommended products.
EMC filter: Soshin Electric HF3000A-UN series
Surge protector: Okaya Electric Industries RSPD-250-U4 series
MR-J4 Series are not intended to be used on a low-voltage public network which supplies domestic premises; radio frequency interference is expected if used on such a network.
The installer shall provide a guide for Installation and use, including recommended mitigation devices.

(2) For Declaration of Conformity (DoC)
Hereby, MITSUBISHI ELECTRIC EUROPE B.V., declares that the servo amplifier with MR-D30 is in compliance with the necessary requirements and standards (2006/42/EC, 2004/108/EC and 2006/95/EC). For the copy of Declaration of Conformity, contact your local sales office.

2.3.2 USA/Canada compliance

The servo amplifiers on which MR-D30 is mounted are designed in compliance with UL 508C and CSA C22.2 No.14.

(1) Installation
The minimum cabinet size is 150% of each MR-J4 servo amplifier's volume including MR-D30. Also, design the cabinet so that the ambient temperature in the cabinet is 55 °C or less. The servo amplifiers on which MR-D30 is mounted must be installed in a metal cabinet. For environment, the units should be used in open type (UL50) and overvoltage category III or lower. MR-D30 and servo amplifier needs to be installed at or below of pollution degree 2. For connection, use only copper wires.

(2) Short-circuit current rating (SCCR)
Each servo amplifier on which MR-D30 is mounted has checked with a short-circuit test.

(3) Overload protection characteristics
The servo amplifier on which MR-D30 is mounted has servo motor overload protective function. (It is set on the basis (full load current) of 120% rated current of the servo amplifier.)

(4) Over-temperature protection for motor
Motor Over temperature sensing is not provided by the drive.
Integral thermal protection(s) is necessary for motor and refer to chapter 4 for the proper connection.

(5) Capacitor discharge
It takes 15 minutes for capacitor discharging of the servo amplifier on which MR-D30 is mounted. Do not touch the unit and terminals immediately after power off.

(6) Branch circuit protection
For installation in United States, branch circuit protection must be provided, in accordance with the National Electrical Code and any applicable local codes. For installation in Canada, branch circuit protection must be provided, in accordance with the Canada Electrical Code and any applicable provincial codes.

2.3.3 South Korea compliance

This product complies with the Radio Wave Law (KC mark). Please note the following to use the product.
이 기기는 업무용 (A급) 전자파적합기기로서 판 매자 또는 사용자는 이 점을 주의하시기 바라며,
가정외의지역에서 사용하는 것을 목적으로 로 합니다.
(The product is for business use (Class A) and meets the electromagnetic compatibility requirements. The seller and the user must note the above point, and use the product in a place except for home.)

2.4 Safety observation function compatible unit

The safety observation function is executed by writing a parameter to MR-D30 in a system using an MR-J4 servo amplifier and motion CPU in the following table. Set the parameters of MR-D30 correctly for a proper operation of the safety observation function. Protective functions such as the safety observation function may not work due to an incorrect setting. Refer to "MR-D30 Instruction Manual" for the parameter setting details.

(1) List of safety observation function compatible unit

Product name	Model
Servo amplifier	MR-J4-_B-RJ/MR-J4-_B4-RJ/MR-J4-_B1-RJ MR-J4-_A-RJ/MR-J4-_A4-RJ/MR-J4-_A1-RJ
Motion CPU module (Note)	Q173DSCPU/Q172DSCPU

Note. For using the safety observation function with SSCNETIII/H

(2) List of safety observation function compatible unit version
(a) Servo amplifier and functional safety unit

Function	Software version	
	MR-D30	Servo amplifier
STO SS1 SBC SLS SSM	A0 or later	MR-J4-_B_-RJ: B3 or later
SS2 (Note2) SOS (Note2)	A1 or later	MR-J4-_B_-RJ: B5 or later MR-J4-_A_-RJ (Note1): B5 or later

Note 1. This is applied to MR-J4-_A_-RJ manufactured in November 2014 or later.
2. Use in combination with HG-KR_W0C, HG-SR_W0C, or HG-JR_W0C.

