Document No.	: SX-DSV03190
Revision No.	: 7.0
Date of Issue	: July 5, 2021
Classification	: □ New ■ Change

SPECIFICATIONS

Product Name：	AC servo driver
Product Series Name：	MINAS A6BE,BF Series
Product Model Number：	Standard type / multi-function type

Motion Control Business Unit, Industrial Device Business Division
Industrial Solutions Company, Panasonic Corporation
7-1-1 Morofuku, Daito－City, Osaka 574-0044, Japan

If you have any questions, please contact the seller (Sales office or Distributor) of the product.

Panasonic

Revisions

Date Date of submission	Page Changed point Changed drawing No.	Rev. Revision No.	Description Reason for change, change contents	Signed
Feb. 15, 2017	-	0.0	Initial Release	-
Apr. 28, 2017	Appendix	1.0	Add the Default value of the parameters	-
	P3		Add the Product Codes and Conformance Tested	
	-		Correct the errors	
Feb. 7, 2018	-	2.0	Add the multi-function type	-
	P1		Add the related documents	
	P9		Add the table of the serial number part of the manufacturing number	
	P66		Add 12-3 Warranty Service	
	-		Correct the errors	
March 20, 2019	-	3.0	Added size G and size H	-
	-		Update other contents according to the latest Japanese version	
Apr.8,2020	-	4.0	Added 400 V input models	-
	-		Update other contents according to the latest japanese version	
	-		Clerical error correction	
Sep. 25,2020	-	5.0	Added notes on appendix	-
	-		Change the title of this document	
Mar. 1, 2021	-	6.0	ADDED SIZE D 400 V INPUT MODELS. CLERICAL ERROR CORRECTION.	-
July 5, 2021	-	7.0	Changeed the Business Unit name	-
	-		Changed the front cover format	
	P41		Updated the requirement for ethernet cable	
	P89		Added a note about network security	
	-		Clerical error correction	

Contents

1. Scope

The contents of this specification document are related to the AC servo driver MINAS A6B series manufactured by the Motion Control Business Unit, Industrial Device Business Division Industrial Solutions Company, Panasonic Corporation.

This product is intended for industrial equipment. It cannot be used for any other purposes (e.g. for household).

<Related documents>

TECHNICAL REFERENCE - Fanction Specification - : SX-DSV03241

TECHNICAL REFERENCE - EtherCAT Communication Specification - : SX-DSV03242

* See our Web site for the above documents.

<About EtherCAT>

EtherCAT (Ethernet for Control Automation Technology) is open network communication using real-time-

-Ethernet between masters and slaves developed by Beckhoff Automation GmbH.

ETG (EtherCAT Technology Group) has control over it.

EtherCAT® is registered trademark and patented technology,
licensed by Beckhoff Automation GmbH, Germany.

EtherCAT® Conformance tested

<IMPORTANT>

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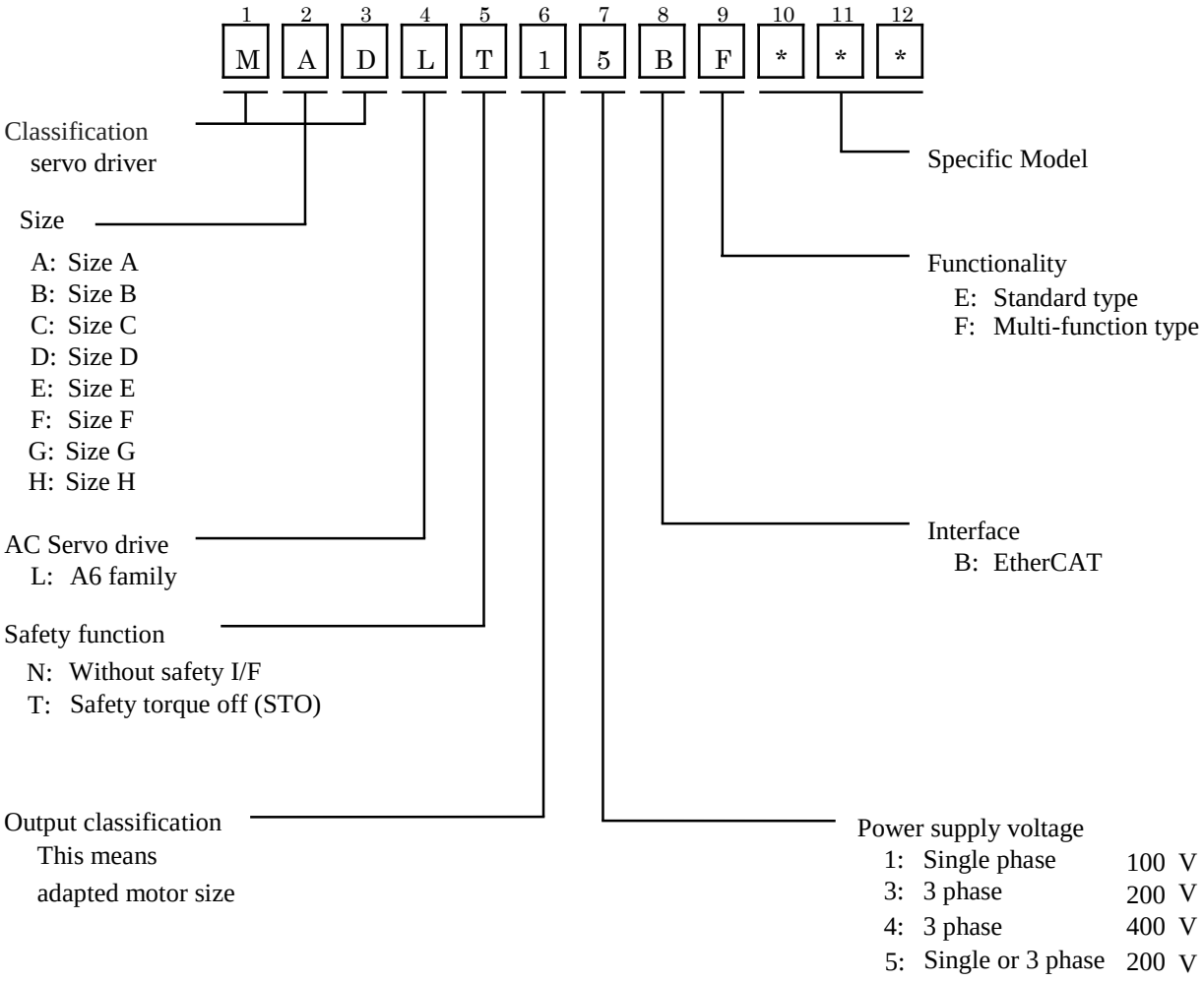
- Motor Business Unit, Panasonic Corporation reserves the right to make modifications and improvements to its products and/or documentation, including specifications and software, without prior notice.
- This product might require upgrade according to the specifications change requested by ETG. We do not have liability for expenses of such upgrades.
- This product includes open source software (OSS). Please refer to the technical reference for details. Your company might be obliged to comply with the OSS license, so please take appropriate handling by yourself.

2. Model Designation

Each segment of the model number has the following meaning.



3. Product Line-up

3-1 Standard type

Model No.	Product Code (*Note 1)	EtherCAT Conformance Test (*Note 2)	Size	Power supply input	Rated output of applicable motor (*Note 3)
MADLN01BE	60380000	○	A	Single-phase AC100-120 V	Max 50 W
MADLN11BE	60380001	○			Max 100 W
MADLN05BE	60380004	○		Single/3-phase AC200-240 V	Max 100 W
MADLN15BE	60380005	○			Max 200 W
MBDLN21BE	60380002	○	B	Single phase AC100-120 V	Max 200 W
MBDLN25BE	60380006	○		Single/3-phase AC200-240 V	Max 400 W
MCDLN31BE	60380003	○	C	Single phase AC100-120 V	Max 400 W
MCDLN35BE	60380007	○		Single/3-phase AC200-240 V	Max 750 W
MDDLN45BE	60380008	○	D	Single/3-phase AC200-240 V	Max 1000 W
MDDLN55BE	60380009	○			Max 1500 W
MEDLN83BE	6038000A	○	E	3-phase AC200-240 V	Max 2000 W
MEDLN93BE	6038000B	○			Max 2400 W
MFDLNA3BE	6038000C	○	F	3-phase AC200-240 V	Max 3000 W
MFDLNB3BE	6038000D	○			Max 5000 W

(Note 1) This is the Product code of our Servo Drive written in the ESI file (Hex numeral).

(Note 2) This shows that this product has passed the EtherCAT conformance Test conducted at EtherCAT test center.

(Note 3) Some of the combinations shown in this table cannot be used depending on motors. For the combination of a driver and a motor, refer to MINAS-A6 series catalog.

*There is no correspondence of Size G and Size H and 400 V input models for standard type.

3-2 Multi-function type

Model No.	Product Code (*Note 1)	EtherCAT Conformance Test (*Note 2)	Size	Power supply input	Rated output of applicable motor (*Note 3)
MADLT01BF	613C0000	○	A	Single-phase AC100-120 V	Max 50 W
MADLT11BF	613C0001	○			Max 100 W
MADLT05BF	613C0004	○		Single/3-phase AC200-240 V	Max 100 W
MADLT15BF	613C0005	○			Max 200 W
MBDLT21BF	613C0002	○	B	Single phase AC100-120 V	Max 200 W
MBDLT25BF	613C0006	○		Single/3-phase AC200-240 V	Max 400 W
MCDLT31BF	613C0003	○	C	Single phase AC100-120 V	Max 400 W
MCDLT35BF	613C0007	○		Single/3-phase AC200-240 V	Max 750 W
MDDLT45BF	613C0008	○	D	Single/3-phase AC200-240 V	Max 1000 W
MDDLT55BF	613C0009	○			Max 1500 W
MEDLT83BF	613C000A	○	E	3-phase AC200-240 V	Max 2000 W
MEDLT93BF	613C000B	○			Max 2400 W
MFDLTA3BF	613C000C	○	F	3-phase AC200-240 V	Max 3000 W
MFDLTB3BF	613C000D	○			Max 5000 W
MGDLTC3BF	613C000E	○	G	3-phase AC200-240 V	Max 7500 W
MHDLTE3BF	613C000F	○	H	3-phase AC200-240 V	Max 15000 W
MHDLTF3BF	613C0010	○			Max 22000 W
MDDLT44BF	613C0011	◯	D	3-phase AC380-480 V TN (Ground the neutral point)	Max 600 W
MDDLT54BF	613C0012	◯			Max 1000 W
MDDLT64BF	613C0013	◯			Max 1500 W
MEDLT84BF	613C0014	◯	E	3-phase AC380-480 V TN (Ground the neutral point)	Max 2000 W
MFDLTA4BF	613C0016	◯	F	3-phase AC380-480 V TN (Ground the neutral point)	Max 3000 W
MFDLTB4BF	613C0017	◯			Max 5000 W

(Note 1) This is the Product code of our Servo Drive written in the ESI file (Hex numeral).

(Note 2) This shows that this product has passed the EtherCAT conformance Test conducted at EtherCAT test center.

(Note 3) Some of the combinations shown in this table cannot be used depending on motors. For the combination of a driver and a motor, refer to MINAS-A6 series catalog.

4. Specifications

Basic specifications

Item				Description
Input power supply	100 V	Main circuit power supply		Single-phase 100 - 120 V +10 % -15 % 50/60 Hz
		Control circuit power supply		Single-phase 100 - 120 V +10 % -15 % 50/60 Hz
	200 V	Main circuit power supply	A-D	Single-phase/3-phase 200 - 240 V +10 % -15 % 50/60 Hz
			E-H	3-phase 200 - 240 V +10 % -15 % 50/60 Hz
		Control circuit power supply	A-D	Single-phase 200 - 240 V +10 % -15 % 50/60 Hz
			E-H	Single-phase 200 - 240 V +10 % -15 % 50/60 Hz
	400 V	Main circuit power supply		3-phase 380 - 480 V +10 % -15 % 50/60 Hz TN (Ground the neutral point)
		Control circuit power supply		DC 24 V ±15 %
Working ambient condition		Temperature		Operation temperature: 0 - 55 degrees C (without freezing) Storage temperature -20 to 65 degrees C (Max.temperature guarantee : 80 degrees C for 72 hours without dew condensation *1)
		Humidity		Working/storage humidity 20 - 85%RH or less (without condensation*1)
		Altitude		1,000 m above sea level or less
		Vibration		5.88 m/s^2 or less, 10 to 60 Hz
		Pollution degree		Pollution degree 2 or 1
Insulation voltage				Withstanding 1,500 VAC between the primary and grounding lines for one minute
Control method				IGBT PWM method, sine wave drive
Encoder feedback				23bit(resolution:8388608) 7wires-serial absolute encoder
External scale feedback *2				A/B phase, homing signal defferential input type Panasonic supported serial communication type *3
Control signal			Input	Each 8 input can be assigned by the parameter
			Output	Each 3 output can be assigned by the parameter
Analog signal			Output	2 outputs (analog monitor 1, analog monitor 2)
Pulse signal			Output	Line driver output for encoder pulse (A/B phase signal) or external scale pulses.
Communication function			EtherCAT	Interface for motion control.
			USB	USB interface to connect to computers (setup software PANATERM) for parameter setting or status monitoring.
Safety terminal *2				Connector to support functional safety
Front panel				1. 7-segment 2-digit LED (double digits) 2. Network status LED (RUN, ERR, L/A IN, L/A OUT) 3. Rotary switch for node address setting 4. Analog monitor output (Analog monitors 1 and 2)
Regeneration				Sizes A,B,G,H: Without built-in regenerative resistor (use external mounting) Sizes C to F: With built-in regenerative resistor (External regenerative resistor is also available)
Dynamic brake				Sizes A to G: Built in Size H : Extercal only
Control mode				Position control: Profile position mode (pp), Cyclic synchronous position mode (csp), Homing mode (hm) Velocity control: Profile velocity mode (pv), Cyclic synchronous velocity mode (csv) Torque control: Torque profile mode (tq), Cyclic synchronous torque mode (cst) These modes are switchable each other with commands through EtherCAT.

*1 Please note that condensation tend to occur when temperature fall.

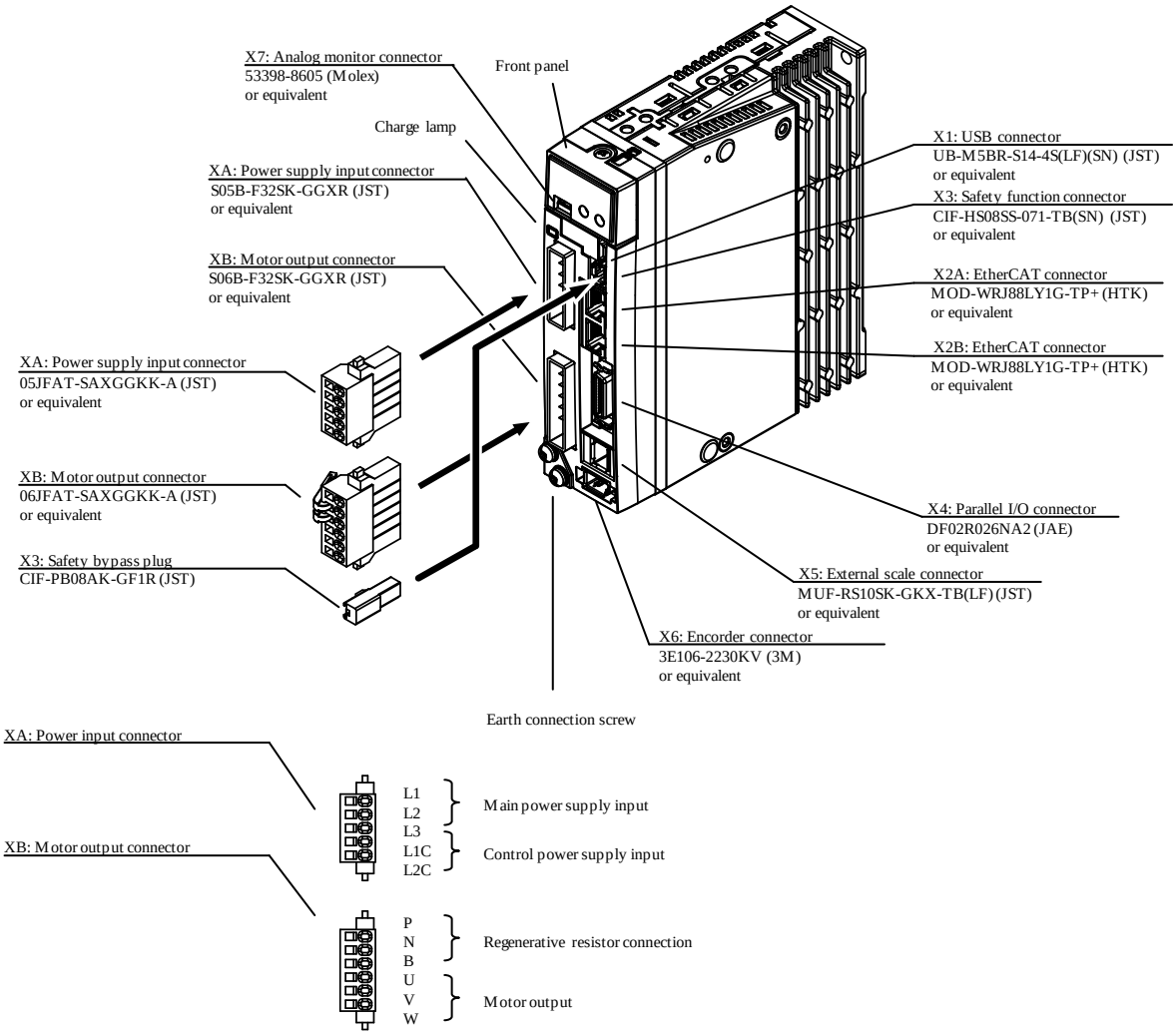
*2 It can not be used for standard type.

*3 Please refer to the collaboration catalog for the corresponding scale maker and part number.

5. Appearance and name of each part

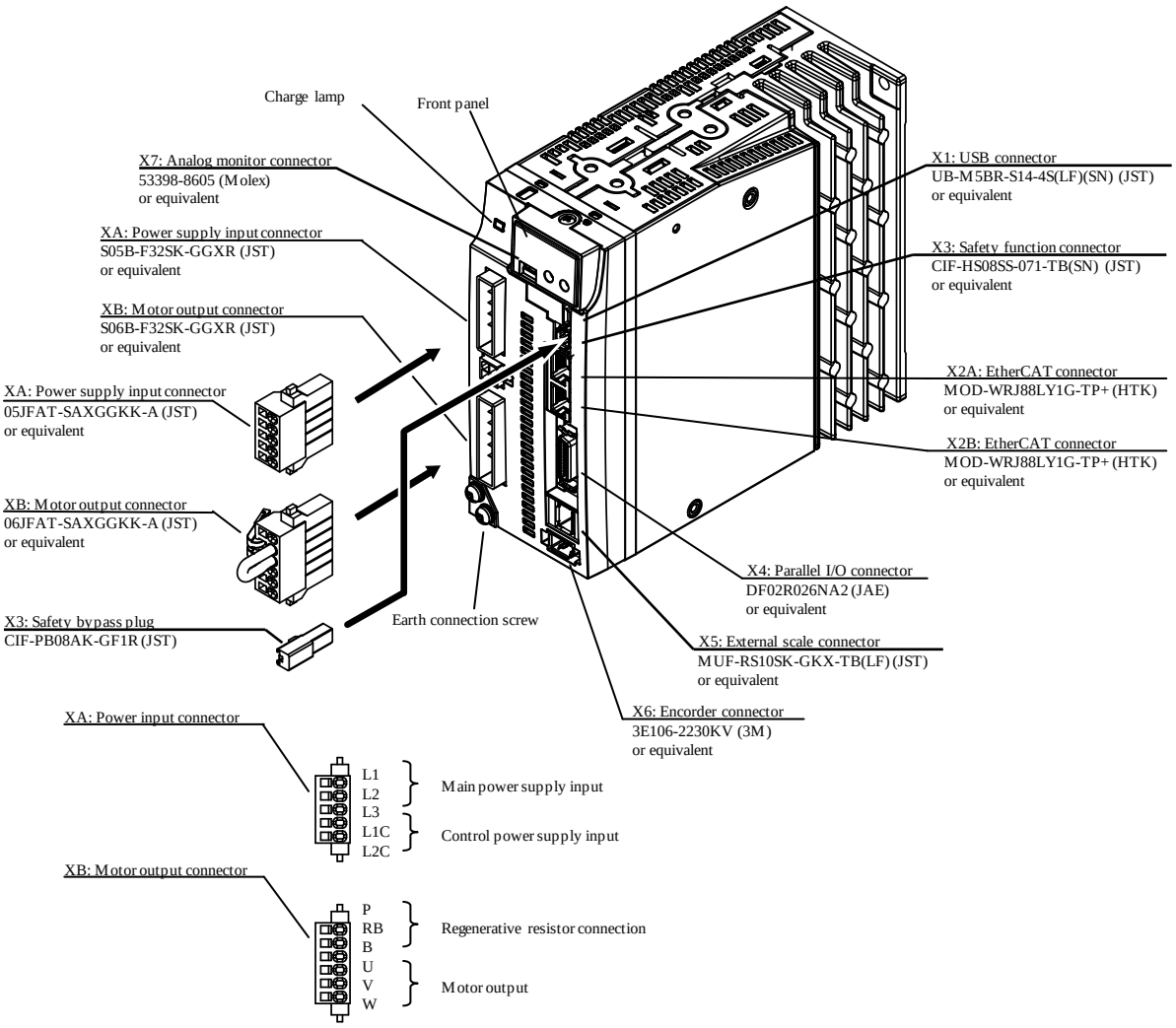
Each size in the figures shows a multi-function type. The standard type is not provided with X3 (safety function connector/safety bypass plug) and X5 (external scale connector).

Size A, B 100 V / 200 V



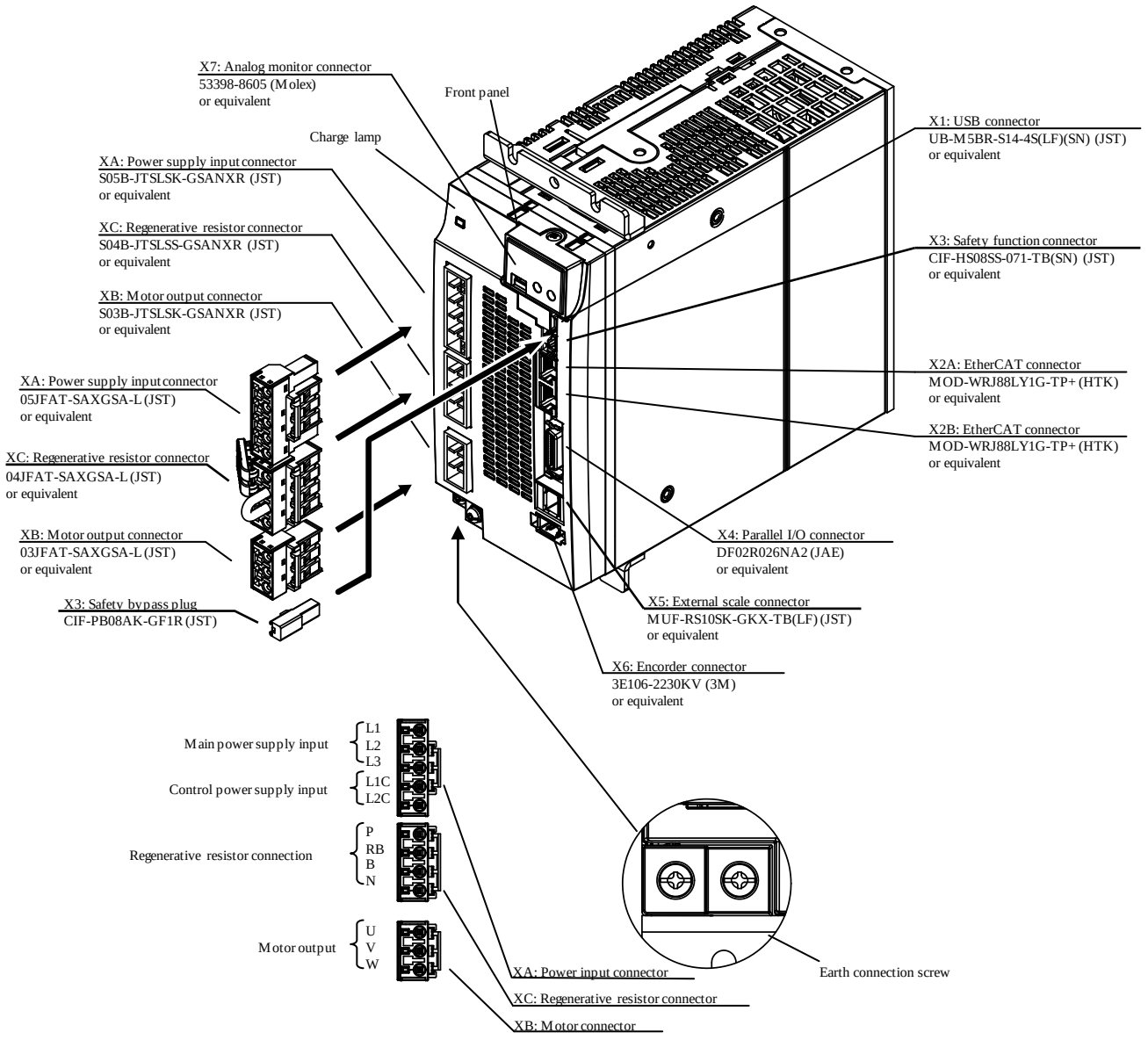
*Remove the safety bypass plug when wiring to X3.

Size C, D 100 V / 200 V



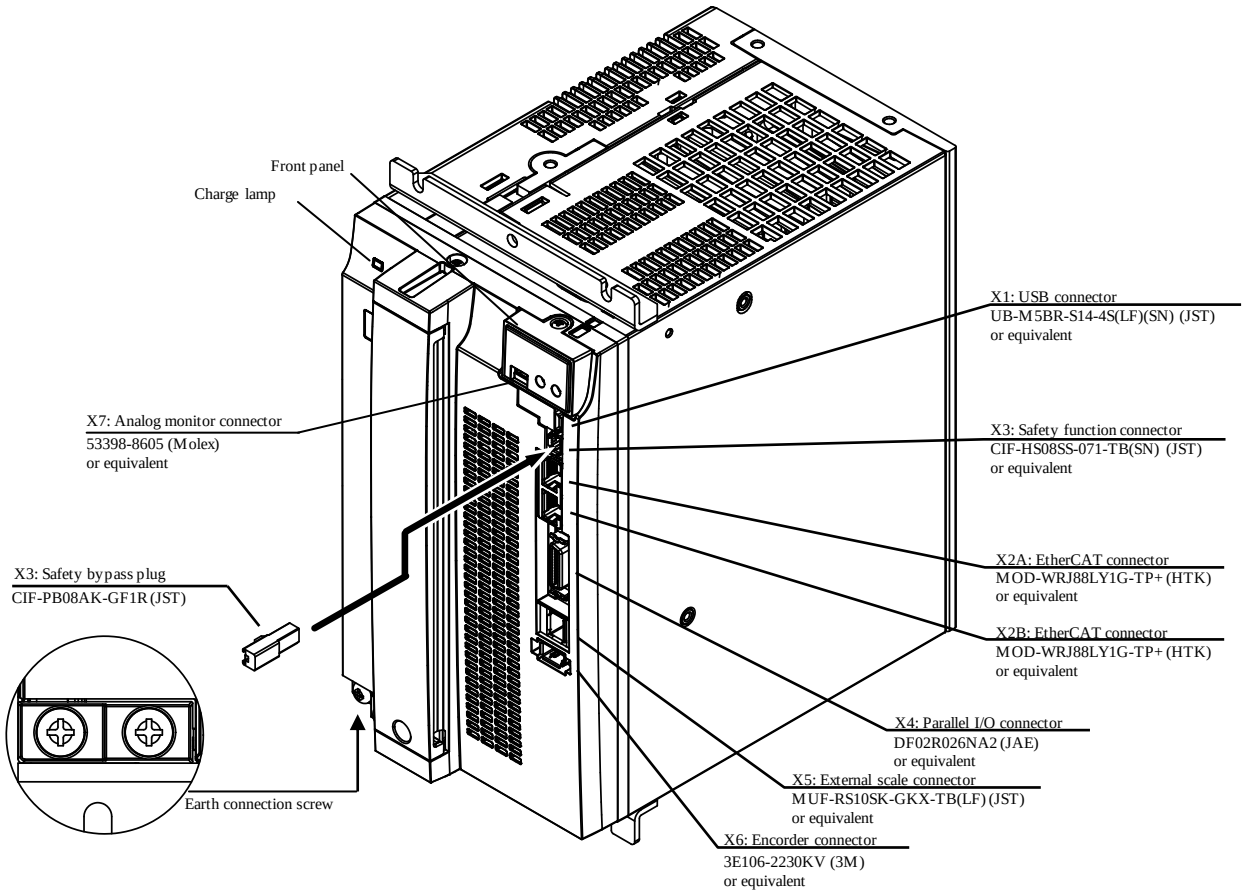
*Remove the safety bypass plug when wiring to X3.

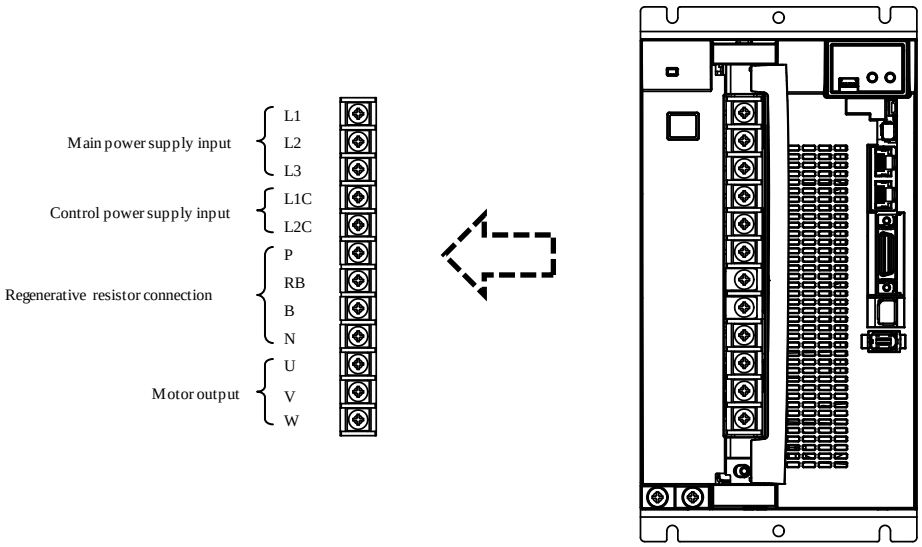
Size E 200 V



*Remove the safety bypass plug when wiring to X3.

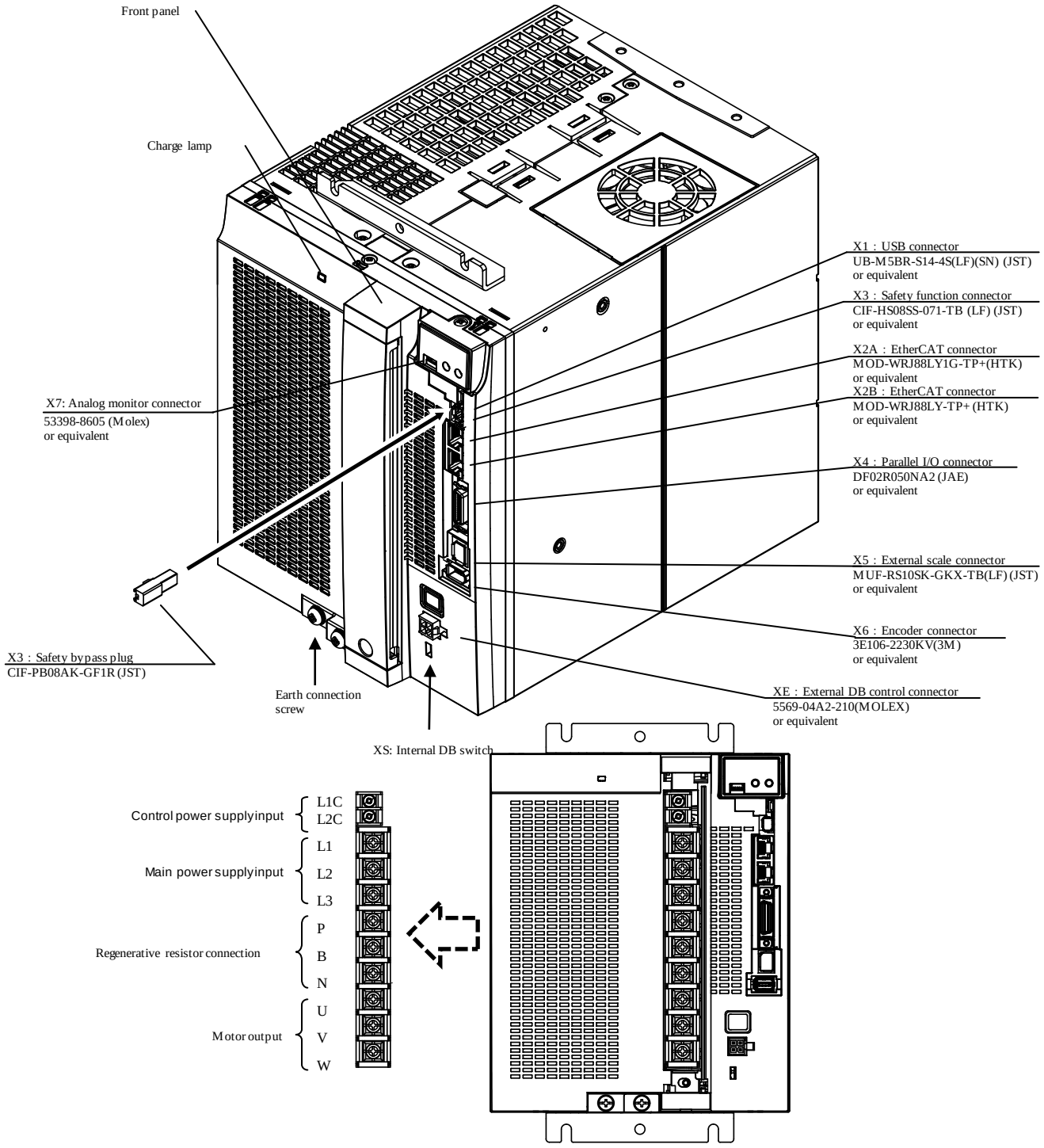
Size F 200 V





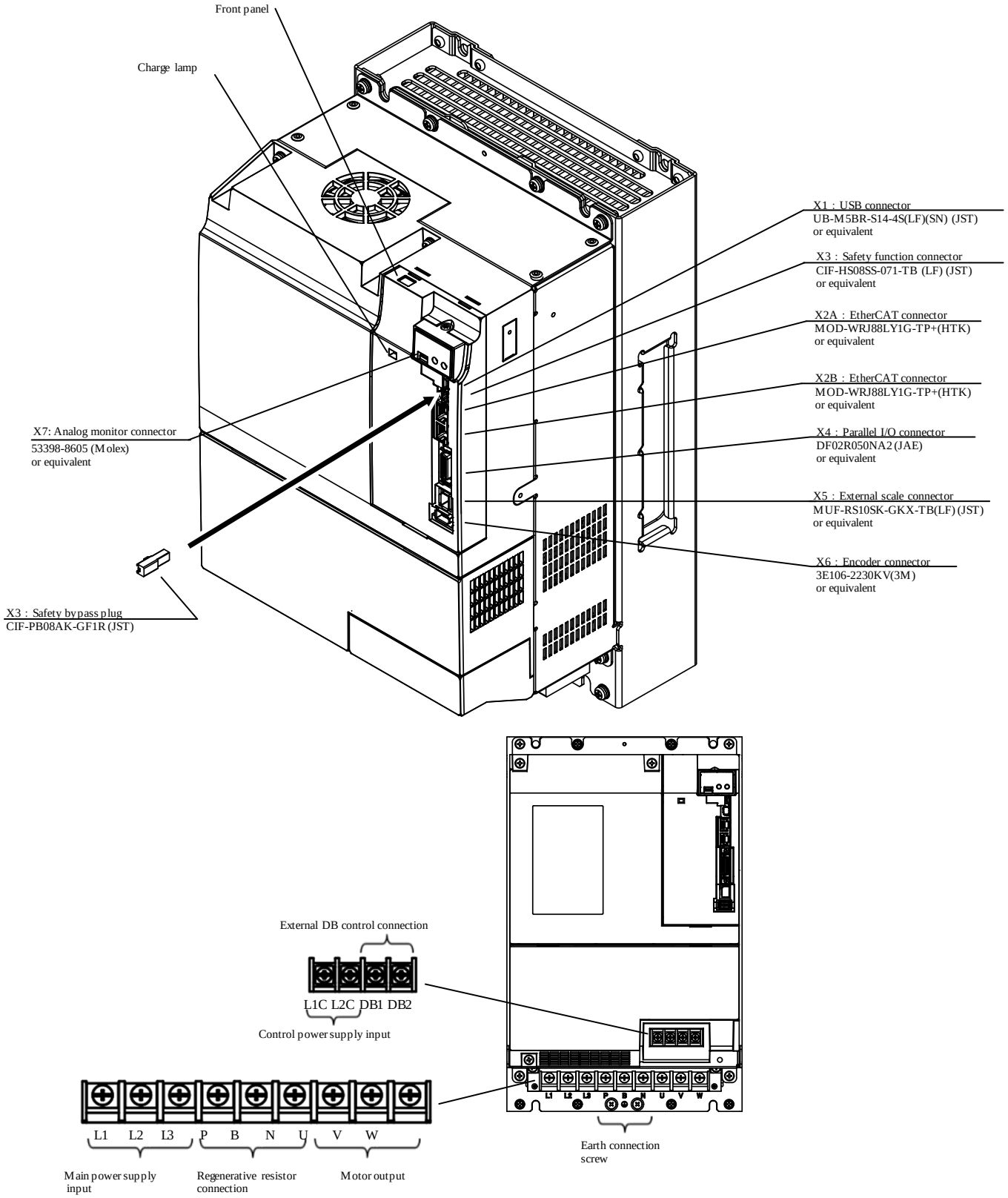
*Remove the safety bypass plug when wiring to X3.

