

Operation Manual

PRODUCT NAME

AC Servo Motor Driver (SSCNETI/H Type)

MODEL/ Series

LECSS2-T Series



SMC Corporation

LECSS2-T Series / Driver 1. Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of "Caution," "Warning" or "Danger." They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC), Japan Industrial Standards (JIS)*1) and other safety regulations*2).

*1) ISO 4414: Pneumatic fluid power -- General rules relating to systems

- ISO 4413: Hydraulic fluid power -- General rules relating to systems
- IEC 60204-1: Safety of machinery -- Electrical equipment of machines (Part 1: General requirements)
- ISO 10218-1992: Manipulating industrial robots -- Safety
- JIS B 8370: General rules for pneumatic equipment.
- JIS B 8361: General rules for hydraulic equipment.
- JIS B 9960-1: Safety of machinery Electrical equipment for machines. (Part 1: General requirements)

JIS B 8433-1993: Manipulating industrial robots - Safety. etc.

2) Labor Safety and Sanitation Law, etc.

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ Caution indicates a hazard with a low level of risk which, if not avoided, could result in minor or Caution moderate injury. Warning indicates a hazard with a medium level of risk which, if not avoided, could result in I Warning death or serious injury. Danger indicates a hazard with a high level of risk which, if not avoided, will result in death or Danger serious injury.

Warning

1. The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results.

The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product.

This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

2. Only personnel with appropriate training should operate machinery and equipment.

The product specified here may become unsafe if handled incorrectly.

The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

3. Do not service or attempt to remove product and machinery/equipment until safety is confirmed.

The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.

When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.

Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

4. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.

1) Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.

- 2) Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalog.
- 3) An application which could have negative effects on people, property, or animals requiring special safety



analysis.

4) Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.

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.



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 installation guide, always keep it accessible to the operator.



LECSS2-T Series / Driver 1. Safety Instructions

The product is provided for use in manufacturing industries.

The product is provided for use in manufacturing industries. The product herein described is basically provided for peaceful use in manufacturing industries. If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract if necessary.

If anything is unclear, contact your nearest sales branch.

Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following "Limited warranty and Disclaimer" and "Compliance Requirements".

Read and accept them before using the product.

Limited warranty and Disclaimer

The warranty period of the product is 1 year in service or 1.5 years after the product is delivered.*3) Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.

For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided. This limited warranty applies only to our product independently, and not to any other damage incurred

This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.

Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.

*3) Vacuum pads are excluded from this 1 year warranty.

A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.

Also, even within the warranty period, the wear of a product due to the use of the vacuum pad

or failure due to the deterioration of rubber material are not covered by the limited warranty.

Compliance Requirements

When the product is exported, strictly follow the laws required by the Ministry of Economy, Trade and Industry (Foreign Exchange and Foreign Trade Control Law).

1. To prevent electric shock, note the following

 Before wiring and inspections, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between P+ and N- is safe with a voltage tester and others. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the driver. Ground the driver and serve 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 driver 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 s driver. Otherwise, it may cause an electric shock.
Do not operate the driver 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 driver even if the power is off. The driver is charged and you may get an electric shock.
To prevent an electric shock, always connect the protective earth (PE) terminal (marked) of the driver to the protective earth (PE) of the cabinet.
 When using a residual current device (RCD), select the type B. To avoid an electric shock, insulate the connections of the power supply terminals.

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

3. To prevent injury, note the following

- •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 driver heat sink, regenerative resistor, servo motor, etc. may be hot while power is on or for some time after power-off. Take safety measures, e.g. provide covers, to prevent accidental contact of hands and parts (cables, etc.) with them.

4. Additional instructions

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

(1) Transportation and installation

\land 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 driver. Otherwise, it may drop. Install the driver and the servo motor in a load-bearing place in accordance with the Instruction Manual. •Do not get on or put heavy load on the equipment. •The equipment must be installed in the specified direction. •Leave specified clearances between the driver and the cabinet walls or other equipment. Do not install or operate the driver and servo motor which have been damaged or have any parts missing. •Do not block the intake and exhaust areas of the driver. Otherwise, it may cause a malfunction. •Do not drop or strike the driver and servo motor. Isolate them from all impact loads. When you keep or use the equipment, please fulfill the following environment. Conditions Environment Driver Servo motor In operation [°C] 0 to +55 (non-freezing) 0 to +40 (non-freezing) Ambient [°F] 32 to 131 (non-freezing) 32 to 104 (non-freezing) temperature [$^{\circ}$ C] -20 to +65 (non-freezing) -15 to +70 (non-freezing)

	in storage	[°F]	-4 to 149 (non-freezi	ng)	5 to 158 (non-freezing)		
Ambient	In operation		90%RH or less (non-c	ondensing)	80%RH or less (non-condensing	J)	
humidity	In storage		90%RH or less (non-c	ondensing)			
Ambience		Indoors (no direct sunl	doors (no direct sunlight) Free from corrosive gas, flammable gas, oil mist, dust and dirt				
Altitude		Max. 1000m (3280 ft) above sea level					
					LECSS2-T5		
(Note)	[m/s ²] 5.9 or le					LECSS2-T7	
Vibration		[m/s ²] 5.9 or less	5.9 or less		LECSS2-T8	X • Y: 49	
				LECSS2-T9 series			

•When the equipment has been stored for an extended period of time, consult your local sales office.

•When handling the driver, be careful about the edged parts such as corners of the driver.

The driver must be installed in the metal cabinet.

(2) Wiring



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

(4) Usage

- Provide an external emergency stop circuit to ensure that operation can be stopped and power switched off immediately.
- •Do not disassemble, repair, or modify the equipment.
- Before resetting an alarm, make sure that the run signal of the driver is off in order to prevent a sudden restart. Otherwise, it may cause an accident.

A CAUTION •Use a noise filter, etc. to minimize the influence of electromagnetic interference. Electromagnetic interference may be given to the electronic equipment used near the driver. Burning or breaking a driver may cause a toxic gas. Do not burn or break it. •Use the driver with the specified servo motor. The lock 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 lock may not hold the motor shaft. To ensure safety, install a stopper on the machine side. (5) Corrective actions When it is assumed that a hazardous condition may occur due to a power failure or product malfunction, use a servo motor with a lock or external lock to prevent the condition. Do not use the 24 V DC interface power supply for the lock. Configure a lock circuit so that it is activated also by an external EMG stop switch. Contacts must be opened when ALM (Malfunction) or MBR (Electromagnetic brake interlock) turns off. Contacts must be opened with the EMG 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

With age, the electrolytic capacitor of the driver will deteriorate. To prevent a secondary accident due to a malfunction, it is recommend that the electrolytic capacitor be replaced every 10 years when it is used in general environment. Please contact your local sales office.

(7) General instruction

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

• DISPOSAL OF WASTE •

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

\land EEP-ROM life

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

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

STO function of the driver

When using the STO function of the driver, refer to chapter 13.

Compliance with global standards

For the compliance with global standards, refer to appendix 4.

«About the manuals»

You must have this Instruction Manual and the following manuals to use this servo. Ensure to prepare them to use the LECSS2-T safely.

«Wiring»

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

«U.S. customary units»

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

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

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1. FUNCTIONS AND CONFIGURATION

1.1 Summary

The LECSS2-T \square series general-purpose AC servo has further higher performance and higher functions compared to the previous LECSS \square -S \square series.

LECSS2-T driver is connected to PC or PLC...etc controllers, including a servo system controller, on the high-speed synchronous network SSCNET III/H. The driver directly receives a command from a PC or PLC...etc to drive a servo motor.

LECSS2-T series compatible servo motor is equipped with 22-bit (4194304 pulses/rev) high-

resolution absolute encoder. In addition, speed frequency response is increased to 2.5 kHz. Thus, faster and more accurate control is enabled as compared to LECSS \Box -S \Box series.

With one-touch tuning and real-time auto tuning, you can automatically adjust the servo gains according to the machine.

The tough drive function and the drive recorder function, which are well-received in the LECSA \Box -S \Box series, have been improved. The LECSS2-T \Box driver supports the improved functions. Additionally, the preventive maintenance support function detects an error in the machine parts. This function provides strong support for the machine maintenance and inspection.

SSCNET III/H achieves high-speed communication of 150 Mbps full duplex with high noise immunity due to the SSCNET III optical cables. Large amounts of data are exchanged in real-time between the PC or PLC...etc and the driver. Servo monitor information is stored in the upper information system and is used for control.

On the SSCNET III/H network, the stations are connected with a maximum distance of 100 m between them. This allows you to create a large system.

The LECSS2-T driver supports the Safe Torque Off (STO) function for safety. When the LECSS2-T driver is connected to a SSCNET III/H-compatible motion controller, in addition to the STO function, the driver also supports the Safe Stop 1 (SS1), Safe Stop 2 (SS2), Safe Operating Stop (SOS), Safely-Limited Speed (SLS), Safe Brake Control (SBC), and Safe Speed Monitor (SSM) functions.

The LECSS2-T driver has a USB communication interface. Therefore, you can connect the driver to the personal computer with setup software (MR Configurator2) installed to perform the parameter setting, test operation, gain adjustment, and others.

1.2 Function block diagram

The function block diagram of this servo is shown below.

(1) LECSS2-T



- Note 1. The built-in regenerative resistor is not provided for LECSS2-T5.
 - 2. For 1-phase 200 V AC to 240 V AC, connect the power supply to L1 and L3. Leave L2 open. Refer to section 1.3 for the power supply specifications.
 - 3. Driver LECSS2-T9 have a cooling fan.
 - 4. LECSS2-T□ driver has P3 and P4 in the upstream of the inrush current suppression circuit. They are different from P1 and P2 of LECSS□-S□ drivers.
 - 5. Short P3 and P4.

1.3 Driver standard specifications

Model: LECSS2-T		5	7	8	9	
Rated voltage			3-phase 1	70 V AC	•	
Oulpul	Rated current [A]		1.1	1.5	2.8	
	Voltage/Frequency		3-phase or 1-	phase 200 V A0	C to 240 V AC,	50 Hz/60 Hz
	Rated current	[A]	0.9	1.5	2.6	3.8
Main circuit power	Permissible voltage fluctuation		3	phase or 1-pha- 264 V	ase 170 V AC to / AC	
supply	Permissible frequency fluctu	ation		Within	±5%	
	Power supply capacity [kVA]			Refer to see	ction 10.2.	
	Inrush current	[A]		Refer to section 10.5.		
	Voltage/Frequency		1-phase	e 200 V AC to 24	40 V AC, 50 Hz	/60 Hz
	Rated current	[A]		0.2	2	
Control circuit power	fluctuation			I-phase 170 V A	AC to 264 V AC	
Supply	Permissible frequency fluctu	ation		Within	±5%	
	Power consumption	[W]		30)	
	Inrush current	[A]		Refer to see	ction 10.5.	
Interface power supply	Voltage		(Nata 1)	24 V DC	$\pm 10\%$	vignala)
Control method	Current capacity [A]			0.3 (Including C		method
Dynamic brake			Sille-way	E F WIN COLLIN, Built		metrioù
SSCNET III/H communicatio	on cycle			0.222 ms, 0.444	l ms, 0.888 ms	
(Note 5) Communication			USB: conr	nection to a pers	sonal computer	or others
function	unction (setup software (MR Configurator2)-compatible)			ipatible)		
Encoder output pulses			C	Compatible (A/B/	/Z-phase pulse)	
Analog monitor Two channels						
Protective functions			overload shut-off (electronic thermal), servo motor overheat protection, encoder error protection, regenerative error protection, undervoltage protection, instantaneous power failure protection, overspeed protection, error excessive protection, magnetic pole, and detection protection			
Safety function			mag	STO (IEC/EN	61800-5-2)	
	Standards certified by CB		EN ISO 13849- SI	1 category 3 PL L CL 2, and EN	d, EN 61508 SI 61800-5-2 SIL	L 2, EN 62061 2
	Response performance		8 ms or	less (STO input	off \rightarrow energy s	hut off)
Safety performance	(Note 3) Test pulse input (STO)		Test pulse interval: 1 Hz to 25 Hz Test pulse off time: Up to 1 ms			
	Mean time to dangerous failu	ure (MTTFd)	100 years or longer			
	Diagnosis coverage (DC)	- (-)		Medium (90	% to 99%)	
	Average probability of dange per hour (PFH)	erous failures	1.68 × 10 ⁻¹⁰ [1/h]			
Compliance to global standards	CE marking		LVD: EN 61800-5-1 EMC: EN 61800-3 MD: EN ISO 13849-1, EN 61800-5-2, EN 62061		N 62061	
Structure (IP rating)			1	Natural cooling, open (IP20)		Force cooling, open (IP20)
Close mounting (Note 2)	i			Poss	ible	
	Ambient temperature	Operation		0 °C to 55 °C (non-freezing)	
	Ambient humidity	Operation	ar	-20 0 10 00 0 (non-condensing)
Environment	Ambience	Storage	Indoors (no direct sunlight),			
			free from corrosive gas, flammable gas, oil mist, dust, and d			t, dust, and dirt
	Vibration resistance		1000 m or less above sea level 5.9 m/s ² at 10 Hz to 55 Hz (directions of X, X and Z avec)			and 7 axes)
Mass		[ka]	0.	8	1.0	1.4

1. FUNCTIONS AND CONFIGURATION

- Note 1. 0.3 A 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. When closely mounting the driver of 3.5 kW, operate them at the ambient temperatures of 0 °C to 45 °C or at 75% or smaller effective load ratio.
 - 3. Test pulse is a signal which instantaneously turns off a signal to the driver at a constant period for external circuit to selfdiagnose.
 - 4. Except for the terminal block.
 - 5. The communication cycle depends on the PC or PLC...etc specifications and the number of axes connected.

1.4 Combinations of driver and servo motors

Drivor	Servo motor
Diwei	LE-□-□
LECSS2-T5	T5, T6
LECSS2-T7	Τ7
LECSS2-T8	T8
LECSS2-T9	Т9

1.5 Function list

The following table lists the functions of this servo. For details of the functions, refer to each section of the detailed description field.

Function	Description	
Position control mode	This servo is used as a position control servo.	
Speed control mode	This servo is used as a speed control servo.	
Torque control mode	This servo is used as a torque control servo.	
High-resolution encoder	High-resolution encoder of 4194304 pulses/rev is used as the encoder of the servo motor compatible with the LECSS2-T□ series.	
Absolute position detection system	Merely setting a home position once makes home position return unnecessary at every power-on.	Chapter 12
Gain switching function	You can switch gains during rotation and during stop, and can use an input device to switch gains during operation.	Section 7.2
Advanced vibration suppression control II	This function suppresses vibration at the arm end or residual vibration.	Section 7.1.5
Adaptive filter II	Driver detects mechanical resonance and sets filter characteristics automatically to suppress mechanical vibration.	Section 7.1.2
Low-pass filter	Suppresses high-frequency resonance which occurs as servo system response is increased.	Section 7.1.4
Machine analyzer function	Analyzes the frequency characteristic of the mechanical system by simply connecting a setup software (MR Configurator2) installed personal computer and driver.	
Robust filter	This function provides better disturbance response in case low response level that load to motor inertia ratio is high for such as roll send axes.	[Pr. PE41]
Slight vibration suppression control	Suppresses vibration of ±1 pulse produced at a servo motor stop.	[Pr. PB24]
Auto tuning	Automatically adjusts the gain to optimum value if load applied to the servo motor shaft varies.	Section 6.3
Regenerative option	Used when the built-in regenerative resistor of the driver does not have sufficient regenerative capability for the regenerative power generated.	Section 11.2
Alarm history clear	Alarm history is cleared.	[Pr. PC21]
Output signal selection (device settings)	The output devices including ALM (Malfunction) and DB (Dynamic brake interlock) can be assigned to certain pins of the CN3 connector.	[Pr. PD07] to [Pr. PD09]
Output signal (DO) forced output	Output signal can be forced on/off independently of the servo status. Use this function for checking output signal wiring, etc.	Section 4.5.1 (1) (d)
Test operation mode	Jog operation, positioning operation, motor-less operation, DO forced output, and program operation Setup software (MR Configurator2) is necessary for this function.	Section 4.5
Analog monitor output	Servo status is output in terms of voltage in real time.	[Pr. PC09], [Pr. PC10]
Setup software (MR Configurator2)	Using a personal computer, you can perform the parameter setting, test operation, monitoring, and others.	Section 11.7
One-touch tuning	Gain adjustment is performed just by one click on a certain button on setup software (MR Configurator2). Setup software (MR Configurator2) is necessary for this function.	Section 6.2

1. FUNCTIONS AND CONFIGURATION

Function	Description	Detailed explanation
Tough drive function	This function makes the equipment continue operating even under the condition that an alarm occurs. The tough drive function includes two types: the vibration tough drive and the instantaneous power failure tough drive.	Section 7.3
Drive recorder function	 This function continuously monitors the servo status and records the status transition before and after an alarm for a fixed period of time. You can check the recorded data on the drive recorder window on setup software (MR Configurator2) by clicking the "Graph" button. However, the drive recorder will not operate on the following conditions. You are using the graph function of setup software (MR Configurator2). You are using the machine analyzer function. [Pr. PF21] is set to "-1". The PC or PLCetc is not connected (except the test operation mode). An alarm related to the PC or PLCetc is occurring. 	[Pr. PA23]
STO function	This function is a safety function that complies with IEC/EN 61800-5-2. You can create a safety system for the equipment easily.	
Driver life diagnosis function	You can check the cumulative energization time and the number of on/off times of the inrush relay. This function gives an indication of the replacement time for parts of the driver including a capacitor and a relay before they malfunction. Setup software (MR Configurator2) is necessary for this function.	
Power monitoring function	This function calculates the power running energy and the regenerative power from the data in the driver such as speed and current. For the SSCNET III/H system, Setup software (MR Configurator2) can display the data, including the power consumption. Since the driver can send the data to a motion controller, you can analyze the data and display the data on a display.	
Machine diagnosis function	From the data in the driver, this function estimates the friction and vibrational component of the drive system in the equipment and recognizes an error in the machine parts, including a ball screw and bearing. Setup software (MR Configurator2) is necessary for this function.	

1.6 Model designation

(1) Rating plate



(2) Option Model

a) Motor cable / Lock cable / Encoder cable



1. FUNCTIONS AND CONFIGURATION





*LE-CSNS is 10126-3000PE (Connector)/ 10320-52F0-008 (Shell kit) of Sumitomo 3M Limited or equivalent goods. Applicable wire size: AWG24~30

d) Regenerative options



e) Setup software (MR Configurator2) (Japanese version)



NIL	Japanese version
Е	English version
С	Chinese version

* SW1DNc-MRC2-J of Mitsubishi Electric Corporation.

Refer to the website of Mitsubishi Electric Corporation for the information of the operating environment and upgrading. Order USB cable separately.

*LECSS2-T cannot be used by LEC-MR-SETUP221 .

f) USB cable(3m)



* MR-J3USB of Mitsubishi Electric Corporation.

g) Battery

LEC-MR-BAT6V1SET

* MR-BAT6V1SET of Mitsubishi Electric Corporation. Battery for replacement. Absolute position data is maintained by installing the battery to the driver.

h) STO cable(3m)

LEC-MR-D05UDL3M

* MR-D05UDL3M of Mitsubishi Electric Corporation. It is a cable that connects the driver with the equipment when the safety function is used. Do not use other cables.

1. FUNCTIONS AND CONFIGURATION

1.7 Structure





No.	Name/Application	Detailed explanation
(1)	Display The 3-digit, seven-segment LED shows the servo status and the alarm number.	Chapter 4
(2)	Axis selection rotary switch (SW1) Used to set the axis No. of driver.	
(3)	Control axis setting switch (SW2) The test operation switch, the control axis deactivation setting switch, and the auxiliary axis number setting switch are available.	Section 4.3
(4)	USB communication connector (CN5) Connect with the personal computer.	Section 11.3
(5)	I/O signal connector (CN3) Used to connect digital I/O signals.	Section 3.2 Section 3.4
(6)	STO input signal connector (CN8) Used to connect STO cable.	Chapter 13
(7)	SSCNET III cable connector (CN1A) Used to connect the servo system controller or the previous axis driver.	Section 3.2
(8)	SSCNET III cable connector (CN1B) Used to connect the next axis driver. For the final axis, put a cap.	Section 3.4
(9)	Encoder connector (CN2) Used to connect the servo motor encoder.	Section 3.4
(10)	Battery connector (CN4) Used to connect the battery or the battery unit for absolute position data backup.	Chapter 12
(11)	Battery holder Install the battery for absolute position data backup.	Section 12.4
(12)	Protective earth (PE) terminal Grounding terminal	Section 3.1
(13)	Main circuit power supply connector (CNP1) Connect the input power supply.	Section 3.3
(14)	Rating plate	Section 1.6
(15)	Control circuit power supply connector (CNP2) Connect the control circuit power supply and regenerative option.	Section 3.1
(16)	Servo motor power output connector (CNP3) Connect the servo motor.	
(17)	Charge lamp When the main circuit is charged, this will light. While this lamp is lit, do not reconnect the cables.	

1. FUNCTIONS AND CONFIGURATION

1.8 Configuration including peripheral equipment



POINT
 Equipment other than the driver and servo motor are optional or recommended products.

(1) LECSS2-T□



Note 1. Short P3 and P4.

- 2. For 1-phase 200 V AC to 240 V AC, connect the power supply to L1 and L3. Leave L2 open. Refer to section 1.3 for the power supply specifications.
- 3. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.

2. INSTALLATION	
2.1 Installation direction and clearances	
2.2 Keep out foreign materials	
2.3 Encoder cable stress	
2.4 SSCNET III cable laying	
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-	

2. INSTALLATION

WARNING • To prevent electric shock, ground each equipment securely.

Stacking in excess of the specified number of product packages is not allowed. Install the equipment on incombustible material. Installing it directly or close to combustibles will lead to a fire. Install the driver and the servo motor in a load-bearing place in accordance with this manual. • Do not get on or put heavy load on the equipment. Otherwise, it may cause injury. Output the equipment within the specified environment. For the environment, refer to section 1.3. Provide an adequate protection to prevent screws and other conductive matter, oil and other combustible matter from entering the driver. •Do not block the intake and exhaust areas of the driver. Otherwise, it may cause a malfunction. Do not drop or strike the driver. Isolate it from all impact loads. •Do not install or operate the driver which have been damaged or have any parts missing. •When the equipment has been stored for an extended period of time, contact your local sales office. When handling the driver, be careful about the edged parts such as corners of the driver. •The driver must be installed in the metal cabinet.

POINT

When pulling out CNP1, CNP2, and CNP3 connectors of LECSS2-T8 or less drivers, pull out CN3 and CN8 connectors 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 driver and the cabinet walls or other equipment. Otherwise, it may cause a malfunction.

(1) Installation clearances of the driver(a) Installation of one driver



(b) Installation of two or more drivers

POINT

•Close mounting is possible depending on the capacity of the driver. Refer to section 1.3 for availability of close mounting.

•When mounting the drivers closely, do not install the driver whose depth is larger than that of the left side driver since CNP1, CNP2, and CNP3 connectors cannot be disconnected.

Leave a large clearance between the top of the driver and the cabinet walls, and install a cooling fan to prevent the internal temperature of the cabinet from exceeding the environment.

When mounting the drivers closely, leave a clearance of 1 mm between the adjacent drivers in consideration of mounting tolerances. In this case, keep the ambient temperature within 0 $^{\circ}$ C to 45 $^{\circ}$ C or use the driver with 75% or less of the effective load ratio.



(2) Others

When using heat generating equipment such as the regenerative option, install them with full consideration of heat generation so that the driver is not affected. Install the driver 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 the driver.
- (2) Prevent oil, water, metallic dust, etc. from entering the driver 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 Encoder cable stress

- (1) The way of clamping the cable must be fully examined so that bending stress and cable's own weight stress are not applied to the cable connection.
- (2) For use in any application where the servo motor moves, fix the cables (encoder, power supply, and lock) with having some slack from the connector connection part of the servo motor to avoid putting stress on the connector connection part. Use the optional encoder cable within the bending life range. Use the power supply and lock wiring cables within the bending life of the cables.
- (3) Avoid any probability that the cable sheath might be cut by sharp chips, rubbed by a machine corner or stamped by workers or vehicles.
- (4) For installation on a machine where the servo motor moves, the bending radius should be made as large as possible. Refer to section 10.4 for the bending life.

2.4 SSCNET III cable laying

SSCNET III cable is made from optical fiber. If optical fiber is added a power such as a major shock, lateral pressure, haul, sudden bending or twist, its inside distorts or breaks, and optical transmission will not be available. Especially, as optical fiber for LE-CSS-□ is made of synthetic resin, it melts down if being left near the fire or high temperature. Therefore, do not make it touched the part, which can become hot, such as heat sink or regenerative option of driver.

Read described item of this section carefully and handle it with caution.

(1) Minimum bend radius

Make sure to lay the cable with greater radius than the minimum bend radius. Do not press the cable to edges of equipment or others. For SSCNET III cable, the appropriate length should be selected with due consideration for the dimensions and arrangement of driver. When closing the door of cabinet, pay careful attention for avoiding the case that SSCNET III cable is hold down by the door and the cable bend becomes smaller than the minimum bend radius. For the minimum bend radius, refer to section 11.1.3.

(2) Prohibition of vinyl tape use

Migrating plasticizer is used for vinyl tape. Keep the LE-CSS-□ cables away from vinyl tape because the optical characteristic may be affected.



SSCNET III cable	Cord
LE-CSS-	Δ

∆: Phthalate ester plasticizer such as DBP and DOP may affect optical characteristic of cable.



(3) Precautions for migrating plasticizer added materials

Generally, soft polyvinyl chloride (PVC), polyethylene resin (PE) and fluorine resin contain nonmigrating plasticizer and they do not affect the optical characteristic of SSCNET III cable. However, some wire sheaths and cable ties, which contain migrating plasticizer (phthalate ester), may affect LE-CSS-□ cable.

A chemical substance may affect its optical characteristic. Therefore, previously check that the cable is not affected by the environment.

(4) Bundle fixing

Fix the cable at the closest part to the connector with bundle material in order to prevent SSCNET III cable from putting its own weight on CN1A/CN1B connector of driver. Optical cord should be given loose slack to avoid from becoming smaller than the minimum bend radius, and it should not be twisted.

When bundling the cable, fix and hold it in position by using cushioning such as sponge or rubber which does not contain migratable plasticizers.

If adhesive tape for bundling the cable is used, fire resistant acetate cloth adhesive tape 570F (Teraoka Seisakusho Co., Ltd) is recommended.



(5) Tension

If tension is added on optical cable, the increase of transmission loss occurs because of external force which concentrates on the fixing part of optical fiber or the connecting part of optical connector. Doing so may cause the breakage of the optical fiber or damage of the optical connector. For cable laying, handle without putting forced tension. For the tension strength, refer to section 11.1.3.

(6) Lateral pressure

If lateral pressure is added on optical cable, the optical cable itself distorts, internal optical fiber gets stressed, and then transmission loss will increase. Doing so may cause the breakage of the optical cable. As the same condition also occurs at cable laying, do not tighten up optical cable with a thing such as nylon band (TY-RAP).

Do not trample it down or tuck it down with the door of cabinet or others.
(7) Twisting

If optical fiber is twisted, it will become the same stress added condition as when local lateral pressure or bend is added. Consequently, transmission loss increases, and the breakage of optical fiber may occur.

(8) Disposal

When incinerating optical cable (cord) used for SSCNET III, hydrogen fluoride gas or hydrogen chloride gas which is corrosive and harmful may be generated. For disposal of optical fiber, request for specialized industrial waste disposal services who has incineration facility for disposing hydrogen fluoride gas or hydrogen chloride gas.

2.5 Inspection items



CAUTION
 Do not perform insulation resistance test on the driver. Otherwise, it may cause a malfunction.
 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 driver.
- (4) Check that the wires are not coming out from the connector.
- (5) Check for dust accumulation on the driver.
- (6) Check for unusual noise generated from the driver.

2.6 Parts having service lives

Service lives of the following parts are listed below. However, the service lives vary depending on operation and environment. If any fault is found in the parts, they must be replaced immediately regardless of their service lives.

Part name	Life guideline
Smoothing capacitor	10 years
Relay	Number of power-on, forced stop by EM1 (Forced stop 1), and PC or PLCetc forced stop times: 100,000 times Number of on and off for STO: 1,000,000 times
Cooling fan	10,000 hours to 30,000 hours (2 years to 3 years)
Absolute position battery	Refer to section 12.2.

(1) Smoothing capacitor

The characteristic of smoothing capacitor is deteriorated due to ripple currents, etc. The life of the capacitor greatly depends on ambient temperature and operating conditions. The capacitor will reach the end of its life in 10 years of continuous operation in normal air-conditioned environment (40 °C surrounding air temperature or less).

(2) Relays

Contact faults will occur due to contact wear arisen from switching currents. Relays reach the end of their lives when the power has been turned on, forced stop by EM1 (Forced stop 1) has occurred, and PC or PLC...etc forced stop has occurred 100,000 times in total, or when the STO has been turned on and off 1,000,000 times while the servo motor is stopped under servo-off state. However, the lives of relays may depend on the power supply capacity.

(3) Driver cooling fan

The cooling fan bearings reach the end of their life in 10,000 hours to 30,000 hours. Normally, therefore, the cooling fan must be replaced in a few years of continuous operation as a guideline. It must also be changed if unusual noise or vibration is found during inspection.

The life indicates under the yearly average ambient temperature of 40 °C, free from corrosive gas, flammable gas, oil mist, dust and dirt.

3. SIGNALS AND WIRING.	
3.1 Input power supply circuit	
3.2 I/O signal connection example	
3.2.1 For sink I/O interface	
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3.4 Connectors and pin assignment	
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3.8 Interfaces	
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3.8.3 Source I/O interfaces	
3.9 SSCNET III cable connection	
3.10 Servo motor with a lock	
3.10.1 Safety precautions	
3.10.2 Timing chart	
3.11 Grounding	

∕	 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 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 driver. Ground the driver and servo motor securely. Do not attempt to wire the driver 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.
	 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.
	Driver 24 V DC DOCOM 24 V DC Control output Control output Signal Control output 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 driver.
- Do not install a power capacitor, surge killer or radio noise filter (FR-BIF of Mitsubishi Electric Corparation) with the power line of the servo motor.
- •When using the 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.



3.1 Input power supply circuit

	 Always connect a magnetic contactor between the power supply and the main circuit power supply (L1, L2, and L3) of the driver, in order to configure a circuit that shuts down the power supply on the side of the driver's power supply. If a magnetic contactor is not connected, continuous flow of a large current may cause a fire when the driver malfunctions.
[▲] CAUTION	 Use ALM (Malfunction) to switch main circuit power supply off. Not doing so may cause a fire when a regenerative transistor malfunctions or the like may overheat the regenerative resistor. Check the driver model, and then input proper voltage to the driver power supply. If input voltage exceeds the upper limit, the driver will break down. The driver has a built-in surge absorber (varistor) to reduce noise and to suppress
	 lightning surge. The variator can break down due to its aged deterioration. To prevent a fire, use a molded-case circuit breaker or fuse for input power supply. Connecting a servo motor of the wrong axis to U, V, W, or CN2 of the driver may cause a malfunction.

POINT

- Even if alarm has occurred, do not switch off the control circuit power supply. When the control circuit power supply has been switched off, optical module does not operate, and optical transmission of SSCNET III/H communication is interrupted. Therefore, the next axis driver displays "AA" at the indicator and turns into base circuit shut-off. The servo motor stops with starting dynamic brake.
- •EM2 has the same function as EM1 in the torque control mode.
- ●Connect the 1-phase 200 V AC to 240 V AC power supply to L1 and L3. One of the connecting destinations is different from LECSS□-S□ Series Driver's. When using LECSS2-T□ as a replacement for LECSS□-S□, be careful not to connect the power to L2.

Configure the wiring so that the main circuit power supply is shut off and the servo-on command turned off after deceleration to a stop due to an alarm occurring, an enabled servo forced stop, or an enabled PC or PLC...etc forced stop. A molded-case circuit breaker (MCCB) must be used with the input cables of the main circuit power supply.



(1) For 3-phase 200 V AC to 240 V AC power supply of LECSS2-T

- Note 1. Always connect between P3 and P4 terminals. (factory-wired)
 - 2. Always connect between P+ and D terminals. (factory-wired) When using the regenerative option, refer to section 11.2.
 - 3. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to section 11.1.
 - 4. If disabling ALM (Malfunction) output with the parameter, configure up the power supply circuit which switches off the magnetic contactor after detection of alarm occurrence on the PC or PLC...etc side.
 - 5. This diagram is for sink I/O interface. For source I/O interface, refer to section 3.8.3.
 - 6. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
 - 7. Configure a circuit to turn off EM2 when the main circuit power is turned off to prevent an unexpected restart of the driver.
 - 8. When not using the STO function, attach the short-circuit connector came with a driver.
 - 9. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker. (Refer to section 11.6.)
 - 10. Connecting a servo motor of the wrong axis to U, V, W, or CN2 of the driver may cause a malfunction.
 - 11. 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.

(2) For 1-phase 200 V AC to 240 V AC power supply of LECSS2-T \Box



Note 1. Always connect between P3 and P4 terminals. (factory-wired)

2. Always connect between P+ and D terminals. (factory-wired) When using the regenerative option, refer to section 11.2.

- 3. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to section 11.1.
- 4. If disabling ALM (Malfunction) output with the parameter, configure up the power supply circuit which switches off the magnetic contactor after detection of alarm occurrence on the PC or PLC...etc side.
- 5. This diagram is for sink I/O interface. For source I/O interface, refer to section 3.8.3.
- 6. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
- 7. Configure a circuit to turn off EM2 when the main circuit power is turned off to prevent an unexpected restart of the driver.
- 8. When not using the STO function, attach the short-circuit connector came with a driver.
- 9. When wires used for L11 and L21 are thinner than wires used for L1, and L3, use a molded-case circuit breaker. (Refer to section 11.6.)
- 10. Connecting a servo motor of the wrong axis to U, V, W, or CN2 of the driver may cause a malfunction.
- 11. 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 I/O signal connection example



3.2.1 For sink I/O interface



- Note 1. To prevent an electric shock, always connect the protective earth (PE) terminal (marked) of the driver to the protective earth (PE) of the cabinet.
 - 2. Connect the diode in the correct direction. If it is connected reversely, the driver will malfunction and will not output signals, disabling EM2 (Forced stop 2) and other protective circuits.
 - 3. If the PC or PLC...etc does not have forced stop function, always install the forced stop 2 switch (normally closed contact).
 - 4. When starting operation, always turn on EM2 (Forced stop 2). (Normally closed contact)
 - 5. Use LEC-MRC2E. (Refer to section 11.3.)
 - 6. Use SSCNET III cables listed in the following table.

Cable	Cable model	Cable length
Standard cord inside cabinet	LE-CSS-	0.15 m to 3 m

- 7. The wiring after the second driver is omitted.
- 8. Up to 64 axes of drivers can be connected. The number of connectable axes depends on the PC or PLC...etc you use. Refer to section 4.3 for setting of axis selection.
- 9. Make sure to cap the unused CN1B connector.
- 10. Supply 24 V DC ± 10% for interfaces from outside. Set the total current capacity to 300 mA. 300 mA 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. Refer to section 3.8.2 (1) 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.
- 11. ALM (Malfunction) turns on in normal alarm-free condition. (Normally closed contact)
- 12. The pins with the same signal name are connected in the driver.
- 13. You can change devices of these pins with [Pr. PD07], [Pr. PD08], and [Pr. PD09].
- Devices can be assigned for these signals with PC or PLC...etc setting. For devices that can be assigned, refer to the PC or PLC...etc instruction manual. The following devices can be assigned for Q172DSCPU, Q173DSCPU, and QD77MS_ of Mitsubishi Electric Corparation.
 - FLS: Upper stroke limit
 - RLS: Lower stroke limit
 - DOG: Proximity dog
- 15. Configure a circuit to turn off EM2 when the main circuit power is turned off to prevent an unexpected restart of the driver.
- 16. When not using the STO function, attach the short-circuit connector came with a driver.

3.2.2 For source I/O interface



3 - 9

3.3 Explanation of power supply system3.3.1 Signal explanations

POINT •For the layout of connector and terminal block, refer to chapter 9 DIMENSIONS.

Symbol	Connection target (application)	Description			
		Supply the following power to L1, L2, and L3. For 1-phase 200 V AC to 240 V AC, connect the power supply to L1 and L3. Leave L2 open.			
	Main circuit power	Driver LECSS2-T5 to Power LECSS2-T9			
L 1/L2/L3	supply	3-phase 200 V AC to 240 V AC, 50 Hz/60 Hz L1/L2/L3			
		1-phase 200 V AC to 240 V AC, 50 Hz/60 Hz L1/L3			
P3/P4	-	Connect P3 and P4. (factory-wired)			
P+/C/D	Regenerative option	When using a driver built-in regenerative resistor, connect P+ and D. (factory-wired) When using a regenerative option, disconnect P+ and D, and connect the regenerative option to P+ and C. Refer to section 11.2 for details.			
		Supply the following power to L11 and L21.			
L11/L21	Control circuit power supply	Driver LECSS2-T5 to LECSS2-T9			
		1-phase 200 V AC to 240 V AC L11/L21			
U/V/W	Servo motor power output	Connect the driver power output (U, V, and W) to the servo motor power input (U, V, and W) directly. Do not let a magnetic contactor, etc. intervene. Otherwise, it may cause a malfunction.			
N-	-	Do not connect to the driver.			
Ð	Protective earth (PE)	Connect it to the grounding terminal of the servo motor and to the protective earth (PE) of the cabinet for grounding.			

3.3.2 Power-on sequence

POINT	
●A voltage, o	utput signal, etc. of analog monitor output may be irregular at power-
on.	

(1) Power-on procedure

- 1) Always wire the power supply as shown in above section 3.1 using the magnetic contactor with the main circuit power supply (3-phase: L1, L2, and L3, 1-phase: L1 and L3). Configure up an external sequence to switch off the magnetic contactor as soon as an alarm occurs.
- 2) Switch on the control circuit power supply (L11 and L21) simultaneously with the main circuit power supply or before switching on the main circuit power supply. If the control circuit power supply is turned on with the main circuit power supply off, and then the servo-on command is transmitted, [AL. E9 Main circuit off warning] will occur. Turning on the main circuit power supply stops the warning and starts the normal operation.
- 3) The driver receives the servo-on command within 3 s to 4 s after the main circuit power supply is switched on.

(Refer to (2) of this section.)

(2) Timing chart



3.3.3 Wiring CNP1, CNP2, and CNP3

POINT	
For the wire	sizes used for wiring, refer to section 11.5.

Use the driver power supply connector for wiring CNP1, CNP2, and CNP3.

- (1) Connector
 - (a) LECSS2-T□



Table 3.1 Connector and applicable wire

Connector Receptacle assembly		Applica	ble wire	Stripped	Open tool	Manufa cturer
		Size	Insulator OD	length [mm]	Open tool	
CNP1	06JFAT-SAXGDK-H7.5					
CNP2	05JFAT-SAXGDK-H5.0	AWG 18 to 14	39 mm or shorter	9	J-FAT-OT	JST
CNP3	03JFAT-SAXGDK-H7.5					

(2) Cable connection procedure

(a) Fabrication on cable insulator

Refer to table 3.1 for stripped length of cable insulator. The appropriate stripped length of cables depends on their type, etc. Set the length considering their status.



Twist strands lightly and straighten them as follows.



Loose and bent strands

Twist and straighten the strands.

You can also use a ferrule to connect with the connectors. The following shows references to select ferrules according to wire sizes.

Driver Wire size		Ferrule model (F	Crimping tool	
Diivei	WITC 312C	For one	For two	(Phoenix Contact)
LECSS2-T5 to	AWG 16	AI1.5-10BK	AI-TWIN2×1.5-10BK	
LECSS2-T9	AWG 14	AI2.5-10BU		

(b) Inserting wire

Insert the open tool as follows and push down it to open the spring. While the open tool is pushed down, insert the stripped wire into the wire insertion hole. Check the insertion depth so that the cable insulator does not get caught by the spring.

Release the open tool to fix the wire. Pull the wire lightly to confirm that the wire is surely connected.



3.4 Connectors and pin assignment



The driver front view shown is that of the LECSS2-T7 or less. Refer to chapter 9 DIMENSIONS for the appearances and connector layouts of the other drivers.



3.5 Signal (device) explanations

For the I/O interfaces (symbols in I/O division column in the table), refer to section 3.8.2. The pin numbers in the connector pin No. column are those in the initial status.

	3.5.1	Input	device
--	-------	-------	--------

Device	Symbol	Connector pin No.		Function and application																				
			Turn off EM2 with comman Turn EM2 or state. Set [Pr. PA04 The following	(open betw ds. (short bet) to "2 1 shows the	veen commons) to decelera ween commons) in the for _" to disable EM2. setting of [Pr. PA04].	te the servo motor to a stop																		
			[Pr. PA04]		Decelerati	on method																		
			setting		EM2 or EM1 is off	Alarm occurred																		
			00	EM1	MBR (Electromagnetic brake interlock) turns off without the forced stop deceleration.	MBR (Electromagnetic brake interlock) turns off without the forced stop deceleration.																		
Forced stop 2	EM2	CN3-20	20	EM2	MBR (Electromagnetic brake interlock) turns off after the forced stop deceleration.	MBR (Electromagnetic brake interlock) turns off after the forced stop deceleration.	DI-1																	
																				01	Not using EM2 or EM1		MBR (Electromagnetic brake interlock) turns off without the forced stop deceleration.	
			21	Not using EM2 or EM1		MBR (Electromagnetic brake interlock) turns off after the forced stop deceleration.																		
			EM2 and EM	1 are mutua	ally exclusive.	ntrol modo																		
			EM2 has the When using I	Same functi EM1, set [Pr	on as EM1 in the torque co . PA04] to "0 0" to enab	ntrol mode. ble EM1.																		
Forced stop 1	EM1	(CN3-20)	Turn EM1 of state. The ba the servo mo Turn EM1 or state. Set [Pr. PA04	Turn EM1 off (open between commons) to bring the motor to an forced stop state. The base circuit is shut off, the dynamic brake is operated and decelerate the servo motor to a stop. Turn EM1 on (short between commons) in the forced stop state to reset that state.																				
	DI1	CN3-2	Devices can	be assigned	for these signals with PC of	or PLCetc setting. For	DI-1																	
	DI2	CN3-12	devices that	can be assig	ned, refer to the PC or PL	Cetc instruction manual. T□ compatible PC or	DI-1																	
	DI3	CN3-19	PLCetc (Q Corparation).	172DSCPU	, Q173DSCPU, and QD77N	/S_ of Mitsubishi Electric	DI-1																	

3.5.2 Output device

(1) Output device pin

The following shows the output device pins and parameters for assigning devices.

Connector pin No.	Parameter	Initial device	I/O division
CN3-13	[Pr. PD07]	MBR	
CN3-15	[Pr. PD09]	ALM	DO-1
CN3-9	[Pr. PD08]	INP	

(2) Output device explanations

Device	Symbol	Function and application
Electromagnetic	MBR	When using the device, set operation delay time of the lock in [Pr. PC02].
brake interlock		When a servo-off status or alarm occurs, MBR will turn off.
Malfunction	ALM	When the protective circuit is activated to shut off the base circuit, ALM will turn off.
		When an alarm does not occur, ALM will turn on after 2.5 s to 3.5 s after power-on.
In-position	INP	When the number of droop pulses is in the in-position range, INP will turn on. The in-position range can be changed using [Pr. PA10]. When the in-position range is increased, INP may be on during low-speed rotation. The device cannot be used in the speed control mode, torque control mode, and for continuous operation to torque control mode.
Dynamic brake interlock	DB	It is not necessary to use this device.
Ready	RD	Enabling servo-on to make the driver ready to operate will turn on RD.
Speed reached	SA	SA will turn off during servo-off. When the servo motor speed reaches the following range, SA will turn on. Set speed ± ((Set speed × 0.05) + 20) r/min When the preset speed is 20 r/min or less, SA always turns on. The device cannot be used in the position control mode and torque control mode.
Limiting speed	VLC	When the speed reaches the speed limit value in the torque control mode, VLC will turn on. When the servo is off, TLC will be turned off. The device cannot be used in the position control mode and speed control mode.
Zero speed detection	ZSP	ZSP turns on when the servo motor speed is zero speed (50r/min) or less. Zero speed can be changed with [Pr. PC07]. Forward rotation direction OFF level 50 r/min Servo motor or /min direction OFF level -0 r/min direction OFF level -50 r/min direction OFF level -50 r/min direction OFF level -70 r/min ZSP ON (Zero speed detection) ZSP will turn on when the servo motor is decelerated to 50 r/min (at 1)), and will turn off when the servo motor is accelerated to 70 r/min again (at 2)). ZSP will turn on when the servo motor is decelerated again to 50 r/min (at 3)), and will turn off when the servo motor speed has reached -70 r/min (at 4)). The range from the point when the servo motor speed has reached on level, and ZSP turns on, to the point when it is accelerated again and has reached off level is called hysteresis width. Hysteresis width is 20 r/min for this driver.

Device	Symbol	Function and application
Limiting torque	TLC	When the torque reaches the torque limit value during torque generation, TLC will turn on. When the servo is off, TLC will be turned off. This device cannot be used in the torque control mode.
Warning	WNG	When warning has occurred, WNG turns on. When a warning is not occurring, turning on the power will turn off WNG after 2.5 s to 3.5 s.
Battery warning	BWNG	BWNG turns on when [AL. 92 Battery cable disconnection warning] or [AL. 9F Battery warning] has occurred. When the battery warning is not occurring, turning on the power will turn off BWNG after 2.5 s to 3.5 s.
Variable gain selection	CDPS	CDPS will turn on during variable gain.
Absolute position undetermined	ABSV	ABSV turns on when the absolute position is undetermined. The device cannot be used in the speed control mode and torque control mode.
During tough drive	MTTR	When a tough drive is enabled in [Pr. PA20], activating the instantaneous power failure tough drive will turn on MTTR.

3.5.3 Output signal

Signal name	Symbol	Connector pin No.	Function and application	
Encoder A-phase pulse (differential line driver)	LA LAR	CN3-6 CN3-16	These devices output pulses of encoder output set in [Pr. PA15] and [Pr. PA16] in the differential line driver type. In CCW rotation of the servo motor, the encoder B-phase pulse lags the encoder A-	
Encoder B-phase pulse (differential line driver)	LB LBR	CN3-7 CN3-17	phase pulse by a phase angle of $\pi/2$. The relation between rotation direction and phase difference of the A-phase and B- phase pulses can be changed with [Pr. PC03]. Output pulse specification, dividing ratio setting, and electronic gear setting can be selected.	
Encoder Z-phase pulse (differential line driver)	LZ LZR	CN3-8 CN3-18	The encoder zero-point signal is output in the differential line driver type. One pulse is output per servo motor revolution. This turns on when the zero-point position is reached. (negative logic) The minimum pulse width is about 400 μ s. For home position return using this pulse, set the creep speed to 100 r/min. or less.	
Analog monitor 1	MO1	CN3-4	This is used to output the data set in [Pr. PC09] to between MO1 and LG in terms of voltage. Resolution: 10 bits or equivalent	
Analog monitor 2	MO2	CN3-14	This signal output the data set in [Pr. PC10] to between MO2 and LG in terms of voltage. Resolution: 10 bits or equivalent	

3.5.4 Power supply

Signal name	Symbol	Connector pin No.	Function and application	
Digital I/F power supply input	DICOM	CN3-5 CN3-10	Input 24 V DC (24 V DC \pm 10% 300 mA) 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.	
Digital I/F common	DOCOM	CN3-3	For source interface, connect - of 24 V DC external power supply. Common terminal of input signal such as EM2 of the driver. This is separated from LG. For sink interface, connect - of 24 V DC external power supply. For source interface, connect + of 24 V DC external power supply.	
Monitor common	LG	CN3-1 CN3-11	Common terminal of MO1 and MO2. Pins are connected internally.	
Shield	SD	Plate	Connect the external conductor of the shielded wire.	

3.6 Forced stop deceleration function

POINT	
-------	--

- When alarms not related to the forced stop function occur, control of motor deceleration can not be guaranteed. (Refer to section 8.1.)
- When SSCNET III/H communication brake occurs, forced stop deceleration will operate. (Refer to section 3.7.1 (3).)
- In the torque control mode, the forced stop deceleration function is not available.
- 3.6.1 Forced stop deceleration function (SS1)

When EM2 is turned off, dynamic brake will start to stop the servo motor after forced stop deceleration. During this sequence, the display shows [AL. E6 Servo forced stop warning].

During normal operation, do not use EM2 (Forced stop 2) to alternate stop and drive. The driver life may be shortened.

(1) Connection diagram



Note. This diagram is for sink I/O interface. For source I/O interface, refer to section 3.8.3.

(2) Timing chart

When EM2 (Forced stop 2) turns off, the motor will decelerate according to [Pr. PC24 Forced stop deceleration time constant]. Once the motor speed is below [Pr. PC07 Zero speed], base power is cut and the dynamic brake activates.



3.6.2 Base circuit shut-off delay time function

The base circuit shut-off delay time function is used to prevent vertical axis from dropping at a forced stop (EM2 goes off), alarm occurrence, or SSCNET III/H communication brake due to delay time of the lock. Set the time from MBR (Electromagnetic brake interlock) off to base circuit shut-off with [Pr. PC02].

(1) Timing chart



(2) Adjustment

While the servo motor is stopped, turn off EM2 (Forced stop 2), adjust the base circuit shut-off delay time in [Pr. PC02], and set the value to approximately 1.5 times of the smallest delay time in which the servo motor shaft does not freefall.

3.6.3 Vertical axis freefall prevention function

The vertical axis freefall prevention function avoids machine damage by pulling up the shaft slightly like the following case.

When the servo motor is used for operating vertical axis, the servo motor lock and the base circuit shutoff delay time function avoid dropping axis at forced stop. However, the functions may not avoid dropping axis a few μ m due to the backlash of the servo motor lock.

The vertical axis freefall prevention function is enabled with the following conditions.

- Other than "0" is set to [Pr. PC31 Vertical axis freefall prevention compensation amount].
- EM2 (Forced stop 2) turned off, an alarm occurred, or SSCNET III/H communication brake occurred while the servo motor speed is zero speed or less.
- The base circuit shut-off delay time function is enabled.
- (1) Timing chart

EM2 (Forced stop 2)	ON OFF (Enabled)	
Position	Travel distance	
Base circuit (Energy supply to the servo motor)	ON	
MBR (Electromagnetic brake interlock)	ON OFF (Enabled)	Set the base circuit shut-off delay time. ([Pr. PC02])
Actual operation of lock	Disabled ————————————————————————————————————	

- (2) Adjustment
 - Set the freefall prevention compensation amount in [Pr. PC31].
 - While the servo motor is stopped, turn off the EM2 (Forced stop 2). Adjust the base circuit shut-off delay time in [Pr. PC02] in accordance with the travel distance ([Pr. PC31). Adjust it considering the freefall prevention compensation amount by checking the servo motor speed, torque ripple, etc.

3.6.4 Residual risks of the forced stop function (EM2)

- (1) The forced stop function is not available for alarms that activate the dynamic brake when the alarms occur.
- (2) When an alarm that activates the dynamic brake during forced stop deceleration occurs, the braking distance until the servo motor stops will be longer than that of normal forced stop deceleration without the dynamic brake.
- (3) If STO is turned off during forced stop deceleration, [AL.63 STO timing error] will occur.

3.7 Alarm occurrence timing chart

When an alarm has occurred, remove its cause, make sure that the operation signal is not being input, ensure safety, and reset the alarm before restarting operation.

POINT In the torque control mode, the forced stop deceleration function is not available.

To deactivate the alarm, cycle the control circuit power or give the error reset or CPU reset command from the servo system controller. However, the alarm cannot be deactivated unless its cause is removed.

3.7.1 When you use the forced stop deceleration function

POINT			
●To enable th	e function, set "2 _	(initial value)" in [Pr. PA04].	

(1) When the forced stop deceleration function is enabled

		Alarm oc	currence		
Servo motor speed	0 r/min	PC or	PLCetc	command is ignored.	Note) fodel speed command 0 nd equal to or less than ero speed
Base circuit (Energy supply to the servo motor) Driver display	ON OFF	No alarm		Alarm No.	
MBR (Electromagnetic brake interlock)	ON OFF				-
ALM (Malfunction)	ON (no alarm) OFF (alarm)				

Note. The model speed command is a speed command generated in the driver for forced stop deceleration of the servo motor.

(2) When the forced stop deceleration function is not enabled



- (3) When SSCNET III/H communication brake occurs
 - The dynamic brake may operate depending on the communication shut-off status.



- Note. The model speed command is a speed command generated in the driver for forced stop deceleration of the servo motor.
- 3.7.2 When you do not use the forced stop deceleration function

POINT	
●To disable the end of the en	ne function, set "0" in [Pr. PA04].

The timing chart that shows the servo motor condition when an alarm or SSCNET III/H communication brake occurs is the same as section 3.7.1 (2).

3.8 Interfaces

3.8.1 Internal connection diagram



- Note $\$ 1. Signal can be assigned for these pins with the PC or PLC...etc setting.
 - For contents of signals, refer to the instruction manual of the PC or PLC...etc.
 - 2. The signal cannot be used in the speed control mode and torque control mode.
 - 3. This diagram is for sink I/O interface. For source I/O interface, refer to section 3.8.3.
 - 4. 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.

3.8.2 Detailed explanation of interfaces

This section provides the details of the I/O signal interfaces (refer to the I/O division in the table) given in section 3.5. Refer to this section and make connection with the external device.

(1) Digital input interface DI-1

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 following is a connection diagram for sink input. Refer to section 3.8.3 for source input.



(2) Digital output interface DO-1

This is a circuit of collector output terminal of the output transistor. When the output transistor is turned on, collector terminal current will be applied for the output.

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: 40 mA or less, maximum current: 50 mA or less, inrush current: 100 mA or less) A maximum of 2.6 V voltage drop occurs in the driver.

The following shows a connection diagram for sink output. Refer to section 3.8.3 for source output.



Note. If the voltage drop (maximum of 2.6 V) interferes with the relay operation, apply high voltage (maximum of 26.4 V) from external source.

(3) Encoder output pulses DO-2 (differential line driver type) (a) Interface

Maximum output current: 35 mA





(b) Output pulse

(4) Analog output



Note. Output voltage range varies depending on the output contents.

3.8.3 Source I/O interfaces

In this driver, source type I/O interfaces can be used.

(1) Digital input interface DI-1

This is an input circuit whose photocoupler anode side is input terminal. Transmit signals from source (open-collector) type transistor output, relay switch, etc.



(2) Digital output interface DO-1

This is a circuit of emitter output terminal of the output transistor. When the output transistor is turned on, current will be applied from the output to a load.

A maximum of 2.6 V voltage drop occurs in the driver.



Note. If the voltage drop (maximum of 2.6 V) interferes with the relay operation, apply high voltage (maximum of 26.4 V) from external source.

3.9 SSCNET III cable connection

POINT
 ●Do not look directly at the light generated from CN1A/CN1B connector of the driver or the end of SSCNET III cable. The light can be a discomfort when it enters the eye.

(1) SSCNET III cable connection

For the CN1A connector, connect the SSCNET III cable connected to a PC or PLC...etc in host side or a driver of the previous axis. For CN1B connector, connect SSCNET III cable connected to driver of the next axis. For CN1B connector of the final axis, put a cap came with driver.



- (2) How to connect/disconnect cable
 - POINT
 - CN1A and CN1B connector are capped to protect light device inside connector from dust. For this reason, do not remove a cap until just before mounting SSCNET III cable. Then, when removing SSCNET III cable, make sure to put a cap.
 - •Keep the cap for CN1A/CN1B connector and the tube for protecting optical cord end of SSCNET III cable in a plastic bag with a zipper of SSCNET III cable to prevent them from becoming dirty.
 - When asking repair of driver for some malfunctions, make sure to cap CN1A and CN1B connector. When the connector is not put a cap, the light device may be damaged at the transit. In this case, replacing and repairing the light device is required.
 - (a) Connection
 - 1) For SSCNET III cable in the shipping status, the tube for protect optical cord end is put on the end of connector. Remove this tube.
 - 2) Remove the CN1A and CN1B connector caps of the driver.

3) With holding a tab of SSCNET III cable connector, make sure to insert it into the CN1A and CN1B connector of the driver until you hear the click. If the end face of optical cord tip is dirty, optical transmission is interrupted and it may cause malfunctions. If it becomes dirty, wipe with a bonded textile, etc. Do not use solvent such as alcohol.



(b) Disconnection

With holding a tab of SSCNET III cable connector, pull out the connector. When pulling out the SSCNET III cable from driver, be sure to put the cap on the connector parts of driver to prevent it from becoming dirty. For SSCNET III cable, attach the tube for protection optical cord's end face on the end of connector.

3.10 Servo motor with a lock

3.10.1 Safety precautions



POINT

Refer to chapter 14 for specifications such as the power supply capacity and operation delay time of the lock.

•Refer to chapter 14 for the selection of a surge absorber for the lock.

Note the following when the servo motor with a lock is used.

- 1) The lock will operate when the power (24 V DC) turns off.
- 2) Turn off the servo-on command after the servo motor stopped.
- (1) Connection diagram



Note 1. Create the circuit in order to shut off by interlocking with the emergency stop switch.

2. Do not use the 24 V DC interface power supply for the lock.

(2) Setting

In [Pr. PC02 Electromagnetic brake sequence output], set the time delay (Tb) from lock operation to base circuit shut-off at a servo-off as in the timing chart in section 3.10.2.

3.10.2 Timing chart

(1) When you use the forced stop deceleration function

POINT			
●To enable th	e function, set "2	_ (initial value)" in [Pr. PA04].	

(a) Servo-on command (from PC or PLC...etc) on/off

When servo-on command is turned off, the servo lock will be released after Tb [ms], and the servo motor will coast. If the lock is enabled during servo-lock, the lock life may be shorter. Therefore, set Tb about 1.5 times of the minimum delay time where the moving part will not drop down for a vertical axis system, etc.



Note 1. ON: Lock is not activated.

OFF: Lock is activated.

- 2. Lock is released after delaying for the release delay time of lock and operation time of external circuit relay. For the release delay time of lock, refer to chapter 14.
- 3. Give the operation command from the PC or PLC...etc after the lock is released.

(b) Forced stop 2 on/off



- Note 1. ON: Lock is not activated.
 - OFF: Lock is activated.
 - 2. The model speed command is a speed command generated in the driver for forced stop deceleration of the servo motor.

(c) Alarm occurrence

The operation status during an alarm is the same as section 3.7.

(d) Both main and control circuit power supplies off



Note1. Variable according to the operation status.2. ON: Lock is not activated.

OFF: Lock is activated.



(e) Main circuit power supply off during control circuit power supply on



Note 1. ON: Lock is not activated.

OFF: Lock is activated.

2. Variable according to the operation status.

(f) Ready-off command from PC or PLC...etc

Servo motor speed	
	0 r/min
Base circuit	ON OFF
MBR (Electromagnetic brake interlock)	(Note) OFF
Ready-on command (from PC or PLCetc)	ON OFF

Note. ON: Lock is not activated. OFF: Lock is activated.



(2) When you do not use the forced stop deceleration function



- (a) Servo-on command (from PC or PLC...etc) on/off It is the same as (1) (a) in this section.
- (b) Off/on of the forced stop command (from PC or PLC...etc) or EM1 (Forced stop)



Note. ON: Lock is not activated. OFF: Lock is activated.

(c) Alarm occurrence

The operation status during an alarm is the same as section 3.7.

- (d) Both main and control circuit power supplies off It is the same as (1) (d) of this section.
- (e) Main circuit power supply off during control circuit power supply on



Note 1. Variable according to the operation status.

2. ON: Lock is not activated. OFF: Lock is activated.


(f) Ready-off command from PC or PLC...etc It is the same as (1) (f) in this section.

3.11 Grounding

●Ground the driver and servo motor securely. ●To prevent an electric shock, always connect the protective earth (PE) terminal (marked ⊕) of the driver to the protective earth (PE) of the cabinet.

The driver switches the power transistor on-off to supply power to the servo motor. Depending on the wiring and ground cable routing, the driver may be affected by the switching noise (due to di/dt and dv/dt) of the transistor. To prevent such a fault, refer to the following diagram and always ground.



