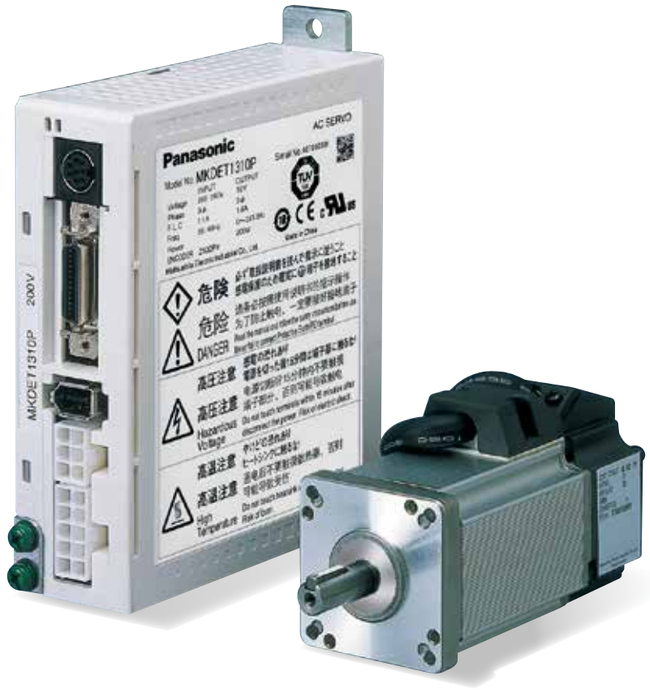
Compact Servo Only for Position Control.

Ultra compact position control type

MINAS E Series

Planned end of orders: April 30, 2025



1 Best Fit to Small Drives

- Further evolution in down-sizing, by 47 % in size.(Note)
- Exclusively designed for position control.

(Note) Compared to MUDS043A1

2 Easy to Handle, Easy to Use

- DIN-rail mounting unit (option) improves handling/installation.
- User-friendly Console makes the setup easy.
- High functionality Real-Time Auto-Gain Tuning enables adjustment-free operation.

Console
Option

3 High-Speed Positioning with Resonance Suppression Filters

- Built-In notch filter suppresses resonance of the machine.
- Built-in adaptive filter detect resonance frequency and suppress vibration.

4 Smoother operation for Low Stiffness Machine

- Damping control function suppresses vibration during acceleration/deceleration

Contents

1. Easy to Handle, Easy to Use

High-functionality Real-Time Auto-Gain Tuning (Note 1)

- Offers real automatic gain tuning for low and high stiffness machines with a combination of an adaptive filter.
- Supports the vertical axis application where the load torque is different in rotational direction.

DIN-rail mounting unit (option)

- DIN-rail mounting unit allows parallel mounting with small control devices such as PLC.
- Easy to mount and easy to dismount.

2. Further Reduction of Vibration

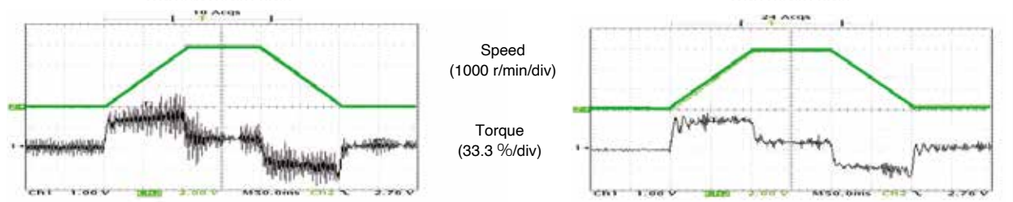
Adaptive filter (Note1)

- Makes the notch filter frequency automatically follow the machine resonance frequency in real-time auto-gain tuning.
- Suppression of “Judder” noise of the machine, which is caused by variation of the machines or resonance frequency due to aging, can be expected.

Notch filter (Note1)

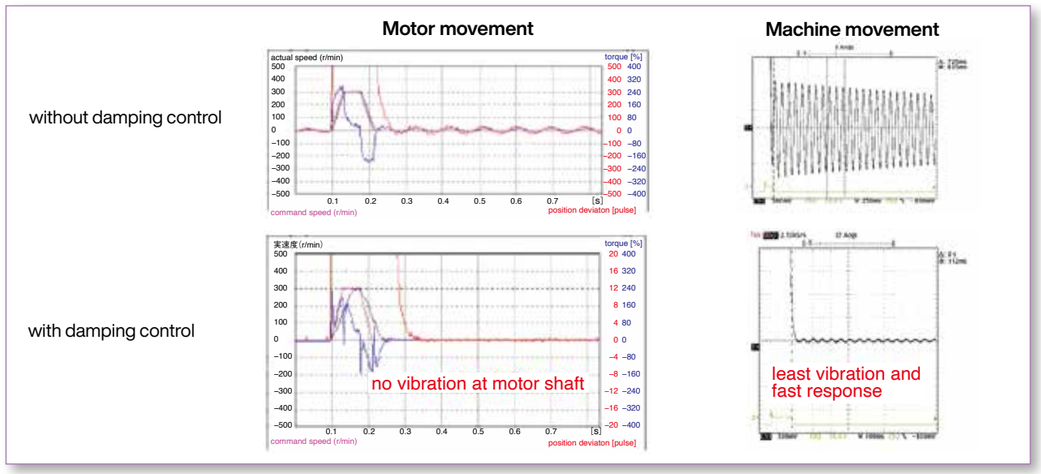
- 1-channel notch filter is equipped in the driver independent from adaptive filter.
- Each of 2 filters can set up frequency and notch width, and frequency in 1Hz unit. Suppression of "Judder" noise of the machine which has multiple resonance points can be expected.

Effect of notch filter



Damping control (Note1)

- You can suppress vibration occurring at both starting and stopping in low stiffness machine, by manually setting up vibration frequency in 0.1 Hz unit. Note) Only applies to manual adjustment



(Note1) Select at positioning action mode.

- At high speed positioning mode (Pr02=0) Select either one of notch filter, damping control or high-functionality real-time auto- gain tuning. Not possible to use them all at the same time. Adaptive filter cannot be used.
- At high-functionality positioning mode (Pr02=1) All of notch filter, damping control, high-functionality real-time auto-gain tuning and adaptive filter can be used at the same time.

3. Further Flexibility and Multiplicity

Console (Option)

- You can set up parameters, copy and make a JOG run.
- Convenient for maintenance at site.
- Refer to P.403, Options.

Command control modes

- Offers 2 command modes, “Position control” and “Internal velocity control”.
- You can make a 4-speed running at preset values with parameter at internal velocity control mode.

Inrush current suppressing function

- Inrush suppressing resistor, which prevent the circuit breaker shutdown of the power supply caused by inrush current at power-on, is equipped in this driver.
- Prevents unintentional shutdown of the power supply circuit breaker in multi axis application and does not give load to the power line.

Regeneration discharging function

- Discharges the regenerative energy with external resistor, where energy is generated while stopping the load with large moment of inertia, or use in up-down operation, and is returned to the driver from the motor.
- No regenerative resistor is installed in the driver.
- It is highly recommended to install an external regenerative resistor (option).

Built-in dynamic brake

- You can select the dynamic brake action which short the servo motor windings of U, V and W, at Servo-OFF, CW/CCW over- travel inhibition, power shutdown and trip.
- You can select the action sequence depending on the machine requirement.

Setup support software (Option)

- With the setup support software, “PANATERM” via RS232 / RS485 communication port, you can monitor the running status of the driver and set up parameters.

  Note) Refer to P.398 for setup support software.

Key-way shaft and tapped shaft end

- Easy pulley attachment and easy maintenance
- Attache screw to the tapped shaft to prevent key or pulley from being pulled out.

Wave-form graphic function

- With the setup support software, “PANATERM”, you can monitor the “Command speed”, “Actual speed”, “Torque”, “Position deviation” and “Positioning complete signal”.
- Helps you to analyze the machine and shorten the setup time.

  Note) Refer to P.398 for setup support software.

Frequency analyzing function

- You can confirm the response frequency characteristics of total machine mechanism including the servo motor with the setup support software, “PANATERM”.
- Helps you to analyze the machine and shorten the setup time.

  Note) Refer to P.398 for setup support software.

Torque limit switching function

- You can select 2 preset torque limit value from external input.
- Use this function for tension control or press-hold control.

Conformity to CE and UL Standards

Subject	Standard conformed		
Motor	IEC60034-1	IEC60034-5 UL1004 CSA22.2 No.100	Conforms to EU Low Voltage Directives/UK Low Voltage Regulation
Motor and driver		UL508C CSA22.2 No.14	
	EN55011	Radio Disturbance Characteristics of Industrial, Scientific and Medical (ISM) Radio-Frequency Equipment	Conforms to references by EU EMC Directives/UK EMC Regulation
	EN61000-6-2	Immunity for Industrial Environments	
	EC61000-4-2	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
EN : Europaischen Normen
EMC : Electromagnetic Compatibility
UL : Underwriters Laboratories
CSA : Canadian Standards Association

Pursuant to at the directive 2004/108/EC,article 9(2)

* When exporting this product, follow statutory provisions of the destination country.

