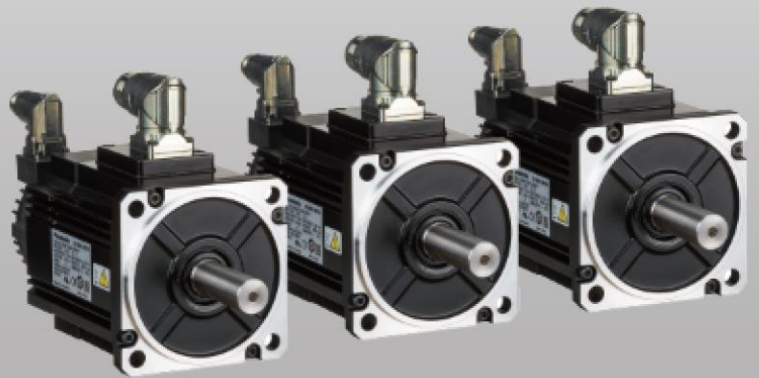


Panasonic[®]

Operating Instructions

AC Servo Motor & Driver

MINAS A6 Multi



This product image is 1 kW 400V type of A6 Multi.

- Thank you for purchasing this Panasonic product.
- Before operating this product, please read the instructions carefully, and save this manual for future use.
- Read the Safety Operating Instructions before using the products (P.vi to ix).
- This product is for industrial equipment. Don't use this product at general household.

Thank you for purchasing Digital AC Servo Motor & Driver, MINAS A6 Multi series. This instruction manual contains information necessary to correctly and safely use the MINAS A6 Multi series motor and driver. By reading this instruction manual, you will learn how to identify the model of the motor and driver that will be best suitable your application, how to wire and set up them, how to set parameters, and how to locate possible cause of symptom and to take corrective action.

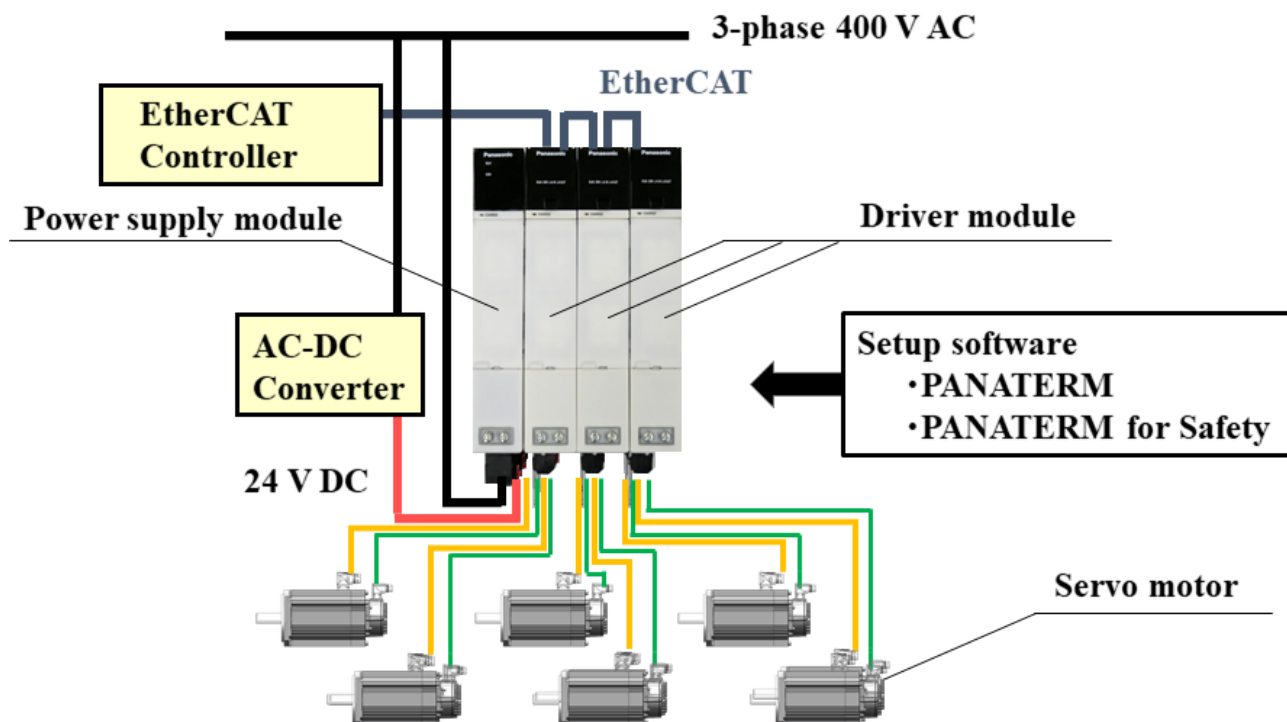
This is the original instruction.

 Caution

- (1) Any part or whole of this document shall not be reproduced without written permission from us.
- (2) Contents of this document are subject to change without notice.

Scope

■ System over view of MINAS A6 Multi



■ Related documents

Manual Name
REFERENCE SPECIFICATIONS - Power supply module and Driver module -
TECHNICAL REFERENCE - Function Specification -
TECHNICAL REFERENCE - EtherCAT Communication Specification -
TECHNICAL REFERENCE - Safety Installation Manual -
TECHNICAL REFERENCE - PANATERM for Safety Programming Manual -

(Note) 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

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- This product might require upgrade according to the specifications change requested by ETG. We do not have liability for expenses of such upgrades.

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Safety Precautions

The following explanations are for things that must be observed in order to prevent harm to people and damage to property.

- Misuses that could result in harm or damage are shown as follows, classified according to the degree of potential harm or damage.



Danger

Indicates great possibility of death or serious injury.



Caution

Indicates the possibility of injury or property damage.

- The following indications show things that must be observed.



Indicates something that must not be done



Indicates something that must be done.



Danger

	Do not subject the Product to water, corrosive or flammable gases, and combustibles.	Failure to observe this instruction could result in fire, electrical shocks, damages and breakdowns.
	Do not place combustibles near by the motor, driverd regenerative resistor and dynamic brake resister.	
	Don't use the motor in a place subject to excessive vibration or shock.	Failure to observe this instruction could result in electrical shock, injury or fire.
	Don't use cables soaked in water or oil.	Failure to observe this instruction could result in electrical shocks, damages and breakdowns.
	The installation area should be away from heat generating objects such as a heater and a large wire wound resistor.	Failure to observe this instruction could result in fire and breakdowns.
	Never connect the motor directly to the commercial power supply.	
	Don't attempt to carry out wiring or manual operation with wet hand.	Failure to observe this instruction could result in electrical shock, injury or fire.
	Do not put your hands in the servo driver.	Failure to observe this instruction could result in burn and electrical shocks.
	In the case of the motor with shaft end keyway, do not touch the keyway with bare hands.	Failure to observe this instruction could result in personal injury.
	Do not touch the rotating portion of the motor while it is running. Failure to observe this instruction could result in damages and breakdowns.	

	Do not touch the motor, servo driver, heat sink, regenerative resistor and dynamic brake resistor, since they become very hot.	Failure to observe this instruction could result in burns.
	Do not drive the motor with external power.	Failure to observe this instruction could result in fire.
	Do not subject the cables to excessive force, heavy object, or pinching force, nor damage the cables.	Failure to observe this instruction could result in electrical shocks, damages and breakdowns.
	Installation area should be free from excessive dust, and from splashing water and oil.	Failure to heed this precaution will result in electric shock, personal injury, fire, malfunction or damage.
	Mount the motor, driver and peripheral equipments on incombustible material such as metal.	Installation on a flammable material may cause fire.
	Wiring has to be carried out by the qualified and authorized specialist.	Allowing a person with no expertise to carry out wiring will result in electrical shocks.
	Correctly run and arrange wiring.	Incorrect wiring will result in short circuit, electric shock, personal injury, etc.
	After correctly connecting cables, insulate the live parts with insulator.	Incorrect wiring will result short circuit, electric shock, fire or malfunction.
	Ground the earth terminal of the motor and driver without fail.	Floating ground circuit will cause electric shock.
	Install and mount the Product and machinery securely to prevent any possible fire or accidents incurred by earthquake.	Failure to heed this requirement will result in electric shock, personal injury, fire, malfunction or damage.
	Install an emergency stop circuit externally so that you can stop the operation and shut off the power immediately.	
	Install an overcurrent protection, earth leakage breaker, over-temperature protection and emergency stop apparatus without fail.	Failure to heed these requirements will result in electric shock, personal injury or fire.
	Check and confirm the safety of the operation after the earthquake.	
	Before transporting, wiring and inspecting the driver, turn off power and wait for a time longer than that specified on the name plate on the side panel of the product; and make sure that there is no risk of electrical shock.	Energized circuit will cause electric shock.
	Install overheat detecting means such as a thermal protector to detect abnormal overheating and shut off the power supply if a regenerative braking resistor is connected to the outside of the servo driver.	Failure to heed these instructions could result in electric shock, personal injury, fire, malfunction or damage.
	Tighten the terminal block screws, the grounding screws and the mounting screws securely with the torque indicated in the specification sheet.	Failure to observe this instruction could result in breakdowns or malfunction.
	Design a system so as to understand and comply with related safety standards and the description items of our manual or technical documents when constructing it using the safety function.	Failure to observe this instruction could result in breakdowns and malfunction.

Caution

	Do not hold the motor cable or motor shaft during the transportation.	Failure to observe this instruction could result in injuries.
	Don't drop or cause topple over of something during transportation or installation.	Failure to observe this instruction could result in injuries and breakdowns.
	Do not step on the Product nor place the heavy object on them.	Failure to observe this instruction could result in electrical shocks, injuries, breakdowns and damages.
	Don't place any obstacle object around the motor and peripheral, which blocks air passage.	Temperature rise will cause burn injury or fire.
	Don't use the equipment under direct sunshine.	Failure to heed these instructions will cause personal injury or fire.
	Do not block the heat dissipating holes or put the foreign particles into them.	Failure to observe this instruction could result in electrical shocks and fire.
	Do not give strong impact shock to the Product.	Failure to observe this instruction could result in breakdowns.
	Do not give strong impact shock to the motor shaft.	Failure to observe this instruction could result in a failure of the detector etc.
	Do not turn on and off the main power of the driver repeatedly.	Failure to observe this instruction could result in breakdowns.
	Never run or stop the motor with the electro-magnetic contactor installed in the main power side.	
	Do not make an extreme gain adjustment or change of the drive. Do not keep the machine running/operating unstably.	Failure to observe this instruction could result in injuries.
	Do not use the built-in brake as a "Braking" to stop the moving load.	Failure to observe this instruction could result in injuries and breakdowns.
	Do not approach to the machine since it may suddenly restart after the power resumption. Design the machine to secure the safety for the operator even at a sudden restart.	Failure to observe this instruction could result in injuries.
	Never attempt to perform modification, dismantle or repair.	Failure to heed this instruction will result in fire, electric shock, personal injury or malfunction.
	Do not approach the driving motor and machine during power-on in preparation for a malfunction.	Failure to observe this instruction could result in personal injury.
	Do not start or stop by on/off of Servo ON command (SRV - ON).	Failure to observe this instruction could result in damages of dynamic brake circuit built into the servo driver.
	Make an appropriate mounting of the Product matching to its wight and output rating.	Failure to heed these requirements will result in personal injury or malfunction.
	Observe the specified mounting method and direction.	

	Use the eye bolt of the motor for transportation of the motor only, and never use this for transportation of the machine.	Using it for transportation of the machine will cause personal injury or malfunction.
	Adjust the motor and driver ambient environmental condition to match the motor operating temperature and humidity.	Failure to heed these requirements will result in personal injury or malfunction.
	Create the specified clearance between the driver and the control panel inner surface or other devices.	
	Observe the specified voltage.	Operation from a voltage outside the rated voltage will cause electric shock, personal injury or fire.
	Connect the brake control relay to the relay which is to shut off at emergency stop in series.	Missing of one of these devices will result in personal injury or malfunction.
	Provide protection device against idling of electromagnetic brake or gear head, or grease leakage from gear head.	No protection will cause personal injury, damage, pollution or fire.
	Use the motor and the driver in the specified combination.	Not using the motor and the driver in the specified combination will result in fire.
	Test-run the securely fixed motor without loading to verify normal operation, and then connect it to the mechanical system.	Operation using a wrong model or wrong wiring connection will result in personal injury.
	When any error occurs, remove the cause and release the error after securing the safety, then restart.	Not removing the cause of the error will result in personal injury.
	If the driver fails, shut off the power on the power supply side of the driver.	Allowing a large current to continue to pass will result in fire.
	Always keep power disconnected when the power is not necessary for a long time.	Improper operation will cause personal injury.
	Failure of combination with the motor and the servo driver may cause thermal damage to the motor, smoke or dust.	Failure to observe this instruction could result in damages and breakdowns or fire. Please note that when used in a clean room etc.
	Maintenance and inspection should be done by experts.	Allowing a person with no expertise to carry out maintenance and inspection will result in damage.
	Set a stop time of about 10 minutes when the dynamic brake built into the servo driver operates from high-speed operation.	Failure to observe this instruction could result in damages or breakdowns. The internal circuit may be disconnected and the brake may not operate.
	Secure the cable so that stress is not applied to the connection part of the connector, terminal block and etc.	Failure to observe this instruction could will result in electric shock, damage or fire.

■ **Disposal Precautions**

- The Product shall be treated as Industrial Waste when you dispose.
- When you dispose the batteries, observe any applicable regulations or laws after insulating them with the tape.

■ **Cautions for Proper Use**

- This product is intended to be used with a general industrial product, but not designed or manufactured to be used in a machine or system that may cause personal death when it is failed.
- The user is responsible for matching between machine and components in terms of configuration, dimensions, life expectancy, characteristics, when installing the machine or changing specification of the machine. The user is also responsible for complying with applicable laws and regulations.

Routine maintenance and inspection of the driver and motor are essential for the proper and safe operation.

Notes on Maintenance and Inspection

- (1) Turn on and turn off should be done by operators or inspectors themselves. When establishing a system using safety functions, completely understand the applicable safety standards and the operating instruction manual or technical documents for the product.
- (2) Internal circuit of the driver is kept charged with high voltage for a while even after power-off. Turn off the power and allow 15 minutes or longer after LED display of the front panel has gone off, before performing maintenance and inspection.
- (3) Disconnect all of the connection to the driver when performing megger test (Insulation resistance measurement) to the driver, otherwise it could result in breakdown of the driver.
- (4) Do not use benzine, thinner, alcohol, acidic cleaner and alkaline cleaner because they can discolor or damage the exterior case.

Inspection Items and Cycles

General and normal running condition:

Ambient conditions : 30 °C (annual average), load factor of 80% or lower, operating hours of 20 hours or less per day.

Perform the daily and periodical inspection as per the items below.

Type	Cycles	Items to be inspected
Daily inspection	Daily	•Ambient temperature, humidity, speck, dust or foreign object •Abnormal vibration and noise •Main circuit voltage •Odor •Lint or other particles at air holes •Cleanness at front portion of the driver and connector •Damage of the cables •Loose connection or misalignment between the motor and machine or equipment •Pinching of foreign object at the load
Periodical inspection	Annual	•Loose tightening •Trace of overheat •Damage to the terminal block •Loose fasteners on terminal block

Note

Inspection cycle may change when the running conditions of the above change.

Guideline for Parts Replacement

Use the table below for a reference. Parts replacement cycle varies depending on the actual operating conditions. Defective parts should be replaced or repaired when any error have occurred.

 Prohibited	Disassembling for inspection and repair should be carried out only by authorized dealers or service company.
--	---

Product	Component	Standard replacement cycles (hour)	Note
Power supply module	Cooling fan	2 to 3 years (10000 to 30000 hours)	These hours or cycles are reference. When you experience any error, replacement is required even before this standard replacement cycle.
	Aluminum electrolytic capacitor	Approx. 5 years	
	Inrush current preventive resistor	Approx. 20000 times (depending on working condition)	
Driver module	Cooling fan	2 to 3 years (10000 to 30000 hours)	
	Aluminum electrolytic capacitor	Approx. 5 years	
Motor	Bearing	3 to 5 years (20000 to 30000 hours)	
	Oil seal	5000 hours	
	Encoder	3 to 5 years (20000 to 30000 hours)	
	Battery for absolute encoder	Life time varies depending on working conditions. Refer to the Operating Instructions attached to the battery for absolute encoder.	

Life and standard time for replacement (This is not a guarantee)

■ Expected basic rating life of bearing (calculated value)

Fatigue life at reliability 90% under the allowable shaft load after statistically correcting variance: 20,000 hours or more at continuous rated load.

Avoid oscillating and repeated sliding movement with the motor shaft at a rotational angle 45 degree or lower, which may cause a fretting phenomenon.

■ Expected life of rotary encoder

Life satisfying the specification of the rotary encoder (until a half-life period of light intensity): 30,000 hours or more at continuous rated load

■ Standard time for replacement of oil seals (only for models with oil seals)

5,000 hours at continuous rated load (variable depending on the environment and operation)

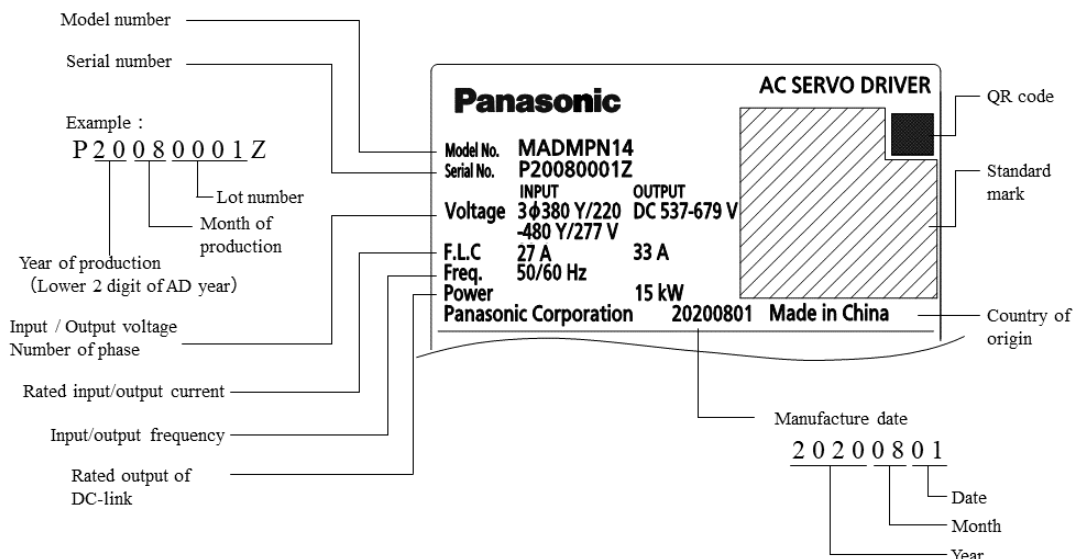
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Before Using the Products

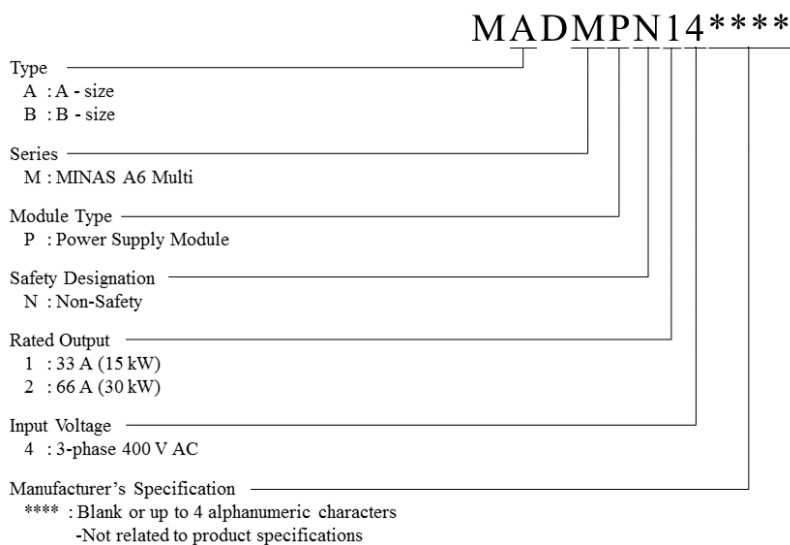
1.1 Power supply module

1.1.1 Check of the Model

Contents of Name Plate



Model Designation



Serial number

The values of the serial number part of the lot 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 Name 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

1.1.2 Power supply module

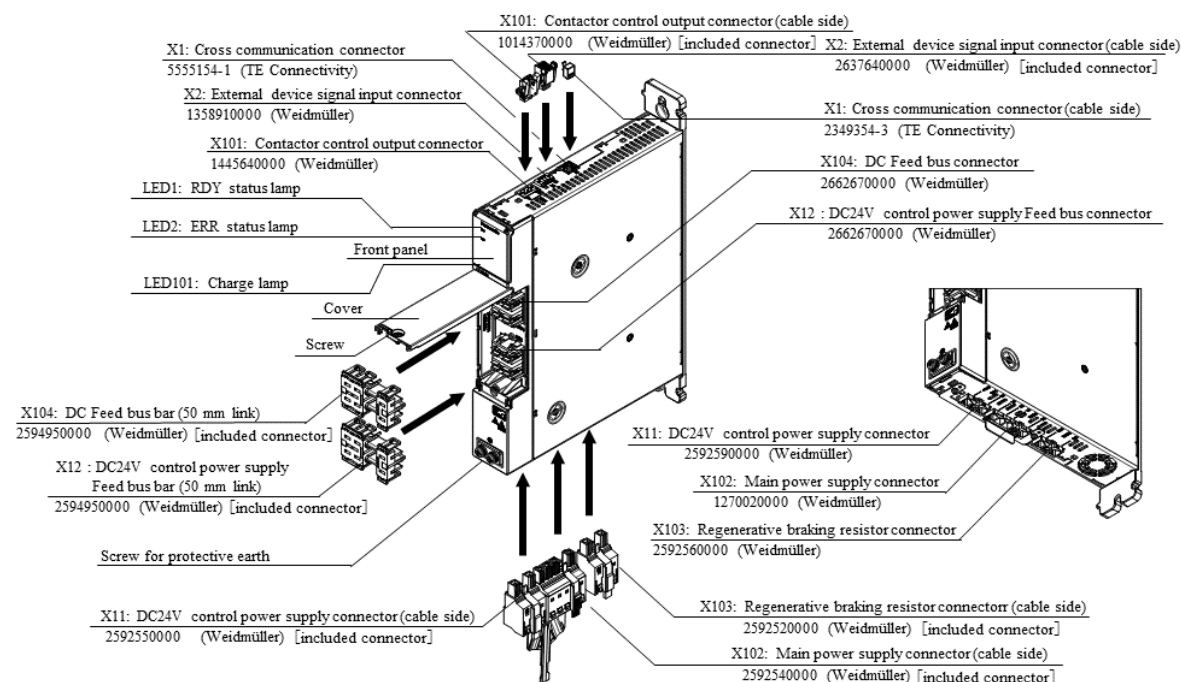
Model No.	Size	Mains Power Supply Input	Rated output (Note 1)
MADMPN14	A	3-phase 380 to 480 V AC	15 kW
MBDMPN24	B	3-phase 380 to 480 V AC	30 kW

(Note 1) The total motor rated output must be selected so that it is less than or equal to the listed value.
See "1.5.1 Power supply / Driver" for detail.

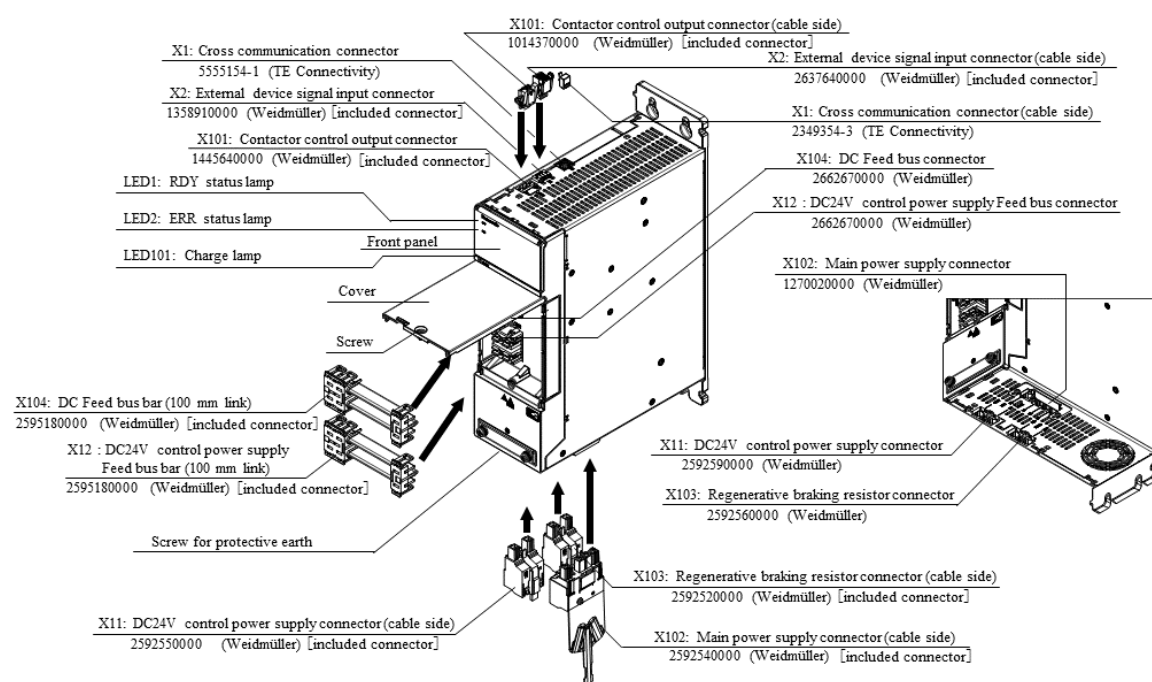
- Power supply module has some parameters. The operation of power supply module is changed by depending on its parameters. Refer to "TECHNICAL REFERENCE - Function Specification -" for detail.
- This product is designed for use in the control panel. When using this product in an environment with strong vibration, such as a transfer robot, pay special attention to vibration.

