



No. SX-DSV03454

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## REFERENCE SPECIFICATIONS

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### MODEL

Product Name.	Book style servo system
Product No.	MINAS A6 Multi Series - Driver module section

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# Revisions

[illegible]

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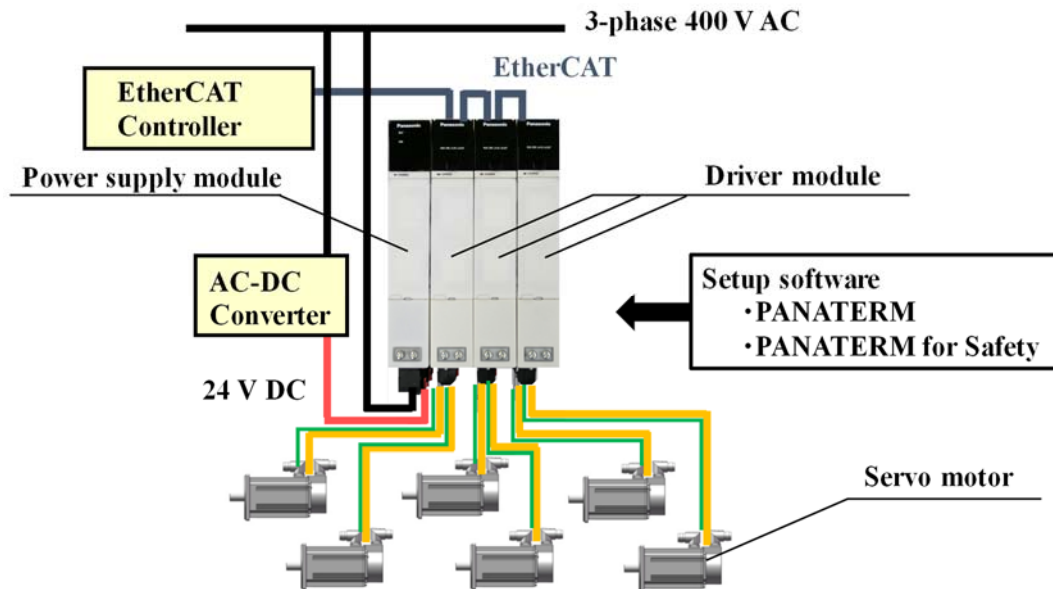
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## 1. Scope

The contents of this specification document are related to the Book style servo system MINAS A6 Multi series manufactured by the Industrial Device Solution 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).

System over view of MINAS A6 Multi



### <Related documents>

REFERENCE SPECIFICATIONS - Power supply module section -	: SX-DSV03452
TECHNICAL REFERENCE - Function Specification -	: SX-DSV03455
TECHNICAL REFERENCE - EtherCAT Communication Specification -	: SX-DSV03456
TECHNICAL REFERENCE - Safety Installation Manual -	: SX-DSV03514
TECHNICAL REFERENCE - PANATERM for Safety Programming Manual -	: SX-DSV03508
* 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.

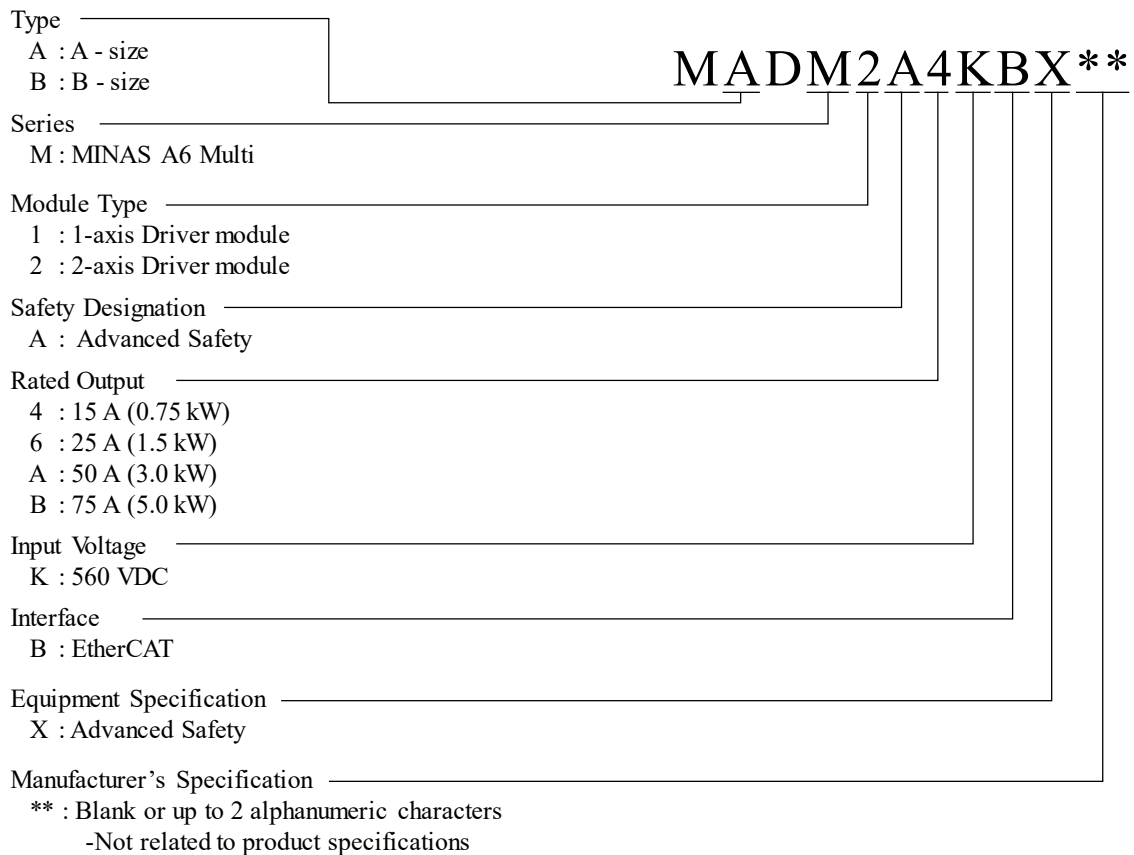
**EtherCAT®**  
Conformance tested

## &lt;IMPORTANT&gt;

- All rights reserved. No part of this publication may be reproduced or transmitted in any form without prior permission.
- Industrial Device Solution 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 has two 1<sup>st</sup>-encoder connectors, 2<sup>nd</sup>-encoder connectors and two motor connectors.  
Using the wrong combination will cause abnormal operation and failure of the servo driver and servo motor.  
Be sure to check that the combination is correct before turning on the power.
- The two motors are represented as A-axis and B-axis. Each axis are found out by suffix A or B.
- When driving only one motor with the product that can drive two motors, disable the B-axis by parameter setting (Pr 0.20 = 1) and use A-axis.

## 2. Model Designation

Each segment of the product number has the following meaning.



## 3. Product Line-up

### 3-1 Driver module

Model No.	Product Code (*Note 1)	EtherCAT Conformance Test (*Note 2)	Size	DC link input	Rated output of applicable motor per 1-axis (*Note 3)
MADM2A4KBX	1652850735	○	A	535 to 675 V DC	0.4 to 0.75 kW
MADM2A6KBX	1652850736	○			0.75 to 1.5 kW
MADM2AAKBX	1652850737	○			1.5 to 3.0 kW
MBDM1ABKBX	1652834354	○	B		3.0 to 5.0 kW

Note 1) This is the Product code of our Servo Driver 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 (e.g. motor type "MGMF294" is driven by only MBDM1ABKBX). For the combination of a driver and a motor, refer to "Motor Specifications (SR-DSV12526, SR-DSV12527, SR-DSV12494 to SR-DSV12501)" and "REFERENCE SPECIFICATIONS -Power supply module section-".

## 3-2 Accessories (included connectors)

Connector	Quantity[pcs]		Manufacturer	Manufacturer part number	Panasonic option number (*Note 1)
	A - size	B - size			
I/O signal connector	1	1	Weidmüller Interface GmbH & Co. KG	B2CF 3.50/20/180LR SN OR BX PRT	DV0PM24646
Safety I/O signal connector	1	1	Weidmüller Interface GmbH & Co. KG	B2CF 3.50/34/180LR SN OR BX PRT	DV0PM24647
Motor output connector	2	1	Weidmüller Interface GmbH & Co. KG	BVFL 7.62HP/04/180MF4 BCF/04 SN BK BX SO	DV0PM24648
Cross communication cable	1	1	TE Connectivity Ltd.	2349354-3	DV0PM24649
50mm Link bus bar	2	0	Weidmüller Interface GmbH & Co. KG	PB-LINK 160 50/02RF AG BK BX	DV0PM24650
100mm Link bus bar	0	2	Weidmüller Interface GmbH & Co. KG	PB-LINK 160 100/02RF AG BK BX	DV0PM24652

Note 1) When the parts are broken or lost, order by Panasonic option number.



## 4. Specifications

### Driver module Basic specifications

Item	Parameter	Unit	Specification			
Model	Model No.	-	MADM2A4KBX	MADM2A6KBX	MADM2AAKBX	MBDM1ABKBX
	Frame Size (*Note 1)	-	A - size			B - size
	Rated Output Power	kW	0.75	1.5	3	5
	Switching Frequency	kHz	6	6	6	6
Input	Input Voltage	V	DC 535 to 675 -15 %, +10 %			
	DC Bus Capacitance	μF	200	200	400	820
Output	Number of axes	-	2	2	2	1
	Rated Output Current	Arms	2.3	4.7	9.1	13.6
	Max Output Current	Ao-p	10.3	18.5	38.5	53.6
Control Power Supply Input	Voltage	V	DC 24 ± 15 % PELV or SELV (With holding brake DC 24 ± 5 %)			
	Maximum Current (Except brake current)	A	2	2	2	1.8
General Digital Inputs	Number of channels	-	8			
	Input type	-	Sink/Source			
	24 V supply current	mA	10/channel			
General Digital Outputs	Number of channels	-	2			
	Input type	-	Sink/Source			
	24 V supply current	mA	100/channel			
Timing pulse output	Number of channels	-	2			
	Maximum Current	mA	50/Line driver output			
Brake Outputs (*Note 2)	Number of channels	-	1 port per a motor output connector			
	Maximum Current	A	1.5			
Safety Digital Inputs	Number of channels	-	4 (Grouped), 1 (Non-Grouped)			
	Input type	-	Sink/Source			
	24 V supply current	mA	30/channel *Comply with IEC61131-2 Type2.			
Safety Digital Outputs	Number of channels	-	2			
	Input type	-	Source			
	24 V supply current	mA	75/channel			
Brake Outputs for Safety (*Note 3)	Number of channels	-	2			
	Rated Output Current	A	1.5			
1st Encoder (*Note 4)	-	-	Panasonic serial			
2nd Encoder	-	-	Panasonic serial, ABZ, EnDat2.2, SSI			
Safety	Safety functions	-	Safe Torque Off (STO), Safe Stop 1 (SS1), Safe Stop 2 (SS2), Safe Operating Stop 1 (SOS), Safe Limited Acceleration (SLA), Safe Acceleration Range (SAR), Safe Limited Speed (SLS), Safe Speed Range (SSR), Safe Limited Increment (SLI), Safe Direction Indication (SDI), Safe Brake Control (SBC), Safe Speed Monitoring (SSM), Safe Limited Position (SLP), Safe Cam (SCA)			
	Optional functions (*Note 5)	-	Safely Emergency Limit (SEL), Safe Referencing on X-Axis (SRX), Safe Referencing State (SRS), External Device Monitoring (EDM), Encoder Control Supervisor (ECS), Input Element Muting (ICS), External Offset Setup (EOS)			
Tool	Tooling communication	-	PANATERM (USB, EoE)			
			PANATERM for safety (USB, EoE)			
Front Panel	LED Panel	-	2 digit 7-segment LED Network status LED (RUN, ERR, L/A IN, L/A OUT) Rotary switch for node address setting of EtherCAT Dip switch for node address setting of cross communication Push switch for display switching			
Network	Industrial Ethernet	-	EtherCAT (CoE, EoE)			
		-	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.			
	Cross Communication	-	RS485. Communication inter modules.			
Dynamic Brake		-	Integrated (3-phase short)			
Cooling (*Note 6)		-	Forced Air Cooling			
Others	Dimensions	mm	W50 × H298 × D250			W100 × H298 × D250
	Weight	kg	3.4	3.4	3.4	5.6

Note 1) See "6. Dimensions" for specifications.

Note 2) See "7-8 Motor output connector" for details.

Note 3) See "7-3 Safety I/O connector" for details.

Note 4) See "Motor Specifications (SR-DSV12526, SR-DSV12527, SR-DSV12494 to SR-DSV12501)" for details.

Note 5) Not included in EN61800-5-2. See "TECHNICAL REFERENCE - PANATERM for Safety Programming Manual" for details.