Motor Line-up

Motor series		Rated output (kW)	Rated rotational speed (Max. speed) (r/min)	Rotary encoder: 2500 P/r incremental	Rotary encoder: 17bit absolute/ incremental	Brake: Holding	Gear: High precision	UL/ CSA	Enclosure	Features	Applications
Ultra low inertia	MUMA 	0.05 to 0.4 0.05 0.1 0.2 0.4	3000 (5000)	○	–	○	○	○	IP65 Except shaft throughhole and connector	Small capacity Ultra low inertia	SMT machines Inserters High repetitive positioning application

Model Designation

Servo Motor

M U M A 5 A Z P 1 S * *

Special specifications

Symbol	Series
MUMA	Ultra low inertia (50 W to 400 W)

Motor structure

Symbol	Shaft	Holding brake		Oil seal	
	Key-way, center tap	without	with	without	with*
S	●	●		●	
T	●		●	●	

* Motor with oil seal is manufactured by order.

Motor rated output

Symbol	Rated output
5A	50 W
01	100 W
02	200 W
04	400 W

Voltage specifications

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

Design order

Symbol	Specifications
1	Standard

Rotary encoder specifications

Symbol	Format	Pulse counts	Resolution	Wires
P	Incremental	2500 P/r	10000	5

See P.389 for motor specifications

Motor with gear reducer

M U M A 0 1 1 P 3 1 N

Symbol	Series
MUMA	Ultra low inertia (100 W to 400 W)

Motor rated output

Symbol	Rated output
01	100 W
02	200 W
04	400 W

Voltage specifications

Symbol	Specifications
1	100 V
2	200 V

Rotary encoder specifications

Symbol	Format	Pulse counts	Resolution	Wires
P	Incremental	2500 P/r	10000	5

Gear reduction ratio, gear type

Symbol	Gear reduction ratio	Motor output (W)			Gear type
		100	200	400	
1N	1/5	●	●	●	For high accuracy
2N	1/9	●	●	●	
4N	1/25	●	●	●	

Motor structure

Symbol	Shaft	Holding brake	
	Key-way	without	with
3	●	●	
4	●		●

See P.394 for motor with gear reducer specifications

Servo Driver

M K D E T 1 3 1 0 P * *

Special specifications

Control mode

Symbol	Specifications
P	Pulse train

Current detector current rating

Symbol	Current rating
05	5 A
10	10 A

Frame symbol

Symbol	Frame
MKDE	E series, K-frame
MLDE	E series, L-frame

Power device Max. current rating

Symbol	Current rating
T1	10 A
T2	15 A

Supply voltage specifications

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

See P.385 for driver specifications

· Wiring of main circuit

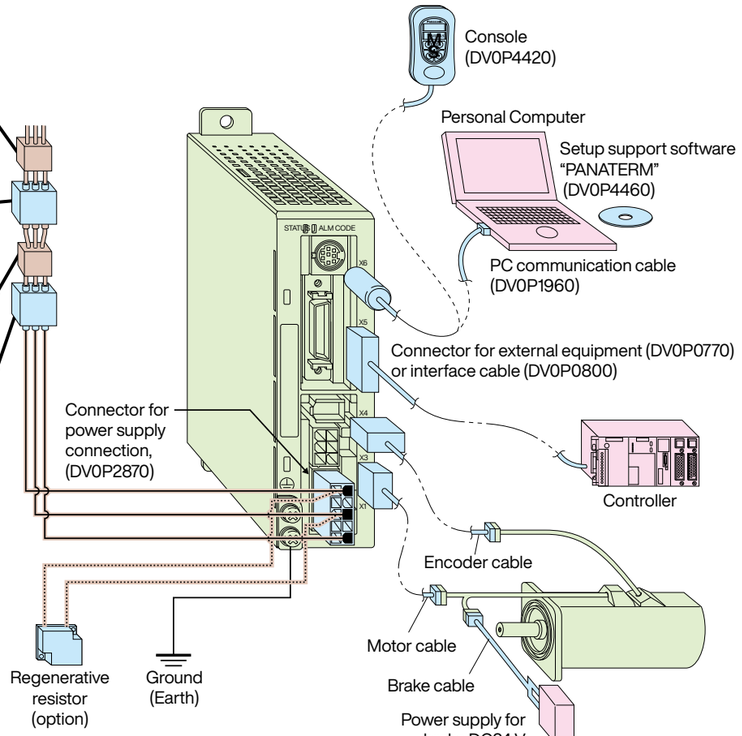
Circuit Breaker (MCCB)
Protects the power lines.
Shuts off the circuit when overcurrent passes.

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.
Surge absorber to be used together with this.

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

Pin-5 and Pin-3 of CN POWER
- Connect an external regenerative resistor (option) between P(pin-5) and B(pin-3) of connector, CN X1, when regenerative energy is large. (Refer to P.404 for regenerative resistor.)



Motor to P.389
Driver to P.385
Option to P.398
Recommended equipments
Parts customer to prepare

List of recommended peripheral devices

Power supply	Motor Series	Motor Output	Power capacity (at rated output)	Circuit Breaker (Rated current)	Noise Filter	Magnetic Contactor Contact Composition	Wire diameter (L1, L2, L3, U, V and W)
Single phase, 100 V	MUMA	50 W	0.3 kVA	5 A	DV0P4160	10 A (3P+1a)	0.75 mm² to 0.85 mm² AWG18
		100 W	0.4 kVA				
		200 W	0.5 kVA	10 A			
Single phase, 200 V		50 W	0.3 kVA	5 A		15 A (3P+1a)	
		100 W					
		200 W	0.5 kVA				
		400 W	0.9 kVA	10 A			
3-phase 200 V		50 W	0.3 kVA	5 A		10 A (3P+1a)	
		100 W					
		200 W	0.5 kVA				
		400 W	0.9 kVA	10 A			

∗ Select the single and 3-phase common specifications corresponding to the power supplies.
- To conform to EU Directives/UK Regulation, install a circuit breaker which conforms to IEC and UL Standards (Listed, UL marked) between noise filter and power supply.
- For details of the noise filters, refer to 416.

<Remarks>
- Use a copper conductor cables with temperature rating of 60 ˚C or higher for main power connector and ground terminal wiring.
  Use a cable for ground with diameter of 2.0 mm² (AWG14) or larger.

Fastening torque list

Ground terminal screw		Connector to host controller[X5]	
Nominal size	Fastening torque (N•m)(Note 3)	Nominal size	Fastening torque (N•m)(Note 3)
M4	0.7～0.8	M2.6	0.2±0.05

(Note 3) **<Caution>**
- Applying fastening torque larger than the maximum value may result in damage to the product.

<Remarks>
- To check for looseness, conduct periodic inspection of fastening torque once a year.

Carrying page

Options		Part No.	Carrying page
Console		DV0P4420	403
Setup Support Software, PANATERM	Japanese	DV0P4460	398
	English		
RS232 Communication Cable (for Connection with PC)		DV0P1960	403
Interface Cable		DV0P0800	403
Connector Kit for Interface		DV0P0770	402
Connector Kit for Motor and Encoder		DV0P3670	401
Connector Kit for Driver Power Supply		DV0P2870	401
Encoder Cable	MFECA0 ∗ ∗ 0EAM		400
Motor Cable	MFMCA0 ∗ ∗ 0AEB		400
Brake Cable	MFMCB0 ∗ ∗ 0GET		400
Cable Set (3 m) (Note 4)	DV0P37300		400
Cable Set (5 m) (Note 4)	DV0P39200		400
DIN Rail Mount Unit	DV0P3811		404
External Regenerative Resistor	100 V	50 Ω 10 W	DV0P2890	404
	200 V	100 Ω 10 W	DV0P2891	
Reactor		100 V	DV0P227	405
			DV0P228	
		200 V	DV0P220	
Noise Filter			DV0P4160	416
Surge Absorber	Single phase 100 V, 200 V		DV0P4190	416
	3-phase 200 V		DV0P1450	
Ferrite core			DV0P1460	416

(Note 4) Cable set (3 m) contains,
1) Interface cable: DV0P0800
2) Encoder cable (3 m) : MFECA0030EAM
3) Motor cable (3 m) : MFMCA0030AEB
4) Connector kit for driver power supply connection : DV0P2870
Cable set (5 m) contains,
1) Interface cable: DV0P0800
2) Encoder cable (5 m) : MFECA0050EAM
3) Motor cable (5 m) : MFMCA0050AEB
4) Connector kit for driver power supply connection : DV0P2870