1.1.3 Parts Description

A-size



B-size



◆ REFERENCE

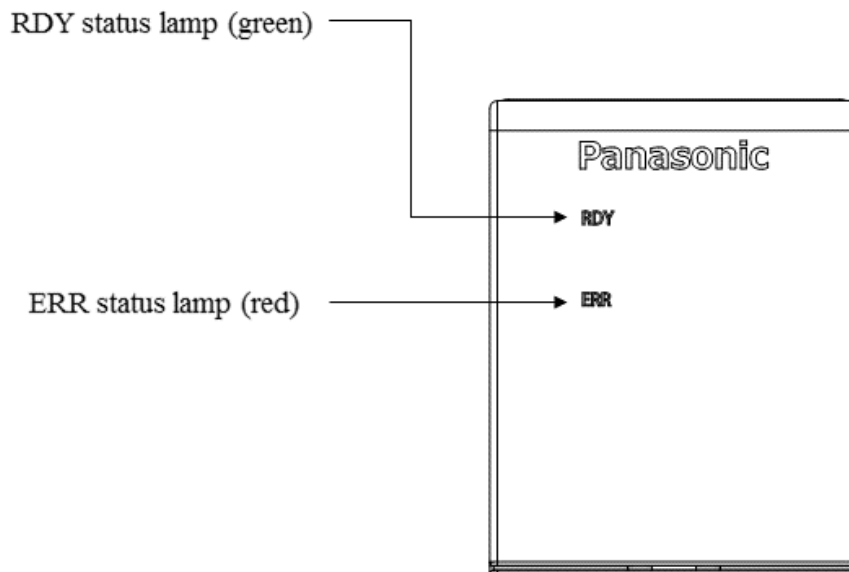
- See page 2-4 for cable.



◆ NOTE

- Do not press on the cover plate of the wiring terminal.

1.1.4 Front panel



Item	Status	Content
RDY status lamp (green)	ON	Main power supply established
	OFF	Main power off
ERR status lamp (red)	ON	Power supply module error detection
	Blinking	No power supply module error/warning detection
	OFF	No power supply module error/no warning

1.1.5 Accessories (included connectors)

Connector		Quantity[pcs]		Manufacturer	Manufacturer part number
		A-size	B-size		
X101	Contact control output connector	1	1	Weidmüller Interface GmbH & Co. KG	1014370000
X2	External device signal input connector	1	1		2637640000
X11	DC24 V control power supply connector	1	1		2592550000
X103	Regenerative braking resistor connector	1	1		2592520000
X102	Main power supply connector	1	1		2592540000
X12 X104	50 mm Feed bus bar	2	0		2594950000
X12 X104	100 mm Feed bus bar	0	2		2595180000
	Endcap	2	2		2594970000

1.1.6 Specifications

Power supply module basic specifications

Item	Parameter	Unit	Specification	
Model	Model No.	-	MADMPN14	MBDMPN24
	Frame Size (Note 1)	-	A-size	B-size
	Rated Output Power	kW	15	30
Mains Power Supply Input	Input Voltage	V	3-phase AC 380 to 480 -15%, +10%	
	Input current	A	27	54
	Power capacity (Note 2)	kVA	59	118
	Power systems (Note 3)	-	TN (with an earthed neutral)	
	Frequency	Hz	50/60	
	In-rush current (Note 4)	A	30	60
Mains Power Output (DC-bus)	Output voltage	V	DC 537 to 679 -15%, +10%	
	Rated output current	Arms	33	66
	Maximum output current	Arms	66	132
	DC-bus capacitance	μF	800	1,800
	DC-bus maximum capacitance (Note 5)	μF	5,000	10,000
Control Power Supply Input	Voltage	V	DC 24 ± 15% PELV or SELV (With holding brake DC 24 ± 5%)	
	Maximum Current (Only power supply module)	A	1.0	1.0
	In-rush current (Note 4, 6)	A	24	24
Regenerative Braking function (Note 7)	Regenerative method	-	Resistor regeneration	
	Brake Resistor	-	External resistor	
	Allowable minimum braking resistor	Ω	15	8
	Over heat protection	-	Recommended (provide thermostat inside the resistor)	
Contactor Control Outputs	Number of channels	ch	1	
	Compatible contactor	-	DC24 V or AC200 V type	
	Maximum current	A	1.6	
Digital Inputs	Number of channels	-	2 (Mirror input of Contactor, Overheat sensing of Regenerative braking resistor)	
	Input type	-	Sink/Source	
	Power Supply	-	12 to 26.4 V (10 mA/channel)	
Indicator (Note 8)	Status LED	-	Ready status lamp (green) Error status lamp (red)	
Network	Cross Communication	-	RS485 Communication inter modules.	
Cooling (Note 9)		-	Forced Air Cooling	
Mass		kg	3.6	6.8

(Note 1) See "4.4 Dimensions" for specifications.

(Note 2) Power factor is 0.7. The margin is 10% for 200% load condition. Please make decision of the power supply capacity with peak load of the actual machine.

(Note 3) Maximum system voltage is 277 V.

(Note 4) The current limit of power supply may be applied at turning on the power. Please thoroughly verify it with the actual machine.

(Note 5) Be sure to check that the total capacitance of Power Supply Module and Driver Module keep less than value described in the table.

(Note 6) In-rush Current will increase as number of Driver Module.

(Note 7) See "2.3 Regenerative braking resistor" for resistor selection and "Technical reference - Function Specification -" for parameter setting.

To make the regenerative resistor small, calculate the time average of regenerative power. It is applicable if the frequency of regenerative running is low. And check the instant tolerance of the resistor to avoid fires.

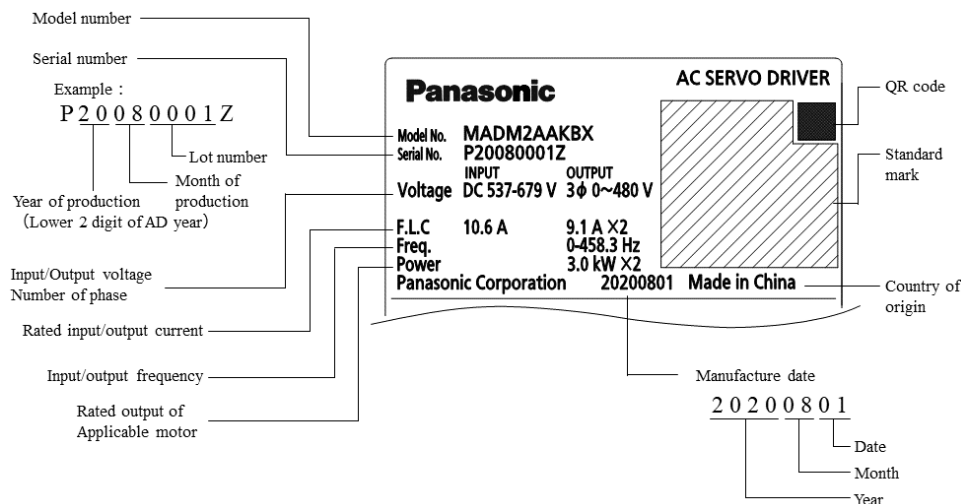
(Note 8) See "1.1.3 Parts Description" for specifications.

(Note 9) Fan speed depends on internal temperature.

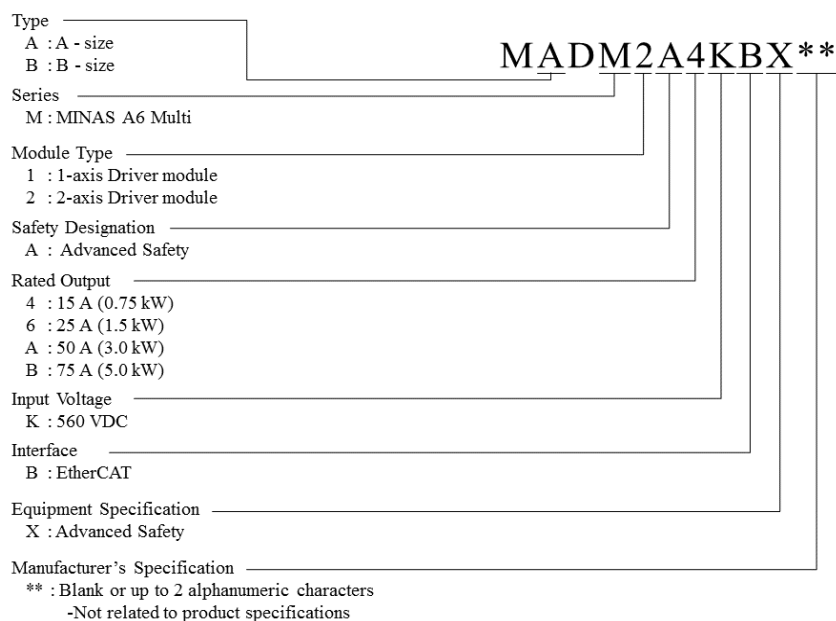
1.2 Driver module

1.2.1 Check of the Model

Contents of Name Plate



Model Designation



Serial number

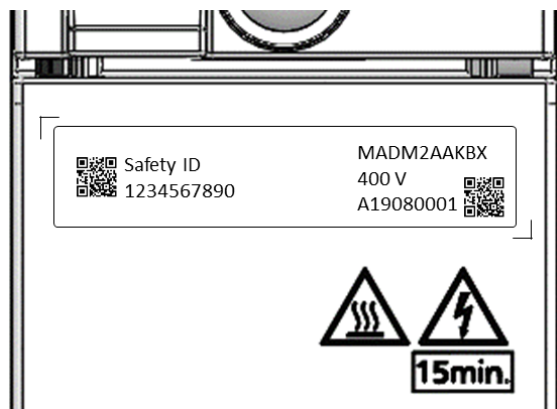
The values of the serial number part of the lot number range from 1 to 33999. On the rating plate, it is indicated in four digits as in the format shown below. "I" and "O" are not used for the fourth-digit alphabet.

Value of the serial number part	Indication on the Name 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.

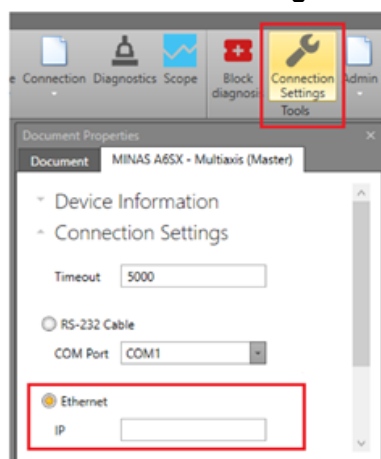


The access method to the driver module by “PANATERM for safety” is shown below.

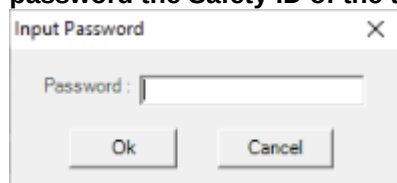


◆ PROCEDURE

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.



▼ Refer to

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

1.2.2 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	537 to 679 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 Drive written in the ESI file (Hex numeral).

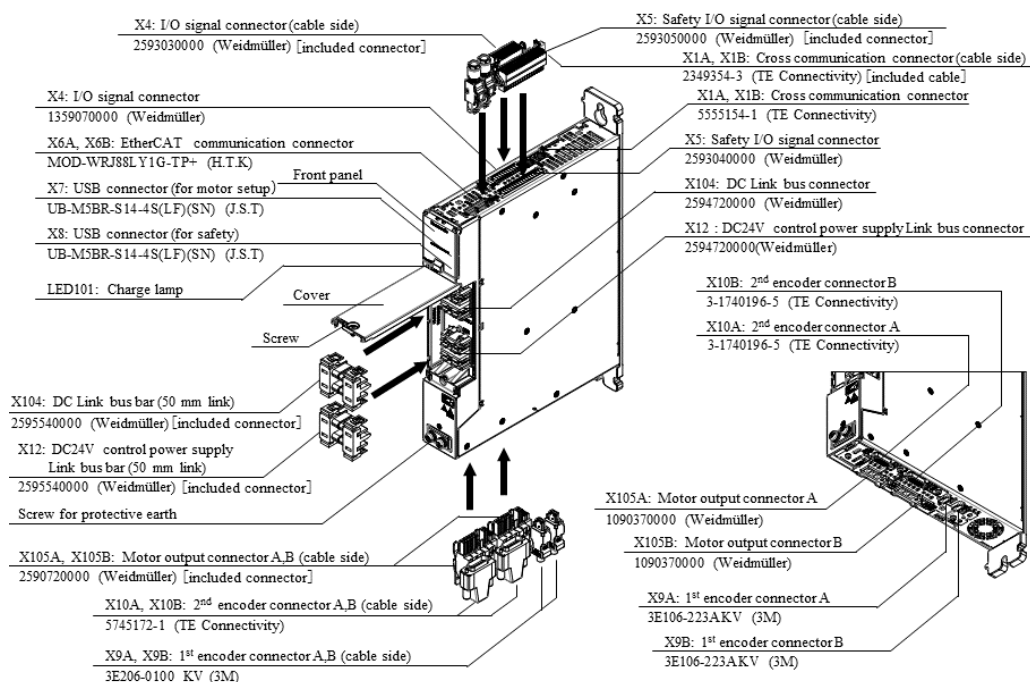
(Note 2) This shows that this product has passed the EtherCAT conformance Test conducted at EtherCAT test center.

(Note 3) Some of the combinations shown in this table cannot be used depending on motors. (e.g. motor type "MGMF294" is driven by only MBDM1ABKBX) For the combination of a driver and a motor. Refer to "Motor Specifications" and "REFERENCE SPECIFICATIONS - Power supply module section -".

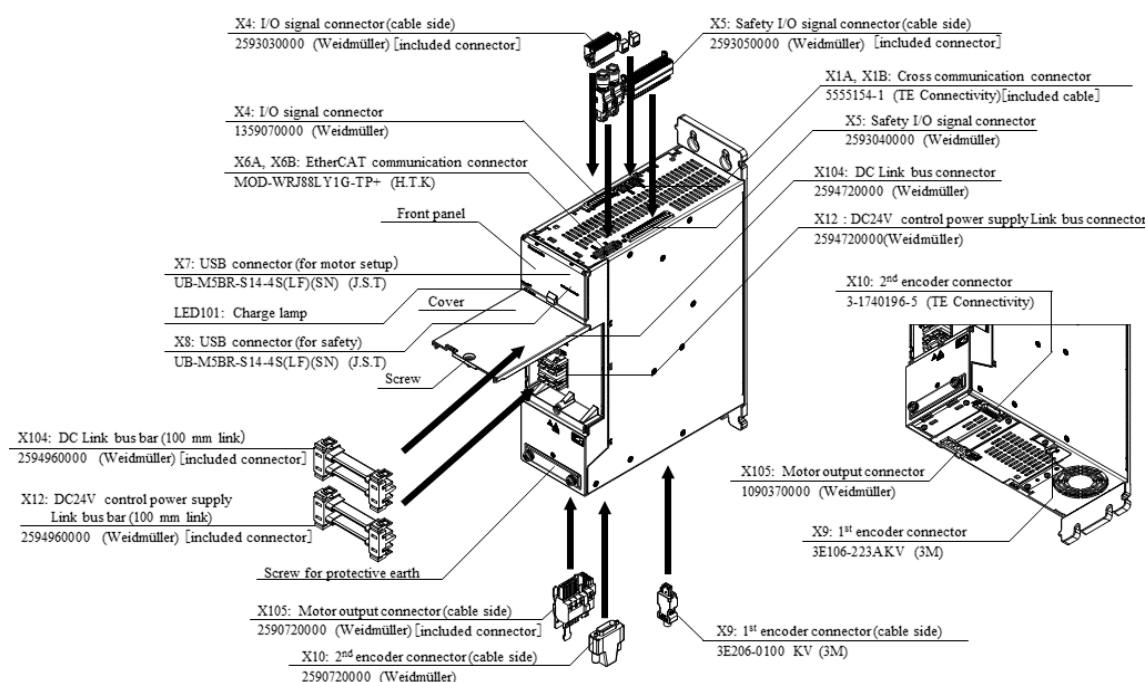
- This product has two 1st-encoder connectors, 2nd-encoder connectors and two motor connectors. Using the wrong combination will cause abnormal operation and failure of the servo driver and servo motor. Be sure to check that the combination is correct before turning on the power.
- The two motors are 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.
- This product is designed for use in the control panel. When using this product in an environment with strong vibration, such as a transfer robot, pay special attention to vibration.

1.2.3 Parts Description

A-size



B-size



◆ REFERENCE

- See page 2-4 for cable.

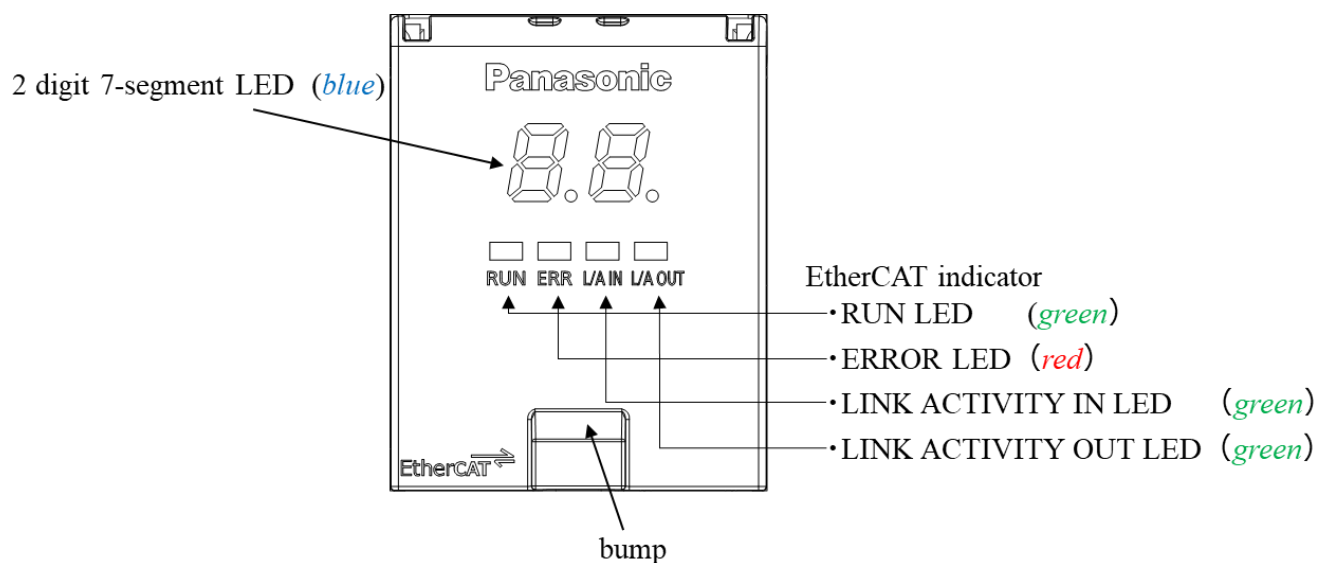


◆ NOTE

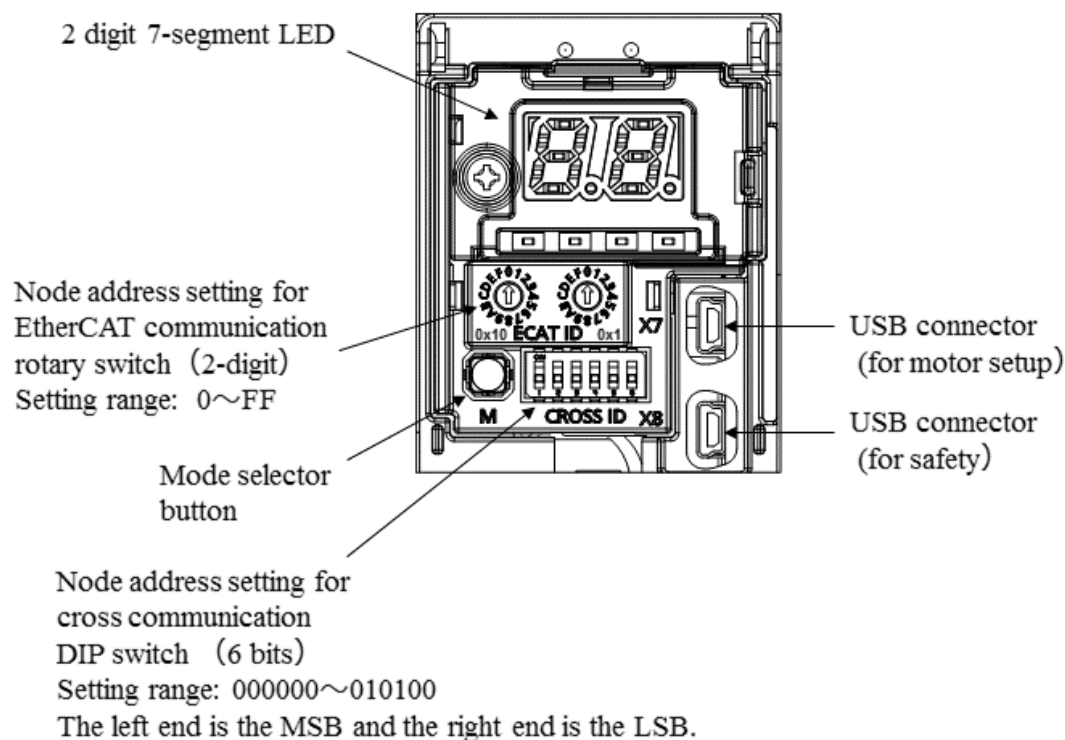
- Do not press on the cover plate of the wiring terminal.

1.2.4 Front panel

Front panel close state



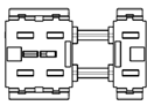
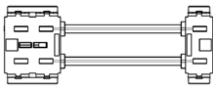
Front panel open state



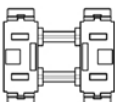
1.2.5 Accessories (included connectors)

Connector		Quantity[pcs]		Manufacturer	Manufacturer part number
		A-size	B-size		
X4	I/O signal connector	1	1	Weidmüller Interface GmbH & Co. KG	2593030000
X5	Safety I/O signal connector	1	1	Weidmüller Interface GmbH & Co. KG	2593050000
X105	Motor output connector	2	1	Weidmüller Interface GmbH & Co. KG	2590720000
X1A X1B	Cross communication cable (200 mm)	1	1	TE Connectivity Ltd.	2349354-3
X104 X12	50 mm Link bus bar	2	0	Weidmüller Interface GmbH & Co. KG	2595540000
X104 X12	100 mm Link bus bar	0	2	Weidmüller Interface GmbH & Co. KG	2594960000

■ Bus bar for power supply module to driver module

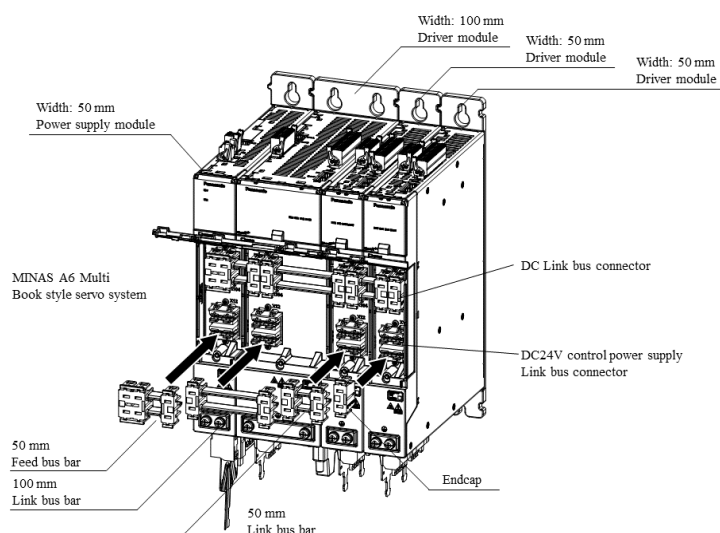
50 mm Feed bus bar	100 mm Feed bus bar
	

■ Bus bar for driver module to driver module

50 mm Link bus bar	100 mm Link bus bar
	

■ Terminator

Endcap

► Note

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.

When installing the bus bar, make sure that the connection of the bus bar is inserted until it clicks into place.

When removing the bus bar, pinch the upper and lower hooks of the bus bar.

When the charge lamp is lit, do not attach or detach the bus bar, there is a risk of electric shock.

1.2.6 Specifications

Driver module Basic specifications

Item	Parameter	Unit	Specification			
			MADM2A4KBX	MADM2A6KBX	MADM2AAKBX	MBDM1ABKBX
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, 8	6, 8	6	6
Input	Input Voltage	V	DC 537 to 679 -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			
	Output 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			
	Output 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			

Item	Parameter	Unit	Specification			
			MADM2A4KBX	MADM2A6KBX	MADM2AAKBX	MBDM1ABKBX
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			
Mass		kg	3.4	3.4	3.4	5.6

(Note 1) See "4.4 Dimensions" for specification.

(Note 2) See "3.3.7 Motor output connector X105 (X105A, X105B)" for details.

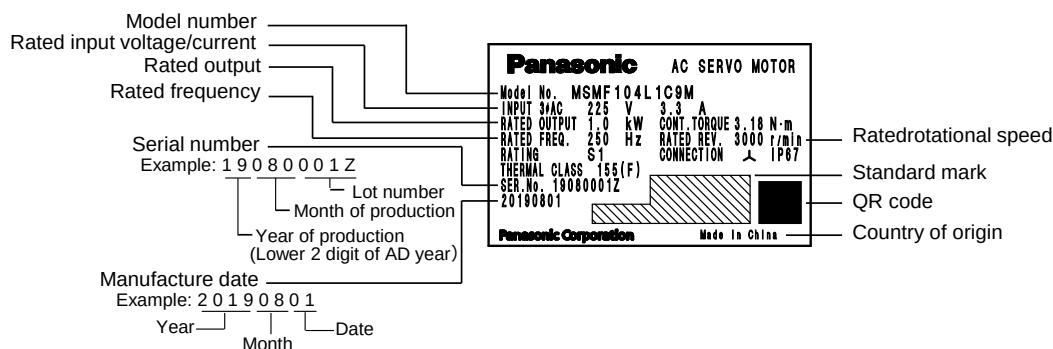
(Note 3) See "3.3.2 Safety I/O connector X5" for details.

(Note 4) See "Motor Specifications" 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.