Note. For 1-phase 200 V AC to 240 V AC, connect the power supply to L1 and L3. Leave L2 open. For the power supply specifications, refer to section 1.3.

4. STARTUP

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4. STARTUP

4. STARTUP

Do not operate the switches with wet hands. Otherwise, it may cause an electric shock.
 Before starting operation, check the parameters. Improper settings may cause some machines to operate unexpectedly. The driver heat sink, regenerative resistor, servo motor, etc. may be hot while power is on or for some time after power-off. Take safety measures, e.g. provide covers, to prevent accidental contact of hands and parts (cables, etc.) with them. During operation, power touch the reter of the serve meter. Otherwise, it may
cause injury.

4.1 Switching power on for the first time

When switching power on for the first time, follow this section to make a startup.

4.1.1 Startup procedure



Check whether the driver and servo motor are wired correctly using visual inspection, DO forced output function (section 4.5.1), etc. (Refer to section 4.1.2.)

Check the surrounding environment of the driver and servo motor. (Refer to section 4.1.3.)

Confirm that the control axis No. set with the auxiliary axis number setting switches (SW2-3 and SW2-4) and with the axis selection rotary switch (SW1) match the control axis No. set with the servo system controller. (Refer to section 4.3.1 (3).)

Set the parameters as necessary, such as the used operation mode and regenerative option selection. (Refer to chapter 5.)

For the test operation, with the servo motor disconnected from the machine and operated at the speed as low as possible, check whether the servo motor rotates correctly. (Refer to section 4.5.)

For the test operation with the servo motor disconnected from the machine and operated at the speed as low as possible, give commands to the driver and check whether the servo motor rotates correctly.

After connecting the servo motor with the machine, check machine motions with sending operation commands from the PC or PLC...etc.

Make gain adjustment to optimize the machine motions. (Refer to chapter 6.)

Stop giving commands and stop operation.



4.1.2 Wiring check

(1) Power supply system wiring

Before switching on the main circuit and control circuit power supplies, check the following items.

(a) Power supply system wiring

The power supplied to the power input terminals (L1, L2, L3, L11, and L21) of the driver should satisfy the defined specifications. (Refer to section 1.3.)

(b) Connection of driver and servo motor

1) The driver power output (U, V, and W) should match in phase with the servo motor power input terminals (U, V, and W).



2) The power supplied to the driver should not be connected to the servo motor power terminals (U, V, and W). To do so will fail the connected driver and servo motor.



3) The grounding terminal of the servo motor is connected to the PE terminal of the driver.



- 4) The CN2 connector of the driver should be connected to the encoder of the servo motor securely using the encoder cable.
- 5) Between P3 and P4 should be connected.



- (c) When you use an option and auxiliary equipment
 - 1) When you use a regenerative option for drivers under 750W for 200 V class
 - The lead wire between P+ terminal and D terminal should not be connected.
 - The regenerative option wire should be connected between P+ and C terminal.
 - A twisted cable should be used. (Refer to section 11.2.3.)
- (2) I/O signal wiring
 - (a) The I/O signals should be connected correctly.

Use DO forced output to forcibly turn on/off the pins of the CN3 connector. This function can be used to perform a wiring check. In this case, switch on the control circuit power supply only. Refer to section 3.2 for details of I/O signal connection.

- (b) 24 V DC or higher voltage is not applied to the pins of the CN3 connector.
- (c) SD and DOCOM of the CN3 connector is not shorted.



4.1.3 Surrounding environment

- (1) Cable routing
 - (a) The wiring cables should not be stressed.
 - (b) The encoder cable should not be used in excess of its bending life. (Refer to section 10.4.)
 - (c) The connector of the servo motor should not be stressed.

(2) Environment

Signal cables and power cables are not shorted by wire offcuts, metallic dust or the like.

4.2 Startup

Connect the servo motor with a machine after confirming that the servo motor operates properly alone.

(1) Power on

When the main and control circuit power supplies are turned on, "b01" (for the first axis) appears on the driver display.

When the absolute position detection system is used in a servo motor, first power-on results in [AL. 25 Absolute position erased] and the servo-on cannot be ready. The alarm can be deactivated by then switching power off once and on again.

Also, if power is switched on at the servo motor speed of 3000 r/min or higher, position mismatch may occur due to external force or the like. Power must therefore be switched on when the servo motor is at a stop.

(2) Parameter setting

POINT

●The following encoder cables are of two-wire type. When using any of the encoder cables, set [Pr. PC04] to "0 _ _ _" to select the two-wire type. Incorrect setting will result in [AL. 16 Encoder initial communication error 1].

Set the parameters according to the structure and specifications of the machine. Refer to chapter 5 for details.

After setting the above parameters, turn power off as necessary. Then switch power on again to enable the parameter values.

(3) Servo-on

Enable the servo-on with the following procedure.

- (a) Switch on main circuit power supply and control circuit power supply.
- (b) Transmit the servo-on command with the PC or PLC...etc.

When the servo-on status is enabled, the driver is ready to operate and the servo motor is locked.

(4) Home position return

Always perform home position return before starting positioning operation.



(5) Stop

If any of the following situations occurs, the driver suspends the running of the servo motor and brings it to a stop.

Refer to section 3.10 for the servo motor with a lock.

	Operation/command	Stopping condition
	Servo-off command	The base circuit is shut off and the servo motor coasts.
Servo system	Ready-off command	The base circuit is shut off and the dynamic brake operates to bring the servo motor to a stop.
	Forced stop command	The servo motor decelerates to a stop with the command. [AL. E7 Controller forced stop warning] occurs.
	Alarm occurrence	The servo motor decelerates to a stop with the command. With some alarms, however, the dynamic brake operates to bring the servo motor to a stop. (Refer to section 8.)
Driver	EM2 (Forced stop 2) off	The servo motor decelerates to a stop with the command. [AL. E6 Servo forced stop warning] occurs. EM2 has the same function as EM1 in the torque control mode. Refer to section 3.5 for EM1.
	STO (STO1, STO2) off	The base circuit is shut off and the dynamic brake operates to bring the servo motor to a stop.

4.3 Switch setting and display of the driver

Switching to the test operation mode, deactivating control axes, and setting control axis No. are enabled with switches on the driver.

On the driver display (three-digit, seven-segment LED), check the status of communication with the servo system controller at power-on, and the axis number, and diagnose a malfunction at occurrence of an alarm.

4.3.1 Switches

●When switching the axis selection rotary switch (SW1) and auxiliary axis number
setting switch (SW2), use insulated screw driver. Do not use a metal screw driver.
Touching patterns on electronic boards, lead of electronic parts, etc. may cause
an electric shock.

POINT

- Turning "ON (up)" all the control axis setting switches (SW2) enables an operation mode for manufacturer setting and displays "off". The mode is not available. Set the control axis setting switches (SW2) correctly according to this section.
- •Cycling the main circuit power supply and control circuit power supply enables the setting of each switch.

The following explains the test operation select switch, the disabling control axis switch, auxiliary axis number setting switches, and the axis selection rotary switch.



(1) Test operation select switch (SW2-1)

To use the test operation mode, turn "ON (up)" the switch. Turning "ON (up)" the switch enables the test operation mode. In the test operation mode, the functions such as JOG operation, positioning operation, and machine analyzer are available with setup software (MR Configurator2). Before turning "ON (up)" the test operation select switch, turn "OFF (down)" the disabling control axis switch.



(2) Disabling control axis switch (SW2-2)

Turning "ON (up)" the disabling control axis switch disables the corresponding servo motor. The servo motor will be disabled-axis status and will not be recognized by the PC or PLC...etc.



(3) Switches for setting control axis No.

POINT

- The control axis No. set to the auxiliary axis number setting switches (SW2-3 and SW2-4) and the axis selection rotary switch (SW1) should be the same as the one set to the servo system controller. The number of the axes you can set depends on the PC or PLC...etc.
- For setting the axis selection rotary switch, use a flat-blade screwdriver with the blade edge width of 2.1 mm to 2.3 mm and the blade edge thickness of 0.6 mm to 0.7 mm.
- When the test operation mode is selected with the test operation select switch (SW2-1), the SSCNET III/H communication for the driver in the test operation mode and the following drivers is blocked.

You can set the control axis No. between 1 and 64 by using auxiliary axis number setting switches with the axis selection rotary switch. (Refer to (3) (c) of this section.)

If the same numbers are set to different control axes in a single communication system, the system will not operate properly. The control axes may be set independently of the SSCNET III cable connection sequence. The following shows the description of each switch.

- (a) Auxiliary axis number setting switches (SW2-3 and SW2-4) Turning these switches "ON (up)" enables you to set the axis No. 17 or more.
- (b) Axis selection rotary switch (SW1)

You can set the control axis No. between 1 and 64 by using auxiliary axis number setting switches with the axis selection rotary switch. (Refer to (3) (c) of this section.)



(c) Switch combination list for the control axis No. setting

The following lists show the setting combinations of the auxiliary axis number setting switches and the axis selection rotary switch.

Auxiliary axis number setting switch	Axis selection rotary switch	Control axis No.	Auxiliary axis number setting switch	Axis selection rotary switch	Control axis No.
	0	1		0	17
	1	2		1	18
	2	3		2	19
	3	4		3	20
	4	5		4	21
	5	6		5	22
	6	7		6	23
	7	8		7	24
	8	9		8	25
	9	10		9	26
	A	11		Α	27
	В	12		В	28
	С	13		С	29
	D	14		D	30
	E	15		E	31
	F	16		F	32
	A				
Auxiliary axis number setting switch	AXIS selection rotary switch	Control axis No.	Auxiliary axis number setting switch	Axis selection rotary switch	Control axis No.
Auxiliary axis number setting switch	AXIS selection rotary switch 0	Control axis No. 33	Auxiliary axis number setting switch	Axis selection rotary switch 0	Control axis No. 49
Auxiliary axis number setting switch	Axis selection rotary switch 0 1	Control axis No. 33 34	Auxiliary axis number setting switch	Axis selection rotary switch 0 1	Control axis No. 49 50
Auxiliary axis number setting switch	Axis selection rotary switch 0 1 2	Control axis No. 33 34 35	Auxiliary axis number setting switch	Axis selection rotary switch 0 1 2	Control axis No. 49 50 51
Auxiliary axis number setting switch	Axis selection rotary switch 0 1 2 3	Control axis No. 33 34 35 36	Auxiliary axis number setting switch	Axis selection rotary switch 0 1 2 3	Control axis No. 49 50 51 52
Auxiliary axis number setting switch	AXIS selection rotary switch 0 1 2 3 4	Control axis No. 33 34 35 36 37	Auxiliary axis number setting switch	Axis selection rotary switch 0 1 2 3 4	Control axis No. 49 50 51 52 53
Auxiliary axis number setting switch	AXIS selection rotary switch 0 1 2 3 4 5	Control axis No. 33 34 35 36 37 38	Auxiliary axis number setting switch	Axis selection rotary switch 0 1 2 3 4 5	Control axis No. 49 50 51 52 53 54
Auxiliary axis number setting switch	AXIS selection rotary switch 0 1 2 3 4 5 6	Control axis No. 33 34 35 36 37 38 39	Auxiliary axis number setting switch	Axis selection rotary switch 0 1 2 3 4 5 6	Control axis No. 49 50 51 52 53 54 55
Auxiliary axis number setting switch	AXIS selection rotary switch 0 1 2 3 4 5 6 7	Control axis No. 33 34 35 36 37 38 39 40	Auxiliary axis number setting switch	Axis selection rotary switch 0 1 2 3 4 5 6 6 7	Control axis No. 49 50 51 52 53 54 55 55 56
Auxiliary axis number setting switch	AXIS selection rotary switch 0 1 2 3 4 5 6 7 8	Control axis No. 33 34 35 36 37 38 39 40 41	Auxiliary axis number setting switch	Axis selection rotary switch 0 1 2 3 4 5 6 7 8	Control axis No. 49 50 51 52 53 54 55 56 56 57
Auxiliary axis number setting switch	AXIS selection rotary switch 0 1 2 3 4 5 6 7 8 9	Control axis No. 33 34 35 36 37 38 39 40 41 42	Auxiliary axis number setting switch	Axis selection rotary switch 0 1 2 3 4 5 6 7 8 9	Control axis No. 49 50 51 52 53 54 55 56 57 58
Auxiliary axis number setting switch	AXIS selection rotary switch 0 1 2 3 4 5 6 7 7 8 9 9 A	Control axis No. 33 34 35 36 37 38 39 40 41 42 43	Auxiliary axis number setting switch	Axis selection rotary switch 0 1 2 3 4 5 6 7 8 9 9 A	Control axis No. 49 50 51 52 53 54 55 56 57 58 59
Auxiliary axis number setting switch	AXIS selection rotary switch 0 1 2 3 4 5 6 6 7 8 9 9 A B	Control axis No. 33 34 35 36 37 38 39 40 41 42 43 44	Auxiliary axis number setting switch	Axis selection rotary switch 0 1 2 3 4 5 6 6 7 7 8 9 9 A B	Control axis No. 49 50 51 52 53 54 55 56 57 58 59 60
Auxiliary axis number setting switch	AXIS selection rotary switch 0 1 2 3 4 5 6 7 7 8 9 4 5 6 7 8 9 9 A B C	Control axis No. 33 34 35 36 37 38 39 40 41 42 43 44 45	Auxiliary axis number setting switch	Axis selection rotary switch 0 1 2 3 4 5 6 6 7 8 9 9 A B C	Control axis No. 49 50 51 52 53 54 55 56 57 58 59 60 61
Auxiliary axis number setting switch	AXIS selection rotary switch 0 1 2 3 4 5 6 7 7 8 9 A 8 9 A B C C D	Control axis No. 33 34 35 36 37 38 39 40 41 42 43 44 45 46	Auxiliary axis number setting switch	Axis selection rotary switch 0 1 2 3 4 5 6 6 7 7 8 9 A 8 9 A B C C D	Control axis No. 49 50 51 52 53 54 55 56 57 58 59 60 61 62
Auxiliary axis number setting switch	AXIS selection rotary switch 0 1 2 3 4 5 6 7 6 7 8 9 A 8 9 A B C D E	Control axis No. 33 34 35 36 37 38 39 40 41 41 42 43 44 45 46 46 47	Auxiliary axis number setting switch	Axis selection rotary switch 0 1 2 3 4 5 6 7 7 8 9 A 8 9 A B C D D E	Control axis No. 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63

4.3.2 Scrolling display

(1) Normal display

When there is no alarm, the axis No. and blank are displayed in rotation.



(2) Alarm display

When an alarm occurs, the alarm number (two digits) and the alarm detail (one digit) are displayed following the status display. For example, the following shows when [AL. 32 Overcurrent] is occurring.



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4.3.3 Status display of an axis





Note. Axis Axis Axis Axis No. 1 No. 2 No. 64 Note: Note

4. STARTUP

(2) Indication list

Indication	Status	Description	
	Initializing	System check in progress	
Ab	Initializing	 Power of the driver was switched on at the condition that the power of the servo system controller is off. The control axis No. set to the auxiliary axis number setting switches (SW2-3 and SW2-4) and the axis selection rotary switch (SW1) do not match the one set to th servo system controller. A driver malfunctioned, or communication error occured with the servo system controller or the previous axis driver. In this case, the indication changes as follows: "Ab", "AC", "Ad", and "Ab" The servo system controller is malfunctioning. 	
Ab.	Initializing	During initial setting for communication specifications	
AC	Initializing	Initial setting for communication specifications completed, and then it synchronized with servo system controller.	
Ad	Initializing	During initial parameter setting communication with servo system controller	
AE	Initializing	During the servo motor/encoder information and telecommunication with servo system controller	
AF	Initializing	During initial signal data communication with servo system controller	
AH	Initializing completion	The process for initial data communication with the servo system controller is completed.	
AA	Initializing standby	The power supply of servo system controller is turned off during the power supply of driver is on.	
(Note 1) b # #	Ready-off	The ready-off signal from the servo system controller was received.	
(Note 1) d # #	Servo-on	The ready-off signal from the servo system controller was received.	
(Note 1) C # #	Servo-off	The ready-off signal from the servo system controller was received.	
(Note 2) * * *	Alarm and warning	The alarm No. and the warning No. that occurred is displayed. (Refer to section 8.)	
888	CPU error	CPU watchdog error has occurred.	
(Note 1) b # #. d # #. C # #.	(Note 3) Test operation mode	Motor-less operation	

Note 1. The meanings of ## are listed below.

##	Description
01	Axis No. 1
2	2
64	Axis No. 64

2. ** indicates the alarm No. and the warning No.

3. Requires the setup software (MR Configurator2).

4.4 Test operation

Before starting actual operation, perform test operation to make sure that the machine operates normally.

Refer to section 4.2 for the power on and off methods of the driver.



4.5 Test operation mode



POINT

The content described in this section indicates that the driver and a personal computer are directly connected.

By using a personal computer and setup software (MR Configurator2), you can execute jog operation, positioning operation, DO forced output program operation without connecting the servo system controller.

4.5.1 Test operation mode in setup software (MR Configurator2)

POINT

When the test operation mode is selected with the test operation select switch (SW2-1), the SSCNET III/H communication for the driver in the test operation mode and the following drivers is blocked.

(1) Test operation mode

(a) Jog operation

Jog operation can be performed without using the servo system controller. Use this operation with the forced stop reset. This operation may be used independently of whether the servo is on or off and whether the servo system controller is connected or not.

Exercise control on the jog operation screen of setup software (MR Configurator2).

1) Operation pattern

Item	initial value	Setting range
Speed [r/min]	200	0 to max. speed
Acceleration/deceleration time constant [ms]	1000	0 to 50000

2) Operation method

 When the check box of "Rotation only while the CCW or CW button is being pushed." is checked.

Operation	Screen control
Forward rotation start	Keep pressing the "Forward" button.
Reverse rotation start	Keep pressing the "Reverse" button.
Stop	Release the "Forward" or "Reverse" button.
Forced stop	Click the "Forced stop" button.

 When the check box of "Rotation only while the CCW or CW button is being pushed." is not checked.

Operation	Screen control
Forward rotation start	Click the "Forward" button.
Reverse rotation start	Click the "Reverse" button.
Stop	Click the "Stop" button.
Forced stop	Click the "Forced stop" button.

(b) Positioning operation

Positioning operation can be performed without using the servo system controller. Use this operation with the forced stop reset. This operation may be used independently of whether the servo is on or off and whether the servo system controller is connected or not. Exercise control on the positioning operation screen of setup software (MR Configurator2).

1) Operation pattern

Item	initial value	Setting range
Travel distance [pulse]	4000	0 to 99999999
Speed [r/min]	200	0 to max. speed
Acceleration/deceleration time constant [ms]	1000	0 to 50000
Repeat pattern	Fwd. rot. (CCW) to rev. rot. (CW)	Fwd. rot. (CCW) to rev. rot. (CW) Fwd. rot. (CCW) to fwd. rot. (CCW) Rev. rot. (CW) to fwd. rot. (CCW) Rev. rot. (CW) to rev. rot. (CW)
Dwell time [s]	2.0	0.1 to 50.0
Number of repeats [time]	1	1 to 9999

2) Operation method

Operation	Screen control
Forward rotation start	Click the "Forward" button.
Reverse rotation start	Click the "Reverse" button.
Pause	Click the "Pause" button.
Stop	Click the "Stop" button.
Forced stop	Click the "Forced stop" button.

(c) Program operation

Positioning operation can be performed in two or more operation patterns combined, without using the servo system controller. Use this operation with the forced stop reset. This operation may be used independently of whether the servo is on or off and whether the servo system controller is connected or not.

Exercise control on the program operation screen of setup software (MR Configurator2).

Operation	Screen control		
Start	Click the "Start" button.		
Pause	Click the "Pause" button.		
Stop	Click the "Stop" button.		
Forced stop	Click the "Forced stop" button.		

(d) Output signal (DO) forced output

Output signals can be switched on/off forcibly independently of the servo status. Use this function for output signal wiring check, etc. Exercise control on the DO forced output screen of setup software (MR Configurator2).

(2) Operation procedure

- 1) Turn off the power.
- 2) Turn "ON (up)" SW2-1.



Turning "ON (up)" SW2-1 during power-on will not start the test operation mode.

3) Turn on the driver.

When initialization is completed, the decimal point on the first digit will flicker.



When an alarm or warning also occurs during the test operation, the decimal point on the first digit will flicker as follows.



4) Start operation with the personal computer.

4. STARTUP

4.5.2 Motor-less operation in PC or PLC...etc

POINT	
●Use motor-le	ess operation which is available by making the servo system
controller pa	rameter setting.
Motor-less c	peration is done while connected with the servo system controller.

(1) Motor-less operation

Without connecting the servo motor, output signals or status displays can be provided in response to the servo system controller commands as if the servo motor is actually running. This operation may be used to check the servo system controller sequence. Use this operation with the forced stop reset. Use this operation with the driver connected to the servo system controller.

To stop the motor-less operation, set the motor-less operation selection to "Disable" in the servo parameter setting of the servo system controller. When the power supply is turned on next time, motor-less operation will be disabled.

(a) Load conditions

Load item	Condition
Load torque	0
Load to motor inertia ratio	Same as the moment of inertia of the servo motor

(b) Alarms

The following alarms and warning do not occur. However, the other alarms and warnings occur as when the servo motor is connected.

Alarm and warning	Servo motor
[AL. 16 Encoder initial communication error 1]	0
[AL. 1E Encoder initial communication error 2]	0
[AL. 1F Encoder initial communication error 3]	0
[AL. 20 Encoder normal communication error 1]	0
[AL. 21 Encoder normal communication error 2]	0
[AL. 25 Absolute position erased]	0
[AL. 28 Linear encoder error 2]	
[AL. 2A Linear encoder error 1]	
[AL. 2B Encoder counter error]	
[AL. 92 Battery cable disconnection warning]	0
[AL. 9F Battery warning]	0
[AL. E9 Main circuit off warning]	0
[AL. 70 Load-side encoder error 1]	
[AL. 71 Load-side encoder error 2]	

(2) Operation procedure

1) Set the driver to the servo-off status.

2) Set [Pr. PC05] to "_ _ _ 1", turn "OFF (down: normal condition side)" the test operation mode switch (SW2-1), and then turn on the power supply.



3) Start the motor-less operation with the servo system controller.

The display shows the following screen.

The decimal point flickers.

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 Never make a drastic adjustment or change to the parameter values as doing so will make the operation unstable. If fixed values are written in the digits of a parameter, do not change these values. Do not change parameters for manufacturer setting.
Do not set values other than described values to each parameter.

POINT

•When you connect the driver to a servo system controller, servo parameter values of the servo system controller will be written to each parameter.

Setting may not be made to some parameters and their ranges depending on the servo system controller model, driver software version, and setup software (MR Configurator2) software version. For details, refer to the servo system controller user's 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 PC or PLC...etc.

**: After setting the parameter, cycle the power.

5.1.1 Basic setting parameters ([Pr. PA_])

No.	Symbol	Name	Initial value	Unit	Setting
PA01	**STY	Operation mode	1000h		0
PA02	**REG	Regenerative option	0000h		0
PA03	*ABS	Absolute position detection system	0000h		0
PA04	*AOP1	Function selection A-1	2000h		0
PA05		For manufacturer setting	10000	\searrow	
PA06			1		
PA07			1		
PA08	ATU	Auto tuning mode	0001h		0
PA09	RSP	Auto tuning response	16		0
PA10	INP	In-position range	1600	[pulse]	0
PA11	\searrow	For manufacturer setting	1000.0	\searrow	
PA12			1000.0		
PA13			0000h		
PA14	*POL	Rotation direction	0		0
PA15	*ENR	Encoder output pulses	4000	[pulse/rev]	0
PA16	*ENR2	Encoder output pulses 2	1		0
PA17	**MSR	Servo motor series setting	0000h		
PA18	**MTY	Servo motor type setting	0000h		
PA19	*BLK	Parameter writing inhibit	00ABh		0
PA20	*TDS	Tough drive setting	0000h		0
PA21	*AOP3	Function selection A-3	0001h		0
PA22	**PCS	Position control composition selection	0000h		0
PA23	DRAT	Drive recorder arbitrary alarm trigger setting	0000h		0
PA24	AOP4	Function selection A-4	0000h		0
PA25	OTHOV	One-touch tuning - Overshoot permissible level	0	[%]	0
PA26	*AOP5	Function selection A-5	0000h		0
PA27	\setminus	For manufacturer setting	0000h	Ν	
PA28	\backslash		0000h		\mathbf{i}
PA29	\backslash		0000h		\backslash
PA30			0000h		\backslash
PA31			0000h		\backslash
PA32			0000h		

5.1.2 Gain/filter setting parameters ([Pr. PB_])

No.	Symbol	Name	Initial value	Unit	Setting
PB01	FILT	Adaptive tuning mode (adaptive filter II)	0000h		0
PB02	VRFT	Vibration suppression control tuning mode (advanced vibration suppression control II)	0000h		0
PB03	TFBGN	Torque feedback loop gain	18000	[rad/s]	0
PB04	FFC	Feed forward gain	0	[%]	0
PB05		For manufacturer setting	500		
PB06	GD2	Load to motor inertia ratio	7.00	[Multiplier]	0
PB07	PG1	Model loop gain	15.0	[rad/s]	0
PB08	PG2	Position loop gain	37.0	[rad/s]	0
PB09	VG2	Speed loop gain	823	[rad/s]	0
PB10	VIC	Speed integral compensation	33.7	[ms]	0
PB11	VDC	Speed differential compensation	980		0
PB12	OVA	Overshoot amount compensation	0	[%]	0
PB13	NH1	Machine resonance suppression filter 1	4500	[Hz]	0
PB14	NHQ1	Notch shape selection 1	0000h		0
PB15	NH2	Machine resonance suppression filter 2	4500	[Hz]	0
PB16	NHQ2	Notch shape selection 2	0000h		0
PB17	NHF	Shaft resonance suppression filter	0000h		0
PB18	LPF	Low-pass filter setting	3141	[rad/s]	0
PB19	 VRF11	Vibration suppression control 1 - Vibration frequency	100.0	[Hz]	0
PB20	VRF12	Vibration suppression control 1 - Resonance frequency	100.0	[Hz]	0
PB21	VRF13	Vibration suppression control 1 - Vibration frequency damping	0.00	[]	0
PB22	VRF14	Vibration suppression control 1 - Resonance frequency damping	0.00		0
PB23	VFBF	I ow-pass filter selection	0000h		0
PB24	*MVS	Slight vibration suppression control	0000h		0
PB25		For manufacturer setting	0000h		\sim
PB26	*CDP	Gain switching function	0000h		\sim
PB27	CDL	Gain switching condition	10	[kpps]/ [pulse]/ [r/min]	0
PB28	CDT	Gain switching time constant	1	[ms]	0
PB29	GD2B	Load to motor inertia ratio after gain switching	7.00	[Multiplier]	0
PB30	PG2B	Position loop gain after gain switching	0.0	[rad/s]	0
PB31	VG2B	Speed loop gain after gain switching	0	[rad/s]	0
PB32	VICB	Speed integral compensation after gain switching	0.0	[ms]	0
PB33	VRF11B	Vibration suppression control 1 - Vibration frequency after gain switching	0.0	[Hz]	0
PB34	VRF12B	Vibration suppression control 1 - Resonance frequency after gain switching	0.0	[Hz]	0
PB35	VRF13B	Vibration suppression control 1 - Vibration frequency damping after gain switching	0.00		0
PB36	VRF14B	Vibration suppression control 1 - Resonance frequency damping after gain switching	0.00		0
PB37		For manufacturer setting	1600	Ν	
PB38	\backslash		0.00		
PB39	\backslash		0.00		
PB40			0.00		\backslash
PB41			0		
PB42			0		
PB43			0000h		
PB44			0.00		
PB45	CNHF	Command notch filter	0000h		0

No.	Symbol	Name	Initial value	Unit	Setting
PB46	NH3	Machine resonance suppression filter 3	4500	[Hz]	0
PB47	NHQ3	Notch shape selection 3	0000h		0
PB48	NH4	Machine resonance suppression filter 4	4500	[Hz]	0
PB49	NHQ4	Notch shape selection 4	0000h		0
PB50	NH5	Machine resonance suppression filter 5	4500	[Hz]	0
PB51	NHQ5	Notch shape selection 5	0000h		0
PB52	VRF21	Vibration suppression control 2 - Vibration frequency	100.0	[Hz]	0
PB53	VRF22	Vibration suppression control 2 - Resonance frequency	100.0	[Hz]	0
PB54	VRF23	Vibration suppression control 2 - Vibration frequency damping	0.00		0
PB55	VRF24	Vibration suppression control 2 - Resonance frequency damping	0.00		0
PB56	VRF21B	Vibration suppression control 2 - Vibration frequency after gain switching	0.0	[Hz]	0
PB57	VRF22B	Vibration suppression control 2 - Resonance frequency after gain switching	0.0	[Hz]	0
PB58	VRF23B	Vibration suppression control 2 - Vibration frequency damping after gain switching	0.00		0
PB59	VRF24B	Vibration suppression control 2 - Resonance frequency damping after gain switching	0.00		0
PB60	PG1B	Model loop gain after gain switching	0.0	[rad/s]	0
PB61	\setminus	For manufacturer setting	0.0		
PB62			0000h		\mathbf{i}
PB63			0000h		
PB64			0000h		\backslash

5.1.3 Extension setting parameters ([Pr. PC_])

No.	Symbol	Name	Initial value	Unit	Setting
PC01	ERZ	Error excessive alarm level	0	[rev]	0
PC02	MBR	Electromagnetic brake sequence output	0	[ms]	0
PC03	*ENRS	Encoder output pulse selection	0000h		0
PC04	**COP1	Function selection C-1	0000h		0
PC05	**COP2	Function selection C-2	0000h		0
PC06	*COP3	Function selection C-3	0000h		0
PC07	ZSP	Zero speed	50	[r/min]	0
PC08	OSL	Overspeed alarm detection level	0	[r/min]	0
PC09	MOD1	Analog monitor 1 output	0000h		0
PC10	MOD2	Analog monitor 2 output	0001h		0
PC11	MO1	Analog monitor 1 offset	0	[mV]	0
PC12	MO2	Analog monitor 2 offset	0	[mV]	0
PC13	MOSDL	Analog monitor - Feedback position output standard data - Low	0	[pulse]	0
PC14	MOSDH	Analog monitor - Feedback position output standard data - High	0	[10000pulses]	0
PC15		For manufacturer setting	0		
PC16			0000h		
PC17	**COP4	Function selection C-4	0000h		0
PC18	*COP5	Function selection C-5	0000h		0
PC19		For manufacturer setting	0000h		
PC20	*COP7	Function selection C-7	0000h		0

No.	Symbol	Name	Initial value	Unit	Setting
PC21	*BPS	Alarm history clear	0000h		0
PC22		For manufacturer setting	0		
PC23			0000h		
PC24	RSBR	Forced stop deceleration time constant	100	[ms]	0
PC25		For manufacturer setting	0		
PC26	**COP8	Function selection C-8	0000h		0
PC27	**COP9	Function selection C-9	0000h		
PC28	/	For manufacturer setting	0000h		
PC29	*COPB	Function selection C-B	0000h		0
PC30	/	For manufacturer setting	0		
PC31	RSUP1	Vertical axis freefall prevention compensation amount	0	[0.0001rev]	0
PC32		For manufacturer setting	0000h	Λ	
PC33			0		\
PC34			100	\	
PC35			0000h		
PC36			0000h		
PC37			0000h		
PC38			0000h		
PC39			0000h		
PC40			0000h		
PC41			0000h	1	
PC42			0000h	1 \	
PC43			0000h	1 \	
PC44			0000h		
PC45			0000h		
PC46			0000h		
PC47			0000h		
PC48			0000h		
PC49			0000h		
PC50			0000h		
PC51			0000h		
PC52			0000h		
PC53			0000h		
PC54			0000h		
PC55			0000h		
PC56			0000h	\	
PC57			0000h		
PC58			0000h	\	
PC59			0000h	\	
PC60			0000h	\	
PC61			0000h		
PC62			0000h	\	\
PC63			0000h	\	\
PC64			0000h	\	\

5.1.4 I/O setting parameters ([Pr. PD_])

No.	Symbol	Name	Initial value	Unit	Setting
PD01	/	For manufacturer setting	0000h		
PD02	*DIA2	Input signal automatic on selection 2	0000h		0
PD03		For manufacturer setting	0020h		
PD04	\mathbf{i}		0021h		
PD05	\backslash		0022h		
PD06	\backslash		0000h		
PD07	*DO1	Output device selection 1	0005h		0
PD08	*DO2	Output device selection 2	0004h		0
PD09	*DO3	Output device selection 3	0003h		0
PD10		For manufacturer setting	0000h		
PD11	\sim		0004h		
PD12	*DOP1	Function selection D-1	0000h		0
PD13	/	For manufacturer setting	0000h		
PD14	*DOP3	Function selection D-3	0000h		0
PD15		For manufacturer setting	0000h		
PD16			0000h	1)	N
PD17			0000h] \	1
PD18			0000h		
PD19			0000h		
PD20			0		
PD21			0		
PD22			0		
PD23			0		
PD24			0000h		
PD25			0000h		
PD26			0000h		
PD27			0000h		
PD28			0000h		
PD29			0000h		
PD30			0		
PD31			0		
PD32			0		
PD33			0000h		
PD34			0000h		
PD35			0000h		
PD36			0000h		
PD37			0000h		
PD38			0000h		
PD39			0000h		
PD40			0000h		
PD41			0000h		
PD42			0000h		
PD43			0000h		
PD44			0000h		\
PD45			0000h		
PD46			0000h		\
PD47			0000h		
PD48			0000h		

5.1.5 Extension setting 2 parameters ([Pr. PE__])

No.	Symbol	Name	Initial value	Unit	Setting
PE01	**FCT1	Fully closed loop function selection 1 (Do not change this value.)	0000h		
PE02		For manufacturer setting	0000h		
PE03	*FCT2	Fully closed loop function selection 2 (Do not change this value.)	0003h		
PE04	**FBN	Fully closed loop control - Feedback pulse electronic gear 1 – Numerator (Do not change this value.)	1		
PE05	**FBD	Fully closed loop control - Feedback pulse electronic gear 1 – Denominator (Do not change this value.)	1		
PE06	BC1	Fully closed loop control - Speed deviation error detection level (Do not change this value.)	400	[r/min]	
PE07	BC2	Fully closed loop control - Position deviation error detection level	100	[kpulse]	
PF08	DUF	Fully closed loop dual feedback filter (Do not change this value.)	10	[rad/s]	
PF09	<u> </u>	For manufacturer setting	0000h		
PE10	FCT3	Fully closed loop function selection 3 (Do not change this value)	0000h	\sim	
PE11		For manufacturer setting	0000h		
PF12	N .		0000h	1\	\
PE13	1		0000h	1	\
PE14	1		0111h	1 \	\mathbf{A}
PE15			20		
PE16			0000h		
DE17			0000h		
			00000		
			00001		
PE19			00001		
PE20			00000		
PE21			0000h		\
PE22			0000h		\
PE23			0000h		
PE24			0000h		
PE25			0000h		
PE26			0000h		\
PE27			0000h		
PE28			0000h		
PE29			0000h		
PE30			0000h		
PE31	\		0000h	\	
PE32			0000h	\	\
PE33			0000h		
PE34	**FBN2	Fully closed loop control - Feedback pulse electronic gear 2 – Numerator (Do not change this value.)	1		
PE35	**FBD2	Fully closed loop control - Feedback pulse electronic gear 2 – Denominator (Do not change this value.)	1		
PE36	Ν	For manufacturer setting	0.0	\backslash	
PE37		-	0.00		
PE38			0.00		
PE39			20		
PE40	$ \setminus$		0000h		
PE41	EOP3	Function selection E-3	0000h		0
PE42	Ν	For manufacturer setting	0		
PE43	$ \rangle$	-	0.0		
			00006		
			00005		
F E 43					
PE46			00000		
PE47			0000h		

No.	Symbol	Name	Initial value	Unit	Setting
PE48 PE49 PE50 PE51 PE52 PE53 PE54 PE55 PE56 PE57 PE58 PE59 PE60 PE61 PE62 PE63 PE64		For manufacturer setting	0000h 0000h 0000h 0000h 0000h 0000h 0000h 0000h 0000h 0000h 0000h 0000h 0000h 0000h 0000h 0.00 0.00		

5.1.6 Extension setting 3 parameters ([Pr. PF__])

No.	Symbol	Name	Initial value	Unit	Setting
PF01		For manufacturer setting	0000h		
PF02	$ \rangle $		0000h		
PF03			0000h] \	
PF04	$ \setminus $		0		
PF05			0000h		
PF06	*FOP5	Function selection F-5	0000h		0
PF07	$\overline{\nabla}$ '	For manufacturer setting	0000h		
PF08	\ '		0000h] 🔪 🛛	
PF09	\ '		0		
PF10			0		
PF11			0		
PF12	DBT	Electronic dynamic brake operating time	2000	[ms]	0
PF13	N '	For manufacturer setting	0000h	\mathbf{V}	Ν
PF14	\ '		10		
PF15	j \ _ '		0000h		
PF16	\ '		0000h		
PF17	i \ '		0000h		
PF18	i \'		0000h		
PF19	j \'		0000h] \	
PF20	<u> </u>		0000h		
PF21	DRT	Drive recorder switching time setting	0	[s]	0
PF22		For manufacturer setting	200		
PF23	OSCL1	Vibration tough drive - Oscillation detection level	50	[%]	0
PF24	*OSCL2	Vibration tough drive function selection	0000h		0
PF25	CVAT	SEMI-F47 function - Instantaneous power failure detection time	200	[ms]	0
	Ļ'	(instantaneous power failure tough drive - detection time)	 	Ļ	Ļ
PF26	\land '	For manufacturer setting	0		\sim
PF27	$ \setminus $		0		
PF28			0		

No.	Symbol	Name	Initial value	Unit	Setting
PF29		For manufacturer setting	0000h	/	/
PF30			0		
PF31	FRIC	Machine diagnosis function - Friction judgement speed	0	[r/min]	0
PF32		For manufacturer setting	50	Ν	Ν
PF33			0000h	\mathbf{A}	\setminus
PF34			0000h	\mathbf{A}	\mathbf{A}
PF35			0000h	\backslash	\backslash
PF36			0000h	\	
PF37			0000h	\backslash	\setminus
PF38			0000h		
PF39			0000h		\setminus
PF40			0000h	\	\setminus
PF41			0000h		\backslash
PF42			0000h		
PF43			0000h		
PF44			0000h	\	
PF45			0000h		
PF46			0000h	\ \	
PF47	\		0000h		
PF48	1		0000h		

5.1.7 Extension setting 4 parameters ([Pr. PL__])

No.	Symbol	Name	Initial value	Unit	Setting
PL01	**LIT1	Linear servo motor/DD motor function selection 1 (Do not change this value.)	0301h		
PL02	**LIM	Linear encoder resolution – Numerator (Do not change this value.)	1000	[µm]	
PL03	**LID	Linear encoder resolution - Denominator (Do not change this value.)	1000	[µm]	
PL04	*LIT2	Linear servo motor/DD motor function selection 2 (Do not change this value.)	0003h		
PL05	LB1	Position deviation error detection level (Do not change this value.)	0	[0.01rev]	
PL06	LB2	Speed deviation error detection level (Do not change this value.)	0	[r/min]	
PL07	LB3	Torque/thrust deviation error detection level (Do not change this value.)	100	[%]	
PL08	*LIT3	Linear servo motor/DD motor function selection 3 (Do not change this value.)	0010h		
PL09	LPWM	Magnetic pole detection voltage level (Do not change this value.)	30	[%]	
PL10 PL11 PL12 PL13 PL14 PL15 PL16		For manufacturer setting	5 100 500 0000h 0 20 0		
PL17	LTSTS	Magnetic pole detection - Minute position detection method - Function selection (Do not change this value.)	0000h		
PL18	IDLV	Magnetic pole detection - Minute position detection method - Identification signal amplitude (Do not change this value.)	0	[%]	

No.	Symbol	Name	Initial value	Unit	Setting
PL19 PL20 PL21 PL22 PL23 PL24 PL25 PL26 PL27 PL28 PL29 PL30 PL31 PL31 PL31 PL33 PL34 PL35 PL36 PL37 PL36 PL37 PL38 PL36 PL37 PL38 PL39 PL40 PL41 PL42 PL43 PL44 PL45 PL44 PL45 PL46 PL47 PL48		For manufacturer setting	0 0 0 0 0000h 0 0000h		

5.2 Detailed list of parameters

POINT ●Set a value to each "x" in the "Setting digit" columns.

5.2.1 Basic setting parameters ([Pr. PA_])

No.	Symbol		Name and function		Initial value [unit]	Setting range			
PA01	**STY	Operation mod Select a opera	Operation mode Select a operation mode.						
		Setting digit	Explanation	Initial value					
		x	For manufacturer setting	0h					
	x Operation mode selection 0h 0: Standard control mode (Set 0.) 0h								
		_x	For manufacturer setting	0h					
		x	Operation mode selection To change this digit, use an application software "MR-J4(W)-B mode selection". When you change it without the application, [AL. 3E Operation mode error] will occur. Refer to App.7 for details. 0: J3 compatibility mode (LECSS	1h					

No.	Symbol		Name and function		Initial value [unit]	Setting range				
PA02	**REG	Regenerative Used to select Incorrect settin If a selected re	Regenerative option Jsed to select the regenerative option. ncorrect setting may cause the regenerative option to burn. f a selected regenerative option is not for use with the driver, [AL. 37 Parameter error] occurs.							
		Setting digit	etting Explanation Initial value							
		x	 Regenerative option selection 00: Regenerative option is not used. For driver of 100 W, regenerative resistor is not used. For driver of 200 W to 750 W, built-in regenerative resistor is used. 02: LEC-MR-RB-032 03: LEC-MR-RB-12 For manufacturer setting 	00h 0h 0h						

No.	Symbol			Name and function			Initial value [unit]	Setting range	
PA03	*ABS	Absolute p Set this pa available i	oosition detectio arameter when ι n the speed con	n system ising the absolute position detection trol mode and torque control mod	on system. The paramete e.	er is not	Refer to N and funct column.	lame ion	
		Setting digit	g	Explanation		Initial value			
			Absolute p 0: Disabled 1: Enabled	osition detection system selection d (used in incremental system) (used in absolute position detecti	on system)	0h			
		×	_ For manufa	acturer setting		0h			
		×				0h			
		×	_			UN			
PA04	PA04 *AOP1 Function selection A-1 This is used to select the forced stop input and forced stop deceleration function.								
		Setting digit	g	Explanation		Initial value			
			K For manufa	acturer setting		Oh			
		×	_	-		0h			
		_×	_ Servo force 0: Enabled 1: Disablec Refer to ta	ed stop selection (The forced stop input EM2 or EM d (The forced stop input EM2 and ble 5.1 for details.	//1 is used.) EM1 are not used.)	0h			
		×	Forced sto 0: Forced sto 2: Forced s Refer to ta	p deceleration function selection stop deceleration function disabled stop deceleration function enabled ble 5.1 for details.	d (EM1) I (EM2)	2h			
				Table 5.1 Deceleration m	ethod				
		Setting	EM2/EM1	Decelerati	on method				
		value		EM2 or EM1 is off	Alarm occurred	hraka			
		00	EMIT	interlock) turns off without the forced stop deceleration.	interlock) turns off without forced stop deceleration	brake out the n.			
		20	EM2	MBR (Electromagnetic brake interlock) turns off after the forced stop deceleration.					
		01	Not using EM2 or EM1						
		21	Not using EM2 or EM1		MBR (Electromagnetic interlock) turns off after forced stop deceleration	brake the n.			
		21	Not using EM2 or EM1		MBR (Electromagnetic interlock) turns off after forced stop deceleration	brake the n.			

No.	Symbol			Name and function		Initial value [unit]	Setting range					
PA08	ATU	Auto tuning m Select the gain	ode n adjustment mode.			Refer to N and functi column.	lame ion					
		Setting digit		Explanation	Initial value							
		×	Gain adjustment mode	e selection	1h							
			0: 2 gain adjustment n	node 1 (interpolation mode)								
			1: Auto tuning mode 1									
			2: Auto tuning mode 2									
			3: Manual mode	nada 2								
			4. 2 gain adjustment in Refer to table 5.2 for c	to table 5.2 for details.								
		×	For manufacturer setti	nanufacturer setting 0h								
		^_										
					0h							
			Table 5.2 Ga	in adjustment mode selection								
		Setting value	Gain adjustment mode	Automatically adjusted parameter								
		0	2 gain adjustment	[Pr. PB06 Load to motor inertia ratio]								
			mode 1 (internelation mode)	[Pr. PB08 Position loop gain]								
			(interpolation mode)	[Pr. PB09 Speed loop gain]								
		1	Auto tuning modo 1	[Pr. PB10 Speed Integral compensation]								
		'	Auto turning mode i	[Pr. PB07 Model loop gain]								
				[Pr. PB08 Position loop gain]								
				[Pr. PB09 Speed loop gain]								
				[Pr. PB10 Speed integral compensation]								
		2	Auto tuning mode 2	[Pr. PB07 Model loop gain]								
				[Pr. PB08 Position loop gain]								
				[Pr. PB09 Speed loop gain]								
		2	Manual modo	[Pr. PBT0 Speed Integral compensation]								
		3	2 gain adjustment	anual mode								
		*	mode 2	[Pr PB09 Speed loop gain]								
			-	[Pr. PB10 Speed integral compensation]								
			1									

No.	Symbol				Name	an	d function	I		Initial value [unit]	Setting range
PA09	RSP	Auto	o tuning r	esponse						16	1 to 40
		Set	a respons	se of the aut	o tuning.						
		ĺ		Machine	e characteristic			Machin	e characteristic		
			Setting		Guideline for		Setting		Guideline for		
			value	Pesnonse	machine		value	Response	machine		
			10.00	Response	resonance			Response	resonance		
					frequency [Hz]				frequency [Hz]		
			1	Low	2.7		21	Middle	67.1		
			2	response	3.6		22	response	75.6		
			3		4.9		23		85.2		
			4		6.6		24		95.9		
			5		10.0		25		108.0		
			6		11.3		26		121.7		
			7		12.7		27		137.1		
			8		14.3		28		154.4		
			9		16.1		29		173.9		
			10		18.1		30		195.9		
			11		20.4		31		220.6		
			12		23.0		32		248.5		
			13		25.9		33		279.9		
			14		29.2		34		315.3		
			15		32.9		35		355.1		
			16		37.0		36		400.0		
			17		41.7		37		446.6		
			18		47.0		38		501.2		
			19	Middle	52.9		39	High	571.5		
			20	response	59.6		40	response	642.7		
						-					
PA10	INP	In-p	osition ra	nge						1600	0 to
		Set	an in-pos	ition range p	er command pulse).				[pulse]	65535

No.	Symbol	Name and	function	Initial value [unit]	Setting range							
PA14	*POL	Rotation direction selection This is used to select a rotation direction.		0	0 to 1							
		Servo motor rotation	n direction									
		value Positioning address F	Positioning address decrease									
		0 CCW or positive direction CW	V or negative direction									
		1 CW or negative direction CC	W or positive direction									
		The following shows the servo motor rotation dir	ections.									
244	1000											
PA15	*ENR	Encoder output pulses Set the encoder output pulses from the driver by revolution, dividing ratio, or electronic gear ratio. To set a numerator of the electronic gear, select setting (3_)" of "Encoder output pulse setting The maximum output frequency is 4.6 Mpps. Set	v using the number of output pulses per (after multiplication by 4) "A-phase/B-phase pulse electronic gear g selection" in [Pr. PC03]. t the parameter within this range.	4000 [pulse/ rev]	1 to 65535							
PA16	*ENR2	Encoder output pulses 2 Set a denominator of the electronic gear for the a of the electronic gear, select "A-phase/B-phase "Encoder output pulse setting selection" in [Pr. P	A/B-phase pulse output. To set a denominator pulse electronic gear setting (3 _)" of PC03].	1	1 to 65535							
PA17	**MSR	Do not change this value.		0000h	0000h							
PA18	**MTY	Do not change this value.		0000h	0000h							
No.	Symbol				Name a	nd functio	n				Initial value [unit]	Setting range
------	--------	--	-------------------	---------	--------	------------	-----------	-----------	----	----	----------------------------	------------------
PA19	*BLK	Parameter w	riting inhibit								00ABh	Refer to
		Select a refe		Name								
		Refer to table 5.3 for settings.										and
		Table 5.3 [Pr. PA19] setting value and reading/writing range										column.
		PA19	Setting operation	PA	PB	PC	PD	PE	PF	PL		
		Other	Reading	0			/					
		than below	Writing	0	\geq		\sum	\sum				
		000Ab	Reading	Only 19								
		000/11	Writing	Only 19			\square	\square				
		000Bh	Reading	0	0	0						
		0000011	Writing	0	0	0						
		000Ch	Reading	0	0	0	0					
			Writing	0	0	0	0					
		000Fh	Reading	0	0	0	0	0		0		
			Writing	0	0	0	0	0		0		
		00AAh	Reading	0	0	0	0	0	0			
			Writing	0	0	0	0	0	0			
		00ABh	Reading	0	0	0	0	0	0	0		
		(Initial value)	Writing	0	0	0	0	0	0	0		
		100Ph	Reading	0		/			/			
		тоовп	Writing	Only 19			/	/		/		
		100Ch	Reading	0	0	0	0	/	/			
		100011	Writing	Only 19	/							
		100Eb	Reading	0	0	0	0	0		0		
		100111	Writing	Only 19								
		10AAh	Reading	0	0	0	0	0	0			
			Writing	Only 19								
		10ABh	Reading	0	0	0	0	0	0	0		
			Writing	Only 19								

No.	Symbol		Name and function		Initial value [unit]	Setting range
PA20	*TDS	Tough drive sett Alarms may not power supply ar You can assign PD07] to [Pr. PD	Refer to N and funct column.	Name ion		
		Setting digit	Explanation	Initial value		
		X F	For manufacturer setting	0h		
		X \ C S C S fi Ie F	Vibration tough drive selection D: Disabled 1: Enabled Selecting "1" enables to suppress vibrations by automatically changing setting values of [Pr. PB13 Machine resonance suppression filter 1] and [Pr. PB15 Machine resonance suppression liter 2] in case that the vibration exceed the value of the oscillation evel set in [Pr. PF23]. Refer to section 7.3 for details.			
		X 5 C C C C C C C C C C C C C C C C C C C	SEMI-F47 function selection (instantaneous power failure tough drive selection) D: Disabled 1: Enabled Selecting "1" enables to avoid occurring [AL. 10.1 Voltage drop in the control circuit power] using the electrical energy charged in the capacitor in case that an instantaneous power failure occurs during operation. Set the time of until [AL. 10.1 Voltage drop in the control circuit power] occurs in [Pr. PF25 SEMI-F47 function - Instantaneous power failure detection time (instantaneous power failure tough drive - detection time)]. For manufacturer setting	Oh Oh		
PA21	*AOP3	Function selection	on A-3		Refer to N	Name
		Setting digit	Explanation	Initial value	and funct column.	ion
		X (0)	One-touch tuning function selection D: Disabled I: Enabled When the digit is "0", the one-touch tuning with setup software (MR Configurator2) will be disabled. For manufacturer setting	1h 0h 0h 0h		

No.	Symbol		Name and function		Initial value [unit]	Setting range			
PA22	**PCS	Position control	ol composition selection		Refer to N	lame			
		Setting digit	Explanation	Initial value	and functi column.	ion			
		×	For manufacturer setting	0h					
		x_		0h					
		×		0h					
		×	Scale measurement mode selection	0h					
			U: DISADIED 1: Lised in absolute position detection system						
			2: Used in incremental system						
			The absolute position detection system cannot be used while an						
			incremental type encoder is used. Enabling absolute position						
			detection system will trigger [AL. 37 Parameter error].						
PA23	DRAT	Drive recorder	arbitrary alarm trigger setting		Refer to Name				
		Setting	Evaluation	Initial	and functi	on			
		digit	Explanation	value	column.				
		××	00h						
			When these digits are "0 0", only the arbitrary alarm No. setting will						
		x x Alarm No. setting							
			for the drive recorder function.						
			When "0 0" are set, arbitrary alarm trigger of the drive recorder will						
		Setting exam							
		To activate the	e drive recorder when IAL. 50 Overload 11 occurs. set "5 0 0 0".						
		To activate the	e drive recorder when [AL. 50.3 Thermal overload error 4 during opera						
		occurs, set "5							
PA24	AOP4	Function selec	ction A-4		Refer to N	lame ion			
		Setting digit	Explanation	Initial value	column.				
		×	Vibration suppression mode selection	0h					
			0: Standard mode						
			1: 3 INEITIA MODE						
			When two low resonance frequencies are generated, select "3						
			inertia mode (1)". When the load to motor inertia ratio exceeds						
			mode (2)"						
			When you select the standard mode or low response mode,						
			"Vibration suppression control 2" is not available.						
			available.						
			Before changing the control mode with the PC or PLCetc during						
			the 3 inertia mode or low response mode, stop the motor.						
		X	For manuracturer setting	Un Ob					
		×	-	0h					
			1	011					

No.	Symbol	Name and function		Initial value [unit]	Setting range
PA25	OTHOV	One-touch tuning - Overshoot permissible level This is used to set a permissible value of overshoot amount with a percentage to in-prange. However, setting "0" will be 50%.	position	0 [%]	0 to 100
PA26	*AOP	Function selection A-5		Refer to N	Name
		Setting digit Explanation	Initial value	column.	ion
		 Torque limit function selection at instantaneous power failure Disabled Enabled When an instantaneous power failure occurs during operation, you can save electric energy charged in the capacitor in the driver by limiting torque at acceleration. You can also delay the time until [AL. 10.2 Voltage drop in the main circuit power] occurs with instantaneous power failure tough drive function. Doing this will enable you to set a longer time in [Pr. PF25 Instantaneous power failure tough drive - Detection time]. To enable the torque limit function at instantaneous power failure, select "Enabled (_ 1)" of "SEMI-F47 function selection (instantaneous power failure tough drive selection)" in [Pr. PA20]. This parameter setting is supported by driver with software version A6 or later. 	Oh		
		x_ For manufacturer setting	0h		
		X	0h		
		x	0h		

5.2.2 Gain/filter setting parameters ([Pr. PB_])

No.	Symbol	Name and function		Initial value [unit]	Setting range					
PB01	FILT	Adaptive tuning mode (adaptive filter II) Set the adaptive filter tuning.		Refer to I and funct column.	Name ion					
		Setting Explanation	Initial value							
		Filter tuning mode selection Select the adjustment mode of the machine resonance suppression filter 1. Refer to section 7.1.2 for details. 0: Disabled 1: Automatic setting 2: Manual setting	Oh							
		x For manufacturer setting	0h							
			0h							
PB02	VRFT	Vibration suppression control tuning mode (advanced vibration suppression control	ration suppression control tuning mode (advanced vibration suppression control II)							
		This is used to set the vibration suppression control tuning. Refer to section 7.1.5 for	r details.	and funct	ion					
		Setting digit Explanation								
		 x Vibration suppression control 1 tuning mode selection Select the tuning mode of the vibration suppression control 1. 0: Disabled 1: Automatic setting 2: Manual setting 								
		2: Manual setting 2: Manual setting x_ Vibration suppression control 2 tuning mode selection Select the tuning mode of the vibration suppression control 2. To enable the digit, select "3 inertia mode (1)" of "Vibration suppression mode selection" in [Pr. PA24 Function selection A-4]. 0: Disabled 1: Automatic setting								
		x For manufacturer setting	0h							
		x	0h							
PB03	TFBGN	Torque feedback loop gain This is used to set a torque feedback loop gain in the continuous operation to torque mode. Decreasing the setting value will also decrease a collision load during continuous o torque control mode. Setting a value less than 6 rad/s will be 6 rad/s	e control peration to	18000 [rad/s]	0 to 18000					
PB04	FFC	Feed forward gain		0	0 to 100					
	-	Set the feed forward gain. When the setting is 100%, the droop pulses during operation at constant speed are zero. However, sudden acceleration/deceleration will increase the overshoot. As a g when the feed forward gain setting is 100%, set 1 s or more as the acceleration time up to the rated speed.	nearly juideline, e constant	[%]						

No.	Symbol	Name and function	Initial value [unit]	Setting range		
PB06	GD2	Load to motor inertia ratio This is used to set the load to motor inertia ratio. The setting of the parameter will be the automatic setting or manual setting depending on the [Pr. PA08] setting. Refer to the following table for details. When the parameter is automatic setting, the value will vary between 0.00 and 100.00.	7.00 Multiplier	0.00 to 300.00		
		Pr. PA08 This parameter				
		0 (2 gain adjustment mode 1 Automatic setting				
		1 (Auto tuning mode 1) 2 (Auto tuning mode 2) 3 (Manual mode)				
		4 (2 gain adjustment mode 2)				
0007	504		45.0	1.0.1		
PB07	PG1	15.0 [rad/s]	1.0 to 2000.0			
		Pr. PA08 This parameter				
		0 (2 gain adjustment mode 1 Manual setting (interpolation mode))				
		1 (Auto tuning mode 1) Automatic setting 2 (Auto tuning mode 2)				
	4 (2 gain adjustment mode 2) Manual setting					
PB08	PG2	Position loop gain This is used to set the gain of the position loop. Set this parameter to increase the position response to level load disturbance. Increasing the setting value will also increase the response level to the load disturbance but will be liable to generate vibration and/or noise. The setting of the parameter will be the automatic setting or manual setting depending on the [Pr. PA08] setting. Refer to the following table for details.	37.0 [rad/s]	1.0 to 2000.0		
		Pr. PA08 This parameter				
		0 (2 gain adjustment mode 1 Automatic setting (interpolation mode))				
		1 (Auto tuning mode 1)				
		2 (Auto tuning mode 2)				
		4 (2 gain adjustment mode 2) Automatic setting				
PB09	VG2	Speed loop gain	823 [rad/a]	20 to		
		Set this parameter when vibration occurs on machines of low rigidity or large backlash	[iau/s]	00000		
		Increasing the setting value will also increase the response level but will be liable to generate vibration and/or noise.				
		The setting of the parameter will be the automatic setting or manual setting depending on the [Pr. PA08] setting. Refer to the table of [Pr. PB08] for details.				
PB10	VIC	Speed integral compensation	33.7	0.1 to		
		This is used to set the integral time constant of the speed loop. Decreasing the setting value will increase the response level but will be liable to generate	[ms]	1000.0		
		The setting of the parameter will be the automatic setting or manual setting depending on the [Pr. PA08] setting. Refer to the table of [Pr. PB08] for details.				

