Panasonic®

Technical reference
AC Servo Motor & Driver
MINAS A4P-series

・This product is for industrial equipment. Don't use this product at general household.

- Thank you very much for your purchase of Panasonic AC Servo Motor & Driver, MINAS A4P-series.
- Before use, refer this technical reference and safety instructions to ensure proper use. Keep this technical reference and read when necessary.
- Make sure to forward this technical reference for safety to the final user.

If you are the first user of this product, please be sure to purchase and read the optional Engineering Material (DV0P4490), or downloaded Instruction Manual from our Web Site.

[Web address of Motor Company, Matsushita Electric Industrial Co., Ltd.]
http://industrial.panasonic.com/ww/i_e/25000/motor_fa_e/motor_fa_e.html

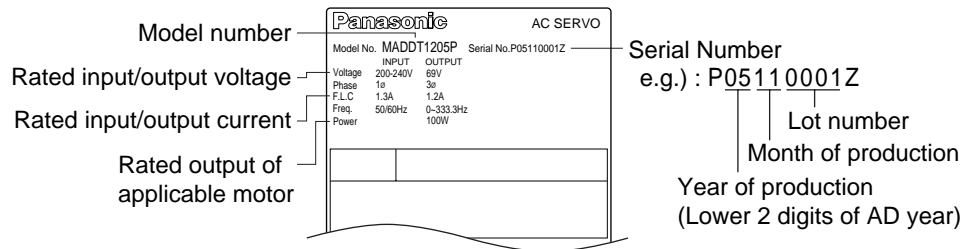## <Contents>

1. Introduction

On Opening the Product Package

- Make sure that the model is what you have ordered.
- Check if the product is damaged or not during transportation.
- Check if the instruction manual is attached or not.
- Check if the power connector and motor connecters (CN X1 and CN X2 connectors) are attached or not (A to D-frame).
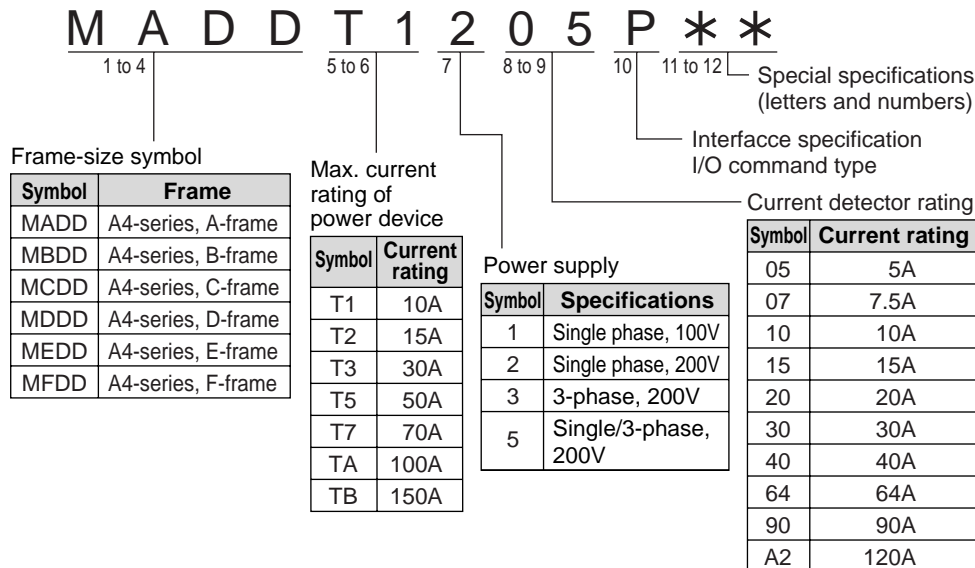
Contact to a dealer if you find any failures.
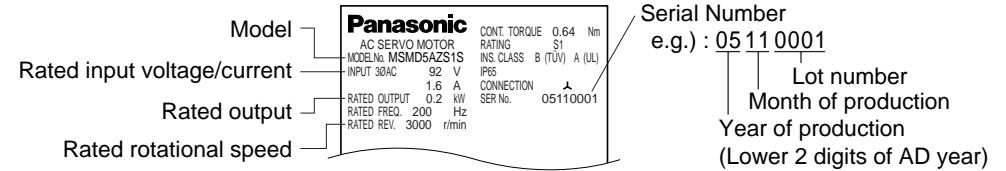
Check of the Driver Model
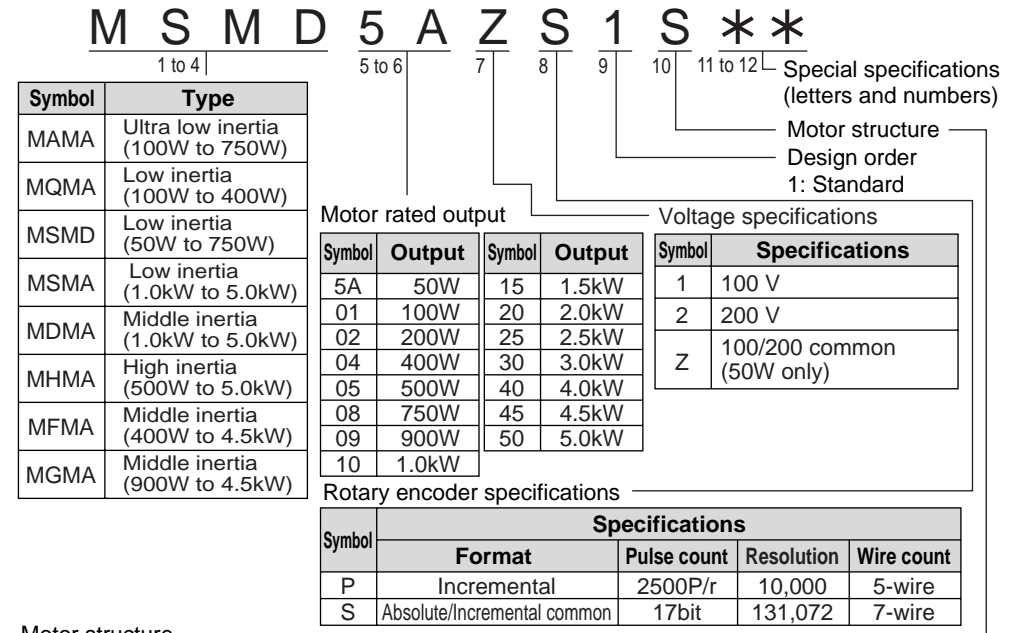
Contents of Name Plate

Model number
Rated input/output voltage
Rated input/output current
Rated output of applicable motor

Panasonic   AC SERVO
Model No. MADDT1205P Serial No.P05110001Z

	INPUT	OUTPUT
Voltage	200-240V	69V
Phase	1ø	3ø
F.L.C	1.3A	1.2A
Freq.	50/60Hz	0–333.3Hz
Power	100W	

Serial Number
e.g.) : P05110001Z
Lot number
Month of production
Year of production
(Lower 2 digits of AD year)

Model Designation

M A D D T 1 2 0 5 P ✳✳

1 to 4   5 to 6   7   8 to 9   10   11 to 12

- Special specifications (letters and numbers)
- Interfacce specification I/O command type
- Current detector rating

Frame-size symbol

Symbol	Frame
MADD	A4-series, A-frame
MBDD	A4-series, B-frame
MCDD	A4-series, C-frame
MDDD	A4-series, D-frame
MEDD	A4-series, E-frame
MFDD	A4-series, F-frame

Max. current rating of power device

Symbol	Current rating
T1	10A
T2	15A
T3	30A
T5	50A
T7	70A
TA	100A
TB	150A

Power supply

Symbol	Specifications
1	Single phase, 100V
2	Single phase, 200V
3	3-phase, 200V
5	Single/3-phase, 200V

Symbol	Current rating
05	5A
07	7.5A
10	10A
15	15A
20	20A
30	30A
40	40A
64	64A
90	90A
A2	120A

Check of the Motor Model

Contents of Name Plate

Model
Rated input voltage/current
Rated output
Rated rotational speed

Panasonic
AC SERVO MOTOR
MODEL No. MSMD5AZS1S
INPUT 3ØAC   92   V
            1.6   A
RATED OUTPUT 0.2 kW
RATED FREQ. 200 Hz
RATED REV. 3000 r/min
CONT. TORQUE 0.64 Nm
RATING   S1
INS. CLASS B (TÜV) A (UL)
IP65
CONNECTION
SER No.   05110001

Serial Number
e.g.) : 05110001
Lot number
Month of production
Year of production
(Lower 2 digits of AD year)

Model Designation

M S M D 5 A Z S 1 S ✳✳

1 to 4   5 to 6   7   8   9   10   11 to 12

- Special specifications (letters and numbers)
- Motor structure
- Design order 1: Standard

Symbol	Type
MAMA	Ultra low inertia (100W to 750W)
MQMA	Low inertia (100W to 400W)
MSMD	Low inertia (50W to 750W)
MSMA	Low inertia (1.0kW to 5.0kW)
MDMA	Middle inertia (1.0kW to 5.0kW)
MHMA	High inertia (500W to 5.0kW)
MFMA	Middle inertia (400W to 4.5kW)
MGMA	Middle inertia (900W to 4.5kW)

Motor rated output

Symbol	Output	Symbol	Output
5A	50W	15	1.5kW
01	100W	20	2.0kW
02	200W	25	2.5kW
04	400W	30	3.0kW
05	500W	40	4.0kW
08	750W	45	4.5kW
09	900W	50	5.0kW
10	1.0kW		

Voltage specifications

Symbol	Specifications
1	100 V
2	200 V
Z	100/200 common (50W only)

Rotary encoder specifications

Symbol	Specifications			
	Format	Pulse count	Resolution	Wire count
P	Incremental	2500P/r	10,000	5-wire
S	Absolute/Incremental common	17bit	131,072	7-wire

Motor structure
MSMD, MQMA

Symbol	Shaft		Holding brake		Oil seal	
	Round	Key way	Without	With	Without	With*1
A	●		●		●	
B	●			●	●	
S		●*2	●		●	
T		●*2		●	●	

MAMA

Symbol	Shaft		Holding brake		Oil seal	
	Round	Key way	Without	With	Without	With
A	●		●		●	
B	●			●	●	
E		●	●		●	
F		●		●	●	

*1 The product with oil seal is a special order product.
*2 Key way with center tap

MSMA, MDMA, MFMA, MGMA, MHMA

Symbol	Shaft		Holding brake		Oil seal	
	Round	Key way	Without	With	Without	With
C	●		●			●
D	●			●		●
G		●	●			●
H		●		●		●

Products are standard stock items or build to order items. For details, inquire of the dealer.

2. Installation

Install the driver and the motor properly to avoid a breakdown or an accident.

Driver

Installation Place

1) Indoors, where the products are not subjected to rain or direct sun beams. The products are not waterproof.
2) Where the products are not subjected to corrosive atmospheres such as hydrogen sulfide, sulfurous acid, chlorine, ammonia, chloric gas, sulfuric gas, acid, alkaline and salt and so on, and are free from splash of inflammable gas, grinding oil, oil mist, iron powder or chips and etc.
3) Well-ventilated and low humidity and dust-free place.
4) Vibration-free place.

### Environmental Conditions

| Item	Conditions
Ambient temperature	0°C to 55°C (free from freezing)
Ambient humidity	Less than 90% RH (free from condensation)
Storage temperature	−20°C to 80°C (free from freezing)
Storage humidity	Less than 90% RH (free from condensation)
Vibration	Lower than 5.9m/s^2 (0.6G), 10 to 60Hz
Altitude	Lower than 1000m

How to Install

1) Rack-mount type. Install in vertical position, and reserve enough space around the servo driver for ventilation.

   Base mount type (rear mount) is standard (A to D-frame)
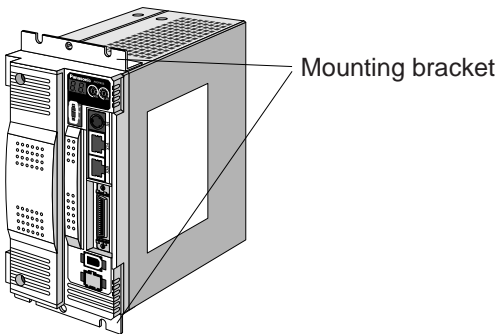2) Use the optional mounting bracket when you want to change the mounting face.

A to D-frame

MADD
MBDD
MCDD
MDDD

e.g.) In case of C-frame

Mounting bracket (optional parts)
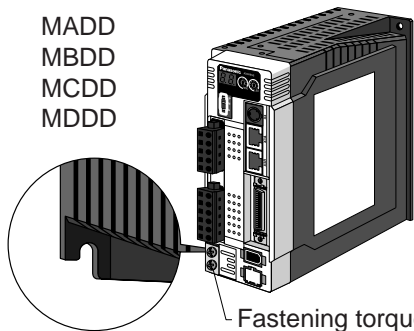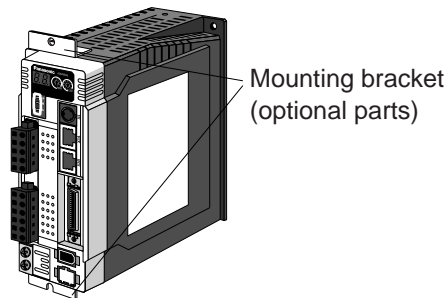
Fastening torque of earth screws (M4) to be 0.39 to 0.59N·m.

E and F-frame

Mounting bracket

Mounting Direction and Spacing

• Reserve enough surrounding space for effective cooling.

• Install fans to provide uniform distribution of temperature in the control panel.

• Observe the environmental conditions of the control panel described in the next page.

<Note>
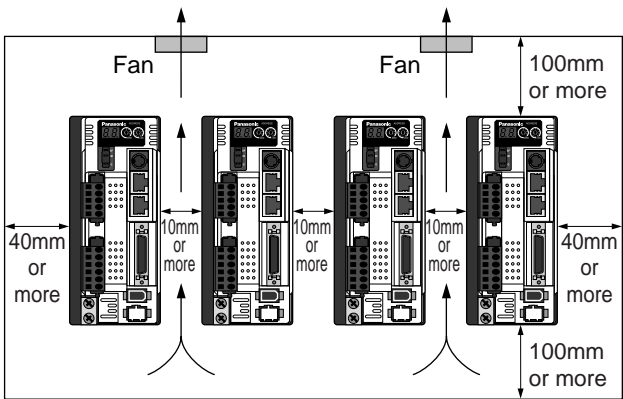
It is recommended to use the conductive paint when you make your own mounting bracket, or repaint after peeling off the paint on the machine for installing the products, in order to make noise countermeasure.

Caution on Installation

We have been making the best effort to ensure the highest quality, however, application of exceptionally large 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.

There might be a chance of smoke generation due to the failure of these products. Pay an extra attention when you apply these products in a clean room environment.

2. Installation

Motor

Installation Place

Since the conditions of location affect a lot to the motor life, select a place which meets the conditions below.

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

Environmental Conditions

Item		Condition
Ambient temperature		0˚C to 40˚C (free from freezing) *1
Ambient humidity		Less than 85% RH (free from condensation)
Storage temperature		–20˚C to 80˚C (free from freezing) *2
Storage humidity		Less than 85% RH (free from condensation)
Vibration	Motor only	Lower than 49m/s^2 (5G) at running, 24.5m/s^2 (2.5G) at stall
Impact	Motor only	Lower than 98m/s^2 (10G)
Enclosure rating	Motor only	IP65 (except rotating portion of output shaft and lead wire end) • These motors conform to the test conditions specified in EN standards (EN60529, EN60034-5). Do not use these motors in application where water proof performance is required such as continuous wash-down operation.

*1 Ambient temperature to be measured at 5cm away from the motor.

*2 Permissible temperature for short duration such as transportation.

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 (non-standard) when mounting the motor with gear reducer to prevent the reducer oil/grease from entering to the motor.
3) For mounting dimensions, refer to the technical reference.

Oil/Water Protection

1) Don't submerge the motor cable to water or oil.
2) Install the motor with the cable outlet facing downward.
3) Avoid a place where the motor is subjected to oil or water.
4) Use the motor with an oil seal when used with the gear reducer, so that the oil may not enter to the motor through shaft.
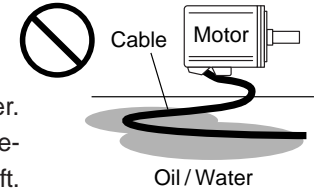
Stress to Cables

1) Avoid a stress application to the cable outlet and connecting portion by bending or self-weight.
2) Especially in an application where the motor itself travels, fix the attached cable and contain the extension junction cable into the bearer so that the stress by bending can be minimized.
3) Take the cable bending radius as large as possible. (Minimum R20mm)

Permissible Load to Output Shaft

1) Design the mechanical system so that the applied radial load and/or thrust load to the motor shaft at installation and at normal operation can meet the permissible value specified to each model.
2) Pay an extra attention when you use a rigid coupling. (Excess bending load may damage the shaft or deteriorate the bearing life.
3) Use a flexible coupling with high stiffness designed exclusively for servo application in order to make a radial thrust caused by micro misalignment smaller than the permissible value.
4) For permissible load of each model, refer to the technical reference. (DV0P4490)

Notes on Installation

1) Do not apply direct impact to the shaft by hammer while attaching/detaching a coupling to and from the motor shaft.
   (Or it may damage the encoder mounted on the other side of the shaft.)
2) Make a full alignment. (incomplete alignment may cause vibration and damage the bearing.)
3) If the motor shaft is not electrically grounded, it may cause electrolytic corrosion to the bearing depending on the condition of the machine and its mounting environment, and may result in the bearing noise. Check and verification by customer is required.
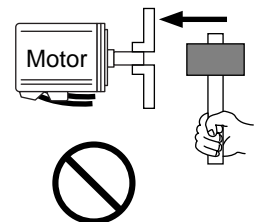
2. Installation

Console

Installation Place

1) Indoors, where the products are not subjected to rain or direct sun beam. The products are not waterproof.
2) Where the products are not subjected to corrosive atmospheres such as hydrogen sulfide, sulfurous acid, chlorine, ammonia, chloric gas, sulfuric gas, acid, alkaline and salt and so on, and are free from splash of inflammable gas, grinding oil, oil mist, iron powder or chips and etc.
3) Well-ventilated and low humidity and dust-free place.
4) Easy-to-access place for inspection and cleaning

Environmental Conditions

Item	Condition
Ambient temperature	0˚C to 55˚C (free from freezing)
Ambient humidity	Less than 90% RH (free from condensation)
Storage temperature	−20˚C to 80˚C (free from freezing)
Storage humidity	Less than 90% RH (free from condensation)
Vibration	Lower than 5.9m/s^2 (0.6G), 10 to 60Hz
Impact	Conform to JISC0044 (Free fall test, 1m for 2 directions, 2 cycles)
Altitude	Lower than 1000m

<Cautions>
- Do not give strong impact to the products.
- Do not drop the products.
- Do not pull the cables with excess force.
- Avoid the place near to the heat source such as a heater or a large winding resistor.