1.3 Motor



Scope

■ Applicable models, Specifications, Outside drawings

Applicable model (Note 1)	Specification	Dimensions
MSMF104●1■▲M	4.2.1 MSMF	4.4.3 Motor
MSMF154●1■▲M		
MSMF204●1■▲M		
MSMF304●1■▲M		
MSMF404●1■▲M		
MSMF504●1■▲M		
MDMF104●1■▲M	4.2.2 MDMF	4.4.3 Motor
MDMF154●1■▲M		
MDMF204●1■▲M		
MDMF304●1■▲M		
MDMF404●1■▲M		
MDMF504●1■▲M		
MGMF094●1■▲M	4.2.3 MGMF	4.4.3 Motor
MGMF134●1■▲M		
MGMF184●1■▲M		
MGMF244●1■▲M		
MGMF294●1■▲M		
MGMF444●1■▲M		
MHMF104●1■▲M	4.2.4 MHMF	4.4.3 Motor
MHMF154●1■▲M		
MHMF204●1■▲M		
MHMF304●1■▲M		
MHMF404●1■▲M		
MHMF504●1■▲M		

(Note 1) ● shows rotary encoder specifications

Symbol	Format	Pulse counts	Resolution	Wires
L	Absolute	23-bit	8388608	7
A	Batteryless absolute	23-bit	8388608	5

■ shows motor structure

		Shaft	
		Straight	With key
Motor brake	Without	C	G
	With	D	H

▲ shows motor structure

Oil Seal	With	9
	With (with protection lip)	A

■ Serial numbers (Production numbers)

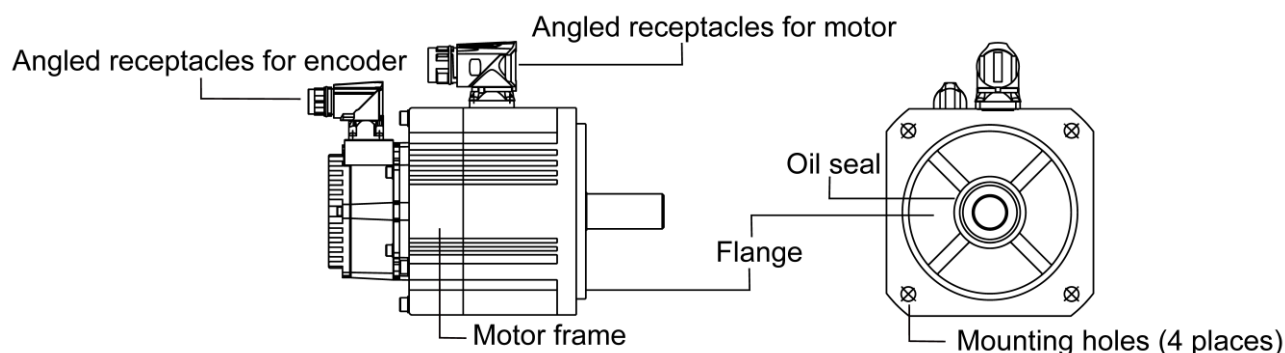
The serial number of a motor nameplate means as follows:

Ex.: SER No. 19 08 0001
 Christian year Production month Serial number

1.3.1 Notice about China Rare earth magnet for this motor

This motor uses the Chinese rare earth magnet. The patent's licenser limits the magnet and it's motor's distributed region. In order to avoid the license infringement, please avoid the motor, or equipment containing the motor to be distributed to Japan, or other regions through Japan.

1.3.2 Parts Description



▼ Refer to

For details of specific model, refer to the Dimensions of Supplement. (4.4.3 Motor)

Connector kit

■ Speedtec type

Title	Part No.	Number	Manufacturer	Note
Plug (power)	B S A 085 N 00 42 0100 000	1	TE Connectivity Ltd.	Speedtec, applicable wire: Φ 9.5 mm - Φ 14.5 mm
Contact Socket	60-0003-011-000	6		Applicable wire: conductor 0.35 - 2.5 mm ² , insulation max. Φ 4.3 mm
Plug (encoder)	A S A 046 N 00 85 050A 000	1		Speedtec, applicable wire: Φ 6.0 mm - Φ 9.5 mm
Contact Socket	60-0172-011-000	7		Applicable wire: conductor 0.03 - 0.34 mm ² , insulation max. Φ 2.1 mm

1.4 Check of the Combination of the Driver and the Motor

1.4.1 Combination of Power supply module and Driver module

The maximum number of driver modules and connected motors are limited by some terms below.

Total rated output of the connected motors

The sum of the rated output of connected motors should be kept equal or less than the rated output of power supply module.

E.g. MADM2A6KBX with 2 motors (MSMF104 and MSMF104), MADM2A6KBX with 2 motors (MSMF154 and MSMF154), MADM2AAKBX with 2 motors (MSMF204 and MSMF204) and MADM2AAKBX with 2 motors (MSMF304 and MSMF304), the total rated output of the connected motors is 15 kW (1 kW + 1 kW + 1.5 kW + 1.5 kW + 2 kW + 2 kW + 3 kW + 3 kW) and is applicable to MADMPN14.

Total DC-bus capacitance

The DC-bus maximum capacitance is specified for each model of power supply module. The total DC bus capacitance of the driver module and power supply module should be kept equal or less than the DC-bus maximum capacitance.

E.g. the sum of DC-bus capacitance of three MADM2AAKBX and MADMPN14 will be 2000 μ F, and it is less than 5000 μ F - the DC-bus maximum capacitance of MADMPN14.

The rated output and DC-bus capacitance are shown below.

Model No.	Rated output (kW)	DC-bus capacitance (μ F)
MADM2A4KBX	0.75, 2 axis	200
MADM2A6KBX	1.5, 2 axis	200
MADM2AAKBX	3.0, 2 axis	400
MBDM1ABKBX	5.0, 1 axis	820
MADMPN14	15	800
MBDMPN24	30	1,800

The DC-bus maximum capacitance are shown below.

Model No.	Rated output (kW)	DC-bus maximum capacitance (μ F)
MADMPN14	15	5,000
MBDMPN24	30	10,000

Maximum number of connectable driver modules

The maximum number of connectable driver modules is specified for each model of power module. The number of connected driver modules should be this maximum number or less. An alarm will be occur if the number of connected driver modules exceeds the maximum number.

The maximum number of connectable driver modules are shown below.

Model No.	Rated output (kW)	Maximum number of connectable driver module units
MADMPN14	15	10 units
MBDMPN24	30	20 units

1.4.2 Combination of Driver module and Motor

Input voltage (V)	Driver module input power DC (V)	Driver module frame symbol	Driver module part number	Maximum output per axis (W)	Applicable motor part number *** is motor specification	Motor rated output (W)
3-phase 400	560	A	MADM2A4KBX	750	MHMF044****	400
					MHMF084****	750
3-phase 400	560	A	MADM2A6KBX	1500	MGMF094****	850
					MSMF104****	1000
					MDMF104****	1000
					MHMF104****	1000
					MGMF134****	1300
					MSMF154****	1500
					MDMF154****	1500
					MHMF154****	1500
3-phase 400	560	A	MADM2AAKBX	3000	MSMF154****	1500
					MDMF154****	1500
					MHMF154****	1500
					MGMF184****	1800
					MSMF204****	2000
					MHMF204****	2000
					MDMF204****	2000
					MGMF204****	2400
					MSMF304****	3000
					MHMF304****	3000
3-phase 400	560	B	MBDM1ABKBX	5000	MDMF304****	3000
					MSMF304****	3000
					MHMF304****	3000
					MGMF294****	2900
					MSMF404****	4000
					MDMF404****	4000
					MHMF404****	4000
					MGMF444****	4400
					MSMF504****	5000
					MDMF504****	5000
					MHMF504****	5000

1.5 Installation

1.5.1 Power supply / Driver

Installation Place

- Install the driver in a control panel enclosed in noncombustible material and placed indoor where the product is not subjected to rain or direct sunlight. The products are not waterproof.
- Where the products are not subjected to corrosive atmospheres such as hydrogen sulfide, sulfurous acid, chlorine, ammonia, sulfur, chloric gas, sulfuric gas, acid, alkaline and salt and so on, and are free from splash of inflammable gas.
- Where the motor is free from grinding oil, oil mist, iron powder or chips.
- Well-ventilated and low humidity and dust-free place.
- Vibration-free place.
- Do not use benzine, thinner, alcohol, acidic cleaner and alkaline cleaner because they can discolor or damage the exterior case.

Environmental conditions

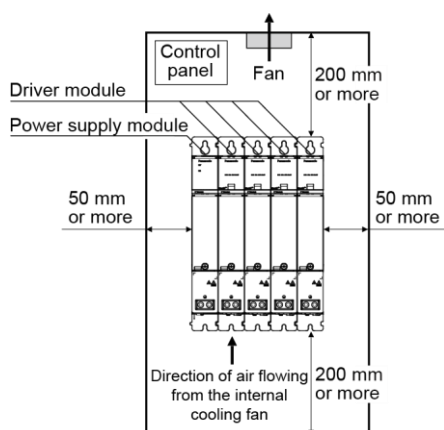
Item	Specification
Ambient temperature	0 °C to 40 °C (free from condensation)
Ambient humidity	20 % to 85 % RH (free from condensation)
Storage temperature	-20 °C to 55 °C (Max.temperature guarantee: 70 °C for 72 hours free from condensation)
Storage humidity	20 % to 85 % RH (free from condensation)
Vibration	Lower than 4.9 m/s ² (0.5 G), 10 Hz to 60 Hz
Altitude	Lower than 1000 m

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. Keep the space for the air flow.
- 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.
- Make sure to secure the cable so that there is no force on the connector.

Temperature around the drive

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 50 mm away from it, perform measurement at the midpoint in the clearance between the obstacle and the drive.

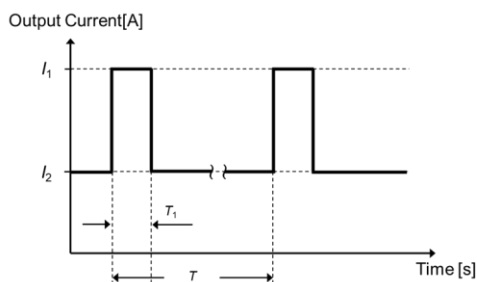
Working temperature range: 0 to 40 °C

Load conditions of power supply module

Output time limit of the power supply module is specified for overload condition. The maximum peak output current is 200% of the rated output current.

Keep the RMS value of the output current to 100% or less for no time limitation. See the figure below for a calculation example. Please refer to Rated output current in 1.1.6 specification Power supply module basic specifications.

-Example of calculating RMS value of output current



RMS value of output current (I_{rms}) is calculated by the following formula.

$$I_{rms} = \sqrt{\frac{1}{T} \int_0^T [I(t)]^2 dt} = \sqrt{\frac{1}{T} [(I_1^2 \times T_1) + (I_2^2 \times (T - T_1))]}$$

According to the formula below, keep the RMS value of the output current (I_{rms}) normalized by the rated output current (I_{rated}) to 100% or less.

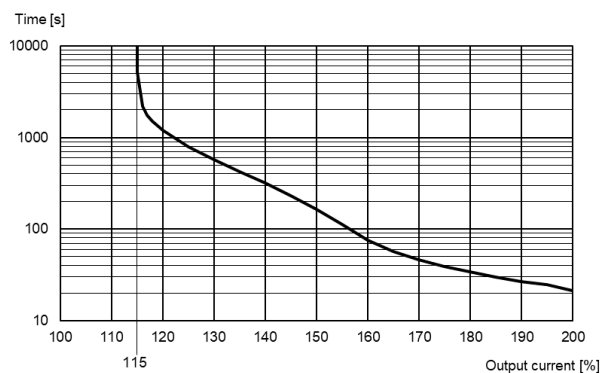
$$\frac{I_{rms}}{I_{rated}} \times 100[\%] \leq 100[\%]$$

If the RMS value of the output current exceeds 115%, output current overload protection for power supply module will be occurred.

Note) The protection is available after soft version 1.02.

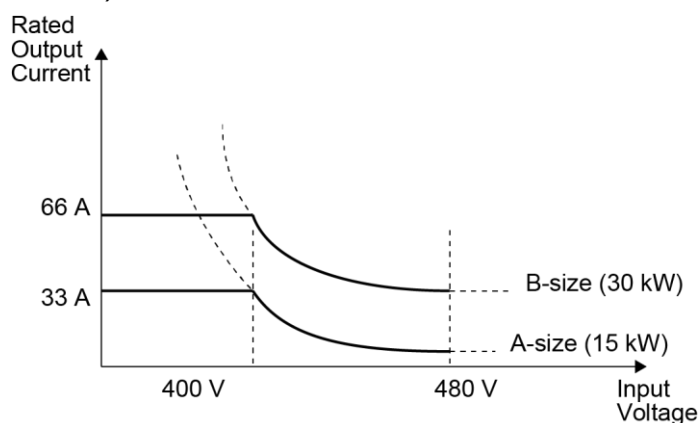
Protection time curve for overload condition is shown below. The curve is an example of step output from 0 % to certain current. Output current overload protection for power supply module will be occurred when the output time exceed the curve.

- Protection time curve for overload condition



Make sure that overload protection does not work by running continuously on the actual machine.

The output current will increase as the input voltage go down. Keep less than the rated current at 400 V AC when the input voltage go down. For example, the output at 380 V AC input will be 14.3 kW (= 15 kW * 380 V/400 V).



1.5.2 Motor

Installation Place

- Indoors, where the products are not subjected to rain or direct sun beam. The products are not waterproof.
- Where the products are not subjected to corrosive atmospheres such as hydrogen sulfide, sulfurous acid, chlorine, ammonia, sulfur, chloric gas, sulfuric gas, acid, alkaline and salt and so on, and are free from splash of inflammable gas.
- Where the motor is free from grinding oil, oil mist, iron powder or chips.
- Well-ventilated and humid and dust-free place, far apart from the heat source such as a furnace.
- Easy-to-access place for inspection and cleaning.
- Vibration-free place.
- Avoid enclosed place. Motor may get hot in those enclosure and shorten the motor life.

Environmental conditions

Item		Specification	
Ambient temperature		0 °C to 40 °C (free from condensation)	
Ambient humidity		20 % to 85 % RH (free from condensation)	
Storage temperature		-20 °C to 60 °C (Max.temperature guarantee: 80 °C for 72 hours free from condensation)	
Storage humidity		20 % to 85 % RH (free from condensation)	
Vibration (Note 1)	Motor only	Motor unit	49 m/s ² or less X,Y,Z directions But when the motor doesn't operate, 24.5 m/s ² or less. (At center of frame, 20 to 3000 Hz, with not more than 1.5 mm amplitude)
		Encoder connector unit and Motor connector unit	Acc. EN60068-2-6 98 m/s ² X, Y, Z directions (At mounting position, with the connectors mated) Frequency : 50 to 2000 Hz Frequency change speed : 1 Octave/min Test duration : 10 cycles each X, Y, Z directions
Impact	Motor only	Lower than 98 m/s ² (10 G)	
Enclosure rating	Motor only (Connector type)	IP67 (except rotating portion of output shaft and connecting pin part of the motor connector and the encoder connector)	
Altitude		Lower than 1000 m	

(Note 1) After mounting the device, ensure that the vibration resistance performance of the motor and connector meets the defined requirements.

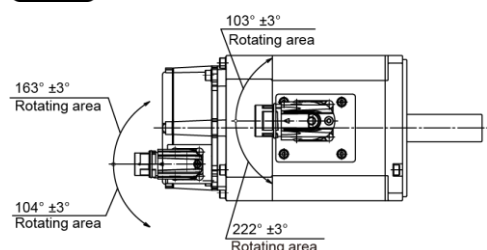
How to Install

You can mount the motor either horizontally or vertically as long as you observe the followings.

- (1) Horizontal mounting
Mount the motor with cable outlet facing downward for water/oil countermeasure.
- (2) Vertical mounting
Use the motor with oil seal when mounting the motor with gear reducer to prevent the reducer oil/grease from entering to the motor.
- (3) For the dimensions and mass of the product, which are necessary design data of the mounting section, refer to the dimensional outline drawing on the operation manual or specifications.



◆ NOTE



- Motor connector and Encoder connector have limited range of movement.
- Don't move beyond stated value.

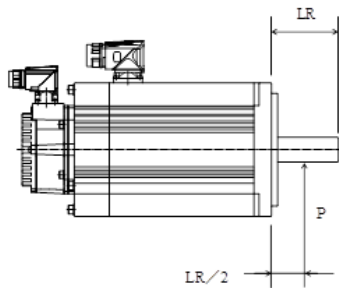
1.6 Permissible Load at Output Shaft

Assembling precision

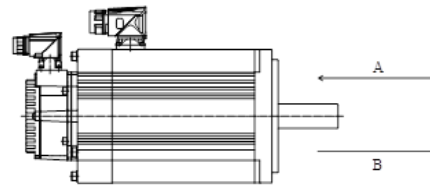
- In accordance with the outline drawings.
 - The axial runout is measured in the lateral direction of the shaft.
 - The flange surface squareness and spigot eccentricity are measured in the vertical direction of the shaft.
- End play (axial play) : 0.3 mm or less. (Reference value)

Shaft allowable load

Radial load (P) position



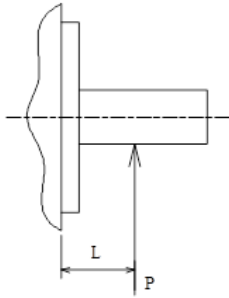
Thrust load direction



Motor	When assembling			When operating	
	Radial load	Thrust load		Radial load	Thrust load
		Direction A	Direction B		
MSMF104, MSMF154, MSMF204, MSMF304	980	588	686	490	196
MSMF404, MSMF504				784	343
MDMF104, MDMF154, MDMF204	980	588	686	490	196
MDMF304				784	343
MDMF404, MDMF504	1666	784	980		
MGMF094, MGMF134, MGMF184	980	588	686	686	196
MGMF244, MGMF294	1666	784	980	1176	490
MGMF444				1470	
MHMF104, MHMF154	980	588	686	490	196
MHMF204, MHMF304, MHMF404, MHMF504	1666	784	980	784	343

(Note) Please refer to the outline drawings for dimensions LR.

When a load position is changed, calculate allowable radial load P by the following relational expression, using load position's distance L from the mounting flange surface, and set the load below a value resulting from such calculation.



Unit : P [N], L [mm]

Applicable models	Relational expression of load and load position
MSMF104, MSMF154, MSMF204, MSMF304	$P = \frac{20090}{L+13.5}$
MSMF404, MSMF504	$P = \frac{36848}{L+14.5}$
MDMF104, MDMF154, MDMF204	$P = \frac{19110}{L+11.5}$
MDMF304	$P = \frac{34496}{L+11.5}$
MDMF404, MDMF504	$P = \frac{42336}{L+19}$
MGMF094, MGMF134, MGMF184	$P = \frac{26754}{L+11.5}$
MGMF244, MGMF294	$P = \frac{63504}{L+19}$
MGMF444	$P = \frac{79380}{L+19}$
MHMF104, MHMF154	$P = \frac{22785}{L+11.5}$
MHMF204, MHMF304, MHMF404, MHMF504	$P = \frac{42336}{L+19}$

2

Preparation

2.1 Conformance to international standards

2.1.1 Conformed Standards

Standard		Driver	Motor
EU Directive/ UK Regulation	EMC Directive / EMC Regulation	EN 61000-6-2 EN 61800-3	
	Low Voltage Directive / Low Voltage Regulation	EN 61800-5-1	EN 60034-1 EN 60034-5
	Machinery Directive / Machinery Regulation Functional safety	EN ISO 13849-1:2015 (Cat 4 PL e) EN 61508 (SIL 3) EN IEC 62061 (maximum SIL 3) EN 61800-5-2 EN 61326-3-1 EN 60204-1	
UL standard		UL 61800-5-1 (file No. E164620)	UL1004-1, UL1004-6 (File No. E327868)
CSA standard		C22.2 No.274	C22.2 No.100
Radio Waves Act of South Korea (KC)		KN 61800-3	

 Note

EN : Europaischen Norman

EMC : Electromagnetic Compatibility

UL : Under writers Laboratoris

CSA : Canadian Standards Association

2.1.2 Functional safety

The parameter of functional safety shown below.

	System model without depending on the encoder		System model with single non-safety encoder	System model with double non-safety encoders
1st encoder	Panasonic A6 enconder	Panasonic A6 enconder	Panasonic A6 enconder	Panasonic A6 enconder
2nd encoder	None	• Third party (Panasonic format) • ABZ • EnDat2.2 (non-safety) • SSI	None	• Third party (Panasonic format) • ABZ • EnDat2.2 (non-safety) • SSI
Safety Integrity Level (EN 61508 / EN IEC 62061)	SIL 3 / maximum SIL 3	SIL 3 / maximum SIL 3	SIL 2 / maximum SIL 2	SIL 3 / maximum SIL 3
Performance Level (EN ISO 13849-1:2015)	Cat. 3 PL e Cat. 4 PL e	Cat. 3 PL e Cat. 4 PL e	Cat. 3 PL d	Cat. 3 PL e Cat. 4 PL e
Safety Function	STO,SBC	STO,SBC	SS1,SLS,SSM,SSR	SS1, SLS, SSR, SSM, SS2, SOS, SLI, SDI, SLA, SAR
Probability of dangerous failure (PFH)	2.2×10^{-8} [1/h]	2.2×10^{-8} [1/h]	4.6×10^{-8} [1/h]	2.2×10^{-8} [1/h]
Mean time to dangerous failure (MTTFd)	100 [years] : High	100 [years] : High	100 [years] : High	94 [years] : High
Average diagnostic coverage (DCavg)	97 [%] : High	97 [%] : High	96 [%] : High	98 [%] : High
Mission time	20 years	20 years	20 years	20 years

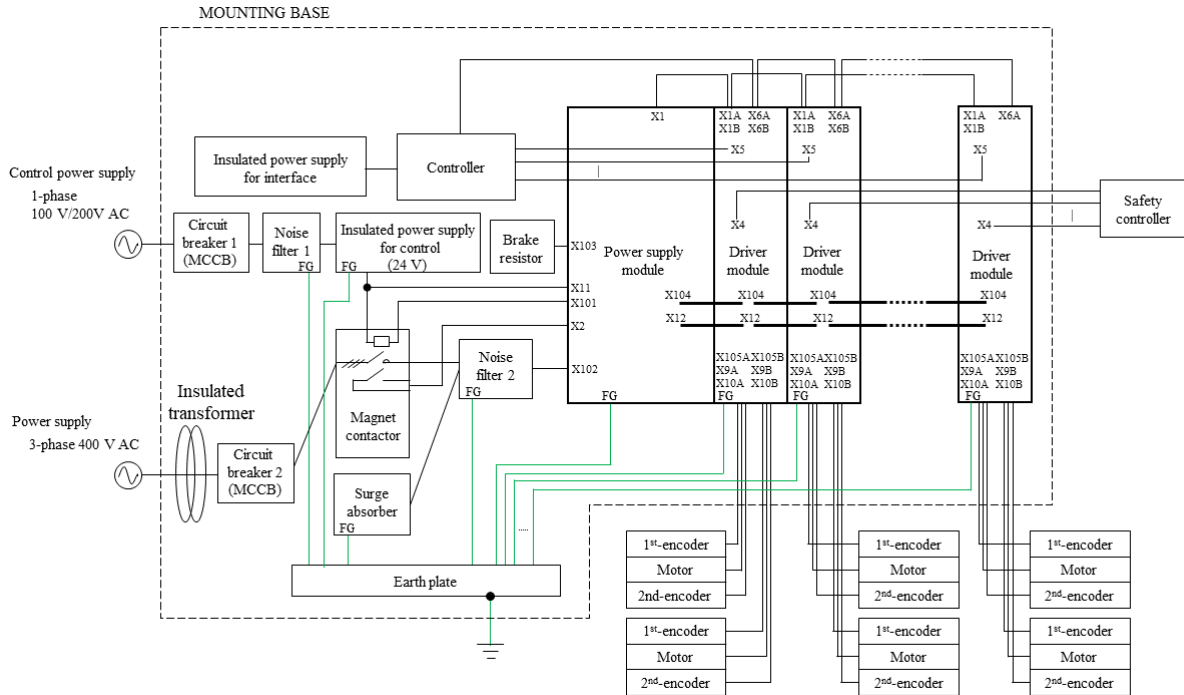
2.1.3 EU Directive / UK Regulation

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

Compliance with the EMC Directive / Regulation

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 / Regulation, use a noise filter, surge absorber. To make the machines and devices comply with the EMC Directive / Regulation, 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.

Power supply

400 V AC TN system	3-phase 380 V to 480 V	+10%	50/60 Hz
		-15%	

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

Molded-case circuit breaker 2 (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.

Examples of MCCB are shown below.

No.	Model No.	MCCB Type	Manufacturer	Home page
1	MADMPN14	BW103E0-75	Fuji Electric FA Components & Systems Co., Ltd.	https://www.fujielectric.co.jp/fcs/
2	MBDMPN24	BW163E0-125		

The load condition of example is 200%. Please select circuit breakers by the actual machine.

Insulated power supply for control (24 V)

Recommended components:

Manufacturer	Manufacturer part number	Applicable module	Home page
OMRON Corporatoin	S8VK-S series	A - size B - size	https://www.fa.omron.co.jp

Noise filter 1

When using multiple units of servo drive 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	Home page
OMRON Corporatoin	S8V-NF series	A - size B - size	https://www.fa.omron.co.jp

* "S8V-NFS206" was used in the EMC compliance tests.

Noise filter 2

When using multiple units of servo drive 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	Home page
Schaffner EMC K.K.	FN3288 series	3-phase 400 V AC	A - size B - size	https://www.schaffner.jp/

* "FN3288-80-34-C35-R65" was used in the EMC compliance tests.

Surge absorber

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

■ Remark

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	Home page
SOSHIN ELECTRIC CO., LTD.	LT-C35G102WS	3-phase 400 V AC	A - size B - size	http://www.soshin.co.jp/

Motor cable

Recommended components:

Manufacturer	Manufacturer part number	Applicable module	Home page
LAPP Japan K.K.	ÖLFLEX SERVO FD 796 CP	A - size B - size	https://lappjapan.lappgroup.com/

Encoder cable

Recommended components:

Manufacturer	Manufacturer part number	Applicable module	Home page
LAPP Japan K.K.	ÖLFLEX SERVO FD 798 CP	A - size B - size	https://lappjapan.lappgroup.com/

Grounding

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

2.1.4 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).

2.1.5 Harmonic suppression measures

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

2.2 System Configuration and Wiring

2.2.1 Wire diameter and maximum wiring length

Name	Symbol	Maximum wiring length (Note 1)	Applicable wire (Note 2)
External device signal input connector	X2	3 m	0.2 to 1.5 mm ²
DC24 V control power supply connector	X11	-	2.5 to 16 mm ² , 300 V
Contactor control output connector	X101	3 m	0.2 to 2.5 mm ² , 300 V
Main power supply connector	X102	-	2.5 to 16 mm ² , 600 V
Regenerative braking resistor connector	X103	3 m	2.5 to 16 mm ² , 600 V
I/O signal connector	X4	20 m	0.2 to 1.5 mm ²
Safety I/O connector	X5	20 m	0.2 to 1.5 mm ²
EtherCAT communication connector	X6A, X6B	100 m	TIA/EIA-568 CAT5e STP
1st Encoder connector	X9 (X9A, X9B)	50 m In case of using Batteryless encoder, Power supply 1.0 to 1.25mm ²	Common shielded twisted pair wire • Power supply 0.5 to 1.25 mm ² • Signal 0.25 to 1.25 mm ²
2nd Encoder connector	X10 (X10A, X10B)	20 m	Common shielded twisted pair wire • Power supply 0.25 mm ² or more • Signal 0.25 mm ² or more (Note 2)
Motor output connector	X105 (X105A, X105B)	50 m  Note The total length of motor cables connected to all drive modules is 300 m	- Motor 0.5 to 6.0 mm² 600 V Select wire suitable for the motor - Brake 0.2 to 1.5 mm² 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) Select wire suitable for the actual current.

2.2.2 Wire processing

Plug connector is available shown below.

