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SPECIFICATIONS

Product Name: Servo Driver

Product Series Name: MINAS A7N (RTEX)

Product Model Number: Rotary motor (Standard / Multi-function / Application specialized)

Motion Control Business Unit, Industrial Device Business Division
Panasonic Industry Co., Ltd.
7-1-1 Morofuku, Daito City, Osaka, 574-0044, Japan

If you have any questions, please contact the sales office or distributor of the product.

Panasonic

REVISIONS

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1 Precautions

1.1 Safety Precautions

This section explains precautions that must be taken to prevent harm to people and damage to property.



SAFETY PRECAUTIONS

The following symbols represent the extent of the harm or damage that may occur through improper use.

DANGER	This indicates "a significant risk of death or serious injury".
CAUTION	This indicates "a risk of minor injury or damage to property".

The following symbols indicate how to comply with safety precautions.

Indicates actions that must not be performed.	
Indicates actions that must be performed without fail.	



DANGER

	1 Ensure that the product is used in environments with a pollution degree of 2 (places free from dust, metal powders, oil mists, and other foreign objects, as well as liquids such as water, oil, or grinding fluids). Do not store or use near combustible materials or in an environment containing corrosive gases (H₂S, SO₂, NO₂, Cl₂, etc.) or flammable gases, or store in atmospheres where helium gas or other gases with small molecular weight are generated. 2 Do not place flammable materials near the motor, servo driver, or regenerative resistor. 3 Do not run the motor using an external power source. If the motor is run externally, it will start acting as an electricity generator. This may cause it to short-circuit during operation of the dynamic brake, which is integrated into the servo driver, resulting in smoke and dust being emitted. Doing so may also cause the dynamic brake to become disconnected, preventing it from functioning. 4 Do not damage the cable, apply excessive stress, place heavy objects on it, or pinch it. 5 Do not use with the cable submerged in oil or water. 6 Do not install the product next to heating elements such as heaters or large winding resistors (Protection such as heat shields should be used to protect the product from heating elements.). 7 Do not connect a commercial power supply directly to the motor. 8 Do not use in places susceptible to strong vibrations or impacts. If installing a servo driver near a source of vibration, attach a vibration dampening device to the servo driver mounting surface. 9 Do not touch the rotating parts of the motor during operation. 10 Do not touch the keyway of the motor output shaft with bare hands. 11 Do not put hands inside the servo driver. 12 Do not touch the heat sink and peripheral devices of the motor or servo driver, as they can get very hot. 13 Do not perform wiring or operate the product with wet hands.
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DANGER



- 14 Wiring work should be carried out by an electrician.
 - 15 Motors other than that specified do not include protective devices. Protect them using overcurrent protection devices, ground-fault circuit interrupters, overheating prevention devices, emergency stop devices, etc.
 - 16 Before operating the servo driver following an earthquake, ensure that the servo driver and motor are properly installed and that the machine is safe.
 - 17 After the power supply is switched off, the internal circuit will be charged at high voltage for a period of time. When relocating, wiring, or inspecting the driver, ensure that the power supply input is completely disconnected on the outside of the servo driver and wait at least 15 minutes before carrying out any work.
 - 18 Install and set up the product so that it does not cause fire or personal injury in the event of an earthquake.
 - 19 An external emergency stop circuit must be installed to enable the power supply to be immediately disconnected in the event of an emergency. Failure of the combined motor and servo driver may result in smoke and dust being emitted. For example, if an electric current is passed through the regenerative control power transistor built into the servo driver following a short-circuit fault, the regenerative resistor installed outside the servo driver may overheat, leading to smoke and dust being emitted. If a regenerative resistor is connected to the outside of the servo driver, it must be installed so that the thermal protector or other overheating detection devices can detect abnormal overheating and to enable the power supply to be disconnected.
 - 20 Install the motor, servo driver, and peripheral devices to nonflammable materials such as metal.
 - 21 Ensure that the product is wired correctly and securely. Insecure or incorrect wiring may cause the motor to malfunction or lead to thermal damage. Also, do not allow any conductive materials such as wire debris to enter the servo driver during installation and wiring.
 - 22 Ensure that the cables are securely connected and that energized parts are insulated.
 - 23 Binding and inserting wires into a metal duct will cause the temperature to increase, which will result in reduced wire current capacity and possibly lead to thermal damage. Please consider the current reduction coefficient before deciding on how to wire the product.
 - 24 Make sure to install a molded case circuit breaker (MCCB) to the power supply. Also, make sure to ground the ground terminal or ground wire. D-type grounding or higher (ground resistance less than 100 Ω) is recommended in order to prevent electric shocks and malfunctions.
 - 25 Securely tighten the screws for connecting the terminal block, as well as the grounding screw, using the torque indicated in the specification sheet.
 - 26 When constructing a system using safety functions, make sure you understand and comply with the relevant safety standards as well as the information in our user manuals or technical reference documents.
 - 27 Your equipment may be affected by switching noise current while the servo driver is operating, depending on the device and the installation environment.
- When installing one of our servo drivers or motors to your equipment, confirm and verify that the earth terminal, the earth cable and the motor itself have been grounded properly.

CAUTION



- 28 When transporting the product, do not hold it by the cable or motor shaft.
- 29 When adjusting the parameters of the servo driver, do not set the gain too high or make extreme modifications to settings simultaneously, as doing so may result in unstable operation.
- 30 Following a power outage, do not get close to the machine once power is restored, as it may restart suddenly. Settings must be made to ensure personal safety even in event the machine restarts suddenly.
- 31 Do not approach the motor or the machine when it is running during power-up to ensure safety in the event of an unexpected malfunction.
- 32 Do not subject the motor shaft to strong shock.
- 33 Do not use the electromagnetic contactor installed on the main power supply side to start or stop the motor.
- 34 If the motor has a built-in brake, it is for holding purposes and should not be used as a stopping (braking) device in order to ensure machine safety.
- 35 Do not turn the servo driver main power supply on and off more frequently than necessary.
- 36 Do not drop or tip over the product during transportation or installation.
- 37 Do not climb on the motor or place heavy objects on it.
- 38 Do not cover the servo driver louver or allow any foreign objects to enter.
- 39 Do not expose the product to direct sunlight. When storing the product, keep it away direct sunlight and store at temperatures and humidity within the specified ranges.
- 40 Do not attempt to overhaul or modify the motor. Overhauls must be carried out by Panasonic or an authorized dealer.
- 41 Do not start or stop the device by turning the servo-on command (SRV-ON) on or off. This may damage the dynamic braking circuit incorporated into the servo drive.

CAUTION



- 42 Use the motor and servo driver within the output range stipulated by Panasonic. If combining the motor with a different servo driver, make sure to confirm its performance and safety.
- 43 Failure of the motor or the servo driver it is combined with may result in thermal damage to the motor and may cause smoke and dust to be emitted. Please consider these possibilities when using the device in cleanrooms, etc.
- 44 Make sure the device is installed in a manner suitable for the power output and the weight of the unit.
- 45 Keep the ambient temperature and humidity of the servo driver and motor within the permitted ambient temperature and humidity ranges.
- 46 Observe the specified mounting method and orientation.
- 47 Keep the required distance between the servo driver and the control panel interior or other equipment.
- 48 If an eyebolt is attached to the motor, it should only be used to transport the motor and not to transport any other equipment. The eyebolt should also not be used if a decelerator, face plate, etc., is attached.
- 49 Connect the relay that disconnects in the event of an emergency stop in series with the brake control relay.
- 50 To perform a test run, secure the motor and check its operation with it disconnected from the mechanical system, then mount it onto the machine.
- 51 Make sure that the input power supply voltage is in line with the servo driver specifications before turning it on and operating. Entering a voltage higher than the rated voltage could cause smoke and dust to be emitted inside the servo driver, which in some cases may cause the motor to malfunction or lead to thermal damage.
- 52 In the event of an alarm, eliminate the cause of the alarm and restart the device. Restarting the device without eliminating the cause of the alarm may cause the motor to malfunction or lead to thermal damage.
- 53 If the motor has a built-in brake, it may not hold due to reasons such as its lifetime or mechanical structure. A stopping device must be installed on the machine side to ensure safety.
- 54 The motor and servo drive emit heat while the motor is in operation. Ambient temperature may rise abnormally if used in an enclosed area. Take care to ensure that the ambient temperatures of the motor and servo driver are within the operating range.
- 55 Maintenance and inspections should be performed by a specialist.
- 56 Make sure to turn off the power supply if the device will not be used for a long period of time.
- 57 If the dynamic brake built into the servo driver is applied when the device is operating at a high speed, allow a stop time of approximately 10 minutes. Failure to do so may cause the internal circuit to disconnect or the brake to no longer be operable.
- 58 Secure the cables so that they do not put stress on the connectors, terminal block, or other connections.
- 59 Use a stabilized power supply with reinforced insulation for the DC power supply.
- 60 If use continues in a warning environment, it may stop, reduce life, or failure due to the protection function of the servo drive. Please do not use until the cause of the warning is ruled out.

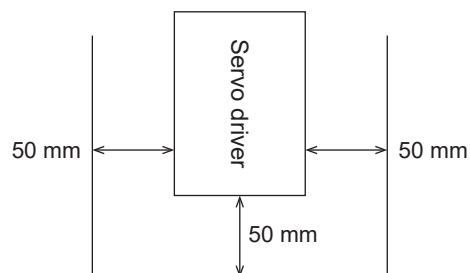
- The capacitance of the capacitors of the power supply rectifier circuit will drop over time. To avoid a secondary problem due to a failure, replacement is recommended approximately every five years. Replacement must be carried out by Panasonic or an authorized dealer.
- Be sure to read the operating manual (safety guide) included with the product before use.

■ Servo Driver Ambient Temperature

The life span of the servo driver is largely dependent on the ambient temperature.

Make sure that the ambient temperature within 50 mm of the servo driver does not exceed the operating temperature range.

If it is not possible to measure the temperature from a distance of 50 mm, instead measure at the midpoint of the gap between the obstacle preventing measurement and the servo driver.

Front View

Operating temperature range: 0–60 °C
(can be used at 55–60°C when derated)

Refer to “Derated Specifications” for details on derating.

1.2 Network Security

As you will use this product connected to a network, your attention is called to the following security risks.

- 1 Leakage or theft of information through this product
- 2 Use of this product for fraudulent operation by persons with malicious intent
- 3 Interference with or stoppage of this product by persons with malicious intent

It is the customer's responsibility to ensure that sufficient network security measures are taken, including the following.

We will not be liable for any damage caused by insufficient network security.

Precautions

- This product is to be used in an environment where only a limited number of parties are permitted access to the product.
- This product is not to be installed in locations where the product and its accessories, such as cables, can be easily destroyed.
- This product is to be used on a network that is not connected to the Internet.
- If an external device, such as a computer or tablet, is connected to this product, there are concerns about the effects of computer viruses and unauthorized programs.
Take appropriate security measures with external devices, such as ensuring that they are checked for computer viruses and that regular cleaning of such viruses is performed before connecting them.
- If this product is turned over to a third party for transfer, disposal, repair, etc., important information may be left recorded in the device.

Make deletions, etc.. at your own risk, and handle such matters with sufficient care.

1.3 Additional Precautions

- 1 Precautions to be taken when exporting the product or equipment incorporating the product
If the end user or end use of this product is related to the military or weaponry, etc., it may be subject to export restrictions as set forth in the Foreign Exchange and Foreign Trade Act. When exporting, please review and follow the necessary export procedures.
- 2 This product is designed for general industrial use. This product is not for use in devices critical to human wellbeing or in specialized environments, such as nuclear power control, aerospace equipment, transportation systems, medical equipment, various safety devices, or equipment that requires a high degree of cleanliness.
- 3 Please ensure that finished equipment complies with standards, laws, and regulations, and confirm that the structure, dimensions, life span, and characteristics of the product match those of your installed equipment and components.
- 4 Since it is possible, albeit unlikely, that your finished equipment will operate abnormally due to a malfunction of our product (such as due to signal disconnections, signal open phases, or operation performed outside the settings as a result of external noise or static electricity being applied), please put in place failsafes and ensure adequate safety within the operational range of your site.
- 5 Make sure to follow indications as overloading products can cause loads to collapse.
- 6 Ensure that the motor shaft is not operated without being electrically grounded, as this may lead to electrolytic corrosion of the motor bearing and increased bearing noise, depending on the machine and the installation environment.
- 7 A tightening torque appropriate for the product mounting screws should be chosen to avoid loosening or damage, taking into account the strength of the screws used and the material to which they are mounted.
- 8 Because noise resistance may be affected by wiring conditions (e.g., earthing methods, cable length, signal wire shielding), please confirm the noise resistance of your equipment.
- 9 When disposing of the servo driver or motor, treat them as industrial waste.
- 10 When disposing of batteries, insulate them with tape and dispose of them in accordance with local regulations.
- 11 As long as you comply with this specifications document, certain components may be modified to improve performance, etc.
- 12 Changes to specifications shall be reflected in the delivery specifications document or in a document specified by your company. If this affects the function or characteristics of the product, the specifications will be changed following a test with a prototype.
- 13 Changes in specifications may affect the price of the product.
- 14 If you require clarification on something that is not covered by this specifications document, please contact us in advance.
- 15 In the event of a problem, the two parties shall resolve the issue following consultations as set forth in this specifications document.
- 16 Depending on the nature of the failure of the product, an amount of smoke equivalent to one cigarette may be emitted.
Please consider these possibilities when using the device in cleanrooms and similar facilities.
- 17 Do not use detergents containing benzene, thinner, alcohol, acid, or alkaline as this may cause discoloration or damage to the product's exterior.
- 18 Reverse engineering, decompiling and disassembling of this product is strictly prohibited.

2 Applicable range

This specification relates to the MINAS A7N Series Rotary Motor Specifications of Servo Drivers manufactured by Motion Control Business Unit, Industrial Device Business Division, Panasonic Industry Co., Ltd.

This product is intended for use as industrial equipment. It must not be used for any other purpose (e.g. for home use).

■ Related Materials

- MINAS A7N Series Operating Instructions (Overall) : IMG11
- MINAS A7N Series Operating Instructions (Tuning) : IMG23
- For MINAS Set-up Support Software (PANATERM ver.7) Operating Manual : IMG15
- MINAS A7N Series Technical Reference Functional Specification : SX-DSV03758
- MINAS A7N Series Technical Reference Communication Specification : SX-DSV03761

The documents listed above can be downloaded from the following site.

<https://industrial.panasonic.com/ac/e/>

■ Precautions

- 1 Reproduction of the contents of this document in whole or in part is strictly prohibited.
- 2 Due to product improvements, this document is subject to change without notice.
- 3 This product makes use of open-source software (OSS).

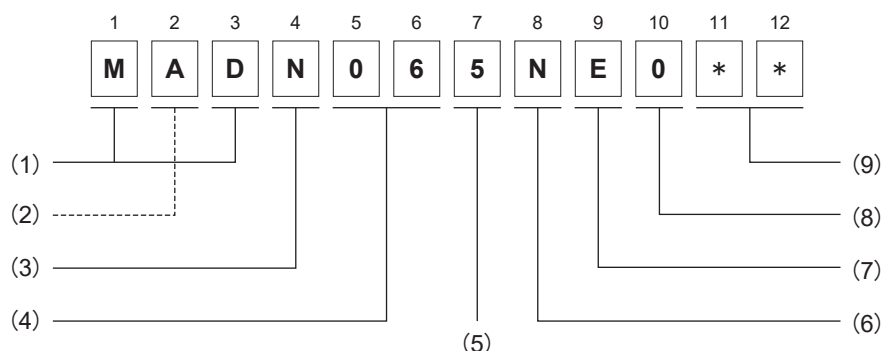
For details, see the Technical Reference.

Your company may also have an obligation to use OSS, so please take appropriate measures at your company.

3 How to Read Product Numbers

The following explains how to read product numbers.

Sample Description



No.	Item	Symbol	Specifications	Remarks
(1)	Product	M□D	Servo driver	□ = size symbol.
(2)	Servo Driver Size	A	Size A	—
		B	Size B	
		C	Size C	
		D	Size D	
(3)	Family	N	A7 family	—
(4)	Instantaneous maximum current (peak value)	06	6 A	—
		08	8 A	
		12	12 A	
		20	20 A	
		40	40 A	
(5)	Power supply and voltage specifications	1	Single phase 100 V	—
		5	Single phase/3-phase 200 V	
(6)	Command interface specification	N	RTEX	—
(7)	Functionality	E	Rotation type Standard type	—
		F	Rotation type Multi-function type Safety STO	
		R	Rotation type Application specialized type Safety STO	
(8)	Special product supported	0	Standard type, multi-function type special product	—
		H	Gantry control supported	
		T	Pressure control supported	
		U	Meandering control, GAP control supported	
(9)	Special specifications	**	—	Alphanumerics

4 Model Product Numbers

4.1 Standard Type

Product number	Size symbol	Power supply input	Rated output of applicable motor	Internal fan
MADN061NE	A	Single-phase 100–120 V	Max 50 W	No
MADN081NE			Max 100 W	No
MADN065NE		Single-phase/3-phase 200–240 V	Max 100 W	No
MADN085NE			Max 200 W	No
MBDN121NE	B	Single-phase 100–120 V	Max 200 W	No
MBDN125NE		Single-phase/3-phase 200–240 V	Max 400 W	No
MCDN201NE	C	Single-phase 100–120 V	Max 400 W	No
MCDN205NE		Single-phase/3-phase 200–240 V	Max 750 W	No
MDDN405NE	D	Single-phase/3-phase 200–240 V	Max 1000 W	Yes

* For servo driver and motor combinations, see Operating Instructions (MINAS A7N Series) “2.3 Driver and Motor Combinations” . Some motors may not be used even if they match the rated outputs shown in this table.

4.2 Multi-function Type

Product number	Size symbol	Power supply input	Rated output of applicable motor	Internal fan
MADN061NF	A	Single-phase 100–120 V	Max 50 W	No
MADN081NF			Max 100 W	No
MADN065NF		Single-phase/3-phase 200–240 V	Max 100 W	No
MADN085NF			Max 200 W	No
MBDN121NF	B	Single-phase 100–120 V	Max 200 W	No
MBDN125NF		Single-phase/3-phase 200–240 V	Max 400 W	No
MCDN201NF	C	Single-phase 100–120 V	Max 400 W	No
MCDN205NF		Single-phase/3-phase 200–240 V	Max 750 W	No
MDDN405NF	D	Single-phase/3-phase 200–240 V	Max 1000 W	Yes

* For servo driver and motor combinations, see Operating Instructions (MINAS A7N Series) “2.3 Driver and Motor Combinations” . Some motors may not be used even if they match the rated outputs shown in this table.

4.3 Application specialized Type

Product number	Size symbol	Power supply input	Rated output of applicable motor	Internal fan
MADN065NR□	A	Single-phase/3-phase 200–240 V	Max 100 W	No
MADN085NR□			Max 200 W	No
MBDN125NR□	B	Single-phase/3-phase 200–240 V	Max 400 W	No
MCDN205NR□	C	Single-phase/3-phase 200–240 V	Max 750 W	No
MDDN405NR□	D	Single-phase/3-phase 200–240 V	Max 1000 W	Yes

* For servo driver and motor combinations, see Operating Instructions (MINAS A7N Series) “2.3 Driver and Motor Combinations” . Some motors may not be used even if they match the rated outputs shown in this table.

5 Basic Specifications

The specifications of this product are as follows.

Item				Description
Input power supply	100 V	Main circuit power supply	Sizes A to C	Single phase 100 to 120 V, -15 % to +10 %, 50/60 Hz
		Control circuit power supply	Sizes A to C	Single phase 100 to 120 V, -15 % to +10 %, 50/60 Hz
	200 V	Main circuit power supply	Sizes A to D	Single phase/3-phase 200 to 240 V, -15 % to +10 %, 50/60 Hz
		Control circuit power supply	Sizes A to D	Single phase 200 to 240 V, -15 % to +10 %, 50/60 Hz
Ambient operating conditions		Temperature		Operating temperature 0 to 60°C (can be used at 55 to 60°C when derated ^(*)5)) (no freezing) Storage temperature: -20°C to 65°C (Max. temperature guarantee: 80°C, cumulative 72 hours, no condensation ^(*)1))
		Humidity		Operating/storage humidity: 20 to 85% RH or less (no condensation ^(*)1))
		Altitude		2000 m or lower (can be used at 1000 to 2000 m when derated ^(*)5))
		Vibration		5.88 m/s ² or less, 10 to 60 Hz
		Pollution degree		Pollution degree 2 (IEC60664-1)
		Mounting intervals		10 mm or more (can be used at 1 to 10 mm when derated ^(*)5))
Overvoltage category				III (IEC60364-4-44 and IEC60664-1)
Protective class				I (IEC61140)
IP rating				IP00
Insulation voltage resistance				Withstanding 1,500 V AC between primary and earth for 1 minute
Control method				IGBT PWM method, sinusoidal drive
Encoder feedback				27-bit (134217728 resolution) absolute encoder, 7-wire serial
External scale feedback ^(*)2)				A/B-phase, home signal differential input type Panasonic supported serial communication type ^(*)4)
Control signal		Input		8 general-purpose inputs Select general-purpose input function based on parameters
		Output		3 general-purpose outputs Select general-purpose output function based on parameters
Analog signal		Input		1 input (16 bit A/D input) ^(*)3)
		Output		2 outputs (analog monitor 1, analog monitor 2)
Pulse signal		Output		Switch with following with parameters and output line driver. - Encoder pulse output (A/B-phase) - Position comparison output (3 outputs)
Communication function		Realtime Express (RTEX)		Real-time operation command transmission, parameter setting, status monitoring, etc.
		USB		Connect to a computer for parameter setting or status monitoring, etc.
Safety terminal ^(*)2)				Safe Torque Off (STO) 2 inputs (safety input 1, 2) 1 output (EDM output)

Item		Description
Front panel		• Rotary switch • 7-segment LED for display (2-digit) and 4 network status LEDs • Analog monitor connector
Regeneration		Sizes A and B: No built-in regenerative resistor (external only) Sizes C and D: Built-in regenerative resistor (external also possible)
Dynamic brake		Built-in
Control mode	Semi-closed control	• Position control: Profile position control (PP) ^(*6)、cyclic position control (CP) • Velocity control: Cyclic velocity control (CV) ^(*6) • Torque control: Cyclic torque control (CT) ^(*6)
	Full-closed control	• Position control: Profile position control (PP) ^(*6)、cyclic position control (CP)

*1 Please note that condensation tends to occur when the temperature drops.

*2 Cannot be used with the standard type.

*3 Only application specialized types can be used.

*4 For supported scale manufacturers and product numbers, see the "AC Servo Partner Products" catalog.

*5 See "Derated Specifications".

*6 The function is not yet supported in this software version.

Derated Specifications

- When using servo drivers at an ambient temperature of 55 to 60°C, or at an altitude between 1000 and 2000 meters, use the load factor obtained by multiplying each of the load factors given in the below diagram.

When derated, change Pr5.110 "Driver derating factor" from the initial value. For details on how to set parameters and check the load factor of the servo driver, see Operating Instructions (MINAS A7N Series) "8.22 Driver Derating Function".

For servo driver overload protection time characteristics, see "Overload Protection Time Characteristics (Driver)".

An example of Pr5.110 "Driver derating factor" configuration is shown below.

- (Example 1) When used at an ambient temperature of 60°C and an altitude of 1000 m

The figure shows that the load factor at an ambient temperature of 60°C is 85% and at an altitude of 1000 m the load factor is 100%. Multiplying each load factor yields $85\% \times 100\% = 85\%$.

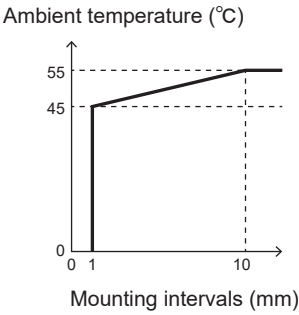
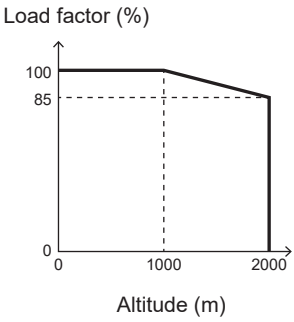
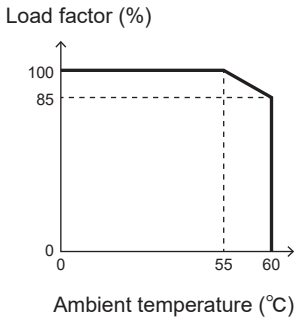
For Pr5.110 "Driver derating factor", set to "85".

- (Example 2) When used at an ambient temperature of 60°C and an altitude of 2000 m or less

The figure shows that the load factor at an ambient temperature of 60°C is 85% and at an altitude of 2000 m the load factor is 85%. Multiplying each load factor yields $85\% \times 85\% = 72\%$ (Round down to nearest decimal point).

For Pr5.110 "Driver derating factor", set to "72".

- If using servo drivers mounted at intervals of 1 to 10 mm, be sure to keep the below ambient temperatures in mind.



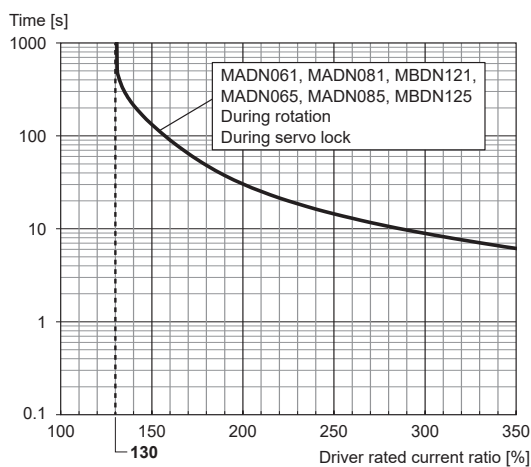
Overload Protection Time Characteristics (Driver)

The driver overload warning function is activated when the overload protection time characteristic (driver) is reached. Servo driver and servo motor overload warnings and protection functions (driver overload warning, motor overload warning, and motor overload protection) give priority to the lower between the overload protection time characteristic (driver) and overload protection time characteristic (motor). For details on overload protection time characteristics (motor), see Operating Instructions (MINAS A7N Series) "2.2.5 Overload Protection Time Characteristics (Motor)".

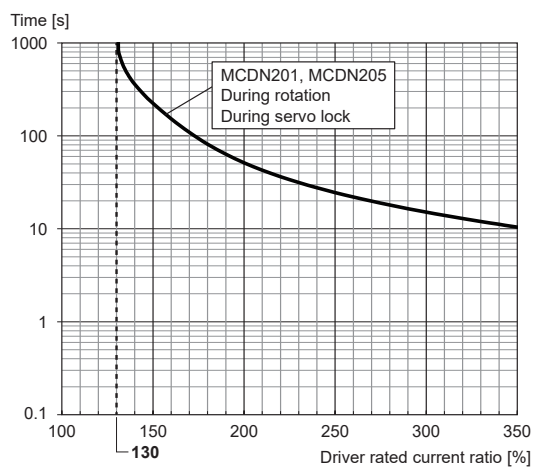
The figure below shows the overload protection time characteristics (driver) when Pr5.110 "Driver derating factor" is set to "100". See "*Derated Specifications*" in "*5 Basic Specifications*" and set Pr5.110 "Driver derating factor" according to the ambient operating conditions. Since the overload protection time characteristic of the servo driver changes depending on the set value of Pr5.110 "Driver derating factor", tune the operating conditions so that the overload protection time characteristic (driver) is not reached.

See Operating Instructions (MINAS A7N Series) "8.22 Driver Derating Function" for more information on the driver derating function.

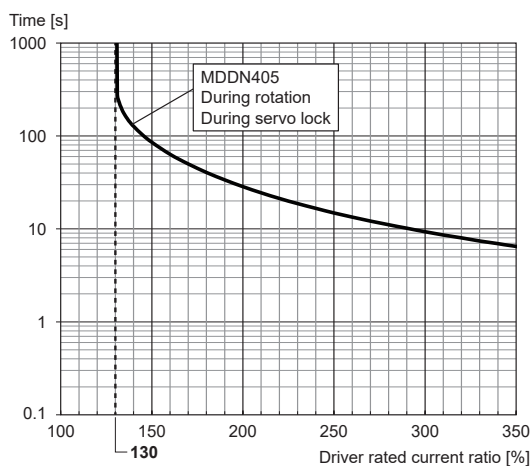
Common to MADN and MBDN



MCDN201, MCDN205



MDDN405

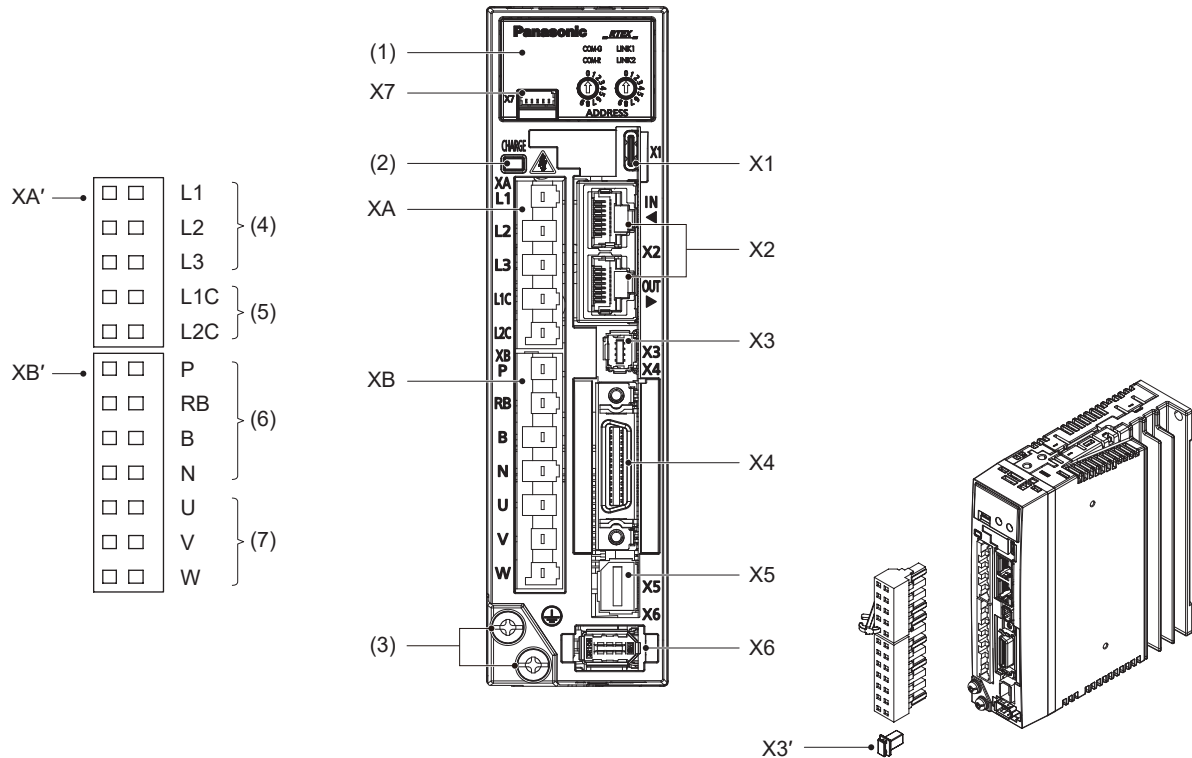


6 Part Names

The names of the driver parts are shown below by driver size.

For each size, the figure is for the multi-function type. The standard type does not have X3 (safety function connectors/safety bypass plug) or X5 (external scale connector).

6.1 Sizes A, B (100 V/200 V)



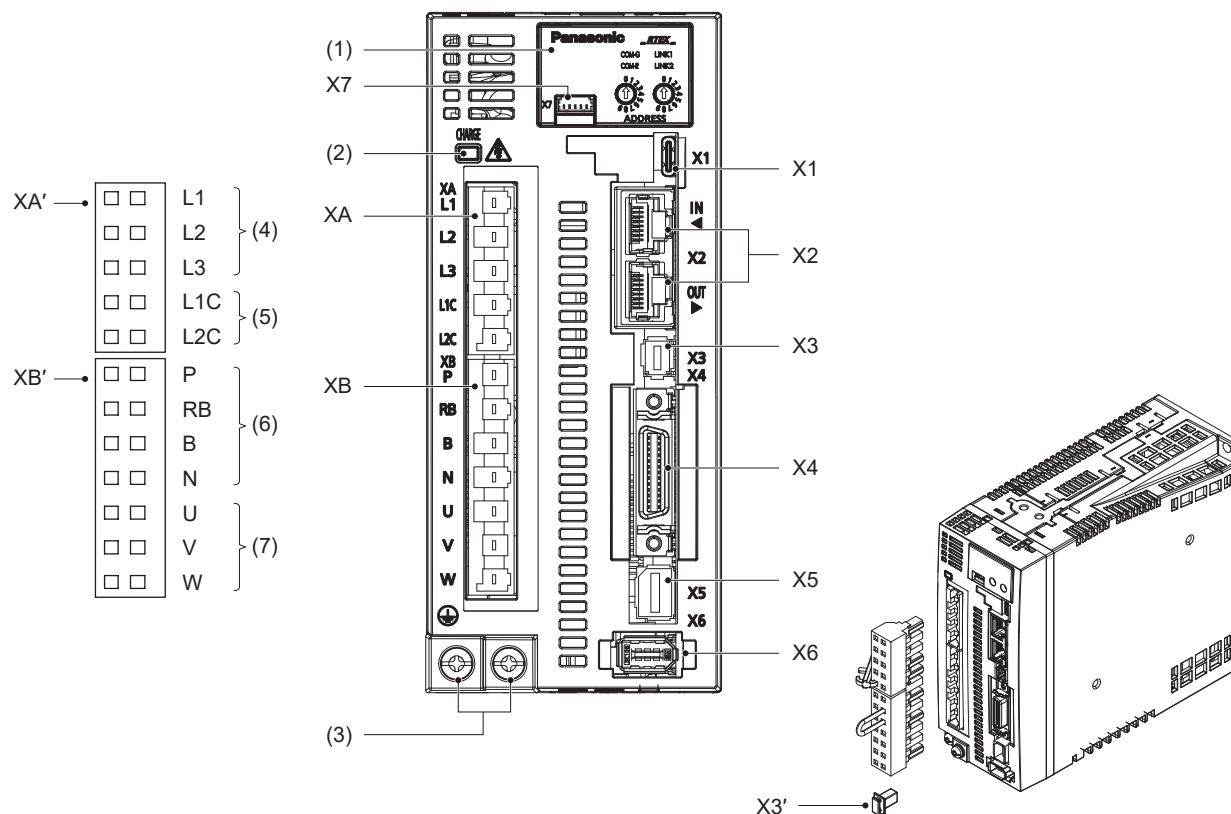
X1	USB connector DX07S016JA3R1500 (JAE) or equivalent	X2	RTEX Connector 2301996-9 (TYCO) or equivalent
X3	Safety function connector 2294417-1 (TYCO) or equivalent	X3'	Safety bypass plug 2371136-3 (TYCO) or equivalent
X4	Parallel I/O connector DF02R026NA2 (JAE) or equivalent	X5	External scale connector MUF-RS10SK-GKX-TB (LF) (JST) or equivalent
X6	Encoder connector 2232261-3 (TYCO) or equivalent	X7	Analog monitor connector 53398-4005 (Molex) or equivalent
XA	Power supply input connector SC05B-JTSKM7.5SK-GSXKR (JST) or equivalent	XA'	Power supply input connector 05JFAT-SAXGSAK-KM7.5 (LA) (JST) or equivalent
XB	Motor output connector SC07B-JTSKM7.5SK-GSXKR (JST) or equivalent	XB'	Motor output connector 07JFAT-SAXGSAK-KM7.5(LA) (JST) or equivalent
(1)	Front panel	(2)	Charge lamp
(3)	Earth connection screw	(4)	Main power input terminal
(5)	Control power input terminal	(6)	Regenerative resistor connection terminal
(7)	Motor output terminal		

* Remove the safety bypass plug when wiring to X3.