Size G 200 V



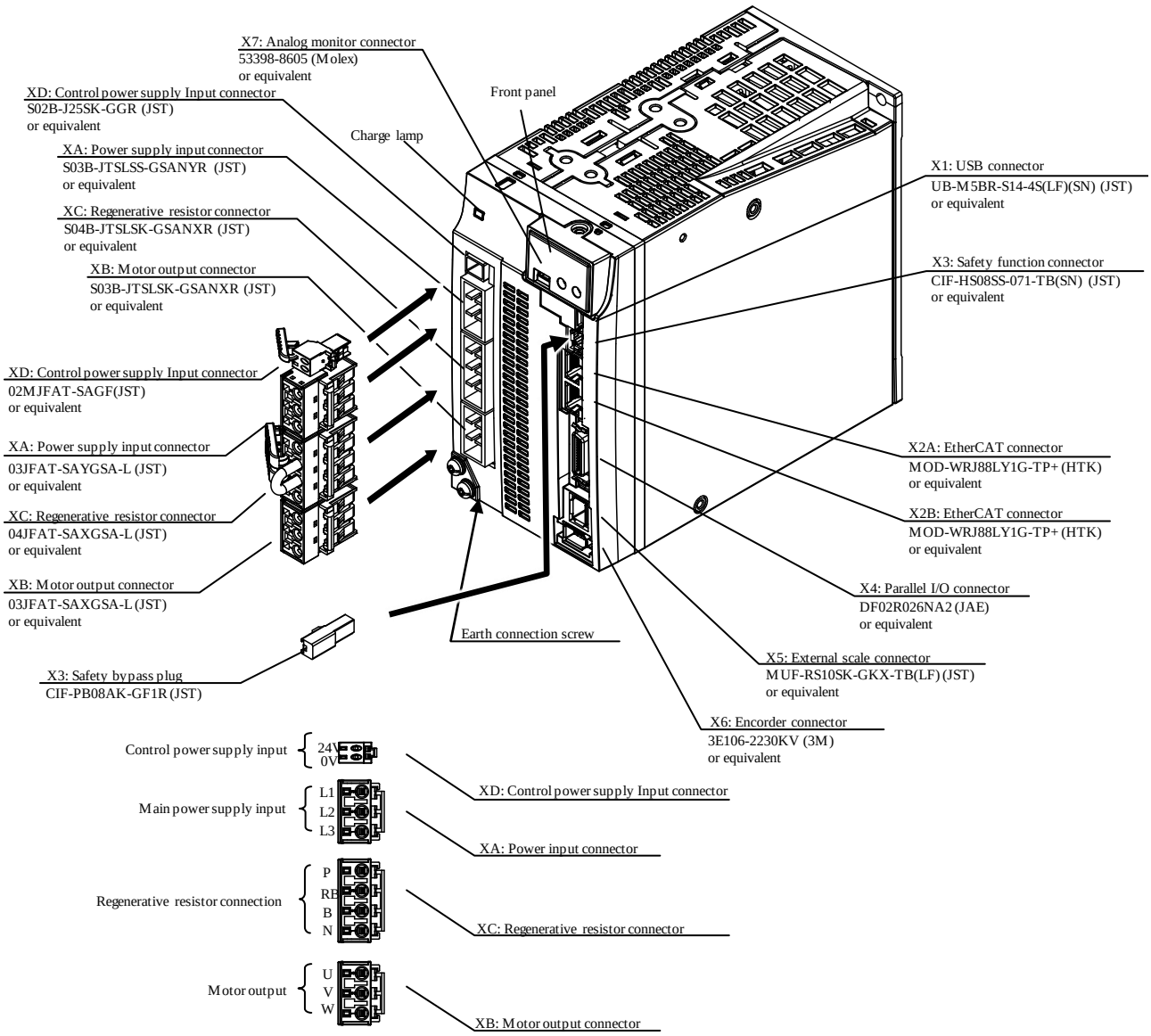
*Remove the safety bypass plug when wiring to X3.

Size H 200 V



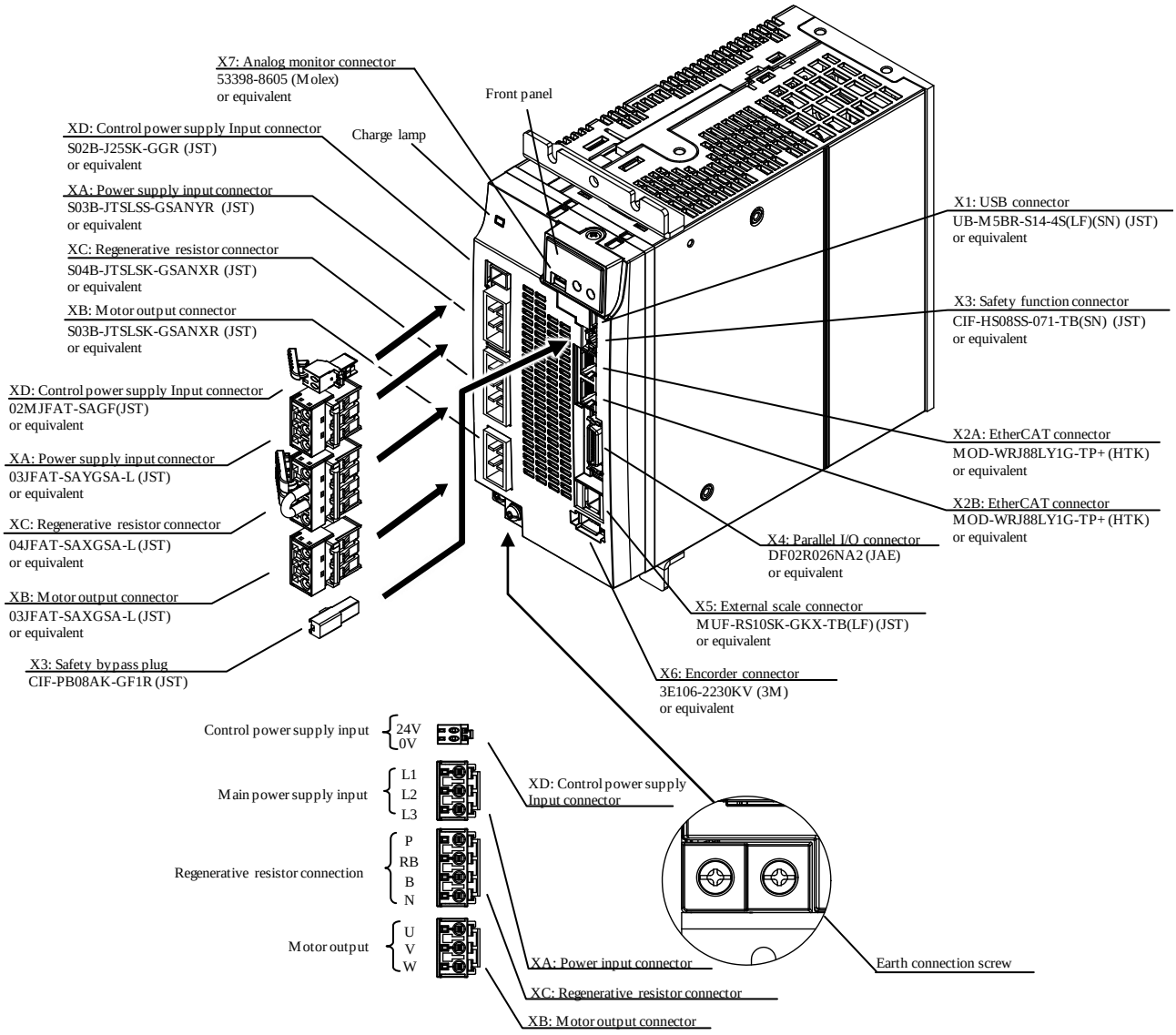
*Remove the safety bypass plug when wiring to X3.

Size D 400 V



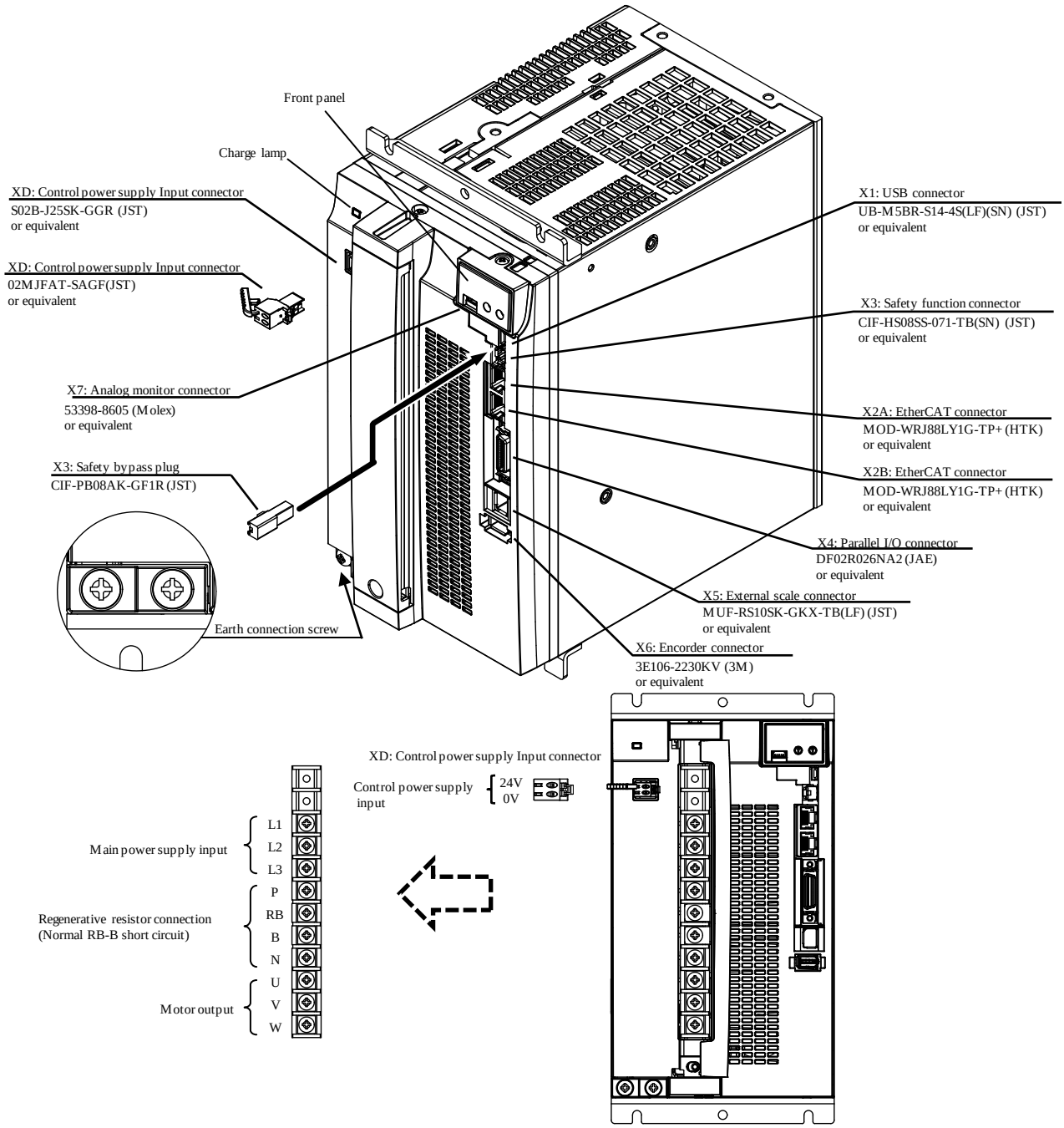
*Remove the safety bypass plug when wiring to X3.

Size E 400 V



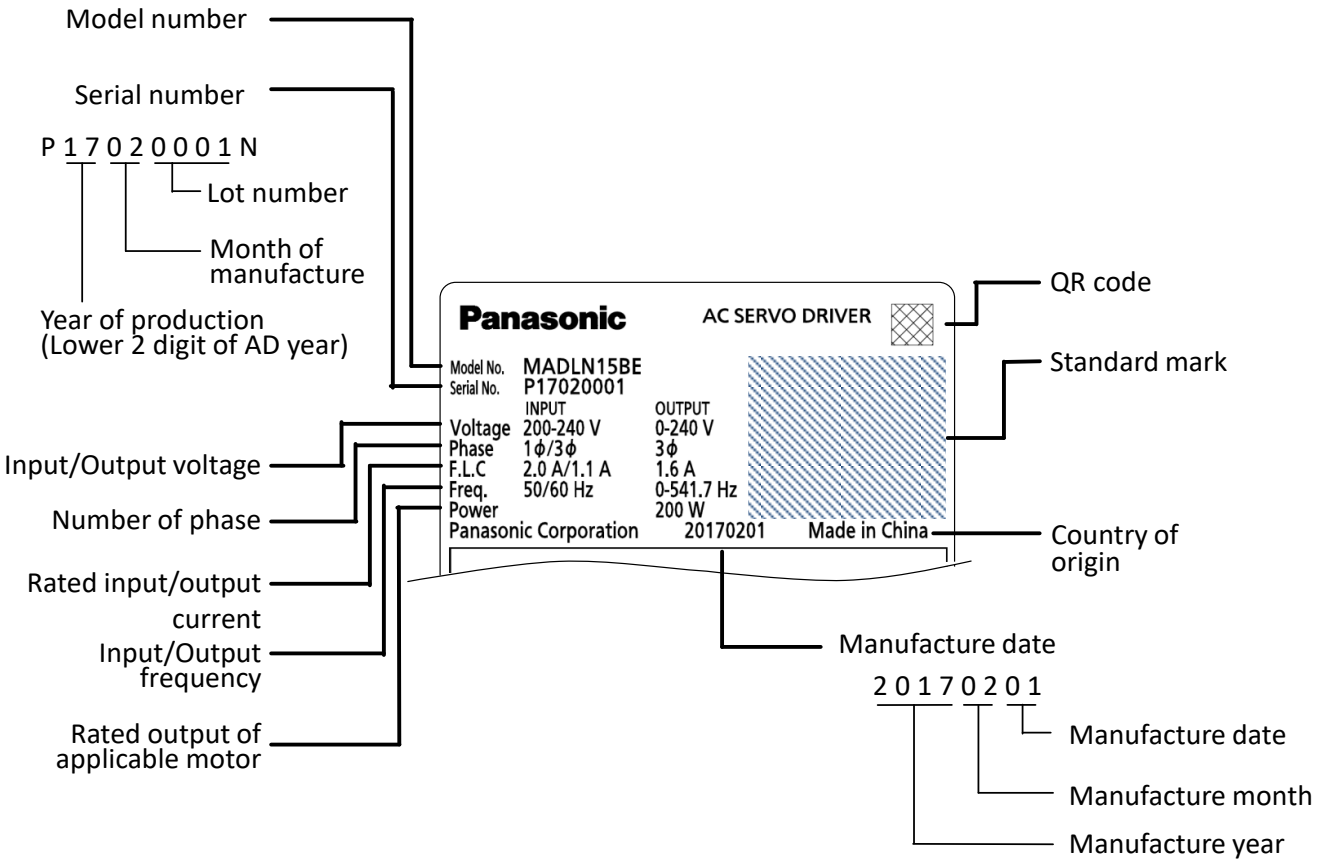
*Remove the safety bypass plug when wiring to X3.

Size F 400 V



*Remove the safety bypass plug when wiring to X3.

Name plate

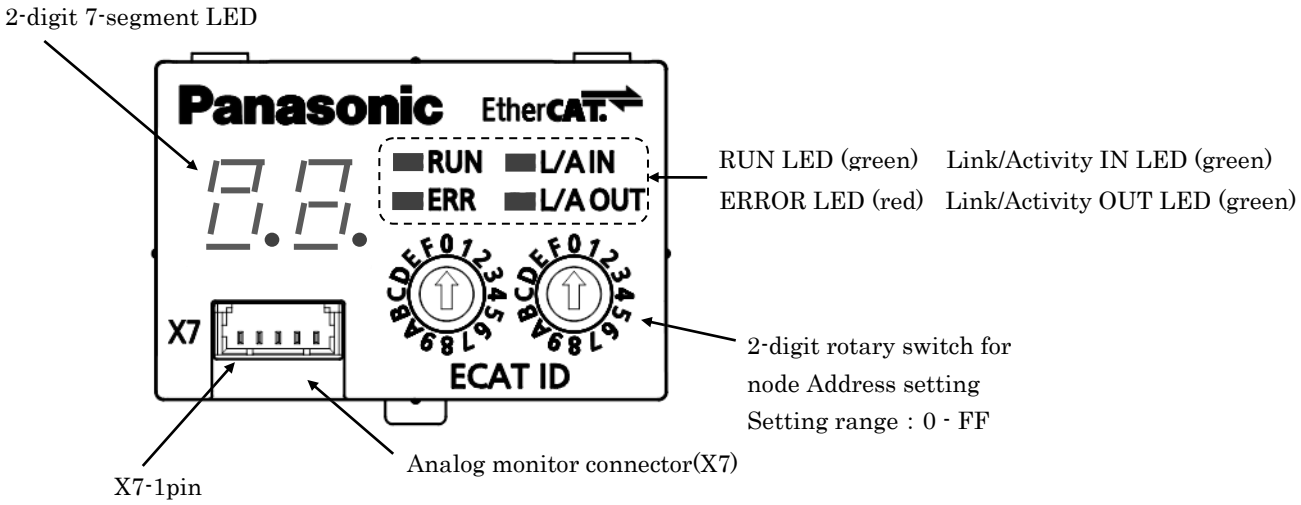


The range of the serial number part of the serial number is 1 to 33999, but on the nameplate it is written in 4 digits in the following format.

"I" and "O" are not used for the fourth-digit alphabet.

Value of the serial number part	Indication on the rating plate
1 - 9999	0001 - 9999
10000 - 10999	A000 - A999
11000 - 11999	B000 - B999
⋮	⋮
17000 - 17999	H000 - H999
18000 - 18999	J000 - J999
⋮	⋮
22000 - 22999	N000 - N999
23000 - 23999	P000 - P999
⋮	⋮
33000 - 33999	Z000 - Z999

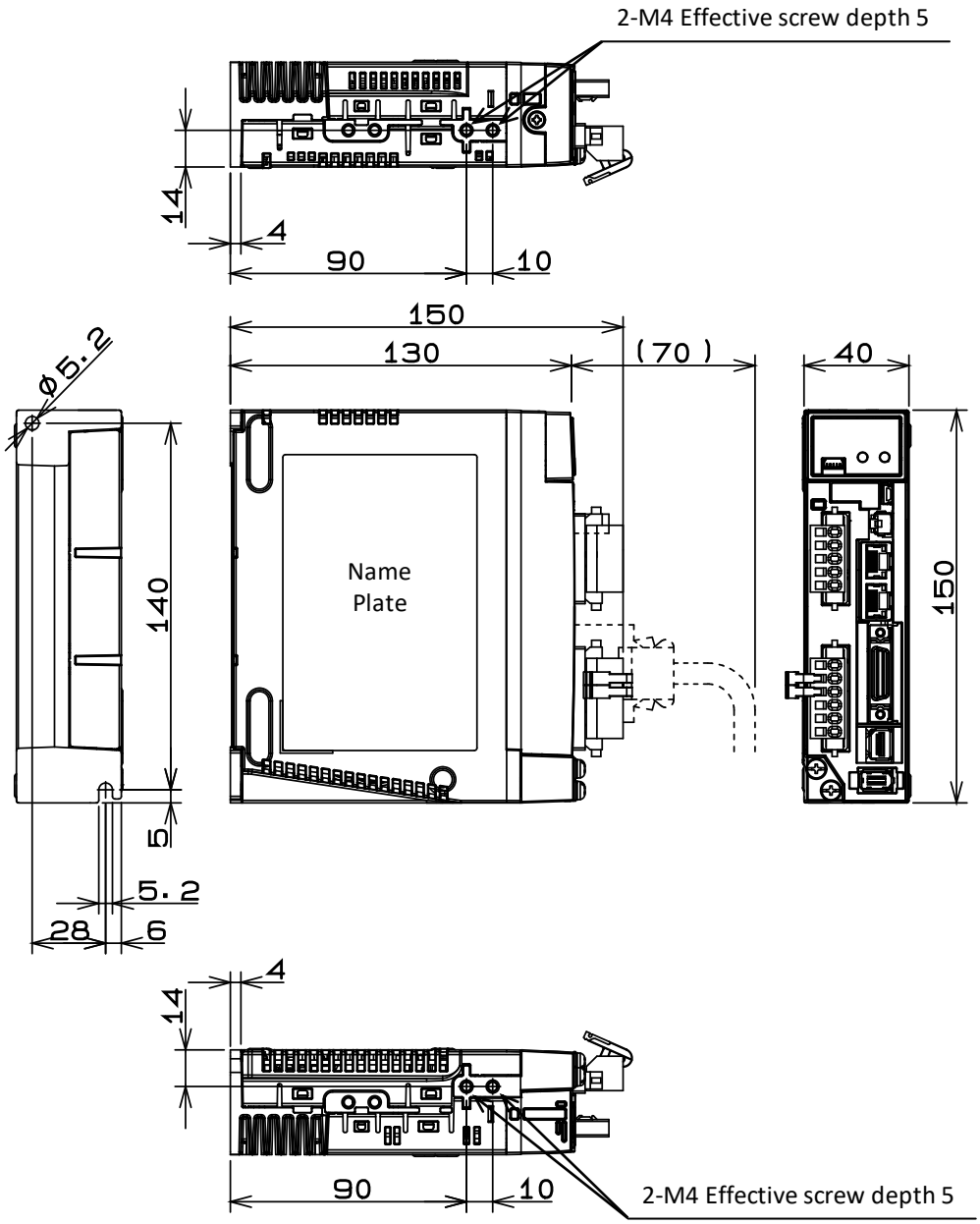
Front panel


2-digit 7-segment LED
Panasonic
EtherCAT
RUN
L/A IN
ERR
L/A OUT
X7
ECAT ID
RUN LED (green) Link/Activity IN LED (green)
ERROR LED (red) Link/Activity OUT LED (green)
2-digit rotary switch for
node Address setting
Setting range : 0 - FF
X7-1pin
Analog monitor connector(X7)

6. Dimensions

In each size, external dimensions of the standard type, general purpose communication type and multifunction type are common. Each figure below shows standard type.
For the 400 V system, some dimensions may be different (See note).

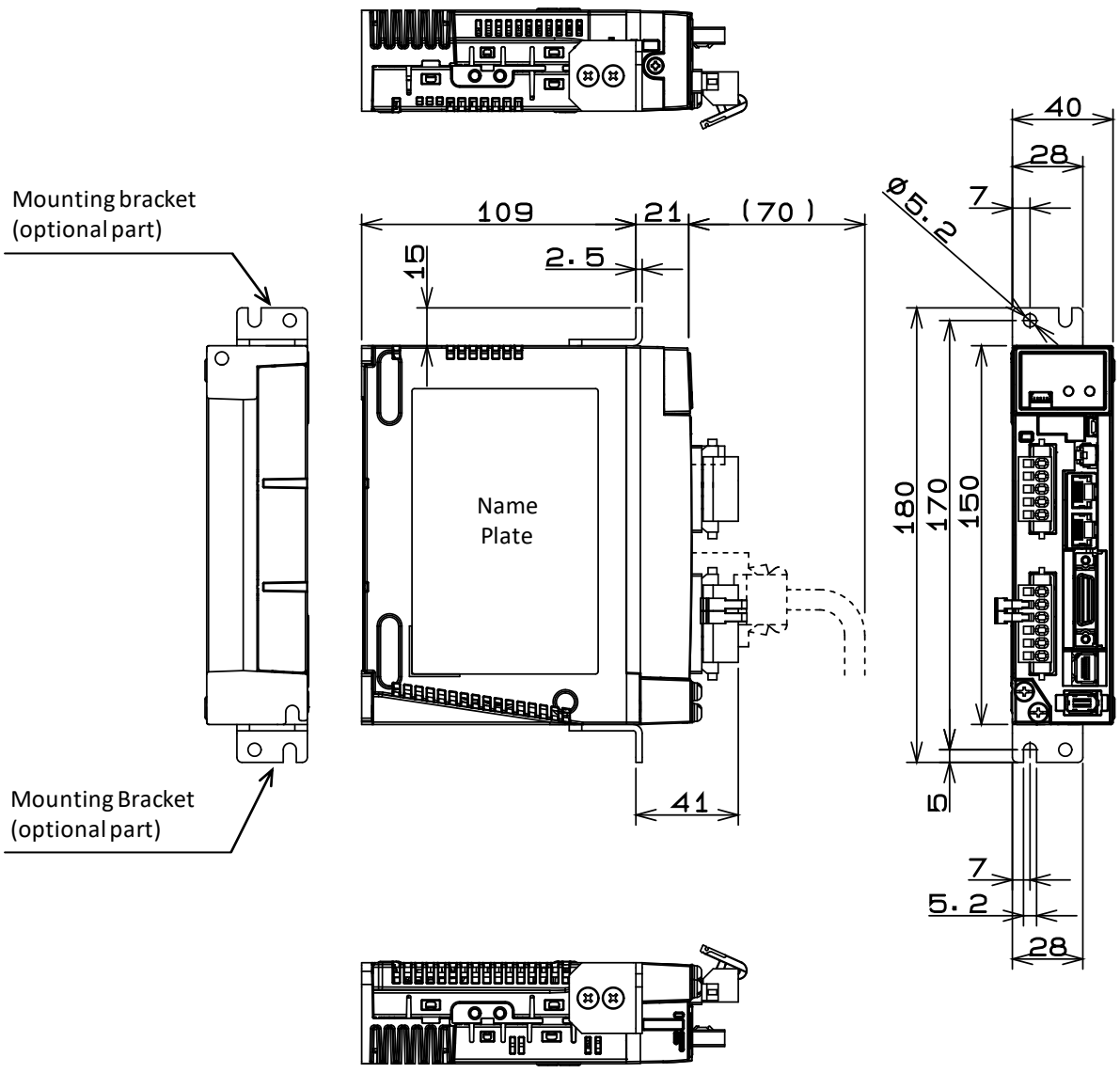
Size A 100 V / 200 V



Unit: mm

* Do not use threaded screw holes that do not have description of dimensions.

[Rack mount installation (Option: Mounted on the front)]

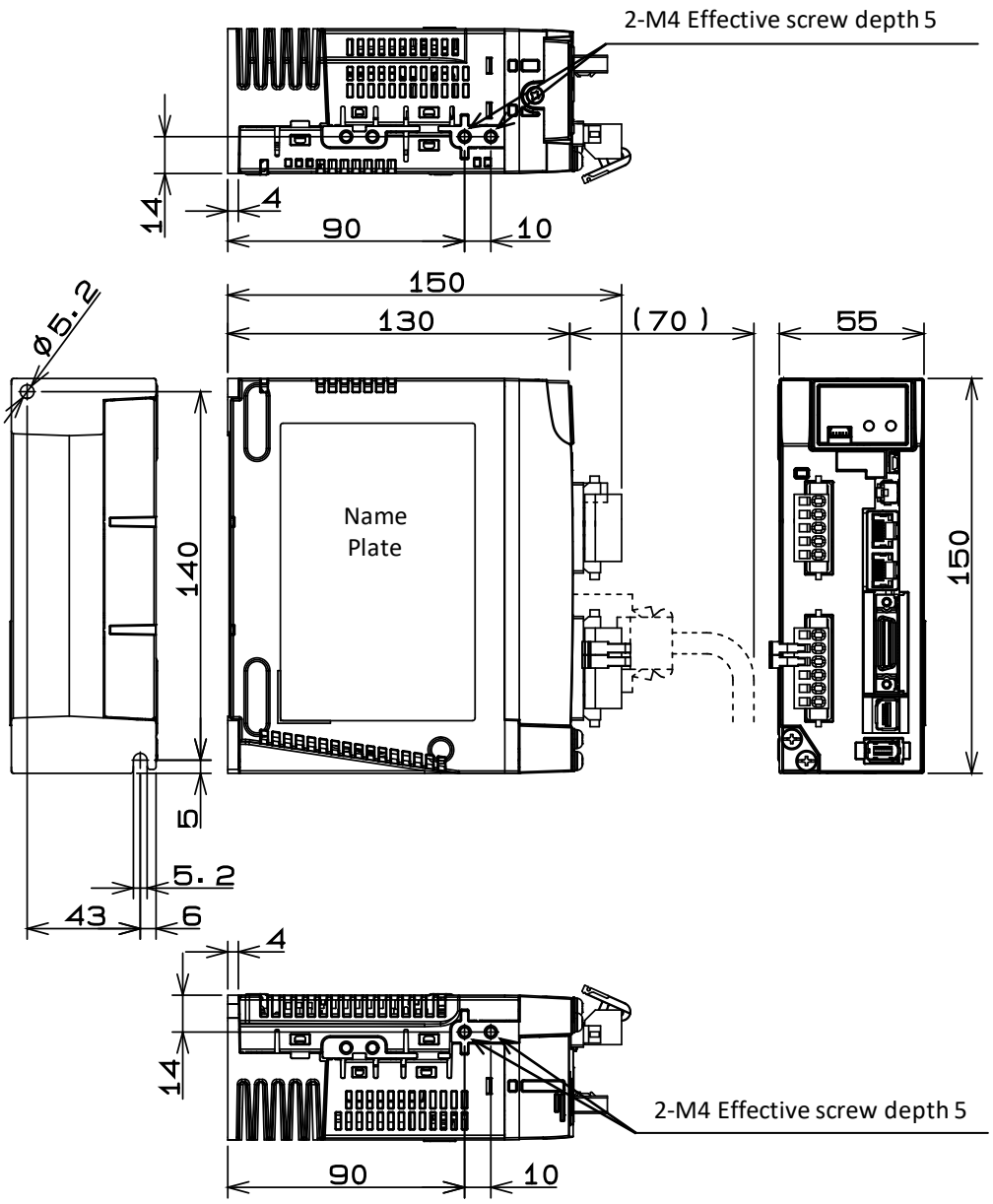


Unit: mm

* Do not use threaded screw holes that do not have description of dimensions.

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

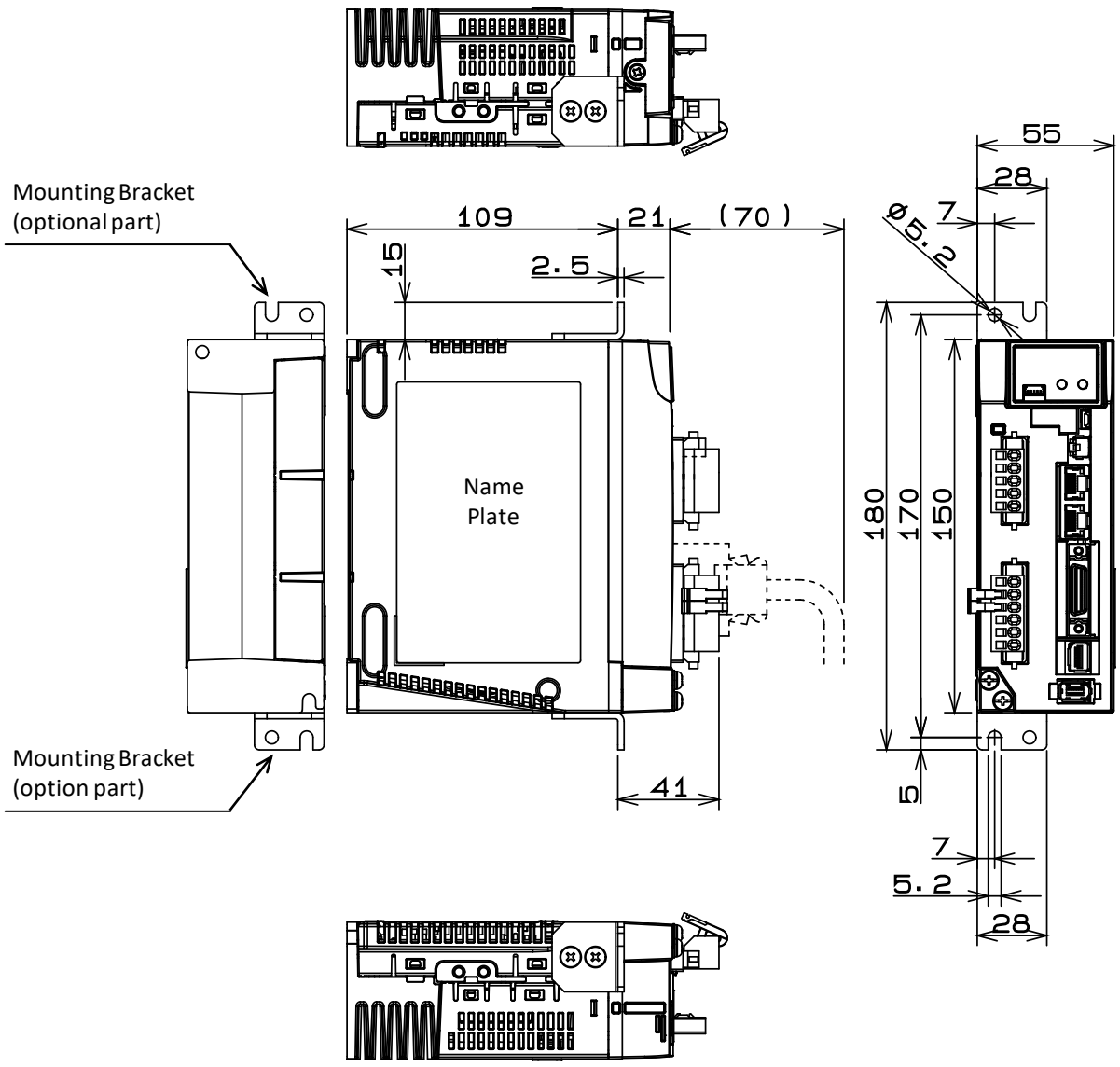
Size B 100 V / 200 V



Unit: mm

* Do not use threaded screw holes that do not have description of dimensions.