Name	Symbol	Product type	Manufacturer	Manufacturer part number	Panasonic option number
1st encoder connector	X9 (X9A, X9B)	Receptacle	3M Japan Limited	3E206-0100 KV	DV0PM20010
		Shell kit	3M Japan Limited	3E306-3200-008	
2nd 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 2nd encoder connector.

For wiring the 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.

■ **External device signal input: X2 (B2CF 3.50)**

Manufacturer part number	Ordering number (Weidmüller)	Wire cross section (mm ²)	Contact surface (mm)
H0,25/12 HBL	9025760000	0.25	8
H0,34/12 TK	9025770000	0.34	8
H0,5/16 OR	9025870000	0.50	10
H0,75/18 W	9025910000	0.75	12
H1,0/18 GE	9025930000	1.0	12

■ **DC24 V control power supply: X11, Main power supply: X102, Regenerative braking resistor connector: X103 (BUF 10.16IT)**

Manufacturer part number	Ordering number (Weidmüller)	Wire cross section (mm ²)	Contact surface (mm)
H2,5/25D BL	9019180000	2.5	18
H4,0/26D GR	9019210000	4.0	18
H6,0/26 SW	0565700000	6.0	18
H10,0/28 EB	0565800000	10	18
H16/28 GN	0566000000	16	18

■ **Contactor control output: X101 (BLF5.08)**

Manufacturer part number	Ordering number (Weidmüller)	Wire cross section (mm ²)	Contact surface (mm)
H0,25/12 HBL	9025760000	0.25	8
H0,5/16 OR	9025870000	0.50	10
H0,75/16 W	9025860000	0.75	10
H1,0/16D R	9019100000	1.0	10
H1,5/16 R	0635100000	1.5	10
H2,5/10	9004080000	2.5	10

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

Manufacturer part number	Ordering number (Weidmüller)	Wire cross section (mm ²)	Contact surface (mm)
H0,25/12 HBL	9025760000	0.25	8
H0,34/12 TK	9025770000	0.34	8
H0,5/16 OR	9025870000	0.50	10
H0,75/18 W	9025910000	0.75	12
H1,0/18 GE	9025930000	1.0	12

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

Manufacturer part number	Ordering number (Weidmüller)	Wire cross section (mm ²)	Contact surface (mm)
H0,5/18 OR	1076980000	0.50	12
H0,75/18 W	9025910000	0.75	12
H1,0/18 GE	9025930000	1.0	12
H1,5/18D SW	9019140000	1.5	12
H2,5/19D BL	9019170000	2.5	12
H4,0/20D GR	9019200000	4.0	12
H6,0/20 SW	0533500000	6.0	12

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

Manufacturer part number	Ordering number (Weidmüller)	Wire cross section (mm ²)	Contact surface (mm)
H0,25/12 HBL	9025760000	0.25	8
H0,34/12 TK	9025770000	0.34	8
H0,5/14 OR	0690700000	0.50	8
H0,75/14 W	0462900000	0.75	8
H1,0/14 GE	0463000000	1.0	8
H1,5/14 R	0463100000	1.5	8

■ Recommended crimping tools

Manufacturer part number	Ordering number (Weidmüller)	Applicable wire cross section (mm ²)
PZ 3	0567300000	0.50 to 6.0
PZ 4	9012500000	0.50 to 4.0
PZ 6/5	9011460000	0.25 to 6.0
PZ 6Roto L	1444050000	0.14 to 6.0
PZ 10 HEX	1445070000	0.14 to 10
PZ 10 SQR	1445080000	0.14 to 10
PZ16	9012600000	6.0 to 16
PZ50	9006450000	25 to 50

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 for protection earth

Screw size	Recommended torque
M6	2.5 to 3.0 N·m

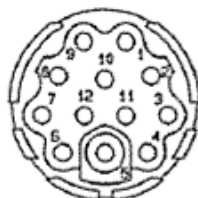
For locking the bus bar cover, the screw is M4. Make sure to tighten the screw scan with the recommended torque.

Screw for bus bar cover

Screw size	Recommended torque
M4	0.4 to 0.6 N·m

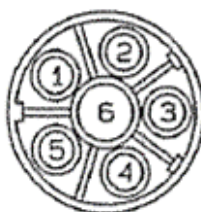
2.2.3 Specifications of Motor Angled receptacles and Encoder Angled receptacles

■ Encoder: AGC047N0000050A000 (TE Connectivity Ltd.)



Pin No.	Signal
1	E0 V
2	E5 V
3	PS(SD)
4	PS(SD)
5	NC
6	NC
7	BAT -
8	BAT +
9	FG
10	NC
11	NC
12	NC

■ Motor: BGC106N00001100000 (TE Connectivity Ltd.)



without brake	Pin No.	Signal
	1	NC
	2	NC
	3	E
	4	U
	5	V
with brake	6	W
	Pin No.	Signal
	1	Brake
	2	Brake
	3	E
	4	U
	5	V
	6	W

2.2.4 Assembly instructions

2.2.4.1 B2CF and BLF series / Symbol [X2], [X4], [X5], [X101]

■ External device signal input: X2 (B2CF 3.50)

Manufacturer part number	Ordering number (Weidmüller)	Wire cross section (mm ²)	Contact surface (mm)
H0,25/12 HBL	9025760000	0.25	8
H0,34/12 TK	9025770000	0.34	8
H0,5/16 OR	9025870000	0.50	10
H0,75/18 W	9025910000	0.75	12
H1,0/18 GE	9025930000	1.0	12

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

Manufacturer part number	Ordering number (Weidmüller)	Wire cross section (mm ²)	Contact surface (mm)
H0,25/12 HBL	9025760000	0.25	8
H0,34/12 TK	9025770000	0.34	8
H0,5/16 OR	9025870000	0.50	10
H0,75/18 W	9025910000	0.75	12
H1,0/18 GE	9025930000	1.0	12

■ Contactor control output: X101 (BLF 5.08)

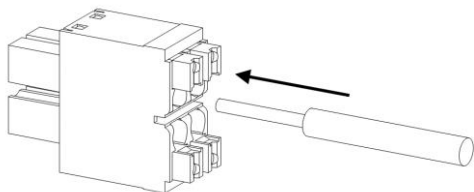
Manufacturer part number	Ordering number (Weidmüller)	Wire cross section (mm ²)	Contact surface (mm)
H0,25/12 HBL	9025760000	0.25	8
H0,5/16 OR	9025870000	0.50	10
H0,75/16 W	9025860000	0.75	10
H1,0/16D R	9019100000	1.0	10
H1,5/16 R	0635100000	1.5	10
H2,5/10	9004080000	2.5	10

■ Recommended tool

- Screwdriver blade 0.4 × 2.5
- Screwdriver blade standard DIN 5264

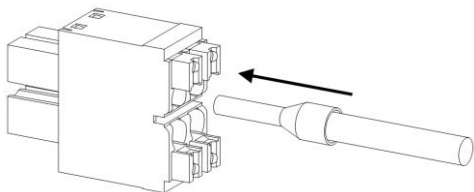
■ Connecting solid conductors

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



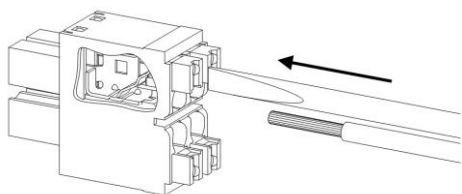
■ Connecting conductors with wire-end ferrule

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.

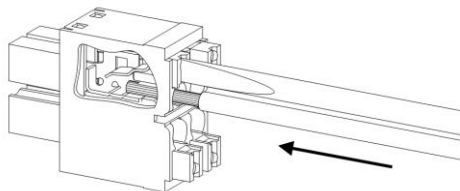


■ **Connecting flexible conductors**

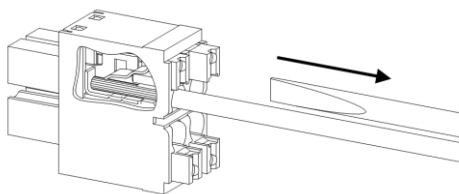
1. Open the contact point by activating the push-button (slider/pusher).



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



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



2.2.4.2 BUF series / Symbol [X11], [X102], [X103]

- DC24 V control power supply: X11, Main power supply: X102, Regenerative braking resistor connector: X103 (BUF 10.16IT)

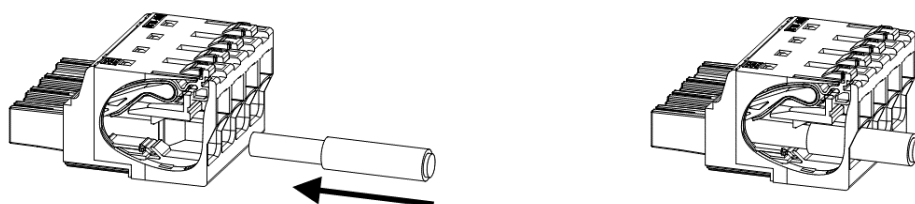
Manufacturer part number	Ordering number (Weidmüller)	Wire cross section (mm ²)	Contact surface (mm)
H2,5/25D BL	9019180000	2.5	18
H4,0/26D GR	9019210000	4.0	18
H6,0/26 SW	0565700000	6.0	18
H10,0/28 EB	0565800000	10	18
H16/28 GN	0566000000	16	18

■ **Recommended tool**

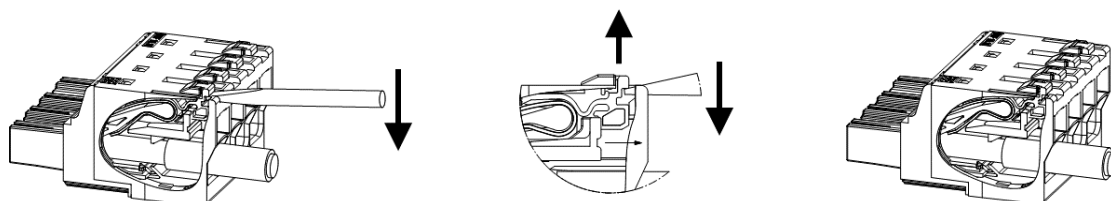
- Screwdriver blade 0.8 × 4.0
- Screwdriver blade standard DIN 5264

■ **Connecting conductors**

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

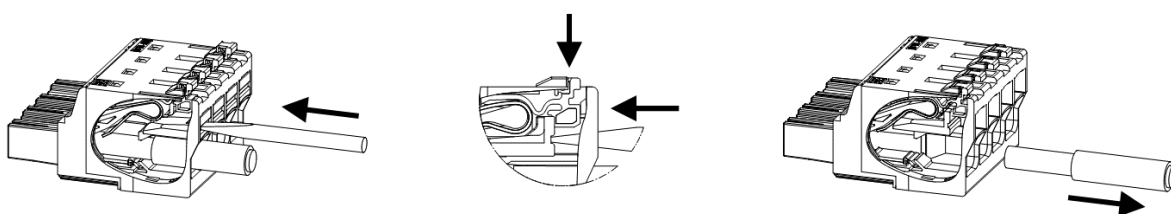


2. Closing clamping unit: Unlock the engaged push-button (slider/pusher) by levering the locking feature. Make sure that the conductor is inserted up to the end stop and ensure by gently pulling on the conductors that the clamping unit is securely engaged.

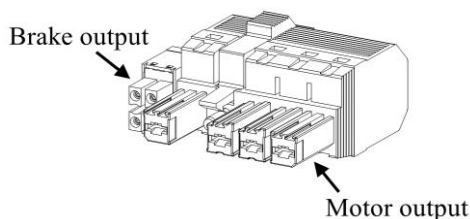


■ **Releasing conductors**

To open the clamping unit press the screwdriver individually onto the push-button (slider/pusher) until it is engaged and remove the conductor.



2.2.4.3 BVFL series / Symbol [X105]



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

Manufacturer part number	Ordering number (Weidmüller)	Wire cross section (mm ²)	Contact surface (mm)
H0,25/12 HBL	9025760000	0.25	8
H0,34/12 TK	9025770000	0.34	8
H0,5/14 OR	0690700000	0.50	8
H0,75/14 W	0462900000	0.75	8
H1,0/14 GE	0463000000	1.0	8
H1,5/14 R	0463100000	1.5	8

▼ Refer to

See section "2.2.4.1 B2CF and BLF series / Symbol [X2], [X4], [X5], [X101]".

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

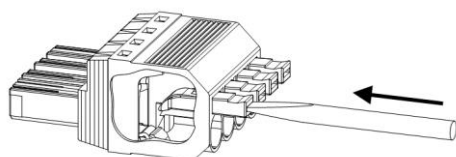
Manufacturer part number	Ordering number (Weidmüller)	Wire cross section (mm ²)	Contact surface (mm)
H0,5/18 OR	1076980000	0.50	12
H0,75/18 W	9025910000	0.75	12
H1,0/18 GE	9025930000	1.0	12
H1,5/18D SW	9019140000	1.5	12
H2,5/19D BL	9019170000	2.5	12
H4,0/20D GR	9019200000	4.0	12
H6,0/20 SW	0533500000	6.0	12

■ Recommended tool

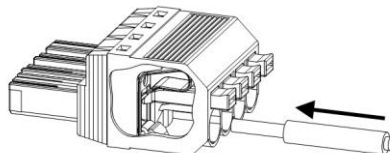
- Screwdriver blade 0.6 × 3.5
- Screwdriver blade standard DIN 5264

■ Connecting flexible conductors

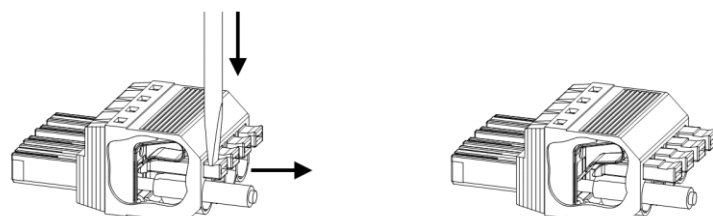
1. Opening clamping unit: Press the screwdriver individually onto the push-button (slider/pusher) until it is engaged.



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

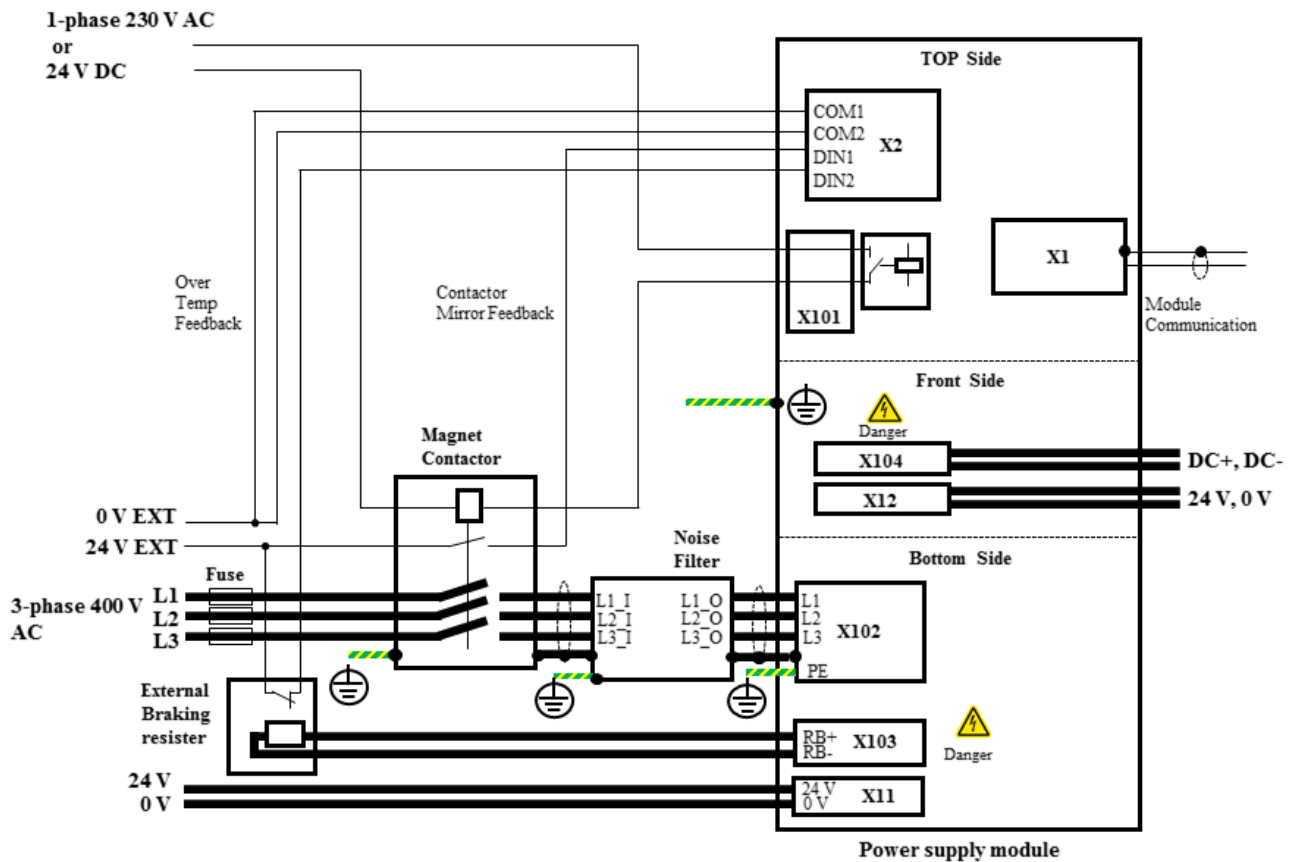


3. Closing clamping unit: Lock the clamping unit by vertically pressing onto the push-button (slider/pusher). Make sure that the conductor is inserted up to the end stop and ensure by gently pulling on the conductors that the clamping unit is securely engaged.



2.2.5 Precautions for wiring

Wiring the connectors and the terminal blocks

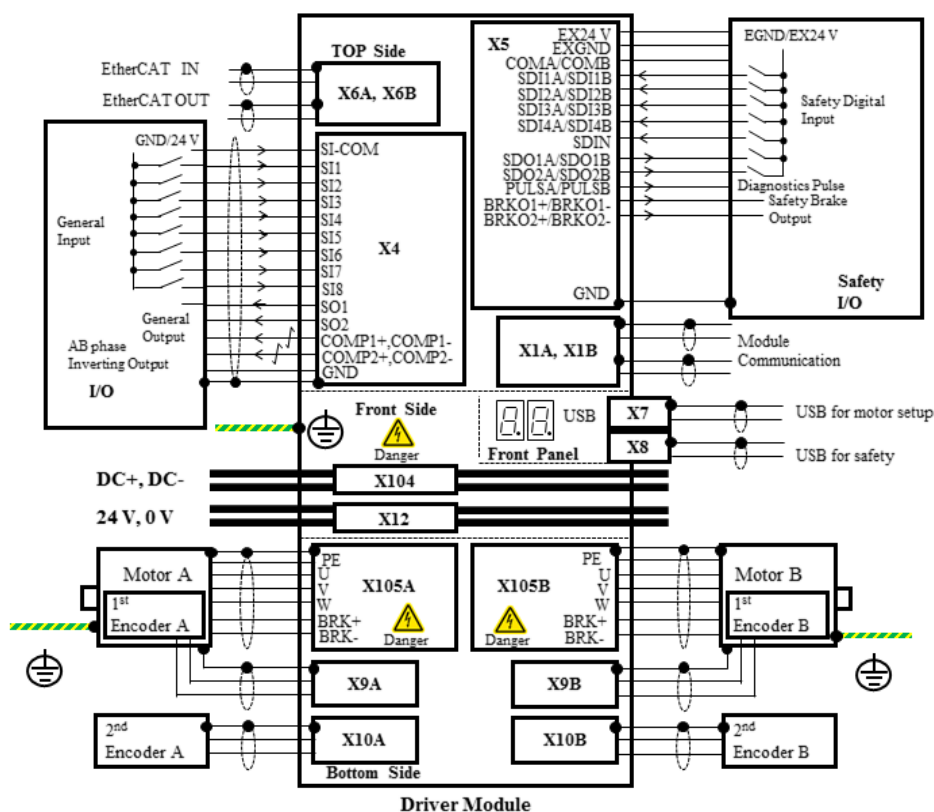


- Insert the connector securely until it is locked.
- Apply power supply voltage as specified in the rating plate.
- High voltage is applied to power connectors X102, X103, X104. Make sure not to touch them. There is a risk to get an electric shock.
- The short circuit current for the power supply to be used should be equal to or less than the maximum input voltage of the product, and the symmetrical current should be 5000 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.
- Make sure to connect the earth terminal of the motor and 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 Ω . 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.
- To prevent noise, insert a surge absorber in the electromagnetic contactor installed around the power supply, the coil between relay contacts of the motor with brake.
- Install a molded-case circuit-breaker (MCCB), and in an emergency, be sure to shut off supply outside the power supply module.
When using an earth leakage breaker, take measures against high frequency.
- To reduce noise voltage of the terminal, install a noise filter.
- Apply power supply voltage after completing wiring.

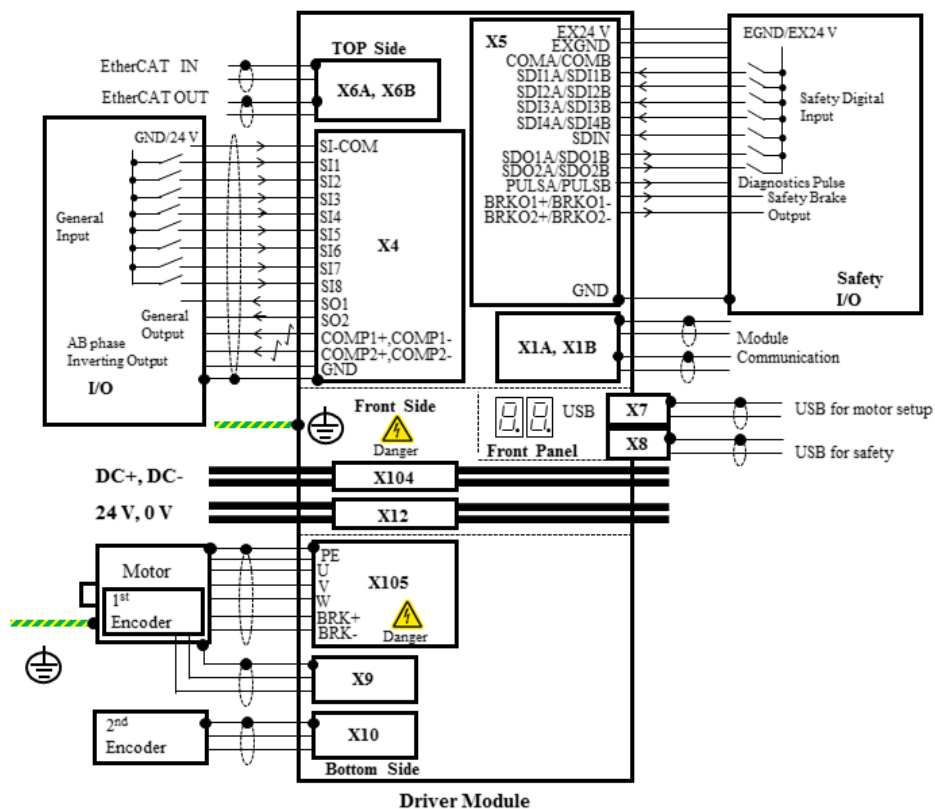
Wiring to the power connector and the terminal block

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.

■ A-size



■ B-size



- Insert the connector securely until it is locked.
- Apply power supply voltage as specified in the rating plate.
- Do not ground or short-circuit the motor output terminals (U, V, and W) each other.
- High voltage is applied to power connectors X104, X105. Make sure not to touch them. There is a risk to get an electric shock.
- 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 5000 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.
- 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).
- 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 Ω . 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.
- 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.
- 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.
- To reduce noise voltage of the terminal, install a noise filter.
- Apply power supply voltage after completing wiring.

2.3 Regenerative braking resistor

2.3.1 Regenerative braking resistor selection

Select a regenerative resistor with values in the following table below.

Model No.	Resistor value
MADMPN14	15 Ω , 10 kW
MBDMPN24	8 Ω , 20 kW

The power capacity of this resistor is a design value that assume continuous regeneration, so select it according to actual use conditions.

Make sure the following:

1. Check the surface temperature according to the specifications of the resistor used.
2. Do not place flammable materials in the surrounding area because the resistance generates heat.
3. Connect an appropriate wire between the power supply module and the resistor.

E.g. the peak current will be 53 A ($= 800 \text{ V}/15 \Omega$). Select the wire AWG 10/5.5 mm² in case of wire with UL 1015 (105 °C, 600 V).

2.3.2 Detailed regenerative resistor selection

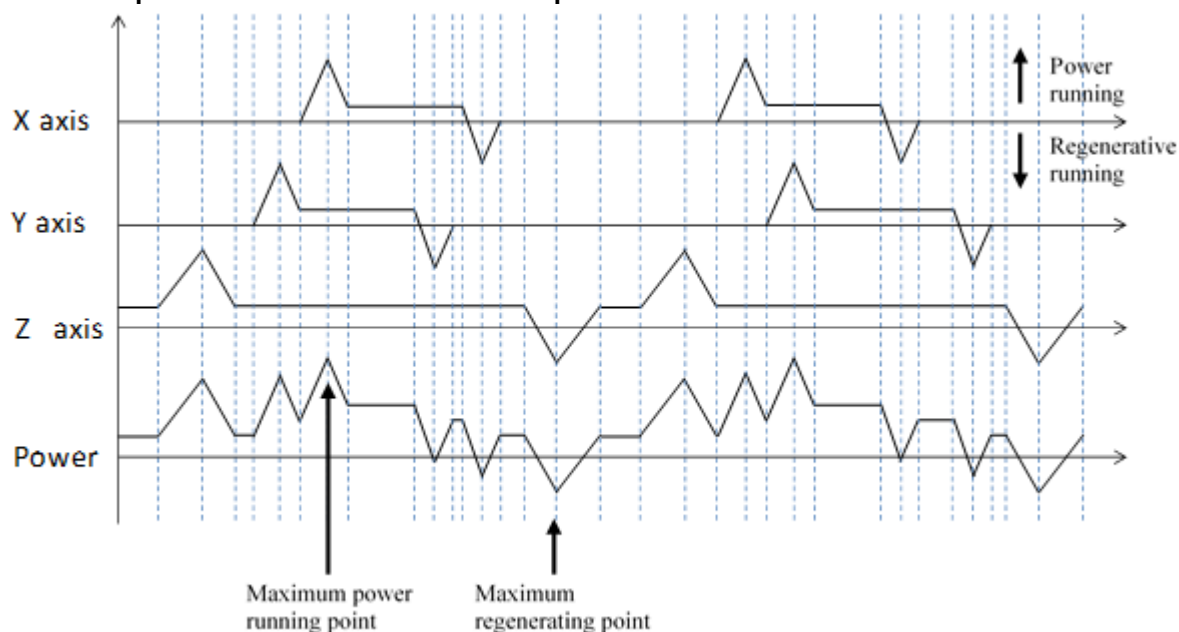


◆ PROCEDURE

1. Decide the resistance value. Do not select a resistance less than the values in the table below.

No.	Model No.	Minimum resistance value
1	MADMPN14	15 Ω
2	MBDMPN24	8 Ω

2. Draw the operating patterns of each motor. For example, xyz system is shown below. Then add the output of each motor to draw all the power.