How to Connect
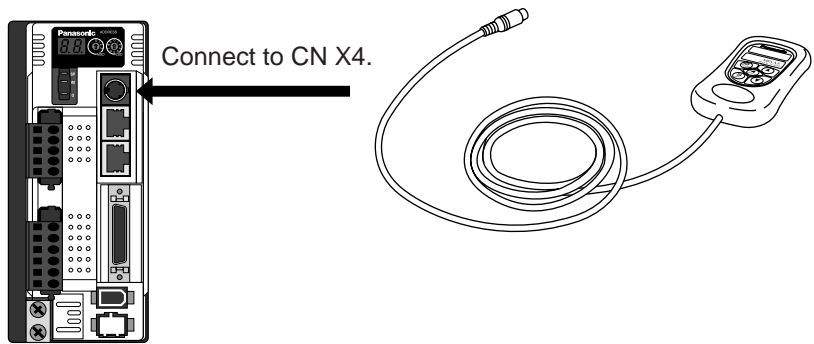
Connect to CN X4.

<Remarks>
- Connect the console connector securely to CN X4 connector of the driver.
- Never pull the cable to plug in or plug out.

3. System Configuration and Wiring

Overall Wiring (Connecting Example of C-frame, 3-phase)

• Wiring of the Main Circuit

Circuit Breaker (NFB)
Use the circuit breaker matching capacity of the power source to protect the power lines.

Noise Filter (NF)
Prevents external noise from the power lines. And reduces an effect of the noise generated by the servo driver.

Magnetic Contactor (MC)
Turns on/off the main power of the servo driver.
Use a surge absorber together with this.
• Never start nor stop the servo motor with this Magnetic Contactor.

Reactor (L)
Reduces harmonic current of the main power.

For specifications, refer to the downloaded Instruction Manual from our Web Site.
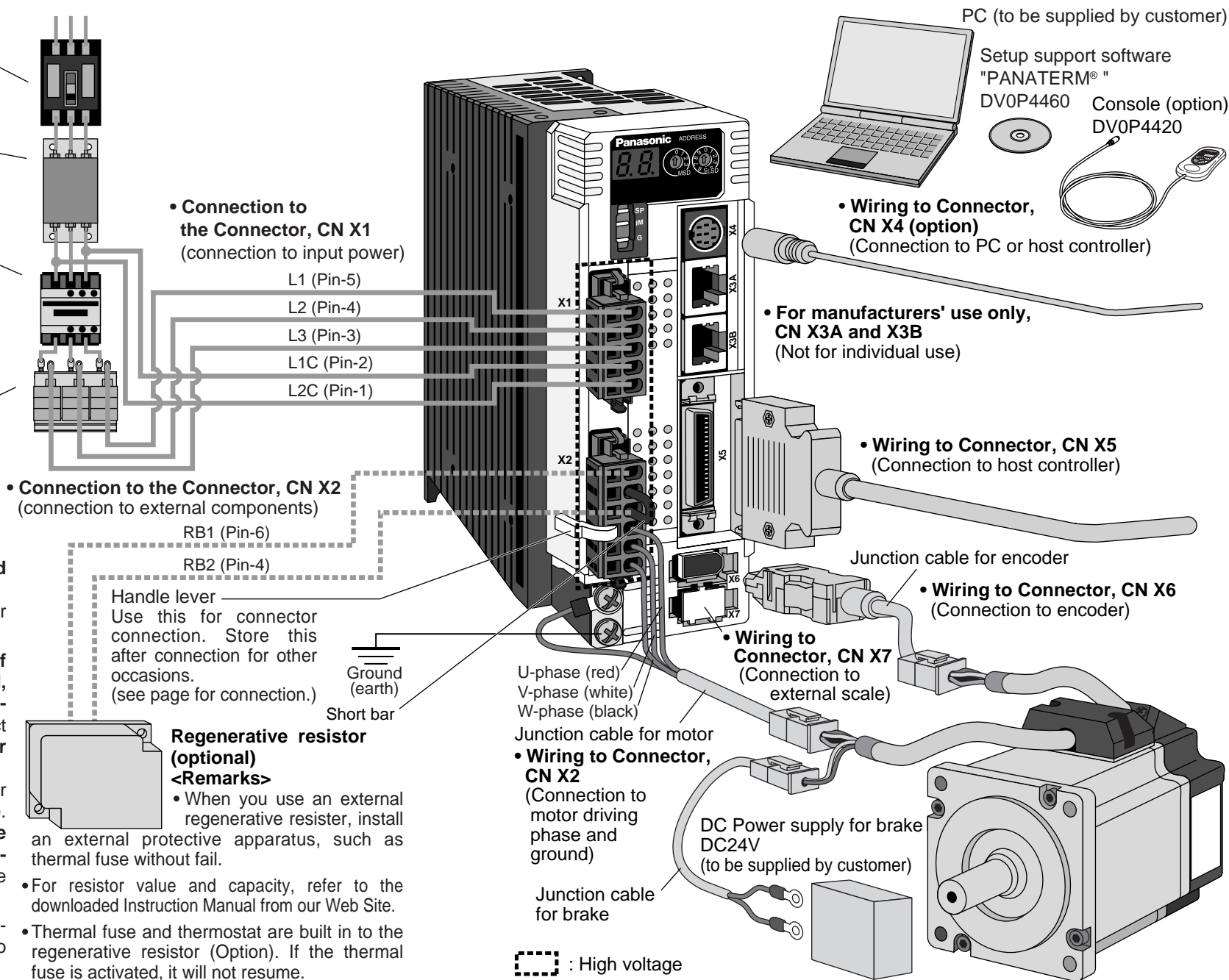
Pin RB1 (6-pin), RB2 (4-pin), and RB3 (5-pin)
• RB2 and RB3 to be kept shorted for normal operation.

• **When the capacity shortage of the regenerative resister is found, disconnect a shorting bar between RB2 and RB3,** then connect **the external regenerative resister** between RB1 and RB2.
(Note that no regenerative resister is equipped in Frame A and B type. **Install an external regenerative resister on incombustible material, such as metal.** Follow the same wiring connection as the above.)

• When you connect an external regenerative resister, set up servo parameter No. 6C to 1 or 2.

• Connection to the Connector, CN X1
(connection to input power)

L1 (Pin-5)
L2 (Pin-4)
L3 (Pin-3)
L1C (Pin-2)
L2C (Pin-1)

• Connection to the Connector, CN X2
(connection to external components)

RB1 (Pin-6)
RB2 (Pin-4)

Handle lever
Use this for connector connection. Store this after connection for other occasions.
(see page for connection.)

Ground (earth)

Short bar

Regenerative resistor (optional)
<Remarks>
• When you use an external regenerative resister, install an external protective apparatus, such as thermal fuse without fail.

• For resistor value and capacity, refer to the downloaded Instruction Manual from our Web Site.

• Thermal fuse and thermostat are built in to the regenerative resistor (Option). If the thermal fuse is activated, it will not resume.

PC (to be supplied by customer)

Setup support software "PANATERM® "
DV0P4460   Console (option)
DV0P4420

• Wiring to Connector, CN X4 (option)
(Connection to PC or host controller)

• For manufacturers' use only, CN X3A and X3B
(Not for individual use)

• Wiring to Connector, CN X5
(Connection to host controller)

Junction cable for encoder

• Wiring to Connector, CN X6
(Connection to encoder)

• Wiring to Connector, CN X7
(Connection to external scale)

U-phase (red)
V-phase (white)
W-phase (black)
Junction cable for motor
• Wiring to Connector, CN X2
(Connection to motor driving phase and ground)

DC Power supply for brake DC24V
(to be supplied by customer)

Junction cable for brake

[   ] : High voltage

3. System Configuration and Wiring

Overall Wiring (Connecting Example of E-frame)

• Wiring of the Main Circuit

Circuit Breaker (NFB)
Use the circuit breaker matching capacity of the power source to protect the power lines.

Noise Filter (NF)
Prevents external noise from the power lines. And reduces an effect of the noise generated by the servo driver.

Magnetic Contactor (MC)
Turns on/off the main power of the servo driver.
Use a surge absorber together with this.
• **Never start nor stop the servo motor with this Magnetic Contactor.**

Reactor (L)
Reduces harmonic current of the main power.

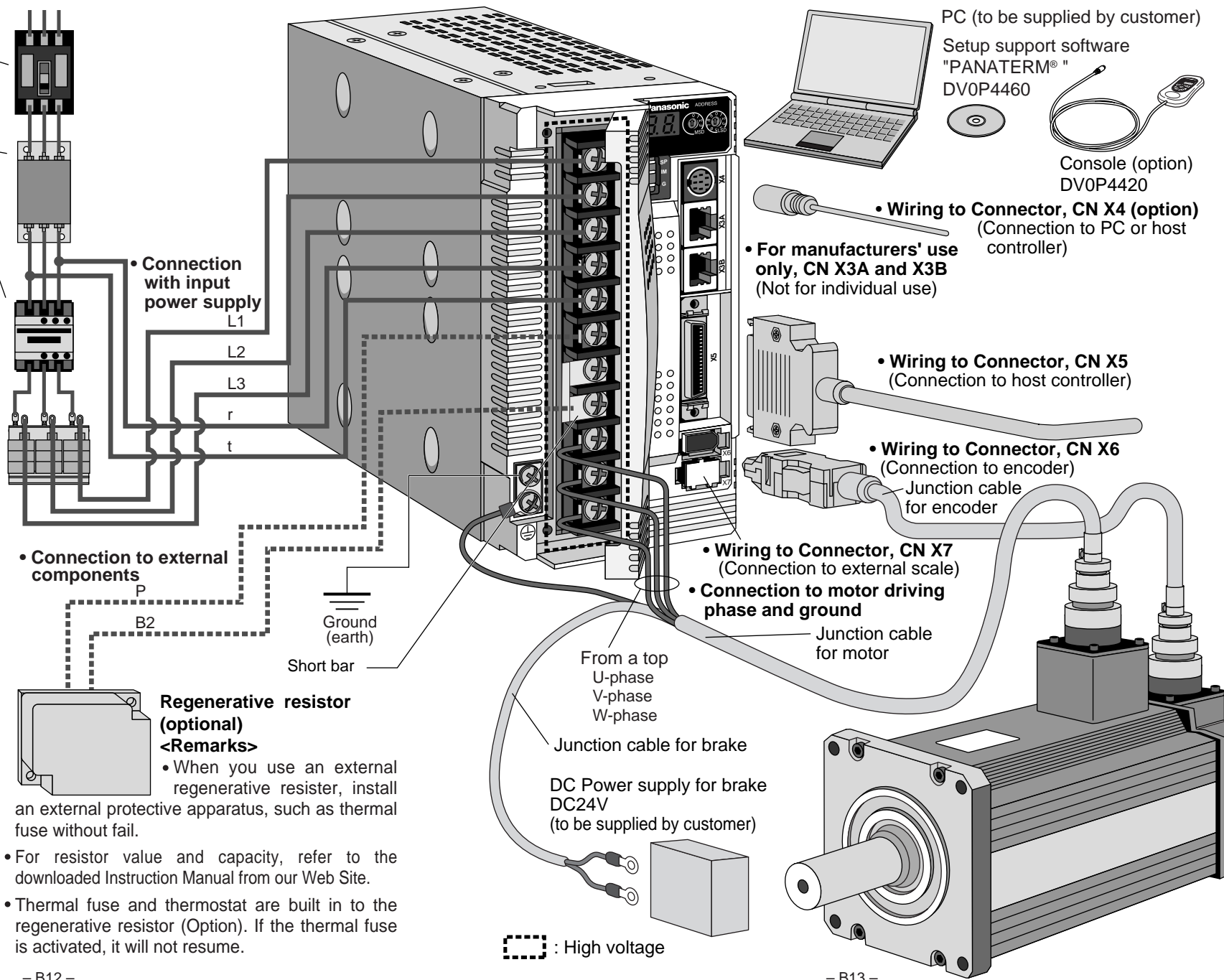For specifications, refer to the downloaded Instruction Manual from our Web Site.

Pin P, B1 and B2...
B1 and B2 to be kept shorted for normal operation.

• **When the capacity shortage of the regenerative resister is found, disconnect a short bar between B1 and B2,** then connect **the external regenerative resister** between P and B2.
Install an external regenerative resister on incombustible material, such as metal. Follow the same wiring connection as the above.

• When you connect an external regenerative resister, set up servo parameter No. 6C to 1 or 2.

• Connection with input power supply
L1
L2
L3
r
t

• Connection to external components
P
B2

Short bar

Ground (earth)

Regenerative resistor (optional)
<Remarks>
• When you use an external regenerative resister, install an external protective apparatus, such as thermal fuse without fail.

• For resistor value and capacity, refer to the downloaded Instruction Manual from our Web Site.

• Thermal fuse and thermostat are built in to the regenerative resistor (Option). If the thermal fuse is activated, it will not resume.

PC (to be supplied by customer)
Setup support software "PANATERM® " DV0P4460

Console (option) DV0P4420

• Wiring to Connector, CN X4 (option)
(Connection to PC or host controller)

• For manufacturers' use only, CN X3A and X3B
(Not for individual use)

• Wiring to Connector, CN X5
(Connection to host controller)

• Wiring to Connector, CN X6
(Connection to encoder)
Junction cable for encoder

• Wiring to Connector, CN X7
(Connection to external scale)

• Connection to motor driving phase and ground
Junction cable for motor

From a top
U-phase
V-phase
W-phase

Junction cable for brake

DC Power supply for brake DC24V
(to be supplied by customer)

[⫶] : High voltage

3. System Configuration and Wiring

Driver and List of Applicable Peripheral Equipments

Driver	Applicable motor	Voltage	Rated output	Required Power (at the rated load)	Circuit breaker (rated current)	Noise filter	Surge absorber	Noise filter for signal	Magnetic contactor	Cable diameter (main circuit)	Cable diameter (control circuit)	Connection
MADD	MSMD	Single phase, 100V	50W to 100W	approx. 0.4kVA	10A	DV0P4170	DV0P4190		BMFT61041N (3P+1a)	0.75 to 2.0mm² AWG 14 to 18	0.75mm² AWG18	Connection to exclusive connector
	MQMA	Single phase, 100V	100W	approx. 0.4kVA								
	MSMD	Single phase, 200V	50W to 200W	approx. 0.5kVA					BMFT61542N (3P+1a)			
	MQMA	Single phase, 200V	100W	approx. 0.3kVA								
			200W	approx. 0.5kVA								
	MAMA		100W	approx. 0.3kVA								
MBDD	MSMD	Single phase, 100V	200W	approx. 0.5kVA					BMFT61041N (3P+1a)			
	MQMA											
	MSMD	Single phase, 200V	400W	approx. 0.9kVA					BMFT61542N (3P+1a)			
	MQMA											
	MAMA		200W	approx. 0.5kVA								
MCDD	MQMA	Single phase, 100V	400W	approx. 0.9kVA	15A	DV0P4180		DV0P1460	BMFT61541N (3P+1a)	0.75mm² AWG18		
	MSMD		750W	approx. 1.3kVA								
	MAMA	Single/3-phase, 200V	400W	approx. 0.9kVA					BMFT61542N (3P+1a)			
	MFMA											
	MHMA		500W	approx. 1.1kVA								
MDDD	MAMA		750W	approx. 1.6kVA	20A	DV0P4220	DV0P1450			2.0mm² AWG14		
	MDMA		1.0kW	approx. 1.8kVA								
	MHMA											
	MGMA		900W	approx. 1.8kVA					BMFT61842N (3P+1a)			
	MSMA	Single/3-phase, 200V	1.0kW	approx. 1.8kVA								
	MHMA											
	MDMA		1.5kW	approx. 2.3kVA								
	MSMA											
	MFMA											
MEDD	MDMA	3-phase, 200V	2.0kW	approx. 3.3kVA	30A				BMF6352N (3P+2a2b)	2.0mm² AWG14		Terminal block M5 11.0 or smaller ø5.3
	MSMA											
	MHMA											
	MFMA		2.5kW	approx. 3.8kVA						3.5mm² AWG12		

Driver	Applicable motor	Voltage	Rated output	Required Power (at the rated load)	Circuit breaker (rated current)	Noise filter	Surge absorber	Noise filter for signal	Magnetic contactor	Cable diameter (main circuit)	Cable diameter (control circuit)	Connection
MFDD	MGMA	3-phase, 200V	2.0kW	approx. 3.8kVA	50A	DV0P3410	DV0P1450	DV0P1460	BMF6352N (3P+2a2b)	3.5mm² AWG12	0.75mm² AWG18	Terminal block M5 11.0 or smaller ø5.3
	MDMA		3.0kW	approx. 4.5kVA								
	MHMA											
	MSMA											
	MGMA											
	MDMA		4.0kW	approx. 6kVA								
	MHMA											
	MSMA											
	MFMA		4.5kW	approx. 6.8kVA					BMF6652N (3P+2a2b)			
	MGMA			approx. 7.5kVA						5.3mm² AWG10		
	MDMA											
	MHMA		5.0kW	approx. 7.5kVA								
	MSMA											

- Select a single and 3-phase common specifications according to the power source.

- Manufacturer of circuit breaker and magnetic contactor : Matsushita Electric Works.
  To comply to EC Directives, install a circuit breaker between the power and the noise filter without fail, and the circuit breaker should conform to IEC Standards and UL recognized (Listed and ⓤ marked).
  5000Arms, 240V is the maximum capacity to be delivered to the circuit of 750W or larger model when the maximum current value of the circuit breaker is limited to 20A.

