

### Mitsubishi Electric AC Servo System

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Safety Instructions and Precautions for AC Servos (Safety Sub-Function)

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1. About the manuals To use the MELSERVO-JET series safely, read MR-JET User's Manuals carefully.

1.1 Purpose of this guide This guide is subject to engineers of machine manufacturers and operators of machines, and explains functional safety of the MR-JET servo amplifier (hereafter "MR-JET"). For detailed information of the products, refer to MR-JET User's Manual. This guide does not explain how to operate equipment that incorporates an MR-JET.

1.2 Terms related to safe	ety
Item	Detailed explanation
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/EN 60204-1.
SS1 (Safe stop 1)	Starts deceleration based on an input signal from an external device (EM2). After a specified time to confirm the the motor has stopped, the STO function will be advized (SSI-1). Alternatively, the SSI function monitors whether the servo motor decelerates according to the deceleration time constant (SS1-r). This corresponds to stop category of tel ECIR 60204-1.
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 specified speed, energy will be shut off by STO.
SSM (Safe speed monitor)	Outputs a safety output signal when the servo motor speed is within a regulated speed.
SBC (Safe brake control)	Outputs a safety output signal for an external brake control.
SDI (Safe direction)	Monitors whether the travel direction of the servo motor is as specified. The STO function shuts off the energy it the direction is different from the specified direction.
SLT (Safely-limited torque)	Monitors whether the torque exceeds the specified torque. The STO function shuts off the energy if the torque exceeds the specified torque.
Status monitor (SM)	Outputs a signal that indicates the status of the safety sub-function. This is an original function of the MR-JET

2. About safety

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

WARNIN	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
	Indicates that incorrect handling may cause however, conditions, you ting is madium as elight initial.

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- 2.1 Professional engineer Only professional engineers should mount this to MR-JET. Here, professional engineers should meet all the conditions below.
- (1) Persons who took a proper training of related work of electrical equipment or persons who can avoid risk based on past experience
- (2) Persons who have read and familiarized himself/herself with this installation guide and operating manuals for the protective devices (e.g. light curtain) connected to the safety control system.
- Conditions of use for the product

   MR-JET complies with a safety standard, but this fact does not guarantee that MR-JET will be free from any malfunction or falue. 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 for the system in which the product is installed or used and shall take the second or third safety measures for the nany 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.

- 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 dnilling
  (h) Other applications where the level of risk to human life, health or property are elevated.

2.3 Correct use

CAUTION <sup>●</sup>If you need to get close to the moving parts of the machine for inspection or other purposes, ensure safety by confirming the power off, etc. Otherwise, it may cause an accident.

Point

- The safety sub-function complies with the immunity-relating basic The safety sub-initial of complex with the immunity-relating basic specifications required for functional safety, and fulfills requirements for industrial uses. The safety sub-function is not for general use. Functional safety is not available for MR-JET\_C44-HS(N1) in a default state. To use functional safety, set the functional safety parameters according to the
- MR-JET user's manual

Only professional engineers can use control systems relating to the safety sub-function that are configured with an MR-JET. Additionally, only when a professional engineer installed, performed test operations, and adjusted a machine following the MR-JET user's Manuals, an operator can use the machine.

24. Safety sub-function compatible unit The safety sub-function is executed by writing parameters and programs to systems configured with the MR-JET and the safety programmable controllers in the following table. Set the safety sub-function parameters of the MR-JET correctly for proper operation of the safety sub-function. Protective functions such as the safety sub-function may not work due to an incorrect setting. Refer to the MR-JET User's Manuals for the parameter setting details. (1) List of safety sub-function compatible unit

Product name	Model
Servo amplifier	MR-JETG4-HS(N1)
Programmable controller 1	R_SFCPU
*1 For using the safety sub-function via CC-Link	IE TSN