Notes

- Connectors XA' and XB' are included with sizes A and B.

6.2 Sizes C, D (100 V/200 V)



X1	USB connector DX07S016JA3R1500 (JAE) or equivalent	X2	RTEC Connector 2301996-9 (TYCO) or equivalent
X3	Safety function connector 2294417-1 (TYCO) or equivalent	X3'	Safety bypass plug 2371136-3 (TYCO) or equivalent
X4	Parallel I/O connector DF02R026NA2 (JAE) or equivalent	X5	External scale connector MUF-RS10SK-GKX-TB (LF) (JST) or equivalent
X6	Encoder connector 2232261-3 (TYCO) or equivalent	X7	Analog monitor connector 53398-4005 (Molex) or equivalent
XA	Power supply input connector SC05B-JTSKM7.5SK-GSXKR (JST) or equivalent	XA'	Power supply input connector 05JFAT-SAXGSAK-KM7.5 (LA) (JST) or equivalent
XB	Motor output connector SC07B-JTSKM7.5SK-GSXKR (JST) or equivalent	XB'	Motor output connector 07JFAT-SAXGSAK-KM7.5 (LA) (JST) or equivalent
(1)	Front panel	(2)	Charge lamp
(3)	Earth connection screw	(4)	Main power input terminal
(5)	Control power input terminal	(6)	Regenerative resistor connection terminal
(7)	Motor output terminal		

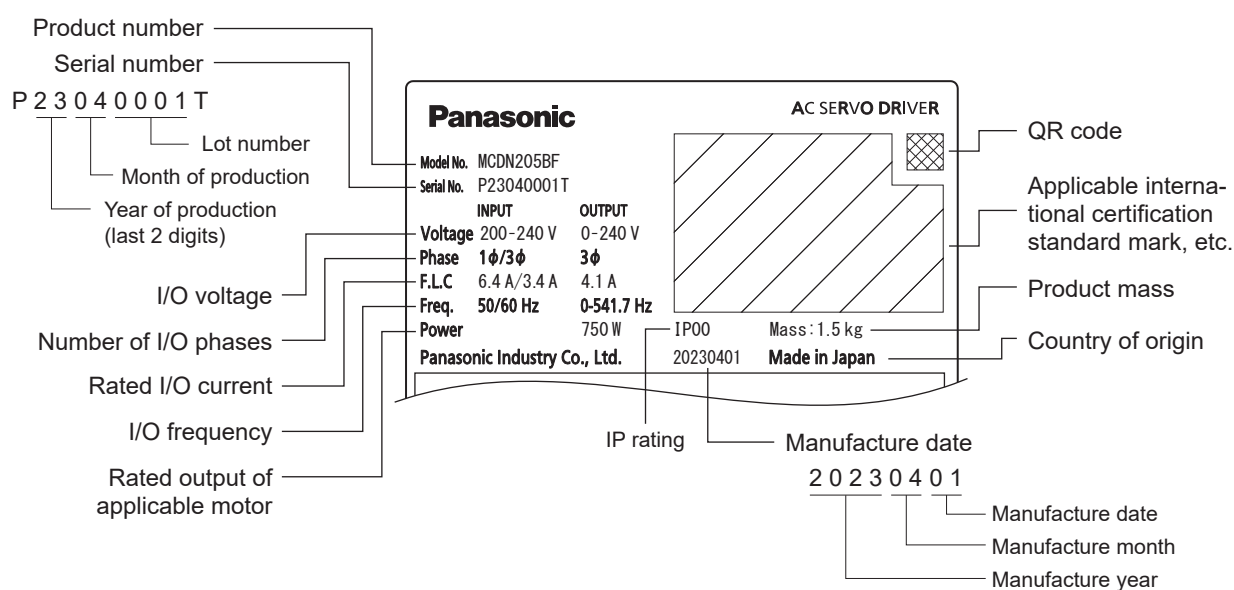
* Remove the safety bypass plug when wiring to X3.

Notes

- Connectors XA' and XB' are included with sizes C and D.

6.3 Nameplate Example

The details shown on nameplates are as shown below.

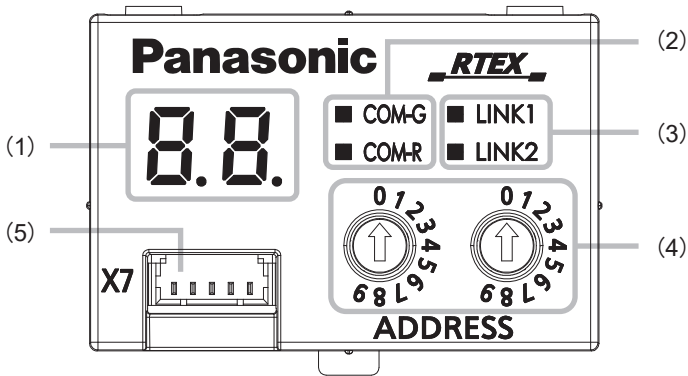


The range of the lot number in serial number is 1 to 33999, but the nameplate has 4 digits in the following format. In the four digits, the alphabet characters "I" (eye) and "O" (o) are not used.

Value of serial number	Notation on the nameplate
1 to 9999	0001 to 9999
10000 to 10999	A000 to A999
11000 to 11999	B000 to B999
...	...
17000 to 17999	H000 to H999
18000 to 18999	J000 to J999
...	...
22000 to 22999	N000 to N999
23000 to 23999	P000 to P999
...	...
33000 to 33999	Z000 to Z999

6.4 Front Panel

Operation and Display of the Front Panel



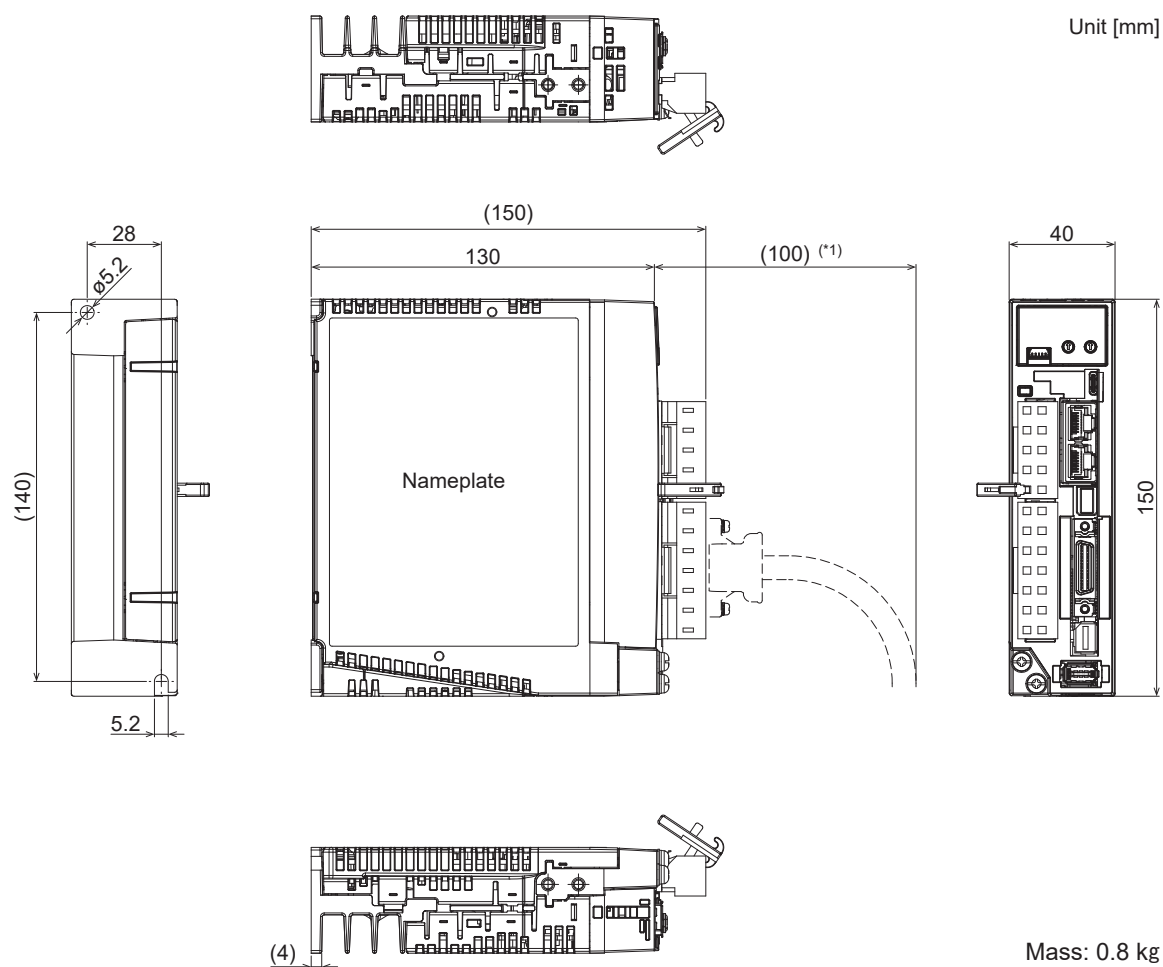
No. in image	Name	
(1)	7-segment LED for display (2-digit)	
(2)	COM-G LED (green) COM-R LED (red)	Network status LED
(3)	LINK1, LINK2 LED (green)	
(4)	Rotary switch for setting node addresses (2-digit) Setting range: 0 to 31	
(5)	Analog monitor connector (X7)	

7 Dimensions

The dimensions are the same for the standard type, multi-function type, and application specialized type for each frame (The figure is for the multi-function type).

7.1 Size A (100 V/200 V)

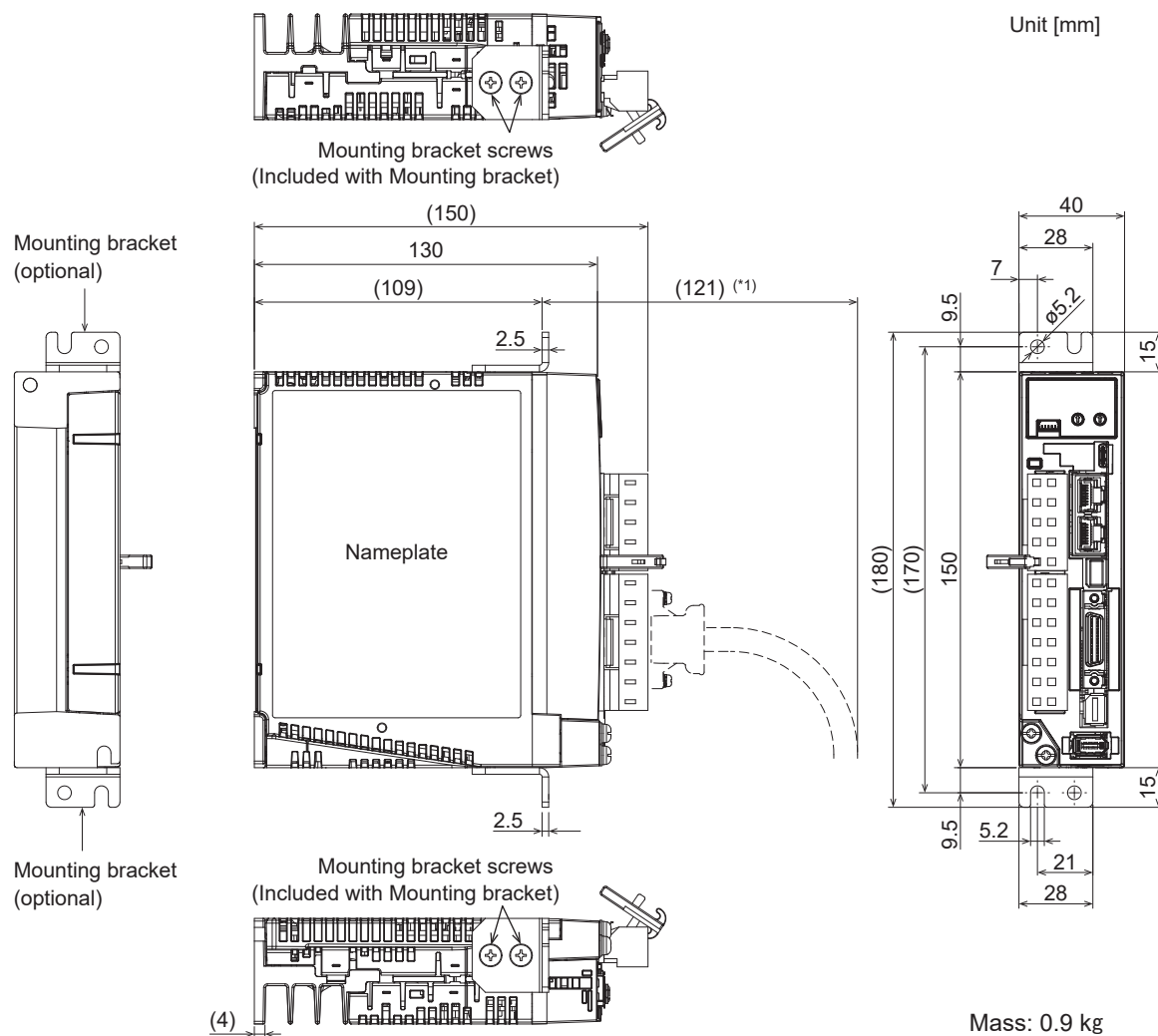
■ Base mount (standard: rear-mount)



*1 Ensure an appropriate distance for the cables used.

* Do not use screw holes for which no dimensions are shown.

■ Rack mount (using optional parts: front-mount)



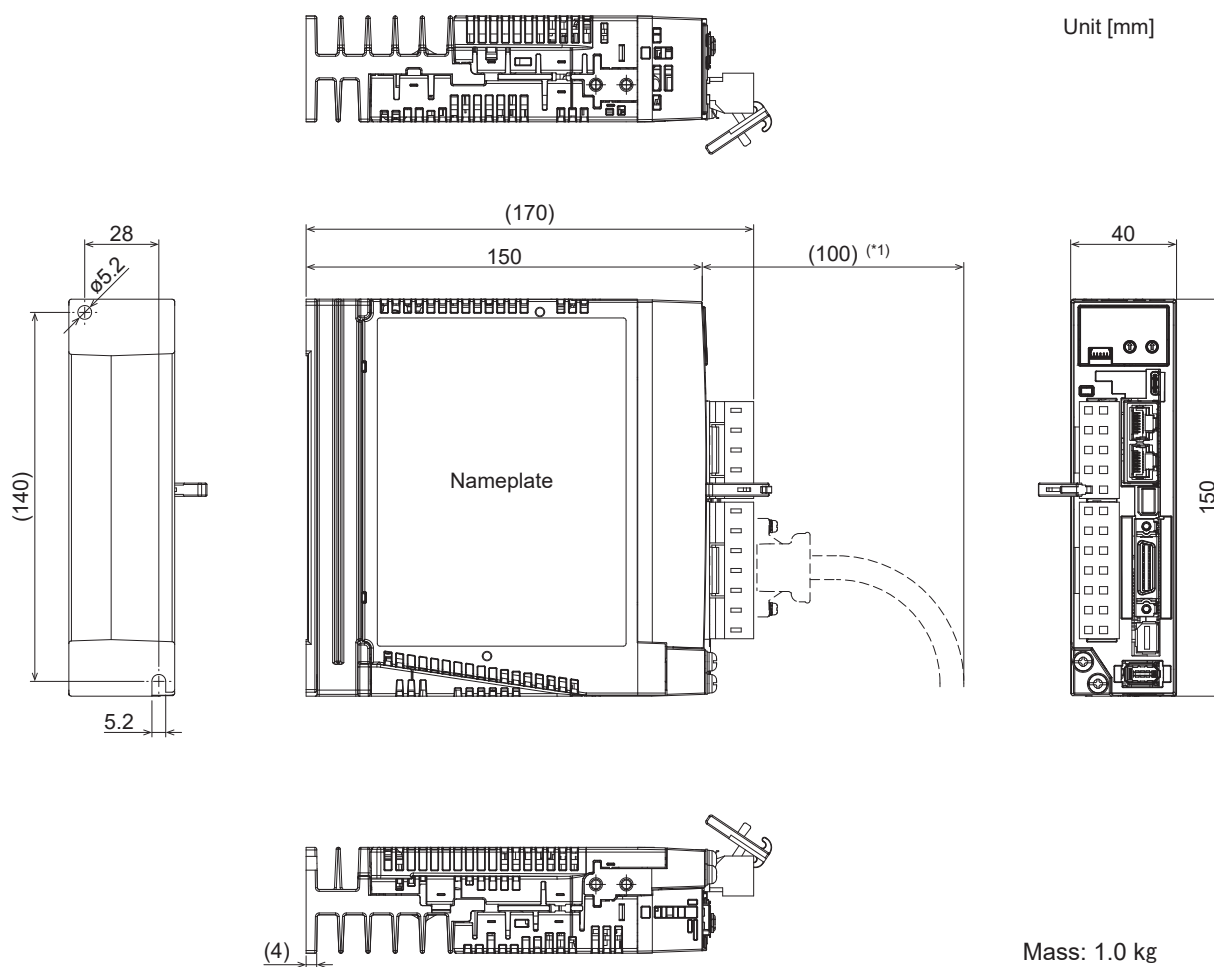
*1 Ensure an appropriate distance for the cables used.

* Do not use screw holes for which no dimensions are shown.

* Mounting brackets are optional parts. They are not included with the product.

7.2 Size B (100 V/200 V)

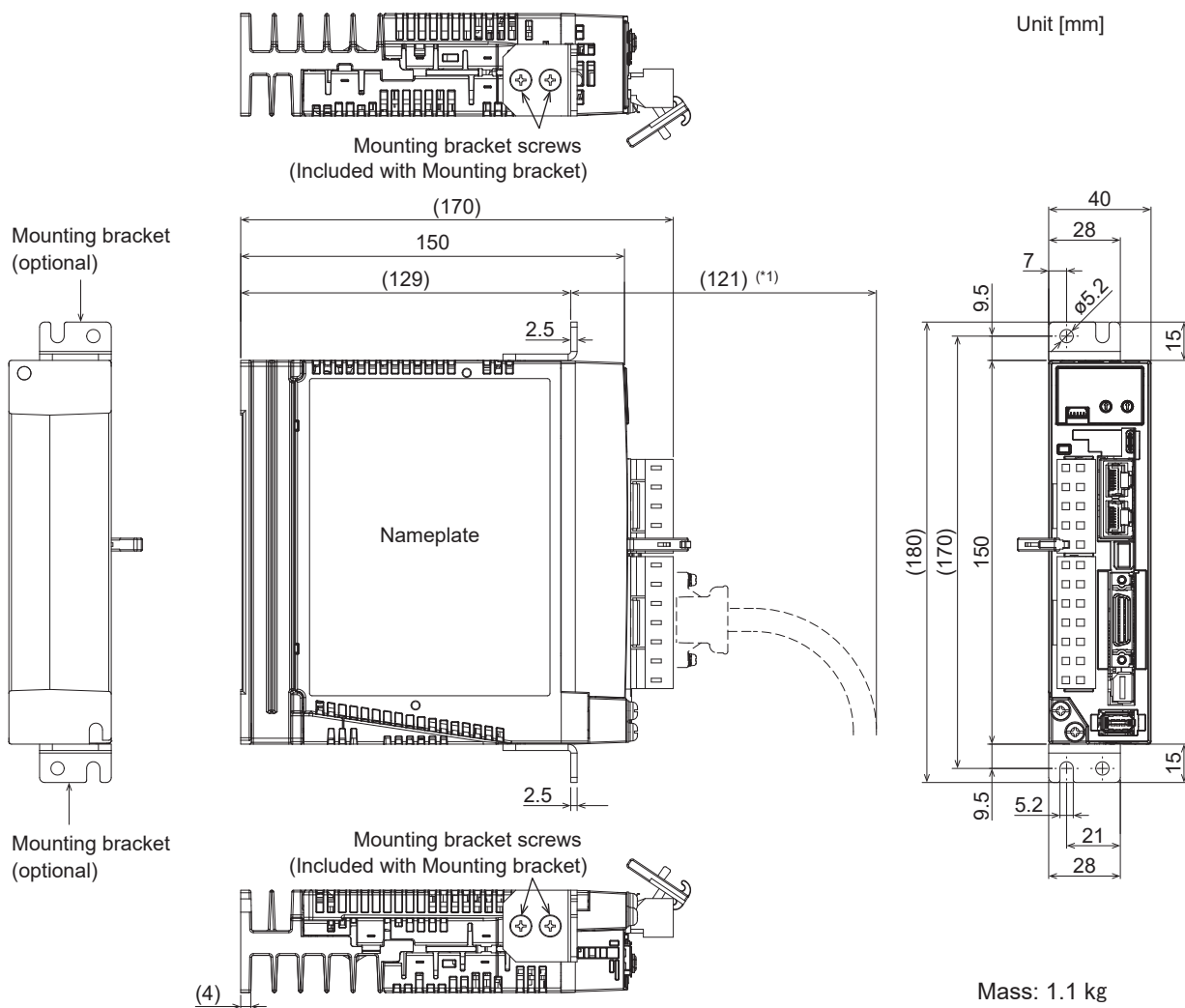
■ Base mount (standard: rear-mount)



*1 Ensure an appropriate distance for the cables used.

* Do not use screw holes for which no dimensions are shown.

■ Rack mount (using optional parts: front-mount)



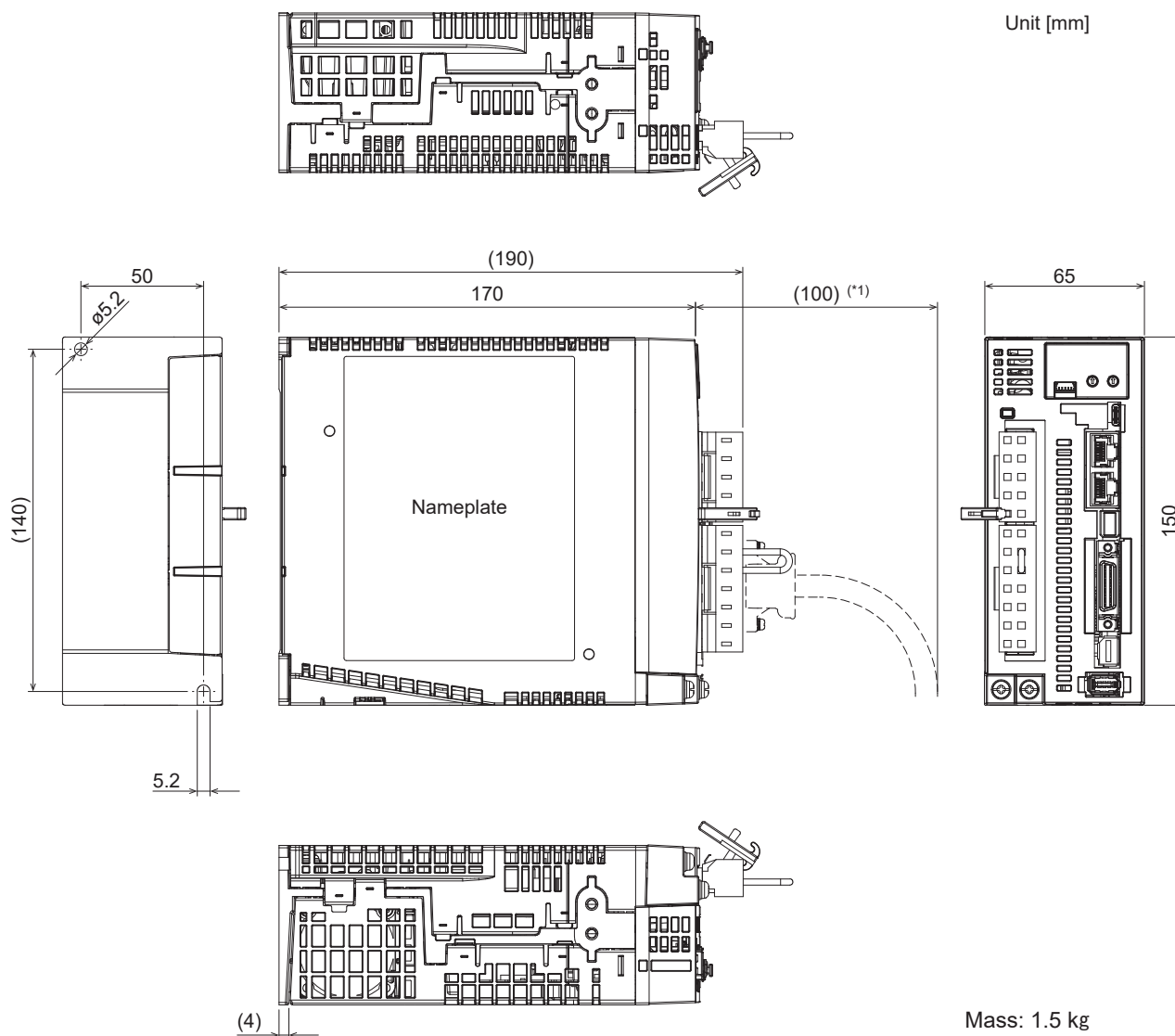
*1 Ensure an appropriate distance for the cables used.

* Do not use screw holes for which no dimensions are shown.

* Mounting brackets are optional parts. They are not included with the product.

7.3 Size C (100 V/200 V)

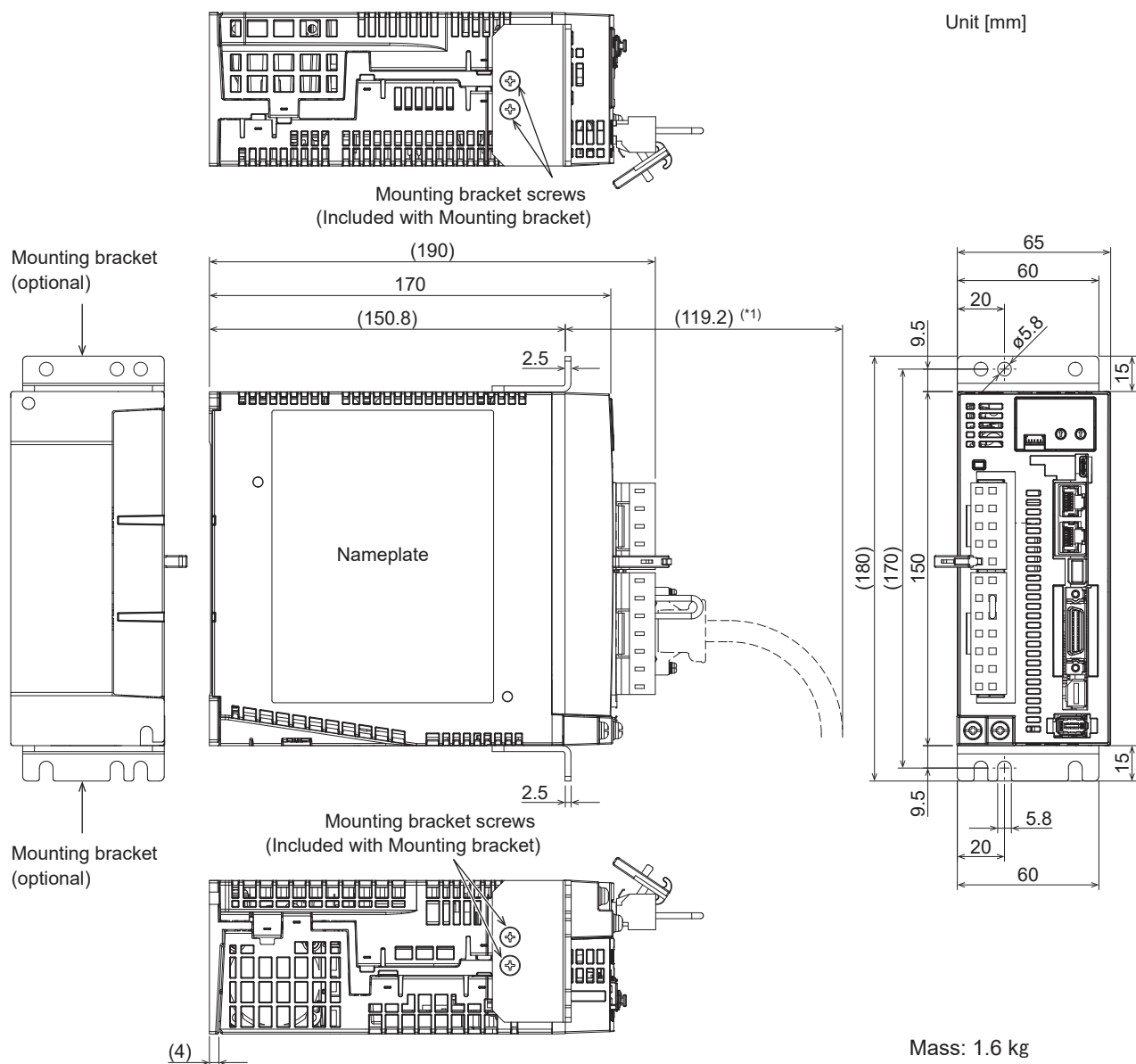
■ Base mount (standard: rear-mount)



*1 Ensure an appropriate distance for the cables used.

* Do not use screw holes for which no dimensions are shown.

■ Rack mount (using optional parts: front-mount)



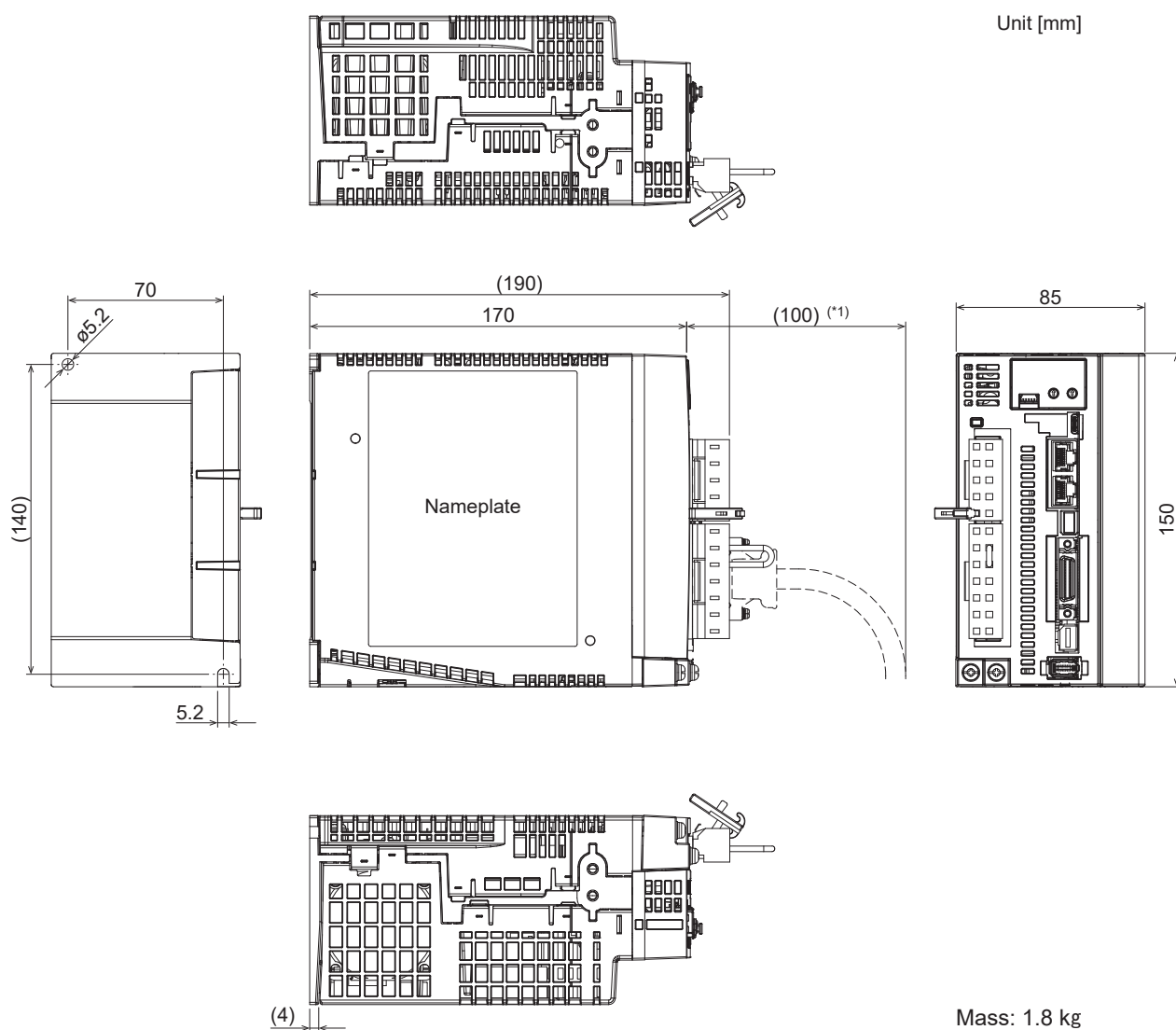
*1 Ensure an appropriate distance for the cables used.