- For details of noise filters, refer to P.B48, "Noise Filter".

<Remarks>

- Select and use the circuit breaker and noise filter with matching capacity to those of the power source, considering the load conditions as well.

- Terminal block and protective earth terminal
  Use a copper conductor cable with temperature rating of 60°C or higher.
  Protective earth terminal is M4 for A to D-frame, and M5 for E and F-frame.
  Larger tightening torque of the screw than the max. value (M4 : 1.2 N·m, M5 : 2.0 N·m) may damage the terminal block.

- Earth cable diameter should be 2.0mm² (AWG14) or larger for 50W to 2.0kW model, and 3.5mm² (AWG12) or larger for 2.5kW to 4.0kW, and 5.3mm² (AWG10) or larger for 4.5kW to 5kW model.

- Use the attached exclusive connectors for A to D-frame, and maintain the peeled off length of 8 to 9mm.

- Tightening torque of the screws for connector (CN X5) for the connection to the host to be 0.3 to 0.35 N·m. Larger tightening torque than these may damage the connector at the driver side.
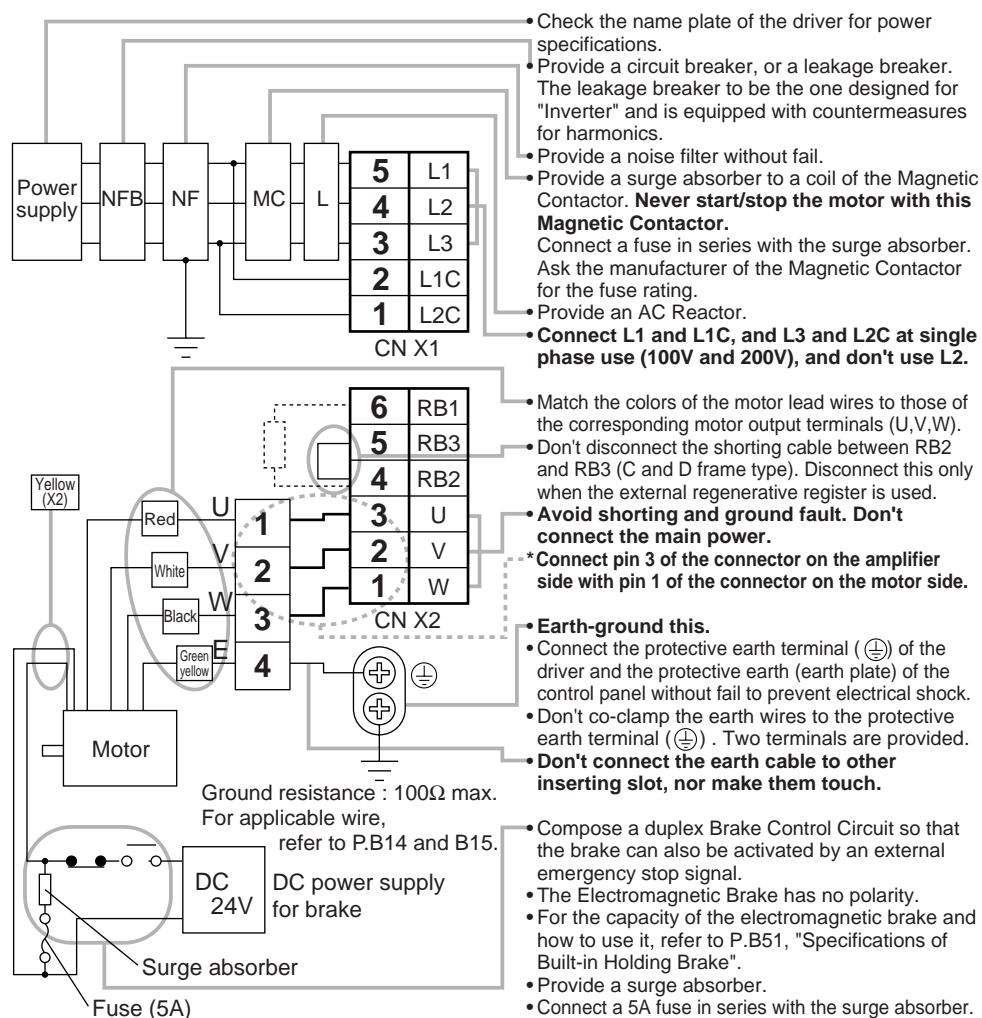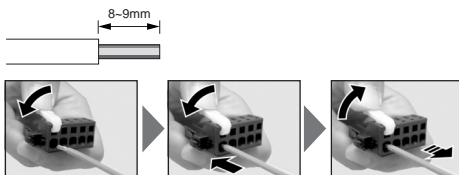
3. System Configuration and Wiring

Wiring of the Main Circuit (A to D-frame)

- Wiring should be performed by a specialist or an authorized personnel.
- Do not turn on the power until the wiring is completed.

Tips on Wiring

1) Peel off the insulation cover of the cable.
   (Observe the dimension as the right fig. shows.)
2) Insert the cable to the connector detached from the driver.(See P.B18 for details.)
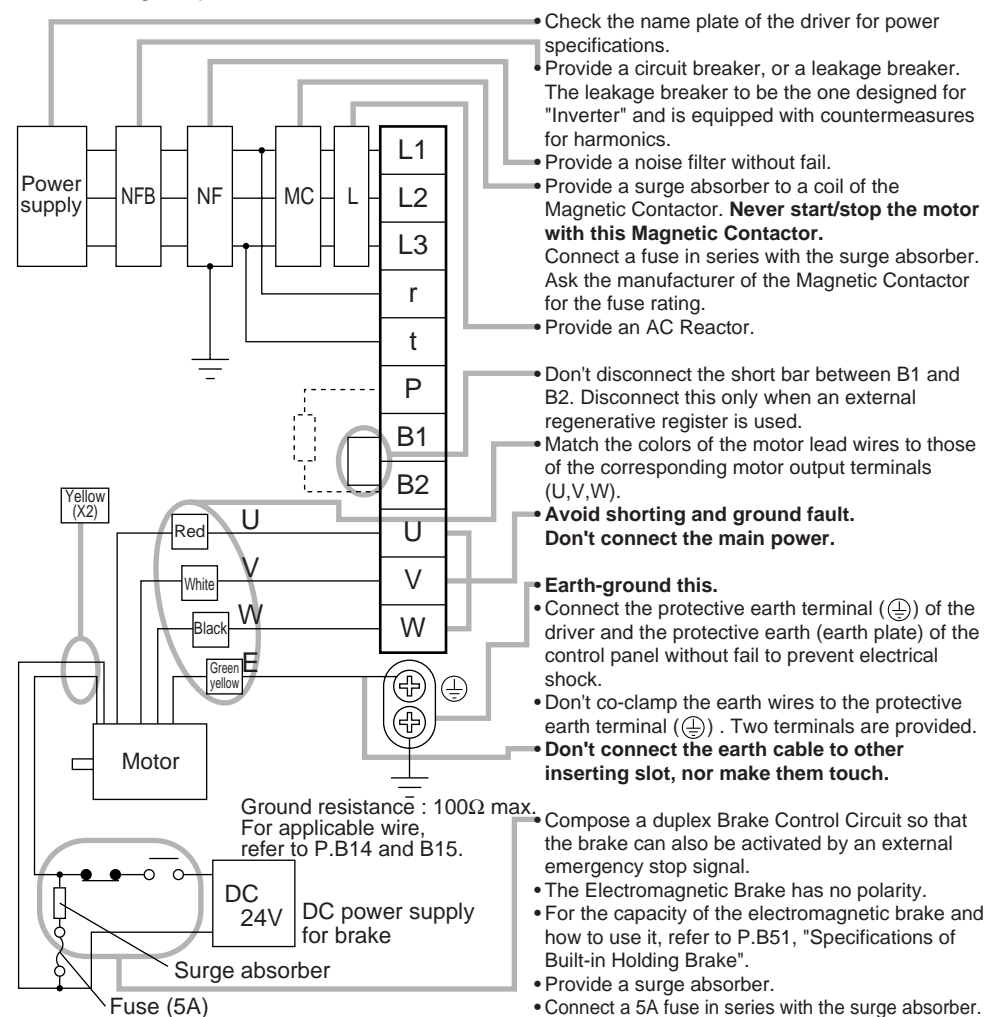3) Connect the wired connector to the driver.

8~9mm

- Check the name plate of the driver for power specifications.
- Provide a circuit breaker, or a leakage breaker. The leakage breaker to be the one designed for "Inverter" and is equipped with countermeasures for harmonics.
- Provide a noise filter without fail.
- Provide a surge absorber to a coil of the Magnetic Contactor. **Never start/stop the motor with this Magnetic Contactor.** Connect a fuse in series with the surge absorber. Ask the manufacturer of the Magnetic Contactor for the fuse rating.
- Provide an AC Reactor.
- **Connect L1 and L1C, and L3 and L2C at single phase use (100V and 200V), and don't use L2.**

5	L1
4	L2
3	L3
2	L1C
1	L2C

CN X1

- Match the colors of the motor lead wires to those of the corresponding motor output terminals (U,V,W).
- Don't disconnect the shorting cable between RB2 and RB3 (C and D frame type). Disconnect this only when the external regenerative register is used.
- **Avoid shorting and ground fault. Don't connect the main power.**
- ***Connect pin 3 of the connector on the amplifier side with pin 1 of the connector on the motor side.**

6	RB1
5	RB3
4	RB2
3	U
2	V
1	W

CN X2

1	U
2	V
3	W
4	E

Yellow (X2)
Red
White
Black
Green yellow

- **Earth-ground this.**
- Connect the protective earth terminal (⏚) of the driver and the protective earth (earth plate) of the control panel without fail to prevent electrical shock.
- Don't co-clamp the earth wires to the protective earth terminal (⏚). Two terminals are provided.
- **Don't connect the earth cable to other inserting slot, nor make them touch.**

Motor

Ground resistance : 100Ω max. For applicable wire, refer to P.B14 and B15.

DC 24V — DC power supply for brake

Surge absorber
Fuse (5A)

- Compose a duplex Brake Control Circuit so that the brake can also be activated by an external emergency stop signal.
- The Electromagnetic Brake has no polarity.
- For the capacity of the electromagnetic brake and how to use it, refer to P.B51, "Specifications of Built-in Holding Brake".
- Provide a surge absorber.
- Connect a 5A fuse in series with the surge absorber.

Wiring of the Main Circuit (E and F-frame)

- Wiring should be performed by a specialist or an authorized personnel.
- Do not turn on the power until the wiring is completed.

Tips on Wiring

1) Take off the cover fixing screws, and detach the terminal cover.
2) Make wiring
   Use clamp type terminals of round shape with insulation cover for wiring to the terminal block. For cable diameter and size, rater to "Driver and List of Applicable Peripheral Equipments" (P.B14 and B15).
3) Attach the terminal cover, and fix with screws.
   Fastening torque of cover fixed screw in less than 0.2 N·m.

- Check the name plate of the driver for power specifications.
- Provide a circuit breaker, or a leakage breaker. The leakage breaker to be the one designed for "Inverter" and is equipped with countermeasures for harmonics.
- Provide a noise filter without fail.
- Provide a surge absorber to a coil of the Magnetic Contactor. **Never start/stop the motor with this Magnetic Contactor.** Connect a fuse in series with the surge absorber. Ask the manufacturer of the Magnetic Contactor for the fuse rating.
- Provide an AC Reactor.

| L1 |
| L2 |
| L3 |
| r |
| t |
| P |
| B1 |
| B2 |
| U |
| V |
| W |

- Don't disconnect the short bar between B1 and B2. Disconnect this only when an external regenerative register is used.
- Match the colors of the motor lead wires to those of the corresponding motor output terminals (U,V,W).
- **Avoid shorting and ground fault. Don't connect the main power.**

- **Earth-ground this.**
- Connect the protective earth terminal (⏚) of the driver and the protective earth (earth plate) of the control panel without fail to prevent electrical shock.
- Don't co-clamp the earth wires to the protective earth terminal (⏚). Two terminals are provided.
- **Don't connect the earth cable to other inserting slot, nor make them touch.**

Yellow (X2)
Red
White
Black
Green yellow

Motor

Ground resistance : 100Ω max. For applicable wire, refer to P.B14 and B15.

DC 24V — DC power supply for brake

Surge absorber
Fuse (5A)

- Compose a duplex Brake Control Circuit so that the brake can also be activated by an external emergency stop signal.
- The Electromagnetic Brake has no polarity.
- For the capacity of the electromagnetic brake and how to use it, refer to P.B51, "Specifications of Built-in Holding Brake".
- Provide a surge absorber.
- Connect a 5A fuse in series with the surge absorber.

3. System Configuration and Wiring

Wiring method to connector (A to D-frame)

• Follow the procedures below for the wiring connection to the Connector CN X1 and X2 .
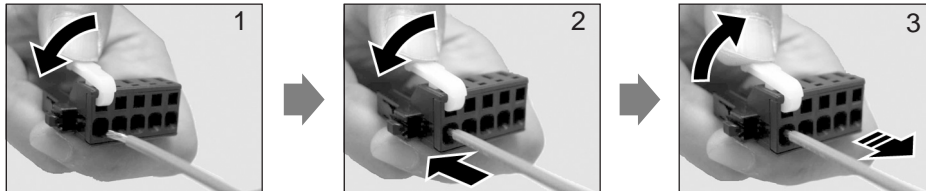
How to connect

8 to 9mm

1. Peel off the insulation cover of the cable.
   (see the right fig for exact length for peeling.)

2. Insert the cable to the connecter in the following 2 methods.
   (a) Using the attached Handle Lever
   (b) Using a screw driver (blade width of 3.0 to 3.5 mm)

(a) Using handle lever

| 1 | 2 | 3 |

Attach the handle lever to the handling slot on the upper portion. Press down the lever to push down the spring.

Insert the peeled cable while pressing down the lever, until it hits the insertion slot (round hole).

Release the lever.

* You can pull out the cable by pushing down the spring as the above.

(b) Using screw driver

| 1 | 2 | 3 |
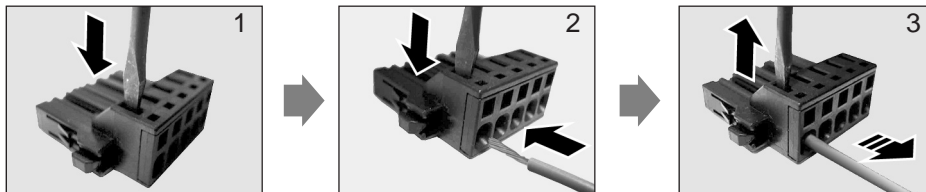
Press the screw driver to the handling slot on the upper portion to push down the spring.

Insert the peeled cable while pressing down the screw driver, until it hits the insertion slot (round hole).

Release the screw driver.

* You can pull out the cable by pushing down the spring as the above.

<CAUTION>
• Peel off the cable with exact length (8 to 9 mm).
• Take off the connector from the Servo Driver before making connection.
• Insert one cable into each one of cable insertion slot.
• Pay attention to injury by screw driver.

Wiring Diagram

Compose the circuit so that the main circuit power will be shut off when an error occurs.

In Case of Single Phase, 100V (A and B-frame)

Power supply Single phase, 100V $^{+10\%}_{-15\%}$ to 115V $^{+10\%}_{-15\%}$
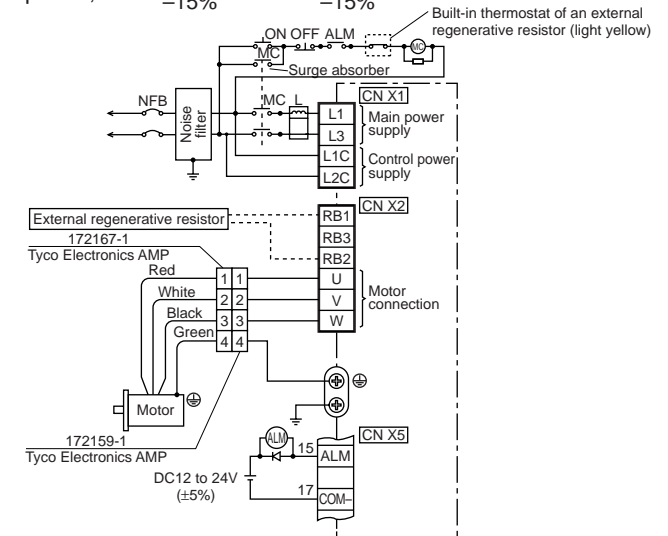
In Case of Single Phase, 200V (A and B-frame)

Power supply Single phase, 200V $^{+10\%}_{-15\%}$ to 240V $^{+10\%}_{-15\%}$
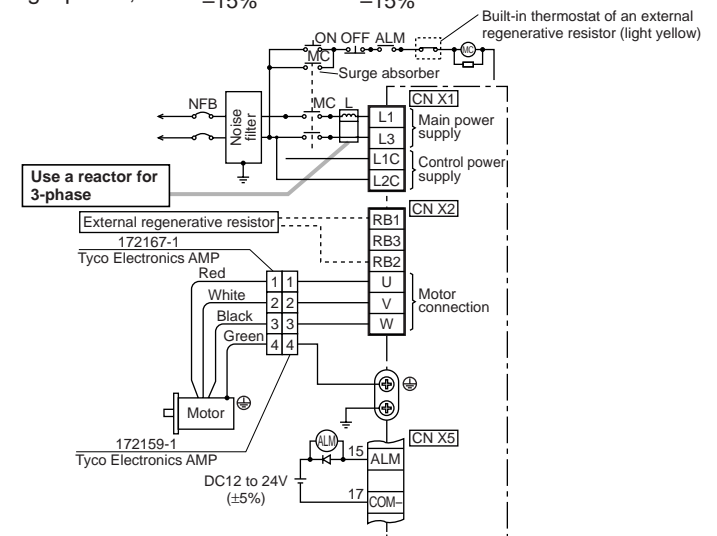
3. System Configuration and Wiring

In Case of Single Phase, 200V (C and D-frame)

Power supply Single phase, 200V $^{+10\%}_{-15\%}$ to 240V $^{+10\%}_{-15\%}$

\<Remarks\>
When you use single phase, connect the main power between L1 and L3 terminals.