[Rack mount installation (Option: Mounted on the front)]

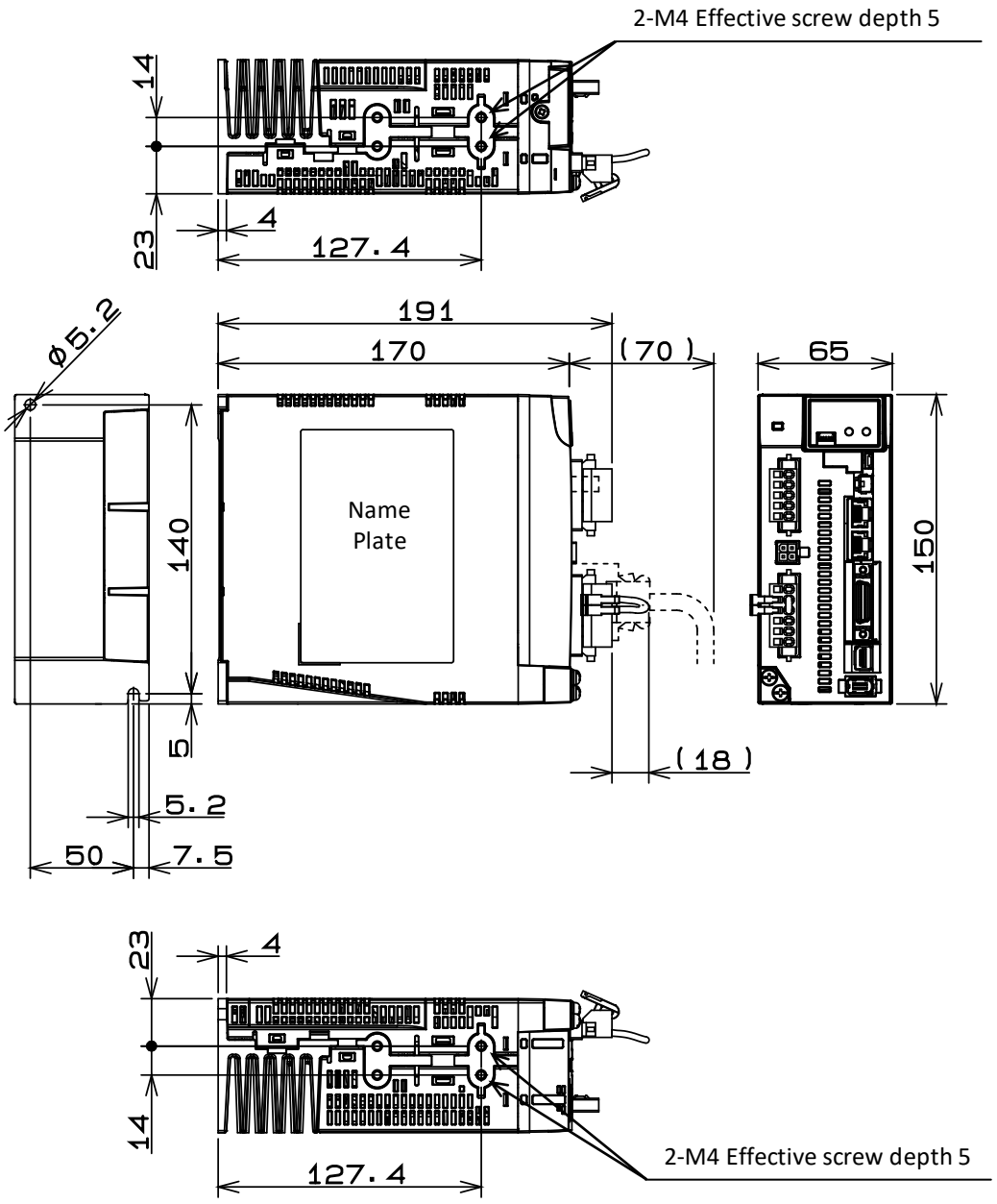


Unit: mm

* Do not use threaded screw holes that do not have description of dimensions.

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

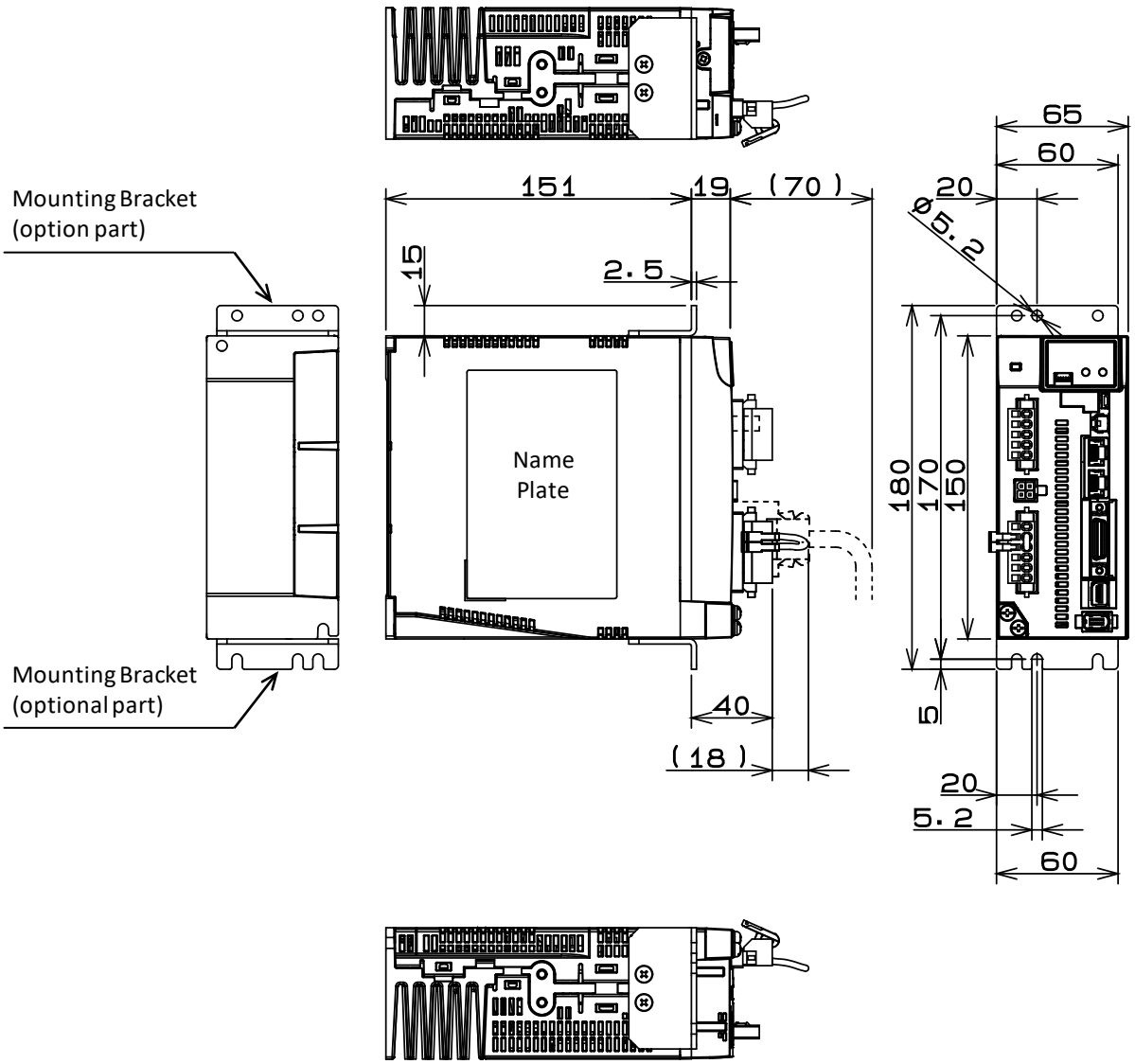
Size C 100 V / 200 V



Unit: mm

* Do not use threaded screw holes that do not have description of dimensions.

[Rack mount installation (Option: Mounted on the front)]

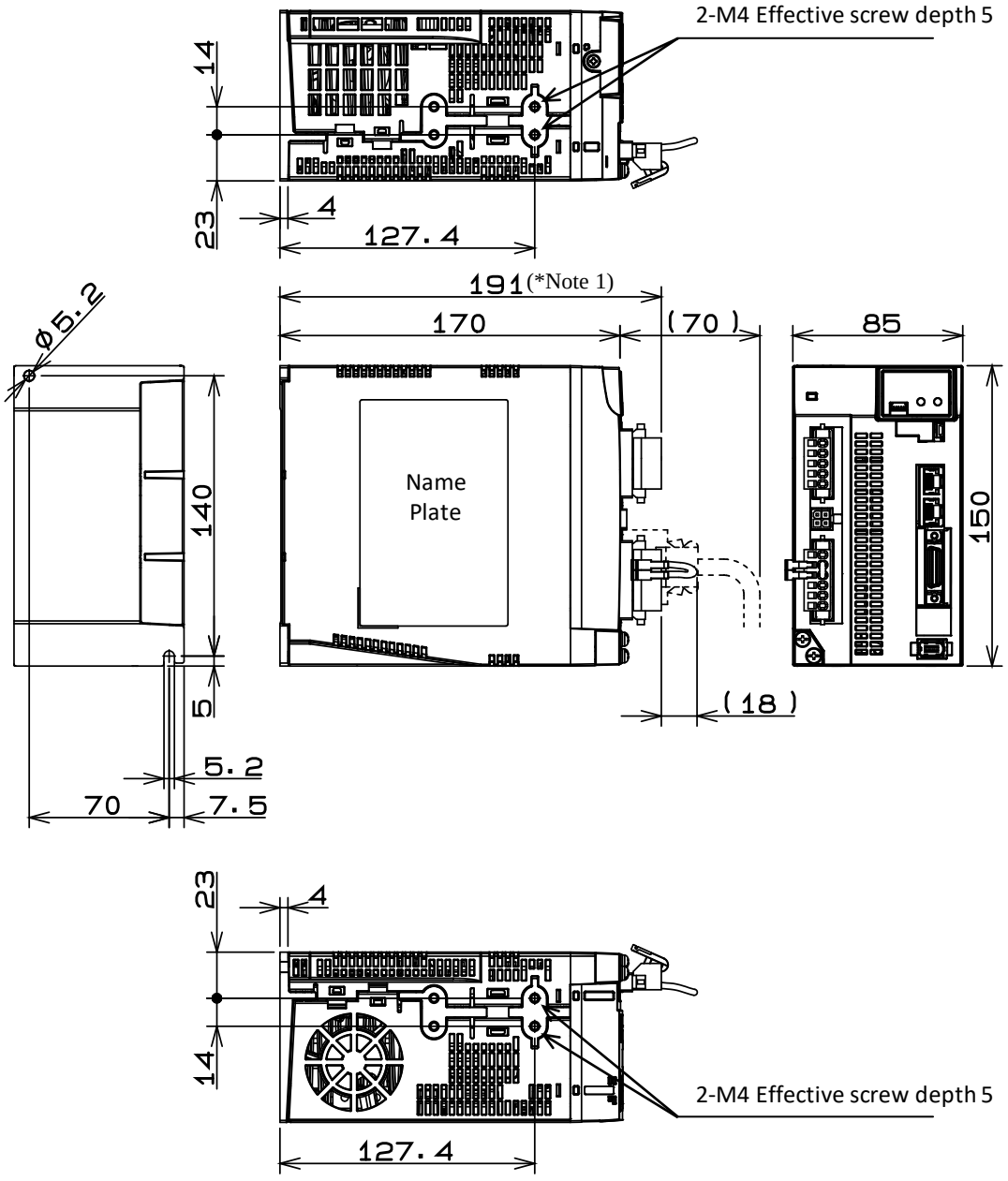


Unit: mm

* Do not use threaded screw holes that do not have description of dimensions.

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

Size D 200 V / 400 V

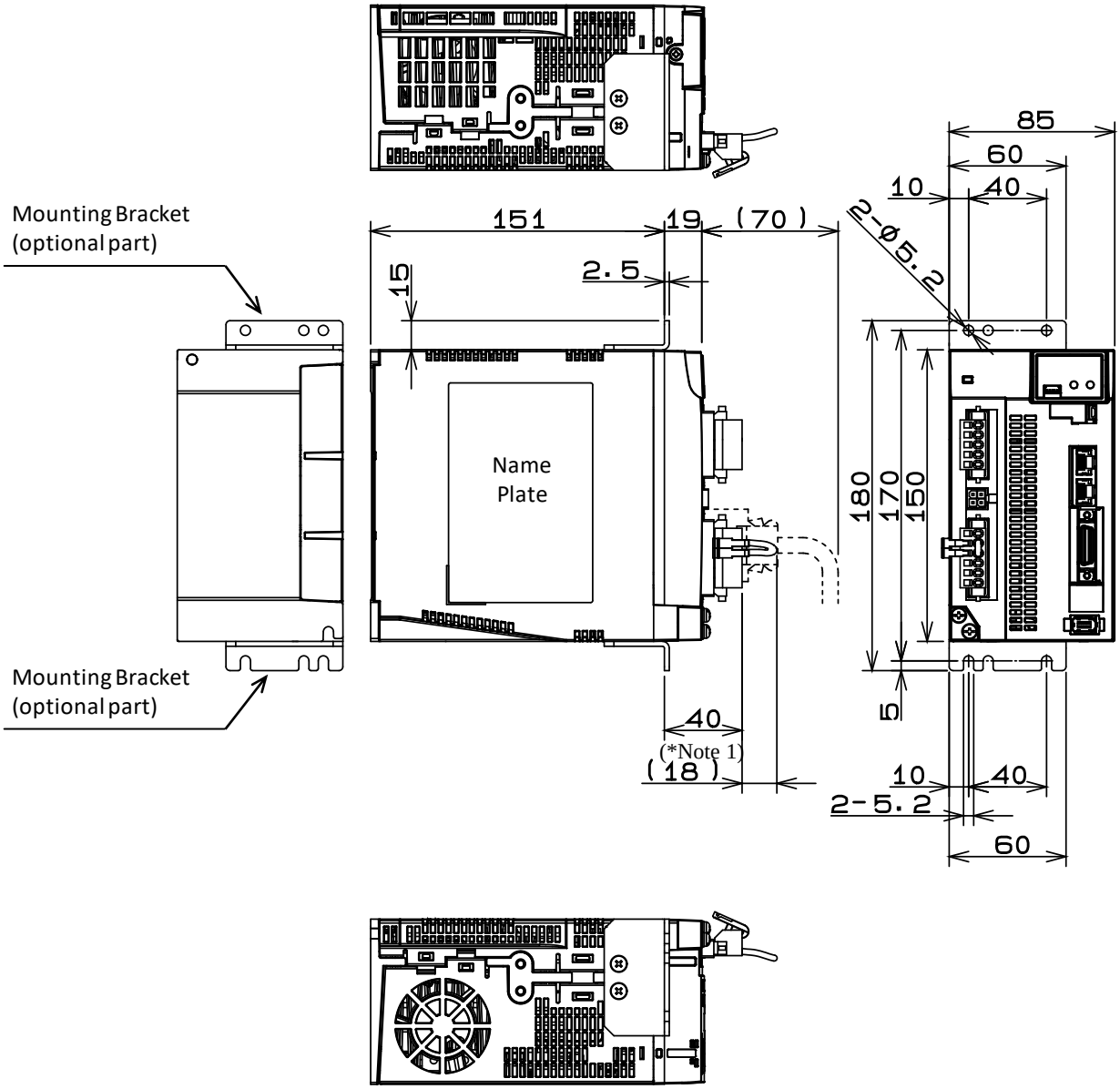


Unit: mm

Note 1) The dimensions of the 400 V system are 188 mm.

* Do not use threaded screw holes that do not have description of dimensions.

[Rack mount installation (Option: Mounted on the front)]



Unit: mm

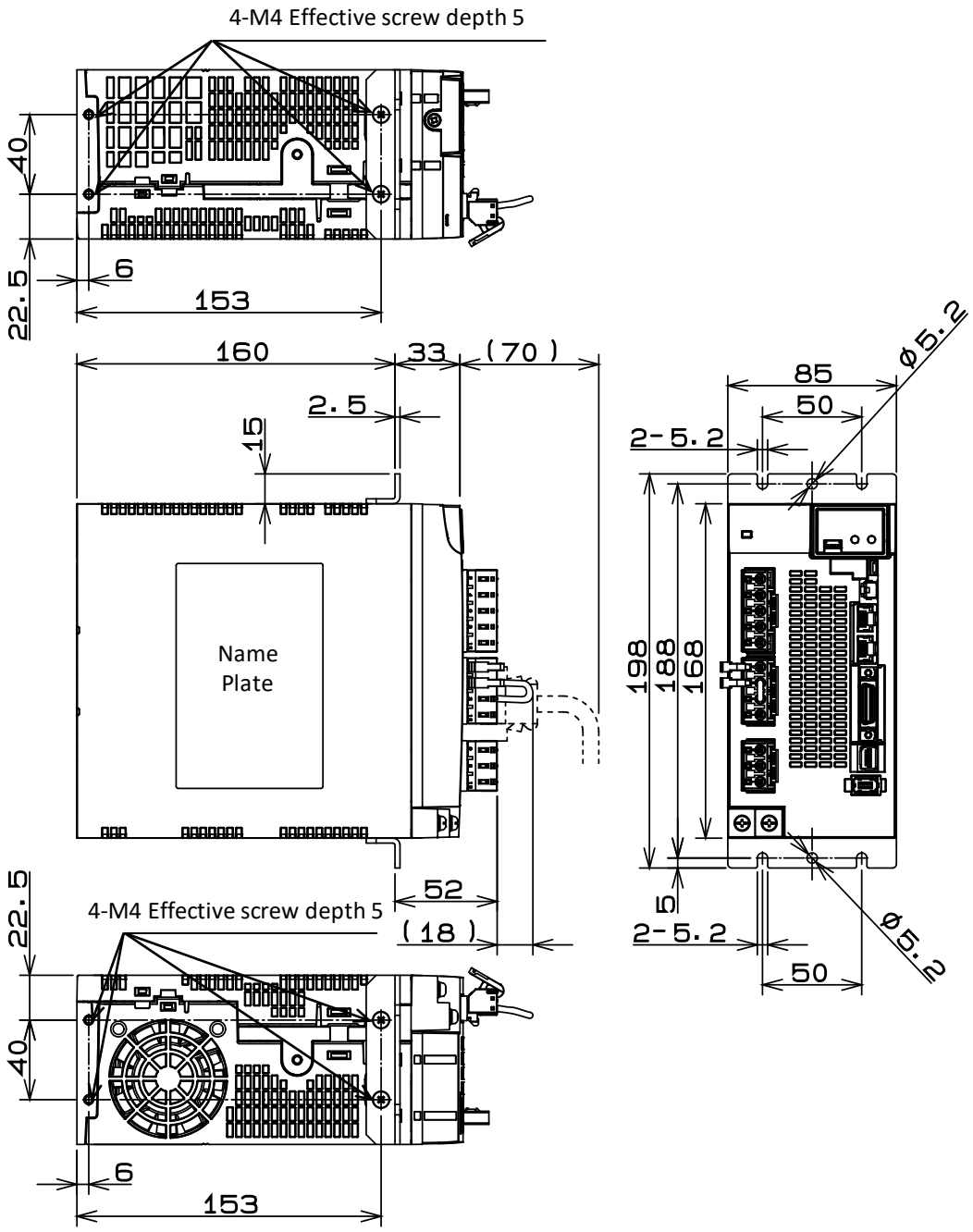
Note 1) The dimensions of the 400 V system are 37 mm.

* Do not use threaded screw holes that do not have description of dimensions.

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

Size E 200 V / 400 V

[Rack mount installation (standard: to be installed on the front)]

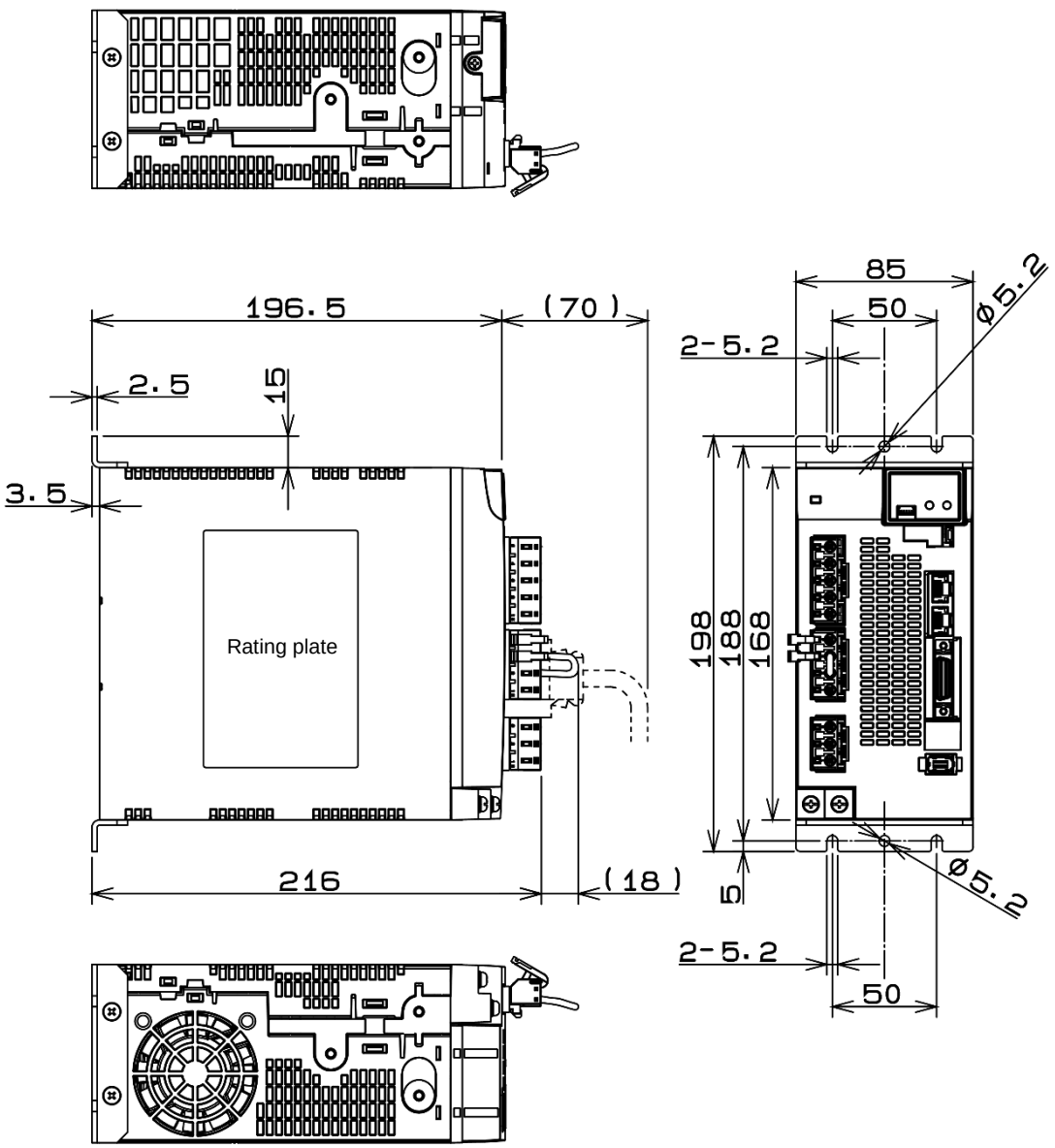


Unit: mm

*Do not use threaded screw holes that do not have description of dimensions.

* When installing the driver, please fix it with 4 U-shaped cutouts of the mounting bracket.

[Base mount installation (with brackets moved: to be installed on the rear)]



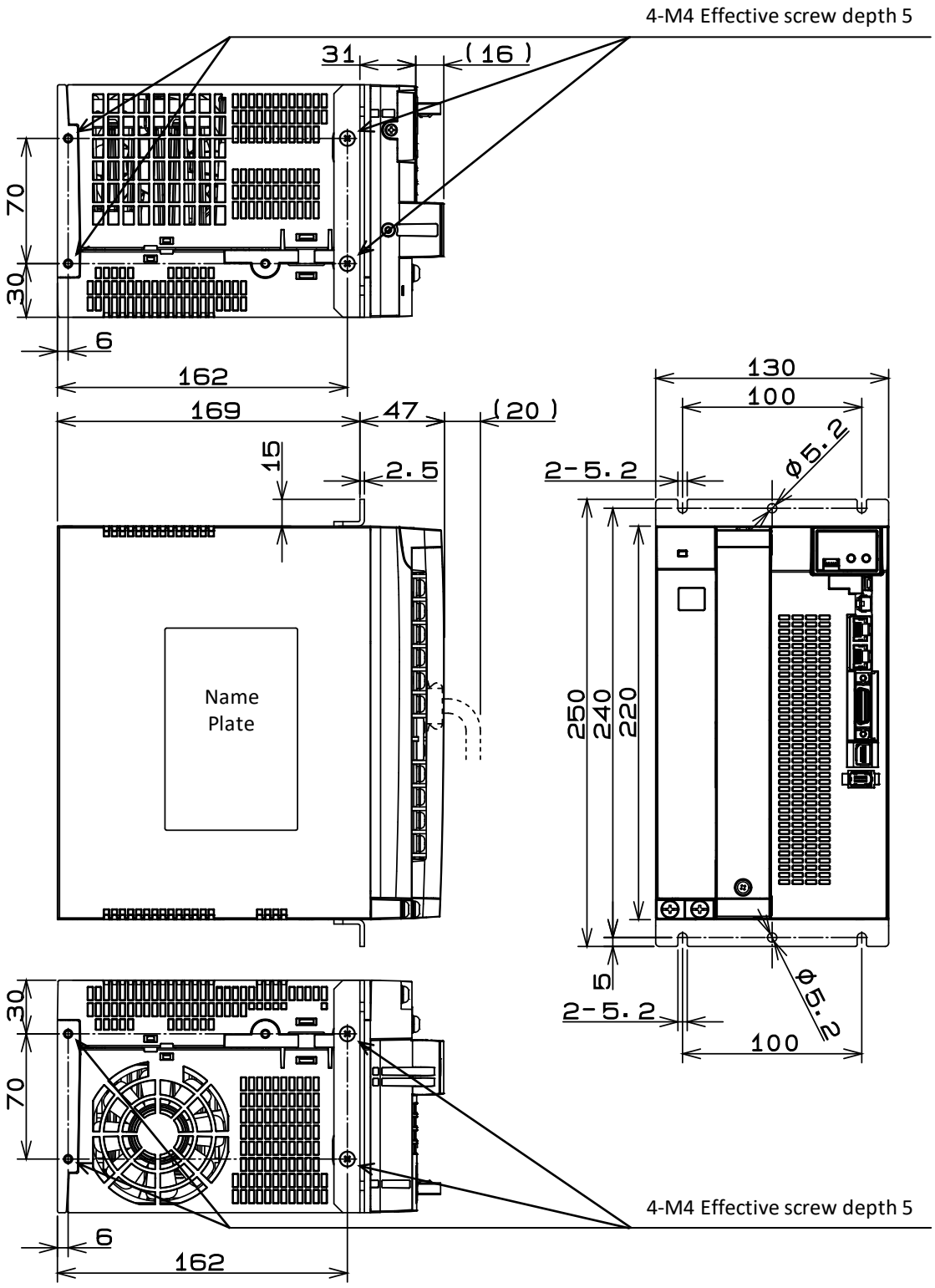
Unit: mm

* Do not use threaded screw holes that do not have description of dimensions.

* When installing the driver, please fix it with 4 U-shaped cutouts of the mounting bracket.

Size F 200 V / 400 V

[Rack mount installation (standard: to be installed on the front)]

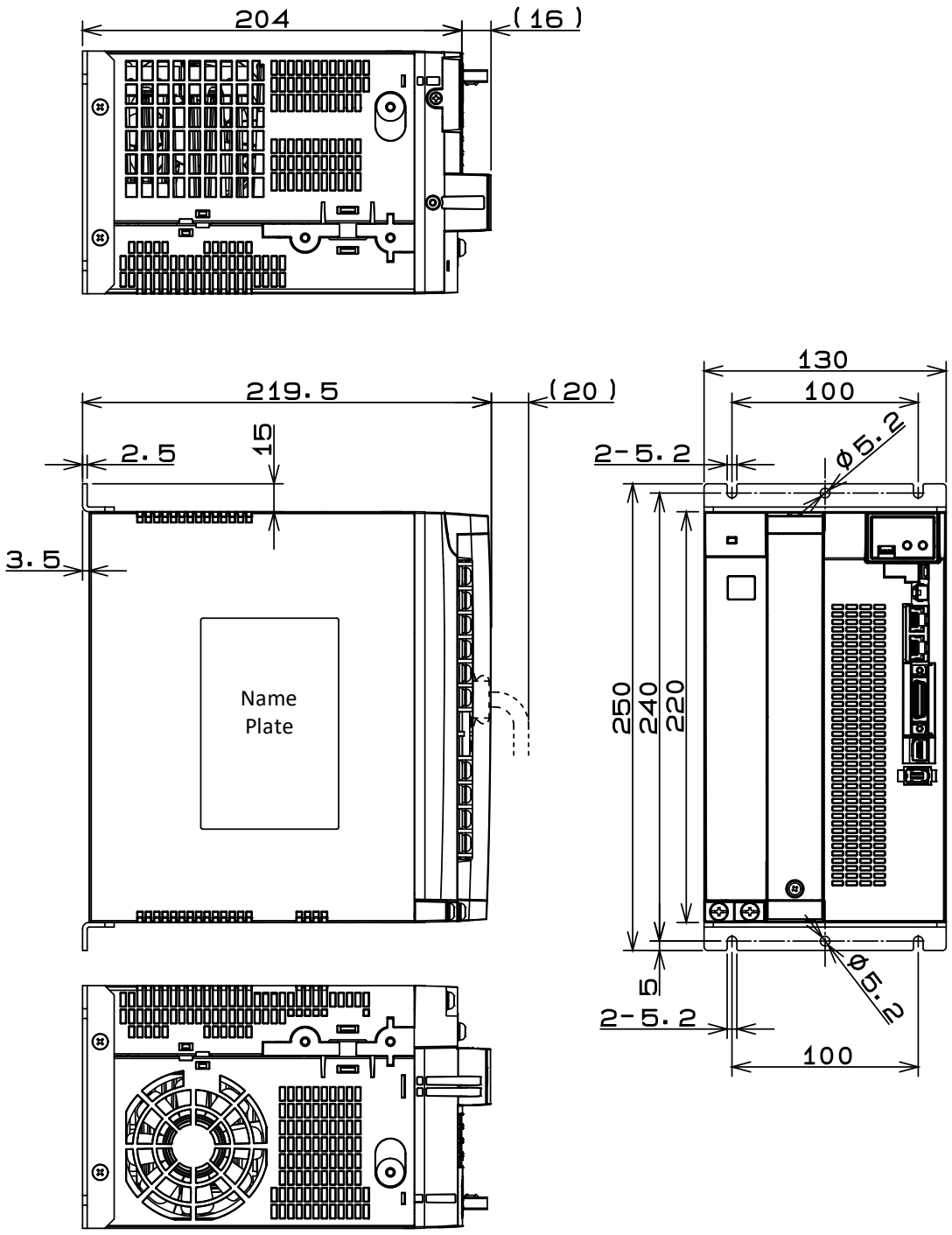


Unit: mm

* Do not use threaded screw holes that do not have description of dimensions.

* When installing the driver, please fix it with 4 U-shaped cutouts of the mounting bracket.

[Base mount installation (with brackets moved: to be installed on the rear)]



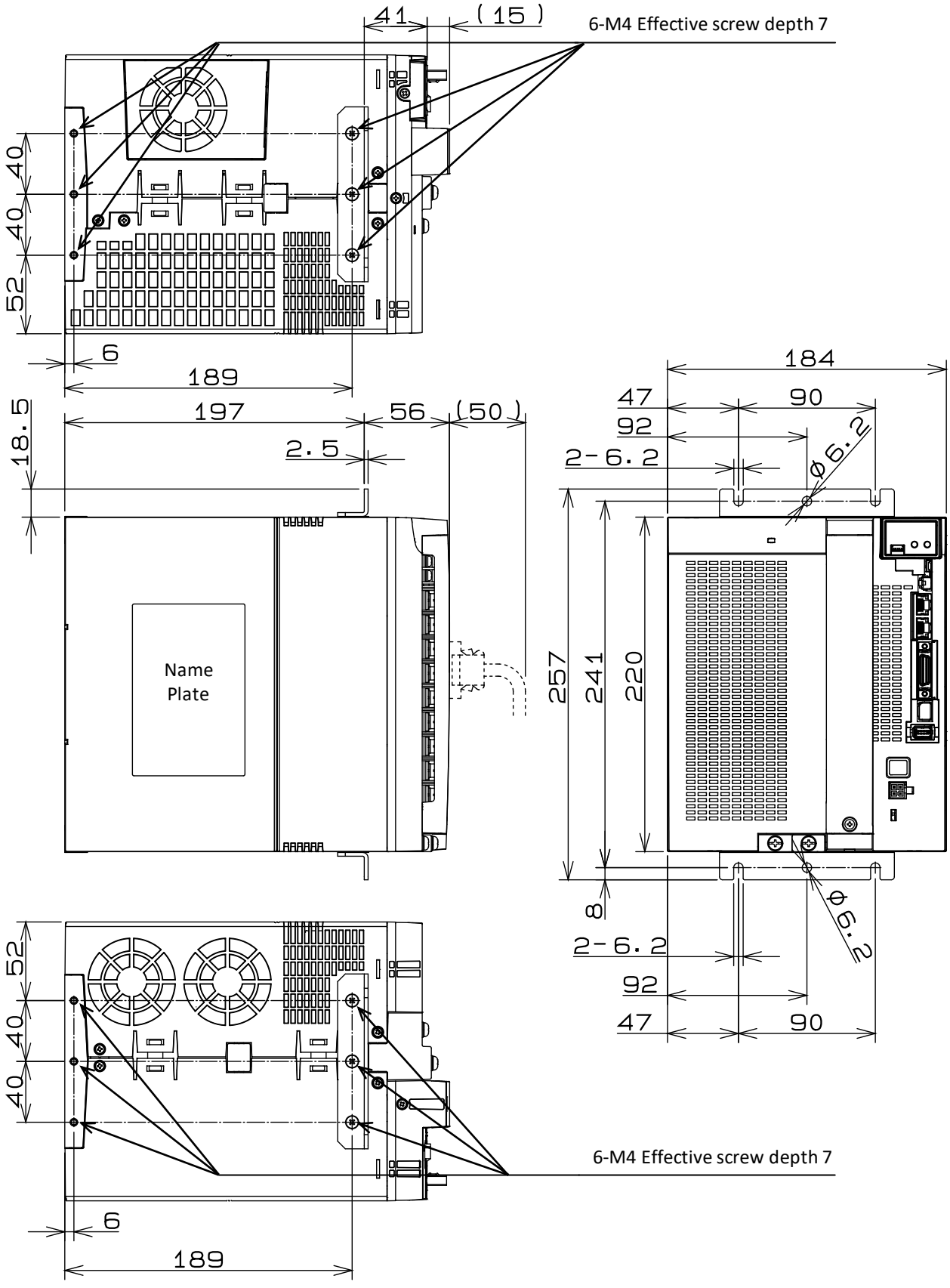
Unit: mm

* Do not use threaded screw holes that do not have description of dimensions.