* Do not use screw holes for which no dimensions are shown.

* Mounting brackets are optional parts. They are not included with the product.

7.4 Size D (200 V)

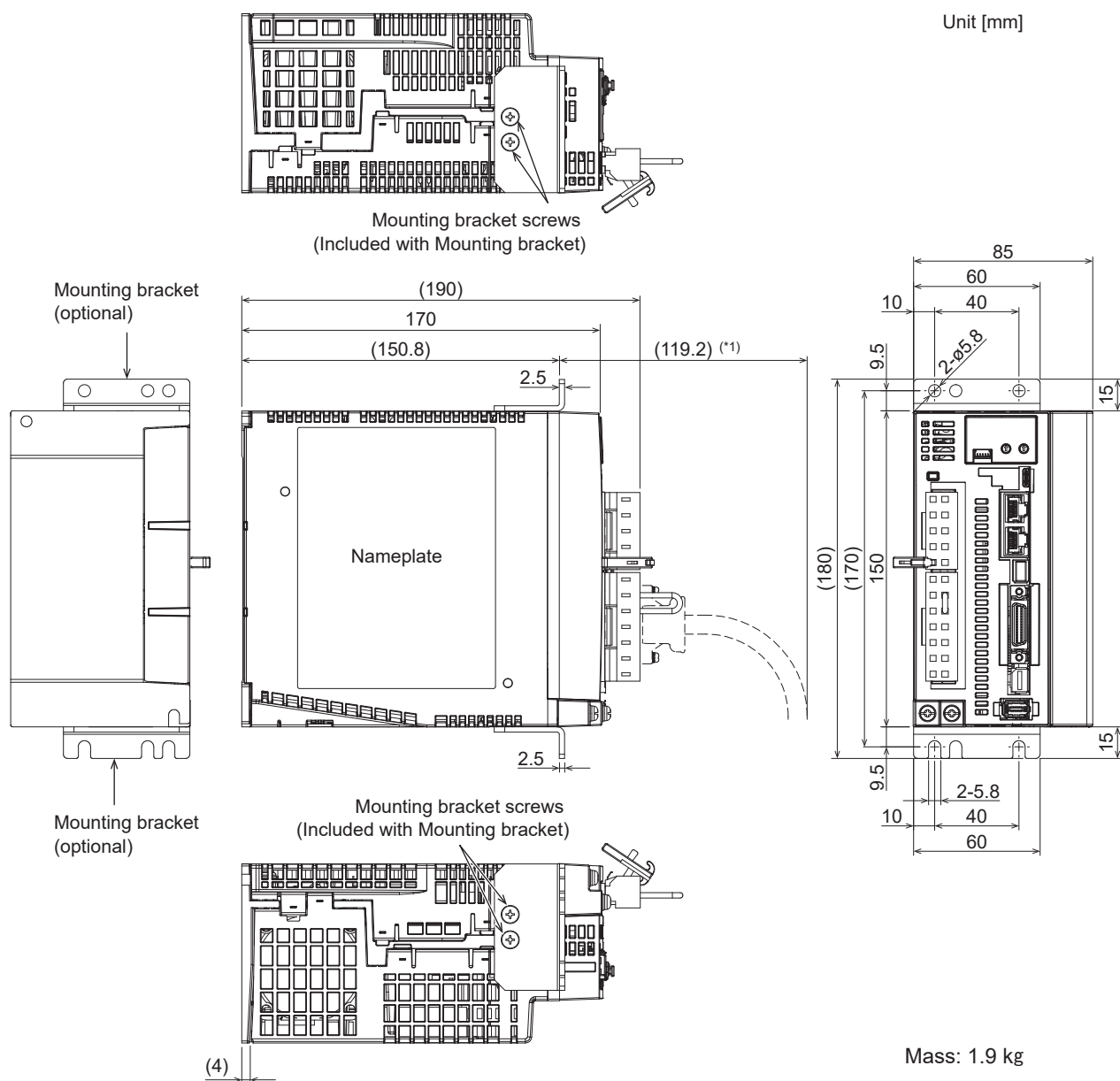
■ Base mount (standard: rear-mount)



*1 Ensure an appropriate distance for the cables used.

* Do not use screw holes for which no dimensions are shown.

■ Rack mount (using optional parts: front-mount)



*1 Ensure an appropriate distance for the cables used.

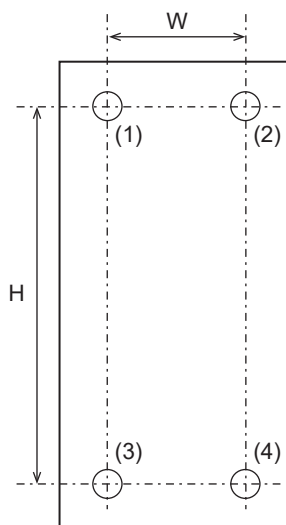
* Do not use screw holes for which no dimensions are shown.

* Mounting brackets are optional parts. They are not included with the product.

7.5 Mounting Hole Dimensions

Use mounting holes to firmly fix the servo driver to a surface.

Recommended mounting hole drilling diagram



Size	Mounting hole machining dimensions [mm]				Mounting holes		Mounting screws (*1)	
	Base mount		Rack mount		Base mount	Rack mount	Nominal	Tightening torque [N·m]
	H	W	H	W				
A	140 ± 0.5	28 ± 0.5	170 ± 0.5	—	(2), (3)	(1), (3)	M5	2.7 to 3.3
B	140 ± 0.5	28 ± 0.5	170 ± 0.5	—	(2), (3)	(1), (3)	M5	2.7 to 3.3
C	140 ± 0.5	50 ± 0.5	170 ± 0.5	—	(2), (3)	(1), (3)	M5	2.7 to 3.3
D	140 ± 0.5	70 ± 0.5	170 ± 0.5	40 ± 0.5	(2), (3)	(1), (2), (3), (4)	M5	2.7 to 3.3

*1 Hexagon socket head cap screws (JIS B 1176:2006) are recommended for use as mounting screws. If the thickness of the mounting plate is 10 mm, use mounting screws with a minimum length of 14 mm.

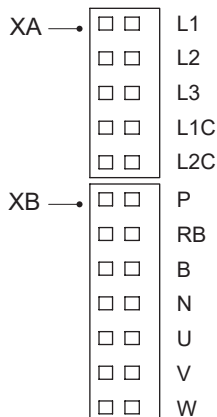
8 Configuration of Connectors

8.1 Power Connectors XA and XB

8.1.1 Sizes A, B (100 V/200 V)

Connect main power supply and control power to XA. Connect motor and regenerative resistor to XB.

Pinout diagram



Name			Symbol	Connector pin no.	Description
Connector	XA	Main power supply input terminal	L1	1	100 V system: Input single-phase 100 to 120 V +10%/-15% 50/60 Hz.
			L2	2	200 V system: Input single-phase/three-phase 200 to 240 V +10%/-15% 50/60 Hz.
			L3	3	For single phase, connect to terminals L1 and L3.
		Control power supply input terminal	L1C	4	100 V system: Input single-phase 100 to 120 V +10%/-15% 50/60 Hz.
			L2C	5	200 V system: Input single-phase 200 to 240 V +10%/-15% 50/60 Hz.
		XB	Regenerative resistor connection terminal	P	1
	RB			2	
	B			3	Do not connect anything to the RB terminal.
	N			4	Do not connect anything to the N terminal.
	Motor connection terminal		U	5	Connect each phase of the motor coil.
			V	6	U: U-phase
			W	7	V: V-phase W: W-phase
Earth terminal				Terminal for grounding. There are two terminals. One should be connected to the earth, and the other should be connected to the motor earth wire.	

* Tighten earth screws with a torque of M4: 0.7 to 0.8 N·m.

Wiring Procedure

- 1 Connect the power supply and motor to Connector XA and Connector XB.
- 2 Connect the wired connector to the driver.

Insert the connector securely until it is locked.

Precautions

- Wiring should be performed by a qualified electrician.
- In order to prevent electric shocks, do not connect to a power source until the wiring is complete.
- The power connectors (XA and XB) conduct high voltages and carry a risk of electric shock.

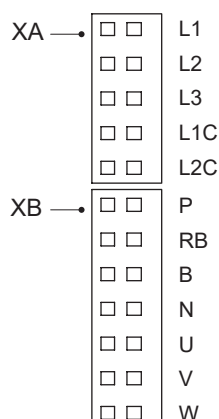
Notes

- When carrying out wiring work, check "9.3.1.4 How to Wire to the Power Connector" for the wiring method of the XA and XB power connectors and Operating Instructions (MINAS A7N Series) "3.2.1.4 Motor Connector Specifications" for the specifications of the motor connector.

8.1.2 Sizes C, D (100 V/200 V)

Connect main power supply and control power to XA. Connect motor and regenerative resistor to XB.

Pinout diagram



Name			Symbol	Connector pin no.	Description
Connector	XA	Main power supply input terminal	L1	1	100 V system: Input single-phase 100 to 120 V +10%/-15% 50/60 Hz. 200 V system: Input single-phase/three-phase 200 to 240 V +10%/-15% 50/60 Hz. For single phase, connect to terminals L1 and L3.
			L2	2	
			L3	3	
		Control power supply input terminal	L1C	4	100 V system: Input single-phase 100 to 120 V +10%/-15% 50/60 Hz. 200 V system: Input single-phase 200 to 240 V +10%/-15% 50/60 Hz.
			L2C	5	
		XB	Regenerative resistor connection terminal	P	1
	RB			2	When adding an external regenerative resistor, disconnect the short wire between RB and B, connect the external regenerative resistor between P and B, and set Pr0.16 to 1 or 2. Do not connect anything to the N terminal.
	B			3	
	N			4	
	Motor connection terminal		U	5	Connect each phase of the motor coil.
			V	6	U: U-phase
			W	7	V: V-phase W: W-phase
Earth terminal				Terminal for grounding. There are two terminals. One should be connected to the earth, and the other should be connected to the motor earth wire.	

* Tighten earth screws with a torque of M4: 0.7 to 0.8 N·m.

Wiring Procedure

- 1 Connect the power supply and motor to Connector XA and Connector XB.
- 2 Connect the wired connector to the driver.

Insert the connector securely until it is locked.

Precautions

- Wiring should be performed by a qualified electrician.
- In order to prevent electric shocks, do not connect to a power source until the wiring is complete.
- The power connectors (XA and XB) conduct high voltages and carry a risk of electric shock.

Notes

- When carrying out wiring work, check "9.3.1.4 How to Wire to the Power Connector" for the wiring method of the XA and XB power connectors and Operating Instructions (MINAS A7N Series) "3.2.1.4 Motor Connector Specifications" for the specifications of the motor connector.

8.2 USB Connector X1

Connecting to a PC or host device via USB allows for parameter setting/changing, control status monitoring, error status/history reference, parameter saving/loading, and other operations.

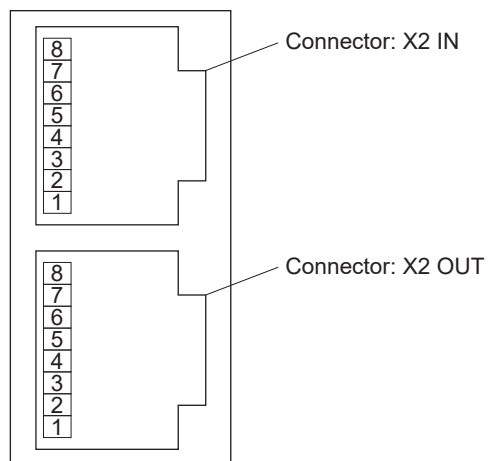
The driver uses USB Type-C connectors. Use a commercially available USB Type-C cable.

8.3 Connector X2 for RTEX

Connect an RTEX communication cable to connector X2 in order to connect to the host device.

This connector is an RJ45 connector used with RTEX and consists of an input X2 IN Connector and an output X2 OUT Connector.

Pinout Diagram



Specifications for each connector shown below.

[X2 IN] connector

Name	Symbol	Connector pin no.	Description
NC	—	1	Connect to pin 1 on TX connector of transmitting-side node.
NC	—	2	Connect to pin 2 on TX connector of transmitting-side node.
Network input +	RX+	3	Connect to pin 3 on TX connector of transmitting-side node.
NC	—	4	Connect to pin 4 on TX connector of transmitting-side node.
NC	—	5	Connect to pin 5 on TX connector of transmitting-side node.
Network input -	RX-	6	Connect to pin 6 on TX connector of transmitting-side node.
NC	—	7	Connect to pin 7 on TX connector of transmitting-side node.
NC	—	8	Connect to pin 8 on TX connector of transmitting-side node.
Frame ground	FG	Shell	Connect to the cable shield.

[X2 OUT] connector

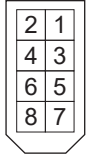
Name	Symbol	Connector pin no.	Description
NC	—	1	Connect to pin 1 on RX connector of receiving-side node.
NC	—	2	Connect to pin 2 on RX connector of receiving-side node.
Network output +	TX+	3	Connect to pin 3 on RX connector of receiving-side node.
NC	—	4	Connect to pin 4 on RX connector of receiving-side node.
NC	—	5	Connect to pin 5 on RX connector of receiving-side node.
Network output -	TX-	6	Connect to pin 6 on RX connector of receiving-side node.
NC	—	7	Connect to pin 7 on RX connector of receiving-side node.
NC	—	8	Connect to pin 8 on RX connector of receiving-side node.
Frame ground	FG	Shell	Connect to the cable shield.

Be sure to use industrial 2P4C or 4P8C shielded twisted pair (STP) Ethernet cables compatible with TIA/EIA-568 CAT5e or higher.

8.4 Safety Function Connector X3

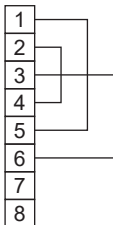
- This is a connector that is compatible with Functional Safety (Safety) specifications, and supports both the multi-function type and application specialized type.
- A safety bypass plug is connected as standard, and set to not use the safety function. If not using the safety function, do not remove the safety bypass plug.
- When using the safety function, remove the safety bypass plug and connect to the host device. For details on the safety functions, see Operating Instructions (MINAS A7N Series) “9 Safety Functions”.

Pinout diagram



Safety bypass plug supplied with driver (internal wiring)

Pin No.



This is the wiring for when no safety circuit is constructed.
Do not connect in this way when using safety functions.

Name	Symbol	Connector pin no.	Description
—	—	1	This terminal is for the safety bypass, so do not connect anything other than the safety bypass plug.
	—	2	
Safety input 1	SF1-	3	• Input 1 for operating the STO function. This input interrupts the power transistor upper arm driving signal. • Make sure that it is connected so that the input circuit photocoupler turns OFF when the STO function is activated.
	SF1+	4	
Safety input 2	SF2-	5	• Input 2 for operating the STO function. This input interrupts the power transistor lower arm driving signal. • Make sure that it is connected so that the input circuit photocoupler turns OFF when the STO function is activated.
	SF2+	6	
EDM output	EDM-	7	This is a monitoring output for monitoring safety function failures. Do not use this monitor output when using the SSU function.
	EDM+	8	
Frame ground	FG	Shell	Connected to the earth terminal inside the servo driver.

For information on safety connectors, see Operating Instructions (MINAS A7N Series) “12.4.8.6 Safety Connector Kit”.

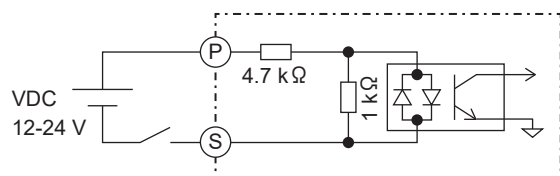
In order to achieve the safety levels SIL3 and PL e, EDM output or SSU function is needed for STO function diagnosis (maximum diagnosis interval is 3 months).

Safety levels are SIL2 and PL d when no STO function diagnosis with EDM output or the SSU function is performed.

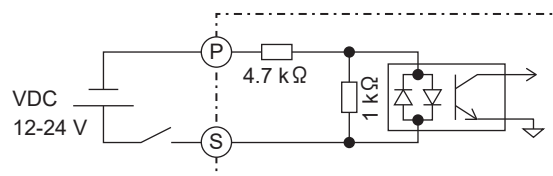
For details on diagnostics via the STO function, see Operating Instructions (MINAS A7N Series) “9.1.4 STO Function Diagnostics”.

Precautions

- The unit will stop immediately if the connection cable to the host device or the safety bypass plug is unplugged during operation.

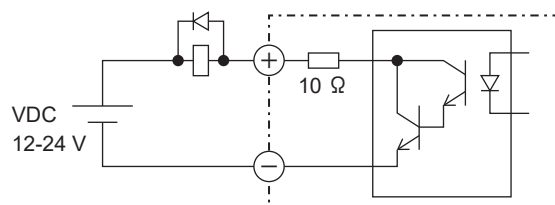
Safety input signal interface

or



P: 4 and 6-pin

S: 3 and 5-pin

EDM output signal interface

+: 8-pin

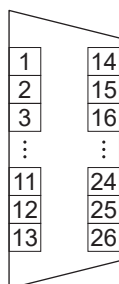
-: 7-pin

- Note the polarity of the control signal power supply (VDC). The servo driver will be damaged if connected in reversed polarity to that shown in the diagram.
- When the relay is directly driven, install a diode in parallel with the relay and in the direction as shown in the figure.

8.5 Parallel I/O Connector X4

This is a connector for external input/output (I/O) to which interface cables (26-strand) are connected.

Pinout diagram



* (View from the cable side)

Connector (Plug): DF02P026F22A1 (Japan Aviation Electronics Industry, Ltd. or equivalent)

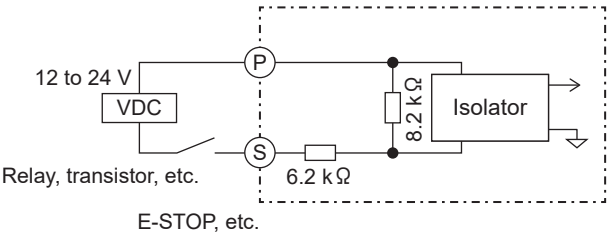
Name	Symbol	Connector pin no.	Description
General-purpose output 1	SO1+	1	Assign the desired function using parameters and output the signal for that function. For example, the external brake release signal outputs the alarm.
	SO1-	2	
General-purpose output 3	SO3+	3	
	SO3-	4	
General-purpose input 1	SI1	5	- SI-COM: Shared terminal for general-purpose inputs 1 to 8. Connect to either terminal of the external DC power supply. - SI1 to 8: When the desired function is assigned using parameters, they operate as signal input terminals for that function. For example, general-purpose motor input, or positive direction over-travel inhibit input.
General-purpose input common	SI-COM	6	
General-purpose input 2	SI2	7	
General-purpose input 3	SI3	8	
General-purpose input 4	SI4	9	
General-purpose input 5	SI5	10	
General-purpose input 6	SI6	11	
General-purpose input 7	SI7	12	
General-purpose input 8	SI8	13	
Absolute encoder battery input	BTP-I	14	Connect the battery for the absolute encoder.
	BTN-I	15	
Signal ground	GND	16	Signal ground.
A-phase output/position comparison output 1	OA+/OCMP1+	17	The following outputs are available using parameter settings. - OA ± and OB ±: Differential output of divided feedback scale signals (A/B-phase). - OCMP1 to 3 ±: Can be used as position comparison output.
	OA-/OCMP1-	18	
B-phase output/position comparison output 2	OB-/OCMP2-	19	
	OB+/OCMP2+	20	
Position comparison output 3	OCMP3+	21	
	OCMP3-	22	
Analog input (NC)	AI (NC)	23	Analog input with 16-bit resolution. (*1)
Signal ground (NC)	GND (NC)	24	Signal ground. (*1)
General-purpose output 2	SO2+	25	Assign the desired function using parameters and output the signal for that function.
	SO2-	26	
Frame ground	FG	Shell	Connected to the earth terminal inside the servo driver.

*1 Analog input and signal ground are supported only by the application specialized type. Do not connect to standard type or multi-function type.

8.5.1 Input Signal

Name	Symbol	Connector pin no.	Description
General-purpose input common	SI-COM	6	- Connect to either the + or - terminal of the external DC power supply (12 to 24 V). - Use a power supply with voltage in the range of 12 V $\pm$5% to 24 V $\pm$5%. - This must be isolated from the primary power supply. Do not connect it to the same power supply. Primary power supply: power supply for motor brake
General-purpose input 1	SI1	5	Functions are allocated using parameters. For details, see the “Technical Reference - Functional Specification”.
General-purpose input 2	SI2	7	
General-purpose input 3	SI3	8	
General-purpose input 4	SI4	9	
General-purpose input 5	SI5	10	
General-purpose input 6	SI6	11	
General-purpose input 7	SI7	12	
General-purpose input 8	SI8	13	

Signal interface



P: 6-pin

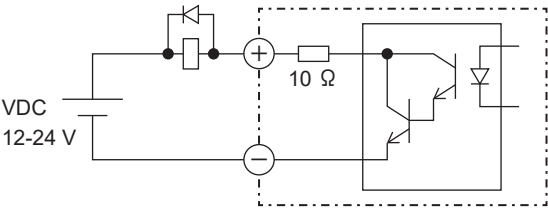
S: 5-, 7-, 8-, 9-, 10-, 11-, 12-, or 13-pin

- The polarity of the control signal power supply (VDC) is random (+ or - polarity).

8.5.2 Output Signal

Name	Symbol	Conne- tor pin no.	Description
General-purpose output 1	SO1+ SO1-	1 2	- Any function can be assigned by using parameters. - The logic of the output pins cannot be changed. - For details on assigning parameters, see Operating Instructions (MINAS A7N Series) "When changing and using the output signal assignment" in "3.2.5.5.1 Control Output Signals" . - For factory standard parameters, see Operating Instructions (MINAS A7N Series) "Default setting assignment status" in "3.2.5.5.1 Control Output Signals" .
General-purpose output 2	SO2+ SO2-	25 26	
General-purpose output 3	SO3+ SO3-	3 4	

Signal interface



+: 1-, 3-, and 25-pin

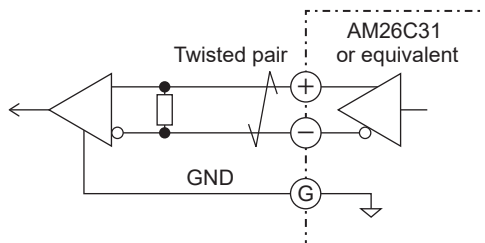
-: 2-, 4-, and 26-pin

- Note the polarity of the control signal power supply (VDC). The servo driver will be damaged if connected in reversed polarity to that shown in the diagram.
- When the relay is directly driven, install a diode in parallel with the relay and in the direction as shown in the figure.

8.5.3 Encoder Output Signal/Position Comparison Output Signal

Name	Symbol	Connector pin no.	Description
A-phase output / Position comparison output 1	OA+ / OCMP1+	17	- Differential output of divided feedback scale signal (A/B phase) (AM26C31 or equivalent). - The division ratio can be set by the parameters. - The ground of the line driver for the output circuit is connected to the signal ground (GND) and is not insulated.
	OA- / OCMP1-	18	
B-phase output / Position comparison output 2	OB+ / OCMP2+	20	- The maximum output frequency is 4 Mpulse/s (after being multiplied by 4). - Pr4.47 "Pulse output selection" can be set to 1 and used as position comparison output. - This differential signal should be received by a line receiver (AM26C32 or equivalent), and a terminating resistor (approx. 330 Ω) should be connected between the line receiver inputs.
	OB- / OCMP2-	19	
Position comparison output 3	OCMP3+	21	Use shielded twisted-pair cables for wiring, and connect the shielded wires to the connector shell.
	OCMP3-	22	
Signal ground	GND	16	- Signal ground. - Always connect the line receiver ground to this terminal.

Signal interface



+: (X4) 17-, 20-, and 21-pin

-: (X4) 18-, 19-, and 22-pin

G: (X4) 16-pin

- Install a terminating resistor (approx. 330 Ω) between line receiver inputs.

8.5.4 Encoder Backup Battery Input

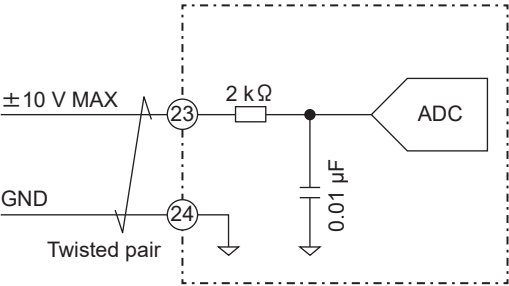
Name	Symbol	Connector pin no.	Description
Battery input for absolute encoder	BTP-I	14	- Connect the battery for the absolute encoder. For details, see "9.3.4 Wiring to Connector X6". BTP-I: Positive+ BTN-I: Negative- - Connect the power for multi-turn data storage to the absolute encoder through BTP-O (3-pin) and BTN-O (4-pin) of encoder connector X6. - Connect the absolute encoder battery using any of the below methods. - Connect to motor side directly - Connect to encoder cable - Connect to this connector
	BTN-I	15	

8.5.5 Analog Input Signal

Analog input and signal ground are supported only by the application specialized type. Do not connect to standard type or multi-function type.

Name	Symbol	Connector pin no.	Description
Analog input	AIN	23	• Analog input with 16-bit resolution. • The maximum allowable input voltage is ± 10 V. • Accuracy of analog input values is not guaranteed. • Assign functions using parameters. For details, see the "Technical Reference - Functional Specification".
Signal ground	GND	24	• Signal ground.

Signal interface



8.5.6 Other

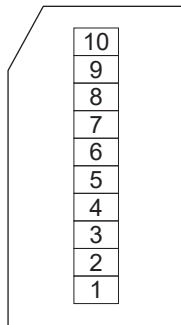
Name	Symbol	Connector pin no.	Description
Frame ground	FG	Shell	• Connected to the earth terminal inside the servo driver.

8.6 External Scale Connector X5

Used to connect to an external scale.

This connector is compatible with both the multi-function type and application specialized type.

Pinout diagram



* Connector (Plug): MUF-PK10K-X (made by J.S.T. Mfg. Co., Ltd.) or equivalent

Name	Symbol	Connector pin no.	Description
External scale power supply output	EX5V	1	Provides power to external scales (for serial signals and ABZ-phase signals). (*1) (*2)
	EX0V	2	Connect with the signal ground using the external scale power supply output ground.
External scale signal input/output (Serial signal)	EXPS	3	Serial signal
	/EXPS	4	Sending and receiving
External scale signal input/output (ABZ-phase signal)	EXA	5	A-/B-/Z-phase pulse signals are received in parallel Supported speed: approx. 4 Mpulse/s (after being multiplied by 4) (*3)
	/EXA	6	
	EXB	7	
	/EXB	8	
	EXZ	9	
	/EXZ	10	
Frame ground	FG	Shell	Connected to the earth terminal inside the servo driver.

*1 EX5V power supply output for external scale is 5 V $\pm$ 5 %, 300 mA MAX.

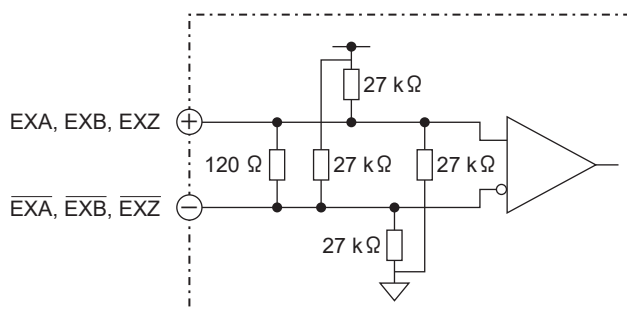
A customer-supplied power supply is necessary if using an external scale with a consumption current higher than this.

Also, some external scales may take time to initialize when powering on. In such a case, it can be handled by adjusting the power-up wait time, which is a function of the servo driver.

*2 If the external scale is powered by an external power supply, the EX5V pin should be open to prevent external voltage from being supplied to this pin.

*3 Note that if the duty ratio of the input signal waveform from the external scale is not 50%, it may not be read correctly.

Signal interface



+: 5-, 7-, and 9-pin

-: 6-, 8-, and 10-pin

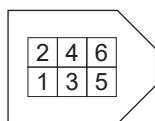
Precautions

- This product supports two types of external scales for serial signals: incremental type and absolute type. Please visit the Panasonic website to check if the external scale of the manufacturer you are using is compatible.
- We recommend a scale ratio of $1/40 \leq \text{External Scale Ratio} \leq 20480$ for external scales.
Increasing the external scale ratio may increase operating noise.

8.7 Encoder Connector X6

Connect the encoder relay cable to the X6 connector.

Pinout diagram



Name	Symbol	Connector pin no.	Description
Encoder power supply output	E5V	1	Encoder power supply.
	E0V	2	Connect with the signal ground using the encoder power supply output ground.
Absolute encoder battery output (*1)	BTP-O	3	Use the battery output (positive+) to connect the connector X4 absolute encoder battery output BTP-I.
	BTN-O	4	Use the battery output (negative-) to connect the connector X4 absolute encoder battery output BTN-I.
Encoder signal input/output	PS	5	Serial signal
	$\overline{\text{PS}}$	6	Sending and receiving
Frame ground	FG	Shell	Connected to the earth terminal inside the servo driver.

*1 When directly connecting the battery to the encoder connection cable, do not connect this terminal to anything.

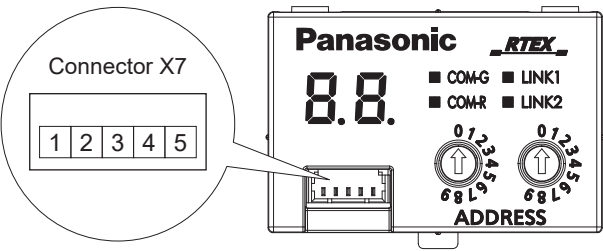
For details on the optional encoder relay cable and connector, see Operating Instructions (MINAS A7N Series) “12.4 Optional Parts”.

8.8 Analog Monitor Connector X7

The connector X7 of the front panel is for monitor output.

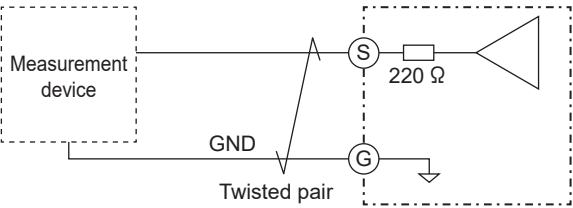
The monitor output has two systems of analog output signals for monitoring.

Output signals can be switched by parameter settings.



Name	Symbol	Connector pin no.	Description
Analog monitor output 1	AM1	1	Outputs analog signals for the monitor. Parameter settings alter the meaning of output signals.
Analog monitor output 2	AM2	2	
Signal ground	GND	3	Connected to the signal ground.
NC	—	4	Do not connect.
NC	—	5	Do not connect.

Signal Interface



- S: 1- and 2-pin
- G: 3-pin
- Output signal amplitude is ±10 V.

9 Wiring and System Configuration

9.1 Wires and Maximum Cable Length

Name	Symbol	Maximum Cable Length (*1)	Wires Used
Main power supply input	L1, L2, L3	—	See “ <i>13 Model Specifications</i> ”.
Control power supply input	L1C, L2C	—	
Motor output	U, V, W, 	20 m	
Earth cable		—	
Encoder connection	X6	10 m	Shielded twisted-pair wire 0.18 mm ² or larger cross-sectional area of core wire
External scale connection (*3)	X5	20 m	
Parallel I/O connection	X4	3 m	
Safety connection (*3)	X3	3 m	0.18 mm ² or larger cross-sectional area of core wire
RTEX connection	X2	100 m (*2)	TIA/EIA-568 CAT5e STP

*1 The above wiring lengths are the maximum lengths used in Panasonic's evaluation environment, and do not guarantee operation in customers' operating environments.

*2 For details, see “*9.3.5 Wiring to Connector X2*”.

*3 Compatible with both the multi-function type and application specialized type. For supported functions by driver type, see Operating Instructions (MINAS A7N Series) “2.1.4.5 Supported Functions (by driver type)”.