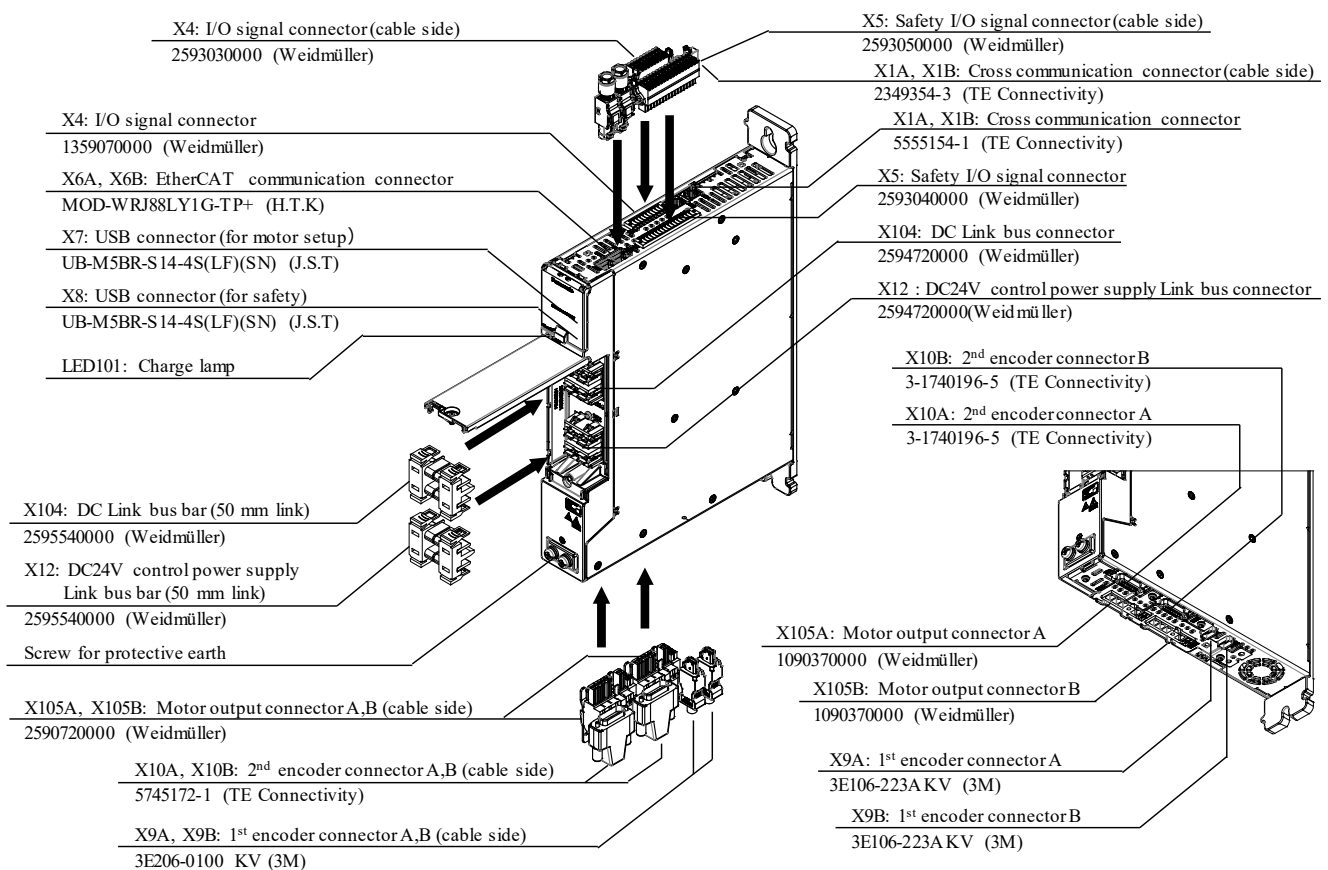
Note 6) Fan speed depends on internal temperature.

Environmental conditions
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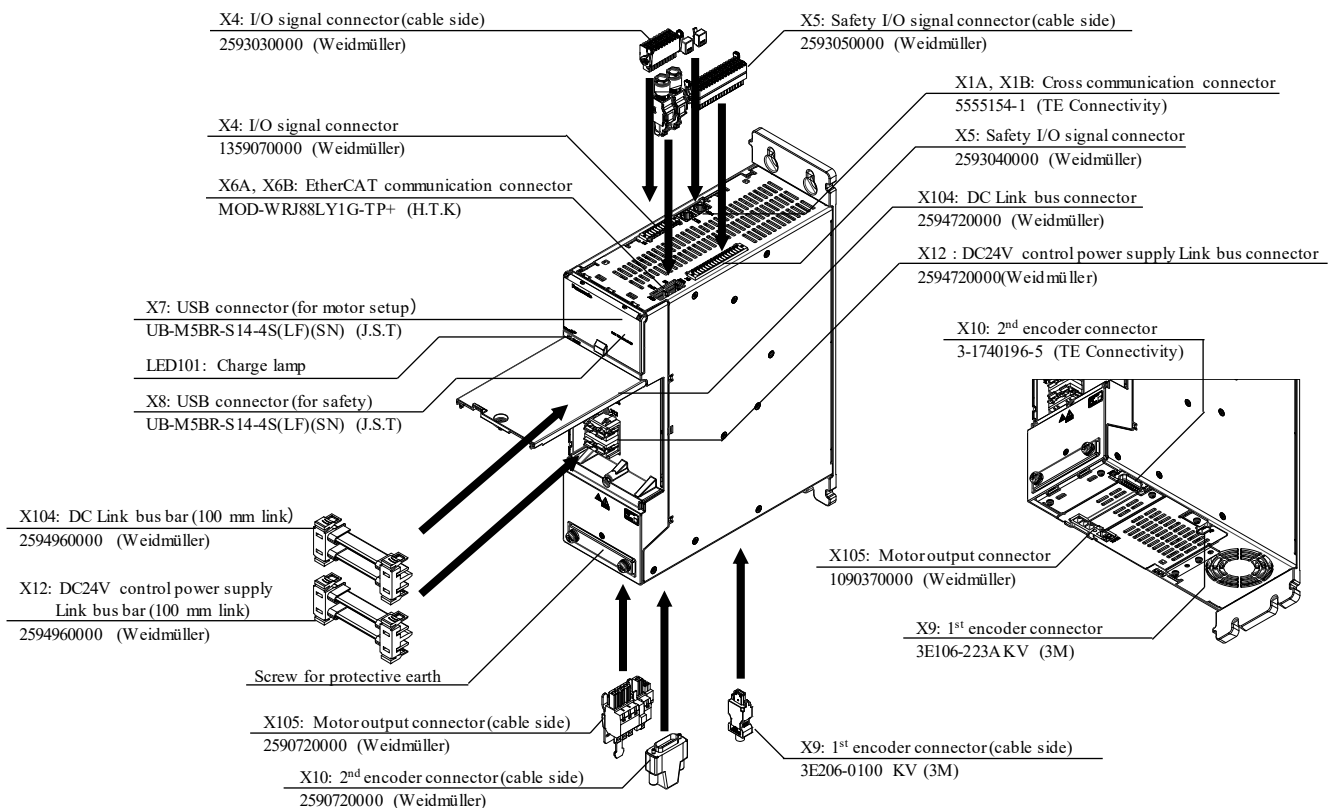
Working ambient condition	Temperature	Operation temperature 0 to 40 °C (without freezing) Storage temperature -20 to 65 °C (maximum temperature guarantee: 80 °C, 72 hours, without condensation)
	Humidity	Working/storage humidity 20 to 85 %RH (without condensation)
	Altitude	1,000 m above sea level or less
	Vibration	5.88 m/s <sup>2</sup> or less, 10 to 60 Hz
	Pollution degree	Pollution degree 2 or 1
Insulation voltage		Withstanding 1,500 V AC between the primary and grounding lines for one minute

## 5. Appearance and name of each part

### Driver module/A - size

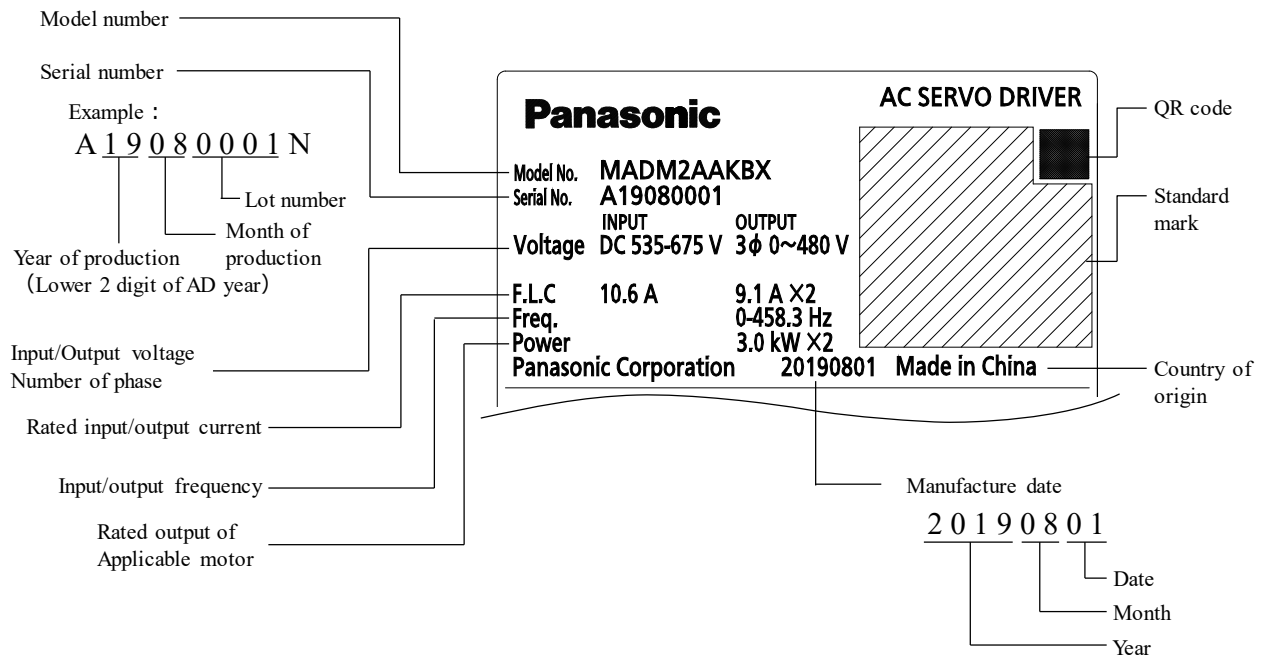


### Driver module/B - size



### Example of a rating plate

#### • Side cover

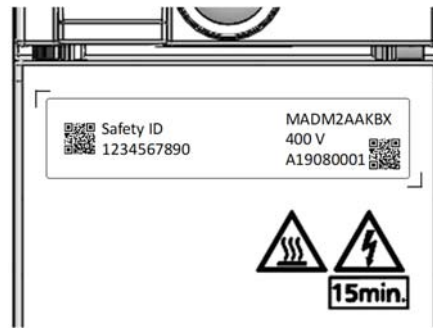


The values of the serial number part of the manufacturing number range from 1 to 33999. On the rating plate, it is indicated in four digits as in the format shown below.

“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

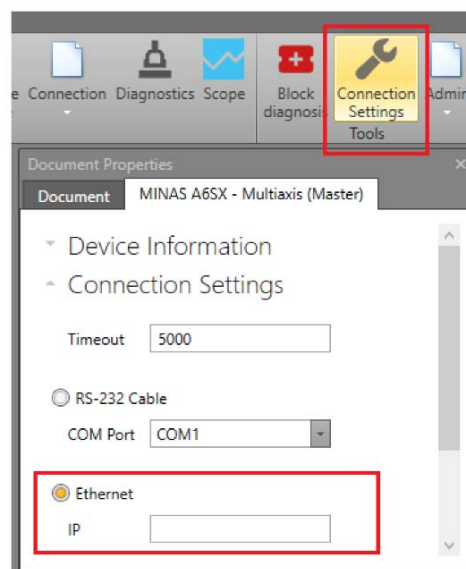


The values of the Safety ID range from 0000050000 to 4294967295.

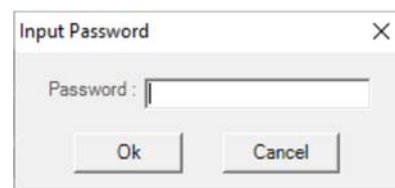
When accessing the driver module using “PANATERM for safety” via Ethernet/EOE, Safety ID is needed.

The access method to the driver module by “PANATERM for safety” is shown below.

1. Use “Connection Settings” for setting the IP address (Connection via Ethernet)



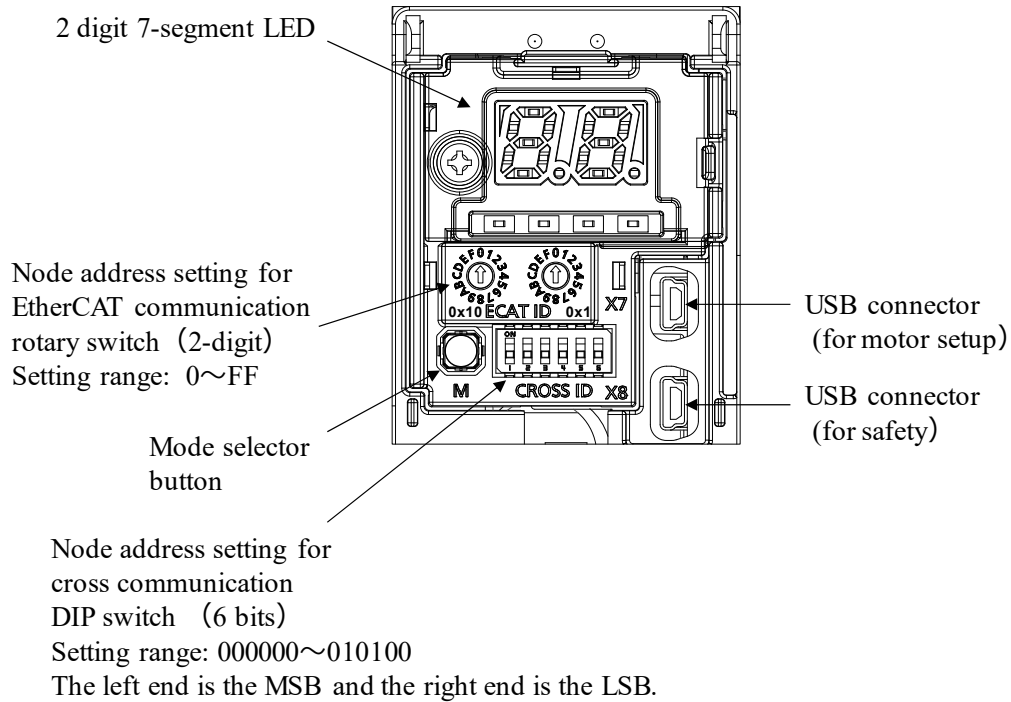
2. When using connection via Ethernet/EOE you have to enter the password in the window “Input Password” that appears automatically when pressing the button “Connect”. As password the Safety ID of the target device is to be entered.