Table of Part Numbers and Options

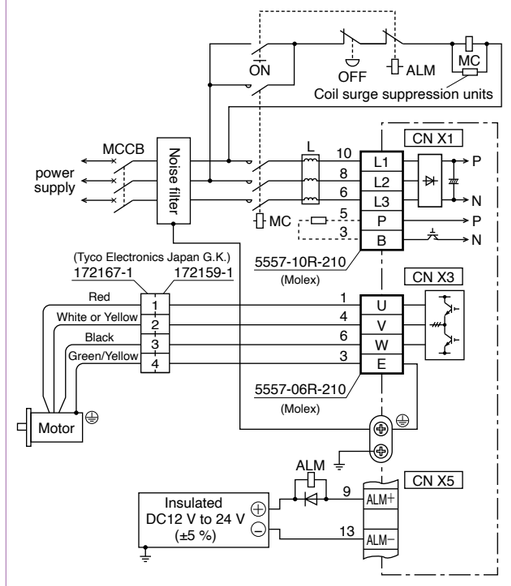
Power supply	Output (W)	2500P/r, Incremental Motor Note) 1	Rating/Spec. (page)	Driver	Dimensions (Frame symbol)	Option Encoder Cable Note) 2	Motor Cable Note) 2		Brake Cable Note) 2	External Regenerative Resistor	Reactor	Noise Filter
Single phase 100 V	50	MUMA5AZP1 □	389	MKDET1105P	388（K）	MFECA0∗∗0EAM	MFMCA0∗∗0AEB		MFMCB0∗∗0GET	DV0P2890	DV0P227	DV0P4160
	100	MUMA011P1 □	389	MKDET1110P	388（K）							
	200	MUMA021P1 □	389	MLDET2110P	388（L）						DV0P228	
Single phase 200 V	50	MUMA5AZP1 □	391	MKDET1505P	388（K）					DV0P2891	DV0P220	
	100	MUMA012P1 □	391	MKDET1505P	388（K）							
	200	MUMA022P1 □	391	MLDET2210P	388（L）							
	400	MUMA042P1 □	391	MLDET2510P	388（L）							
3-phase 200 V	50	MUMA5AZP1 □	391	MKDET1505P	388（K）							
	100	MUMA012P1 □	391	MKDET1505P	388（K）							
	200	MUMA022P1 □	391	MKDET1310P	388（K）							
	400	MUMA042P1 □	391	MLDET2510P	388（L）							
				MLDET2310P								

Note) 1 Motor model number suffix: □
S : Key way with center tap, without brake
T : Kew way with center tap, with brake
Note) 2 ∗ ∗ represents cable length. For details, refer to P.399.

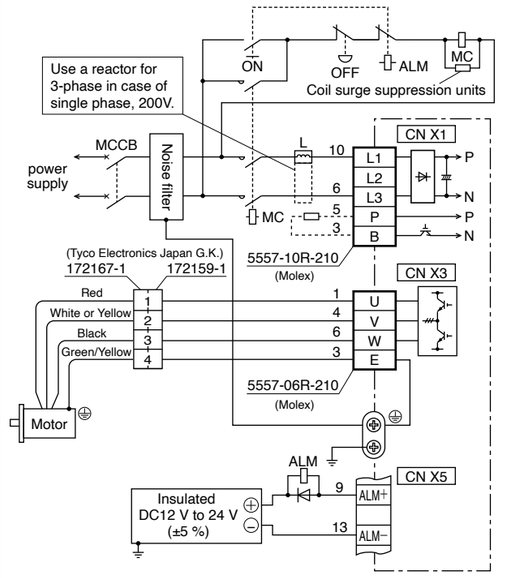
Basic Specifications	Input power	Single phase, 100 V	Single phase, 100 V to 115 V +10 % –15 % 50 Hz/60 Hz
		Single phase, 200 V	Single phase, 200 V to 240 V +10 % –15 % 50 Hz/60 Hz
		3-phase, 200 V	3-phase, 200 V to 240 V +10 % –15 % 50 Hz/60 Hz
	Environment	Temperature	Operating : 0 ˚C to 55 ˚C, Storage : –20 ˚C to 65 ˚C (Max.temperature guarantee 80 ˚C for 72 hours <Nomal temperature>)
		Humidity	Both operating and storage : 90 %RH or less (free from condensation)
		Altitude	1000 m or lower
		Vibration	5.88 m/s^2 or less, 10 Hz to 60 Hz (No continuous use at resonance frequency)
	Withstand voltage		Should be 1500 VAC (Sensed current: 20 mA) for 1 minute between Primary and Ground.
	Control method		IGBT PWM Sinusoidal wave drive
	Encoder feedback		2500 P/r (10000 resolution) incremental encoder
	Control signal	Input	7 inputs (1) Servo-ON, (2) Alarm clear and other inputs vary depending on the control mode.
		Output	4 outputs (1) Servo alarm, (2) Alarm, (3) Release signal of external brake and other outputs vary depending on the control mode.
	Pulse signal	Input	2 inputs Supports both line driver I/F and open collector I/F.
		Output	4 outputs Feed out the encoder pulse (A, B and Z-phase) in line driver. Z-phase pulse is also feed out in open collector.
	Communication function	RS232	1 : 1 communication to a host with RS232 interface is enabled.
	Display LED		(1) Status LED (STATUS), (2) Alarm code LED (ALM-CODE)
	Regeneration		No built-in regenerative resistor (external resistor only)
	Dynamic brake		Built-in
	Control mode		3 modes of (1) High-speed position control, (2) Internal velocity control and (3) High-functionality positioning control are selectable with parameter.
Functions	Position control	Control input	(1) CW over-travel inhibition, (2) CCW over-travel inhibition, (3) Deviation counter clear, (4) Gain switching, (5) Electronic gear switching
		Control output	(1) Positioning complete (In-position)
		Pulse input: Max. command pulse frequency	Line driver : 500 kpps, Open collector : 200 kpps
		Pulse input: Type of input pulse train	Differential input. Selectable with parameter, ((1) CW/CCW, (2) A and B-phase, (3) Command and Direction)
		Pulse input: Electronic gear (Division/Multiplication of command pulse)	Setup of electronic gear ratio Setup range of (1-10000) × 2$^{(0-17)}$/(1-10000)
		Pulse input: Smoothing filter	Primary delay filter or FIR type filter is selectable to the command input.
	Internal speed control	Control input	(1) CW over-travel inhibition, (2) CCW over-travel inhibition, (3) Selection 1 of internal command speed, (4) Selection 2 of internal command speed, (5) Speed zero clamp
		Control output	(1) Speed arrival (at-speed)
		Internal speed command	Internal 4-speed is selectable with control input.
		Soft-start/down function	Individual setup of acceleration and deceleration are enabled, with 0 s to 10 s/1000 r/min. Sigmoid acceleration/deceleration is also enabled.
		Zero-speed clamp	0-clamp of internal speed command with speed zero clamp input is enabled.
	Common	Auto-gain tuning: Real-time	Estimates the load inertia in real-time in actual operation and sets up the gain automatically corresponding to the machine stiffness. Useable at (1) High-response position control, (2) Internal speed control and (3) High-functionality position control.
		Auto-gain tuning: Normal mode	Estimates the load inertia with an action command inside of the driver, and sets up the gain automatically corresponding to setup of the machine stiffness. Useable at (1) High-response position control, (2) Internal speed control and (3) High-functionality position control.
		Masking of unnecessary input	Masking of the following input signal is enabled. (1) Over-travel inhibition, (2) Speed zero clamp, (3) Torque limit switching
		Division of encoder feedback pulse	1 P/r to 2500 P/r (encoder pulses count is the max.).
		Protective function: Hardware error	Over-voltage, under-voltage, over-speed over-load, over-heat, over-current and encoder error etc.
		Protective function: Software error	Excess position deviation, command pulse division error, EEPROM error etc.
		Traceability of alarm data	Traceable up to past 14 alarms including the present one.
		Damping control function	Manual setup with parameter
		Setup: Manual	Console
		Setup: Setup support software	PANATERM (Supporting OS : Windows98, Windows ME, Windows2000, and WindowsXP)

Standard Wiring Example of Main Circuit

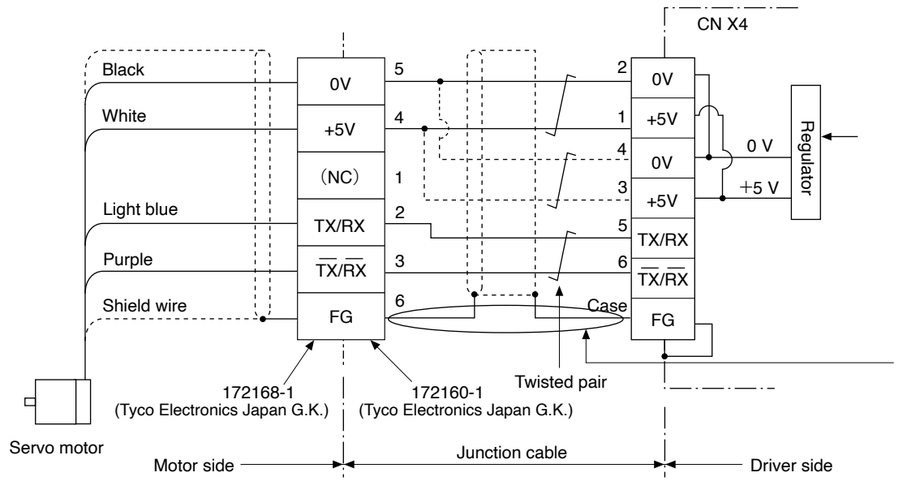
3-Phase, 200 V



Single Phase, 100 V / 200 V



Encoder Wiring Diagram



When you make your own junction cable for encoder (Refer to P.401, P.402 "Options" for connector.)