9.2 Cable-side connectors

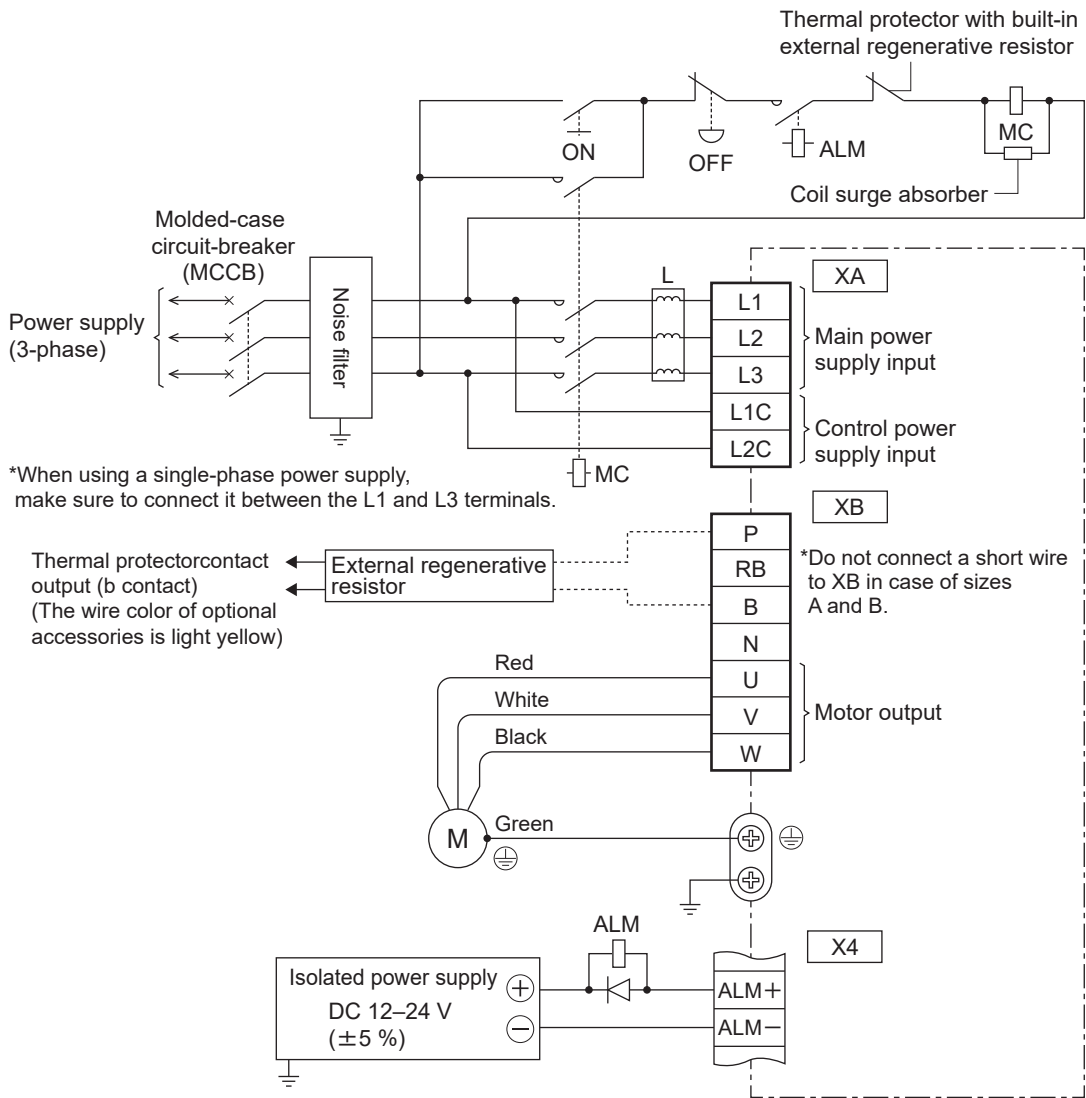
Connector symbol	Product Name	Product number	Manufacturer
X3	Connector	2013595-1	Tyco Electronics Japan G.K.
X4	Solder plug (soldered type)	DF02P026F22A1	Japan Aviation Electronics Industry, Ltd.
	Plug hood	DF02D026B22	
X5	Connector	MUF-PK10K-X	J.S.T. Mfg. Co., Ltd.
X6	Receptacle	3E206-0100 KV	3M Japan
	Shell kit	3E306-3200-008	
X7	Connector	51021-0500	Molex Japan LLC
	Terminal	50058-8020	

* Use the connectors above or an equivalent.

9.3 Precautions for Wiring

9.3.1 Wiring to Power Connectors and Terminal Blocks

9.3.1.1 Sizes A, B (100 V/200 V)



Regenerative resistor connection

Size	Short wire (accessory)	Built-in regenerative resistor	Connection of connector XB	
			When using an external regenerative resistor	When not using an external regenerative resistor
Size A Size B	None	None	Between P and B: Connect the external regenerative resistor.	Between P and B: Keep open.

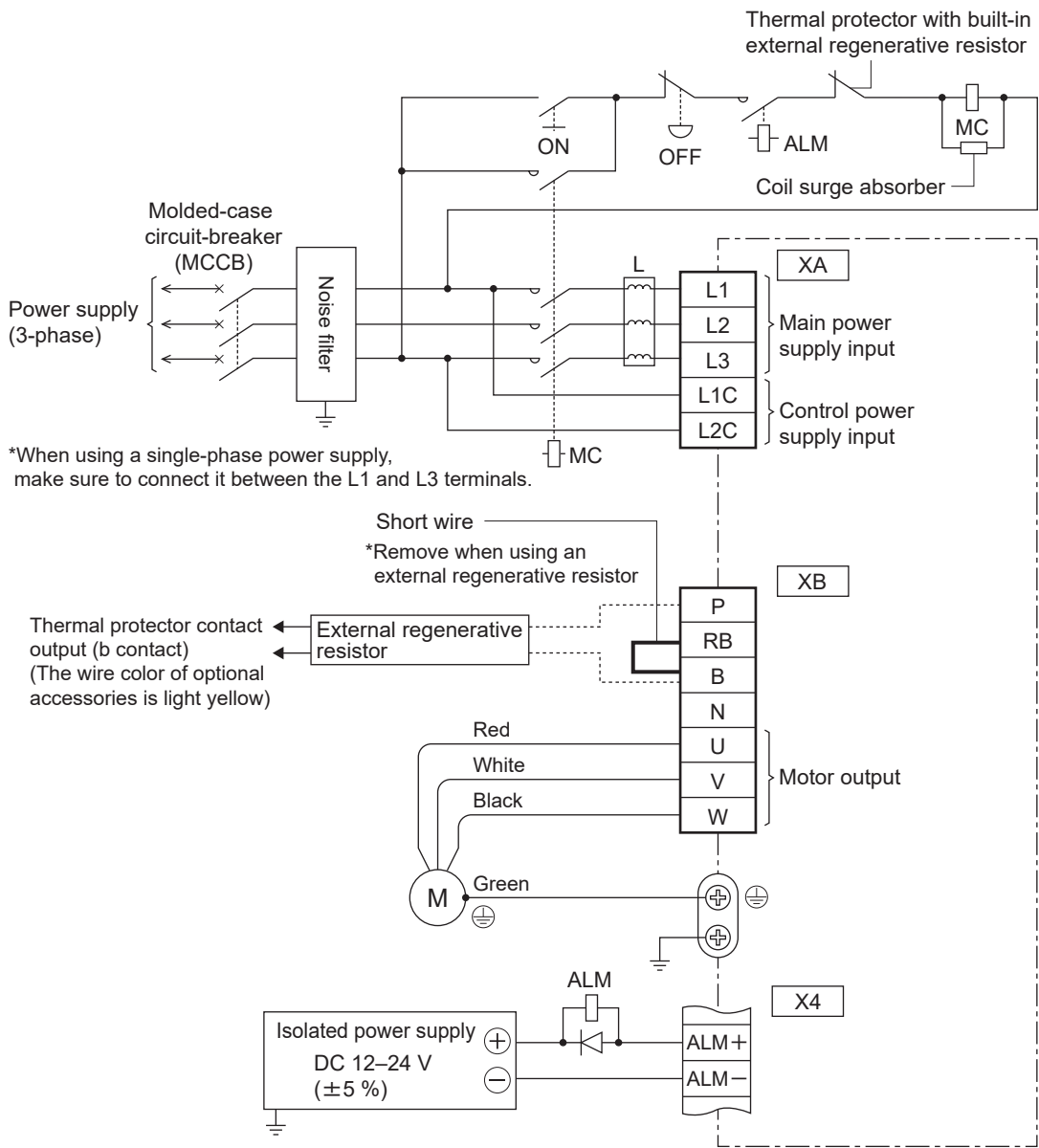
* Connectors X1–X7 are secondary-side circuits (Refer to “6 Part Names”).

The primary-side power supply (power supply for the motor brake) must be isolated.

Do not connect it to the same power supply.

* Refer to “8.1.1 Sizes A, B (100 V/200 V)” for details.

9.3.1.2 Sizes C, D (100 V/200 V)



Regenerative resistor connection

Size	Short wire (accessory)	Built-in regenerative resistor	Connection of connector XB	
			When using an external regenerative resistor	When not using an external regenerative resistor
Size C Size D	Provided	Provided	Between the RB and B: Disconnect the short wire. Between P and B: Connect the external regenerative resistor.	Between RB and B: Short circuit with the short wire.

* Connectors X1–X7 are secondary-side circuits (Refer to “6 Part Names”).

The primary-side power supply (power supply for the motor brake) must be isolated.

Do not connect it to the same power supply.

* Refer to “8.1.2 Sizes C, D (100 V/200 V)” for details.

9.3.1.3 Precautions

- 1 When the servo driver uses a single-phase power supply for sizes A–D, connect the servo driver to main power supply input terminals L1 and L3. Do not connect anything to the terminal L2.
- 2 Insert the connector securely until it is locked.
- 3 Apply the power supply of the voltage indicated on the nameplate.
- 4 Do not reverse-connect the power supply input terminals (L1, L2, and L3) and the motor output terminals (U, V, and W).
- 5 Do not connect the motor output terminals (U, V, and W) to ground or short circuit them.
- 6 Power connectors XA and XB are supplied with high voltage, so do not touch them while the charge lamp is lit. There is a danger of electric shock.
- 7 The short-circuit current of the power supply used should be capable of not more than 5,000 Arms symmetrical amperes, below the maximum input voltage of the product.

If the short-circuit current of the power supply exceeds this, limit the short-circuit current by using a current-limiting device (such as a current-limiting fuse, current-limiting breaker, transformer).

- 8 Unlike an induction motor, an AC servo motor cannot change the rotation direction by exchanging three phases. Make sure to match the motor output terminals (U, V, and W) of the servo driver with the colors (pin number for cannon plugs) of the motor output cables.
- 9 Make sure to connect the earth terminal of the motor to the earth terminal of the servo driver and ground it together with the earth terminal of the noise filter. Also ground the machine body. Use a D model ground (grounding resistance: 100 Ω or less). Tighten the servo driver's ground screw with the appropriate torque specified for each size.

Use an earth cable with a wire diameter equal to or larger than the wire diameter specified in "Model Specifications".

Also, avoid direct contact between aluminum and copper to avoid the effects of electrolytic corrosion.

- 10 Insert surge absorbing circuits for preventing noise to electromagnetic contactors placed around the servo driver, to coils between relay contact points, and to the brake windings of motors with a brake.
- 11 Install a molded case circuit breaker (MCCB) and make sure to shut off the power supply from outside the servo driver in case of an emergency.

When using a residual current device, use one with countermeasures for high frequencies.

- 12 Install a noise filter to reduce terminal noise voltage.
- 13 The power supply for the brake of motors with a brake must be supplied by the customer.
- 14 Ensure that voltage is applied to the power supply only after wiring has been completed.
- 15 External regenerative resistor
 - Sizes A and B do not have built-in regenerative resistors.
 - Sizes C and D have built-in regenerative resistors which are activated by shorting between RB and B.
 - If tripping occurs due to a regenerative overload protection error (Err18.0), an external regenerative resistor must be installed. For external regenerative resistors, remove the short wire or short bar between RB and B and connect it between P and B. In addition, parameters must be used for regenerative resistor settings.

For details, refer to "Technical Reference - Basic Function Specifications".

Optional Parts

The following resistors are recommended for use as external regenerative resistors.

Product name	Optional product number	Manufacturer (*3) format	Specifications					Internal thermal protector operating temperature
			Resistance value	Core cable outer diameter	Mass	Rated power (reference value) (*1)		
						Free air	Fan used (*2)	
			Ω	mm	kg	W	W	
External regenerative resistor	DV0P4280	RF70M	50	φ1.27 (AWG18) Stranded wire	0.1	10	25	140 ± 5 °C
	DV0P4281	RF70M	100		0.1	10	25	B contact
	DV0P4282	RF180B	25		0.4	17	50	Switching capacity (resistance load) 1 A
	DV0P4283	RF180B	50		0.2	17	50	125 V AC 6000 times
	DV0P4284	RF240	30		0.5	40	100	0.5 A 250 V AC 10000 times

*1 Power available without running the built-in thermal protector

Each regenerative resistor has a built-in thermal fuse and thermal protector for safety.

When using a thermal protector, configure the circuit to turn off the power supply (Refer to "9 Wiring and System Configuration").

The built-in thermal fuse may break due to heat dissipation conditions, operating temperature range, power supply voltage, or load fluctuation.

When operating in conditions where the regenerative resistor is likely to generate heat (e.g., when the power supply voltage is high, when load inertia is large, or when deceleration times are short), incorporate it into the device to ensure that the surface temperature of the regenerative resistor remains at less than 100°C and confirm the operation thereof.

*2 If the fan is used for wind speeds of at least 1 m/s

*3 Manufacturer: Iwaki Musen Kenkyusho

Driver and external regenerative resistor combinations are shown below.

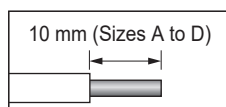
Driver part no.	Driver voltage specifications	Regenerative resistor
		Optional product number
MADN061□□	Single phase 100 V	DV0P4280
MADN081□□		
MBDN121□□		DV0P4283
MCDN201□□		DV0P4282
MADN065□□	Single phase/3-phase 200 V	DV0P4281
MADN085□□		DV0P4283
MBDN125□□		
MCDN205□□		
MDDN405□□		DV0P4284

9.3.1.4 How to Wire to the Power Connector

Follow the procedures below to wire the power supply and motor to connectors XA and XB.

Procedure

1. Strip the wires for use.



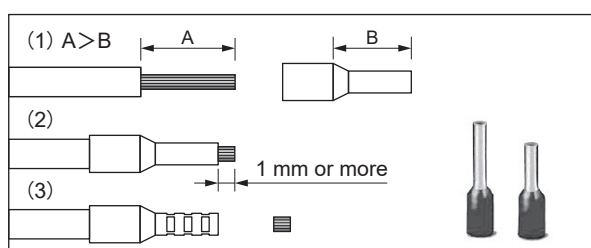
Precautions

- Be careful not to damage or cut the core wire when stripping the wire.

For single wires, refer to the dimensions in the figure above.

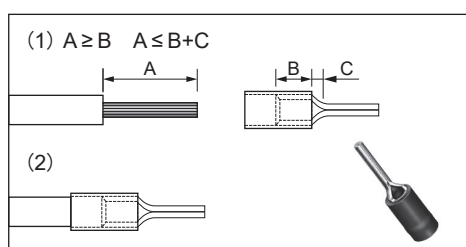
For stranded wires, be sure to use terminals. Examples given for reference below.

(Example) AI Series terminals with insulating sleeves made by Phoenix Contact



- 1 Peel off the sheath so that the conductor portion of the wire protrudes from the tip of the terminal (It should protrude 1 mm or more from the terminal.).
- 2 Insert the wire into the terminal and crimp it with an appropriate crimping tool.
Part No. of the crimping tool: CRIMPFOX U-D66 (1204436) made by Phoenix Contact
- 3 After crimping, cut off the wire conductor portion protruding from the terminal (The allowable protruding length after cutting should be 0 to 0.5 mm.).

(Example) VTUB Series vinyl-insulated terminal made by J.S.T. Mfg. Co., Ltd.



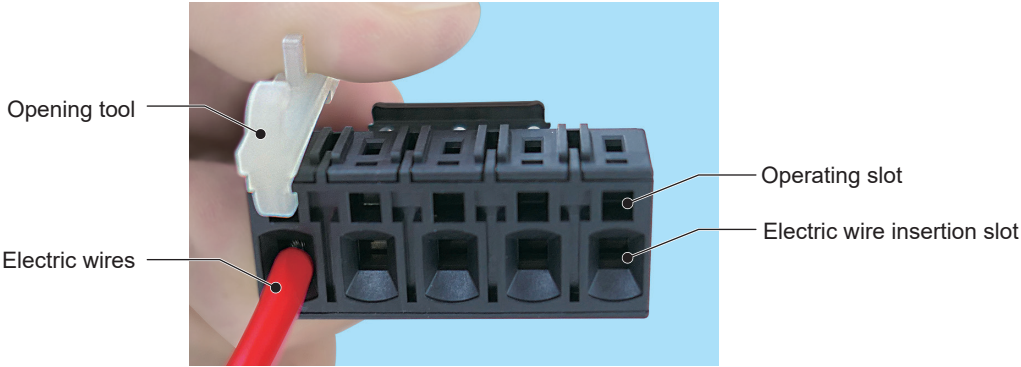
- 1 Peel off the sheath of the wire conductor portion to the length equal to that of the sheath on the terminal.
 - 2 Insert the wire into the terminal and crimp it with an appropriate crimping tool.
Part No. of the crimping tool: YNT-1614 made by J.S.T. Mfg. Co., Ltd.
- When peeling off the sheath of the wire, take care not to damage other portions.
 - If the conductors of the wire stick out from the insulation cover or protrude excessively from the tip of the terminal, accidents such as electric shocks or fires caused by short circuits may result. When crimping the terminal, carefully check the status of the terminal and wire.

The specifications for adaptive wires for connectors and recommended terminals are shown below.

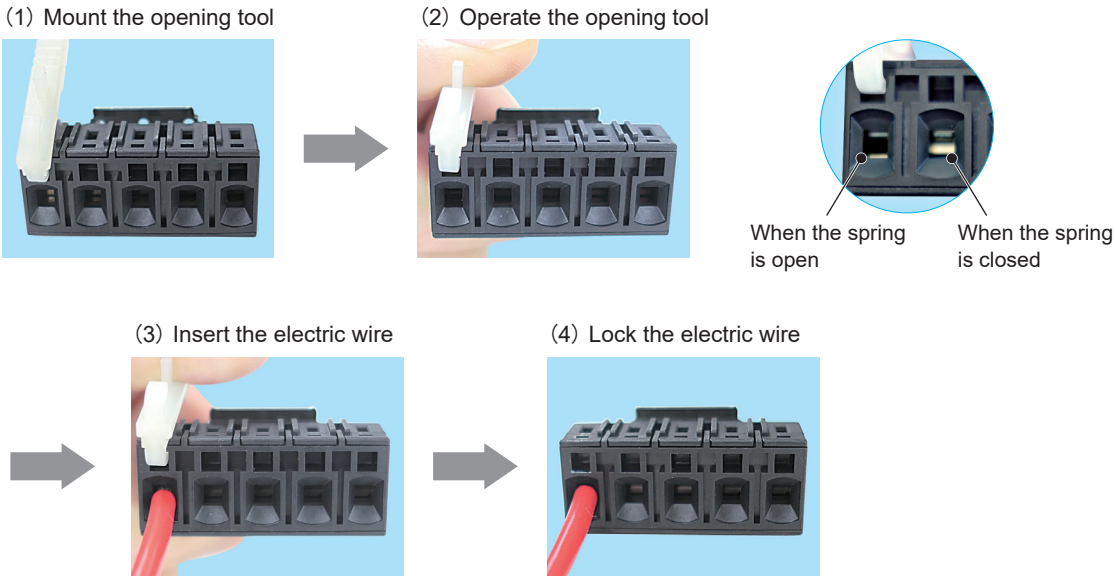
		Sizes A to C (100 V/200 V)	Size D (200 V)
Compatible wires	Conductor size	AWG18 to 14	
	Sheath outline	Φ2.1 to 3.8 mm	
Recommended terminals	Conductor size	AWG18	
	Terminal model number	AI0.75-8GY (Phoenix Contact)	

2. Insert the wire into the connector.

Connector external appearance



Insertion procedure



- 1 Insert the opening tool through the operating slot and attach it to the connector.
- 2 Push the opening tool down to open the spring.
*The wire can be removed by pressing down on the spring in the same manner as the insertion operation.
- 3 While holding the opening tool down, insert the wire straight into the wire insertion hole.
*Make sure that the entire strand section that has been peeled is inserted into the spring opening.
- 4 Release the opening tool and lock the wire. Gently pull on the wires to make sure they are securely connected. Make sure that the wire coating is not pinched by the spring. Remove the opening tool once the wiring has been completed.

Precautions

- Remove the connector from the driver before making the connection.

- Insert only one wire into each wire insertion hole of the connector.
- Keep the opening tool for the next time you may need to use it.
- Since the strip length of the wire depends on the type of wire, decide the optimum strip length according to the processing condition.

9.3.2 Wiring to Connector X4

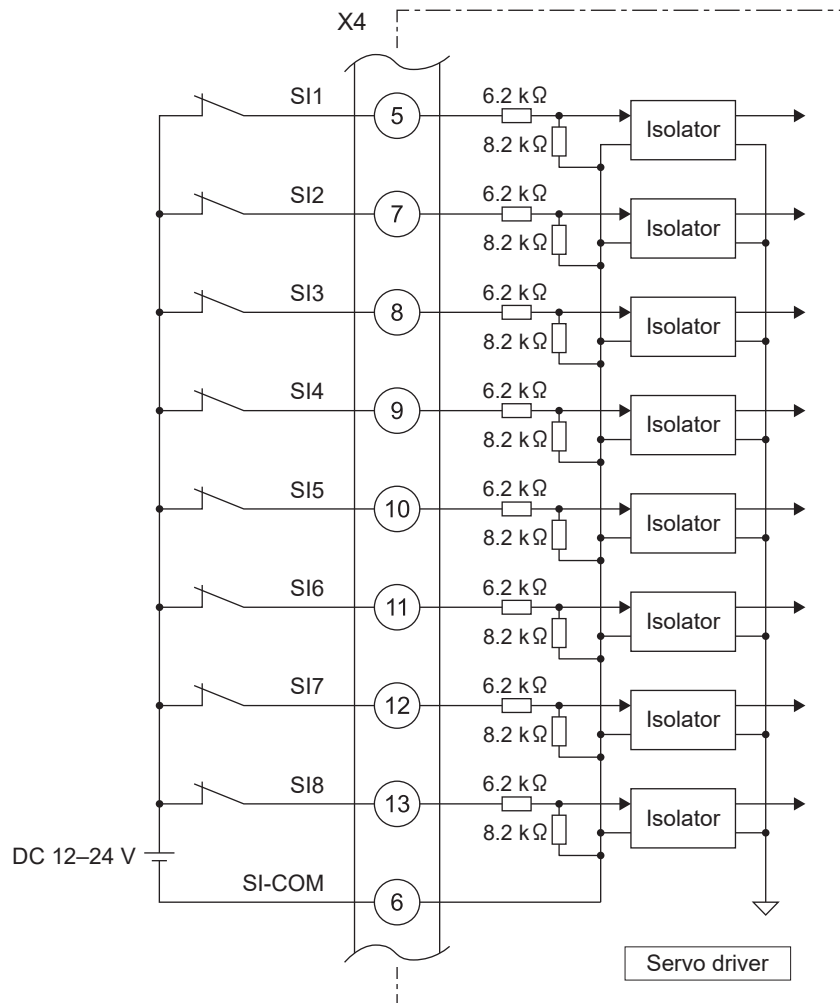
- 1 The customer is required to prepare provide a DC 12 - 24 V control signal power supply for external control to be connected to SI-COM.

It must be isolated from the primary power supply (motor brake power supply).

Do not connect to the same power supply.

- 2 Install peripheral devices as close to the servo driver as possible to minimize the wiring length (within 3 m).
- 3 Keep the cables as far away from the wiring of the power lines (L1, L2, L3, L1C, L2C, U, V, W, $\oplus$) as possible (at least 30 cm). Do not pass the wires through the same duct or bundle them together.

9.3.2.1 Control Input



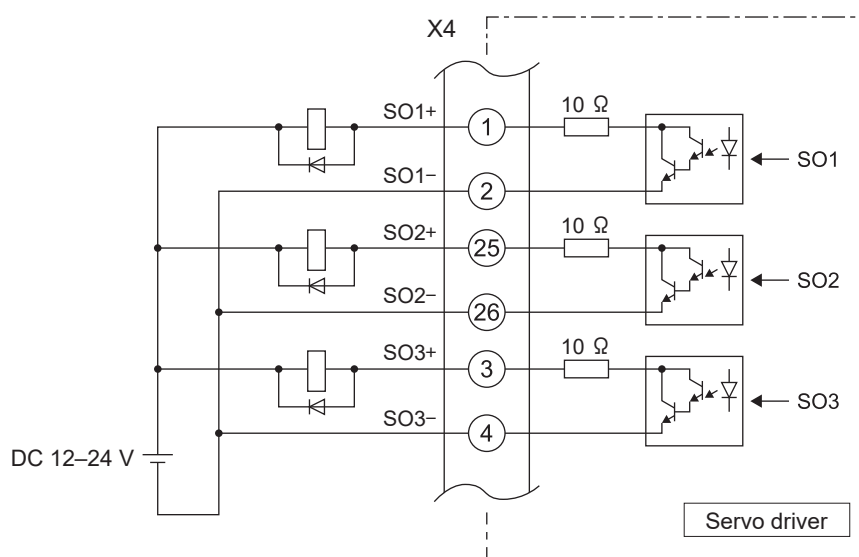
The functions of SI1 to SI8 are assigned using parameters.

For details, refer to "Technical Reference - Basic Function Specifications".

9.3.2.2 Control output

- 1 Be aware of the polarity of the power supply for control signals. Polarity connections contrary to the figure shown above can damage the servo driver.
- 2 If the relay is to be driven directly by the output signal, install a diode in parallel with the relay in the direction shown below. Failure to install a diode or installing it in the opposite direction will damage the servo driver.
- 3 When each output signal is received by a logic circuit such as a gate, ensure that it is not affected by noise.
- 4 The current to be passed through each output must not exceed a rated current of 40 mA, a maximum current of 50 mA, or an inrush current of 90 mA.
- 5 The output circuit is equipped with a limiting resistor (10 Ω).

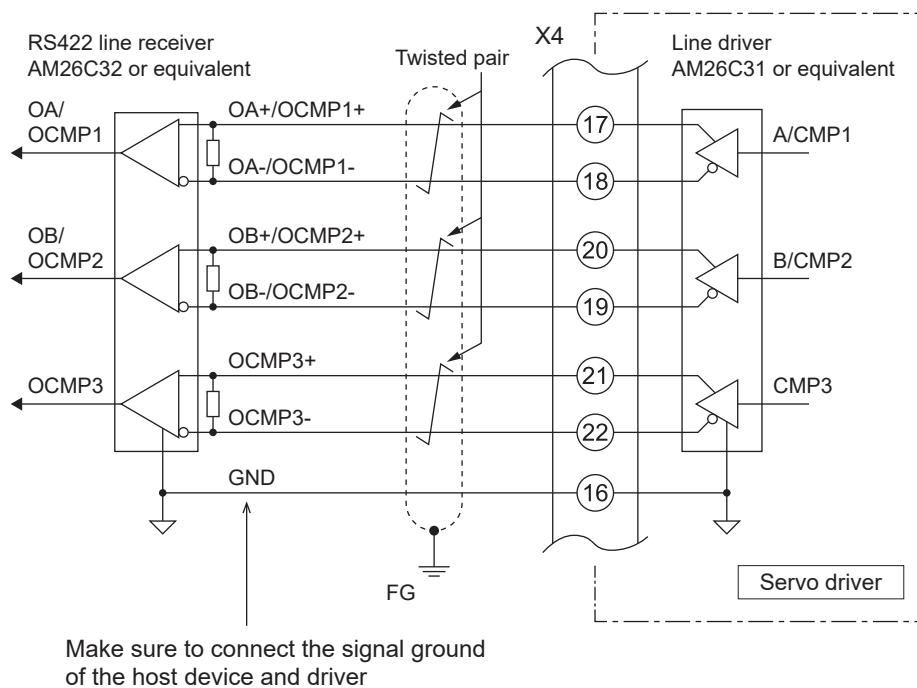
Also, because the output transistor is a Darlington connection, voltage $V_{CE(SAT)}$ is approx. 1 V between the collector and emitter when the transistor is ON, meaning that direct connections are not possible due to the fact that V_{IL} cannot be satisfied with a normal TTL IC.



The functions of SO1 to SO3 are assigned using parameters.

For details, refer to “Technical Reference - Functional Specification”.

9.3.2.3 Encoder output signal/position compare signal output

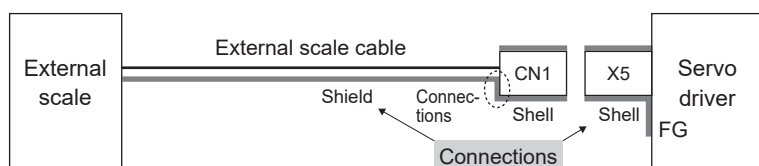


- 1 Use an RS422 line receiver (AM26C32 or equivalent) to receive output pulses. Ensure that an appropriate terminating resistor (approx. 330 Ω) is installed between the line receiver inputs.
- 2 Use at a maximum output frequency of 4 Mpps (after being multiplied by 4) or less.

9.3.3 Wiring to Connector X5

- Wire the signals from the external scale to the X5 connector of the external scale.
- The core wire used to connect to the external scale cable should be a stranded wire of 0.18 mm² or more. Use a shielded twisted-pair wire.
- Keep cable lengths within 20 m. If using a long cable lengths, double wiring (with the wires connected in parallel) is recommended for the cable connecting to the external scale in order to slightly reduce the impact of voltage drops on the 5 V power supply.
- Make sure to connect the jacket of the external scale side cable shield to the shell (FG) of the driver connector X5.
Note that the relay cable shield and the shell (FG) of connector X5 are connected via connecting the shell of the external scale-side cable connector plug CN1 and the external scale-side cable shield.

When there is no relay cable

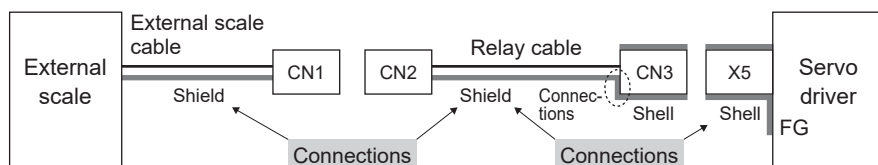


* The connector X5 shell is connected to the servo driver FG.

- Connect the relay cable shield to the external scale-side cable shield when using a relay cable for the external scale connection. Also make sure to connect the relay cable shield to the shell (FG) of the connector X5 on the driver-side too.

Note that the relay cable shield and the shell (FG) of connector X5 are connected via connecting the shell of the relay cable connector plug CN3 and the relay cable shield.

When there is a relay cable

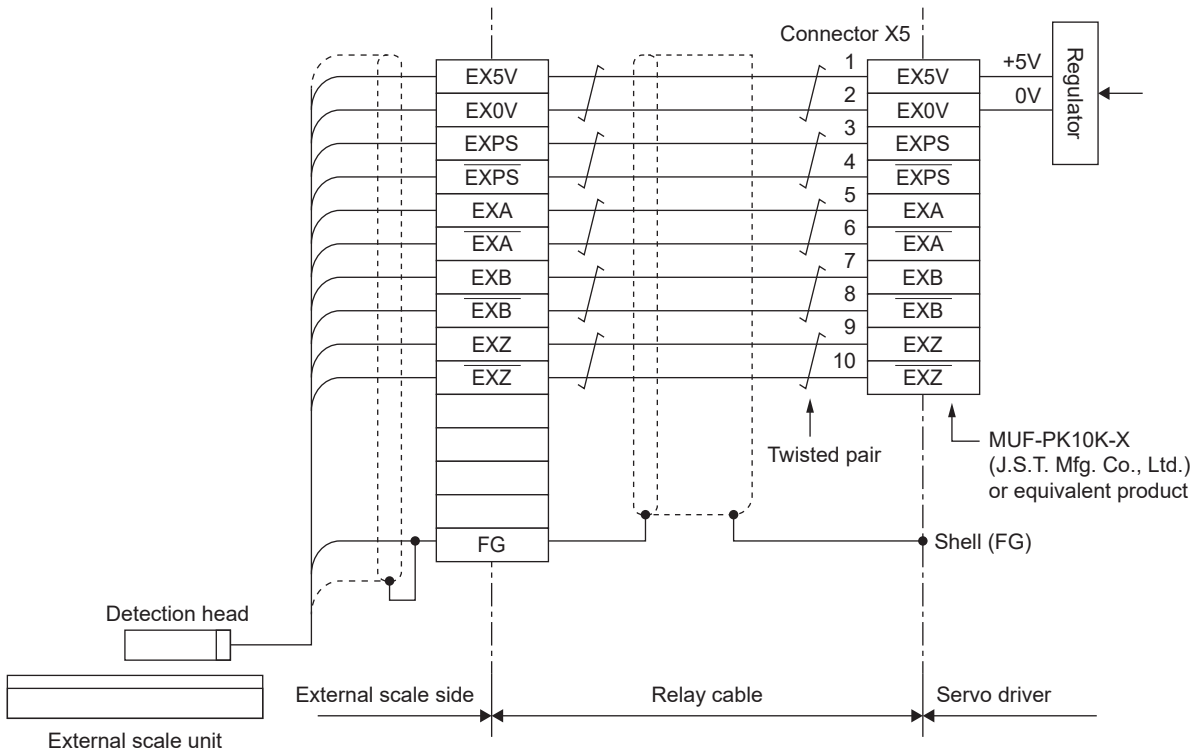


* The connector X5 shell is connected to the servo driver FG.