(b) Motion controller

Model	OS	Software version
Q173DSCPU	SW8DNC-SV22QJ/SW8DNC-SV13QJ	00E or later
Q172DSCPU	SW8DNC-SV22QL/SW8DNC-SV13QL	

2.5 General cautions for safety protection and protective measures

POINT
●Observe the cautions for safety protection and protective measures. ●Observe the items of this section for proper use of MR-D30.

(1) When mounting, installing, and using the MR-D30, always observe standards and directives applicable in the country.

(2) When using an MR-D30 in an EU member state, comply with the following directives.
- Machinery directive 2006/42/EC
- EMC directive 2004/108/EC
- Low-voltage directive 2006/95/EC
- Other laws/regulations of labor safety

(3) The manufacturer and owner of machines on which an MR-D30 is used should be familiarized with all the applicable laws and regulations and should be responsible to observe them.
For Declaration of Conformity (DoC), our company declares that the servo amplifiers are in compliance with the necessary requirements and standards (2006/42/EC, 2004/108/EC and 2006/95/EC). You can obtain the copy of Declaration of Conformity from our website.

(4) The contents of "MR-D30 Instruction Manual" must be observed.

(5) Tests should be performed by professional engineers, especially qualified and responsible personnel, and should be recorded/documented for a third party to rebuild and confirm the tests.

(6) An external power supply of equipment should have resistance to instantaneous power failure for 20 ms according to the specifications of IEC60204-1.

2.6 Disposal

Disposal of unusable or irreparable devices should always occur in accordance with the applicable country-specific waste disposal regulations. (Example: European Waste 16 02 14)

2.7 Risk assessment

To ensure safety, users should decide all the risk assessments and residual risks in the entire machine equipment. A company and/or 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.

2.7.1 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 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 wirings.
(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.

2.7.2 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 are 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 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.

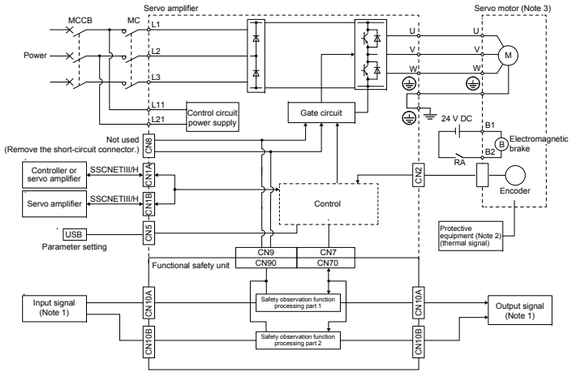
3. Conditions of use for the product

(1) 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.

(2) 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.
(a) Power plants
(b) Trains, railway systems, airplanes, airline operations, and other transportation systems
(c) Hospitals, medical care, dialysis and life support facilities or equipment
(d) Amusement equipment
(e) Incineration and fuel devices
(f) Handling of nuclear or hazardous materials or chemicals
(g) Mining and drilling
(h) Other applications where the level of risk to human life, health or property are elevated.

4. Block diagram and timing chart

(1) Function block diagram (for using input signal)
This is an example of a combination with MR-J4-_B_-RJ.



Note 1. Safety switch, safety relay, etc.
2. Please use a thermal sensor, etc. for thermal protection of the servo motor.
3. The HG-KR_W0C, HG-SR_W0C, or HG-JR_W0C servo motor is required to use the SS2/SOS functions.

(2) How to use the functions
To use the safety observation functions, combine MR-D30 with MR-J4. For how to use the functions, refer to "MR-D30 Instruction Manual".

5. Maintenance and disposal

MR-D30 safety logic unit is equipped with LED displays to check errors for maintenance.
Please dispose this unit according to your local laws and regulations.
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.