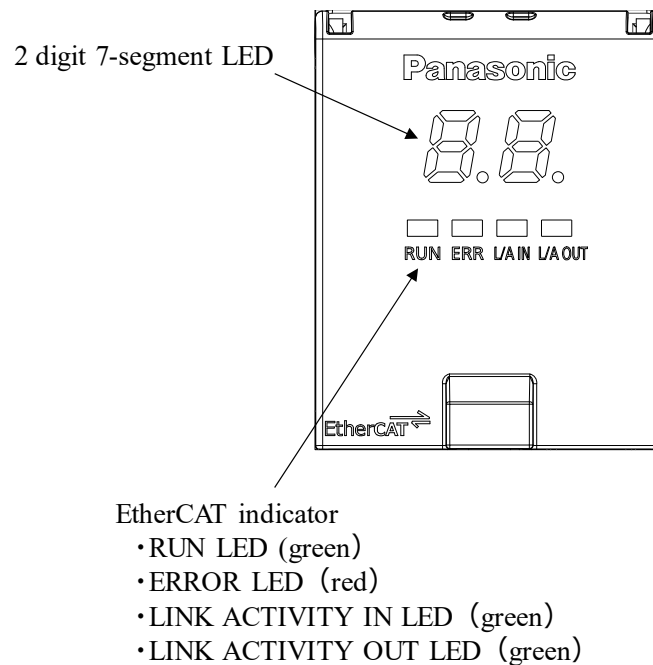
See “TECHNICAL REFERENCE - PANATERM for Safety Programming Manual -” for details.

# Front panel

## • Front panel open state

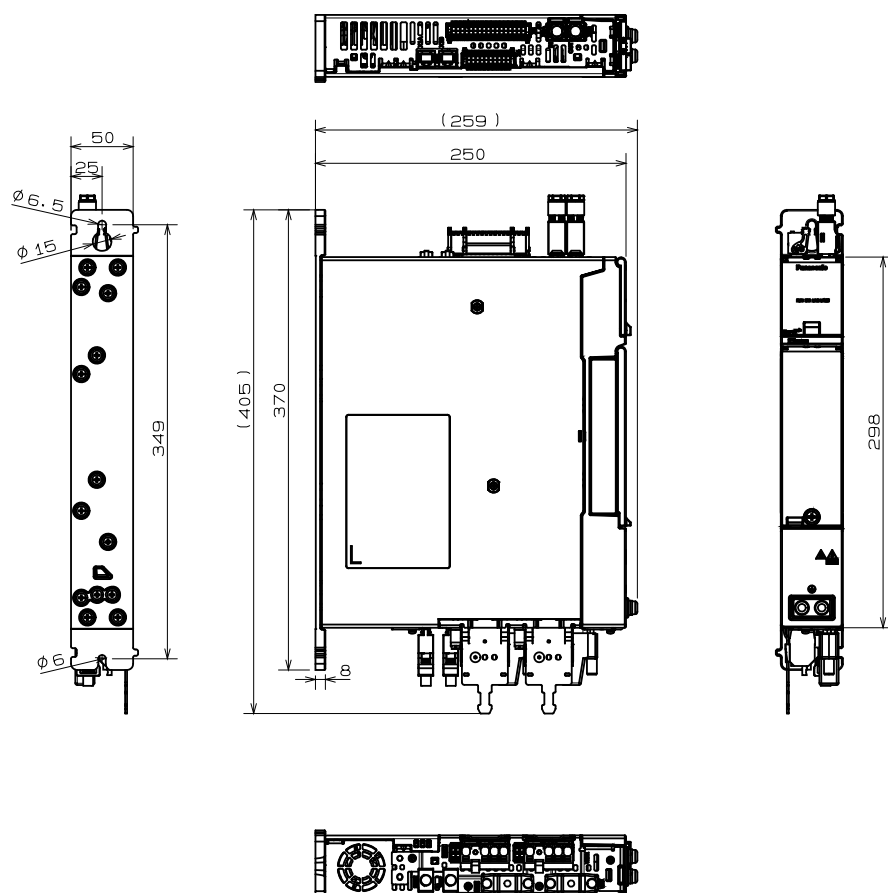


## • Front panel close state



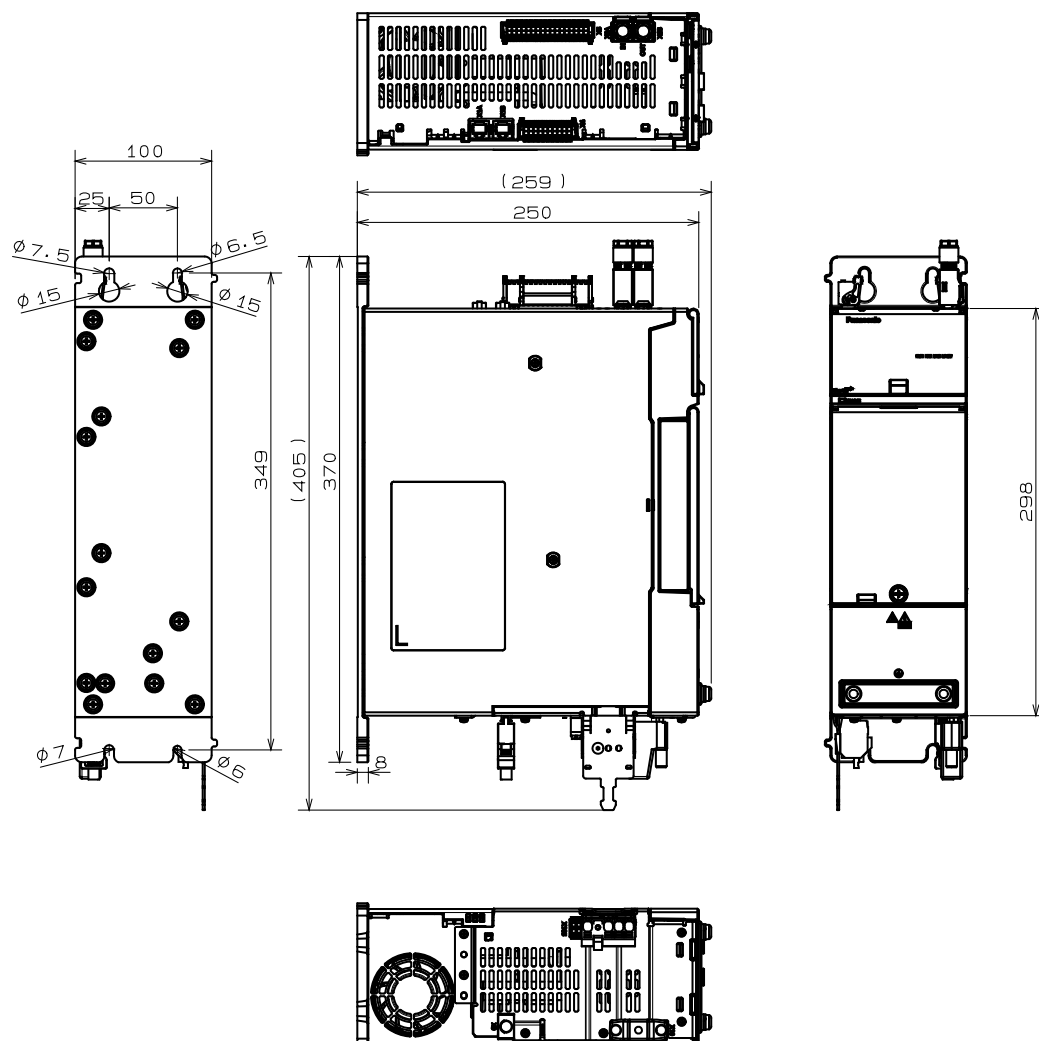
## 6. Dimensions

A - size



Unit: mm

B - size



Unit: mm



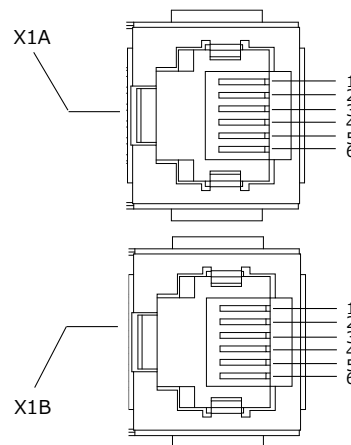
## 7. Configuration of connectors and terminal blocks

### 7-1 Cross communication connector X1A, X1B

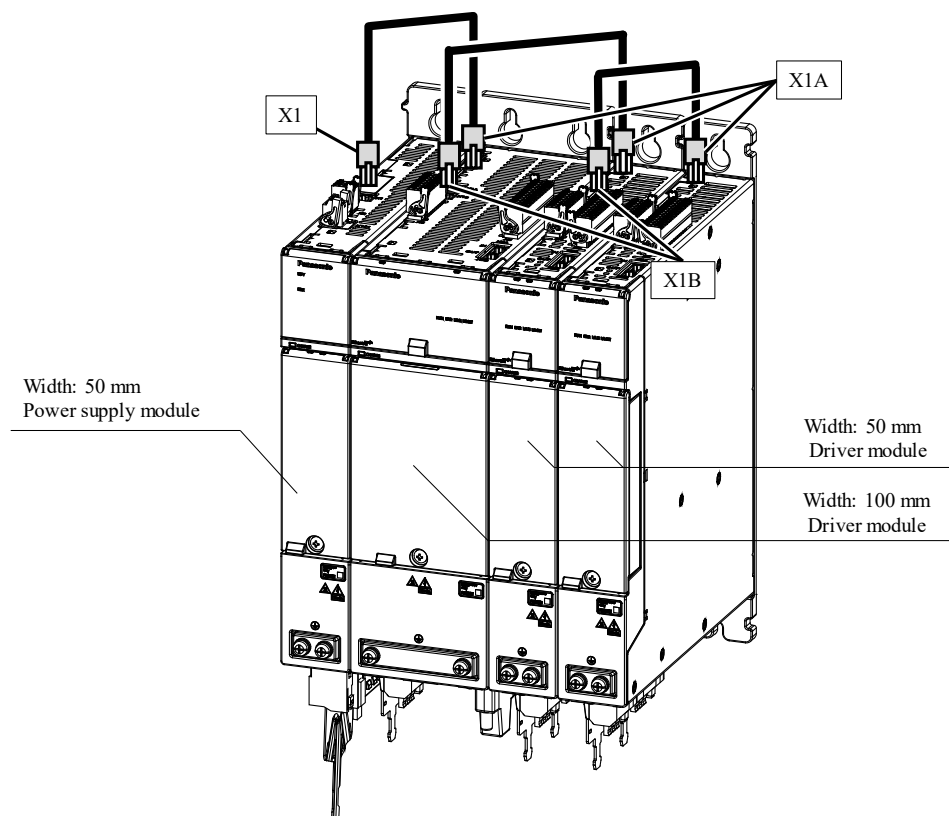
Pin No.	Symbol	Polarity	Description
1	DATA+	IN/OUT	Only for system-internal usage/communication.
2	DATA-	IN/OUT	
3	SYNC+	IN/OUT	
4	SYNC-	IN/OUT	
5	EMG	IN	
6	SG	-	

\* Use the Cross communication cable included with the product.

\* Connect the Cross communication cable from X1B to X1A of the next driver module.