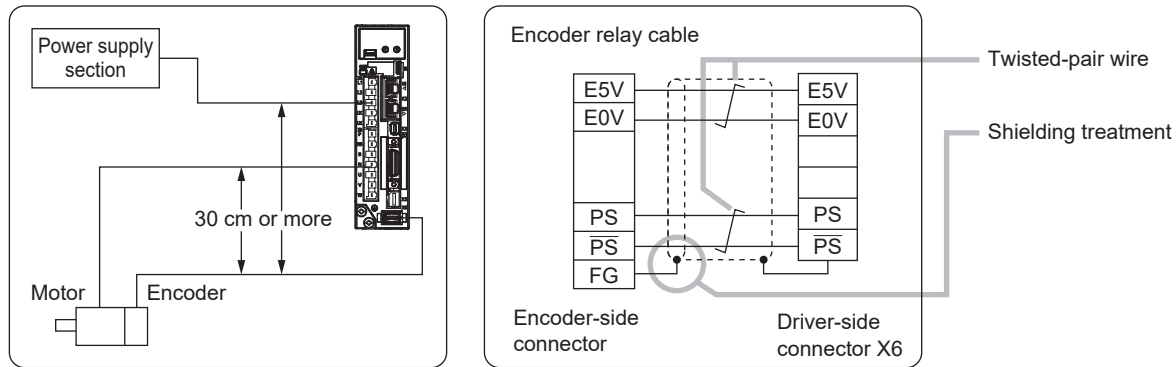
- Keep as much distance from the main circuit (L1, L2, L3, L1C, L2C, U, V, W ⊕) wiring as possible (at least 30 cm). Do not pass the wires through the same duct or bundle them together.
- Do not connect anything to the vacant pins of the X5 connector.
- If the external scale is powered by an external power supply, the EX5V pin should be open to prevent external voltage from being supplied to this pin. Connect the external power supply of 0 V (GND) to EX0V (connector X5: 2-pin) of the driver to eliminate potential difference.

Wiring Example

The wiring diagram of the X5 connector is shown below.



9.3.4 Wiring to Connector X6



- Maintain at least a 30 cm distance from the main circuit wiring (L1, L2, L3, L1C, L2C, U, V, W, $\ominus$). Do not pass the wires through the same duct or bundle them together.

Check the description below if making your own encoder relay cable.

- Refer to the wiring diagram in the figure above for details on the wiring.
- Select cables and wires to ensure that the DC input voltage of the connector on the encoder side is within $5\text{ V} \pm 5\%$.
Reference:

Use stranded, highly bend-resistant, shielded twisted pair wire with a cross-section area of min. 0.18 mm^2 (24 AWG) if the cable length is max. 10 m. Optional accessories are listed in Operating Instructions (MINAS A7N Series) “12.4.4 Encoder Relay Cable”.

- Use twisted-pair wire for the corresponding signal/cable wiring.
- Shield relay cables in the following manner.
 - Driver-side shield jacket
Connect to connector X6 shell
 - Motor-side shield jacket
Connect to FG terminal
- Do not connect anything to the empty terminals of each connector.

9.3.4.1 When Using Multi-turn Data (Constructing an Absolute System)

The absolute encoder is an encoder that can back up motor position information when the power supply is off.

A system using an absolute encoder is called an "absolute system". The absolute system eliminates the need for homing operations when the power is on and can be useful for robots and other applications.

For details on how to use absolute encoders, see Operating Instructions (MINAS A7N Series) “7.2.7 Absolute Encoder”.

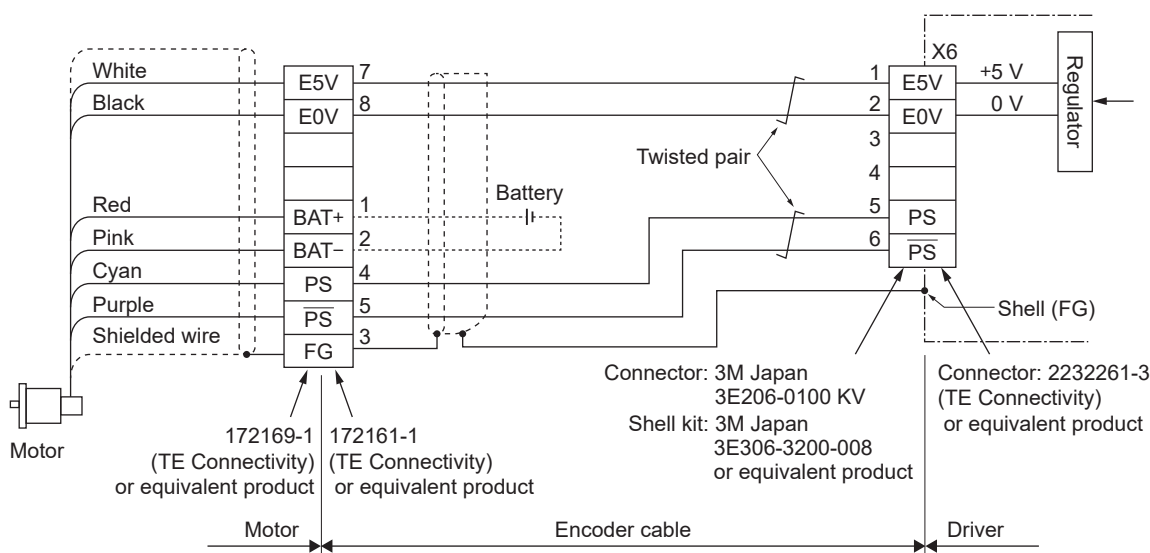
There are two types of absolute encoder as described below.

- Absolute Encoder (Battery Backup)
- Batteryless absolute encoder

The absolute encoder (battery backup) requires the connection of an absolute encoder battery to back up multi-turn data.

Specifications mainly describes this absolute encoder (battery backup).

Lead wire-type motor (for multi-turn data)

MHMG 50 W and 1000 W ($\square 80$)

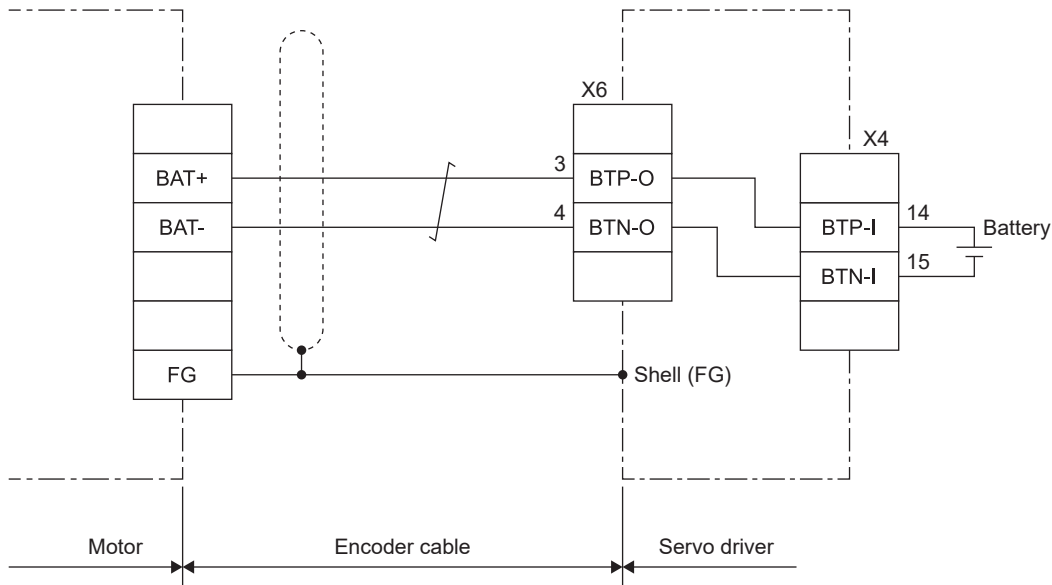
■ Connecting the absolute encoder battery

- 1 Connecting on the motor side using optional accessories (recommended)
 - Connect between encoder connectors BAT+ (1-pin) and BAT- (2-pin) on the motor side as shown in “Lead wire-type motor (for multi-turn data)” . In practice, a relay cable or other means is used between the battery and the BAT+ and BAT- terminals.
 - For the actual connection method, see “9.3.4.3 Precautions for Absolute Encoder Battery Usage” .
- 2 Directly connect to motor side
 - Connect a battery directly between encoder connectors BAT+ (1-pin) and BAT- (2-pin) on the motor side as shown in “Lead wire-type motor (for multi-turn data)” .
 - Batteries and cables must be purchased by the customer. The recommended battery is the Toshiba Lifestyle ER6V 3.6 V. Consult the battery manufacturer for information on the configuration of the battery's peripheral circuit and how to refresh the battery.

3 Connecting on the driver side

- Connect the battery between BTP-I (14-pin) and BTN-I (15-pin) of the X4 connector and to BAT+ (1-pin) and BAT- (2-pin) of the motor via BTP-O (3-pin) and BTN-O (4-pin) of the X6 connector as shown in “When connecting a battery to X4”.
- Batteries and cables must be purchased by the customer. The recommended battery is the Toshiba Lifestyle ER6V 3.6 V. Consult the battery manufacturer for information on the configuration of the battery's peripheral circuit and how to refresh the battery.

When connecting a battery to X4

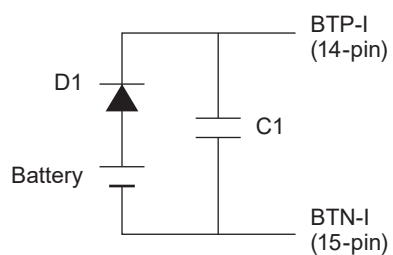


Precautions

- When directly connecting the battery to the motor-side encoder connector (connecting “1”), do not connect anything to connector X6 3-pin and 4-pin.
- For battery boxes and battery connection cables, use the optional relay cable or prepare a cable yourself.

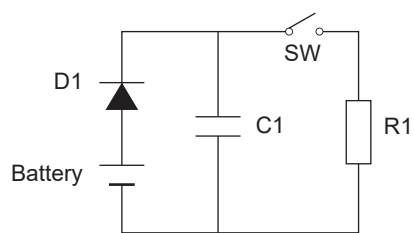
Notes

- The following is the configuration used for optional accessories. The following information is only provided for reference when implementing connections 2 and 3. Please consult the battery manufacturer for the final configuration.
 - Connect a diode to prevent charging and an electric double layer capacitor to reduce voltage drop against the battery, as shown in “Protection Circuit”. Note that with lithium batteries, the voltage may drop temporarily (voltage delay phenomenon) when the battery begins to discharge current. Connect an electric double layer capacitor to reduce this voltage drop. Also, use diodes of a type with low leakage current.
 - As shown in “Battery Refresh Circuit”, connect a resistor when refreshing the battery.
 - Do not connect anything to BTP-O (3-pin) or BTN-O (4-pin) of the X6 connector.

Protection Circuit

C1 (electric double layer capacitor) : 0.1 μ F

D1: Diode (low leakage current)

Battery Refresh Circuit

C1 (electric double layer capacitor) : 0.1 μ F

D1: Diode (low leakage current)

R1: 220 Ω

SW: Switch (closed during refresh)

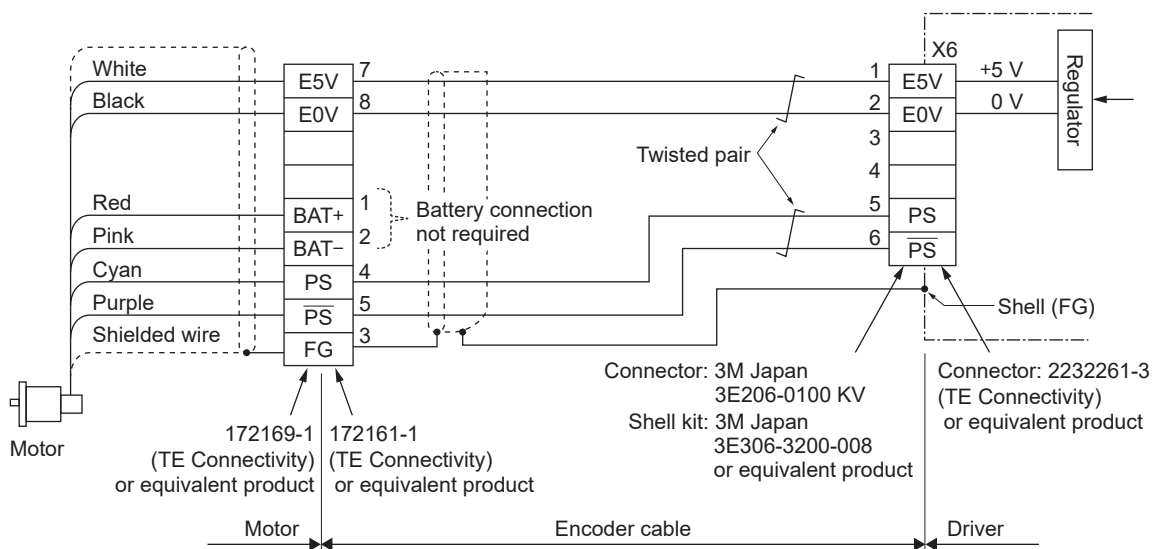
9.3.4.2 If Not Using Multi-Turn Data

When using as an incremental encoder or single-turn absolute encoder.

Lead wire-type motor (without multi-turn data)

When using as an incremental encoder or single-turn absolute encoder.

MHMG 50 W and 1000 W (□80)



9.3.4.3 Precautions for Absolute Encoder Battery Usage

When using the optional battery unit provided by our company, install, replace, and set up (initialize) batteries in an absolute system using an absolute encoder (battery backup) according to the following procedure.

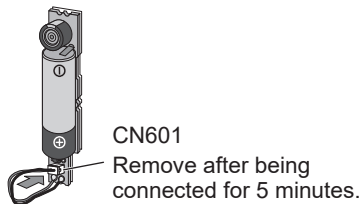
For details of battery product numbers and specifications, see Operating Instructions (MINAS A7N Series) “12.4.9 Battery for Absolute Encoder”.

9.3.4.3.1 How to Install Batteries (How to Install to Encoder Junction Cable)

Follow the procedure below to install batteries.

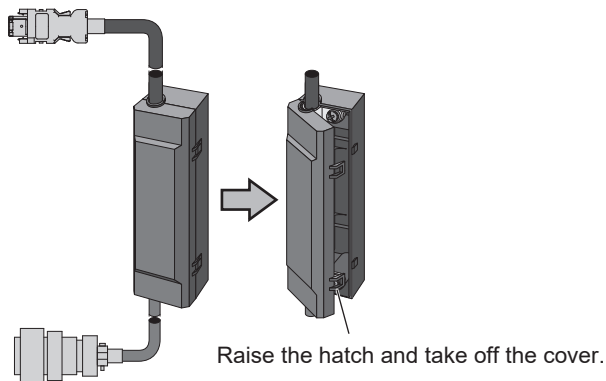
Procedure

1. Perform a refresh of the new battery.

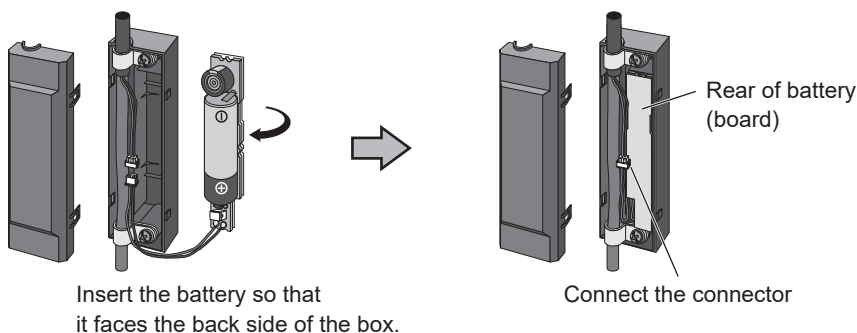


Connect the connector with battery lead wire to CN601 and leave for 5 minutes. After five minutes, remove the connector from CN601.

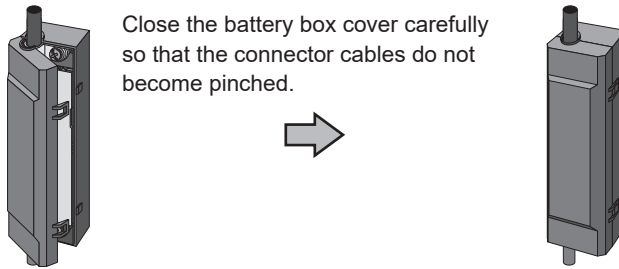
2. Remove the battery box cover.



3. Install the battery to the battery box.



4. Close the cover of the battery box.



Precautions

- Using batteries incorrectly may result in product corrosion due to battery leakage and in damage to the battery. When using batteries, be sure to observe the following.
 - 1 The positive and negative poles of the battery must be correctly oriented and the CN601 connector with lead wires must be correctly connected.
 - 2 Because leaving batteries that have been used for long periods of time or that are no longer usable inside the device may cause problems such as leaks, make sure to replace them promptly. (Replacement is recommended roughly every two years). The electrolyte in the battery is highly corrosive and can corrode peripheral parts. It is also conductive and can cause issues such as short circuits. Therefore, make sure to replace the battery periodically.
 - 3 Do not attempt to disassemble the battery or place it in a fire. Do not attempt to disassemble the battery as it is very dangerous if contents are splashed into your eyes. It may also explode if put into a fire or heated.
 - 4 Do not short-circuit the battery. Do not remove the battery tube. If metal or other such materials come into contact with the positive or negative pole terminals of the battery, a large current flows all at once, which would not only weaken the battery, but also generate severe heat and possibly cause the battery to explode.
 - 5 Do not attempt to charge it. This battery cannot be charged.

- Disposal of batteries after replacement is regulated by municipalities in some cases. Please dispose of batteries according to local regulations.
- Applications for shipment as a hazardous material may be required for air shipments (both passenger and cargo aircraft). Consult with the shipping company when requesting air shipments.

9.3.4.3.2 First Installation of the Battery

After installing and connecting the absolute encoder battery to the motor, set up the absolute encoder. For details, see "9.3.4.3.5 Setup (Initialization) of Absolute Encoder".

We recommend turning the control power supply ON/OFF (battery refresh operation) after installing the battery for the absolute encoder. For details on refreshing the battery, see "9.3.4.3.3 Battery Refresh (Method Using Set-up Support Software (PANATERM ver.7))".

Lithium batteries have a transient minimum voltage (voltage delay phenomenon), which causes a temporary voltage drop when the battery begins to discharge current. A battery error might occur due to this phenomenon if you fail to refresh the battery.

We recommend that the battery be refreshed about once a day after the battery unit is installed.

We also recommend that you refresh the battery even if you have prepared it yourself. Please consult with the battery manufacturer regarding the method of doing so.

"A voltage drop in the battery may be primarily caused by battery life. Battery life may be shortened depending on ambient conditions.

9.3.4.3.3 Battery Refresh (Method Using Set-up Support Software (PANATERM ver.7))

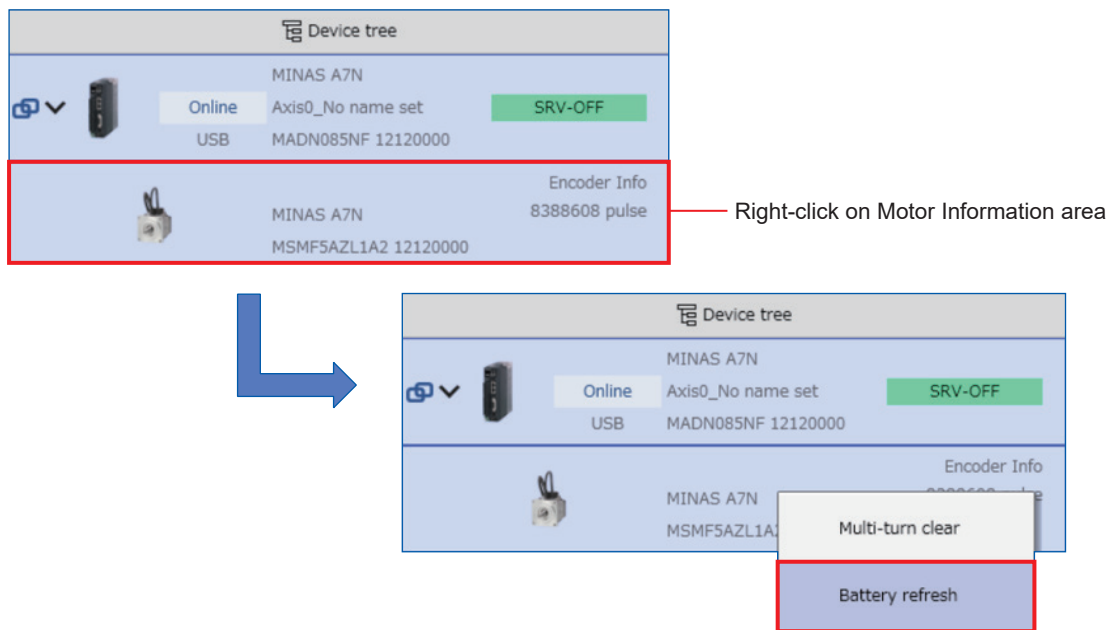
If the battery (battery for absolute encoder) is not discharged continuously, a battery alarm may be triggered. Perform the battery refresh process (forced discharge) to prevent this from happening.

The battery refresh process is required in cases such as the following:

- When replacing with a new battery
- When operating after a period of inactivity

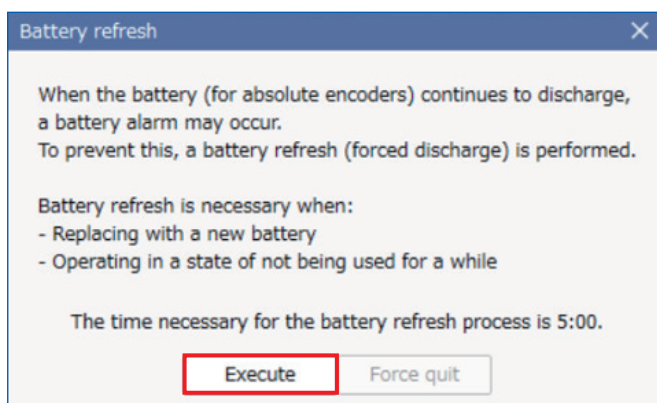
Procedure

1. Right-click on the motor information area of the device tree and select "Battery Refresh" from the context menu.



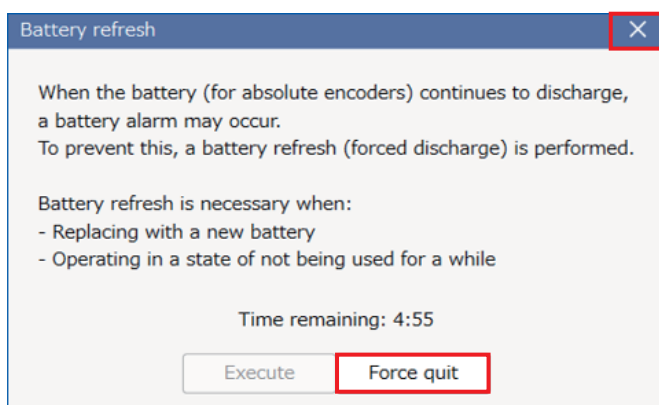
The Battery Refresh dialog box appears.

2. Click the "[Execute]" button.



The remaining time for the battery refresh process will start counting down.

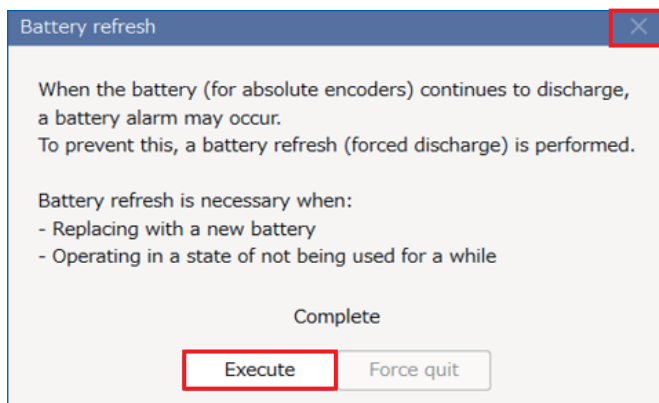
3. The battery refresh process starts.



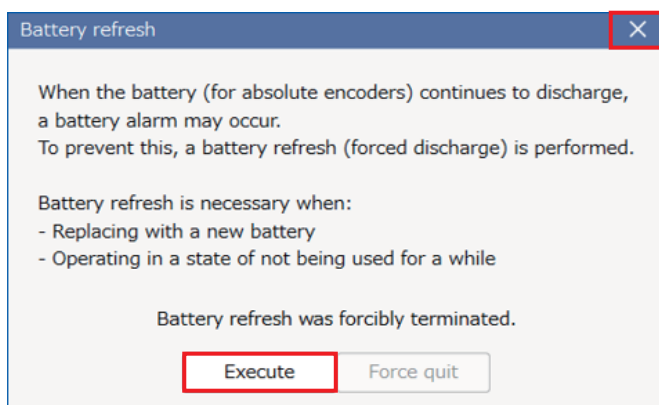
For clicking the [Force Quit] button during the battery refresh process, see “Step 5”. For clicking the [X] button, see “Step 6”.

4. The following screen will appear once the battery refresh process is complete.

Click the [Execute] button to refresh the battery again, or click the [X] button to exit.



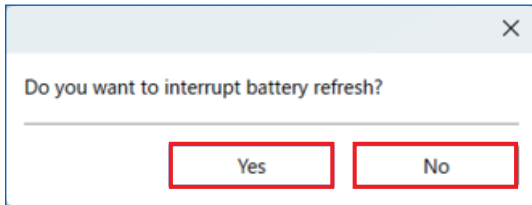
5. Clicking the [Force Quit] button during the battery refresh process forcefully terminates the battery refresh process. Click the [Execute] button to refresh the battery again, or click the [X] button to exit.



6. Clicking the [×] button during battery refresh displays a dialog box.

Clicking the [Yes] button will cancel the battery refresh process and return you to main screen operations.

Clicking the [No] button will return you to main screen operations while the battery refresh process continues.



Precautions

- The battery refresh process is not available for batteryless or incremental encoders.
- The battery refresh process cannot be used in full-closed control mode.
- Be aware that a battery alarm may be triggered. during the battery refresh process.

9.3.4.3.4 Replacement of the Battery

It is necessary to replace the absolute encoder battery if a battery warning occurs.

Replace the battery with the driver control power ON. Data stored in the encoder might be lost if you replace the battery while the control power of the driver is OFF.

After replacing the absolute encoder battery, clear the battery warning. Click the warning clear button on the Set-up Support Software (PANATERM ver.7) monitor display window to clear alarms, or do so via RTEX communication.

Precautions

- If you clear the absolute encoder rather than the alarm, all error and multi-turn data will be cleared together with the warning.

9.3.4.3.5 Setup (Initialization) of Absolute Encoder

Absolute multi-turn data is retained by the absolute encoder battery. When operating the machine for the first time after installing an absolute encoder battery, you must clear the absolute encoder data (multi-turn data) to 0 at the origin by clearing the encoder at the home position. This clearing operation is called "multi-turn data clear".

Multi-turn data is cleared with Set-up Support Software (PANATERM ver.7) or RTEX communication. After performing the multi-turn data clearing operation, turn off the control power supply once, and then turn it back on. For the method and procedure for clearing the multi-turn data using RTEX communication, check the host device specifications.

9.3.5 Wiring to Connector X2

- Be sure to use shielded twisted pair cables (STP) compatible with CAT5e or higher.
- If both ends of the shield are not grounded, EMC characteristics will degrade.

When attaching the connector plug to each end of the cables, ensure that the shielded wire of the cable is connected to the metal shell of the plug.

- For lead wire colors and matching connector terminals, follow TIA/EIA-568B (see [“9.3.5.1 X2 IN/X2 OUT Connections”](#)).

Pins 1-2 and 3-6 are signal wires. Make sure to also wire connectors for the three unused 4-5 and 7-8 pin pairs.

- When using two-pair wires in place of four-pair wires, connect the two-pair wires to pins 1-2 and 3-6 on the connectors, and leave 4-5 and 7-8 unconnected.
- Communication cable length should meet both of the below conditions for use.

1 **Length of each node: max. 100 m**

2 **Total length of cables between all nodes in the communication loop: Max. 200 m**

Both the above conditions should be met for use.

Please contact Panasonic if the condition “2” is to be exceeded.

Cable specifications such as bending characteristics, temperature ranges, and covering materials will vary by manufacturer.

Select a cable that meets the usage conditions at your company.

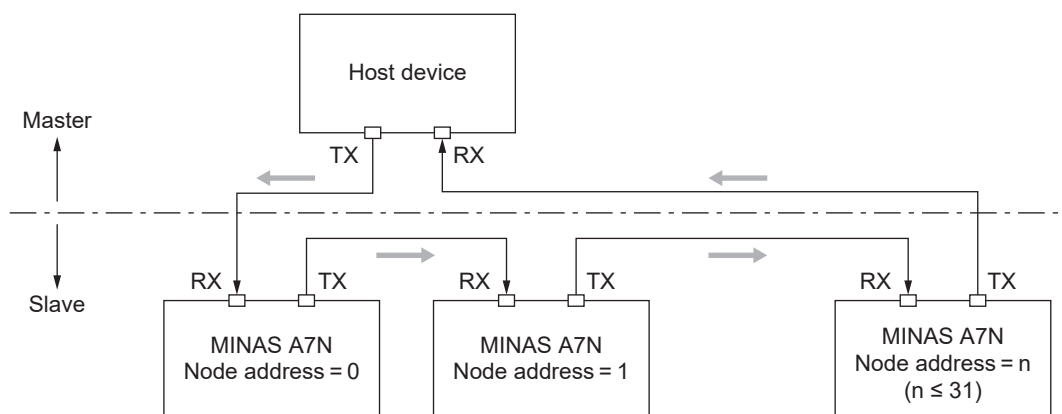
Also select a movable cable that meets the usage conditions at your company.

<Communication cable for evaluations at Panasonic>

Manufacturer: SANWA SUPPLY INC.

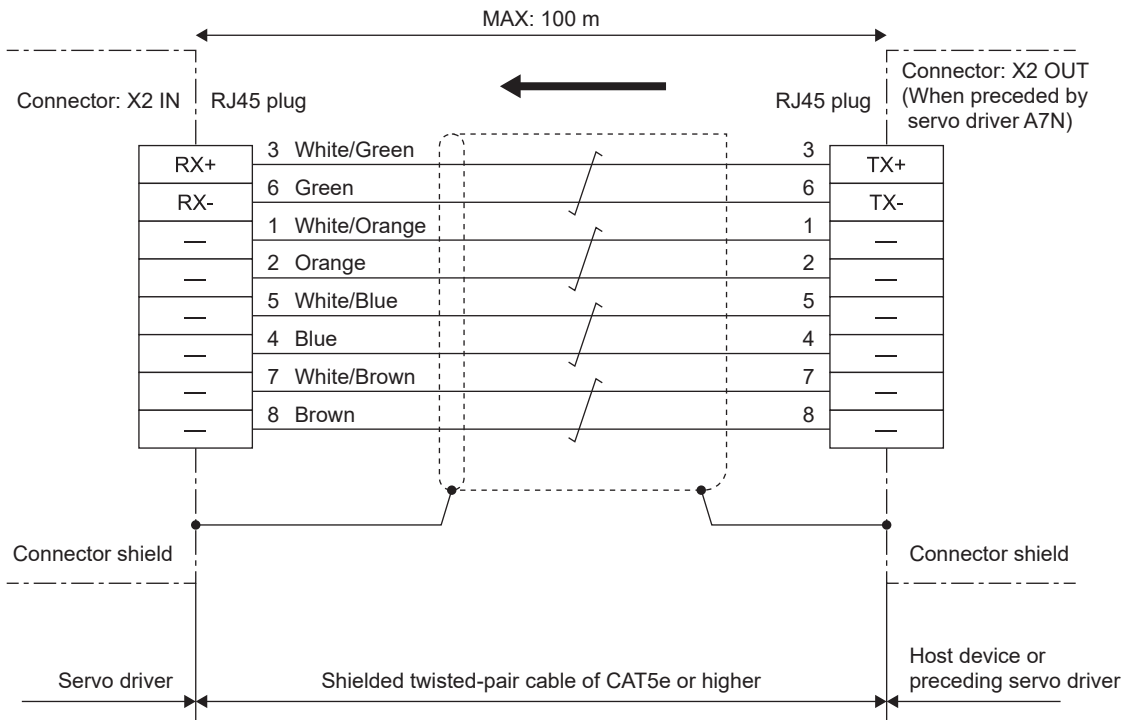
Product number: KB-STP-*LBN CAT5e, STP

System Configuration Diagram

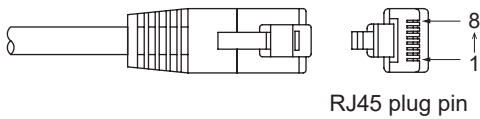
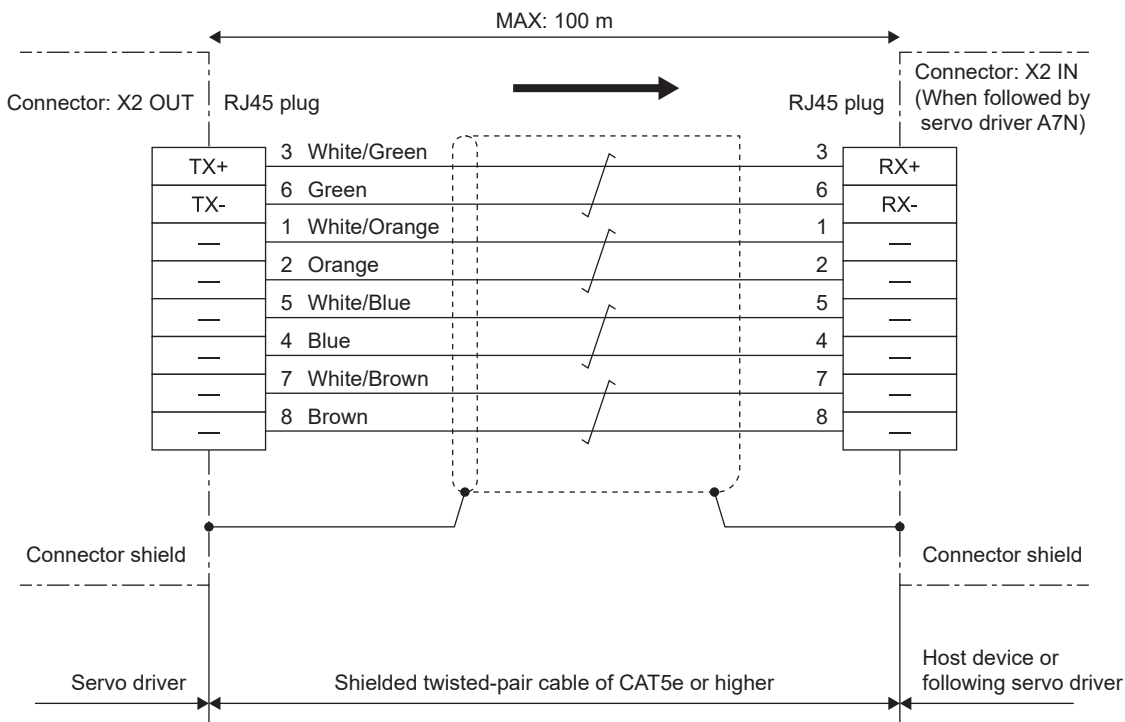


9.3.5.1 X2 IN/X2 OUT Connections

Wiring for X2 IN



Wiring for X2 OUT



9.4 Dynamic Brake

Servo drivers (sizes A–D) feature a built-in dynamic brake for emergency stopping.