6. Functions and configuration

6.1 Summary

(1) Safety observation functions are available with your servo amplifier.
Mounting the functional safety unit to the servo amplifier enables you to use the safety observation functions such as STO/SS1/SS2/SOS/SLS/SSM/SBC without depending on a motion controller.

(2) Compatible with safety integrated motion controller
Safety communication with motion controllers is available by using MR-D30 with MR-J4-B-RJ. With this, the wiring which was required can be reduced for the STO signal and encoder signal for safety observation.

6.2 Transportation and storage

⚠CAUTION	●Transport the products correctly according to their mass. ●Stacking in excess of the limited number of product packages is not allowed. ●Install the equipment in a load-bearing place in accordance with "MR-D30 Instruction Manual". ●Do not get on or put heavy load on the equipment.

When you keep or use it, please fulfill the following environment.

Item		Environment
Ambient temperature	Operation [°C]	0 to 55 Class 3K3 (IEC/EN 60721-3-3)
	Transportation (Note) [°C]	-20 to 65 Class 2K4 (IEC/EN 60721-3-2)
	Storage (Note) [°C]	-20 to 65 Class 1K4 (IEC/EN 60721-3-1)
Ambient humidity	Operation, transportation, storage	5 %RH to 90 %RH
Vibration resistance	Test condition	10 Hz to 57 Hz with amplitude of 0.075 mm 57 Hz to 150 Hz with constant acceleration of 9.8 m/s² to IEC/EN 61800-5-1 (Test Fc of IEC 60068-2-6)
	Operation	5.9 m/s²
	Transportation (Note)	Class 2M3 (IEC/EN 60721-3-2)
	Storage	Class 1M2 (IEC/EN 60721-3-2)
Pollution degree		2
IP rating		Mounted on a servo amplifier: IP20 (IEC/EN 60529) MR-D30 (single): IP00 (IEC/EN 60529)
		Open type (UL 50)
Altitude	Operation, storage	1000 m or less above sea level
	Transportation	10000 m or less above sea level

Note. In regular transport packaging

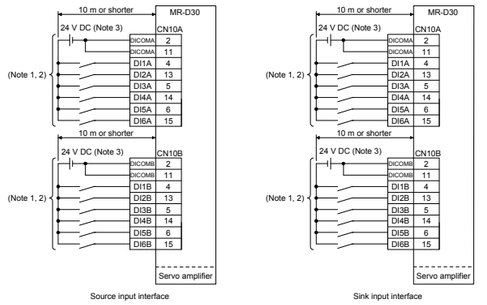
6.3 Specifications

	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 SIL 2 and SIL 3
	Mean time to dangerous failure		MTTFd ≥ 100 [years]
	Effectiveness of fault monitoring of a system or subsystem		DC ≥ 90 [%]
	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
	Speed observation resolution		Depends on a command resolution (22 bit position command: 0.1 r/min or less)
	Position observation resolution		1/32 rev
	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 to 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)
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, an input 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 achievable safety level, 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.

6.4 When using MR-D30 for an MR-J4 series servo amplifier

6.4.1 Input signal

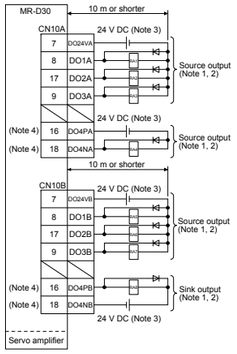


Note 1. Separate all the external wires by two types, CN10A and CN10B.
2. Assign each input device to the following combinations of connector and pin. Refer to chapter 7 for each device.

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 7.2 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.

6.4.2 Output signal
DO1A to DO3A, DO1B to DO3B, and DO4NA can be used as source outputs, and DO4PB can be used as a 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. Refer to chapter 7 for each device.

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 7.2 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) will not be available with MR-D30 manufactured in September 2014 or before. Do not connect anything to these pins.