(2) List of safety sub-function compatible units

	Function	Servo motor type '7	Safety sub-function (IEC/EN 61800-5-2) <sup>6</sup>							
Servo amplifier	achieving method (wiring direction)		STO	SS1-t	S1 SS1-r " <sup>3</sup>	SBC	SLS "3	SSM "3	SDI "3	SLT
MR-JETG4-HS (N1)	DI/O connection "2 "5 (CN3)	RO/LI	Cat. 4 PL e, SIL 3	Cat. 4 PL e, SIL 3	Cat. 3 PL d, SIL 2	Cat. 4 PL e, SIL 3	Cat. 3 PL d, SIL 2			
	Network connection "1"4 (CN1A/CN1B)	RO/LI	Cat. 4 PL e, SIL 3	Cat. 4 PL e, SIL 3	Cat. 3 PL d, SIL 2	Cat. 4 PL e, SIL 3	Cat. 3 PL d, SIL 2			

- I. (Contraction of the safety sub-function of the safety sub-function control is performed by a programmable controller R, SFCPU with a firmware version 20 or later.
   The safety levels in the table apply if the safety sub-function control is performed by a programmable controller, a safety CPU or a safety
   the safety levels in the table apply if the safety sub-function control is performed by a programmable controller, a safety CPU or a safety
   the safety levels in the table apply if the safety sub-function control is performed by a programmable controller, a safety CPU or a safety
   if the RN-ET and interty connected with emergency stop switches, safety switches, enabling switches, or other similar devices, the safety level
   Catagory 3 PL d, SL 2 applies.
   Fully closed loop control systems do not support SS1 + (SLS, SSM, and SDL
   The safety sub-function via a network connection with CC-Link IE Field Network Basic cannot be used.
   The safety sub-function via a network connection with CC-Link IE Field Network Basic cannot be used.
   Concept of the SBC coupt test publes valid. Category 3 If it is not.
   Go r information on the firmware versions of the MR-ET with which the safety sub-function can be used, refer to the User's Manual (Introduction).
   TR: Rolary serve motor, IL lenser serve motor

- 2.5 General cautions for safety protection and protective measures

 Point

 Observe the cautions for safety protection and protective measures.

 Observe the items in this section for proper use of the safety sub-function.

- (1) When mounting, installing, and using the safety sub-function, always observe the standards and directives applicable in the respective countries.
- (2) The manufacturer and owner of machines for which the safety sub-function of MR-JET is used should be
- (2) The manufacturer and owner of machines for which the safety sub-function of MR-JET 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 MR-JET is in compliance with the necessary requirements and standards (2006/42/EC, 2014/30/EU, 2014/35/EU, 2011/65/EU, and (EU)2015/863). For the copy of Declaration of Conformity, contact your local sales office.
  (3) The contents of the MR-JET User's Manuals must be observed. When using an encoder manufactured by another company that complies with Mitsubin Electric Serial ENC communication or ABZ-pulse (TTL), also according to the manual for that encoder, estimate the PFH for the vhole safety system according to the diagnostic coverage (DCC) of the encoder given in specifications under the responsibility of the customer. All the encoder for PDS should comply IEC/EN 61800-5-1 and 5-2 including environmental and EMC. When there is no PFH value of encoder, it should be calculate from based MTBF (acceptable range of failure rate of encoder Ad = 50 %, Adu = (1-DC) \* Ad). And at least PFH < 9E-7 (for SIL2), PFH < 9E-8 (for SIL3) or less.</p>
- (4) 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.
- (5) An external power supply of equipment should have resistance to instantaneous power failure for 20 ms according to the specifications of IEC/EN 60204-1.

2.6 Disposal Disposal of unusable or irreparable devices should always occur in accordance with the applicable country-specific

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 sub-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 sub-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, startup, repair or adjust the machines in which the components are installed. Only trained engineers should install and operate the equipment. (ISO 13849-1:2015 Table F.1 No.
- (4) Separate the wiring for the safety sub-function from other signal wirings. (ISO 13849-1:2015 Table F.1 No. 1)
- (ISO 13849-1:2015 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 detect a safety observation error depends on the parameter setting.

2.7.2 Residual risks specific to 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 the test mechanical section becaused and the speed of the mechanical section such as slid of shaft and wanting of a timing belt, etc. is not covered. Be
- (c) The defect of the mechanical section such as slid of shaft and wanting of a timing bell, rec. 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. Errors in shorter than this time are not detected.
   (e) After speed is over the limit, a safety observation error (shut-off signal off does not occur during the speed error detection time set by parameters. 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) Set before control (SPC)

- (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.
- (4) Safe rotation direction limit (SDI) If the shaft of the servo motor (or a coil, if a linear servo motor is used) remains at a stop for a long time after the motor has traveled as specified, switch the function to the SBC function.