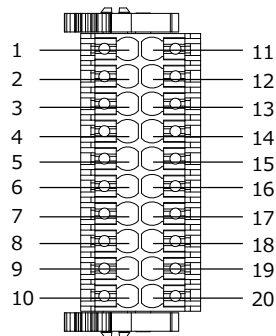
Terminal pin assignment of Cross communication connector X1A, X1B



Description of Cross communication cable connection

## 7-2 I/O signal connector X4

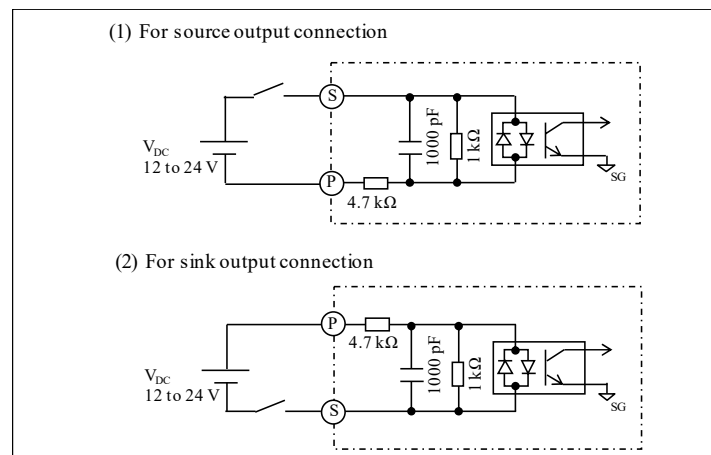
Pin No.	Symbol	Polarity	Description
1	SI1	IN	General purpose digital input
2	SI2	IN	General purpose digital input
3	SI3	IN	General purpose digital input
4	SI4	IN	General purpose digital input
5	SI-COM	-	-
6	COMP1+	OUT	Position comparison output1+
7	COMP2+	OUT	Position comparison output2+
8	SO1+	OUT	General purpose digital output
9	SO2+	OUT	General purpose digital output
10	FG	-	Frame ground
11	SI5	IN	General purpose digital input
12	SI6	IN	General purpose digital input
13	SI7	IN	General purpose digital input
14	SI8	IN	General purpose digital input
15	GND	-	Signal ground
16	COMP1-	OUT	Position comparison output1-
17	COMP2-	OUT	Position comparison output2-
18	SO1-	OUT	General purpose digital output
19	SO2-	OUT	General purpose digital output
20	FG	-	Frame ground



Terminal pin assignment of I/O signal connector X4

## 7-2-1 Connection example for I/O signal connector

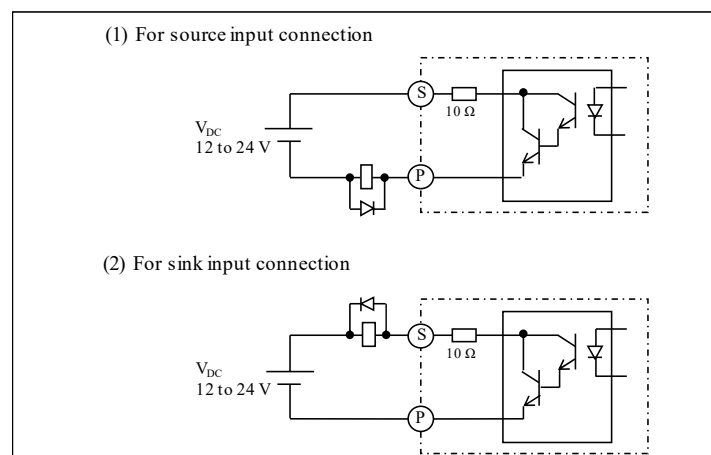
## i-1: General purpose input



S: Terminal No. 1, 2, 3, 4, 11, 12, 13, 14

P: Terminal No. 5

## o-1: General purpose output

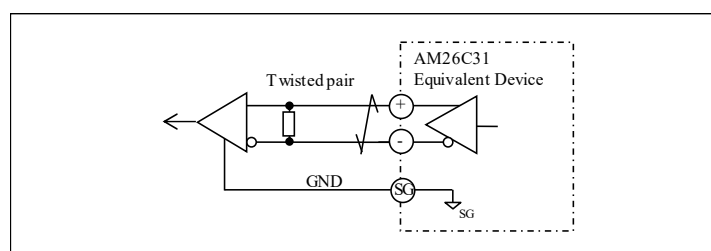


S: Terminal No. 8, 9

P: Terminal No. 18, 19

\* When driving the relay directly, mount a diode in parallel with the relay in the direction shown in the above figure.

## o-2: Position comparison output



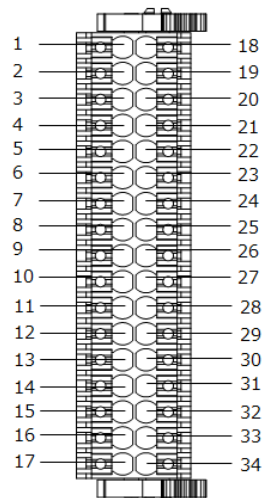
+ : Terminal No. 6, 7

- : Terminal No. 16, 17

SG: Terminal No. 15 (Signal ground)

## 7-3 Safety I/O connector X5

Pin No.	Symbol	Polarity	Description
1	FG	-	Frame ground
2	BRKO1-	OUT	Safety brake output 1-
3	BRKO1+	OUT	Safety brake output 1+
4	SDO2A	OUT	Safety output 2A
5	SDO1A	OUT	Safety output 1A
6	NC	-	*Do NOT connect.
7	NC	-	*Do NOT connect.
8	NC	-	*Do NOT connect.
9	NC	-	*Do NOT connect.
10	PULSA	OUT	Diagnostics pulse output
11	SDIN	IN	Non-Grouped Safety digital input
12	SDI4A	IN	Grouped safety digital input 4A
13	SDI3A	IN	Grouped safety digital input 3A
14	SDI2A	IN	Grouped safety digital input 2A
15	SDI1A	IN	Grouped safety digital input 1A
16	COMA	-	Safety input common A
17	EX24V	-	External power supply +24 V for safety
18	FG	-	Frame ground
19	BRKO2-	OUT	Safety brake output 2-
20	BRKO2+	OUT	Safety brake output 2+
21	SDO2B	OUT	Safety output 2B
22	SDO1B	OUT	Safety output 1B
23	NC	-	*Do NOT connect.
23	NC	-	*Do NOT connect.
24	NC	-	*Do NOT connect.
25	NC	-	*Do NOT connect.
26	NC	-	*Do NOT connect.
27	PULSB	OUT	Diagnostics pulse output
28	GND	-	Signal ground
29	SDI4B	IN	Grouped safety digital input 4B
30	SDI3B	IN	Grouped safety digital input 3B
31	SDI2B	IN	Grouped safety digital input 2B
32	SDI1B	IN	Grouped safety digital input 1B
33	COMB	-	Safety input common B
34	EXGND	-	External ground



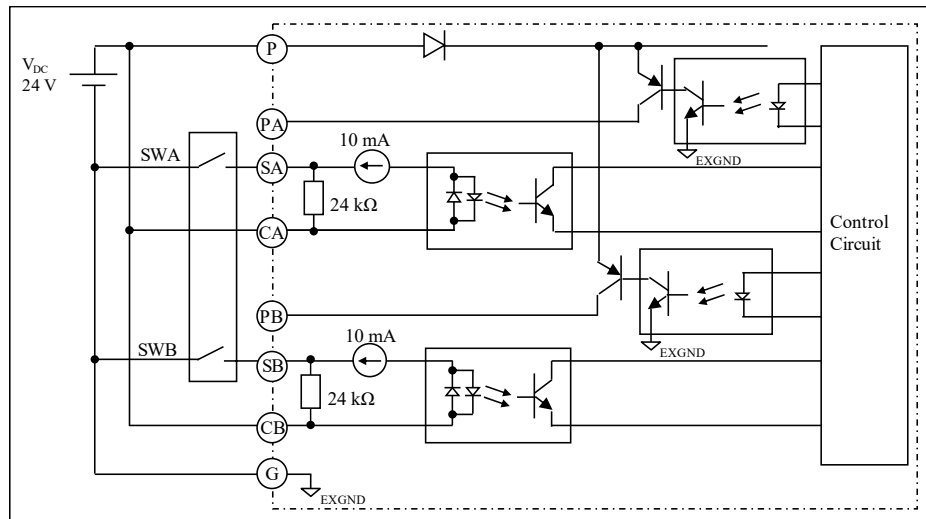
Terminal pin assignment of Safety I/O connector X5

## 7-3-1 Connection example for Safety I/O connector

## (1) Safety input for sink output connection

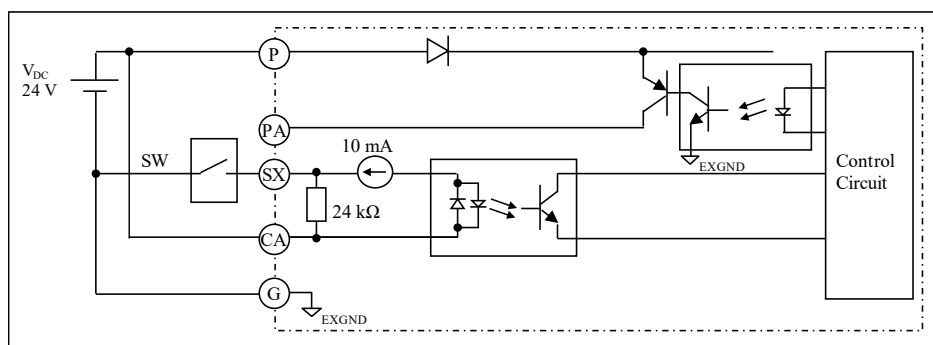
When connecting the sink output circuit to the safety input, connect the positive terminal of the external power supply DC 24 V to the common input (COMA, COMB).

i-1: Grouped Safety Digital input (without Diagnostic test pulse)



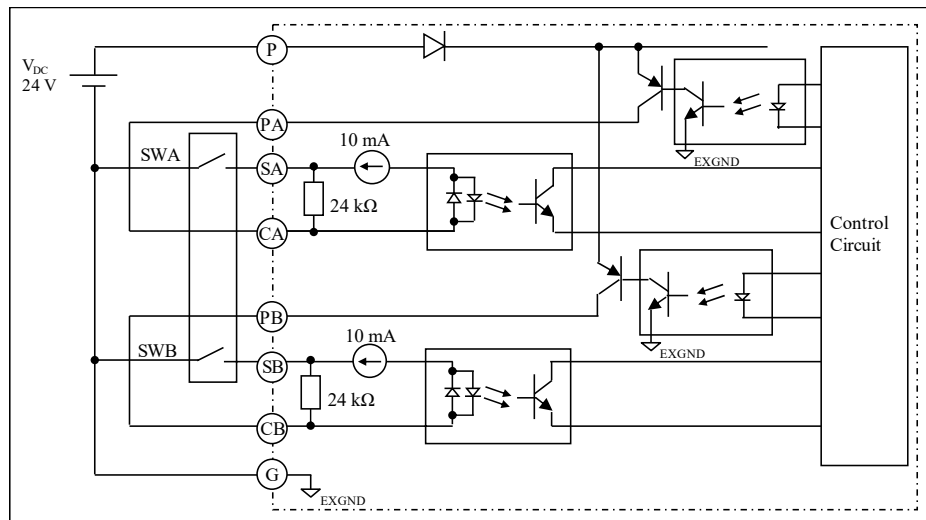
P : Terminal No. 17  
 PA : Terminal No. 10  
 SA : Terminal No. 12, 13, 14, 15  
 CA : Terminal No. 16  
 PB : Terminal No. 27  
 SB : Terminal No. 29, 30, 31, 32  
 CB : Terminal No. 33  
 G : Terminal No. 34

i-2: Non-Grouped Safety Digital input (without Diagnostic test pulse)



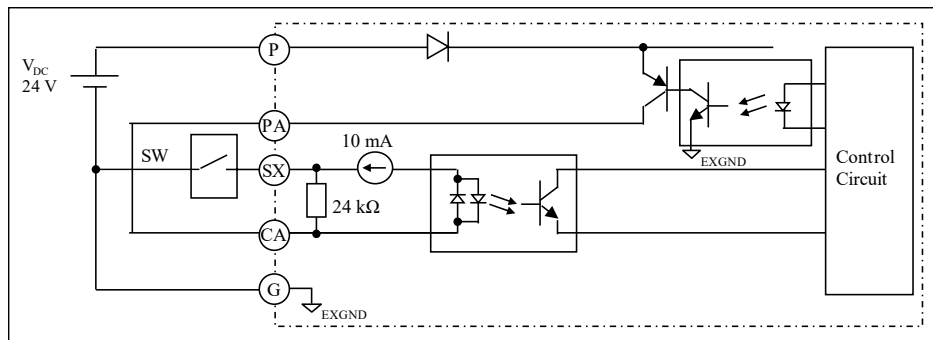
P : Terminal No. 17  
 PA : Terminal No. 10  
 SX : Terminal No. 11  
 CA : Terminal No. 16  
 G : Terminal No. 34

i-3: Grouped Safety Digital input (with Diagnostic test pulse)



P : Terminal No. 17  
 PA : Terminal No. 10  
 SA : Terminal No. 12, 13, 14, 15  
 CA : Terminal No. 16  
 PB : Terminal No. 27  
 SB : Terminal No. 29, 30, 31, 32  
 CB : Terminal No. 33  
 G : Terminal No. 34

i-4: Non- Grouped Safety Digital input (with Diagnostic test pulse)

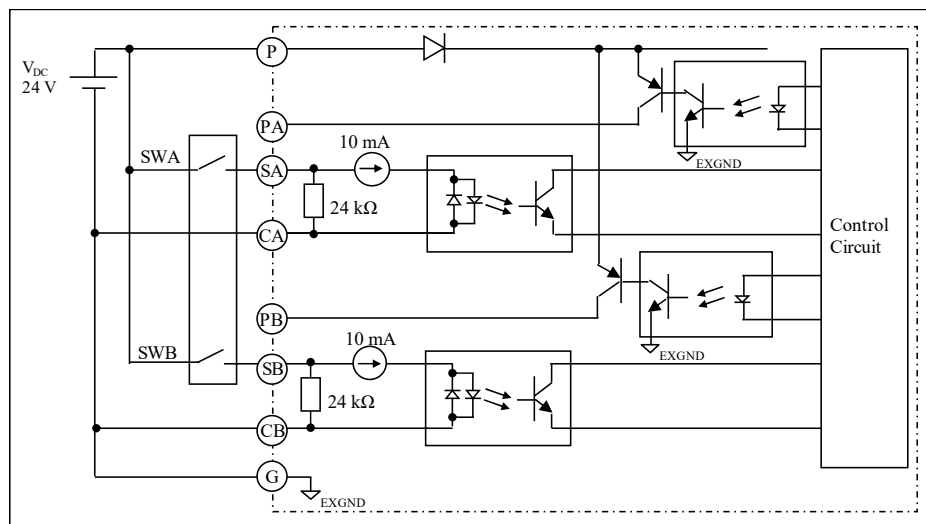


P : Terminal No. 17  
 PA : Terminal No. 10  
 SX : Terminal No. 11  
 CA : Terminal No. 16  
 G : Terminal No. 34