1) Refer the wiring diagram.
2) Use the twisted pair wire with shield, with core diameter of 0.18 mm2 (AWG24) or larger, with higher bending resistance.
3) Use the twisted pair wire for the corresponding signal and power supply.
4) Shielding
   Connect the shield of the driver to the case of CN X4.
   Connect the shield of the motor to Pin-6.

CN X 5 Wiring Example at Position Control Mode

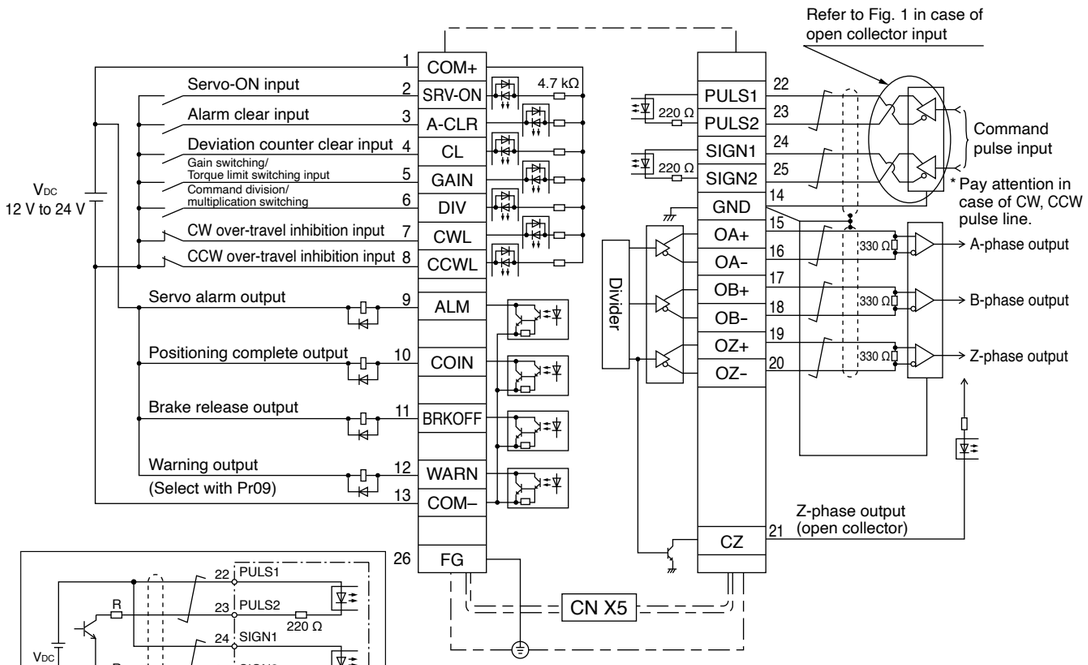
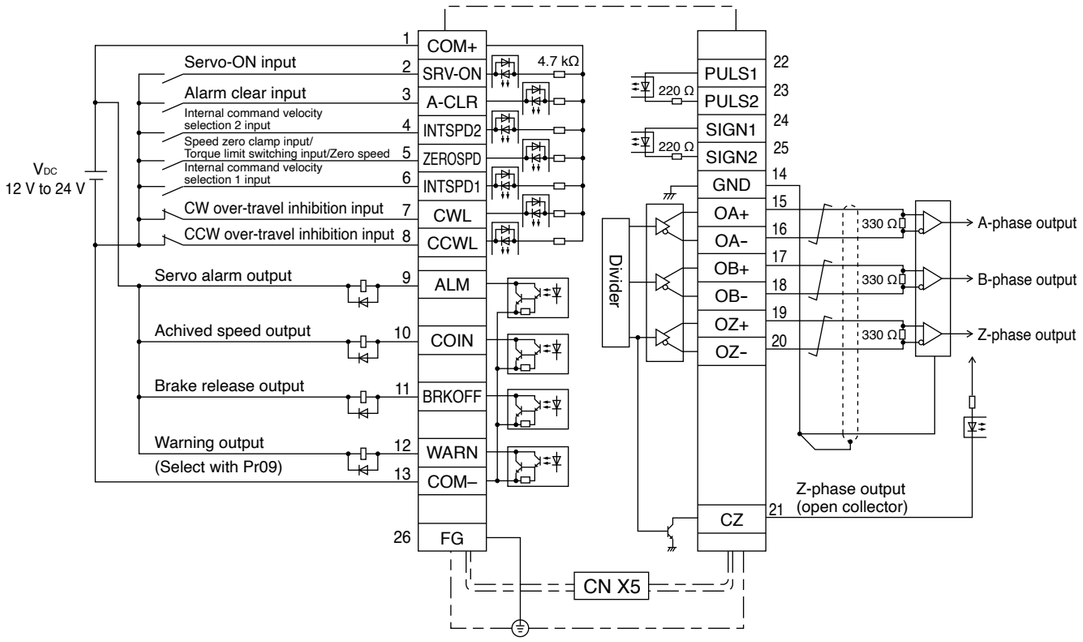


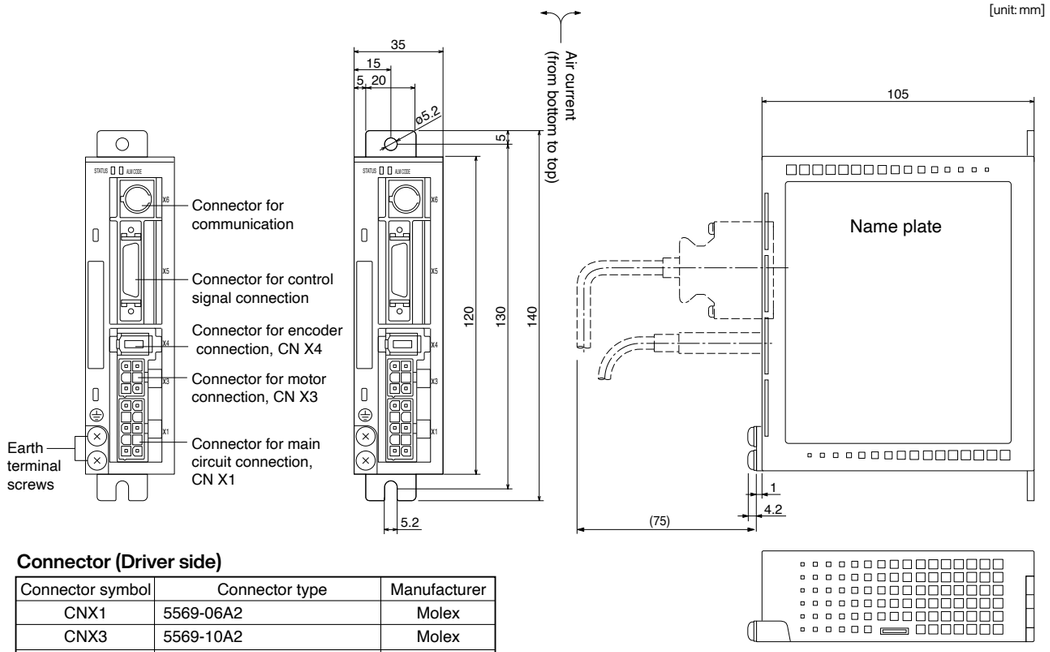
Fig. 1
This fig. shows the usage of an external control signal power supply.
You need to install an resistor R for current limit corresponding to VDC.

CN X 5 Wiring Example at Internal Velocity Control Mode



Frame K

[unit: mm]



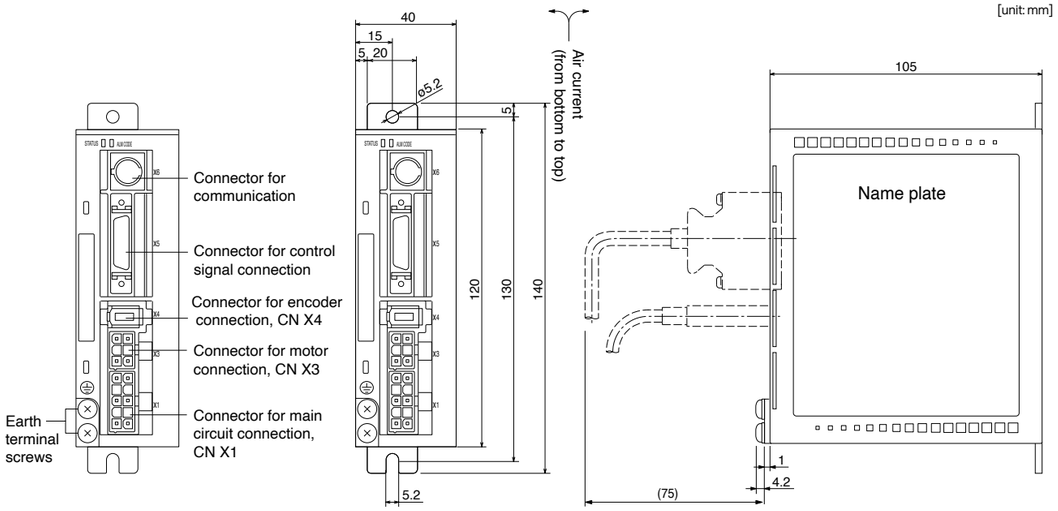
Connector (Driver side)