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- 3. Using safety sub-functions and block diagram 3.1 Using safety sub-functions 3.2 Function block diagrams The safety sub-functions can be used on the This is an example of a combination with the MR-JET\_\_G4-HS. MR-JET\_\_G4-HS(N1), Refer to the MR-JET User's Manuals for applications and setting methods of the functions.

- (1) Using safety sub-functions by MR-JET
- The safety sub-functions can be used by assigning them (STO, SLS, etc.) to CN3 without depending on controllers, etc.
- (2) Using safety sub-functions by
- Using safety sub-functions by combining with safety programmable controllers The MR-JET\_G4-HS are used to establish a safe communication with safety programmable controllers via CC-Link IE TSN. This enables the electrical winnings (for example STO) to the MR-JET to be omitted. the MR-JE I to be omitted.
  (3) Using safety sub-functions by combining with FSoE Master The MR-JET\_C4-HSN1 are used to establish safe communication with the FSoE Master via FSoE. This enables



Safety CPU

Safety switch (i.e. STO)



1 1

DIA

Digital I/D control

External encoder

4. Technical specifications





required to satisfy Category 4 PL e, SIL 3.
 me of the product is regarded as not necessary. For example, on IEC 61800-5-2:2016, three months for Category 3 PL e, SIL 3.

4.2 Function specifi



- <sup>11</sup> For DIO connection (CN3) a diagnosis using test pulses is required to satisfy Catagory 4 FL e, SIL 3.
  <sup>12</sup> This value is applicable when the transmission interval monitor time is 320 ms or less.
  <sup>13</sup> For the MR-JET- G4HS, connect to a network with a communication cycle of 125 µs or longer. For the MR-JET-\_G4HSN1, connect to a network with a communication cycle of 250 µs or longer.
  <sup>14</sup> The safety observation speed can be set separately.
  <sup>15</sup> A test pulse is a signal which instantaneously turns off a signal to the MR-JET at a constant period for external circuits to perform self-diagnosis.
  <sup>16</sup> The specifications are for using the safety-sub functions via a network connection.
  <sup>17</sup> This value is applicable when FSoE Watchdog Time is 30.0 ms or less.

SLS1C (SLS1 command) is off while the states of CN3-8A pin and the CN3-8B pin do not match. SLS (SLS1 command) tums on when the states of both CN3-8A pin and the CN3-8B pin are on. If a misma continues longer than the permissible mismatch tin specified by the parenter, [AL. 55B Safety input he activated colon will occur and the SS1 function he activated.

Pulses to turn off the signal will be output periodically to the CN3-11A and CN3-11B pins when STOS (STO) output) is turned on. The pulses to turn off the signal will be output from the CN3-11A and CN3-11B pins separately at different timings, and the pulses will not be the pulses to turn off the signal can be set in IPr. PSD30 Output device. Test pulse off time). Make sure that the time length for the output pulses to turn off the signal will not affect the external devices.

Pin No. 1B 2B

3B

4B 5B

6B

8B 9B

10B

11B

12B

13B 14B

15B

Input pin states tha enable functions

Open

Open

Open

Open

Open

Open

Dutput p status

Close

Open

Open

Symbol MBR/DO ALM

EM1

TPR2

LSN

TPR3

SDI1B

SDICOMB

SDO24VB

SDO1B

SDI2B

SDO2B

SDO3PB

SD03NB

FUNCTION

The SLS function 1 to SLS function 4 operates by the SLS1 command to SLS4 command. Four sets of SLS speed and SLS deceleration monitor time can be set with the SLS function.

The SDIP command activates the SDI function for the address increasing direction

The SDIN command activates the SDI function for the address decreasing direction

The SLT function 1 to SLT function 4 operates by the SLT1 command to SLT4 command. Four sets of SLT torque upper limit value and SLT torque lower limit value can be set with the SLT function.