## (2) Safety input for source output connection

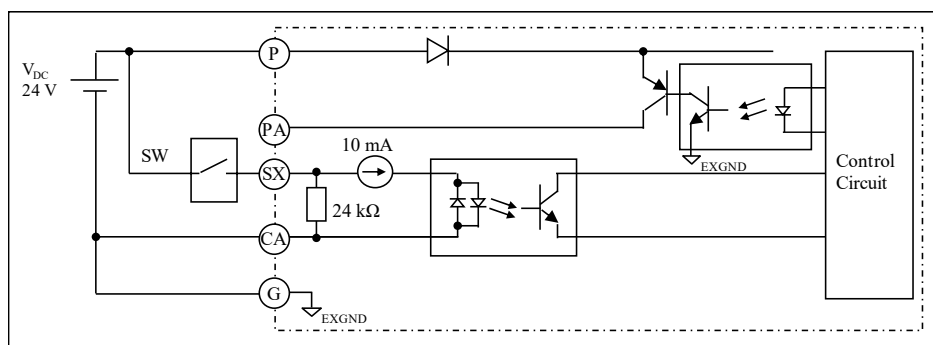
When connecting the source output circuit to the safety input, connect the negative terminal of the external power supply DC 24 V to the common input (COMA, COMB).

i-5: Grouped Safety Digital input (without Diagnostic test pulse)



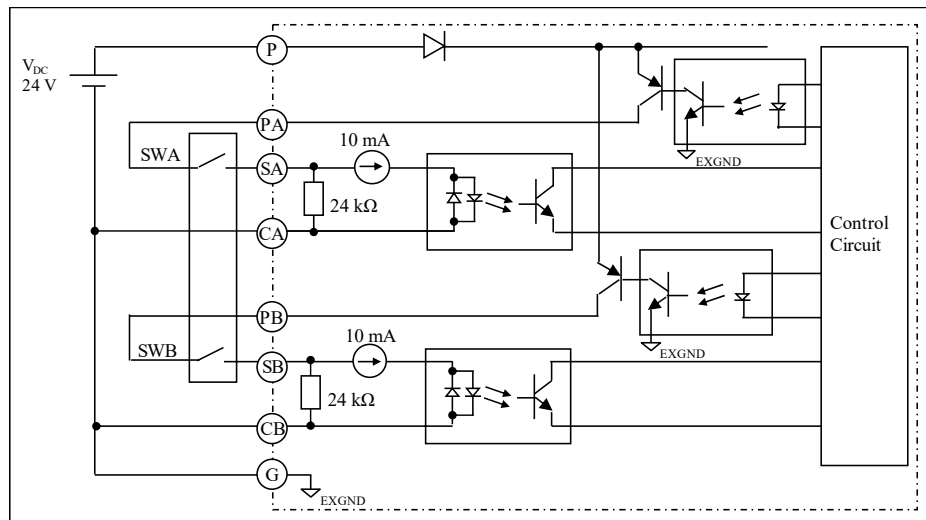
- P : Terminal No. 17  
 PA : Terminal No. 10  
 SA : Terminal No. 12, 13, 14, 15  
 CA : Terminal No. 16  
 PB : Terminal No. 27  
 SB : Terminal No. 29, 30, 31, 32  
 CB : Terminal No. 33  
 G : Terminal No. 34

i-6: Non-Grouped Safety Digital input (without Diagnostic test pulse)



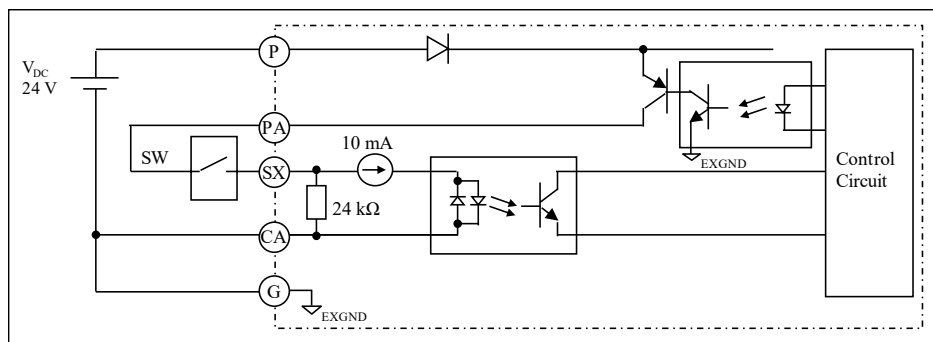
- P : Terminal No. 17  
 PA : Terminal No. 10  
 SX : Terminal No. 11  
 CA : Terminal No. 16  
 G : Terminal No. 34

i-7: Grouped Safety Digital input (with Diagnostic test pulse)



P : Terminal No. 17  
 PA : Terminal No. 10  
 SA : Terminal No. 12, 13, 14, 15  
 CA : Terminal No. 16  
 PB : Terminal No. 27  
 SB : Terminal No. 29, 30, 31, 32  
 CB : Terminal No. 33  
 G : Terminal No. 34

i-8: Non-Grouped Safety Digital input (with Diagnostic test pulse)

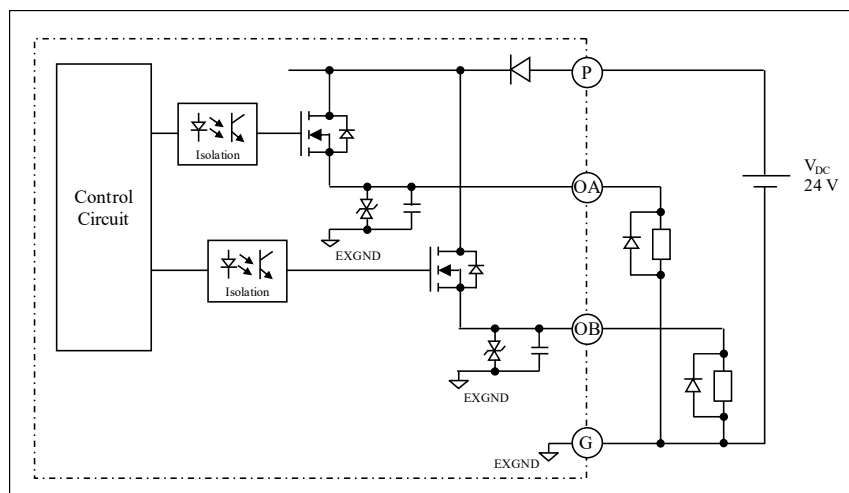


P : Terminal No. 17  
 PA : Terminal No. 10  
 SX : Terminal No. 11  
 CA : Terminal No. 16  
 G : Terminal No. 34



## (3) Safety output

o-1: Safety output



P : Terminal No. 17

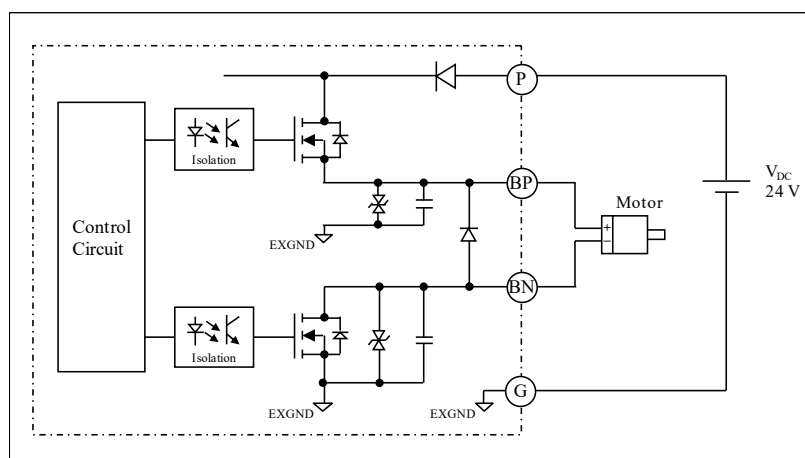
OA : Terminal No. 4, 5

OB : Terminal No. 21, 22

G : Terminal No. 34

\* When driving the relay directly, mount a diode in parallel with the relay in the direction shown in the above figure.

o-2: Safety brake output



P : Terminal No. 17

BP : Terminal No. 3, 20

BN : Terminal No. 2, 19

G : Terminal No. 34

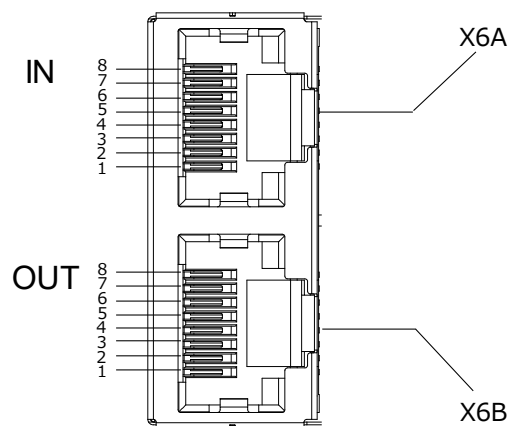
## 7-4 EtherCAT communication connector X6A, X6B

Pin No.	Symbol	Polarity	Description
1	TX/RX+	OUT/IN	Network output/input +
2	TX/RX-	OUT/IN	Network output/input -
3	RX/TX+	IN/OUT	Network input/output +
4	-	-	-
5	-	-	-
6	RX/TX-	IN/OUT	Network input/output -
7	-	-	-
8	-	-	-
Shell	FG	-	Frame ground

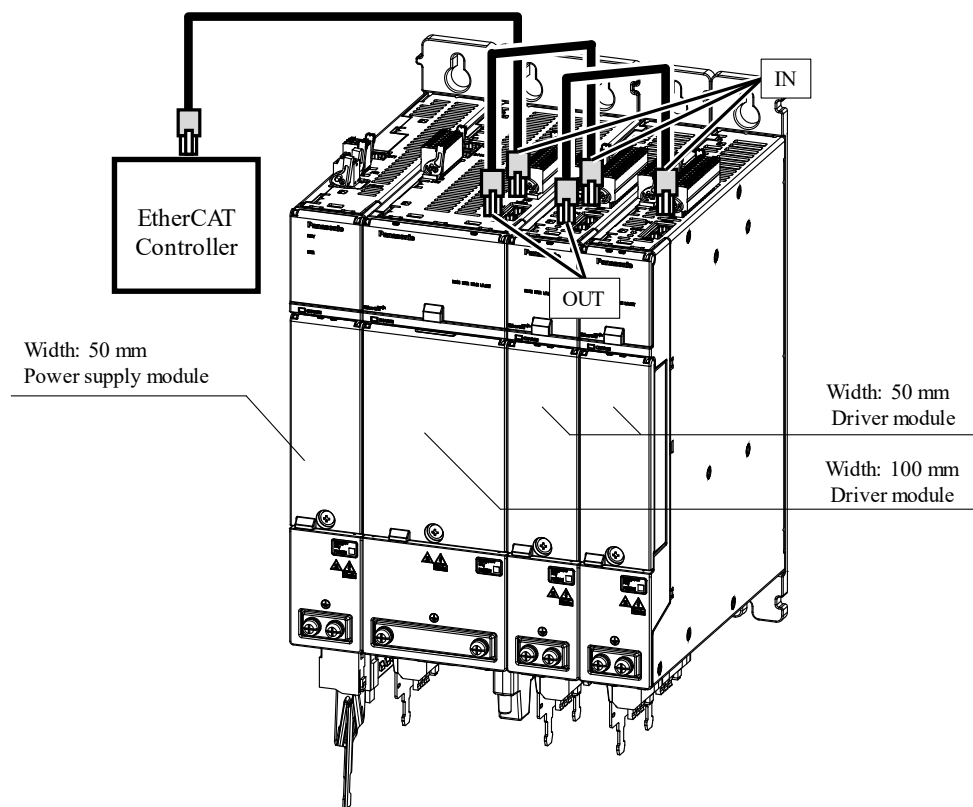
\* Be sure to use shielded twisted pair (STP) compatible with category 5e or higher in TIA/EIA-568.

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

\* Connect the EtherCAT cable according to the IN or OUT indicated on the driver module.



Terminal pin assignment of EtherCAT communication connector X6A, X6B

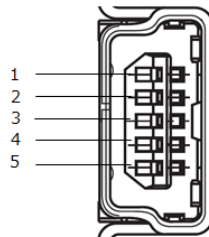


Description of EtherCAT cable connection

## 7-5 USB connector (for motor setup), USB connector (for safety) X7, X8

Pin No.	Symbol	Polarity	Description
1	VBUS	-	VBUS
2	D-	IN/OUT	USB signal terminal
3	D+	IN/OUT	USB signal terminal
4	-	-	For manufacturer
5	GND	-	Signal ground

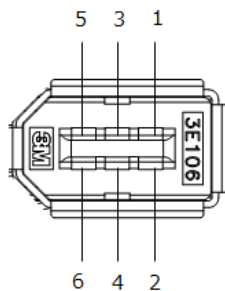
\*The connector type is USB mini-B.