Use a reactor for 3-phase
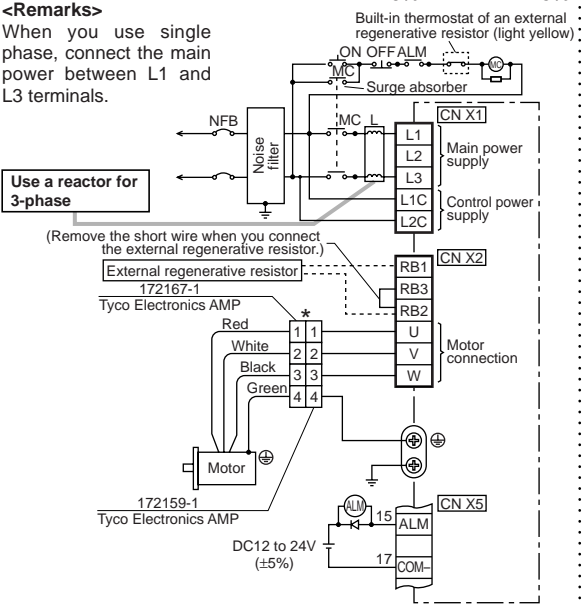
In Case of 3-Phase, 200V (C and D-frame)

Power supply 3-phase, 200V $^{+10\%}_{-15\%}$ to 240V $^{+10\%}_{-15\%}$

\<Remarks\>
When you use single phase, connect the main power between L1 and L3 terminals.

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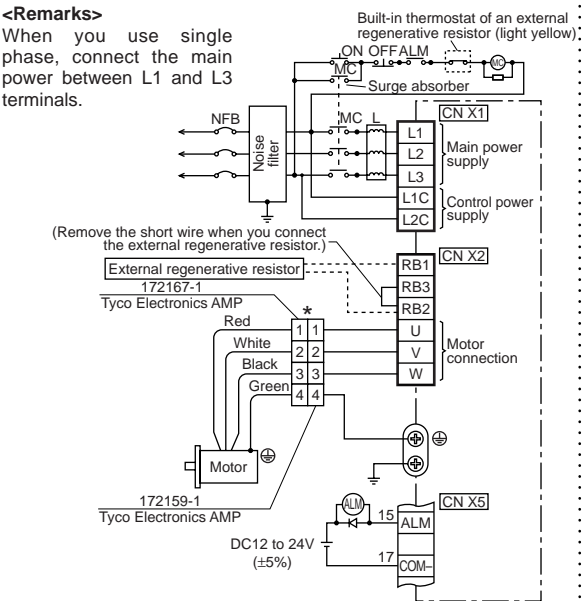
* When you use motor model of MSMA, MDMA, MFMA, MHMA and MGMA, use the connections as the below table shows.

[Motor portion]
Connector : by Japan Aviation Electronics Ind.

JL04V-2E20-4PE-B-R
JL04HV-2E22-22PE-B-R

PIN No.	Application
A	U-phase
B	V-phase
C	W-phase
D	Ground

JL04V-2E20-18PE-B-R

PIN No.	Application
G	Brake
H	Brake
A	NC
F	U-phase
I	V-phase
B	W-phase
E	Ground
D	Ground
C	NC

JL04V-2E24-11PE-B-R
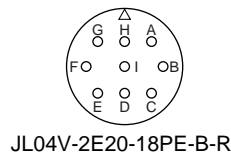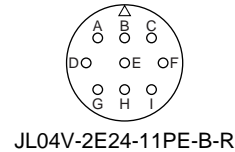
PIN No.	Application
A	Brake
B	Brake
C	NC
D	U-phase
E	V-phase
F	W-phase
G	Ground
H	Ground
I	NC

\<Remark\>
Do not connect anything to NC.

In Case of 3-Phase, 200V (E and F-frame)

Power supply 3-phase, 200V $^{+10\%}_{-15\%}$ to 230V $^{+10\%}_{-15\%}$

[Motor portion]
Connector : by Japan Aviation Electronics Ind.

JL04V-2E20-4PE-B-R
JL04HV-2E22-22PE-B-R

PIN No.	Application
A	U-phase
B	V-phase
C	W-phase
D	Ground

JL04V-2E20-18PE-B-R

PIN No.	Application
G	Brake
H	Brake
A	NC
F	U-phase
I	V-phase
B	W-phase
E	Ground
D	Ground
C	NC

JL04V-2E24-11PE-B-R
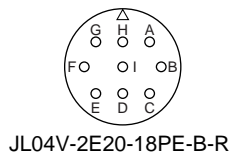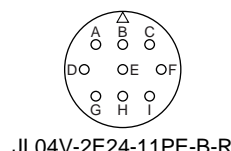
PIN No.	Application
A	Brake
B	Brake
C	NC
D	U-phase
E	V-phase
F	W-phase
G	Ground
H	Ground
I	NC

\<Remark\>
Do not connect anything to NC.

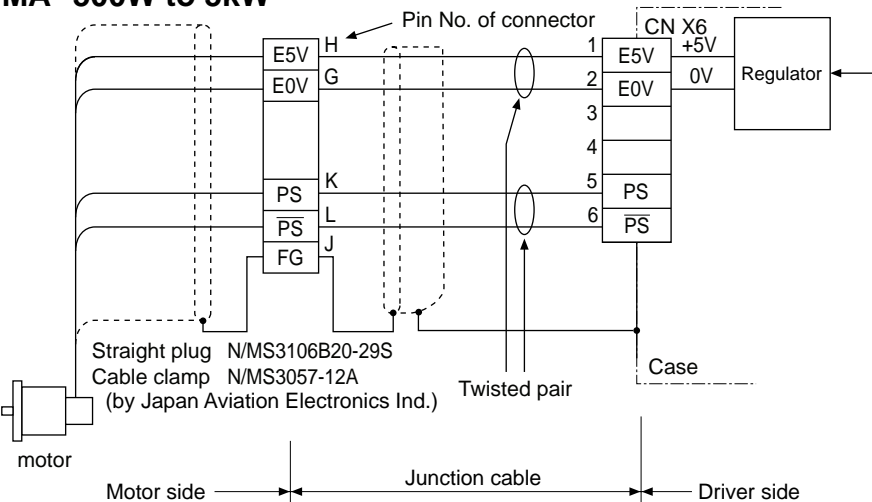# 3. System Configuration and Wiring

Wiring Diagram In case of 2500P/r incremental encoder
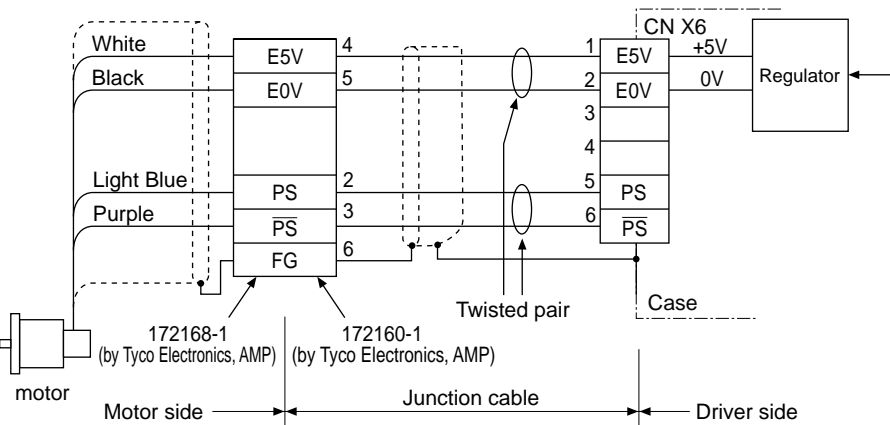
MSMD　50W to 750W
MAMA　100W to 750W
MQMA　100W to 400W

MSMA　1kW to 5kW　MFMA　400W to 4.5kW
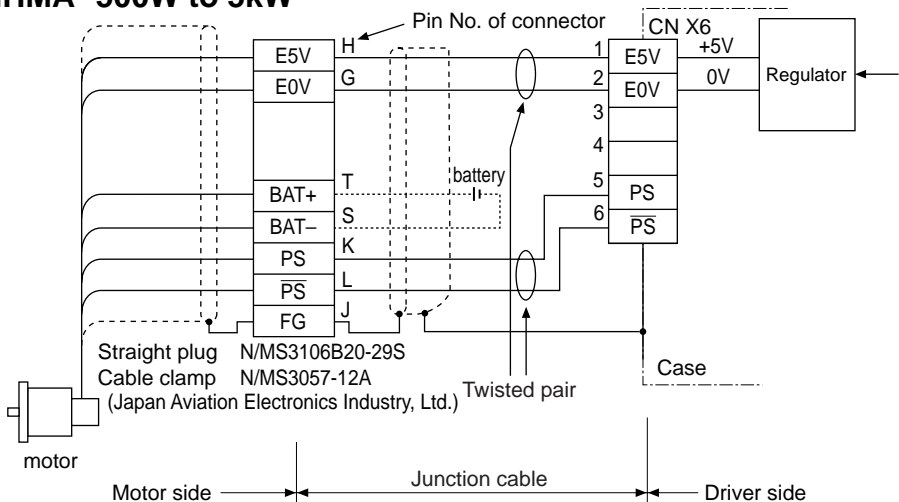MDMA　1kW to 5kW　MGMA　900W to 4.5kW
MHMA　500W to 5kW

Straight plug　N/MS3106B20-29S
Cable clamp　N/MS3057-12A
(by Japan Aviation Electronics Ind.)

Wiring Diagram In case of 17-bit absolute/incremental encoder
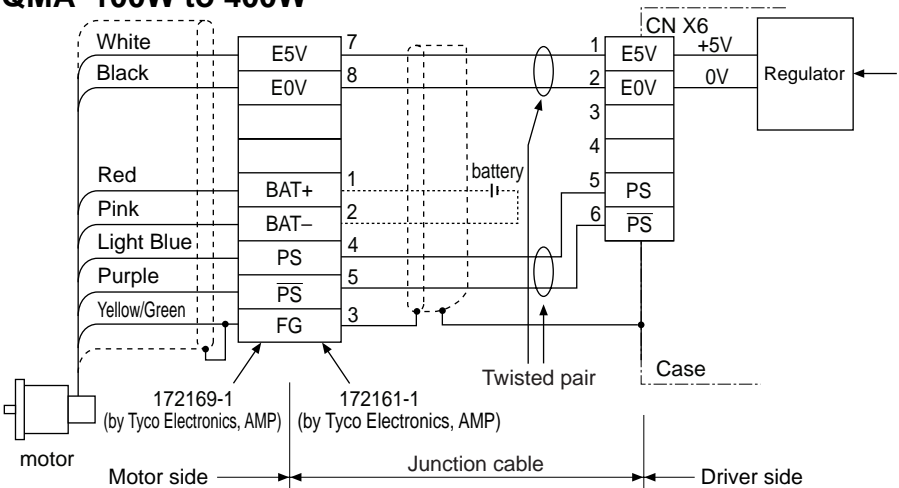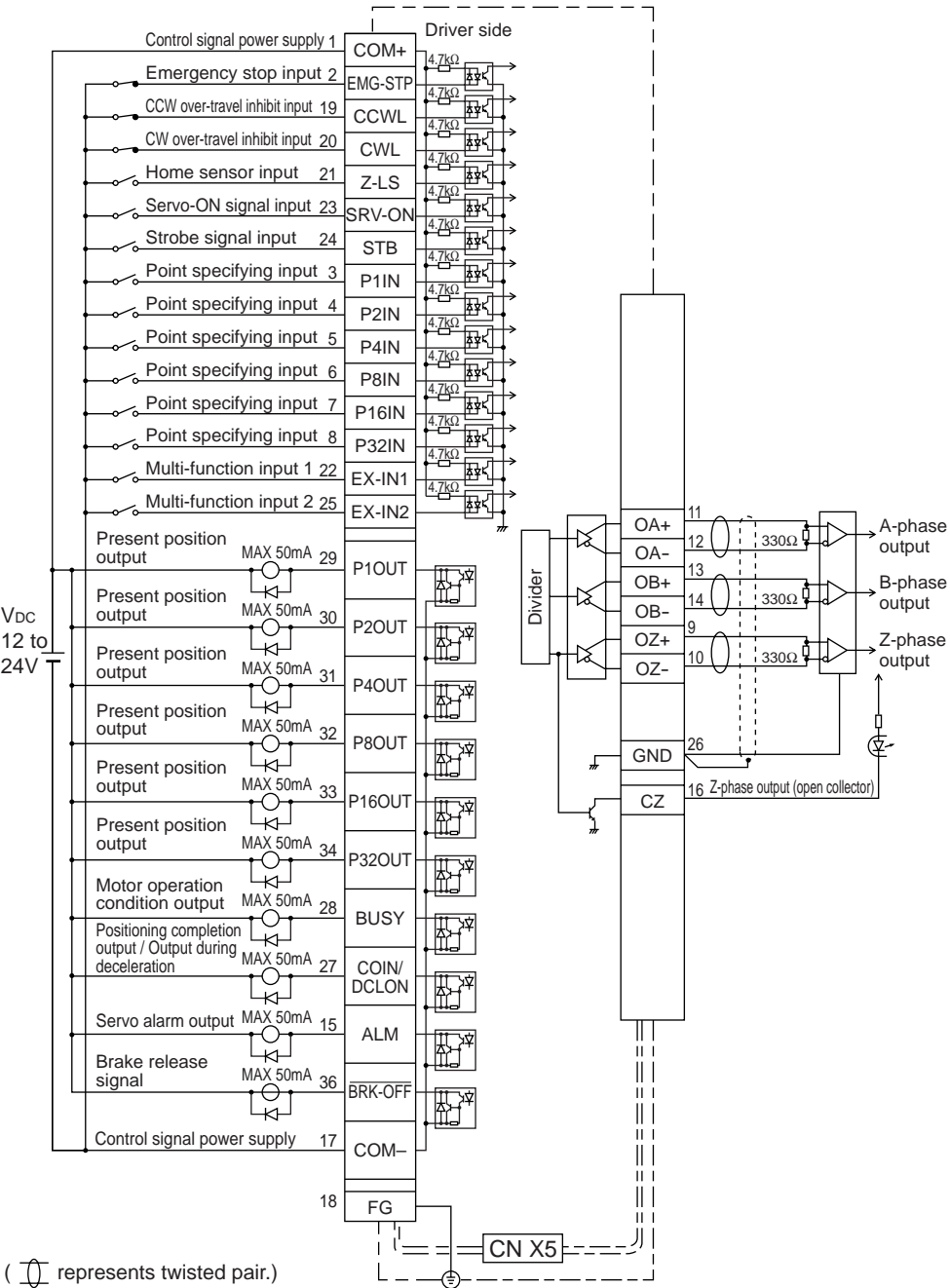

MSMD　50W to 750W
MAMA　100W to 750W
MQMA　100W to 400W

MSMA　1kW to 5kW　MFMA　400W to 4.5kW
MDMA　1kW to 5kW　MGMA　900W to 4.5kW
MHMA　500W to 5kW

Straight plug　N/MS3106B20-29S
Cable clamp　N/MS3057-12A
(Japan Aviation Electronics Industry, Ltd.)

3. System Configuration and Wiring

Wiring for Connector CN X5

Control signal power supply 1 — COM+
Emergency stop input 2 — EMG-STP
CCW over-travel inhibit input 19 — CCWL
CW over-travel inhibit input 20 — CWL
Home sensor input 21 — Z-LS
Servo-ON signal input 23 — SRV-ON
Strobe signal input 24 — STB
Point specifying input 3 — P1IN
Point specifying input 4 — P2IN
Point specifying input 5 — P4IN
Point specifying input 6 — P8IN
Point specifying input 7 — P16IN
Point specifying input 8 — P32IN
Multi-function input 1 22 — EX-IN1
Multi-function input 2 25 — EX-IN2

Present position output MAX 50mA 29 — P1OUT
Present position output MAX 50mA 30 — P2OUT
Present position output MAX 50mA 31 — P4OUT
Present position output MAX 50mA 32 — P8OUT
Present position output MAX 50mA 33 — P16OUT
Present position output MAX 50mA 34 — P32OUT
Motor operation condition output MAX 50mA 28 — BUSY
Positioning completion output / Output during deceleration MAX 50mA 27 — COIN/DCLON
Servo alarm output MAX 50mA 15 — ALM
Brake release signal MAX 50mA 36 — BRK-OFF
Control signal power supply 17 — COM–
18 — FG

V_{DC} 12 to 24V

OA+ 11 / OA– 12 — 330Ω — A-phase output
OB+ 13 / OB– 14 — 330Ω — B-phase output
OZ+ 9 / OZ– 10 — 330Ω — Z-phase output
GND 26
CZ 16 Z-phase output (open collector)

Driver side
Divider

CN X5

(⊡ represents twisted pair.)

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List of Signal for Connector CN X5

Common input signals

Application	Code	Connector pin No.	Function
Control signal power supply	COM+	1	• Connected to the ⊕ terminal of an external DC power supply (12 to 24 V) • Use a 12 V (±5%) to 24 V (±5%) power supply.
	COM–	17	• Connected to the ⊖ terminal of an external DC power supply (12 to 24 V). • The power supply capacity differs depending on the configuration of the input/output circuits used. A capacity of more than 0.5A is recommended.
Emergency stop input	EMG-STP	2	• When connection with COM– is opened, emergency stop input error (error code No.39) occurs, and the circuit trips. • Tripping can be reset using an alarm clear input initiated by specifying point 0 or assigning the multi-function inputs (EX-IN1, EX-IN2).
Point specifying input	P1IN	3	• Specify an operation point number when operation command is input. The number at which operation point can be specified depends on the number of points set by servo parameter No.57. Servo parameter No.58 can be used for setting input logic. When the point described below is specified, special operation is performed. • Specify point 0, and input a strobe signal, then alarm is cleared. • Specify the maximum point number specified in servo parameter No. 57, and input a strobe signal, then system returns to the home position. • Specify the maximum point number specified in servo parameter No. 57 –1 and input a strobe signal, then high-speed normal rotation jog is performed. • Specify the maximum point number specified in servo parameter No. 57 –2 and input a strobe signal, then high-speed reverse rotation jog is performed.
	P2IN	4	
	P4IN	5	
	P8IN	6	
	P16IN	7	
	P32IN	8	
CCW over-travel inhibit input	CCWL	19	• CCW drive prohibition input (CCWL). • Connect so as to open COM– connection when movable part of the equipment exceeds the movable range in CCW direction. • When this input is open, operation command in CCW direction is not issued. (Torque is generated) • Servo parameter No. 53, 54, and 55 enable for setting of valid/invalid, input logic, and operation.