FUNCTION

is a monitor output signal indicating that the SDI function has been activated. is a monitor output signal indicating that the SLT function 1 to SLT function 4

motor speed is equal to or lower than the SSM speed while y the SSM function is activated.

example

CN3-8A pin

CN3-8B pin

SLS1C

an example STOS (STO output

CN3-114 pip

CN3-11B nin

5. Signals

Symbol

STOC

SS1C

SLS1C to SLS4C

SDIPC

SDINC

SLT1C to SLT4C

Symbol

Connector-

CN3-14B CN3-15A CN3-15B CN3-16A CN3-16B

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5.2 Input devices

Devices

nand

nand

nand

Devices

4 output

SSM output SSMS

SBC output SBCS

Servo amplifie

4.3 When using the I/O of the CN3 connector of the MR-JET This I/O function can be used when the safety sub-function control by network is not used.

SLS in operation SLS in operation SS1 in operation

4.3.2 Selecting input devices The input devices can be assigned to CN3 by functional safety parameters. (Refer to chapter 5)

r the safety ou

4.3.4 Selecting output devices The output devices can be assigned to CN3 by functional safety parameters. (Refer to chapter 5)

Pin No. Symbol 1A DOCOM 2A INP

Pin No.

3A

5A

6A

8A

9A

10A

11A

12A

13A

14A

15A

16A

Input signal and), SS1C (SS1 command), SLS1C (SLS1 command), SDIPC (SDIP command), SDINC (SDIN command), and SLT1C (SL

Output signal put), SS1S (SS1 output), SLS1S (SLS1 output) to SLS45 (SLS4 output), SSMS (SSM output), SBCS (SBC output), SDIPS (SLIF (SDIN output) and SI 115 (SI 11 output) to 124 (SI 14 output)

5.1 Connector pin assignment of the safety sub-function I/O signals The following shows connector pin assignments of the MR-JET-8064-HS as a typical example. Refer to "MR-JET User's Manual (Hardware)" for precautions for wiring or other operations.

DICOM

TPR1

LSP

DICOM

SDI1A

SDICOMA

SDO24VA

SDO1A SDI2A SDI3A

SDO2A

SDO3PA

SD03NA

Assign the input devices to CN3 by functional safety parameters. The devices can be input via network if the safety sub-function is controlled by network.

The STO function operates by the STO command.

The SS1 function operates by the SS1 command.

5.3 Output devices The CN3 output the status monitor (SM) of the safety sub-function. The output devices can be assigned to CN3 by functional safety parameters. The status monitor can be output via network if the safety sub-function is controlled by network. In that case, the CN3 can also be used at the same time.

4.3.3 Output signal sequence An operation sequence with STOS (STO output) assigned to the input wiring CN3-11A and CN3-11B pins is shown as

4.3.1 I/O signal sequence An operation sequence with the SLS function achieved by the input wiring CN3-8A and CN3-8B pins is shown as an

### Setting method

If using the safety sub-function, follow the procedure in this chapter.

Step	Detailed explanation		
Checking the wiring	Check that the CN3 connector and network have been wired correctly.		
Setting functional safety parameters	Refer to information on the settings of the function and set functional safety parameters.		
Setting a password	Set a password for the functional safety parameters to prevent them from being changed easily.		
Verifying functional safety parameters	Read the functional safety parameters to verify that they have been set correctly.		
Ensuring the correct functioning of safety sub-functions	Ensure that the safety sub-functions work correctly.		

6.1 Parameter setting The safety sub-function parameters can be set with MR Configurator2. Settings related to the safety sub-function are been sub-function parameters have a password to prevent unintended The safety sub-function parameters. The safety such minimic comparators, county rotated to the output such as configured with this group of parameters. The safety sub-function parameters have a password to prevent unin changes of the parameters. The password is "000000" at the factory setting. The following parameters must be set.