No.	Symbol		Name and function		Initial value [unit]	Setting range						
PB11	VDC	Speed differen	ntial compensation		980	0 to						
		This is used to	set the differential compensation.	D		1000						
		switching cont	rol selection" in [Pr. PB24].	D								
PB12	OVA	Overshoot am	ount compensation		0	0 to 100						
		This is used to	o set a viscous friction torque in percentage unit at servo motor rated s	peed.	[%]							
		When the resp may be lower	ponse level is low or when the torque is limited, the efficiency of the pa	rameter								
PB13	NH1	Machine resor	nance suppression filter 1		4500	10						
		Set the notch	frequency of the machine resonance suppression filter 1.		[Hz]	to						
		When you sel	en you select "Automatic setting (1)" of "Filter tuning mode selection" in [Pr. PB01],									
		this parameter When you seld	r will be adjusted automatically. ect "Manual setting (2)" of "Filter tuning mode selection" in [Pr. P	B011 the								
		setting value v	etting value will be enabled.									
PB14	NHQ1	Notch shape s	Notch shape selection 1									
		Set the shape	of the machine resonance suppression filter 1.	00011	and funct	ion						
		this parameter	r will be adjusted automatically.	. PB01],	column.							
		Set manually	for the manual setting.									
		Sotting		Initial								
		digit	Explanation	value								
		X	For manufacturer setting	0h								
	x_ Notch depth selection 0h											
			0: -40 dB 1: -14 dB									
	2: -8 dB 3: -4 dB											
		_×	Notch width selection $0 = 2$	0h								
			1: α = 3									
			2: α = 4									
			$3: \alpha = 5$	01-								
			For manufacturer setting	Un								
PB15	NH2	Machine resor	nance suppression filter 2		4500	10						
		Set the notch	frequency of the machine resonance suppression filter 2.		[Hz]	to						
		To enable the	setting value, select "Enabled (1)" of "Machine resonance suppr	ession		4500						
DD16		filter 2 selection	n" in [Pr. PB16].		Defer to 1	lama						
FDIO	NEQZ	Set the shape	of the machine resonance suppression filter 2.		and funct	ion						
		, ,			column.							
		Setting	Explanation	Initial value								
		X	Machine resonance suppression filter 2 selection	0h								
			0: Disabled									
			1: Enabled	01-								
		×-	0: -40 dB	UN								
			1: -14 dB									
			2: -8 dB									
		×	x Notch width selection 0h									
		-^	0: α = 2									
			1: $\alpha = 3$									
			2. u - 4 3: α = 5									
		x	For manufacturer setting	0h								

Symbol			Na	me and functio	n		Initial value [unit]	Setting range
NHF	Shaft resonand This is used fo This is used to When you sele in [Pr. PB23], t to motor inertia When "Shaft re setting value o When you sele [Pr. PB49], the	filter selection" u use and load r. PB23], the selection" in	Refer to N and funct column.	Name ion				
	Setting			Explanation		Initial		
		Shaft resonance supp This is used for setting Refer to table 5.4 for s Set the value closest t	res g the setti	sion filter settir e shaft resonal ngs. he frequency ve	g frequency selection nce suppression filter. ou need.	00h		
	_×	Notch depth selection 0: -40 dB 1: -14 dB 2: -8 dB 3: -4 dB		1 · · · · · · · · · · · · · · · · · · ·		Oh		
	3: -4 dB x For manufacturer setting 0h							
	Table							
	Setting value Frequency [Hz] Setting value Frequency [Hz]							
	00	Disabled		10	562			
	01	Disabled		11	529			
	02	4500		12	500			
	03	3000		13	473			
	04	1800		14	430			
	05	1500		16	420			
	07	1285		10	391			
	08	1125		18	375			
	09	1000		19	360			
	0A	900		1A	346			
	0B	818		1B	333			
	0C	750		1C	321			
	0D	692		1D	310			
	0E	642		1E	300			
	0F	600		1F	290			
LPF	Low-pass filter Set the low-pas The following s $[Pr. PB2$ $\0_(Initia)$ $\1$	setting ss filter. shows a relation of a re 23] [Pr. PB1 I value) Automatic s _ Setting va enable _ Setting va disable	quii 8] settii alue d alue	red parameter	to this parameter.		3141 [rad/s]	100 to 18000
	Symbol NHF	Symbol Shaft resonand This is used fo This is used to When you sele in [Pr. PB23], th to motor inertia When "Shaft re- setting value o When you sele [Pr. PB49], the Setting digit	Symbol NHF Shaft resonance suppression filter This is used for setting the shaft reson This is used to suppress a low-freque When you select "Automatic setting (in [Pr. PB23], the value will be calcula to motor inertia ratio. Set manually fo When "Shaft resonance suppression setting value of this parameter will be When you select "Enabled (1)", [Pr. PB49], the shaft resonance supp This is used for setting Refer to table 5.4 fors Set the value closest fi 2.8 dB 3.2 dB <td>Symbol Na NHF Shaft resonance suppression filter This is used for setting the shaft resonan This is used to suppress a low-frequency When you select "Automatic setting (in [Pr. PB23], the value will be calculated to motor inertia ratio. Set manually for "M When "Shaft resonance suppression filte setting value of this parameter will be dis When you select "Enabled (1)" of "M When "Shaft resonance suppression filte setting digit </br></td> <td>Symbol Name and function NHF Shaft resonance suppression filter This is used for setting the shaft resonance suppression This is used for setting (0)" of "Shaft in [Pr. PB23], the value will be calculated automatically to motor inertia ratio. Set manually for "Manual setting (0)" of "Machine resonance suppression filter selection" is "setting value of this parameter will be disabled. When "Shaft resonance suppression filter selection" is "setting value of this parameter will be disabled. When "Shaft resonance suppression filter selection" is "setting value of this parameter will be disabled. When "Shaft resonance suppression filter is not digit in [Pr. PB49], the shaft resonance suppression filter is not [Pr. PB49], the shaft resonance suppression filter is not [Pr. PB49], the shaft resonance suppression filter is not [Pr. PB49], the value closest to the frequency or [Pr. 40 dB] 1 = X X Shaft resonance suppression filter setting Setting Setting the shaft resonance suppression filter setting 2 = 8 dB 3: -4 dB x For manufacturer setting Setting value 10 Di abled 11 Di abled 12 13 04 2250 14 Di abled 15 16 06 1500 16 17 08 1125 18 18 0C 750 0D<</td> <td>Symbol Name and function NHF Shaft resonance suppression filter. This is used for setting the shaft resonance suppression filter. This is used to suppress a low-frequency machine vibration. When you select "Automatic setting (0)" of "Shaft resonance suppression in (Pr, PB23), the value will be calculated automatically from the servo motor yo to motor inertia ratio. Set manually for "Manual setting (1")". When 'Shaft resonance suppression filter setting shabled (2")" in [P setting value of this parameter will be disabled. VPr. PB23), the shaft resonance suppression filter setting frequency selection This is used for setting the shaft resonance suppression filter setting digit Explanation Setting digit Explanation If is is used for setting the shaft resonance suppression resonance suppression filter setting frequency selection This is used for setting the shaft resonance suppression filter setting Setting Explanation </td> <td>Symbol Name and function NHF Shaft resonance suppression filter This is used for setting the shaft resonance suppression filter. This is used to suppress a low-frequency machine vibration. When you select "Automatic setting (1')" When 'Shaft resonance suppression filter selection' in [Pr. PB23], the value will be calculated automatically from the servo motor you use and load to motor inertia ratio. Setting manufactor is "Disabled (2")" in [Pr. PB23], the setting value of this parameter will be disabled. When you select "Enabled (1")" of "Machine resonance suppression filter is election" in [Pr. PB49], the shaft resonance suppression filter is not available. Initial walue Setting Explanation Initial (walue X =</td> <td>Symbol Name and function Initial value (unit) NHF Shaft resonance suppression filter This is used for setting the shaft resonance suppression filter. This is used for suppress a low-frequency machine vibration. When you select "Automatic setting (0)" of "Shaft resonance suppression filter selection" in [Pr. PE3], the value will be calculated automatically from the serve motor you use and load to motor inertia ratio. When you select "Enabled (1)" of "Abatine resonance suppression filter selection" in [Pr. PE3], the value of usabled. Initial value Setting Explanation Initial value value (unit) Setting Explanation Initial value X Shaft resonance suppression filter setting frequency selection (unit) Oth X Shaft resonance suppression filter setting frequency selection Oth X Shaft resonance suppression filter setting frequency selection Oth X This is used for setting the shaft resonance suppression filter setting frequency selection Oth Table 5.4 Shaft resonance suppression filter setting frequency selection Oth Table 5.4 Shaft resonance suppression filter setting frequency [Hz] 10 00 Disabled 01 10 562 01 Disabled 02 11</br></br></br></br></br></br></br></br></br></td>	Symbol Na NHF Shaft resonance suppression filter This is used for setting the shaft resonan 	Symbol Name and function NHF Shaft resonance suppression filter This is used for setting the shaft resonance suppression This is used for setting (0)" of "Shaft in [Pr. PB23], the value will be calculated automatically to motor inertia ratio. Set manually for "Manual setting (0)" of "Machine resonance suppression filter selection" is "setting value of this parameter will be disabled. When "Shaft resonance suppression filter selection" is "setting value of this parameter will be disabled. When "Shaft resonance suppression filter selection" is "setting value of this parameter will be disabled. When "Shaft resonance suppression filter is not digit in [Pr. PB49], the shaft resonance suppression filter is not [Pr. PB49], the shaft resonance suppression filter is not [Pr. PB49], the shaft resonance suppression filter is not [Pr. PB49], the value closest to the frequency or [Pr. 40 dB] 1 = X X Shaft resonance suppression filter setting Setting Setting the shaft resonance suppression filter setting 2 = 8 dB 3: -4 dB x For manufacturer setting Setting value 10 Di abled 11 Di abled 12 13 04 2250 14 Di abled 15 16 06 1500 16 17 08 1125 18 18 0C 750 0D<	Symbol Name and function NHF Shaft resonance suppression filter. This is used for setting the shaft resonance suppression filter. This is used to suppress a low-frequency machine vibration. When you select "Automatic setting (0)" of "Shaft resonance suppression in (Pr, PB23), the value will be calculated automatically from the servo motor yo to motor inertia ratio. Set manually for "Manual setting (1")". When 'Shaft resonance suppression filter setting shabled (2")" in [P setting value of this parameter will be disabled. VPr. PB23), the shaft resonance suppression filter setting frequency selection This is used for setting the shaft resonance suppression filter setting digit Explanation Setting digit Explanation If is is used for setting the shaft resonance suppression resonance suppression filter setting frequency selection This is used for setting the shaft resonance suppression filter setting Setting Explanation	Symbol Name and function NHF Shaft resonance suppression filter This is used for setting the shaft resonance suppression filter. This is used to suppress a low-frequency machine vibration. When you select "Automatic setting (1')" When 'Shaft resonance suppression filter selection' in [Pr. PB23], the value will be calculated automatically from the servo motor you use and load to motor inertia ratio. Setting manufactor is "Disabled (2")" in [Pr. PB23], the setting value of this parameter will be disabled. When you select "Enabled (1")" of "Machine resonance suppression filter is election" in [Pr. PB49], the shaft resonance suppression filter is not available. Initial walue Setting Explanation Initial (walue X =	Symbol Name and function Initial value (unit) NHF Shaft resonance suppression filter This is used for setting the shaft resonance suppression filter. This is used for suppress a low-frequency machine vibration. When you select "Automatic setting (0)" of "Shaft resonance suppression filter selection" in [Pr. PE3], the value will be calculated automatically from the serve motor you use and load to motor inertia ratio. When you select "Enabled (1)" of "Abatine resonance suppression filter selection" in [Pr. PE3], the value of usabled. Initial value Setting Explanation Initial value value (unit) Setting Explanation Initial

No.	Symbol	Name and function	Initial value [unit]	Setting range
PB19	VRF11	Vibration suppression control 1 - Vibration frequency Set the vibration frequency for vibration suppression control 1 to suppress low-frequency machine vibration. When "Vibration suppression control 1 tuning mode selection" is "Automatic setting (1)" in [Pr. PB02], this parameter will be set automatically. Set manually for "Manual setting (2)". Refer to section 7.1.5 for details.	100.0 [Hz]	0.1 to 300.0
PB20	VRF12	Vibration suppression control 1 - Resonance frequency Set the resonance frequency for vibration suppression control 1 to suppress low-frequency machine vibration. When "Vibration suppression control 1 tuning mode selection" is "Automatic setting (1)" in [Pr. PB02], this parameter will be set automatically. Set manually for "Manual setting (2)". Refer to section 7.1.5 for details.	100.0 [Hz]	0.1 to 300.0
PB21	VRF13	Vibration suppression control 1 - Vibration frequency damping Set a damping of the vibration frequency for vibration suppression control 1 to suppress low- frequency machine vibration. When "Vibration suppression control 1 tuning mode selection" is "Automatic setting (1)" in [Pr. PB02], this parameter will be set automatically. Set manually for "Manual setting (2)". Refer to section 7.1.5 for details.	0.00	0.00 to 0.30
PB22	VRF14	Vibration suppression control 1 - Resonance frequency damping Set a damping of the resonance frequency for vibration suppression control 1 to suppress low- frequency machine vibration. When "Vibration suppression control 1 tuning mode selection" is "Automatic setting (1)" in [Pr. PB02], this parameter will be set automatically. Set manually for "Manual setting (2)". Refer to section 7.1.5 for details.	0.00	0.00 to 0.30
PB23	VFBF	Low-pass filter selection Select the shaft resonance suppression filter and low-pass filter. Setting digit Explanation Initial value x Shaft resonance suppression filter selection 0: Automatic setting 1: Manual setting 2: Disabled When you select "Enabled (1)" of "Machine resonance suppression filter 4 selection" in [Pr. PB49], the shaft resonance suppression filter is not available. x Low-pass filter selection 0: Automatic setting 1: Manual setting 1: Manual setting	Refer to N and funct column.	Vame ion
PB24	*MVS	2: Disabled 0h x For manufacturer setting 0h x 0h 0h	Refer to N	Name
		Setting digit Explanation Initial value x Slight vibration suppression control selection 0: Disabled 1: Enabled To enable the slight vibration suppression control, select "Manual mode (3)" of "Gain adjustment mode selection" in [Pr. PA08]. Slight vibration suppression control cannot be used in the speed control mode. 0h x PI-PID switching control selection 0: PI control enabled (Switching to PID control is possible with commands of PC or PLCetc.) 3: Continuous PID control enabled 0h -x For manufacturer setting 0h	column.	

No.	Symbol	Name and function		Initial value [unit]	Setting range
PB26	*CDP	Gain switching function Select the gain switching condition. Set conditions to enable the gain switching values set in [Pr. PB29] to [Pr. PB36] and PB56] to [Pr. PB60].	մ [Pr.	Refer to N and funct column.	Name ion
		Setting digit Explanation	Initial value		
		Gain switching selection 0: Disabled 1: Control command from PC or PLCetc is enabled 2: Command frequency 3: Droop pulses 4: Servo motor speed	0h		
		 x_ Gain switching condition selection 0: Gain after switching is enabled with gain switching condition or more 1: Gain after switching is enabled with gain switching condition or less 	0h		
		x For manufacturer setting			
			UII		
PB27	CDL	Gain switching condition This is used to set the value of gain switching (command frequency, droop pulses, a motor speed) selected in [Pr. PB26]. The set value unit differs depending on the switching condition item. (Refer to sectio	10 [kpps]/ [pulse]/ [r/min]	0 to 65535	
PB28	CDT	Gain switching time constant This is used to set the time constant at which the gains will change in response to th conditions set in [Pr. PB26] and [Pr. PB27].	1 [ms]	0 to 100	
PB29	GD2B	Load to motor inertia ratio after gain switching This is used to set the load to motor inertia ratio to motor mass ratio when gain switc enabled. This parameter is enabled only when you select "Manual mode (3)" of "Gain ac	hing is ljustment	7.00 [Multipli er]	0.00 to 300.00
PB30	PG2B	Position loop gain after gain switching Set the position loop gain when the gain switching is enabled. When you set a value less than 1.0 rad/s, the value will be the same as [Pr. PB08]. This parameter is enabled only when you select "Manual mode (3)" of "Gain ad mode selection" in [Pr. PA08].	ljustment	0.0 [rad/s]	0.0 to 2000.0
PB31	VG2B	Speed loop gain after gain switching Set the speed loop gain when the gain switching is enabled. When you set a value less than 20 rad/s, the value will be the same as [Pr. PB09]. This parameter is enabled only when you select "Manual mode (3)" of "Gain ad mode selection" in [Pr. PA08].	ljustment	0 [rad/s]	0 to 65535
PB32	VICB	Speed integral compensation after gain switching Set the speed integral compensation when the gain changing is enabled. When you set a value less than 0.1 ms, the value will be the same as [Pr. PB10]. This parameter is enabled only when you select "Manual mode (3)" of "Gain ac mode selection" in [Pr. PA08].	ljustment	0.0 [ms]	0.0 to 5000.0
PB33	VRF11B	 Vibration suppression control 1 - Vibration frequency after gain switching Set the vibration frequency for vibration suppression control 1 when the gain switching enabled. When you set a value less than 0.1 Hz, the value will be the same as [Pr. PB19]. This parameter will be enabled only when the following conditions are fulfilled. "Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (3)". "Vibration suppression control 1 tuning mode selection" in [Pr. PB02] is "Manual s2)". "Gain switching selection" in [Pr. PB26] is "Control command from PC or PLCet enabled (1"). Switching during driving may cause a shock. Be sure to switch them after the servor stops. 	ng is etting (c is motor	0.0 [Hz]	0.0 to 300.0

No.	Symbol	Name and function	Initial value [unit]	Setting range
PB34	VRF12B	 Vibration suppression control 1 - Resonance frequency after gain switching Set the resonance frequency for vibration suppression control 1 when the gain switching is enabled. When you set a value less than 0.1 Hz, the value will be the same as [Pr. PB20]. This parameter will be enabled only when the following conditions are fulfilled. "Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (3)". "Vibration suppression control 1 tuning mode selection" in [Pr. PB02] is "Manual setting (2)". "Gain switching selection" in [Pr. PB26] is "Control command from PC or PLCetc is enabled (1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor stops. 	0.0 [Hz]	0.0 to 300.0
PB35	VRF13B	 Vibration suppression control 1 - Vibration frequency damping after gain switching Set a damping of the vibration frequency for vibration suppression control 1 when the gain switching is enabled. This parameter will be enabled only when the following conditions are fulfilled. "Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (3)". "Vibration suppression control 1 tuning mode selection" in [Pr. PB02] is "Manual setting (2)". "Gain switching selection" in [Pr. PB26] is "Control command from PC or PLCetc is enabled (1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor stops. 	0.00	0.00 to 0.30
PB36	VRF14B	 Vibration suppression control 1 - Resonance frequency damping after gain switching Set a damping of the resonance frequency for vibration suppression control 1 when the gain switching is enabled. This parameter will be enabled only when the following conditions are fulfilled. "Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (3)". "Vibration suppression control 1 tuning mode selection" in [Pr. PB02] is "Manual setting (_2)". "Gain switching selection" in [Pr. PB26] is "Control command from PC or PLCetc is enabled (1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor stops. 	0.00	0.00 to 0.30

No.	Symbol			Na	ame and functio	n				Initial value [unit]	Setting range	
PB45	CNHF	Command r	notch filter							Refer to I	Name	
		Set the com	imand notch filte	er.						column.	ion	
		Setting			Explanation				Initial value			
		x x	Command n	otch filter set	ting frequency	sele	ection		00h			
			Refer to tabl	e 5.5 for the	relation of setti	ng v	values to fr	equency.				
		_×	Notch depth	selection					0h			
			Refer to tabl	er to table 5.6 for details.								
		L_^		sturer setting					UII			
		Table	able 5.5 Command notch filter setting frequency selection									
		Setting value	Frequency [Hz]	Setting value	Frequency [Hz]		Setting value	Frequency [Hz]				
		00	Disabled	20	70		40	17.6				
		01	2250	21	66		41	16.5				
		02	1125	22	62		42	15.6]			
		03	750	23	59		43	14.8				
		04	562	24	56		44	14.1				
		05	450	25	53		45	13.4				
		06	375	26	51		46	12.8				
		07	321	27	48		47	12.2				
		08	281	28	46		48	11.7				
		09	250	29	45		49	11.3				
			225	2A	43		4A	10.8				
		08	204	2B	41		4B	10.4				
			107	20	40		40 4D	0.7				
			173	20	30		4D 4E	9.7				
			150	2L 2E	36		4E	9.4				
		10	140	30	35.2		50	8.8				
		11	132	31	33.1		51	8.3				
		12	125	32	31.3		52	7.8				
		13	118	33	29.6		53	7.4	1			
		14	112	34	28.1		54	7.0				
		15	107	35	26.8		55	6.7	1			
		16	102	36	25.6		56	6.4				
		17	97	37	24.5		57	6.1				
		18	93	38	23.4		58	5.9				
		19	90	39	22.5		59	5.6				
		1A	86	3A	21.6		5A	5.4				
		1B	83	3B	20.8		5B	5.2	l			
		1C	80	3C	20.1		5C	5.0				
		1D	77	3D	19.4		5D	4.9				
		1E	75	3E	18.8		5E	4.7				
		1F	72	3F	18.2		5F	4.5	J			

No.	Symbol			Initial value [unit]	Setting range				
PB45	CNHF		Table 5.6 Notch	depth selection			Refer to Name and function		
		Setting value	Depth [dB]	Setting value	Depth [dB]		column.		
		0							
		1							
		2	-18.1	A	-4.1				
		3	-14.5	В	-3.3				
		4	-12.0	С	-2.5				
		5	-10.1	D	-1.8				
		6	-8.5	E	-1.2				
		7	-7.2	F	-0.6				
PB46	NH3	Machine resonance suppression filter 3 4500 Set the notch frequency of the machine resonance suppression filter 3. [Hz] To enable the setting value, select "Enabled (1)" of "Machine resonance suppression [Hz] filter 3 selection" in IPr. PB471 [Hz]						10 to 4500	
PB47	NHQ3	Notch shape s	election 3				Refer to Name		
		Set the shape	of the machine resonance	ce suppression filter	3.		and funct	ion	
		Sotting				Initial	column.		
		diait		Explanation		value			
		x	Machine resonance suc	pression filter 3 sele	ction	Oh			
			0: Disabled						
			1: Enabled						
		×_	Notch depth selection			0h			
			0: -40 dB						
			1: -14 dB						
			2: -8 dB						
			3: -4 dB						
		_ ×	Notch width selection			0h			
			$0: \alpha = 2$						
			$1: \alpha = 3$						
		×							
		^		9		UII			
PB48	NH4	Machine resor	ance suppression filter 4	L			4500	10 to	
		Set the notch f	frequency of the machine	e resonance suppres	sion filter 4.		[Hz]	4500	
		To enable the	setting value, select "Ena	abled (1)" of "M	lachine resonance sup	pression			
		filter 4 selectio	n" in [Pr. PB49].		•	-			

No.	Symbol		Name and function		Initial value [unit]	Setting range
PB49	NHQ4	Notch shape sele Set the shape of	ection 4 the machine resonance suppression filter 4.		Refer to N and functi column.	lame on
		Setting digit	Explanation	Initial value		
		X M 0: 1: W	lachine resonance suppression filter 4 selection : Disabled : Enabled /hen you select "Enabled" of this digit, [Pr. PB17 Shaft resonance	0h		
		x Notch depth selection 0h 0: -40 dB 1: -14 dB 2: -8 dB 3: -4 dB				
		X N. 0: 1: 2: 3:	lotch width selection : $\alpha = 2$: $\alpha = 3$: $\alpha = 4$: $\alpha = 5$	0h		
		x Fo	or manufacturer setting	0h		
PB50	NH5	Machine resonance suppression filter 5 Set the notch frequency of the machine resonance suppression filter 5. To enable the setting value, select "Enabled (1)" of "Machine resonance suppression filter 5 selection" in [Pr. PB51].				10 to 4500
PB51	NHQ5	Notch shape sele Set the shape of When you select resonance suppre-	ection 5 the machine resonance suppression filter 5. "Enabled (1)" of "Robust filter selection" in [Pr. PE41], the ma ression filter 5 is not available.	chine	Refer to N and functi column.	lame on
		Setting digit	Explanation	Initial value		
		X M 0: 1:	lachine resonance suppression filter 5 selection : Disabled : Enabled	0h		
		X N 0: 1: 2: 3:	lotch depth selection : -40 dB : -14 dB : -8 dB : -4 dB	Oh		
		X N 0: 1: 2: 3:	lotch width selection : $\alpha = 2$: $\alpha = 3$: $\alpha = 4$: $\alpha = 5$	Oh		
		x Fo	or manufacturer setting	0h		
PB52	VRF21	Vibration suppres Set the vibration machine vibration To enable this, se [Pr. PA24]. When "Vibration in [Pr. PB02], this _)".	100.0 [Hz]	0.1 to 300.0		

No.	Symbol	Name and function	Initial value [unit]	Setting range
PB53	VRF22	Vibration suppression control 2 - Resonance frequency Set the resonance frequency for vibration suppression control 2 to suppress low-frequency machine vibration. To enable this, select "3 inertia mode (1)" of "Vibration suppression mode selection" in [Pr. PA24]. When "Vibration suppression control 2 tuning mode selection" is "Automatic setting (1 _)" in [Pr. PB02], this parameter will be set automatically. Set manually for "Manual setting (2 _)".	100.0 [Hz]	0.1 to 300.0
PB54	VRF23	Vibration suppression control 2 - Vibration frequency damping Set a damping of the vibration frequency for vibration suppression control 2 to suppress low- frequency machine vibration. To enable this, select "3 inertia mode (1)" of "Vibration suppression mode selection" in [Pr. PA24]. When "Vibration suppression control 2 tuning mode selection" is "Automatic setting (1_)" in [Pr. PB02], this parameter will be set automatically. Set manually for "Manual setting (2)".	0.00	0.00 to 0.30
PB55	VRF24	Vibration suppression control 2 - Resonance frequency damping Set a damping of the resonance frequency for vibration suppression control 2 to suppress low- frequency machine vibration. To enable this, select "3 inertia mode (1)" of "Vibration suppression mode selection" in [Pr. PA24]. When "Vibration suppression control 2 tuning mode selection" is "Automatic setting (1_)" in [Pr. PB02], this parameter will be set automatically. Set manually for "Manual setting (2)".	0.00	0.00 to 0.30
PB56	VRF21B	 Vibration suppression control 2 - Vibration frequency after gain switching Set the vibration frequency for vibration suppression control 2 when the gain switching is enabled. To enable this, select "3 inertia mode (1)" of "Vibration suppression mode selection" in [Pr. PA24]. This parameter will be enabled only when the following conditions are fulfilled. "Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (3)". "Vibration suppression control 2 tuning mode selection" in [Pr. PB02] is "Manual setting (2_)". "Gain switching selection" in [Pr. PB26] is "Control command from PC or PLCetc is enabled (1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor stops. 	0.0 [Hz]	0.0 to 300.0
PB57	VRF22B	Vibration suppression control 2 - Resonance frequency after gain switching Set the resonance frequency for vibration suppression control 2 when the gain switching is enabled. To enable this, select "3 inertia mode (1)" of "Vibration suppression mode selection" in [Pr. PA24]. This parameter will be enabled only when the following conditions are fulfilled. • "Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (3)". • "Vibration suppression control 2 tuning mode selection" in [Pr. PB02] is "Manual setting (2_)". • "Gain switching selection" in [Pr. PB26] is "Control command from PC or PLCetc is enabled (1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor stops.	0.0 [Hz]	0.0 to 300.0

No.	Symbol	Name and function	Initial value [unit]	Setting range
PB58	VRF23B	 Vibration suppression control 2 - Vibration frequency damping after gain switching Set a damping of the vibration frequency for vibration suppression control 2 when the gain switching is enabled. To enable this, select "3 inertia mode (1)" of "Vibration suppression mode selection" in [Pr. PA24]. This parameter will be enabled only when the following conditions are fulfilled. "Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (3)". "Vibration suppression control 2 tuning mode selection" in [Pr. PB02] is "Manual setting (2_)". "Gain switching selection" in [Pr. PB26] is "Control command from PC or PLCetc is enabled (1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor stops. 	0.00	0.00 to 0.30
PB59	VRF24B	Vibration suppression control 2 - Resonance frequency damping after gain switching Set a damping of the resonance frequency for vibration suppression control 2 when the gain switching is enabled. To enable this, select "3 inertia mode (1)" of "Vibration suppression mode selection" in [Pr. PA24]. This parameter will be enabled only when the following conditions are fulfilled. • "Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (3)". • "Vibration suppression control 2 tuning mode selection" in [Pr. PB02] is "Manual setting (2_)". • "Gain switching selection" in [Pr. PB26] is "Control command from PC or PLCetc is enabled (1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor stops.	0.00	0.00 to 0.30
PB60	PG1B	 Model loop gain after gain switching Set the model loop gain when the gain switching is enabled. When you set a value less than 1.0 rad/s, the value will be the same as [Pr. PB07]. This parameter will be enabled only when the following conditions are fulfilled. "Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (3)". "Gain switching selection" in [Pr. PB26] is "Control command from PC or PLCetc is enabled (1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor stops. 	0.0 [rad/s]	0.0 to 2000.0

5.2.3 Extension setting parameters ([Pr. PC__])

No.	Symbol	Name and function	Initial value [unit]	Setting range				
PC01	ERZ	Error excessive alarm level Set an error excessive alarm level. Set this per rev. for servo motors. Setting "0" will be 3 rev. Setting over 200 rev will be clamped with 200 rev.	Error excessive alarm level Set an error excessive alarm level. Set this per rev. for servo motors. Setting "0" will be 3 rev. Setting over 200 rev will be clamped with 200 rev.					
		Note. Setting can be changed in [Pr. PC06].						
PC02	MBR	Electromagnetic brake sequence output This is used to set the delay time between MBR (Electromagnetic brake interlock) and base drive circuit is shut-off.	l the	0 [ms]	0 to 1000			
PC03	*ENRS	Encoder output pulse selection This is used to select the encoder pulse direction and encoder output pulse setting.		Refer to N and functi column.	lame ion			
		Setting Explanation	Initial value					
		 Encoder output pulse phase selection 0: Increasing A-phase 90° in CCW or positive direction 1: Increasing A-phase 90° in CW or negative direction Setting Servo motor rotation direction CCW or positive direction CCW or positive direction A-phase A-phase A-phase A-phase A-phase A-phase A-phase B-phase A-phase B-phase B-phase B-phase B-phase 	Oh					
		x_ Encoder output pulse setting selection 0: Output pulse setting (When "1 0 _" is set to this parameter, [AL. 37 Parameter error] will occur.) 1: Division ratio setting 3: A-phase/B-phase pulse electronic gear setting x Selection of the encoders for encoder output pulse	0h					
		This is used for selecting an encoder for driver output. 0: Servo motor encoder (Do not change this value.)	Oh					
			011					

No.	Symbol	Name and function		Initial value [unit]	Setting range			
PC04	**COP1	Function selection C-1 Select the encoder cable communication method selection.		Refer to N and functi column.	lame on			
		Setting Explanation	Initial value					
		x For manufacturer setting	0h					
		X	0h 0h					
		x Encoder cable communication method selection						
		0: Two-wire type	0: Two-wire type					
		(Do not change this value.)						
PC05	**COP2	Function selection C-2		Refer to N	lame			
		This is used to select the motor-less operation.		and functi	on			
		Setting	Initial	column.				
		digit	value					
		x Motor-less operation selection	0h					
		0: Disabled 1: Enabled						
		x For manufacturer setting						
		_x						
		x	0h					
PC06	*COP3	Function selection C-3 Select the error excessive alarm level setting for [Pr. PC01]. The parameter is not ava the speed control mode and torque control mode.	iilable in	Refer to N and functi column.	lame on			
		Setting Explanation	Initial					
		x For manufacturer setting	0h					
			0h					
		_x	0h					
		x Error excessive alarm level unit selection	0h					
		1: Per 0.1 rev						
		2: Per 0.01 rev						
		3: Per 0.001 rev						
PC07	ZSP	Zero speed		50	0			
		Used to set the output range of ZSP (Zero speed detection).		[r/min]	to			
PC08	OSI	25P (Zero speed detection) has hysteresis of 20 r/min or 20 mm/s.		0	0000			
. 500	2.22	This is used to set an overspeed alarm detection level.		[r/min]	to			
		When you set a value more than "servo motor maximum speed × 120%", the set valu clamped.	ie will be		20000			
		When you set "0", the value of "servo motor maximum speed × 120%" will be set.						

No.	Symbol		Initial value [unit]	Setting range						
PC09	MOD1	Analog mor Select a sig	nitor 1 output nal to output to MO1 (Analog monitor 1).			Refer to N and funct column.	lame ion			
		Setting digit	Setting Explanation Initial value							
		××	x x Analog monitor 1 output selection 00h Refer to table 5.7 for settings.							
		x For manufacturer setting 0h x 0h								
			Table 5.7 Analog monitor setting value							
		Catting								
	Setting Item Setting									
		00	Servo motor speed (±8 V/max. speed)		0					
		01 T	Torque (±8 V/max. torque)		0					
		02	Servo motor speed (+8V/max. speed)		0					
		03	Torque (+8 V/max. torque)		0					
		04	Current command (±8 V/max. current command)		0					
		05	Speed command (±8 V/max. speed)		0					
		06	Servo motor-side droop pulses (±10 V/100 pulses) (Note 1)		0					
		07	Servo motor-side droop pulses (±10 V/1000 pulses) (Note 1)		0					
		08	Servo motor-side droop pulses (±10 V/10000 pulses) (Note 1)		0					
		09	Servo motor-side droop pulses (±10 V/100000 pulses) (Note 1)		0					
		0A 0D	Feedback position (±10 V/1 Mpulses) (Note 1)		0					
		08	Feedback position (±10 V/10 Mpulses) (Note 1)		0					
		00	Preduback position (±10 V/100 Mpulses) (Note 1)		0					
			Speed command 2 (+8 V/max_speed)		0					
	OE Speed command 2 (±8 V/max. speed) O 15 Servo motor-side position deviation (±10 V/100000 pulses)									
	17 Encoder inside temperature (±10 V/±128 °C)									
		Note 1. E	incoder pulse unit							

No.	Symbol		Name and function		Initial value [unit]	Setting range		
PC10	MOD2	Analog monito Select a signa	or 2 output I to output to MO2 (Analog monitor 2).		Refer to I and funct column.	Name ion		
		Setting digit	Explanation	Initial value				
		××	Analog monitor 2 output selection Refer to [Pr. PC09] for settings.	01h				
		× 						
PC11	MO1	Analog monito	or 1 offset	· · · · · · · · · · · · · · · · · · ·	0	-999 to		
		This is used to	This is used to set the offset voltage of MO1 (Analog monitor 1).					
PC12	MO2	Analog monito	or 2 offset		0	-999 to		
D 040	MOODI	This is used to	set the offset voltage of MO2 (Analog monitor 2).		[mV]	999		
PC13	MOSDL	Set a monitor selecting "Fee Monitor output	or - Feedback position output standard data - Low output standard position (lower 4 digits) for the feedback position for v oback position" for MO1 (Analog monitor 1) and MO2 (Analog monito t standard position = [Pr. PC14] setting × 10000 + [Pr. PC13] setting	vhen ⁻ 2).	0 [pulse]	-9999 to 9999		
PC14	MOSDH	Analog monitor Set a monitor selecting "Fee Monitor output	0 [10000 pulses]	-9999 to 9999				
PC17	**COP4	Function select This is used to	ction C-4 o select a home position setting condition.		Refer to I and funct column.	Name ion		
		Setting digit	Explanation	Initial value				
		×	Selection of home position setting condition 0: Need to pass servo motor Z-phase after power on 1: Not need to pass servo motor Z-phase after power on	0h				
		×_	For manufacturer setting	0h				
		×		0h				
		×		0h				
PC18	*COP5	Function select This is used to	ction C-5 o select an occurring condition of [AL. E9 Main circuit off warning].		Refer to I and funct column.	Name ion		
		Setting digit	Explanation	Initial value				
		×						
		×_	X0h					
		_×	IAL EQ Main aircuit off worning a startion	0h				
		×	[AL. E9 Waln circuit on warning] selection 0: Detection with ready-on and servo-on command	Un				
			1: Detection with servo-on command					

No.	Symbol	Name and function	Initial value [unit]	Setting range
PC20	*COP7	Function selection C-7 This is used to select an undervoltage alarm detection method.	Refer to I and funct column.	Name tion
		Setting Explanation Initial value		
		Image: Construction of the section		
		Oh		
		Oh		
PC21	*BPS	Alarm history clear Used to clear the alarm history.	Refer to l and funct column.	Name tion
		Setting Explanation Initial value		
		Alarm history clear selection Oh		
		0: Disabled 1: Enabled When you select "Enabled", the alarm history will be cleared at next power-on. After the alarm history is cleared, the setting is automatically disabled.		
		x_ For manufacturer setting 0h		
		x 0h		
PC24	RSBR	Forced stop deceleration time constant This is used to set deceleration time constant when you use the forced stop deceleration function. Set the time per ms from the rated speed to 0 r/min.	100 [ms]	0 to 20000
		Rated speed Forced stop deceleration Dynamic brake deceleration		
		0 r/min [Pr.PC24]		
		 [Precautions] If the servo motor torque is saturated at the maximum torque during forced stop deceleration because the set time is too short, the time to stop will be longer than the set time constant. [AL. 50 Overload alarm 1] or [AL. 51 Overload alarm 2] may occur during forced stop deceleration, depending on the set value. After an alarm that leads to a forced stop deceleration, if an alarm that does not lead to a forced stop deceleration occurs or if the control circuit power supply is cut, dynamic braking will start regardless of the deceleration time constant setting. 		
		Set a longer time than deceleration time at quick stop of the PC or PLCetc. If a shorter time is set, [AL. 52 Error excessive] may occur.		



No.	Symbol		Name and function					
PC26	**COP8	Function selec	ction C-8		Refer to Name and function			
		Setting digit	Setting Explanation Initial value					
		X	_x For manufacturer setting 0h					
		×_	x0h					
		×		Oh				
		×	Load-side encoder communication method	0h				
			0: Two-wire type					
			(Do not change this value.)					
PC27	**COP9	Function select (Do not chang	Function selection C-9 (Do not change this value.)					
PC29	*COPB	Function select This is used to	ction C-B o select the POL reflection at torque control.		Refer to N and funct column.	Name ion		
		Setting digit	Explanation	Initial value				
		×	For manufacturer setting	0h				
		×_		0h				
		×		0h				
		x POL reflection selection at torque control 0h						
		0: Enabled						
		┃						

No.	Symbol	Name and function	Initial value [unit]	Setting range
PC31	RSUP1	 Vertical axis freefall prevention compensation amount Set the compensation amount of the vertical axis freefall prevention function. Set it per servo motor rotation amount. When a positive value is set, compensation is performed to the address increasing direction. When a negative value is set, compensation is performed to the address decreasing direction. The vertical axis freefall prevention function is performed when all of the following conditions are met. 1) Position control mode 2) The value of the parameter is other than "0". 3) The forced stop deceleration function is enabled. 4) Alarm occurs or EM2 turns off when the servo motor speed is zero speed or less. 5) MBR (Electromagnetic brake interlock) was enabled in [Pr. PD07] to [Pr. PD09], and the base circuit shut-off delay time was set in [Pr. PC16]. 	0 [0.0001 rev]	-25000 to 25000

5.2.4 I/O setting parameters ([Pr. PD_])

No.	Symbol	Name and function						Setting range	
PD02	*DIA2	Input signal autom	matic on se	lection 2			Refer to Name		
		Setting di HEX.	Setting digit a HEX BIN				column.	on	
		$\begin{array}{c c} HEX. \\ \hline \\ $	BIN. x x x x x x x x	FLS (Upper stroke limit) selection 0: Disabled 1: Enabled RLS (Lower stroke limit) selection 0: Disabled 1: Enabled For manufacturer setting For manufacturer setting o hexadecimal as follows. Image: Signal name Image: FLS (Upper stroke limit) selection RLS (Lower stroke limit) selection BIN 0: Use for an external input signal. BIN 1: Automatic on	Initial val BIN HI 0 0 0 0	Oh Oh Oh Oh Ue EX			

No.	Symbol	Name and function				Initial value [unit]	Setting range	
PD07	*DO1	Output device You can assig	selection 1 In any output device to the CN3-13 pin.			Refer to Name and function		
		Setting digit	Explanation		Initial value	column.		
		××	Device selection Refer to table 5.8 for settings.		05h			
		_x x	For manufacturer setting 0h 0h					
		Table	5.8 Selectable output devices					
		Setting value	Output device					
		00	Always off					
		02	RD (Ready)					
		03	ALM (Malfunction)					
		04	INP (In-position)					
		05	MBR (Electromagnetic brake interlock)					
		06	DB (Dynamic brake interlock)					
		07	TLC (Limiting torque)					
		08	WNG (Warning)					
		09	BWNG (Battery warning)					
		0A	0A SA (Speed reached)					
		0C	DC ZSP (Zero speed detection)					
		0F	CDPS (Variable gain selection)					
		11	ABSV (Absolute position undetermined)					
		1/	MITR (During tough drive)					
0000	*0.00	Outruit day is a				Defende	1	
PD08	^m DO2	Output device selection 2 You can assign any output device to the CN3-9 pin. INP (In-position) is assigned as the initial value.		and functi column.	ion			
		The devices t	e devices that can be assigned and the setting method are the same as in [Pr. PD07].					
		Setting	Europetice		Initial			
		digit	Explanation		value			
		××	Device selection		04h			
			Refer to table 5.8 in [Pr. PD07] for settings.					
		x	For manufacturer setting		0h			
		×			0h			
PD09	*DO3	Output device	selection 3			Refer to N	Name	
		initial value	In any output device to the CN3-15 pm. Alivi (Manu	unction) is assigned a	astne	column.		
		The devices t	The devices that can be assigned and the setting method are the same as in [Pr. PD07].					
		0.5411115.55			1			
		Setting	Explanation		Initiai			
		v v	Device selection		03h			
		^^	Refer to table 5.8 in [Pr. PD07] for settings		0011			
		x	For manufacturer setting		0h			
		x	Ĭ		0h			
			•	1				

No.	Symbol	Name and function		Initial value [unit]	Setting range
PD12	*DOP1	Function selection D-1		Refer to Name	
		Setting Explanation	Initial value	and functi column.	on
		x For manufacturer setting	0h		
		X_	0h		
		_x	0h		
		x Servo motor thermistor enabled/disabled selection (Supported by drivers with software version A5 or above.) 0: Enabled 1: Disabled For servo motors without thermistor, the setting will be disabled.	Oh		
PD14	*DOP3	Function selection D-3		Refer to N	lame
		Setting Explanation	Initial value	and functi column.	on
		x For manufacturer setting	0h		
		x _ Selection of output device at warning occurrence Select WNG (Warning) and ALM (Malfunction) output status at warning occurrence. Driver output Setting (Note 1) Device status	Oh		
		Value WNG 1 0 ALM 1 Warning occurrence			
		1 WNG 0 ALM 0 Warning occurrence (Note 2)			
		Note 1. 0: Off 1: On 2. Although ALM is turned off upon occurrence of the warning, the forced stop deceleration is performed.			
		_x For manufacturer setting	0h		
		x	0h		

5.2.5 Extension setting 2 parameters ([Pr. PE_])

No.	Symbol	Name and function			Initial value [unit]	Setting range
PE01	**FCT1	Fully closed loop (Do not change th	function selection 1 his value.)		0000h	0000h
PE03	*FCT2	Fully closed loop (Do not change th	function selection 2 his value.)		0003h	0003h
PE04	**FBN	Fully closed loop (Do not change th	control - Feedback pulse electronic gear 1 - Numerator his value.)		1	1
PE05	**FBD	Fully closed loop (Do not change th	control - Feedback pulse electronic gear 1 - Denominator his value.)		1	1
PE06	BC1	Fully closed loop (Do not change th	control - Speed deviation error detection level his value.)		400 [r/min]	400 [r/min]
PE07	BC2	Fully closed loop control - Position deviation error detection level (Do not change this value.)				100 [kpulse]
PE08	DUF	Fully closed loop dual feedback filter (Do not change this value.)				10 [rad/s]
PE10	FCT3	Fully closed loop function selection 3 (Do not change this value.)				0000h
PE34	**FBN2	Fully closed loop control - Feedback pulse electronic gear 2 - Numerator (Do not change this value.)				1
PE35	**FBD2	Fully closed loop control - Feedback pulse electronic gear 2 - Denominator 1 1 (Do not change this value.) 1				1
PE41	EOP3	Function selection	n E-3		Refer to N	Name
		Setting digit	Explanation	Initial value	column.	ion
		X Ro 0: 1: Wi su X Fo X	obust filter selection Disabled Enabled /hen you select "Enabled" of this digit, the machine resonance uppression filter 5 set in [Pr. PB51] is not available. or manufacturer setting	Oh Oh Oh		
		x		0h		

5.2.6 Extension setting 3 parameters ([Pr. PF__])

No.	Symbol		Initial value [unit]	Setting range		
PF06	*FOP5	Function selection F-5			Refer to Name	
		Setting digit	Explanation	Initial value	and funct column.	ion
		X	Electronic dynamic brake selection 0h			
			0: Automatic (enabled only for specified servo motors)			
			Refer to the following table for the specified servo motors.			
			Series Servo motor			
			LE-□-□ LE-T5-□/LE-T6-□/LE-T7-□/LE-T8-□]		
		×	For manufacturer setting	0h		
		X		0h 0h		
		^		UI		
PF12	DBT	Electronic dyn	amic brake operating time		2000	0 to
		Set a operatin	g time for the electronic dynamic brake.		[ms]	10000
PF21	DRT	Drive recorder	switching time setting		0 [s]	-1 to 32767
		I his is used to set a drive recorder switching time. When a USB communication is cut during using a graph function, the function will be changed			[3]	52707
		to the drive re	the drive recorder function after the settling time of this parameter.			
		When a value	from "1" to "32767" is set, it will switch after the setting value.			
		However, whe	n "0" is set, it will switch after 600 s. et the drive recorder function is disabled			
PF23	OSCL1	Vibration toud	Vibration tough drive - Oscillation detection level			
		This is used to set a filter readjustment sensitivity of [Pr. PB13 Machine resonance		[%]		
		suppression fi	on filter 1] and [Pr. PB15 Machine resonance suppression filter 2] while the vibration e is enabled			
		Example: Whe	en you set "50" to the parameter, the filter will be readjusted at the			
		or m	or more oscillation level.			
PF24	*OSCL2	Vibration tough drive function selection Refer to Name				Vame
		Setting digit	Explanation	Initial value	column.	1011
		×	Oscillation detection alarm selection	0h		
			0: [AL. 54 Oscillation detection] will occur at oscillation detection.			
			detection.			
			2: Oscillation detection function disabled			
			Select alarm or warning when a oscillation continues at a filter			
			The digit is continuously enabled regardless of the vibration tough			
			drive in [Pr. PA20].			
		×_	For manufacturer setting	0h		
		X		0h		
		^		UII		
PF25	CVAT	SEMI-F47 fun	ction - Instantaneous power failure detection time (instantaneous p	ower failure	200	30 to
		tough drive - d	etection time)		[ms]	200
		Set the time of	r the [AL. 10.1 Voltage drop in the control circuit power] occurrence	tion		
		(instantaneous	s power failure tough drive selection)" in [Pr. PA20].			

No.	Symbol	Name and function	Initial value [unit]	Setting range
PF31	FRIC	Machine diagnosis function - Friction judgement speed Set a servo motor speed to divide a friction estimation area into high and low for the friction estimation process of the machine diagnosis. However, setting "0" will be the value half of the rated speed. When your operation pattern is under rated speed, we recommend that you set half value to the maximum speed with this. Forward rotation	0 [r/min]	0 to permiss -ible speed

5.2.7 Extension setting 4 parameters ([Pr. PL__])

No.	Symbol	Name and function	Initial value [unit]	Setting range
PL01	**LIT1	Linear servo motor/DD motor function selection 1	0301h	0301h
		(Do not change this value.)		
PL02	**LIM	Linear encoder resolution - Numerator	1000	1000
		(Do not change this value.)	[µm]	[µm]
PL03	**LID	Linear encoder resolution - Denominator	1000	1000
		(Do not change this value.)	[µm]	[µm]
PL04	*LIT2	Linear servo motor/DD motor function selection 2	0003h	0003h
		(Do not change this value.)		
PL05	LB1	Position deviation error detection level	0	0
		(Do not change this value.)	[0.01rev]	[0.01rev]
PL06	LB2	Speed deviation error detection level	0	0
		(Do not change this value.)	[r/min]	[r/min]
PL07	LB3	Torque/thrust deviation error detection level	100	100
		(Do not change this value.)	[%]	[%]
PL08	*LIT3	Linear servo motor/DD motor function selection 3	0010h	0010h
		(Do not change this value.)		
PL09	LPWM	Magnetic pole detection voltage level	30	30
		(Do not change this value.)	[%]	[%]
PL17	LTSTS	Magnetic pole detection - Minute position detection method - Function selection	0000h	0000h
		(Do not change this value.)		
PL18	IDLV	Magnetic pole detection - Minute position detection method - Identification signal amplitude	0	0
		(Do not change this value.)	[%]	[%]

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6. NORMAL GAIN ADJUSTMENT

POINT

In the torque control mode, you do not need to make gain adjustment.
Before making gain adjustment, check that your machine is not being operated at maximum torque of the servo motor. If operated over maximum torque, the machine may vibrate and may operate unexpectedly. In addition, make gain adjustment with a safety margin considering characteristic differences of each machine. It is recommended that generated torque during operation is under 90% of the maximum torque of the servo motor.

- 6.1 Different adjustment methods
- 6.1.1 Adjustment on a single driver

The following table shows the gain adjustment modes that can be set on a single driver. For gain adjustment, first execute "Auto tuning mode 1". If you are not satisfied with the result of the adjustment, execute "Auto tuning mode 2" and "Manual mode" in this order.

Gain adjustment mode	[Pr. PA08] setting	Estimation of load to motor inertia ratio	Automatically set parameters	Manually set parameters
Auto tuning mode 1 (initial value)	1	Always estimated	GD2 ([Pr. PB06]) PG1 ([Pr. PB07]) PG2 ([Pr. PB08]) VG2 ([Pr. PB09]) VIC ([Pr. PB10])	RSP ([Pr. PA09])
Auto tuning mode 2	2	Fixed to [Pr. PB06] value	PG1 ([Pr. PB07]) PG2 ([Pr. PB08]) VG2 ([Pr. PB09]) VIC ([Pr. PB10])	GD2 ([Pr. PB06]) RSP ([Pr. PA09])
Manual mode	3			GD2 ([Pr. PB06]) PG1 ([Pr. PB07]) PG2 ([Pr. PB08]) VG2 ([Pr. PB09]) VIC ([Pr. PB10])
2 gain adjustment mode 1 (interpolation mode)	0	Always estimated	GD2 ([Pr. PB06]) PG2 ([Pr. PB08]) VG2 ([Pr. PB09]) VIC ([Pr. PB10])	PG1 ([Pr. PB07]) RSP ([Pr. PA09])
2 gain adjustment mode 2	4	Fixed to [Pr. PB06] value	PG2 ([Pr. PB08]) VG2 ([Pr. PB09]) VIC ([Pr. PB10])	GD2 ([Pr. PB06]) PG1 ([Pr. PB07]) RSP ([Pr. PA09])

(1) Gain adjustment mode explanation

(2) Adjustment sequence and mode usage



6.1.2 Adjustment using setup software (MR Configurator2)

This section explains the functions and adjustment using the driver with setup software (MR Configurator2).

Function	Description	Adjustment
Machine analyzer	With the machine and servo motor coupled, the characteristic of the mechanical system can be measured by giving a random vibration command from a personal computer to the servo and measuring the machine response.	You can grasp the machine resonance frequency and determine the notch frequency of the machine resonance suppression filter.

6.2 One-touch tuning

Connect setup software (MR Configurator2) and open the one-touch tuning window, and you can use the function. The following parameters are set automatically with one-touch tuning.

Parameter	Symbol	Name
PA08	ATU	Auto tuning mode
PA09	RSP	Auto tuning response
PB01	FILT	Adaptive tuning mode (adaptive filter II)
PB02	VRFT	Vibration suppression control tuning mode (advanced vibration suppression control II)
PB06	GD2	Load to motor inertia ratio
PB07	PG1	Model loop gain
PB08	PG2	Position loop gain
PB09	VG2	Speed loop gain
PB10	VIC	Speed integral compensation
PB12	OVA	Overshoot amount compensation
PB13	NH1	Machine resonance suppression filter 1
PB14	NHQ1	Notch shape selection 1
PB15	NH2	Machine resonance suppression filter 2

		<u> </u>
Parameter	Symbol	Name
PB16	NHQ2	Notch shape selection 2
PB18	LPF	Low-pass filter setting
PB19	VRF11	Vibration suppression control 1 - Vibration frequency
PB20	VRF12	Vibration suppression control 1 - Resonance frequency
PB21	VRF13	Vibration suppression control 1 - Vibration frequency damping
PB22	VRF14	Vibration suppression control 1 - Resonance frequency damping
PB23	VFBF	Low-pass filter selection
PB47	NHQ3	Notch shape selection 3
PB48	NH4	Machine resonance suppression filter 4
PB49	NHQ4	Notch shape selection 4
PB51	NHQ5	Notch shape selection 5
PE41	EOP3	Function selection E-3

6.2.1 One-touch tuning flowchart

Make one-touch tuning as follows.



Startup a system referring to chapter 4.

Rotate the servo motor by an external PC or PLC...etc. (The one-touch tuning cannot be performed if the servo motor is not operating.)

Start one-touch tuning of setup software (MR Configurator2).

Select a response mode (high mode, basic mode, and low mode) in the one-touch tuning window of setup software (MR Configurator2).

One-touch tuning execution



Push the start button to start one-touch tuning. Push it during motor driving. When one-touch tuning is completed normally, the parameters described in table 6.1 will be set automatically.

- 6.2.2 Display transition and operation procedure of one-touch tuning
 - (1) Response mode selection

Select a response mode from 3 modes in the one-touch tuning window of setup software (MR Configurator2).

One-touch Tuning					
Axis 1 💌 🖍 Return to value before adjustment 🐻 Return to initial value					
Start to operate before pressing "Start" button. The one-touch tuning cannot be performed if the servo motor is not operating.					
Response mode					
O High mode Execute the response mode for machines with high rigidity					
Basic mode Basic mode for standard machines Start					
C Low mode for standard machines Start					
Error code					
Status					
Adjustment result					
Settling time ms					
Overshoot amount pulse					
To further improve performance					
Fine-adjust the model loop gain					
Detailed Setting					
Set the detailed parameter relating to One-touch tuning Parameter					

Response mode	Explanation
High mode	This mode is for high rigid system.
Basic mode	This mode is for standard system.
Low mode	This mode is for low rigid system.

Refer to the following table for selecting a response mode.

	Response mode		Response	Machine characteristic
Low mode	Basic mode	High mode		Guideline of corresponding machine
•	*		Low response	Arm robot General machine tool conveyor Precision working machine Inserter Mounter Bonder

POINT

•For equipment in which overshoot during one-touch tuning is in the permissible level of the in-position range, changing the value of [Pr. PA25 One-touch tuning - Overshoot permissible level] will shorten the settling time and improve the response.

(2) One-touch tuning execution

After the response mode is selected in (1), pushing the start button during driving will start one-touch tuning. If the start button is pushed while the motor stops, "C 0 0 2" or "C 0 0 4" will be displayed at status in error code. (Refer to (4) in this section for error codes.)

One-touch Tuning	×					
Axis1 Return to value before adjustment 🕅 Return to initial value						
Start to operate before pressing "Start" button. The one-touch tuning cannot be performed if the servo motor is not operating.						
Response mode						
O High mode Execute the response mode for machines with high rigidity						
Basic mode						
Response mode for standard machines						
Control Low mode Execute the response mode for machines with low rigidity						
Error code						
Status C002 Error Code List						
Adjustment result						
Settling time ms						
Overshoot amount pulse						
To further improve performance						
Fine-adjust the model loop gain						
Detailed Setting						
Set the detailed parameter relating to One-touch tuning Parameter						

During processing of one-touch tuning, the status will be displayed in the progress window as follows. One-touch tuning will be finished at 100%.

Progress Display Screen	×
0%	100%
Stop	

Completing the one-touch tuning starts writing tuning parameters to the driver. "0 0 0 0" is displayed at status in error code. In addition, settling time and overshoot amount will be displayed in "Adjustment result" after adjustment.



(3) One-touch tuning execution

During one-touch tuning, pushing the stop button stops one-touch tuning. If the one-touch tuning is stopped, "C 0 0 0" will be displayed at status in error code.

(4) If an error occur

If a tuning error occurs during tuning, one-touch tuning will be forcibly terminated. With that, the following error code will be displayed in status. Check the cause of tuning error.

Error code	Name	Description	Action
C000	Tuning canceled	The stop button was pushed during one-touch tuning.	
C001	Overshoot exceeded	The overshoot amount is lager than the value set in [Pr. PA10 In-position range].	Increase the in-position range.
C002	Servo-off during tuning	The one-touch tuning was attempted during servo-off.	Perform the one-touch tuning after servo-on.
C003	Control mode error	The one-touch tuning was attempted while the torque control mode was selected in the control modes.	Select the position control mode or speed control mode for the control mode from the PC or PLCetc, and then make one-touch tuning.
C004	Time-out	 1 cycle time during the operation has been over 30 s. 	Set the 1 cycle time during the operation to 30 s or less.
		2. The command speed is low.	Set the servo motor speed to100 r/min or higher.
		 The operation interval of the continuous operation is short. 	Maintain the operation interval during motor driving about 200 ms.
C005	Load to motor inertia ratio misestimated	 The estimation of the load to motor inertia ratio at one-touch tuning was a failure. 	 Drive the motor with meeting conditions as follows. The acceleration/deceleration time constant to reach 2000 r/min is 5 s or less. Speed is 150 r/min or higher. The load to servo motor inertia ratio is 100 times or less. The acceleration/deceleration torque is 10% or more of the rated torque.
		 The load to motor inertia ratio was not estimated due to such as an oscillation. 	 Set to the auto tuning mode that does not estimate the load to motor inertia ratio as follows, and then execute the one-touch tuning. Select "Auto tuning mode 2 (2)", "Manual mode (3)", or "2 gain adjustment mode 2 (4)" of "Gain adjustment mode selection" in [Pr. PA08]. Set [Pr. PB06 Load to motor inertia ratio] properly with manual setting.
C00F	One-touch tuning disabled	"One-touch tuning function selection" in [Pr. PA21] is "Disabled (0)"	Select "Enabled (1)".

(5) If an alarm occur

If an alarm occurs during tuning, one-touch tuning will be forcibly terminated. Remove the cause of the alarm and execute one-touch tuning again.

(6) If a warning occur

If a warning which continue the motor driving occurs during the tuning, one-touch tuning will be continued.

If a warning which does not continue the motor driving occurs during the tuning, one-touch tuning will be stopped.
(7) Clearing one-touch tuning

You can clear the parameter values set with one-touch tuning.

Refer to table 6.1 for the parameters which you can clear.

Pushing "Return to value before adjustment" in the one-touch tuning window of setup software (MR Configurator2) enables to rewrite the parameter to the value before pushing the start button. In addition, pushing "Return to initial value" in the one-touch tuning window enables to rewrite the parameter to the initial value.

One-touch	Tuning		- O ×			
Axis1	Return to value b	efore adjustment	Return to initial value			
Start to opera The one-touc Response mode	Start to operate before pressing "Start" button. The one-touch tuning cannot be performed if the servo motor is not operating. Response mode					
O High mode Execute th	ie response mode for mac	hines with high rigidi	ty			
Basic mod Response	e mode for standard machir	ies	Start			
O Low mode Execute th	e response mode for mac	hines with low rigidit	by			
Error code ~ Status	0000		Error Code List			
Adjustment res	ult					
Settling tim	le		0 ms			
Overshoot	t amount		29 pulse			
To further impro	ove performance					
Fine-adjus	t the model loop gain		Tuning			
Detailed Setting						
Set the de	tailed parameter relating to	One-touch tuning	Parameter			

Clearing one-touch tuning is completed, the following window will be displayed. (returning to initial value)



6.2.3 Caution for one-touch tuning

- (1) The tuning is not available in the torque control mode.
- (2) The one-touch tuning cannot be executed while an alarm or warning which does not continue the motor driving is occurring.

- (3) The tuning is not available during the following test operation mode.
 - (a) Output signal (DO) forced output
 - (b) Motor-less operation

6.3 Auto tuning

6.3.1 Auto tuning mode

The driver has a real-time auto tuning function which estimates the machine characteristic (load to motor inertia ratio) in real time and automatically sets the optimum gains according to that value. This function permits ease of gain adjustment of the driver.

(1) Auto tuning mode 1

The driver is factory-set to the auto tuning mode 1.

In this mode, the load to motor inertia ratio of a machine is always estimated to set the optimum gains automatically.

The following parameters are automatically adjusted in the auto tuning mode 1.

Parameter	Symbol	Name
PB06	GD2	Load to motor inertia ratio
PB07	PG1	Model loop gain
PB08	PG2	Position loop gain
PB09	VG2	Speed loop gain
PB10	VIC	Speed integral compensation

POINT

- The auto tuning mode 1 may not be performed properly if all of the following conditions are not satisfied.
 - The acceleration/deceleration time constant to reach 2000 r/min is 5 s or less.
 - Speed is 150 r/min or higher.
 - The load to servo motor inertia ratio is 100 times or less.
 - The acceleration/deceleration torque is 10% or more of the rated torque.
- Under operating conditions which will impose sudden disturbance torque during acceleration/deceleration or on a machine which is extremely loose, auto tuning may not function properly, either. In such cases, use the auto tuning mode 2 or manual mode to make gain adjustment.

(2) Auto tuning mode 2

Use the auto tuning mode 2 when proper gain adjustment cannot be made by auto tuning mode 1. Since the load to motor inertia ratio is not estimated in this mode, set the value of a correct load to motor inertia ratio in [Pr. PB06].