Terminal pin assignment of USB connector (for motor setup) X7, USB connector (for safety) X8

7-6 1<sup>st</sup> Encoder connector X9 (X9A, X9B)

Pin No.	Symbol	Polarity	Description
1	E5V	-	1 <sup>st</sup> Encoder power output
2	E0V	-	1 <sup>st</sup> Encoder ground
3	-	-	-
4	-	-	-
5	PS	IN/OUT	1 <sup>st</sup> Encoder signal non-inverting input/output
6	/PS	IN/OUT	1 <sup>st</sup> Encoder signal inverting input/output
Shell	FG	-	Frame ground



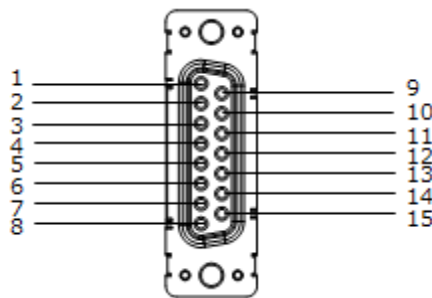
Terminal pin assignment of 1<sup>st</sup> encoder connector X9A, X9B

\* X9A connector is for A axis, and X9B connector is for B axis.

\* Terminal pin assignment is common to A and B axes.

7-7 2<sup>nd</sup> Encoder connector X10 (X10A, X10B)

Pin No.	Symbol	Polarity	Description
1	EX5V	-	2 <sup>nd</sup> Encoder power output (Panasonic/ABZ)
2	EX0V	-	2 <sup>nd</sup> Encoder ground
3	EXPS	IN/OUT	Serial signal non-inverting input/output
4	/EXPS	IN/OUT	Serial signal inverting input/output
5	EXA	IN	A-phase signal non-inverting input
6	/EXA	IN	A-phase signal inverting input
7	EXB	IN	B-phase signal non-inverting input
8	/EXB	IN	B-phase signal inverting input
9	EXZ	IN	Z-phase signal non-inverting input
10	/EXZ	IN	Z-phase signal inverting input
11	DATA	IN/OUT	Serial signal non-inverting input/output (EnDat2.2/SSI)
12	/DATA	IN/OUT	Serial signal inverting input/output (EnDat2.2/SSI)
13	CLK	OUT	Clock signal non-inverting input/output (EnDat2.2/SSI)
14	/CLK	OUT	Clock signal inverting input/output (EnDat2.2/SSI)
15	EVDD	-	2 <sup>nd</sup> Encoder power output (EnDat2.2/SSI)

Terminal pin assignment of 2<sup>nd</sup> encoder connector X10A, X10B

- \* X10A connector is for A axis, and X10B connector is for B axis.
- \* Terminal pin assignment is common to A and B axes.

Supported encoder types (1<sup>st</sup> encoder)

Supported encoder types
Panasonic 23bit multi-turn absolute encoder

Supported encoder types (2<sup>nd</sup> encoder)

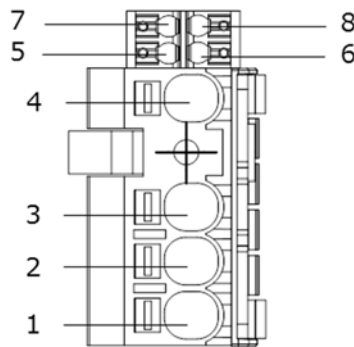
Supported encoder types	For feedback scale	For safety (Reduplication)
Panasonic serial	Available	Available
ABZ	Available	Available
EnDat 2.2	-	Available
SSI	-	Available

## Connect terminal

Pin No.	Symbol	Panasonic	ABZ	EnDat2.2	SSI
1	EX5V	✓	✓	No use	No use
2	EX0V	✓	✓	✓	✓
3	EXPS	✓	No use	No use	No use
4	/EXPS	✓	No use	No use	No use
5	EXA	No use	✓	No use	No use
6	/EXA	No use	✓	No use	No use
7	EXB	No use	✓	No use	No use
8	/EXB	No use	✓	No use	No use
9	EXZ	No use	✓	No use	No use
10	/EXZ	No use	✓	No use	No use
11	DATA	No use	No use	✓	✓
12	/DATA	No use	No use	✓	✓
13	CLK	No use	No use	✓	✓
14	/CLK	No use	No use	✓	✓
15	EVDD	No use	No use	✓	✓

## 7-8 Motor output connector X105 (X105A, X105B)

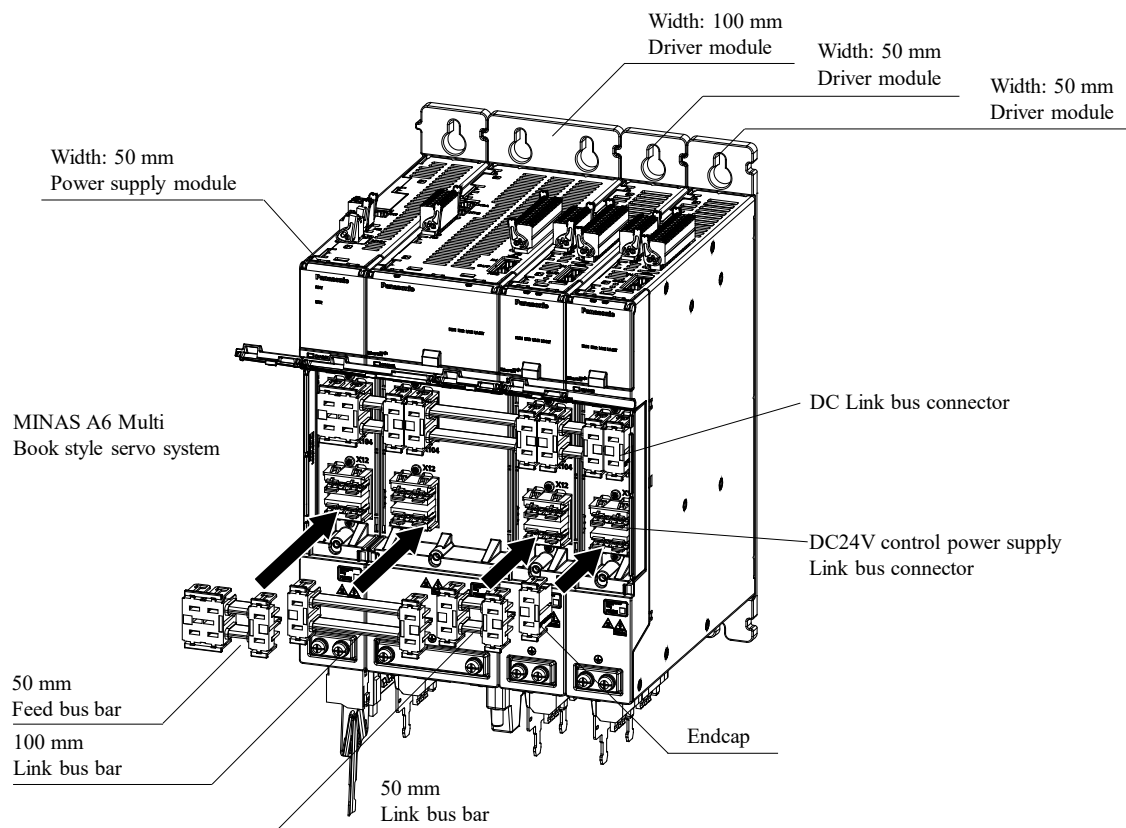
Pin No.	Symbol	Polarity	Description
1	W	OUT	Motor output (W phase)
2	V	OUT	Motor output (V phase)
3	U	OUT	Motor output (U phase)
4	PE	-	Protective Earth
5	BRK-	OUT	Brake output-
6	-	-	
7	BRK+	OUT	Brake output+
8	-	-	



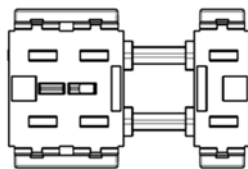
Pin assignment of Motor output connector X105A, X105B

- \* X105A connector is for A axis, and X105B connector is for B axis.
- \* Terminal pin assignment is common to A and B axes.
- \* See “TECHNICAL REFERENCE - Function Specification-” for brake parameter setting.

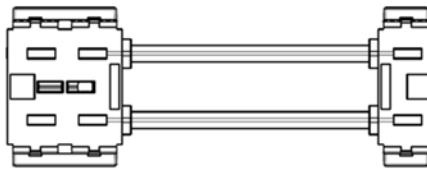
## 7-9 Power bus system



## Bus bar for power supply module to driver module

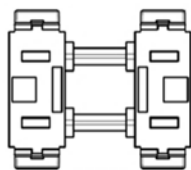


50 mm Feed bus bar



100 mm Feed bus bar

## Bus bar for driver module to driver module



50 mm Link bus bar



100 mm Link bus bar

## Terminator




Endcap

When installing the bus bar, remove unnecessary side covers and attach side covers only to the left and right ends. For safe use, do not remove the side covers at both ends of the modules.

## 8. Wiring and system configuration

### 8-1 Wire rods used and maximum wiring length

Name	Symbol	Maximum wiring length (*Note 1)	Electric wire used
I/O signal connector	X4	20 m	0.2 mm <sup>2</sup> to 1.5 mm <sup>2</sup>
Safety I/O connector	X5	20 m	0.2 mm <sup>2</sup> to 1.5 mm <sup>2</sup>
EtherCAT communication connector	X6A, X6B	100 m	TIA/EIA-568 CAT5e STP
1 <sup>st</sup> Encoder connector	X9 (X9A, X9B)	50 m	Common shielded twisted pair wire • Power supply 0.5 mm <sup>2</sup> to 1.25 mm <sup>2</sup> • Signal 0.25 mm <sup>2</sup> to 1.25 mm <sup>2</sup>
2 <sup>nd</sup> Encoder connector	X10 (X10A, X10B)	20 m	Common shielded twisted pair wire • Power supply 0.25 mm <sup>2</sup> or more • Signal 0.25 mm <sup>2</sup> or more (*Note 2)
Motor output connector	X105 (X105A, X105B)	50 m * The total length of motor cables connected to all driver modules is 300 m.	• Motor 0.5 to 6.0 mm <sup>2</sup> 600 V Select wire suitable for the motor
			• Brake 0.2 to 1.5 mm <sup>2</sup> 300 V Select wire suitable for the motor
Protective earth		-	

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) It is necessary to determine the wire diameter considering the 2<sup>nd</sup> encoder specification and wire length.



## 8-2 Wire processing

For wiring the push-in connectors, ferrule terminal is recommended. Examples of ferrule terminals (Weidmüller Interface GmbH & Co. KG) are shown below. See datasheet of manufacturers for details.  
Make sure to use tools recommended by manufacturers.

I/O signal connector: X4, Safety I/O connector: X5 (B2CF 3.50)

No.	Manufacturer part number	Ordering number	Wire diameter (mm <sup>2</sup> )	Contact surface length (mm)
1	H0,25/12 HBL	9025760000	0.25	8
2	H0,34/12 TK	9025770000	0.34	8
3	H0,5/16 OR	9025870000	0.50	10
4	H0,75/18 W	9025910000	0.75	12
5	H1,0/18 GE	9025930000	1.0	12

Motor output connector: Motor: X105 (BVFL 7.62HP Hybrid)

No.	Manufacturer part number	Ordering number	Wire diameter (mm <sup>2</sup> )	Contact surface length (mm)
1	H0,5/18 OR	1076980000	0.50	12
2	H0,75/18 W	9025910000	0.75	12
3	H1,0/18 GE	9025930000	1.0	12
4	H1,5/18D SW	9019140000	1.5	12
5	H2,5/19D BL	9019170000	2.5	12
6	H4,0/20D GR	9019200000	4.0	12
7	H6,0/20 SW	0533500000	6.0	12

Motor output connector: Brake: X105 (BVFL 7.62HP Hybrid)

No.	Manufacturer part number	Ordering number	Wire diameter (mm <sup>2</sup> )	Contact surface length (mm)
1	H0,25/12 HBL	9025760000	0.25	8
2	H0,34/12 TK	9025770000	0.34	8
3	H0,5/14 OR	0690700000	0.50	8
4	H0,75/14 W	0462900000	0.75	8
5	H1,0/14 GE	0463000000	1.0	8
6	H1,5/14 R	0463100000	1.5	8

## Recommended crimping tools

No.	Manufacturer part number	Ordering number	Applicable wire diameter (mm <sup>2</sup> )
1	PZ 3	0567300000	0.50 to 6.0
2	PZ 4	9012500000	0.50 to 4.0
3	PZ 6/5	9011460000	0.25 to 6.0
4	PZ 6Roto L	1444050000	0.14 to 6.0
5	PZ 10 HEX	1445080000	0.14 to 10
6	PZ 10 SQR	9012600000	0.14 to 10
7	PZ16	9006450000	6.0 to 16

Cable-side connector is available shown below.