Connector symbol	Connector type	Manufacturer
CNX1	5569-06A2	Molex
CNX3	5569-10A2	Molex
CNX4	53460-0621	Molex
CNX5	10226-52A11L(or equivalent)	3M Japan

Mass: 0.35 kg

Frame L

[unit: mm]



Connector (Driver side)

Connector symbol	Connector type	Manufacturer
CNX1	5569-06A2	Molex
CNX3	5569-10A2	Molex
CNX4	53460-0621	Molex
CNX5	10226-52A11L(or equivalent)	3M Japan

Mass: 0.40 kg

		AC100 V		
Motor model	MUMA	5AZP1□	011P1□	021P1□
Applicable driver	Model No.	MKDET1105P	MKDET1110P	MLDET2110P
	Frame symbol	Frame K		Frame L
Power supply capacity (kVA)		0.3	0.4	0.5
Rated output (W)		50	100	200
Rated torque (N·m)		0.16	0.32	0.64
Momentary Max. peak torque (N·m)		0.48	0.95	1.91
Rated current (Arms)		1.0	1.6	2.5
Max. current (Ao-p)		4.3	6.9	11.7
Regenerative brake frequency (times/min) Note)1	Without option	No limit Note)2		
	DV0P2890	No limit Note)2		
Rated rotational speed (r/min)		3000		
Max. rotational speed (r/min)		5000		
Moment of inertia of rotor ($\times10^{-4}$ kg·m^2)	Without brake	0.021	0.032	0.10
	With brake	0.026	0.036	0.13
Recommended moment of inertia ratio of the load and the rotor Note)3		30 times or less		
Rotary encoder specifications		2500 P/r Incremental		
	Resolution per single turn	10000		
Protective enclosure rating		IP65 (except rotating portion of output shaft and lead wire end)		
Environment	Ambient temperature	0 ˚C to 40 ˚C (free from freezing), Storage : –20 ˚C to 65 ˚C (Max.temperature guarantee 80 ˚C for 72 hours <nomal humidity>)		
	Ambient humidity	85 %RH or lower (free from condensing)		
	Installation location	Indoors (no direct sunlight), free from corrosive gas, inflammable gas, oil mist and dust		
	Altitude	1000 m or lower		
	Vibration resistance	49 m/s^2 or less		
Mass (kg), ( ) represents holding brake type		0.4 (0.6)	0.5 (0.7)	0.96 (1.36)

Brake specifications (This brake will be released when it is energized. Do not use this for braking the motor in motion.)		
Static friction torque (N·m)	0.29	1.27
Engaging time (ms)	25	50
Releasing time (ms) Note)4	20 (30)	15 (100)
Exciting current (DC) (A)	0.26	0.36
Releasing voltage	DC 1 V or more	
Exciting voltage	DV 24 V ±10 %	

Permissible load				
During assembly	Radial load P-direction (N)	147	392	
	Thrust load A-direction (N)	88	147	
	Thrust load B-direction (N)	117	196	
During operation	Radial load P-direction (N)	68	245	
	Thrust load A-direction (N)	58	98	
	Thrust load B-direction (N)	58	98	

For motor dimensions, refer to P.393, and for the driver, refer to P.388.

Model Designation

e.g.) M U M A 5 A Z P 1 S

Symbol	Series
MUMA	Ultra low inertia (50 W to 200 W)

Motor rated output

Symbol	Rated output
5A	50 W
01	100 W
02	200 W

Voltage specifications

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

Design order
1: Standard

Motor structure

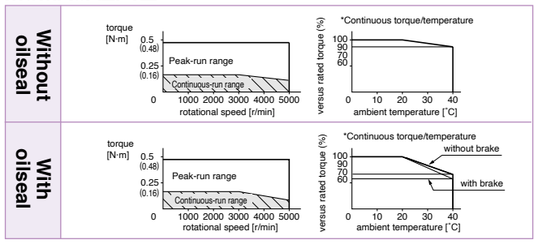
Symbol	Shaft	Holding brake		Oil seal	
	Key-way, center tap	without	with	without	with
S	●	●		●	
T	●		●	●	

Rotary encoder specifications

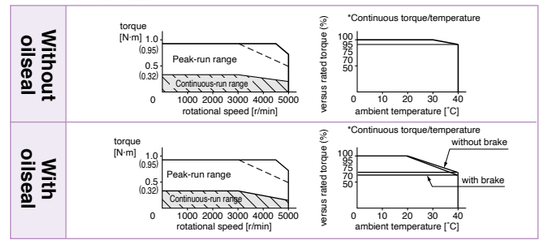
Symbol	Format	Pulse counts	Resolution	Wires
P	Incremental	2500 P/r	10000	5

Torque Characteristics [at AC100 V of power voltage (Dotted line represents the torque at 10 % less supply voltage.)]

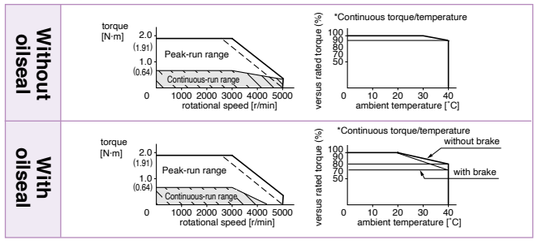
MUMA5AZP1□



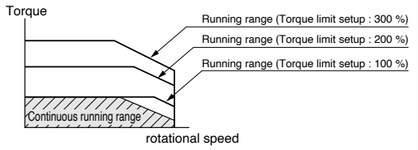
MUMA011P1□

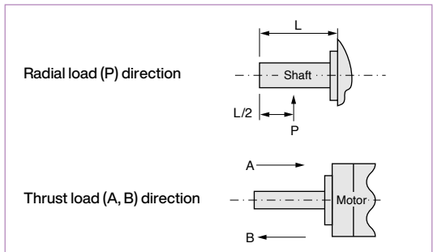


MUMA021P1□



*When you lower the torque limit setup (Pr5E and 5F), running range at high speed might be lowered as well.





Note) 1. Regenerative brake frequency represents the frequency of the motor's stops from the rated speed with deceleration without load.
- If the load is connected, frequency will be defined as 1/(m+1), where m = (load moment of inertia) / (rotor moment of inertia).
- When the motor speed exceeds the rated speed, regenerative brake frequency is in inverse proportion to the square of (running speed/rated speed).
- Power supply voltage is AC115 V (at 100 V of the main voltage). If the supply voltage fluctuates, frequency is in inverse proportion to the square of (Running supply voltage/115) relative to the value in the table.
- When regeneration occurs continuosly such cases as running speed frequently changes or vertical feeding, consult us or a dealer.

2. If the effective torque is within the rated torque, there is no limit in regenerative brake.
3. Consult us or a dealer if the load moment of inertia exceeds the specified value.
4. Specified releasing time is obtained with the use of surge absorber for brake (Z15D151 by SEMITEC Corporation or equivalent). ( ) represents the actually measured value using a diode (200 V, 1 A or equivalent)

		AC200 V			
Motor model	MUMA	5AZP1□	012P1□	022P1□	042P1□
Applicable driver	Model No.	MKDET1505P		MKDET1310P	MLDET2310P
				MKDET2210P	MLDET2510P
	Frame symbol	Frame K		Frame K	Frame L
				Frame L	
Power supply capacity (kVA)		0.3	0.3	0.5	0.9
Rated output (W)		50	100	200	400
Rated torque (N · m)		0.16	0.32	0.64	1.3
Momentary Max. peak torque (N · m)		0.48	0.95	1.91	3.8
Rated current (Arms)		1.0	1.0	1.6	2.5
Max. current (Ao-p)		4.3	4.3	7.5	11.7
Regenerative brake frequency (times/min) Note)1	Without option	No limit Note)2			
	DV0P2891	No limit Note)2			
Rated rotational speed (r/min)		3000			
Max. rotational speed (r/min)		5000			
Moment of inertia of rotor ($\times 10^{-4}$ kg·m^2)	Without brake	0.021	0.032	0.10	0.17
	With brake	0.026	0.036	0.13	0.20
Recommended moment of inertia ratio of the load and the rotor Note)3		30 times or less			
Rotary encoder specifications		2500 P/r Incremental			
	Resolution per single turn	10000			
Protective enclosure rating		IP65 (except rotating portion of output shaft and lead wire end)			
Environment	Ambient temperature	0 ˚C to 40 ˚C (free from freezing), Storage : –20 ˚C to 65 ˚C (Max.temperature guarantee 80 ˚C for 72 hours <nomal humidity>)			
	Ambient humidity	85 %RH or lower (free from condensing)			
	Installation location	Indoors (no direct sunlight), free from corrosive gas, inflammable gas, oil mist and dust			
	Altitude	1000 m or lower			
	Vibration resistance	49 m/s^2 or less			
Mass (kg), ( ) represents holding brake type		0.4 (0.6)	0.5 (0.7)	0.96 (1.36)	1.5 (1.9)

Brake specifications (This brake will be released when it is energized. Do not use this for braking the motor in motion.)		
Static friction torque (N · m)	0.29	1.27
Engaging time (ms)	25	50
Releasing time (ms) Note)4	20 (30)	15 (100)
Exciting current (DC) (A)	0.26	0.36
Releasing voltage	DC 1 V or more	
Exciting voltage	DV 24 V ±10 %	

Permissible load			
During assembly	Radial load P-direction (N)	147	392
	Thrust load A-direction (N)	88	147
	Thrust load B-direction (N)	117	196
During operation	Radial load P-direction (N)	68	245
	Thrust load A-direction (N)	58	98
	Thrust load B-direction (N)	58	98

For motor dimensions, refer to P.393, and for the driver, refer to P.388.