3. The power of maximum regenerating point will be power consumption at regenerative braking resistor. Take 1.5 times to twice margin for power capacity.



◆ NOTE

- To make the regenerative braking resistor small, calculate the time average of regenerative power. It is applicable if the frequency of regenerative running is low. And check the instant tolerance of the resistor to avoid fires. Please thoroughly verify it with the actual machine.
- For thermal protection of the regenerative braking resistor, recommend providing thermostat on the resistor. Thermostat signal input is also available.
- Optional parts shown below are available. Use them by combination, when rated power of regenerative resistor is not enough.

No.	Panasonic option number	Manufacturer part number	Specifications					Activation temperature of built-in thermal protector
			Resistance	Cable core Outside diameter	Mass	Rated power (reference) (Note 1)		
						Free air	With fan 1 m/s	
1	DV0P4285	RH450F	20 Ω	Φ 1.27 mm AWG18 stranded wire	1.2 kg	52 W	130 W	140 ± 5 °C B-contact Open/Close capacity (resistance load) 1 A 125 V AC 6000 times 0.5 A 250 V AC 10000 times
2	DV0PM20049	RH450F	80 Ω		1.2 kg	65 W	190 W	

Manufacturer: [Iwaki Musen Kenkyusho Co., Ltd.](#)

(Note 1) Power with which the driver can be used without activating the built-in thermal protector.

A built-in thermal fuse and a thermal protector are provided for safety.

The circuit should be so designed that the power supply will be turned off as the thermal protector operates.

The built-in thermal fuse blows depending on changes in heat dissipation condition, operating temperature limit, power supply voltage or load.

Mount the regenerative resistor on a machine operating under aggressive regenerating condition (high power supply voltage, large load inertia, shorter deceleration time, etc.) and make sure that the surface temperature will not exceed 100 °C.

Attach the regenerative resistor to a nonflammable material such as metal.

Cover the regenerative resistor with a nonflammable material so that it cannot be directly touched.

Temperatures of parts that may be directly touched by people should be kept below 70 °C.

2.3.3 Compliance with the UL standard

• 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.

• 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 5000 A or less.

• Branch circuit protection

Protect the branch circuit in accordance with the NEC and the local standard.

• 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.

2.4 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.



◆ NOTE

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

3

Connection

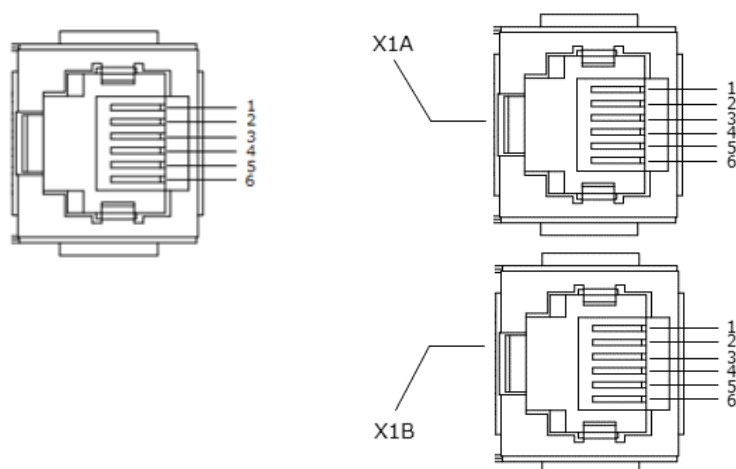
3.1 Common to modules

3.1.1 Cross communication connector X1, X1A, X1B

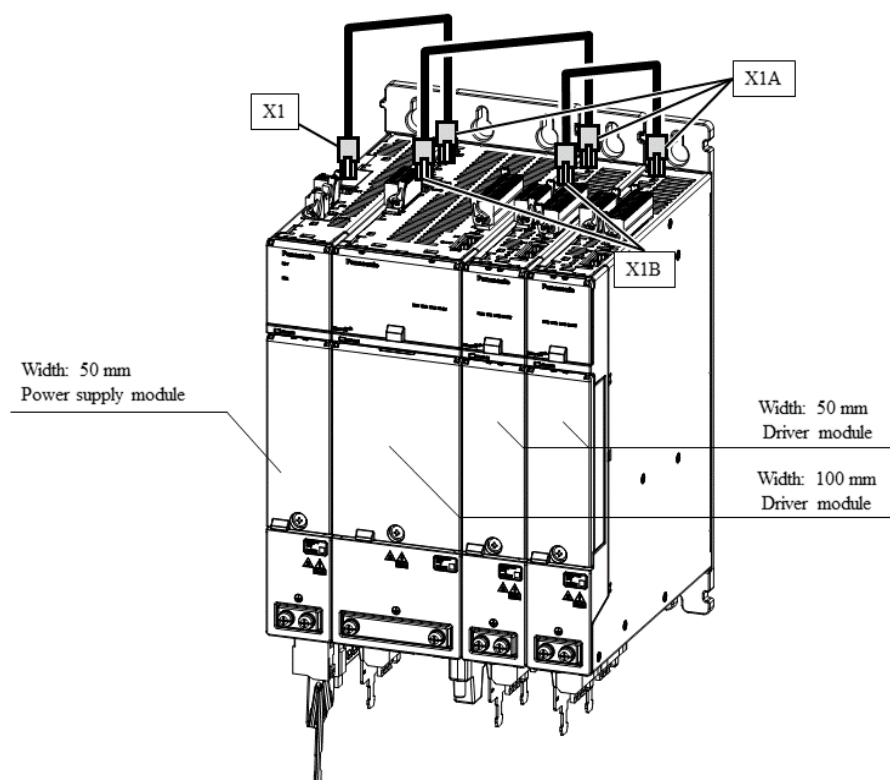
Pin No.	Symbol	Polarity	Description
1	DATA+	IN/OUT	Only for system-internal usage/communication.
2	DATA-	IN/OUT	
3	SYNC+	IN/OUT	
4	SYNC-	IN/OUT	
5	EMG	IN	
6	SG	-	

- Connect the Cross communication cable from X1 to X1A of the next driver module.
- 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 X1, X1A, X1B



■ Description of Cross communication cable connection

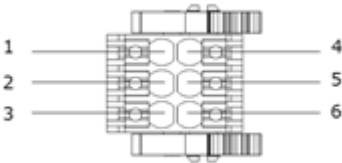


3.2 Power supply module

3.2.1 External device signal input connector X2

Pin No.	Symbol	Polarity	Description
1	DIN1	IN	Digital input 1 for magnet contactor feedback
2	DIN2	IN	Digital input 2 for braking resistor temperature feedback
3	FG	-	Frame ground
4	COM1	-	Digital input common 1
5	COM2	-	Digital input common 2
6	Not used	-	-

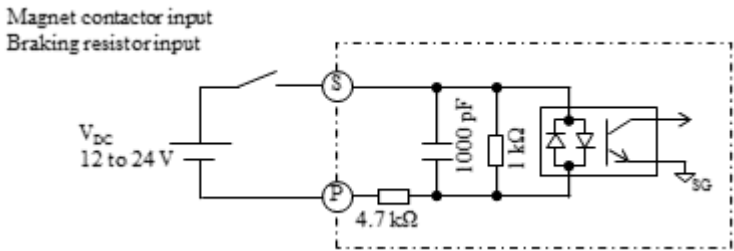
■ Terminal pin assignment of external device signal input connector X2



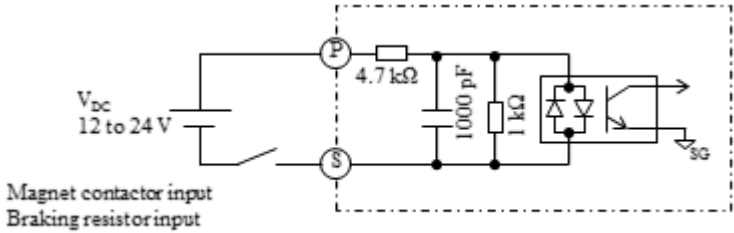
When temperature monitoring of the regenerative resistor is not used, change the parameter setting (PSM Pr. 05).

■ i-1: Digital input

Source output connection



Sink output connection

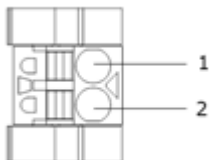


S	Terminal No. 1, 2
P	Terminal No. 4, 5

3.2.2 Contactor control output connector X101

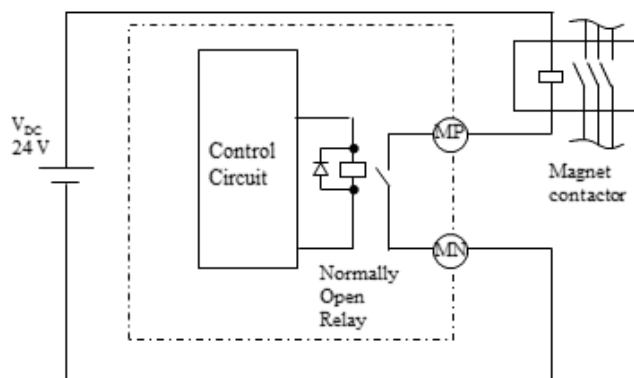
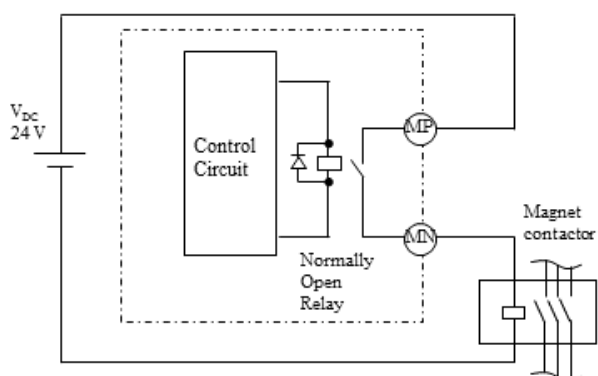
Pin No.	Symbol	Polarity	Description
1	MC1	-	Magnet contactor output 1
2	MC2	-	Magnet contactor output 2

■ Terminal pin assignment of Contactor control output connector X101

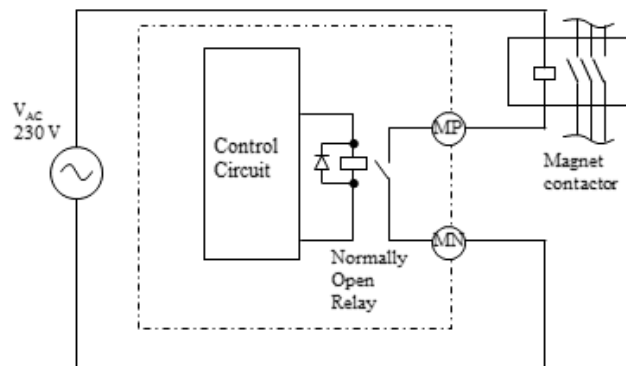
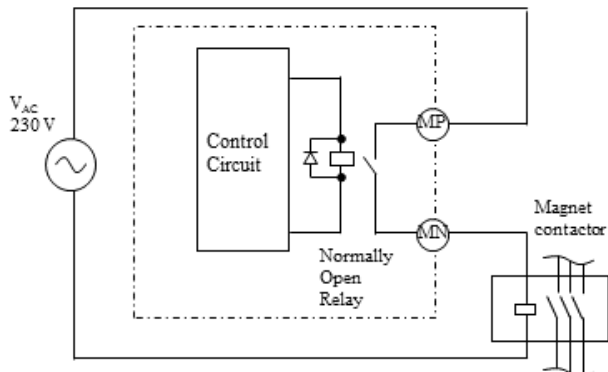


When magnet contactor is not used, change the parameter setting (PSM Pr. 04).

■ For control voltage 24 V DC



■ For control voltage 230 V AC



MN	Terminal No. 1
MP	Terminal No. 2

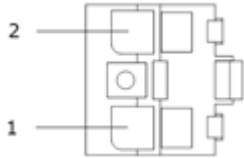
▶ Note

Connect a varistor compatible with the contactor to protect the internal contact from contactor surge.

3.2.3 DC24 V control power supply connector X11

Pin No.	Symbol	Polarity	Description
1	0 V	-	External ground
2	+24 V	-	+24 V Control supply

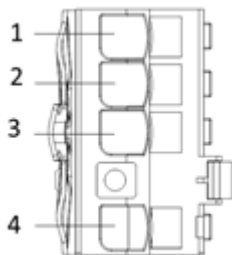
■ Terminal pin assignment of DC24 V control power supply connector X11



3.2.4 Main power supply connector X102

Pin No.	Symbol	Polarity	Description
1	L3	-	Main power supply input L3
2	L2	-	Main power supply input L2
3	L1	-	Main power supply input L1
4	PE	-	Protective earth

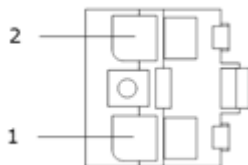
■ Pin assignment of main power supply connector X102



3.2.5 Regenerative braking resistor connector X103

Pin No.	Symbol	Polarity	Description
1	RB-	-	Regenerative braking resistor connector -
2	RB+	-	Regenerative braking resistor connector +

■ Terminal pin assignment of regenerative braking resistor connector X103



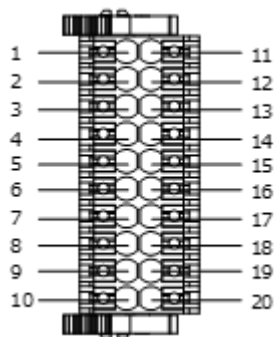
When regenerative resistor is not used, change the parameter setting (PSM Pr. 00).

3.3 Driver module

3.3.1 I/O signal connector X4

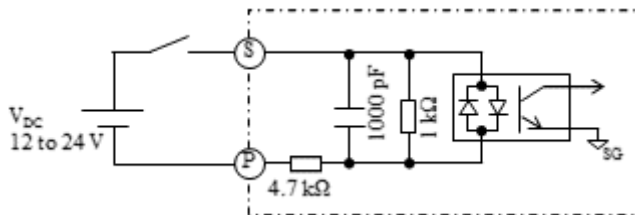
Pin No.	Symbol	Polarity	Description
1	SI1	IN	General purpose digital input
2	SI2	IN	General purpose digital input
3	SI3	IN	General purpose digital input
4	SI4	IN	General purpose digital input
5	SI-COM	-	-
6	COMP1+	OUT	Position comparison output1+
7	COMP2+	OUT	Position comparison output2+
8	SO1+	OUT	General 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

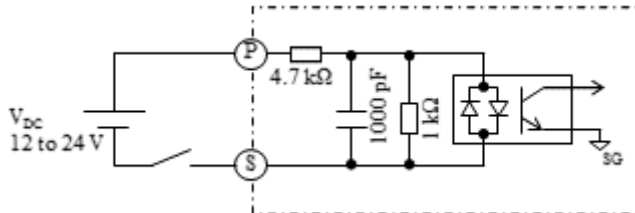


■ i-1: General purpose input

Source output connection



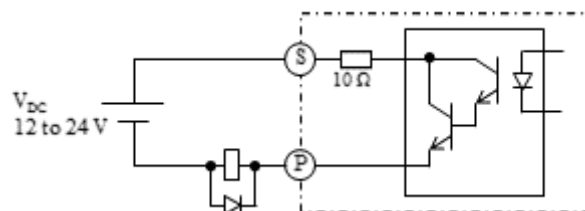
Sink output connection



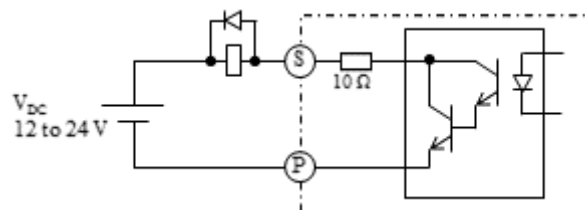
S	Terminal No. 1, 2, 3, 4, 11, 12, 13, 14
P	Terminal No. 5

■ o-1: General purpose output

Source input connection



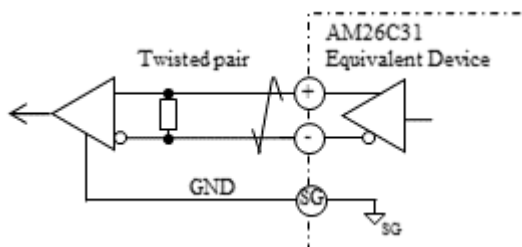
Sink input connection



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

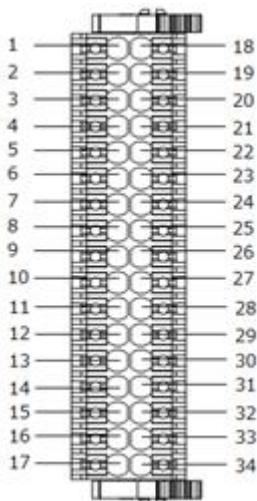


+	Terminal No. 6, 7
-	Terminal No. 16,17
SG	Terminal No. 15 (Signal ground)

3.3.2 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 +24V 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.
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

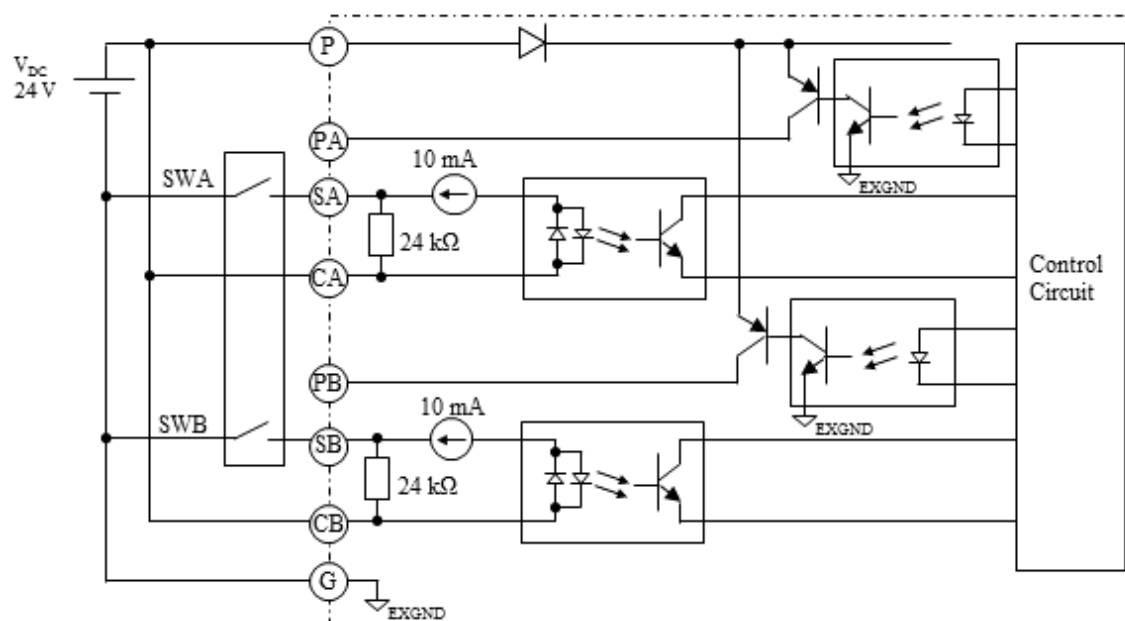
■ Terminal pin assignment of Safety I/O connector X5



Safety input for sink output connection

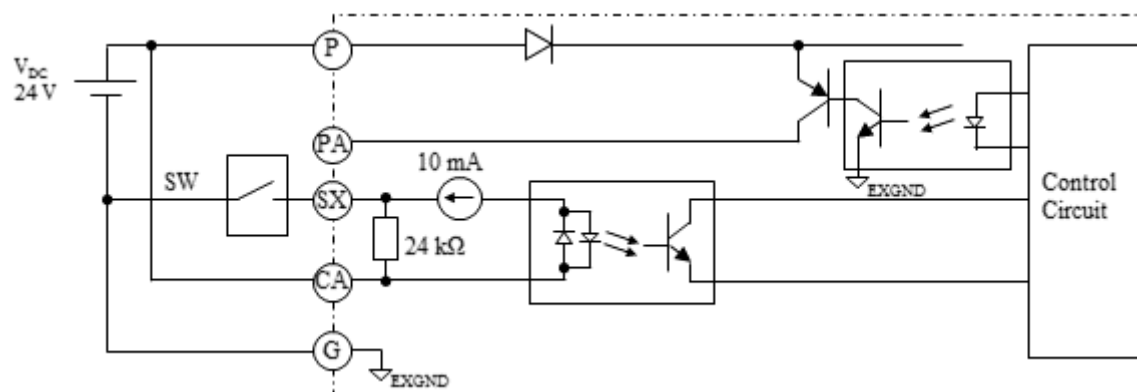
When connecting the sink output circuit to the safety input, connect the positive terminal of the external power supply DC 24 V to the common input (COMA, COMB).

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



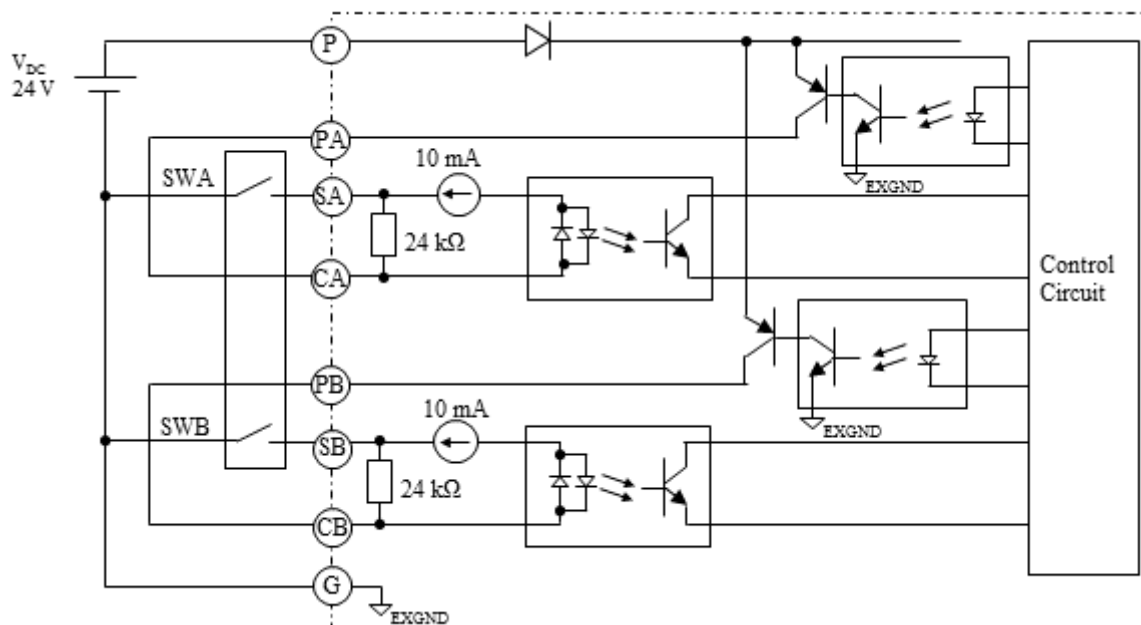
P	Terminal No. 17
PA	Terminal No. 10
SA	Terminal No. 12, 13, 14, 15
CA	Terminal No. 16
PB	Terminal No. 27
SB	Terminal No. 29, 30, 31, 32
CB	Terminal No. 33
G	Terminal No. 34

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



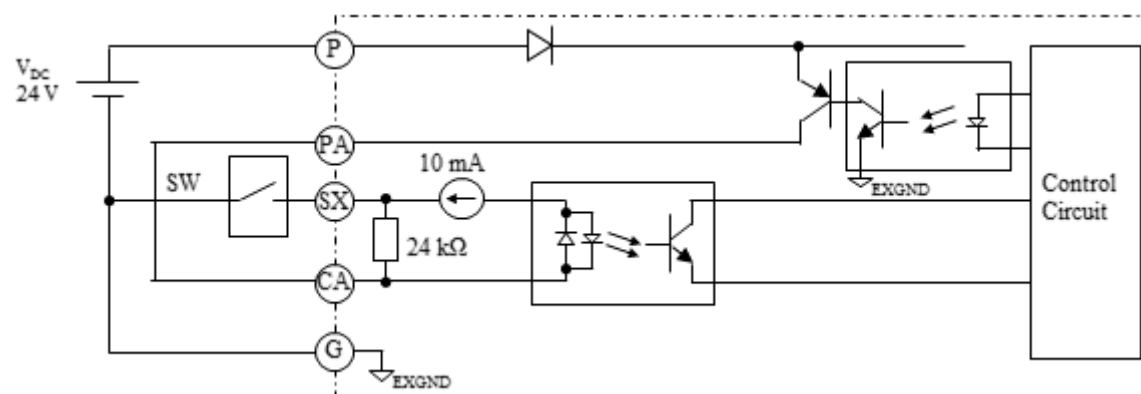
P	Terminal No. 17
PA	Terminal No. 10
SX	Terminal No. 11
CA	Terminal No. 16
G	Terminal No. 34

■ 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)

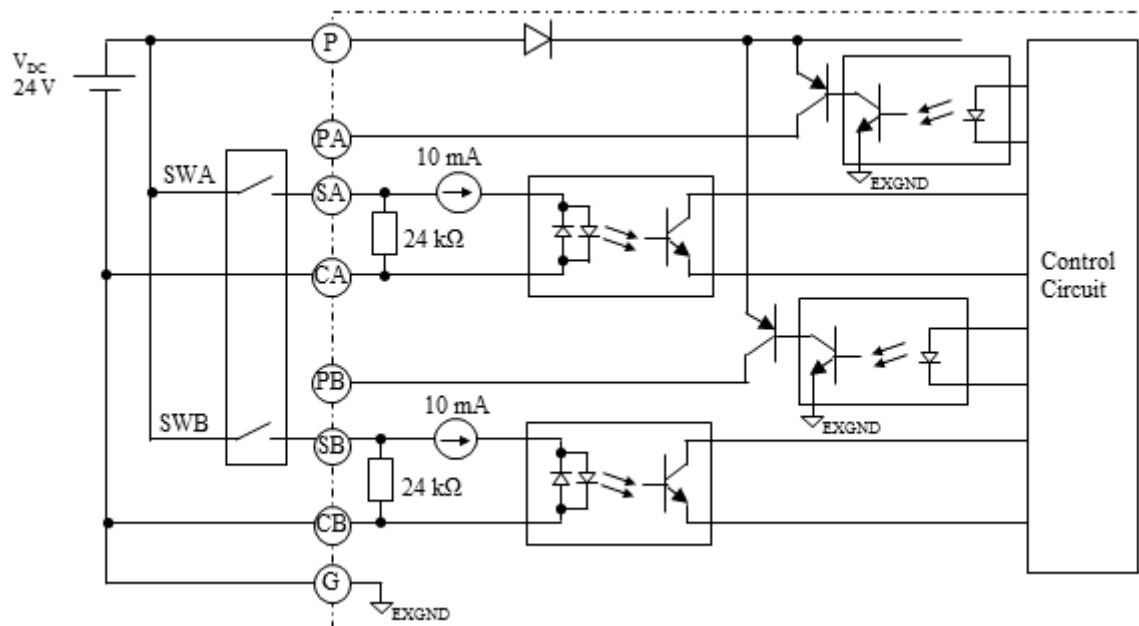


P	Terminal No. 17
PA	Terminal No. 10
SX	Terminal No. 11
CA	Terminal No. 16
G	Terminal No. 34

Safety input for source output connection

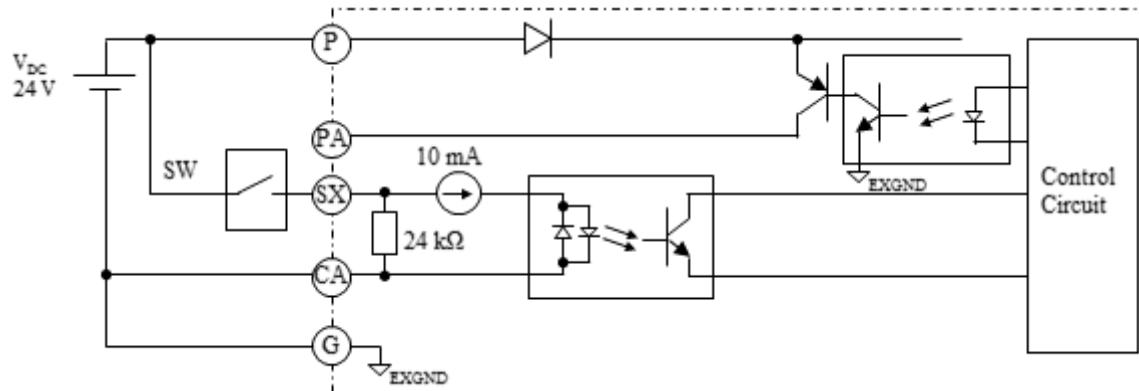
When connecting the source output circuit to the safety input, connect the negative terminal of the external power supply DC 24 V to the common input (COMA, COMB).