The dynamic brake can be activated when the:

- 1 main power supply is off;
- 2 servo is off;
- 3 protection function is activated;
- 4 over-travel inhibit inputs (POT, NOT) of connector X4 are operated.

Under conditions (1) to (4) above, dynamic brake operation or free running can be selected using parameters during deceleration or after stopping.

However, when the control power supply input is off, the dynamic brake continues operating for servo driver sizes A–D.

Because the dynamic brake is only designed to be used for short time periods for emergency stopping, please adhere to the following.

- 1 Do not start or stop the device by turning the servo-on signal (SRV-ON) on or off.
This may damage the dynamic braking circuit incorporated into the servo drive.
- 2 Do not run the motor using an external power source.
If the motor is run externally, it will start acting as an electricity generator. This may cause it to short-circuit during operation of the dynamic brake, resulting in smoke or fire.
Doing so may also cause the dynamic brake to become disconnected, preventing it from functioning.
- 3 If the dynamic brake is applied when the device is operating at a high speed, allow a stop time of approximately 10 minutes.
Failure to do so may cause the dynamic brake to disconnect or the brake to no longer be operable.

9.5 Mounting Orientation and Intervals

- 1 The servo driver is a vertically mounted type. Ensure that it is mounted vertically.
- 2 Servo driver sizes A–D come standard as base-mounted types (rear-mounted).
- 3 If changing the mounting surface of servo driver sizes A–D, use a separately sold mounting bracket. During installation, use the mounting screws provided with the product and the following tightening torque.
 - 1.0 to 1.35 N·m

For optional mounting brackets, see Operating Instructions (MINAS A7N Series) “12.4.10 Mounting Bracket” .

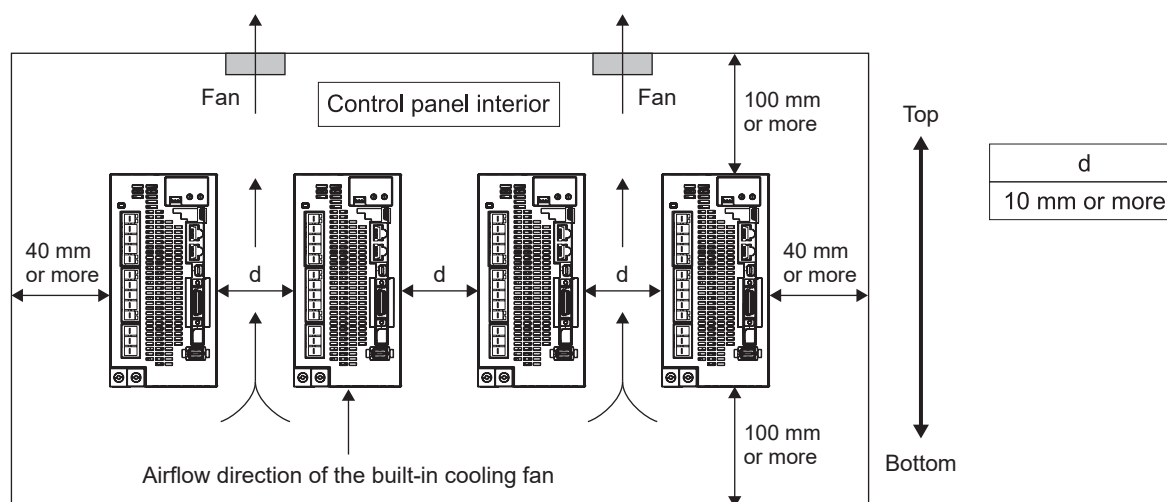
- 4 Select a tightening torque for the mounting screws used to secure your product by considering screw strength and the material to which it will be mounted.

Example: Mounting to steel with steel screws

Sizes A–D: M5 2.7–3.3 N·m

- 5 To ensure effective cooling, ensure surrounding space for airflow.
- 6 Install a fan to achieve a uniform temperature within the control panel.
- 7 Size D frames are equipped with a cooling fan on the bottom.
- 8 Observe the environmental conditions for the control panel as described in [“10.2.1 Installation Environment”](#) .
- 9 The servo driver must be secured to a grounded conductive frame.
- 10 If the areas where the servo driver and fan are to be mounted are painted, removing the paint before installation may help to prevent noise.
- 11 If using custom brackets, the bracket surface must have a conductive plating.
- 12 Measure the ambient temperature of the servo driver at a location that is 50 mm from the side or bottom of the servo driver.

If measuring from a distance of 50 mm is not possible, instead measure at the midpoint of the gap between the obstacle preventing measurement and the servo driver.



Can be used derated when mounting interval d is 1–10 mm. Refer to [“Derated Specifications”](#) for details on derating.

10 Compliance with International Standards

10.1 Conforming Standards

10.1.1 List of Conforming Standards

A list of conforming standards is shown below.



Servo Driver Conforming Standards

Conforming Standard Name		Servo Driver
EU/UK Standards	EMC	EN 55011 (Group1, Class A) EN 61000-6-2 EN 61000-6-4 EN 61800-3 (CategoryC2, Second environment)
	Low Voltage	EN 61800-5-1
	Machinery (Functional Safety)	EN ISO 13849-1:2015 EN 61508 EN IEC 62061 EN 61800-5-2 EN 61326-3-1 IEC 60204-1
UL Standards		UL 61800-5-1 (File No. E164620)
CSA Standards		C22.2 No. 274
Radio Waves Act (South Korea) (KC)		KN 11 KN 61000-4-2, 3, 4, 5, 6, 8, 11

Safety Parameters

Parameters	With SSU diagnostic	With EDM diagnostic	With neither EDM nor SSU diagnostic
Safety integrity level	EN 61508 (SIL3) EN IEC 62061 (maximum SIL 3)	EN 61508 (SIL3) EN IEC 62061 (maximum SIL 3)	EN 61508 (SIL2) EN IEC 62061 (maximum SIL 2)
Performance level	EN ISO 13849-1:2015 Category 3 PL e	EN ISO 13849-1:2015 Category 3 PL e	EN ISO 13849-1:2015 Category 3 PL d
Safety function	EN 61800-5-2 (SIL 3, STO)	EN 61800-5-2 (SIL 3, STO)	EN 61800-5-2 (SIL 2, STO)
Probability of dangerous failure per unit of time	PFH=0.88 ×10 ⁻⁸ [1/h] (% SIL3=8.8 %)	PFH=0.88 ×10 ⁻⁸ [1/h] (% SIL3=8.8 %)	PFH=0.91× 10 ⁻⁸ [1/h] (% SIL2=0.91 %)
Average time to dangerous failure	MTTFd: High (100 years)	MTTFd: High (100 years)	MTTFd: High (100 years)
Average self-diagnosis coverage	DC: Medium 94.6 [%]	DC: Medium 94.6 [%]	DC: Low 68.1 [%]
Mission time	15 years	15 years	15 years
Stop category	IEC 60204-1 (stop category 0)	IEC 60204-1 (stop category 0)	IEC 60204-1 (stop category 0)

For details about diagnostics via SSU and EDM, see Operating Instructions (MINAS A7N Series) “9.1.4 STO Function Diagnostics” .

When exporting, follow the statutory provisions of the destination country.

Precautions

- The standard type does not support the functional safety standards.
- This product is not subject to China Compulsory Certification (CCC).

10.1.2 EU Directives and UK Regulations

Panasonic complies with the low voltage regulations of the EU and UK, in order to facilitate compliance of built-in equipment and devices with EU Directive/UK Regulations.

10.1.3 Compliance with EU Directives/UK Regulations

1 EN55011

Warning: Class A equipment is intended for use in an industrial environment. Conductive and radioactive interference can make it difficult to ensure electromagnetic compatibility in other environments.

Note: This product is not intended for use in a residential environment, and protection against radio reception may be inadequate in such an environment.

2 EN61800-3

This product is not intended for ordinary home use, or for connection to low-voltage public communication circuits. Radio frequency interference may occur when connected to such circuits.

In order to comply with EU EMC Directives and UK EMC Regulations, use a noise filter, a surge absorber, and a ferrite core. Compliance with EU EMC Directives and UK EMC Regulations must be confirmed using final equipment and devices with built-in servo drivers and servo motors.

10.1.4 Compliance with UL Standards

1 Installation Environment

Use in an environment with a pollution degree of 2 as stipulated in IEC60664-1.

Make sure to connect a UL-approved (with LISTED mark) molded-case circuit-breaker (MCCB) and fuse to the main power supply.

Only use copper conductor wires with a temperature rating of 75°C for wiring.

2 Short-Circuit Current Rating (SCCR)

The servo driver of this product is compatible with power supplies with a symmetrical current of 5000 Arms or less at less than the maximum input voltage of the product.

3 Branch Circuit Protection

Implement branch circuit protection in accordance with National Electrical Code (NEC) standards and local standards.

10.1.5 Support for SEMI F47 Momentary Power Failure Standard

The SEMI F47 standard includes requirements for voltage drops in semiconductor manufacturing equipment.

The control power supply for the servo driver complies with the SEMI F47 standard. The main circuit power supply complies with the SEMI F47 standard with no load or light loads.

Precautions

- The single phase 100 V specification servo driver is excluded.
- Always use the actual equipment for evaluation and review with respect to the SEMI F47 standard.

10.1.6 Radio Waves Act (South Korea) (KC)

The servo driver in this product is Class A device (broadcast communication device for business use) under the South Korea Radio Waves Act.

Please be aware of the following precautions before using this product.

A 급 기기 (업무용 방송통신기자재)

이 기기는 업무용(A 급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.

(대상기종 : Servo Driver)

[Reference translation]

Class A device (broadcast communication device for business use)

This device is an electromagnetic wave generating device for business use (Class A), and is intended for non-household use.

Users and distributors should note this fact.

(Applicable model: Servo Driver)

10.1.7 Compliance with China RoHS

Hazardous material content information (English, Chinese)

AC Servo Driver

Applicable models and components

	Applicable models	Components						
		Printed circuit board	Heat sink	Plastic case	Screw	Fan	Cable	Accessory plug
A7 series	MADN * * * * *	●	●	●	●	—	—	●
	MBDN * * * * *	●	●	●	●	—	—	●
	MCDN205 * * * * *	●	●	●	●	—	●	●
	MCDN245 * * * * *	●	●	●	●	●	●	●
	MDDN * * * * *	●	●	●	●	●	●	●
● : With components — : Without components								

Name and content of hazardous material in a product

Name of component	Hazardous material					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent chromium (Cr (VI))	Polybrominated bi-phenyl (PBB)	Polybrominated diphenyl ether (PBDE)
Printed circuit board	×	○	○	○	○	○
Heat sink	○	○	○	○	○	○
Plastic case	○	○	○	○	○	○
Screw	○	○	○	○	○	○
Fan	×	○	○	○	○	○
Cable	○	○	○	○	○	○
Accessory plug	○	○	○	○	○	○

This table is prepared based on the rules specified in SJ/T11364.

○ : The amount of hazardous materials in materials of all applicable components does not exceed the limit specified in GB/T26572.

×

交流伺服驱动器

对象机型及构成部位

	型号	构成部位						
		印刷电路板完成品	散热器	树脂机箱	螺丝	风扇	配线类	附带连接器
A7 系列	MADN*****	●	●	●	●	—	—	●
	MBDN*****	●	●	●	●	—	—	●
	MCDN205*****	●	●	●	●	—	●	●
	MCDN245*****	●	●	●	●	●	●	●
	MDDN*****	●	●	●	●	●	●	●
●：有构成部位 —：无构成部位								

产品中有害物质的名称及含量

部件名称	有害物质					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr (VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
印刷电路板完成品	×	○	○	○	○	○
散热器	○	○	○	○	○	○
树脂机箱	○	○	○	○	○	○
螺丝	○	○	○	○	○	○
风扇	×	○	○	○	○	○
配线类	○	○	○	○	○	○
附带连接器	○	○	○	○	○	○
本表格依据 SJ/T11364 的规定编制。 ○：表示该有害物质在该部件所有均质材料中的含量均在 GB/T26572 规定的限量要求以下。 ×：表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T26572 规定的限量要求。						

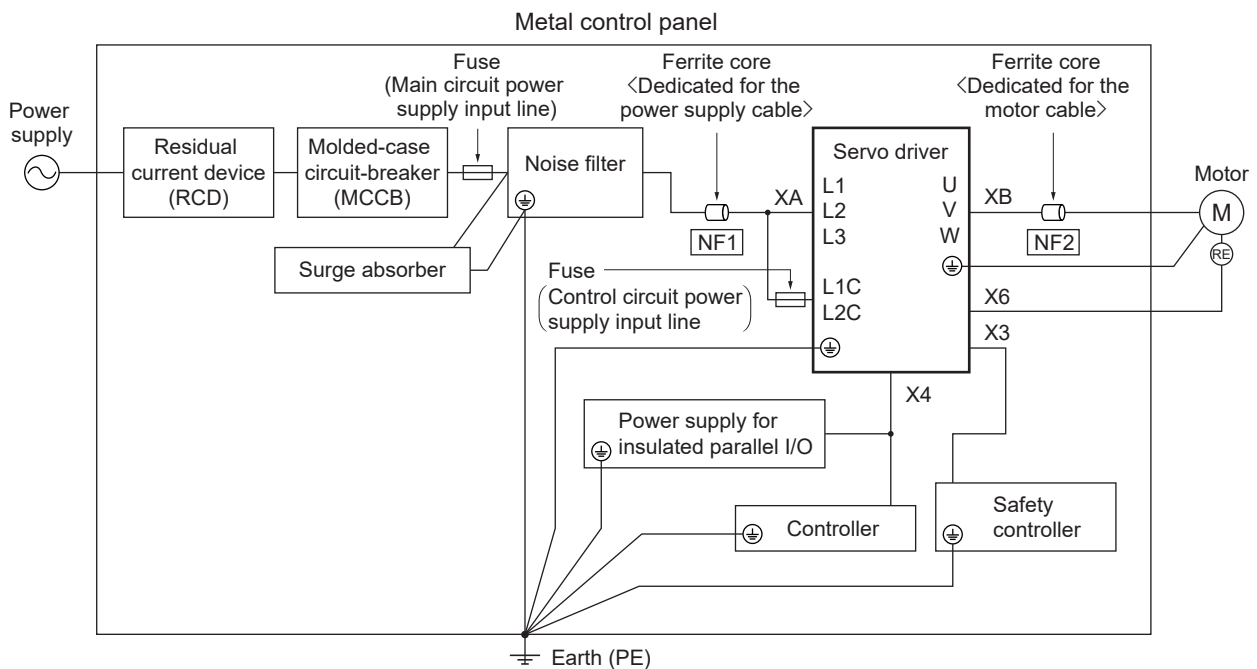
10.2 Configuration of Peripheral Devices

10.2.1 Installation Environment

- Use in an environment with a pollution degree of 2 as stipulated in IEC60664-1.
(Example) Installation in an IP54 metal control panel.
- Make sure to connect an IEC Standard and UL-approved (with LISTED mark) molded-case circuit-breaker (MCCB) and fuse to the main power supply.
- Use a 24 V DC power supply with double insulation or reinforced insulation for the parallel I/O power supply.

Example installation in a metal control panel

100 V/200 V System specifications



The conditions required for compliance with EU EMC Directive/UK EMC Regulations are indicated below.

- Install the servo driver on the metallic casing (control panel).
- Install a noise filter and surge absorber in the power supply line.
- Shielded twisted-pair cables must be used for input/output signal cables and encoder cables. Use tin plated annealed copper wire for the shield.
- Provide a ferrite core, according to the diagram, for each power source cable and motor cable to be connected to the servo driver.
- Cable shields (not shown in the diagram) should be directly grounded to protective earth (PE).

The foregoing are conditions for compliance with EU EMC Directives and UK EMC Regulations, and since installation and wiring conditions are affected by the statuses of connected devices and wiring when incorporated into the equipment used, compatibility with all devices must be confirmed.

Notes

- For details on the structures of the wires, cables, peripheral devices, and control panel in the above diagram, see “[10.2.2 List of Peripheral Devices](#)” to “[10.2.14 Overload Protection and Overheating Protection](#)” from the next section onwards.

Precautions

- Use the parts correctly after reading the respective operating instructions for each, and sufficiently reviewing the precautions. Also, ensure that excessive stress is not applied to the parts.

10.2.2 List of Peripheral Devices

Peripheral devices used together with the servo driver, as well as device installation methods, methods of use, and installation precautions are indicated below. For an installation example, see *“10.2.1 Installation Environment”*.

Servo Driver (*1)	Voltage Specification	Motor rated output	Power Supply Capacity (At rated load)	Molded-case Circuit-Breaker (MCCB) Rated Current	Short protection element (fuse)		Noise filter (*3)	Surge absorber (*3)	Ferrite core (*3)		Electro-magnetic Contactor (Rated carrying current/Open thermal current)
					Main circuit power supply input line	Control circuit power supply input line			Power Supply Cable	Motor cable	
MADN061□□	Single phase 100 V	50 W	Approx. 0.4 kVA	15 A	10 A	1 A	DV0P4170	RSPD-2 50-Q4	—	DV0P1 460	20 A
MADN081□□		100 W	Approx. 0.4 kVA						—		
MBDN121□□		200 W	Approx. 0.5 kVA						—		
MCDN201□□		400 W	Approx. 0.9 kVA		20 A		DV0PM20 042		—		
MADN065□□	Single phase/3-phase 200 V	50 W	Approx. 0.5 kVA		10 A		DV0P4170 (for single phase) / DV0PM20 042 (for 3-phase)	RSPD-2 50-Q4 (for single phase) / RSPD-2 50-U4 (for 3-phase)	—		
		100 W							—		
MADN085□□		200 W	Approx. 0.6 kVA						—		
MBDN125□□		400 W	Approx. 1.0 kVA						—		
MCDN205□□		750 W	Approx. 1.9 kVA		20 A		DV0PM20 042		—		
MDDN405□□ (*2)		1000 W	Approx. 2.4 kVA		35 A		DV0P4220		—		32 A

*1 The "□" in the model number represents the difference in specification.

*2 When using a single-phase power supply, the driver input RMS current must be derated to 12 Arms or less for UL certification.

	Optional Product Number	Manufacturer Product Number	Manufacturer
Surge absorber	—	RSPD-250-U4	Okaya Electric Industries
	—	RSPD-250-Q4	
Ferrite core	DV0P1460	ZCAT3035-1330	TDK Corporation
Noise filter	DV0P4170	SUP-EK5-ER-6	Okaya Electric Industries
	DV0P4220	3SUP-HU30-ER-6	
	DV0PM20042	3SUP-HU10-ER-6	

Notes

- For models with single-phase/3-phase 200 V specifications, select the peripheral devices according to the power source used.
- For details on servo driver product numbers, see *“3 How to Read Product Numbers”* and *“4 Model Product Numbers”*.
- For details on peripheral device specifications, see Operating Instructions (MINAS A7N Series) “12.4 Optional Parts”.

Precautions

- Select a molded-case circuit-breaker (MCCB) noise filter with a capacity that matches the power supply capacity (considering load conditions).

- **Earth terminal**
Use copper conductor wires with a temperature rating of 75°C or higher for wiring.
Protective earth terminals are M4 for sizes A to D.
- The wire diameter of the earth wire cable should be 2.0 mm² (AWG 14) or more for outputs of 50 W to 2.5 kW, 3.5 mm² (AWG 12) or more for outputs of 3.0 kW to 5.0 kW, 8.0 mm² (AWG 8) or more for 7.5 kW, 22 mm² (AWG 4) or more for 15.0 kW, and 38 mm² (AWG 2) or more for 22.0 kW.
- For sizes A to D, use the included dedicated connectors.
- The tightening torque of the screws used for connecting the host controller to connector X4 should be 0.2 ± 0.05 N·m.
The servo driver-side connector may break if you exceed the maximum screw tightening torque.

10.2.3 Electric Wires

For details on electric wires, see [“9.1 Wires and Maximum Cable Length”](#).

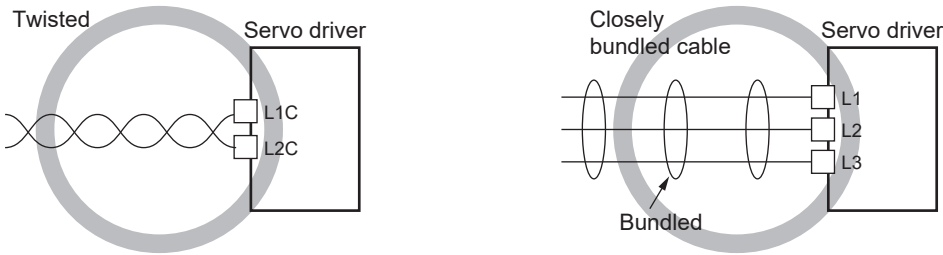
10.2.4 Power Supply

- Use this product in the Overvoltage Category III environment provided for in IEC60664-1.
- Use a parallel I/O power supply product that is CE marking compliant or an insulated 12-24 V DC power supply that is EN standard (EN60950) compliant.
- The power supply voltage specifications are as follows.

Voltage	Servo Driver Size	Voltage Specification	Frequency
100 V	A to C	Single phase: 100 to 120 V, -15% to +10%	50/60 Hz
200 V	A to D	Single phase/3-phase: 200 to 240 V, -15% to +10%	50/60 Hz

Precautions

- Power cable and signal wires must be isolated from each other in wiring.
- Use a sheathed (jacketed) cable, twisted cable (illustrated on the left below), or closely bundled cable (illustrated on the right below) for the power cable.



10.2.5 Molded-Case Circuit-Breaker (MCCB)

- In order to ensure compliance with EU Directives/UK Regulations, make sure to connect a molded-case circuit-breaker (MCCB) between the power supply and noise filter.

The short-circuit current of the power supply used should be a symmetrical current of 5,000 Arms or less, at or below the maximum input voltage of the product.

If the short-circuit current of the power supply exceeds this, limit the short-circuit current by using a current-limiting device (such as a current-limiting fuse, current-limiting breaker, transformer).

- The product's short-circuit protection circuit is not intended to protect branch circuits. Select branch circuit protection in accordance with the NEC standard and local standards.
- This product does not have earth fault protection functions. Please install a molded-case circuit-breaker or residual current device that corresponds to the corresponding earthing system.

Earth fault protection conditions for when using a molded-case circuit-breaker are as shown below. These conditions satisfy the requirements of EN 60364-4-41.

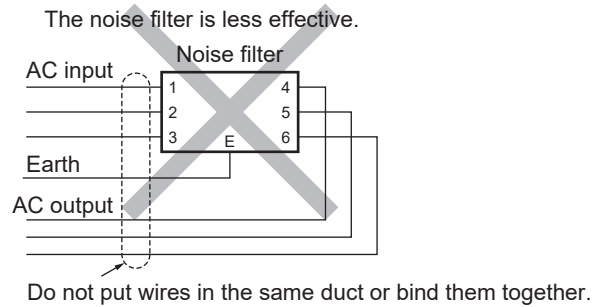
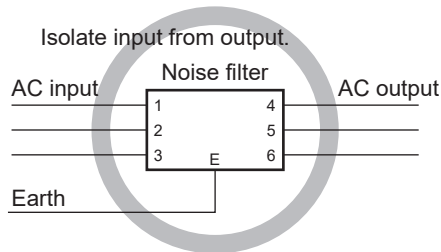
Servo driver	Molded-case circuit-breaker			Voltage to ground [V]	Maximum allowable fault loop impedance (Ω)
	Rating [A]	Recommended model	Manufacturer		
MADN061□□	15	BW50RAGU	Fuji Electric Co., Ltd.	100	0.25
MADN081□□	15	BW50RAGU	Fuji Electric Co., Ltd.	100	0.31
MBDN121□□	15	BW50RAGU	Fuji Electric Co., Ltd.	100	0.31
MCDN201□□	15	BW50RAGU	Fuji Electric Co., Ltd.	100	0.42
MADN065□□	15	BW50RAGU	Fuji Electric Co., Ltd.	115	0.33
MADN085□□	15	BW50RAGU	Fuji Electric Co., Ltd.	115	0.39
MBDN125□□	15	BW50RAGU	Fuji Electric Co., Ltd.	115	0.42
MCDN205□□	15	BW50RAGU	Fuji Electric Co., Ltd.	115	0.50
MDDN405□□	15	BW50RAGU	Fuji Electric Co., Ltd.	115	0.51

Notes

- Select a molded-case circuit-breaker (MCCB) with a capacity that matches the power supply capacity (considering load conditions).

10.2.6 Noise Filter

- Select a noise filter with a capacity that matches the power supply capacity (considering load conditions).
- For the detailed specifications of each noise filter, contact the manufacturer.
- Consult with the manufacturer of the noise filter if using multiple servo drivers and installing one noise filter for all power supplies.
- Noise immunity is reduced if the same wiring is used for input and output (Illustrated on the right below.).
- Isolate input from output (Illustrated on the left below.).



Notes

- For details of optional product numbers and specifications, see Operating Instructions (MINAS A7N Series) "12.4.1 Noise Filter" .

10.2.7 Surge Absorber

- Install the surge absorber on the primary side of the noise filter.
- For details of optional product numbers and specifications, see Operating Instructions (MINAS A7N Series) "12.4.2 Surge Absorber" .

Precautions

- Always remove the surge absorber before high voltage insulation testing machinery and equipment. Failure to do so may result in damage to the surge absorber.

10.2.8 Ferrite Core

- Ensure all cables (motor cables, encoder cables, interface cables, USB cables) have a ferrite core.

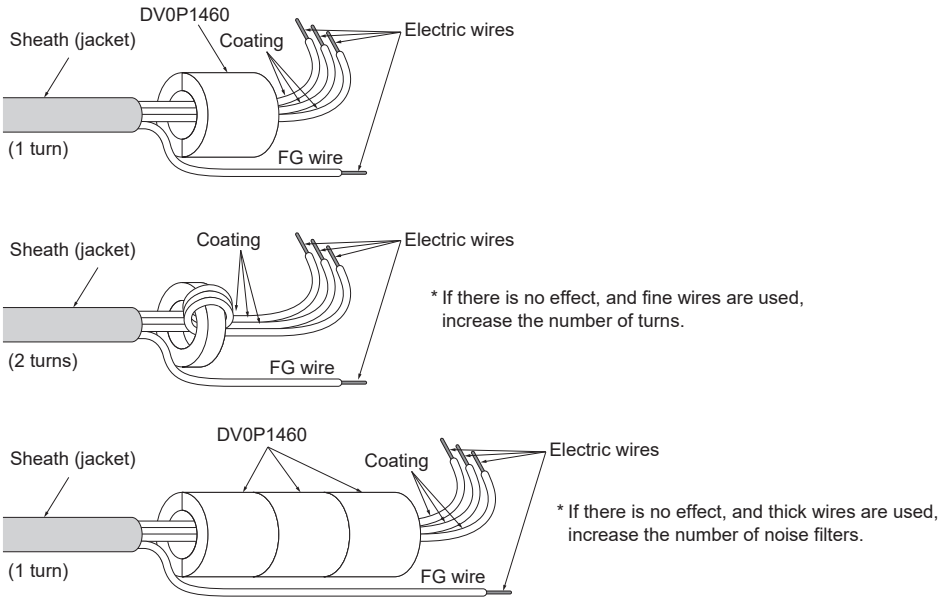
Symbol (*1)	Place of use	Applicable size	Option product number	Manufacturer product number	Manufacturer	Number required
NF1	Power supply cable	(100 V) A, B, C (200 V) A, B, C, D	—	—	—	0
NF2	Motor cable	(100 V) A, B, C (200 V) A, B, C, D	DV0P1460	ZCAT3035-1330	TDK Corporation	1 (*2)

*1 For symbols, see “10.2.1 Installation Environment” .

*2 For ferrite cores, attach the motor cables (U, V, and W) together into a single unit using 1 turn (once through).

- Attach ferrite cores according to the following procedure.

Signal cables	Wind the ferrite cores for the required number of turns.
Motor cable	When attaching ferrite cores (including those that are power line-dedicated) to Panasonic’s optional cables, remove the sheaths (jackets) from the parts attached, and combine the motor cables (U, V, and W) to obtain a noise reducing effect. If there is no effect, take measures such as increasing the number of ferrite cores (including those that are power line-dedicated) (See the figure below.).
Encoder wires	Wind the ferrite cores for the required number of turns.



10.2.9 Residual Current Device

- Install a residual current device (RCD) on the primary side of the power supply.
- Use IEC 60947-2/JISC 8201-2-2 Type B (DC sensing type) for the residual current devices.
- This product does not have earth fault protection. Please install a molded-case circuit-breaker or residual current device that corresponds to the corresponding earthing system.

Earth fault protection conditions for when using residual current devices are as shown below. These conditions satisfy the requirements of EN 60364-4-41.

Ensure your TT system complies with your local national or regional laws and regulations. The rated sensed current and loop impedance of residual current devices may sometimes be stipulated by law or regulation. Further, Type B residual current devices may be mandatory.

Servo driver	Residual current device				Voltage to ground [V]	Maximum allowable loop impedance [Ω]
	Rating [A]	Rated sensed current [mA]	Recommended model	Manufacturer		
MADN061□□	15	30	EW50RAGU	Fuji Electric Co., Ltd.	100	360
MADN081□□	15	30	EW50RAGU	Fuji Electric Co., Ltd.	100	360
MBDN121□□	15	30	EW50RAGU	Fuji Electric Co., Ltd.	100	360
MCDN201□□	15	30	EW50RAGU	Fuji Electric Co., Ltd.	100	360
MADN065□□	15	100	EW50RAGU	Fuji Electric Co., Ltd.	115	207
MADN085□□	15	100	EW50RAGU	Fuji Electric Co., Ltd.	115	207
MBDN125□□	15	100	EW50RAGU	Fuji Electric Co., Ltd.	115	207
MCDN205□□	15	100	EW50RAGU	Fuji Electric Co., Ltd.	115	207
MDDN405□□	15	100	EW50RAGU	Fuji Electric Co., Ltd.	115	207

10.2.10 Earth

- To prevent electric shock, make sure to connect the earth terminal (⊕) of the servo driver to the earth (PE) of the control panel.
- Do not tighten the connection to the protective earth terminal (⊕). Two earth terminals are provided.

10.2.11 Control Panel Structure

- If there is a gap at a cable inlet/outlet, the mounting hole of operation panel, a door, etc., radio waves may leak out of or penetrate into the control panel. In order to prevent this, please observe the following in designing or selecting the control panel.
 - The control board should be made of metal and ensure that it is electrically conductive.
 - The control board should not have electrically floating conductive parts.
 - The units mounted inside the case should be connected to the case.

10.2.12 Control Input/Output Signal Noise Immunity Enhancement

- When noise is introduced to the control input/output, it causes displacement and input/output signal malfunction.
- Connectors X1 to X7 are used for the secondary circuit.
The 24 V DC power supply for brakes requires insulation. Do not connect to the same power supply. Do not connect a ground wire. This may cause erroneous operation of the input/output signal.
- The control power source should be completely isolated from external operating power sources. Take care not to connect the ground wire of the control power source to that of external power source.
- Use a shielded cable as the signal cable, and earth both of the shielded ends.

10.2.13 Installing Short Protection Elements

- Connect fuses on the main circuit power supply input and control circuit power supply input lines. For details on fuse insertion locations, see below.
- A, B Frames: Operating Instructions (MINAS A7N Series) "3.2.1.1.2 Overall Connection Example" "3.2.1.1.3 Key Points on Wiring"
- C, D Frames: Operating Instructions (MINAS A7N Series) "3.2.1.2.2 Overall Connection Example" "3.2.1.2.3 Key Points on Wiring"
- Refer to the descriptions in the below table when selecting fuse rated currents. If compliance with UL61800-5-1 is required, use UL Listed fuses.

Servo driver	Main circuit power supply input line fuse				Control circuit power supply input line fuse			
	Rating	Options			Rating	Options		
		UL class	Recommended model	Manufacturer		UL class	Product number	Manufacturer
MADN061□□	10 A	CC	LP-CC-10	COOPER BUSSMANN LLC	1 A	CC	LP-CC-1	COOPER BUSSMANN LLC
MADN081□□	10 A	CC	LP-CC-10	COOPER BUSSMANN LLC	1 A	CC	LP-CC-1	COOPER BUSSMANN LLC
MBDN121□□	10 A	CC	LP-CC-10	COOPER BUSSMANN LLC	1 A	CC	LP-CC-1	COOPER BUSSMANN LLC
MCDN201□□	20 A	CC	LP-CC-20	COOPER BUSSMANN LLC	1 A	CC	LP-CC-1	COOPER BUSSMANN LLC
MADN065□□	10 A	CC	LP-CC-10	COOPER BUSSMANN LLC	1 A	CC	LP-CC-1	COOPER BUSSMANN LLC
MADN085□□	10 A	CC	LP-CC-10	COOPER BUSSMANN LLC	1 A	CC	LP-CC-1	COOPER BUSSMANN LLC
MBDN125□□	10 A	CC	LP-CC-10	COOPER BUSSMANN LLC	1 A	CC	LP-CC-1	COOPER BUSSMANN LLC
MCDN205□□	20 A	CC	LP-CC-20	COOPER BUSSMANN LLC	1 A	CC	LP-CC-1	COOPER BUSSMANN LLC
MDDN405□□	35 A	J	LPJ-35SP	COOPER BUSSMANN LLC	1 A	CC	LP-CC-1	COOPER BUSSMANN LLC

10.2.14 Overload Protection and Overheating Protection

- The servo driver has a built-in servo motor overload protection function. The overload protection function operates on the basis of specified time characteristics at 115% or more of the rated current.
- The servo motor does not have an overheating protection function. If NEC standard compliance is required, implement overheating protection measures for the servo motor.
- The servo driver is equipped with a thermal memory (shutdown) as required by EN 61800-5-1/UL 61800-5-1; however, it does not have thermal memory (power loss) or velocity sensor functions.