* When installing the driver, please fix it with 4 U-shaped cutouts of the mounting bracket.

Size G 200 V

[Rack-mounting TYPE (Standard)]

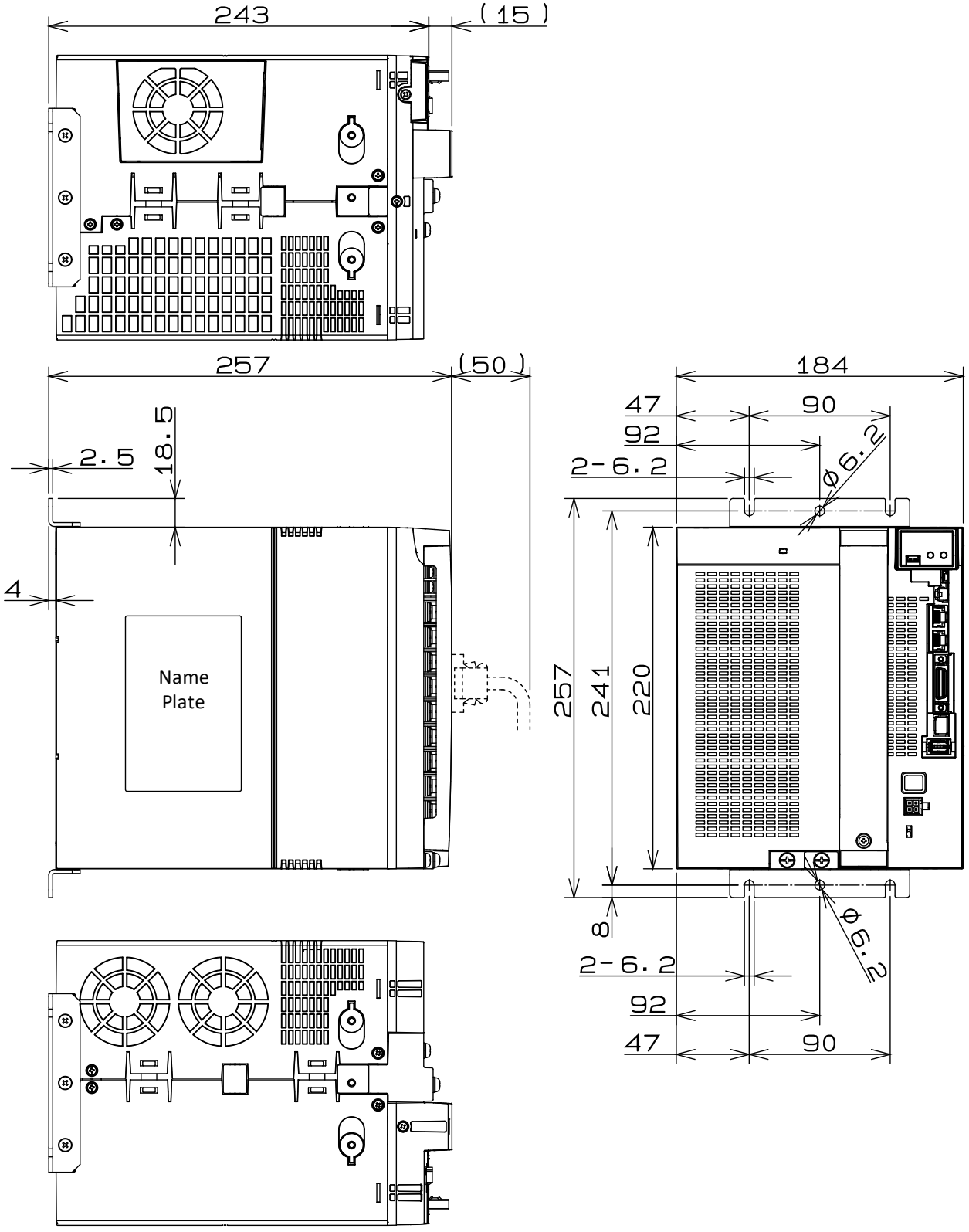


Unit[mm]

*Do not use threaded screw holes that do not have description of dimensions.

*When installing the driver, please fix it with 4 U-shaped cutouts of the mounting bracket.

[Base-mounting TYPE (Change from standard)]



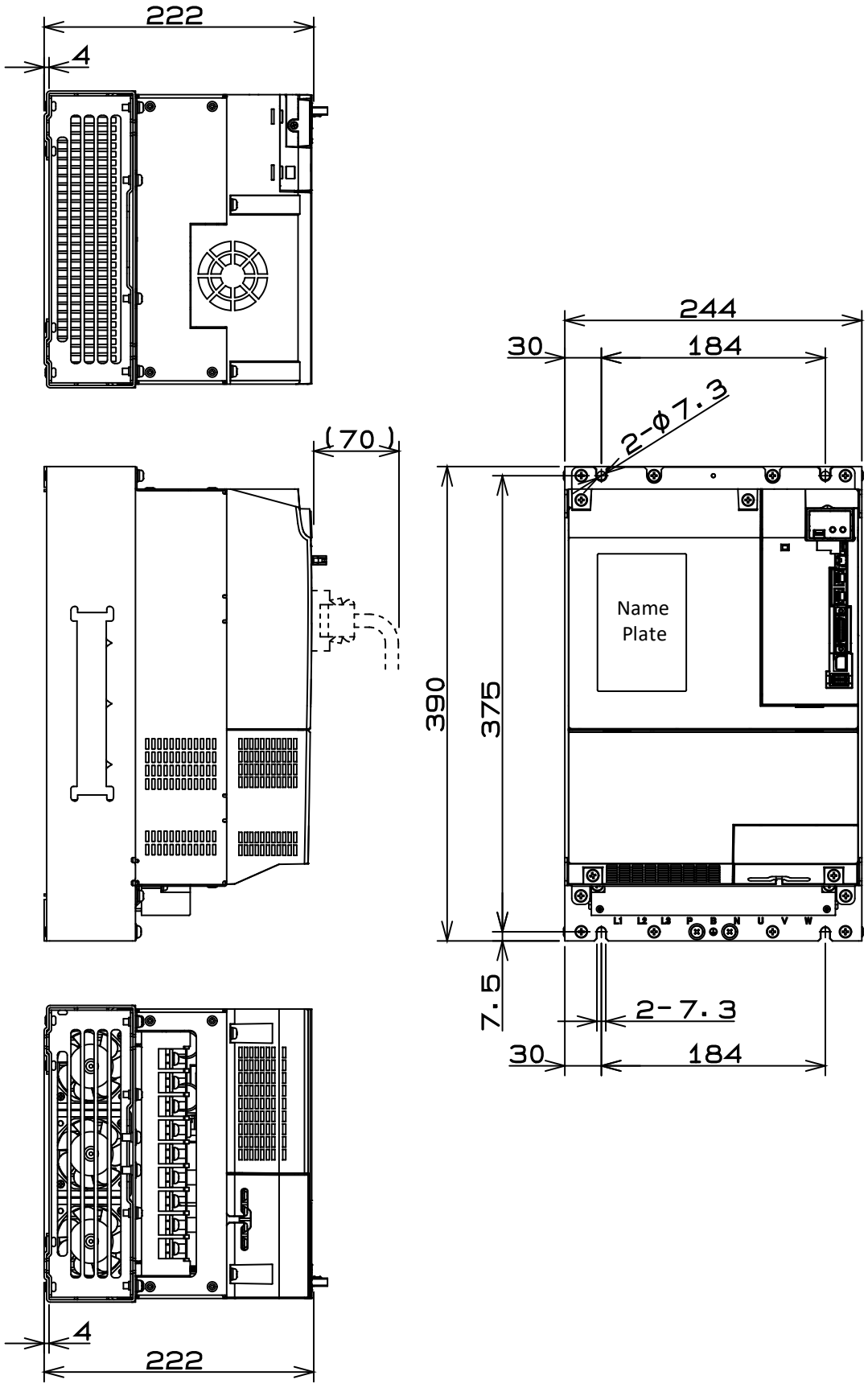
Unit[mm]

*Do not use threaded screw holes that do not have description of dimensions.

*When installing the driver, please fix it with 4 U-shaped cutouts of the mounting bracket.

Size H 200 V

[Base-mounting TYPE (Standard)]



Unit[mm]

*Do not use threaded screw holes that do not have description of dimensions.

7. Configuration of connectors and terminal blocks

7-1 Power connectors XA , XB , XC , XD and terminal block

Size A, B 100 V / 200 V

	Pin No.	Symbol	Name	Description	
XA	5	L1	Main power input terminal	100 V	Single-phase 100 - 120 V +10 % -15 % , 50/60 Hz Use L1 and L3 terminal for single phase input.
	4	L2		200 V	Single-phase/3-phase 200 - 240 V +10 % -15 % , 50/60 Hz
	3	L3			Use L1 and L3 terminal for single phase input.
	2	L1C	Control power input terminal	100 V	Single-phase 100 - 120 V +10 % -15 % , 50/60 Hz
	1	L2C		200 V	Single-phase 200 - 240 V +10 % -15 % , 50/60 Hz
XB	6	P	Regenerative resistor connecting terminal	• To use an external regenerative resistor (customer prepared), connect an external regenerative resistor between P and B. In addition, parameter setting is required for the regenerative resistor. For details, refer to “Technical Refarence - Functional Specification-”. • Do not connect anything to the N terminal.	
	5	N			
	4	B			
	3	U	Motor output terminal	Connect each phase of the motor wiring. U: U phase, V: V phase, W: W phase	
	2	V			
	1	W			
	⏚	⏚	Erath	Earth terminal for grounding	

*Tighten the Earth screw with a torque of M4: 1.0 to 1.2 N · m.

Size C, D 100 V / 200 V

	Pin No.	Symbol	Name	Description	
XA	5	L1	Main power input terminal	100 V	Single-phase 100 - 120 V + 10 % - 15 % , 50/60 Hz Use L1 and L3 terminal for single phase input.
	4	L2		200 V	Single-phase/3-phase 200 - 240 V + 10 % - 15 % , 50/60 Hz
	3	L3			Use L1 and L3 terminal for single phase input.
	2	L1C	Control power input terminal	100 V	Single-phase 100 - 120 V + 10 % - 15 % , 50/60 Hz
	1	L2C		200 V	Single-phase 200 - 240 V + 10 % - 15 % , 50/60 Hz
XC	4	N	-	• Do not connect anything to this connector.	
	3				
	2	P			
	1				
XB	6	P	Regenerative resistor connecting terminal	•Normally, short out the circuit between B and RB. •To use an external regenerative resistor (customer prepared), open between RB and B and connect an external regenerative resistor between P and B. In addition, parameter setting is required for the regenerative resistor. For details, refer to “Technical Refarence - Functional Specification-”.	
	5	RB			
	4	B			
	3	U	Motor output terminal	Connect each phase of the motor wiring. U: U phase, V: V phase, W: W phase	
	2	V			
	1	W			
	⏚	⏚	Earth	Earth terminal for grounding	

*Tighten the Earth screw with a torque of M4: 1.0 to 1.2 N · m.

Size E 200 V

	Pin No.	Symbol	Name	Description	
XA	5	L1	Main power input terminal		3-phase 200 - 240 V + 10 % - 15 % , 50/60 Hz
	4	L2			
	3	L3			
	2	L1C	Control power input terminal		Single-phase 200 - 240 V + 10 % - 15 % , 50/60 Hz
	1	L2C			
XC	4	P	Regenerative resistor connecting terminal	• Normally, short out the circuit between B and RB. • To use an external regenerative resistor (customer prepared), open between RB and B and connect an external regenerative resistor between P and B. In addition, parameter setting is required for the regenerative resistor. For details, refer to “Technical Refarence - Functional Specification-”.. • Do not connect anything to the N terminal.	
	3	RB			
	2	B			
	1	N			
XB	3	U	Motor output terminal	Connect each phase of the motor wiring. U: U phase, V: V phase, W: W phase	
	2	V			
	1	W			
	⏚	⏚	Earth	Earth terminal for grounding	

*Tighten the Earth screw with a torque of M4: 1.0 to 1.2 N · m.

Size F 200 V

Use terminal blocks.

	Terminal block No. (From above)	Symbol	Name	Description
Terminal block	1	L1	Main power input terminal	3-phase 200 - 240 V + 10 % - 15 % , 50/60 Hz
	2	L2		
	3	L3		
	4	L1C	Control power input terminal	Single-phase 200 - 240 V + 10 % - 15 % , 50/60 Hz
	5	L2C		
	6	P	Regenerative resistor connecting terminal	• Normally, short out the circuit between B and RB. • To use an external regenerative resistor (customer prepared), open between RB and B and connect an external regenerative resistor between P and B. In addition, parameter setting is required for the regenerative resistor. For details, refer to “Technical Refarence - Functional Specification-”. • Do not connect anything to the N terminal.
	7	RB		
	8	B		
	9	N		
	10	U	Motor output terminal	Connect each phase of the motor wiring. U: U phase, V: V phase, W: W phase
	11	V		
	12	W		
	⏚	⏚	Earth	Earth terminal for grounding

* Tighten the Earth screw with a torque of M5: 1.8 to 2.0 N · m.
* Tighten the terminal block screws with a torque of M5: 1.8 to 2.0 N · m.
* Tighten the fixing for the terminal block cover screws with a torque of M3: 0.19 to 0.21 N · m.
* The screws may be damaged if the tightening torque has exceeded the maximum value.

Size G 200 V

Use terminal blocks.

	Terminal No. (Upper to bottom)	Symbol	Name	Description
Upper	1	L1C	Control power input terminal	Single phase 200 - 240 V + 10 % - 15 % 50/60 Hz
	2	L2C		
Lower	1	L1	Main power input terminal	3-phase 200 - 240 V + 10 % - 15 % 50/60 Hz
	2	L2		
	3	L3		
	4	P	Regenerative resistor connecting terminal	・To use an external regenerative resistor (customer prepared), connect an external regenerative resistor between P and B. In addition, parameter setting is required for the regenerative resistor. For details, refer to “Technical Refarence - Functional Specification-”. ・Do not connect anything to N terminal.
	5	B		
	6	N		
	7	U	Motor output terminal	Connect each phase of the motor winding. U: U phase V: V phase W: W phase
	8	V		
	9	W		
	⏚	⏚	Earth	Earth terminal for grounding

Connector

	Pin No.	Symbol	Name	Description
X E	1	DB1	External Dynamic brake Control connection	· This is a terminal for controlling the electromagnetic contactor (MC) for external dynamic brake resistor (customer preparation). Please connect if necessary. · The applied voltage between DB1 and DB2 must be AC 300 V or less, DC 100 V or less
	2	DB2		

* Tighten the Earth screw with a torque of M5: 1.8 to 2.0 N · m
* Tighten the terminal block (control power) screw with a torque of M3: 0.4 to 0.6 N · m.
If the tightening torque exceeds the maximum value, the terminal block may be damaged.
* Tighten the terminal block (main power supply, regenerative resistance, motor) screw with torque of
M5: 1.8 to 2.0 N · m.
If the tightening torque exceeds the maximum value, the terminal block may be damaged
* Tighten the fixing screws for the terminal block cover with a torque of M3: 0.19 to 0.21 N · m.
If it exceeds the maximum value of tightening torque, it may be damaged.

Size H 200 V

Use terminal blocks.

	Terminal No. (Upper to bottom)	Symbol	Name	Description
Upper	1	L1C	Control power input terminal	Single phase200 - 240 V + 10 % - 15 % 50/60 Hz
	2	L2C		
	3	DB1	External Dynamic brake Control terminal	· This is a terminal for controlling the electromagnetic contactor (MC) for external dynamic brake resistor (customer preparation). Please connect if necessary. · The applied voltage between DB1 and DB2 must be AC 300 V or less, DC 100 V or less
	4	DB2		
Lower	1	L1	Main power input terminal	3-phase 200 - 240 V + 10 % - 15 % 50/60 Hz
	2	L2		
	3	L3		
	4	P	Regenerative resistor connecting terminal	・To use an external regenerative resistor (customer prepared), connect an external regenerative resistor between P and B. In addition, parameter setting is required for the regenerative resistor. For details, refer to “Technical Refarence - Functional Specification-”. ・Do not connect anything to N terminal.
	5	B		
	6	N		
	7	U	Motor connection	Connect each phase of the motor winding. U: U phase V: V phase W: W phase
	8	V		
	9	W		
	⏚	⏚	Earth	Earth terminal for grounding

*Tighten the grounding screw with a torque of M6: 2.4 to 2.6 N · m.

*Tighten the terminal block (upper side: control power supply, dynamic brake) screws with M4: torque of 0.7 to1.0 N · m.

If the tightening torque exceeds the maximum value, the terminal block may be damaged.

*Tighten the terminal block (lower side: main power supply, regenerative resistance, motor) screw with torque of M6: 2.2 to 2.5 N · m.

If the tightening torque exceeds the maximum value, the terminal block may be damaged.

*Tighten the fixing screw for the terminal block cover 1 (transparent) with torque of M3: 0.19 to 0.21 N · m.

*Tighten the fixing screw for the terminal block cover 2 (black) with a torque of M5: 2.0 to 2.5 N · m.

Size D, E 400 V

	Pin No.	Symbol	Name	Description
XD	1	24 V	Control power input terminal	DC 24 V ± 15 %
	2	0 V		
XA	3	L1	Main power input terminal	3-phase 380Y/220-480Y/277 V + 10 % 50/60 Hz TN (Ground the neutral point) - 15 %
	2	L2		
	1	L3		
XC	4	P	Regenerative resistor connecting terminal	・Normally, short out the circuit between B and RB. ・To use an external regenerative resistor (customer prepared), open between RB and B and connect an external regenerative resistor between P and B. In addition, parameter setting is required for the regenerative resistor. For details, refer to "Technical Reference - Functional Specification ". ・Do not connect anything to the N terminal.
	3	RB		
	2	B		
	1	N		
XB	3	U	Motor output terminal	Connect each phase of the motor winding. U: U phase V: V phase W: W phase
	2	V		
	1	W		
	⏚	⏚	Earth	Earth terminal for grounding.

*Tighten the Earth screw with a torque of M4: 1.0 to 1.2 N · m.

Size F 400 V

Use terminal blocks.

	Terminal block No. (From above)	Symbol	Name	Description
Terminal block	1	–	Non-connection	
	2	–		
	3	L1	Main power input terminal	3-phase 380 - 480 V + 10 % - 15 % TN (neutral point to ground) 50/60 Hz
	4	L2		
	5	L3		
	6	P	Regenerative resistor connecting terminal	• Normally, short out the circuit between B and RB. • To use an external regenerative resistor (customer prepared), open between RB and B and connect an external regenerative resistor between P and B. In addition, parameter setting is required for the regenerative resistor. For details, refer to "Technical Reference - Functional Specification ". • Do not connect anything to the N terminal.
	7	RB		
	8	B		
	9	N		
	10	U	Motor output terminal	Connect each phase of the motor winding. U: U phase, V: V phase, W: W phase
	11	V		
	12	W		
	⏚	⏚	Earth	Earth terminal for grounding.

Connector

	Pin No.	Symbol	Name	Description
XD	1	24 V	Control power supply input	DC 24 V ± 15 %
	2	0 V		

* Tighten the Earth screw with a torque of M5: 1.8 to 2.0 N · m.
* Tighten the terminal block screws with a torque of M5: 1.8 to 2.0 N · m.
* Tighten the fixing for the terminal block cover screws with a torque of M3: 0.19 to 0.21 N · m.
* If the maximum value of tightening torque is exceeded, the terminal block could be damaged.

7-2 USB connector X1

By connecting to computer or controller via USB interface, the following operations are available parameter reference / change parameter save / load monitoring of status checking alarm status or alarm history

Name	Symbol	Pin No.	Description
USB signal	VBUS	1	• Communicate with computer or controller.
	D-	2	
	D+	3	
For manufacturer	-	4	• Do not connect anything to this connector.
Signal ground	GND	5	• Signal ground

The connector shape on the driver side is USB mini-B.

7-3 EtherCATconnectors X2A X2B

They are RJ45 connectors used for EtherCAT.

[X2A] / [X2B]

Name	Symbol	Connector pin no.	Description
Network output / input +	TX/RX+	1	Connect to pin 1 on the RJ45 connector of communication node.
Network output / input -	TX/RX-	2	Connect to pin 2 on the RJ45 connector of communication node
Network input / output +	RX/TX+	3	Connect to pin 3 on the RJ45 connector of communication node
Unused	-	4	Connect to pin 4 on the RJ45 connector of communication node
Unused	-	5	Connect to pin 5 on the RJ45 connector of communication node
Network input / output -	RX/TX-	6	Connect to pin 6 on the RJ45 connector of communication node
Unused	-	7	Connect to pin 7 on the RJ45 connector of communication node
Unused	-	8	Connect to pin 8 on the RJ45 connector of communication node
Frame ground	-	Shell	Connect to shield of cable.

* Be sure to use shielded twisted pair (STP) industrial ethernet cable compatible with the category 5e or higher according to TIA/EIA-568. Refer to ETG (EtherCAT Technology Group) specification.

* Auto MDI/MDI-X assigns functions to pin no.1,2,3,6.

7-4 Safety function connector X3

It is a terminal for supporting functional safety.

This connector is supported only for the multi-function type.

Name	Symbol	Pin No.	Description	Input/output signal Interface
Reserved	-	1	• Do not connect anything to this connector.	-
	-	2		-
Safety input 1	SF1-	3	• 2 channel inputs with independent circuit to cut off the drive signal to the power module in the servo driver.	i-1
	SF1+	4		
Safety input 2	SF2-	5		
	SF2+	6		
EDM output	EDM-	7	• It is monitor output for monitoring malfunctions of the safety function.	o-1
	EDM+	8		
Frame ground	FG	Shell	• Internally connected to the earth terminal.	-

In order to set the safety level to SIL 3, PL e, DCavg Medium, diagnosis by EDM output is required (diagnosis interval is up to 3 months).
Safety levels are SIL 2, PL d, DCavg Low when diagnosis by EDM output is not performed.

7-5 Parallel I/O connector X4

Input signal

Name	Symbol	Pin No.	Description	Input/output signal interface
General input common	SI-COM	6	• Connect to the + terminal or - terminal of an external DC power supply (12 to 24 V) • Use 12 V±5% to 24 V±5% for power supply. • Insulation is needed against the primary side power supply. Do not connect with the same power supply. * primary power supply : Power supply for Motor brake	-
Control input 1	SI1	5	• Allocate functions by parameters. For details, refer to "Technical Reference -Functional Specification-" • Range of available functions is limited. For example, external latch input EXT1 can be allocated only to SI5, EXT2 to SI6 and EXT3 to SI7.	i-1
Control input 2	SI2	7		
Control input 3	SI3	8		
Control input 4	SI4	9		
Control input 5	SI5	10		
Control input 6	SI6	11		
Control input 7	SI7	12		
Control input 8	SI8	13		

Output signal

Name	Symbol	Pin No.	Description	Input/output signal Interface
Control output 1	SO1+ SO1-	1 2	• Functions are allocated according to parameters. For details, refer to "Technical Reference -Functional Specification-"	o-1
Control output 2	SO2+ SO2-	25 26		
Control output 3	SO3+ SO3-	3 4		

Encoder output signal/ position comparison output signal

Name	Symbol	Pin No.	Description	Input/output signal Interface
A-phase output Position comparison Output 1	OA+/ OCMP1+	17	• Differential output of divided encoder signal or external scale signal (A – B phase). (RS422 compatible) • 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 kept non-insulated. • Maximum output frequency is 4 Mpps (after multiplied by 4). • It can be used as position compare output by parameter setting. For details, refer to "Technical Reference -Functional Specification-" • This differential signal should be received by a line receiver (AM26C32 or equivalent). Connect a terminating resistor (approx. 330 Ω) between the line receiver inputs. • For wiring, use shielded twisted pair cable, please connect shielded wire to connector shell.	Do-1
	OA-/ OCMP1-	18		
B-phase output/ Position comparison Output 2	OB+/ OCMP2+	20		
	OB-/ OCMP2-	19		
Position comparison Output 3	OCMP3+	21		
	OCMP3-	22		
Signal Ground	GND	16	• Signal ground • Be sure to connect the line receiver ground to this terminal.	-

Battery input for encoder backup

Name	Symbol	Pin No.	Description	Input/output signal nterface
Battery input for absolute encoder	BTP-I	14	• Connect to the absolute encoder backup battery. (Recommended item:ER6V 3.6 V manufactured by Toshiba Lifestyle Products & Services) BTP-I: positive, BTN-I: negative • The power necessary to store multi-turn data is supplied to the absolute encoder via BTP-0 (pin 3) and BTN-0 (pin 4) of encoder connector X6 • The battery for the absolute encoder should be connected using any of the following methods. (1) Direct connection to the motor side (2) Connection to the encoder cable (3) Connection to this connector	-
	BTN-I	15		-

Other

Name	Symbol	Pin No.	Description	Input/output signal nterface
Reserved	-	23,24	• Do not connect anything to this connector.	-
Frame Ground	FG	Shell	• It is connected with the earth terminal inside the servo driver.	-

7-6 External scale connector X5

This connector is supported only for the multi-function type.

Name	Symbol	Pin No.	Description
External scale power output	EX5V	1	• External scale power output (Note 1) (Note 2)
	EX0V	2	• Ground of external scale power output (Note 3)
External scale signal input/output (Serial signal)	EXPS	3	• Serial signal non-inverting input/output
	/EXPS	4	• Serial signal inverting input/output
External scale signal input (A/B/Z-phase signal) (Note4)	EXA	5	• A-phase signal non-inverting input
	/EXA	6	• A-phase signal inverting input
	EXB	7	• B-phase signal non-inverting input
	/EXB	8	• B-phase signal inverting input
	EXZ	9	• Z-phase signal non-inverting input
	/EXZ	10	• Z-phase signal inverting input
Frame ground	FG	Shell	• It is connected with the earth terminal inside the servo driver.

Note 1) EX5V of external scale power supply output is 5 V ± 5%, 250 mA MAX.
If you are using an external scale with more current consumption,
please prepare the external power supply by the customer.
Also, some external scale may take time to initialize after turning on the power.
In that case, it is possible to adjust by adjusting the power-on wait time which is the function of the servo driver.For details, refer to "Technical Reference -Functional Specification-"

Note 2) If the external scale is driven by an external power supply, leave the EX 5 V pin open so that no voltage is supplied to this pin from the outside.

Note 3) The EX0V of the external scale power supply output is connected to the control circuit ground connected to the connector X5

Note 4) Up to 4 Mpps can be received with A / B phase multiplied by 4. However, please note that if the duty ratio of the scale input signal waveform is not 50%, it may not be able to be read normally.

7-7 Encoder connector X6

Name	Symbol	Pin No.	Description
Encoder power output	E5V	1	• Encoder power supply output
	E0V	2	• Ground of encoder power output (Note 1)
Battery output for absolute encoder (Note 2)	BTP-O	3	• Battery output (positive)
	BTN-O	4	• Battery output (negative)
Encoder signal I/O (differential serial signal)	PS	5	• Encoder signal No-inverting input and output
	/PS	6	• Encoder signal Inverting input and output
Frame ground	FG	Shell	• Internally connected to the earth terminal.

Note 1) The E0V of the encoder power supply output is connected with the control circuit ground of the connector X4.

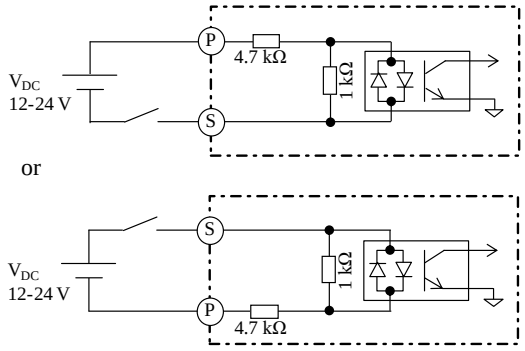
Note 2) Connected to the absolute encoder battery input terminals BTP-I and BTN-I of connector X4 in the servo driver.
When connecting the battery directly to the encoder connecting cable, do not connect anything to this terminal.

7-8 Analog monitor connector X7

Name	Symbol	Pin No.	Description	Input/output signal interface
Analog monitor output 1	AM1	1	• Analog signal output for monitoring. • The meaning of the output signal varies depending on the parameter setting.	Ao-1
Analog monitor output 2	AM2	2		
Signal ground	GND	3	• Signal ground	-
Reserved	-	4,5	• Do not connect anything to this connector.	-

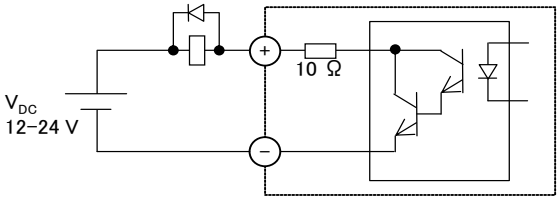
7-9 Input / output signal interface

i-1



Pins ;
S :(X3) 3,5
(X4) 8,9,26,27,28,29,30,31,32,33
P :(X3) 4,6
(X4) 7

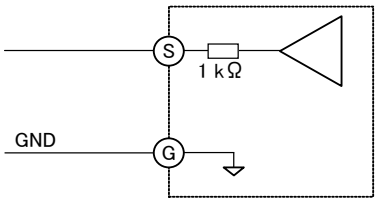
o-1



+: (X3) 8pin / (X4) 1,3,25pin
-: (X3) 7pin / (X4) 2,4,26pin

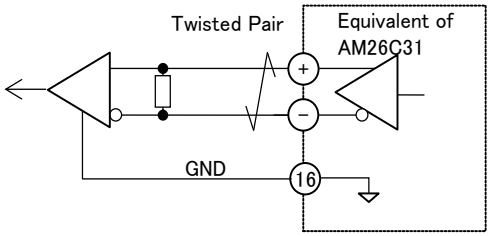
Note) When driving the relay directly, install a diode in parallel with the relay in the direction shown above.

Ao-1



S: (X7) 1,2pin
G: (X7) 3pin
The output signal amplitude is ±10 V.

Do-1



+: (X4) 17,20,21pin
-: (X4) 18,19,22pin
G: (X4) 16pin

Connect a terminating resistor (approx. 330 Ω) between the line receiver inputs.

8. Wiring and system configuration

8-1 Used cables and maximum cable lengths

Name	Symbol	Maximum cable length (Note 1)	Electric wire used
Main power supply	L1,L2,L3	-	Refer to chapter 14 “specification for each models”
Control power supply	L1C,L2C (100 V / 200 V)	-	Refer to chapter 14 “specification for each models”
	24V,0V(400 V)	—	Refer to chapter 14 “specification for each models”
Motor output	U, V, W, ⏚	20 m	Refer to chapter 14 “specification for each models”
Earth cable	⏚	-	Refer to chapter 14 “specification for each models”
Encoder connection	X6	20 m	Shielded twisted-pair cable Core cable: 0.18mm^2 or more
External scale connection (Note 3)	X5	20 m	
I/O connection	X4	3 m	
Safety connection (Note 3)	X3	3 m	Core cable 0.18 mm^2 or more
EtherCAT connection	X2A, X2B	100 m (Note 2)	TIA/EIA-568 CAT5e STP

Note 1) The above wiring length is the maximum value under the evaluation environment of Panasonic. It does not guarantee the operation under the working environment of the customer.

Note 2) Refer to 8-3-5 Connection to connectors X2A X2B.

Note 3) Only multi function type is supported.

8-2 Cable-side connector

Connector symbol	Product Name	Product No.	Manufacturer
X3	Connector	2013595-1	TE Coneectivity
X4	Solder plug (soldered type)	DF02P026F22A1	Japan Aviation Electronics Industry(JAE)
	Plug hood	DF02D026B22A	
X5	Connector	MUF-PK10K-X	JST
X6	Receptacle	3E206-0100 KV	3M
	Shell kit	3E306-3200-008	
X7	Connector	51021-0500	Molex
	Terminal	50058-8500	
XE (Note1)	Connector	5557-04R-210	Molex
	Terminal	5556PBTL	

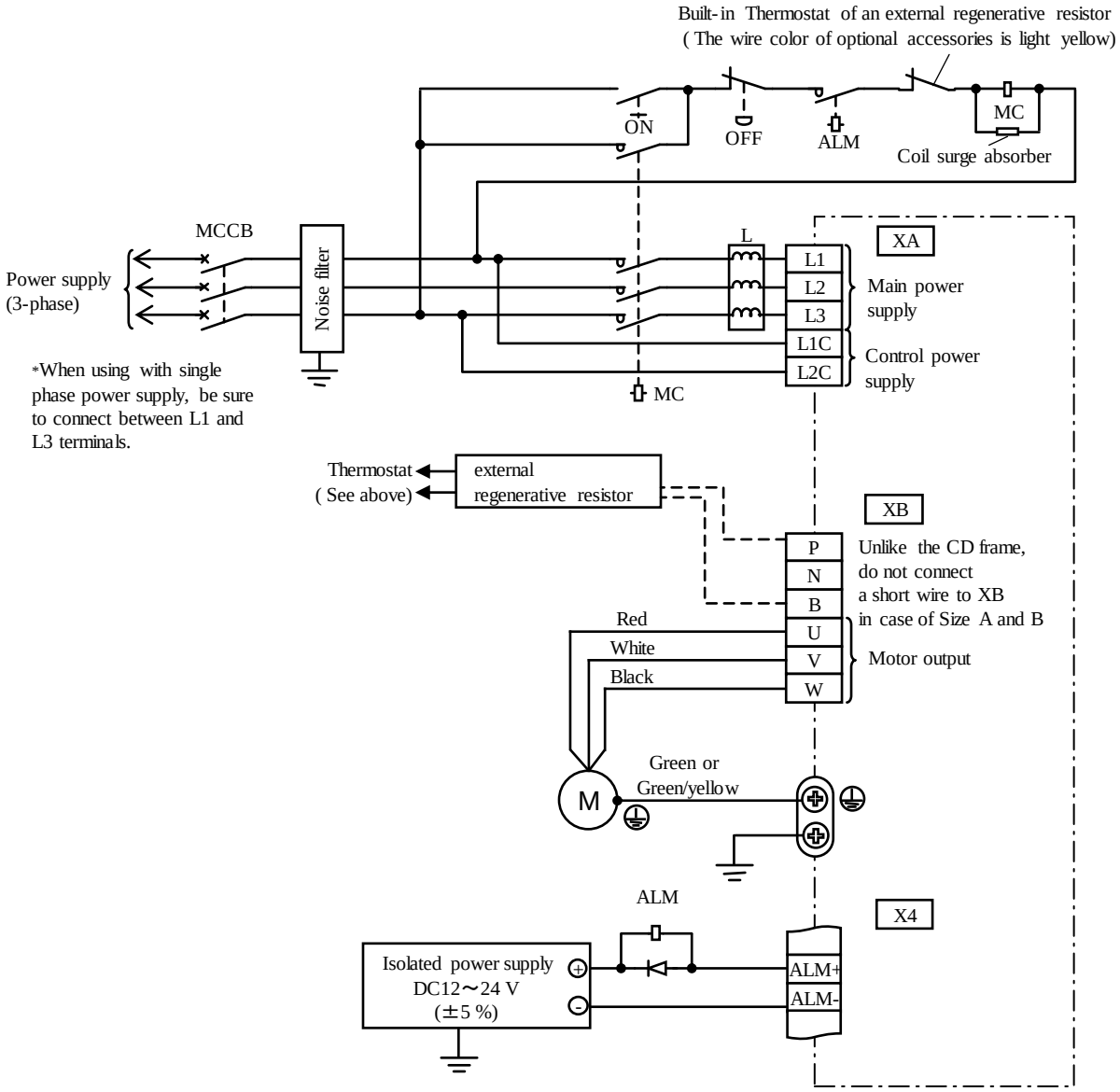
Use the above connector or equivalent.