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



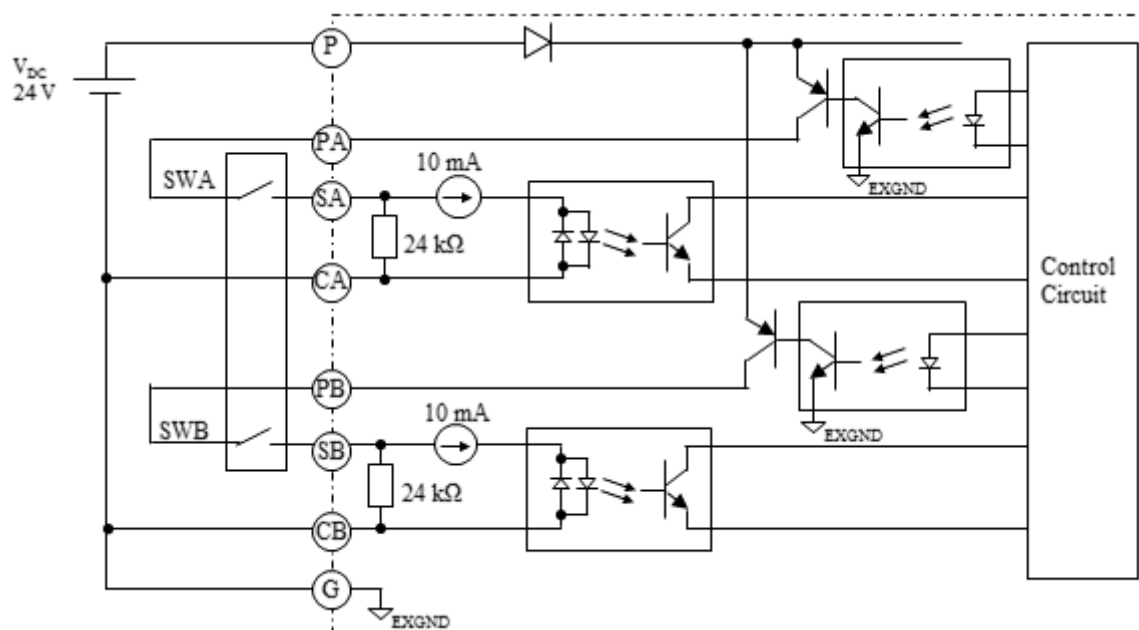
P	Terminal No. 17
PA	Terminal No. 10
SA	Terminal No. 12, 13, 14, 15
CA	Terminal No. 16
PB	Terminal No. 27
SB	Terminal No. 29, 30, 31, 32
CB	Terminal No. 33
G	Terminal No. 34

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



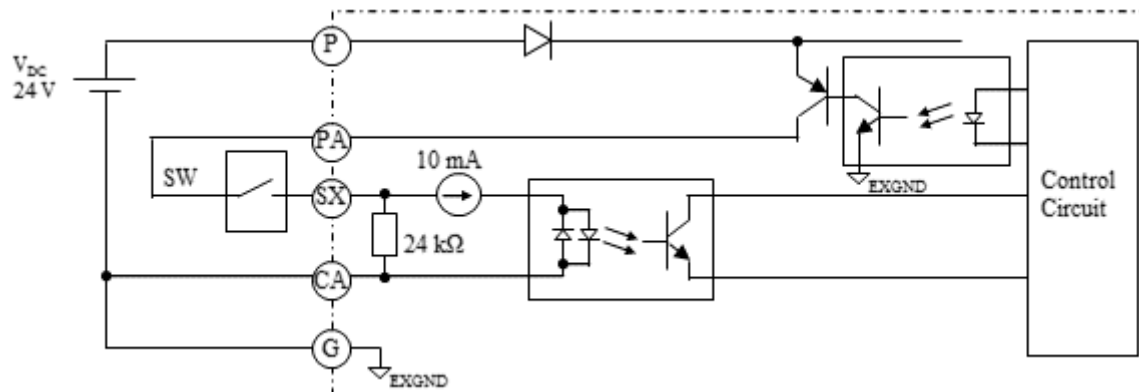
P	Terminal No. 17
PA	Terminal No. 10
SX	Terminal No. 11
CA	Terminal No. 16
G	Terminal No. 34

■ 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

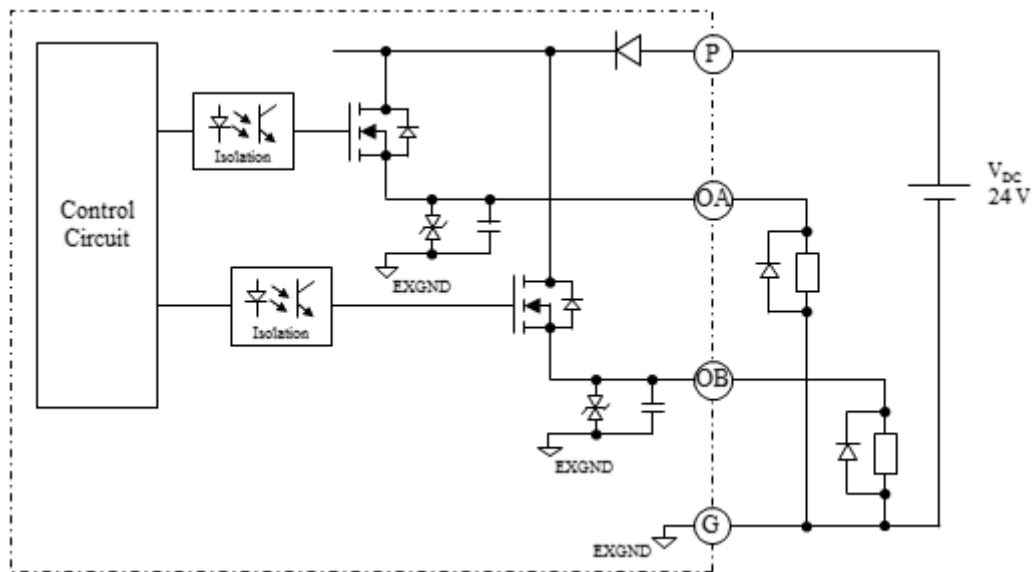
■ i-8: Non-Grouped Safety Digital input (with Diagnostic test pulse)



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

Safety output

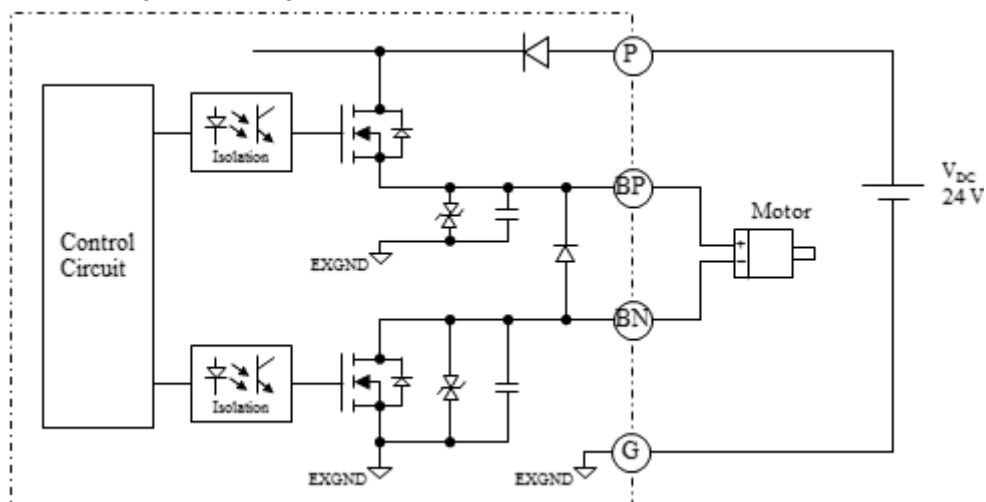
■ o-1: Safety output



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

3.3.3 EtherCAT communication connector X6A, X6B

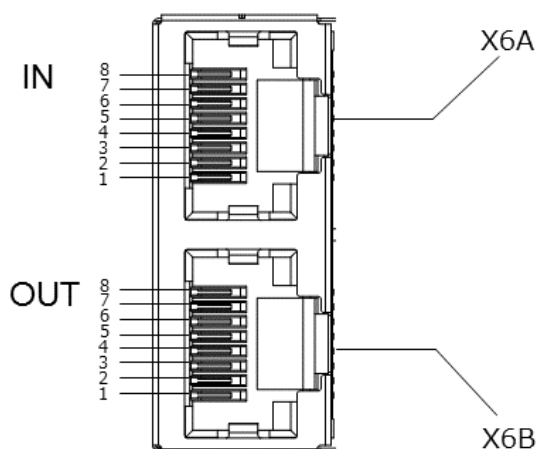
Pin No.	Symbol	Polarity	Description
1	TX/RX+	OUT/IN	Network output / input +
2	TX/RX-	OUT/IN	Network output / input -
3	RX/TX+	IN/OUT	Network input / output +
4	-	-	-
5	-	-	-
6	RX/TX-	IN/OUT	Network input / output -
7	-	-	-
8	-	-	-
Shell	FG	-	Frame ground

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

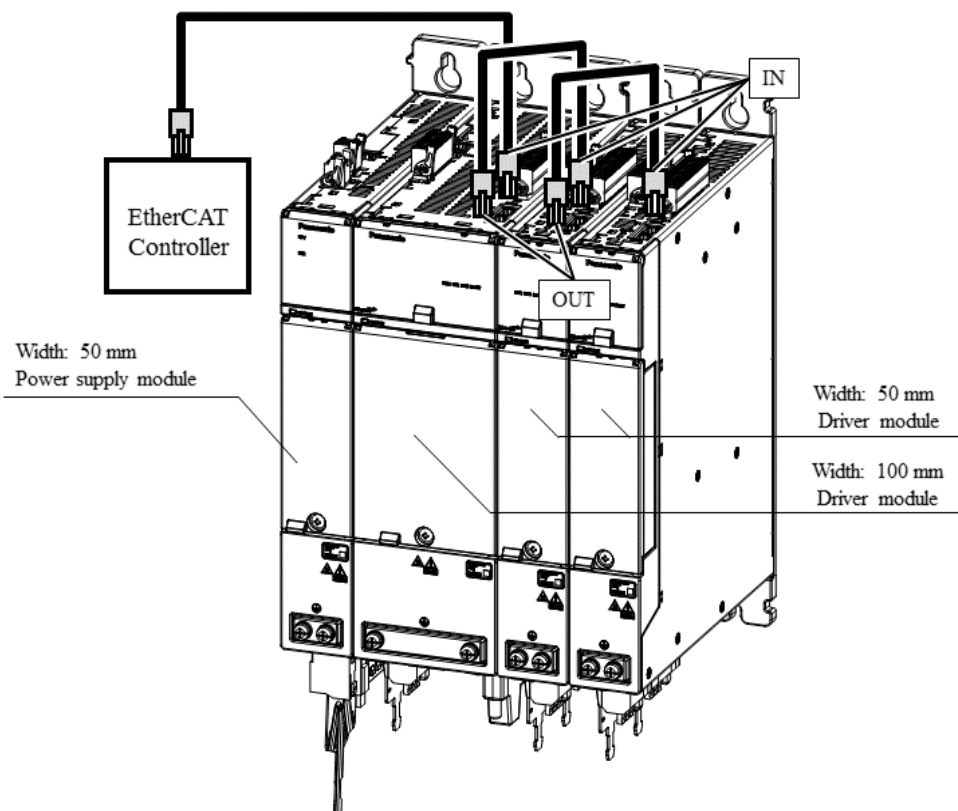
* Auto MDI/MDI-X assigns functions to pin no.1, 2, 3, 6.

* 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

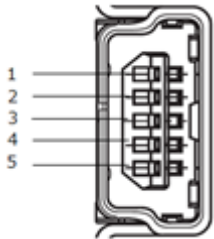


3.3.4 USB connector (for motor setup), USB connector (for safety) X7, X8

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.

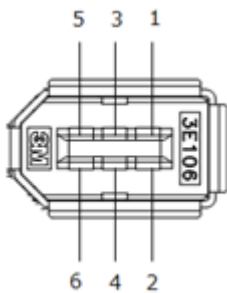
■ Terminal pin assignment of USB connector (for motor setup) X7, USB connector (for safety) X8



3.3.5 1st Encoder connector X9 (X9A, X9B)

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

■ Terminal pin assignment of 1st encoder connector X9A, X9B



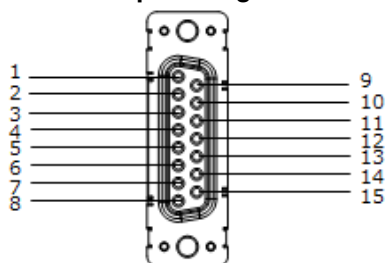
* X9A connector is for A axis, and X9B connector is for B axis.

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

3.3.6 2nd Encoder connector X10 (X10A, X10B)

Pin No.	Symbol	Polarity	Description
1	EX5V	-	2nd Encoder power output (Panasonic / ABZ)
2	EX0V	-	2nd 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	-	2nd Encoder power output (EnDat2.2 / SSI)

■ Terminal pin assignment of 2nd 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

Supported encoder types		For feedback scale	For safety (Reduplication)
1st encoder	Panasonic 23bit multi-turn absolute encoder	-	-
2nd encoder	Panasonic serial	Available	Available
	ABZ	Available	Available
	EnDat 2.2	-	Available
	SSI	-	Available

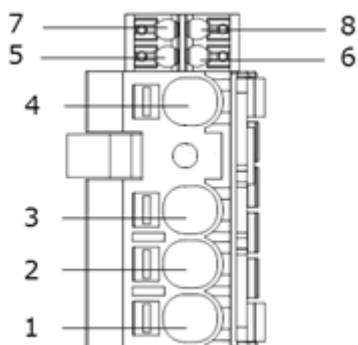
■ Connect terminal

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	✓	✓

3.3.7 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.

4

Supplement

4.1 Specification

4.1.1 Rotary encoder specification

- Absolute encoder 23bit
- Batteryless absolute encoder 23bit



◆ NOTE

- Precautions for battery exchange in the case of absolute encoder.
 - When you exchange the battery, please hold the main power of encoder in the ON position (as supplying the encoder with 5 V) and exchange the battery. Please notice that all data in the encoder would be disappeared if you exchange the battery with the main power of encoder being OFF.

4.1.2 Motor brake specification

- This brake is non-excited operation type brake.
- Armature pull in time and Armature release time are delay time of brake operation. Please confirm these by actual machine when motor is used.
- When the motor was forwarded, the brake's backlash is 2 ° or less.
- Power supply for motor brake must be prepared by user side. (Either way of connection for polarity would be acceptable)
- The above-mentioned all allowable braking energy shall be braking energy complying with the brake specification (Braking energy capable of performing a suction motion in consideration of brake temperature increases).
- The motor life with the repetitions of acceleration and deceleration at the above allowable angular acceleration : 10 million times. (The number of acceleration-deceleration cycles until brake's backlash changes rapidly)
- The series connection of the protection parts such as fuses is recommended in the case of the use with varistor.

MSMF

Items	Units	Applicable motor			
		MSMF104○1□△M MSMF154○1□△M MSMF204○1□△M	MSMF304○1□△M	MSMF404○1□△M	MSMF504○1□△M
Static friction torque (Note 1)	N·m	8.0 or more	12.0 or more	16.2 or more	22.0 or more
Rotary part inertia (Note 2)	10 ⁻⁴ kg·m ²	0.175		1.12	
Armature pull in time (Note 2)	ms	50 or less	80 or less	110 or less	
Armature release time (Note 2)	ms	15 or less (Note 3)		50 or less (Note 3)	
Release voltage (Note 1)	DC, V	2 or more			
Suction voltage (Note 1)	DC, V	24 ± 2.4			
Rated current (at DC24 V) (Note 2)	DC, A	0.81 ± 0%		0.90 ± 10%	
Allowable braking energy ; 1 time each (Note 2)	J	600		1470	1545
All allowable braking Energy (Note 2)	J	5.0 × 10 ⁴	9.0 × 10 ⁵	2.16 × 10 ⁶	2.0 × 10 ⁶
Allowable angular acceleration (Note 2)	rad/s ²	10000			

(Note 1) Value of our delivery inspection.

(Note 2) Representative value at 20 °C.

(Note 3) 4.1.3 Surge absorber for motor brake

MDMF

Items	Units	Applicable motor			
		MDMF104○1□△M MDMF154○1□△M MDMF204○1□△M	MDMF304○1□△M	MDMF404○1□△M	MDMF504○1□△M
Static friction torque (Note 1)	N·m	13.7 or more	22.0 or more	25.0 or more	44.1 or more
Rotary part inertia (Note 2)	10 ⁻⁴ kg·m ²	1.12		4.7	4.1
Armature pull in time (Note 2)	ms	100 or less	110 or less	80 or less	150 or less
Armature release time (Note 2)	ms	50 or less (Note 3)		25 or less (Note 3)	30 or less (Note 3)
Release voltage (Note 1)	DC, V	2 or more			
Suction voltage (Note 1)	DC, V	24 ± 2.4			
Rated current (at DC24 V) (Note 2)	DC, A	0.79 ± 10%	0.90 ± 10%	1.29 ± 10%	
Allowable braking energy ; 1 time each (Note 2)	J	1470	1545	1800	
All allowable braking Energy (Note 2)	J	2.16 × 10 ⁶	2.0 × 10 ⁶	3.0 × 10 ⁶	3.1 × 10 ⁶
Allowable angular acceleration (Note 2)	rad/s ²	10000		5440	5108

(Note 1) Value of our delivery inspection.

(Note 2) Representative value at 20 °C.

(Note 3) 4.1.3 Surge absorber for motor brake

MGMF

Items	Units	Applicable motor		
		MGMF094○1□△M MGMF134○1□△M MGMF184○1□△M	MGMF244○1□△M MGMF294○1□△M	MGMF444○1□△M
Static friction torque (Note 1)	N·m	13.7 or more	25.0 or more	44.1 or more
Rotary part inertia (Note 2)	10 ⁻⁴ kg·m ²	1.12	4.7	3.93
Armature pull in time (Note 2)	ms	100 or less	80 or less	150 or less
Armature release time (Note 2)	ms	50 or less (Note 3)	25 or less (Note 3)	30 or less (Note 3)
Release voltage (Note 1)	DC, V	2 or more		
Suction voltage (Note 1)	DC, V	24 ± 2.4		
Rated current (at DC24 V) (Note 2)	DC, A	0.79 ± 10%	1.29 ± 10%	
Allowable braking energy ; 1 time each (Note 2)	J	1470	1800	
All allowable braking energy (Note 2)	J	2.16 × 10 ⁶	3.0 × 10 ⁶	3.1 × 10 ⁶
Allowable angular acceleration (Note 2)	rad/s ²	10000	5440	5108

(Note 1) Value of our delivery inspection.

(Note 2) Representative value at 20 °C.

(Note 3) 4.1.3 Surge absorber for motor brake

MHMF

Items	Units	Applicable motor		
		MHMF104□1□ΔM MHMF154□1□ΔM	MHMF204□1□ΔM MHMF304□1□ΔM MHMF404□1□ΔM	MHMF504□1□ΔM
Static friction torque (Note 1)	N·m	13.7 or more	25.0 or more	44.1 or more
Rotary part inertia (Note 2)	10 ⁻⁴ kg·m ²	1.12	4.7	4.1
Armature pull in time (Note 2)	ms	100 or less	80 or less	150 or less
Armature release time (Note 2)	ms	50 or less (Note 3)	25 or less (Note 3)	30 or less (Note 3)
Release voltage (Note 1)	DC, V	2 or more		
Suction voltage (Note 1)	DC, V	24 ± 2.4		
Rated current (at DC24 V) (Note 2)	DC, A	0.79 ± 10%	1.29 ± 10%	1.29 ± 10%
Allowable braking energy ; 1 time each (Note 2)	J	1470	1800	1800
All allowable braking energy (Note 2)	J	2.16 × 10 ⁶	3.0 × 10 ⁶	3.1 × 10 ⁶
Allowable angular acceleration (Note 2)	rad/s ²	10000	5440	5108

(Note 1) Value of our delivery inspection.

(Note 2) Representative value at 20 °C.

(Note 3) 4.1.3 Surge absorber for motor brake

4.1.3 Surge absorber for motor brake

Motor		Part No.	Manufacturer
MSMF	1.0 kW(□100) to 3.0 kW	Z15D151	SEMITEC Corporation
	4.0 kW, 5.0 kW	NVD07SCD082	KOA Corporation
MDMF	1.0 kW to 3.0 kW	NVD07SCD082	KOA Corporation
	4.0 kW	Z15D151	SEMITEC Corporation
	5.0 kW	NVD07SCD082	KOA Corporation
MGMF	0.85 kW to 1.8 kW	NVD07SCD082	KOA Corporation
	2.4 kW to 2.9 kW	Z15D151	SEMITEC Corporation
	4.4 kW	NVD07SCD082	KOA Corporation
MHMF	1.0 kW(□130), 1.5 kW	NVD07SCD082	KOA Corporation
	2.0 kW, 4.0 kW	Z15D151	SEMITEC Corporation
	5.0 kW	NVD07SCD082	KOA Corporation

4.2 Motor Characteristics

4.2.1 MSMF

Items	Units	MSMF104 ○1□△M		MSMF154 ○1□△M		MSMF204 ○1□△M		MSMF304 ○1□△M		MSMF404 ○1□△M		MSMF504 ○1□△M	
		Without brake	With brake	Without brake	With brake	Without brake	With brake	Without brake	With brake	Without brake	With brake	Without brake	With brake
Rated output	kW	1.0		1.5		2.0		3.0		4.0		5.0	
Rated speed	r/min	3000		3000		3000		3000		3000		3000	
Max. speed	r/min	5500		5500		5500		5500		5000		5000	
Rated torque	N·m	3.18		4.77		6.37		9.55		12.7		15.9	
Continuous stall torque	N·m	3.82		5.73		7.64		11.0		15.3		19.1	
Max. torque	N·m	9.55		14.3		19.1		28.7		38.2		47.8	
Rated current	A(rms)	(3.3)		(4.1)		(5.7)		(9.1)		(10.1)		(12.6)	
Stall current	A(rms)	(4.0)		(4.9)		(6.8)		(10.4)		(12.1)		(15.1)	
Rotor inertia	$\times 10^{-4}$ kg·m ²	2.15	2.47	3.10	3.45	4.06	4.41	7.04	7.38	14.4	15.6	19.0	20.2

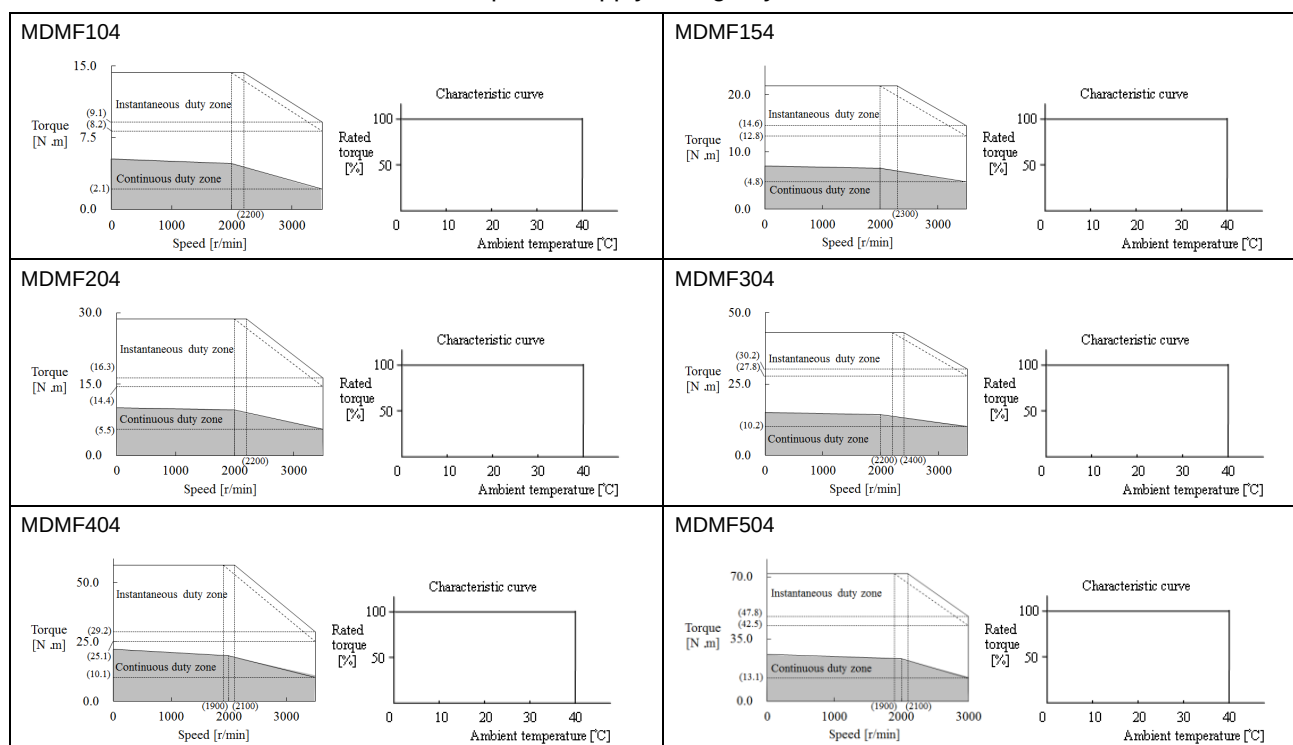
- This specification is guaranteed after combining and adjusting with the servo driver. (Representative value at 20 °C)
- Rated torque is the result that have been considered dispersions of motor specification under our measurement method.
- Please use the motor frame temperature within the temperature shown in the table below at the rated torque. (When ambient temperature is 40 °C)
- Speed - Torque characteristic (Representative value)
Servo driver power supply voltage: at AC 400 V
Dotted line indicates fall of servo driver power supply voltage by 10%