Note) Driver for 50 W and 100 W has a common power supply of single phase and 3-phase 200 V.
Driver for 200 W, the upper row is the power supply of 3-phase 200 V, and lower is the power supply of single-phase 200 V.
Driver for 400 W, the upper row is the power supply of 3-phase 200 V, and lower is the common power supply of single-phase and 3-phase 200 V.

Model Designation

e.g.) M U M A 5 A Z P 1 S

Symbol	Series
MUMA	Ultra low inertia (50 W to 400 W)

Motor rated output

Symbol	Rated output
5A	50 W
01	100 W
02	200 W
04	400 W

Voltage specifications

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

Design order
1: Standard

Motor structure

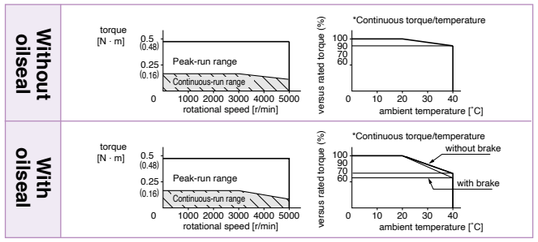
Symbol	Shaft	Holding brake		Oil seal	
	Key-way, center tap	without	with	without	with
S	●	●		●	
T	●		●	●	

Rotary encoder specifications

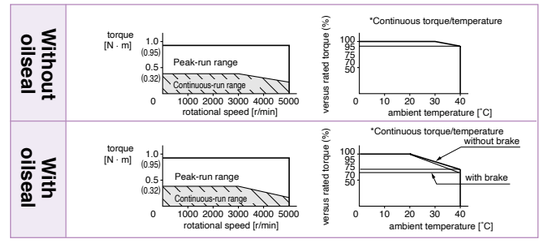
Symbol	Format	Pulse counts	Resolution	Wires
P	Incremental	2500 P/r	10000	5

Torque Characteristics [at AC200 V of power voltage (Dotted line represents the torque at 10 % less supply voltage.)]

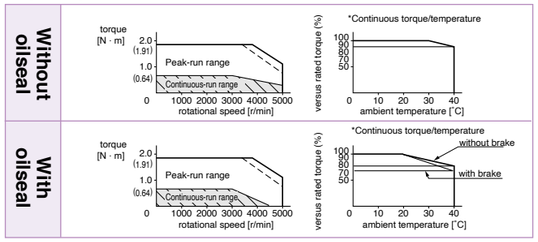
MUMA5AZP1□



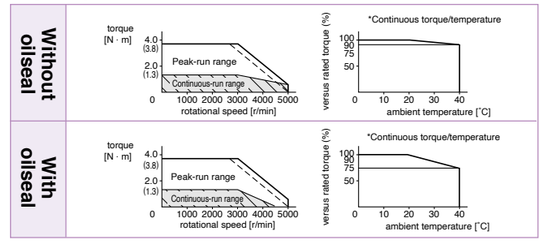
MUMA012P1□



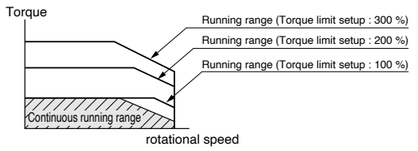
MUMA022P1□

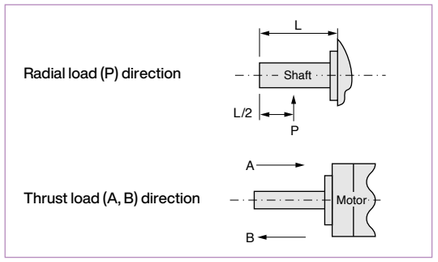


MUMA042P1□



*When you lower the torque limit setup (Pr5E and 5F), running range at high speed might be lowered as well.

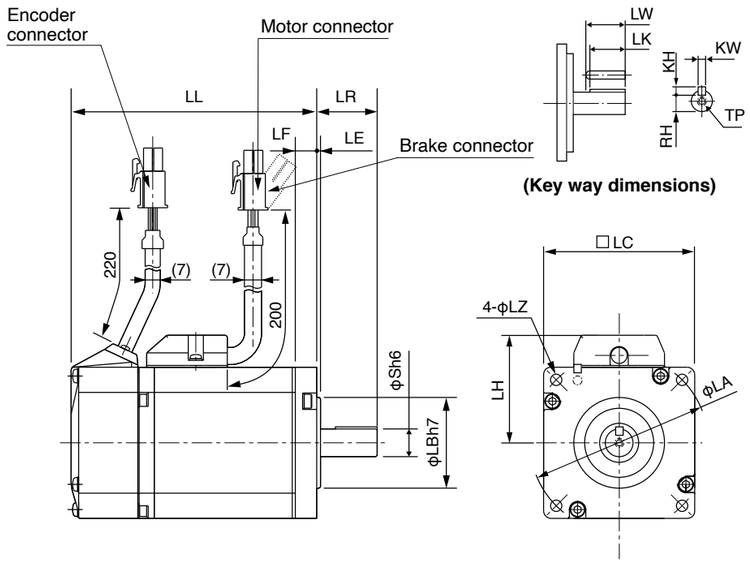




Note) 1. Regenerative brake frequency represents the frequency of the motor's stops from the rated speed with deceleration without load.
- If the load is connected, frequency will be defined as 1/(m+1), where m = (load moment of inertia) / (rotor moment of inertia).
- When the motor speed exceeds the rated speed, regenerative brake frequency is in inverse proportion to the square of (running speed/rated speed).
- Power supply voltage is AC240 V (at 200 V of the main voltage). If the supply voltage fluctuates, frequency is in inverse proportion to the square of (Running supply voltage/240) relative to the value in the table.
- When regeneration occurs continuously such cases as running speed frequently changes or vertical feeding, consult us or a dealer.

2. If the effective torque is within the rated torque, there is no limit in regenerative brake.
3. Consult us or a dealer if the load moment of inertia exceeds the specified value.
4. Specified releasing time is obtained with the use of surge absorber for brake (Z15D151 by SEMITEC Corporation or equivalent). ( ) represents the actually measured value using a diode (200 V, 1 A or equivalent)

[Unit: mm]



* Dimensions are subject to change without notice. Contact us or a dealer for the latest information

[Unit: mm]

		MUMA series (Ultra low inertia)			
Motor output		50 W	100 W	200 W	400 W
Motor model	MUMA	5A□P1□	01□P1□	02□P1□	04□P1□
Rotary encoder specifications		2500 P/r Incremental	2500 P/r Incremental	2500 P/r Incremental	2500 P/r Incremental
LL	Without brake	75.5	92.5	96	123.5
	With brake	107	124	129	156.5
LR		24	24	30	30
S		8	8	11	14
LA		48	48	70	70
LB		22	22	50	50
LC		42	42	60	60
LE		2	2	3	3
LF		7	7	7	7
LH		34	34	43	43
LZ		3.4	3.4	4.5	4.5
Key way	LW	14	14	20	25
	LK	12.5	12.5	18	22.5
	KW	3h9	3h9	4h9	5h9
	KH	3	3	4	5
	RH	6.2	6.2	8.5	11
	TP	M3 × 6 (depth)	M3 × 6 (depth)	M4 × 8 (depth)	M5 × 10 (depth)
Mass (kg)	Without brake	0.40	0.50	0.96	1.5
	With brake	0.60	0.70	1.36	1.9
Connector/Plug specifications		refer to Options, P.401, P.402.			

<Cautions>

Reduce the moment of inertia ratio if high speed response operation is required.

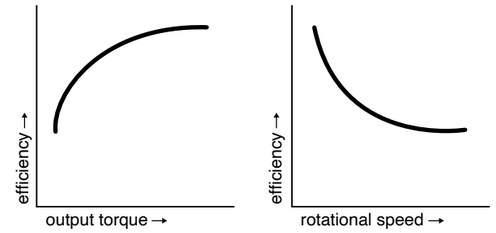
Read the Instruction Manual carefully and understand all precautions and remarks before using the products.