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3. System Configuration and Wiring

Application	Code	Connector pin No.	Function
CW over-travel inhibit input	CWL	20	• CW drive prohibition input (CWL). • Connect so as to open COM– connection when movable part of the equipment exceeds the movable range in CW direction. • When this input is open, operation command in CW direction is not issued. (Torque is generated) • Servo parameter No.53, 54, and 55 enable setting of valid/invalid, input logic, and operation.
Home sensor input	Z-LS	21	• Connect so as to close the home sensor input when system is in the vicinity of home position (default). Servo parameter No.56 can be used for setting input logic. • Connected to the home sensor signal.
Servo-ON signal input	SRV-ON	23	• Connect so as to close the home sensor input when system is in the vicinity of home position. Pr56 can be used for setting input logic. • When servo amplifier is connected to COM– of control signal power supply, it is set in servo-ON condition. • When connection to COM– is opened, servo-OFF condition is set, and energization of motor is cut off. • Dynamic brake operation and deviation counter clearing operation in servo-OFF condition can be chosen by servo parameter No.69 (sequence at servo-off). • Servo parameter No.5D enable setting of valid/invalid. Note. 1 When shifting from servo-OFF to servo-ON, make sure that the motor is stopped. Note 2 After shifting to servo-ON, allow 100ms or more before giving an instruction. Note 3 Frequent repeating of servo-ON/OFF may damage the dynamic brake circuit contained in servo amplifier. Avoid such a use.
Strobe signal input	STB	24	• When this is connected to COM– of the control signal power supply, the servo amplifier starts the movement to the specified point. • When 10ms or more has passed after setting specified point input, connect the strobe signal input (STB) to COM–. It is possible that the servo amplifier is unable to read specified point input properly. • Input STB signal 10ms or longer. Also, reset STB signal to opened condition after receiving BUSY signal from the servo amplifier in order to ensure that STB signal is received reliably.
Multi-function input 1	EX-IN1	22	Function can be selected and set by Pr5A and 5C out of the options below. Instantaneous stop, temporary stop, deceleration stop, high-speed normal rotation jog, high-speed reverse rotation jog, and alarm clearing Input logic can be set by servo parameter No.59 and 5B.
Multi-function input 2	EX-IN2	25	

Common output signals and their functions

Application	Code	Connector pin No.	Function
Servo alarm output	ALM	15	Output signal indicating that the alarm is on. Output transistor turns on in normal condition, and output transistor turns off when alarm is on.
Positioning completion output/ Output during deceleration	COIN/ DCLON	27	• This output signal can be used by choosing positioning completion output (COIN) or output during deceleration (DCLON) by servo parameter No.64. COIN: When the amount of position deviation pulse is within the range set by servo parameter No.60 (in-position range), the transistor turns on. However, while the operation command is being processed, it will not turn ON even inside the positioning completion range. DCLON: Transistor turns ON while the motor is decelerating. However, the signal is not output when the motor has stopped because the deceleration time is zero.
Motor operation condition output	BUSY	28	• Transistor turns OFF while the servo amplifier is processing operation command. <Notes> When an operation command has been started by the strobe signal input (STB), the motor operation status output remains OFF until the strobe signal input is set to the opened condition.
Present position output	P1OUT	29	• Outputs the present motor position (point number) when the step operation is completed. • All the transistors are OFF (point 0) when the power is turned on. However, when the absolute mode is established or when the 16 bit positioning parameter No.38 is set to 1 (homing is invalid), the maximum point number set in the servo parameter No.57 (input point number selection) is output. • Upon completion of homing, the maximum point number set in the servo parameter No.57 (input point number selection) is output. • During high-speed normal rotation jog operations, the maximum point number set in the servo parameter No.57 (input point number selection) minus 1 is output after the motor has stopped. • During high-speed reverse rotation jog operations, the maximum point number set in the servo parameter No.57 (input point number selection) minus 2 is output after the motor has stopped. When an alarm has occurred, all the transistors are set OFF. <Note> When an operation has been aborted because of servo OFF, instantaneous stop or deceleration stop, the last status is held as the current position output. To obtain the correct output, move to the reference position (home point, absolute position command point).
	P2OUT	30	
	P4OUT	31	
	P8OUT	32	
	P16OUT	33	
	P32OUT	34	

3. System Configuration and Wiring

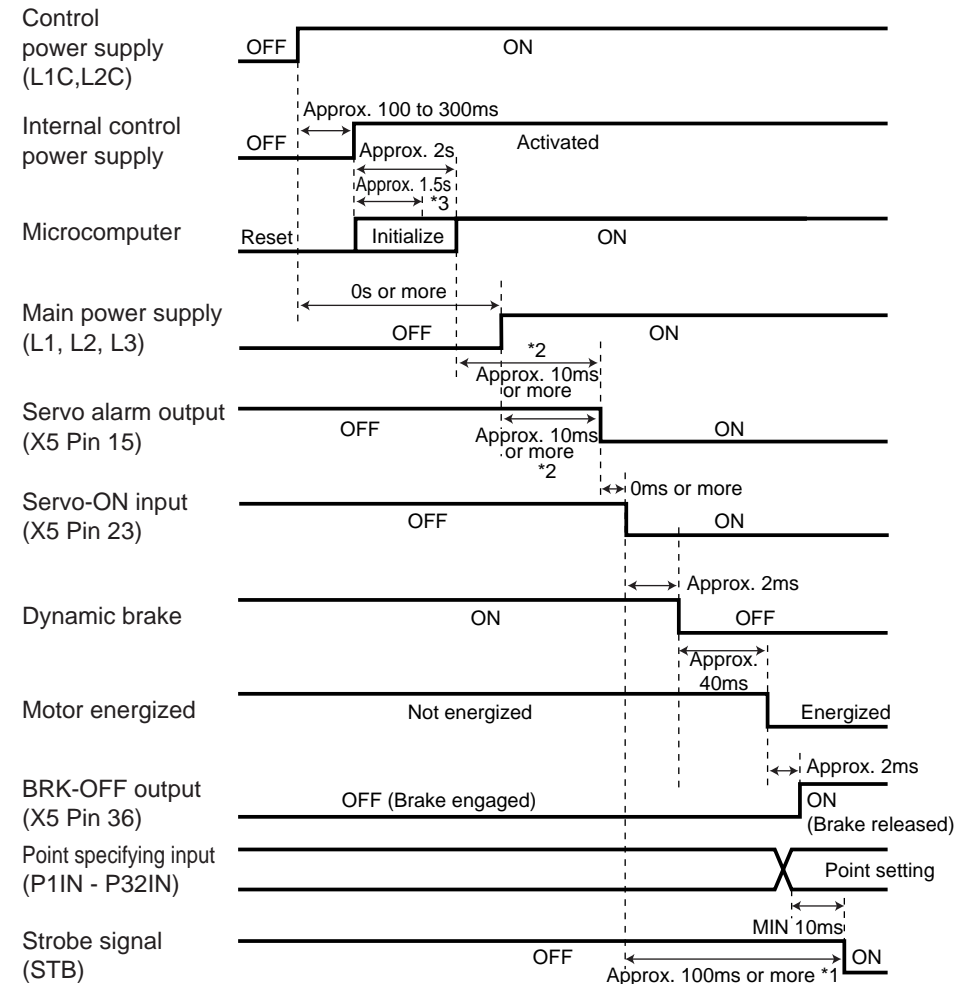| Application	Code	Connector pin No.	Function
Brake release output	BRK-OFF	36	• Defines the timing signal to activate the electromagnetic brake for the motor. When the electromagnetic brake is released, the output transistor turns ON. • Output timing of this signal can be set by servo parameter No.6A (mechanical brake delay at motor standstill) and servo parameter No.6B (Mechanical brake delay at motor in motion).

Output signal (pulse train) and function

Application	Code	Connector pin No.	Function
A-phase output	OA+	11	• Division-processed encoder signal or external scale signal (A/B-phase) is output in differential mode. (RS422) • Servo parameter No.44 (numerator of output pulse ratio) and servo parameter No.45 (denominator of output pulse ratio) can be used to set the division ratio. • Servo parameter No.46 (pulse output logic inversion) can be used to select the logic relation of phase B with regard to the pulse of phase A, and its output source. • Ground of line driver of the output circuit is connected to signal ground (GND); not insulated. • The maximum output frequency is 4 Mpps (after being multiplied by 4).
	OA–	12	
B-phase output	OB+	13	
	OB–	14	
Z-phase output	OZ+	9	
	OZ–	10	
Z-phase output	CZ	16	• Open collector output of Z-phase signal. • Emitter side of the transistor of the output circuit is connected to signal ground (GND); not insulated.

Others

Application	Code	Connector pin No.	Function
Frame ground	FG	18	• Internally connected to the ground terminal inside the servo amplifier.
Signal ground	GND	26	• Signal ground • Internally insulated from the control signal power supply (COM–) inside the servo amplifier.

Operation Timing after Power-ON

Control power supply (L1C,L2C): OFF → ON
Internal control power supply: OFF → Activated (Approx. 100 to 300ms)
Approx. 2s
Approx. 1.5s *3
Microcomputer: Reset → Initialize → ON
0s or more
Main power supply (L1, L2, L3): OFF → ON
Approx. 10ms or more *2
Servo alarm output (X5 Pin 15): OFF → ON
Approx. 10ms or more *2
Servo-ON input (X5 Pin 23): OFF → ON
0ms or more
Dynamic brake: ON → OFF
Approx. 2ms
Motor energized: Not energized → Energized
Approx. 40ms
BRK-OFF output (X5 Pin 36): OFF (Brake engaged) → ON (Brake released)
Approx. 2ms
Point specifying input (P1IN - P32IN): Point setting
Strobe signal (STB): OFF → ON
MIN 10ms
Approx. 100ms or more *1

\<Notes\>
- The above chart shows the timing from AC power-ON to command input.
- Activate the external command input according to the above timing chart.
  - *1. In this term Servo-ON input (CN X5 SRV-ON:pin23) turns ON as a hard ware, but operation command can not be received.
  - *2. Servo alarm output (CN X5 ALM:pin15) turns ON when the microcomputer's initialization is completed, and the condition of no error is occurring. Servo-ON input turns ON after Servo alarm turns ON and the main power supply is activated sufficiently.
  - *3. After Internal control power supply , protective functions are active from approx. 1.5 sec after the start of initializing microcomputer. Please set the signals, especially for protective function, for example over-travel inhibit input (CWL,CCWL) or emergency stop input (EMG-STP), so as to decide their logic until this term.

3. System Configuration and Wiring

Overview of function

Operation instruction is specified by use of signal for point specifying input (P1IN to P32IN). See the table below for the relation between point specifying input and operation instruction.

In order to execute an instruction, determine the kind of instruction by P1IN to P32IN, and then input a strobe signal.

\<Remarks\>

Because down of the signal wires during moving operation or exceptionally larger external noise disturbance may result in unexpected action, the protective equipments like limit sensors or emergency stop input must be installed before using.

Ex) When servo parameter No.57 = 3 (6 bits) is set

Point No.	P32IN	P16IN	P8IN	P4IN	P2IN	P1IN	Description
0 (00H)	H	H	H	H	H	H	Alarm clearing instruction
1 (01H)	H	H	H	H	H	L	Moves to step parameter 1.
2 (02H)	H	H	H	H	L	H	Moves to step parameter 2.
3 (03H)	H	H	H	H	L	L	Moves to step parameter 3.
4 (04H)	H	H	H	L	H	H	Moves to step parameter 4.
5 (05H)	H	H	H	L	H	L	Moves to step parameter 5.
6 (06H)	H	H	H	L	L	H	Moves to step parameter 6.
7 (07H)	H	H	H	L	L	L	Moves to step parameter 7.
8 (08H)	H	H	L	H	H	H	Moves to step parameter 8.
9 (09H)	H	H	L	H	H	L	Moves to step parameter 9.
10 (0AH)	H	H	L	H	L	H	Moves to step parameter 10.
⋮							⋮
59 (3BH)	L	L	L	H	L	L	Moves to step parameter 59.
60 (3CH)	L	L	L	L	H	H	Moves to step parameter 60.
61 (3DH)	L	L	L	L	H	L	High-speed jog operation (negative)
62 (3EH)	L	L	L	L	L	H	High-speed jog operation (positive)
63 (3FH)	L	L	L	L	L	L	Homing instruction

\<Notes\>

• H indicates the opened contact condition and L the closed contact condition.

• The number of point inputs can be set by servo parameter No.57.

• The logic of point input can be changed by servo parameter No.58.
  The table above describes the case where servo parameter No.58 is "1: Point input valid by closed connection with COM–".
  In the case of "0: Point input valid by opened connection with COM–", "H" and "L" are reversed.

• Point number of "High-speed jog operation (negative)", "High-speed jog operation (positive)", and "Homing instruction" depends on the setting of servo parameter No.57.

Setup with the Front Panel

Composition of Touch Panel and Display

Display LED (2 digits)
In the case of an error, the alarm code will flash.
In the case of a warning, the warning code (about 2 seconds) will alternate at about 4 seconds intervals with $\boxed{00}$.

ID address setup rotary switch
LSD : Lower-shifting (Default : 0)
MSD : Upper-shifting (Default : 0)
For manufacturers' use only.
(Not for individual use)

Output signal (Analog signal)
Speed monitor output
Torque monitor output
Signal ground

Output Signals (Analog) and Their Functions

Application	Code	Function
Speed monitor signal output	SP	• The content of the output signal varies depending on Pr07 (Speed monitor (IM) selection). • You can set up the scaling with Pr07 value.

SV.Pr07	Control mode	Function

0 to 4	Motor speed	• Feeds out the voltage in proportion to the motor speed with polarity.
		  + : rotates to CCW
		  – : rotates to CW

5 to 9	Command speed	• Feeds out the voltage in proportion to the command speed with polarity.
		  + : rotates to CCW
		  – : rotates to CW

3. System Configuration and Wiring

Application	Code	Function
Torque monitor signal output	IM	• The content of output signal varies depending on Pr08 (Torque monitor (IM) selection). • You can set up the scaling with Pr08 value.

SV.Pr08	Control mode	Function
0, 11,12	Torque command	• Feeds out the voltage in proportion to the motor torque command with polarity. + : generates CCW torque – : generates CW torque
1 – 5	Positional deviation	• Feeds out the voltage in proportion to the positional deviation pulse counts with polarity. + : positional command to CCW of motor position – : positional command to CW of motor position

4. Parameter

Outline of Parameter

This driver is equipped with various parameters to set up its characteristics and functions. This section describes the outline of each parameter. Read and comprehend very well so that you can adjust this diver in optimum condition for your running requirements.

<Remarks>
The parameter numbers not be mentioned in this section are not for individual use but for manufacturers' use .Do not change these parameters from the default setting.

How to Set

• You can refer and set up the parameter with either one of the following.
1) console (DV0P4420, option)
2) combination of the setup support software, "PANATERM®" (Option, DV0P4460: Japanese / English version) and PC.

<Note>
For setup of the parameters on PC screen, refer to the instruction manual of the "PANATERM®".

Outline of PANATERM®

With the PANATERM®, you can execute the followings.
1) Setup and storage of parameters, and writing to the memory (EEPROM).
2) Monitoring of I/O and pulse input and load factor.
3) Display of the present alarm and reference of the error history.
4) Data measurement of the wave-form graphic and bringing of the stored data.
5) Normal auto-gain tuning
6) Frequency characteristic measurement of the machine system.

How to Connect

RS232 connection cable (option)
DV0P1960 (for DOS/V machines)
Connect to CN X4
Connect to CN X4

Console : DV0P4420 (option)

Setup disc of setup support software, PANATERM®
• DV0P4460 : Japanese / English version (option)
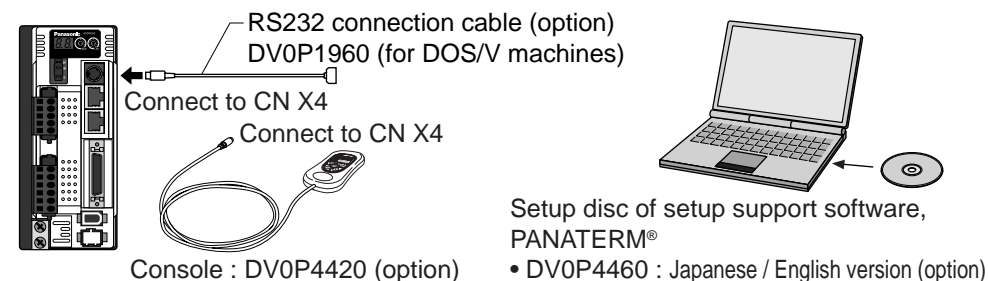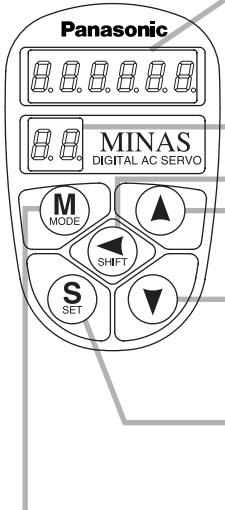
<Remarks>
• Connect the console connector to the connector, CN X4 of the driver securely.
• Do not pull the cable to insert/unplug.

4. Parameter

Setup with the Console

Display LED (6-digit)
All of LED will flash when error occurs, and switch to error display screen.

Display LED (in 2 digits)
Parameter No. is displayed at parameter setup mode.
Point No. is displayed at teaching mode.

Press this to shift the digit for data change.

Press these to change data or execute selected action of parameter.
Numerical value increases by pressing , $(\blacktriangle)$, decreases by pressing $(\blacktriangledown)$.