MSMF104	MSMF154		
MSMF204	MSMF304		
MSMF404	MSMF504		
Test method	Motor model MSMF104 MSMF154 MSMF204 MSMF304 MSMF404 MSMF504	Motor frame temperature at the rated torque 75 °C 80 °C 90 °C 95 °C 95 °C 105 °C	Test flange size 320 x 300 x t20 380 x 350 x t30

4.2.2 MDMF

Items	Units	MDMF104 ø1□ΔM		MDMF154 ø1□ΔM		MDMF204 ø1□ΔM		MDMF304 ø1□ΔM		MDMF404 ø1□ΔM		MDMF504 ø1□ΔM	
		Without brake	With brake	Without brake	With brake	Without brake	With brake	Without brake	With brake	Without brake	With brake	Without brake	With brake
Rated output	kW	1.0		1.5		2.0		3.0		4.0		5.0	
Rated speed	r/min	2000		2000		2000		2000		2000		2000	
Max. speed	r/min	3500		3500		3500		3500		3500		3000	
Rated torque	N·m	4.77		7.16		9.55		14.3		19.10		23.87	
Continuous stall torque	N·m	5.25		7.52		10.0		15.0		22.0		26.3	
Max. torque	N·m	14.3		21.5		28.7		43.0		57.3		71.6	
Rated current	A(rms)	(2.7)		(4.0)		(5.1)		(8.6)		(10.0)		(12.0)	
Stall current	A(rms)	(3.0)		(4.2)		(5.4)		(9.0)		(11.5)		(13.2)	
Rotor inertia	$\times 10^{-4}$ kg·m ²	6.18	7.40	9.16	10.40	12.1	13.3	18.6	19.6	46.9	52.3	58.2	63.0

- This specification is guaranteed after combining and adjusting with the servo driver. (Representative value at 20 °C)
- Rated torque is the result that have been considered dispersions of motor specification under our measurement method.
- Please use the motor frame temperature within the temperature shown in the table below at the rated torque. (When ambient temperature is 40 °C)
- Speed - Torque characteristic (Representative value)
Servo driver power supply voltage: at AC 400 V
Dotted line indicates fall of servo driver power supply voltage by 10%

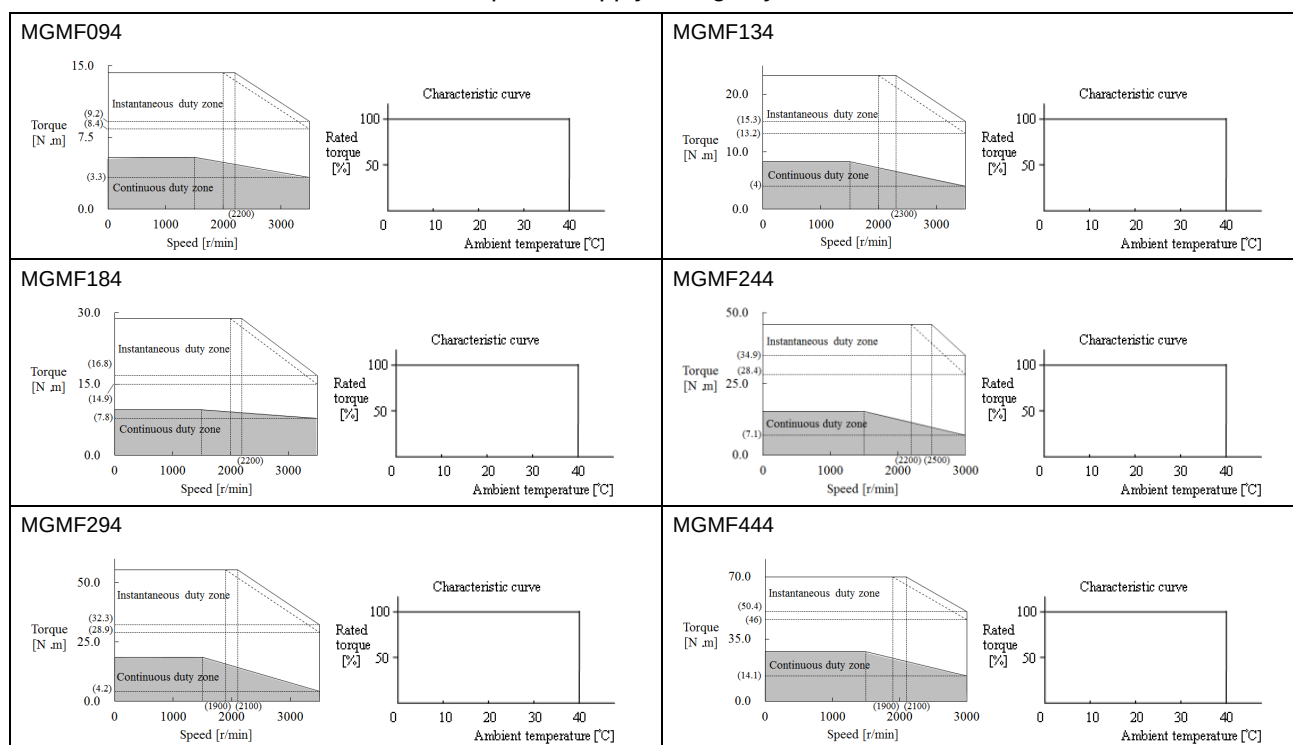


Test method	Motor model	Motor frame temperature at the rated torque	Test flange size
	MDMF104	75 °C	275 x 260 x t15
	MDMF154	85 °C	
	MDMF204	90 °C	
	MDMF304	95 °C	380 x 350 x t30
	MDMF404	85 °C	470 x 440 x t30
	MDMF504	90 °C	

4.2.3 MGMF

Items	Units	MGMF094 ø1□ΔM		MGMF134 ø1□ΔM		MGMF184 ø1□ΔM		MGMF244 ø1□ΔM		MGMF294 ø1□ΔM		MGMF444 ø1□ΔM	
		Without brake	With brake	Without brake	With brake	Without brake	With brake	Without brake	With brake	Without brake	With brake	Without brake	With brake
Rated output	kW	0.85		1.3		1.8		2.4		2.9		4.4	
Rated speed	r/min	1500		1500		1500		1500		1500		1500	
Max. speed	r/min	3500		3500		3500		3000		3500		3000	
Rated torque	N·m	5.41		8.28		11.5		15.3		18.5		28.0	
Continuous stall torque	N·m	5.41		8.28		11.5		15.3		18.5		28.0	
Max. torque	N·m	14.3		23.3		28.8		45.8		55.4		70.0	
Rated current	A(rms)	(2.9)		(4.7)		(5.9)		(8.0)		(9.7)		(13.6)	
Stall current	A(rms)	(2.9)		(4.7)		(5.9)		(8.0)		(9.7)		(13.6)	
Rotor inertia	$\times 10^{-4}$ kg·m ²	6.18	7.4	9.16	10.40	12.1	13.3	46.9	52.3	46.9	52.3	58.2	63.0

- This specification is guaranteed after combining and adjusting with the servo driver. (Representative value at 20 °C)
- Rated torque is the result that have been considered dispersions of motor specification under our measurement method.
- Please use the motor frame temperature within the temperature shown in the table below at the rated torque. (When ambient temperature is 40 °C)
- Speed - Torque characteristic (Representative value)
Servo driver power supply voltage: at AC 400 V
Dotted line indicates fall of servo driver power supply voltage by 10%.

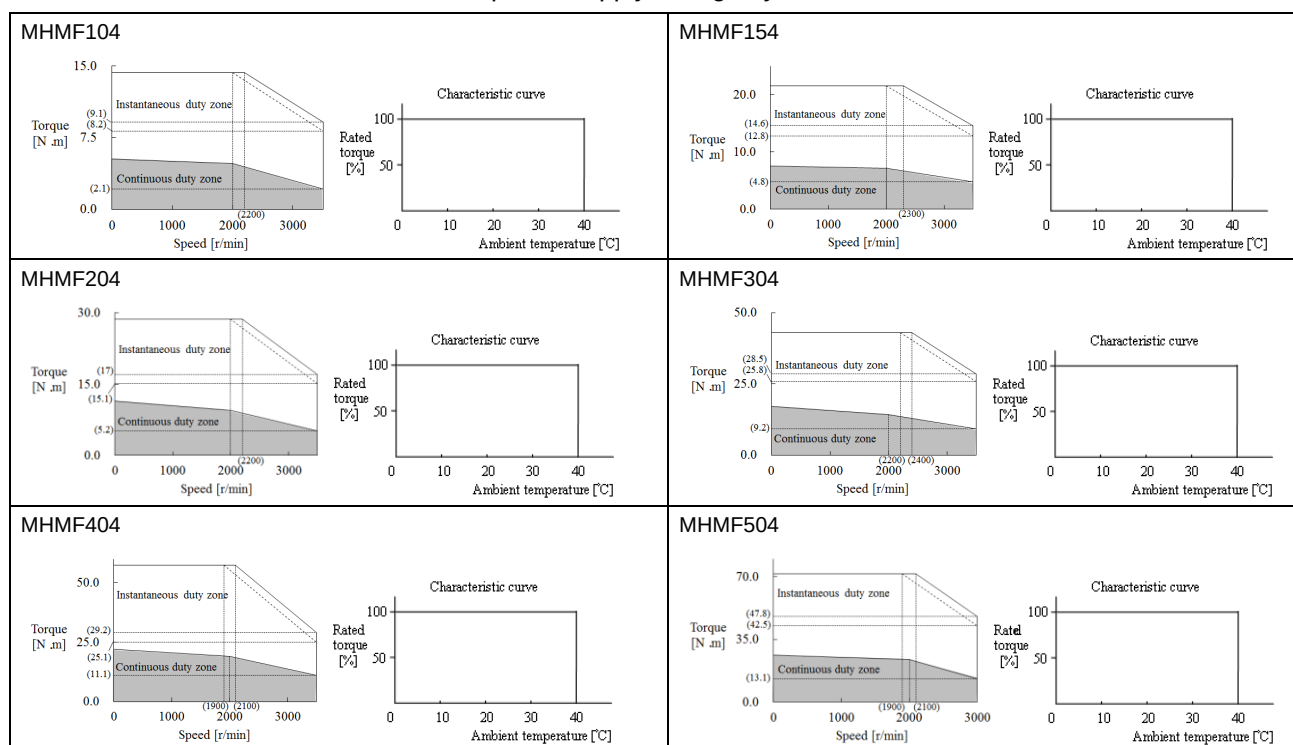


Test method	Motor model	Motor frame temperature at the rated torque	Test flange size
	MGMF094	75 °C	400 x 400 x t20
	MGMF134	85 °C	
	MGMF184	90 °C	
	MGMF244	65 °C	550 x 550 x t30
	MGMF294	75 °C	
	MGMF444	95 °C	

4.2.4 MHMF

Items	Units	MHMF104 ø1□ΔM		MHMF154 ø1□ΔM		MHMF204 ø1□ΔM		MHMF304 ø1□ΔM		MHMF404 ø1□ΔM		MHMF504 ø1□ΔM	
		Without brake	With brake	Without brake	With brake	Without brake	With brake	Without brake	With brake	Without brake	With brake	Without brake	With brake
Rated output	kW	1.0		1.5		2.0		3.0		4.0		5.0	
Rated speed	r/min	2000		2000		2000		2000		2000		2000	
Max. speed	r/min	3500		3500		3500		3500		3500		3000	
Rated torque	N·m	4.77		7.16		9.55		14.3		19.1		23.9	
Continuous stall torque	N·m	5.25		7.52		11.5		17.2		22.0		26.3	
Max. torque	N·m	14.3		21.5		28.7		43.0		57.3		71.6	
Rated current	A(rms)	(2.7)		(4.0)		(6.2)		(8.8)		(10.0)		(12.0)	
Stall current	A(rms)	(3.0)		(4.2)		(7.5)		(10.6)		(11.5)		(13.2)	
Rotor inertia	$\times 10^{-4}$ kg·m ²	22.9	24.1	33.4	34.6	55.7	61.0	85.3	90.7	104	110	146	151

- This specification is guaranteed after combining and adjusting with the servo driver. (Representative value at 20 °C)
- Rated torque is the result that have been considered dispersions of motor specification under our measurement method.
- Please use the motor frame temperature within the temperature shown in the table below at the rated torque. (When ambient temperature is 40 °C)
- Speed - Torque characteristic (Representative value)
Servo driver power supply voltage: at AC 400 V
Dotted line indicates fall of servo driver power supply voltage by 10%.



Test method	Motor model	Motor frame temperature at the rated torque	Test flange size
	MHMF104	75 °C	275 x 260 x t15
	MHMF154	80 °C	
	MHMF204	90 °C	
	MHMF304	80 °C	470 x 440 x t30
	MHMF404	85 °C	
	MHMF504	85 °C	

4.3 Time characteristics (our standard servo driver)

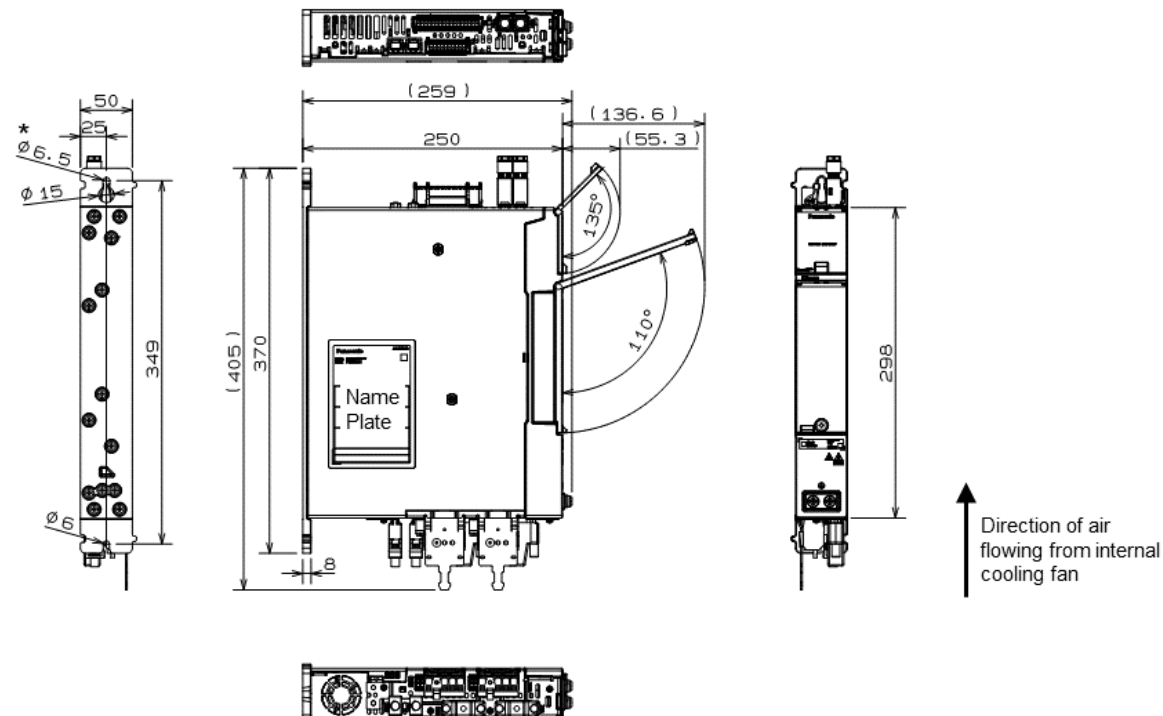
MSMF	104, 154, 204, 304, 404, 504	
MDMF	104, 154, 204, 304	404, 504
MGMF	094, 134, 184	244, 294, 444
MHMF	104, 154, 204	304, 404, 504

- Please use the motor under conditions limiting effective torque within continuous duty zone of Speed - Torque characteristic.
- About the Speed - Torque characteristic, please confirm each motor specification.
- When anything other than our standard driver is used, be sure of setting its overload to the below time of the above.
- As for the time characteristics of specific models, contact us to make an inquiry.

4.4 Dimensions

4.4.1 Driver module

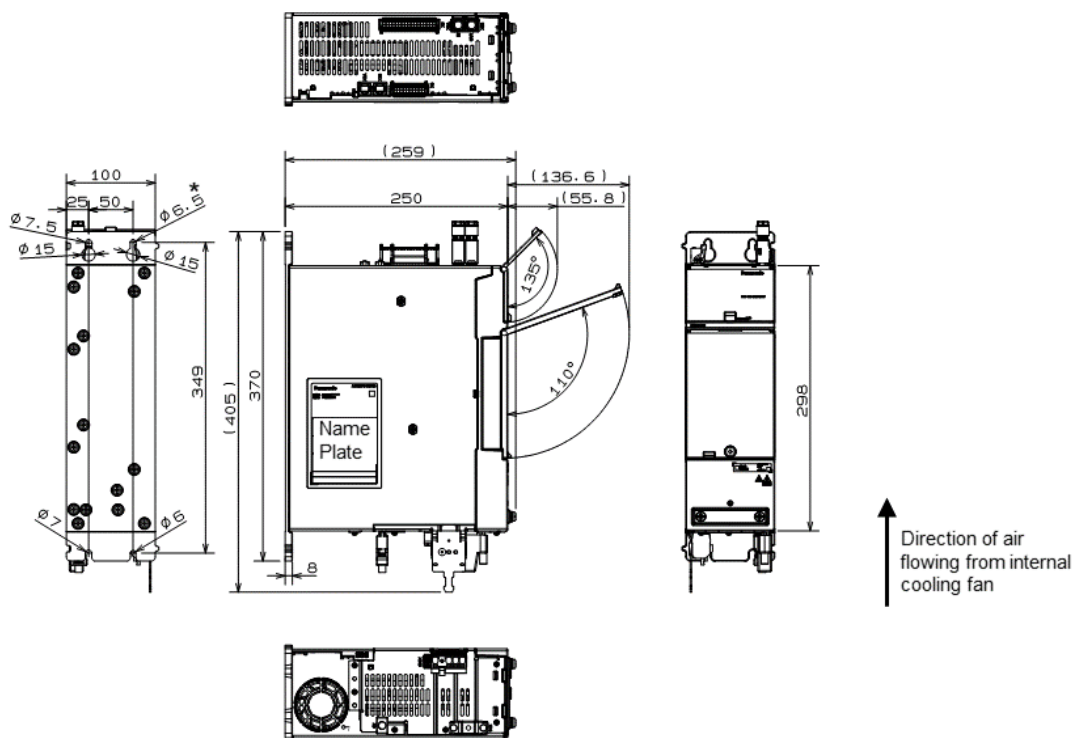
A-size



Unit: mm

* Recommended screw : M6
Tightening torque 4.68 N·m to 5.72 N·m

B-size

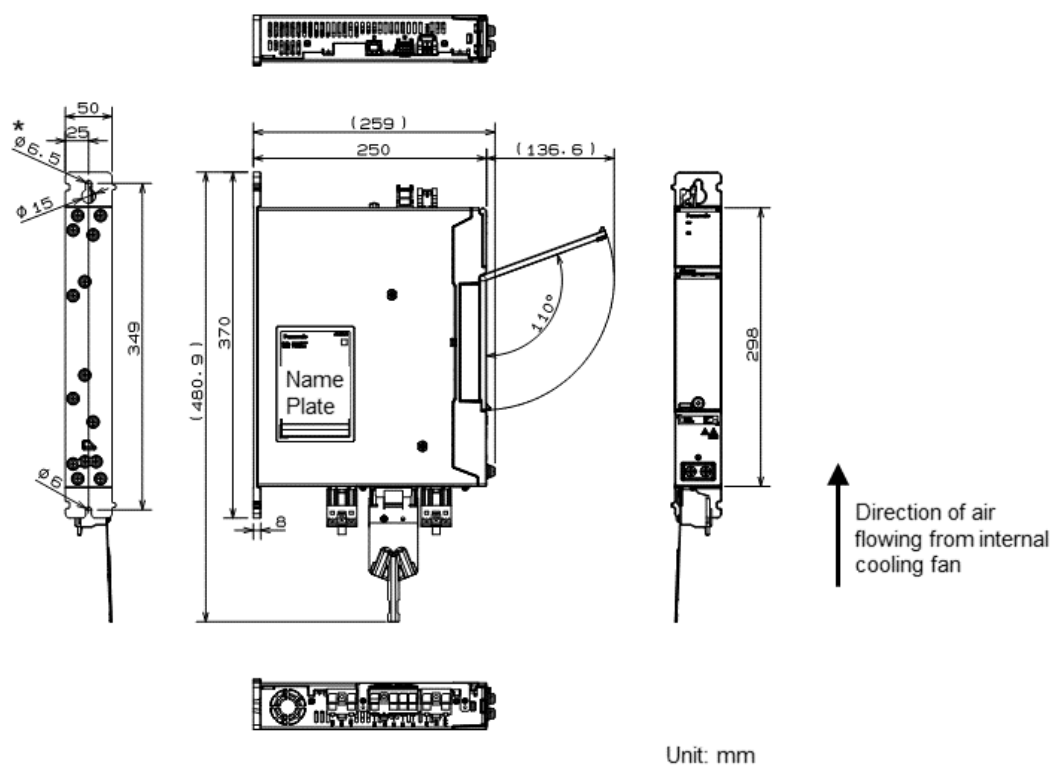


Unit: mm

* Recommended screw : M6
Tightening torque 4.68 N·m to 5.72 N·m

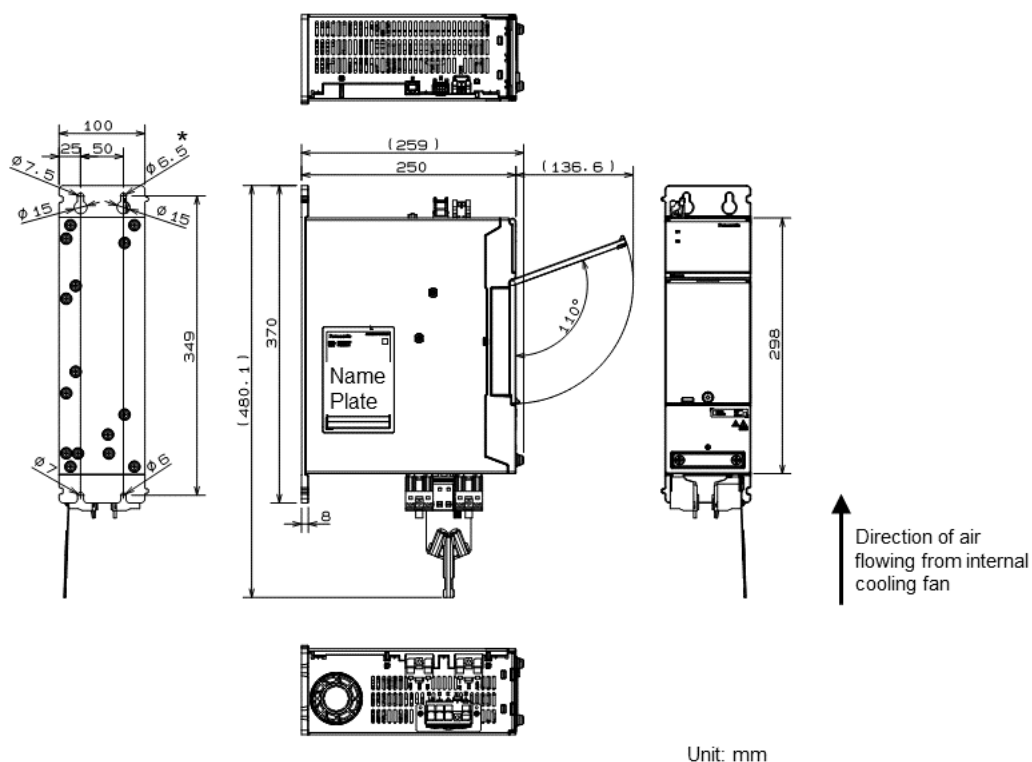
4.4.2 Power supply module

A-size



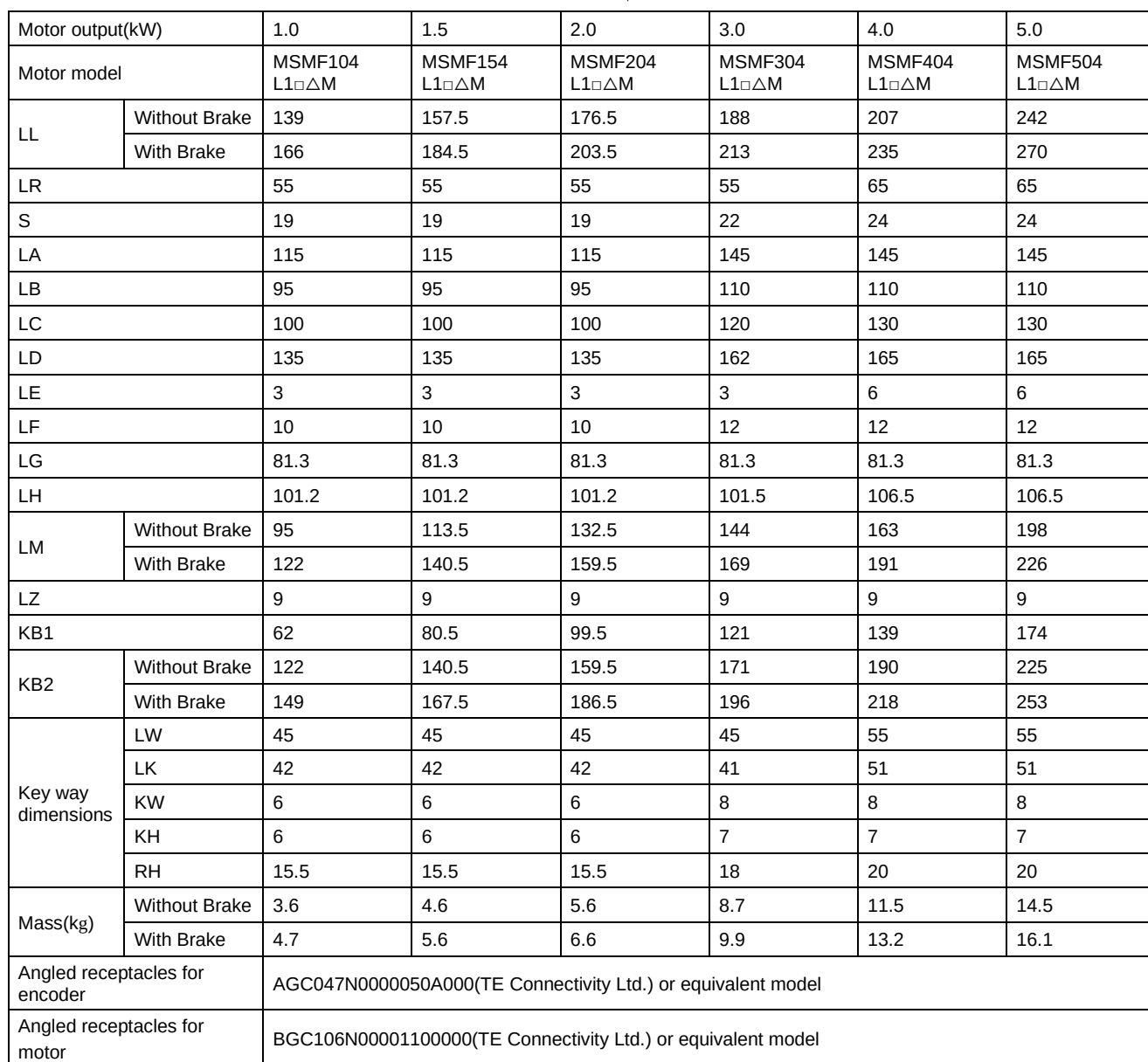
* Recommended screw : M6
Tightening torque 4.68 N·m to 5.72 N·m