Note 1) Correspond to Size G only.

8-3 Precautions for wiring

8-3-1 Wiring to the power connector and the terminal block

Size A, B 100 V / 200 V



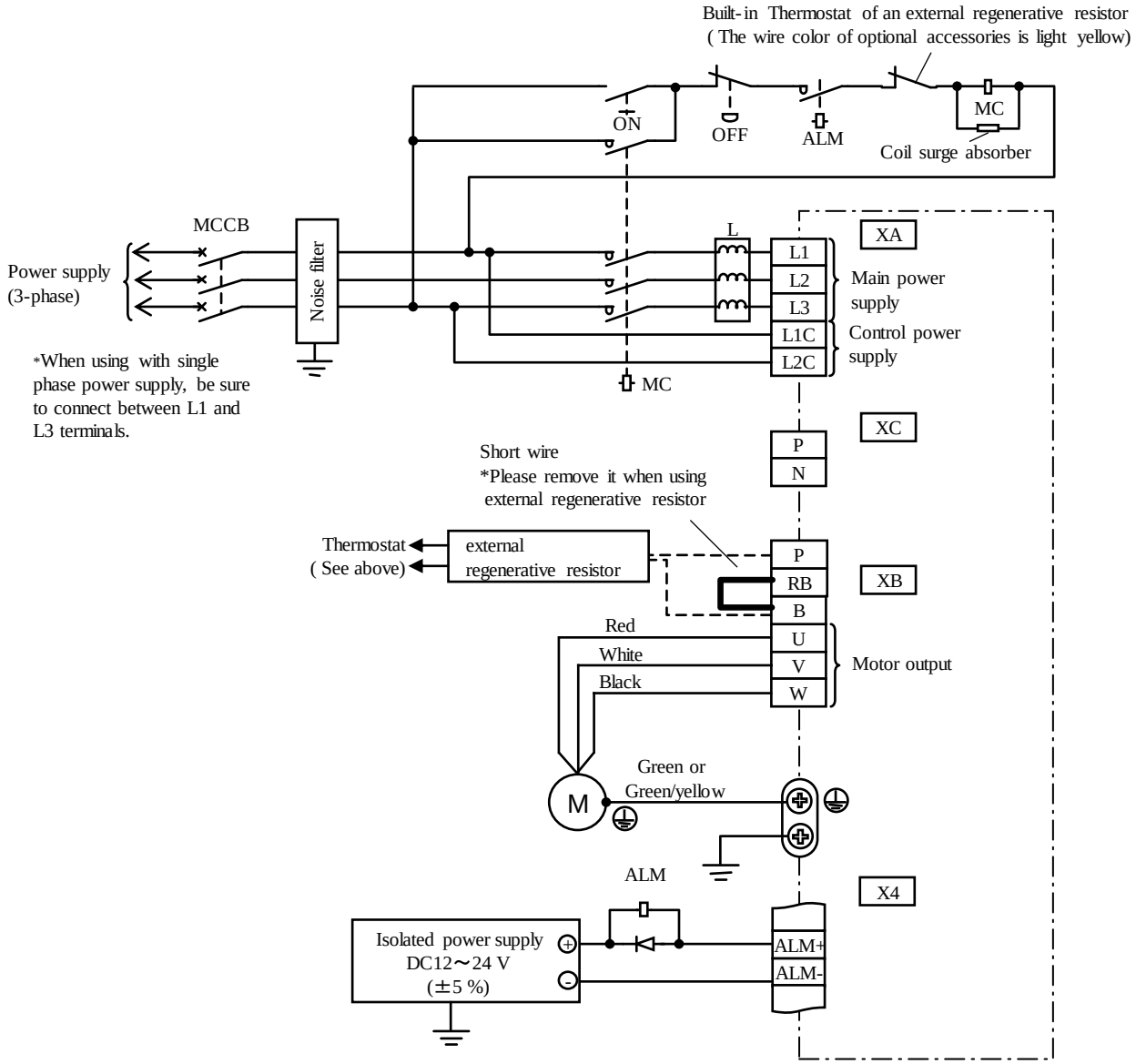
■ Connection of a regenerative resistor

Size	Short wire (accessory)	Internal regenerative resistor	Connection of connector XB	
			In case of using the external regenerative resistor	In case of not using the external regenerative resistor
A B	None	None	Between P and B: Connect the external regenerative resistor.	Between P and B: Keep open

* The circuit connected to terminal X1 – X7 are secondary circuits. (See [5. Appearance and name of each part])
Insulation is needed against the primary side power supply (power supply of the motor brake).
Please do not connect them with the same power supply.

* For details, refer to 7-1 Power connector XA, XB, XC, XD and terminal block.

Size C, D 100 V / 200 V



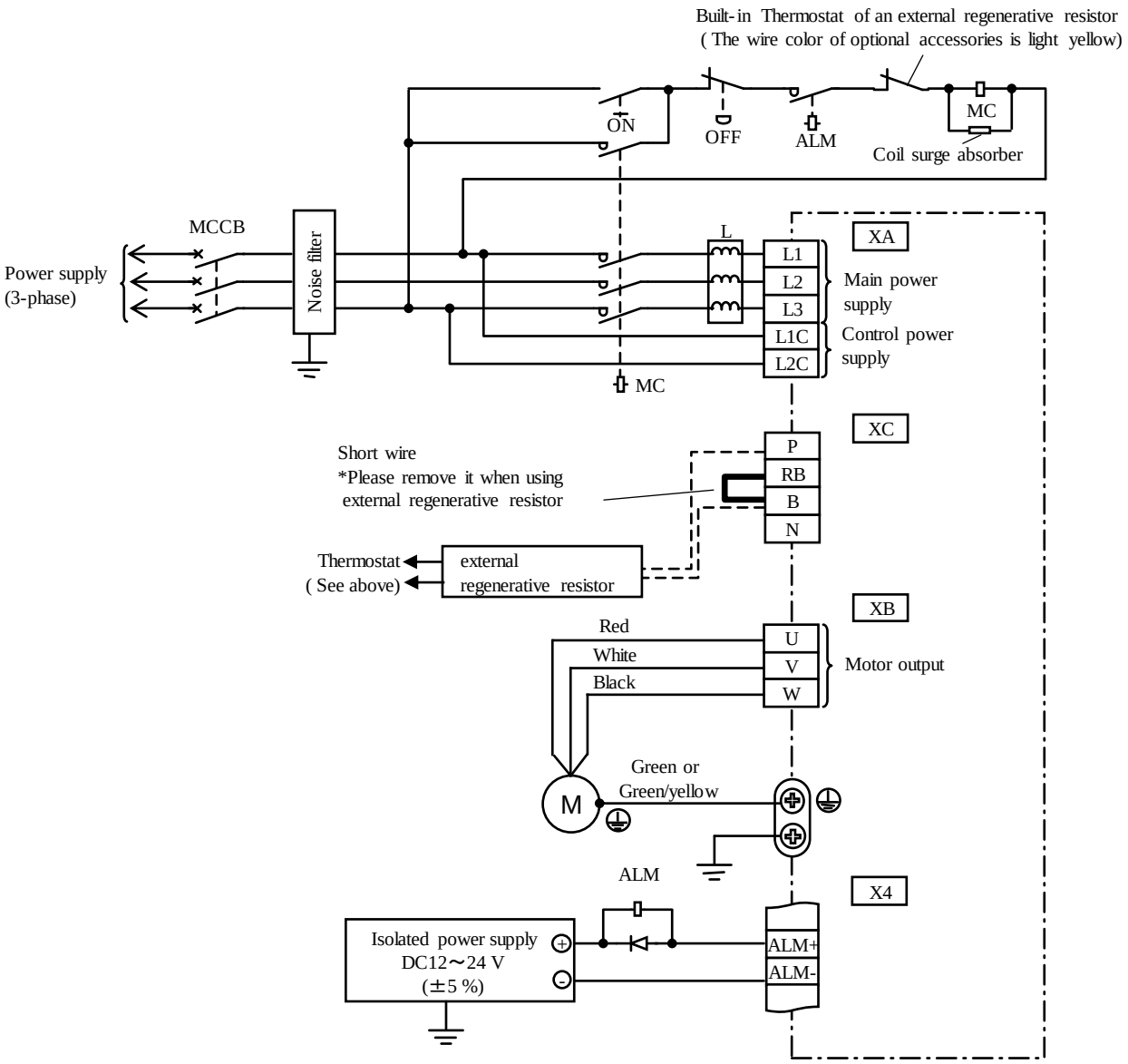
■ Connection of a regenerative resistor

Size	Short wire (accessory)	Internal regenerative resistor	Connection of connector XB	
			In case of using the external regenerative resistor	In case of not using the external regenerative resistor
C D	Installed	Installed	Between RB and B: Disconnect the short cable Between P and B: Connect the external regenerative resistor	Between RB and B: Connect the shorting cable

* The circuit connected to terminal X1 – X7 are secondary circuits. (See [5. Appearance and name of each part])
Insulation is needed against the primary side power supply (power supply of the motor brake).
Please do not connect them with the same power supply.

* For details, refer to 7-1 Power connector XA, XB, XC, XD and terminal block.

Size E 200 V

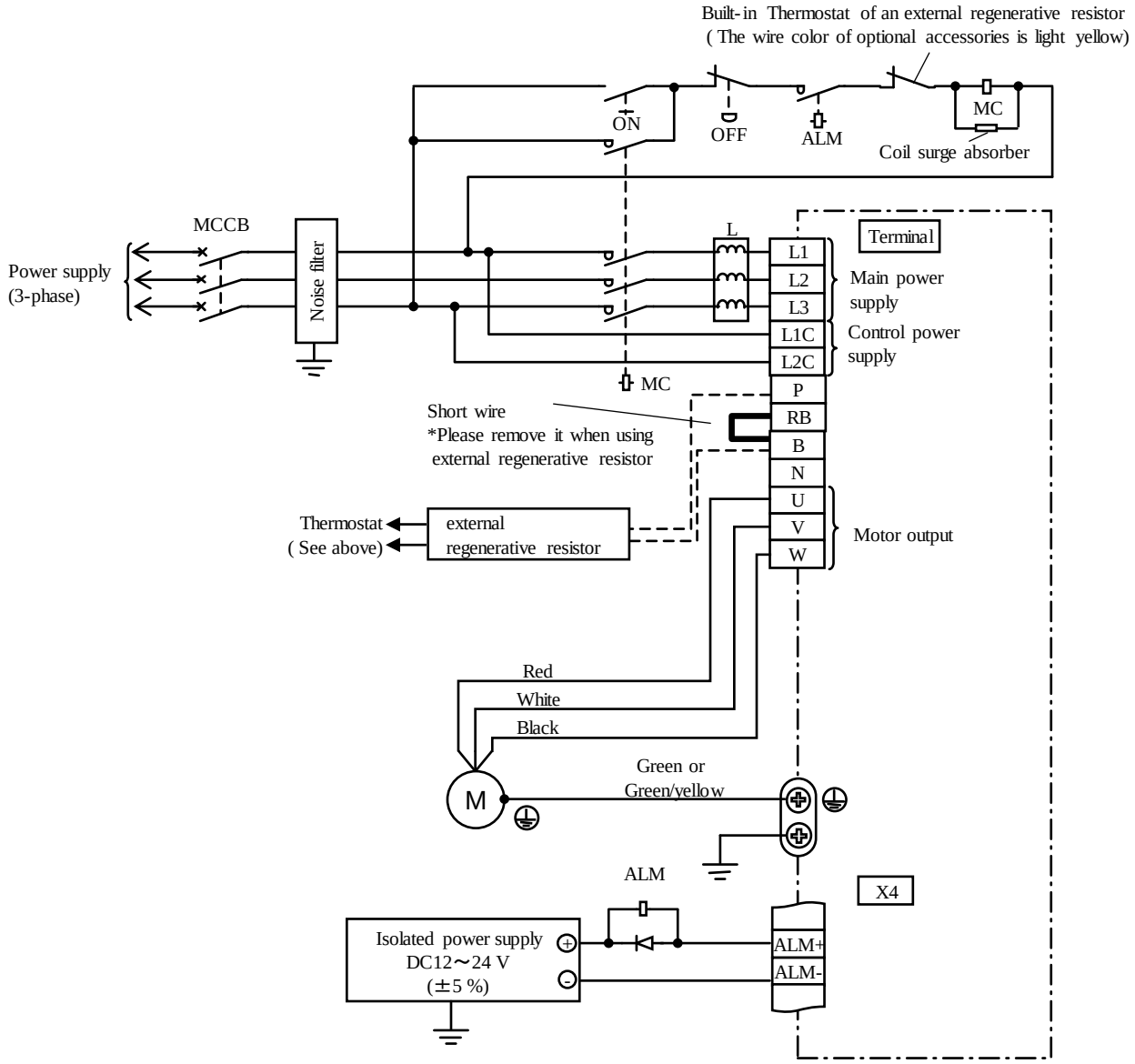


■ Connection of a regenerative resistor

Size	Short wire (accessory)	Internal regenerative resistor	Connection of connector XC	
			In case of using the external regenerative resistor	In case of not using the external regenerative resistor
E	Installed	Installed	Between RB and B: Disconnect the short cable Between P and B: Connect the external regenerative resistor	Between RB and B: Connect the shorting cable

* The circuit connected to terminal X1 – X7 are secondary circuits. (See [5. Appearance and name of each part])
Insulation is needed against the primary side power supply (power supply of the motor brake).
Please do not connect them with the same power supply.
* For details, refer to 7-1 Power connector XA, XB, XC, XD and terminal block.

Size F 200 V

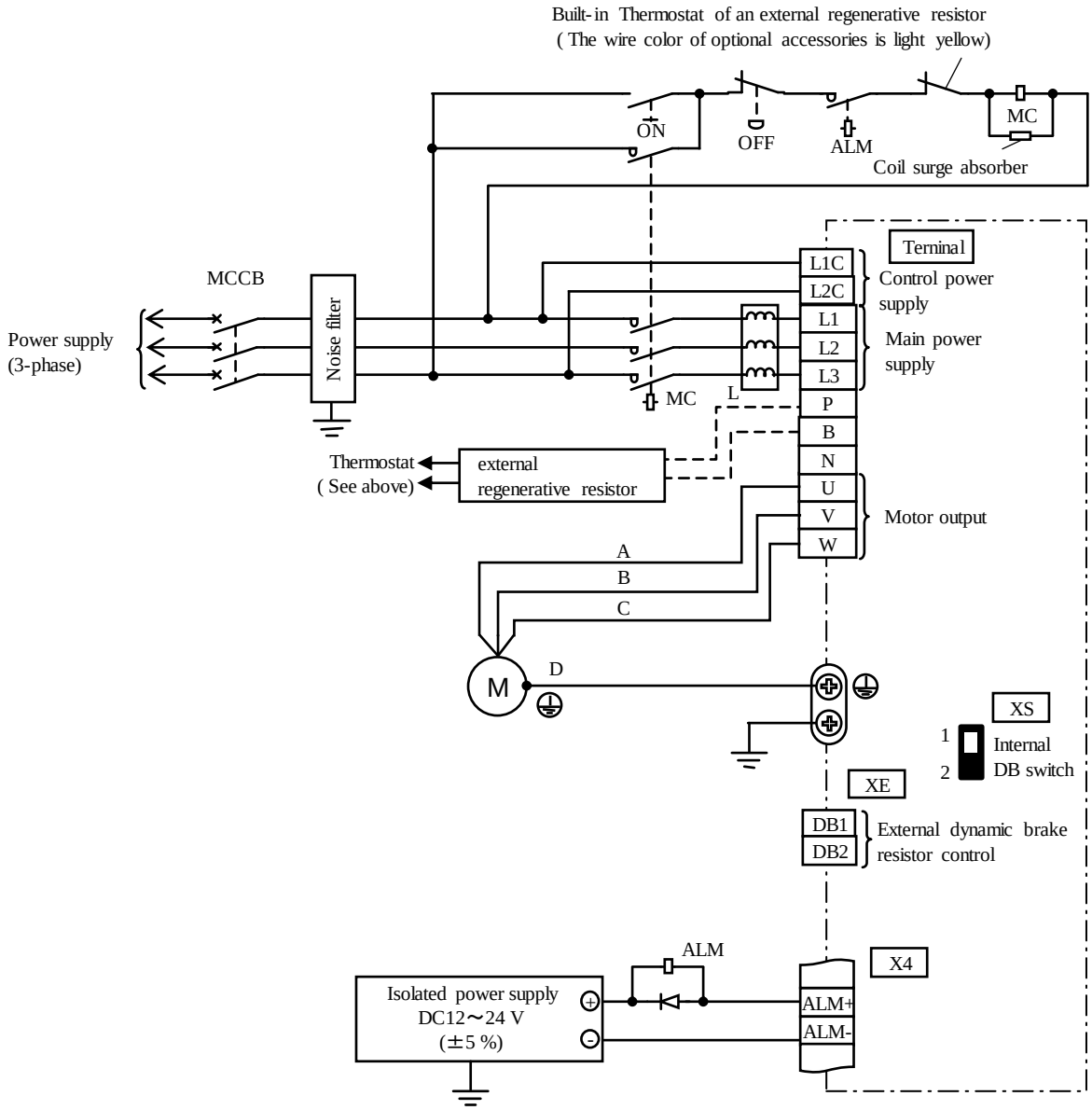


■ Connection of a regenerative resistor

Size	Short bar (accessory)	Internal regenerative resistor	Connection of the Terminal	
			In case of using the external regenerative resistor	In case of using the external regenerative resistor
F	Installed	Installed	Between RB and B: Disconnect the short bar Between P and B: Connect the external regenerative resistor	Between RB and B: Disconnect the short bar Between P and B: Connect the external regenerative resistor

* The circuit connected to terminal X1 – X7 are secondary circuits. (See [5. Appearance and name of each part])
Insulation is needed against the primary side power supply (power supply of the motor brake).
Please do not connect them with the same power supply.
* The standard of the ability of the built-in dynamic brake resistor is up to continuousness three times in the stop from the allowance and maximum inertia and the rated speed.
Resistor is damaged and the dynamic brake might not work when using it under more critical operating condition.
* For details, refer to 7-1 Power connector XA, XB, XC, XD and terminal block.

Size G 200 V

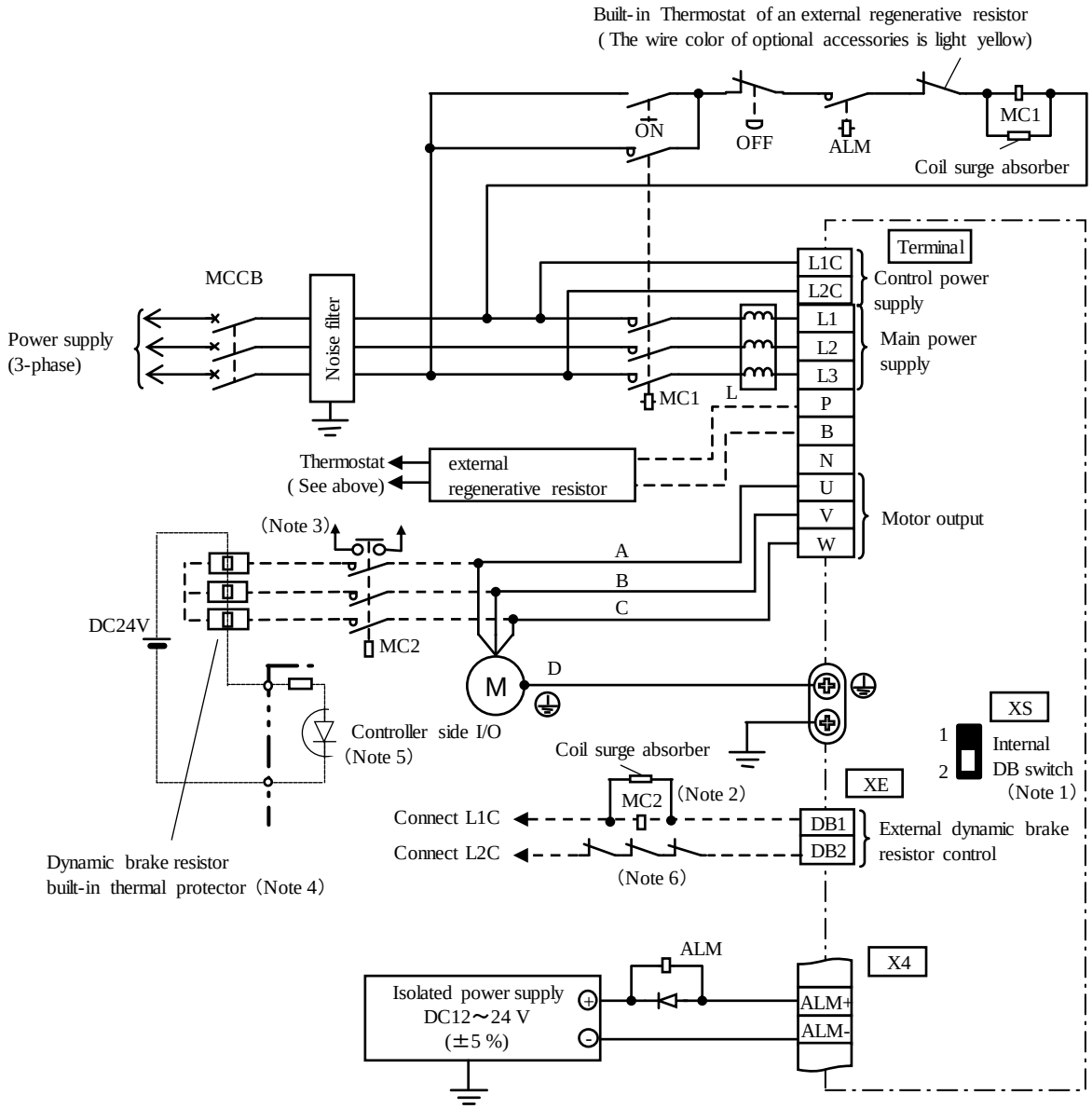


■ Connection of regenerative resistor

Size	Internal regenerative resistor	Connection of the Terminal	
		In case of using the external regenerative resistor	In case of not using the external regenerative resistor
G	None	Between P and B: Connect the external regenerative resistor	Between RB and B : Keep open

* Connectors X1 to X7 are secondary side circuits. (See [5. Appearance and name of each part])
  Insulation is required from the primary side power supply (power supply for motor brake).
  Do not connect to the same power supply.
* Size G has a built-in dynamic brake. When using built-in dynamic brake, set switch XS to "1" side.
  (Shipping setting is set to "1" side.)
*The indication of built-in dynamic brake resistance is up to 3 times in succession due to maximum allowable inertia, stop from rated speed. If it is used under more conditions, the resistance may be broken and the dynamic brake may not operate.
* When exceeding the capacity of the built-in dynamic brake resistor, set the switch XS to "2" side and use the external dynamic brake resistor. For connection, refer to the example of external dynamic brake connection.
* For details, refer to 7-1 Power connector XA, XB, XC, XD and terminal block.

Size G 200 V External Dynamic Brake Connection Example



Note1) To attach a dynamic brake resistor externally, set switch XS to "2" side.

Note2) Make the electromagnetic contactor (MC2) the same as the electromagnetic contactor (MC1) of the main circuit.

Note 3) When auxiliary contact is provided and main contact is welded Configure protection so that servo on will not be turned on by external sequence

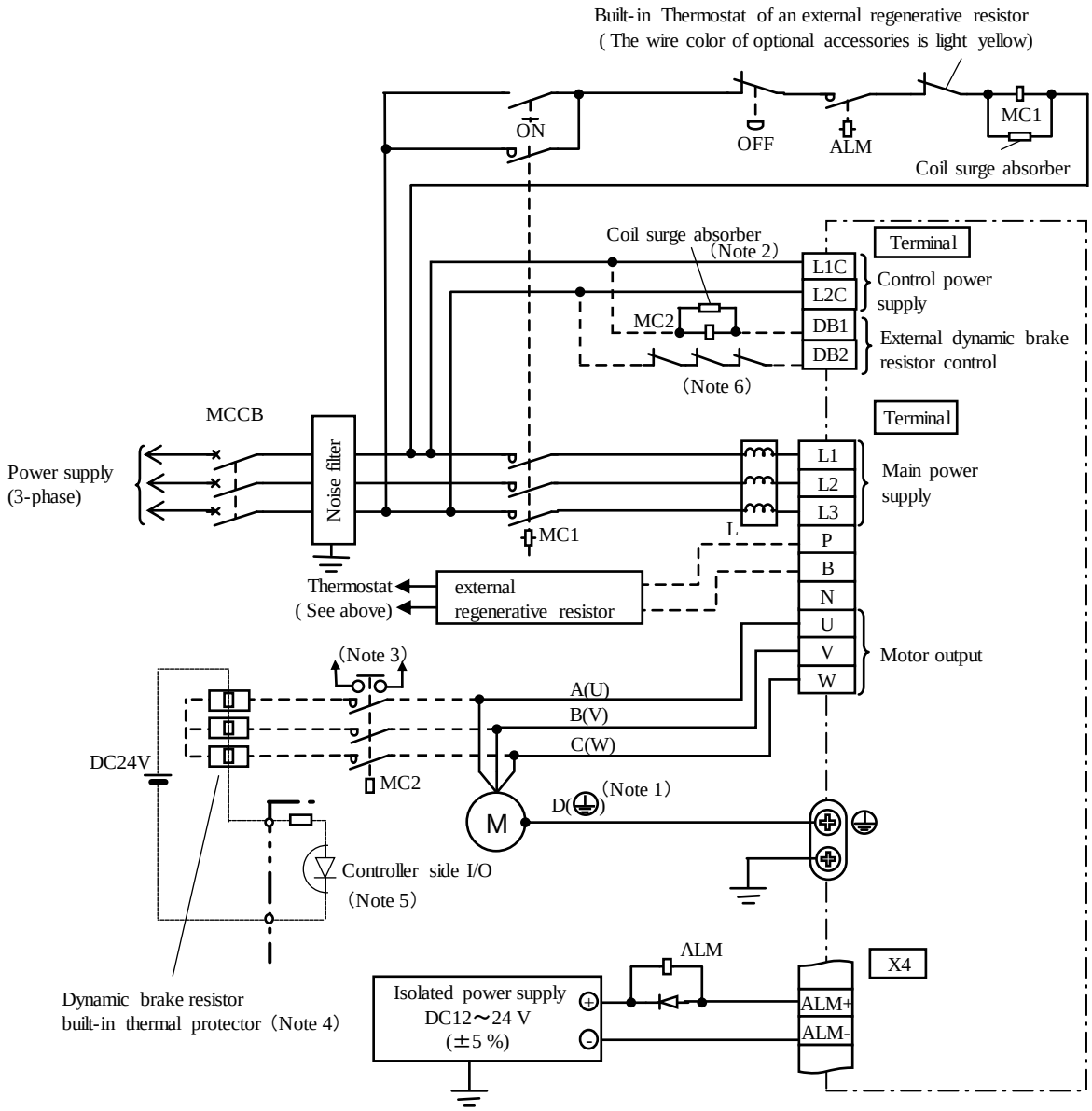
Note 4) Please use three 1.2 Ω 400 W dynamic brake resistors.
Please attach dynamic brake resistance to incombustible material such as metal.

Note 5) Install the thermal protector on the dynamic brake resistor and monitor with the upper side I / O and configure the protection so that the servo will not be turned on in the sequence during thermal protector operation.

Note 6) If the thermal protector can not be monitored by the upper I / O, input the thermal protector output between L2C and DB2 so that the dynamic brake does not operate when temperature protection works.

* External dynamic brake resistance should be used when exceeding the dynamic brake resistance capability.
* Do not use the built-in dynamic brake and the external dynamic brake together.
* For details, refer to 7-1 Power connector XA, XB, XC, XD and terminal block.

Size H 200 V



Note 1) The PIN No. of the motor side connector is stated.
22 kW specification only the notation in parentheses () is the connection destination.

Note 2) Make the electromagnetic contactor (MC2) the same as the electromagnetic contactor (MC1) of the main circuit.

Note 3) To prevent servo-on when the main contact is welded, provide auxiliary contacts to configure protection by external sequence.

Note 4) Please use three 1.2 Ω 400 W dynamic brake resistors.
Please attach dynamic brake resistance to incombustible material such as metal.

Note 5) Install the thermal protector on the dynamic brake resistor and monitor with the upper side I / O and configure the protection so that the servo will not be turned on in the sequence during thermal protector operation.

Note 6) If the thermal protector can not be monitored by the upper I / O, input the thermal protector output Between L2C and DB2 so that the dynamic brake does not operate when temperature protection works.

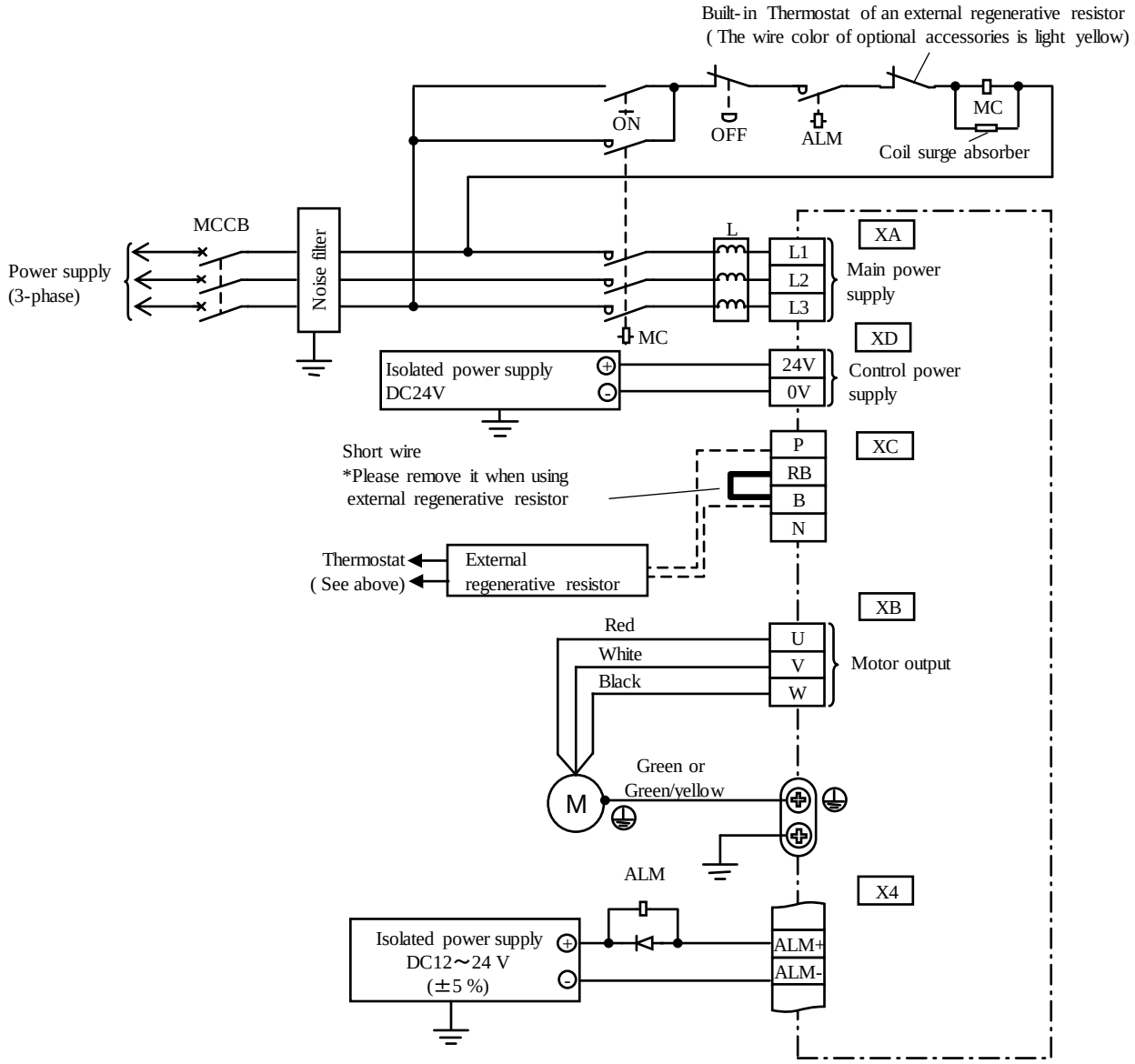
* For details, refer to 7-1 Power connector XA, XB, XC, XD and terminal block.

■ Connection of regenerative resistor

Size	Internal regenerative resistor	Connection of the Terminal	
		In case of using the external regenerative resistor	In case of not using the external regenerative resistor
H	None	Between P and B: Connect the external regenerative resistor	Between RB and B : Keep open

* Connectors X1 to X7 are secondary side circuits. (See [5. Appearance and name of each part])
Insulation is required from the primary side power supply (power supply for motor brake).
Do not connect to the same power supply.
* Since the dynamic brake is not built in, it is in the free-run state when the motor emergency stops.
If it can cause a machine collision accident, please use the external dynamic brake resistor.
*The indication of built-in dynamic brake resistance is up to 3 times in succession due to maximum allowable inertia, stop from rated speed.
If it is used under more conditions, the resistance may be broken and the dynamic brake may not operate.