Parameter	Name	Detailed explanation
PSA01.0	Safety sub-function activation setting	Set this parameter to "1" only after confirming the settings of the functional set by functional safety parameters.
PSA01.1	Input mode selection	Set the safety sub-function to be controlled either by input device or by network.
PSA02	Functional safety setting	Recommended parameter settings and achievable safety levels differ depending on the system configuration.
PSA03	SS1 deceleration monitor time	Settings of the parameters for the SS1 function are necessary as the SS1 function is to be used if a problem is found by self-diagnosis.
PSA20	Servo motor encoder resolution	Set the encoder resolution of the servo motor being connected. This parameter does not need to be set if position/speed monitoring is not performed.
PSA23	Servo motor rated speed	The rated speed of the servo motor being connected must be set if speed monitoring is performed.
PSC03	Functional safety - Rotation direction selection/Movement direction selection	Set the same value in [Pr. PSC03.0] and [Pr. PA14 Rotation direction selection/travel direction selection].
PSL02	Functional safety - Linear motor encoder resolution - Numerator	The observation direction by the SDIP command is the address increasing direction. If POL is set to *1*, the observation direction is the address increasing direction (CW or negative direction).
PSL03	Functional safety - Linear motor encoder resolution -	If position/speed monitoring is performed with a linear servo motor, set this parameter to the same value as [Pr. PL02] and [Pr. PL03].

## 6.2 Test operation

6.2 Test operation Test operation can be performed with the safety sub-function temporarily disabled. Set [Pr. PSA01.1 Input mode selection] to "2". Some of the diagnosis functions and the safety sub-functions are disabled in the test operation mode. The test operation can be used for JOG operation, positioning operation, machine analyzer, or other operations if safety devices have not been started up. Cerent the test operation can be used [PF. PSA01.1 Input mode selection] to "0" or "1" depending on the system configuration