SET Button
Press this to shift each mode which is selected by mode switching button to EXECUTION display.

Mode Switching Button   Press this to switch 7 kinds of mode.
1) Monitor mode
2) Teaching mode
   • Target position settings established by teaching
   • Test operation
3) Parameter setup mode
4) EEPROM write mode
5) Normal auto-gain tuning mode
6) Auxiliary function mode
   • Alarm clear
   • Absolute encoder clear
7) Copy mode
   • Copying of parameters from the driver to the console.
   • Copying of parameters from the console to the driver.

The data for the parameters is set after the mode has been switched to the parameter setup mode. For details on operation, refer to the instruction manual provided with the console.

Composition of Parameters

• Servo parameter

Group		Servo parameter No.	Outline
Servo parameter	Function selection	01 to 03, 07,08,0B, 0C,0F	You can select a control mode, and set up a baud rate.
	Adjustment	10 to 1E, 27 to 2E	You can set up servo gains (1st and 2nd) of position, velocity, integration, etc, and time constants of various filters.
		20 to 26, 2F	Parameters related to Real Time Auto-Gain Tuning. You can set up a mode and select a mechanical stiffness.
		30 to 35	You can set up parameters related to gain switching(1st ⟷ 2nd)
	Position Control	44 to 46, 4C, 4D	You can set up dividing of encoder output pulse.
	Input signals	53 to 5D	You can set up the logic of input signals and the number of point input.
		5E to 5F	You can set up a torque limit of torque command.
	Sequence	60, 64, 65, 67 to 6E	You can set up detecting conditions of output signals, such as positioning-completion. You can also set up a deceleration/stop action at main power-off, at alarm output and at servo-off, and clear condition of the deviation counter.
		70, 72, 73	You can set up actions of protective functions.
	Full-Closed Control	78 to 7C	You can set up dividing of external scale.

4. Parameter

• 16-bit positioning parameter

Group		16-bit positioning parameter No.	Outline
16-bit positioning parameter	Motor speed	00 to 0F	You can set speed data of step operation.
	Acceleration and Deceleration	10 to 1F	You can set acceleration and deceleration data of step operation.
	Homing	30 to 3B	You can set data for homing.
	Jog operation	40 to 45	You can set data for jog operation.
	Others	48 to 54	You can set data for teaching or operation direction and so on.

• 32-bit positioning parameter

Group	32-bit positioning parameter No.	Outline
32-bit positioning parameter	00 to 03	You can set data for offset or maximum movement.

• Step parameter

Group		Outline
Step parameter	Operation mode	Specifying the positioning procedure. ABS (absolute position), INC (relative position), Rotary (rotation coordinates), and Dwell time (standby time)
	Position/waiting time	Inputting the coordinate data for positioning. When dwell time is selected in operation mode, set the standby time.
	Speed	Selecting a speed selection number in positioning. Setting the speed by 16-bit positioning parameter.
	Acceleration	Selecting an acceleration speed selecting number in positioning. Setting the speed by 16-bit positioning parameter.
	Deceleration	Selecting a deceleration speed selecting number in positioning. Setting the speed by 16-bit positioning parameter.
	Block	Choosing either single operation or block operation.

• In this document, following symbols represent each mode.

Symbol	Control mode	Setup value of servo parameter No.02
P	Position control	0
F	Full-Closed control	6

Parameters for Functional Selection

Servo parameter No.	Set up of parameter	Range	Default	Unit	Related control mode
01	7-segment LED status for console, initial condition display	0 to 15	1	–	P, F
02*1	Control mode	0, 6	0	–	P, F
03	Torque limit selection	0 to 3	1	–	P, F
07	Speed monitor (SP) selection	0 to 9	3	–	P, F
08	Torque monitor (IM) selection	0 to 12	0	–	P, F
0B*1	Absolute encoder set up	0 to 2	1	–	P, F
0C*1	Baud rate of RS232	0 to 5	2	–	P, F
0F	Node address	(Read Only) *2	–	–	P, F

*2 Depend on Rotary switch of the front panel.

Parameters for Adjustment of Time Constant for Gains and Filters

Servo parameter No.	Set up of parameter	Range	Default A to C-frame	Default D to F-frame	Unit	Related control mode
10	1st position loop gain	0 to 3000	<63>	<32>	1/s	P, F
11	1st velocity loop gain	1 to 3500	<35>	<18>	Hz	P, F
12	1st velocity loop integration time constant	1 to 1000	<16>	<31>	ms	P, F
13	1st speed detection filter	0 to 5	<0>		–	P, F
14	1st torque filter time constant	0 to 2500	<65>	<126>	0.01ms	P, F
15	Velocity feed forward	–2000 to 2000	<300>		0.1%	P, F
16	Feed forward filter time constant	0 to 6400	<50>		0.01ms	P, F
18	2nd position loop gain	0 to 3000	<73>	<38>	1/s	P, F
19	2nd velocity loop gain	1 to 3500	<35>	<18>	Hz	P, F
1A	2nd velocity loop integration time constant	1 to 1000	<1000>		ms	P, F
1B	2nd speed detection filter	0 to 5	<0>		–	P, F
1C	2nd torque filter time constant	0 to 2500	<65>	<126>	0.01ms	P, F
1D	1st notch frequency	100 to 1500	1500		Hz	P, F
1E	1st notch width selection	0 to 4	2		–	P, F

<Notes>

• For parameters with suffix of "*1", change will be validated after the reset of the control power.

• For parameters which default values are parenthesized by "< >", default value varies automatically by the real-time auto-gain tuning function. Set up servo parameter No.21 (Setup of Real-time auto-gain tuning mode) to 0 (invalid) when you want to adjust manually.

* **In this documentation, each mode is represented by the following symbols**
P : Position control, F : Full-closed control.

4. Parameter

Servo parameter No.	Set up of parameter	Range	Default	Unit	Related control mode
27	Velocity observer	0 to 1	<0>	–	P
28	2nd notch frequency	100 to 1500	1500	Hz	P, F
29	2nd notch width selection	0 to 4	2	–	P, F
2A	2nd notch depth selection	0 to 99	0	–	P, F
2B	1st vibration suppression frequency	0 to 2000	0	0.1Hz	P, F
2C	1st vibration suppression filter	–200 to 2000	0	–	P, F
2D	2nd vibration suppression frequency	0 to 2000	0	0.1Hz	P, F
2E	2nd vibration suppression filter	–200 to 2000	0	–	P, F

Parameters for Auto-Gain Tuning

Servo parameter No.	Set up of parameter	Range	Default A to C-frame	Default D to F-frame	Unit	Related control mode
20	Inertia ratio	0 to 10000	<250>		%	P, F
21	Real time auto tuning set up	0 to 7	1		–	P, F
22	Machine stiffness at auto tuning	0 to 15	4	1	–	P, F
23	Adaptive filter mode	0 to 2	1		–	P, F
24	Vibration suppression filter switching selection	0 to 2	0		–	P, F
25	Normal auto tuning motion setup	0 to 7	0		–	P, F
26	Software limit set up	0 to 1000	10		0.1rev	P, F
2F*3	Adaptive filter frequency	0 to 64	0		–	P, F

*3 this parameter will be automatically set up when the adaptive filter is validated (servo parameter No.23, "Setup of adaptive filter mode" is "1", and you cannot set this up at your discretion. Set up servo parameter No.23, "Setup of adaptive filter mode" to "0" (invalid) to clear this parameter.

Parameters for Adjustment (2nd Gain Switching Function)

Servo parameter No.	Set up of parameter	Range	Default	Unit	Related control mode
30	2nd gain action set up	0 to 1	<1>	–	P, F
31	1st control switching mode	0 to 10	<10>	–	P, F
32	1st control switching delay time	0 to 10000	<30>	166µs	P, F
33	1st control switching level	0 to 20000	<50>	–	P, F
34	1st control switching hysteresis	0 to 20000	<33>	–	P, F
35	Position loop gain switching time	0 to 10000	<20>	(1+Setup value) x 166µs	P, F

* **In this documentation, each mode is represented by the following symbols**
  P : Position control, F : Full-closed control.

Parameters for Position Control

Servo parameter No.	Set up of parameter	Range	Default	Unit	Related control mode
44*1	Numerator of output pulse ratio	1 to 32767	10000	–	P, F
45*1	Denominator of output pulse ratio	0 to 32767	10000	–	P, F
46*1	Pulse output logic inversion	0 to 3	0	–	P, F
4C	Smoothing filter	0 to 7	1	–	P, F
4D*1	FIR filter set up	0 to 31	0	–	P, F

Parameters for Input signals

Servo parameter No.	Set up of parameter	Range	Default	Unit	Related control mode
53	Over-travel inhibit input valid	0 to 1	1	–	P, F
54	Over-travel inhibit input logic	0 to 1	0	–	P, F
55	Over-travel inhibit input operation setting	0 to 3	1	–	P, F
56	Home sensor input logic	0 to 1	1	–	P, F
57*1	Selecting the number of input points	0 to 3	2	–	P, F
58	Point specifying input logic setting	0 to 1	1	–	P, F
59	Multi-function input 1 Signal logic	0 to 1	1	–	P, F
5A*1	Multi-function input 1 Signal selection	0 to 6	0	–	P, F
5B	Multi-function input 2 Signal logic	0 to 1	1	–	P, F
5C*1	Multi-function input 2 Selection logic	0 to 6	0	–	P, F
5D*1	Servo-ON input valid	0 to 1	1	–	P, F

Parameters for Torque limit

Servo parameter No.	Set up of parameter	Range	Default	Unit	Related control mode
5E	1st torque limit	0 to 500	<500>*4	%	P, F
5F	2nd torque limit	0 to 500	<500>*4	%	P, F

<Notes>

• For parameters with suffix of "*1", change will be validated after the reset of the control power.

*4 Defaults of Pr5E and Pr5F vary depending on the combination of the driver and the motor.

• For parameters which default values are parenthesized by "< >", default value varies automatically by the real-time auto-gain tuning function. Set up Pr21 (Setup of Real-time auto-gain tuning mode) to 0 (invalid) when you want to adjust manually.

4. Parameter

Parameters for Sequence

Servo parameter No.	Set up of parameter	Range	Default A, B-frame	Default C to F-frame	Unit	Related control mode
60	In-position range	0 to 32767	131		Pulse	P, F
64	Output signal selection	0 to 1	0		–	P, F
65	Undervoltage error response at main power-off	0 to 1	1		–	P, F
67	Error response at main power-off	0 to 9	0		–	P, F
68	Error response action	0 to 3	0		–	P, F
69	Sequence at Servo-OFF	0 to 9	0		–	P, F
6A	Mechanical brake delay at motor standstill	0 to 100	0		2ms	P, F
6B	Mechanical brake delay at motor in motion	0 to 100	0		2ms	P, F
6C*1	External regenerative resistor set up	0 to 3	3	0	–	P, F
6D*1	Main power-off detection time	35 to 1000	35		2ms	P, F
6E	Emergency stop torque set up	0 to 500	0		–	P, F

Parameters for Protective function

Servo parameter No.	Set up of parameter	Range	Default	Unit	Related control mode
70	Position deviation error level	0 to 32767	25000	256Pulse	P, F
72	Overload level	0 to 500	0	%	P, F
73	Overspeed level	0 to 20000	0	r/min	P, F

Parameters for Full-Closed Control

Servo parameter No.	Set up of parameter	Range	Default	Unit	Related control mode
78*1	Numerator of external scale ratio	0 to 32767	10000	–	F
79*1	Multiplier of numerator of external scale ratio	0 to 17	0	–	F
7A*1	Denominator of external scale ratio	1 to 32767	10000	–	F
7B*1	Setup of hybrid deviation excess	1 to 10000	100	16 X external scale pulses	F
7C*1	External scale direction	0 to 1	0	–	F

<Notes>
• For parameters with suffix of "*1", change will be validated after the reset of the control power.

List of 16-bit Positioning Parameters

Parameters for Motor speed

16-bit positioning parameter No.	Set up of parameter	Range	Default	Unit	Related control mode
00	1st speed	0 to 6000	0	r/min	P, F
01	2nd speed	0 to 6000	0	r/min	P, F
02	3rd speed	0 to 6000	0	r/min	P, F
03	4th speed	0 to 6000	0	r/min	P, F
04	5th speed	0 to 6000	0	r/min	P, F
05	6th speed	0 to 6000	0	r/min	P, F
06	7th speed	0 to 6000	0	r/min	P, F
07	8th speed	0 to 6000	0	r/min	P, F
08	9th speed	0 to 6000	0	r/min	P, F
09	10th speed	0 to 6000	0	r/min	P, F
0A	11th speed	0 to 6000	0	r/min	P, F
0B	12th speed	0 to 6000	0	r/min	P, F
0C	13th speed	0 to 6000	0	r/min	P, F
0D	14th speed	0 to 6000	0	r/min	P, F
0E	15th speed	0 to 6000	0	r/min	P, F
0F	16th speed	0 to 6000	0	r/min	P, F

Parameters for Acceleration and Deceleration

16-bit positioning parameter No.	Set up of parameter	Range	Default	Unit	Related control mode
10	1st acceleration	0 to 10000	0	ms	P, F
11	1st S-shaped acceleration	0 to 1000	0	ms	P, F
12	1st deceleration	0 to 10000	0	ms	P, F
13	1st S-shaped deceleration	0 to 1000	0	ms	P, F
14	2 nd acceleration	0 to 10000	0	ms	P, F
15	2 nd S-shaped acceleration	0 to 1000	0	ms	P, F
16	2 nd deceleration	0 to 10000	0	ms	P, F
17	2 nd S-shaped deceleration	0 to 1000	0	ms	P, F

* **In this documentation, each mode is represented by the following symbols**

P : Position control, F : Full-closed control.

16-bit positioning parameter No.	Set up of parameter	Range	Default	Unit	Related control mode
18	3rd acceleration	0 to 10000	0	ms	P, F
19	3rd S-shaped acceleration	0 to 1000	0	ms	P, F
1A	3rd deceleration	0 to 10000	0	ms	P, F
1B	3rd S-shaped deceleration	0 to 1000	0	ms	P, F
1C	4 th acceleration	0 to 10000	0	ms	P, F
1D	4 th S-shaped acceleration	0 to 1000	0	ms	P, F
1E	4 th deceleration	0 to 10000	0	ms	P, F
1F	4 th S-shaped deceleration	0 to 1000	0	ms	P, F

Parameters for Homing

16-bit positioning parameter No.	Set up of parameter	Range	Default	Unit	Related control mode
30	Homing speed (fast)	0 to 6000	0	r/min	P, F
31	Homing speed (slow)	0 to 6000	0	r/min	P, F
32	Homing offset speed	0 to 6000	0	r/min	P, F
33	Homing acceleration	0 to 10000	0	ms	P, F
34	Homing deceleration	0 to 10000	0	ms	P, F
35	Homing direction	0 to 1	0	–	P, F
36	Homing type	0 to 7	0	–	P, F
37	Home complete type	0 to 1	0	–	P, F
38*1	Homing skip	0 to 1	0	–	P, F
39	Bumping detection time	0 to 10000	0	ms	P, F
3A	Torque limit for bumping homing	0 to 100	0	%	P, F
3B	Homing Z-phase count setting	0 to 100	0	–	P, F

Parameters for Jog operation

16-bit positioning parameter No.	Set up of parameter	Range	Default	Unit	Related control mode
40	Jog speed (low)	0 to 6000	0	r/min	P, F
41	Jog speed (high)	0 to 6000	0	r/min	P, F
42	Acceleration setting in jog operation	0 to 10000	0	ms	P, F
43	Setting of S-shaped acceleration in jog operation	0 to 1000	0	ms	P, F
44	Setting of deceleration in jog operation	0 to 10000	0	ms	P, F
45	Setting of S-shaped deceleration in jog operation	0 to 1000	0	ms	P, F

Other Parameters

16-bit positioning parameter No.	Set up of parameter	Range	Default	Unit	Related control mode
48	Teaching movement amount setting	0 to 32767	0	Pulse	P, F
49	Instantaneous stop deceleration time	0 to 10000	0	ms	P, F
50*1	Operation direction setting	0 to 1	1	–	P, F
51*1	Wrap around permission	0 to 1	0	–	P, F
52*1	Sequential operation setting	0 to 1	0	–	P, F
53	Sequential operation maximum point number	0 to 60	0	–	P, F
54*1	Block operation type	0 to 1	0	–	P, F

List of 32-bit Positioning Parameters

32-bit positioning parameter No.	Set up of parameter	Range	Default	Unit	Related control mode
00*1	Home offset	–2147483647 to 2147483647	0	Pulse	P, F
01*1	Setting of maximum movement in plus direction	0 to 2147483647	0	Pulse	P, F
02*1	Setting of maximum movement in minus direction	–2147483648 to 0	0	Pulse	P, F
03*1	Movement per rotation in rotation coordinates	0 to 2147483647	0	Pulse	P, F

List of Step Parameters

Step parameter No.	Set up of parameter	Range	Default	Unit	Related control mode
01H to 3CH	Operation mode	ABS/INC/Rotary/Dwelltime	Incremental	–	P, F
	Position/waiting time	–2147483648 to 2147483647	0	Pulse/10ms	P, F
	Speed	V1 to V16	V1	–	P, F
	Acceleration	A1 to A4	A1	–	P, F
	Deceleration	D1 to D4	D1	–	P, F
	Block	Single/Block	Single	–	P, F

<Notes>

• For parameters with suffix of "*1", change will be validated after the reset of the control power.

* **In this documentation, each mode is represented by the following symbols**
  P : Position control, F : Full-closed control.

5. Protective Functions

## Protective Function (What Is Error Code ?)

- Various protective functions are equipped in the driver. When these are triggered, the motor will stall due to error, the driver will turn the Servo-Alarm output (ALM) to off (open).

- Error status ands their measures
  - During the error status, the error code No. will be displayed on the front panel LED, and you cannot turn Servo-ON.

  - You can clear the error status by turning on the alarm clear input for 120ms or longer.

  - When overload protection is triggered, you can clear it by turning on the alarm clear signal 10 sec or longer after the error occurs. You can clear the time characteristics by turning off the connection between L1C and L2C or r and t of the control power supply of the driver.