Size D, E 400 V

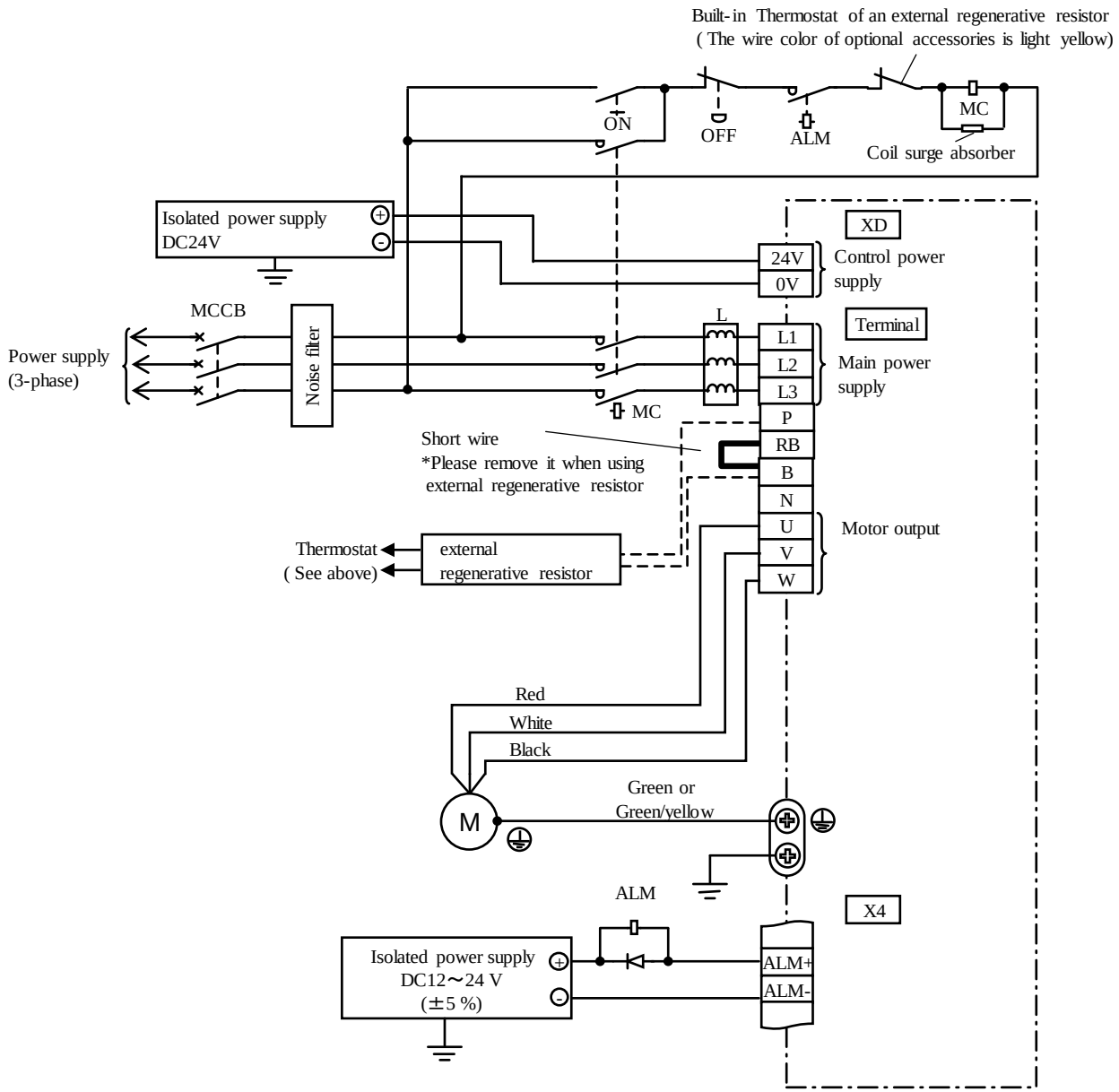


■ Connection of a regenerative resistor

Size	Short wire (accessory)	Built-in regenerative resistor	Connection of connector XC	
			When an external regenerative resistor is used	When an external regenerative resistor is not used
D E	Installed	Installed	Between RB and B: Disconnect the short cable Between P and B: Connect the external regenerative resistor	Between RB and B: Connect the shorting cable

* The circuit connected to terminal X1 – X7 are secondary circuits. (See [5. Appearance and name of each part])
Insulation is needed against the primary side power supply (power supply of the motor brake).
Please do not connect them with the same power supply.
* For details, refer to 7-1 Power connector XA, XB, XC, XD and terminal block.

Size F 400 V



■ Connection of a regenerative resistor

Size	Short bar (accessory)	Built-in regenerative resistor	Connection of the Terminal	
			In case of using the external regenerative resistor	In case of not using the external regenerative resistor
F	Installed	Installed	Between RB and B: Disconnect the short bar Between P and B: Connect the external regenerative resistor	Between RB and B: Connect the short bar

* The circuit connected to terminal X1 – X7 are secondary circuits. (See [5. Appearance and name of each part])
Insulation is needed against the primary side power supply (power supply of the motor brake).
Please do not connect them with the same power supply.
* The standard of the ability of the built-in dynamic brake resistor is up to continuousness three times in the stop from the allowance and maximum inertia and the rated speed.
Resistor is damaged and the dynamic brake might not work when using it under more critical operating condition.

* For details, refer to 7-1 Power connector XA, XB, XC, XD and terminal block.

[1] When the servo driver uses single phase power supply for sizes A - D, connect the servo driver to the terminals L1, L3 of main power supply input. Do not connect anything to the terminal L2.

[2] Insert the connector securely until it is locked.

[3] Make sure to use an insulation coated crimp terminal when connecting to each terminal on the terminal block. (size F,G,H)

[4] For models with terminal block covers, the terminal block cover is screwed. When wiring to the terminal block, unscrew these screws to uncover the cover. Please tighten the cover fixing screw to 0.19 - 0.21 N · m or less, and only tighten the terminal block cover 2 (black) of size H to less than 2.0 - 2.5 N · m torque.

[5] Apply the power supply of the voltage indicated on the nameplate.

[6] Do not reverse-connect the power input terminals (L1, L2, and L3) and the motor output terminals (U, V, and W).

[7] Do not connect the motor output terminals (U, V, and W) to ground or short out them.

[8] Power connector XA, XB, XC, XD, and the terminal block, are supplied with voltage, so do not touch them. There is a danger of electric shock.

[9] Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, below the maximum input voltage of the product.

[10] An AC servomotor, unlike an induction motor, cannot change the rotation direction by exchanging three phases.
Make sure to coincide 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.

[11] Be sure to connect the earth ground terminal of the motor to the grounding terminal of the servo driver and ground it together with the ground terminal of the noise filter. Please also ground the machine body. Grounding resistance should be less than 100 Ω. Tighten the servo driver's ground screw with the appropriate torque specified for each size. Please use the wire diameter of the ground wire be equal to or larger than the wire diameter specified in the each model specification. Also, please avoid direct contact between aluminum and copper to avoid the effect of electrolytic corrosion.

[12] Attach the serge absorbing circuits for preventing noises to an electromagnetic contactor placed around the servo driver, a coil between relay contact points, and a brake winding of motor with a brake.

[13] Attach the no fuse breaker (MCCB). In case of emergency, make sure to power off outside the servo driver. To use an earth leakage circuit breaker, use that in which a high frequency wave countermeasure is taken.

[14] In order to reduce the terminal noise voltage, install a noise filter.

[15] Customer is responsible for the power supply of the brake attached to a motor.

[16] Turn ON the power after the wiring was finished.

[17]About external regenerative resistance

· Size A, B, G, and H do not have built-in regenerative resistors.

· Size C, D, E, and F have built-in regenerative resistors, and the built-in regenerative resistor is effective by short-circuiting between RB terminal and B terminal.

· When tripping with regenerative load protection error (Err 18.0), it is necessary to install external regenerative resistor. Remove the short or short bar between the RB terminal and the B terminal, and connect the external regenerative resistor between the P terminal and the B terminal. In addition, it is necessary to set regenerative resistance with parameters.

· For details, refer to "Technical Data -Functional Specification-".

* As for external regenerative resistor, we recommend the resistors below:

	Input Power Voltage		
Size	Single phase 100 V	Single/3 phase 200 V	3 phase 400 V
A	DV0P4280	DV0P4281 (100 W or less), DV0P4283 (200 W)	—
B	DV0P4283	DV0P4283	
C	DV0P4282	DV0P4283	
D	—	DV0P4284	DV0PM20048
E		DV0P4284 x 2 in parallel or DV0P4285 x 1	DV0PM20049
F		DV0P4285 x 2 in parallel	DV0PM20049 x 2 in parallel
G	—	DV0P4285 x 3 in parallel	—
H	—	DV0P4285 x 6 in parallel	—

Manufacturer by Iwaki Musen Kenkyusho

Part number	Manufacturer's model	Specification			Built-in thermal protector operational temperature (Note2)
		Resistance value	Rated power (for reference) (Note1)		
			Free air	Fan used (1 m/s)	
		Ω	[W]	[W]	
DV0P4280	RF70M	50	10	25	140 ± 5 deg. Celsius Contact point B Open/close capacity (resistance load) 1 A 125 VAC, 6000 times 0.5 A 250 VAC, 10000 times
DV0P4281	RF70M	100	10	25	
DV0P4282	RF180B	25	17	50	
DV0P4283	RF180B	50	17	50	
DV0P4284	RF240	30	40	100	
DV0P4285	RH450F	20	52	130	
DV0PM20048	RF240TF	120	35	80	
DV0PM20049	RH450FTF	80	65	190	

Note1)Electric power available without running the built-in thermal protector.

Note2) Each regenerative resistor has built-in thermal fuse and thermal protector for safety.

· When using the thermal protector, please configure the circuit to turn off the power supply. (See "Wiring and system configuration")

· Built-in thermal fuse may break due to heat dissipation condition, operating temperature range, power supply voltage, load fluctuation.
Please perform operation confirmation by incorporating it in the machine so that the surface temperature of regenerative resistance becomes 100 ° C or less in conditions where regenerative resistance is easy to generate heat (when the power supply voltage is high, when load inertia is large, deceleration time is short, etc.) .

· Please install the regenerative resistance so that people do not touch directly, such as covering with incombustible material.

· Please make sure that the place where the person touches directly is less than 70 ℃.

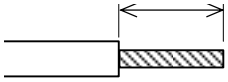
Procedure of connection to the power connector

To connect to Connector XA XB XC XD, follow the procedure below.

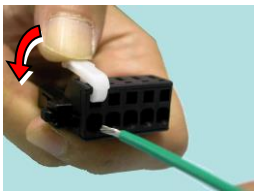
＜Wiring method＞

1. Stripping electric wires to be used. Please refer to the figure below for the strip length

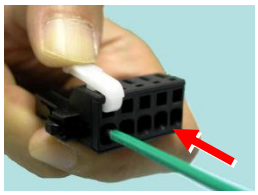
10 mm (Size A- C , Size D 200 V XA XB)
11 mm (Size D 400 V, Size E XA XB XC)
8 mm (Size D- E 400 V XD)



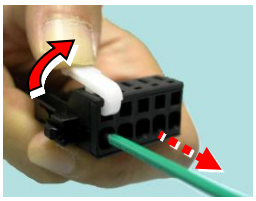
2.Insert the wire into the connector.



①Push down the spring by pushing the control lever attached to the upper operating slot with your fingers.



②Insert the wire while pressing the control lever. Please be careful that all strands are inserted into the spring opening



③You can wire it by releasing the control lever. Please pull the wire lightly and make sure that the wire is securely connected.

<Notes>

· Be careful not to damage the Core cable or cut it when stripping the wire.
· Because the strip length of the electric wire depends on the size and type of electric wire, please decide the optimum strip length according to the processing condition.
· For wiring, please disconnect the connector from the servo driver main body.
· Insert one wire into one wire insertion slot of the connector.
· When the control lever is pushed down, the wire can be removed.

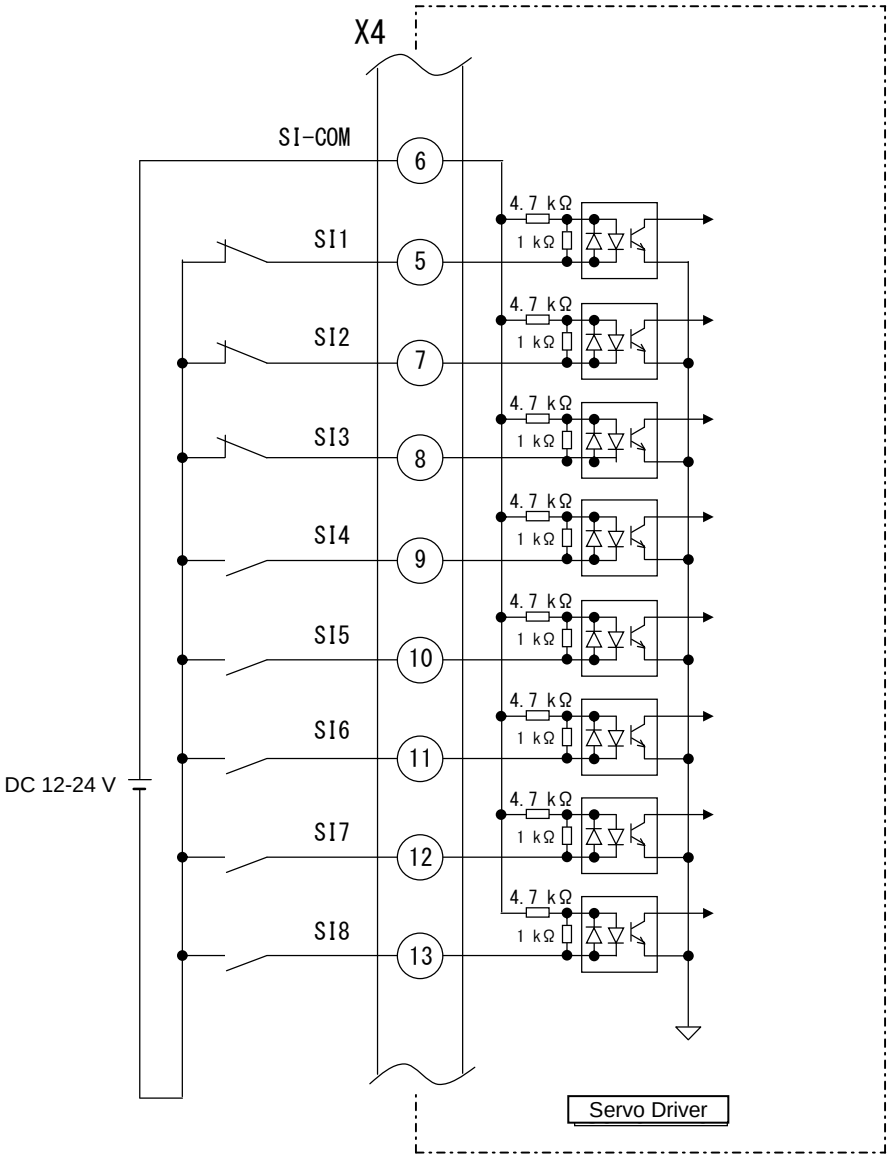
8-3-2 Wiring to connector X4

[1]The customer is required to prepare the 12 to 24 VDC control signal power supply for external control to be connected to SI-COM. Insulation is needed against the primary side power supply (power supply of the motor brake).
Do not connect to the same power supply.

[2] Install peripheral devices close to the servo driver as much as possible so that wiring length is minimized (within 3 m).

[3] Keep the cables away from the wiring of the power lines (L1, L2, L3, L1C, L2C, U, V, W, ⏚) as much as possible (at least 30 cm). Do not put them in the same duct or bind them together.

Control input



The functions of SI1 to SI8 are assigned with parameters.
For details, refer to "Technical Reference -Functional Specification-"

Control output

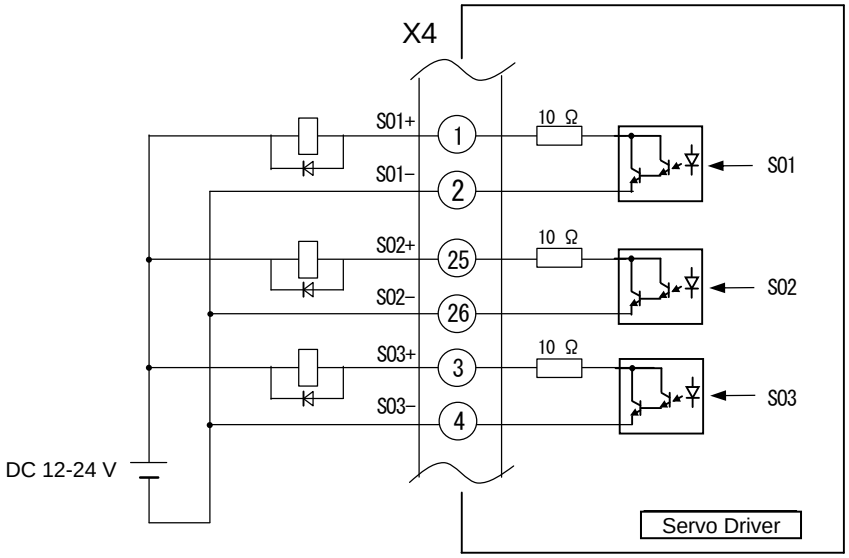
[1] Pay attention to the polarity of the control signal power supply. The polarity connection contrary to the figure shown above can damage the servo driver.

[2] To directly drive the relay with each output signal, make sure to install a diode in parallel to the relay and in the direction as shown in the figure below. If a diode is not mounted or it is mounted in the reverse direction, the servo driver may be damaged.

[3] When receiving each output signal by a logical circuit such as a gate, be careful not to be affected by noise.

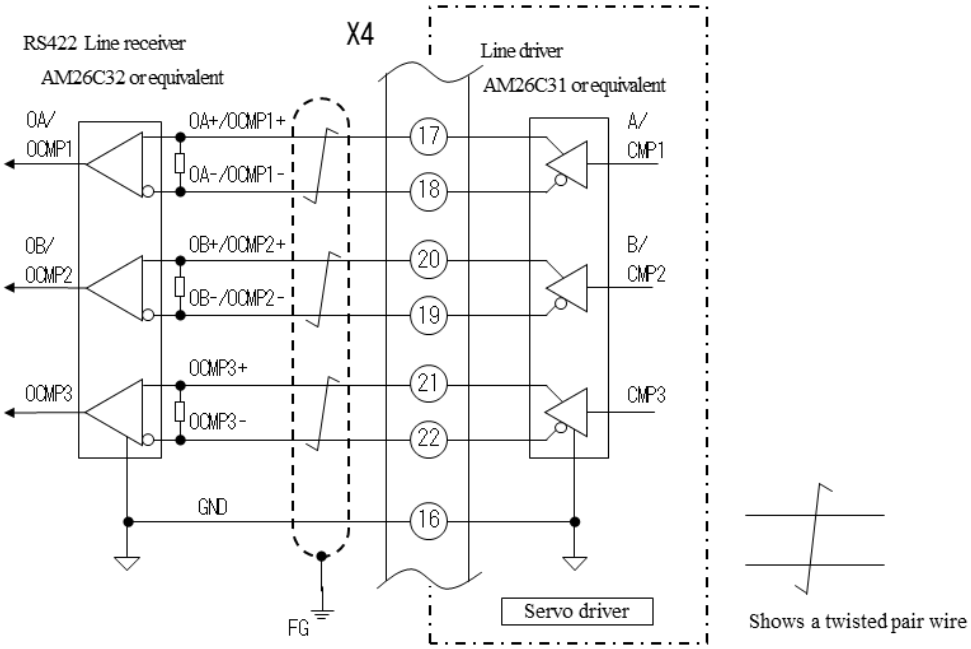
[4] The current to be passed through each output should be rated current 40 mA, maximum current 50 mA, inrush current 90 mA or less.

[5] Limiting resistance (10 Ω) is connected to the output circuit.
Also, since the output transistor is a Darlington connection, the collector-emitter voltage VCE (SAT) at the time of transistor ON is about 1 V, and since VIL can not be satisfied with a normal TTL IC Please be aware that it can not be connected directly.



The functions of SO1 to SO3 are assigned with parameters.
For details, refer to "Technical Reference - Functional Specification-".

Feedback pulse of the rotary encoder / Position compare output

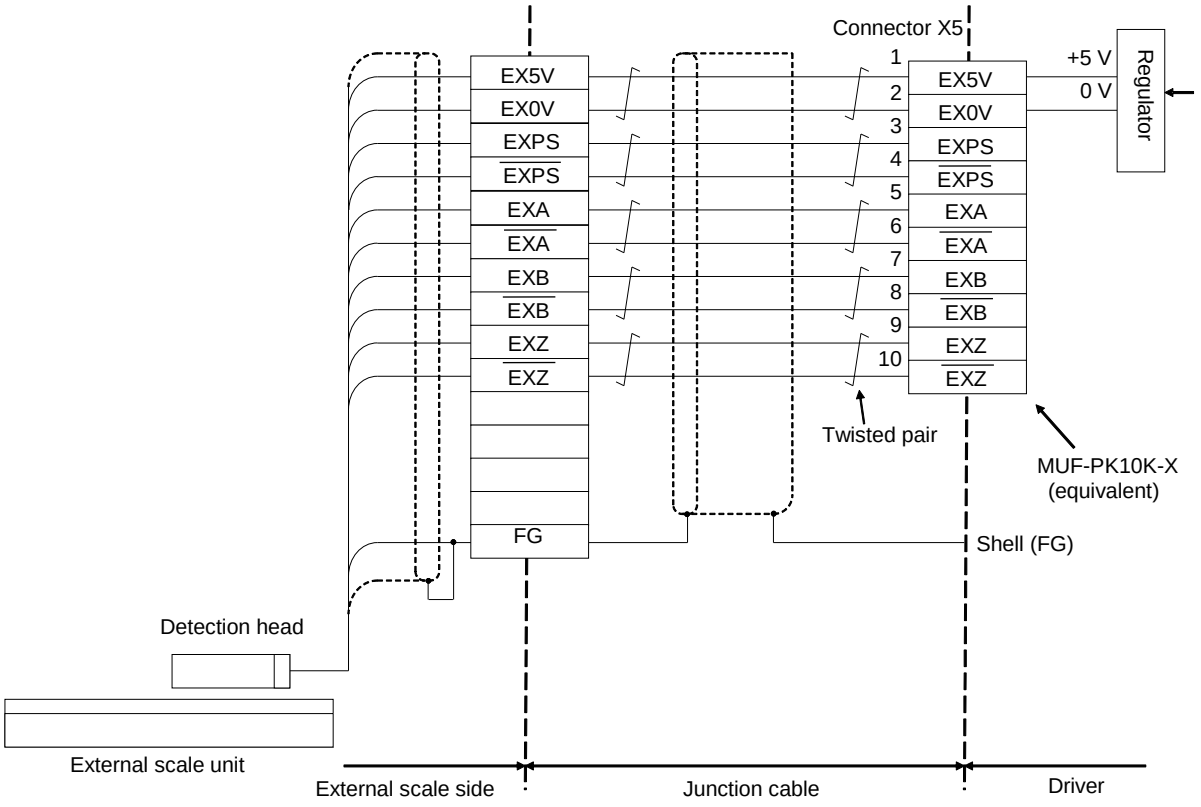


[1] Use an RS422 line receiver (AM26C32 or equivalent) to receive output pulse.
At that time, install an appropriate terminating resistor (approx. 330 Ω) between the line receiver inputs.

[2] The maximum output frequency should be 4 Mpps (after quad edge evaluation) or less.

8-3-3 Wiring to connector X5

[1] Only multi-function type is supported.
[2] The Core cable of the external scale cable should be a strand wire of 0.18 mm^2 or more. Use a common shielded twisted pair wire.
[3] The maximum cable length is 20 m. When the wiring length is long, double wiring is recommended to reduce the influence of voltage drop in the 5 V power supply.
[4] Connect the outer sheath of the motor side shield wire to the shield wire shield from the external scale.
Be sure to connect the sheath of the shielded wire on the servo driver side to the X5 shell (FG).
[5] Keep the cables away from the wiring of the power lines (L1, L2, L3, L1C, L2C, U, V, W, ⏚) as much as possible (at least 30 cm). Do not put them in the same duct or bind them together.
[6] Do not connect anything to the empty terminals of X5.
[7] The power supply that can be supplied from X5 is 5 V ± 5% 250 mA MAX. If you are using an external scale with more current consumption, please prepare the power supply by the customer. Also, some external scale may take time to initialize after turning on the power. Make a design so as to satisfy the operation timing after supplying power.
[8] When driving an external scale using external power supply, make the EX5V terminal open so that voltage is not supplied to this terminal from outside. In addition, connect 0 V (GND) of the external power supply with EX0V (X5 terminal of No.2) of the driver to obtain the same electric potential.

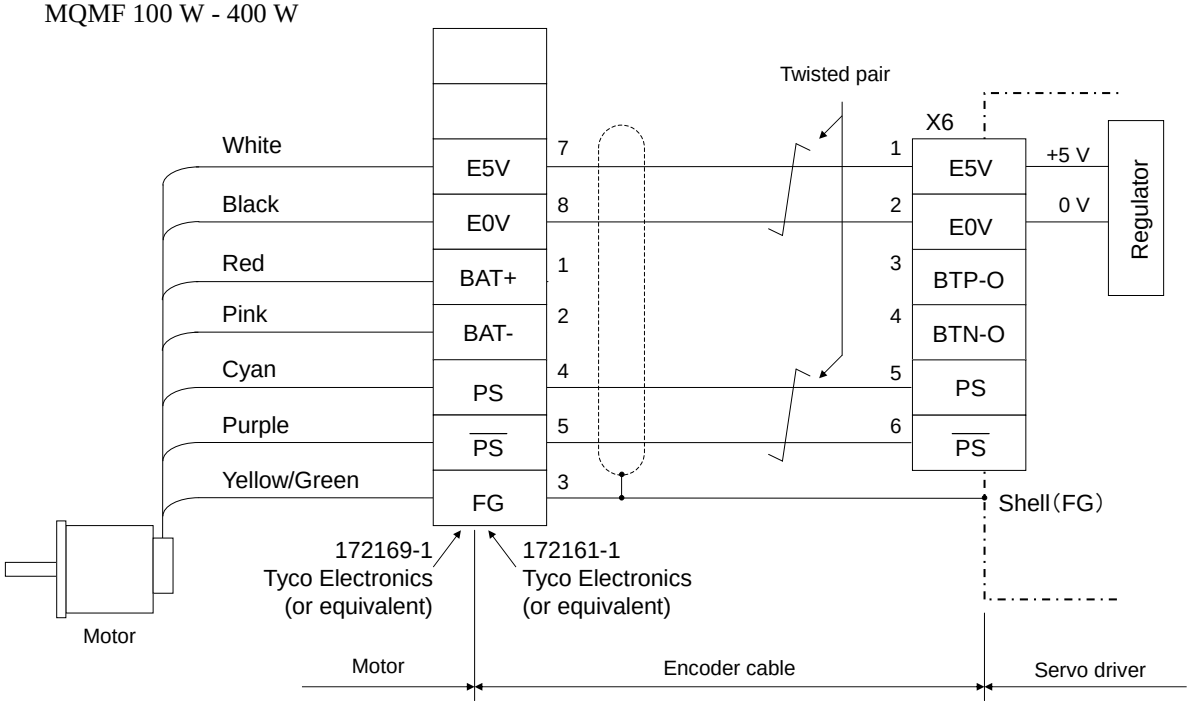


8-3-4 Wiring to connector X6

[1] The Core cable of the encoder cable should be a strand wire of 0.18 mm^2 or more. Use a common shielded twisted pair wire.
[2] The maximum cable length should be 20 m or less. If the wiring length is long, double wiring is recommended for the 5 V power supply to reduce influence of voltage drop.
[3] Be sure to connect the shield wires of the encoder cable to the Earh terminal on the motor side and the shell of X6 (FG) on the servo driver side.
[4] Keep the wires away from the wiring of the power lines (L1, L2, L3, L1C, L2C, U, V, W, ⏚) as much as possible (at least 30 cm). Do not route the wires through the same duct and do not tie them together.
[5] Do not connect anything to the empty pins of X6.

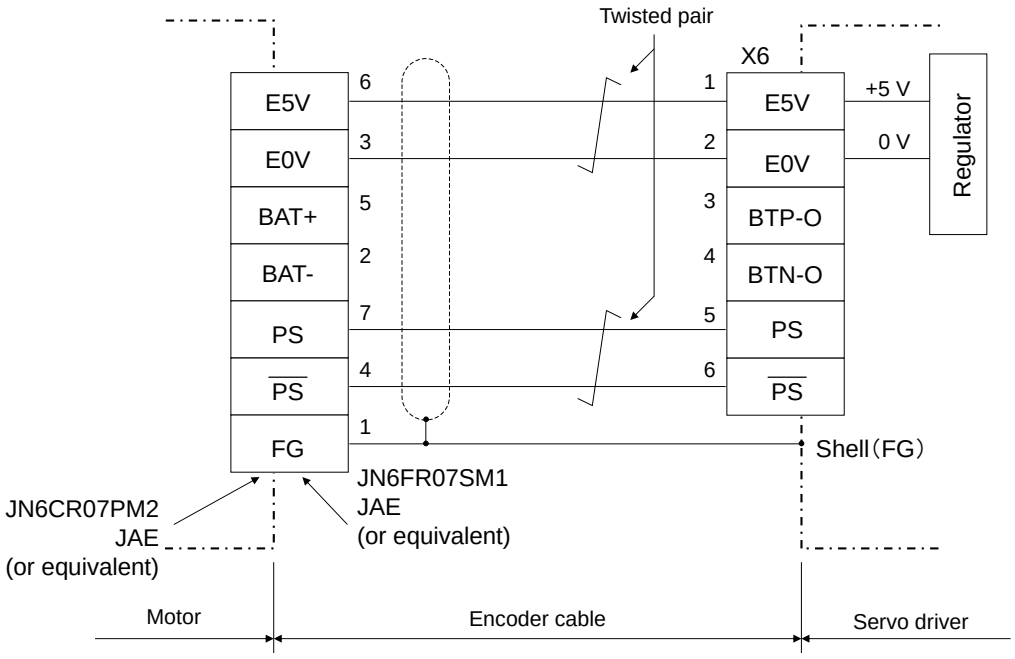
When multi-rotation data is not used
*When used as an incremental encoder
*When used as a single-rotation absolute encoder

■Lead wire type
MSMF 50 W - 1000 W
MHMF 50 W - 1000 W
MQMF 100 W - 400 W

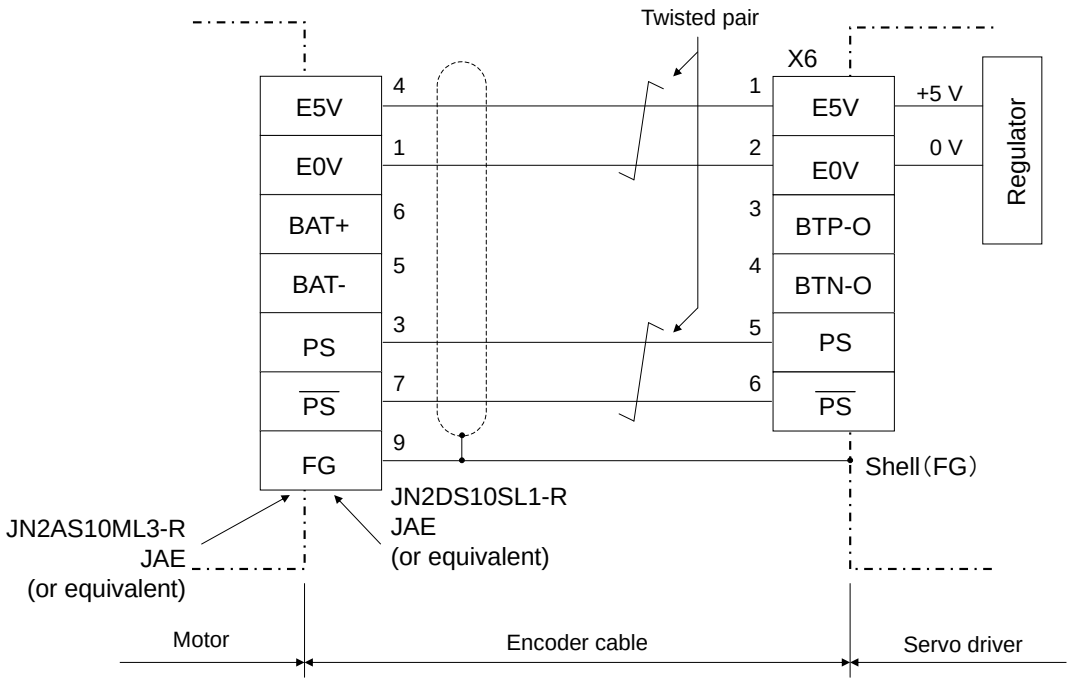


■Connector type

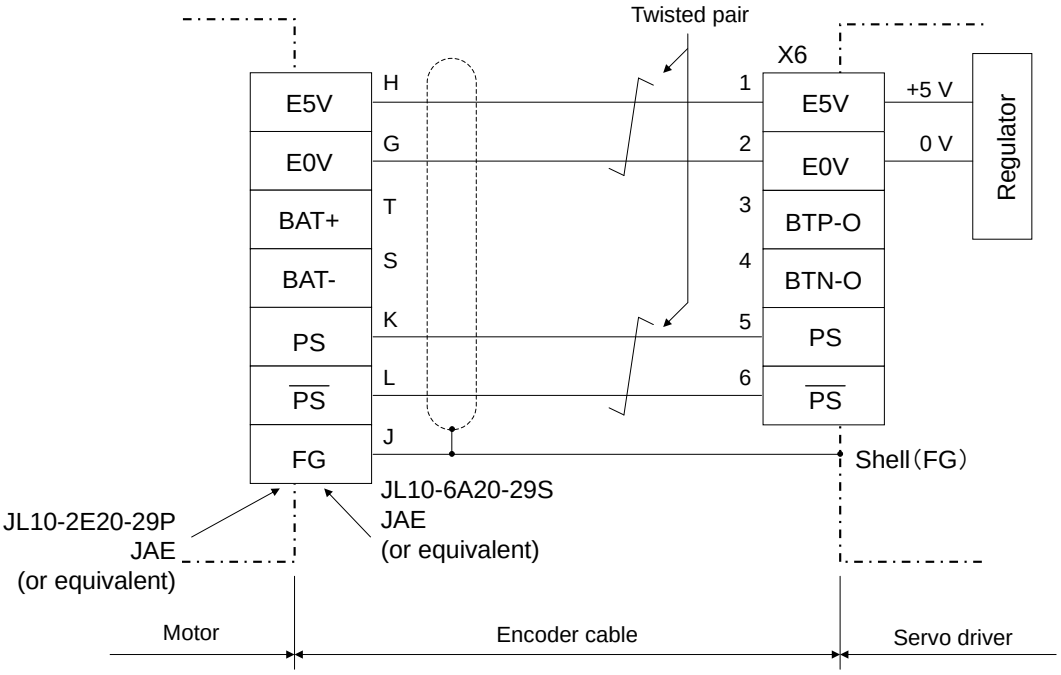
MSMF 50 W - 1000 W
MHMF 50 W - 1000 W
MQMF 100 W - 400 W



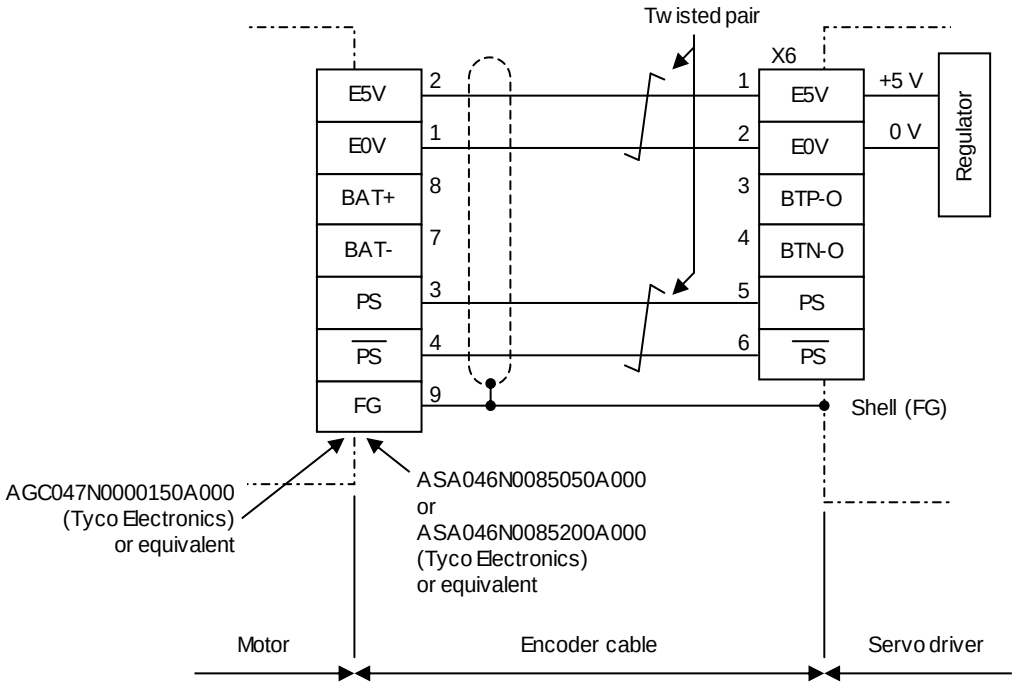
MSMF 1.0 kW - 5.0 kW
MHMF 1.0 kW - 5.0 kW
MDMF 1.0 kW - 5.0 kW
MGMF 0.85 kW - 4.4 kW