7. Troubleshooting Details of main alarms related to the safety sub-function are shown in the following table.

Alarm name	Alarm No.	Cause	Action
STO timing error	063.1	When detection of [AL 063 STO timing error] is enabled, STO1 was turned off (enabled) under the following speed conditions. Rotary servo motor speed: 50 r/min or higher Linear servo motor speed: 50 mm/s or higher	After the servo motor stops, turn off (enable) STO1. Review the setting of "STO timing error selection" by using any of the following parameters. [G]: [Pr. PF06.1 STO timing error selection]
	063.2	When detection of [AL 063 STO timing error] is enabled, STO2 was turned off (enabled) under the following speed conditions. Rotary servo motor speed: 50 r/min or higher Linear servo motor speed: 50 mm/s or higher	After the servo motor stops, turn off (enable) STO2. Review the setting of "STO timing error selection" by using any of the following parameters. [G]: [Pr. PF06.1 STO timing error selection]
Encoder initial communication - Receive data error 1 (safety sub-function)	066.1 516.1	There is a problem with the encoder cable.	Check if the encoder cable has been disconnected or has shorted. If there is a problem with the cable, repair or replace the cable.
STO	068.1	STO1 or STO2 is inputted incorrectly.	Check that STO1 and STO2 of the CN3 connector are wired correctly.
error		The input status of \$101 and \$102 are dillerent.	input status for STO1 and STO2 are different, create the same
		The setting of [Pr. PF18 STO diagnosis error detection time] is incorrect.	Set a longer time in the servo parameter setting, and then check the repeatability. If the error does not repeat, review the value of the servo parameter.
Network	086.1	The STO circuit has malfunctioned. A network cable has been disconnected	Replace the MR-JET. Check if the network cable is connected correctly
communication error	000.1		onour internetion dable is connected contexty.
STO function error	168.1	An MR-JET that is not compatible with the STO function does not have a short-circuit connector connected to its CN3 connector.	Install the short-circuit connector attached to the MR-JET in the CN3.
Position feedback error (safety sub-function)	52A.1	The position feedback data does not change within the time set in [Pr. PSA22 Position feedback error detection time].	Review the setting of [Pr. PSA22]. Alternatively, perform operation by the end of the time set within [Pr. PSA22].
Parameter setting range error (safety	537.1	A functional safety parameter has been set outside of its setting range.	Check the parameter error No. on the alarm display screen of MR Configurator2 or with another method, then review the setting value of the functional safety parameter.
sub-function)	537.2	A servo parameter or a functional safety parameter has been set incorrectly.	Check the parameter error No. on the alarm display screen of MR Configurator2 or with another method, then review the setting value of the servo parameter or the functional safety parameter.
Parameter verification error (safety sub-function)	53A.2	A functional safety parameter has an error.	Check the parameter which has an error with MR Configurator2, then set the parameter correctly.
Output device diagnosis error 1 (safety	555.1	A signal of an output device has not been output correctly or the load of the output device is out of the specification range.	Check if the output device cable is wired correctly. Alternatively, check if the load of the output device is within specifications.
sub-function)		Current of an output device is too large.	Check if the current value is within specifications. If the value is out of specifications, lower the output current.
Input device mismatch detection (safety sub- function)	557.1	The input signal mismatch between the CN3-8A and the CN3-8B continued longer than the specified time (the time set in [Pr. PSD18 Mismatch permissible time SD11]).	Review the wiring. Alternatively, set [Pr. PSD18 Mismatch permissible time SD11] to a longer time than the mismatched time between the CN3-8A and the CN3-8B.
Safety speed monitor error 1 (safety sub- function)	561.1	The state where the absolute value of the servo motor speed exceeds [Pr. PSA11 SLS speed 1] continued for longer than the time set in [Pr. PSA15 Speed detection delay time] while the SLS function is activated.	Check the parameter or the operation pattern. Take actions such as setting the speed command to a value equal to or lower than [Pr. PSA11] or setting time required for deceleration in [Pr. PSA07 SLS deceleration monitor time 1].
		The settings of the electronic gear are incorrect. The connection destination of the encoder cable is incorrect.	Check the setting value of the electronic gear. Check the connection destination of the encoder.
Deceleration monitor error (safety sub- function)	563.1	The servo motor speed exceeded the speed which is determined by the observation speed of when the SS1 command has been turned off and the observation speed according to [Pr. PSA24 SS1 Deceleration observation time constant].	Check the parameter or the operation pattern. Take actions such as setting a longer time in [Pr. PSA26 SS1 deceleration monitor delay time] or adjusting the servo gains.
		The connection destination of the encoder cable is incorrect.	Check the connection destination of the encoder.
		There is a problem with the servo motor or servo motor power cable.	Replace the servo motor or servo motor power cable.
Direction monitor error (safety sub- function)	565.1	The servo motor traveled in the address increasing direction while the SDI function is activated.	Check the parameter or the operation pattern. Check if a command for the address increasing direction has been input.
Torque monitor error 1 (safety sub- function)	568.1	The connection of the servo motor is incorrect. The torque feedback exceeded the torque specified in the parameters ([Pr. PSB12 SLT1 Torque (positive direction)] and [Pr. PSB16 Torque (negative direction)]) after the SLT function has been activated	Check the UV/W Wing. Check the parameter or the operation pattern. Check if the threshold of the torque monitor is too small or if the servo motor collides with the machine.
Safety communication setting error (safety sub- function)	580.3	The safety verification code of the controller and the setting of [Pr. PSC06 Safety verification code] do not match.	The controller may have been communicated with an unintended MR- JET. Check if the IP address of the safety communication setting on the master station matches the IP address setting of the corresponding MR-JET.
FSoE Address mismatch error (safety sub-function)	584.1	FSoE Address set in FSoE Master does not match the setting of [Pr. PSC07 FSoE Address setting].	Review the setting of FSoE Address in FSoE Master or the setting of [Pr. PSC07 FSoE Address setting].
FSoE communicatio n parameter setting error (safety sub- function)	584.2	The setting value of FSoE Watchdog Timer notified from FSoE Master does not correspond to the MR-JET.	Review the setting value of FSoE Watchdog Timer set in FSoE Master.
FSoE communicatio n error 2 - Receive time- out error (safety sub-	586.5	The safe communication update time exceeded the time set in FSoE Watchdog Time.	Review the setting value of FSoE Watchdog Time set in FSoE Master.

8. Maintenance, inspection, and environment

Refer to chapter 6 and 7 in "MR-JET Safety Instructions and Precautions for AC Servos (IB(NA)0300492)".

9. Check list for user documentation

Refer to chapter 9 in "MR-JET Safety Instructions and Precautions for AC Servos (IB(NA)0300492)".