The following parameters are automatically adjusted in the auto tuning mode 2.

Parameter	Symbol	Name
PB07	PG1	Model loop gain
PB08	PG2	Position loop gain
PB09	VG2	Speed loop gain
PB10	VIC	Speed integral compensation

6.3.2 Auto tuning mode basis

The block diagram of real-time auto tuning is shown below.



When a servo motor is accelerated/decelerated, the load to motor inertia ratio estimation section always estimates the load to motor inertia ratio from the current and speed of the servo motor. The results of estimation are written to [Pr. PB06 Load to motor inertia ratio]. These results can be confirmed on the status display screen of the setup software (MR Configurator2).

If you have already known the value of the load to motor inertia ratio or failed to estimate, set "Gain adjustment mode selection" to "Auto tuning mode 2 (___2)" in [Pr. PA08] to stop the estimation (turning off the switch in above diagram), and set the load to motor inertia ratio or load to motor mass ratio ([Pr. PB06]) manually.

From the preset load to motor inertia ratio ([Pr. PB06]) value and response ([Pr. PA09]), the optimum loop gains are automatically set on the basis of the internal gain table.

The auto tuning results are saved in the EEP-ROM of the driver every 60 minutes since power-on. At power-on, auto tuning is performed with the value of each loop gain saved in the EEP-ROM being used as an initial value.

POINT

- If sudden disturbance torque is imposed during operation, the load to motor inertia ratio may be misestimated temporarily. In such a case, set "Gain adjustment mode selection" to "Auto tuning mode 2 (___2)" in [Pr. PA08] and then set the correct load to motor inertia ratio in [Pr. PB06].
- •When any of the auto tuning mode 1 and auto tuning mode settings is changed to the manual mode 2 setting, the current loop gains and load to motor inertia ratio estimation value are saved in the EEP-ROM.

6.3.3 Adjustment procedure by auto tuning

Since auto tuning is enabled before shipment from the factory, simply running the servo motor automatically sets the optimum gains that match the machine. Merely changing the response level setting value as required completes the adjustment. The adjustment procedure is as follows.



6.3.4 Response level setting in auto tuning mode

Set the response of the whole servo system by [Pr. PA09]. As the response level setting is increased, the track ability and settling time for a command decreases, but a too high response level will generate vibration. Hence, make setting until desired response is obtained within the vibration-free range. If the response level setting cannot be increased up to the desired response because of machine resonance beyond 100 Hz, filter tuning mode selection in [Pr. PB01] or machine resonance suppression filter in [Pr. PB13] to [Pr. PB16], [Pr. PB46] to [Pr. PB51] may be used to suppress machine resonance. Suppressing machine resonance may allow the response level setting to increase. Refer to section 7.2 and 7.3 for settings of the adaptive tuning mode and machine resonance suppression filter.

	Mach	ne characteristic	Reference		Mach	ine characteristic	Reference
Setting value	Response	Guideline for machine resonance frequency [Hz]	(setting value of LECSS□-S □)	Setting value	Response	Guideline for machine resonance frequency [Hz]	(setting value of LECSS□-S □)
1	Low	2.7		21	Middle	67.1	17
2	response	3.6		22	response	75.6	18
3	†	4.9		23	l 1	85.2	19
4		6.6		24		95.9	20
5		10.0	1	25		108.0	21
6		11.3	2	26		121.7	22
7		12.7	3	27		137.1	23
8		14.3	4	28		154.4	24
9		16.1	5	29		173.9	25
10		18.1	6	30		195.9	26
11		20.4	7	31		220.6	27
12		23.0	8	32		248.5	28
13		25.9	9	33		279.9	29
14		29.2	10	34		315.3	30
15		32.9	11	35		355.1	31
16		37.0	12	36		400.0	32
17		41.7	13	37		446.6	/
18	•	47.0	14	38] ↓	501.2	
19	Middle	52.9	15	39	High	571.5	
20	response	59.6	16	40	response	642.7	

[Pr. PA09]

6.4 Manual mode

If you are not satisfied with the adjustment of auto tuning, you can make simple manual adjustment with three parameters.

If machine resonance occurs, filter tuning mode selection in [Pr. PB01] or machine resonance suppression filter in [Pr. PB13] to [Pr. PB16] and [Pr. PB46] to [Pr. PB51] may be used to suppress machine resonance. (Refer to section 7.2 to 7.3.)

(1) For speed control

(a) Parameter

The following parameters are used for gain adjustment.

Parameter	Symbol	Name
PB06	GD2	Load to motor inertia ratio
PB07	PG1	Model loop gain
PB09	VG2	Speed loop gain
PB10	VIC	Speed integral compensation

(b) Adjustment procedure

Step	Operation	Description
1	Brief-adjust with auto tuning. Refer to section 6.2.3.	
2	Change the setting of auto tuning to the manual mode ([Pr. PA08]: 3).	
3	Set the estimated value to the load to motor inertia ratio. (If the estimate value with auto tuning is correct, setting change is not required.)	
4	Set a slightly smaller value to the model loop gain Set a slightly larger value to the speed integral compensation.	
5	Increase the speed loop gain within the vibration- and unusual noise-free range, and return slightly if vibration takes place.	Increase the speed loop gain.
6	Decrease the speed integral compensation within the vibration- free range, and return slightly if vibration takes place.	Decrease the time constant of the speed integral compensation.
7	Increase the model loop gain, and return slightly if overshoot takes place.	Increase the model loop gain.
8	If the gains cannot be increased due to mechanical system resonance or the like and the desired response cannot be achieved, response may be increased by suppressing resonance with the adaptive tuning mode or machine resonance suppression filter and then executing steps 3 to 7.	Suppression of machine resonance Refer to section 7.2 and 7.3.
9	While checking the motor status, fine-adjust each gain.	Fine adjustment

(c) Parameter adjustment

1) [Pr. PB09 Speed loop gain]

This parameter determines the response level of the speed control loop. Increasing this value enhances response but a too high value will make the mechanical system liable to vibrate. The actual response frequency of the speed loop is as indicated in the following expression.

Speed loop response frequency [Hz]

Speed loop gain

(1 + Load to motor inertia ratio) × 2π

2) [Pr. PB10 Speed integral compensation]

To eliminate stationary deviation against a command, the speed control loop is under proportional integral control. For the speed integral compensation, set the time constant of this integral control. Increasing the setting lowers the response level. However, if the load to motor inertia ratio is large or the mechanical system has any vibratory element, the mechanical system is liable to vibrate unless the setting is increased to some degree. The guideline is as indicated in the following expression.

Speed integral compensation setting [ms] 2000 to 3000

Speed loop gain/(1 + Load to motor inertia ratio)

3) [Pr. PB07 Model loop gain]

This parameter determines the response level to a speed command. Increasing the value improves track ability to a speed command, but a too high value will make overshoot liable to occur at settling.

Model loop gain guideline $\leq \frac{\text{Speed loop gain}}{(1 + \text{Load to motor inertia ratio})} \times \left(\frac{1}{4} \text{ to } \frac{1}{8}\right)$

(2) For position control

(a) Parameter

The following parameters are used for gain adjustment.

Parameter	Symbol	Name
PB06	GD2	Load to motor inertia ratio
PB07	PG1	Model loop gain
PB08	PG2	Position loop gain
PB09	VG2	Speed loop gain
PB10	VIC	Speed integral compensation

(b) Adjustment procedure

Step	Operation	Description
1	Brief-adjust with auto tuning. Refer to section 6.2.3.	
2	Change the setting of auto tuning to the manual mode ([Pr. PA08]:3).	
3	Set the estimated value to the load to motor inertia ratio. (If the estimate value with auto tuning is correct, setting change is not required.)	
4	Set a slightly smaller value to the model loop gain and the position loop gain. Set a slightly larger value to the speed integral compensation.	
5	Increase the speed loop gain within the vibration- and unusual noise-free range, and return slightly if vibration takes place.	Increase the speed loop gain.
6	Decrease the speed integral compensation within the vibration- free range, and return slightly if vibration takes place.	Decrease the time constant of the speed integral compensation.
7	Increase the position loop gain, and return slightly if vibration takes place.	Increase the position loop gain.
8	Increase the model loop gain, and return slightly if overshoot takes place.	Increase the model loop gain.
9	If the gains cannot be increased due to mechanical system resonance or the like and the desired response cannot be achieved, response may be increased by suppressing resonance with the adaptive tuning mode or machine resonance suppression filter and then executing steps 3 to 8.	Suppression of machine resonance Refer to section 7.2 and 7.3.
10	While checking the settling characteristic and motor status, fine- adjust each gain.	Fine adjustment

(c) Parameter adjustment

1) [Pr. PB09 Speed loop gain]

This parameter determines the response level of the speed control loop. Increasing this value enhances response but a too high value will make the mechanical system liable to vibrate. The actual response frequency of the speed loop is as indicated in the following expression.

Speed loop response frequency [Hz]

(1 + Load to motor inertia ratio) × 2π

2) [Pr. PB10 Speed integral compensation]

To eliminate stationary deviation against a command, the speed control loop is under proportional integral control. For the speed integral compensation, set the time constant of this integral control. Increasing the setting lowers the response level. However, if the load to motor inertia ratio is large or the mechanical system has any vibratory element, the mechanical system is liable to vibrate unless the setting is increased to some degree. The guideline is as indicated in the following expression.

Speed integral compensation setting [ms] 2000 to 3000

Speed loop gain/(1 + Load to motor inertia ratio)

3) [Pr. PB08 Position loop gain]

This parameter determines the response level to a disturbance to the position control loop. Increasing the value increases the response level to the disturbance, but a too high value will increase vibration of the mechanical system.

Position loop gain guideline Speed loop gain

 $\leq \frac{\text{Speed loop gain}}{(1 + \text{Load to motor inertia ratio})} \times \left(\frac{1}{4} \text{ to } \frac{1}{8}\right)$

4) [Pr. PB07 Model loop gain]

This parameter determines the response level to a position command. Increasing the value improves track ability to a position command, but a too high value will make overshoot liable to occur at settling.

Model loop gain guideline $\leq \frac{\text{Speed loop gain}}{(1 + \text{Load to motor inertia ratio})} \times \left(\frac{1}{4} \text{ to } \frac{1}{8}\right)$

6.5 2gain adjustment mode

The 2 gain adjustment mode is used to match the position loop gains of the axes when performing the interpolation operation of servo motors of two or more axes for an X-Y table or the like. In this mode, manually set the model loop gain that determines command track ability. Other parameters for gain adjustment are set automatically.

(1) 2 gain adjustment mode 1 (interpolation mode)

The 2 gain adjustment mode 1 manually set the model loop gain that determines command track ability.

The mode constantly estimates the load to motor inertia ratio, and automatically set other parameters for gain adjustment to optimum gains using auto tuning response. The following parameters are used for 2 gain adjustment mode 1.

(a) Automatically adjusted parameter

The following parameters are automatically adjusted by auto tuning.

Parameter	Symbol	Name
PB06	GD2	Load to motor inertia ratio
PB08	PG2	Position loop gain
PB09	VG2	Speed loop gain
PB10	VIC	Speed integral compensation

(b) Manually adjusted parameter

The following parameters are adjustable manually.

Parameter	Symbol	Name
PA09	RSP	Auto tuning response
PB07	PG1	Model loop gain

(2) 2 gain adjustment mode 2

Use 2 gain adjustment mode 2 when proper gain adjustment cannot be made with 2 gain adjustment mode 1. Since the load to motor inertia ratio is not estimated in this mode, set the value of a proper load to motor inertia ratio in [Pr. PB06].

The following parameters are used for 2 gain adjustment mode 2.

(a) Automatically adjusted parameter

The following parameters are automatically adjusted by auto tuning.

Parameter	Symbol	Name
PB08	PG2	Position loop gain
PB09	VG2	Speed loop gain
PB10	VIC	Speed integral compensation

(b) Manually adjusted parameter

The following parameters are adjustable manually.

Parameter	Symbol	Name
PA09	RSP	Auto tuning response
PB06	GD2	Load to motor inertia ratio
PB07	PG1	Model loop gain

(3) Adjustment procedure of 2 gain adjustment mode

POINT	
	_

Set the same value in [Pr. PB07 Model loop gain] for the axis used in 2 gain adjustment mode.

Step	Operation	Description
1	Set to the auto tuning mode.	Select the auto tuning mode 1.
2	During operation, increase the response level setting value in [Pr. PA09], and return the setting if vibration occurs.	Adjustment in auto tuning mode 1.
3	Check value of the model loop gain and the load to motor inertia ratio in advance.	Check the upper setting limits.
4	Set the 2 gain adjustment mode 1 ([Pr. PA08]: 0).	Select the 2 gain adjustment mode 1 (interpolation mode).
5	When the load to motor inertia ratio is different from the design value, select the 2 gain adjustment mode 2 ([Pr. PA08]: 4) and then set the load to motor inertia ratio manually in [Pr. PB06].	Check the load to motor inertia ratio.
6	Set the model loop gain of all the axes to be interpolated to the same value. At that time, adjust to the setting value of the axis, which has the smallest model loop gain.	Set position loop gain.
7	Considering the interpolation characteristic and motor status, fine-adjust the model loop gain and response level setting.	Fine adjustment

(4) Parameter adjustment

[Pr. PB07 Model loop gain]

This parameter determines the response level of the position control loop. Increasing the value improves track ability to a position command, but a too high value will make overshoot liable to occur at settling. The droop pulse value is determined by the following expression.

Number of droop pulses [pulse] = Position command frequency [pulse/s]

Model loop gain setting

Position command frequency differs depending on the operation mode.

Position command frequency

 $= \frac{\text{Speed [r/min]}}{60} \times \text{Encoder resolution (number of pulses per servo motor revolution)}$

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7. SPECIAL ADJUSTMENT FUNCTIONS

POINT
 The functions given in this chapter need not be used normally. Use them if you are not satisfied with the machine status after making adjustment in the methods in chapter 6.

7.1 Filter setting

The following filters are available with LECSS2-T \square drivers.



7.1.1 Machine resonance suppression filter



If a mechanical system has a natural resonance point, increasing the servo system response level may cause the mechanical system to produce resonance (vibration or unusual noise) at that resonance frequency. Using the machine resonance suppression filter and adaptive tuning can suppress the resonance of the mechanical system. The setting range is 10 Hz to 4500 Hz.

(1) Function

The machine resonance suppression filter is a filter function (notch filter) which decreases the gain of the specific frequency to suppress the resonance of the mechanical system. You can set the gain decreasing frequency (notch frequency), gain decreasing depth and width.



You can set five machine resonance suppression filters at most.

Filter	Setting parameter	Precaution	Parameter that is reset with vibration tough drive function	Parameter automatically adjusted with one- touch tuning
Machine resonance suppression filter 1	PB01/PB13/PB14	The filter can be set automatically with "Filter tuning mode selection" in [Pr. PB01].	PB13	PB01/PB13/PB14
Machine resonance suppression filter 2	PB15/PB16		PB15	PB15/PB16
Machine resonance suppression filter 3	PB46/PB47			PB47
Machine resonance suppression filter 4	PB48/PB49	Enabling the filter disables the shaft resonance suppression filter. The shaft resonance suppression filter is enabled for the initial setting.		PB48/PB49
Machine resonance suppression filter 5	PB50/PB51	The setting of this filter is disabled while you use the robust filter. The robust filter is disabled for the initial setting.		PB51

- (2) Parameter
 - (a) Machine resonance suppression filter 1 ([Pr. PB13] and [Pr. PB14])
 Set the notch frequency, notch depth and notch width of the machine resonance suppression filter 1 ([Pr. PB13] and [Pr. PB14])
 When you select "Manual setting (___2)" of "Filter tuning mode selection" in [Pr. PB01], the setting of the machine resonance suppression filter 1 is enabled.
 - (b) Machine resonance suppression filter 2 ([Pr. PB15] and [Pr. PB16]) To use this filter, select "Enabled (___1)" of "Machine resonance suppression filter 2 selection" in [Pr. PB16]. How to set the machine resonance suppression filter 2 ([Pr. PB15] and [Pr. PB16]) is the same as for the machine resonance suppression filter 1 ([Pr. PB13] and [Pr. PB14]).
 - (c) Machine resonance suppression filter 3 ([Pr. PB46] and [Pr. PB47]) To use this filter, select "Enabled (___1)" of "Machine resonance suppression filter 3 selection" in [Pr. PB47]. How to set the machine resonance suppression filter 3 ([Pr. PB46] and [Pr. PB47]) is the same as for the machine resonance suppression filter 1 ([Pr. PB13] and [Pr. PB14]).
 - (d) Machine resonance suppression filter 4 ([Pr. PB48] and [Pr. PB49])
 To use this filter, select "Enabled (_ _ 1)" of "Machine resonance suppression filter 4
 selection" in [Pr. PB49]. However, enabling the machine resonance suppression filter 4 disables
 the shaft resonance suppression filter.
 How to set the machine resonance suppression filter 4 ([Pr. PB48] and [Pr. PB49]) is the same
 - as for the machine resonance suppression filter 1 ([Pr. PB13] and [Pr. PB14]).
 - (e) Machine resonance suppression filter 5 ([Pr. PB50] and [Pr. PB51]) To use this filter, select "Enabled (___1)" of "Machine resonance suppression filter 5
 - selection" in [Pr. PB51]. However, enabling the robust filter ([Pr. PE41: _ _ 1]) disables the machine resonance suppression filter 5.

How to set the machine resonance suppression filter 5 ([Pr. PB50] and [Pr. PB51]) is the same as for the machine resonance suppression filter 1 ([Pr. PB13] and [Pr. PB14]).

7.1.2 Adaptive filter II

- ●The machine resonance frequency which adaptive filter II (adaptive tuning) can respond to is about 100 Hz to 2.25 kHz. As for the resonance frequency out of the range, set manually.
- •When adaptive tuning is executed, vibration sound increases as an excitation signal is forcibly applied for several seconds.
- When adaptive tuning is executed, machine resonance is detected for a maximum of 10 seconds and a filter is generated. After filter generation, the adaptive tuning mode automatically shifts to the manual setting.
- Adaptive tuning generates the optimum filter with the currently set control gains. If vibration occurs when the response setting is increased, execute adaptive tuning again.
- During adaptive tuning, a filter having the best notch depth at the set control gain is generated. To allow a filter margin against machine resonance, increase the notch depth in the manual setting.
- Adaptive vibration suppression control may provide no effect on a mechanical system which has complex resonance characteristics.

(1) Function

Adaptive filter II (adaptive tuning) is a function in which the driver detects machine vibration for a predetermined period of time and sets the filter characteristics automatically to suppress mechanical system vibration. Since the filter characteristics (frequency, depth) are set automatically, you need not be conscious of the resonance frequency of a mechanical system.





When machine resonance is large and frequency is low

0

When machine resonance is small and frequency is high

(2) Parameter

Select how to set the filter tuning in [Pr. PB01 Adaptive tuning mode (adaptive filter II)].



(3) Adaptive tuning mode procedure



7.1.3 Shaft resonance suppression filter

(1) Function

When a load is mounted to the servo motor shaft, resonance by shaft torsion during driving may generate a mechanical vibration at high frequency. The shaft resonance suppression filter suppresses the vibration.

When you select "Automatic setting", the filter will be set automatically on the basis of the motor you use and the load to motor inertia ratio. The disabled setting increases the response of the driver for high resonance frequency.

(2) Parameter

Set "Shaft resonance suppression filter selection" in [Pr. PB23].



To set [Pr. PB17 Shaft resonance suppression filter] automatically, select "Automatic setting". To set [Pr. PB17 Shaft resonance suppression filter] manually, select "Manual setting". The setting values are as follows.

Shaft resonance suppression filter setting frequency selection

Setting value	Frequency [Hz]	Setting value	Frequency [Hz]
00	Disabled	10	562
01	Disabled	11	529
02	4500	12	500
03	3000	13	473
04	2250	14	450
05	1800	15	428
06	1500	16	409
07	1285	17	391
08	1125	18	375
09	1000	19	360
0 A	900	1A	346
0 B	818	1B	333
0 C	750	1C	321
0 D	692	1 D	310
0E	642	1E	300
0F	600	1F	290

7.1.4 Low-pass filter

(1) Function

When a ball screw or the like is used, resonance of high frequency may occur as the response level of the servo system is increased. To prevent this, the low-pass filter is enabled for a torque command as a default. The filter frequency of the low-pass filter is automatically adjusted to the value in the following equation.

Filter frequency ([rad/s])

$$= \frac{VG2}{1 + GD2} \times 10$$

To set [Pr. PB18] manually, select "Manual setting (_ 1 _)" of "Low-pass filter selection" in [Pr. PB23].

(2) Parameter

Set "Low-pass filter selection" in [Pr. PB23].



7.1.5 Advanced vibration suppression control II

POINT

- The function is enabled when "Gain adjustment mode selection" in [Pr. PA08] is "Auto tuning mode 2 (___2)", "Manual mode (___3)", or "2 gain adjustment mode 2 (___4)".
- The machine resonance frequency supported in the vibration suppression control tuning mode is 1.0 Hz to 100.0 Hz. As for the vibration out of the range, set manually.
- •Stop the servo motor before changing the vibration suppression control-related parameters. Otherwise, it may cause an unexpected operation.
- •For positioning operation during execution of vibration suppression control tuning, provide a stop time to ensure a stop after vibration damping.
- •Vibration suppression control tuning may not make normal estimation if the residual vibration at the servo motor side is small.
- •Vibration suppression control tuning sets the optimum parameter with the currently set control gains. When the response setting is increased, set vibration suppression control tuning again.
- When using the vibration suppression control 2, set "___1" in [Pr. PA24].

0

(1) Function

Vibration suppression control is used to further suppress load-side vibration, such as work-side vibration and base shake. The servo motor-side operation is adjusted for positioning so that the machine does not vibrate.



When the advanced vibration suppression control II ([Pr. PB02 Vibration suppression control tuning mode]) is executed, the vibration frequency at load side is automatically estimated to suppress machine side vibration two times at most.

In the vibration suppression control tuning mode, this mode shifts to the manual setting after the positioning operation is performed the predetermined number of times. For manual setting, adjust the vibration suppression control 1 with [Pr. PB19] to [Pr. PB22] and vibration suppression control 2 with [Pr. PB52] to [Pr. PB55].

(2) Parameter

Set [Pr. PB02 Vibration suppression control tuning mode (advanced vibration suppression control II)].

When you use a vibration suppression control, set "Vibration suppression control 1 tuning mode selection". When you use two vibration suppression controls, set "Vibration suppression control 2 tuning mode selection" in addition.



PB52/PB53/PB54/PB55

7 -	10	
725	SMC	

Automatic setting

Manual setting

1

(3) Vibration suppression control tuning procedure

The following flow chart is for the vibration suppression control 1. For the vibration suppression control 2, set "__1_" in [Pr. PB02] to execute the vibration suppression control tuning.



(4) Vibration suppression control manual mode

POINT

- •When load-side vibration does not show up in servo motor-side vibration, the setting of the servo motor-side vibration frequency does not produce an effect.
- When the anti-resonance frequency and resonance frequency can be confirmed using the machine analyzer or external equipment, do not set the same value but set different values to improve the vibration suppression performance.
- A vibration suppression control effect is not produced if the relation between the [Pr. PB07 Model loop gain] value and vibration frequency is as follows. Vibration suppression control 1:

$$[Pr. PB19] < \frac{1}{2\pi} (0.9 \times [Pr. PB07])$$

$$[Pr. PB20] < \frac{1}{2\pi} (0.9 \times [Pr. PB07])$$

Vibration suppression control 2:

[Pr. PB52] < 5.0 + 0.1 × [Pr. PB07] [Pr. PB53] < 5.0 + 0.1 × [Pr. PB07]

Measure work-side vibration and device shake with the machine analyzer or external measuring instrument, and set the following parameters to adjust vibration suppression control manually.

Setting item	Vibration suppression control 1	Vibration suppression control 2
Vibration suppression control - Vibration frequency	[Pr. PB19]	[Pr. PB52]
Vibration suppression control - Resonance frequency	[Pr. PB20]	[Pr. PB53]
Vibration suppression control - Vibration frequency damping	[Pr. PB21]	[Pr. PB54]
Vibration suppression control - Resonance frequency damping	[Pr. PB22]	[Pr. PB55]

- Step 1 Select "Manual setting (___2)" of "Vibration suppression control 1 tuning mode selection" or "Manual setting (__2)" of "Vibration suppression control 2 tuning mode selection" in [Pr. PB02].
- Step 2 Set "Vibration suppression control Vibration frequency" and "Vibration suppression control -Resonance frequency" as follows.
- (a) When a vibration peak can be confirmed with machine analyzer using setup software (MR Configurator2), or external equipment.



(b) When vibration can be confirmed using monitor signal or external sensor



Step 3 Fine-adjust "Vibration suppression control - Vibration frequency damping" and "Vibration suppression control - Resonance frequency damping".

7.1.6 Command notch filter

POINT	
By using the	advanced vibration suppression control II and the command notch
filter, the loa	d-side vibration of three frequencies can be suppressed.
The frequent	cy range of machine vibration, which can be supported by the
	tab filter is between 4 5 He and 0050 He. Oat a framman also a ta

- command notch filter, is between 4.5 Hz and 2250 Hz. Set a frequency close to the machine vibration frequency and within the range.
 When [Pr. PB45 Command notch filter] is changed during the positioning
- operation, the changed setting is not reflected. The setting is reflected approximately 150 ms after the servo motor stops (after servo-lock).

(1) Function

Command notch filter has a function that lowers the gain of the specified frequency contained in a position command. By lowering the gain, load-side vibration, such as work-side vibration and base shake, can be suppressed. Which frequency to lower the gain and how deep to lower the gain can be set.





Command notch filter: disabled

Command notch filter: enabled

(2) Parameter

Set [Pr. PB45 Command notch filter] as shown below. For the command notch filter setting frequency, set the closest value to the vibration frequency [Hz] at the load side.



Command notch filter setting frequency Frequency [Hz] Setting Frequency [Hz] Frequency [Hz] Setting Setting value value value 00 Disabled 20 40 17.6 70 2250 01 21 66 41 16.5 02 1125 22 62 42 15.6 03 750 23 59 43 14.8 04 562 24 56 44 14.1 05 450 25 53 45 13.4 06 375 26 51 46 12.8 07 321 27 47 48 12.2 80 281 28 48 46 11.7 09 250 29 49 11.3 45 0A 225 4A 10.8 2A 43 0B 204 4B 2B 41 10.4 0C 187 4C 10.0 2C 40 0D 173 2D 38 4D 9.7 0E 160 2E 37 4E 9.4 0F 150 2F 36 4F 9.1 10 140 30 35.2 50 8.8 11 31 51 132 33.1 8.3 12 32 52 7.8 125 31.3 13 118 7.4 33 29.6 53 7.0 14 112 34 28.1 54 15 107 35 26.8 55 6.7 102 25.6 6.4 16 36 56 17 97 37 24.5 57 6.1 18 23.4 93 38 58 5.9 19 90 39 22.5 59 5.6 1A 86 3A 21.6 5A 5.4 1B 83 3B 20.8 5B 5.2 1C 80 3C 20.1 5C 5.0 1D 77 3D 19.4 5D 4.9 1E 75 3E 18.8 5E 4.7 1F 72 3F 18.2 5F 4.5

7.2 Gain switching function

You can switch gains with the function. You can switch gains during rotation and during stop, and can use a control command from a PC or PLC...etc to switch gains during operation.

7.2.1 Applications

The following shows when you use the function.

- (1) You want to increase the gains during servo-lock but decrease the gains to reduce noise during rotation.
- (2) You want to increase the gains during settling to shorten the stop settling time.
- (3) You want to change the gains using a control command from a PC or PLC...etc to ensure stability of the servo system since the load to motor inertia ratio varies greatly during a stop (e.g. a large load is mounted on a carrier).

7.2.2 Function block diagram

The control gains, load to motor inertia ratio, and vibration suppression control settings are changed according to the conditions selected by [Pr. PB26 Gain switching function] and [Pr. PB27 Gain switching condition].



7.2.3 Parameter

When using the gain switching function, always select "Manual mode (___3)" of "Gain adjustment mode selection" in [Pr. PA08 Auto tuning mode]. The gain switching function cannot be used in the auto tuning mode.

(1) Variable gain operation setting parameter

Parameter	Symbol	Name	Unit	Description
PB26	CDP	Gain switching selection		Used to select the changing condition.
PB27	CDL	Gain switching condition	[kpps] /[pulse] /[r/min]	Used to set the changing condition values.
PB28	CDT	Gain switching time constant	[ms]	You can set the filter time constant for a gain change at changing.

(a) [Pr. PB26 Gain switching function]

Used to set the gain switching condition. Select the switching condition in the first digit and second digit.



(b) [Pr. PB27 Gain switching condition]

Set a level to switch gains after you select "Command frequency", "Droop pulses", or "Servo motor speed " in [Pr. PB26 Gain switching function]. The setting unit is as follows.

Gain switching condition	Unit
Command frequency	[kpps]
Droop pulses	[pulse]
Servo motor speed	[r/min]

(c) [Pr. PB28 Gain switching time constant]

You can set the primary delay filter to each gain at gain switching. This parameter is used to suppress shock given to the machine if the gain difference is large at gain switching, for example.

(2) Switchable gain parameter

Leen noin	Before switching		After switching			
Loop gain	Parameter	Symbol	Name	Parameter	Symbol	Name
Load to motor inertia ratio	PB06	GD2	Load to motor inertia ratio	PB29	GD2B	Load to motor inertia ratio after gain switching
Model loop gain	PB07	PG1	Model loop gain	PB60	PG1B	Model loop gain after gain switching
Position loop gain	PB08	PG2	Position loop gain	PB30	PG2B	Position loop gain after gain switching
Speed loop gain	PB09	VG2	Speed loop gain	PB31	VG2B	Speed loop gain after gain switching
Speed integral compensation	PB10	VIC	Speed integral compensation	PB32	VICB	Speed integral compensation after gain switching
Vibration suppression control 1 - Vibration frequency	PB19	VRF11	Vibration suppression control 1 - Vibration frequency	PB33	VRF11B	Vibration suppression control 1 - Vibration frequency after gain switching
Vibration suppression control 1 - Resonance frequency	PB20	VRF12	Vibration suppression control 1 - Resonance frequency	PB34	VRF12B	Vibration suppression control 1 - Resonance frequency after gain switching
Vibration suppression control 1 - Vibration frequency damping	PB21	VRF13	Vibration suppression control 1 - Vibration frequency damping	PB35	VRF13B	Vibration suppression control 1 - Vibration frequency damping after gain switching
Vibration suppression control 1 - Resonance frequency damping	PB22	VRF14	Vibration suppression control 1 - Resonance frequency damping	PB36	VRF14B	Vibration suppression control 1 - Resonance frequency damping after gain switching
Vibration suppression control 2 - Vibration frequency	PB52	VRF21	Vibration suppression control 2 - Vibration frequency	PB56	VRF21B	Vibration suppression control 2 - Vibration frequency after gain switching
Vibration suppression control 2 - Resonance frequency	PB53	VRF22	Vibration suppression control 2 - Resonance frequency	PB57	VRF22B	Vibration suppression control 2 - Resonance frequency after gain switching
Vibration suppression control 2 - Vibration frequency damping	PB54	VRF23	Vibration suppression control 2 - Vibration frequency damping	PB58	VRF23B	Vibration suppression control 2 - Vibration frequency damping after gain switching
Vibration suppression control 2 - Resonance frequency damping	PB55	VRF24	Vibration suppression control 2 - Resonance frequency damping	PB59	VRF24B	Vibration suppression control 2 - Resonance frequency damping after gain switching

(a) [Pr. PB06] to [Pr. PB10]

These parameters are the same as in ordinary manual adjustment. Gain switching allows the values of load to motor inertia ratio, position loop gain, speed loop gain, and speed integral compensation to be switched.

(b) [Pr. PB19] to [Pr. PB22]/[Pr. PB52] to [Pr. PB55]

These parameters are the same as in ordinary manual adjustment. Executing gain switching while the servo motor stops, You can change vibration frequency, resonance frequency, vibration frequency damping, and resonance frequency damping.

- (c) [Pr. PB29 Load to motor inertia ratio after gain switching] Set the load to motor inertia ratio after gain switching. If the load to motor inertia ratio does not change, set it to the same value as [Pr. PB06 Load to motor inertia ratio].
- (d) [Pr. PB30 Position loop gain after gain switching], [Pr. PB31 Speed loop gain after gain switching], and [Pr. PB32 Speed integral compensation after gain switching] Set the values of after switching position loop gain, speed loop gain and speed integral compensation.
- (e) Vibration suppression control after gain switching ([Pr. PB33] to [Pr. PB36]/[Pr. PB56] to [Pr. PB59]), and [Pr. PB60 Model loop gain after gain switching] The gain switching vibration suppression control and model loop gain are used only with control command from the PC or PLC...etc. You can switch the vibration frequency, resonance frequency, vibration frequency damping, resonance frequency damping, and model loop gain of the vibration suppression control 1 and vibration suppression control 2.

7.2.4 Gain switching procedure

This operation will be described by way of setting examples.

- (1) When you choose switching by control command from the PC or PLC...etc
 - (a) Setting

Parameter	Symbol	Name	Setting value	Unit
PB06	GD2	Load to motor inertia ratio	4.00	[Multiplier]
PB07	PG1	Model loop gain	100	[rad/s]
PB08	PG2	Position loop gain	120	[rad/s]
PB09	VG2	Speed loop gain	3000	[rad/s]
PB10	VIC	Speed integral compensation	20	[ms]
PB19	VRF11	Vibration suppression control 1 - Vibration frequency	50	[Hz]
PB20	VRF12	Vibration suppression control 1 - Resonance frequency	50	[Hz]
PB21	VRF13	Vibration suppression control 1 - Vibration frequency damping	0.20	
PB22	VRF14	Vibration suppression control 1 - Resonance frequency damping	0.20	
PB52	VRF21	Vibration suppression control 2 - Vibration frequency	20	[Hz]
PB53	VRF22	Vibration suppression control 2 - Resonance frequency	20	[Hz]
PB54	VRF23	Vibration suppression control 2 - Vibration frequency damping	0.10	
PB55	VRF24	Vibration suppression control 2 - Resonance frequency damping	0.10	
PB29	GD2B	Load to motor inertia ratio after gain switching	10.00	[Multiplier]
PB60	PG1B	Model loop gain after gain switching	50	[rad/s]
PB30	PG2B	Position loop gain after gain switching	84	[rad/s]
PB31	VG2B	Speed loop gain after gain switching	4000	[rad/s]
PB32	VICB	Speed integral compensation after gain switching	50	[ms]
PB26	CDP	Gain switching function	0001 (Switch by control command from the PC or PLCetc.)	
PB28	CDT	Gain switching time constant	100	[ms]
PB33	VRF11B	Vibration suppression control 1 - Vibration frequency after gain switching	60	[Hz]
PB34	VRF12B	Vibration suppression control 1 - Resonance frequency after gain switching	60	[Hz]
PB35	VRF13B	Vibration suppression control 1 - Vibration frequency damping after gain switching	0.15	
PB36	VRF14B	Vibration suppression control 1 - Resonance frequency damping after gain switching	0.15	
PB56	VRF21B	Vibration suppression control 2 - Vibration frequency after gain switching	30	[Hz]
PB57	VRF22B	Vibration suppression control 2 - Resonance frequency after gain switching	30	[Hz]
PB58	VRF23B	Vibration suppression control 2 - Vibration frequency damping after gain switching	0.05	
PB59	VRF24B	Vibration suppression control 2 - Resonance frequency damping after gain switching	0.05	

7. SPECIAL ADJUSTMENT FUNCTIONS

(b) Switching timing chart



Load to motor inertia ratio	4.00	\rightarrow	10.00	\rightarrow	4.00
Position loop gain	120	\rightarrow	84	\rightarrow	120
Speed loop gain	3000	\rightarrow	4000	\rightarrow	3000
Speed integral compensation	20	\rightarrow	50	\rightarrow	20
Vibration suppression control 1 - Vibration frequency	50	\rightarrow	60	\rightarrow	50
Vibration suppression control 1 - Resonance frequency	50	\rightarrow	60	\rightarrow	50
Vibration suppression control 1 - Vibration frequency damping	0.20	\rightarrow	0.15	\rightarrow	0.20
Vibration suppression control 1 - Resonance frequency damping	0.20	\rightarrow	0.15	\rightarrow	0.20
Vibration suppression control 2 - Vibration frequency	20	\rightarrow	30	\rightarrow	20
Vibration suppression control 2 - Resonance frequency	20	\rightarrow	30	\rightarrow	20
Vibration suppression control 2 - Vibration frequency damping	0.10	\rightarrow	0.05	\rightarrow	0.10
Vibration suppression control 2 - Resonance frequency damping	0.10	\rightarrow	0.05	\rightarrow	0.10

(2) When you choose switching by droop pulses

In this case, the vibration suppression control after gain switching and model loop gain after gain switching cannot be used.

(a) Setting

Parameter	Symbol	Name	Setting value	Unit
PB06	GD2	Load to motor inertia ratio	4.00	[Multiplier]
PB08	PG2	Position loop gain	120	[rad/s]
PB09	VG2	Speed loop gain	3000	[rad/s]
PB10	VIC	Speed integral compensation	20	[ms]
PB29	GD2B	Load to motor inertia ratio after gain switching	10.00	[Multiplier]
PB30	PG2B	Position loop gain after gain switching	84	[rad/s]
PB31	VG2B	Speed loop gain after gain switching	4000	[rad/s]
PB32	VICB	Speed integral compensation after gain switching	50	[ms]
PB26	CDP	Gain switching selection	0003 (switching by droop pulses)	
PB27	CDL	Gain switching condition	50	[pulse]
PB28	CDT	Gain switching time constant	100	[ms]

(b) Switching timing chart



Load to motor inertia ratio	4.00	\rightarrow	10.00	\rightarrow	4.00	\rightarrow	10.00
Position loop gain	120	\rightarrow	84	\rightarrow	120	\rightarrow	84
Speed loop gain	3000	\rightarrow	4000	\rightarrow	3000	\rightarrow	4000
Speed integral compensation	20	\rightarrow	50	\rightarrow	20	\rightarrow	50

7.3 Tough drive function

POINT	
●Set enable/c	lisable of the tough drive function with [Pr. PA20 Tough drive
setting]. (Re	fer to section 5.2.1.)

This function makes the equipment continue operating even under the condition that an alarm occurs.

7.3.1 Vibration tough drive function

This function prevent from vibrating by resetting a filter instantaneously when machine resonance occurs due to varied vibration frequency caused machine aging.

To reset the machine resonance suppression filters with the function, [Pr. PB13 Machine resonance suppression filter 1] and [Pr. PB15 Machine resonance suppression filter 2] should be set in advance. Set [Pr. PB13] and [Pr. PB15] as follows.

- (1) One-touch tuning execution (section 6.1)
- (2) Manual setting (section 4.2.2)

The vibration tough drive function operates when a detected machine resonance frequency is within $\pm 30\%$ for a value set in [Pr. PB13 Machine resonance suppression filter 1] or [Pr. PB15 Machine resonance suppression filter 2].

To set a detection level of the function, set sensitivity in [Pr. PF23 Vibration tough drive - Oscillation detection level].

POINT

- Resetting [Pr. PB13] and [Pr. PB15] by the vibration tough drive function is performed constantly. However, the number of write times to the EEPROM is limited to once per hour.
- The vibration tough drive function does not reset [Pr. PB46 Machine resonance suppression filter 3], [Pr. PB48 Machine resonance suppression filter 4], and [Pr. PB50 Machine resonance suppression filter 5].
- •The vibration tough drive function does not detect a vibration of 100 Hz or less.

The following shows the function block diagram of the vibration tough drive function.

The function detects machine resonance frequency and compare it with [Pr. PB13] and [Pr. PB15], and reset a machine resonance frequency of a parameter whose set value is closer.

Filter	Setting parameter	Precaution	Parameter that is reset with vibration tough drive function
Machine resonance suppression filter 1	PB01/PB13/PB14	The filter can be set automatically with "Filter tuning mode selection" in [Pr. PB01].	PB13
Machine resonance suppression filter 2	PB15/PB16		PB15
Machine resonance suppression filter 3	PB46/PB47		
Machine resonance suppression filter 4	PB48/PB49	Enabling the filter disables the shaft resonance suppression filter. The shaft resonance suppression filter is enabled for the initial setting.	
Machine resonance suppression filter 5	PB50/PB51	The setting of this filter is disabled while you use the robust filter. The robust filter is disabled for the initial setting.	


7.3.2 Instantaneous power failure tough drive function

The instantaneous power failure tough drive function avoids [AL. 10 Undervoltage] even when an instantaneous power failure occurs during operation. When the instantaneous power failure tough drive activates, the function will increase the immunity to instantaneous power failures using the electrical energy charged in the capacitor in the driver and will change an alarm level of [AL. 10 Undervoltage] simultaneously. The [AL. 10.1 Voltage drop in the control circuit power] detection time for the control circuit power supply can be changed by [Pr. PF25 SEMI-F47 function - Instantaneous power failure detection time (instantaneous power failure tough drive - detection time)]. In addition, [AL. 10.2 Voltage drop in the main circuit power] detection level for the bus voltage is changed automatically.

POINT

MBR (Electromagnetic brake interlock) will not turn off during the instantaneous power failure tough drive.

When the load of instantaneous power failure is large, the undervoltage alarm ([AL. 10.2]) caused by the bus voltage drop may occur regardless of the set value of [Pr. PF25 SEMI-F47 function - Instantaneous power failure detection time (instantaneous power failure tough drive - detection time)].

 Instantaneous power failure time of the control circuit power supply > [Pr. PF25 SEMI-F47 function -Instantaneous power failure detection time (instantaneous power failure tough drive - detection time)]

The alarm occurs when the instantaneous power failure time of the control circuit power supply exceeds [Pr. PF25 SEMI-F47 function - Instantaneous power failure detection time (instantaneous power failure tough drive - detection time)].

MTTR (During tough drive) turns on after detecting the instantaneous power failure.

MBR (Electromagnetic brake interlock) turns off when the alarm occurs.

	ON		- -	
Control circuit power supply	OFF		 	-
		[Pr. PF25] ◀────►		
Bus voltage			 	 /
		1		-
Undervoltage level (158 V DC)		I ┣	 	
			I I	1
ALM (Malfunction)				
(
WNG	ON		1	
(Warning)	OFF			
MTTO			 4	
(During tough drive)				
		1	, 	
(Electromagnetic	ON			
brake interlock)	OFF	1		
Roop pirquit	ON	 		
Dase Circuit	OFF	I		

Instantaneous power failure time of the control circuit power supply

(2) Instantaneous power failure time of the control circuit power supply < [Pr. PF25 SEMI-F47 function -Instantaneous power failure detection time (instantaneous power failure tough drive - detection time)]

Operation status differs depending on how bus voltage decrease.

(a) When the bus voltage decrease lower than 158 V DC within the instantaneous power failure time of the control circuit power supply

[AL. 10 Undervoltage] occurs when the bus voltage decrease lower than 158 V DC regardless of the enabled instantaneous power failure tough drive.



Instantaneous power failure time of the control circuit power supply

(b) When the bus voltage does not decrease lower than 158 V DC within the instantaneous power failure time of the control circuit power supply

The operation continues without alarming.



7.4 Compliance with SEMI-F47 standard

POIN			

• The control circuit power supply of the driver can be possible to comply with SEMI-F47. However, a back-up capacitor may be necessary for instantaneous power failure in the main circuit power supply depending on the power supply impedance and operating situation. Be sure to check them by testing the entire equipment using actual machines.

•Use a 3-phase for the input power supply of the driver.

The following explains the compliance with "SEMI-F47 semiconductor process equipment voltage sag immunity test" of LECSS2-T series.

(1) Parameter setting

Setting [Pr. PA20] and [Pr. PF25] as follows will enable SEMI-F47.

Parameter	Setting value	Description
PA20	_1	SEMI-F47 selection
PF25	200	Set the time [ms] of the [AL. 10.1 Voltage drop in the control circuit power] occurrence.

Enabling SEMI-F47 will change operation as follows.

- (a) The voltage will drop in the control circuit power with "Rated voltage × 50% or less". 200 ms later, [AL. 10.1 Voltage drop in the control circuit power] will occur.
- (b) [AL. 10.2 Voltage drop in the main circuit power] will occur when bus voltage is as follows.

Driver	Bus voltage which triggers alarm
LECSS2-T5	158 V DC
LECSS2-T9	

- (c) MBR (Electromagnetic brake interlock) will turn off when [AL. 10.1 Voltage drop in the control circuit power] occurs.
- (2) Requirements and recommended conditions of SEMI-F47 standard

Table 7.1 shows the permissible time of instantaneous power failure for instantaneous power failure of SEMI-F47 standard.

Table 7.1 Requirements and recommended conditions of SEM	II-F47 standard
--	-----------------

Instantaneous power failure	Permissible time of instantaneous power failure [s]			
voltage	Requirement	Recommended condition		
Rated voltage × 90%		10 to 100		
Rated voltage × 80%	0.5 to 1	0.5 to 10		
Rated voltage × 70%	0.2 to 0.5	0.2 to 0.5		
Rated voltage × 50%	0.05 to 0.2	0.02 to 0.2		
Rated voltage × 0%		to 0.02		

8. TROUBLESHOOTING	
8.1 Alarms and warning list	2
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 POINT

 ●As soon as an alarm occurs, make the Servo-off status and interrupt the main circuit power.

8.1 Alarms and warning list

When an error occurs during operation, the corresponding alarm or warning is displayed. When the alarm or the warning occurs, refer to this section to remove the failure. When an alarm occurs, ALM will turn off.

After its cause has been removed, the alarm can be deactivated in any of the methods marked \circ in the alarm deactivation column in the following table. Warnings are automatically canceled after the cause of occurrence is removed.

For the alarms and warnings in which "SD" is written in the stop method column, the axis stops with the dynamic brake after forced stop deceleration. For the alarms and warnings in which "DB" or "EDB" is written in the stop method column, the axis stops with the dynamic brake without forced stop deceleration.

\setminus					Cton	Al	arm res	et
	No.	Name	Detail display	Detail name	Method (Note 3, 4)	Error reset	CPU reset	Power off \rightarrow on
'n	10	Lindenvoltage	10.1	Voltage drop in the control circuit power	EDB	0	0	0
Alaı	10	Undervoltage	10.2	Voltage drop in the main circuit power	SD	0	0	0
			12.1	RAM error 1	DB		Ϊ	0
			12.2	RAM error 2	DB		Ϊ	0
	12	Memory error 1 (RAM)	12.3	RAM error 3	DB		/	0
			12.4	RAM error 4	DB		/	0
			12.5	RAM error 5	DB		/	0
	13	Clock error	13.1	Clock error 1	DB	/	Ϊ	0
	15		13.2	Clock error 2	DB		Ϊ	0
			14.1	Control process error 1	DB		/	0
			14.2	Control process error 2	DB		/	0
			14.3	Control process error 3	DB		/	0
			14.4	Control process error 4	DB		/	0
	14	Control process error	14.5	Control process error 5	DB		/	0
	17	Control process entor	14.6	Control process error 6	DB		/	0
			14.7	Control process error 7	DB		/	0
			14.8	Control process error 8	DB		/	0
			14.9	Control process error 9	DB		/	0
			14.A	Control process error 10	DB		/	0
	15	Memory error 2	15.1	EEP-ROM error at power on	DB		/	0
	15 (EEP-ROM)	15.2	EEP-ROM error during operation	DB	$\overline{\ }$	\backslash	0	

\setminus						Al	arm res	et
	No.	Name	Detail display	Detail name	Stop method (Note 3, 4)	Error reset	CPU reset	$\begin{array}{l} \text{Power} \\ \text{off} \rightarrow \text{on} \end{array}$
Alarm			16.1	Encoder initial communication - Receive data error 1	DB	$\overline{\ }$	\nearrow	0
1			16.2	Encoder initial communication - Receive data error 2	DB	$\overline{\ }$	\nearrow	0
			16.3	Encoder initial communication - Receive data error 3	DB	$\overline{\ }$	\nearrow	0
			16.5	Encoder initial communication - Transmission data error 1	DB	$\overline{\ }$	\nearrow	0
	16	Encoder initial communication error 1	16.6	Encoder initial communication - Transmission data error 2	DB	$\overline{\ }$	\nearrow	0
			16.7	Encoder initial communication - Transmission data error 3	DB	$\overline{\ }$	\nearrow	0
			16.A	Encoder initial communication - Process error 1	DB		Ϊ	0
			16.B	Encoder initial communication - Process error 2	DB		Ϊ	0
			16.C	Encoder initial communication - Process error 3	DB		Ϊ	0
			16.D	Encoder initial communication - Process error 4	DB	/	Ϊ	0
			16.E	Encoder initial communication - Process error 5	DB		Ϊ	0
			16.F	Encoder initial communication - Process error 6	DB	/	Ϊ	0
		Board error	17.1	Board error 1	DB	/	Ϊ	0
			17.3	Board error 2	DB	/	Ϊ	0
	17		17.4	Board error 3	DB	$\overline{}$	\backslash	0
	17		17.5	Board error 4	DB		Ϊ	0
			17.6	Board error 5	DB	$\overline{}$	\backslash	0
			17.8	Board error 6 (Note 5)	EDB	$\overline{}$	\backslash	0
	10	Memory error 3	19.1	Flash-ROM error 1	DB	\leq	\setminus	0
	19	(FLASH-ROM)	19.2	Flash-ROM error 2	DB	\leq	\setminus	0
	1 4	Servo motor combination	1A.1	Servo motor combination error	DB	\leq	\setminus	0
	IA	error	1A.2	Servo motor control mode combination error	DB	\leq	\setminus	0
	45	Encoder initial	1E.1	Encoder malfunction	DB	\sim	\setminus	0
	1E	communication error 2	1E.2	Load-side encoder malfunction	DB	\leq	\backslash	0
	45	Encoder initial	1F.1	Incompatible encoder	DB	\leq	\backslash	0
	1F	communication error 3	1F.2	Incompatible load-side encoder	DB	\leq	\setminus	0
			20.1	Encoder normal communication - Receive data error 1	EDB	$\overline{\ }$		0
			20.2	Encoder normal communication - Receive data error 2	EDB	$\overline{\ }$		0
			20.3	Encoder normal communication - Receive data error 3	EDB	$\overline{\ }$		0
	20	Encoder normal	20.5	Encoder normal communication - Transmission data error 1	EDB	$\overline{\ }$		0
	20	communication error 1	20.6	Encoder normal communication - Transmission data error 2	EDB	\sum		0
			20.7	Encoder normal communication - Transmission data error 3	EDB			0
			20.9	Encoder normal communication - Receive data error 4	EDB			0
			20.A	Encoder normal communication - Receive data error 5	EDB	$\overline{\ }$		0

\						Al	arm res	et
	No.	Name	Detail display	Detail name	Stop method (Note 3, 4)	Error reset	CPU reset	Power off → on
E			21.1	Encoder data error 1	EDB	/	/	0
Alar			21.2	Encoder data update error	EDB	\geq	\setminus	0
			21.3	Encoder data waveform error	EDB	\geq	\setminus	0
	21	Encoder normal	21.4	Encoder non-signal error	EDB	\backslash	\setminus	0
			21.5	Encoder hardware error 1	EDB	\geq	\setminus	0
			21.6	Encoder hardware error 2	EDB	\geq	\backslash	0
			21.9	Encoder data error 2	EDB	\backslash	\backslash	0
	24	Main aircuit arrar	24.1	Ground fault detected by hardware detection circuit	DB		/	0
	24		24.2	Ground fault detected by software detection function	DB	0	0	0
	25	Absolute position erased	25.1	Servo motor encoder - Absolute position erased	DB	/	/	0
			27.1	Magnetic pole detection - Abnormal termination	DB	/	/	0
			27.2	Magnetic pole detection - Time out error	DB	\geq	\backslash	0
			27.3	Magnetic pole detection - Limit switch error	DB	\geq	\setminus	0
	27	Initial magnetic pole	27.4	Magnetic pole detection - Estimated error	DB	\geq	\setminus	0
	21	detection error	27.5	Magnetic pole detection - Position deviation error	DB			0
			27.6	Magnetic pole detection - Speed deviation error	DB		\backslash	0
			27.7	Magnetic pole detection - Current error	DB	\geq	\backslash	0
	28	Linear encoder error 2	28.1	Linear encoder - Environment error	EDB	\geq	\backslash	0
			2A.1	Linear encoder error 1-1	EDB	\backslash	\setminus	0
		Linear encoder error 1	2A.2	Linear encoder error 1-2	EDB		\backslash	0
			2A.3	Linear encoder error 1-3	EDB		/	0
	24		2A.4	Linear encoder error 1-4	EDB	/	/	0
	28		2A.5	Linear encoder error 1-5	EDB	/	/	0
			2A.6	Linear encoder error 1-6	EDB	/	/	0
			2A.7	Linear encoder error 1-7	EDB	/	/	0
			2A.8	Linear encoder error 1-8	EDB	/	/	0
	2B	Encoder counter error	2B.1	Encoder counter error 1	EDB	\geq	\geq	0
	20		2B.2	Encoder counter error 2	EDB			0
			30.1	Regeneration heat error	DB	O (Note 1)	O (Note 1)	O (Note 1)
	30	Regenerative error (Note 1)	30.2	Regeneration signal error	DB	O (Note 1)	O (Note 1)	O (Note 1)
			30.3	Regeneration feedback signal error	DB	O (Note 1)	O (Note 1)	O (Note 1)
	31	Overspeed	31.1	Abnormal motor speed	SD	0	0	0
			32.1	Overcurrent detected at hardware detection circuit (during operation)	DB		/	0
	22	Quantum t	32.2	Overcurrent detected at software detection function (during operation)	DB	0	0	0
	32	Overcurrent	32.3	Overcurrent detected at hardware detection circuit (during a stop)	DB			0
			32.4	Overcurrent detected at software detection function (during a stop)	DB	0	0	0
	33	Overvoltage	33.1	Main circuit voltage error	EDB	0	0	0
			34.1	SSCNET receive data error	SD	0	O (Note 2)	0
	34	SSCNET receive error 1	34.2	SSCNET connector connection error	SD	0	0	0
			34.3	SSCNET communication data error	SD	õ	õ	õ
			34.4	Hardware error signal detection	SD	0	0	0
	35	Command frequency error	35.1	Command frequency error	SD	0	0	0
	36	SSCNET receive error 2	36.1	Continuous communication data error	SD	0	0	0

\ \						AI	arm res	et
	No.	Name	Detail display	Detail name	Stop method (Note 3, 4)	Error reset	CPU reset	Power off → on
٦		_	37.1	Parameter setting range error	DB		0	0
Aları	37	Parameter error	37.2	Parameter combination error	DB	\backslash	0	0
	3A	Inrush current suppression circuit error	3A.1	Inrush current suppression circuit error	EDB			0
	3E	Operation mode error	3E.1	Operation mode error	DB	\mathbb{Z}	/	0
		Sonio control orror	42.1	Servo control error by position deviation	EDB	O (Note 3)	O (Note 3)	0
		(for linear servo motor and direct drive motor)	42.2	Servo control error by speed deviation	EDB	O (Note 3)	O (Note 3)	0
	42		42.3	Servo control error by torque/thrust deviation	EDB	O (Note 3)	O (Note 3)	0
	72	Fully closed loop control	42.8	Fully closed loop control error by position deviation	EDB	O (Note 3)	O (Note 3)	0
		error (during fully closed loop control)	42.9	Fully closed loop control error by speed deviation	EDB	O (Note 3)	O (Note 3)	0
			42.A	Fully closed loop control error by position deviation during command stop	EDB	O (Note 3)	O (Note 3)	0
	45	Main circuit device overheat (Note 1)	45.1	Main circuit device overheat error	SD	O (Note 1)	O (Note 1)	O (Note 1)
			46.1	Abnormal temperature of servo motor 1	SD	O (Note 1)	O (Note 1)	O (Note 1)
		Servo motor overheat (Note 1)	46.2	Abnormal temperature of servo motor 2	SD	O (Note 1)	O (Note 1)	O (Note 1)
	46		46.3	Thermistor disconnected	SD	O (Note 1)	O (Note 1)	O (Note 1)
			46.5	Abnormal temperature of servo motor 3	DB	O (Note 1)	O (Note 1)	O (Note 1)
			46.6	Abnormal temperature of servo motor 4	DB	O (Note 1)	O (Note 1)	O (Note 1)
	47	Cooling fan error	47.1	Cooling fan stop error	SD	/	/	0
		5	47.2	Cooling fan speed reduction error	SD			0
			50.1	Thermal overload error 1 during operation	SD	O (Note 1)	O (Note 1)	O (Note 1)
		Overload 1 (Note 1)	50.2	Thermal overload error 2 during operation	SD	O (Note 1)	O (Note 1)	O (Note 1)
	50		50.3	Thermal overload error 4 during operation	SD	O (Note 1)	O (Note 1)	O (Note 1)
		· · · · · · · · · · · · · · · · · · ·	50.4	Thermal overload error 1 during a stop	SD	O (Note 1)	O (Note 1)	O (Note 1)
			50.5	Thermal overload error 2 during a stop	SD	O (Note 1)	O (Note 1)	O (Note 1)
			50.6	Thermal overload error 4 during a stop	SD	O (Note 1)	O (Note 1)	O (Note 1)
	51	Overload 2 (Note 1)	51.1	Thermal overload error 3 during operation	DB	O (Note 1)	O (Note 1)	O (Note 1)
	•••		51.2	Thermal overload error 3 during a stop	DB	O (Note 1)	O (Note 1)	O (Note 1)
			52.1	Excess droop pulse 1	SD	0	0	0
	52	Error excessive	52.3	Excess droop pulse 2	SD	0	0	0
			52.4	Error excessive during 0 torque limit	SD	0	0	0
		0 11 11 1 1 1	52.5	Excess droop pulse 3	EDB	0	0	0
ļ	54	Oscillation detection	54.1	Oscillation detection error	EDB	0	0	0
	56	Forced stop error	56.2	Over speed during forced stop	EDB	0	0	0
			50.3 63.1			0		0
	63	STO timing error	63.2	STO2 off	DB		0	0
			55.L		20			

Ι						Al	arm res	et
	No.	Name	Detail display	Detail name	Stop method (Note 3, 4)	Error reset	CPU reset	Power off \rightarrow on
Alarm			70.1	Load-side encoder initial communication - Receive data error 1	DB			0
1			70.2	Load-side encoder initial communication - Receive data error 2	DB			0
			70.3	Load-side encoder initial communication - Receive data error 3	DB		\nearrow	0
			70.5	Load-side encoder initial communication - Transmission data error 1	DB	\sum	\geq	0
			70.6	Load-side encoder initial communication - Transmission data error 2	DB	\sum	\geq	0
	70	Load-side encoder initial	70.7	Load-side encoder initial communication - Transmission data error 3	DB	\sum	\geq	0
		communication error 1	70.A	Load-side encoder initial communication - Process error 1	DB	\sum	\geq	0
			70.B	Load-side encoder initial communication - Process error 2	DB	\sum	\sum	0
			70.C	Load-side encoder initial communication - Process error 3	DB	\sum	\sum	0
			70.D	Load-side encoder initial communication - Process error 4	DB	\sum	\sum	0
			70.E	Load-side encoder initial communication - Process error 5	DB	\sum	\sum	0
			70.F	Load-side encoder initial communication - Process error 6	DB	\sum	\sum	0
		Load-side encoder normal communication error 1	71.1	Load-side encoder communication - Receive data error 1	EDB	\sum	\searrow	0
			71.2	Load-side encoder communication - Receive data error 2	EDB	\sum	\searrow	0
			71.3	Load-side encoder communication - Receive data error 3	EDB	\sum	\sum	0
	71		71.5	Load-side encoder communication - Transmission data error 1	EDB	\sum	\sum	0
			71.6	Load-side encoder communication - Transmission data error 2	EDB	\sum	\sum	0
			71.7	Load-side encoder communication - Transmission data error 3	EDB	\sum	\sum	0
			71.9	Load-side encoder communication - Transmission data error 4	EDB	\sum	\sum	0
			71.A	Load-side encoder communication - Transmission data error 5	EDB	\sum	\sum	0
			72.1	Load-side encoder data error 1	EDB		\backslash	0
			/2.2	Load-side encoder data update error	EDB		$\langle \rangle$	0
	70	Load-side encoder normal	72.4	Load-side encoder data waveform error	EDB	\langle	\backslash	0
	12	communication error 2	12.4 72 5		EDB		$\langle \rangle$	0
			72.5	Load-side encoder hardware error 2	EDB		$\langle \rangle$	0
			72.9	Load-side encoder data error 2	EDB	\sim		0
	8A	USB communication time- out error	8A.1	USB communication time-out error	SD	0	0	0
			8E.1	USB communication receive error	SD	0	0	0
			8E.2	USB communication checksum error	SD	0	õ	0
	8E	USB communication error	8E.3	USB communication character error	SD	0	0	0
			8E.4	USB communication command error	SD	0	0	0
			8E.5	USB communication data number error	SD	0	0	0
	888	Watchdog	88	Watchdog	DB		\backslash	0

- Note 1. Leave for about 30 minutes of cooling time after removing the cause of occurrence.
 - 2. In some controller communication status, the alarm factor may not be removed.
 - 3. Stop method indicates as follows:
 - DB: Stops with dynamic brake. (Coasts for the driver without dynamic brake.)
 - EDB: Stops with electronic dynamic brake for 400 W or less drivers
 - Stops with dynamic brake for 750 W drivers
 - SD: Forced stop deceleration
 - 4. 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].
 - 5. This alarm will occur only in the J3 compatibility mode.