■Cannon plug type
MSMF 1.0 kW - 5.0 kW
MHMF 1.0 kW – 7.5 kW
MDMF 1.0 kW - 22.0 kW
MGMF 0.85 kW – 5.5 kW



■Angled cannon plug type
MSMF 1.0 kW - 5.0 kW (400 V)
MHMF 1.0 kW - 5.0 kW (400 V)
MDMF 1.0 kW - 5.0 kW (400 V)
MGMF 0.85 kW - 4.4 kW (400 V)

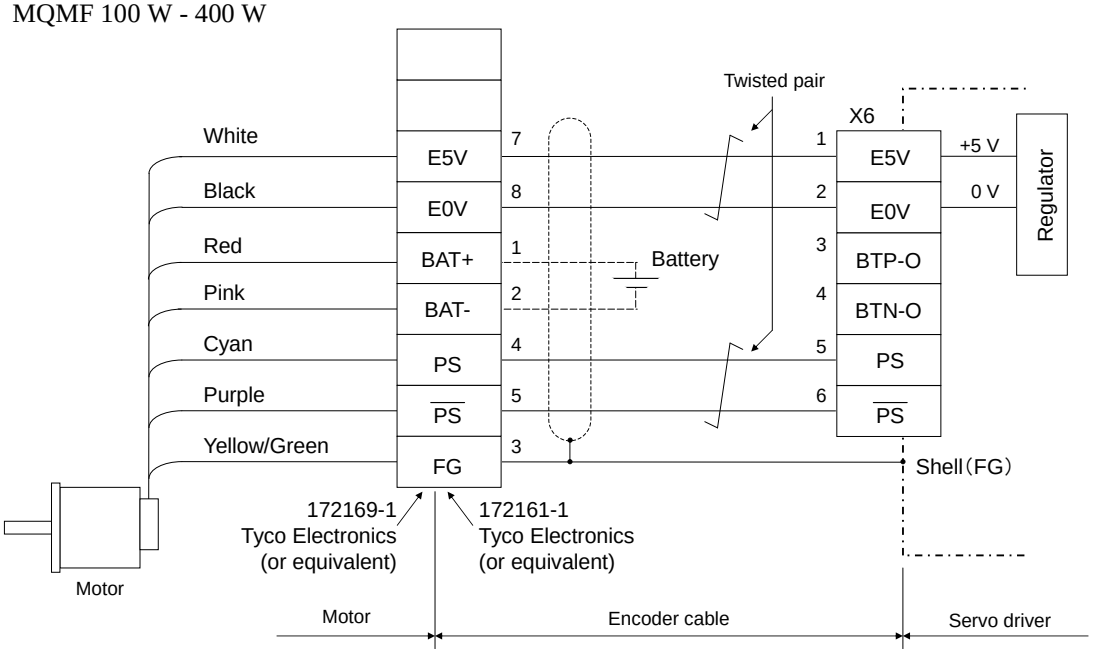


When multi-rotation data is used

*When an absolute system is constructed

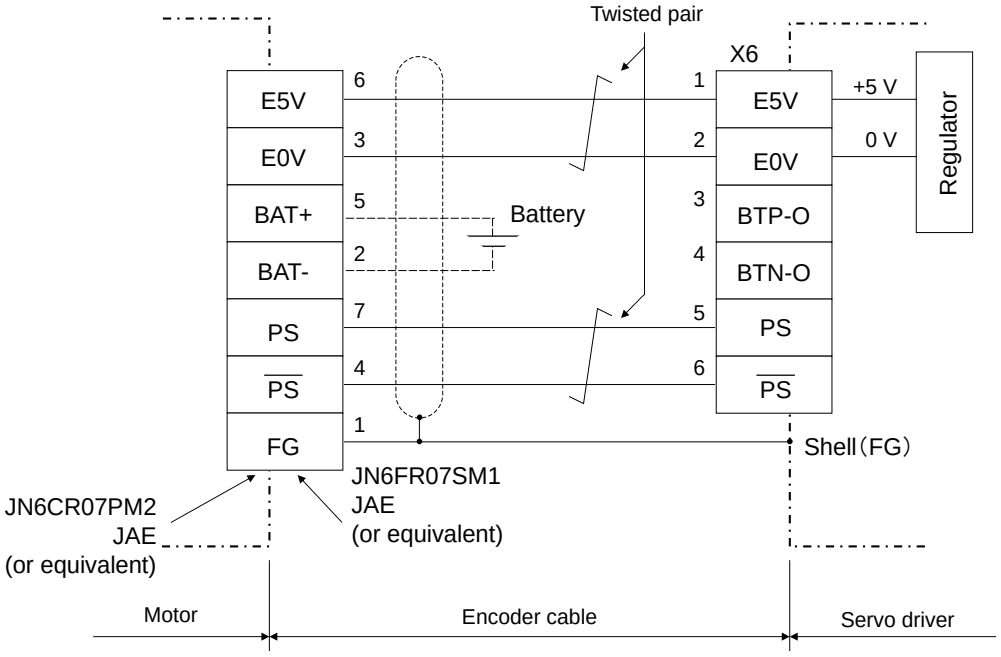
■Lead wire type

MSMF 50 W - 1000 W
MHMF 50 W - 1000 W
MQMF 100 W - 400 W

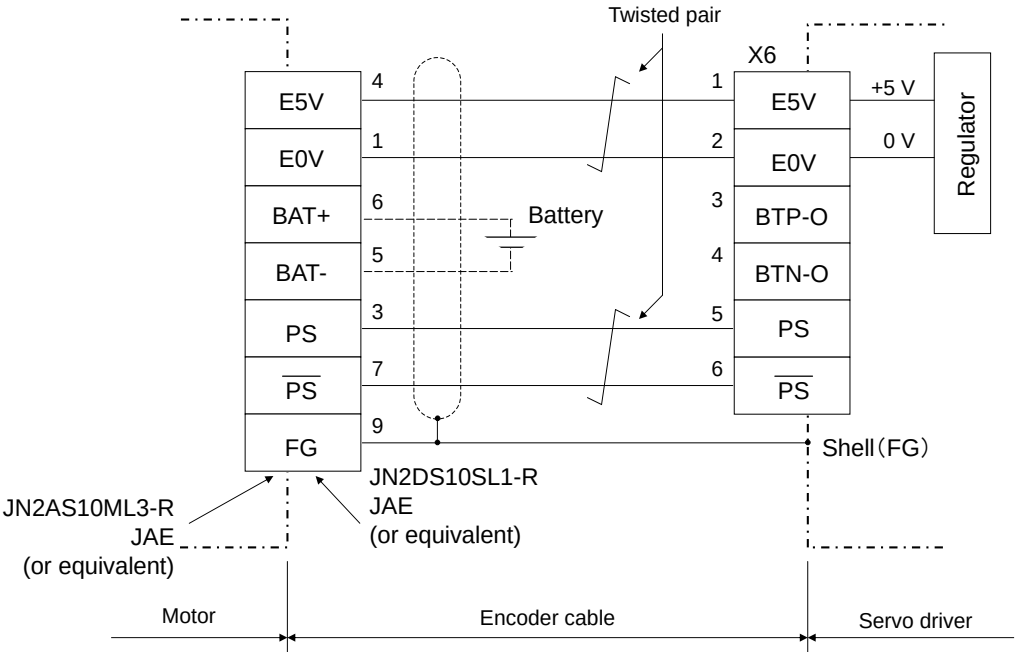


■Connector type

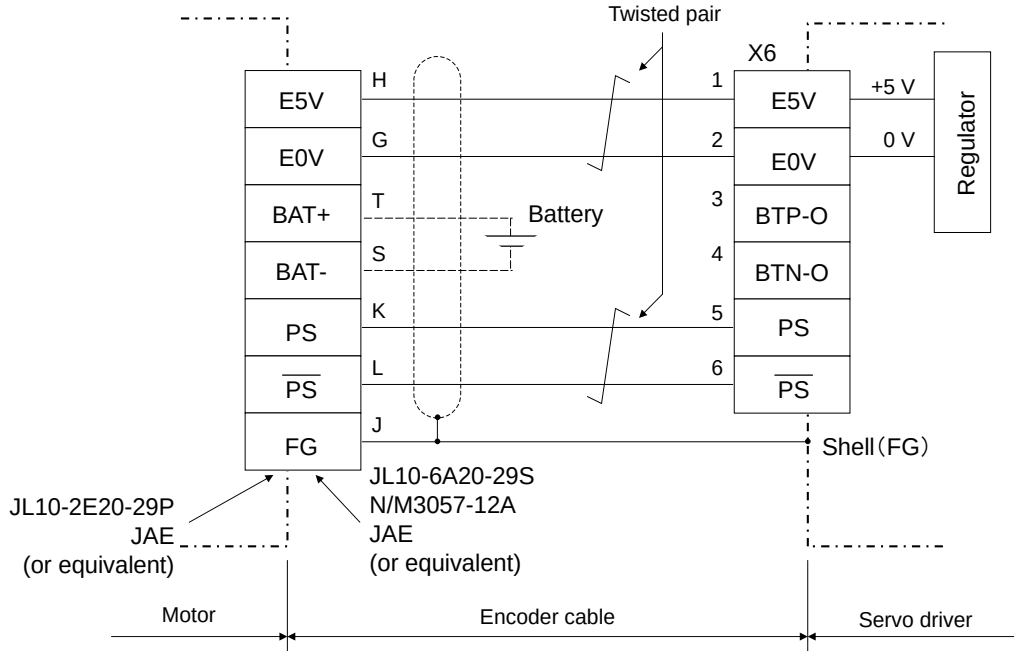
MSMF 50 W - 1000 W
MHMF 50 W - 1000 W
MQMF 100 W - 400 W



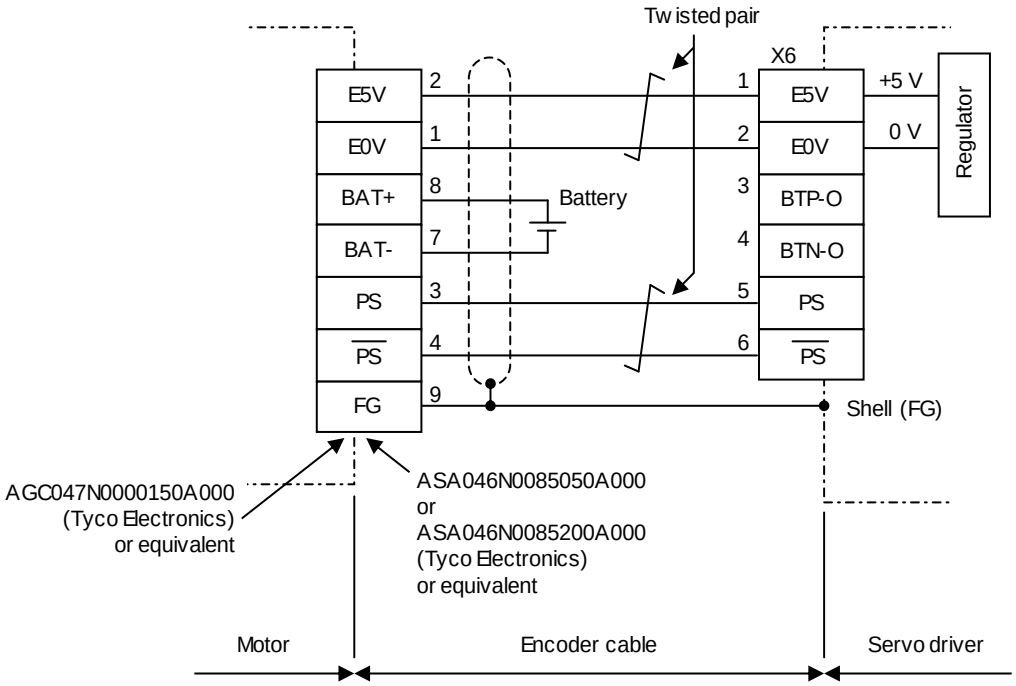
MSMF 1.0 kW - 5.0 kW
MHMF 1.0 kW - 5.0 kW
MDMF 1.0 kW - 5.0 kW
MGMF 0.85 kW - 4.4 kW



■Cannon plug type
MSMF 1.0 kW - 5.0 kW
MHMF 1.0 kW – 7.5 kW
MDMF 1.0 kW - 22.0 kW
MGMF 0.85 kW – 5.5 kW

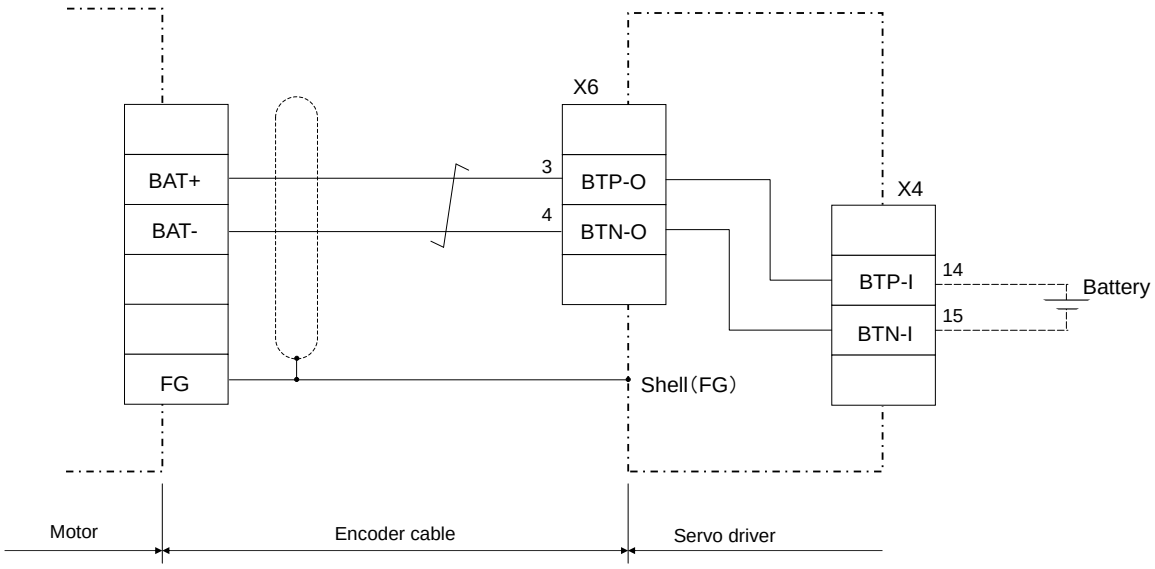


■Angled cannon plug type
MSMF 1.0 kW - 5.0 kW (400 V)
MHMF 1.0 kW - 5.0 kW (400 V)
MDMF 1.0 kW - 5.0 kW (400 V)
MGMF 0.85 kW - 4.4 kW (400 V)



Connection of a battery for the absolute encoder

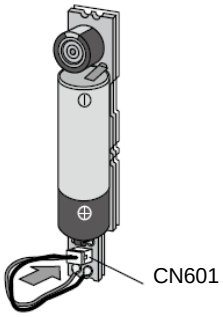
Connect a battery for the absolute encoder directly between BAT+ and BAT- of the encoder connector on the motor side. Or, it is also possible to connect the battery to the terminals 14 and 15 of the X4, and then connect through the terminals 3 and 4 of the X6.



Note: If the battery is directly connected to the encoder connectors at the motor, do not connect any wire to the terminals 3 and 4 of the X6.

Precautions when using the battery for the absolute encoder

- If the battery voltage drops, an error occurs in the absolute encoder.
  Voltage drop is caused by either the end of the battery life or a voltage delay.
  [1] Note that the battery life is shortened depending on surrounding environmental conditions.
  [2] A lithium battery has the minimum transient voltage (voltage delay phenomenon). Voltage may drop temporarily when the battery starts discharging current. Therefore, it is necessary to refresh the battery before using it.
  <When using the battery for the first time>
  If you use battery unit DV0P2990 (built-in battery: ER6V 3.6V made by Toshiba Lifestyle Products & Services), which is an optional item of Panasonic, connect the connector with lead wire to CN601 as shown in the right figure and set it aside for five minutes.
  Then, disconnect the connector from CN601 and attach it to the servo driver.
  Even when a battery is prepared by the customer, it is recommended to perform refreshing before using it. For the refreshing procedure, consult with the corresponding battery manufacturer.

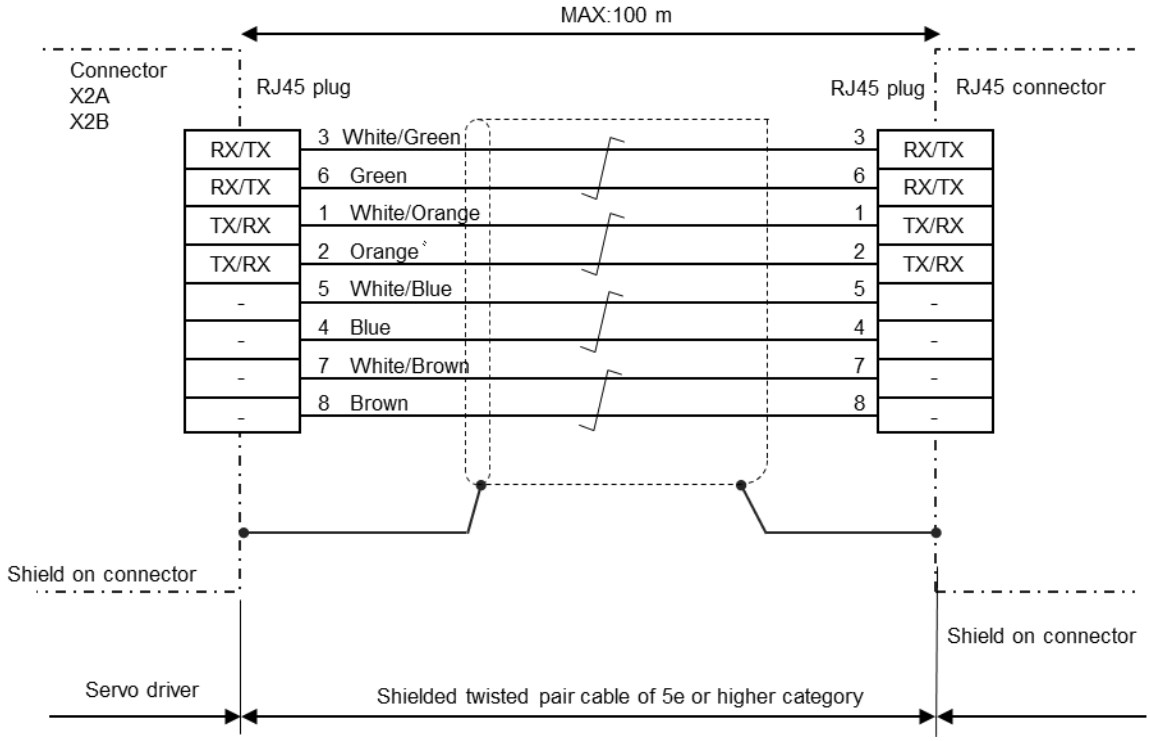


  <After mounting the battery unit>
  It is recommended to perform turning ON/OFF of the control power supply approx. once in a day.
- Incorrect use of the battery can cause troubles such as corrosion of the product due to leakage from the battery or risks such as breakage of the battery. Therefore, be sure to observe the following.
  [1] Make sure that the directions of the positive and negative electrodes are correct.
  [2] If the battery that has been used for a long period or the battery that cannot be used any more is kept set in the device, troubles such as leakage may occur. Replace it with a new one promptly. (As a guide, it is recommended to replace the battery every two years.)
  • The electrolytic solution of the battery is not only highly corrosive, which corrodes peripheral parts, but also conductive, which can cause short circuiting. Periodical replacement is needed.
  [3] Do not dismantle the battery and do not put it into a fire.
  • Never dismantle it because it is very dangerous if the scattered content enters the eye. Putting it into a fire or heating it may cause a bursting, which is dangerous.
  [4] Do not short circuit the battery and do not peel the battery tube.
  • If a metal or the like touches the positive or negative electrode terminal of the battery, large current is applied at a time, which weakens the battery.
  Further, heavy heat generation may occur, resulting in bursting, which is dangerous.
  [5] This battery cannot be charged. Do not charge the battery.
- Disposal of the used battery after replacement is regulated by some municipalities. Dispose of the battery according to the regulations of each municipality.
- Air transportation
  At the time of transportation by aircraft (both passenger airplane and cargo airplane), it is necessary to make an application with regard to hazardous materials. (UN packaging is required.)
  When requesting air transportation, it is required to submit necessary documents (such as a parameter sheet and SDS) to the transport company. Please make the request for it via the distributor.
- UN packaging
  For details, contact each transport company.

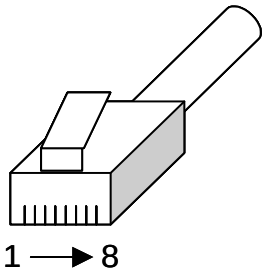
8-3-5 Wiring to connectors X2A and X2B

[1] Use a shielded twisted pair (STP) cable in conformance with category 5e of SIA/EIA-568 or higher.
[2] If both ends of the shield are not grounded, the EMC characteristic will deteriorate.
When installing connector plug on both ends of shielded cable, positively connect the shield to the metallic plug shell.
[3] For colors of wire and matching connector terminals, refer to TIA/EIA568B (see figure below).
The terminals 1-2 and 3-6 are signal lines. Three terminals 1-2, 4-5, and 7-8 that are not used must also be connected to the connector.
[4] When using a 2-pair line instead of a 4-pair line, connect the wires to the terminals 1-2 and 3-6 of the connector and do not connect anything to the terminals 4-5 and 7-8.
[5] The wiring length of the communication cable should be within the range that satisfies the following conditions.
Length between respective nodes: within 100 m
[6] Cable specifications including flexural property, temperature range, and materials used for covering are different according to manufacturers.
Select the cable according to the working conditions of the customer.
A movable cable should also be selected according to the working conditions of the customer.

Connection of X2A / X2B



Terminal layout of the RJ45 plug



8-4 Dynamic brake

Servo driver (sizes A to G) has dynamic brake built in for emergency stop.

Size H driver does not have built-in dynamic brake.

Dynamic brake can be operated in the following cases.

1. The main power off
2. The servo off
3. Protection action
4. Connector X4 driving ban importation (POT, NOT) action

On the above 1~4 cases, valid or invalid of dynamic brake can be determined by the parameters.

However, when the control power off, dynamic brake of size A-F keep valid condition and the dynamic brake of size G, H is released.

The dynamic brake is provided only for the short-time usage in case of emergency stop. Therefore, note the following points.

1. Do not start or stop operation by turning on/off the servo ON signal. Otherwise, the dynamic brake circuit built in the servo driver may get damaged.
2. Do not drive the motor with external power.
   If the motor is driven from outside, it will work as a generator. Therefore, short circuit current is applied during operation of the dynamic brake, which can cause smoking or ignition. In addition, the dynamic brake may be disconnected, which can cause disabling the operation.
3. If the dynamic brake is operated during high-speed operation, provide stop time for approx. 10 minutes.
   If the dynamic brake is used beyond that condition, the brake may be disconnected, which can cause disabling the operation.

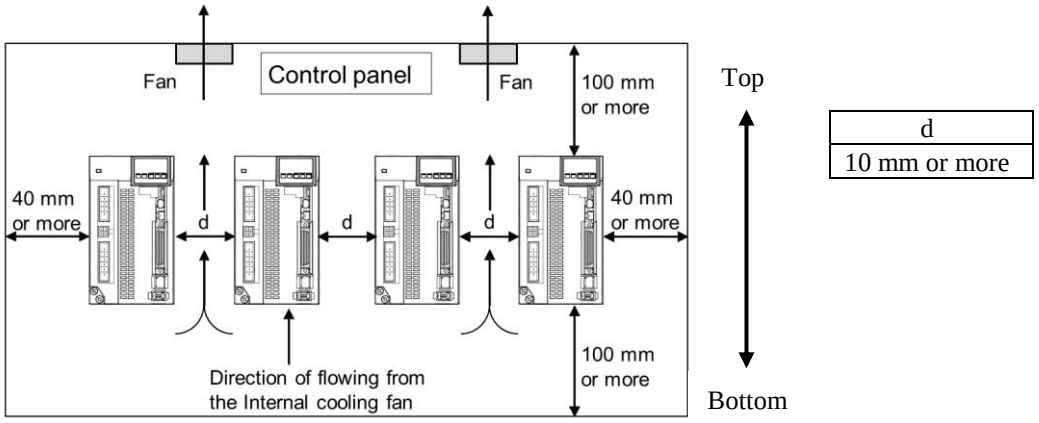
Size G and H driver can attach a dynamic brake circuit (electromagnetic contactor for driving and resistor) externally.

Size G driver should be externally attached when the built-in dynamic brake resistance capacity is insufficient.

Wiring according to the above notes "Wiring to power connector and terminal block", and wiring diagram of Size G 200 V, Size H 200 V .

8-5 Mounting direction and spacing

· The servo driver is a vertical placement type. Mounting should be vertical.
· The base mount type (rear mounted) is the standard for drivers Size A to D and Size H.
· When changing mounting surface with amp of Size A to D, please use the optional mounting bracket.
· Please select the tightening torque of the product fixing screws considering the strength of the screws and the material of the installation destination.
Example) When mounting with steel screws to steel
Size A to G: M5 2.7 to 3.3 N · m, Size H: M6 4.7 to 5.7 N · m
· To ensure effective cooling, ensure the surrounding space.
· Install a fan to make the temperature inside the control panel uniform.
· The cooling fans are attached to the lower side of the size D - F, the lower side and the upper side of the size G and H.
· Please observe the environmental conditions in the control panel environment.
· Secure the servo driver to the grounded conductive frame.
· If there is paint on the part where the servo driver or fan is to be installed, if you remove the paint and install it, there is a possibility of it being effective for noise control.
· In case you install the mounting bracket yourself, there is a possibility that noise countermeasure may be effective if using conductive plating process.
· The ambient temperature should be measured 50 mm away from the side or bottom of the servo driver.
If it can not be measured at a distance of 50 mm, measure at the midpoint of the gap between the obstacle and the driver.



d
10 mm or more

9. Compliance with global standards

9-1 Conforming standards

		Applicable standard
European EU directive	EMC directive	EN 55011:2009/A1:2010 (Group 1, Class A) EN61000-6-2 EN61000-6-4 EN 61800-3:2004/A1:2012 (Category C3, Second environment)
	Low voltage directive	EN61800-5-1 EN50178
	Machinery directive Functional Safety	ISO13849-1 EN61508 EN62061 EN61800-5-2 IEC61326-3-1 IEC60204-1
UL standard		UL61800-5-1 (File No. E164620)
CSA standard		C22. 2 No. 274
KC		KN11 KN61000-4-2,3,4,5,6,8,11

IEC : International Electrotechnical Commission
EN : Europaischen Norman
EMC : Electromagnetic Compatibility
UL : Under writers Laboratoris
CSA : Canadian Standards Association
KC : Radio Waves Act(South Korea)

The parameter of functional safety

	With diagnosis of "EDM output"	Without diagnosis of "EDM output"
Safety Integrity Level	EN61508(SIL3) EN62061(SILCL3)	EN61508(SIL2) EN62061(SILCL2)
Performance Level	ISO13849-1 PL e (Cat.3)	ISO13849-1 PL d (Cat.3)
Safety Function	EN61800-5-2 (SIL 3, STO)	EN61800-5-2 (SIL 2, STO)
Probability of dangerous failure	<For size A,B,C,D,E,F> PFH = 1.34×10^{-8} (%SIL3=13.4%) <For size G and H> PFH = 1.78×10^{-8} (%SIL3=17.8%)	<For size A,B,C,D,E,F> PFH = 1.40×10^{-8} (%SIL2=1.40%) <For size G and H> PFH = 1.85×10^{-8} (%SIL2=1.85%)
Mean time to dangerous failure	MTTFd : High (100 years)	MTTFd : High (100 years)
Average diagnostic coverage	DC : Medium	DC : Low
Mission time	15 years	15 years

9-2 European EU directive

Our products, in order to make it easy for the embedded equipments and devices to be compliant with EU directive, provide the compliance with the standards associated with low voltage directive.

9-2-1 Compliance with EMC directive

EN 55011

Warning: Class A equipment is intended for use in an industrial environment. In the documentation for the user, a statement shall be included drawing attention to the fact that there may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.

EN 61800-3

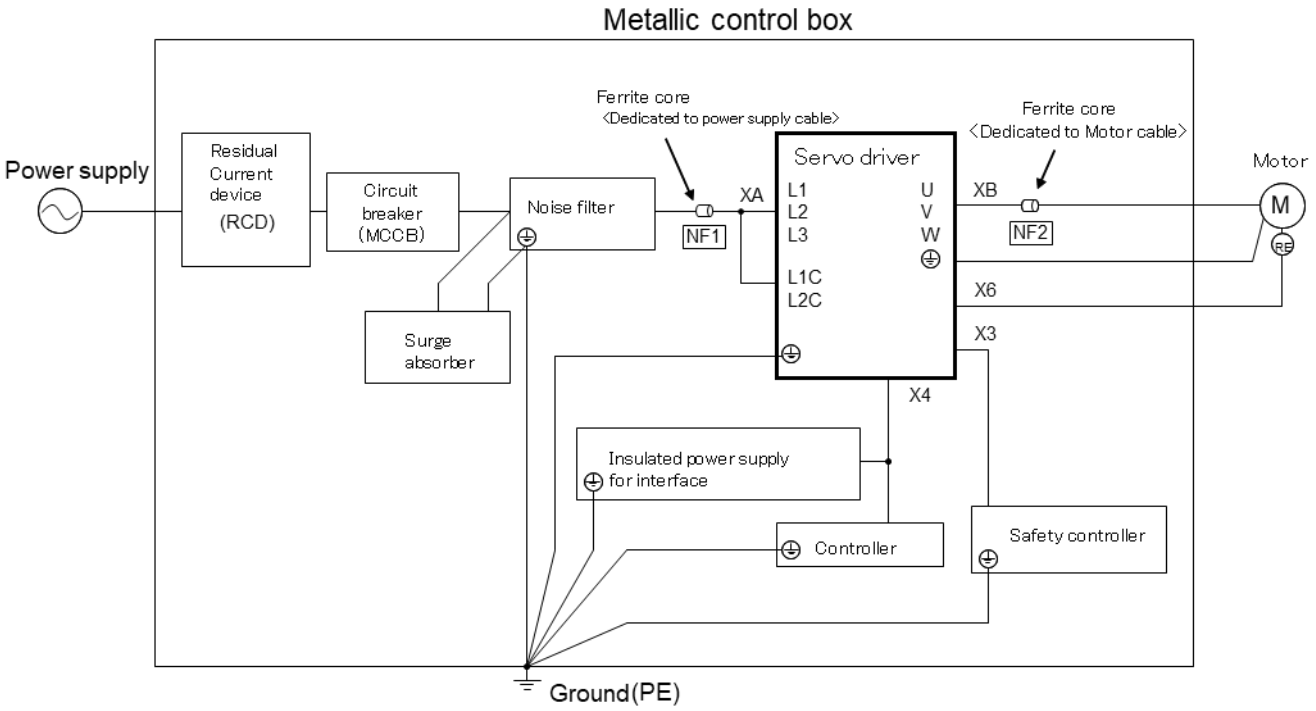
This type of PDS is not intended to be used on a low-voltage public network which supplies domestic premises;
Radio frequency interference is expected if used on such a network.
The manufacturer shall provide a guide for installation and use, including recommended mitigation devices.

9-3 Configuration of peripheral devices

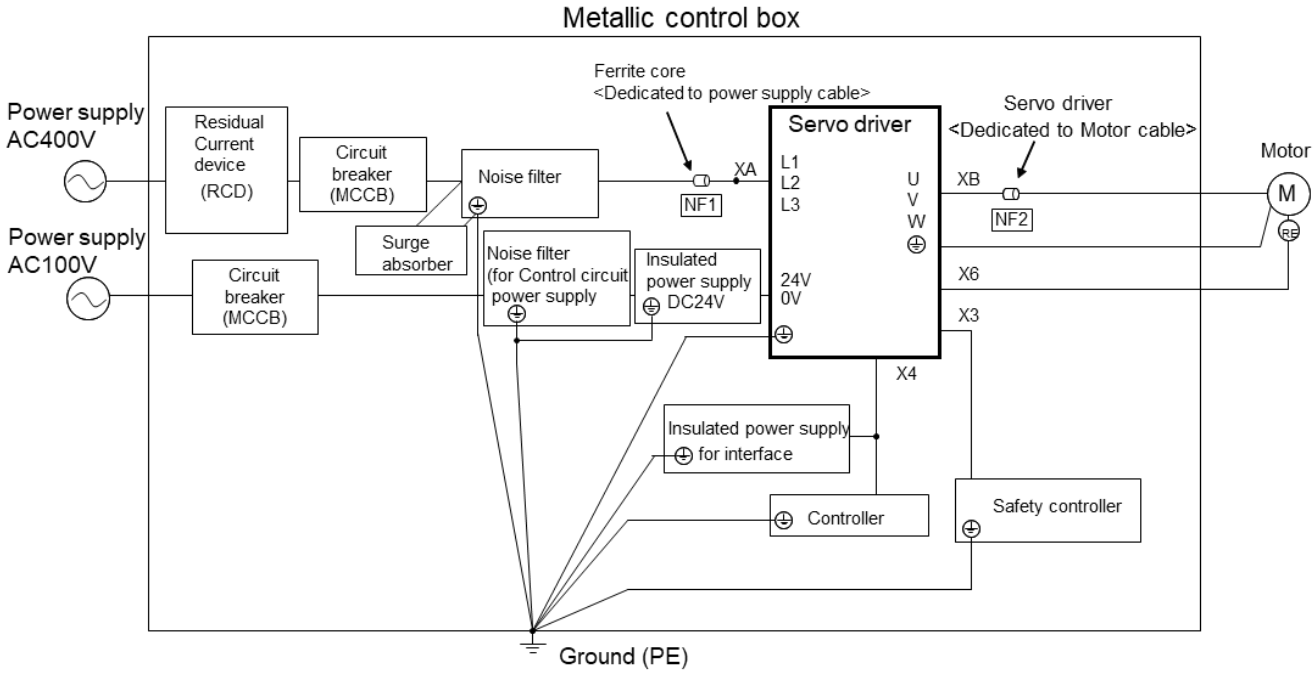
9-3-1 Installation environment

Use the servo driver under the environment of pollution degree 2 or 1 defined in IEC60664-1.
(Example: Installed in the IP54 control panel.)
Be sure to connect the circuit breaker (MCCB) or fuse of IEC standard and UL approved type to the main power supply.
For power supply for parallel I / O, use double insulated or reinforced insulated DC 24 V power supply.

100 V/200 V type



400 V type



Ferrite core installation status in EMC certification test

Symbol	Location	Applicable Size of servo driver	Option part number	Manufacturer's part number	Manufacturer	Qty.
NF1	Power supply able	(100 V) C (200 V) C,D,F	-	-	-	No need
		(100 V) A,B (200 V) A,B,E (400 V) D,E,F	DV0P1460	ZCAT3035-1330	TDK Corp.	1 *1
		(200 V) G,H	DV0P1460	ZCAT3035-1330	TDK Corp.	3 *2
			Recommended parts	RJ8095	Konno Kogyosho Co.Ltd	1 *3
NF2	Motor cable	(100 V) A,B,C (200 V) A,B,C,D,E (400 V) D,E,F	DV0P1460	ZCAT3035-1330	TDK Corp.	1 *1
		(200 V) F			TDK Corp.	2 *4
		(200V) G,H	DV0P1460	ZCAT3035-1330	TDK Corp.	3 *2
			Recommended parts	T400-61D	MICROMETALS	1 *3

* 1 Power wires(L1,L2,L3) should be wound together for one circle. Motor lines(U,V,W) should be wound together for one circle. 1 circle(bypass 1 line)

*2 Please wind the power wires(L1,L2,L3) for one circle separately. Please wind the motor lines(U,V,W) for one circle separately. 1 circle(bypass 1 line)

*3 Power wires(L1,L2,L3) should be wound together for four circles. Motor lines(U,V,W) should be wound together for Four circles. If wires cannot be laid down by four circles, two separate ferrite coils should be used to circle two wires separately.