B-size

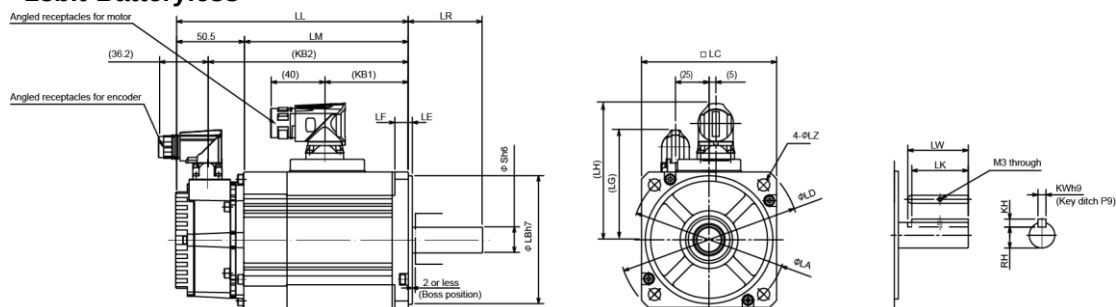


* Recommended screw : M6
Tightening torque 4.68 N·m to 5.72 N·m

■ 23bit



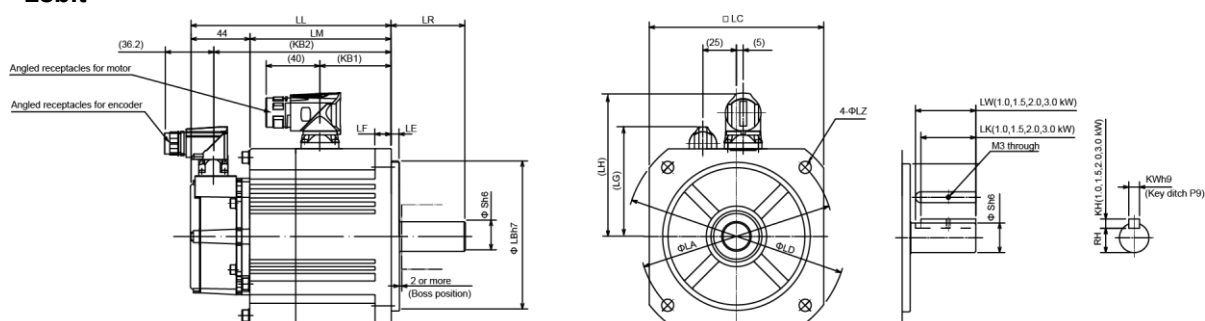
■ 23bit-Batteryless



Motor output(kW)		1.0	1.5	2.0	3.0	4.0	5.0
Motor model		MSMF104 A1□△M	MSMF154 A1□△M	MSMF204 A1□△M	MSMF304 A1□△M	MSMF404 A1□△M	MSMF504 A1□△M
LL	Without Brake	145.5	164	183	194.5	213.5	248.5
	With Brake	172.5	191	210	219.5	241.5	276.5
LR		55	55	55	55	65	65
S		19	19	19	22	24	24
LA		115	115	115	145	145	145
LB		95	95	95	110	110	110
LC		100	100	100	120	130	130
LD		135	135	135	162	165	165
LE		3	3	3	3	6	6
LF		10	10	10	12	12	12
LG		81.3	81.3	81.3	81.3	81.3	81.3
LH		101.2	101.2	101.2	101.5	106.5	106.5
LM	Without Brake	95	113.5	132.5	144	163	198
	With Brake	122	140.5	159.5	169	191	226
LZ		9	9	9	9	9	9
KB1		62	80.5	99.5	121	139	174
KB2	Without Brake	122	140.5	159.5	171	190	225
	With Brake	149	167.5	186.5	196	218	253
Key way dimensions	LW	45	45	45	45	55	55
	LK	42	42	42	41	51	51
	KW	6	6	6	8	8	8
	KH	6	6	6	7	7	7
	RH	15.5	15.5	15.5	18	20	20
Mass(kg)	Without Brake	3.6	4.6	5.6	8.7	11.5	14.5
	With Brake	4.7	5.6	6.6	9.9	13.2	16.1
Angled receptacles for encoder		AGC047N0000050A000(TE Connectivity Ltd.) or equivalent model					
Angled receptacles for motor		BGC106N00001100000(TE Connectivity Ltd.) or equivalent model					

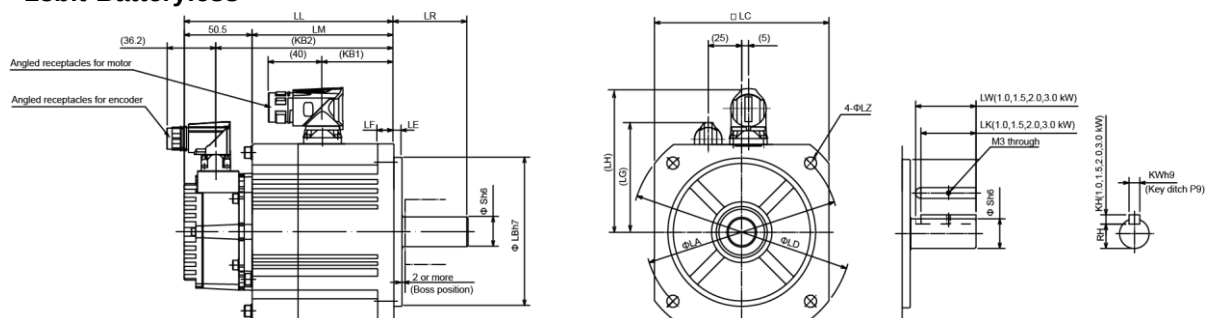
MDMF

■ 23bit



Motor output(kW)		1.0	1.5	2.0	3.0	4.0	5.0
Motor model		MDMF104 L1□△M	MDMF154 L1□△M	MDMF204 L1□△M	MDMF304 L1□△M	MDMF404 L1□△M	MDMF504 L1□△M
LL	Without Brake	121	135	149	177	163	178
	With Brake	149	163	177	205	192	207
LR		55	55	55	65	70	70
S		22	22	22	24	35	35
LA		145	145	145	145	200	200
LB		110	110	110	110	114.3	114.3
LC		130	130	130	130	176	176
LD		165	165	165	165	233	233
LE		6	6	6	6	3.2	3.2
LF		12	12	12	12	18	18
LG		81.3	81.3	81.3	81.3	81.3	81.3
LH		106.5	106.5	106.5	106.5	129.8	129.8
LM	Without Brake	77	91	105	133	119	134
	With Brake	105	119	133	161	148	163
LZ		9	9	9	9	13.5	13.5
KB1		53	67	81	109	94	109
KB2	Without Brake	104	118	132	160	146	161
	With Brake	132	146	160	188	175	190
Key way dimensions	LW	45	45	45	55	55	55
	LK	41	41	41	51	50	50
	KW	8	8	8	8	10	10
	KH	7	7	7	7	8	8
	RH	18	18	18	20	30	30
Mass(kg)	Without Brake	4.6	5.7	6.9	9.3	13.4	15.6
	With Brake	6.1	7.2	8.4	10.9	16.8	19.0
Angled receptacles for encoder		AGC047N0000050A000(TE Connectivity Ltd.) or equivalent model					
Angled receptacles for motor		BGC106N00001100000(TE Connectivity Ltd.) or equivalent model					

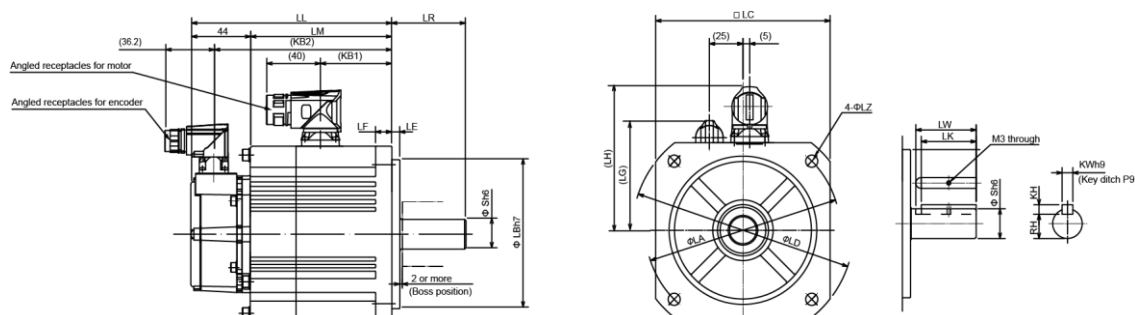
■ 23bit-Batteryless



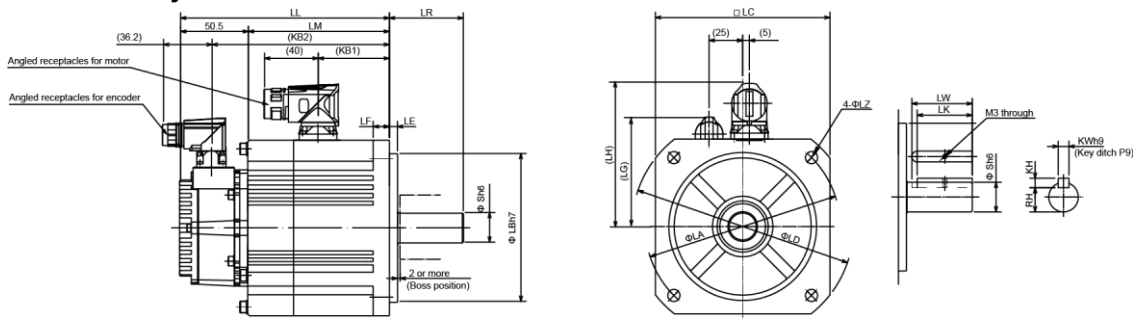
Motor output(kW)		1.0	1.5	2.0	3.0	4.0	5.0
Motor model		MDMF104 A1□△M	MDMF154 A1□△M	MDMF204 A1□△M	MDMF304 A1□△M	MDMF404 A1□△M	MDMF504 A1□△M
LL	Without Brake	127.5	141.5	155.5	183.5	169.5	184.5
	With Brake	155.5	169.5	183.5	211.5	198.5	213.5
LR		55	55	55	65	70	70
S		22	22	22	24	35	35
LA		145	145	145	145	200	200
LB		110	110	110	110	114.3	114.3
LC		130	130	130	130	176	176
LD		165	165	165	165	233	233
LE		6	6	6	6	3.2	3.2
LF		12	12	12	12	18	18
LG		81.3	81.3	81.3	81.3	81.3	81.3
LH		106.5	106.5	106.5	106.5	129.8	129.8
LM	Without Brake	77	91	105	133	119	134
	With Brake	105	119	133	161	148	163
LZ		9	9	9	9	13.5	13.5
KB1		53	67	81	109	94	109
KB2	Without Brake	104	118	132	160	146	161
	With Brake	132	146	160	188	175	190
Key way dimensions	LW	45	45	45	55	55	55
	LK	41	41	41	51	50	50
	KW	8	8	8	8	10	10
	KH	7	7	7	7	8	8
	RH	18	18	18	20	30	30
Mass(kg)	Without Brake	4.6	5.7	6.9	9.3	13.4	15.6
	With Brake	6.1	7.2	8.4	10.9	16.8	19.0
Angled receptacles for encoder		AGC047N0000050A000(TE Connectivity Ltd.) or equivalent model					
Angled receptacles for motor		BGC106N00001100000(TE Connectivity Ltd.) or equivalent model					

MGMF

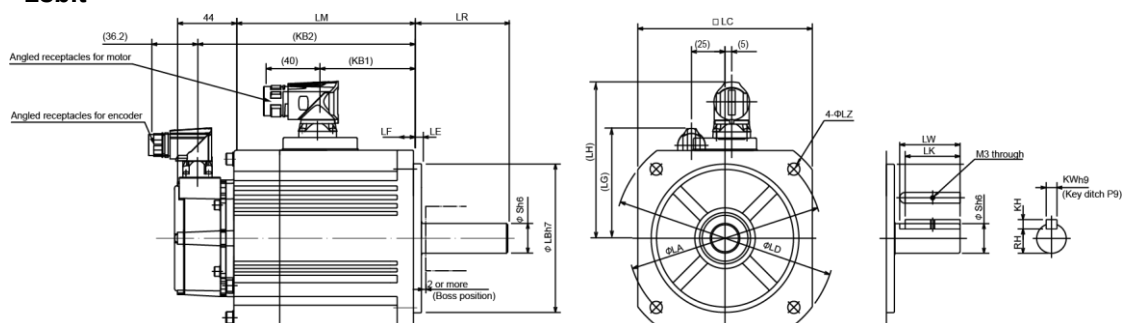
■ 23bit



Motor output(kW)		0.9	1.3	1.8	2.4	2.9	4.4
Motor model		MGMF094 L1□△M	MGMF134 L1□△M	MGMF184 L1□△M	MDMF244 L1□△M	MGMF294 L1□△M	MGMF444 L1□△M
LL	Without Brake	121	135	149	163	163	178
	With Brake	149	163	177	192	192	207
LR		55	55	55	70	70	70
S		22	22	22	35	35	35
LA		145	145	145	200	200	200
LB		110	110	110	114.3	114.3	114.3
LC		130	130	130	176	176	176
LD		165	165	165	233	233	233
LE		6	6	6	3.2	3.2	3.2
LF		12	12	12	18	18	18
LG		81.3	81.3	81.3	81.3	81.3	81.3
LH		106.5	106.5	106.5	129.8	129.8	129.8
LM	Without Brake	77	91	105	119	119	134
	With Brake	105	119	133	148	148	163
LZ		9	9	9	13.5	13.5	13.5
KB1		53	67	81	94	94	109
KB2	Without Brake	104	118	132	146	146	161
	With Brake	132	146	160	175	175	190
Key way dimensions	LW	45	45	45	55	55	55
	LK	41	41	41	50	50	50
	KW	8	8	8	10	10	10
	KH	7	7	7	8	8	8
	RH	18	18	18	30	30	30
Mass(kg)	Without Brake	4.6	5.7	6.9	13.4	13.4	15.6
	With Brake	6.1	7.2	8.4	16.8	16.8	19.0
Angled receptacles for encoder		AGC047N0000050A000(TE Connectivity Ltd.) or equivalent model					
Angled receptacles for motor		BGC106N00001100000(TE Connectivity Ltd.) or equivalent model					

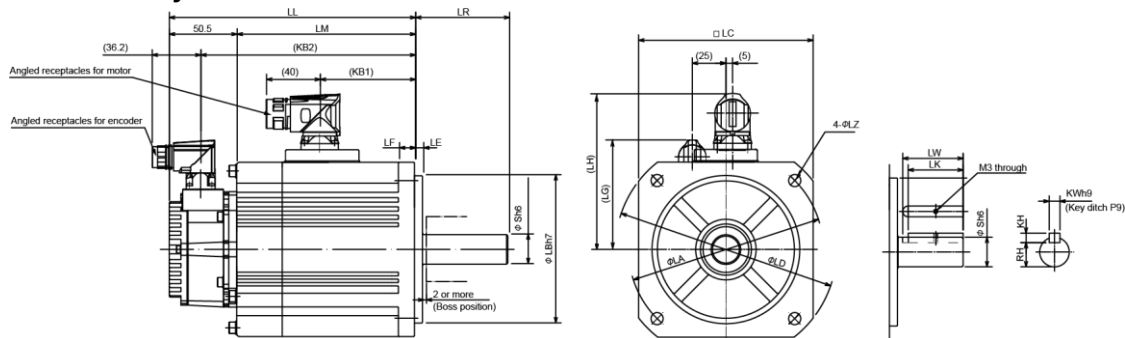


Motor output(kW)		0.9	1.3	1.8	2.4	2.9	4.4
Motor model		MGMF094 A1□△M	MGMF134 A1□△M	MGMF204 A1□△M	MGMF244 A1□△M	MDMF294 A1□△M	MGMF444 A1□△M
LL	Without Brake	127.5	141.5	155.5	169.5	169.5	184.5
	With Brake	155.5	169.5	183.5	198.5	198.5	213.5
LR		55	55	55	70	70	70
S		22	22	22	35	35	35
LA		145	145	145	200	200	200
LB		110	110	110	114.3	114.3	114.3
LC		130	130	130	176	176	176
LD		165	165	165	233	233	233
LE		6	6	6	3.2	3.2	3.2
LF		12	12	12	18	18	18
LG		81.3	81.3	81.3	81.3	81.3	81.3
LH		106.5	106.5	106.5	129.8	129.8	129.8
LM	Without Brake	77	91	105	119	119	134
	With Brake	105	119	133	148	148	163
LZ		9	9	9	13.5	13.5	13.5
KB1		53	67	81	94	94	109
KB2	Without Brake	104	118	132	146	146	161
	With Brake	132	146	160	175	175	190
Key way dimensions	LW	45	45	45	55	55	55
	LK	41	41	41	50	50	50
	KW	8	8	8	10	10	10
	KH	7	7	7	8	8	8
	RH	18	18	18	30	30	30
Mass(kg)	Without Brake	4.6	5.7	6.9	13.4	13.4	15.6
	With Brake	6.1	7.2	8.4	16.8	16.8	19.0
Angled receptacles for encoder		AGC047N0000050A000(TE Connectivity Ltd.) or equivalent model					
Angled receptacles for motor		BGC106N00001100000(TE Connectivity Ltd.) or equivalent model					

MHMF**■ 23bit**

Motor output(kW)		1.0	1.5	2.0	3.0	4.0	5.0
Motor model		MHMF104 L1□△M	MHMF154 L1□△M	MHMF204 L1□△M	MHMF304 L1□△M	MHMF404 L1□△M	MHMF504 L1□△M
LL	Without Brake	149	163	163	178	192.5	208.5
	With Brake	177	191	192	207	221.5	237.5
LR		70	70	80	80	80	80
S		22	22	35	35	35	35
LA		145	145	200	200	200	200
LB		110	110	114.3	114.3	114.3	114.3
LC		130	130	176	176	176	176
LD		165	165	233	233	233	233
LE		6	6	3.2	3.2	3.2	3.2
LF		12	12	18	18	18	18
LG		81.3	81.3	81.3	81.3	81.3	81.3
LH		116.2	116.2	139.2	139.2	139.2	139.2
LM	Without Brake	105	119	119	134	148.5	164.5
	With Brake	133	147	148	163	177.5	193.5
LZ		9	9	13.5	13.5	13.5	13.5
KB1		71	85	80.5	95.5	110	126
KB2	Without Brake	132	146	146	161	175.5	191.5
	With Brake	160	174	175	190	204.5	220.5
Key way dimensions	LW	45	45	55	55	55	55
	LK	41	41	50	50	50	50
	KW	8	8	10	10	10	10
	KH	7	7	8	8	8	8
	RH	18	18	30	30	30	30
Mass(kg)	Without Brake	6.1	7.7	11.3	13.8	16.2	19.6
	With Brake	7.6	9.2	14.6	17.2	19.4	22.8
Angled receptacles for encoder		AGC047N0000050A000(TE Connectivity Ltd.) or equivalent model					
Angled receptacles for motor		BGC106N00001100000(TE Connectivity Ltd.) or equivalent model					

■ 23bit-Batteryless



Motor output(kW)		1.0	1.5	2.0	3.0	4.0	5.0
Motor model		MHMF104 A1□△M	MHMF154 A1□△M	MHMF204 A1□△M	MHMF304 A1□△M	MHMF404 A1□△M	MHMF504 A1□△M
LL	Without Brake	155.5	169.5	169.5	184.5	199	215
	With Brake	183.5	197.5	198.5	213.5	228	244
LR		70	70	80	80	80	80
S		22	22	35	35	35	35
LA		145	145	200	200	200	200
LB		110	110	114.3	114.3	114.3	114.3
LC		130	130	176	176	176	176
LD		165	165	233	233	233	233
LE		6	6	3.2	3.2	3.2	3.2
LF		12	12	18	18	18	18
LG		81.3	81.3	81.3	81.3	81.3	81.3
LH		116.2	116.2	139.2	139.2	139.2	139.2
LM	Without Brake	105	119	119	134	148.5	164.5
	With Brake	133	147	148	163	177.5	193.5
LZ		9	9	13.5	13.5	13.5	13.5
KB1		71	85	80.5	95.5	110	126
KB2	Without Brake	132	146	146	161	175.5	191.5
	With Brake	160	174	175	190	204.5	220.5
Key way dimensions	LW	45	45	55	55	55	55
	LK	41	41	50	50	50	50
	KW	8	8	10	10	10	10
	KH	7	7	8	8	8	8
	RH	18	18	30	30	30	30
Mass(kg)	Without Brake	6.1	7.7	11.3	13.8	16.2	19.6
	With Brake	7.6	9.2	14.6	17.2	19.4	22.8
Angled receptacles for encoder		AGC047N0000050A000(TE Connectivity Ltd.) or equivalent model					
Angled receptacles for motor		BGC106N00001100000(TE Connectivity Ltd.) or equivalent model					

Cautions for Proper Use

- Practical considerations for exporting the product or assembly containing the product When the end user of the product or end use of the product is associated with military affair or weapon, its export may be controlled by the Foreign Exchange and Foreign Trade Control Law. Complete review of the product to be exported and export formalities should be practiced.
- This product is intended to be used with a general industrial product, but not designed or manufactured to be used in a machine or system that may cause personal death when it is failed.
- Installation, wiring, operation, maintenance, etc., of the equipment should be done by qualified and experienced personnel.
- Apply adequate tightening torque to the product mounting screw by taking into consideration strength of the screw and the characteristics of material to which the product is installed. Overtightening can damage the screw and/or material; undertightening can result in loosening.

(Example) Steel screw into steel section:

M4	1.35 N·m to 1.65 N·m.
M5	2.7 N·m to 3.3 N·m.
M6	4.68 N·m to 5.72 N·m.
M8	11.25 N·m to 13.75 N·m.
M10	22.05 N·m to 26.95 N·m.
M11	37.8 N·m to 46.2 N·m.

- Install a safety equipments or apparatus in your application, when a serious accident or loss of property is expected due to the failure of this product.
- Consult us if the application of this product is under such special conditions and environments as nuclear energy control, aerospace, transportation, medical equipment, various safety equipments or equipments which require a lesser air contamination.
- We have been making the best effort to ensure the highest quality of the products, however, application of exceptionally larger external noise disturbance and static electricity, or failure in input power, wiring and components may result in unexpected action. It is highly recommended that you make a fail-safe design and secure the safety in the operative range.
- If the motor shaft is not electrically grounded, it may cause an electrolytic corrosion to the bearing, depending on the condition of the machine and its mounting environment, and may result in the bearing noise. Checking and verification by customer is required.
- Failure of this product depending on its content, may generate smoke of about one cigarette. Take this into consideration when the application of the machine is clean room related.
- Please be careful when using in an environment with high concentrations of sulfur or sulfuric gases, as sulfuration can lead to disconnection from the chip resistor or a poor contact connection.
- Take care to avoid inputting a supply voltage which significantly exceeds the rated range to the power supply of this product. Failure to heed this caution may result in damage to the internal parts, causing smoking and/or a fire and other trouble.
- The user is responsible for matching between machine and components in terms of configuration, dimensions, life expectancy, characteristics, when installing the machine or changing specification of the machine. The user is also responsible for complying with applicable laws and regulations.
- The product will not be guaranteed when it is used outside its specification limits.
- Parts are subject to minor change to improve performance.

Warranty

Warranty period

- Panasonic warrants 12 months from date of delivery or maximum 18 months from date of manufacture whichever comes first.
For a motor with brake, the axis accelerated and decelerated more times than the specified limit is not covered by warranty.

Warranty scope

- Should any defect develop during warranty period under standard service conditions as described in the manual, the company agrees to make repairs free of charge.
Even during warranty period, the company makes fee-based repair on product containing:
 - (1) Failure or damage due to misuse, improper repair or alteration.
 - (2) Failure or damage due to falling, or damage during transportation, after the original delivery
 - (3) Defects resulting from neglect of the specification in use of the product.
 - (4) Failure or damage due to unregulated voltage and fire, and act of natural disasters such as earthquake, lightning, wind, flood and salt pollution.
 - (5) Defects resulting from invasion of foreign materials such as water, oil and metal pieces.Parts exceeding their standard lifetime specified in this document are excluded.
 - The company shall not be liable for any indirect, incidental or consequential damage or loss of any nature that may arise in connection with the product.
-

After-Sale Service (Repair)

Repair

Consult to a dealer from whom you have purchased the product for details of repair.

When the product is incorporated to the machine or equipment you have purchased, consult to the manufacture or the dealer of the machine or equipment.

Technical information

Technical information of this product (Operating Instructions, CAD data) can be downloaded from the following web site.

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

For your records:

The model number and serial number of this product can be found on either the back or the bottom of the unit. Please note them in the space provided and keep for future reference.

Model No.		Serial No.	
Date of purchase			
Store name			
	Phone () -		

Industrial Device Business Division, Panasonic Industry Co., Ltd.

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