	No.	Name	Detail display	Detail name	Stop method (Note 2, 3)
rning	91	Servo amplifier overheat warning (Note 1)	91.1	Main circuit device overheat warning	
Wa	~~~	Battery cable	92.1	Encoder battery cable disconnection warning	
	92	disconnection warning	92.3	Battery degradation	
	05	STO warning	95.1	STO1 off detection	DB
	90	STO warning	95.2	STO2 off detection	DB
	06	Home position setting	96.1	In-position warning at home positioning	
	90	warning	96.2	Command input warning at home positioning	
	QE	Battery warning	9F.1	Low battery	
	31	Dattery warning	9F.2	Battery degradation warning	
	E0	Excessive regeneration warning (Note 1)	E0.1	Excessive regeneration warning	
			E1.1	Thermal overload warning 1 during operation	
			E1.2	Thermal overload warning 2 during operation	
			E1.3	Thermal overload warning 3 during operation	
	⊏1	Overlead warning 1 (Note 1)	E1.4	Thermal overload warning 4 during operation	
		Ovenuau warning r (riote r)	E1.5	Thermal overload error 1 during a stop	
			E1.6	Thermal overload error 2 during a stop	
			E1.7	Thermal overload error 3 during a stop	
			E1.8	Thermal overload error 4 during a stop	
	E2	Servo motor overheat warning	E2.1	Servo motor temperature warning	
	E 3	Absolute position counter	E3.2	Absolute position counter warning	
	EJ	warning	E3.5	Encoder absolute positioning counter warning	
	E4	Parameter warning	E4.1	Parameter setting range error warning	
	E6	Servo forced stop warning	E6.1	Forced stop warning	SD
	E7	Controller forced stop warning	E7.1	Controller forced stop warning	SD
	F8	Cooling fan speed	E8.1	Decreased cooling fan speed warning	
	20	reduction warning	E8.2	Cooling fan stop	
	[E9.1	Servo-on signal on during main circuit off	DB
	E9	Main circuit off warning	E9.2	Bus voltage drop during low speed operation	DB
			E9.3	Ready-on signal on during main circuit off	DB
	EC	Overload warning 2 (Note 1)	EC.1	Overload warning 2	
	ED	Output watt excess warning	ED.1	Output watt excess warning	
	FO	Tough drive warning	F0.1	Instantaneous power failure tough drive warning	
		Tough anto Maning	F0.3	Vibration tough drive warning	
	F2	Drive recorder - Miswriting	F2.1	Drive recorder - Area writing time-out warning	
		warning	F2.2	Drive recorder - Data miswriting warning	
	F3	Oscillation detection warning	F3.1	Oscillation detection warning	

Note 1. Leave for about 30 minutes of cooling time after removing the cause of occurrence.

2. Stop method indicates as follows:

• DB: Stops with dynamic brake. (Coasts for the driver without dynamic brake.)

SD: Decelerates to a stop

3. 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].

8.2 Troubleshooting at power on

When the servo system does not boot and system error occurs at power on of the servo system controller, improper boot of the driver might be the cause. Check the display of the driver, and take actions according to this section.

Display	Description	Cause	Checkpoint	Action
AA	Communication with the servo system controller has disconnected.	The power of the servo system controller was turned off.	Check the power of the servo system controller.	Switch on the power of the servo system controller.
		A SSCNET III cable was disconnected.	"AA" is displayed in the corresponding axis and following axes.	Replace the SSCNET III cable of the corresponding axis.
			Check if the connectors (CNIA, CNIB) are unplugged.	Connect it correctly.
		The power of the driver	"AA" is displayed in the	Check the power of the driver.
		was turned off.	corresponding axis and following axes.	Replace the driver of the corresponding axis.
Ab	Initialization communication with the	The control axis is disabled.	Check if the disabling control axis switch (SW2-2) is on.	Turn off the disabling control axis switch (SW2-2).
	servo system controller has not completed.	The setting of the axis No. is incorrect.	Check that the other driver is not assigned to the same axis No.	Set it correctly.
		Axis No. does not match with the axis No. set to the servo system controller.	Check the setting and axis No. of the servo system controller.	Set it correctly.
		Information about the servo series has not set in the simple motion module.	Check the value set in Servo series (Pr.100) in the simple motion module.	Set it correctly.
		Communication cycle does not match.	Check the communication cycle at the servo system controller side. When using 8 axes or less: 0.222 ms When using 16 axes or less: 0.444 ms When using 32 axes or less: 0.888 ms	Set it correctly.
		A SSCNET III cable was disconnected.	"Ab" is displayed in the corresponding axis and following axes.	Replace the SSCNET III cable of the corresponding axis.
			Check if the connectors (CNIA, CNIB) are unplugged.	Connect it correctly.
		The power of the driver was turned off.	"Ab" is displayed in an axis and the following axes.	Check the power of the driver.
		The driver is malfunctioning.	"Ab" is displayed in an axis and the following axes.	Replace the driver of the corresponding axis.
b##. (Note)	The system has been in the test operation mode.	Test operation mode has been enabled.	Test operation setting switch (SW2-1) is turned on.	Turn off the test operation setting switch (SW2-1).
off	Operation mode for manufacturer setting is set.	Operation mode for manufacturer setting is enabled.	Check if all of the control axis setting switches (SW2) are on.	Set the control axis setting switches (SW2) correctly.

Note. ## indicates axis No.

8.3 Remedies for alarms

<u>∕</u> CAUTION	 When any ala the alarm before If [AL. 25 Abs again. Otherw As soon as an circuit power. 	 When any alarm has occurred, eliminate its cause, ensure safety, and deactivate the alarm before restarting operation. Otherwise, it may cause injury. If [AL. 25 Absolute position erased] occurs, always make home position setting again. Otherwise, it may cause an unexpected operation. As soon as an alarm occurs, make the Servo-off status and interrupt the main circuit power. 					
	POINT						
	When any or repeatedly to	f the following alarms has occurred, do not cycle the power o restart. Doing so will cause a malfunction of the driver and the					

- servo motor. Remove its cause and allow about 30 minutes for cooling before resuming the operation. [AL. 30 Regenerative error] • [AL. 45 Main circuit device overheat] [AL. 46 Servo motor overheat]
- [AL. 50 Overload 1]
- [AL. 51 Overload 2]

Remove the cause of the alarm in accordance with this section. Use setup software (MR Configurator2) to refer to a factor of alarm occurrence.

Alarm No.: 10		Nar	Name: Undervoltage							
Alarm content		• T • T	he voltage of the control c he voltage of the main circ	ircuit power supply has o cuit power supply has dr	dropped. opped.					
Display	Detail name		Cause	Check method	Check result	Action	Target			
10.1	Voltage drop in the control circuit power	(1)	The connection of the control circuit power supply connector	Check the control circuit power supply connector.	It has a failure.	Connect it correctly. Check (2).	LECSS 2-T□			
		(2)	(CNP2) has a failure. The voltage of the control circuit power supply is low.	Check if the voltage of the control circuit power supply is lower than prescribed value.	The voltage is the prescribed value or lower.	Review the voltage of the control circuit power supply.				
				LECSS2-T⊡ driver: 160 V AC or less	The voltage is higher than the prescribed value.	Check (3).				
		(3)	The power was cycled before the internal control circuit power supply stopped.	Check the power-on method if it has a problem.	It has a problem.	Cycle the power after the seven-segment LED of the driver is turned off.				
					problem.	Check (4).				
		(4)	An instantaneous power failure has occurred for longer time than the specified time. The time will be 60 ms when [Pr. PA20] is "_0". The time will be the value set in [Pr. PF25] when [Pr. PA20] is "_1".	Check if the power has a problem.	It has a problem.	Review the power.				
10.2	Voltage drop in the main circuit power	(1)	The main circuit power supply connector (CNP1) was	Check the main circuit power supply connector.	It is disconnected.	Connect it correctly. Check (2).				
		(2)	disconnected. The voltage of the main circuit power supply is low.	Check if the voltage of the main circuit power supply is the prescribed value or	The voltage is the prescribed value or lower.	Increase the voltage of the main circuit power supply.				
				LECSS2-T driver: 160 V AC or less	The voltage is higher than the prescribed value.	Check (3).				
		(3)	The alarm has occurred during acceleration.	Check that the bus voltage during acceleration is the prescribed value or more.	The voltage is lower than the prescribed value.	Increase the acceleration time constant. Or increase the power supply capacity.				
				LECSS2-T□ driver: 200 V DC or less	The voltage is the prescribed value or higher.	Check (4).				
		(4)	The driver is malfunctioning.	Check the bus voltage value.	The voltage of the main circuit power supply is 160 V AC or more, and the bus voltage is less than 200 V DC. LECSS2-T driver: 200 V DC or less	Replace the driver.				

Alarm No.: 12		Name: Memory error 1 (RAM)							
Alarm content		A part (RAM) in the driver is failure.							
Display	Detail name		Cause	Check method	Check result	Action	Target		
12.1	RAM error 1	(1)	A part in the driver is failure.	Disconnect the cables except the control	It is repeatable.	Replace the driver.	LECSS 2-T		
			and then cl repeatabilit	and then check the repeatability.	It is not repeatable.	Check (2).			
			Something near the device caused it.	Check the power supply for noise.	lt has a failure.	Take countermeasures against its cause.			
12.2	RAM error 2	Che	eck it with the check method	od for [AL. 12.1].					
12.3	RAM error 3								
12.4	RAM error 4								
12.5	RAM error 5								

Alarm	No.: 13	Nar	ne: Clock error						
Alarm content		 A part in the driver is failure. A clock error transmitted from the PC or PLCetc occurred. 							
Display	Detail name		Cause	Check method	Check result	Action	Target		
13.1	Clock error 1	(1)) A part in the driver is failure.	Disconnect the cables except the control circuit power supply, and then check the repeatability.	It is repeatable.	Replace the driver.	LECSS 2-T		
					It is not repeatable.	Check (2).			
		(2)	(2) A clock error transmitted (from the PC or c PLCetc occurred. t	Check if the error occurs when you connect the driver to the PC or PLCetc.	It occurs.	Replace the PC or PLCetc.	LECSS 2-T		
					It does not occur.	Check (3).			
			The driver of the next axis is malfunctioning.	Check if the driver of the next axis is malfunctioning.	It is malfunctioning.	Replace the driver of the next axis.			
					It is not malfunctioning.	Check (4).			
		(4)	Something near the device caused it.	Check the power supply for noise. Check if the connector is shorted.	It has a failure.	Take countermeasures against its cause.	LECSS 2-T□		
13.2	Clock error 2	Che	eck it with the check metho	od for [AL. 13.1].					

Alarm No.: 14		Nar	Name: Control process error							
Alarm content		The process did not complete within the specified time.								
Display	Detail name		Cause	Check method	Check result	Action	Target			
14.1 Con erro	Control process error 1	6 (1)	The parameter setting is incorrect.	Check if the parameter setting is incorrect.	It is incorrect.	Set it correctly.	LECSS 2-T□			
				-	It is correct.	Check (2).				
		(2) 8	Something near the device caused it.	Check the power supply for noise. Check if the connector is shorted.	It has a failure.	Take countermeasures against its cause.				
					It has no failure.	Check (3).				
		(3)	The driver is malfunctioning.	Replace the driver, and then check the repeatability.	It is not repeatable.	Replace the driver.				

Alarm I	No.: 14	Nar	Name: Control process error						
Al	arm content	• T	he process did not comple	te within the specified til	me.				
Display	Detail name		Cause	Check method	Check result	Action	Target		
14.2	Control process error 2	2 (1) A synchronous signal F error transmitted from F the PC or PLCetc occurred.	Replace the PC or PLCetc, and then check the	It is repeatable.	Replace the driver.	LECSS 2-T 🗆			
			occurred. r	repeatability.	it is not repeatable.				
		(2)	The parameter setting is	Check if the parameter	It is incorrect.	Set it correctly.	LECSS		
			incorrect. setting	setting is incorrect.	It is correct.	Check (3).	2-T□		
		(3)	Something near the device caused it.	Check the power supply for noise. Check if the connector	lt has a failure.	Take countermeasures against its cause.			
			i	is shorted.	It has no failure.	Check (4).			
		(4)	The driver is malfunctioning.	Replace the driver, and then check the repeatability.	It is not repeatable.	Replace the driver.			
14.3	Control process error 3	Che	eck it with the check metho	od for [AL. 14.1].					
14.4	Control process error 4								
14.5	Control process error 5								
14.6	Control process error 6								
14.7	Control process error 7								
14.8	Control process error 8								
14.9	Control process error 9								
14.A	Control process error 10								

Alarm I	No.: 15	Nar	ne: Memory error 2 (EEP-	ROM)					
Alarm content		A part (EEP-ROM) in the driver is failure.							
Display	Display Detail name		Cause	Check method	Check result	Action	Target		
15.1	EEP-ROM error at power on	(1)	EEP-ROM is malfunctioning at power	Disconnect the cables except the control	It is repeatable.	Replace the driver.	LECSS 2-T□		
			on.	and then check the repeatability.	It is not repeatable.	Check (2).			
		(2)	Something near the device caused it.	Check the power supply for noise. Check if the connector	It has a failure.	Take countermeasures against its cause.			
				is shorted.	It has no failure.	Check (3).			
		(3)	The number of write times exceeded 100,000.	Check if parameters has been used very frequently.	It has a failure.	Replace the driver. Change the process to use parameters less frequently after replacement.			
15.2	EEP-ROM error during operation	(1)	EEP-ROM is malfunctioning during	Check if the error occurs when you change parameters	It occurs.	Replace the driver.	LECSS 2-T□		
		1	normal operation.	during normal operation.	It does not occur.	Check (2).			
		(2)	A write error occurred while tuning results was	Check if the alarm occurs after an hour	It takes an hour or more.	Replace the driver.			
			processed.	from power on.	It takes less than an hour.	Check (3).			
		(3)	Something near the device caused it.	Check the power supply for noise. Check if the connector is shorted.	It has a failure.	Take countermeasures against its cause.			

Alarm No.: 16		Nar	ne: Encoder initial commu	nication error 1						
Alarm content		۰C	Communication error occurred between encoder and driver							
Display	Detail name		Cause	Check method	Check result	Action	Target			
16.1	Encoder initial communication	(1)	An encoder cable is malfunctioning.	Check if the encoder cable is disconnected	It has a failure.	Replace or repair the cable.	LECSS 2-T□			
	- Receive data error 1			or shorted.	It has no failure.	Check (2).				
		(2)	When you use a linear servo motor with an A/B/Z-phase differential	Check if the driver is compatible with the A/B/Z-phase differential output	The driver is not compatible with it.	Use a driver which is compatible with it.	LECSS 2-T 🗆			
			output linear encoder, diffe the driver is not linear compatible with the linear encoder.	linear encoder.	The driver is compatible with it.	Check (3).				
		(3) When you use a li servo motor with a A/B/Z-phase differ output linear enco the connection wit linear encoder is incorrect.	When you use a linear servo motor with an A/B/Z-phase differential	r Check if the wiring of the linear encoder is al correct. (Check if it is wired to PSEL.)	The wiring is incorrect.	Wire it correctly.				
			the connection with the linear encoder is incorrect.		The wiring is correct.	Check (4).				
		(4)	The driver is malfunctioning.	Replace the driver, and then check the	It is not repeatable.	Replace the driver.	LECSS 2-T			
				repeatability.	It is repeatable.	Check (5).				
		(5)	An encoder is malfunctioning.	Replace the servo motor or linear	It is not repeatable.	Replace the servo motor.				
				check the repeatability.	It is repeatable.	Check (6).				
		(6)	Something near the	Check the noise,	It has a failure.	Take				
			device caused it.	ambient temperature, vibration, etc.		countermeasures against its cause.				
16.2	Encoder initial communication - Receive data error 2	Che	eck it with the check metho	od for [AL. 16.1].						

Alarm	No.: 16	Nar	ne: Encoder initial commu	nication error 1			
AI	arm content	۰C	ommunication error occur	red between encoder ar	d driver.		
Display	Detail name		Cause	Check method	Check result	Action	Target
16.3	Encoder initial communication - Receive data error 3	(1)	An encoder cable was disconnected.	Check if the encoder cable is connected correctly.	It is not connected.	Connect it correctly.	[A] [B] [WB] [RJ010]
					It is connected.	Check (2).	
		(2)	The parameter setting of two-wire type/four- wire type is incorrect.	Check the parameter setting.	The setting is incorrect.	Set it correctly.	
			[Pr. PC04]		The setting is correct.	Check (3).	
		(3)	An encoder cable is malfunctioning.	Check if the encoder cable is disconnected	It has a failure.	Replace or repair the cable.	
				or shorted.	It has no failure.	Check (4).	
		(4)	When you use a linear servo motor with an A/B/Z-phase differential	Check if the wiring of the linear encoder is correct. (Check if it is	The wiring is incorrect.	Wire it correctly.	[A] [B]
			the connection with the linear encoder is incorrect.	wired to PSEL.)	The wiring is correct.	Check (5).	
		(5)	The voltage of the control circuit power supply has been unstable.	Check the voltage of the control circuit power supply.	The control circuit power supply has been an instantaneous power failure.	Review the power and related parts.	[A] [B] [WB] [RJ010]
					It has no failure.	Check (6).	
		(6)	The driver is malfunctioning.	Replace the driver, and then check the	It is not repeatable.	Replace the driver.	
				repeatability.	It is repeatable.	Check (7).	
		(7)	An encoder is malfunctioning.	Replace the servo motor, and then check	It is not repeatable.	Replace the servo motor.	
				the repeatability.	It is repeatable.	Check (8).	
		(8)	Something near the device caused it.	Check the noise, ambient temperature,	It has a failure.	Take countermeasures	
16.5	Encoder initial	Che	L ack it with the check metho	$\frac{1}{16} \frac{1}{16} \frac$	1	ayamat ita Gause.	1
10.5	- Transmission data error 1	Che		μι οι [ΑΕ. 10.1].			
16.6	Encoder initial communication - Transmission						
16.7	Encoder initial communication						
	data error 3						

Alarm	No.: 16	Nar	ne: Encoder initial commu	nication error 1					
Alarm content		Communication error occurred between encoder and driver.							
Display	Detail name	Cause		Check method	Check result	Action	Target		
16.A	Encoder initial communication - Process error 1	(1)	The driver is malfunctioning.	Replace the driver, and then check the	It is not repeatable.	Replace the driver.	LECSS 2-T		
			repea	repeatability.	It is repeatable.	Check (2).	_		
		(2)	An encoder is malfunctioning.	Replace the servo motor, and then check	It is not repeatable.	Replace the servo motor.			
				the repeatability.	It is repeatable.	Check (3).			
			(3)	Something near the device caused it.	Check the noise, ambient temperature, vibration, etc.	lt has a failure.	Take countermeasures against its cause.		
16.B	Encoder initial communication - Process error 2	Che	eck it with the check method for [AL. 16.A].						
16.C	Encoder initial communication - Process error 3								
16.D	Encoder initial communication - Process error 4								
16.E	Encoder initial communication - Process error 5								
16.F	Encoder initial communication - Process error 6								

Alarm	No.: 17	Nar	ne: Board error				
AI	arm content	۰A	part in the driver is malfur	nctioning.			
Display	Detail name		Cause	Check method	Check result	Action	Target
17.1	Board error 1	(1)	A current detection circuit is malfunctioning.	Check if the alarm	It occurs.	Replace the driver.	LECSS 2-T□
			circuit is manufactoring.	servo-on status.			
		(2)	Something near the device caused it.	Check the noise, ambient temperature, etc.	lt has a failure.	Take countermeasures against its cause.	
17.3	Board error 2	Che	eck it with the check metho	od for [AL. 17.1].			
17.4	Board error 3	ard error 3 (1) The driver recognition signal was not read properly.	Disconnect the cables except the control	It is repeatable.	Replace the driver.		
			property.	and then check the repeatability.	It is not repeatable.	Check (2).	
		(2)	Something near the	Check the noise,	It has a failure.	Take	
				etc.		against its cause.	
17.5	Board error 4	oard error 4 (1) The setting value of the rotary switch (SW1) was not read properly.	r 4 (1) The setting value of the rotary switch (SW1) was	Disconnect the cables except the control	It is repeatable.	Replace the driver.	LECSS 2-T
	(2)		and then check the repeatability.	It is not repeatable.	Check (2).		
		(2) Something near the device caused it.	Check the noise,	It has a failure.	Take		
			device caused it.	ambient temperature, etc		countermeasures	
				0.0.		agamet no oddoo.	

Alarm No.: 17		Nar	Name: Board error							
A	larm content	۰A	part in the driver is malfu	nctioning.						
Display	Detail name		Cause	Check method	Check result	Action	Target			
17.6	Board error 5	(1)	The setting value of the DIP switches (SW2)	Disconnect the cables except the control	It is repeatable.	Replace the driver.	LECSS 2-T			
			was not read property.	and then check the repeatability.	It is not repeatable.	Check (2).				
		(2) Something r device cause	Something near the device caused it.	Check the noise, ambient temperature, etc.	lt has a failure.	Take countermeasures against its cause.				
17.8	Board error 6	(1)	Inrush current suppressor circuit is malfunctioning.	Replace the driver, and then check the repeatability.	It is not repeatable.	Replace the driver.				

Alarm No.: 19		Nar	Name: Memory error 3 (Flash-ROM)							
AI	arm content	۰A	part (Flash-ROM) in the	driver is failure.						
Display	Detail name		Cause	Check method	Check result	Action	Target			
19.1	Flash-ROM error 1	(1)	The Flash-ROM is malfunctioning.	Disconnect the cables except the control circuit power supply, and then check the repeatability.	It is repeatable.	Replace the driver.	LECSS 2-T			
					It is not repeatable.	Check (2).				
		(2)	Something near the device caused it.	Check the noise, ambient temperature, etc.	lt has a failure.	Take countermeasures against its cause.				
19.2	Flash-ROM error 2	Che	eck it with the check meth	od for [AL. 19.1].						

Alarm I	No.: 1A	Nar	ne: Servo motor combinat	ion error							
Al	arm content	• T	The combination of driver and servo motor is incorrect.								
Display	Detail name	Cause		Check method	Check result	Action	Target				
1A.1	Servo motor combination	(1)	The driver and the servo Cl motor was connected na	Check the model name of the servo	The combination is incorrect.	Use them in the correct combination.	LECSS 2-T□				
	enor		incorrectly.	corresponding driver.	The combination is correct.	Check (2).					
		(2)	 The setting of [Pr. PA01] is not corresponding to the connected servo motor. 	Check the [Pr. PA01] setting. Servo motor: "0_"	The combination is incorrect.	Set [Pr. PA01] correctly.	LECSS 2-T□				
					The combination is correct.	Check (3).					
		(3)	An encoder is malfunctioning.	Replace the servo motor, and then check the repeatability.	It is not repeatable.	Replace the servo motor.	LECSS 2-T				
1A.2	Servo motor control mode combination error	(1)	The setting of [Pr. PA01] is not corresponding to the connected servo motor.	Check the [Pr. PA01] setting. Servo motor: "0_"	The combination is incorrect.	Set [Pr. PA01] correctly.	LECSS 2-T□				

Alarm I	No.: 1E	Nar	me: Encoder initial commu	inication error 2							
Al	Alarm content		An encoder is malfunctioning.								
Display	Detail name		Cause	Check method	Check result	Action	Target				
1E.1	Encoder malfunction	(1)	An encoder is Repla malfunctioning. motor the re	Replace the servo motor, and then check	It is not repeatable.	Replace the servo motor.	LECSS 2-T□				
				the repeatability.	It is repeatable.	Check (2).					
45.0			Something near the device caused it.	Check the noise, ambient temperature, vibration, etc.	It has a failure.	Take countermeasures against its cause.					
1E.2 L e n	Load-side encoder	d-side (1) oder function	(1) /) A load-side encoder is malfunctioning.	Replace the load-side encoder, and then	It is not repeatable.	Replace the load-side encoder.	LECSS 2-T			
	malfunction			check the repeatability.	It is repeatable.	Check (2).					
		(2)	Something near the device caused it.	Check the noise, ambient temperature, vibration, etc.	lt has a failure.	Take countermeasures against its cause.					

Alarm I	No.: 1F	Nar	me: Encoder initial commu	nication error 3			
Alarm content		• T	he connected encoder is r	not compatible with the c	lriver.		
Display	Detail name		Cause	Check method	Check result	Action	Target
1F.1	Incompatible encoder	(1)	A servo motor or linear encoder, which is not compatible with the	Check the model the servo motor/linear encoder.	It is not compatible with the driver.	Replace it with a compatible one.	LECSS 2-T
			driver, was connected.		It is compatible with the driver.	Check (2).	
		(2)	The software version of the driver does not support the servo motor or linear encoder.	Check if the software version supports the servo motor/linear encoder.	It is not supported.	Replace the driver to one which software version supports the servo motor/linear encoder.	
					It is supported.	Check (3).	
		(3) An encoder is malfunctioning.	Replace the servo motor or linear encoder, and then	It is not repeatable.	Replace the servo motor or linear encoder.		
				check the repeatability.	It is repeatable.	Replace the driver.	/er.
1F.2	Incompatible load-side encoder	(1) A load-side e which is not o with the drive connected.	A load-side encoder, which is not compatible with the driver, was connected.	Check the model of the load-side encoder.	It is not compatible with the driver.	Use a load-side encoder which is compatible with the driver.	LECSS 2-T□
					It is compatible with the driver.	Check (2).	
		(2)	The software version of the driver does not support the load-side encoder.	Check if the software version of the driver supports the load-side encoder.	It is not supported.	Replace the driver to one which software version supports the load-side encoder.	
					It is supported.	Check (3).	
		(3)	(3) A load-side encoder is malfunctioning.	s Replace the load-side I encoder, and then	It is not repeatable.	Replace the load-side encoder.	
				check the repeatability.	It is repeatable.	Replace the driver.	

Alarm I	No.: 20	Nan	ne: Encoder normal comm	nunication error 1			
Al	arm content	۰C	ommunication error occur	red between encoder an	d driver.		
Display	Detail name		Cause	Check method	Check result	Action	Target
20.1	Encoder normal communication - Receive data error 1	(1)	An encoder cable is malfunctioning.	Check if the encoder cable is disconnected or shorted.	It has a failure.	Repair or replace the cable.	LECSS 2-T
					It has no failure.	Check (2).	
		(2)	The driver is malfunctioning.	Replace the driver, and then check the	It is not repeatable.	Replace the driver.	
				repeatability.	It is repeatable.	Check (3).	
		(3)	An encoder is malfunctioning.	Replace the servo motor, and then check	It is not repeatable.	Replace the servo motor.	
				the repeatability.	It is repeatable.	Check (4).	
		(4)	Something near the device caused it.	Check the noise, ambient temperature, vibration, etc.	It has a failure.	Take countermeasures against its cause.	
20.2	Encoder normal communication - Receive data error 2 Encoder normal communication - Receive data error 3	Che	ck it with the check metho	od for [AL. 20.1].			
20.5	Encoder normal	(1)	When you use an	Check if the A/B-	It is disconnected or	Repair the encoder	LECSS
	communication - Transmission data error 1	()	A/B/Z-phase differential output linear encoder, the wiring of the linear encoder is incorrect.	phase pulse signals (PA, PAR, PB, and PBR) of the encoder cable are disconnected or shorted.	shorted. It is not disconnected or shorted.	cable. Check (2).	2-T□
		(2)	An encoder cable is malfunctioning.	Check it with the check	method for [AL. 20.1]	L	LECSS 2-T□
		(3)	The driver is malfunctioning.				
		(4)	An encoder is malfunctioning.				
		(5)	Something near the device caused it.				
20.6	Encoder normal communication - Transmission	(1)	When you use an A/B/Z- phase differential output linear encoder, the	Check if the Z-phase pulse signals (PZ and PZR) of the encoder	It is disconnected or shorted.	Repair the encoder cable.	LECSS 2-T□
	data error 2		wiring of the linear encoder is incorrect.	cable are disconnected or shorted.	It is not disconnected or shorted.	Check (2).	
		(2)	An encoder cable is malfunctioning.	Check it with the check	method for [AL. 20.1].		LECSS 2-T□
		(3)	The driver is malfunctioning.				
		(4)	An encoder is malfunctioning.				
		(5)	Something near the device caused it.				

Alarm No.: 20		Name: Encoder normal comm	Name: Encoder normal communication error 1						
Al	arm content	 Communication error occurr 	red between encoder an	d driver.					
Display	olay Detail name Cause Check method Check result Act								
20.7	Encoder normal communication - Transmission data error 3	Check it with the check metho	id for [AL. 20.1].						
20.9	Encoder normal communication - Receive data error 4								
20.A	Encoder normal communication - Receive data error 5								

Alarm I	No.: 21	Nar	ne: Encoder normal comm	nunication error 2			
Al	arm content	۰T	he encoder detected an ei	rror signal.			
Display	Detail name		Cause	Check method	Check result	Action	Target
21.1	Encoder data error 1	(1)	The encoder detected a high speed/acceleration	a Decrease the loop n gain, and then check	It is not repeatable.	Use the encoder with low loop gain.	LECSS 2-T
			or other factors.	the repeatability.	it is repeatable.	Check (2).	
		(2)	An encoder is malfunctioning.	Replace the servo motor, and then check	It is not repeatable.	Replace the servo motor.	
		_		the repeatability.	It is repeatable.	Check (3).	
		(3)	Something near the device caused it.	Check the noise, ambient temperature, vibration, etc.	lt has a failure.	Take countermeasures against its cause.	
21.2 Enco upda	Encoder data update error	(1)	An encoder is malfunctioning.	Replace the servo motor, and then check	It is not repeatable.	Replace the servo motor.	
			the repeatability.	It is repeatable.	Check (2).		
		(2)	Something near the device caused it.	Check the noise, ambient temperature, etc.	lt has a failure.	Take countermeasures against its cause.	
21.3	Encoder data waveform error	Che	eck it with the check metho	od for [AL. 21.2].			
21.4	Encoder non-	(1)	A signal of the encoder	Check if the encoder	It has a failure.	Review the wiring.	LECSS
	Signal error		has not been inputted.	correctly.	It has no failure.	Check (2).	2-1
		(2)	Something near the device caused it.	Check the noise, ambient temperature,	It has a failure.	Take countermeasures	
21.5	Encoder hardware error 1	Che	I eck it with the check metho	od for [AL. 21.2].	1	againet to cause.	1
21.6	Encoder hardware error 2						
21.9	Encoder data error 2	Che	eck it with the check metho	od for [AL. 21.1].			

Alarm No.: 24		Nar	ne: Main circuit error						
AI	arm content	 A ground fault occurred on the servo motor power lines. 							
		۰A	ground fault occurred at t	he servo motor.		1			
Display	Detail name		Cause	Check method	Check result	Action	Target		
24.1	Ground fault detected by hardware detection circuit	(1)	The driver is malfunctioning.	Disconnect the servo motor power cables	It occurs.	Replace the driver.	LECSS 2-T		
				check if the alarm occurs.	It does not occur.	Check (2).			
		(2)	A ground fault or short occurred at the servo	Check if only the servo motor power cable is	It is shorted.	Replace the servo motor power cable.			
			motor power cable.	shorted.	It is not shorted.	Check (3).			
		(3)	A ground fault occurred at the servo motor.	Disconnect the servo motor power cables on motor side, and check	It is shorted.	Replace the servo motor.			
				insulation of the motor (between U, V, W, and ⊕).	It is not shorted.	Check (4).			
		(4)	The main circuit power supply cable and servo motor power cable were	Shut off the power, and check if the main circuit power supply	They are in contact.	Correct the wiring.			
			shorted.	cable and servo motor power cable are in contact.	They are not in contact.	Check (5).			
		(5)	Something near the device caused it.	Check the noise, ambient temperature, etc.	It has a failure.	Take countermeasures against its cause.			
24.2	Ground fault detected by software detection function	Che	eck it with the check metho	od for [AL. 24.1].					

Alarm	No.: 25	Nar	ne: Absolute position eras	ed					
AI	arm content	• A • P	bsolute position data in er ower was switched on for	ror the first time in the abso	lute position detection	system.			
Display	Detail name		Cause	Check method	Check result	Action	Target		
25.1	Servo motor encoder - Absolute position erased	(1)	Power was switched on for the first time in the absolute position detection system.	Check if this is the first time in the absolute position detection system.	This is the first time.	Check that the battery is mounted, and make home position return.	LECSS 2-T 🗆		
					This is not the first time.	Check (2).			
		(2)	The battery was removed (replaced) when the control circuit power supply was off.	Check if the battery was removed (changed) when the control circuit power	It was removed.	Check that the battery is mounted, and make home position return.			
				supply was off.	It was not removed.	Check (3).			
		(3)	The battery voltage is low. The battery is	Check the battery voltage with a tester.	It is less than 3.0 V DC .	Replace the battery.			
			consumed.		It is 3.0 V DC or more.	Check (4).			
		(4)	The voltage drop of the battery cable is large.	Check if a recommended wire is	It is not used.	Use a recommended wire.			
				used.	It is used.	Check (5).			
		(5)	A battery cable is malfunctioning.	Check for the loose connection with a	It has a failure.	Replace the battery cable.			
				tester.	It has no failure.	Check (6).			
		(6)	(6)	(6)	There is a loose connection of the encoder cable on the servo motor side.	Check for the loose connection with a tester. Measure the voltage on the servo motor side.	It has a failure.	Repair or replace the encoder cable.	
		(7)	The absolute position storage unit was not connected for using a	Check if the absolute position storage unit is connected correctly.	It is not connected.	Connect the absolute position storage unit correctly.	LECSS 2-T 🗆		
			direct drive motor.		It is connected.	Check (8).			
		(8)	The driver is malfunctioning.	Replace the driver, and then check the	It is not repeatable.	Replace the driver.	LECSS 2-T□		
				repeatability.	It is repeatable.	Check (9).			
	-	(9)	An encoder is malfunctioning.	Replace the servo motor, and then check the repeatability.	It is not repeatable.	Replace the servo motor.			

Alarm I	No.: 27	Nar	ne: Initial magnetic pole de	etection error			
Al	arm content	۰T	he initial magnetic pole de	tection was not complete	ed properly.		
Display	Detail name		Cause	Check method	Check result	Action	Target
27.1	Magnetic pole detection - Abnormal termination	(1)	A moving part collided against the machine.	Check if it collided.	It collided.	Move the start position of the magnetic pole detection.	LECSS 2-T 🗆
		(2)	The wiring of the servo	Check if the wiring of	It did not conided.	Correct the wiring	
		(2)	motor power cable is	the servo motor power cable is correct	It has no failure.	Check (3).	
		(3)	The linear encoder resolution setting differs	Check the setting of [Pr. PL02] and [Pr.	The setting is incorrect.	Set it correctly.	
			from the setting value.	PL03].	The setting is correct.	Check (4).	
		(4)	The direction of mounting linear encoder	Check polarities of the linear encoder and the	The mounting direction is incorrect.	Mount it correctly.	
			is incorrect.	linear servo motor.	The mounting direction is correct.	Check (5).	
		(5)	The magnetic pole detection voltage level is small.	Check if the travel distance during the magnetic pole detection is too short (for a position detection method).	It is too short.	Increase it with the [Pr. PL09] setting.	
				Check if the travel distance during the magnetic pole detection is too long or if a vibration is occurring (for a minute position detection method).	The travel distance is too long or a vibration is occurring.	Review the [Pr. PL17] setting.	
27.2	Magnetic pole detection - Time out error	(1)	Only one of the limit switches is on during magnetic pole detection.	Check the limit switches.	It has a failure.	Remove the cause. Move the start position of the magnetic pole detection.	
					It has no failure.	Check (2).	
		(2)	The magnetic pole detection voltage level is small.	check if the travel distance during the magnetic pole detection is too short (for a position detection method).	It is too short.	[Pr. PL09] setting.	
27.3	Magnetic pole detection - Limit switch error	(1)	Both of the limit switches are off during the magnetic pole detection.	Check the limit switches.	Both of them are off.	Turn on the limit switches.	
27.4	Magnetic pole detection -	Che	eck it with the check metho	od for [AL. 27.1].			
27.5	Estimated error Magnetic pole detection - Position deviation error						
27.6	Magnetic pole detection - Speed deviation error						
27.7	Magnetic pole detection - Current error						

Alarm No.: 28		Nar	Name: Linear encoder error 2						
Alarm content		- V	Working environment of linear encoder is not normal.						
Display	Detail name		Cause	Check method	Check result	Action	Target		
28.1	Linear encoder - Environment error	(1)	The ambient temperature of the linear encoder is out of specifications.	Check the ambient temperature of the linear encoder.	It is out of specifications. It is within specifications.	Lower the temperature. Contact the linear encoder manufacturer. Check (2).	LECSS 2-T		
		(2)	The signal level of the linear encoder has dropped.	Check the mounting condition of the linear encoder.	lt has a failure.	Correct the mounting method of the linear encoder.			

Alarm No.: 2A		Nar	Name: Linear encoder error 1							
Alarm content		• A n	An error of the linear encoder was detected. (The details differ depending on the linear encoder manufacturer.)							
Display	Detail name		Cause	Check method	Check result	Action	Target			
2A.1	Linear encoder error 1-1	Linear encoder error 1-1	Linear encoder error 1-1	(1)	Mounting condition of the linear encoder and	Adjust the positions of the scale and head,	It is not repeatable.	Use the equipment at the adjusted position.	LECSS 2-T□	
			head is failure.	and then check the repeatability.	It is repeatable.	Check (2).				
		(2)	Something near the device caused it.	Check the noise, ambient temperature, vibration, etc.	lt has a failure.	Take countermeasures against its cause.				
					It has no failure.	Check (3).				
		(3)	An alarm of the linear encoder was detected.	Check the content of the alarm detail list of the Linear Encoder Instruction Manual. (Note)	Remove its cause described in the instruction manual. (Note)	Contact each encoder manufacturer for how to deal with it.				
2A.2	Linear encoder error 1-2	Che	eck it with the check metho	od for [AL. 2A.1].						
2A.3	Linear encoder error 1-3									
2A.4	Linear encoder error 1-4									
2A.5	Linear encoder error 1-5									
2A.6	Linear encoder error 1-6									
2A.7	Linear encoder error 1-7									
2A.8	Linear encoder error 1-8									

Note. Please download the Linear Encoder Instruction Manual from the Mitsubishi Electric Corporation website.

Alarm I	No.: 2B	Nar	Name: Encoder counter error							
AI	arm content	۰D	Data which encoder created is failure.							
Display	Detail name		Cause	Check method	Check result	Action	Target			
2B.1	Encoder counter error 1	(1)	An encoder cable is malfunctioning.	Check if the encoder cable is disconnected	It has a failure.	Repair or replace the cable.	LECSS 2-T			
				or shorted.	It has no failure.	Check (2).				
		(2)	Something near the device caused it.	Check the noise, ambient temperature, vibration, etc.	It has a failure.	Take countermeasures against its cause.				
					It has no failure. Check (3).	Check (3).				
		(3)	An encoder is malfunctioning.	Replace the direct drive motor, and then check the repeatability.	It is not repeatable.	Replace the direct drive motor.				
2B.2	Encoder counter error 2	Che	eck it with the check method	od for [AL. 2B.1].	·					

Alarm	No.: 30	Nar	Name: Regenerative error						
Alarm content		• P • A	ermissible regenerative po regenerative transistor in	ower of the built-in reger the driver is malfunction	erative resistor or regening.	nerative option is excee	ded.		
Display	Detail name		Cause	Check method	Check result	Action	Target		
30.1	Regeneration heat error	Regeneration heat error	(1)	The setting of the regenerative resistor (regenerative option) is incorrect	Check the regenerative resistor (regenerative option) and IPr PA021 setting	The setting value is incorrect. It is set correctly.	Set it correctly. Check (2).	LECSS 2-T 🗆	
		(2)	The regenerative resistor (regenerative option) is not	Check if the regenerative resistor (regenerative option)	It is not connected correctly. It is connected	Connect it correctly. Check (3).			
		(3)	connected. Power supply voltage high.	is connected correctly. Check the input power supply voltage.	correctly. It is higher than the prescribed value. LECSS2-T□ driver: 264 V AC or less	Reduce the power supply voltage.			
					It is the prescribed value or lower.	Check (4).			
		(4)	The regenerative load ratio has been over 100%.	Check the regenerative load ratio when alarm occurs.	It is 100% or more.	Reduce the frequency of positioning. Reduce the load. Use a regenerative option if not being using. Review the regenerative option capacity.			
30.2	Regeneration signal error	(1)	A detection circuit of the driver is malfunctioning.	Check if the regenerative resistor (regenerative option) is overheating.	It is overheating abnormally.	Replace the driver.			
30.3	Regeneration feedback signal error	(1)	A detection circuit of the driver is malfunctioning.	Remove the regenerative option or built-in regenerative resistor and then check if the alarm occur at power on.	The alarm occurs. The alarm does not occur.	Replace the driver. Check (2).			
		(2)	Something near the device caused it.	Check the noise, ground fault, ambient temperature, etc.	It has a failure.	Take countermeasures against its cause.			

Alarm	No.: 31	Nar	ne: Overspeed						
AI	arm content	۰T	he servo motor seed has e	exceeded the permissibl	e instantaneous speed.				
Display	Detail name		Cause	Check method	Check result	Action	Target		
31.1	Abnormal motor speed	(1)	The command from the PC or PLCetc is excessive.	Check if the command from the PC or PLCetc is over the	It is over the permissible speed.	Check operation pattern.	LECSS 2-T 🗆		
				permissible speed.	It is less than the permissible speed.	Check (2).			
		(2)	A larger speed command than the overspeed alarm level was inputted.	Check that the actual motor speed is higher than the setting value of [Pr. PC08	The motor speed is higher than the overspeed alarm detection level.	Review the [Pr. PC08] setting.			
				Overspeed alarm detection level].	The motor speed is lower than the overspeed alarm level.	Check (3).			
		(3)	The servo motor was at the maximum torque at the time of acceleration.	Check if the torque at the time of acceleration is the maximum torque.	It is the maximum torque.	Increase the acceleration/decelerat ion time constant. Or reduce the load.	LECSS 2-T□		
					It is less than the maximum torque.	Check (4).			
		(4)	The servo system is unstable and oscillating.	Check if the servo motor is oscillating.	It is oscillating.	Adjust the servo gain. Or reduce the load.			
					It is not oscillating.	Check (7).			
		(5)	The velocity waveform has overshot.	Check if it is overshooting because the acceleration time constant is too short.	It is overshooting.	Increase the acceleration/decelerat ion time constant.			
		((6)	The encoder or liner encoder is malfunctioning.	Check if the alarm is occurring during less than permissible instantaneous speed.	It is occurring during less than permissible instantaneous speed.

Alarm I	No.: 32	Nar	ne: Overcurrent				
Al	arm content	۰C	urrent that flew is higher t	han the permissible curre	ent of the driver.		
Display	Detail name		Cause	Check method	Check result	Action	Target
32.1	Overcurrent detected at hardware detection circuit	(1)	The driver is malfunctioning.	Disconnect the servo motor power cables (U, V, and W) and check if the alarm	It occurs. It does not occur.	Replace the driver. Check (2).	LECSS 2-T
	(during operation)	(2)	A ground fault or short occurred at the servo motor power cable.	occurs. Check if only the servo motor power cable is shorted.	It is shorted.	Replace the servo motor power cable.	
		(3)	The servo motor is malfunctioning.	Disconnect the servo motor power cables on motor side, and check	A ground fault is occurring.	Replace the servo motor.	
				insulation of the motor (between U, V, W, and (-)).	A ground fault is not occurring.	Check (4).	
		(4)	The dynamic brake is malfunctioning.	Check if the error occurs when you turn on the servo-on command.	It occurs.	Replace the driver.	
		(5) S d	(5) Something near the device caused it.	Check the noise, ambient temperature, etc.	It has a failure.	Take countermeasures against its cause.	LECSS 2-T
					It has no failure.	Check it with the check method for [AL. 45.1].	
32.2	Overcurrent detected at	(1)	The servo gain is high.	Check if an oscillation is occurring.	An oscillation is occurring.	Reduce the speed loop gain ([Pr. PB09]).	LECSS 2-T□
	software detection				An oscillation is not occurring.	Check (2).	
	operation)	(2)	The driver is malfunctioning.	Disconnect the servo motor power cables	It occurs.	Replace the driver.	
				check if the alarm occurs.	It does not occur.	Check (3).	
		(3)	A ground fault or short occurred at the servo	Check if only the servo motor power cable is	It is shorted.	Replace the servo motor power cable.	
			motor power cable.	shorted.	It is not shorted.	Check (4).	
		(4)	The servo motor is malfunctioning.	Disconnect the servo motor power cables on motor side, and check insulation of the motor (between U, V, W, and ⊕).	A ground fault is occurring.	Replace the servo motor.	
		(5)	Something near the device caused it.	Check the noise, ambient temperature, etc.	It has a failure.	Take countermeasures against its cause.	LECSS 2-T

Alarm	No.: 32	Name: Overcurrent						
A	larm content	Current that flew is higher than the permissible current of the driver.						
Display	Detail name	Cause	Check method	Check result	Action	Target		
32.3	Overcurrent detected at hardware detection circuit (during a stop)	Check it with the check metho	od for [AL. 32.1].					
32.4	Overcurrent detected at software detection function (during a stop)	Check it with the check metho	od for [AL. 32.2].					

Alarm	No.: 33	Nar	ne: Overvoltage								
Alarm content		• TI • LI	he value of the bus voltage ECSS2-T□ driver: 400 V	e exceeded the prescrib DC or less	ed value.						
Display	Detail name		Cause	Check method	Check result	Action	Target				
33.1	Main circuit (1 voltage error	Main circuit voltage error	ain circuit (1) Itage error	in circuit (1) tage error	Main circuit (1) voltage error	lain circuit (1) oltage error	The setting of the regenerative resistor	Check the regenerative resistor	The setting value is incorrect.	Set it correctly.	LECSS 2-T□
			incorrect.	and [Pr. PA02] setting.	It is set correctly.	Check (2).					
		(2)	The regenerative resistor (regenerative	Check if the regenerative resistor	It is not connected correctly.	Connect it correctly.					
			option) is not connected.	(regenerative option) is connected correctly.	It is connected correctly.	Check (3).					
		(3)	Wire breakage of built-in regenerative resistor or regenerative option	Measure the resistance of the built- in regenerative resistor or regenerative option.	The resistance is abnormal.	When using a built-in regenerative resistor, replace the driver. When using a regenerative option, replace the regenerative option.					
						The resistance is normal.	Check (4).				
		(4)	The regeneration capacity is insufficient.	Set a larger deceleration time constant, and then check the repeatability.	It is not repeatable.	When using a built-in regenerative resistor, use a regenerative option. When using a regenerative option, use a larger capacity one.					
					It is repeatable.	Check (5).					
		(5)	Power supply voltage high.	Check the input voltage.	It is higher than the prescribed value. LECSS2-T□ driver: 264 V AC or less	Reduce the input voltage.					
						It is the prescribed value or lower.	Check (6).				
		(6)	Something near the device caused it.	Check the noise, ambient temperature, etc.	lt has a failure.	Take countermeasures against its cause.					

Alarm I	No.: 34	Nar	ne: SSCNET receive error	· 1			
AI	arm content	۰A	n error occurred in SSCN	ET III/H communication.	(continuous communica	ation error with 3.5 ms i	nterval)
Display	Detail name		Cause	Check method	Check result	Action	Target
34.1	SSCNET receive data error	(1)	The SSCNET III cable is disconnected.	Check the SSCNET III cable connection.	It is disconnected.	Turn off the control circuit power supply of the driver, and then connect the SSCNET III cable.	LECSS 2-T
					It is connected.	Check (2).	
		(2)	The surface at the end of SSCNET III cable got dirty.	Wipe off the dirt from the cable tip, and then check the	It is not repeatable.	Take measure to keep the cable tip clean.	
		(0)			It is repeatable.	Check (3).	
		(3)	The SSCNET III cable is broken or severed.	Check if the SSCNET	It has a failure.	Replace the SSCNET III cable.	
				malfunctioning.	It has no failure.	Check (4).	
	(4	(4) A to O cc pl th	(4) A vinyl tape is stacked Ch to the SSCNET III cable. use Or a wire insulator cal	Check if a vinyl tape is used. Check if the cable is contacting	It is used. They are in contact.	Take countermeasures against its cause.	
			containing migrating plasticizer is adhered to the cable.	with other cables.	It is not used. They are not in contact.	Check (5).	
		(5)	The driver is malfunctioning.	Replace the driver, and then check the	It is not repeatable.	Replace the driver.	
				repeatability.	It is repeatable.	Check (6).	
	(6)	(6)	The previous or next axis driver of the alarm occurred is	Replace the previous and next driver of the alarm occurred axis,	It is not repeatable.	Replace the driver.	
		malfunctioning.	and then check the repeatability.	It is repeatable.	Check (7).		
		(7)	The PC or PLCetc is malfunctioning.	Replace the PC or PLCetc, and then	It is not repeatable.	Replace the PC or PLCetc.	
				check the repeatability.	It is repeatable.	Check (8).	
		(8)	Something near the device caused it.	Check the noise, ambient temperature, etc.	It has a failure.	Take countermeasures against its cause.	
34.2	SSCNET connector connection error	Che	eck it with the check metho	od for [AL. 34.1].			
34.3	SSCNET communication data error						
34.4	Hardware error signal detection						

Alarm I	No.: 35	Nar	Name: Command frequency error									
AI	arm content	• Ir	put pulse frequency of co	mmand pulse is too high	l.							
Display	Detail name		Cause	Check method	Check result	Action	Target					
35.1	Command frequency error	ommand (1) The command from th quency error (1) PC or PLCetc is excessive. (2) The PC or PLCetc is malfunctioning. (2) The PC or PLCetc is	The command from the PC or PLCetc is excessive.	Check if the command from the PC or PLCetc is over the	It is over the permissible speed.	Check operation pattern.	LECSS 2-T					
				permissible speed.	It is less than the permissible speed.	Check (2).						
			The PC or PLCetc is malfunctioning.	Replace the PC or PLCetc, and then	It is not repeatable.	Replace the PC or PLCetc.						
				check the repeatability.	It is repeatable.	Check (3).						
		(3)	Something near the device caused it.	Check the noise, ambient temperature, etc.	It has a failure.	Take countermeasures against its cause.	LECSS 2-T					
Alarm I	No.: 36	Nar	ne: SSCNET receive error	· 2								
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Alarm content		• A ir	n error occurred in SSCNI hterval)	ET III/H communication.	(intermittent communic	ation error with about 7	0 ms					
Display	Detail name		Cause	Check method	Check result	Action	Target					
36.1	Continuous communication data error	(1)	The SSCNET III cable is disconnected.	Check the SSCNET III cable connection.	It is disconnected.	Turn off the control circuit power supply of the driver, and then connect the SSCNET III cable.	LECSS 2-T□					
					It is connected.	Check (2).						
		(2)	The surface at the end of SSCNET III cable got dirty.	Wipe off the dirt from the cable tip, and then check the	It is not repeatable.	Take measure to keep the cable tip clean.						
				repeatability.	It is repeatable.	Check (3).						
		(3)	The SSCNET III cable is broken or severed.	Check if the SSCNET III cable is	It has a failure.	Replace the SSCNET III cable.						
				malfunctioning.	It has no failure.	Check (4).						
		 (4) A vinyl tape is stacked to the SSCNET III cable. Or a wire insulator containing migrating plasticizer is adhered to the cable. 	Check if a vinyl tape is lt is use used. Check if the contact cable is contacting	It is used. They are in contact.	Take countermeasures against its cause.							
			containing migrating plasticizer is adhered to the cable.	with other cables.	It is not used. They are not in contact.	Check (5).						
		(5)	The driver is malfunctioning.	Replace the driver, and then check the	It is not repeatable.	Replace the driver.						
				repeatability.	It is repeatable.	Check (6).						
		(6)	The previous or next axis driver of the alarm occurred is	Replace the previous and next driver of the alarm occurred axis,	It is not repeatable.	Replace the driver.						
			malfunctioning.	and then check the repeatability.	It is repeatable.	Check (7).						
		(7)	The PC or PLCetc is malfunctioning.	Replace the PC or PLCetc, and then	It is not repeatable.	Replace the PC or PLCetc.						
				repeatability.	It is repeatable.	Check (8).						
		(8	(8	(((8)	Something near the device caused it.	Check the noise, ambient temperature, etc.	lt has a failure.	Take countermeasures against its cause.	

Alarm	Alarm No.: 37		Name: Parameter error						
AI	Alarm content		arameter setting is incorre	ect.					
Display	Detail name		Cause	Check method	Check result	Action	Target		
37.1	Parameter setting range error	(1)	A parameter was set out of setting range.	Check the parameter error No. and setting	It is out of setting range.	Set it within the range.	LECSS 2-T		
					value.	It is within the setting range.	Check (2).		
		(2)	The parameter setting has changed due to a driver malfunction.	Replace the driver, and then check the repeatability.	It is not repeatable.	Replace the driver.			
37.2	Parameter combination error	(1)	A parameter setting contradicts another.	Check the parameter error No. and setting value.	A setting value is incorrect.	Correct the setting value.			

Alarm No.: 3A		Nar	Name: Inrush current suppression circuit error						
Alarm content		• T	The inrush current suppression circuit error was detected.						
Display	Detail name		Cause	Check method	Check result	Action	Target		
3A.1	Inrush current suppression circuit error	(1)	Inrush current suppressor circuit faulty.	Replace the driver, and then check the repeatability.	It is not repeatable.	Replace the driver.	LECSS 2-T		

Alarm I	Alarm No.: 3E		Name: Operation mode error							
Al	arm content	۰T	The operation mode setting was changed.							
Display	Detail name		Cause	Check method	Check result	Action	Target			
3E.1	Operation mode error	(1)	The LECSS2-T driver used in J3 compatibility mode was connected to the other SSCNET III/H PC or PLCetc. Or a LECSS2-T driver which was connected another SSCNET III/H PC or PLCetc was connected to the SSCNET III controller.	Check if the connection was changed to like these.	It is changed.	Initialize the driver with the built-in application software "MR-J4(W)-B mode selection" of setup software (MR Configurator2), and then connect the driver to the PC or PLCetc.	LECSS 2-T 🗆			
		(2)	The [Pr. PA01] setting value was changed.	Check if [Pr. PA01] was changed.	It is changed.	Set [Pr. PA01] correctly.				

Alarm I	No.: 42	Nan	ne: Servo control error						
Alarm content		A servo control error occurred.							
Display	Detail name		Cause	Check method	Check result	Action	Target		
42.1	42.1 Servo control error by position deviation	(1)	The linear encoder resolution setting differs	Check the setting of [Pr. PL02] and [Pr.	The setting is incorrect.	Set it correctly.	LECSS 2-T 🗌		
			from the setting value. PL03j.	The setting is correct.	Check (2).				
	deviation	(2)	The direction of mounting linear encoder	Check polarities of the linear encoder and the	The mounting direction is incorrect.	Mount it correctly.			
			is incorrect.	linear servo motor.	The mounting direction is correct.	Check (3).			
		(3)	The connection of the servo motor is incorrect.	Check the wiring.	The wiring is incorrect.	Connect it correctly.			
					The wiring is correct.	Check (4).			
		(4)	The initial magnetic pole detection was not	Execute the magnetic pole detection, and	It is not repeatable.	Execute the magnetic pole detection.			
			executed.	then check the repeatability.	It is repeatable.	Check (5).			
		(5)	The position deviation exceeded the detection level.	Check the value of droop pulses.	The deviation is large.	Review the operation status. Review the [Pr. PL05] setting depending on circumstances.			

Alarm I	No.: 42	Nar	ne: Servo control error				
AI	arm content	۰A	servo control error occurr	ed.			
Display	Detail name		Cause	Check method	Check result	Action	Target
42.2	Servo control error by speed	(1)	The linear encoder resolution setting differs	Check the setting of [Pr. PL02] and [Pr.	The setting is incorrect.	Set it correctly.	LECSS 2-T□
	deviation		from the setting value.	PL03].	The setting is correct.	Check (2).	
		(2)	The direction of mounting linear encoder	Check polarities of the linear encoder and the	The mounting direction is incorrect.	Mount it correctly.	
			is incorrect.	linear servo motor.	The mounting direction is correct.	Check (3).	
		(3)	The connection of the servo motor is incorrect.	Check the wiring.	The wiring is incorrect.	Connect it correctly.	
					The wiring is correct.	Check (4).	
		(4)	The initial magnetic pole detection was not	Execute the magnetic pole detection, and	It is not repeatable.	Execute the magnetic pole detection.	
			executed.	then check the repeatability.	It is repeatable.	Check (5).	
		(5) The speed exceeded t level.	The speed deviation exceeded the detection level.	Calculate the deviation between the speed command and actual speed.	The deviation is large.	Review the operation status. Review the [Pr. PL06] setting depending on circumstances.	
42.3	Servo control error by torque/	(1)	The linear encoder resolution setting differs	Check the setting of [Pr. PL02] and [Pr.	The setting is incorrect.	Set it correctly.	
	thrust deviation		from the setting value.	PL03].	The setting is correct.	Check (2).	
		(2) The direction of mounting linear encoder	Check polarities of the linear encoder and the	The mounting direction is incorrect.	Mount it correctly.		
			is incorrect.	linear servo motor.	The mounting direction is correct.	Check (3).	
		(3) The connection of the servo motor is incorrect.	Check the wiring.	The wiring is incorrect.	Connect it correctly.		
					The wiring is correct.	Check (4).	
		(4)	The initial magnetic pole detection was not	Execute the magnetic pole detection, and	It is not repeatable.	Execute the magnetic pole detection.	
			executed.	then check the repeatability.	It is repeatable.	Check (5).	
		(5)	The torque deviation exceeded the detection level.	Calculate the deviation between the current command and torque.	The deviation is large.	Review the operation status. Review the [Pr. PL07] setting depending on circumstances.	

Alarm I	No.: 42	Nar	Name: Fully closed loop control error detection (during fully closed loop control)							
Alarm content		۰A	A fully closed loop control error has occurred.							
Display	Detail name		Cause	Check method	Check result	Action	Target			
42.8	Fully closed loop control	(1)	The resolution of the load-side encoder	The resolution of the load-side encoder setting differs from the setting value. Check the setting of [Pr. PE04] and [Pr. In [PE05]] The resolution of the in [Pr. PE05]	The setting is incorrect.	Set it correctly.	LECSS 2-T			
	error by position deviation		setting differs from the setting value.		The setting is correct.	Check (2).				
		(2)	(2) T n	2) The direction of mounting load-side	Check the mounting direction of the load-	The mounting Mount it correctly. direction is incorrect.	Mount it correctly.			
			encoder is incorrect.	side encoder.	The mounting direction is correct.	Check (3).				
		(3)	The position deviation exceeded the detection level.	Check the value of droop pulses.	The deviation is large.	Review the operation status. Review the [Pr. PE07] setting depending on circumstances.				