  - You can also clear the above error by operating the "PANATERM®".

<Remarks>
  - When the protective function with a prefix of "*" in the protective function table is triggered, you cannot clear with alarm clear input (A-CLR). For resumption, shut off the power to remove the cause of the error and re-enter the power.

  - Following errors will not be stored in the error history.
Control power supply under-voltage protection	(Error code No. 11)
Main power supply under-voltage protection	(Error code No. 13)
EEPROM parameter error protection	(Error code No. 36)
EEPROM check code error protection	(Error code No. 37)
Emergency stop input error protection	(Error code No. 39)
External scale auto recognition error protection	(Error code No. 93)
Motor auto recognition error protection	(Error code No. 95)

Warning Function

- The MINAS-A4P Series outputs a warning signal before its protective function is activated, enabling you to check the overload and other error conditions in advance.
  The warning code (about 2 seconds) will alternate at about 4 seconds intervals with [0 0] on 7-segment LED of front panel when the warning is on.

Warning code No.	Warning function
16	Over-load warning
18	Over-regeneration warning
40	Battery warning
88	Fan-lock warning
89	External scale warning

<Protective function table>

Error code No.	Protective function	Error code No.	Protective function
11	Control power supply under- voltage protection	44	* Absolute single turn counter error protection
12	Over-voltage protection	45	* Absolute multi-turn counter error protection
13	Main power supply under-voltage protection	47	Absolute status error protection
14	* Over-current protection	48	* Encoder Z-phase error protection
15	* Over-heat protection	49	* Encoder CS signal error protection
16	Over-load protection	50	* External scale status 0 error protection
18	* Over-regeneration load protection	51	* External scale status 1 error protection
21	* Encoder communication error protection	52	* External scale status 2 error protection
23	* Encoder communication data error protection	53	* External scale status 3 error protection
24	Position deviation excess protection	54	* External scale status 4 error protection
25	* Hybrid deviation excess error protection	55	* External scale status 5 error protection
26	Over-speed protection	68	Homing error protection
28	* External scale communication data error	69	Undefined data error protection
29	Deviation counter overflow protection	70	* Present position overflow error protection
34	Software limit protection	71	Drive prohibition detection error protection
35	* External scale communication error protection	72	* Maximum movement limit error protection
36	* EEPROM parameter error protection	82	* ID setting error protection
37	* EEPROM check code error protection	93	* External scale auto recognition error protection
39	Emergency stop input error protection	95	* Motor auto recognition error protection
40	Absolute system down error protection	Other No.	* Other error
41	* Absolute counter over error protection		
42	Absolute over-speed error protection		

6. Maintenance and Inspections

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.
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.

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 connecter • 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 of the terminals

<Notes>
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
Driver	Smoothing condenser	Approx. 5 years	These hours or cycles are reference. When you experience any error, replacement is required even before this standard replacement cycle.
	Cooling fan	2 to 3 years (10,000 to 30,000 hours)	
	Aluminum electrolytic capacitor (on PCB)	Approx. 5 years	
	Rush current preventive relay	Approx. 100,000 times (depending on working condition)	
	Rush current preventive resistor	Approx. 20,000 times (depending on working condition)	
Motor	Bearing	3 to 5 years (20,000 to 30,000 hours)	
	Oil seal	5000 hours	
	Encoder	3 to 5 years (20,000 to 30,000 hours)	
	Battery for absolute encoder	Life time varies depending on working conditions. Refer to the instruction manual attached to the battery for absolute encoder.	
Motor with gear reducer	Gear reducer	10,000 hours	

7. Conformity to EC Directives and UL Standards

EC Directives

The EC Directives apply to all such electronic products as those having specific functions and have been exported to EU and directly sold to general consumers. Those products are required to conform to the EU unified standards and to furnish the CE marking on the products.

However, our AC servos meet the relevant EC Directives for Low Voltage Equipment so that the machine or equipment comprising our AC servos can meet EC Directives.

EMC Directives

MINAS Servo System conforms to relevant standard under EMC Directives setting up certain model (condition) with certain locating distance and wiring of the servo motor and the driver. And actual working condition often differs from this model condition especially in wiring and grounding. Therefore, in order for the machine to conform to the EMC Directives, especially for noise emission and noise terminal voltage, it is necessary to examine the machine incorporating our servos.

Conformed Standards

Subject	Conformed Standard		
Motor	IEC60034-1 IEC60034-5 UL1004 CSA22.2 No.100		Conforms to Low-Voltage Directives
Motor/ Motor and driver	EN50178 UL508C		Standards referenced by EMC Directives
	EN55011	Radio Disturbance Characteristics of Industrial, Scientific and Medical (ISM) Radio-Frequency Equipment	
	EN61000-6-2	Immunity for Industrial Environments	
	IEC61000-4-2	Electrostatic Discharge Immunity Test	
	IEC61000-4-3	Radio Frequency Electromagnetic Field Immunity Test	
	IEC61000-4-4	Electric High-Speed Transition Phenomenon/Burst Immunity Test	
	IEC61000-4-5	Lightening Surge Immunity Test	
	IEC61000-4-6	High Frequency Conduction Immunity Test	
	IEC61000-4-11	Instantaneous Outage Immunity Test	

IEC : International Electrotechnical commission
E N : Europaischen Normen
EMC : Electromagnetic Compatibility
UL   : Underwriters Laboratories
CSA : Canadian Standards Association

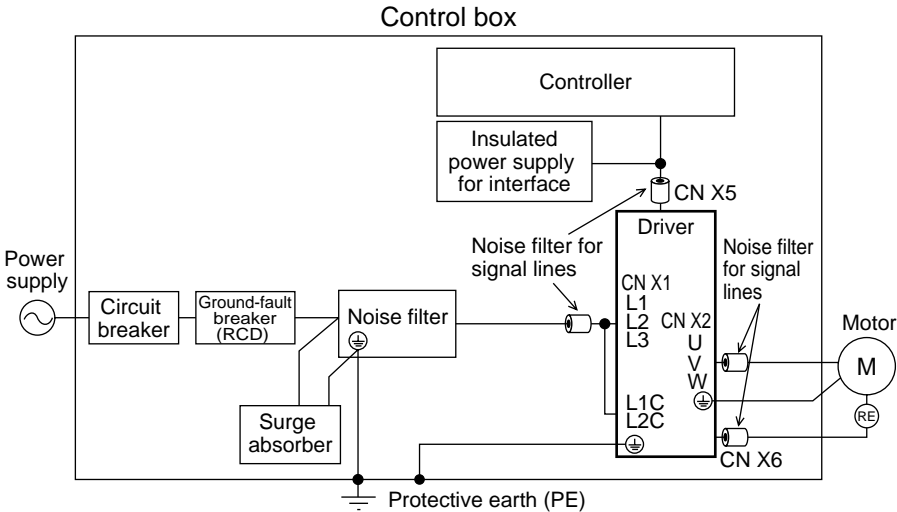**<Precautions in using options>**
Use options correctly after reading operation manuals of the options to better understand the precautions.
Take care not to apply excessive stress to each optional part.

Composition of Peripheral Equipments

Installation Environment

Use the servo driver in the environment of Pollution Degree 1 or 2 prescribed in IEC-60664-1 (e.g. Install the driver in control panel with IP54 protection structure.)

Power Supply

100V type : Single phase, (A, B and C-frame)
$100V \begin{smallmatrix} +10\% \\ -15\% \end{smallmatrix}$ to $115V \begin{smallmatrix} +10\% \\ -15\% \end{smallmatrix}$ 50/60Hz

200V type : Single phase, (B, C-frame)
$200V \begin{smallmatrix} +10\% \\ -15\% \end{smallmatrix}$ to $240V \begin{smallmatrix} +10\% \\ -15\% \end{smallmatrix}$ 50/60Hz

200V type : Single/3-phase, (C, D-frame)
$200V \begin{smallmatrix} +10\% \\ -15\% \end{smallmatrix}$ to $240V \begin{smallmatrix} +10\% \\ -15\% \end{smallmatrix}$ 50/60Hz

200V type : 3-phase, (E, F-frame)
$200V \begin{smallmatrix} +10\% \\ -15\% \end{smallmatrix}$ to $230V \begin{smallmatrix} +10\% \\ -15\% \end{smallmatrix}$ 50/60Hz

(1) This product is designed to be used at over-voltage category (Installation category) II of EN 50178:1997. If you want to use this product un over-voltage category (Installation category) III, install a surge absorber which complies with EN61634-11:2002 or other relevant standards at the power input portion.

(2) Use an insulated power supply of DC12 to 24V which has CE marking or complies with EN60950

Circuit Breaker

Install a circuit breaker which complies with IEC Standards and UL recognizes (Listed and ⓊⓁ marked) between power supply and noise filter.

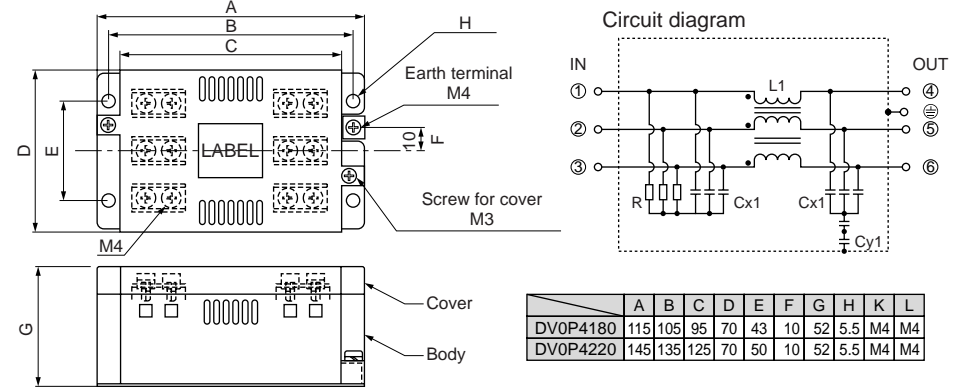# 7. Conformity to EC Directives and UL Standards

Noise Filter

When you install one noise filter at the power supply for multi-axes application, contact to a manufacture of the noise filter.
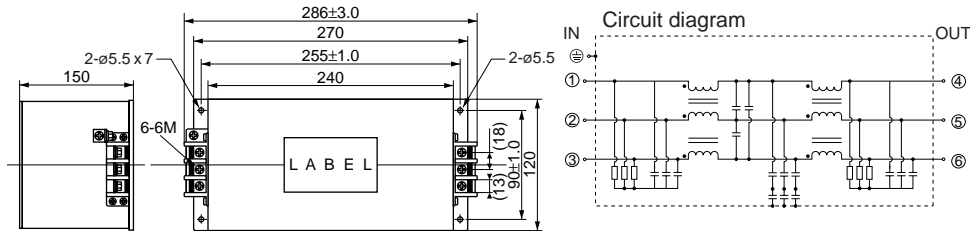
Option part No.	Voltage specifications for driver	Manufacturer's part No.	Applicable driver (frame)	Manufacturer
DV0P4170	Single phase 100V/200V	SUP-EK5-ER-6	A and B-frame	Okaya Electric Ind.
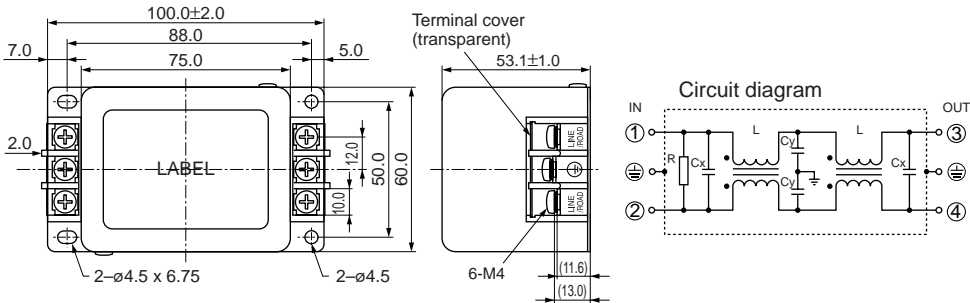
Option part No.	Voltage specifications for driver	Manufacturer's part No.	Applicable driver (frame)	Manufacturer
DV0P4180	3-phase 200V	3SUP-HQ10-ER-6	C-frame	Okaya Electric Ind.
DV0P4220		3SUP-HU30-ER-6	D and E-frame	

	A	B	C	D	E	F	G	H	K	L
DV0P4180	115	105	95	70	43	10	52	5.5	M4	M4
DV0P4220	145	135	125	70	50	10	52	5.5	M4	M4

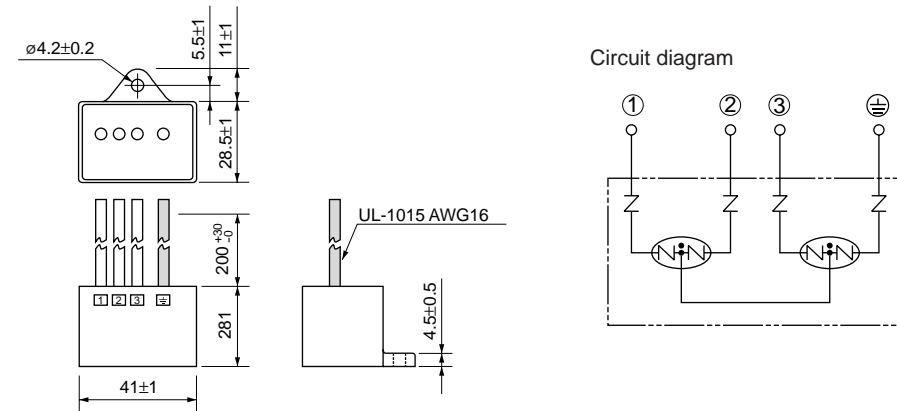| Option part No.	Voltage specifications for driver	Manufacturer's part No.	Applicable driver (frame)	Manufacturer
DV0P3410	Three-phase 200V	3SUP-HL50-ER-6B	F-frame	Okaya Electric Ind.

Surge Absorber

Provide a surge absorber for the primary side of noise filter.

<Remarks>

Take off the surge absorber when you execute a dielectric test to the machine or equipment, or it may damage the surge absorber.

Option part No.	Voltage specifications for driver	Manufacturer's part No.	Manufacturer
DV0P1450	3-phase 200V	R . A .V-781BXZ-4	Okaya Electric Ind.

| Option part No.	Voltage specifications for driver	Manufacturer's part No.	Manufacturer
DV0P4190	Single phase 100/200V	R . A .V-781BWZ-4	Okaya Electric Ind.
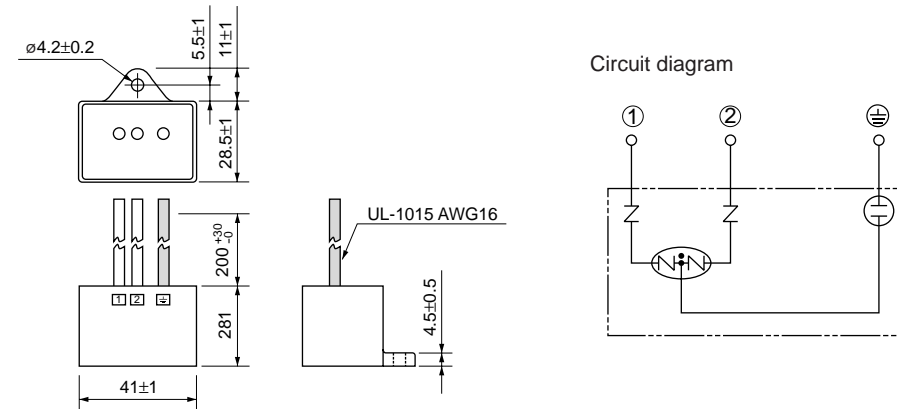
7. Conformity to EC Directives and UL Standards

Noise Filter for Signal Lines *

Install noise filters for signal lines to all cables (power cable, motor cable, encoder cable and interface cable)

* In case of D-frame, install 3 noise filters at power line.

39±1
34±1
Mass: 62.8g
13±1
30±1

Option part No.	DV0P1460
Manufacturer's part No.	ZCAT3035-1330
Manufacturer	TDK Corp.
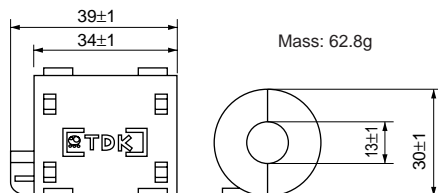
<Caution> Fix the signal line noise filter in place to eliminate excessive stress to the cables.

Ground-Fault Breaker

Install a type B ground fault breaker (RCD) at primary side of the power supply.

Grounding

(1) Connect the protective earth terminal (⏚) of the driver and the protective earth terminal (PE) of the control box without fail to prevent electrical shocks.
(2) Do not make a joint connection to the protective earth terminals (⏚). 2 terminals are provided for protective earth.

<Note>
For driver and applicable peripheral equipments, refer to P.B14 "Driver and List of Applicable Peripheral Equipments" .

Conformity to UL Standards

Observe the following conditions of (1) and (2) to make the system conform to UL508C (File No. E164620).
(1) Use the driver in an environment of Pollution Degree 2 or 1 prescribed in IEC60664-1. (e.g. Install in the control box with IP54 enclosure.)
(2) Install a circuit breaker or fuse which are UL recognized (Listed ⓤ marked) between the power supply and the noise filter without fail.
   For the rated current of the circuit breaker or fuse, refer to P.14, "Driver and List of Applicable Peripheral Equipments".
   Use a copper cable with temperature rating of 60˚C or higher.
   Tightening torque of more than the max. values (M4:1.2N·m, M5: 2.0N·m) may break the terminal block.
(3) Over-load protection level
   Over-load protective function will be activated when the effective current exceeds 115% or more than the rated current based on the time characteristics. Confirm that the effective current of the driver does not exceed the rated current. Set up the peak permissible current with servo parameter No.5E (Setup of 1st torque limit) and servo parameter No.5F (Setup 2nd torque limit).

8. Built-in Holding Brake

In the applications where the motor drives the vertical axis, this brake would be used to hold and prevent the work (moving load) from falling by gravity while the power to the servo is shut off.

Use this built-in brake for "Holding" purpose only, that is to hold the stalling status. Never use this for "Brake" purpose to stop the load in motion.