Notes

- For overload protection characteristics, see “Overload Protection Time Characteristics (Driver)” in “5 Basic Specifications” and Operating Instructions (MINAS A7N Series) “2.2.5 Overload Protection Time Characteristics (Motor)”.

10.2.15 Harmonics Suppression Measures

- Harmonics suppression measures vary by country. Install in accordance with local regulations.
- Servo drivers for Japan whose input current exceeds 20 A are subject to the “Guidelines for harmonic suppression measures for users who receive high-voltage or extra-high voltage power”. Calculate the equivalent capacity and harmonic outflow current based on the guidelines. If the harmonic current is found to exceed the limit value predetermined for the contract demand, appropriate measures must be taken. Furthermore, when calculating the equivalent capacity, assume that the conversion factor of the servo driver is $K_{31}=3.4$ (Refer to JEM-TR210 and JEM-TR225*.).

*These are technical references issued by JEMA (Japan Electrical Manufacturers' Association).

11 Life Span

(Life span is not guaranteed.)

11.1 Expected Life Span of Servo Driver

When used continuously under the following conditions, the expected life span is 28,000 hours.

Definition of life span: "Life span" is defined as the time it takes for the electrolytic capacitor to decrease in capacity by 20% once shipped from the factory.

Condition Input power supply : Single-phase 100 V 50/60 Hz
Single-phase/3-phase 200 V 50/60 Hz

Ambient temperature : 55°C

Output torque : Constant rated torque

Speed : Constant rated speed

The life span varies greatly depending on the conditions of use.

11.2 Standard Life Span

■ Inrush Current Prevention Circuit

The expected life span of the inrush current prevention circuit is approximately 20,000 cycles. Note that criteria may vary depending on environmental and working conditions.

■ Cooling Fan

The standard replacement time for the cooling fan is approximately 20,000 hours. Note that criteria may vary depending on environmental and working conditions.

12 Warranty

12.1 Warranty Period

The warranty period for products is 1 year from purchase, or 1 year and 6 months from the month of production by Panasonic.

However, the warranty will be void in any of the following cases, even within the warranty period:

- When caused by incorrect usage or inappropriate repairs or modifications
- When caused by falling post-purchase or damage during shipping
- When caused by usage outside the scope of product specifications
- When caused by fire, earthquake, lightning, wind or water damage, salt damage, voltage anomalies, or other natural disaster or force majeure
- When caused by infiltration of water, oil, metal flakes or other foreign matter
- When individual parts with listed standard lifetimes which have exceeded said lifetimes

12.2 Warranty Coverage

Only malfunctioning component replacements or repairs are covered for individual devices delivered by Panasonic, in the event of malfunctions attributable to Panasonic during the warranty period. Please note that our above-stated responsibility is limited to the replacement and repair of the equipment provided by us and that we do not accept any responsibility for damage to your company or any third party that may occur in connection with the failure of the equipment provided by us.

Panasonic is not liable in any way for device malfunctions or damages incurred by your company or third parties in the event of any exemptions listed under “12.1 Warranty Period” or in any of the following cases.

- When the device is assembled or used counter to the precautions and directions listed in this document
- When caused by the combination of the device and devices it is incorporated into
- When we are unable to process your request regarding this document
- When the device malfunction is otherwise not attributable to our company

12.3 Warranty Service

If you require warranty service (fault cause investigation, repair, etc.), please contact the retailer from which you purchased the product.

If you wish to send it directly to us with the permission of the retailer, please receive a repair/investigation request form from the place of purchase, fill out the necessary information, and send it to our motor service desk along with the product.

As a general rule, you will be responsible for shipping costs.

13 Model Specifications

Product number	MADN061NE MADN061NF	MADN081NE MADN081NF	MADN065NE MADN065NF MADN065NR□	MADN085NE MADN085NF MADN085NR□
Power supply input	Single phase 100 V	Single phase 100 V	Single phase/3-phase 200 V	Single phase/3-phase 200 V
Maximum output current	6 A	8 A	6 A	8 A
Rotary encoder	134217728 resolution	134217728 resolution	134217728 resolution	134217728 resolution
Regenerative resistor	External	External	External	External
Auto gain tuning function	Yes	Yes	Yes	Yes
Dynamic brake function	Yes	Yes	Yes	Yes
Absolute System	Available	Available	Available	Available
Control power supply cable	2.0 mm ²	2.0 mm ²	2.0 mm ²	2.0 mm ²
	AWG 14	AWG 14	AWG 14	AWG 14
Main power supply cable	2.0 mm ²	2.0 mm ²	2.0 mm ²	2.0 mm ²
	AWG 14	AWG 14	AWG 14	AWG 14
Earth Cable Material	2.0 mm ²	2.0 mm ²	2.0 mm ²	2.0 mm ²
	AWG 14	AWG 14	AWG 14	AWG 14
Motor cable	0.75 mm ²	0.75 mm ²	0.75 mm ²	0.75 mm ²
	AWG 18	AWG 18	AWG 18	AWG 18
Inrush current (main power supply) (*1)	Max. 7 A	Max. 7 A	Max. 14 A	Max. 14 A
Inrush current (control power supply) (*1)	Max. 14 A	Max. 14 A	Max. 14 A	Max. 14 A
Product weight	Approx. 0.8 kg	Approx. 0.8 kg	Approx. 0.8 kg	Approx. 0.8 kg
External frame	A Frame	A Frame	A Frame	A Frame

*1 When the product power input voltage is the 100 V specification, the current is the value calculated with the voltage as 100 V. Likewise, the current is the value calculated with the voltage as 200 V when the product power input voltage is the 200 V specification.

Product number	MBDN121NE MBDN121NF	MBDN125NE MBDN125NF MBDN125NR□	MCDN201NE MCDN201NF	MCDN205NE MCDN205NF MCDN205NR□
Power supply input	Single phase 100 V	Single phase/3-phase 200 V	Single phase 100 V	Single phase/3-phase 200 V
Maximum output current	12 A	12 A	20 A	20 A
Rotary encoder	134217728 resolution	134217728 resolution	134217728 resolution	134217728 resolution
Regenerative resistor	External	External	Built-in	Built-in
Auto gain tuning function	Yes	Yes	Yes	Yes
Dynamic brake function	Yes	Yes	Yes	Yes
Absolute System	Available	Available	Available	Available
Control power supply cable	2.0 mm ²	2.0 mm ²	2.0 mm ²	2.0 mm ²
	AWG 14	AWG 14	AWG 14	AWG 14
Main power supply cable	2.0 mm ²	2.0 mm ²	2.0 mm ²	2.0 mm ²
	AWG 14	AWG 14	AWG 14	AWG 14
Earth Cable Material	2.0 mm ²	2.0 mm ²	2.0 mm ²	2.0 mm ²
	AWG 14	AWG 14	AWG 14	AWG 14
Motor cable	0.75 mm ²	0.75 mm ²	0.75 mm ²	0.75 mm ²
	AWG 18	AWG 18	AWG 18	AWG 18
Inrush current (main power supply) (*1)	Max. 7 A	Max. 14 A	Max. 14 A	Max. 28 A
Inrush current (control power supply) (*1)	Max. 14 A	Max. 14 A	Max. 14 A	Max. 14 A
Product weight	Approx. 1.0 kg	Approx. 1.0 kg	Approx. 1.5 kg	Approx. 1.5 kg
External frame	B Frame	B Frame	C Frame	C Frame

*1 When the product power input voltage is the 100 V specification, the current is the value calculated with the voltage as 100 V. Likewise, the current is the value calculated with the voltage as 200 V when the product power input voltage is the 200 V specification.

Product number	MDDN405NE MDDN405NF MDDN405NR□
Power supply input	Single phase/3-phase 200 V
Maximum output current	40 A
Rotary encoder	134217728 resolution
Regenerative resistor	Built-in
Auto gain tuning function	Yes
Dynamic brake function	Yes
Absolute System	Available
Control power supply cable	2.0 mm ²
	AWG 14
Main power supply cable	2.0 mm ²
	AWG 14
Earth Cable Material	2.0 mm ²
	AWG 14
Motor cable	1.25 mm ²
	AWG16
Inrush current (main power supply) (*1)	Max. 28 A
Inrush current (control power supply) (*1)	Max. 14 A
Product weight	Approx. 1.8 kg
External frame	D Frame

*1 When the product power input voltage is the 100 V specification, the current is the value calculated with the voltage as 100 V. Likewise, the current is the value calculated with the voltage as 200 V when the product power input voltage is the 200 V specification.

14 Appendix: List of Default Parameters

The following pages show default parameters set when the servo driver is shipped from the factory.

Operation must be confirmed for each customer machine before use and the optimal values set.

14.1 Sample Description

The following is an example of entries for a List of Parameters.

Class 0: Basic Settings

○: Enabled X: Disabled —: N/A

Parameter No.	Parameter names (*3)		Setting range	Factory default values	Unit	Attribute (*4)	Related control modes (*5)				References (*6)
	Class (*1)	No. (*2)					P	S	T	F	
**	**	*****	—	*****	—	—	X	X	X	X	—
**	**	*****	*****	*****	—	B	○	○	○	○	*****

*1 Shows the classification of the parameter (large number). Shows the X section of PrX.YY.

*2 Shows the parameter No. (small number). Shows the Y section of PrX.YY.

*3 Shows the parameter name. Do not change the setup value from the factory default value for the “Manufacturer use” parameter.

*4 For parameter attributes, see “[Parameter Attributes](#)”.

*5 Shows the relationships between parameters and control modes. Shows whether a parameter is enabled or disabled for each control mode.

Control modes are indicated using the symbols below.

Symbol	Control mode
P	Position control
S	Velocity control
T	Torque control
F	Full-closed control

*6 Parameter references. The references provide details on parameters and describe their related functions.

For details on abbreviations used for document names, see Operating Instructions (MINAS A7N Series) “1.2 Related Documents”.

■ Parameter Attributes

There are attributes for the parameters.

The attribute indicates the timing under which the parameter change description is enabled.

Symbol	When the changed parameter details are enabled
A	Always enabled
B	Always enabled Changes are prohibited while the motor is running and during command transfer. If parameters are changed while the motor is running and during position command transfer, the time it takes for the changes to be reflected will be uncertain, which may transiently lead to unstable operation.
C	Enabled after executing the RTEX communication reset command attribute C parameter enabling mode or by the same operation as attribute R below
R	Enabled by turning the control power back on after EEPROM writing or after executing the RTEX communication reset command software reset mode
RO	In read-only, changes cannot be made using the normal procedure for changing parameters

For the details on the RTEX communication reset command, see Technical Reference Communication Specifications (SX-DSV03761) - “5.4.3 Reset Command (Command Code: □1h)” .

For details on bit allocation of parameter attributes that can be read by parameter attribute reading, see Technical Reference Communication Specifications (SX-DSV03761) - “5.4.8.4 MINAS A7N Series Parameter Attributes” .

Precautions

- If, after changing a parameter, the power is turned off or the reset command software reset mode is executed, the changed value is lost.

To save the changed value, ensure that it is written to EEPROM.

Use the parameter command or Set-up Support Software (PANATERM ver.7) to write values to EEPROM.

Refer to the operating instructions for the host device or the operating instructions for the Set-up Support Software (PANATERM ver.7) .

■ Attribute C Parameter Enabling Mode

This is executed using the RTEX communication reset command from the host device. Refer to the operating instructions for the host device for the reset command for the host device.

Use this mode to enable the attribute C parameter change value when communication with the host device is established without turning the servo driver control power on again or performing a software reset.

It is not necessary to write the parameter to EEPROM before executing this mode. (It is not an issue if it is written to EEPROM).

Execute the reset command in a servo-off state and maintain servo-off state during reset command processing. If this command is received in servo-on state, this leads to command error (0045h). Also, if servo-on is executed (Servo_On = 1) while this command is processed, Err27.7.0 “Position information initialization error protection” is generated.

After the command is executed, position information is initialized, including actual position and position deviation, and is the same as when reset. Also, homing is not completed (excluding when in absolute mode) and latch is not completed. After the command is completed successfully, execute homing again.

The status during command execution and the output signals are as follows.

Status/output signal	Before execution	While executing	After execution
Position information	Current position information	Initialization	Information on current position with reference to the position at which command was executed (*1)
Homing state	Current state	Indeterminate	• Not complete in incremental mode • Complete in absolute mode
Latch state	Current state	Indeterminate	Not complete
Busy (non-cyclic status)	0	1	0
Other status	Current state	Indeterminate	Current state
Output signal	Current state	Indeterminate	Current state

*1 Position information after command execution (initialization)

- Incremental mode

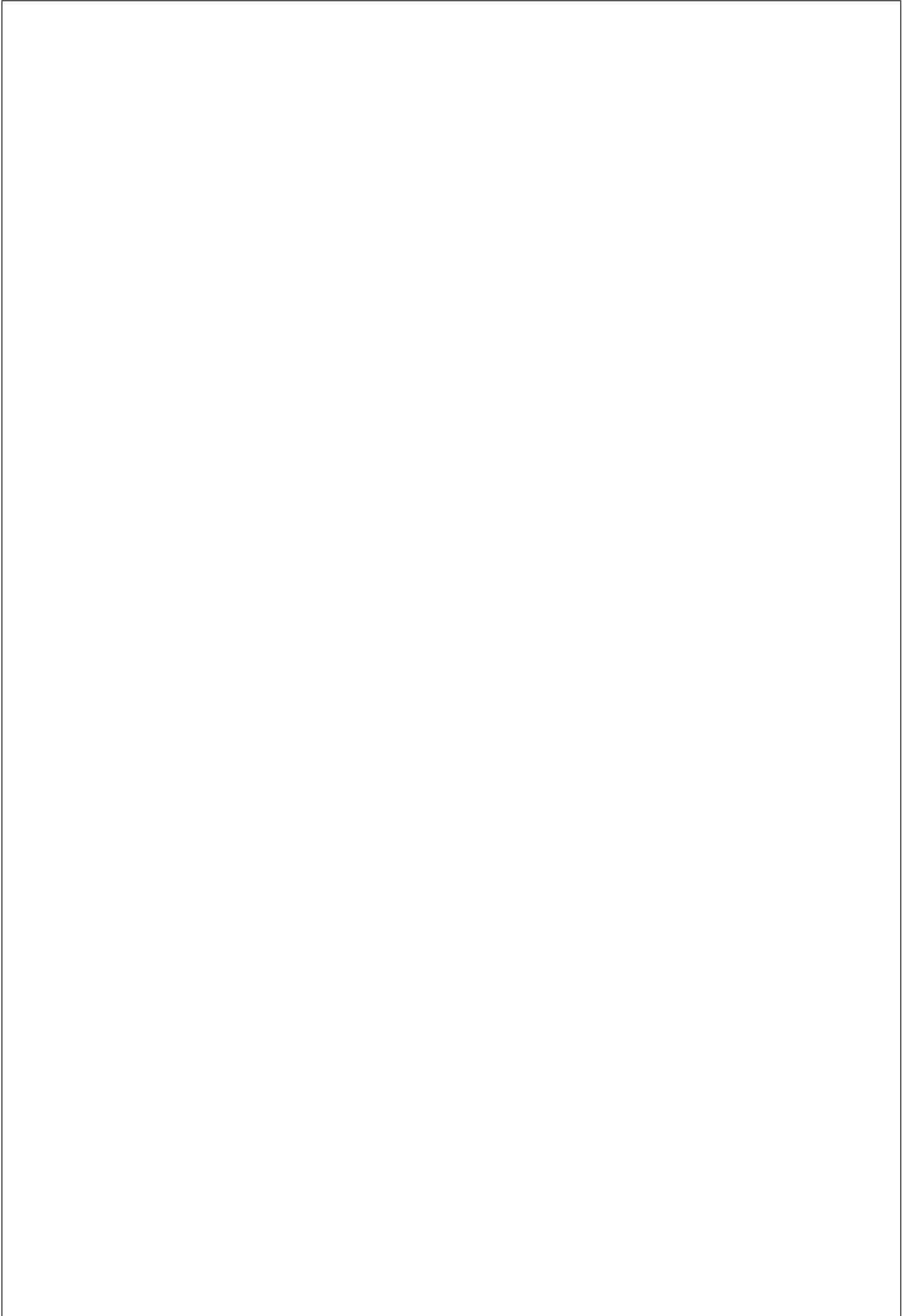
All position information = 0

- Absolute mode

All position information = Value of absolute encoder (scale)/ electronic gear ratio + Pr7.13 “Absolute home position offset”

Precautions

- While executing the command, do not run operations from Set-up Support Software (PANATERM ver.7) .



14.2 Class 0: Basic Settings

○: Enabled X: Disabled —: N/A

Parameter No.		Parameter name	Setting range	Factory default value	Unit	Attribute	Related control mode				Reference
Class	No.						P	S	T	F	
0	00	Rotational direction setup	0 to 1	1	—	C	○	○	○	○	—
0	01	Control mode setup	0 to 6	0	—	R	○	○	○	○	—
0	02	Real-time auto-gain tuning setup	0 to 7	1	—	B	○	○	○	○	—
0	03	Real-time auto-tuning machine stiffness setup	0 to 31	Sizes A, B: 13 Sizes C, D: 11 (13) (*3)	—	B	○	○	○	○	
0	04	Inertia ratio	0 to 100000	250	%	B	○	○	○	○	—
0	08	Number of command pulses per one motor revolution	0 to 134217728	8388608	pulse	C	○	○	○	○	—
0	09	Numerator of electronic gear	0 to 2 ³⁰	1	—	C	○	○	○	○	
0	10	Denominator of electronic gear	1 to 2 ³⁰	1	—	C	○	○	○	○	
0	11	Number of output pulses per motor revolution	1 to 33554432	2500	pulse	R	○	○	○	○	—
0	12	Reversal of pulse output logic	0 to 3	0	—	R	○	○	○	○	
0	13	1st torque limit	0 to 500	500 (*2)	%	B	○	○	○	○	—
0	14	Position deviation excess setup	0 to 2 ³⁰	83886080	Command unit	A	○	X	X	○	—
0	15	Absolute encoder setup	0 to 4	1	—	C	○	○	○	X	—
0	16	External regenerative resistor setup	0 to 3	Sizes A, B: 3 Sizes C, D: 0	—	C	○	○	○	○	—
0	17	Selection of load factor for external regenerative resistor	0 to 4	0	—	C	○	○	○	○	
0	18	Manufacturer use	—	0	—	—	—	—	—	—	—
0	22	Sensor feedback control mode setup (*1)	0 to 1	0	—	R	○	X	X	X	—
0	27	Selection of machine stiffness at real-time auto-gain tuning 2	0 to 44	Sizes A, B: 16 Sizes C, D: 12 (16) (*3)	—	B	○	○	○	○	—
0	28	Selection of feed forward stiffness at real-time auto-gain tuning	0 to 44	Sizes A, B: 16 Sizes C, D: 12 (16) (*3)	—	B	○	○	○	○	

*1 Cannot be used with the standard type or multi-function type. Do not change the factory default value.

*2 Factory default values vary depending on the servo driver and motor combination.

For details, see Operating Instructions (MINAS A7N Series) "8.1 Torque Limit Switching Function".

*3 Values in parentheses are initial values for models with an instantaneous maximum current (peak value) of less than 24 A.

14.3 Class 1: Gain Adjustment

○: Enabled X: Disabled —: N/A

Parameter No.		Parameter name	Setting range	Factory default value	Unit	Attribute	Related control mode				Reference
Class	No.						P	S	T	F	
1	00	1st gain of position loop	0 to 30000	Sizes A, B : 480 Sizes C, D: 320 (480) (*1)	0.1 s ⁻¹	B	○	×	×	○	—
1	01	1st velocity loop gain	1 to 32767	Sizes A, B: 270 Sizes C, D: 180 (270) (*1)	0.1 Hz	B	○	○	○	○	
1	02	1st velocity loop integration time constant	1 to 10000	Sizes A, B: 210 Sizes C, D: 310 (210) (*1)	0.1 ms	B	○	○	○	○	
1	03	1st filter of velocity detection	0 to 5	0	—	B	○	○	○	○	
1	04	1st torque filter time constant	0 to 2500	Sizes A, B: 84 Sizes C, D: 126 (84) (*1)	0.01 ms	B	○	○	○	○	—
1	05	2nd gain of position loop	0 to 30000	Sizes A, B: 480 Sizes C, D: 320 (480) (*1)	0.1 s ⁻¹	B	○	×	×	○	—
1	06	2nd velocity loop gain	1 to 32767	Sizes A, B: 270 Sizes C, D: 180 (270) (*1)	0.1 Hz	B	○	○	○	○	
1	07	2nd velocity loop integration time constant	1 to 10000	Sizes A, B: 210 Sizes C, D: 310 (210) (*1)	0.1 ms	B	○	○	○	○	
1	08	2nd filter of velocity detection	0 to 5	0	—	B	○	○	○	○	
1	09	2nd torque filter time constant	0 to 2500	Sizes A, B: 84 Sizes C, D: 126 (84) (*1)	0.01 ms	B	○	○	○	○	—
1	10	Velocity feed forward gain	0 to 4000	1000	0.1 %	B	○	×	×	○	—
1	11	Velocity feed forward filter	0 to 6400	0	0.01 ms	B	○	×	×	○	
1	12	Torque feed forward gain	0 to 2000	1000	0.1 %	B	○	○	○	○	
1	13	Torque feed forward filter	0 to 6400	0	0.01 ms	B	○	○	○	○	
1	14	2nd gain setup	0 to 1	1	—	B	○	○	○	○	—
1	15	Mode of position control switching	0 to 10	0	—	B	○	×	×	○	—
1	16	Delay time of position control switching	0 to 10000	10	0.1 ms	B	○	×	×	○	
1	17	Level of position control switching	0 to 20000	0	—	B	○	×	×	○	—
1	18	Hysteresis at position control switching	0 to 20000	0	—	B	○	×	×	○	
1	19	Position gain switching time	0 to 10000	10	0.1 ms	B	○	×	×	○	
1	20	Mode of velocity control switching	0 to 5	0	—	B	×	○	×	×	
1	21	Delay time of velocity control switching	0 to 10000	0	0.1 ms	B	×	○	×	×	
1	22	Level of velocity control switching	0 to 20000	0	—	B	×	○	×	×	
1	23	Hysteresis at velocity control switching	0 to 20000	0	—	B	×	○	×	×	
1	24	Mode of torque control switching	0 to 3	0	—	B	×	×	○	×	
1	25	Delay time of torque control switching	0 to 10000	0	0.1 ms	B	×	×	○	×	
1	26	Level of torque control switching	0 to 20000	0	—	B	×	×	○	×	
1	27	Hysteresis at torque control switching	0 to 20000	0	—	B	×	×	○	×	
1	28	Manufacturer use	—	0	—	—	—	—	—	—	—
⋮											
1	78	Manufacturer use	—	0	—	—	—	—	—	—	

Parameter No.		Parameter name	Setting range	Factory default value	Unit	Attribute	Related control mode				Reference
Class	No.						P	S	T	F	
1	106	1st position loop gain change ratio	0 to 300	100	%	B	○	×	×	○	—
1	107	1st velocity integration change ratio	0 to 300	100	%	B	○	○	○	○	
1	108	1st torque filter change ratio	0 to 300	100	%	B	○	○	○	○	
1	109	2nd position loop gain change ratio	0 to 300	100	%	B	○	×	×	○	
1	110	2nd velocity loop gain change ratio	0 to 300	100	%	B	○	○	○	○	
1	111	2nd velocity integration change ratio	0 to 300	100	%	B	○	○	○	○	
1	112	2nd torque filter change ratio	0 to 300	100	%	B	○	○	○	○	
1	113	Load fluctuation compensation filter change ratio	0 to 300	100	%	B	○	○	○	○	
1	114	Smoothing filter change ratio	0 to 300	100	%	B	○	○	○	○	
1	115	Tuning filter change ratio	0 to 300	100	%	B	○	○	○	○	

*1 Values in parentheses are initial values for models with an instantaneous maximum current (peak value) of less than 24 A.

14.4 Class 2: Vibration Suppression

○: Enabled X: Disabled —: N/A

Parameter No.		Parameter name	Setting range	Factory default value	Unit	Attribute	Related control mode				Reference	
Class	No.						P	S	T	F		
2	00	Adaptive filter mode setup	0 to 6	0	—	B	O	O	X	O	—	
2	01	1st notch frequency	10 to 5000	5000	Hz	B	O	O	O	O	—	
2	02	1st notch width selection	0 to 20	2	—	B	O	O	O	O		
2	03	1st notch depth selection	0 to 99	0	—	B	O	O	O	O		
2	04	2nd notch frequency	10 to 5000	5000	Hz	B	O	O	O	O		
2	05	2nd notch width selection	0 to 20	2	—	B	O	O	O	O		
2	06	2nd notch depth selection	0 to 99	0	—	B	O	O	O	O		
2	07	3rd notch frequency	10 to 5000	5000	Hz	B	O	O	O	O	—	
2	08	3rd notch width selection	0 to 20	2	—	B	O	O	O	O		
2	09	3rd notch depth selection	0 to 99	0	—	B	O	O	O	O		
2	10	4th notch frequency	10 to 5000	5000	Hz	B	O	O	O	O		
2	11	4th notch width selection	0 to 20	2	—	B	O	O	O	O		
2	12	4th notch depth selection	0 to 99	0	—	B	O	O	O	O		
2	13	Selection of damping filter switching	0 to 7	0	—	B	O	X	X	O	—	
2	14	1st damping frequency	0 to 3000	0	0.1 Hz	B	O	X	X	O	—	
2	15	1st damping filter setup	0 to 1500	0	0.1 Hz	B	O	X	X	O		
2	16	2nd damping frequency	0 to 3000	0	0.1 Hz	B	O	X	X	O		
2	17	2nd damping filter setup	0 to 1500	0	0.1 Hz	B	O	X	X	O		
2	18	3rd damping frequency	0 to 3000	0	0.1 Hz	B	O	X	X	O		
2	19	3rd damping filter setup	0 to 1500	0	0.1 Hz	B	O	X	X	O		
2	20	4th damping frequency	0 to 3000	0	0.1 Hz	B	O	X	X	O		
2	21	4th damping filter setup	0 to 1500	0	0.1 Hz	B	O	X	X	O		
2	22	Positional command smoothing filter	0 to 10000	Sizes A, B: 92 Sizes C, D: 139 (92) (*1)	0.1 ms	B	O	O	X	O	—	
2	23	Positional command FIR filter	0 to 10000	10	0.1 ms	B	O	X	X	O	—	
2	24	5th notch frequency	10 to 5000	5000	Hz	B	O	O	O	O	—	
2	25	5th notch width selection	0 to 20	2	—	B	O	O	O	O		
2	26	5th notch depth selection	0 to 99	0	—	B	O	O	O	O		
2	27	1st damping width setting	0 to 1000	0	—	B	O	X	X	O	—	
2	28	2nd damping width setting	0 to 1000	0	—	B	O	X	X	O		
2	29	3rd damping width setting	0 to 1000	0	—	B	O	X	X	O		
2	30	4th damping width setting	0 to 1000	0	—	B	O	X	X	O		
2	31	Manufacturer use	—	0	—	—	—	—	—	—	—	
⋮												
2	37	Manufacturer use	—	0	—	—	—	—	—	—		
2	38	Filter function switching	-32768 to 32767	3	—	B	O	O	O	O		—
		● bit 0: Custom notch filter										—
		● bit 1: Tuning filter 2										—
2	39	Custom notch compensation coefficient	0 to 1000	0	0.01	B	O	O	O	O	—	
2	40	Custom notch compensation frequency 1	0 to 10000	0	0.1 Hz	B	O	O	O	O		
2	41	Custom notch compensation frequency 2	0 to 10000	0	0.1 Hz	B	O	O	O	O		
2	42	Custom notch frequency	10 to 5000	5000	Hz	B	O	O	O	O		
2	43	Custom notch width	0 to 20	2	—	B	O	O	O	O		
2	44	Custom notch depth	0 to 99	0	—	B	O	O	O	O		

Parameter No.		Parameter name	Setting range	Factory default value	Unit	Attribute	Related control mode				Reference
Class	No.						P	S	T	F	
2	45	Function expansion setup 10	-2147483648 to 2147483647	61	—	B	O	O	O	O	—
		● bit 1 to 0: Two-degree-of-freedom control function setting									—
		● bit 2: Friction torque compensation parameter selection									—
		● bit 3: Load fluctuation suppression function automatic calculation									—
		● bit 5 to 4: Stiffness setting resolution, individual FB/FF setting switching									—
2	46	Tuning filter 2	0 to 20000	Size A: 110 Size B: 120 Sizes C, D: 170 (120) (*1)	0.01 ms	B	O	X	X	O	—
2	50	Detection start vibration count	0 to 100	3	—	B	O	X	X	X	—
2	51	Detected vibration amplitude	0 to 134217728	0	Command unit	B	O	X	X	X	
2	52	Torque command additional value 2	-1000 to 1000	0	0.1 %	B	O	O	X	O	
2	53	Positive direction torque compensation value 2	-1000 to 1000	0	0.1 %	B	O	X	X	O	—
2	54	Negative direction torque compensation value 2	-1000 to 1000	0	0.1 %	B	O	X	X	O	
2	61	Target settling time	0 to 32767	0	ms	A	O	O	O	O	
2	62	Settling time count condition	0 to 1	0	—	A	O	O	O	O	—
2	63	Allowable overshoot amount	0 to 500	100	%	A	O	O	O	O	
2	64	Tuning amount of movement	0 to 2147483647	0	Command unit	A	O	O	O	O	
2	65	Tuning max speed	0 to 20000	0	r/min	A	O	O	O	O	
2	66	Tuning acceleration and deceleration time	0 to 5000	0	ms	A	O	O	O	O	
2	67	Tuning wait time	0 to 10000	2000	ms	A	O	O	O	O	
2	68	Tuning operating range upper limit	0 to 1073741823	8388608	Command unit	A	O	O	O	O	
2	69	Tuning operating range lower limit	-1073741824 to 0	-8388608	Command unit	A	O	O	O	O	
2	70	Tuning overspeed level setting	0 to 20000	0	r/min	A	O	O	O	O	
2	71	Tuning torque limit	0 to 500	0	%	A	O	O	O	O	
2	72	Tuning start RTAT machine stiffness setting	0 to 44	8	—	A	O	O	O	O	
2	73	Tuning stability margin	0 to 100	80	%	A	O	O	O	O	
2	74	Tuning auto tuning application selection	-32768 to 32767	0	—	A	O	O	O	O	—
2	75	Tuning step selection	-32768 to 32767	3	—	A	O	O	O	O	—
		● bit 0: Advance operation									—
		● bit 1: Homing operation									
2	76	Tuning target function selection	-32768 to 32767	1009	—	A	O	O	O	O	—
		● bit 0: Inertia ratio									—
		● bit 1: Unbalanced load compensation (default disabled)									
		● bit 2: Dynamic friction compensation (default disabled)									
		● bit 3: Viscous friction compensation (default disabled)									
		● bit 4: RTAT machine stiffness setting (position and speed gains, speed integration time constant, torque filter)									
		● bit 5: RTAT feedforward control section stiffness setting (smoothing filter time constant)									
		● bit 6: Notch filter									
		● bit 7: 1st damping filter									
		● bit 8: 2nd damping filter									
		● bit 9: Load fluctuation control function									

Parameter No.		Parameter name	Setting range	Factory default value	Unit	Attribute	Related control mode				Reference
Class	No.						P	S	T	F	
2	77	Tuning start position	-1073741824 to 1073741823	0	Command unit	A	○	○	○	○	—
2	78	Tuning vibration automatic suppression effective level	0 to 100	15	%	A	○	○	○	○	
2	79	Tuning JOG test run command speed	0 to 500	60	r/min	A	○	○	○	○	
2	80	Tuning JOG test run acceleration and deceleration time	0 to 5000	50	ms	A	○	○	○	○	

*1 Values in parentheses are initial values for models with an instantaneous maximum current (peak value) of less than 24 A.

14.5 Class 3: Velocity/Torque Control/Full-closed Control

○: Enabled X: Disabled —: N/A

Parameter No.		Parameter name	Setting range	Factory default value	Unit	Attribute	Related control mode				Reference
Class	No.						P	S	T	F	
3	04	Manufacturer use	—	0	—	—	—	—	—	—	—
⋮											
3	07	Manufacturer use	—	0	—	—	—	—	—	—	—
3	12	Acceleration time setup	0 to 10000	0	ms/(1000 r/min)	B	X	○	X	X	—
3	13	Deceleration time setup	0 to 10000	0	ms/(1000 r/min)	B	X	○	X	X	—
3	14	Sigmoid acceleration / deceleration time setup	0 to 1000	0	ms	B	X	○	X	X	—
3	17	Selection of speed limit	0 to 1	0	—	B	X	X	○	X	—
3	21	Velocity limit value 1	0 to 20000	0	r/min	B	X	X	○	X	—
3	22	Velocity limit value 2	0 to 20000	0	r/min	B	X	X	○	X	—
3	23	External scale selection	0 to 2	0	—	R	○	○	○	○	—
3	24	Numerator of external scale division	0 to 2 ²⁷	0	—	R	X	X	X	○	—
3	25	Denominator of external scale division	1 to 2 ²⁷	10000	—	R	X	X	X	○	—
3	26	Reversal of direction of external scale	0 to 3	0	—	R	○	○	○	○	—
3	27	External scale Z phase disconnection detection disable	0 to 1	0	—	R	○	○	○	○	—
3	28	Hybrid deviation excess setup	1 to 2 ²⁷	16000	Command unit	C	X	X	X	○	—
3	29	Hybrid deviation clear setup	0 to 100	0	Rotation	C	X	X	X	○	—
3	33	Analog input gain (*1)	0 to 30000	0	Command unit/mV	B	○	X	X	○	—
3	34	Analog input polarity (*1)	0 to 1	0	—	B	○	X	X	○	—
3	35	Analog input integration time constant (*1)	0 to 100000	0	0.01 ms	B	○	X	X	○	—
3	36	Analog input integration limit (*1)	0 to 2147483647	0	Command unit	B	○	X	X	○	—
3	42	Sensor feedback control function extended setup (*1)	-32768 to 32767	0	—	B	○	X	X	X	—
bit 0: Displacement control function position command latch switching											—

*1 Cannot be used with the standard type or multi-function type. Do not change the factory default value.