7. Signals

7.1 Connector and pin assignment

(1) Input device
Assign the devices to DI1_ to DI6_ with [Pr. PSD02 Input device selection DI1] to [Pr. PSD07 Input device selection DI6]. When using a drive Safety integrated motion controller, inputting them via SSCNETIII/H is available.

Device	Symbol	Connector and pin No.	Function	Input pin status which the function turns to be 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.	Opened
SS1 command	SS1C		The SS1 function operates by the SS1 command.	Opened
SS2 command	SS2C		The SS2/SOS functions operate by the SS2 command.	Opened
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 as parameters.	Opened
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 as parameters.	Opened
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 as parameters.	Opened
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 as parameters.	Opened
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.	

(2) Output device
The status monitor (SM) of the safety observation function is output from 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 DO3]. When using a drive Safety integrated motion controller, outputting them via SSCNETIII/H is also available. Then, DO1_ to DO4_ can be used simultaneously.

Device	Symbol	Connector and pin No.	Function	Output pin status 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.	Closed
SBC output	SBCS		Outputs a control signal of the electromagnetic brake.	Opened
STO output	STOS		This is a monitor output signal meaning that the STO function is operating.	Opened
SOS output	SOSS		This is a monitor output signal meaning that the SS2/SOS function is operating.	Opened
SS1 output	SS1S		This is a monitor output signal meaning that the SS1 function is operating.	Opened
SS2 output	SS2S		This is a monitor output signal meaning that the SS2/SOS function monitors the servo motor is in the stop state.	Opened
SLS1 output	SLS1S		This is a monitor output signal meaning that the SLS function 1 is operating.	Opened
SLS2 output	SLS2S		This is a monitor output signal meaning that the SLS function 2 is operating.	Opened
SLS3 output	SLS3S		This is a monitor output signal meaning that the SLS function 3 is operating.	Opened
SLS4 output	SLS4S		This is a monitor output signal meaning that the SLS function 4 is operating.	Opened

(3) Power supply

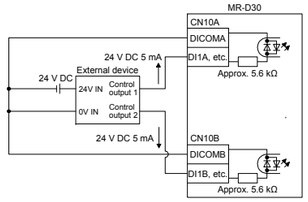
Name	Symbol	Connector and pin No.	Function and application
Digital input I/F common A	DICOMA	CN10A-2 CN10A-11	This is a common terminal for input signal. Input 24 V DC (24 V DC ± 10% 0.8 A) for I/O interface. The power supply capacity changes depending on the number of I/O interface points to be used. 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 the positive terminal 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 24 V DC external power supply.
DO4A power supply for digital output I/F	DO4PA	CN10A-16	This is the power terminal for the DO4A output signal. Connect the positive terminal of the 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 changes 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 the positive terminal 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 24 V DC external power supply.
DO4B power supply for digital output I/F	DO4NB	CN10B-18	This is the power terminal for the DO4B output signal. Connect the negative terminal of the 24 V DC external power supply.

7.2 Interface (source I/O)

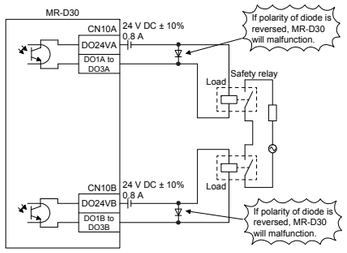
For MR-D30, source type I/O interfaces can be used. The following shows an example of source interface.

(1) Input interface
For MR-D30, source type and sink type I/O interfaces can be used. Transmit signals from source (open-collector) type transistor output, relay switch, etc. For sink interface, refer to "MR-D30 Instruction Manual".

(a) External device connection
Connect the output signal to DI_ _.



(2) Output interface
When the output transistor is turned on, the current flows from 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 2.4 V voltage drop occurs in MR-D30.



7.3 Wiring method of CN10A and CN10B connectors

Handle with the tool with care when connecting wires.