Name	Symbol	Product type	Manufacturer	Manufacturer part number	Panasonic option number
1 <sup>st</sup> encoder connector	X9 (X9A, X9B)	Receptacle	3M	3E206-0100 KV	DV0PM20010
		Shell kit	3M	3E306-3200-008	
2 <sup>nd</sup> encoder connector	X10 (X10A, X10B)	Shield Kit	TE Connectivity Ltd.	5745172-1 (Cable dia. range: 8.51 to 9.52 mm)	-
		Split-Ring Ferrule	TE Connectivity Ltd.	745508-6	-
		Pin	TE Connectivity Ltd.	66570-3	-
		Plug Connector	TE Connectivity Ltd.	205206-1	-

\* Use the above connector or equivalent.

\* Use the shielded 2-rows 15-contact D-sub (male DA-15 connector) for 2<sup>nd</sup> encoder connector.

For wiring the protective earth, the screw is M6. Make sure to tighten the screw scan with the recommended torque. Thickness of earth terminal should be 0.5 mm or more.

Screw size	Recommended torque
M6	2.5 to 3.0 N·m

### 8-3 Assembly instructions

#### 8-3-1 B2CF series

##### Connector

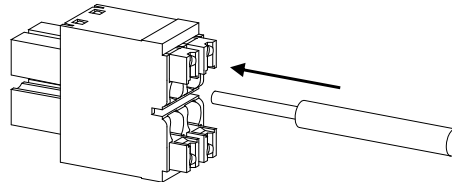
- I/O signal connector (X4)
- Safety I/O connector (X5)

##### Recommended tool

- Screwdriver blade  $0.4 \times 2.5$
- Screwdriver blade standard DIN 5264

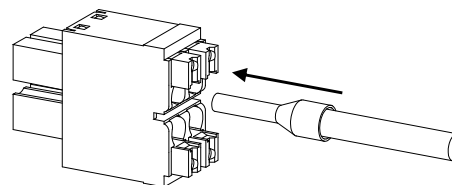
##### Connecting solid conductors

1. A stripped solid conductor is simply plugged into the contact point up to the end stop.



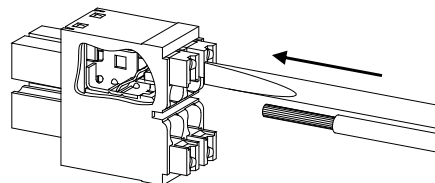
##### Connecting conductors with wire-end ferrule

1. Stranded conductors with crimped-on wire-end ferrules, with and without plastic collars, are simply plugged into the contact point up to the end stop. When plugging-in, an initial resistance (spring clamp) has to be overcome.

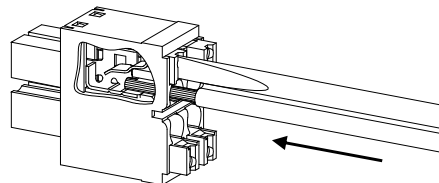


##### Connecting flexible conductors

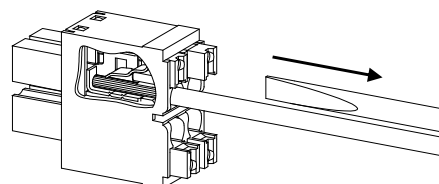
1. Open the contact point by activating the push-button (slider/pusher).



2. Insert stranded conductors, without crimped-on wire-end ferrules.



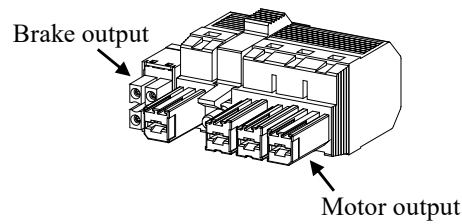
3. Remove tool from push-button (slider/pusher).



## 8-3-2 BVFL series

**Connector**

- Motor output connector (X105A, X105B)



## &lt;Brake output&gt;

See section 8-3-1 for details.

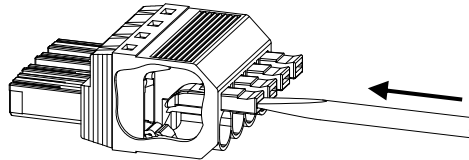
## &lt;Motor output&gt;

**Recommended tool**

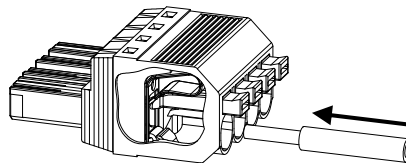
- Screwdriver blade  $0.6 \times 3.5$
- Screwdriver blade standard DIN 5264

**Connecting flexible conductors**

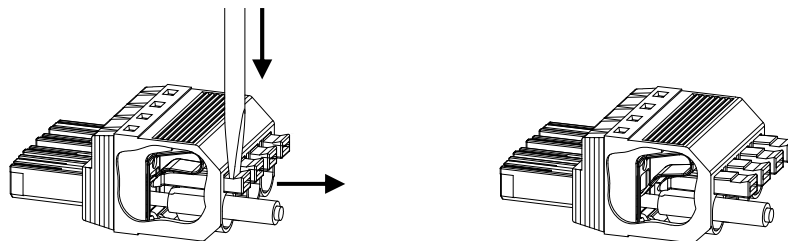
1. Opening clamping unit: Press the screwdriver individually onto the push-button (slider/pusher) until it is engaged.



2. Connecting conductor: Plug in the conductor into the clamping unit up to the end stop.



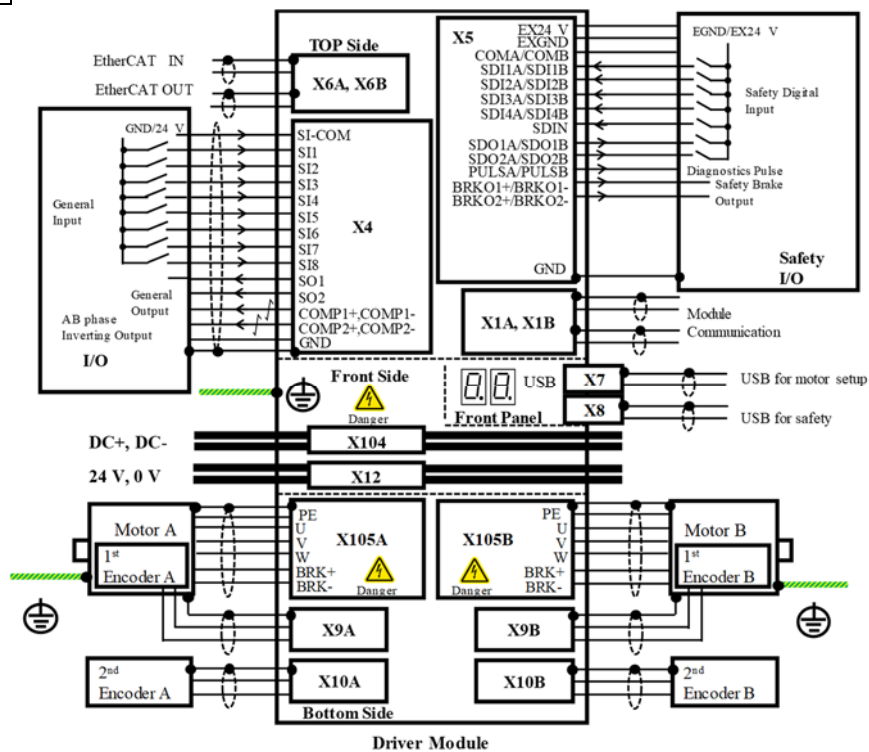
3. Closing clamping unit: Lock the clamping unit by vertically pressing onto the push-button (slider/pusher). Make sure that the conductor is inserted up to the end stop and ensure by gently pulling on the conductors that the clamping unit is securely engaged.



## 8-4 Precautions for wiring

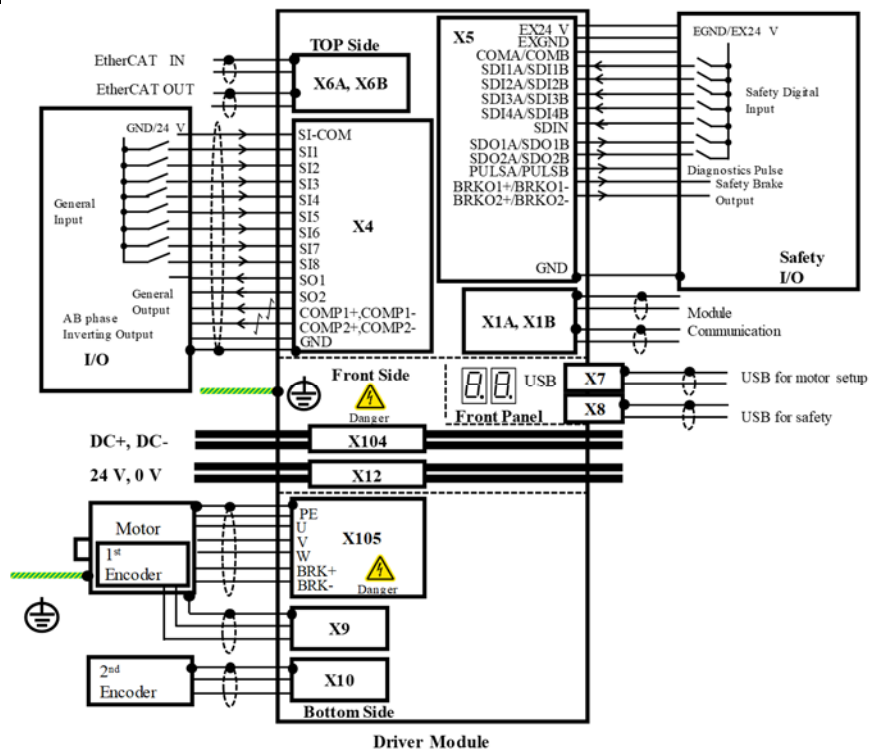
## 8-4-1 Wiring to the power connector and the terminal block

A - size



\* Connectors X1 to X10 are used for the secondary side circuit.  
They need to be isolated from the primary side power supply.  
Do not connect to the same power supply.

B - size



\* Connectors X1 to X10 are used for the secondary side circuit.  
They need to be isolated from the primary side power supply.  
Do not connect to the same power supply.

- [1] Insert the connector securely until it is locked.
- [2] Apply power supply voltage as specified in the rating plate.
- [3] Do not ground or short-circuit the motor output terminals (U, V, and W) each other.
- [4] High voltage is applied to power connectors X104X105. Make sure not to touch them. There is a risk to get an electric shock.
- [5] The short circuit current for the power supply to be used should be equal to or less than the maximum input voltage of the product, and the symmetrical current should be 5,000 Arms or less. If the short circuit current for the power supply exceeds this value, install a track current limiting device (such as a current-limiting fuse, current-limiting breaker, or transformer) to limit the short circuit current.
- [6] The rotating direction of the AC servo motor cannot be changed by exchanging the three phases as in the case of the induction motor. Make sure that the motor output terminals (U, V, and W) of the servo drive match the colors of the lead wires of the motor (or pin numbers for the motor side plug).
- [7] Make sure to connect the earth terminal of the motor with the earth terminal of the servo drive and ground them with the earth terminal of the noise filter at a single point. The machine body should also be grounded. Grounding resistance should be less than 100  $\Omega$ . Tighten the earth screws of the servo drive with an appropriate torque designated for each size. Use the earth wire with the diameter described in the specifications for each model or more. To avoid influence by electrolytic corrosion, make sure that aluminum is not in direct contact with copper.
- [8] To prevent noise, insert a surge absorber in the electromagnetic contactor installed around the servo drive, the coil between relay contacts of the motor with brake.
- [9] Install a molded-case circuit-breaker (MCCB), and in an emergency, be sure to shut off power supply outside the servo drive.  
When using an earth leakage breaker, take measures against high frequency.
- [10] To reduce noise voltage of the terminal, install a noise filter.
- [11] Apply power supply voltage after completing wiring.

## 8-5 Dynamic brake

Driver module (sizes A to B) has a dynamic brake built in for emergency stop. The dynamic brake can be operated in the following cases.

- [1] When power supply is turned off
- [2] When the servo is turned off
- [3] When the protective function is operated
- [4] When drive prohibiting input (POT, NOT) of connector X4 is operated

During deceleration in the above cases [1] to [4] or after the stop of the servo drive, whether the dynamic brake is operated or free run is applied can be selected by setting the parameter.

However, when the control power input is turned off, the dynamic brake of the drive for sizes A to B is kept operated.

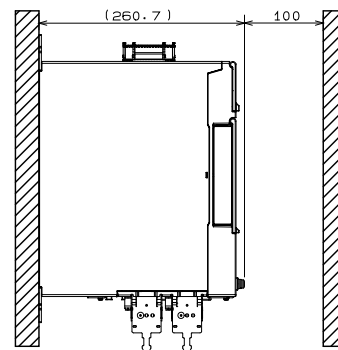
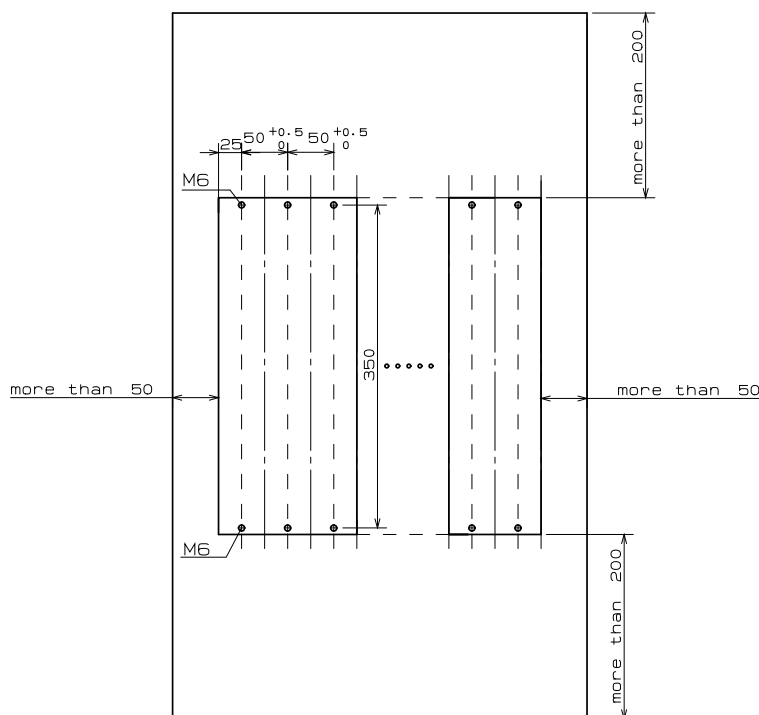
The dynamic brake is provided only for the short-time usage in case of emergency stop. Therefore, note the following points.