*4 Motor lines(U,V,W) should be wound together and bypass two ferrite coils of parallel connection. 1 circle(bypass 1 line)

9-3-2 Power supply

100 V system:	Single phase 100 V - 120 V	+10 % -15%	50/60 Hz
200 V system (Sizes A-D):	Single / 3 phase 200 V - 240 V	+10 % -15%	50/60 Hz
200 V system (Sizes E-H):	3 phase 200 V - 240 V	+10 % -15%	50/60 Hz
400 V system (Sizes D-F) Main power:	3 phase 380Y/220-480Y/277 V TN (neutral point to ground)	+10 % -15%	50/60 Hz
400 V system (Sizes D-F) Control power supply:	DC 24 V	±15%	

(1) Use them under the environment of overvoltage category III stipulated in IEC60664-1.
(2) Use insulated-type 12 to 24 VDC power supply for parallel I/O in compliance with the CE marking or the EN standard (EN60950).

9-3-3 Molded-case circuit-breaker (MCCB)

Be sure to connect a UL-certified molded-case circuit-breaker (MCCB) in compliance with the IEC standard (LISTED, Ⓤ with mark) between the power supply and the noise filter.
The short circuit protective circuit of the product is not intended to protect the branch circuit.
Select the protection for the branch circuit in accordance with the NEC standard and the local standard.

9-3-4 Noise filter

When using multiple units of servo drivers and installing one noise filter collectively in the power supply section, consult with the noise filter manufacturer.

9-3-5 Surge absorber

Install the surge absorber in the primary side of the noise filter.
- Caution
When performing a withstand test for the machines and devices, be sure to remove the surge absorber.
Otherwise, the surge absorber may get damaged.

9-3-6 Ferrite core

Install ferrite cores in the power input line and the motor output line.

9-3-7 Grounding

(1) To avoid electric shocks, be sure to connect the protective earth terminal (⏚) of the servo driver and the protective earth (PE) of the control panel.

(2) Avoid co-fastening for the connection to the protective earth terminal (⏚). The servo driver is equipped with two protective earth terminals.

9-4 List of servo drivers and applicable peripheral devices

Servo driver	Voltage spec	Power capacity (Rated current)	Electromagnetic contactor (Rated current/ Released heat current)	Circuit breaker (MCCB) Rated current	Noise filter	Surge absorber	Ferrite core	
							Power supply cable	Motor cable
MADL*01**	Single phase 100 V	Approx. 0.4 kVA	20 A	10 A	DV0P4170 (for single phase) / DV0PM20042	DV0P4190 (for single phase) / DV0P1450 (for 3 phase)	DV0P 1460	DV0P 1460
MADL*11**								
MADL*05**	Single/ 3 phase 200 V	Approx. 0.5 kVA						
MADL*15**								
MBDL*21**	Single phase 100 V	Approx. 0.5 kVA						
MBDL*25**	Single/ 3 phase 200 V	Approx. 0.9 kVA						
MCDL*31**	Single phase 100 V	Approx. 0.9 kVA		15 A	DV0PM20042			
MCDL*35**	Single/ 3 phase 200 V	Approx. 1.8 kVA						
MDDL*45**	Single/ 3 phase 200 V	Approx. 2.4 kVA	30 A	20 A	DV0P4220			
MDDL*55**		Approx. 2.9 kVA						
MEDL*83**	3 phase 200 V	Approx. 3.8 kVA	60 A	30 A	DV0PM20043	DV0P1450		
MEDL*93**		Approx. 4.5 kVA						
MFDL*A3**		Approx. 5.2 kVA	100 A	50 A	DV0P3410			
MFDL*B3**		Approx. 7.8 kVA						
MGDL*C3**		Approx. 11 kVA	100A	60 A	HF3080C-SZA		DV0P1460 RJ8095	DV0P1460 T400-61D
MHDL*E3**		Approx. 20 kVA	150A	125 A	HF3100C-SZA			
MHDL*F3**		Approx. 28 kVA		175 A				
MDDL*44**	3 phase 400 V	Approx. 1.8 kVA	20 A	10 A	FN3258-16-44	LT-C34G801 WS	DV0P1460	DV0P1460
MDDL*54**		Approx. 2.4 kVA						
MDDL*64**		Approx. 2.9 kVA						
MEDL*84**		Approx. 3.8 kVA	30 A	15 A				
MFDL*A4**		Approx. 5.2 kVA	60 A	30 A	FN3258-30-33			
MFDL*B4**		Approx. 7.8 kVA						

- Select the specification common to single/ 3 phase 200 V according to the power supply.

- Notes

· Select a circuit breaker (MCCB) and a noise filter with capacity appropriate for power supply capacity (considering load conditions).
· Terminal block and ground terminal, Use copper conductor wires with a temperature rating of 75 ° C or higher for wiring. The protective earth terminal is from size A to size E is M4, size F to size G is M5, size H is M6. If the tightening torque of the screw exceeds the maximum value (refer to the terminal block explanation page), the terminal block may be damaged.
· The wire diameter of the ground wire is at least 2.0 mm 2 (AWG 14) at 50 W to 2.5 kW output, 3.5 mm 2 (AWG 12) or more at 3.0 kW to 5.0 kW output, 7.0 kW at 8.0 mm 2 (AWG 8) Or more, please use 22 mm 2 (AWG 4) or more for output 15.0 kW and 38 mm 2 (AWG 2) or more for 22.0 kW output.
· Use the supplied dedicated connector from size A to E.
· Tighten the screw of the connecting connector (X4) to the host controller at a tightening torque of 0.3 to 0.35 N · m. If it exceeds 0.35 N · m, the driver side connector may be damaged.

	Optional part number	Part number of manufacturer	Manufacturer
Absorber	DV0P1450	R･A･V-781BXZ-4	Okaya Electric Industries
	DV0P4190	R･A･V-781BWZ-4	
		LT-C34G801WS	Soshin Electric
Ferrite core	DV0P1460	ZCAT3035-1330	TDK
	—	RJ8095	Konno Kogyousho
	—	T400-61D	MICROMETALS
Noise filter	DV0P4170	SUP-EK5-ER-6	Okaya Electric Industries
	DV0P4220	3SUP-HU30-ER-6	
	DV0P3410	3SUP-HL50-ER-6B	
	DV0PM20042	3SUP-HU10-ER-6	
	DV0PM20043	3SUP-HU50-ER-6	
	—	HF3080C-SZA	Soshin Electric
	—	HF3100C-SZA	
	—	HF3040C-SZC	
	—	FN3258-16-44	Schaffner EMC
	—	FN3258-30-33	

9-5 Compliance with the UL standard

[1] Installation environment

Install the servo driver under the environment at pollution degree 2 or 1 stipulated in IEC60664-1.
Be sure to connect a UL-certified molded-case circuit-breaker (MCCB) or fuse to the main power supply.
Use copper conductor wires whose temperature rating is 75°C or higher.

[2] Short circuit current rating (SCCR)

This servo driver is compatible with power supply whose voltage is less than the maximum input voltage and symmetrical current is 5,000 A or less.

[3] Branch circuit protection

Protect the branch circuit in accordance with the NEC (National Electrical Code) and the local standard.
This servo driver has the thermal memory (shut down) function specified in EN61800-5-1: 2007 / A1: 2016, but does not have the thermal memory (loss of Power) and speed senstivity functions.

[4] Load protection and overheating protection

The servo driver has a built-in function to protect against servo motor overload.
The overload protection function is operated based on the specified time limit characteristics when current has reached 115% or more of the rating.
The servo motor is not provided with an overheating protection function. When it is necessary to satisfy the NEC, implement overheating protection measures for the servo motor.

9-6 Radio Waves Act of South Korea

The servo driver is a Class A device (broadcast communication device for business use) based on the Radio Waves Act of South Korea.
Use the product after understanding the following precautions.

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 product is an electromagnetic wave generating device for business use (Class A), which is intended for the use in places other than household.

The distributor and the user should be attentive to this point.

(Applicable model: Servo Driver)

9-7 Compliance with the SEMI F47 standard

- The SEMI F47 standard includes requirements for voltage drop in semiconductor manufacturing equipment.
- The control power supply for the servo driver is applicable to the SEMI F47 standard.
  The main circuit power supply is applicable to the SEMI F47 standard in the case of no load or light load.

(Cautions)

[1]This shall not apply to the single-phase 100 V servo driver whose control power input is 24 VDC.

[2]Make sure to verify the evaluation for the SEMI F47 standard using the actual equipment.

9-8 Harmonic suppression measures

- Harmonic suppression measures are different depending on countries. Perform installation in accordance with regulations in each country.
- The servo driver for Japan whose input current exceeds 20 A is applicable 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 exceeds the limit value predetermined for the contract demand, appropriate measures must be taken.
  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*.)

  * They are technical documents issued by JEMA (Japan Electrical Manufacture’s Association).

Safety precautions

10. Safety precautions

■The degree of the injury or damage caused when using the product improperly is categorized and an explanation is provided.

DANGER	Indicates “actions carrying a significant risk of death or serious injury.”
CAUTION	Indicates “actions carrying the risk of the occurrence of minor injury or property damage.”

■The actions to be observed are explained with the following symbols.

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

DANGER

(1) Please use it in the environment of pollution degree 2 or 1 (where there is no foreign matter such as dust, metal powder, oil mist, etc., where it does not come in contact with liquids such as water, oil and grinding liquid). Avoid storing or using it near combustibles or in an atmosphere of corrosive gas (H2S, SO2, NO2, Cl2 etc.) or flammable gas.

(2) Do not place combustible objects near the motor, servo driver, or regenerative resistor.

(3) Do not drive the motor with external power. As the motor is driven from the outside, it becomes a generator, so a short circuit current will flow during the dynamic brake operation built into the servo driver, possibly causing smoke and dust. Also, the dynamic brake may break and the brake may not operate.

(4) Do not damage the cable, apply excessive stress, place heavy objects on it, or pinch it.

(5) Please do not use cable with oil and water soaked.

(6) Do not install near heating elements such as heaters or large winding resistors. (Provide a heat shield plate, etc. so that it is not affected by the heating element.)

(7) Do not connect commercial power directly to the motor.

(8) Please do not use in places subject to vibration / shock. When installing the servo driver near the vibration source, attach the vibration isolator to the servo driver mounting surface.

(9) Do not touch the rotating parts of the motor during operation.

(10) Do not touch the key groove of the motor output shaft with bare hands.

(11) Do not touch the inside of the servo driver.

(12) Temperature of the heat sink and peripheral devices of the motor / servo driver will increase, so please do not touch it.

(13) Do not wire or operate with wet hands.

SAFETY PRECAUTIONS

(14) Wiring work should be done by an electrician's expert.

(15) Protective devices are not attached to motors other than those specified. Please protect with overcurrent protection device · earth leakage circuit breaker · temperature overheat prevention device · emergency stop device etc.

(16) When operating the servo driver after the earthquake, please check the installation condition of the servo driver / motor and the safety of the machine beforehand and check that there is no abnormality before driving.

(17) After turning off the power supply, the internal circuit is charged with high voltage for a while. When carrying out movement, wiring and inspection, completely shut off the power supply input outside the servo driver, leave it for 15 minutes or more, then perform the operation.

(18) When earthquakes occur, please ensure installation so that fire and personal injury will not occur due to installation.

(19) Install an emergency stop circuit externally so that operation can be immediately stopped and the power can be shut off in case of emergency.There is a possibility of smoking and dust generation due to malfunction of the motor and servo driver to be combined.As an example, if the regenerative control power transistor with built-in servo driver is energized with a short-circuit fault, smoke generation and dust generation due to overheating of the regenerative resistor installed outside the servo driver can occur.If a regenerative resistor is connected to the outside of the servo driver, install overheat detecting means such as a thermal protector to detect abnormal overheating and shut off the power supply.

(20) Mount the motor, servo driver and peripheral devices on incombustible materials such as metal.

(21) Wiring should be done correctly and reliably. Uncertain wiring and incorrect wiring may cause motor malfunction or thermal damage. Also, during installation / wiring work, please make sure that conductors such as wire scraps do not get inside the servo driver.

(22) Be sure to connect the cables, and insulate the current-carrying parts securely with insulation.

(23) When binding the wires and inserting them in a metal duct or the like for use, the permissible current of the wire will decrease due to the temperature rise, causing thermal damage. Please consider the current reduction coefficient and select the electric wire.

(24) Be sure to install the wiring breaker (MCCB) on the power supply. Be sure to ground the earth terminal or the ground wire.To prevent electric shock and malfunction, we recommend ground resistance 100 Ω or less.

(25) Tighten the screws of the terminal block for connection and the grounding screw securely and securely with the torque indicated in the specification sheet.

(26) When constructing a system using the safety function, please design so as to understand and comply with related safety standards and the description items of our manual or technical document.

CAUTION

(27) Do not hold the cable or motor shaft during transportation.

(28) In parameter adjustment of the servo driver, do not do extreme gain setting and action of changing the setting value greatly at once, as it may lead to unexpected unstable operation.

(29) Do not approach the machine because there is a possibility of a sudden restart after recovery at the time of a power failure. Please set up the machine to ensure safety to people even after restarting.

(30) Do not approach the motor and the machine driven by it during power-on in preparation for a malfunction.

(31) Do not apply strong impact to the motor shaft.

(32) Do not operate or stop the motor with the magnetic contactor installed on the main power supply side.

(33) Do not turn on / off the main power supply of the servo driver frequently.

(34) When the brake is built in the motor, the built-in brake is for holding, so do not use it for a stop device (braking) to ensure machine safety.

SAFETY PRECAUTIONS

(35) Do not drop or fall over during transportation or installation work.

(36) Do not climb onto the motor or place heavy objects on it.

(37) Please block the heat release hole of the servo driver, please do not put foreign matter.

(38) Please do not use in direct sunlight. When saving, please save at direct sunlight and temperature and humidity within the use range.

(39) Do not disassemble, repair, or modify.Please disassemble repair at our company or our designated store.

(40) Do not start or stop by ON / OFF of Servo ON command (SRV - ON). Dynamic brake circuit built into the servo driver may be damaged.

(41) Please use a combination of motor and servo driver in combination specified by us. Please check your company's performance and safety when combined with other servo driver s.

(42) Failure of the motor and the servo driver to be combined may cause thermal damage to the motor, smoke or dust. Please note that when used in a clean room etc.

(43) Make an appropriate fitting to match the output or body mass.

(44) Ambient temperature and ambient humidity of servo driver / motor should be within allowable ambient temperature and allowable ambient humidity range.

(45) Please observe the specified mounting method and direction.

(46) Set the distance between the servo driver and control panel inner surface or other equipment with a specified distance.

(47) When eye bolts are attached to the motor, use eye bolts only for motor transport and do not use for transporting equipment. Do not use it even when a speed reducer, a face plate, etc. are installed.

(48) Connect a relay that shuts off with an emergency stop in series with the relay for brake control.

(49) When performing trial operation, secure the motor firmly and confirm it in a state separated from the mechanical system.

(50) Make sure that the input power supply voltage is in accordance with the specifications of the servo driver, turn on the power supply and operate. Inputting a voltage higher than the rating may cause smoke or dust inside the servo driver,which may cause motor malfunction or thermal damage in some cases.

(51) When an alarm occurs, remove the cause and restart it. If you restart it unnecessarily without removing the cause, it may cause motor malfunction and thermal damage.

(52) When the brake is built in the motor, the built-in brake may not be able to be held due to the life and machine structure. Please install a stop device to ensure safety on the machine side.

(53) The motor and servo driver generate heat as the motor operates.If it is used in a sealed place, the ambient temperature may rise abnormally. Be careful that the ambient temperature of the motor / servo driver meets the usage range.

(54) Maintenance and inspection should be done by experts.

(55) When not using for a long time, be sure to turn off the power.

(56) When the dynamic brake built into the servo driver operates from high-speed operation, set a stop time of about 10 minutes. If it is used under more conditions, the internal circuit may be disconnected and the brake may not operate.

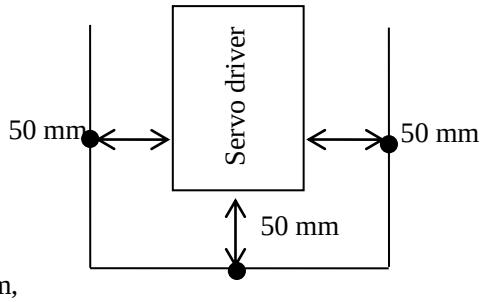
(57) Secure the cable so that stress is not applied to the connection part of the connector, terminal block, etc.

- Capacitance of the capacitors of power supply rectifier circuit drops over time. To avoid a secondary problem due to a failure, replacement of capacitors is recommended at an interval of Abt imately 5 years. Commission the manufacturer or sales agency authorized by the manufacturer to replace the parts.
- Be sure to read operating manual (safety guide) that shipped with product before use.

SAFETY PRECAUTIONS

Servo driver's ambient temperature

The driver's service life significantly depends on the ambient temperature.
Make sure that the driver's ambient temperature (at 50 mm distant from the driver) does not exceed the operating temperature range.



If the temperature can not be measured at a distance of 50 mm, measure it at the midpoint between the obstacle and the air gap of the driver.

Operating temperature range: 0 to 55 °C

11. Product life

(This item is not guaranteed)

11-1 Life expectancy of the driver

The driver has 28000 hours of life expectancy when used continuously under the following conditions,

Definition of the life: Life end shall be defined as the capacitance of the electrolytic capacitor is reduced by 20 % from the ex-factory status.

Condition			
	Input power	:	Single phase 100 VAC 50/60 Hz Single phase or 3 phase 200 VAC 50/60 Hz 3 phase 400 VAC 50/60 Hz
	Working temperature.	:	55 degrees C
	Above sea level	:	Below 100 m
	Output thrust	:	Constant thrust at rating
	Speed	:	Constant speed at rating

Note that the life varies due to the working conditions.

11-2 Typical life

11-2-1 In-rush current prevention relay

Replace the in-rush current prevention relay when it is activated typically 20000 times. Note that the criteria may vary depending on the environmental and working condition.

11-2-2 Cooling fan

Replace the cooling fan in 20000 hours. Note that the criteria may vary depending on the environmental and working condition.

12. Warranty

12-1 Warranty period

Warranty period shall be 12 months from the ex-factory date or 18 months from the date of manufacturing.

This Warranty shall be exempted in the following cases,

[1] defects resulting from misuse and/or repair or modification by the customer.

[2] defects resulting from drop of the Product or damage during transportation.

[3] defects resulting from improper usage of the Product beyond the Specifications.

[4] defects resulting from fire, earthquake, lightening, flood, damage from salt, abnormal voltage or other natural disasters.

[5] defects resulting from the intrusion of foreign material to the Product, such as water, oil or metallic particles.

[6] when the typical life of components that is described exceeds.

12-2 Warranty scope

When failure occurs due to our responsibility during the warranty period, we will respond only to the replacement or repair of the failed part of the single unit delivered by our company. In addition, the responsibility of our company is limited to the replacement and repair of the single unit delivered by our company, we shall not bear any responsibility for damages of your company and third parties caused by equipment malfunction delivered by our company. We are not responsible for any of the exclusion items stated in 12-1 above or any malfunction of the equipment which occurred in any of the cases and damages of your company and third party.

① If the equipment is incorporated or used contrary to the instructions or notices stipulated in this specification.

② When there is a cause for the combination of the equipment and the product incorporating the equipment.

③ If you can not respond to the items you are asking for in this specification.

④ In case of malfunction of equipment other than our responsibility.

12-3 Guarantee service

If you need to receive warranty service (troubleshooting cause repair / repair etc), please contact us.
If you send us directly to our company after consent of the purchaser, please receive "repair / survey request form" from the supplier, after filling in the necessary items, attach it to the product and send it to our motor service reception. As a rule shipping fee will be paid by the customer.

13. Network Security

When using this product connected to a network, the following damages may occur.

(1) Leakage of information via this product.

(2) Unauthorized operation of this product by a malicious third party.

(3) Interference of this product by a malicious third party.

In order to prevent such damage, take sufficient network security countermeasures including the following under your responsibility.
We are not responsible for any damage caused by insufficient network security.

<Notes on network security>

・Please use this product in an environment where only a limited member can enter.

・Do not install this product in a place where the product and accessories such as cables can be easily destroyed.

・Use this product on a network that is not connected to the Internet.

・If anexternal device such as a PC or tablet is connected to this product, there is a concern about the effects of computer viruses and malicious programs.
Take appropriate security measures for external devices, such as checking for computer virus infection and periodic removal before connecting external devices.

14. Others

(1) Precautions for exporting this product and equipment incorporating this product.
When the end user of this product and the end use relates to military or weapons etc., it may become subject to export restrictions prescribed by the "Foreign Exchange and Foreign Trade Control Law", so when it is exported, the examination and necessary export Please take a procedure.

(2) This product is designed for general industrial products etc. Do not use it in nuclear power control, aerospace equipment, transportation equipment, medical equipment, various safety devices, devices requiring cleanliness such as devices related to human life, special environment.

(3) Please confirm the conformity of the standards, laws, etc. in the finished equipment, and the matching of the structure, dimensions, life span, characteristics, etc. with your equipment and parts installed at your company.

(4) Since it is possible that your completed equipment will malfunction due to malfunction of our products (signal breakage, signal phase loss, etc.) and external noise / static electricity applied operation, so your company to ensure safe operation within the operable range at the operation location.

(5) Since overloading of products causes load collapse, please follow the display.

(6) If the machine is operated in a state where the motor shaft is not electrically grounded, there is a risk of electric corrosion of the motor bearing occurring depending on the actual machine and the installation environment and the bearing sound may become large, so at your company please confirm.

(7) Tighten properly the tightening torque of the mounting screw of the product so as not to loosen or break, considering the strength of the screw to be used and the material of the installation destination.

(8) Since there is a possibility that noise resistance performance may be influenced by the wiring situation (earth grounding method, cable length, signal line shielding situation) etc, please check noise immunity even if placed in your completed equipment.

(9) When discarding the servo driver / motor, please handle it as industrial waste.

(10) When disposing of the battery, please insulate the battery with tape etc and dispose according to the ordinance of the municipality.

(11) For performance improvement or other reasons, some components of this product may be modified in a range that satisfies the specifications given in this document.

(12) Specification change shall be made by our specifications or documents specified by your company, and if there is an influence on function / characteristics, we will change specification after reviewing on prototype.

(13) If there is a change in the specification, the product price may change.

(14) Please contact us beforehand with items that are not described in this specification and in particular need to be arranged.

(15) When a problem occurs, we will respond after consultation on both sides based on the items described in this specification.

(16) There is a possibility of smoking of about 1 cigarette depending on the content of breakdown of this product. Please note that when used in a clean room etc.

(17) Do not use benzine, thinner, alcohol, acidic or alkaline detergents as they may discolor or break the exterior.

15. Specification for each model

Model No.	MADLN01BE MADLT01BF	MADLN11BE MADLT11BF	MADLN05BE MADLT05BF	MADLN15BE MADLT15BF
Power 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	Resolution: 8388608 P/r	Resolution: 8388608 P/r	Resolution: 8388608 P/r	Resolution: 8388608 P/r
Regenerative resistor	External	External	External	External
Auto gain tuning function	Provided	Provided	Provided	Provided
Dynamic brake function	Provided	Provided	Provided	Provided
Absolute system	Available	Available	Available	Available
Working ambient temperature	0-55 ºC	0-55 ºC	0-55 ºC	0-55 ºC
Control power cable	HVSF 0.75 mm²	HVSF 0.75 mm²	HVSF 0.75 mm²	HVSF 0.75 mm²
	AWG18	AWG18	AWG18	AWG18
Main power supply cable	HVSF 0.75-2.0 mm²	HVSF 0.75-2.0 mm²	HVSF 0.75-2.0 mm²	HVSF 0.75-2.0 mm²
	AWG14-18	AWG14-18	AWG14-18	AWG14-18
Ground cable	HVSF 2.0 mm²	HVSF 2.0 mm²	HVSF 2.0 mm²	HVSF 2.0 mm²
	AWG14	AWG14	AWG14	AWG14
Motor cable	HVSF 0.75-2.0 mm²	HVSF 0.75-2.0 mm²	HVSF 0.75-2.0 mm²	HVSF 0.75-2.0 mm²
	AWG14-18	AWG14-18	AWG14-18	AWG14-18
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.7 A	Max.7 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
Dimension	Size A	Size A	Size A	Size A

(*1) The current value has been calculated assuming that power input voltage is 100 V for the 100 V specification or 200 V for the 200 V specification.

Model No.	MBDLN21BE MBDLT21BF	MBDLN25BE MBDLT25BF	MCDLN31BE MCDLT31BF	MCDLN35BE MCDLT35BF
Power 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	22 A	22 A
Rotary encoder	Resolution: 8388608 P/r	Resolution: 8388608 P/r	Resolution: 8388608 P/r	Resolution: 8388608 P/r
Regenerative resistor	External	External	Built in	Built in
Auto gain tuning function	Provided	Provided	Provided	Provided
Dynamic brake function	Provided	Provided	Provided	Provided
Absolute system	Available	Available	Available	Available
Working ambient temperature	0-55 ºC	0-55 ºC	0-55 ºC	0-55 ºC
Control power cable	HVSF 0.75 mm²	HVSF 0.75 mm²	HVSF 0.75 mm²	HVSF 0.75 mm²
	AWG18	AWG18	AWG18	AWG18
Main power supply cable	HVSF 0.75-2.0 mm²	HVSF 0.75-2.0 mm²	HVSF 0.75-2.0 mm²	HVSF 0.75-2.0 mm²
	AWG14-18	AWG14-18	AWG14-18	AWG14-18
Ground cable	HVSF 2.0 mm²	HVSF 2.0 mm²	HVSF 2.0 mm²	HVSF 2.0 mm²
	AWG14	AWG14	AWG14	AWG14
Motor cable	HVSF 0.75-2.0 mm²	HVSF 0.75-2.0 mm²	HVSF 0.75-2.0 mm²	HVSF 0.75-2.0 mm²
	AWG14-18	AWG14-18	AWG14-18	AWG14-18
Inrush current (main power supply) (*1)	Max.7 A	Max.14 A	Max.15 A	Max.29 A
Inrush current (control power supply) (*1)	Max.7 A	Max.14 A	Max.7 A	Max.14 A
Product weight	Approx. 1.0 kg	Approx. 1.0 kg	Approx. 1.6 kg	Approx. 1.6 kg
Dimension	Size B	Size B	Size C	Size C

(*1) The current value has been calculated assuming that power input voltage is 100 V for the 100 V specification or 200 V for the 200 V specification.

Model No.	MDDLN45BE MDDLT45BF	MDDLN55BE MDDLT55BF	MEDLN83BE MEDLT83BF	MEDLN93BE MEDLT93BF
Power input	Single-phase/ 3-phase 200 V	Single-phase/ 3-phase 200 V	3-phase 200 V	3-phase 200 V
Maximum output current	24 A	40 A	60 A	80 A
Rotary encoder	Resolution: 8388608 P/r	Resolution: 8388608 P/r	Resolution: 8388608 P/r	Resolution: 8388608 P/r
Regenerative resistor	Built in	Built in	Built in	Built in
Auto gain tuning function	Provided	Provided	Provided	Provided
Dynamic brake function	Provided	Provided	Provided	Provided
Absolute system	Available	Available	Available	Available
Working ambient temperature	0-55 ºC	0-55 ºC	0-55 ºC	0-55 ºC
Control power cable	HVSF 0.75 mm²	HVSF 0.75 mm²	HVSF 0.75 mm²	HVSF 0.75 mm²
	AWG18	AWG18	AWG18	AWG18
Main power supply cable	HVSF 2.0 mm²	HVSF 2.0 mm²	HVSF 2.0 mm²	HVSF 2.0 mm²
	AWG14	AWG14	AWG14	AWG14
Ground cable	HVSF 2.0 mm²	HVSF 2.0 mm²	HVSF 2.0 mm²	HVSF 2.0 mm²
	AWG14	AWG14	AWG14	AWG14
Motor cable	HVSF 2.0mm²	HVSF 2.0 mm²	HVSF 2.0 mm²	HVSF 3.5 mm²
	AWG14	AWG14	AWG14	AWG12
Inrush current (main power supply) (*1)	Max.29 A	Max.29 A	Max.29 A	Max.29 A
Inrush current (control power supply) (*1)	Max.14 A	Max.14 A	Max.14 A	Max.14 A
Product weight	Approx. 2.1 kg	Approx. 2.1 kg	Approx. 2.7 kg	Approx. 2.7 kg
Dimension	Size D	Size D	Size E	Size E

(*1) The current value has been calculated assuming that power input voltage is 100 V for the 100 V specification or 200 V for the 200 V specification.

Model No.	MFDLNA3BE MFDLTA3BF	MFDLNB3BE MFDLTB3BF
Power input	3-phase 200 V	3-phase 200 V
Maximum output current	100 A	120 A
Rotary encoder	Resolution: 8388608 P/r	Resolution: 8388608 P/r
Regenerative resistor	Built in	Built in
Auto gain tuning function	Provided	Provided
Dynamic brake function	Provided	Provided
Absolute system	Available	Available
Working ambient temperature	0-55 ºC	0-55 ºC
Control power cable	HVSF 0.75 mm²	HVSF 0.75 mm²
	AWG18	AWG18
Main power supply cable	HVSF 3.5 mm²	HVSF 3.5 mm²
	AWG12	AWG12
Ground cable	HVSF 3.5 mm²	HVSF 3.5 mm²
	AWG12	AWG12
Motor cable	HVSF 3.5 mm²	HVSF 3.5 mm²
	AWG12	AWG12
Inrush current (main power supply) (*1)	Max.22 A	Max.22 A
Inrush current (control power supply) (*1)	Max.14 A	Max.14 A
Product weight	Approx. 5.2 kg	Approx. 5.2 kg
Dimension	Size F	Size F

(*1) The current value has been calculated assuming that power input voltage is 100 V for the 100 V specification or 200 V for the 200 V specification.

Model No.	MGDLTC3BF	MHDLTE3BF	MHDLTF3BF
Power supply input	3-phase 200 V	3-phase 200 V	3-phase 200 V
Maximum output current	160 A	240 A	360 A
Rotary encoder	Resolution: 8388608 P/r	Resolution: 8388608 P/r	Resolution: 8388608 P/r
Regenerative discharge	Externally	Externally	Externally
Auto gain tuning function	Provided	Provided	Provided
Dynamic brake function	Provided	None	None
Absolute system	Available NOTE)	Available NOTE)	Available NOTE)
Ambient temperature main power supply cable	0-55 ℃	0-55 ℃	0-55 ℃
Control power cable	HVSF 0.75 mm^2	HVSF 0.75 mm^2	HVSF 0.75 mm^2
	AWG18	AWG18	AWG18
Main power supply cable	HVSF 8.0 mm^2	HVSF 22 mm^2	HVSF 38 mm^2
	AWG8	AWG4	AWG2
Ground cable	HVSF 8.0 mm^2	HVSF 22 mm^2	HVSF 38 mm^2
	AWG8	AWG4	AWG2
Motor cable	HVSF 14 mm^2	HVSF 22 mm^2	HVSF 38 mm^2
	AWG6	AWG4	AWG2
Inrush current (Main power supply) (*1)	Max. 66 A	Max. 66 A	Max. 66 A
Inrush current (Control power supply) (*1)	Max. 15 A	Max. 15 A	Max. 15 A
Weight	Approx.8.2 kg	Approx14.2 kg	Approx15.2 kg
Dimensions	Size G	Size H	Size H

(*1) The current is the value calculated with the voltage as 100 V when the product power input voltage is 100 V specification and 200 V when the product is 200 V specification.

Model No.	MDDLT44BF	MDDLT54BF	MDDLT64BF	MEDLT84BF
Power input	3-phase 400 V	3-phase 400 V	3-phase 400 V	3-phase 400 V
Maximum output current	6.5 A	13 A	20 A	28 A
Rotary encoder	Resolution: 8388608 P/r	Resolution: 8388608 P/r	Resolution: 8388608 P/r	Resolution: 8388608 P/r
Regenerative resistor	Built in	Built in	Built in	Built in
Auto gain tuning function	Provided	Provided	Provided	Provided
Dynamic brake function	Provided	Provided	Provided	Provided
Absolute system	Available	Available	Available	Available
Working ambient temperature	0-55 ºC	0-55 ºC	0-55 ºC	0-55 ºC
Control power cable	HVSF 0.52 mm²	HVSF 0.52 mm²	HVSF 0.52 mm²	HVSF 0.52 mm²
	AWG20	AWG20	AWG20	AWG20
Main power supply cable	HVSF 2.0 mm²	HVSF 2.0 mm²	HVSF 2.0 mm²	HVSF 2.0 mm²
	AWG14	AWG14	AWG14	AWG14
Ground cable	HVSF 2.0 mm²	HVSF 2.0 mm²	HVSF 2.0 mm²	HVSF 2.0 mm²
	AWG14	AWG14	AWG14	AWG14
Motor cable	HVSF 2.0 mm²	HVSF 2.0 mm²	HVSF 2.0 mm²	HVSF 2.0 mm²
	AWG14	AWG14	AWG14	AWG14
Inrush current (main power supply) (*1)	Max. 30 A	Max. 30 A	Max. 30 A	Max. 30 A
Inrush current (control power supply) (*1)	Max. 48 A	Max. 48 A	Max. 48 A	Max. 48 A
Product weight	Approx. 2.1 kg	Approx. 2.1 kg	Approx. 2.1 kg	Approx. 2.7 kg
Dimension	Size D	Size D	Size D	Size E

(*1) The current is the value calculated with the voltage as 400 V(or DC 24 V: Control power supply) when the product power input voltage is 400 V specification.

Model No.	MFDLTA4BF	MFDLTB4BF
Power input	3-phase 400 V	3-phase 400 V
Maximum output current	40 A	60 A
Rotary encoder	Resolution: 8388608 P/r	Resolution: 8388608 P/r
Regenerative resistor	Built in	Built in
Auto gain tuning function	Provided	Provided
Dynamic brake function	Provided	Provided
Absolute system	Available	Available
Working ambient temperature	0-55 ºC	0-55 ºC
Control power cable	HVSF 0.52 mm²	HVSF 0.52 mm²
	AWG20	AWG20
Main power supply cable	HVSF 3.5 mm²	HVSF 3.5 mm²
	AWG12	AWG12
Ground cable	HVSF 3.5 mm²	HVSF 3.5 mm²
	AWG12	AWG12
Motor cable	HVSF 3.5 mm²	HVSF 3.5 mm²
	AWG12	AWG12
Inrush current (main power supply) (*1)	Max. 30 A	Max. 30 A
Inrush current (control power supply) (*1)	Max. 48 A	Max. 48 A
Product weight	Approx. 5.2 kg	Approx. 5.2 kg
Dimension	Size F	Size F

(*1) The current is the value calculated with the voltage as 400 V(or DC 24 V: Control power supply) when the product power input voltage is 400 V specification.

Appendix Default value of the parameters and objects

The following pages show the default value of the parameters and objects that are set at the time of shipment from our factory.
It is necessary to confirm the operation for each customer's machines before use and set the optimum value.