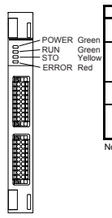
(1) Wire strip
(a) Use wires with size of AWG 24 to 16 (recommended electric wire: UL1007) and strip the wires to make the stripped length 10 mm ± 0.5 mm. Confirm the stripped length with gauge, etc. before using the wires.
(b) If the stripped wires are bent, feazed or too thick due to twisting too much, fix the wires by twisting lightly, etc. Then, confirm the stripped length before using the wires. Do not use excessively deformed wires.
(c) Smooth out the wire surface and stripped insulator surface.

(2) Connecting wires
Before connecting wires, be sure to pull out the receptacle assembly from the header connector. If wires are connected with inserted connector, the connector and the printed board may malfunction.
With pressing the release button with a flat-blade screwdriver with the blade edge width of 2.0 mm to 2.5 mm, insert a wire all the way in and remove the screwdriver. Refer to "MR-D30 Instruction Manual" for wiring.

(3) Connectors
Be sure to insert the connector all the way straight until you hear or feel clicking. After connection, tighten the screw came with the connector using a flat-blade screwdriver. Loosen the screw before disconnection.

8. Display

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



LED	Lighting status	Description
POWER	Lit	Power is being supplied.
	Extinguished	Power is not supplied.
RUN	Lit	The safety observation function is performing. STO, SS1, SS2/SOS, or SLS function is being executed normally, performing shutoff or observation.
	Extinguished	The safety observation function is not performing. Because the operation commands are not inputted or an internal diagnosis error has occurred.
STO	Lit	STO function is performing. The power to the motors is shut off.
	Extinguished	STO function is not performing. The power to the motors is not shut off.
ERROR	Lit	Some errors have been detected for MR-D30. (Note)
	Flickering	Some errors have been detected for MR-D30.
	Extinguished	An error is not being detected in MR-D30.

Note. When a servo amplifier which is not compatible with MR-D30 is connected to MR-D30, "ERROR" will light. Check if MR-D30 is connected to the MR-J4-_B_-RJ servo amplifier with the software version B3 or later, or the MR-J4-_A_-RJ servo amplifier with the software version B5 or later. (Refer to (3) (a) of section 2.3.4.)

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	A diagnosis has not been completed. When input devices are used, perform the fixing diagnosis at start-up. When using a drive Safety integrated motion controller, connect networks.
○	●	●	●	Normal	Safety observation function is not performing.	The safety observation function is not performing.
○	○	○	●	95_	Safety observation function is performing (shutting power off).	STO or SS1 functions is performing.
○	○	●	●	Normal	Safety observation function is performing (monitoring).	SLS or SS2/SOS function is performing.
○	◎/○	○	◎/○	Alarm No.	Error has occurred.	An error has been detected. Refer to chapter 8 for error details. (Note)
○	○	○	○	Alarm No.	Error has occurred (watchdog)	Watchdog is occurring due to parts error, such as the CPU.

(○: Lit, ◎: Flickers, ●: Extinguished)

Note. When a servo amplifier which is not compatible with MR-D30 is connected to MR-D30, "ERROR" will light. Check if MR-D30 is connected to the MR-J4-_B_-RJ servo amplifier with the software version B3 or later, or the MR-J4-_A_-RJ servo amplifier with the software version B5 or later. (Refer to (3) (a) of section 2.3.4.)

9. Setting method

Use MR Configurator2 for the settings. Refer to "MR-D30 Instruction Manual" for details.
Check the contents of [Pr. PSA_ _], [Pr. PSC_ _], and [Pr. PSD_ _] and set [Pr. PSA01 Safety observation function activation setting] to "_ _ _ 1". Until setting this parameter, STO cannot be canceled due to [AL. 7A Parameter setting error (safety observation function)] occurrence.