Output Timing of BRK-OFF Signal

• For the brake release timing at power-on, or braking timing at Servo-OFF/Servo-Alarm while the motor is in motion, refer to the technical reference. (DV0P4490)
• With the parameter, servo parameter No.6B (Setup of mechanical brake action while the motor is in motion), you can set up a time between when the motor enters to a free-run from energized status and when BRK-OFF signal turns off (brake will be engaged), when the Servo-OFF or alarm occurs while the motor is in motion.

<Notes>
1. The lining sound of the brake (chattering and etc.) might be generated while running the motor with built-in brake, however this does not affect any functionality.
2. Magnetic flux might be generated through the motor shaft while the brake coil is energized (brake is open). Pay an extra attention when magnetic sensors are used nearby the motor.

Specifications of Built-in Holding Brake

Motor series	Motor output	Static friction torque N·m	Rotor inertia x 10^{-4} kg·m²	Engaging time ms	Releasing time ms*	Exciting current DC A (at cool-off)	Releasing voltage	Permissible work (J) per one braking	Permissible total work x 10^3 J
MSMD MAMA	50W, 100W	0.29 or more	0.002	35 or less	10 or less	0.25	DC2V or more	39.2	4.9
	200W, 400W	1.27 or more	0.018	50 or less		0.30		137	44.1
	750W	2.45 or more	0.075	70 or less	20 or less	0.35		196	147
MQMA	100W	0.29 or more	0.03	50 or less	15 or less	0.29	DC1V or more	137	44.1
	200W, 400W	1.27 or more	0.09	60 or less		0.41		196	147
MSMA	1.0kW	4.9 or more	0.25	50 or less	15 (100) or less	0.74	DC2V or more	392	196
	1.5kW, 2.0kW	7.8 or more	0.33			0.81			490
	3.0kW	11.8 or more		80 or less					
	4.0kW, 5.0kW	16.1 or more	1.35	110 or less	50 (130) or less	0.90		1470	2156

(Continues to next page)

8. Built-in Holding Brake

Motor series	Motor output	Static friction torque N·m	Rotor inertia x 10⁻⁴ kg·m²	Engaging time ms	Releasing time ms*	Exciting current DC A (at cool-off)	Releasing voltage	Permissible work (J) per one braking	Permissible total work x 10³J
MDMA	1.0kW	4.9 or more	1.35	80 or less	70 (200) or less	0.59		588	780
	1.5kW, 2.0kW	13.7 or more		100 or less	50 (130) or less	0.79		1176	1470
	3.0kW	16.1 or more		110 or less		0.90		1470	2156
	4.0kW	21.5 or more	4.25	90 or less	35 (150) or less	1.10		1078	2450
	5.0kW	24.5 or more	4.7	80 or less	25 (200) or less	1.30		1372	2940
MHMA	500W, 1.0kW	4.9 or more	1.35		70 (200) or less	0.59	DC2V or more	588	784
	1.5kW	13.7 or more		100 or less	50 (130) or less	0.79		1176	1470
	2.0kW to 5.0kW	24.5 or more	4.7		25 (200) or less	1.30		1372	2940
MFMA	400W	4.9 or more	1.35	80 or less	70 (200) or less	0.59		588	784
	1.5kW	7.8 or more	4.7		35 (150) or less	0.83		1372	2940
	2.5kW	21.6 or more	8.75	150 or less	100 (450) or less	0.75		1470	1470
	4.5kW	31.4 or more							2156
MGMA	900W	13.7 or more	1.35	100 or less	50 (130) or less	0.79		1176	1470
	2.0kW	24.5 or more		80 or less	25 (200) or less	1.3		1372	2940
	3.0kW, 4.5kW	58.8 or more	4.7	150 or less	50 (130) or less	1.4			

- Excitation voltage is DC24V±10%.
- Values represent the ones with DC-cutoff using a surge absorber for holding brake. Values in ( ) represent those measured by using a diode (V03C by Renesas Technology Corp.).
- Above values (except static friction torque, releasing voltage and excitation current) represent typical values.
- Backlash of the built-in holding brake is kept ±1°or smaller at ex-factory point.
- Permissible angular acceleration : 30000rad/s² for MAMA series
    10000rad/s² for MSMD, MQMA, MSMA MDMA,MHMA MFMA and MGMA series
- Service life of the number of acceleration/deceleration with the above permissible angular acceleration is more than 10 million times.

(Life end is defined as when the brake backlash drastically changes.)

9. Dynamic Brake

This driver is equipped with a dynamic brake for emergency stop.
Pay a special attention to the followings.

<Caution>
1.Dynamic brake is only for emergency stop.

> **Do not start/stop the motor by turning on/off the Servo-ON signal (SRV-ON).**
> **Or it may damage the dynamic brake circuit of the driver.**

> **The motor becomes a dynamo when driven externally, and shorting current runs while this dynamic brake is activated and might cause smoking or fire.**

2. Dynamic brake is a short-duration rating, and designed for only emergency stop. Allow approx. 3 minutes pause when the dynamic brake is activated during high-speed running.
 • You can activate the dynamic brake in the following cases.
   1) when the main power is turned off
   2) at Servo-OFF
   3) when one of the protective function is activated.
     In the above cases from 1) to 3), you can select either activation of the dynamic brake or making the motor free-run during deceleration or after the stop, with parameter.
     Note that when the control power is off, the dynamic brake will be kept activated.

10. Check of the Combination of the Driver and the Motor

This drive is designed to be used in a combination with the motor which are specified by us. Check the series name of the motor, rated output torque, voltage specifications and encoder specifications.

Incremental Specifications, 2500P/r

<Remarks> Do not use in other combinations than those listed below.

Power supply	Applicable motor				Applicable driver	
	Motor series	Rated rotational speed	Model	Rated output	Model	Frame
Single phase, 200V 3-phase, 200V	MAMA Ultra low inertia	5000r/min	MAMA012P1*	100W	MADDT1207P	A-frame
			MAMA022P1*	200W	MBDDT2210P	B-frame
			MAMA042P1*	400W	MCDDT3520P	C-frame
			MAMA082P1*	750W	MDDDT5540P	D-frame
Single phase, 100V Single phase, 200V	MQMA Low inertia	3000r/min	MQMA011P1*	100W	MADDT1107P	A-frame
			MQMA021P1*	200W	MBDDT2110P	B-frame
			MQMA041P1*	400W	MCDDT3120P	C-frame
			MQMA012P1*	100W	MADDT1205P	A-frame
			MQMA022P1*	200W	MADDT1207P	A-frame
			MQMA042P1*	400W	MBDDT2210P	B-frame
Single phase, 100V Single phase, 200V	MSMD Low inertia	3000r/min	MSMD5AZP1*	50W	MADDT1105P	A-frame
			MSMD011P1*	100W	MADDT1107P	
			MSMD021P1*	200W	MBDDT2110P	B-frame
			MSMD041P1*	400W	MCDDT3120P	C-frame
			MSMD5AZP1*	50W	MADDT1205P	A-frame
			MSMD012P1*	100W		
			MSMD022P1*	200W	MADDT1207P	
			MSMD042P1*	400W	MBDDT2210P	B-frame
			MSMD082P1*	750W	MCDDT3520P	C-frame
Single/3-phase, 200V 3-phase, 200V	MSMA Low inertia	3000r/min	MSMA102P1*	1.0kW	MDDDT5540P	D-frame
			MSMA152P1*	1.5kW		
			MSMA202P1*	2.0kW	MEDDT7364P	E-frame
			MSMA302P1*	3.0kW	MFDDTA390P	F-frame
			MSMA402P1*	4.0kW	MFDDTB3A2P	
			MSMA502P1*	5.0kW		
Single/3-phase, 200V 3-phase, 200V	MDMA Middle inertia	2000r/min	MDMA102P1*	1.0kW	MDDDT3530P	D-frame
			MDMA152P1*	1.5kW	MDDDT5540P	
			MDMA202P1*	2.0kW	MEDDT7364P	E-frame
			MDMA302P1*	3.0kW	MFDDTA390P	F-frame
			MDMA402P1*	4.0kW	MFDDTB3A2P	
			MDMA502P1*	5.0kW		
Single/3-phase, 200V 3-phase, 200V	MHMA High inertia	2000r/min	MHMA052P1*	500W	MCDDT3520P	C-frame
			MHMA102P1*	1.0kW	MDDDT3530P	D-frame
			MHMA152P1*	1.5kW	MDDDT5540P	
			MHMA202P1*	2.0kW	MEDDT7364P	E-frame
			MHMA302P1*	3.0kW	MFDDTA390P	F-frame
			MHMA402P1*	4.0kW	MFDDTB3A2P	
			MHMA502P1*	5.0kW		

Power supply	Applicable motor				Applicable driver	
	Motor series	Rated rotational speed	Model	Rated output	Model	Frame
Single/3-phase, 200V 3-phase, 200V	MFMA Middle inertia	2000r/min	MFMA042P1*	400W	MCDDT3520P	C-frame
			MFMA152P1*	1.5kW	MDDDT5540P	D-frame
			MFMA252P1*	2.5kW	MEDDT7364P	E-frame
			MFMA452P1*	4.5kW	MFDDTB3A2P	F-frame
Single/3-phase, 200V 3-phase, 200V	MGMA Middle inertia	1000r/min	MGMA092P1*	900W	MDDDT5540P	D-frame
			MGMA202P1*	2.0kW	MFDDTA390P	
			MGMA302P1*	3.0kW	MFDDTB3A2P	F-frame
			MGMA452P1*	4.5kW		

<Note>

Suffix of " * " in the applicable motor model represents the motor structure.

Absolute/Incremental Specifications, 17-bit

<Remarks> Do not use in other combinations than those listed below.

Power supply	Applicable motor				Applicable driver	
	Motor series	Rated rotational speed	Model	Rated output	Model	Frame
Single phase, 200V 3-phase, 200V	MAMA Ultra low inertia	5000r/min	MAMA012S1*	100W	MADDT1207P	A-frame
			MAMA022S1*	200W	MBDDT2210P	B-frame
			MAMA042S1*	400W	MCDDT3520P	C-frame
			MAMA082S1*	750W	MDDDT5540P	D-frame
Single phase, 100V Single phase, 200V	MQMA Low inertia	3000r/min	MQMA011S1*	100W	MADDT1107P	A-frame
			MQMA021S1*	200W	MBDDT2110P	B-frame
			MQMA041S1*	400W	MCDDT3120P	C-frame
			MQMA012S1*	100W	MADDT1205P	A-frame
			MQMA022S1*	200W	MADDT1207P	A-frame
			MQMA042S1*	400W	MBDDT2210P	B-frame
Single phase, 100V Single phase, 200V	MSMD Low inertia	3000r/min	MSMD5AZS1*	50W	MADDT1105P	A-frame
			MSMD011S1*	100W	MADDT1107P	
			MSMD021S1*	200W	MBDDT2110P	B-frame
			MSMD041S1*	400W	MCDDT3120P	C-frame
			MSMD5AZS1*	50W	MADDT1205P	A-frame
			MSMD012S1*	100W		
			MSMD022S1*	200W	MADDT1207P	
			MSMD042S1*	400W	MBDDT2210P	B-frame
			MSMD082S1*	750W	MCDDT3520P	C-frame
Single/3-phase, 200V 3-phase, 200V	MSMA Low inertia	3000r/min	MSMA102S1*	1.0kW	MDDDT5540P	D-frame
			MSMA152S1*	1.5kW		
			MSMA202S1*	2.0kW	MEDDT7364P	E-frame
			MSMA302S1*	3.0kW	MFDDTA390P	F-frame
			MSMA402S1*	4.0kW	MFDDTB3A2P	
			MSMA502S1*	5.0kW		

10. Check of the Combination of the Driver and the Motor

Power supply	Applicable motor				Applicable driver	
	Motor series	Rated rotational speed	Model	Rated output	Model	Frame
Single/3-phase, 200V	MDMA Middle inertia	2000r/min	MDMA102S1*	1.0kW	MDDDT3530P	D-frame
			MDMA152S1*	1.5kW	MDDDT5540P	
3-phase, 200V			MDMA202S1*	2.0kW	MEDDT7364P	E-frame
			MDMA302S1*	3.0kW	MFDDTA390P	F-frame
			MDMA402S1*	4.0kW	MFDDTB3A2P	
			MDMA502S1*	5.0kW		
Single/3-phase, 200V	MHMA High inertia	2000r/min	MHMA052S1*	500W	MCDDT3520P	C-frame
			MHMA102S1*	1.0kW	MDDDT3530P	D-frame
			MHMA152S1*	1.5kW	MDDDT5540P	
3-phase, 200V			MHMA202S1*	2.0kW	MEDDT7364P	E-frame
			MHMA302S1*	3.0kW	MFDDTA390P	F-frame
			MHMA402S1*	4.0kW	MFDDTB3A2P	
			MHMA502S1*	5.0kW		
Single/3-phase, 200V	MFMA Middle inertia	2000r/min	MFMA042S1*	400W	MCDDT3520P	C-frame
			MFMA152S1*	1.5kW	MDDDT5540P	D-frame
3-phase, 200V			MFMA252S1*	2.5kW	MEDDT7364P	E-frame
			MFMA452S1*	4.5kW	MFDDTB3A2P	F-frame
Single/3-phase, 200V	MGMA Middle inertia	1000r/min	MGMA092S1*	900W	MDDDT5540P	D-frame
3-phase, 200V			MGMA202S1*	2.0kW	MFDDTA390P	F-frame
			MGMA302S1*	3.0kW	MFDDTB3A2P	
			MGMA452S1*	4.5kW		

\<Notes\>

1) Suffix of " * " in the applicable motor model represents the motor structure.

2) Default of the driver is set for the incremental encoder specifications.

  When you use in absolute, make the following operations.

  a) Install a battery for absolute encoder.

  b) Switch the parameter servo parameter No.0B (Absolute encoder setup) from "1 (default)" to "0".

3) No wiring for back up battery is required when you use the absolute 17-bit encoder in incremental.

10. General specifications

For detail specifications, refer to engineering material or downloaded Instruction Manual from our Web Site.

Basic specifications	Input power supply	100V-line	Main circuit power	Single-phase 100 to 115V +10% −15% 50/60Hz
			Control circuit power	Single-phase 100 to 115V +10% −15% 50/60Hz
		200V-line	Main circuit power — Type A, B	Single-phase 200 to 240V +10% −15% 50/60Hz
			Type C, D	Single/three-phase 200 to 240V +10% −15% 50/60Hz
			Type E, F	Three-phase 200 to 230V +10% −15% 50/60Hz
			Control circuit power — Type A to D	Single-phase 200 to 240V +10% −15% 50/60Hz
			Type E, F	Single-phase 200 to 230V +10% −15% 50/60Hz
	Operation conditions	Temperature		Operation temperature: 0 to 55 degrees Storage temperature: −20 to 80 degrees
		Humidity		Operation/storage humidity 90%RH or less (no condensation)
		Height above the sea		Height above the sea level: 1000 m or less
		Vibration		5.88 m/s² or less, 10 to 60 Hz (Continuous operation at resonance point is not allowed)
	Control method			IGBT PWM method, sinusoidal drive
	Control mode			Select Position control or Full-closed control by parameter.
	Encoder feedback			17 Bit (resolution: 131072) 7-serial absolute encoder / 2500 p/r (resolution: 10000) 5-serial incremental encoder
	External scale feedback			Compatible with ST771 and AT500 made by Mitutoyo Corporation
	Control signal	Input		CW over-travel inhibit, CCW over-travel inhibit, Home sensor, Emergency stop, Point specifying x6 Servo-ON, Strobe, Multi- function input x2
		Output		Servo alarm, Brake release signal, Present position output x6, Positioning completion / Output during deceleration, Motor operation condition,
	Pulse signal	Output		Encoder pulse (A/B/Z-phase) or external scale pulse (EXA/EXB-phase)is output by the line driver. For encoder Z-phase pulse, an open collector output is also available.
	Setup			Setup with Panaterm® or a console is available. (Panaterm® and a console are sold separately)
	Front panel			[1] 7-segment LED 2-digit [2] Analogue monitor pin (velocity monitor and torque monitor)
	Regeneration			Type A-B : No internal regenerative resist (external only) Type C-F : internal regenerative resist (external is also available)
	Dynamic brake			Built in
Function	Position control	Instantaneous speed observer		Usable
		Vibration reducing control		Usable
	Full-closed related	External scale division gradual increase setting range		Ratio between the encoder pulse (numerator) and the external scale pulse (denominator) can be set within the setting range : (1 to 10000 x 2^(0−17))/(1 to 10000)
	Common	The number of points		maximum 60 points
		Operation mode		Homing operation, Jog operation, Step operation, Continuous block operation, Combined block operation, Sequential operation, Teaching (need a console sold separately)
		Auto tuning	Real time	Load inertia is determined at real time in the state of actual operation and gain corresponding to the rigidity is set automatically.
			Normal mode	Load inertia is determined by driving the equipment with operation command within the amplifier and gain corresponding to the rigidity is set automatically.
		Unnecessary wiring mask function		The following control input signal can be masked: CW over-travel inhibit, CCW over-travel inhibit, multi function input1 and 2 , point specifying input(P8-IN,P16-IN,P32-IN), Servo-ON
		Division function of encoder feedback pulse		The number of pulses can be set up arbitrarily. (at the maximum encoder pulse)
		Protection function	Hardware error	Overload, undervoltage, overspeed, overload, overheat, over current, encoder error, etc.
			Software error	Large positional deviation, Undefined data error , EEPROM error, etc.
		Alarm data trace back function		Traceable up to 14 alarm data including present alarm data.

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.

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.
- 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 sulphur or sulphuric gases, as sulphuration 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.

Technical information

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

http://industrial.panasonic.com/ww/i_e/25000/motor_fa_e/motor_fa_e.html

MEMO (Fill in the blanks for reference in case of inquiry or repair.)

Date of purchase		Model No.	M☐DD _____
			M☐MD _____
			M☐MA _____
Dealer			
	Tel : ( ) -		

Motor Company
Matsushita Electric Industrial Co., Ltd.

7-1-1 Morofuku, Daito, Osaka, 574-0044, Japan   Tel : (81)-72-871-1212

MEMO