MINAS E Series Motors with Gear Reducer

Motor Types with Gear Reducer

Reduction ratio	Motor output (W)			Type of reducer
	100	200	400	
1/ 5	●	●	●	For high precision
1/ 9	●	●	●	
1/25	●	●	●	

Efficiency of the gear reducer shows the following inclination in relation to output torque and rotational speed.



Model No. Designation

e.g.) M U M A 0 1 1 P 3 1 N

Symbol	Series
MUMA	Low inertia (100 to 400 W)

Motor rated output

Symbol	Rated output
01	100 W
02	200 W
04	400 W

Voltage specifications

Symbol	Specifications
1	100 V
2	200 V

Rotary encoder specifications

Symbol	Format	Pulse counts	Pulse counts	Wire
P	Incremental	2500 P/r	10000	5

Motor types with gear reducer

Symbol	Reduction ratio	Motor output 100	200	400	Type of reducer
1N	1/ 5	●	●	●	For High precision
2N	1/ 9	●	●	●	
4N	1/25	●	●	●	

Motor structure

Symbol	Shaft	Holding brake	
	Key-way	without	with
3	●	●	
4	●		●

Specifications of Motor with Gear Reducer

Motor series		MUMA
Gear reducer	Backlash	3 minutes or smaller (initial value) at output shaft of the reducer
	Composition of gear	Planetary gear
	Gear efficiency	65 % to 85 %
	Rotational direction at output shaft (of reducer)	Same direction as the motor output shaft
	Composition of gear	Planetary gear
	Mounting method	Flange mounting
	Permissible moment of inertia of the load (conversion to the motor shaft)	10 times or smaller than rotor moment of inertia of the motor
	Protective structure	IP44 (at gear reducer)
Environment	Ambient temperature	0 ˚C to 40 ˚C
	Ambient humidity	85 %RH (free from condensation) or less
	Vibration resistance	49 m/s² or less (at motor frame)
	Impact resistance	98 m/s² or less

Table of Motor with Gear Reducer Specifications

Model	Motor Output	MUMA with gear reducer Reduction ratio	Output	Rated speed	Max. speed	Rated torque	Peak max. torque	Moment of inertia (motor + reducer/converted to motor shaft) w/o brake	Moment of inertia (motor + reducer/converted to motor shaft) w/ brake	Mass w/o brake	Mass w/ brake	Permissible radial load	Permissible thrust load
	(W)		(W)	(r/min)	(r/min)	(N·m)	(N·m)	J (× 10⁻⁴kg·m²)		(kg)		(N)	(N)
MUMA01□P□1N	100	1/5	75	600	1000	1.18	3.72	0.072	0.076	1.05	1.25	490	245
MUMA01□P□2N		1/9	80	333	555	2.25	6.86	0.0663	0.0703	1.05	1.25	588	294
MUMA01□P□4N		1/25	80	120	200	6.27	19.0	0.0645	0.0685	2.20	2.40	1670	833
MUMA02□P□1N	200	1/5	170	600	1000	2.65	8.04	0.218	0.248	1.68	2.08	490	245
MUMA02□P□2N		1/9	132	333	555	3.72	11.3	0.368	0.398	2.66	3.06	1180	588
MUMA02□P□4N		1/25	140	120	200	11.1	33.3	0.388	0.418	2.66	3.06	1670	833
MUMA042P□1N	400	1/5	340	600	1000	5.39	16.2	0.533	0.563	3.2	3.6	980	490
MUMA042P□2N		1/9	332	333	555	9.51	28.5	0.438	0.468	3.2	3.6	1180	588
MUMA042P□4N		1/25	332	120	200	26.4	79.2	0.470	0.500	4.7	5.1	2060	1030

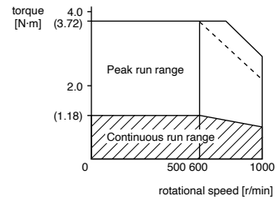
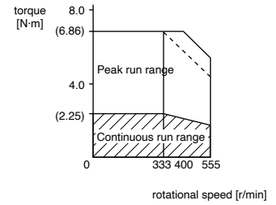
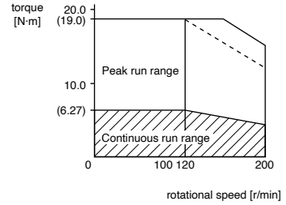
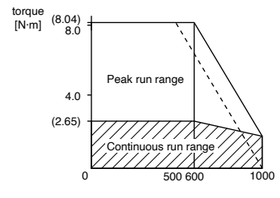
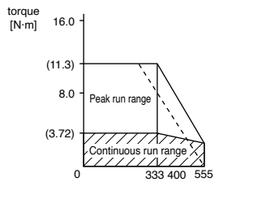
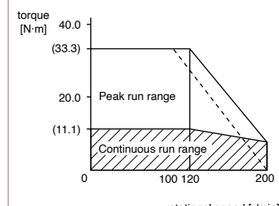
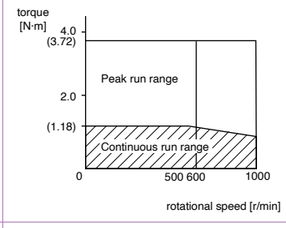
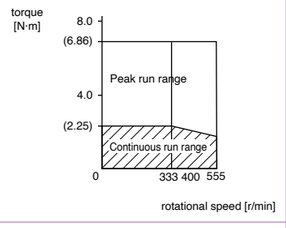
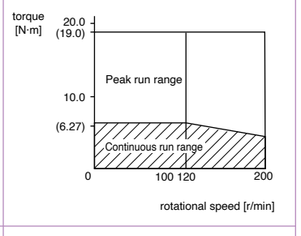
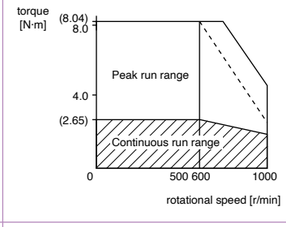
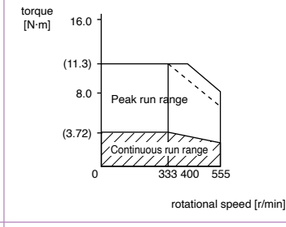
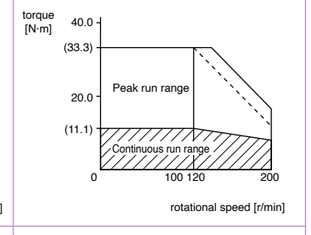
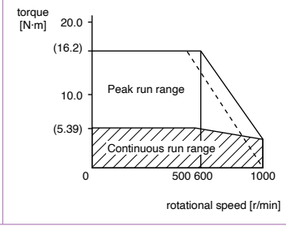
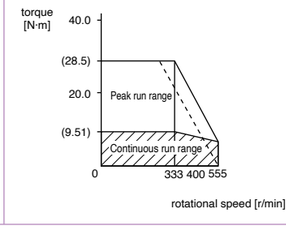
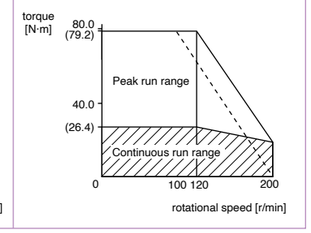
For dimensions, refer to P.397.

The Combination of the Driver and the Motor with Gear Reducer

Combination with driver		100 V		200 V		
Encoder	Motor output	Part No. of motor with gear reducer	Single phase, 100 V Part No. of driver	Part No. of motor with gear reducer	3-phase, 200 V Part No. of driver	Single phase, 200 V Part No. of driver
2500 P/r Incremental	100 W	MUMA011P□□N	MKDET1110P	MUMA012P□□N	MKDET1505P	MKDET1505P
	200 W	MUMA021P□□N	MLDET2110P	MUMA022P□□N	MKDET1310P	MLDET2210P
	400 W	–	–	MUMA042P□□N	MLDET2510P	MLDET2510P
					MLDET2310P	

For dimensions of driver, refer to P.388.

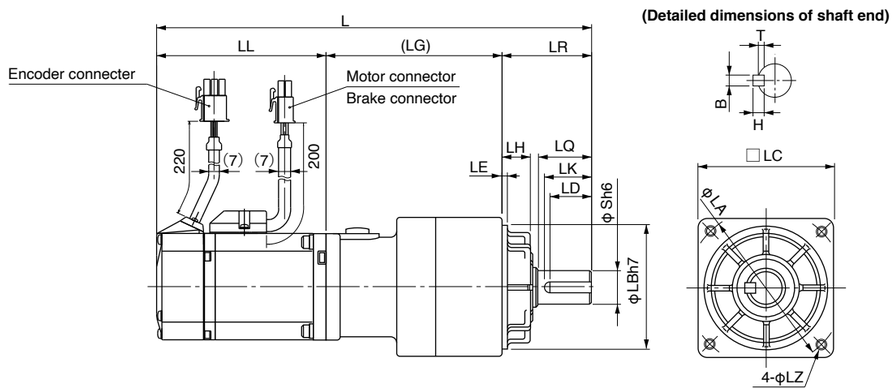
For High Precision (MUMA Series 100 W to 400 W)

Supply voltage to driver	Motor output \ Reduction ratio	1/5	1/9	1/25
100 V	100 W	MUMA011P□1N 	MUMA011P□2N 	MUMA011P□4N 
	200 W	MUMA021P□1N 	MUMA021P□2N 	MUMA021P□4N 
200 V	100 W	MUMA012P□1N 	MUMA012P□2N 	MUMA012P□4N 
	200 W	MUMA022P□1N 	MUMA022P□2N 	MUMA022P□4N 
	400 W	MUMA042P□1N 	MUMA042P□2N 	MUMA042P□4N 

Dotted line represents the torque at 10 % less supply voltage.