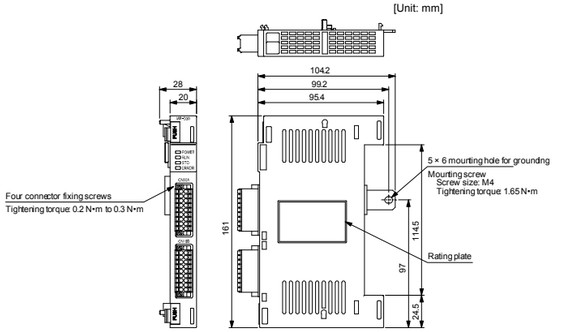
10. Troubleshooting

When power is not supplied or ERROR LED turns on, refer the following table and take the appropriate action.

Event	Description	Cause	Action
Power is not supplied.	Power LED does not turn on although power is supplied.	1. The servo amplifier is malfunctioning.	Replace the servo amplifier.
		2. MR-D30 is not connected to the servo amplifier properly.	Check the connection.
		3. MR-D30 is malfunctioning.	Replace the MR-D30.
ERROR LED is flickering.	ERROR LED is flickering and an alarm No. is displayed on the servo amplifier.	An error has occurred in MR-D30 or servo amplifier.	Check the alarm No. and remove the problem referring "MELSERVO-J4 Servo Amplifier Instruction Manual Trouble Shooting".
ERROR LED is on.	ERROR LED has been on.	MR-D30 is malfunctioning.	Replace the MR-D30.

11. Dimensions

[Unit: mm]



CN10A

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

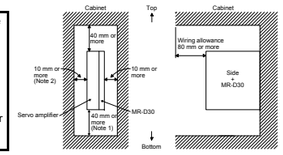
No.	Symbol	Symbol	No.
10	DC24VB	DC24VB	1
11	DICOMB	DICOMB	2
12	PLSB		3
13	DI2B	DI1B	4
14	DI4B	DI3B	5
15	DI6B	DI5B	6
16	DO4PB	DO24VB	7
17	DO2B	DO1B	8
18	DO4NB	DO3B	9

Mass: 0.15 [kg]

12. Installation

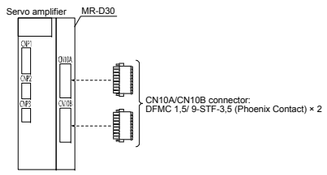
Installation direction and clearances

⚠CAUTION
- The devices must be installed in the specified direction. Not doing so may cause a malfunction.
- Mount the servo amplifier on a cabinet which meets IP54 in the correct vertical direction to maintain pollution degree 2.
- Even if the power turned off, touching the resistor will cause an electric shock because the capacitor of the servo amplifier is charged for a while.



Note 1. For 11 kW to 22 kW servo amplifiers, the clearance between the bottom and ground will be 120 mm or more.
2. For MR-J4-500_-RJ, the clearance on the left side will be 25 mm or more.

13 Connector



14. Check list for user documentation

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MR-D30 installation checklist for manufacturer/installer

The following items must be satisfied by the initial test operation at least. The manufacturer/installer must be responsible for checking the standards in the items.
Maintain and keep this checklist with related documents of machines to use this for periodic inspection.

1. Is it based on directive/standard applied to the machine? Yes [ ], No [ ]
2. Is directive/standard contained in Declaration of Conformity (DoC)? Yes [ ], No [ ]
3. Does the protection instrument conform to the category required? Yes [ ], No [ ]
4. Are electric shock protective measures (protection class) effective? Yes [ ], No [ ]
5. Is the safety observation function checked (test of all the shut-off wiring)? Yes [ ], No [ ]

Checking the items will not be instead of the first test operation or periodic inspection by professional engineers.

[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 responsibility for compensation against loss of opportunity, secondary loss, etc.
Whether under or after the term of warranty, we assume no responsibility for any damages arisen from causes for which we are not responsible, any losses of opportunity and/or profit incurred by you due to a failure of the Product, any damages, secondary damages or compensation for accidents arisen under a specific circumstance that are foreseen or unforeseen by our company, any damages to products other than the Product, and also compensation for any replacement work, readjustment, start-up test run of local machines and the Product and any other operations conducted by you.

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.