Alarm I	No.: 42	Nar	ne: Fully closed loop contr	rol error detection (during	g fully closed loop contr	ol)				
Alarm content		۰A	A fully closed loop control error has occurred.							
Display	ay Detail name		Cause	Check method	Check result	Action	Target			
42.9	Fully closed loop control error by speed deviation	(1)	The resolution of the load-side encoder setting differs from the	Check the setting of [Pr. PE04] and [Pr. PE05].	The setting is incorrect. The setting is correct.	Set it correctly. Check (2).	LECSS 2-T			
		(2)	The direction of mounting load-side	Check the mounting direction of the load-	The mounting direction is incorrect.	Mount it correctly.				
		encoder is incorrect.	side encoder.	The mounting direction is correct.	Check (3).					
		(3) The speed deviation exceeded the detection level.	The speed deviation exceeded the detection level.	Calculate the deviation between the speed command and actual speed.	The deviation is large.	Review the operation status. Review the [Pr. PE06] setting depending on circumstances.				
42.A	Fully closed loop control error by position deviation during command stop	Che	eck it with the check metho	od for [AL. 42.8].						

Alarm	No.: 45	Nar	me: Main circuit device ove	erheat						
AI	arm content	• Ir	Inside of the driver overheated.							
Display	Detail name		Cause	Check method	Check result	Action	Target			
45.1	Main circuit device	(1)	Ambient temperature has exceeded 55 °C.	Check the ambient temperature.	It is over 55 °C.	Lower the ambient temperature.	LECSS 2-T			
	overheat error				It is less than 55 °C.	Check (2).				
		(2)	The close mounting is out of specifications.	Check the specifications of close	It is out of specifications.	Use within the range of specifications.				
		(3)		mounting.	It is within specifications.	Check (3).				
			Turning on and off were repeated under the	Check if the overload status occurred many	It occurred.	Check operation pattern.				
			overload status.	times.	It did not occur.	Check (4).				
		(4)	A cooling fan, heat sink, or openings is clogged	Clean the cooling fan, heat sink, or openings,	It is not repeatable.	Clean it periodically.				
			with foreign matter.	and then check the repeatability.	It is repeatable.	Check (5).				
		(5)	The driver is malfunctioning.	Replace the driver, and then check the repeatability.	It is not repeatable.	Replace the driver.				

Alarm I	No.: 46	Nar	ne: Servo motor overheat					
Al	arm content	۰T	he servo motor overheated	d.				
Display	Detail name		Cause	Check method	Check result	Action	Target	
46.1	Abnormal temperature of	(1)	Ambient temperature of the servo motor has	Check the ambient temperature of the	It is over 40 °C.	Lower the ambient temperature.	LECSS 2-T	
	servo motor 1		exceeded 40 °C.	servo motor.	It is less than 40 °C.	Check (2).		
		(2)	Servo motor is overloaded.	Check the effective load ratio.	The effective load ratio is large.	Reduce the load or review the operation pattern.		
					The effective load ratio is small.	Check (3).		
		(3)	The thermal sensor in the encoder is malfunctioning.	Check the servo motor temperature when the alarm occurs.	The servo motor temperature is low.	Replace the servo motor.		
46.2	Abnormal temperature of	(1)	Ambient temperature of the linear servo motor or	Check the ambient temperature of the	It is over 40 °C.	Lower the ambient temperature.	LECSS 2-T	
	servo motor 2		direct drive motor has exceeded 40 °C.	linear servo motor or direct drive motor.	It is less than 40 °C.	Check (2).		
		(2)	(2)	The linear servo motor or direct drive motor has been under overload	Check the effective load ratio.	The effective load ratio is large.	Reduce the load or review the operation pattern.	
			status.		The effective load ratio is small.	Replace the servo motor.		
46.3	Thermistor	(1)	A thermistor wire is not	Check the thermistor	It is not connected.	Connect it correctly.		
	disconnected		connected.	wire.	It is connected.	Check (2).		
		(2)	The thermistor wire is	Check the thermistor	It is disconnected.	Repair the lead wire.		
			disconnected.	wire.	It is not disconnected.	Replace the servo motor.		
46.5	Abnormal temperature of servo motor 3	Che	eck it with the check metho	od for [AL. 46.1].			LECSS 2-T	
46.6	Abnormal temperature of servo motor 4	(1)	A current was applied to the driver in excess of its continuous output current.	Check the effective load ratio.	The effective load ratio is high.	Reduce the load or review the operation pattern. Or use a larger capacity motor.		

Alarm	No.: 47	Nar	ne: Cooling fan error							
Alarm content		• T • O	 The speed of the driver cooling fan decreased. Or the fan speed decreased to the alarm occurrence level or less. 							
Display	Detail name		Cause	Check method	Check result	Action	Target			
47.1	Cooling fan stop error	(1)	Foreign matter was caught in the cooling	Check if a foreign matter is caught in the	Something has been caught.	Remove the foreign matter.	LECSS 2-T□			
			fan.	cooling fan.	Nothing has been caught.	Check (2).				
		(2)	Cooling fan life expired.	Check if the cooling fan is stopping.	It is stopping.	Replace the driver.				
47.2	Cooling fan speed reduction	(1)	Foreign matter was caught in the cooling	Check if a foreign matter is caught in the	Something has been caught.	Remove the foreign matter.				
	error		fan.	cooling fan.	Nothing has been caught.	Check (2).				
		(2)	Cooling fan life expired.	Check the cooling fan speed.	The fan speed is less than the alarm occurrence level.	Replace the driver.				

Alarm I	No.: 50	Nar	ne: Overload 1				
Al	arm content	۰L	oad exceeded overload pr	otection characteristic o	f driver.		
Display	Detail name		Cause	Check method	Check result	Action	Target
50.1	Thermal overload error 1 during operation	(1)	The servo motor power cable was disconnected.	Check the servo motor power cable.	It is disconnected.	Repair or replace the servo motor power cable.	LECSS 2-T
					It is not disconnected.	Check (2).	-
		(2)	The connection of the	Check the wiring of U,	It is incorrect.	Connect it correctly.	
			servo motor is incorrect.	V, and W.	It is correct.	Check (3).	
		(3)	The lock has not	Check if the lock is	It is not released.	Release the lock .	
			released. (The lock has been activated.)	released during operation.	It is released.	Check (4).	
		(4)	A current was applied to the driver in excess of its continuous output current.	Check the effective load ratio.	The effective load ratio is high.	Reduce the load. Or use a larger capacity motor.	
		(5)	The servo system is	Check if it is	It is resonating.	Adjust gains.	
			resonating.	resonating.	It is not resonating.	Check (6).	2-1
		(6)	The driver is malfunctioning.	Replace the driver, and then check the	It is not repeatable.	Replace the driver.	
				repeatability.	It is repeatable.	Check (7).	
		(7)	The encoder or liner encoder is malfunctioning.	Replace the servo motor or linear encoder, and then check the repeatability.	It is not repeatable.	Replace the servo motor or linear encoder.	
50.2	Thermal	Che	eck it with the check metho	od for [AL. 50.1].			
	overload error 2						
50.0	during operation						
50.3	I hermal						
	during operation						

Alarm I	No.: 50	Nar	ne: Overload 1				
AI	arm content	۰Lo	oad exceeded overload pr	otection characteristic of	f driver.		-
Display	Detail name		Cause	Check method	Check result	Action	Target
50.4	Thermal overload error 1	(1)	A moving part collided against the machine.	Check if it collided.	It collided.	Check operation pattern.	LECSS 2-T□
	during a stop				It did not collide.	Check (2).	
		(2)	The servo motor power cable was disconnected.	Check the servo motor power cable.	It is disconnected.	Repair or replace the servo motor power cable.	
					It is not disconnected.	Check (3).	
		(3)	Hunting occurs during servo-lock.	Check if the hunting is occurring.	The hunting is occurring.	Adjust gains.	
					The hunting is not occurring.	Check (4).	
		(4)	The lock has not	Check if the lock is	It is not released.	Release the lock.	
			released. (The lock has been activated.)	released.	It is released.	Check (5).	
		(5)	A current was applied to the driver in excess of its continuous output current.	Check the effective load ratio.	The effective load ratio is high.	Reduce the load. Or use a larger capacity motor.	
		(6)	The servo system is	Check if it is	It is resonating.	Adjust gains.	
			resonating.	resonating.	It is not resonating.	Check (7).	2-1
		(7)	The driver is malfunctioning.	Replace the driver, and then check the	It is not repeatable.	Replace the driver.	
				repeatability.	It is repeatable.	Check (8).	
		(8)	The encoder or liner encoder is malfunctioning.	Replace the servo motor or linear encoder, and then check the repeatability.	It is not repeatable.	Replace the servo motor or linear encoder.	
50.5	Thermal overload error 2 during a stop	Che	ck it with the check metho	od for [AL. 50.4].			
50.6	Thermal overload error 4 during a stop						

Alarm	No.: 51	Nar	ne: Overload 2				
AI	arm content	• M	laximum output current flo	wed continuously due to	machine collision or th	e like.	
Display	Detail name		Cause	Check method	Check result	Action	Target
51.1	Thermal overload error 3 during operation	(1)	The servo motor power cable was disconnected.	Check the servo motor power cable.	It is disconnected.	Repair or replace the servo motor power cable.	LECSS 2-T 🗆
					It is not disconnected.	Check (2).	
		(2)	The connection of the	Check the wiring of U,	It is incorrect.	Connect it correctly.	-
		(0)			It is correct.	Check (3).	-
		(3)	The connection of the	Check if the encoder	It is incorrect.	Connect it correctly.	
			incorrect.	correctly.	It is correct.	Check (4).	
		(4)	The torque is insufficient.	Check the peak load ratio.	The torque is saturated.	Reduce the load or review the operation pattern. Or use a larger capacity motor.	
					The torque is not saturated.	Check (5).	
		(5)	The driver is malfunctioning.	Replace the driver, and then check the	It is not repeatable.	Replace the driver.	
				repeatability.	It is repeatable.	Check (6).	
		(6)	An encoder is malfunctioning.	Replace the servo motor, and then check the repeatability.	It is not repeatable.	Replace the servo motor.	
51.2	Thermal overload error 3	(1)	A moving part collided against the machine.	Check if it collided.	It collided.	Check operation pattern.	
	during a stop				It did not collide.	Refer to (2).	
		(2)	The servo motor power cable was disconnected.	Check it with the check	method for [AL. 51.1].		
		(3)	The connection of the servo motor is incorrect.				
		(4)	The connection of the encoder cable is incorrect.				
		(5)	The torque is saturated.				
		(6)	The driver is malfunctioning.				
		(7)	An encoder is malfunctioning.				

Alarm I	Alarm No.: 52		ne: Error excessive				
Al	arm content	۰D	roop pulses have exceede	ed the alarm occurrence	level.		
Display	Detail name		Cause	Check method	Check result	Action	Target
52.1	Excess droop pulse 1	(1)	The servo motor power cable was disconnected.	Check the servo motor power cable.	It is disconnected.	Repair or replace the servo motor power cable.	LECSS 2-T□
		(0)	The compaction of the	Charle the wining of L	It is not disconnected.	Check (2).	
		(2)	servo motor is incorrect	V and W	It is incorrect.	Connect it correctly.	
		(3)	The connection of the	Check if the encoder	It is incorrect	Connect it correctly	
		(0)	encoder cable is incorrect.	cable is connected correctly.	It is correct.	Check (4).	
		(4)	The torque limit has been enabled.	Check if the limiting torque is in progress.	The limiting torque is in progress.	Increase the torque limit value.	
					The limiting torque is not in progress.	Check (5).	
		(5)	A moving part collided against the machine.	Check if it collided.	It collided.	Check operation pattern.	
					It did not collide.	Check (6).	
		(6)	The torque is insufficient.	Check the peak load ratio.	The torque is saturated.	Reduce the load or review the operation pattern. Or use a larger capacity motor.	
		(7)			The torque is not saturated.	Check (7).	
			Power supply voltage dropped.	Check the bus voltage value.	The bus voltage is low.	Check the power supply voltage and power supply capacity.	
					The bus voltage is high.	Check (8).	
		(8)	Acceleration/deceleratio n time constant is too short.	Set a longer deceleration time constant, and then	It is not repeatable.	Increase the acceleration/deceleration/deceleration/deceleration/deceleration time constant.	
				check the repeatability.	It is repeatable.	Check (9).	
		(9)	The position loop gain is small.	Increase the position loop gain, and then	It is not repeatable.	Increase the position loop gain ([Pr. PB08]).	
				check the repeatability.	It is repeatable.	Check (10).	
		(10)	Servo motor shaft was rotated by external	Measure the actual position under the	It was rotated by external force.	Review the machine.	
			force.	servo-lock status.	It was not rotated by external force.	Check (11).	
		(11)	An encoder is malfunctioning.	Replace the servo motor, and then check the repeatability.	It is not repeatable.	Replace the servo motor.	
52.3	Excess droop pulse 2	Che	ck it with the check metho	od for [AL. 52.1].			
52.4	Error excessive during 0 torque limit	(1)	The torque limit has been 0.	Check the torque limit value.	The torque limit has been 0.	Do not input a command while the torque limit value is 0.	LECSS 2-T□
52.5	Excess droop pulse 3	Che	eck it with the check metho	od for [AL. 52.1].			

Alarm No.: 54		Nar	Name: Oscillation detection							
Alarm content		۰A	An oscillation of the servo motor was detected.							
Display	Detail name	Cause		Check method	Check result	Action	Target			
54.1	Oscillation detection error	(1)	The servo system is unstable and oscillating.	Check if the servo motor is oscillating. Check the torque ripple with setup software (MR Configurator2).	The torque ripple is vibrating.	Adjust the servo gain with the auto tuning. Set the machine resonance suppression filter.	LECSS 2-T			
					The torque ripple is not vibrating.	Check (2).				
		(2)	The resonance frequency has changed due to deterioration.	Measure the resonance frequency of the equipment and compare it with the setting value of the	The resonance frequency of the equipment is different from the filter setting value.	Change the setting value of the machine resonance suppression filter.				
				machine resonance suppression filter.	The resonance frequency of the equipment is the same as the filter setting value.	Check (3).				
		(3)	The encoder or liner encoder is malfunctioning.	Replace the servo motor or linear encoder, and then check the repeatability.	It is not repeatable.	Replace the servo motor or linear encoder.				

Alarm No.: 56		Nar	Name: Forced stop error								
Al	Alarm content		 The servo motor does not decelerate normally during forced stop deceleration. 								
Display	Detail name	Cause		Check method	Check result	Action	Target				
56.2	Over speed during forced stop	(1)	The forced stop deceleration time constant value is short.	Increase the parameter setting value, and then check	It is not repeatable.	Adjust the deceleration time constant.	LECSS 2-T				
			[Pr. PC24]	the repeatability.	It is repeatable.	Check (2).					
		(2) The torque limit has been enabled.	The torque limit has been enabled.	Check if the limiting torque is in progress.	The limiting torque is in progress.	Review the torque limit value.					
					The limiting torque is not in progress.	Check (3).					
		(3)	The servo system is unstable and oscillating.	Check if the servo motor is oscillating. Check the torque ripple with setup	The torque ripple is vibrating.	Adjust the servo gain. Set the machine resonance suppression filter.					
				software (MR Configurator2).	The torque ripple is not vibrating.	Check (4).					
		(4)	The encoder or liner encoder is malfunctioning.	Replace the servo motor or linear encoder, and then check the repeatability.	It is not repeatable.	Replace the servo motor or linear encoder.					

Alarm No.: 56		Nar	Name: Forced stop error							
Alarm content		۰T	The servo motor does not decelerate normally during forced stop deceleration.							
Display	Detail name		Cause	Check method	Check result	Action	Target			
56.3	Estimated distance over during forced	(1)	The forced stop deceleration time constant value is short.	Increase the parameter setting value, and then check	It is not repeatable.	Adjust the deceleration time constant.	LECSS 2-T			
	stop		[Pr. PC24]	the repeatability.	It is repeatable.	Check (2).				
		(2)	The torque limit has been enabled.	Check if the limiting torque is in progress.	The limiting torque is in progress.	Review the torque limit value.				
					The limiting torque is not in progress.	Check (3).				
		(3)	The encoder or liner encoder is malfunctioning.	Replace the servo motor or linear encoder, and then check the repeatability.	It is not repeatable.	Replace the servo motor or linear encoder.				

Alarm I	No.: 63	Nam	ne: STO timing error						
Alarm content		STO was activated during motor driving.							
Display	Detail name	Cause		Check method	Check result	Action	Target		
63.1	STO1 off	(1)	 STO1 was turned off under the following speed conditions. 1) Servo motor speed: 50 r/min or more 2) Linear servo motor speed: 50 mm/s or more 3) Direct drive motor speed: 5 r/min or more 	Check if STO1 is off.	It is off.	Turn on STO1.	LECSS 2-T		
63.2	STO2 off	(1)	 STO2 was turned off under the following speed conditions. 1) Servo motor speed: 50 r/min or more 2) Linear servo motor speed: 50 mm/s or more 3) Direct drive motor speed: 5 r/min or more 	Check if STO2 is off.	It is off.	Turn on STO2.			

Alarm I	No.: 70	Nar	ne: Load-side encoder init	ial communication error	1		
Al	arm content	 An error occurs in the comr 		nunication between the	load-side encoder and	the driver.	
Display	Detail name		Cause	Check method	Check result	Action	Target
70.1	Load-side encoder initial communication - Receive data	(1)	A load-side encoder cable is malfunctioning.	Check if the load-side encoder cable is disconnected or shorted.	It has a failure. It has no failure.	Replace or repair the cable. Check (2).	LECSS 2-T
	error 1	(2)	When you use an A/B/Z- phase differential output linear encoder, thedriver is not compatible with	Check if the driver is compatible with the A/B/Z-phase differential output	The driver is not compatible with it.	Use a driver which is compatible with it.	LECSS 2-T□
			the linear encoder.	linear encoder.	The driver is compatible with it.	Check (3).	
		(3) When you use an A/B/Z- phase differential output linear encoder, the connection with the linear encoder is incorrect.	Check if the wiring of the linear encoder is correct. (Check if it is	The wiring is incorrect.	Wire it correctly.		
			connection with the linear encoder is incorrect.	wired to PSEL.)	The wiring is correct.	Check (4).	
		(4)	The driver is malfunctioning.	Replace the driver, and then check the	It is not repeatable.	Replace the driver.	LECSS 2-T
			_	repeatability.	It is repeatable.	Check (5).	
		(5)	A load-side encoder is malfunctioning.	Replace the load-side encoder, and then	It is not repeatable.	Replace the load-side encoder.	!
				check the repeatability.	It is repeatable.	Check (6).	
		(6)	Something near the device caused it.	Check the noise, ambient temperature, vibration, etc.	lt has a failure.	Take countermeasures against its cause.	
70.2	Load-side encoder initial communication - Receive data error 2	Che	eck it with the check metho	od for [AL. 70.1].			

Alarm I	No.: 70	Nar	ne: Load-side encoder init	ial communication error	1		
Al	arm content	۰A	n error occurs in the comr	nunication between the	load-side encoder and t	he driver.	
Display	Detail name		Cause	Check method	Check result	Action	Target
70.3	Load-side encoder initial communication - Receive data error 3	(1)	The load-side encoder cable is malfunctioning.	Check if the load-side encoder cable is connected correctly.	It is not connected correctly.	Connect it correctly.	LECSS 2-T
					It is connected.	Check (2).	
		(2)	A load-side encoder cable is malfunctioning.	Check if the load-side encoder cable is	It has a failure.	Replace or repair the cable.	
			dis	shorted.	It has no failure.	Check (3).	
		(3)	The power voltage has been unstable. (For the	Check the power capacity and voltage.	It has a failure.	Review the power and related parts.	
			load-side encoder with the external power supply input)	It has no failure.	Check (4).		
		(4)	When you use an A/B/Z- phase differential output linear encoder, the	Check if the wiring of the linear encoder is correct. (Check if it is	The wiring is incorrect.	Wire it correctly.	LECSS 2-T
			connection with the willinear encoder is incorrect.	wired to PSEL.)	The wiring is correct.	Check (5).	
		 (5) When you use a four- wire type linear encoder, of the driver is not compatible with the four- wire type linear encoder. 	Check if the driver is compatible with the	It is not supported.	Use a driver which is compatible with it.		
			the driver is not compatible with the four- wire type linear encoder.	encoder.	It is supported.	Check (6).	
		(6)	The driver is malfunctioning.	Replace the driver, and then check the	It is not repeatable.	Replace the driver.	LECSS 2-T 🗆
		<i>(</i>)		repeatability.	It is repeatable.	Check (7).	
		(7)	A load-side encoder is malfunctioning.	Replace the load-side encoder, and then	It is not repeatable.	Replace the load-side encoder.	
				repeatability.	It is repeatable.	Check (8).	
		(8)	Something near the device caused it.	Check the noise, ambient temperature, vibration, etc.	It has a failure.	Take countermeasures against its cause.	
70.5	Load-side encoder initial communication	(1)	When you use an A/B/Z- phase differential output linear encoder, the	- Check if the A/B- phase pulse signals (PA, PAR, PB, and	It is disconnected or shorted.	Repair the encoder cable.	LECSS 2-T□
	data error 1		encoder is incorrect.	cable are disconnected or shorted.	It is not disconnected or shorted.	Check (2).	
		(2)	An load-side encoder cable is malfunctioning.	Check it with the check	method for [AL. 70.1].		LECSS 2-T□
		(3)	The driver is malfunctioning.				
		(4)	A load-side encoder is malfunctioning.				
		(5)	Something near the device caused it.				

Alarm No.: 70		Nan	ame: Load-side encoder initial communication error 1						
Al	arm content	۰A	n error occurred in the init	ial communication betwe	een the load-side encod	ler and driver.			
Display	Detail name		Cause	Check method	Check result	Action	Target		
70.6	Load-side encoder initial communication - Transmission data error 2	(1)	When you use an A/B/Z- phase differential output linear encoder, the wiring of the linear encoder is incorrect.	Check if the Z-phase pulse signals (PZ and PZR) of the encoder cable are disconnected or	It is disconnected or shorted. It is not disconnected or shorted.	Repair the encoder cable. Check (2).	LECSS 2-T		
				shorted.	or shorted.				
		(2)	An load-side encoder cable is malfunctioning.	Check it with the check	method for [AL. 70.1].		LECSS 2-T□		
		(3)	The driver is malfunctioning.						
		(4)	A load-side encoder is malfunctioning.	3					
		(5)	device caused it.						
70.7	Load-side encoder initial communication - Transmission data error 3	Che	ck it with the check metho	od for [AL. 70.1].					
70.A	Load-side encoder initial	(1)	The driver is malfunctioning	Replace the driver, and then check the	It is not repeatable.	Replace the driver.	LECSS 2-T□		
	communication		indianotoring.	repeatability.	It is repeatable.	Check (2).			
	- Process error 1	(2)	A load-side encoder is malfunctioning.	Replace the load-side encoder, and then	It is not repeatable.	Replace the load-side encoder.			
				check the repeatability.	It is repeatable.	Check (3).			
		(3)	Something near the device caused it.	Check the noise, ambient temperature, vibration, etc.	It has a failure.	Take countermeasures against its cause.			
70.B	Load-side encoder initial communication - Process error 2	Che	ck it with the check metho	od for [AL. 70.A].					
70.C	Load-side encoder initial communication - Process error 3								
70.D	Load-side encoder initial communication - Process error 4								
70.E	Load-side encoder initial communication - Process error 5								
70.F	Load-side encoder initial communication - Process error 6								

Alarm I	No.: 71	Nar	ne: Load-side encoder no	rmal communication err	or 1		
AI	arm content	۰A	n error occurred in the cor	mmunication between th	ne load-side encoder a	and driver.	
Display	Detail name		Cause	Check method	Check result	Action	Target
71.1	Load-side encoder	(1)	A load-side encoder cable is malfunctioning.	Check if the load-side encoder cable is	It has a failure.	Repair or replace the cable.	LECSS 2-T□
	communication - Receive data			disconnected or shorted.	It has no failure.	Check (2).	
	error 1	(2)	The driver is malfunctioning.	Replace the driver, and then check the	It is not repeatable.	Replace the driver.	
	-			repeatability.	It is repeatable.	Check (3).	
		(3) A load-side encoder is malfunctioning.	Replace the load-side encoder, and then	It is not repeatable.	Replace the load-side encoder.		
			check the repeatability.	It is repeatable.	Check (4).		
		(4)	Something near the device caused it.	Check the noise, ambient temperature, vibration. etc.	lt has a failure.	Take countermeasures against its cause.	
71.2	Load-side encoder communication - Receive data error 2	Che	ck it with the check metho	od for [AL. 71.1].	1		1
71.3	Load-side encoder communication - Receive data						
71 5	error 3						
71.5	encoder						
	communication - Transmission data error 1						
71.6	Load-side encoder communication - Transmission						
74 7	data error 2						
71.7	encoder communication - Transmission data error 3						
71.9	Load-side encoder communication - Transmission data error 4						
71.A	Load-side encoder communication - Transmission data error 5						

Alarm I	No.: 72	Nar	ne: Load-side encoder nor	mal communication error	or 2		
AI	arm content	• T	he load-side encoder dete	cted an error signal.			
Display	Detail name		Cause	Check method	Check result	Action	Target
72.1	Load-side encoder data error 1	(1)	The encoder detected a high speed/acceleration rate due to an oscillation or other factors.	Decrease the loop gain, and then check the repeatability.	It is not repeatable. It is repeatable.	Use the encoder with low loop gain. Check (2).	LECSS 2-T□
		(2)	A load-side encoder is malfunctioning.	Replace the load-side encoder, and then check the repeatability.	It is not repeatable. It is repeatable.	Replace the load-side encoder. Check (3).	
		(3)	Something near the device caused it.	Check the noise, ambient temperature, vibration, etc.	It has a failure.	Take countermeasures against its cause.	
72.2	Load-side encoder data update error	(1)	A load-side encoder is malfunctioning.	Replace the load-side encoder, and then check the	It is not repeatable. It is repeatable.	Replace the load-side encoder. Check (2).	
		(2)	Something near the device caused it.	Check the noise, ambient temperature, etc.	It has a failure.	Take countermeasures against its cause.	
72.3	Load-side encoder data waveform error	Che	eck it with the check metho	od for [AL. 72.2].			
72.4	Load-side encoder non-	(1)	A signal of the load-side encoder has not been	Check if the load-side encoder cable is wired	It has a failure.	Review the wiring.	LECSS 2-T□
	signal error	(2)	inputted. Something near the device caused it.	correctly. Check the noise, ambient temperature, etc.	It has a failure.	Take countermeasures against its cause.	
72.5	Load-side encoder hardware error 1	Che	eck it with the check metho	od for [AL. 72.2].			
72.6	Load-side encoder hardware error 2						
72.9	Load-side encoder data error 2	Che	eck it with the check metho	od for [AL. 72.1].			

Alarm No.: 8A		Nar	Name: USB communication time-out error							
Al	arm content	• C	Communication between the driver and a personal computer stopped for the specified time or longer.							
Display	Detail name		Cause	Check method	Check result	Action	Target			
8A.1	USB communication time-out error	(1)	A communication cable is disconnected.	Replace the communication cable, and then check the repeatability.	It is not repeatable.	Replace the communication cable.	LECSS 2-T□			
		(2)	The driver is malfunctioning.	Replace the driver, and then check the repeatability.	It is not repeatable.	Replace the driver.				

Alarm I	No.: 8E	Nar	ne: USB communication e	error/serial communication	on error		
Al	arm content	• T	he communication error o	ccurred between driver a	and a personal compute	er.	
Display	Detail name		Cause	Check method	Check result	Action	Target
8E.1	USB communication receive error/Serial	(1)	A communication cable is malfunctioning.	Check the communication cable, and then check the repeatability.	It is not repeatable. It is repeatable.	Replace the communication cable. Check (2).	LECSS 2-T□
	communication receive error	(2)	The setting of the personal computer is	Check the setting of the personal	It is incorrect.	Review the settings.	
05.0		(3)	Incorrect. The driver is malfunctioning.	computer. Replace the driver, and then check the repeatability.	It is not repeatable.	Replace the driver.	
8E.2	USB communication checksum error/Serial communication checksum error	(1)	The setting of the personal computer is incorrect.	Check the setting of the personal computer.	It is incorrect.	Review the settings.	
8E.3	USB communication character error/Serial communication character error	(1)	The transmitted character is out of specifications.	Check the character code at the time of transmission.	The transmitted character is out of specifications. The transmitted character is within specifications.	Correct the transmission data. Check (2).	
		(2)	The communication protocol is failure.	Check if transmission data conforms the communication protocol.	It is not conforming.	Modify the transmission data according to the communication protocol.	
	(5	(3)	The setting of the personal computer is incorrect.	Check the setting of the personal computer.	It is conforming. It is incorrect.	Check (3). Review the settings.	

Alarm I	No.: 8E	Nar	ne: USB communication e	error			
Al	arm content	۰T	he communication error o	ccurred between driver a	and a personal compute	er.	_
Display	Detail name		Cause	Check method	Check result	Action	Target
8E.4	USB communication command error	(1)	The transmitted command is out of specifications.	Check the command at the time of transmission.	The transmitted command is out of specifications.	Correct the transmission data.	LECSS 2-T 🗆
					command is within specifications.		
		(2)	The communication protocol is failure.	Check if transmission data conforms the communication protocol.	It is not conforming.	Modify the transmission data according to the communication protocol.	
					It is conforming.	Check (3).	
		(3)	The setting of the personal computer is incorrect.	Check the setting of the personal computer.	It is incorrect.	Review the settings.	
8E.5	USB communication data number error	munication number	The transmitted data number is out of specifications.	Check the data number at the time of transmission.	The transmitted data number is out of specifications.	Correct the transmission data.	
					The transmitted data number is within specifications.	Check (2).	
		(2)	The communication protocol is failure.	Check if transmission data conforms the communication protocol.	It is not conforming.	Modify the transmission data according to the communication protocol.	
					It is conforming.	Check (3).	
	((;	(3)	(3) The setting of the personal computer is incorrect. Check the setting of the personal computer. It is incorrect. Rev	Review the settings.	1	

Alarm No.: 88888		Nar	Name: Watchdog							
Alarm content		A part such as CPU is malfunctioning.								
Display	Detail name		Cause	Check method	Check result	Action	Target			
88/ 8888	Watchdog	(1)	A part in the driver is failure.	Replace the driver, and then check the repeatability.	It is not repeatable.	Replace the driver.	LECSS 2-T			

8.4 Remedies for warnings

●If [AL. E3 Absolute position counter warning] occurs, always make home position
setting again. Otherwise, it may cause an unexpected operation.

POINT

•When any of the following alarms has occurred, do not cycle the power of the driver repeatedly to restart. Doing so will cause a malfunction of the driver and the servo motor. If the power of the driver is switched off/on during the alarms, allow more than 30 minutes for cooling before resuming operation.

- [AL. 91 Driver overheat warning]
- [AL. E0 Excessive regeneration warning]
- [AL. E1 Overload warning 1]
- [AL. E2 Servo motor overheat warning]
- [AL. EC Overload warning 2]

If [AL. E6], [AL. E7], or [AL. E9] occurs, the servo-off status is established. If any other warning occurs, operation can be continued but an alarm may take place or proper operation may not be performed. Remove the cause of warning according to this section. Use Setup software (MR Configurator2) to refer to a factor of warning occurrence.

Alarm No.: 91		Nar	Name: Driver overheat warning						
AI	Alarm content		The temperature inside of the driver reached a warning level.						
Display	Detail name		Cause	Check method	Check result	Action	Target		
91.1	Main circuit device overheat warning	(1)	Ambient temperature of the driver has exceeded 55 °C.	Check the ambient temperature.	It is over 55 °C. It is less than 55 °C.	Lower the ambient temperature. Check (2).	LECSS 2-T		
		(2)	The close mounting is out of specifications.	Check the specifications of close mounting.	It is out of specifications.	Use within the range of specifications.			

Alarm I	Alarm No.: 92		ne: Battery cable disconne	ection warning						
AI	arm content	۰A	Absolute position detection system battery voltage is low.							
Display	Detail name		Cause	Check method	Check result	Action	Target			
92.1	Encoder battery cable	(1)	Battery cable is disconnected.	Check if the battery cable is	It has a failure.	Replace or repair the cable.	LECSS 2-T□			
	disconnection			malfunctioning.	It has no failure.	Check (2).				
	warning	(2)	The battery voltage is low. The battery is	Check the battery voltage with a tester.	It is less than 3.1 V DC.	Replace the battery.				
			consumed.		It is 3.1 V DC or more.	Check (3).				
		(3)	An encoder cable was disconnected.	Check if the encoder cable is disconnected.	It is disconnected.	Replace or repair the cable.				
92.3	Battery degradation	ion (1)	The battery voltage is low. The battery is	Check the battery voltage with a tester.	It is less than 3.0 V DC.	Replace the battery.				
			consumed.		It is 3.0 V DC or more.	Check (2).				
		(2)	The battery has deteriorated.	Replace the battery, and then check the repeatability.	It is not repeatable.	Replace the battery.				

Alarm	No.: 95	Nar	Name: STO warning							
AI	arm content	The STC signal turned off while the servo motor is stopped.								
Display	Detail name		Cause	Check method	Check result	Action	Target			
95.1	STO1 off detection	(1)	 STO1 was turned off under the following speed conditions. 1) Servo motor speed: 50 r/min or less 2) Linear servo motor speed: 50 mm/s or less 3) Direct drive motor speed: 5 r/min or less 	Check if STO1 is off.	It is off.	Turn on STO1.	LECSS 2-T			
95.2	STO2 off detection	(1)	 STO2 was turned off under the following speed conditions. 1) Servo motor speed: 50 r/min or less 2) Linear servo motor speed: 50 mm/s or less 3) Direct drive motor speed: 5 r/min or less 	Check if STO2 is off.	It is off.	Turn on STO2.				

Alarm I	Alarm No.: 96		Name: Home position setting warning							
Al	Alarm content		Home position setting could not be made.							
Display	Detail name		Cause	Check method	Check result	Action	Target			
96.1	In-position warning at home positioning	(1)	INP (In-position) did not turn on within the specified time during home positioning.	Check the droop pulses during home positioning.	It is In-position range or more.	Adjust gains to set droop pulses within the In-position range. Remove the cause of droop pulse occurrence.	LECSS 2-T			
96.2	Command input warning at home positioning	(1)	A command has already inputted at the time of home positioning.	Check if a command is inputted at home positioning.	A command is inputted. A command is not inputted.	Set it after home positioning. Check (2).				
		(2)	Creep speed is high.	Decrease the creep speed, and then check the repeatability.	It is not repeatable.	Reduce the creep speed.				

Alarm No.: 9F		Nar	Name: Battery warning							
A	arm content	• A	 Absolute position detection system battery voltage is low. 							
Display	Detail name		Cause	Check method	Check result	Action	Target			
9F.1	Low battery	(1)	The battery voltage is low. The battery is consumed.	Check the battery voltage with a tester.	It is less than 4.9 V DC.	Replace the battery.	LECSS 2-T			
9F.2	Battery degradation warning	(1)	The absolute position storage unit has not connected.	Check if the absolute position storage unit is connected correctly.	It is not connected.	Connect it correctly.	LECSS 2-T□			

Alarm	Alarm No.: E0		Name: Excessive regeneration warning							
AI	Alarm content		 There is a possibility that regenerative power may exceed permissible regenerative power of built-in regenerative resistor or regenerative option. 							
Display	Detail name		Cause	Check method	Check result	Action	Target			
E0.1	Excessive regeneration warning	(1)	The regenerative power exceeded 85% of the permissible regenerative power of the built-in regenerative resistor or regenerative option.	Check the effective load ratio.	It is 85% or more.	Reduce the frequency of positioning. Increase the deceleration time constant. Reduce the load. Use a regenerative option if not being using.	LECSS 2-T			

Alarm I	No.: E1	Nar	Name: Overload 1					
Al	arm content	• [A	L.50 Overload 1] or [AL.5	1 Overload 2] may occur				
Display	Detail name		Cause	Check method	Check result	Action	Target	
E1.1	Thermal overload warning 1 during operation	(1)	The load was over 85% to the alarm level of [AL. 50.1 Thermal overload error 1 during operation].	Check it with the check	method for [AL. 50.1].		LECSS 2-T	
E1.2	Thermal overload warning 2 during operation	(1)	The load was over 85% to the alarm level of [AL. 50.2 Thermal overload error 2 during operation].	Check it with the check	method for [AL. 50.2].			
E1.3	Thermal overload warning 3 during operation	(1)	The load was over 85% to the alarm level of [AL. 51.1 Thermal overload error 3 during operation].	Check it with the check	method for [AL. 51.1].			
E1.4	Thermal overload warning 4 during operation	(1)	The load was over 85% to the alarm level of [AL. 50.3 Thermal overload error 4 during operation].	Check it with the check	method for [AL. 50.3].			
E1.5	Thermal overload warning 1 during a stop	(1)	The load was over 85% to the alarm level of [AL. 50.4 Thermal overload error 1 during a stop].	Check it with the check	method for [AL. 50.4].			
E1.6	Thermal overload warning 2 during a stop	(1)	The load was over 85% to the alarm level of [AL. 50.5 Thermal overload error 2 during a stop].	Check it with the check	method for [AL. 50.5].			
E1.7	Thermal overload warning 3 during a stop	(1)	The load was over 85% to the alarm level of [AL. 51.2 Thermal overload error 3 during operation].	Check it with the check	method for [AL. 51.2].			
E1.8	Thermal overload warning 4 during a stop	(1)	The load was over 85% to the alarm level of [AL. 50.6 Thermal overload error 4 during a stop].	Check it with the check	method for [AL. 50.6].			

Alarm	Alarm No.: E2		Name: Servo motor overheat warning						
Alarm content		• [4	 [AL. 46.2 Abnormal temperature of servo motor 2] may occur. 						
Display	Detail name		Cause	Check method	Check result	Action	Target		
E2.1	Servo motor temperature warning	In content • [AL: 46.2 Abitormal temperature] Detail name Cause Servo motor (1) The temperature of the linear servo motor or direct drive motor reached 85% of the occurrence level of [AL. 46.2 Abnormal temperature of servo motor 2]		Check it with the check	method for [AL. 46.2].		LECSS 2-T		

Alarm	No.: E3	Nar	me: Absolute position cour	nter warning						
A	Alarm content		 The multi-revolution counter value of the absolute position encoder exceeded the maximum range. Absolute position encoder pulses are faulty. 							
Display	Detail name		Cause	Check method	Check result	Action	Target			
E3.2	Absolute position counter	(1)	Something near the device caused it.	Check the noise, ambient temperature, etc.	It has a failure.	Take countermeasures against its cause.	LECSS 2-T⊡			
	warning				It has no failure.	Check (2).				
		(2)	An encoder is malfunctioning.	Replace the servo motor, and then check the repeatability.	It is not repeatable.	Replace the servo motor.				
E3.5	Encoder absolute positioning counter warning	Che	eck it with the check method	od for [AL. E3.2].						

Alarm No.: E4		Nar	ne: Parameter warning						
Alarm content		• 0	 Out of the setting range was attempted to write during parameter writing. 						
Display	Detail name		Cause	Check method	Check result	Action	Target		
E4.1	Parameter setting range error warning	(1)	Parameter value set from servo system controller is outside setting range.	Check the parameter setting value set with the servo system controller.	It is out of setting range.	Set it within the range.	LECSS 2-T□		

Alarm I	No.: E6	Nar	ne: Servo forced stop war	ning						
AI	arm content	۰E	EM2/EM1 (Forced stop) turned off.							
Display	Detail name		Cause	Cause Check method Check result						
E6.1 Fo	Forced stop warning	ed stop (1) EM2/EM1 (Forced stop) turned off.	Check the status of EM2/EM1.	It is off.	Ensure safety and turn on EM2/EM1 (Forced stop).	LECSS 2-T				
					It is on.	Check (2).				
		(2)	An external 24 V DC power supply have not	Check if the external 24 V DC power supply	It is not inputted.	Input the 24 V DC power supply.				
			inputted.	is inputted.	It is inputted.	Check (3).				
		(3)	The driver is malfunctioning.	Replace the driver, and then check the repeatability.	It is not repeatable.	Replace the driver.				

Alarm No.: E7		Nar	ne: Controller forced stop	warning			I	
Alarm content		• T!	The forced stop signal of the servo system controller was enabled.					
Display	Detail name		Cause	Check method	Check result	Action	Target	
E7.1	Controller forced stop warning	(1)	The forced stop signal of the servo system controller was inputted.	Check if the servo system controller is a forced stop status.	It is the forced stop status.	Ensure safety and cancel the forced stop signal of the PC or PLCetc.	LECSS 2-T⊡	

Alarm I	No.: E8	Nar	Name: Cooling fan speed reduction warning							
Alarm content		۰T	he cooling fan speed decr	eased to the warning oc	currence level or less.					
Display Detail name			Cause	Check method	Check result	Action	Target			
E8.1	Decreased cooling fan speed warning	(1)	Foreign matter caught in the cooling fan and the speed was decreased.	Check if a foreign matter is caught in the cooling fan.	Something has been caught. Nothing has been caught.	Remove the foreign matter. Check (2).	LECSS 2-T 🗆			
		(2)	Cooling fan life expired.	Check the total of power on time of the driver.	It exceed the cooling fan life.	Replace the driver.				
E8.2	Cooling fan stop	Che	eck it with the check metho	od for [AL. E8.1].						

Alarm I	No.: E9	Nar	me: Main circuit off warning	g						
AI	arm content	• T • T	 The servo-on command was inputted with main circuit power supply off. The bus voltage dropped during the servo motor driving under 50 r/min. 							
Display	Detail name	Cause		Check method	Check result	Action	Target			
E9.1	Servo-on signal on during main	(1)	The main circuit power supply is off.	Check if the main circuit power supply is	It is not inputted.	Turn on the main circuit power.	LECSS 2-T			
	circuit off		inp	inputted.	It is inputted.	Check (2).				
		(2)	The main circuit power	Check the main circuit	It is disconnected.	Connect it correctly.				
			disconnected.	connector.	It has no failure.	Check (3).				
		(3)	The bus voltage is less than the prescribed value.	Check the bus voltage.	The voltage is lower than the prescribed value.	Review the wiring. Check the power supply capacity.				
			215 V E	215 V DC		The voltage is the prescribed value or higher.	Check (4).			
		(4)	The driver is malfunctioning.	Replace the driver, and then check the repeatability.	It is not repeatable.	Replace the driver.				
E9.2	Bus voltage drop during low speed operation	(1)	The bus voltage dropped during the servo motor driving under 50 r/min.	Check the bus voltage.	It is lower than the prescribed value. 200 V driver: 200 V DC	Review the power supply capacity. Increase the acceleration time constant.	LECSS 2-T			
E9.3	Ready-on signal on during main circuit off	Che	eck it with the check metho	od for [AL. E9.1].			LECSS 2-T□			

Alarm No.: EC		Nar	ne: Overload 2					
Alarm content		• 0	 Operations over rated output were repeated while the servo motor shaft was not rotated. 					
Display	Detail name		Cause	Check method	Check result	Action	Target	
EC.1	Overload warning 2	(1)	The load is too large or the capacity is not enough.	Check the effective load ratio.	The effective load ratio is high.	Reduce the load. Replace the servo motor with the one of larger capacity.	LECSS 2-T□	

Alarm	No.: ED	Nar	Name: Output watt excess warning							
A	arm content	• T c	The status, in which the output wattage (speed × torque) of the servo motor exceeded the rated output, continued steadily.							
Display Detail name			Cause	Check method	Check result	Action	Target			
ED.1	Output watt excess warning	(1)	The status, in which the output wattage (speed × torque or thrust) of the servo motor exceeded 150% of the rated output (continuous thrust), continued steadily.	Check the servo motor speed and torque.	The output wattage is 150% of rating.	Reduce the servo motor speed. Reduce the load.	LECSS 2-T			

Alarm	No.: F0	Nar	me: Tough drive warning					
AI	arm content	• T	Tough drive function was activated.					
Display	Detail name		Cause	Check method	Check result	Action	Target	
F0.1	Instantaneous power failure tough drive warning	(1)	The voltage of the control circuit power supply has dropped.	Check it with the check	: method for alarm No. '	'10.1".	LECSS 2-T□	
F0.3	Vibration tough drive warning	(1)	The setting value of the machine resonance suppression filter was changed due to a machine resonance.	Check if it was changed frequently.	It was changed frequently.	Set the machine resonance suppression filter. Check the machine status if screws are loose or the like.		

Alarm I	No.: F2	Nar	Name: Drive recorder - Miswriting warning							
AI	Alarm content		 A waveform measured by the drive recorder function was not recorded. 							
Display	Detail name	il name Cause Check method Check result Actio					Target			
F2.1	Drive recorder - Area writing time-out warning	(1)	The Flash-ROM is malfunctioning.	Disconnect the cables except the control circuit power supply, and then check the repeatability.	It is repeatable.	Replace the driver.	LECSS 2-T			
F2.2	Drive recorder - Data miswriting warning	(1)	Data were not written to the drive recorder area.	Check if clearing alarm history disables this alarm with setup software MR Configurator2.	It is not disabled.	Replace the driver.				

Alarm No.: F3		Name: Oscillation detection warning						
Alarm content		[AL. 54 Oscillation detection] may occur.						
Display	Detail name	Cause	Check method	Check result	Action	Target		
F3.1	Oscillation detection warning	Check it with the check metho	od for [AL. 54.1].			LECSS 2-T		

8.5 Trouble which does not trigger alarm/warning

POINT	
When the dr	iver, servo motor, or encoder malfunctions, the following status may
occur.	

The following example shows possible causes which do not trigger alarm or warning. Remove each cause referring this section.

Description	Possible cause	Check result	Action	Target
The display shows "AA".	The power of the servo system controller was turned off.	Check the power of the servo system controller.	Switch on the power of the servo system controller.	LECSS2 -T
	A SSCNET III cable was disconnected.	Check if "AA" is displayed in the corresponding axis and following axes.	Replace the SSCNET III cable of the corresponding axis.	
		Check if the connectors (CNIA, CNIB) are unplugged.	Connect it correctly.	
	The power of the driver was turned off.	Check if "AA" is displayed in the corresponding axis and following axes.	Check the power of the driver.	
	The driver-less operation function of servo system controller is enabled.	Check if the driver -less operation function of servo system controller is enabled.	Disable the driver -less operation function.	

Description	Possible cause	Check result	Action	Target
The display shows "Ab".	The axis is disabled.	Check if the disabling control axis switch is on. SW2-2	Turn off the disabling control axis switch.	LECSS2 -T□
	The setting of the axis No. is incorrect.	Check that the other driver is not assigned to the same axis No.	Set it correctly.	
	Axis No. does not match with the axis No. set to the servo system controller.	Check the setting and axis No. of the servo system controller.	Set it correctly.	
	Information about the servo series has not set in the simple motion module.	Check the value set in Servo series (Pr.100) in the simple motion module.	Set it correctly.	
	Communication cycle does not match.	Check the communication cycle at the servo system controller side. When using 8 axes or less: 0.222 ms	Set it correctly.	
		When using 16 axes or less: 0.444 ms When using 32 axes or less: 0.888 ms		
	A SSCNET III cable was disconnected.	Check if "Ab" is displayed in the corresponding axis and following axes.	Replace the SSCNET III cable of the corresponding axis.	LECSS2 -T□
		Check if the connectors (CNIA, CNIB) are unplugged.	Connect it correctly.	
	The power of the driver was turned off.	Check if "Ab" is displayed in the corresponding axis and following axes.	Check the power of the driver.	
	The driver-less operation function of servo system controller is enabled.	Check if the driver-less operation function of servo system controller is enabled.	Disable the driver-less operation function.	
	The driver is malfunctioning.	Check if "Ab" is displayed in the corresponding axis and following axes.	Replace the driver of the corresponding axis.	

Description	Possible cause	Check result	Action	Target
The display shows "b##". (Note)	Test operation mode has been enabled.	Test operation setting switch (SW2-1) is turned on.	Turn off the test operation setting switch (SW2-1).	LECSS2 -T□
	The system has been in the ready-off state.	Check if the servo ready state is off with the servo system controller.	Turn on the servo-on signals for all axes.	
The display shows "off".	Operation mode for manufacturer setting is enabled.	Check if all of the control axis setting switches (SW2) are on.	Set the control axis setting switches (SW2) correctly.	LECSS2 -T
The display turned off.	The external I/O terminal was shorted.	When the display is on by disconnecting the following connectors, check if the disconnected cable wire is shorted. CN2, CN3	Review the wiring of I/O signals.	LECSS2 -T
	The control circuit power supply is not applied.	Check if the control circuit power supply of the driver is off.	Turn on the control circuit power.	
	The voltage of the control circuit power supply has dropped.	Check if the voltage of the control circuit power supply dropped.	Increase the voltage of the control circuit power supply.	
The servo motor does not operate.	The connection of the servo motor is incorrect.	Check the wiring of U, V, and W.	Connect it correctly.	LECSS2 -T
	The servo motor power supply cable was connected to a driver of other axis.	Check if the encoder cable and servo motor power supply cable are connected to the same driver.	Connect the encoder cable and servo motor power supply cable correctly.	
	The servo-on command was inputted with main circuit power supply off.	Check if [AL. E9] is occurring.	Turn on the main circuit power.	
	An alarm or warning is occurring.	Check if an alarm or warning is occurring.	Check the content of the alarm/warning and remove its cause.	
	The system has been in the test operation mode.	Check if the test operation setting switch (SW2-1) is on (up).	Cancel the test operation mode.	
	The motor-less operation has been enabled.	Check the [Pr. PC05] setting.	Disable the motor-less operation.	
	The torque is insufficient due to large load.	Check instantaneous torque using status display (only [A]) or setup software (MR Configurator2) if the load exceeds the maximum torque or torque limit value.	Reduce the load or use a larger capacity servo motor.	
	An unintended torque limit has been enabled.	Check if the torque limit is enabled.	Cancel the torque limit.	

Note. ## indicates axis No.

Description	Possible cause	Check result	Action	Target
The servo motor does not operate.	The setting of the torque limit is incorrect.	Check if the torque limit is "0". Setting on PC or PLCetc side	Set it correctly.	LECSS2 -T□
	Machine is interfering with the motor.	Check if machine is interfering.	Remove the interference.	
	For a servo motor with a lock, the lock has not released.	Check the power supply of the lock.	Turn on the lock power.	

Description	Possible cause	Check result	Action	Target
The servo motor does not operate.	The axis is disabled.	Check if the disabling control axis switch is on. SW2-2	Turn off the disabling control axis switch.	LECSS2 -T
	An error is occurring on the servo system controller side.	Check if an error is occurring on the servo system controller side.	Cancel the error of the servo system controller.	
	The setting of a servo	Check the settings of servo	Review the setting of the	
	servo system controller side.	system controller side.	servo system controller side.	
	The position command is not inputted correctly.	Check cumulative command pulses using setup software (MR Configurator2) and check if numerical values are changed by inputting the command.	Review the setting of the servo system controller and the servo program.	
The speed of the servo motor is not increased. Or the speed is increased too	The setting of the speed command, speed limit, or electronic gear is not correct	Check the settings of the speed command, speed limit, and electronic dear	Review the settings of the speed command, speed limit, and electronic gear	LECSS2 -T□
much.	The connection of the servo motor is incorrect.	Check the wiring of U, V, and W.	Connect it correctly.	
	The voltage of the main circuit power supply has dropped.	Check if the voltage of the main circuit power supply dropped.	Increase the voltage of the main circuit power supply.	
	For a servo motor with a lock, the lock has not released.	Check the power supply of the lock.	Turn on the lock power.	
The servo motor vibrates with low frequency.	The estimated value of the load to motor inertia ratio by auto tuning is incorrect. When the load to motor inertia ratio is set by manual, the setting value is incorrect.	If the servo motor may be driven with safety, repeat acceleration and deceleration several times to complete auto tuning. Check if the load to motor inertia ratio is proper compared with the actual ratio for manual setting.	Execute auto tuning and one-touch tuning to reset the load to motor inertia ratio. Set the load to motor inertia ratio correctly for manual setting.	LECSS2 -T
	The command from the PC or PLCetc is unstable.	Check the command from the PC or PLCetc.	Review the command from the PC or PLCetc. Check the cable for command if there is failure such as disconnection.	
	Torque during acceleration/deceleration is overshooting exceeding the limit of the servo motor when the motor stops.	Check the effective load ratio during acceleration/deceleration if torque exceeds the maximum torque/thrust.	Reduce the effective load ratio by increasing acceleration/deceleration time and reducing load.	
	The servo gain is low. Or the response of auto tuning is low.	Check if the trouble is solved by increasing auto tuning response ([Pr. PA09]).	Adjust gains.	

Description	Possible cause	Check result	Action	Target
An unusual noise is occurring at the servo motor.	The servo gain is low. Or the response of auto tuning is low.	Check if the trouble is solved by increasing auto tuning response ([Pr. PA09]).	Adjust gains.	LECSS2 -T
	Bearing life expired.	If the servo motor may be driven with safety, remove the load and check the noise with the motor only. If you can remove the servo motor from machine, remove the servo motor power cable to release the lock and check the noise by rotating the shaft by your hands.	Noising means that the bearing life expired. Replace the servo motor. When not noising, maintain the machine.	
	For a servo motor with a lock, the lock has not released.	Check the power supply of the lock.	Turn on the lock power.	
	For a servo motor with a lock, the lock release timing is not correct.	Check the lock release timing.	Review the lock release timing. Please consider that the lock has release delay time.	
The servo motor vibrates.	The servo gain is too high. Or the response of auto tuning is too high.	Check if the trouble is solved by reducing auto tuning response ([Pr. PA09]).	Adjust gains.	LECSS2 -T
	The machine is vibrating (resonating).	If the servo motor may be driven with safety, check if the trouble is solved by one- touch tuning or adaptive tuning.	Adjust the machine resonance suppression filter.	
	The load side is vibrating.	If the servo motor may be driven with safety, check if the trouble is solved by advanced vibration suppression control II.	Execute the advanced vibration suppression control II.	
	Feedback pulses are being miscounted due to entered noise into an encoder cable.	Check the cumulative feedback pulses using status display (only [A]) or setup software (MR Configurator2) if its numerical value is skipped.	Please take countermeasures against noise by laying the encoder cable apart from power cables, etc.	
	There is a backlash between the servo motor and machine (such as gear, coupling).	Check if there is a backlash on the machine.	Adjust the backlash on the coupling and machine.	
	The rigidity of the motor mounting part is low.	Check the mounting part of the servo motor.	Increase the rigidity of the mounting part by such as increasing the board thickness and by reinforcing the part with ribs.	
	The connection of the servo motor is incorrect.	Check the wiring of U, V, and W.	Connect it correctly.	
	An unbalanced torque of the machine is large.	Check if the vibration varies depending on the speed.	Adjust balance of the machine.	
	The eccentricity due to core gap is large.	Check the mounting accuracy of the servo motor and machine.	Review the accuracy.	
	A load for the shaft of the servo motor is large.	Check the load for the shaft of the servo motor.	Adjust the load for the shaft to within specifications of the servo motor.	
	An external vibration propagated to the servo motor.	Check the vibration from outside.	Prevent the vibration from the external vibration source.	

Description	Possible cause	Check result	Action	Target
The rotation accuracy is low. (The speed is unstable.)	The servo gain is low. Or the response of auto tuning is low.	Check if the trouble is solved by increasing auto tuning response ([Pr. PA09]).	Adjust gains.	LECSS2 -T
	The torque is insufficient due to large load.	Check instantaneous torque using status display (only [A]) or setup software (MR Configurator2) if the load exceeds the maximum torque or torque limit value.	Reduce the load or use a larger capacity servo motor.	
	An unintended torque limit has been enabled.	Check if TLC (Limiting torque) is on using status display or setup software (MR Configurator2).	Cancel the torque limit.	
	The setting of the torque limit is incorrect.	Check if the limiting torque is too low. Setting on PC or PLCetc side	Set it correctly.	
	For a servo motor with a lock, the lock has not released.	Check the power supply of the lock.	Turn on the lock power.	
	The command from the PC or PLCetc is unstable.	Check the ripple of the command frequency with MR Configurator2.	Review the command from the PC or PLCetc. Check the cable for command if there is failure such as disconnection.	
The machine vibrates unsteadily when it stops.	The servo gain is low. Or the response of auto tuning is low.	Check if the trouble is solved by increasing auto tuning response ([Pr. PA09]).	Adjust gains.	LECSS2 -T
The motor starts to drive immediately after power on of the driver. The motor starts to drive immediately after servo-on.	For a servo motor with a lock, the lock release timing is not correct.	Check the lock release timing.	Review the lock release timing.	LECSS2 -T□
	The connection of the servo motor is incorrect.	Check the wiring of U, V, and W.	Connect it correctly.	

Description	Possible cause	Check result	Action	Target
Home position deviates at home position return.	For the dog type home position return, the point which the dog turns off and the point which Z-phase pulse is detected (CR input position) are too close.	Check if a fixed amount (in one revolution) deviates.	Adjust the dog position.	LECSS2 -T
	The in-position range is too large.	Check the setting of the in- position range in [Pr. PA10].	Set a narrower in-position range.	
	The proximity dog switch is failure. Or mounting proximity dog switch is incomplete.	Check if the proximity dog signal is inputted correctly.	Repair or replace the proximity dog switch. Adjust the mounting of the proximity dog switch.	
	The program on the PC or PLCetc side is incorrect.	Check the program on the PC or PLCetc side such as home position address settings or sequence programs.	Review the programs on the PC or PLCetc side.	
The position deviates during operation after home position return.	An alarm or warning is occurring.	Check if an alarm or warning is occurring.	Check the content of the alarm/warning and remove its cause.	LECSS2 -T□
	The servo gain is low. Or the response of auto tuning is low.	Check if the trouble is solved by increasing auto tuning response ([Pr. PA09]).	Adjust gains.	
	The reduction ratio is not calculated correctly for the geared servo motor.	Check the following settings. Number of pulses per revolution, travel distance (setting on the PC or PLCetc side)	Review the calculation of the reduction ratio.	
	The in-position range is too large.	Check the setting of the in- position range in [Pr. PA10].	Set a narrower in-position range.	
	A mechanical slip occurred. Or backlash of the machine part is large.	Check if "cumulative feedback pulses × travel distance per pulse" matches actual machine position.	Adjust the machine part.	

Description	Possible cause	Check result	Action	Target
A restoration position deviates at restoration of power for the absolute position detection system.	The motor was rotated exceeding the maximum permissible speed at power failure (6000 r/min) by an external force during driver power off. (Note: The acceleration time is 0.2 s or less.)	Check if the motor was accelerated suddenly to 6000 r/min by an external force.	Extend the acceleration time.	LECSS2 -T
	The driver power turned on while the servo motor was rotated exceeding 3000 r/min by an external force.	Check if the driver power turned on while the servo motor was rotated exceeding 3000 r/min by an external force.	Review the power-on timing.	
Overshoot/undershoot occurs.	The servo gain is low or too high. The response of auto tuning is low or too high.	Check the velocity waveform with a graph using setup software (MR Configurator2) if overshoot/undershoot is occurring.	Adjust the response of auto tuning and execute the gain adjustment again.	LECSS2 -T
	Capacity shortage or shortage of the maximum torque due to too large load	Check the instantaneous torque using status display if the maximum torque exceeds the torque limit value.	Reduce the effective load ratio by increasing acceleration/deceleration time and reducing load.	
	The setting of the torque limit is incorrect.	Check the instantaneous torque using status display if the maximum torque exceeds the torque limit value.	Review the torque limit setting.	
	Backlash of the machine part is large.	Check if there is a backlash on the machine part.	Adjust the backlash on the coupling and machine part.	

Description	Possible cause	Check result	Action	Target
A communication with driver	They are off-line status.	Check if they are off-line.	Set them to on-line.	LECSS2
fails using setup software (MR Configurator2).	A communication cable is malfunctioning.	Check if the communication cable is malfunctioning.	Replace the communication cable.	-T□
(For details, refer to Help of setup software (MR Configurator2).)	The communication setting is incorrect.	Check the communication setting such as baud rate and ports.	Set the communication setting correctly.	
	A model is being connected other than the model set in model selection.	Check if the model selection is set correctly.	Set the mode selection correctly.	
	The driver was not set correctly.	Check the bottom of the USB (Universal Serial Bus) controller with the device manager of the personal computer if "MITSUBISHI MELSERVO USB Controller" is being displayed.	Delete an unknown device or other devices, cycle the power of the driver, and reset according to Found New Hardware Wizard.	
For a servo motor with a lock, the lock went out.	The lock is failure due to its life.	Remove the servo motor and all wirings from the machine and check if the motor shaft can be rotated by hands. (If it is rotated by hands, the lock is failure.)	Replace the servo motor.	LECSS2 -T□
The coasting distance of the servo motor became longer.	The load was increased and permissible load to motor inertia ratio was exceeded.	Check if the load was increased.	Reduce the load.	LECSS2 -T
	An external relay is malfunctioning. Or the wiring of MBR (Electromagnetic brake interlock) is incorrect.	Check the external relay and wirings connected to MBR (Electromagnetic brake interlock) if they are malfunctioning.	Replace the external relay. Or review the wiring.	
	The lock is failure due to its life.	Remove the servo motor and all wirings from the machine and check if the motor shaft can be rotated by hands. (If it is rotated by hands, the lock is failure.)	Replace the servo motor.	