- [1] Do not start or stop operation by turning on/off the servo ON signal. Otherwise, the dynamic brake circuit built in the servo drive 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.

## 8-6 Mounting direction and interval

- Secure the surrounding space for effective cooling.
- Install a fan to equalize the temperature in the control panel.
- Sizes A to B have a cooling fan on the lower side.
- Satisfy the environmental conditions for the inside of the control panel.
- Fix the servo drive to the grounded conductive size.
- If the servo drive is mounted to a painted portion, anti-noise measures can be taken by installing it after peeling off the paint.
- If you make a mounting bracket by yourself, apply conductive plating to the surface of the bracket.
- The temperature around the servo drive should be measured at a position 50 mm away from the side or bottom surface of the drive.

If it is impossible to measure the temperature at a position 200 mm away from it, perform measurement at the midpoint in the clearance between the obstacle and the drive.





## 9. Compliance with the international standards

### 9-1 List of compatible standards for the servo drive

Standard		No.
European Communities Directive	EMC Directive	EN61000-6-2 IEC61326-3-1 EN61800-3
	Low Voltage Directive	EN61800-5-1 EN50178
	Machinery Directive Functional safety	ISO13849-1 (PL e, Cat.3) EN61508 (SIL 3) EN62061 (SILCL 3) EN61800-5-2 (Please see 9-2) IEC61326-3-1
UL standard		UL61800-5-1 (file No. E164620)
CSA standard		C22.2 No. 274
Radio Waves Act of South Korea (KC)		KN61800-3

IEC: International Electrotechnical Commission

EN: Europaischen Norman

EMC: Electromagnetic Compatibility

UL: Under writers Laboratories

CSA: Canadian Standards Association

### 9-2 Functional safety

There is a possibility that content will change depending on the result of the compliance tests.

Encoder		Safety target and applicable safety functions
1st	2nd	
Panasonic A6 encoder	None	SIL3, PL e Cat 3/Cat 4 for STO, SBC, SLP, SCA (*Note 1) SIL2, PL d Cat 3 for SS1, SLS, SSM, SSR
Panasonic A6 encoder	<ul style="list-style-type: none"> <li>•Third party (Panasonic format)</li> <li>•ABZ</li> <li>•EnDat2.2 (non-safety)</li> <li>•SSI</li> </ul>	SIL3, PL e Cat.3/Cat 4 for STO, SBC SS1, SLS, SSM, SSR, SS2, SOS, SLA, SAR, SLI, SDI (*Note 1)  SIL3, PL e Cat.3/Cat 4 for SEL, EOS (*Note 1, 2)

Note 1) The use of diagnostic pulse is required to meet Cat 4.

Note 2) Not include in EN61800-5-2. See “TECHNICAL REFERENCE - PANATERM for Safety Programming Manual” for details.

The parameter of functional safety

Item	Description
Safety Integrity Level	EN61508(SIL3) EN62061(SILCL3)
Performance Level	ISO13849-1 PL e (Cat.3)
Safety Function	EN61800-5-2 (SIL 3, STO)
Probability of dangerous failure	PFH = $4.568 \times 10^{-8}$ [1/h] (*Note 3)
Mean time to dangerous failure	MTTFd : High (100 years)
Average diagnostic coverage	DC : Medium
Mission time	20 years

Note 3) The result is shown of the typical system model with a single non-safety encoder. Other models will give different results.

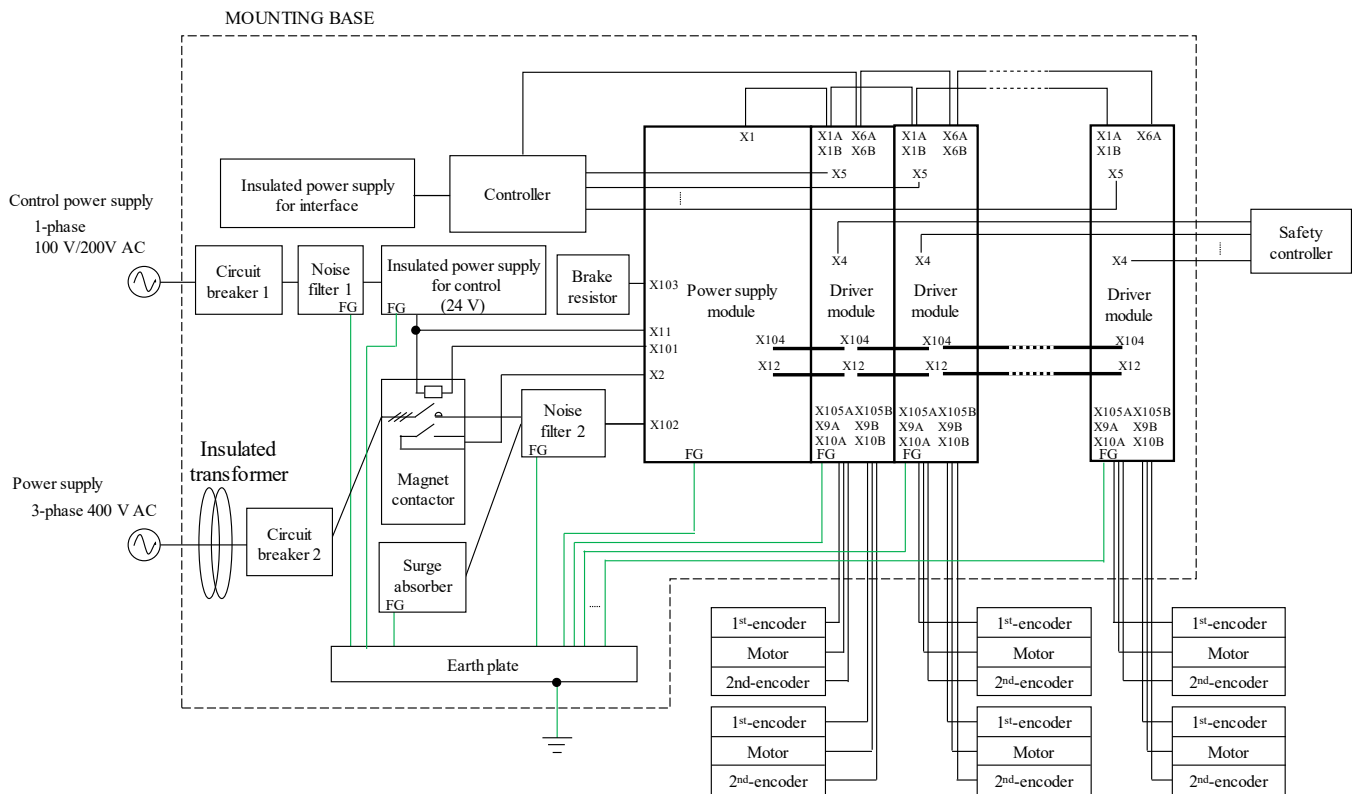
### 9-3 European Union (EU) Directive

We achieve compliance with the standards related to the Low Voltage Directive, so that the embedded machines and devices can easily comply with the EU Directive.

#### 9-3-1 Compliance with the EMC Directive

The servo drive and the servo motor are not intended to be used on a low-voltage public network which supplies residential premises; Radio frequency interference is expected if used on such a network.

To comply with the EMC Directive, use a noise filter, surge absorber. To make the machines and devices comply with the EMC Directive, it is necessary to perform checking using the final machines/devices in which the servo system and the servo motor have been embedded.




\* The number of driver module that can be connected is limited by the motor cables. The total length of motor cables connected to all driver modules is 300 m.

## 9-3-2 Power supply

400 V AC TN system	3-phase 380 V to 480 V	+10 % -15 %	50/60 Hz
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- (1) Use them under the environment of overvoltage category III stipulated in IEC60664-1.
- (2) Use insulated-type 12 to 24 V DC power supply for 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 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 (National Electrical Code) standard and the local standard.

## 9-3-4 Insulated power supply for control (24 V)

## • Recommended components

Manufacturer	Manufacturer part number	Applicable module
OMRON	S8VK-S series	A - size B - size

“S8VK-S48024” was used in the EMC compliance tests.

## 9-3-5 Noise filter 1

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

## • Recommended components

Manufacturer	Manufacturer part number	Applicable module
OMRON	S8V-NF series	A - size B - size

“S8V-NFS206” was used in the EMC compliance tests.

## 9-3-6 Noise filter 2

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

## • Recommended components

Manufacturer	Manufacturer part number	Voltage specifications for module	Applicable module
SCHAFFNER	FN3288 series	3-phase 400 V AC	A - size B - size

“FN3288-80-34-C35-R65” was used in the EMC compliance tests.

## 9-3-7 Surge absorber

Install a surge absorber on the primary side of the noise filter.

<Request>

When performing a withstand test for the machines and devices, be sure to remove the surge absorber. Otherwise, the surge absorber may get damaged.

## • Recommended components

Manufacturer	Manufacturer part number	Voltage specifications for module	Applicable module
SOSHIN ELECTRIC	LT-C35G102WS	3-phase 400 V AC	A - size B - size

## 9-3-8 Motor cable

## • Recommended components



Manufacturer	Manufacturer part number	Applicable module
ÖLFLEX	SERVO FD 796 CP	A - size B - size

## 9-3-9 Encoder cable

## • Recommended components

Manufacturer	Manufacturer part number	Applicable module
ÖLFLEX	SERVO FD 798 CP	A - size B - size

## 9-3-10 Grounding

- (1) To avoid electric shocks, be sure to connect the protective earth terminal () of the servo drive and the protective earth (PE) of the control panel.
- (2) Avoid co-fastening for the connection to the protective earth terminal (). The servo drive is equipped with two protective earth terminals.

#### 9-4 Compliance with the UL standard

##### [1] Installation environment

Install the servo drive under the environment at pollution level 2 stipulated in IEC60664-1.

Be sure to connect a UL-certified 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 drive 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 and the local standard.

##### [4] Load protection and overheating protection

The drive 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.

#### 9-5 Radio Waves Act of South Korea

The drive 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: Drive)

#### 9-6 Harmonic suppression measures

Harmonic suppression measures are different depending on countries. Perform installation in accordance with regulations in each country.



# 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.

<b>DANGER</b>	Indicates “actions carrying a significant risk of death or serious injury.”
<b>CAUTION</b>	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 (H<sub>2</sub>S, SO<sub>2</sub>, NO<sub>2</sub>, Cl<sub>2</sub> 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  $\Omega$  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 approximately 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.





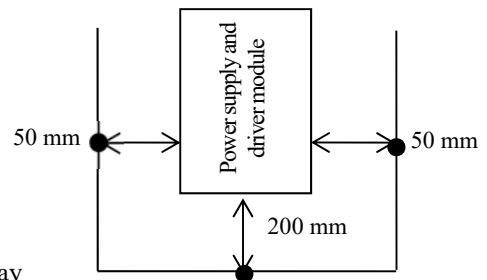
# Safety Precautions

## Temperature around the drive

The life span of the drive significantly depends on ambient temperature.

Make sure that temperature within 200 mm from the drive and power supply not exceed the working temperature range.

If it is impossible to measure temperature in a place 50 mm away from the servo drive, perform measurement at the mid point in the clearance between the obstacle and the servo drive.



**Working temperature range: 0 to 40 °C**

## 11. Life span

(This is not a guaranteed item.)

### 11-1 Expected life span of the power supply and driver module

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

Definition of life ... The time from when the product is shipped until the capacity of the electrolytic capacitor is reduced by 20%

Conditions	Input power supply	: 3-phase 400 V AC, 50/60 Hz,
	Ambient temperature	: 40 °C
	Above sea level	: 1,000 m or less
	Output torque	: Constant rated torque
	Rotation speed	: Constant rated rotation speed

Life span changes significantly depending on working conditions.

### 11-2 Standard life span

#### 11-2-1 In-rush current protection circuit

The expected life span of the in-rush current protection circuit is approx. 20,000 times. However, it varies depending on environmental conditions and usage.

#### 11-2-2 Cooling fan

The standard replacement period of the cooling fan is approx. 20,000 hours. However, it varies depending on environmental conditions and usage.

## 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 cannot respond to the items you are asking for in this specification.
- (4) In case of malfunction of equipment other than our responsibility.

### 12-3 Warranty 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 an external 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 benzene, thinner, alcohol, acidic or alkaline detergents as they may discolor or break the exterior.
- (18) Do not reverse engineer, decompile, or disassemble this product.