14.6 Class 4: I/O Monitor Settings

○: Enabled X: Disabled —: N/A

Parameter No.		Parameter name	Setting range	Factory default value	Unit	Attribute	Related control mode				Reference
Class	No.						P	S	T	F	
4	00	SI1 input selection	0 to 00FFFFFFh	3289650	—	C	○	○	○	○	—
4	01	SI2 input selection	0 to 00FFFFFFh	8487297	—	C	○	○	○	○	
4	02	SI3 input selection	0 to 00FFFFFFh	8553090	—	C	○	○	○	○	
4	03	SI4 input selection	0 to 00FFFFFFh	3026478	—	C	○	○	○	○	
4	04	SI5 input selection	0 to 00FFFFFFh	2236962	—	C	○	○	○	○	
4	05	SI6 input selection	0 to 00FFFFFFh	2171169	—	C	○	○	○	○	
4	06	SI7 input selection	0 to 00FFFFFFh	2829099	—	C	○	○	○	○	
4	07	SI8 input selection	0 to 00FFFFFFh	3223857	—	C	○	○	○	○	—
4	10	SO1 output selection	0 to 00FFFFFFh	197379	—	C	○	○	○	○	
4	11	SO2 output selection	0 to 00FFFFFFh	1052688	—	C	○	○	○	○	
4	12	SO3 output selection	0 to 00FFFFFFh	65793	—	C	○	○	○	○	—
4	16	Type of analog monitor 1	0 to 35	0	—	A	○	○	○	○	
4	17	Analog monitor 1 output gain	0 to 214748364	0	—	A	○	○	○	○	
4	18	Type of analog monitor 2	0 to 35	0	—	A	○	○	○	○	
4	19	Analog monitor 2 output gain	0 to 214748364	0	—	A	○	○	○	○	
4	21	Analog monitor output setup	0 to 2	0	—	A	○	○	○	○	—
4	22	Analog input (AIN) offset setting (*1)	-26666 to 26666	0	0.375 mV	B	○	○	○	○	
4	23	Analog input (AIN) filter setting (*1)	0 to 6400	0	0.01 ms	B	○	○	○	○	
4	24	Analog input (AIN) excessive setting (*1)	0 to 100	0	0.1 V	B	○	○	○	○	—
4	31	Positioning complete (In-position) range	0 to 2097152	8400	Command unit	A	○	×	×	○	
4	32	Positioning complete (In-position) output setup	0 to 10	0	—	A	○	×	×	○	
4	33	INP hold time	0 to 30000	0	ms	A	○	×	×	○	—
4	34	Zero-speed	10 to 20000	50	r/min	A	○	○	○	○	
4	35	Speed coincidence range	10 to 20000	50	r/min	A	×	○	○	×	
4	36	At-speed (Speed arrival)	10 to 20000	1000	r/min	A	×	○	○	×	—
4	37	Mechanical brake action at stalling setup	0 to 10000	0	ms	B	○	○	○	○	—
4	38	Mechanical brake action at running setup	0 to 32000	0	ms	B	○	○	○	○	—
4	39	Brake release speed setup	30 to 3000	30	r/min	B	○	○	○	○	—
4	40	Selection of alarm output 1	0 to 32767	0	—	A	○	○	○	○	—
4	41	Selection of alarm output 2	0 to 32767	0	—	A	○	○	○	○	
4	42	Positioning complete (In-position) range 2	0 to 2097152	8400	Command unit	A	○	×	×	○	—
4	44	Position comparison output pulse width setting	0 to 32767	0	0.1 ms	R	○	○	○	○	—
4	45	Position comparison output polarity selection	0 to 7	0	—	R	○	○	○	○	—
		● bit 0: Polarity for SO1 (general-purpose output) or OCMP1 (encoder/position comparison output terminal)									—
		● bit 1: Polarity for SO2 (general-purpose output) or OCMP2 (encoder/position comparison output terminal)									
		● bit 2: Polarity for SO3 (general-purpose output) or OCMP3 (encoder/position comparison output terminal)									
4	47	Pulse output selection	0 to 1	0	—	R	○	○	○	○	—
4	48	Position comparison value 1	-2147483648 to 2147483647	0	Command unit	A	○	○	○	○	—
4	49	Position comparison value 2	-2147483648 to 2147483647	0	Command unit	A	○	○	○	○	

Parameter No.		Parameter name	Setting range	Factory default value	Unit	Attribute	Related control mode				Reference
Class	No.						P	S	T	F	
4	50	Position comparison value 3	-2147483648 to 2147483647	0	Command unit	A	O	O	O	O	—
4	51	Position comparison value 4	-2147483648 to 2147483647	0	Command unit	A	O	O	O	O	
4	52	Position comparison value 5	-2147483648 to 2147483647	0	Command unit	A	O	O	O	O	
4	53	Position comparison value 6	-2147483648 to 2147483647	0	Command unit	A	O	O	O	O	
4	54	Position comparison value 7	-2147483648 to 2147483647	0	Command unit	A	O	O	O	O	
4	55	Position comparison value 8	-2147483648 to 2147483647	0	Command unit	A	O	O	O	O	
4	56	Position comparison output delay compensation amount	-32768 to 32767	0	0.1 μ s	B	O	O	O	O	
4	57	Position comparison output assignment setting	-2147483648 to 2147483647	0	—	R	O	O	O	O	—
		• bit 3 to 0: Position comparison 1 • bit 7 to 4: Position comparison 2 • bit 11 to 8: Position comparison 3 • bit 15 to 12: Position comparison 4 • bit 19 to 16: Position comparison 5 • bit 23 to 20: Position comparison 6 • bit 27 to 24: Position comparison 7 • bit 31 to 28: Position comparison 8									—
4	63	Manufacturer use	—	5242884	—	—	—	—	—	—	—
4	64	Manufacturer use	—	64	—	—	—	—	—	—	—
4	65	Analog input internal offset setting	-32768 to 32767	0	mV	A	O	O	O	O	—
4	66	Analog input deviation limit setting	0 to 65535	0	mV	A	O	O	O	O	
4	67	Analog input voltage dead zone setting	0 to 65535	0	mV	B	O	O	O	O	

*1 Cannot be used with the standard type or multi-function type. Do not change the factory default value.

14.7 Class 5: Enhancing Settings

○: Enabled X: Disabled —: N/A

Parameter No.		Parameter name	Setting range	Factory default value	Unit	Attribute	Related control mode				Reference
Class	No.						P	S	T	F	
5	03	Denominator of pulse output division	0 to 134217728	0	—	R	○	○	○	○	—
5	04	Over-travel inhibit input setup	0 to 2	1	—	C	○	○	○	○	—
5	05	Sequence at over-travel inhibit	0 to 2	0	—	C	○	○	○	○	—
5	06	Sequence at servo-off	0 to 9	0	—	B	○	○	○	○	—
5	07	Sequence upon main power off	0 to 9	0	—	B	○	○	○	○	—
5	08	L/V trip selection upon main power off	0 to 3	1	—	B	○	○	○	○	—
		• bit 0: Operation selection with main power supply OFF									—
		• bit 1: Main power off warning condition detection time									—
5	09	Detection time of main power off	20 to 2000	70	ms	C	○	○	○	○	—
5	10	Sequence at alarm	0 to 7	0	—	B	○	○	○	○	—
5	11	Torque setup for emergency stop	0 to 500	0	%	B	○	○	○	○	—
5	12	Motor overload level setup	0 to 500	0	%	A	○	○	○	○	—
5	13	Over-speed level setup	0 to 20000	0	r/min	B	○	○	○	○	—
5	14	Motor working range setup	0 to 1000	10	0.1 rotation	A	○	X	X	○	—
5	15	Control input signal reading setup	0 to 3	0	—	C	○	○	○	○	—
5	20	Position setup unit select	0 to 1	0	—	C	○	X	X	○	—
5	21	Selection of torque limit	0 to 4	1	—	B	○	○	X	○	—
5	22	2nd torque limit	0 to 500	500 (*1)	%	B	○	○	X	○	—
5	23	Torque limit switching setup 1	0 to 4000	0	ms/100 %	B	○	○	X	○	
5	24	Torque limit switching setup 2	0 to 4000	0	ms/100 %	B	○	○	X	○	
5	25	Positive direction torque limit	0 to 500	500 (*1)	%	B	○	○	X	○	
5	26	Negative direction torque limit	0 to 500	500 (*1)	%	B	○	○	X	○	
5	29	Manufacturer use	—	2	—	—	—	—	—	—	—
5	31	USB axis address	0 to 127	1	—	C	○	○	○	○	—
5	33	Pulse regenerative output limit setup	0 to 1	0	—	C	○	○	○	○	—
5	34	Manufacturer use	—	4	—	—	—	—	—	—	—
5	36	Manufacturer use	—	0	—	—	—	—	—	—	—
5	45	Quadrant glitch positive-direction compensation value	-1000 to 1000	0	0.1 %	B	○	X	X	○	—
5	46	Quadrant glitch negative-direction compensation value	-1000 to 1000	0	0.1 %	B	○	X	X	○	
5	47	Quadrant glitch compensation delay time	0 to 1000	0	ms	B	○	X	X	○	
5	48	Quadrant glitch compensation filter setting L	0 to 6400	0	0.01 ms	B	○	X	X	○	
5	49	Quadrant glitch compensation filter setting H	0 to 10000	0	0.1 ms	B	○	X	X	○	—

Parameter No.		Parameter name	Setting range	Factory default value	Unit	Attribute	Related control mode				Reference
Class	No.						P	S	T	F	
5	50	Manufacturer use	—	0	—	—	—	—	—	—	—
⋮											
5	55	Manufacturer use	—	0	—	—	—	—	—	—	
5	56	Slow stop deceleration time setting	0 to 10000	0	ms/(1000 r/min)	B	○	○	○	×	—
5	57	Slow stop S-shape acceleration and deceleration setting	0 to 1000	0	ms	B	○	○	○	×	
5	66	Deterioration diagnosis convergence judgment time	0 to 10000	0	0.1 s	A	○	○	○	○	—
5	67	Deterioration diagnosis inertia ratio upper limit	0 to 10000	0	%	A	○	○	○	○	
5	68	Deterioration diagnosis inertia ratio lower limit	0 to 10000	0	%	A	○	○	○	○	
5	69	Deterioration diagnosis unbalanced load upper limit	-1000 to 1000	0	0.1 %	A	○	○	○	○	
5	70	Deterioration diagnosis unbalanced load lower limit	-1000 to 1000	0	0.1 %	A	○	○	○	○	
5	71	Deterioration diagnosis dynamic friction upper limit	-1000 to 1000	0	0.1 %	A	○	○	○	○	
5	72	Deterioration diagnosis dynamic friction lower limit	-1000 to 1000	0	0.1 %	A	○	○	○	○	
5	73	Deterioration diagnosis viscous friction upper limit	0 to 10000	0	0.1%/(10000 r/min)	A	○	○	○	○	
5	74	Deterioration diagnosis viscous friction lower limit	0 to 10000	0	0.1%/(10000 r/min)	A	○	○	○	○	
5	75	Deterioration diagnosis velocity setting	-20000 to 20000	0	r/min	A	○	○	○	○	
5	76	Deterioration diagnosis torque average time	0 to 10000	0	ms	A	○	○	○	○	
5	77	Deterioration diagnosis torque upper limit	-1000 to 1000	0	0.1 %	A	○	○	○	○	
5	78	Deterioration diagnosis torque lower limit	-1000 to 1000	0	0.1 %	A	○	○	○	○	
5	95	Manufacturer use	—	0	0	—	—	—	—	—	—
5	110	Driver derating factor	0 to 100	100	%	A	○	○	○	○	—
5	112	Manufacturer use	—	0	—	—	—	—	—	—	—

*1 Factory default values vary depending on the servo driver and motor combination.

For details, see Operating Instructions (MINAS A7N Series) "8.1 Torque Limit Switching Function".

14.8 Class 6: Special Settings

○: Enabled X: Disabled —: N/A

Parameter No.		Parameter name	Setting range	Factory default value	Unit	Attribute	Related control mode				Reference	
Class	No.						P	S	T	F		
6	02	Speed deviation excess setup	0 to 20000	0	r/min	A	○	×	×	×	—	
6	03	Manufacturer use	—	0	—	—	—	—	—	—	—	
6	05	Position 3rd gain valid time	0 to 10000	0	0.1 ms	B	○	×	×	○	—	
6	06	Position 3rd gain scale factor	50 to 1000	100	%	B	○	×	×	○		
6	07	Torque command additional value	-100 to 100	0	%	B	○	○	×	○	—	
6	08	Positive direction torque compensation value	-100 to 100	0	%	B	○	×	×	○		
6	09	Negative direction torque compensation value	-100 to 100	0	%	B	○	×	×	○		
6	10	Function expansion setup	-32768 to 32767	16	—	B	○	○	○	○	—	
		● bit 1: Load fluctuation control function										—
		● bit 2: Load fluctuation stabilization setting										
		● bit 4: Current response improvement										—
		● bit 10: Fall prevention function during an alarm										—
		● bit 11: Encoder overheat error protection detection										—
		● bit 14: Load fluctuation suppression function automatic tuning										—
● bit 15: Slow stop function										—		
6	11	Current loop gain response setup	10 to 300	100	%	B	○	○	○	○	—	
6	14	Emergency stop time at alarm	0 to 1000	200	ms	B	○	○	○	○	—	
6	15	2nd overspeed level setting	0 to 20000	0	r/min	B	○	○	○	○	—	
6	18	Power-up wait time	0 to 100	0	0.1 s	R	○	○	○	○	—	
6	19	Manufacturer use	—	0	—	—	—	—	—	—	—	
⋮												
6	21	Manufacturer use	—	0	—	—	—	—	—	—		
6	22	AB phase external scale pulse outputting method selection	0 to 1	0	—	R	×	×	×	○	—	
6	23	Load change compensation gain	-100 to 100	0	%	B	○	○	×	○	—	
6	24	Load change compensation filter	10 to 2500	53	0.01 ms	B	○	○	×	○	—	
6	26	Manufacturer use	—	0	—	—	—	—	—	—	—	
6	27	Warning latch state setup	0 to 3	0	—	C	○	○	○	○	—	
		● bit 0: Expanded warnings										—
		● bit 1: General warnings										
6	30	Manufacturer use	—	0	—	—	—	—	—	—	—	
6	31	Real time auto tuning estimation speed	0 to 3	1	—	B	○	○	○	○	—	

Parameter No.		Parameter name	Setting range	Factory default value	Unit	Attribute	Related control mode				Reference
Class	No.						P	S	T	F	
6	32	Real time auto tuning custom setup	-32768 to 32767	0	—	B	O	O	O	O	—
		bit 1 to 0: Load characteristics estimation									—
		bit 3 to 2: Inertia Ratio Update									—
		bit 6 to 4: Torque compensation									—
		bit 7: Stiffness Setup									—
		bit 8: Fixed Parameter Setup									—
		bit 10 to 9: Gain Switching Setup									—
		bit 11: Torque compensation setting switching									—
		bit 15 to 12: Individual torque compensation settings									—
6	34	Hybrid vibration suppression gain	0 to 30000	0	0.1 s ⁻¹	B	X	X	X	O	—
6	35	Hybrid vibration suppression filter	0 to 32000	10	0.01 ms	B	X	X	X	O	—
6	36	Dynamic brake operation input setup	0 to 1	0	—	R	O	O	O	O	—
6	37	Oscillation detecting level	0 to 1000	0	0.1 %	B	O	O	O	O	—
6	38	Warning mask setup	-32768 to 32767	4	—	C	O	O	O	O	—
6	39	Warning mask setup 2	-32768 to 32767	0	—	C	O	O	O	O	—
6	41	1st damping depth	0 to 1000	0	—	B	O	X	X	O	—
6	42	2-stage torque filter time constant	0 to 2500	0	0.01 ms	B	O	O	O	O	—
6	43	2-stage torque filter attenuation term	0 to 1000	0	—	B	O	O	O	O	—
6	47	Function expansion setup 2	-32768 to 32767	1	—	R	O	O	O	O	—
		bit 0: Two-degree-of-freedom control mode									—
		bit 2: Encoder communication error/warning judgment setup									—
		bit 3: Two-degree-of-freedom control real-time auto tuning selection									—
		bit 14: Quadrant glitch compensation function									—
6	48	Tuning filter	0 to 2000	Size A: 11 Size B: 12 Sizes C, D: 17 (12) (*1)	0.1 ms	B	O	O	X	O	—
6	49	Command response/tuning filter attenuation term	0 to 99	15	—	B	O	X	X	O	—
6	50	Viscous friction compensating gain	0 to 10000	0	0.1 %/ (10000 r/min)	B	O	O	X	O	—
6	51	Wait time for emergency stop	0 to 10000	0	ms	B	O	O	O	O	—
6	52	Manufacturer use	—	0	—	—	—	—	—	—	—
⋮											
6	54	Manufacturer use	—	0	—	—	—	—	—	—	—
6	57	Torque saturation error protection detection time	0 to 5000	0	ms	B	O	O	X	O	—
6	58	Manufacturer use	—	0	—	—	—	—	—	—	—
6	59	Manufacturer use	—	0	—	—	—	—	—	—	—
6	60	2nd damping depth	0 to 1000	0	—	B	O	X	X	O	—
6	61	1st resonance frequency	0 to 3000	0	0.1 Hz	B	O	X	X	X	—
6	62	1st resonance attenuation ratio	0 to 1000	0	—	B	O	X	X	X	—
6	63	1st anti-resonance frequency	0 to 3000	0	0.1 Hz	B	O	X	X	X	—
6	64	1st anti-resonance attenuation ratio	0 to 1000	0	—	B	O	X	X	X	—

Parameter No.		Parameter name	Setting range	Factory default value	Unit	Attribute	Related control mode				Reference	
Class	No.						P	S	T	F		
6	65	1st response frequency	0 to 3000	0	0.1 Hz	B	○	×	×	×	—	
6	66	2nd resonance frequency	0 to 3000	0	0.1 Hz	B	○	×	×	×		
6	67	2nd resonance attenuation ratio	0 to 1000	0	—	B	○	×	×	×		
6	68	2nd anti-resonance frequency	0 to 3000	0	0.1 Hz	B	○	×	×	×		
6	69	2nd anti-resonance attenuation ratio	0 to 1000	0	—	B	○	×	×	×		
6	70	2nd response frequency	0 to 3000	0	0.1 Hz	B	○	×	×	×		
6	71	3rd damping depth	0 to 1000	0	—	B	○	×	×	○	—	
6	72	4th damping depth	0 to 1000	0	—	B	○	×	×	○		
6	73	Load estimation filter	0 to 2500	0	0.01 ms	B	○	○	×	○	—	
6	74	Torque compensation frequency 1	0 to 5000	0	0.1 Hz	B	○	○	×	○		
6	75	Torque compensation frequency 2	0 to 5000	0	0.1 Hz	B	○	○	×	○		
6	76	Load estimation count	0 to 8	0	—	B	○	○	×	○		
6	85	Retracting operation condition setting	-32768 to 32767	0	—	C	○	○	○	○	—	
		● bits 0 to 3: Retracting operation initialization conditions (I/O)										—
		● bits 7 to 4: Retracting operation initialization conditions (communication)										
		● bits 9 to 8: Judgment condition for stopping retracting operation										
6	86	Retracting operation alarm setting	-32768 to 32767	0	—	C	○	○	○	○	—	
		● bit 0: Err85.0.0 “Retracting operation completion (I/O)” /Err87.1.0 “Retracting operation completion (I/O)”									—	
		● bit 1: Err85.1.0 “Retracting operation completion (communication)” /Err87.2.0 “Retracting operation completion (communication)”										
		● bit 2: Err85.2.0 “Retracting operation error” /Err87.3.□ “Retracting operation error”										
		● bit 15: Retracting operation-related alarm switching										
6	87	Manufacturer use	—	0	—	—	—	—	—	—		
6	88	Absolute encoder multi-turn data upper-limit value	0 to 65534	0	—	C	○	○	○	○	—	
6	95	Motor overload warning detection level	0 to 114	0	%	A	○	○	○	○	—	
6	96	Motor overload warning release level	0 to 114	0	%	A	○	○	○	○		
6	97	Function expansion setup 3	-2147483648 to 2147483647	1024	—	B	○	○	○	○	—	
		● bit 0: Quadrant glitch compensation HPF clear									—	
		● bit 1: Deterioration Diagnosis Warning Function									—	
		● bit 2: Motor movable range error protection expansion									—	
		● bit 6: Manufacturer use									—	
		● bit 10: Position comparison output function selection									—	
		● bit 27: Alarm display switch setting									—	
6	98	Function expansion setup 4	-2147483648 to 2147483647	0	—	R	○	○	○	○	—	
		● bit 3: Effective bit expansion for multi-turn data									—	
		● bit 9: Virtual full-closed control mode function									—	
6	104	Open-phase monitoring setup	0 to 3	0	—	B	○	○	○	○	—	
6	106	Manufacturer use	—	0	—	—	—	—	—	—	—	
6	121	Current feed forward response setup	0 to 300	100	%	B	○	○	○	○	—	
6	125	Manufacturer use	—	0	—	—	—	—	—	—	—	

Parameter No.		Parameter name	Setting range	Factory default value	Unit	Attribute	Related control mode				Reference
Class	No.						P	S	T	F	
6	126	Warning 2 mask setup	-2147483648 to 2147483647	0	—	C	O	O	O	O	—
6	127	Warning 3 mask setup	-2147483648 to 2147483647	0	—	C	O	O	O	O	

*1 Values in parentheses are initial values for models with an instantaneous maximum current (peak value) of less than 24 A.

14.9 Class 7: Special Settings 2

○: Enabled X: Disabled —: N/A

Parameter No.		Parameter name	Setting range	Factory default value	Unit	Attribute	Related control mode				Reference
Class	No.						P	S	T	F	
7	00	Display on LED	0 to 32767	0	—	A	○	○	○	○	—
7	01	Address display time setup upon power-up	-1 to 1000	0	100 ms	R	○	○	○	○	—
7	03	Output setup during torque limit	0 to 1	0	—	A	×	×	○	×	—
7	04	Manufacturer use	—	0	—	—	—	—	—	—	—
⋮											
7	08	Manufacturer use	—	0	—	—	—	—	—	—	—
7	09	Correction time of latch delay 1	-2000 to 2000	360	25 ns	B	○	○	○	○	—
7	10	Software limit function	0 to 3	0	—	A	○	×	×	○	—
7	11	Positive side software limit value	-1073741823 to 1073741823	500000	Command unit	A	○	×	×	○	—
7	12	Negative side software limit value	-1073741823 to 1073741823	-500000	Command unit	A	○	×	×	○	—
7	13	Absolute home position offset	-2147483648 to 2147483647	0	Command unit	C	○	○	○	○	—
7	14	Main power off warning detection time	0 to 2000	0	ms	C	○	○	○	○	—
7	15	Positioning proximity range	0 to 1073741823	10	Command unit	A	○	×	×	○	—
7	16	Torque saturation error protection frequency	0 to 30000	0	Incidences	B	○	○	×	○	—
7	20	RTEX communication cycle setup	-1 to 12	3	—	R	○	○	○	○	—
7	21	RTEX command updating cycle ratio setup	1 to 2	2	—	R	○	○	○	○	—
7	22	RTEX function expansion setup 1	-32768 to 32767	0	—	R	○	○	○	○	—
bit 0: RTEX communication data size											—
bit 1: Interaxis full-synchronous mode using RTEX communication TMG_CNT											—
bit 4: External scale position information monitoring function setting for semi-closed control											—
bit 5: Command position change saturation function selection											—
bit 6: Homing return velocity limit enabled											—
7	23	RTEX function expansion setup 2	-32768 to 32767	18	—	B	○	○	○	○	—
bit 0: Parameter writing via RTEX communication permitted											—
bit 1: Alarm No. sub-number setting											—
bit 2: RTEX status response condition setting with POT and NOT functions disabled											—
bit 3: POT and NOT RTEX status bit arrangement settings											—
bit 4: COM-LED compatibility (COM-LED is the phase status)											—
bit 5: Non-cyclic Command Startup Mode Settings											—
bit 6: POT and NOT RTEX status logical settings											—
bit 7: RTEX status bit arrangement settings for PSL and NSL											—
bit 8: RTEX status selection of In_Progress/AC_OFF											—
bit 9: Command error return switching for commands received in the direction of over-travel inhibit input after over-travel inhibit deceleration to stop											—
bit 14: Position deviation [command unit] output setup											—
bit 15: In_Progress/AC_OFF/Pr7.112 value											—

Parameter No.		Parameter name	Setting range	Factory default value	Unit	Attribute	Related control mode				Reference
Class	No.						P	S	T	F	
7	24	RTEX function expansion setup 3	-32768 to 32767	0	—	C	○	○	○	○	—
		bit 0: EX-OUT1 output status setting at the time of communication interrupted after RTEX communication is established									—
		bit 1: EX-OUT2 output status setting at the time of communication interrupted after RTEX communication is established									—
		bit 3: RTEX communication In_Position judgment condition setting									—
		bit 4: Servo_Active ON timing switching									—
		bit 5: Latch position detection delay compensation function switching									—
		bit 7: Internal value status selection of TFF from RTEX communication (fall prevention when servo-on)									—
7	25	RTEX velocity unit setup	0 to 1	0	—	C	○	○	○	○	—
7	26	RTEX continuous communication error warning setup	0 to 32767	0	Incidences	A	○	○	○	○	—
7	27	RTEX accumulated communication error warning setup	0 to 32767	0	Incidences	A	○	○	○	○	—
7	28	RTEX_Update_Counter error warning setup	0 to 32767	0	Incidences	A	○	○	○	○	—
7	29	RTEX monitor select 1	0 to 32767	0	—	A	○	○	○	○	—
7	30	RTEX monitor select 2	0 to 32767	0	—	A	○	○	○	○	—
7	31	RTEX monitor select 3	0 to 32767	0	—	A	○	○	○	○	—
7	32	RTEX monitor select 4	0 to 32767	0	—	A	○	○	○	○	—
7	33	RTEX monitor select 5	0 to 32767	0	—	A	○	○	○	○	—
7	34	RTEX monitor select 6	0 to 32767	0	—	A	○	○	○	○	—
7	35	RTEX command setup 1	0 to 2	0	—	C	○	○	○	○	—
7	36	RTEX command setup 2	0 to 2	0	—	C	○	○	○	○	—
7	37	RTEX command setup 3	0 to 2	0	—	C	○	○	○	○	—
7	38	RTEX_Update_Counter error protection setup	0 to 32767	0	Incidences	A	○	○	○	○	—
7	39	Manufacturer use	—	0	—	—	—	—	—	—	—
7	41	RTEX function expansion setup 5	-32768 to 32767	0	—	R	○	○	○	○	—
		bit 7: Over-travel inhibit input detection setting during Z-phase homing return operation									—
7	44	Manufacturer use	—	16908546	—	—	—	—	—	—	—
7	78	Latch trigger signal reading setting with stop function	0 to 3	0	—	C	○	×	×	○	—
7	80	Manufacturer use	—	0	—	—	—	—	—	—	—
7	87	Manufacturer use	—	0	—	—	—	—	—	—	—
⋮											
7	89	Manufacturer use	—	0	—	—	—	—	—	—	—
7	91	RTEX communication cycle expansion setup	0 to 2000000	500000	ns	R	○	○	○	○	—
7	92	Correction time of latch delay 2	-2000 to 2000	0	25 ns	B	○	○	○	○	—
7	93	Homing return speed limit value	0 to 20000	0	r/min	C	○	○	○	○	—
7	95	RTEX continuous communication error protection 1 detection count	0 to 17	4	Incidences	R	○	○	○	○	—
7	96	RTEX continuous communication error protection 2 detection count	0 to 17	12	Incidences	R	○	○	○	○	—
7	97	RTEX communication timeout error protection detection count	0 to 17	4	Incidences	R	○	○	○	○	—
7	98	RTEX cyclic data error protection 1/2 detection count	0 to 17	4	Incidences	R	○	○	○	○	—
7	99	RTEX function expansion setup 6	-32768 to 32767	0	—	B	○	○	○	○	—
		bit 0: Enable/disable FFT execution while RTEX communication is established									—
		bit 3: Command pulse accumulated value [command unit] output setting									—
		bit 7: Monitor command regenerative load factor unit switching									—
7	100	Manufacturer use	—	0	—	—	—	—	—	—	—

Parameter No.		Parameter name	Setting range	Factory default value	Unit	Attribute	Related control mode				Reference
Class	No.						P	S	T	F	
											—
7	104	Manufacturer use	—	0	—	—	—	—	—	—	—
7	108	RTEX communication synchronization setup	0 to 7	7	—	R	○	○	○	○	—
7	109	Manufacturer use	—	1	—	—	—	—	—	—	—
7	110	RTEX function expansion setup 7	-2147483648 to 2147483647	0	—	B	×	×	×	○	—
		• bit 4: Profile position control mode startup condition expansion									—
		• bit 16: External scale position variation enabled during virtual full-closed control mode									—
7	111	Trigger signal allocation setting of latch mode with stop function	0 to 64	0	—	C	○	×	×	○	—
7	112	Selection of RTEX communication status flag	0 to 2	0	—	B	○	○	○	○	—
7	127	Manufacturer use	—	0	—	—	—	—	—	—	—

14.10 Class 8: Special Settings 3

○: Enabled X: Disabled —: N/A

Parameter No.		Parameter name	Setting range	Factory default value	Unit	Attribute	Related control mode				Reference
Class	No.						P	S	T	F	
8	00	Manufacturer use	—	0	—	—	—	—	—	—	—
8	01	Profile linear acceleration constant	1 to 429496	100	10,000 command units/s ²	B	○	○	○	○	—
8	02	Manufacturer use	—	0	—	—	—	—	—	—	—
8	03	Manufacturer use	—	0	—	—	—	—	—	—	—
8	04	Profile linear deceleration constant	1 to 429496	100	10,000 command units/s ²	B	○	○	○	○	—
8	05	Manufacturer use	—	0	—	—	—	—	—	—	—
8	10	Amount of travel after profile position latch detection	-1073741823 to 1073741823	0	Command unit	B	○	X	X	○	—
8	12	Profile homing mode setting	0 to 1	0	—	B	○	X	X	○	
8	13	Profile homing speed 1	0 to 2147483647	50	Command unit/s or r/min	B	○	X	X	○	
8	14	Profile homing speed 2	0 to 2147483647	5	Command unit/s or r/min	B	○	X	X	○	
8	15	Manufacturer use	—	0	—	—	—	—	—	—	—
8	17	Relative movement of retracting operation	-2147483647 to 2147483647	0	Command unit	B	○	○	○	○	—
8	18	Retracting operation speed	0 to 2147483647	0	Command unit/s or r/min	B	○	○	○	○	
8	19	Manufacturer use	—	0	—	—	—	—	—	—	—

14.11 Class 11: Manufacturer Use

○: Enabled X: Disabled —: N/A

Parameter No.		Parameter name	Setting range	Factory default value	Unit	Attribute	Related control mode				Reference
Class	No.						P	S	T	F	
11	00	Manufacturer use	—	1	—	—	—	—	—	—	—
11	01	Manufacturer use	—	503578880	—	—	—	—	—	—	—
11	02	Manufacturer use	—	658185	—	—	—	—	—	—	—
11	03	Manufacturer use	—	-1	—	—	—	—	—	—	—
11	04	Manufacturer use	—	-1	—	—	—	—	—	—	—
11	05	Manufacturer use	—	-1	—	—	—	—	—	—	—
11	06	Manufacturer use	—	-1	—	—	—	—	—	—	—
11	07	Manufacturer use	—	16	—	—	—	—	—	—	—
11	08	Manufacturer use	—	6	—	—	—	—	—	—	—
11	09	Manufacturer use	—	1	—	—	—	—	—	—	—
11	10	Manufacturer use	—	129	—	—	—	—	—	—	—
11	11	Manufacturer use	—	0	—	—	—	—	—	—	—
11	12	Manufacturer use	—	0	—	—	—	—	—	—	—
11	13	Manufacturer use	—	0	—	—	—	—	—	—	—
11	14	Manufacturer use	—	0	—	—	—	—	—	—	—
11	15	Manufacturer use	—	0	—	—	—	—	—	—	—
11	16	Manufacturer use	—	255	—	—	—	—	—	—	—
11	17	Manufacturer use	—	0	—	—	—	—	—	—	—
11	18	Manufacturer use	—	0	—	—	—	—	—	—	—
11	19	Manufacturer use	—	0	—	—	—	—	—	—	—
11	20	Manufacturer use	—	0	—	—	—	—	—	—	—
11	21	Manufacturer use	—	0	—	—	—	—	—	—	—
11	22	Manufacturer use	—	15	—	—	—	—	—	—	—
11	23	Manufacturer use	—	0	—	—	—	—	—	—	—
11	24	Manufacturer use	—	0	—	—	—	—	—	—	—
11	25	Manufacturer use	—	0	—	—	—	—	—	—	—
11	26	Manufacturer use	—	0	—	—	—	—	—	—	—