8.6 How to use drive recorder

POINT				
The drive regime	corder will not operate on the following conditions.			
 You are using the graph function of setup software (MR Configurator2). 				
 You are us 	sing the machine analyzer function.			
• [Pr. PF21]	is set to "1".			
The PC or	PLCetc is not connected (except the test operation mode).			
 You are optimized 	perating in the J3 compatibility mode.			
When the for	llowing alarms occur, the drive recorder will not operate.			
• [AL. 10.1 \	Voltage drop in the control circuit power]			
• [AL. 12 Me	emory error 1 (RAM)]			
• [AL. 15 Me	emory error 2 (EEP-ROM)]			
• [AL. 16 Er	ncoder initial communication error 1]			
• [AL. 17 Bo	pard error]			
• [AL. 19 Me	emory error 3 (FLASH-ROM)]			
• [AL. 1A Se	ervo motor combination error]			
• [AL. 1E Er	ncoder initial communication error 2]			
• [AL. 1F Er	ncoder initial communication error 3]			
• [AL. 25 Ab	osolute position erased]			
• [AL. 37 Pa	arameter error]			
• [AL. 70 Lo	ad-side encoder initial communication error 1]			
• [AL. 888 V	Vatchdog]			
When the gr	aph is displayed with setup software (MR Configurator2), the drive			
recorder fun	ction will be enabled. After the graph function is completed, passing			
time set with	[Pr. PF21] or cycling the power of the driver will enable the drive			
recorder fun	ction again.			

When an alarm occurs at the driver, the conditions (such as motor speed and droop pulses) of the driver before/after alarm occurrences will be recorded. You can refer to the recorded data with setup software (MR Configurator2).

The drive recorder records sixteen data at alarm occurrences in the past. Occurring an alarm deletes the oldest data.

(1) Trigger setting of drive recorder

When you operate the drive recorder only for any alarms, set [Pr. PA23 Drive recorder arbitrary alarm trigger setting].

When the setting value is "0 0 0 0" (initial value) in [Pr. PA23 Drive recorder arbitrary alarm trigger setting], the drive recorder will operate at alarm occurrences other than alarms described in above POINT.

(2) Recordable data by drive recorder

When the setting value is "0 0 0 0" (initial value) in [Pr. PA23 Drive recorder arbitrary alarm trigger setting], the drive recorder will record data of standard column in table 2.1 or 2.2 for all alarms. When you set an alarm in table 2.1 or 2.2 to [Pr. PA23], each data described in alarm column will be recorded. When you set an alarm other than in table 2.1 and 2.2, data described in standard column will be recorded. Refer to table 2.3 for description of each signal.

- (3) When the power of the driver is turned off during data storage (immediately after alarm occurrence), the data at alarm occurrence can not be recorded normally. When the following alarms occur, the data at alarm occurrence can not be recorded depending on its circumstances.
 - [AL. 13 Clock error]
 - [AL. 14 Control process error]
 - [AL. 34 SSCNET receive error 1]
 - [AL. 36 SSCNET receive error 2]
| Standard Analog Motor speed Torque Current Droppulses Speed Effective load Infective load Digital CSON ENG ALM2 NP MBR RD STO IPF AL10 Digital CSON ENG ALM2 NP MBR RD STO IPF AL20 Analog Motor speed Torque Current Coropulses Speed RD STO IPF AL20 Digital CSON ENG ALM2 NP MBR RD STO IPF Analog Motor speed Torque ASS courter Within one-
revolution Courrent Courrent Courter 1 Courere 1 Courere 1 Courer | | | Data 1 | Data 2 | Data 3 | Data 4 | Data 5 | Data 6 | Data 7 | Data 8 |
|--|----------|----------|---------------------|--------|----------------|---------------------|----------------|---------------------|---------------------------|--------------|
| Standard main command (1 pulse) command (1 pulse) command (1 pulse) RD STO IPF A1.0 Malog McGoN espect Torque Current Current Orop pulses Speed Bus valage Effective load Into A1.20 Analog Motor speed Torque ABS NP MBR RD STO IPF A1.20 Digital CSON EMS ALMZ NP MBR RD STO IPF A1.21 Digital CSON EMG ALMZ NP MBR RD STO IPF Analog McGr speed Torque ABS current Within one-
command Current Ontiminor Bioxediage V-phase Encoder error
counter 2 Foreback | | Analog | Motor speed | Torque | Current | Droop pulses | Speed | Bus voltage | Effective load | |
| Digital CSON EMS ALM2 NP MER RD STO PF AL-10 Andog Motor speed Torque Cormand Corpupules Speed Bus voltage Effective load PF AL-20 Malos Motor speed Torque ALM2 NP MBR RD STO PF AL-20 Digital CSON EMS ALM2 NP MBR RD STO Encoder error counter 1 Counter 2 Counter 2 Counter 2 Encoder error counter 2 Encoder error counter 2 Encoder error counter 2 Counter 1 Counter 2 Encoder error counter 2 Encode error counter 2 | Standard | | | | command | (1 pulse) | command | | ratio | |
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command Displai Command Based Based Envice Envire | | Digital | CSON | EMG | ALM2 | INP | MBR | RD | STO | IPF |
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counter r Encoder error
counter r Finder error
counter r AL.20 Digital CSON EMG ALM2 NP MBR RD STO IPF AL.21 Digital CSON EMG ALM2 NP MBR RD STO IPF AL.21 Digital CSON EMG ALM2 NP MBR RD STO IPF AL.24 Digital CSON EMG ALM2 NP MBR RD STO IPF AL.30 Digital CSON EMG ALM2 NP MBR RD STO IPF AL.30 Digital CSON EMG ALM2 NP MBR RD STO IPF AL.30 Digital CSON EMG <td></td> <td>Analog</td> <td>Motor speed</td> <td>Torque</td> <td>Current</td> <td>Droop pulses</td> <td>Speed</td> <td>Bus voltage</td> <td>Effective load</td> <td></td> | | Analog | Motor speed | Torque | Current | Droop pulses | Speed | Bus voltage | Effective load | |
| Jugual Jugual< | AL.10 | Digital | CSON | EMC. | command | (1 puise) | command | DD | ratio | |
| AL.20 Notice Notice Note of the section Content of the section Content of the section Content of the section AL.21 Analog Motor speed Torque ABS counter NBP MBR RD STO IPF AL.21 Digital CSON EMG ALM2 NBP MBR RD STO IPF AL.24 Digital CSON EMG ALM2 NBP MBR RD STO IPF AL.30 Motor speed Torque Current Within one-
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Motor speed | EMIG | ALM2 | Within one- | | RD
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Encoder error | |
| AL 20 Image Image <th< td=""><td></td><td>Analog</td><td>wotor speed</td><td>Torque</td><td>ABS counter</td><td>revolution</td><td>command</td><td>counter 1</td><td>counter 2</td><td></td></th<> | | Analog | wotor speed | Torque | ABS counter | revolution | command | counter 1 | counter 2 | |
| Digital CSON EMG ALM2 NP MBR RD RD BTO IPF AL.21 Analog Motor speed Torque ABS counter Winith one-
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counter 2 Digital CSON EMG AL/2 NP MSR RD STO IPF AL.24 Analog Motor speed Torque Current
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| AL.21 Digital CSON EMG ALM2 INP MBR RD Counter 1 Counter 2 AL.24 Motor speed Torque Current command Current revolution Busing and the provided in theprovided in the provided in theprovided in the provided in thepr | | Analog | Motor speed | Torque | ABS counter | Within one- | Current | Encoder error | Encoder error | |
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| AL.24 Interface Interface Command
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(reged unt) <th< td=""><td></td><td>Analog</td><td>Motor speed</td><td>Torque</td><td>Current</td><td>Within one-</td><td>Bus voltage</td><td>U-phase</td><td>V-phase</td><td></td></th<> | | Analog | Motor speed | Torque | Current | Within one- | Bus voltage | U-phase | V-phase | |
| NLL-16 Interval < | AL 24 | 5 | | | command | revolution | | current | current | |
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| AL.30 Digital CSON EMG AllM2 INP MBR RD STO IPF Analog Motor speed Torque Current
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| AL.31 Intermediate Intermediate Command
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| AL-31 mask | 41.04 | 7 tholog | motor opecu | Torquo | command | pulse | revolution | command | Duo voltago | |
| Digital CSON EMG ALM2 INP MBR RD STO IPF AL.32 Analog Motor speed Torque Current
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(10 pulse) Sto IPF AL.42 Analog Motor speed Torque ALM2 INP MBR RD STO IPF AL.42 Ingital CSON EMG ALM2 INP MBR RD STO IPF Analog Motor speed Torque Current
orqure Internal <td></td> <td>Digital</td> <td>CSON</td> <td>EMG</td> <td>ALM2</td> <td>INP</td> <td>MBR</td> <td>RD</td> <td>STO</td> <td>IPF</td> | | Digital | CSON | EMG | ALM2 | INP | MBR | RD | STO | IPF |
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| AL.33 Image: Constraint of the second se | | Analog | Motor speed | Torque | Current | Speed | Bus voltage | Regenerative | Effective load | |
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| AL.35AnalogMotor speedTorqueCurrent
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pulse
frequencyCommand
(1 pulse)Speed
commandBus voltageDigitalCSONEMGALM2INPMBRRDSTOIPFA.1.42AnalogMotor speedTorqueMotor-
side/load-side
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odeviation (10)Motor-
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position
deviation (10)RDSTOIPFAL.42AnalogMotor speedTorqueCurrent
commandInternal
temperature of
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thermistorRDSTOIPFAL.46AnalogMotor speedTorqueCurrent
commandTomperature of
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| AL.35 Command pulse
frequency
(1 pulse) (1 pulse) Command
(1 pulse) | | Analog | Motor speed | Torque | Current | Command | Droop pulses | Speed | Bus voltage | |
| DigitalCSONEMGALM2INPMBRRDSTOIPFAL.42AnalogMotor speedTorqueMotor-
side/load-side
position
deviation (100
pulses)Motor-
side/load-side
speed
deviationCommand
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(speed unit)Droop pulses
(100 pulses)Load-side
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droop pulsesLoad-side
droop pulsesLoad-side
droop pulsesEffective load
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(100 pulses)Overload
alarm marginBus voltageEffective load
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alarm marginBus voltageEffective load
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(100 pulses)NBRRDSTOIPFAL.52AnalogMotor speedTorqueCurrent
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(100 pulses)Current
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commandLoad-side
commandEffective lo | AL.35 | | | | command | frequency | (1 pulse) | command | | |
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side/load-side
position
deviation (100
pulses) Motor-
side/load-side
speed
deviation Motor-
side/load-side
position Droop pulses
(100 pulses) Load-side
droop pulses
(100 pulses) Digital CSON EMG ALM2 INP MBR RD STO IPF AL.46 Analog Motor speed Torque Current
command Internal
temperature of
encoder Temperature
of motor
encoder Bus voltage Effective load
ratio Effective load
ratio AL.46 Analog Motor speed Torque Current
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command Droop pulses
diarm margin Overload
alarm margin Bus voltage Effective load
ratio IPF AL.51 Analog Motor speed Torque Current
command Droop pulses
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alarm margin Bus voltage Effective load
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| AL. 42AL. 42Image: Side/Load-side position deviation (100 pulses)side/Load-side position deviation (100 pulses)pulse frequency (speed unt)(100 pulses)droop pulses (100 pulses)DigitalCSONEMGALM2INPMBRRDSTOIPFAL.46AnalogMotor speedTorqueCurrent commandInternal temperature of encoderTemperature of encoderBus voltageEffective load ratioAL.50DigitalCSONEMGALM2INPMBRRDSTOIPFAL.50DigitalCSONEMGALM2INPMBRRDSTOIPFAL.51DigitalCSONEMGALM2INPMBRRDSTOIPFAL.51DigitalCSONEMGALM2INPMBRRDSTOIPFAL.51DigitalCSONEMGALM2INPMBRRDSTOIPFAL.52DigitalCSONEMGALM2INPMBRRDSTOIPFAL.52DigitalCSONEMGALM2INPMBRRDSTOIPFDigitalCSONEMGALM2INPMBRRDSTOIPFAL.52DigitalCSONEMGALM2INPMBRRDSTOIPFDigitalCSONEMGALM2INPMBRRDSTOIPFAL.52DigitalCSONEMGALM2INPMBRRDSTO< | | Analog | Motor speed | Torque | Motor- | Motor- | Command | Droop pulses | Load-side | |
| AL. 42 Image: mark mark mark mark mark mark mark mark | | _ | | - | side/load-side | side/load-side | pulse | (100 pulses) | droop pulses | |
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(100 pulses)Speed
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(100 pulses)Current
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of motor
encoderBus voltageEffective load
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(100 pulses)Overload
alarm marginBus voltageEffective load
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| AL.46AnalogMotor speedTorqueCurrent
commandInternal
temperature of
encoderTemperature
of motor
thermistorBus voltageEffective load
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| AL.46Image: Second | | Analog | Motor speed | Torque | Current | Internal | Temperature | Bus voltage | Effective load | |
| NumberImage: Constraint of the second se | AI 46 | - | | - | command | temperature of | of motor | _ | ratio | |
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(100 pulses)Overload
alarm marginBus voltageEffective load
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(100 pulses)Overload
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(100 pulses)Speed
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(100 pulses)Overload
alarm marginBus voltageEffective load
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commandDroop pulses
(100 pulses)Overload
alarm marginBus voltageEffective load
ratioAL.51DigitalCSONEMGALM2INPMBRRDSTOIPFAnalogMotor speedTorqueCurrent
commandDroop pulses
(100 pulses)Speed
commandBus voltageEffective load
ratioAL.52AnalogMotor speedTorqueCurrent
commandDroop pulses
(100 pulses)Speed
commandBus voltageError
excessive
alarm marginAL.52AnalogMotor speedTorqueLoad-side
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Deces autoes | MBR | RD | SIO | |
| DigitalCSONEMGALM2INPMBRRDSTOIPFAL.51AnalogMotor speedTorqueCurrent
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(100 pulses)Overload
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(100 pulses)Speed
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excessive
alarm marginAL.52AnalogMotor speedTorqueCurrent
commandDroop pulses
(100 pulses)Speed
commandBus voltageError
excessive
alarm marginAL.71
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(Note)AnalogMotor speedTorqueLoad-side
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encoder< | AL 50 | Analog | wotor speed | rorque | command | (100 pulses) | alarm margin | Bus voltage | Enective load
ratio | |
| AL.51AnalogMotor speedTorqueCurrent
commandDroop pulses
(100 pulses)Overload
alarm marginBus voltageEffective load
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(Note)Motor speedTorqueLoad-side
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(Note)CSONEMGALM2INPMBRRDSTOIPFAL.72
(Note)DigitalCSONEMGALM2INPMBRRDSTOIPFDigitalCSONEMGALM2INPMBRRDSTOIPFDigitalCSONEMGALM2INPMBRRDSTOIPFDigitalCSONEMGALM2INPMBRRDSTOIPF | , 12.00 | Digital | CSON | EMG | ALM2 | INP | MBR | RD | STO | IPF |
| AL.51Image: command c | | Analog | Motor speed | Torque | Current | Droop pulses | Overload | Bus voltage | Effective load | |
| DigitalCSONEMGALM2INPMBRRDSTOIPFAL.52AnalogMotor speedTorqueCurrent
commandDroop pulses
(100 pulses)Speed
commandBus voltage
commandError
excessive
alarm marginError
excessive
alarm marginAL.52DigitalCSONEMGALM2INPMBRRDSTOTLCDigitalCSONEMGALM2INPMBRRDSTOTLCAL.71
(Note)Motor speedTorqueLoad-side
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(Note)Motor speedTorqueLoad-side
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encoderSTOIPFAL.72
(Note)DigitalCSONEMGALM2INPMBRRDSTOIPF | AL.51 | | | | command | (100 pulses) | alarm margin | | ratio | |
| AL.52AnalogMotor speedTorqueCurrent
commandDroop pulses
(100 pulses)Speed
commandBus voltageError
excessive
alarm marginDigitalCSONEMGALM2INPMBRRDSTOTLCAL.71
(Note)AnalogMotor speedTorqueLoad-side
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information 2Load-side
encoder
information 1Current
commandLoad-side
encoder
error counter 1Load-side
error counter 2AL.72
(Note)CSONEMGALM2INPMBRRDSTOIPFAL.72
(Note)Motor speedTorqueLoad-side
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information 2Load-side
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encoder <td></td> <td>Digital</td> <td>CSON</td> <td>EMG</td> <td>ALM2</td> <td>INP</td> <td>MBR</td> <td>RD</td> <td>STO</td> <td>IPF</td> | | Digital | CSON | EMG | ALM2 | INP | MBR | RD | STO | IPF |
| AL.52 Image: Command information of the pulses) command information of the pulses) <td></td> <td>Analog</td> <td>Motor speed</td> <td>Torque</td> <td>Current</td> <td>Droop pulses</td> <td>Speed</td> <td>Bus voltage</td> <td>Error</td> <td>\backslash</td> | | Analog | Motor speed | Torque | Current | Droop pulses | Speed | Bus voltage | Error | \backslash |
| Digital CSON EMG ALM2 INP MBR RD STO TLC AL.71 Analog Motor speed Torque Load-side
encoder
information 2 Load-side
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information 2 Current
encoder
information 1 Load-side
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error counter 1 Load-side
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error counter 1 Load-side
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error counter 2 AL.71 Malog Motor speed Torque Load-side
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encoder
information 2 Current
information 1 Load-side
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encoder BR RD STO IPF AL.72
(Note) Motor speed Torque Load-side
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information 2 Current
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information 1 Current
encoder
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encoder Load-side
encoder
encoder STO IPF AL.72
(Note) Digital CSON EMG ALM2 INP MBR RD STO IPF | AL.52 | | | | command | (100 puises) | command | | excessive
alarm margin | |
| AL. 71
(Note) Analog Motor speed Torque Load-side
encoder
information 2 Load-side
encoder
information 2 Current
encoder
information 1 Load-side
encoder
error counter 1 Load-side
encoder
error counter 1 Load-side
encoder
error counter 2 AL. 71
(Note) Digital CSON EMG ALM2 INP MBR RD STO IPF AL. 72
(Note) Motor speed Torque Load-side
encoder
information 2 Load-side
encoder
information 2 Current
encoder
information 1 Current
command Load-side
encoder
error counter 1 Load-side
encoder
error counter 2 AL. 72
(Note) Digital CSON EMG ALM2 INP MBR RD STO IPF | | Digital | CSON | EMG | ALM2 | INP | MBR | RD | STO | TLC |
| AL. 71
(Note) AL. 71 encoder encoder encoder command encoder encoder Digital CSON EMG ALM2 INP MBR RD STO IPF AL. 72
(Note) Motor speed Torque Load-side
encoder Load-side
encoder Current
command Load-side
encoder Load-side
encoder Load-side
encoder Load-side
encoder Current
command Load-side
encoder Load-side
encoder INP MBR RD STO IPF Juigital CSON EMG ALM2 INP MBR RD STO IPF | | Analog | Motor speed | Torque | Load-side | Load-side | Current | Load-side | Load-side | |
| (Note) Image: Constraint of the system o | AL. 71 | - 5 | | | encoder | encoder | command | encoder | encoder | |
| Digital CSON EMG ALM2 INP MBR RD STO IPF AL.72
(Note) Motor speed Torque Load-side
encoder
information 2 Load-side
encoder
information 1 Current
command
error counter 1 Load-side
encoder
error counter 1 INP MBR RD STO IPF | (Note) | | | | information 2 | information 1 | | error counter 1 | error counter 2 | |
| AL. 72
(Note) AL. 72 Digital CSON AL. 72 (Note) AL. 72 (N | | Digital | CSON | EMG | ALM2 | INP | MBR | RD | STO | IPF |
| (Note) Digital CSON EMG ALM2 INP MBR RD STO IPF | ΔI 70 | Analog | Motor speed | Iorque | Load-side | Load-side | Current | Load-side | Load-side | \sim |
| Digital CSON EMG ALM2 INP MBR RD STO IPF | (Note) | | | | information 2 | information 1 | commanu | error counter 1 | error counter 2 | |
| | (| Digital | CSON | EMG | ALM2 | INP | MBR | RD | STO | IPF |

Table 2.1 LECSS2-T□

/	Signal name	Description	Unit
bo	Motor speed	The servo motor speed is displayed.	[r/min]
nalo	Torque	The servo motor torque is displayed with current value.	[0.1%]
∢		The value of torque being occurred is displayed in real time considering a rated torque as	
		100%.	
	Current command	This indicates current command applying to the servo motor.	[0.1%]
	Droop pulses (1 pulse)	This indicates the number of droop pulses in the deviation counter per pulse.	[pulse]
	Droop pulses	This indicates the number of droop pulses in the deviation counter per 100 pulses.	[100 pulses]
	(100 pulses)	This indicates around explains to the serve meter	Fur/maine 1
	Speed command	This indicates speed command applying to the servo motor.	[r/min]
	Bus voltage	I his indicates bus voltage at the converter of the driver.	[V]
		The continuous effective load torque is displayed. This indicates effective value for past 15 seconds.	[0.1%]
	ABS counter	The travel distance from the home position is displayed as multi-revolution counter value of the absolution position encoder in the absolution position detection system.	[rev]
	Within one-revolution position	Position within one revolution is displayed in encoder pulses.	[16 pulses]
	Encoder error counter 1	This indicates the number of cumulative errors during a communication with the encoder.	[times]
	Encoder error counter 2	The same as encoder error counter 1.	[times]
	U-phase current feedback	This indicates U-phase current value applying to the servo motor per internal unit.	
	V-phase current feedback	This indicates V-phase current value applying to the servo motor per internal unit.	\backslash
	Regenerative load ratio	The ratio of regenerative power to permissible regenerative power is displayed in %.	[0.1%]
	Command pulse frequency	This indicates the command pulse frequency.	[1.125 kpps]
	Command pulse frequency (speed unit)	This converts and indicates command pulse frequency per servo motor speed.	[r/min]
	Motor-side/load-side position deviation	This indicates a deviation between motor-side position and load-side position during fully closed loop control.	[100 pulses]
	(100 pulses)	The number of pulses displayed is in the load-side encoder pulse unit.	
	Motor-side/load-side	This indicates a deviation between motor speed and load-side speed during fully closed	[r/min]
	speed deviation	loop control.	
	Load-side droop pulses (100 pulses)	Droop pulses of the deviation counter between a load-side position and a command are displayed.	[100 pulses]
	Internal temperature of encoder	Inside temperature of encoder detected by the encoder is displayed.	[°C]
	Temperature of motor thermistor	The thermistor temperature is displayed for the rotary servo motor with thermistor, linear servo motor with thermistor, and direct drive motor.	[°C]
	Overload alarm margin	This indicates margins to the levels which trigger [AL. 50 Overload 1] and [AL. 51 Overload 2] in percent. When the value becomes 0%, the overload alarm will occur.	[0.1%]
	Error excessive alarm margin	This indicates a margin to the level which trigger the error excessive alarm in encoder pulse unit. When the value becomes 0 pulse, the error excessive alarm will occur.	[pulse]
	Load-side encoder information 1	The position in load-side encoder 1-revolution is displayed. This indicates a Z-phase counter for the INC linear encoder. The value is counted up from 0 based on the home position (reference mark). This indicates an absolute position for the ABS linear encoder. It is displayed in load-side encoder pulse unit.	[pulse]
	Load-side encoder information 2	Multi-revolution counter of the load-side encoder is displayed.	[pulse]
	Load-side encoder error counter 1	This indicates the number of cumulative errors during a communication with the load-side encoder.	[times]
	Load-side encoder error counter 2	The same as load-side encoder error counter 1.	[times]

Table 2.3 Signal explanations

8. TROUBLESHOOTING

\backslash	Signal name	Description	Unit
tal	CSON	This indicates status of the servo-on signal from the PC or PLCetc.	
Digi	SON	This Indicates the SON status of the external input signal.	
	EMG	This indicates status of the emergency stop input.	
	EM2/EM1	This Indicates the EM2/EM1 status of the external input signal.	
	ALM2	This will turn on when an alarm is detected in the driver. This changes faster than ALM of the external output signal.	
	INP	This indicates INP status of the external output signal.	
	MBR	This indicates MBR status of the external output signal.	/
	RD	This indicates RD status of the external output signal.	
	STO	This Indicates the STO status of the external input signal.	
	IPF	This will turn on when the control circuit power becomes instantaneous power failure status.	\square

8. TROUBLESHOOTING

8.7 How to display drive recorder information Select "Diagnosis" and "Drive Recorder" from the menu bar of setup software (MR Configurator2). The window shown in the right hand image will be displayed.

(a) Click the Waveform-Display button to display the graph preview window which shows data before and after alarm occurrence.

For operating the graph preview window, refer to Help of setup software (MR Configurator2).

(b) Click the Display button of Alarm onset data to display each data at alarm occurrence.



(c) Click the History Clear button to delete all data at alarm occurrence recorded in the driver. After clicking the History Clear button, cycle the power of the driver. Note that the time to restart will be longer than usual due to the deletion of the data.

9. OUTLINE DRAWINGS	
9.1 Driver	
9.2 Connector	

9. OUTLINE DRAWINGS

9.1 Driver

(1) LECSS2-T5/LECSS2-T7







(2) LECSS2-T8



(3) LECSS2-T9

[Unit: mm]



Mounting hole process drawing

9.2 Connector

(1)CN1A/CN1B connector

F0-PF2D103

[Unit: mm]



(2) LE-CSNS



Connector	Shell kit	Each type of dimension				
Connector	Offen Kit	А	В	С	D	E
10120-3000PE	10320-52F0-008	22.0	33.3	14.0	10.0	12.0

Accept wire : AWG 24, 26, 28, 30

10. CHARACTERISTICS	2
10.1 Overload protection characteristics	2
10.2 Power supply capacity and generated loss	4
10.3 Dynamic brake characteristics	6
10.3.1 Dynamic brake operation	6
10.3.2 Permissible load to motor inertia when the dynamic brake is used	7
10.4 Cable bending life	8
10.5 Inrush currents at power-on of main circuit and control circuit	8

10. CHARACTERISTICS

10.1 Overload protection characteristics

An electronic thermal is built in the driver to protect the servo motor, driver and servo motor power wires from overloads.

[AL. 50 Overload 1] occurs if overload operation performed is above the electronic thermal protection curve shown in fig. 10.1 [AL. 51 Overload 2] occurs if the maximum current is applied continuously for several seconds due to machine collision, etc. Use the equipment on the left-hand side area of the continuous or broken line in the graph.

When unbalanced torque is generated, such as in a vertical lift machine, it is recommended that the unbalanced torque of the machine be kept at 70% or less of the motor's rated torque.

This driver has solid-state servo motor overload protection. (The servo motor overload current (full load current) is set on the basis of 120% rated current of the driver.)

The following table shows combinations of each servo motor and graph of overload protection characteristics.

Servo motor	Graph of overload protection characteristics	
LE-D-D	Graph of overload protection characteristics	
Т5	Characteristics a	
Т6		
T7	Characteristics b	
Т8		
Т9		



The following graphs show overload protection characteristics.

- Note 1. If operation that generates torque more than 100% of the rating is performed with an abnormally high frequency in a servo motor stop status (servo-lock status) or in a 30 r/min or less low-speed operation status, the driver may malfunction regardless of the electronic thermal protection.
 - 2. The load ratio ranging from 300% to 350% applies to the LE-□-□ servo motor.

Fig. 10.1 Electronic thermal protection characteristics

10.2 Power supply capacity and generated loss

(1) Amount of heat generated by the driver

Table 10.1 indicates drivers' power supply capacities and losses generated under rated load. For thermal design of an enclosed type cabinet, use the values in the table in consideration for the worst operating conditions. The actual amount of generated heat will be intermediate between values at rated torque and servo-off according to the duty used during operation. When the servo motor is run at less than the rated speed, the power supply capacity will be smaller than the value in the table, but the driver's generated heat will not change.

Driver	Servo motor	(Note 1) Power supply	(Note 2) Driver- [V	Area required for beat dissination		
Biivoi		capacity [kVA]	At rated output	With servo-off	[m ²]	
LECSS2-T5	LE-T5-🗆	0.3	25	15	0.5	
	LE-T6-🗆	0.3	25	15	0.5	
LECSS2-T7	LE-T7-D	0.5	25	15	0.5	
LECSS2-T8	LE-T8-🗆	0.9	35	15	0.7	
LECSS2-T9	LE-T9-🗆	1.3	50	15	1.0	

Table 10.1 Power supply capacity and generated loss per servo motor at rated output

Note 1. Note that the power supply capacity will vary according to the power supply impedance.

2. Heat generated during regeneration is not included in the driver-generated heat.

(2) Heat dissipation area for an enclosed type cabinet

The enclosed type cabinet (hereafter called the cabinet) which will contain the driver should be designed to ensure that its temperature rise is within +10 °C at the ambient temperature of 40 °C. (With an approximately 5 °C safety margin, the system should operate within a maximum 55 °C limit.) The necessary cabinet heat dissipation area can be calculated by equation 10.1.

 $A = \frac{P}{K \cdot \Delta T}$ (10.1)

- A: Heat dissipation area [m²]
- P: Loss generated in the cabinet [W]
- ΔT : Difference between internal and ambient temperatures [°C]
- K: Heat dissipation coefficient [5 to 6]

When calculating the heat dissipation area with equation 10.1, assume that P is the sum of all losses generated in the cabinet. Refer to table 10.1 for heat generated by the driver. "A" indicates the effective area for heat dissipation, but if the cabinet is directly installed on an insulated wall, that extra amount must be added to the cabinet's surface area. The required heat dissipation area will vary with the conditions in the cabinet. If convection in the cabinet is poor and heat builds up, effective heat dissipation will not be possible. Therefore, arrangement of the equipment in the cabinet and the use of a cooling fan should be considered. Table 10.1 lists the cabinet dissipation area for each driver (guideline) when the driver is operated at the ambient temperature of 40 °C under rated load.



Fig. 10.2 Temperature distribution in an enclosed type cabinet

When air flows along the outer wall of the cabinet, effective heat exchange will be possible, because the temperature slope inside and outside the cabinet will be steeper.

10.3 Dynamic brake characteristics

POINT

- •Do not use dynamic brake to stop in a normal operation as it is the function to stop in emergency.
- For a machine operating at the recommended load to motor inertia ratio or less, the estimated number of usage times of the dynamic brake is 1000 times while the machine decelerates from the rated speed to a stop once in 10 minutes.
- Be sure to enable EM1 (Forced stop 1) after servo motor stops when using EM1 (Forced stop 1) frequently in other than emergency.
- ●Servo motors for LECSS2-T□ may have the different coasting distance from that of the previous model.
- The electronic dynamic brake operates in the initial state for the servo motors of 400 W or smaller capacity. The time constant "r" for the electronic dynamic brake will be shorter than that of normal dynamic brake. Therefore, coasting distance will be longer than that of normal dynamic brake. For how to set the electronic dynamic brake, refer to [Pr. PF06] and [Pr. PF12].

10.3.1 Dynamic brake operation

(1) Calculation of coasting distance

Fig. 10.3 shows the pattern in which the servo motor comes to a stop when the dynamic brake is operated. Use equation 10.2 to calculate an approximate coasting distance to a stop. The dynamic brake time constant τ varies with the servo motor and machine operation speeds. (Refer to (2) of this section.)

A working part generally has a friction force. Therefore, actual coasting distance will be shorter than a maximum coasting distance calculated with the following equation.



V ₀ : Machine's fast feed speed ······	······ [mm/min]
J_M : Moment of inertia of the servo motor	····[× 10 ⁻⁴ kg•m ²]
JL: Load moment of inertia converted into equivalent value on servo motor shaft	$\cdot \cdot [\times 10^{-4} \text{ kg} \cdot \text{m}^2]$
T: Dynamic brake time constant	····· [s]
t _e : Delay time of control section ······	····· [s]
For LEOCOO TE there is internal relatividulations of about 40 mm	

For LECSS2-T , there is internal relay delay time of about 10 ms.



(2) Dynamic brake time constant

The following shows necessary dynamic brake time constant τ for equation 10.2.



10.3.2 Permissible load to motor inertia when the dynamic brake is used

Use the dynamic brake under the load to motor inertia ratio indicated in the following table. If the load inertia moment is higher than this value, the dynamic brake may burn. If the load to motor inertia ratio exceeds the indicated value, contact your local sales office.

The values of the permissible load to motor inertia ratio in the table are the values at the maximum rotation speed of the servo motor.

Servo motor	Permissible load to motor inertia ratio [multiplier]
LE-T5-	
LE-T6-	
LE-T7-	30
LE-T8-	
LE-T9-	

10.4 Cable bending life

The bending life of the cables is shown below. This graph calculated values. Since they are not guaranteed values, provide a little allowance for these values.



10.5 Inrush currents at power-on of main circuit and control circuit

The following table indicates the inrush currents (reference data) that will flow when 240 V AC is applied at the power supply capacity of 2500 kVA and the wiring length of 1 m. Even when you use a 1-phase 200 V AC power supply with LECSS2-T5 to LECSS2-T9, the inrush currents of the main circuit power supply is the same.

Driver	Inrush currents (A _{0-P})			
Driver	Main circuit power supply (L1, L2, and L3)	Control circuit power supply (L11 and L21)		
LECSS2-T5/ LECSS2-T7/ LECSS2-T8	30 A (attenuated to approx. 3 A in 20 ms)	20 A to 30 A		
LECSS2-T9	34 A (attenuated to approx. 7 A in 20 ms)	(attenuated to approx. 1 A in 20 ms)		

Since large inrush currents flow in the power supplies, always use molded-case circuit breakers and magnetic contactors. (Refer to section 11.6.)

When circuit protectors are used, it is recommended that the inertia delay type, which is not tripped by an inrush current, be used.

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11. OPTIONS AND PERIPHERAL EQUIPMENT

	Before connecting any option or peripheral equipment, turn off the power and wait
^	for 15 minutes or more until the charge lamp turns off. Then, confirm that the
/!\WARNING	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 driver.

CAUTION •Use the specified peripheral equipment and options to prevent a malfunction or a fire.

POINT

•We recommend using HIV wires to wire the drivers, options, and peripheral equipment. Therefore, the recommended wire sizes may differ from those used for the previous drivers.

11.1 Cable/connector sets

POINT	
●The IP rating	indicated for cables and connectors is their protection against
ingress of du	ist and raindrops when they are connected to a driver or servo
motor. If the	IP rating of the cable, connector, driver and servo motor vary, the
overall IP rat	ing depends on the lowest IP rating of all components.

Please purchase the cable and connector options indicated in this section.



11.1.1 Combinations of cable/connector sets For LECSS2-T□ driver

Note 1. When not using the STO function, attach the short-circuit connector (6)) came with a driver.

11. OPTIONS AND PERIPHERAL EQUIPMENT

No.	Product name	Model		Description		Application
1)	Driver power connector set					Supplied with drivers of 750 W or less
			CNP1 Connector: 06JFAT-SAXGDK-H7.5 (JST) Applicable wire size: 0.8 (AWG - Insulator OD: to 3.9 mm	CNP2 Connector: 05JFAT-SAXGDK-H5.0 (JST) mm ² to 2.1 mm ² 18 to 14)	CNP3 Connector: 03JFAT-SAXGDK-H7.5 (JST) Open tool J-FAT-OT (JST)	
2)	SSCNET III cable	LE-CSS-□ Cable length: 0.15 m to 3 m (Refer to section 11.1.3.)	Connector: PF-2D103 (JAE)	Connector: (JAE)	PF-2D103	Standard cord inside cabinet
3)	USB cable	LEC-MR-J3USB Cable length: 3 m	CN5 connector mini-B connector (5 pins)	Personal co A connecto	omputer connector r	For connection with PC-AT compatible personal computer
4)	Connector set	LE-CSNS		Connector: Shell kit: 10 (Sumitomo equivalent)	10120-3000PE 320-52F0-008 3M Limited or	
5)	STO cable	LEC-MR- D05UDL3M		Connector s (TE Connector)	set: 2069250-1 ctivity)	Connection cable for the CN8 connector
6)	Short-circuit connector					Supplied with driver

11. OPTIONS AND PERIPHERAL EQUIPMENT

No.	Product	Model	Description	Application
7)	Motor power supply cable	LE-CSM-S⊡A Cable length: 2 • 5 • 10m		IP65 Load side lead
8)	Motor power supply cable	LE-CSM-R⊟A Cable length: 2 • 5 • 10m	series	IP65 Load side lead Robot cable
9)	Motor power supply cable	LE-CSM-S⊡B Cable length: 2 • 5 • 10m	Motor cable	IP65 Opposite-to- load side lead
10)	Motor power supply cable	LE-CSM-R⊟B Cable length: 2 • 5 • 10m	series	IP65 Opposite-to- load side lead Robot cable
11)	Lock cable	LE-CSB-S⊡A Cable length: 2 • 5 • 10m		IP65 Load side lead
12)	Lock cable	LE-CSB-R⊟A Cable length: 2 • 5 • 10m		IP65 Load side lead Robot cable
13)	Lock cable	LE-CSB-S⊟B Cable length: 2 • 5 • 10m		IP65 Opposite-to- load side lead
14)	Lock cable	LE-CSB-R⊟B Cable length: 2 ∙ 5 ∙ 10m	series	IP65 Opposite-to- load side lead Robot cable
15)	Encoder cable	LE-CSE-S⊡A Cable length: 2 • 5 • 10m		IP65 Load side lead
16)	Encoder cable	LE-CSE-R⊟A Cable length: 2 ∙ 5 • 10m	series series	IP65 Load side lead Robot cable
17)	Encoder cable	LE-CSE-S⊟B Cable length: 2 • 5 • 10m		IP65 Opposite-to- load side lead
18)	Encoder cable	LE-CSE-R⊟B Cable length: 2 ∙ 5 ∙ 10m	series	IP65 Opposite-to- load side lead Robot cable

11.1.2 STO cable

This cable is for connecting an external device to the CN8 connector.

Cable model	Cable length	Application
LEC-MR-D05UDL3M	3 m	Connection cable for the CN8 connector

(1) Configuration diagram



(2) Internal wiring diagram



Note. Do not use the two core wires with orange insulator (with red or black dots).

11.1.3 SSCNET III cable

POINT
 Do not look directly at the light generated from CN1A/CN1B connector of driver or the end of SSCNET III cable. The light can be a discomfort when it enters the eye.

(1) Model explanations

The numbers in the cable length field of the table indicate the symbol filling the underline "_" in the cable model. The cables of the lengths with the symbols are available.

Cable model	Cable length					Bending	Application/remark	
Cable model	0.15 m	0.3 m	0.5 m	1 m	3 m	life	Application/remark	
LE-CSS-	L	к	J	1	3	Standard	Using standard cord inside cabinet	

(2) Specifications

		Descr	iption		
SSCNET III cable model		LE-CSS-			
SSCNET III	cable length	0.15 m	0.3 m to 3 m		
Optical cable (cord)	Minimum bend radius	25	mm		
	Tension strength	70 N	140 N		
	Temperature range for use (Note)	-40 °C t	o 85 °C		
	Ambience	Indoors (no direct sun	light), no solvent or oil		
	Appearance [mm]	2.2 ± 0.07	Z000 7 27 7 000		

Note. This temperature range for use is the value for optical cable (cord) only. Temperature condition for the connector is the same as that for driver.

(3) Dimensions

(a) LE-CSS-L



(b) LE-CSS-K, LE-CSS-J, LE-CSS-1, LE-CSS-3 Refer to the table shown in (1) of this section for cable length (L).

[Unit: mm]

Protective tube



Note. Dimension of connector part is the same as that of LE-CSS-L.

11. OPTIONS AND PERIPHERAL EQUIPMENT

11.2 Regenerative options

Do not use drivers with regenerative options other than the combinations specified below.
Otherwise, it may cause a fire.

11.2.1 Combination and regenerative power

The power values in the table are resistor-generated powers and not rated powers.

	Regenerative power [W]				
Driver	Built-in	LEC-MR-	LEC-MR-		
Billion	regenerative	RB-032	RB-12		
	resistor	[40 Ω]	[40 Ω]		
LECSS2-T5	/	30			
LECSS2-T7	10	30	100		
LECSS2-T8	10	30	100		
LECSS2-T9	20	30	100		

11.2.2 Parameter setting

Set [Pr. PA02] according to the option to be used.



11.2.3 Selection of regenerative option

POINT	
For the wire	sizes used for wiring, refer to section 11.5.

The regenerative option generates heat of 100 °C higher than the ambient temperature. Fully consider heat dissipation, installation position, wires used, etc. before installing the option. For wiring, use flame-resistant wires or make the wires flame-resistant and keep them away from the regenerative option. Always use twisted cables of max. 5 m length for connection with the driver.

(1) LECSS2-T

Always remove the wiring from across P+ to D and fit the regenerative option across P+ to C. G3 and G4 are thermal sensor's terminals. Between G3 and G4 is opened when the regenerative option overheats abnormally.



- Note 1. Make up a sequence which will switch off the magnetic contactor when abnormal heating occurs.
 - G3-G4 contact specifications Maximum voltage: 120 V AC/DC Maximum current: 0.5 A/4.8 V DC Maximum capacity: 2.4 VA

11.2.4 Dimensions

(1) LEC-MR-RB-032/LEC-MR-RB-12



Pegaparativa option	Variable dimensions					Mass	
Regenerative option	LA	LB	LC	LD	[kg]	[lb]	
LEC-MR-RB-032	30	15	119	99	0.5	1.1	
LEC-MR-RB-12	40	15	169	149	1.1	2.4	

11.3 Setup software (MR Configurator2)

Setup software (MR Configurator2) (LEC-MRC2E) uses the communication function of the driver to perform parameter setting changes, graph display, test operation, etc. on a personal computer.

(1) Specifications

Item	Description
Project	Create/read/save/delete project, system setting, and print
Parameter	Parameter setting
Monitor	Display all, I/O monitor, graph, and ABS data display
Diagnosis	Alarm display, alarm onset data, drive recorder, no motor rotation, system configuration, life diagnosis, and machine diagnosis
Test operation	JOG operation (Note 1), positioning operation, motor-less operation (Note), DO forced output, and program operation
Adjustment	One-touch tuning, tuning, and machine analyzer
Others	Servo assistant, parameter setting range update, machine unit conversion setting, and help display

Note 1. This is available only in the standard control mode. This will be available in the fully closed loop control mode, linear servo motor control mode, and DD motor control mode in the future.

(2) System configuration

(a) Components

To use this setup software, the following components are required in addition to the driver and servo motor.

Equipment		Description				
Equipment (Note 1, 2, 3, 4, 5, 6, 7) Personal computer Hard Disk Communicat interface		Microsoft [®] Windows [®] 8 Enterprise Operating System Microsoft [®] Windows [®] 8 Pro Operating System Microsoft [®] Windows [®] 7 Enterprise Operating System Microsoft [®] Windows [®] 7 Enterprise Operating System Microsoft [®] Windows [®] 7 Ultimate Operating System Microsoft [®] Windows [®] 7 Home Premium Operating System Microsoft [®] Windows [®] 7 Starter Operating System Microsoft [®] Windows [®] 7 Starter Operating System Microsoft [®] Windows [®] 7 Starter Operating System Microsoft [®] Windows Vista [®] Enterprise Operating System Microsoft [®] Windows Vista [®] Enterprise Operating System Microsoft [®] Windows Vista [®] Home Premium Operating System Microsoft [®] Windows Vista [®] Home Premium Operating System Microsoft [®] Windows Vista [®] Home Basic Operating System Microsoft [®] Windows Vista [®] Home Basic Operating System Microsoft [®] Windows [®] XP Professional Operating System, Service Pack 2 or later Microsoft [®] Windows [®] 2000 Professional Operating System, Service Pack 2 or later Microsoft [®] Windows [®] 2000 Professional Operating System, Service Pack 4 or later 1GB or more of free space USB port				
Display	One whose resolution Connectable with	esolution is 1024 × 768 or more and that can provide a high color (16 bit) display. with the above personal computer.				
Keyboard	Connectable with	ith the above personal computer.				
Mouse	Connectable with	ectable with the above personal computer.				
Printer	Connectable with	nectable with the above personal computer.				
USB cable (Note 8)	LEC-MR-J3USB	EC-MR-J3USB				

Note 1. Before using a personal computer for setting LECSA point table method/program method, upgrade to version 1.18U(Japanese version)/version1.19V(English version). Refer to Mitsubishi Electric corporation's website for version upgrade information.

- 2. Windows and Windows Vista are registered trademarks of Microsoft Corporation in the United States and other countries.
- 3. On some personal computers, MR Configurator2 may not run properly.
- 4. When Windows[®] XP is used, the following functions cannot be used.
 - Windows Program Compatibility mode
 - Fast User Switching
 - Remote Desktop
 - Large Fonts Mode (Display property)
 - DPI settings other than 96 DPI (Display property)
 - For 64-bit operating system, this software is compatible with Windows® 7 and Windows® 8.

5. When Windows[®]7 is used, the following functions cannot be used.

- Windows XP Mode
- Windows touch

6. When using this software with Windows Vista® or later, log in as a user having USER authority or higher.

- 7. When Windows[®] 8 is used, the following functions cannot be used.
 - Hyper-V
 - Modern UI style
- 8. Order USB cable separately.

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11. OPTIONS AND PERIPHERAL EQUIPMENT

(b) Connection with driver



11.4 Battery (LEC-MR-BAT6V1SET)

POINT • Refer to appendix 2 and 3 for battery transportation and the new EU Battery Directive.

(1) Purpose of use for LEC-MR-BAT6V1SET

This battery is used to construct an absolute position detection system. Refer to section 12.3 for the fitting method, etc.



(2) Year and month of manufacture of battery The year and month of manufacture of LEC-MR-BAT6V1SET have been described to the rating plate.



11.5 Selection example of wires

POINT
Refer to section 11.1.3 for SSCNET III cable.
●To comply with the UL/CSA standard, use the wires shown in appendix 4 for
wiring. To comply with other standards, use a wire that is complied with each
standard.
Selection conditions of wire size is as follows.
Construction condition: One wire is constructed in the air.
Wire length: 30 m or less

The following diagram shows the wires used for wiring. Use the wires given in this section or equivalent.



(1) Example of selecting the wire sizes

Use the 600 V Grade heat-resistant polyvinyl chloride insulated wire (HIV wire) for wiring. The following shows the wire size selection example.

	Wire [mm ²] (Note 1)					
Driver	1) L1/L2/L3/🕀	2) L11/L21	3) P+/C	4) U/V/W/⊕ (Note 2)		
LECSS2-T5	2 (AWG 14)	1.25 to 2	2 (AWG 14)	AWG 18 to 14 (Note 3)		
LECSS2-T7						
LECSS2-T8		(Note 3)				
LECSS2-T9		(11010-0)				

Table 11.1 Wire size selection example (HIV wire)

Note 1. Alphabets in the table indicate crimping tools. For crimp terminals and applicable tools, refer to (2) in this section.

- 2. The wire size shows applicable size of the driver connector.
- 3. Be sure to use the size of 2 mm^2 when corresponding to UL/CSA standard.

(2) Selection example of crimp terminals

Crimp terminal selection examples for the driver terminal blocks are indicated below.

	Driver-side crimp terminals						
Symbol	(Note 2) Crimp		Monufacturar				
	terminal	Body	Head	Dice	Manulacturer		
а	FVD5.5-4	YNT-1210S					
b (Note 1)	8-4NS	YHT-8S					
С	FVD2-4	VNT 1614					
d	FVD2-M3	1111-1014					
е	FVD1.25-M3	YNT-2216					
£	FVD14-6	YF-1	YNE-38	DH-122			
I				DH-112			
g	FVD5.5-6	YNT-1210S			JST		
h	FVD22-6	YF-1		DH-123			
n			TNL-30	DH-113			
i	FVD38-8	YF-1	YNE-38	DH-124			
				DH-114			
j	FVD5.5-8	YNT-1210S					
k		VE_1/E_4	VNE-38	DH-121			
		11-1/6-4	1112-30	DH-111			

Note 1. Coat the crimping part with an insulation tube.

2. Some crimp terminals may not be mounted depending on the size. Make sure to use the recommended ones or equivalent ones.

(3) Wires for cables

When fabricating a cable, use the wire models given in the following table or equivalent.

	Model	Length [m]	Core size [mm²]	Number of Cores	Characteristics of one core				
Туре					Structure [Wires/mm]	Conductor resistance [Ω/mm]	Insulation coating OD d [mm] (Note 1)	(Note 3) Finishing OD [mm]	Wire model
Encoder Cable	LE-CSE-S□A	• 2 to 10	AWG22	6 (3 pairs)	7/0.26	53 or less	1.2	7.1±0.3	(Note 3) VSVP 7/0.26 (AWG#22 or equivalent)-3P Ban-gi-shi-16823
	LE-CSE-S□B								
	LE-CSE-R□A	2 to 10	AWG22	6 (3 pairs)	70/0.08	56 or less	1.2	7.1±0.3	(Note 3) ETFE • SVP 70/0.08 (AWG#22 or equivalent)-3P Ban-gi-shi-16824
	LE-CSE-R□B								
Motor cable	LE-CSM-S□A	2 to 10	(Note 5) AWG19	4	50/0.08	25.40 or less	1.8	5.7±0.3	(Note 4) UL Style 2103 AWG19 4 cores
	LE-CSM-S□B	2 to 10							
	LE-CSM-R□A	2 to 10							
	LE-CSM-R□B	2 to 10							
Lock cable	LE-CSB-S□A	2 to 10	(Note 5) AWG20	2	100/0.08	38.14 or less	1.3	4.0±0.3	(Note 4) UL Style 2103 AWG20 2 cores
	LE-CSB-S□B	2 to 10							
	LE-CSB-R□A	2 to 10							
	LE-CSB-R□B	2 to 10							

Table 11.3 Wires for option cables

Note 1. d is as shown below.



Conductor Insulation sheath

2. Purchased from Toa Electric Industry

3. Standard OD. Max. OD is about 10% greater.

4. Kurabe

5. These wire sizes assume that the UL-compliant wires are used at the wiring length of 10m.

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11.6 Molded-case circuit breakers, fuses, magnetic contactors (recommended)

(1) For main circuit power supply

Always use one molded-case circuit breaker and one magnetic contactor with one driver. When using a fuse instead of the molded-case circuit breaker, use the one having the specifications given in this section.

	Molded-case circu		Magnetic			
Driver	Frame, rated current	Voltage AC [V]	Class Current [A] V		Voltage AC [V]	contactor (Note 1)
LECSS2-T5	30 A frame 5 A			10	300	S-N10
LECSS2-T7		240	т	10		
LECSS2-T8	30 A frame 10 A	240	I	15	500	
LECSS2-T9	30 A frame 15 A			20		

Note 1. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less.

(2) For control circuit power supply

When the wiring for the control circuit power supply (L11, L21) is thinner than that for the main circuit power supply (L1, L2, L3), install an overcurrent protection device (molded-case circuit breaker or fuse) to protect the branch circuit.

Driver	Molded-case circu	Fuse (0	Class T)	Fuse (Class K5)		
Diver	Frame, rated current	Voltage AC [V]	Current [A]	Voltage AC [V]	Current [A]	Voltage AC [V]
LECSS2-T5						
LECSS2-T7	30 A frame 5 A	240	1	300	1	250
LECSS2-T8						
LECSS2-T9						

11.7 Relay (recommended)

The following relays should be used with the interfaces

Interface	Selection example
Digital input (interface DI-1) Relay used for digital input command signals	To prevent defective contacts, use a relay for small signal (twin contacts). (Ex.) Omron : type G2A, MY
Digital output (interface DO-1) Relay used for digital output signals	Small relay with 12 V DC or 24 V DC of rated current 40 mA or less (Ex.) Omron : type MY

11.8 Noise reduction techniques

Noises are classified into external noises which enter the driver to cause it to malfunction and those radiated by the driver to cause peripheral equipment to malfunction. Since the driver is an electronic device which handles small signals, the following general noise reduction techniques are required. Also, the driver can be a source of noise as its outputs are chopped by high carrier frequencies. If peripheral equipment malfunction due to noises produced by the driver, noise suppression measures must be taken. The measures will vary slightly with the routes of noise transmission.

(1) Noise reduction techniques

- (a) General reduction techniques
 - Avoid bundling power lines (input/output) and signal cables together or running them in parallel to each other. Separate the power lines from the signal cables.
 - Use a shielded twisted pair cable for connection with the encoder and for control signal transmission, and connect the external conductor of the cable to the SD terminal.
 - Ground the driver, servo motor, etc. together at one point. (Refer to section 3.11.)
- (b) Reduction techniques for external noises that cause the driver to malfunction If there are noise sources (such as a magnetic contactor, a lock, and many relays which make a large amount of noise) near the driver and the driver may malfunction, the following countermeasures are required.
 - Provide surge absorbers on the noise sources to suppress noises.
 - Attach data line filters to the signal cables.
 - Ground the shields of the encoder connecting cable and the control signal cables with cable clamp fittings.
 - Although a surge absorber is built into the driver, to protect the driver and other equipment against large exogenous noise and lightning surge, attaching a varistor to the power input section of the equipment is recommended.
- (c) Techniques for noises radiated by the driver that cause peripheral equipment to malfunction Noises produced by the driver are classified into those radiated from the cables connected to the driver and its main circuits (input and output circuits), those induced electromagnetically or statically by the signal cables of the peripheral equipment located near the main circuit cables, and those transmitted through the power supply cables.





Noise transmission route	Suppression techniques
	When measuring instruments, receivers, sensors, etc. which handle weak signals and may malfunction due to noise and/or their signal cables are contained in a cabinet together with the driver or run near the driver, such devices may malfunction due to noises transmitted through the air. The following techniques are required. 1. Provide maximum clearance between easily affected devices and the driver.
1) 2) 3)	2. Provide maximum clearance between easily affected signal cables and the I/O cables of the driver.
	 Avoid wiring the power lines (input/output lines of the driver) and signal lines side by side or bundling them together.
	4. Insert a line noise filter to the I/O cables or a radio noise filter on the input line.
	5. Use shielded wires for the signal and power lines, or put the lines in separate metal conduits.
	When the power lines and the signal lines are laid side by side or bundled together, magnetic induction noise and static induction noise will be transmitted through the signal cables and malfunction may occur. The following techniques are required.
	1. Provide maximum clearance between easily affected devices and the driver.
4) 5) 6)	 Provide maximum clearance between easily affected signal cables and the I/O cables of the driver.
	 Avoid wiring the power lines (input/output lines of the driver) and signal lines side by side or bundling them together.
	4. Use shielded wires for the signal and power lines, or put the lines in separate metal conduits.
	When the power supply of peripheral equipment is connected to the power supply of the driver system, noises produced by the driver may be transmitted back through the power supply cable and the devices may malfunction. The following techniques are required.
7)	 Install the radio noise filter (FR-BIF of Mitsubishi Electric Corparation) on the power lines (Input lines) of the driver.
	 Install the line noise filter (FR-BSF01/FR-BLF of Mitsubishi Electric Corparation) on the power lines of the driver.
8)	When the cables of peripheral equipment are connected to the driver to make a closed loop circuit, leakage current may flow to malfunction the peripheral equipment. If so, malfunction may be prevented by disconnecting the grounding cable of the peripheral device.

(2) Noise reduction techniques

(a) Data line filter (recommended)

Noise can be prevented by installing a data line filter onto the encoder cable, etc. For example, ZCAT3035-1330 by TDK, ESD-SR-250 by NEC TOKIN, and GRFC-13 by Kitagawa Industries are available as data line filters.

As a reference example, the impedance specifications of the ZCAT3035-1330 (TDK) are indicated below. This impedances are reference values and not guaranteed values.



Outline drawing (ZCAT3035-1330)

φ13±`

(b) Surge killer (recommended)

Use of a surge killer is recommended for AC relay, magnetic contactor or the like near the driver. Use the following surge killer or equivalent.



(within 20 cm).

(Ex.) CR-50500 Okaya Electric Industries)

Rated voltage AC [V]	C [µF ± 20%]	R [Ω ± 30%]	Test voltage	Dimensions [Unit: mm]
250	0.5	50 (1/2W)	Between terminals: 625 V AC, 50 Hz/60 Hz 60 s Between terminal and case: 2000 V AC 50/60 Hz 60 s	Band (clear) Soldered 6 ± 1 6 ± 1
				48 ± 1.5

Note that a diode should be installed to a DC relay or the like.

Maximum voltage: Not less than four times the drive voltage of the relay or the like.

Maximum current: Not less than twice the drive current of the relay or the like.



(c) Cable clamp fitting AERSBAN-_SET

Generally, the grounding of the shielded wire may only be connected to the connector's SD terminal. However, the effect can be increased by directly connecting the cable to an grounding plate as shown below.

Install the grounding plate near the driver for the encoder cable. Peel part of the cable sheath to expose the external conductor, and press that part against the grounding plate with the cable clamp. If the cable is thin, clamp several cables in a bunch.

The cable clamp comes as a set with the grounding plate.



Dimensions



Note. Screw hole for grounding. Connect it to the grounding plate of the cabinet.

Model	А	В	С	Accessory fittings	Clamp fitting	L
AERSBAN-DSET	100	86	30	Clamp A: 2pcs.	A	70
AERSBAN-ESET	70	56	/	Clamp B: 1pc.	В	45

(d) Line noise filter (FR-BSF01/FR-BLF of Mitsubishi Electric Corparation)

This filter is effective in suppressing noises radiated from the power supply side and output side of the driver and also in suppressing high-frequency leakage current (0-phase current). It especially affects the noises between 0.5 MHz and 5 MHz band.



(e) Radio noise filter (FR-BIF of Mitsubishi Electric Corparation)

This filter is effective in suppressing noises radiated from the power supply side of the driver especially in 10 MHz and lower radio frequency bands. The FR-BIF is designed for the input only.

200 V class: FR-BIF



(f) Varistor for input power supply (recommended)

Varistors are effective to prevent exogenous noise and lightning surge from entering the driver. When using a varistor, connect it between each phase of the input power supply of the equipment. For varistors, the TND20V-431K and TND20V-471K, manufactured by NIPPON CHEMI-CON, are recommended. For detailed specification and usage of the varistors, refer to the manufacturer catalog.

Power				Maximum ra	ting		Maxi lir volt	mum nit age	Static capacity	Varistor voltage rating	
supply voltage	Varistor	Permissib volta	le circuit ge	Surge current immunity	Energy immunity	Rated pulse power	[A]	[V]	(reference value)	V1 mA	
		AC [Vrms]	DC [V]	8/20 µs [A]	2 ms [J]	[W]			[pF]	[V]	
200 V	TND20V-431K	275	350	10000/1 times	195	1.0	100	710	1300	430 (387 to 473)	
class	TND20V-471K	300	385	7000/2 times	215	1.0	100	775	1200	470 (423 to 517)	



						[Unit: mm]
Model	D Max.	H Max.	T Max.	E ±1.0	(Note) L min.	φd ±0.05	W ±1.0
TND20V-431K	21.5	24.5	6.4	3.3	20	0.8	10.0
TND20V-471K	21.5	24.5	6.6	3.5	20	0.8	10.0

Note. For special purpose items for lead length (L), contact the manufacturer.

11.9 Earth-leakage current breaker

(1) Selection method

High-frequency chopper currents controlled by pulse width modulation flow in the AC servo circuits. Leakage currents containing harmonic contents are larger than those of the motor which is run with a commercial power supply.

Select an earth-leakage current breaker according to the following formula, and ground the driver, servo motor, etc. securely.

To minimize leakage currents, make the input and output cables as short as possible, and make the grounding cable longer than 30 cm.

Rated sensitivity current \geq 10 • {lg1 + lgn + lga + K • (lg2 + lgm)} [mA] ······(11.1)



- Ig1: Leakage current on the electric channel from the earth-leakage current breaker to the input terminals of the driver (Found from Fig. 11.5.)
- Ig2: Leakage current on the electric channel from the output terminals of the driver to the servo motor (Found from Fig. 11.5.)
- Ign: Leakage current when a filter is connected to the input side (4.4 mA per one FR-BIF)
- Iga: Leakage current of the driver (Found from table 11.3.)
- Igm: Leakage current of the servo motor (Found from table 11.2.)



Fig. 11.7 Example of leakage current per km (lg1, lg2) for CV cable run in metal conduit

Table 11.2 Servo motor leakage current example (Igm)

Servo motor power [W]	Leakage current [mA]
50 to 750	0.1

Table 11.3 Driver leakage current example (Iga)

Driver capacity [W]	Leakage current [mA]
100 to 400	0.1
750	0.15

Table 11.4 Earth-leakage current breaker selection example

Driver	Rated sensitivity current of earth- leakage current breaker [mA]
LECSS2-T	15

(2) Selection example

Indicated below is an example of selecting an earth-leakage current breaker under the following conditions.



Use an earth-leakage current breaker designed for suppressing harmonics/surges. Find the terms of equation (11.1) from the diagram.

$$lg1 = 20 \cdot \frac{5}{1000} = 0.1 \text{ [mA]}$$

lg2

$$= 20 \cdot \frac{5}{1000} = 0.1 \text{ [mA]}$$

Ign = 0 (not used)

lga = 0.1 [mA]

Insert these values in equation (11.1).

$$\begin{split} & \text{Ig} \geq 10 \bullet \{0.1 + 0 + 0.1 + 1 \bullet (0.1 + 0.1)\} \\ & \geq 4 \; [\text{mA}] \end{split}$$

According to the result of calculation, use an earth-leakage current breaker having the rated sensitivity current (Ig) of 4.0 mA or more.

An earth-leakage current breaker having Ig of 15 mA is used with the NV-SP/SW/CP/CW/HW series.

11.10 EMC filter (recommended)

It is recommended that one of the following filters be used to comply with EN EMC directive. Some EMC filters have large in leakage current.

(1) Combination with the driver

		Mass				
Driver	Model Rated current [A]		Rated voltage [VAC]	Leakage current [mA]	[kg]	
LECSS2-T	(Note) HF3010A-UN	10	250	5	3.5	

Note. A surge protector is separately required to use any of these EMC filters.

(2) Connection example



- Note 1. For 1-phase 200 V AC to 240 V AC, connect the power supply to L1 and L3. Leave L2 open.
 - 2. The example is when a surge protector is connected.

- (3) Dimensions
 - (a) EMC filter

HF3010A-UN



HF3030A-UN/HF-3040A-UN

[Unit: mm]



Model	Dimensions [mm]											
	Α	В	С	D	Е	F	G	Н	J	К	L	М
HF3030A-UN HF3040A-UN	260	210	85	155	140	125	44	140	70	R3.25 length: 8	M5	M4

11. OPTIONS AND PERIPHERAL EQUIPMENT

HF3100A-UN



TF3005C-TX/TX3020C-TX/TF3030C-TX





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(b) Surge protector





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12. ABSOLUTE POSITION DETECTION SYSTEM

	●If [AL. 25 Absolute position erased] or [AL. E3 Absolute position counter warning] has occurred, always perform home position setting again. Otherwise, it may
	 Refer to appendix 2 and 3 for battery transportation and the new EU Battery Directive.
	●If [AL. 25], [AL. 92], or [AL. 9F] occur due to such as short circuit of the battery, the battery can become hot. Use the battery with case to prevent getting burnt.

POINT

Disconnecting the encoder cable will erase the absolute position data. After disconnecting the encoder cable, always execute home position setting and then positioning operation.

Before replacing batteries, check that the new batteries are within battery life.

12.1 Features

For normal operation, as shown below, the encoder consists of a detector designed to detect a position within one revolution and a cumulative revolution counter designed to detect the number of revolutions. The absolute position detection system always detects the absolute position of the machine and keeps it battery-backed, independently of whether the servo system controller power is on or off. Therefore, once home position return is made at the time of machine installation, home position return is not needed when power is switched on thereafter.

Even at a power failure or a malfunction, the system can be easily restored.



12.2 Specifications

(1) Specification list

	Item	Description		
System		Electronic battery backup type		
Battery	Model	LEC-MR-BAT6V1SET		
	Battery pack	2CR17335A (Primary lithium battery)		
	Nominal voltage [V]	6		
	Nominal capacity [mAh]	1650		
	Storage temperature [°C]	0 to 55		
	Operating temperature [°C]	0 to 55		
	Amount of lithium metal [g]	1.2		
	Mercury content	Less than 1 ppm		
	Dangorous goods class	Inapplicable to Class 9		
	Dangerous goods class	(Battery pack containing 2 g or less lithium)		
	Operating humidity and storage humidity	90% RH or less (non-condensing)		
	Mass [g]	34		
Maximum revolution	n range	Home position ±32767 rev.		
(Note 1) Maximum speed at power failure [r/min]	Servo motor	6000 (However, it is only when the acceleration time up to 6000 r/min is 0.2 s or longer.)		
(Note 2) Battery backup Servo motor time		Approximately 20,000 hours (equipment power supply: off, ambient temperature: 20 °C) Approximately 29,000 hours (power-on time ratio: 25%, ambient temperature: 20 °C) (Note 4)		
(Note 3) Battery life		5 years from date of manufacture		

Note 1. Maximum speed available when the shaft is rotated by external force at the time of power failure or the like.

- The data-holding time using a battery of LEC-MR-BAT6V1SET on condition that the power supply of the driver is off. Replace the batteries within 3 years since the operation start whether the power supply of the driver is on/off. If the battery is used out of specification, [AL. 25 Absolute position erased] may occur.
- 3. Quality of battery degrades by the storage condition. The life of battery is 5 years from the production date regardless of the connection.
- 4. The power-on time ratio 25% is equivalent to 8 hours power on for a weekday and off for a weekend.

(2) Structure



(3) Parameter setting

Set "___1" in [Pr. PA03] to make the absolute position detection system valid.



12.3 Battery replacement procedure

 Before installing a battery, turn off the main circuit power and wait for 15 minutes or longer until the charge lamp turns off. Then, check the voltage between P+ and N- with a voltage tester or 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 driver.
 The internal circuits of the driver 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.
POINT

•Replacing battery with the control circuit power off will erase the absolute position data.

•Before replacing batteries, check that the new batteries are within battery life.

Replace the battery with only the control circuit power on. Replacing battery with the control circuit power on will not erase the absolute position data.

Refer to section 12.4 for installation procedure of battery to the driver.

- 12.4 Battery installation and removal procedure
 - (1) Installation procedure

POINT

•For the driver with a battery holder on the bottom, it is not possible to wire for the earth with the battery installed. Insert the battery after executing the earth wiring of the driver.



(2) Removal procedure



Pulling out the connector of the LEC-MR-BAT6V1SET without the lock release lever pressed may damage the CN4 connector of the driver or the connector of the LEC-MR-BAT6V1SET.



12.5 Confirmation of absolute position detection data

You can check the absolute position data with setup software (MR Configurator2).

Choose "Monitor" and "ABS Data Display" to open the absolute position data display screen.

ABS Data Display	
Absolute position data (ABS position)	stem controller and servo amplifier is displayed.
Value of each motor edge pulse	Value of each command pulse 28948316
Encoder data	
Amp. val Absolute encoder data	Home position Absolute encoder data at home position
CYC (Command pulse value) 107423 pulse	CYC0 (Command pulse value) 0 pulse
ABS 239 rev	ABS0 rev

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13. USING STO FUNCTION

POINT In the torque control mode, the forced stop deceleration function is not available.

13.1 Introduction

This section provides the cautions of the STO function.

13.1.1 Summary

This driver complies with the following safety standards.

- ISO/EN ISO 13849-1 category 3 PL d
- IEC/EN 61508 SIL 2
- IEC/EN 61800-5-2 SIL 2

13.1.2 Terms related to safety

The STO function shuts down energy to servo motors, thus removing torque. This function electronically cuts off power supply in the driver.

The purpose of this safety function is as follows.

- (1) Uncontrolled stop according to stop category 0 of IEC/EN 60204-1
- (2) Preventing unexpected start-up
- 13.1.3 Cautions

The following basic safety notes must be read carefully and fully in order to prevent injury to persons or damage to property.

Only qualified personnel are authorized to install, start-up, repair, or service the machines in which these components are installed.

They must be familiar with all applicable local regulations and laws in which machines with these components are installed, particularly the standards mentioned in this manual.

The staff responsible for this work must be given express permission from the company to perform startup, programming, configuration, and maintenance of the machine in accordance with the safety standards.



Improper installation of the safety related components or systems may cause WARNING improper operation in which safety is not assured, and may result in severe injuries or even death.

Protective Measures

 This driver satisfies the Safe Torque Off (STO) function described in IEC/EN 61800-5-2 by preventing the energy supply from the driver to the servo motor. If an external force acts upon the drive axis, additional safety measures, such as locks or counterbalances must be used.

13.1.4 Residual risks of the STO function

Machine manufacturers are responsible for all risk evaluations and all associated residual risks. Below are residual risks associated with the STO function. SMC is not liable for any damages or injuries caused by these risks.

- (1) The STO function disables energy supply to the servo motor by electrical shut-off. The function does not mechanically disconnect electricity from the motor. Therefore, it cannot prevent exposure to electric shock. To prevent an electric shock, install a magnetic contactor or a molded-case circuit breaker to the main circuit power supply (L1, L2, and L3) of the driver.
- (2) The STO function disables energy supply to the servo motor by electrical shut-off. It does not guarantee the stop control or the deceleration control of the servo motor.
- (3) For proper installation, wiring, and adjustment, thoroughly read the manual of each individual safety related component.
- (4) In the safety circuit, use components that are confirmed safe or meet the required safety standards.
- (5) The STO function does not guarantee that the drive part of the servo motor will not rotate due to external or other forces.
- (6) Safety is not assured until safety-related components of the system are completely installed or adjusted.
- (7) When replacing this driver, confirm that the model name of drivers are exactly the same as those being replaced. Once installed, make sure to verify the performance of the safety functions before commissioning the system.
- (8) Perform all risk assessments to the machine or the whole system.
- (9) To prevent accumulation of malfunctions, perform malfunction checks at regular intervals based on the risk assessments of the machine or the system. Regardless of the system safety level, malfunction checks should be performed at least once per year.
- (10) If the upper and lower power module in the driver are shorted and damaged simultaneously, the servo motor may make a half revolution at a maximum.
- (11) The STO input signals (STO1 and STO2) must be supplied from one power source. Otherwise, the STO function may not function properly due to a sneak current, failing to bring the STO shut-off state.
- (12) For the STO I/O signals of the STO function, supply power by using a safety extra low voltage (SELV) power supply with the reinforced insulation.

13.1.5 Specifications (1) Specifications

Item	Specifications		
Safety function	STO (IEC/EN 61800-5-2)		
Safety performance	ISO/EN ISO 13849-1 category 3 PL d, IEC/EN 61508 SIL 2, EN 62061 SIL CL2, EN 61800-5-2 SIL 2		
Mean time to dangerous failure (MTTFd)	100 years or more (Note)		
Diagnostic converge (DC)	medium (90% to 99%) (Note)		
Average probability of dangerous failures per hour (PFH) [1/h]	1.68×10^{-10}		
Number of on/off times of STO	1,000,000 times		
	LVD: EN 61800-5-1		
CE marking	EMC: EN 61800-3		
	MD: EN ISO 13849-1, EN 61800-5-2, EN 62061		

Note. This is the value required by safety standards.

(2) Function block diagram (STO function)



13.1.6 Maintenance

This driver has alarms and warnings for maintenance that supports the drive safety function. (Refer to chapter 8.)

13.2 STO I/O signal connector (CN8) and signal layouts

13.2.1 Signal layouts

POINT
 The pin configurations of the connectors are as viewed from the cable connector wiring section.



13.2.2 Signal (device) explanations

(1) I/O device

Signal name Connector Descripin No.		Description	I/O division		
STOCOM	CN8-3	Common terminal for input signal of STO1 and STO2			
STO1	CN8-4	Inputs STO state 1.	DI-1		
		STO state (base shut-off): Open between STO1 and STOCOM.			
		STO release state (in driving): Close between STO1 and STOCOM.			
		Be sure to turn off STO1 after the servo motor stops by the servo-off state or with forced stop deceleration by turning off EM2 (Forced stop 2).			
STO2	CN8-5 Inputs STO state 2.		DI-1		
		STO state (base shut-off): Open between STO2 and STOCOM.			
		STO release state (in driving): Close between STO2 and STOCOM.			
		Be sure to turn off STO2 after the servo motor stops by the servo-off state or with forced			
		stop deceleration by turning off EM2 (Forced stop 2).			
TOFCOM	CN8-8	Common terminal for monitor output signal in STO state	DO-1		
TOFB1	OFB1 CN8-6 Monitor output signal in STO1 state		DO-1		
		STO state (base shut-off): Between TOFB1 and TOFCOM is closed.			
		STO release state (in driving): Between TOFB1 and TOFCOM is opened.			
TOFB2	CN8-7 Monitor output signal in STO2 state		DO-1		
		STO state (base shut-off): Between TOFB2 and TOFCOM is closed.			
		STO release state (in driving): Between TOFB2 and TOFCOM is opened.			

(2) Signals and STO state

The following table shows the TOFB and STO states when the power is on in normal state and STO1 and STO2 are on (closed) or off (opened).

Input signal		State				
STO1	STO2	Between TOFB1 and TOFCOM (Monitoring STO1 state)	Between TOFB2 and TOFCOM (Monitoring STO2 state)	Between TOFB1 and TOFB2 (Monitoring STO state of driver)		
Off	Off	On: STO state (base circuit shut-off)	On: STO state (base circuit shut-off)	On: STO state (base circuit shut-off)		
Off	On	On: STO state (base circuit shut-off)	Off: STO release state	Off: STO state (base circuit shut-off)		
On	Off	Off: STO release state	On: STO state (base circuit shut-off)	Off: STO state (base circuit shut-off)		
On	On	Off: STO release state	Off: STO release state	Off: STO release state		

(3) Test pulse of STO input signal

Set the test pulse off time inputted from outside to 1 ms or less.

13.2.3 How to pull out the STO cable

The following shows how to pull out the STO cable from the CN8 connector of the driver.



While pressing knob 1) of the STO cable plug in the direction of the arrow, pull out the plug 2).

13.3 Connection example



13.3.1 Connection example for CN8 connector

This driver is equipped with the connector (CN8) in accordance with the STO function. When this connector is used with a certified external safety relay, power to the motor can be safely removed and unexpected restart can be prevented. The safety relay used should meet the applicable safety standards and have forcibly guided or mirror contacts for the purpose of error detection. In addition, the MR-J3-D05 safety logic unit of Mitsubishi Electric Corporation can be used instead of a safety relay for implementation of various safety standards. Refer to Appendix 5 for details. The following diagram is for source interface. For sink interface, refer to section 13.4.1.



- Note 1. By using TOFB, whether the servo is in the STO state can be confirmed. For connection examples, refer to section 13.3.2 to 13.3.4.
 - When using the STO function, turn off STO1 and STO2 at the same time. Turn off STO1 and STO2 after the servo motor stops by the servo off state or with forced stop deceleration by turning off EM2 (Forced stop 2).
 - 3. Configure the interlock circuit so that the door is open after the servo motor is stopped.

13. USING STO FUNCTION

13.3.2 External I/O signal connection example using an MR-J3-D05 safety logic unit of Mitsubishi Electric Corporation



(1) Connection example 24 V -S2 RESA S1 Ľ₁₀F MR-J3-D05 (Note) (Note) Θ Θ SW1 SW2 STOA STOB €M2 (B-axis) EM2 (A-axis) CN9 SDI1A+ 1A ≮* ⊉ 本 1B SDI1A-MC Driver SDO1A+ 4A CN8 |本 Ň Control circuit 4B SDO1A-CN8A STO1 4 ⋬⋧⋧ ¥ STO2 5 CN10 ¥4* ЗA SDI2A+ STOCOM 3 ₹¥Z 3B SDI2A-TOFB1 6 SRESA+ 1A 本 SRESA-1B TOFB2 7 本 6A SDO2A+ TOFCOM 8 6B SDO2A-8A TOFA CN3 EM2 (A-axis) М Servo motor CN9 2A SDI1B+ 2B SDI1B-MC Driver SDO1B+ ЗA CN8B CN8 хĽ 本 Control circuit 3B SDO1B-STO1 4 ¥4* ¥ STO2 5 CN10 ¥**4*** SDI2B+ 4A STOCOM 3 ₹¥Z 4B SDI2B-TOFB1 6 SRESB+ 2A 本 * **₹**¥_4 FG 2B SRESB-TOFB2 7 Ē 木 本 5A SDO2B+ TOFCOM 8 5B SDO2B-8B TOFB CN3 文本 EM2 (B-axis) ------7A +24 V М 0 V 7B Servo motor 0 V

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(2) Basic operation example

The switch status of STOA is input to SDI2A+ of MR-J3-D05 of Mitsubishi Electric Corporation, and then it will be input to STO1 and STO2 of the driver via SDO1A and SDO2A of MR-J3-D05 of Mitsubishi Electric Corporation.

The switch status of STOB is input to SDI2B+ of MR-J3-D05 of Mitsubishi Electric Corporation, and then it will be input to STO1 and STO2 of the driver via SDO1B and SDO2B of MR-J3-D05 of Mitsubishi Electric Corporation.



13. USING STO FUNCTION

13.3.3 External I/O signal connection example using an external safety relay unit

POINT
 ●This connection is for the source interface. For the other I/O signals, refer to the connection examples in section 3.2.2.

This connection example complies with the requirement of ISO/EN ISO 13849-1 category 3 PL d.



Note. To enable the STO function of the driver by using "Emergency switching off", change S1 to EMG. The stop category at this time is "0". If STO is turned off while the servo motor is rotating, [AL. 63 STO timing error] will occur.



13.3.4 External I/O signal connection example using a motion controller

POINT

This connection is for the source interface. For the other I/O signals, refer to the connection examples in section 3.2.2.

For MC-Y0B and PC-Y0B, design a ladder program to output MC-Y0B and PC-Y0B after the servo motor stops.

This connection diagram is an example of STO circuit configured with a driver and motion controller. Use the switch that complies with the requirement of ISO/EN ISO 13849-1 category 3 PL d as an emergency stop switch. This connection example complies with the requirement of ISO/EN ISO 13849-1 category 3 PL d. The following shows an example of I/O (X and Y) signal assignment of the motion controller safety signal module.



Servo motor

13.4 Detailed description of interfaces

This section provides the details of the I/O signal interfaces (refer to the I/O division in the table) given in section 13.2. Refer to this section and make connection with the external device.

13.4.1 Sink I/O interface

(1) Digital input interface DI-1

This is an input circuit whose photocoupler cathode side is input terminal. Transmit signals from sink (open-collector) type transistor output, relay switch, etc.



(2) Digital output interface DO-1

This is a circuit of collector output terminal of the output transistor. When the output transistor is turned on, collector terminal current will be applied for the output.

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: 40 mA or less, maximum current: 50 mA or less, inrush current: 100 mA or less) A maximum of 5.2 V voltage drop occurs in the driver.

(a) When outputting two STO states by using each TOFB



Note. If the voltage drop (maximum of 2.6 V) interferes with the relay operation, apply high voltage (maximum of 26.4 V) from external source.

(b) When outputting two STO states by using one TOFB



Note. If the voltage drop (maximum of 5.2 V) interferes with the relay operation, apply high voltage (maximum of 26.4 V) from external source.

13.4.2 Source I/O interface

In this driver, source type I/O interfaces can be used.

(1) Digital input interface DI-1

This is an input circuit whose photocoupler anode side is input terminal. Transmit signals from source (open-collector) type transistor output, relay switch, etc.



(2) Digital output interface DO-1

This is a circuit of emitter output terminal of the output transistor. When the output transistor is turned on, current will be applied from the output to a load. A maximum of 5.2 V voltage drop occurs in the driver.

(a) When outputting two STO states by using each TOFB



Note. If the voltage drop (maximum of 2.6 V) interferes with the relay operation, apply high voltage (maximum of 26.4 V) from external source.

(b) When outputting two STO states by using one TOFB



Note. If the voltage drop (maximum of 5.2 V) interferes with the relay operation, apply high voltage (maximum of 26.4 V) from external source.


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App. 1 Peripheral equipment manufacturer (for reference) Names given in the table are as of February 2013.

Manufacturer	Reference
JST	J.S.T. Mfg. Co., Ltd.
Junkosha	Purchase from Toa Electric Industry Co. Ltd., Nagoya Branch
3M	Sumitomo 3M Ltd.
Soshin Electric	Soshin Electric Co., Ltd.
TE Connectivity	TE Connectivity
Molex	Molex

App. 2 Handling of AC driver batteries for the United Nations Recommendations on the

Transport of Dangerous Goods

United Nations Recommendations on the Transport of Dangerous Goods Rev. 15 (hereinafter Recommendations of the United Nations) has been issued. To reflect this, transport regulations for lithium metal batteries are partially revised in the Technical Instruction (ICAO-TI) by the International Civil Aviation Organization (ICAO) and the International Maritime Dangerous Goods Code (IMDG Code) by the International Maritime Organization (IMO).

To comply the instruction and code, we have modified the indication on the package for generalpurpose AC servo batteries.

The above change will not affect the function and performance of the product.

(1) Target model

(a) Battery unit (assembled)



(2) Purpose

Safer transportation of lithium metal batteries.

(3) Change in regulations

The following points are changed for lithium metal batteries transportation by sea or air due to Recommendations of the United Nations Rev. 15 and ICAO-TI 2009-2010 edition. For lithium metal batteries, cells are classified as UN3090, and batteries contained in or packed with equipment are classified as UN3091.

- (a) A package containing 24 cells or 12 batteries or less that are not contained in equipment are no longer exempt from the following: attachment of a handling label, submission of the Shipper's Declaration for Dangerous Goods, and a 1.2 m drop test.
- (b) A battery handling label (size: 120 mm × 110 mm) is required. Emergency telephone number must be filled out in the additional handling information of the Shipper's Declaration for Dangerous Goods.

(c) New handling label design containing battery illustration must be used. (only air transportation)



Figure. Example of Label with Battery Illustration

(4) Action

The following caution will be added to the packages of the target batteries. "Containing lithium metal battery. Regulations apply for transportation."

(5) Transportation precaution for customers

For sea or air transportation, attaching the handling label (figure) and the Shipper's Declaration for Dangerous Goods are required to the package of a cell or battery. In addition, attaching them to the outer package containing several packages of cells or batteries are also required. Please attach the documentations in the specified design to the packages and the outer packages.

App. 3 Symbol for the new EU Battery Directive

Symbol for the new EU Battery Directive (2006/66/EC) that is plastered to general-purpose AC servo battery is explained here.



Note. This symbol mark is for EU countries only.

This symbol mark is according to the directive 2006/66/EC Article 20 Information for end-users and Annex II.

Theproduct is designed and manufactured with high quality materials and components which can be recycled and/or reused.

This symbol means that batteries and accumulators, at their end-of-life, should be disposed of separately from your household waste.

If a chemical symbol is printed beneath the symbol shown above, this chemical symbol means that the battery or accumulator contains a heavy metal at a certain concentration.

This will be indicated as follows.

Hg: mercury (0.0005%), Cd: cadmium (0.002%), Pb: lead (0.004%)

In the European Union there are separate collection systems for used batteries and accumulators. Please, dispose of batteries and accumulators correctly at your local community waste collection/recycling centre.

Please, help us to conserve the environment we live in!

App. 4 Compliance with global standards

App. 4.1 Terms related to safety (IEC 61800-5-2 Stop function)

STO function (Refer to IEC/EN 61800-5-2: 2007 4.2.2.2 STO.)

LECSS2-T drivers have the STO function. The STO function shuts down energy to servo motors, thus removing torque. This function electronically cuts off power supply in the driver.

App. 4.2 About safety

This section explains safety of users and machine operators. Please read the section carefully before mounting the equipment.



App. 4.2.1 Professional engineer

Only professional engineers should mount LECSS2-T drivers.

Here, professional engineers should meet the all conditions below.

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.

App. 4.2.2 Applications of the devices

LECSS2-T drivers comply with the following safety standards. ISO/EN ISO 13849-1 Category 3 PL d, IEC/EN 62061 SIL CL 2, IEC/EN 61800-5-2 SIL 2 (STO), IEC/EN 61800-5-1, IEC/EN 61800-3, IEC/EN 60204-1 In addition, LECSS2-T drivers can be used with the MR-J3-D05 safety logic unit of Mitsubishi Electric Corporation or safety PLCs.

App. 4.2.3 Correct use

Always use the LECSS2-T drivers within specifications (voltage, temperature, etc.). SMC Co. accepts no claims for liability if the equipment is used in any other way or if modifications are made to the device, even in the context of mounting and installation.

WARNING [•]It takes 15 minutes for capacitor discharging. Do not touch the unit and terminals immediately after power off.

- (1) Peripheral device and power wiring
 - (a) Local wiring and crimping tool Use only copper wires for wiring. The following table shows the wire sizes [AWG] and the crimp terminal symbols rated at 75 °C / 60 °C.

	75 °C / 60 °C wire [AWG] (Note 1)						
Driver	L1/L2/L3 +	L11/L21	P+/C	U/V/W/ (Note 2)			
LECSS2-T5/ LECSS2-T7/ LECSS2-T8/ LECSS2-T9	14	14	14	14			

Note 1. Alphabets in the table indicate crimping tools. Refer to the following table for the crimp terminals and crimping tools.

2. Select wire sizes depending on the rated output of the servo motors. The values in the table are sizes based on rated output of the drivers.

Symbol	Crimp terminal		Applicable tool				
	(Note 2)	Body	Head	Dice			
а	FVD5.5-4	YNT-1210S					
b (Note 1)	8-4NS	YHT-8S					
С	FVD2-4	YNT-1614					
d	FVD14-6	YF-1	YNE-38	DH-122 DH-112			
е	FVD5.5-6	YNT-1210S					
f	FVD22-6	YF-1	YNE-38	DH-123 DH-113	JST		
g	FVD38-6	YF-1	YNE-38	DH-124 DH-114			
h	R60-8	YF-1	YET-60-1	TD-125 TD-113			
i	FVD5.5-8	YNT-1210S					
j	CB70-S8	YF-1	YET-150-1	TD-226 TD-213			

Table: Recommended crimp terminals

Note 1. Coat the crimping part with an insulation tube.

2. Some crimp terminals may not be mounted depending on the size. Make sure to use the recommended ones or equivalent ones.

(b) Selection example of MCCB and fuse

When a driver is protected by T class fuses or circuit breaker having an interrupting rating not less than 300 A effective value and 240 V maximum, use T class fuses or molded-case circuit breaker (UL489 Listed MCCB) as the following table. The T class fuses and molded-case circuit breakers in the table are selected examples based on rated I/O of the drivers. When you select a smaller capacity servo motor to connect it to the driver, you can also use smaller capacity T class fuses or molded-case circuit breaker than ones in the table. For selecting ones other than Class T fuses and molded-case circuit breakers below, refer to section 11.10.

Driver	Molded-case circuit breaker (240 V AC)	Fuse (300 V)
LECSS2-T5/ LECSS2-T7/ LECSS2-T8/ LECSS2-T9	NF50-SVFU-5A (50 A frame 5 A)	10 A
LECSS2-T9 (Note)	NF50-SVFU-10A (50 A frame 10 A)	15 A

Note. For 1-phase 200 V AC power input

(c) Power supply

This driver can be supplied from star-connected supply with grounded neutral point of overvoltage category III set forth in IEC/EN 60664-1. However, when you use the neutral point for single phase supply, a reinforced insulating transformer is required in the power input section. For the interface power supply, use an external 24 V DC power supply with reinforced insulation on I/O terminals.

(d) Grounding

To prevent an electric shock, always connect the protective earth (PE) terminal (marked \textcircled) of the driver to the protective earth (PE) of the cabinet. Do not connect two grounding cables to the same protective earth (PE) terminal. Always connect cables to the terminals one-to-one.

If using an earth-leakage current breaker, always ground the protective earth (PE) terminal of the driver to prevent an electric shock. Only an RCD (earth-leakage current breaker) of type B can be used for the power supply side of the product.



(2) EU compliance

The LECSS2-T drivers are 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).

(a) EMC requirement

LECSS2-T drivers comply with category C3 in accordance with IEC/EN 61800-3. As for I/O wires (max. length 10 m. However, 3 m for STO cable for CN8.) and encoder cables (max. length 10 m), connect them to a shielded grounding. Use a 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

- LECSS2-T 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.

(3) USA/Canada compliance

This driver is designed in compliance with UL 508C and CSA C22.2 No.14 standards.

(a) Installation

The minimum cabinet size is 150% of eachLECSS2-T \square driver's volume. Also, design the cabinet so that the ambient temperature in the cabinet is 55 °C or less. The driver must be installed in a metal cabinet. Environment is open type (UL 50) and overvoltage category III. The driver needs to be installed at or below of pollution degree 2. Use copper conductors only.

(b) Short-circuit current rating (SCCR)

Suitable For Use On A Circuit Capable Of Delivering Not More Than 100 kA rms Symmetrical Amperes, 500 Volts Maximum.



(c) Overload protection characteristics

The LECSS2-T drivers have servo motor overload protective function. (It is set on the basis (full load current) of 120% rated current of the driver.)

- (d) Over-temperature protection for motor Motor Over temperature sensing is not provided by the drive.
- (e) Capacitor discharge

It takes 15 minutes for capacitor discharging. Do not touch the unit and terminals immediately after power off.

(f) 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.

App. 4.2.4 General cautions for safety protection and protective measures

Observe the following items to ensure proper use of the LECSS2-T \square drivers.

- (1) For safety components and installing systems, only qualified personnel and professional engineers should perform.
- (2) When mounting, installing, and using the LECSS2-T□ driver, always observe standards and directives applicable in the country.
- (3)The item about noises of the test notices in the manuals should be observed.
- (4)The LECSS2-T□ drivers fulfill the requirements to conducted emissions at the main connections in the frequency range from 150 kHz to 30 MHz. (Bases for the evaluation: Product standard IEC/EN 61800, adjustable speed electrical power drive systems, Part 3: EMC)

App. 4.2.5 Residual risk

- (1) Be sure that all safety related switches, relays, sensors, etc., meet the required safety standards.
- (2) Perform all risk assessments and safety level certification to the machine or the system as a whole.
- (3) If the upper and lower power modules in the driver are shorted and damaged simultaneously, the servo motor may make a half revolution at a maximum.
- (4) Only qualified personnel are authorized to install, start-up, repair or service 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)
- (5) Separate the wiring for safety function from other signal wirings. (ISO 13849-1 Table F.1 No.1)
- (6) Protect the cables with appropriate ways (routing them in a cabinet, using a cable guard, etc.).
- (7) Keep the required clearance/creepage distance depending on voltage you use.



App. 4.2.6 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)

App. 4.2.7 Lithium battery transportation

To transport lithium batteries, take actions to comply with the instructions and regulations such as the United Nations (UN), the International Civil Aviation Organization (ICAO), and the International Maritime Organization (IMO).

The battery options (LEC-MR-BAT6V1SET) are assembled batteries from lithium metal battery CR17335A which are not subject to the dangerous goods (Class 9) of the UN Recommendations.

App. 4.3 Mounting/dismounting

Installation direction and clearances

The devices must be installed in the specified direction. Not doing so may cause
a malfunction.
Mount the driver on a cabinet which meets IP54 in the correct vertical direction to

Mount the driver on a cabinet which meets IP54 in the correct vertical direction to maintain pollution degree 2.





App. 4.4 Electrical Installation and configuration diagram

Turn off the molded-case circuit breaker (MCCB) to avoid electrical shocks or NARNING damages to the product before starting the installation or wiring.

The installation complies with IEC/EN 60204-1. The voltage supply to machines must be 20 ms of immunity to instantaneous power failures as specified in IEC/EN 60204-1.

The following shows representative configuration diagram examples to conform to the IEC/EN/UL/CSA standards.

(1) 3-phase input for LECSS2-T driver



The control circuit connectors described by rectangles are safely separated from the main circuidescribed by circles.

The connected motors will be limited as follows.

- (1) LE-D-D series servo motors
- (2) Using a servo motor complied with IEC60034-1 and encoder (OBA, OSA) of Mitsubishi Electric corporation

App. 4.5 Signal

App. 4.5.1 Signal

The following shows LECSS2-T5 signals as a typical example.



App. 4.5.2 Input device

	Input device		
Symbol	Device	Connector	Pin No.
EM2	Forced stop 2	CN3	20
STOCOM	Common terminal for input signals STO1/STO2		3
STO1	STO1 state input	CN8	4
STO2	STO2 state input		5

	Output device		
Symbol	Device	Connector	Pin No.
TOFCOM	Common terminal for monitor output signal in STO state		8
TOFB1	Monitor output signal in STO1 state	CN8	6
TOFB2	Monitor output signal in STO2 state		7

Power supply

Symbol	Device	Connector	Pin No.
DICOM	Digital I/F power supply input		5, 10
DOCOM	Digital I/F common	CN3	3
SD	Shield		Plate

App. 4.6 Maintenance and service

WARNING To avoid an electric shock, only qualified personnel should attempt inspections. For repair and parts replacement, contact your local sales office.

^	•Do not perform insulation resistance test on the driver. Otherwise, it may cause a
	malfunction.
	Do not disassemble and/or repair the equipment on customer side.

App. 4.6.1 Inspection items

It is recommended that the following points periodically be checked.

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

Driver		Tightening torque [N•m]													
		L2	L3	N-	P3	P4	P+	С	D	L11	L21	U	V	W	PE
LECSS2-T5/				_											
LECSS2-T7/															1 2
LECSS2-T8/															1.2
LECSS2-T9															

- (2) Check servo motor bearings, lock section, etc. for unusual noise.
- (3) Check the cables and the like for scratches or cracks. Perform periodic inspection according to operating conditions.
- (4) Check that the connectors are securely connected to the servo motor.
- (5) Check that the wires are not coming out from the connector.
- (6) Check for dust accumulation on the driver.
- (7) Check for unusual noise generated from the driver.
- (8) Check the servo motor shaft and coupling for connection.



App. 4.6.2 Parts having service lives

Service lives of the following parts are listed below. However, the service life vary depending or operating methods and environment. If any fault is found in the parts, they must be replaced immediately regardless of their service lives. For parts replacement, please contact your local sales office.

Part name			Life guideline		
Smoothing capacitor			(Note 3) 10 years		
Relay			Number of power-on, forced stop and controller forced stop times: 100 000 times Number of on and off for STO: 1,000,000 times		
Cooling fan			10,000 hours to 30,000 hours (2 years to 3 years)		
Battery backup time	(Note 1) LECSS2-T⊡ driver	Servo motor	Approximately 20,000 hours (equipment power supply: off, ambient temperature: 20 °C) Approximately 29,000 hours (power-on time ratio: 25%, ambient temperature: 20 °C) (Note 4)		
(Note 2) Battery life			5 years from date of manufacture		

Note 1. The data-holding time using a battery of LEC-MR-BAT6V1SET on condition that the power supply of the driver is off. Replace the batteries within three years since the operation start whether the power supply of the driver is on/off. If the battery is used out of specification, [AL. 25 Absolute position erased] may occur.

2. Quality of the batteries degrades by the storage condition. The battery life is 5 years from the production date regardless of the connection status.

3. The characteristic of smoothing capacitor is deteriorated due to ripple currents, etc. The life of the capacitor greatly depends on ambient temperature and operating conditions. The capacitor will reach the end of its life in 10 years of continuous operation in normal air-conditioned environment (40 °C surrounding air temperature or less).

4. The power-on time ratio 25% is equivalent to 8 hours power on for a weekday and off for a weekend.



App. 4.7 Transportation and storage

	Transport the products correctly according to their mass.
	Stacking in excess of the limited number of product packages is not allowed.
AUTION	Do not hold the front cover to transport the driver. Otherwise, it may drop.
	●Install the driver and servo motor in a load-bearing place in accordance with the
	Instruction Manual.
	Do not get on or put heavy load on the equipment.

	Item		Environment
	Operation	[°C]	0 to 55 Class 3K3 (IEC/EN 60721-3-3)
Ambient temperature	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% to 90 %RH
			10 Hz to 57 Hz with constant deviation of 0.075 mm
Vibration	Test values		57 Hz to 150 Hz with constant acceleration of 9.8 m/s2 (1 g) to IEC/EN 61800-5-1 (Test Fc of IEC 60068-2-6)
load	Operation		5.9 m/s ² (0.6 g)
	Transportation (Note)		Class 2M3 (IEC/EN 60721-3-2)
	Storage		Class 1M2 (IEC/EN 60721-3-2)
Pollution deg	ree		2
IP rating			Except terminal block IP20 (IEC/EN 60529) and fan finger guard
ii raung			Open type (UL 50)
Altitude	Operation, storage		1000 m or less above sea level
Annuale	Transportation		10000 m or less above sea level

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

Note. In regular transport packaging

App. 4.8 Technical data

App. 4.8.1 LECSS2-T driver

	Item	LECSS2-T5/LECSS2-T7/LECSS2-T8/LECSS2-T9		
	Main circuit (line voltage)	3-phase or 1-phase 200 V AC to 240 V AC, 50 Hz/60 Hz		
Power supply	Control circuit (line voltage)	1-phase 200 V AC to 240 V AC, 50 Hz/60 Hz		
	Interface (SELV)	24 V DC, (required current capacity: MR-J4A, 500 mA; MR-J4B, 300 mA; MR-J4W2B, 350 mA; MR-J4W3B, 450 mA)		
Control	method	Sine-wave PWM control, current control method		
Safety fu IEC/EN	unction (STO) 61800-5-2	EN ISO 13849-1 category 3 PL d, IEC 61508 SIL 2, EN 62061 SIL CL 2, and EN 61800-5-2 SIL 2		
Mean tin	ne to dangerous failure	MTTFd ≥ 100 [years]		
Effective a system	eness of fault monitoring of n or subsystem	DC = 90 [%]		
Average failures	probability of dangerous per hour	PFH = 1.68 × 10 ⁻¹⁰ [1/h]		
Mission	time	TM = 20 [years]		
Respons	se performance	8 ms or less (STO input off \rightarrow energy shut off)		
Pollution	n degree	2 (IEC/EN 60664-1)		
Overvolt	tage category	1-phase 200 V AC: II (IEC/EN 60664-1), 3-phase 200 V AC: III (IEC/EN 60664-1),		
Protectio	on class	I (IEC/EN 61800-5-1)		
Short-cir	rcuit current rating (SCCR)	100 kA		

App. 4.8.2 Driver dimensions

	Driver	Variabl	Mass [ko]		
TI II	Biwei	W	Н	D	Mass [kg]
	LECSS2-T5/LECSS2-T7	40	168	135	0.8
н	LECSS2-T8	40	168	170	1.0
	LECSS2-T9	60	168	185	1.4

App. 4.8.3 Mounting hole

c∰

b

c⋕

a1 ◀	Driver		Variable dimensions [mm]					
		а	a1	b	С	d	d1	е
	LECSS2-T5/LECSS2-T7/LECSS2-T8	6	6	156 ± 0.5	6			M5
	LECSS2-T9	12	12	156 ± 0.5	6	42 ± 0.3		M5

App. 4.9 Check list for user documentation

LECS 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?
- 2. Is directive/standard contained in Declaration of Conformity (DoC)?
- 3. Does the protection instrument conform to the category required?
- 4. Are electric shock protective measures (protection class) effective?
- 5. Is the STO function checked (test of all the shut-off wiring)?

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



- Yes [], No [] Yes [], No []
- Yes [], No []
- Yes [], No [] Yes [], No []

App. 5 MR-J3-D05 Safety logic unit of Mitsubishi Electric Corporation

- App. 5.1 Terms related to safety
- App. 5.1.1 Stop function for IEC/EN 61800-5-2
 - (1) STO function (Refer to IEC/EN 61800-5-2: 2007 4.2.2.2 STO.)

This function is integrated into the LECSS2-T \square series drivers.

The STO function shuts down energy to servo motors, thus removing torque. This function electronically cuts off power supply in drivers for LECSS2-T_□ series drivers. The purpose of this safety function is as follows.

1)Uncontrolled stop according to stop category 0 of IEC/EN 60204-1

2) Preventing unexpected start-up

(2) SS1 function (Refer to IEC/EN 61800-5-2: 2007 4.2.2.3C Safe stop 1 temporal delay.) SS1 is a function which initiates the STO function when the previously set delay time has passed

after the servo motor starts decelerating. The delay time can be set with MR-J3-D05 of Mitsubishi Electric Corporation.

The purpose of this safety function is as follows. This function is available by using an LECSS2-T□ series driver with MR-J3-D05 of Mitsubishi Electric Corporation.

Controlled stop according to stop category 1 of IEC/EN 60204-1

App. 5.1.2 Emergency operation for IEC/EN 60204-1

- (1) Emergency stop (Refer to IEC/EN 60204-1: 2005 9.2.5.4.2 Emergency Stop.) Emergency stop must override all other functions and actuation in all operation modes. Power to the machine driving part which may cause a hazardous state must be either removed immediately (stop category 0) or must be controlled to stop such hazardous state as soon as possible (stop category 1). Restart must not be allowed even after the cause of the emergency state has been removed.
- (2) Emergency switching off (Refer to IEC/EN 60204-1: 2005 9.2.5.4.3 Emergency Switching OFF.) Removal of input power to driving device to remove electrical risk and to meet above mentioned safety standards.

App. 5.2 Cautions

The following basic safety notes must be read carefully and fully in order to prevent injury to persons or damage to property.

Only qualified personnel are authorized to install, start-up, repair or service the machines in which these components are installed.

They must be familiar with all applicable local safety regulations and laws in which machines with these components are installed, particularly the standards and guidelines mentioned in this Instruction Manual and the requirements mentioned in ISO/EN ISO 13849-1, IEC/EN 61508, IEC/EN 61800-5-2, and IEC/EN 60204-1.

The staff responsible for this work must be given express permission from the company to perform startup, programming, configuration, and maintenance of the machine in accordance with the safety standards.

•Improper installation of the safety related components or systems may cause improper operation in which safety is not assured, and may result in severe injuries or even death.

Protective Measures

 As described in IEC/EN 61800-5-2, the Safe Torque Off (STO) function only prevents the driver from supplying energy to the servo motor. Therefore, if an external force acts upon the drive axis, additional safety measures, such as locks or counter-weights must be used.

App. 5.3 Residual risk

Machine manufacturers are responsible for all risk evaluations and all associated residual risks. Below are residual risks associated with the STO/EMG function. SMC is not liable for any damages or injuries caused by the residual risks.

- (1) The SS1 function only guarantees the delay time before STO/EMG is engaged. Proper setting of this delay time is the full responsibility of the company and/or individuals responsible for installation and commissioning of the safety related system. The system, as a whole, must pass safety standards certification.
- (2) When the SS1 delay time is shorter than the required servo motor deceleration time, if the forced stop function is malfunctioning, or if STO/EMG is engaged while the servo motor is still rotating; the servo motor will stop with the dynamic brake or freewheeling.
- (3) For proper installation, wiring, and adjustment, thoroughly read the manual of each individual safety related component.
- (4) Be sure that all safety related switches, relays, sensors, etc., meet the required safety standards.
- (5) Safety is not assured until safety-related components of the system are completely installed or adjusted.
- (6) When replacing a driver etc. or MR-J3-D05 of Mitsubishi Electric Corporation, confirm that the new equipment is exactly the same as those being replaced. Once installed, be sure to verify the performance of the safety functions before commissioning the system.



- (7) Perform all risk assessments and safety 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.
- (8) To prevent accumulation of multiple malfunctions, perform a malfunction check at regular intervals as deemed necessary by the applicable safety standard. Regardless of the system safety level, malfunction checks should be performed at least once per year.
- (9) If the upper and lower power module in the driver are shorted and damaged simultaneously, the servo motor may make a half revolution at a maximum. For a linear servo motor, the primary side will move a distance of pole pitch.

App. 6 Analog monitor

POINT ●A voltage of analog monitor output may be irregular at power-on.

The servo status can be output to two channels in terms of voltage.

(1) Setting

Change the following digits of [Pr. PC09] and [Pr. PC10].



Analog monitor 2 output selection (the signal provided to the output across MO2 and LG)

[Pr. PC11] and [Pr. PC12] can be used to set the offset voltages to the analog output voltages. Setting value is -999 mV to 999 mV.

Parameter	Description	Setting range [mV]
PC11	This is used to set the offset voltage of MO1 (Analog monitor 1).	-999 to 999
PC12	This is used to set the offset voltage of MO2 (Analog monitor 2).	-333 10 333

(2) Setting

The driver is factory-set to output the servo motor speed to MO1 (Analog monitor 1) and the torque to MO2 (Analog monitor 2). The setting can be changed as listed below by setting the [Pr. PC09] and [Pr. PC10] value.

Setting value	Output item	Description	Setting value	Output item	Description
00	Servo motor speed	8 [V] CCW direction Maximum speed 0 Maximum speed CW direction	01	Torque	Power running in CCW direction Maximum torque 0 Maximum torque Power running in CW direction
02	Servo motor speed	CW direction	03	Torque	Power running in CCW direction
04	Current command	8 [V] CCW direction Maximum current command (Maximum torque command) Maximum current command (Maximum torque command) Maximum torque command) CW direction	05	Speed command	Maximum speed 0 Maximum speed CW direction 0 Maximum speed 0 Maximum speed 0 Maximum speed
06	Servo motor-side droop pulses (Note 1, 3, 5, 6) (±10 V/100 pulses)	10 [V] <u>CCW</u> direction 100 [pulse] 0 100 [pulse] CW direction	07	Servo motor-side droop pulses (Note 1, 3, 5, 6) (±10 V/1000 pulses)	10 [V] CCW direction 1000 [pulse] 0 1000 [pulse] CW direction CW direction
08	Servo motor-side droop pulses (Note 1, 3, 5, 6) (±10 V/10000 pulses)	10 [V] <u>CCW</u> direction 10000 [pulse] 0 10000 [pulse] CW direction -10 [V]	09	Servo motor-side droop pulses (Note 1, 3, 5, 6) (±10 V/100000 pulses)	10 [V] 10

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Setting value	Output item	Description	Setting value	Output item	Description
0A	Feedback position (Note 1, 2, 3) (±10 V/1 Mpulse)	10 [V] CCW direction 1 [Mpulse] 0 1 [Mpulse] CW direction -10 [V]	0B	Feedback position (Note 1, 2, 3) (±10 V/10 Mpulse)	10 [V] CCW direction 10 [Mpulse] 0 10 [Mpulse] CW direction CW direction
0C	Feedback position (Note 1, 2, 3) (±10 V/100 Mpulse)	10 [Mpulse] 0 100 [Mpulse] CW direction CW direction	0D	Bus voltage	8 [V] 0 400 [V]
0E	Speed command 2 (Note 3)	8 [V] CW direction	15	Motor-side/load-side position deviation (Note 3, 4, 5, 6) (±10 V/100000 pulses)	10 [V] CCW direction 100000 [pulse] 0 100000 [pulse] CW direction CW direction
16	Servo motor-side/load- side speed deviation (Note 4)	8 [V] Maximum speed Maximum speed Maximum speed CW direction CW direction	17	Encoder inside temperature (±10 V/±128 °C)	-128 [°C]

Note 1. Encoder pulse unit.

- 2. Available in position control mode
- 3. This cannot be used in the torque control mode.
- 4. This can be used with setup software (MR Configurator2) with software version 1.19V or later.
- 5. This cannot be used in the speed control mode.

App. 7 J3 compatibility mode

POINT

Specifications of the J3 compatibility mode of the driver with software version A4 or earlier differ from those with software version A5. Refer to table 8.8.

App. 7.1 Outline of J3 compatibility mode

LECSS2-T drivers have two operation modes. "J4 mode" is for using all functions with full performance and "J3 compatibility mode" is compatible with LECSS -S series for using the drivers as the conventional series.

When you connect a driver with SSCNET III/H communication for the first PC or PLC...etc communication by factory setting, the operation mode will be fixed to "J4 mode". For SSCNET communication, it will be fixed to "J3 compatibility mode". When you set the mode back to the factory setting, use the application "MR-J4(W)-B mode selection".

The application "MR-J4(W)-B mode selection" is packed with setup software (MR Configurator2) of software version 1.12N or later.

For the operating conditions of the application "MR-J4(W)-B mode selection", use setup software (MR Configurator2).



App. 7.2 Operation modes supported by J3 compatibility mode

The J3 compatibility mode supports the following operation modes.

Operation mode in J3 compatibility mode	Model of LECSS□-S□
LECSSD-SD standard control mode (servo motor)	MR-J3B

Each operation mode has the same ordering as conventional LECSS \Box -S \Box series drivers and is compatible with their settings. Therefore, new functions added for LECSS2-T \Box drivers cannot be used. In addition, the control response characteristic in the J3 compatibility mode will be the same as that of LECSS \Box -S \Box series. When you need a higher response, using the J4 mode is recommended.

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		Corresponding (□: J4 new, ○: Equivalent to J3, ×: Not available)				
Function	Name	LECSS2-	T series			
		J4 mode	J3 compatibility mode	(Note 3)		
Basic specification	Speed frequency response	2.5 kHz	2.1 kHz	2.1 kHz		
Dasic specification	Encoder resolution	22 bit (Note 1)	18 bit (Note 1)	18 bit		
SSCNET III/H communication or	Communication baud rate	150 Mbps	50 Mbps	50 Mbps		
SSCNET III communication	Maximum distance between stations	100 m	50 m	50 m		
	Absolute position detection system	0	0	0		
Basic function	Motor-less operation	0	0	0		
	Rotation direction selection	0	0	0		
Encoder output pulses	A/B-phase pulse output	0	0	0		
	Z-phase pulse output	0	0	0		
Input/output	Analog monitor output	0	0	0		
mpuroutput	Motor thermistor	0	0	×		
	Position control mode	0	0	0		
	Speed control mode	0	0	0		
Control mode	Torque control mode	0	0	0		
	Continuous operation to torque control mode	0	0	0		
	Auto tuning mode 1	0	0	0		
	Auto tuning mode 2	0	0	0		
Auto tuning	2 gain adjustment mode 1 (interpolation mode)	0	0	0		
	2 gain adjustment mode 2		×	×		
	Manual mode	0	0	0		

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		Corresponding (□: J4 new, ○: Equivalent to J3, ×: Not available)			
Function	Name	MR-J4/J4			
		J4 mode	J3 compatibility mode	MR-J3 series (Note 8)	
	Machine resonance suppression filter 1	0	0	0	
	Machine resonance suppression filter 2	0	0	0	
	Machine resonance suppression filter 3		×	×	
Filter function	Machine resonance suppression filter 4		×	×	
	Machine resonance suppression filter 5		×	×	
	Shaft resonance suppression filter	0	×	×	
	Low-pass filter	0	0	0	
	Robust disturbance compensation (Note 10)	×	0	0	
	Robust filter		×	×	
	Standard mode/3 inertia mode		×	×	
Vibration suppression	Vibration suppression control 1	0	0	0	
control	Vibration suppression control 2		×	×	
	Command notch filter	0	0	0	
	Gain switching	0	0	0	
	Slight vibration suppression control	0	0	0	
	Overshoot amount compensation	0	0	0	
	PI-PID switching control	0	0	0	
Applied control	Feed forward	0	0	0	
	Torque limit	0	0	0	
	Master-slave operation function	× (Available in the future)	× (Available in the future)	0	
	One-touch tuning		×	×	
Adjustment function	Adaptive tuning	0	0	0	
	Vibration suppression control 1 tuning	0	0	0	
	Vibration suppression control 2 tuning		×	×	

		Corresponding (□: J4 new, ○: Equivalent to J3, ×: Not available)			
Function	Name	MR-J4/J	4W series		
		J4 mode	J3 compatibility mode	MR-J3 series (Note 8)	
	STO function	0	0	×	
Safety function	Forced stop deceleration function at alarm occurrence	0	0	×	
	Vertical axis freefall prevention function	0	0	×	
	Vibration tough drive		×	×	
Tough drive function	Instantaneous power failure tough drive		×	×	
	3-digit alarm display			×	
Diagnosis function	16 alarm histories supported		× (Note 2)	× (Note 2)	
Diagnosis function	Drive recorder function		×	×	
	Machine diagnosis function		×	×	
	SSCNET III	×	0	0	
Controller	SSCNET III/H		×	×	
	Home position return function	0	0	0	
Others	J4/J3 compatibility mode automatic identification (Note 11)	0	0	×	
	Power monitoring function		×	×	

Note 1. The value is at the LE- - series servo motor driving.

2. Alarm history will be saved up to five times.

3. The functions of the product with modified parts (GA) in the LECSS -S drivers are all covered by the J3 compatibility mode of the LECSS2-T drivers.

4. For LECSS2-T series, the robust filter and vibration tough drive are available instead.

5. The operation mode will be adjusted automatically at the first PC or PLC...etc communication. You can change the operation mode with the application "MR-J4(W)-B mode selection".

App. 7.4 How to switch J4/J3 compatibility mode

There are two ways to switch the J4/J3 compatibility mode with the LECSS2-T driver.

(1) Mode selection by the automatic identification of the driver

J4/J3 compatibility mode is identified automatically depending on the connected PC or PLC...etc. When the PC or PLC...etc make a connection request with SSCNET III/H communication, the mode will be "J4 mode". For SSCNET communication, it will be "J3 compatibility mode". For the J3 compatibility mode, standard control will be identified automatically with a motor (encoder)

connected to the driver. For the J4 mode, the operation mode will be the setting of [Pr. PA01].





(2) Mode selection by the automatic identification of the driver

You set the factory setting, J4/J3 compatibility mode, and operation mode with the dedicated application.



App. 7.5 How to use the J3 compatibility mode

(1) Setting of the PC or PLC...etc

To use in the J3 compatibility mode, select MR-J3 series in the system setting window.

Operation mode in J3 compatibility mode	System setting
LECSS -S standard control mode (servo motor)	Select MR-J3B.

(2) Setting of setup software (MR Configurator)

To use in the J3 compatibility mode, make the system setting as follows.

Operation mode in J3 compatibility mode	System setting
LECSS -S standard control mode (servo motor)	Select MR-J3B.

Cautions for using setup software (MR Configurator)

• The gain search cannot be used. You can use the advanced gain search.

(3) Setting of setup software (MR Configurator2)

To use in the J3 compatibility mode, make the system setting as follows.

Operation mode in J3 compatibility mode	System setting
LECSS -S standard control mode (servo motor)	Select MR-J3B.

Cautions for using setup software (MR Configurator2)

- Use setup software (MR Configurator2) with software version 1.12N or later. Older version than 1.12N cannot be used.
- Information about existing models (MR-J3) cannot be updated with the parameter setting range update function. Register a new model to use.
- The alarm will be displayed by 3 digits.
- The robust disturbance compensation cannot be used.

App. 7.6 Cautions for switching J4/J3 compatibility mode

The J3 compatibility mode of the operation mode is automatically identified by factory setting depending on a connected encoder. If a proper encoder is not connected at the first connection, the system will not start normally due to a mismatch with a set mode with the PC or PLC...etc. (For the J4 mode, you can set the operation mode with [Pr. PA01].) When the operation mode mismatches, the driver will display [AL. 3E.1 Operation mode error]. Set the mode correctly (J4/J3 compatibility mode and operation mode).

App. 7.7 Cautions for the J3 compatibility mode

The J3 compatibility mode are partly changed and has restrictions compared with MR-J3 series.

- (1) The alarm display was changed from 2 digits (_ _) to 3 digits (_ _. _). The alarm detail number (._) is displayed in addition to the alarm No (_ _). The alarm No. (_ _) is not changed.
- (2) When the power of the driver is cut or fiber-optic cable is disconnected, the same type communication can be cut regardless of connection order. When you power on/off the driver during operation, use the connect/disconnect function of the PC or PLC...etc. Refer to the following manuals for detail of Mitsubishi Electric Corporation.

 Motion controller Q series Programming Manual (COMMON) (Q173D(S)CPU/Q172D(S)CPU) (IB-0300134) "4.11.1 Connect/disconnect function of SSCNET communication"

- MELSEC-Q QD77MS Simple Motion Module User's Manual (IB-0300185) "14.12 Connect/disconnect function of SSCNET communication"
- MELSEC-L LD77MH Simple Motion Module User's Manual (IB-0300172) "14.13 Connect/disconnect function of SSCNET communication"
- (3) The J3 compatibility mode has a functional compatibility. However, the operation timing may differ. Check the operation timing on customer side to use.

App. 7.8 Change of specifications of "J3 compatibility mode" switching process Confirm details of Motion controller, simple motion module and positioning module to PLC manufacturer.

App. 7.8.1 Detailed explanation of "J3 compatibility mode" switching

(1) Operation when using a driver before change of specifications

For the PC or PLC...etc in which "Not required" is described to PC or PLC...etc reset in table app. 1, the mode will be switched to "J3 compatibility mode" for all axes at the first connection. However, it takes about 10 s per axis for completing the connection.

For the PC or PLC...etc in which "Reset required" is described in table app. 1, the operation at the first connection is shown in table app. 2. The LED displays will be "Ab." for all axes at the first connection to the PC or PLC...etc as shown in table app. 2. After that, resetting PC or PLC...etc will change the 1-axis to "b01". The 2-axis and later will not change from "Ab.". After that, one axis will be connected per two times of PC or PLC...etc reset.

Table app. 1 PC or PLC...etc reset required/not required list (before change of specifications)

PC or PLCetc	Model	PC or PLCetcreset required/not required	
		Single-axis connection	Multi-axis connection
Motion controller	Q17_DSCPU	Not required	Not required
	Q17_DCPU	Not required	Not required
	Q17_HCPU	Not required	Not required
	Q170MCPU	Not required	Not required
Simple motion module Positioning module	QD77MS_	Not required	Not required
	QD75MH_	Not required	Not required
	QD74MH_	Reset required	Reset required
	LD77MH_	Not required	Not required
	FX3U-20SSC-H	Not required	Reset required

Table app. 2 PC or PLC...etc connection operation before change of specifications

	Before change of specifications (software version A4 or earlier)		
First connection of PC or PLCetc	PC or PLCetc "Ab." is displayed and stops Ab. Ab. Axis No. 1 No. 2 No. 3		
After PC or PLCetc reset	PC or PLCetc "b01" is displayed on axis No. 1, "Ab." is displayed on axis No. 2 and later. b01 Ab. Axis Axis No. 1 No. 2		



(2) Operation when using a driver after change of specifications

For the PC or PLC...etc in which "Not required" is described to PC or PLC...etc reset in table app. 3, the mode will be switched to "J3 compatibility mode" for all axes at the first connection. It takes about 10 s for completing the connection not depending on the number of axes.

For the PC or PLC...etc in which "Reset required" is described in table app. 3, the operation at the first connection is shown in table app. 4. The driver's mode will be "J3 compatibility mode" and the LED displays will be "rST" for all axes at the first connection to the PC or PLC...etc as shown in table app. 4. At the status, resetting PC or PLC...etc once will change the display to "b##" (## means axis No.) for all axes and all axes will be ready to connect.

(One PC or PLC...etc reset enables to all-axis connection.)

Table app. 3 PC or PLC...etc reset required/not required list (after change of specifications)

PC or PLCetc	Model	PC or PLCetc reset required/not required	
		Single-axis connection	Multi-axis connection
Motion controller	Q17_DSCPU	Not required	Not required
	Q17_DCPU	Not required	Not required
	Q17_HCPU	Not required	Not required
	Q170MCPU	Not required	Not required
Simple motion module Positioning module	QD77MS_	Not required	Not required
	QD75MH_	Not required	Not required
	QD74MH_	Reset required	Reset required
	LD77MH_	Not required	Not required
	FX3U-20SSC-H	Reset required	Reset required

Table app. <u>4 PC or PLC...etc connection operation after change of specifications</u>



(3) Using drivers before and after change of specifications simultaneously When using drivers before change of specifications and after change of specifications simultaneously, PC or PLC...etc reset is necessary for number of connecting axes of drivers.

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SMC Corporation

4-14-1, Sotokanda, Chiyoda-ku, Tokyo 101-0021 JAPAN Tel: + 81 3 5207 8249 Fax: +81 3 5298 5362 URL <u>http://www.smcworld.com</u>

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