MUMA series with Gear Reducer

[Unit: mm]



2500 P/r Encoder

[Unit: mm]

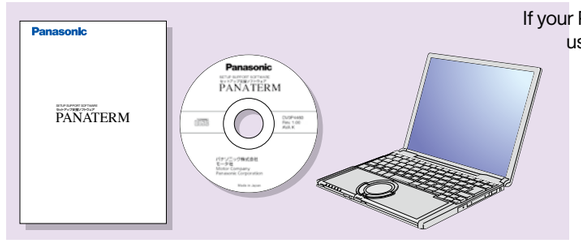
Model	Motor output	Reduction ratio	L	LL	LR	LQ	LC	LB	LA	S	LH	LZ	LK	(LG)	LE	Key way B×H×LD	T
MUMA01□P□1N	100 W	1 / 5	192	92.5	32	20	52	50	60	12	10	M5 (Depth: 12)	18	67.5	3	4×4×16	2.5
			223.5	124													
MUMA01□P□2N		1 / 9	192	92.5													
			223.5	124													
MUMA01□P□4N		1/25	234.5	92.5	50	30	78	70	90	19	17	M6 (Depth: 20)	26	92		6×6×22	3.5
			266	124													
MUMA02□P□1N	200 W	1 / 5	200.5	96	32	20	52	50	60	12	10	M5 (Depth: 12)	18	72.5		4×4×16	2.5
			233.5	129													
MUMA02□P□2N		1 / 9	235.5	96	50	30	78	70	90	19	17	M6 (Depth: 20)	26	89.5		6×6×22	3.5
			268.5	129													
MUMA02□P□4N		1/25	246	96										100			
			279	129													
MUMA042P□1N	400 W	1 / 5	263	123.5										89.5			
			296	156.5													
MUMA042P□2N		1 / 9	263	123.5													
			296	156.5													
MUMA042P□4N		1/25	288.5	123.5	61	40	98	90	115	24	18	M8 (Depth: 20)	35	104	5	8×7×30	4
			321.5	156.5													

Upper column : without brake
Lower column : with brake

Setup Support Software "PANATERM" for MINAS series AC Servo Motor & Driver

Part No.	DV0P4460 (Japanese/English version)

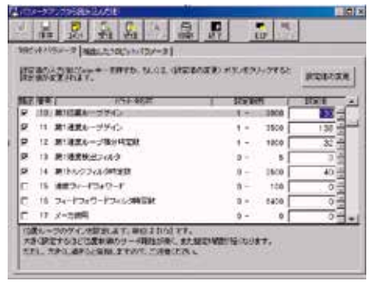
The PANATERM assists users in setting parameters, monitoring control conditions, setup support, and analyzing mechanical operation data on the PC screen, when installed in a commercially available personal computer, and connected to the MINAS A4 series, E series through the RS232 serial interface.



If your PC does not have RS232 port, use RS232-USB converter.

Basic Function

Parameter setup
- After a parameter is defined on the screen, it will be sent to the driver immediately.
- Once you register parameters you frequently use, they can be easily set up on the screen.

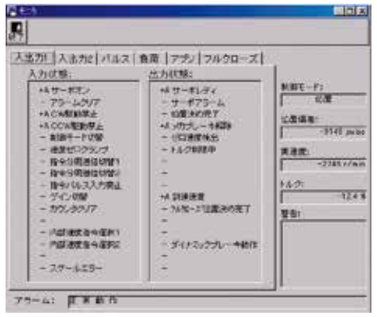


Parameter

Monitoring Control Conditions

Monitor
- Control conditions: Control mode, velocity, torque, error and warning
- Driver input signal
- Load conditions: Total count of command/feedback pulses, Load ratio, Regenerative resistor load ratio

Alarm
- Displays the numbers and contents of the current alarm and up to 14 error events in the past.
- Clears the numbers and contents of the current alarm and up to 14 error events in the past.



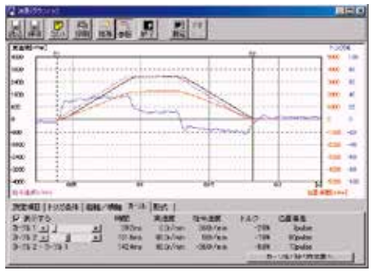
Monitor

Setup

Auto tuning
- Gain adjustment and inertia ratio measurement

Graphic waveform display
- The graphic display shows command velocity, actual velocity, torque, and error waveforms.

Absolute encoder setup
- Clears absolute encoder at the origin.
- Displays single revolution/multi-revolution data.
- Displays absolute encoder status.



Graphic waveform display

Analysis of Mechanical Operation Data

Frequency analysis
- Measures frequency characteristics of the machine, and displays Bode diagram.

■ Can not use with A5, A6 Family.

Hardware configuration
[Personal computer] • CPU : Pentium 100MHz or more • Memory : 16 MB or more (32 MB recommended)
• Hard disk capacity (vacancy of 25 MB or more recommended) • OS : Windows® 98, Windows® Me, Windows® 2000, Windows® XP (US version)
• Communication speed of serial communication port : 2400 bps or more (The software may not operate normally using USB-to-Serial adapter.) **[Display]** • Resolution : 640*480 (VGA) or more (desirably 1024*768) • Number of colors : 256 colors or more
[CD-ROM drive] • CD-ROM drive operable on the above-mentioned personal computer

Encoder Cable For available optional items, please refer to P.400.

1	2	3	4	5	6	7	8	9	10	11	12
M	F	E	C	A	0	0	5	0	E	A	M

Cable end (Driver side)

M	Connector (MUMA)

Cable end (Encoder side)

A	Tyco Electronics Japan G.K. connector

Cable type

E	PVC cable with shield by Oki Electric Cable Co., 0.20 mm² × 3P

Cable length

0030	3 m
0050	5 m
0100	10 m
0200	20 m

Type classification

MFECA: Encoder cable

Motor Cable, Brake Cable For available optional items, please refer to P.400.

1	2	3	4	5	6	7	8	9	10	11	12
M	F	M	C	A	0	0	5	0	A	E	B

Cable end at driver side

B	Molex
T	Clamp terminal

Cable end at motor side

E	Tyco Electronics Japan G.K. connector

Cable type

A	ROBO-TOP® 4-wire (DYDEN CORPORATION)
G	ROBO-TOP® 2-wire (DYDEN CORPORATION)

Cross section of cable core

0	0.75 mm²
1	1.25 mm²
2	2.0 mm²
3	3.5 mm²

Type classification

A	Standard
B	Special
⋮	Design Oder

Cable length

003	3 m
005	5 m
010	10 m
020	20 m

AC servo motor cable

ROBO-TOP® is a trade mark of DYDEN CORPORATION

Cable Set (3 m)

Part No.	DV0P37300

1) Interface cable : DV0P0800
2) Encoder cable (3 m) : MFECA0030EAM
3) Motor cable (3 m) : MFMCA0030AEB
4) Connector kit for driver power supply connection : DV0P2870

Cable Set (5 m)

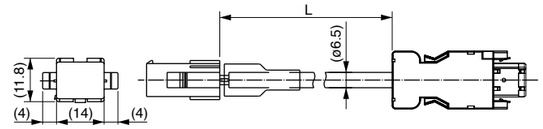
Part No.	DV0P39200

1) Interface cable : DV0P0800
2) Encoder cable (5 m) : MFECA0050EAM
3) Motor cable (5 m) : MFMCA0050AEB
4) Connector kit for driver power supply connection : DV0P2870

Encoder Cable

Part No.	MFECA0 ＊ ＊ 0EAM

[Unit: mm]



Title	Part No.	Manufacturer
Connector (Driver side)	3E206-0100KV	3M Japan or equivalent
Shell kit	3E306-3200-008	
Connector	172160-1	Tyco Electronics
Connector Pin	170365-1	
Cable	0.20 mm² × 3P	Oki Electric Cable Co., Ltd.

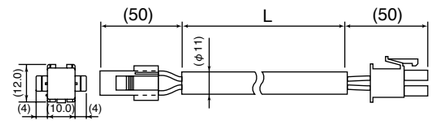
L (m)	Part No.
3	MFECA0030EAM
5	MFECA0050EAM
10	MFECA0100EAM
20	MFECA0200EAM

Motor Cable (ROBO-TOP® 105 °C 600 V . DP)

ROBO-TOP® is a trade mark of DYDEN CORPORATION

Part No.	MFMCA0 ＊ ＊ 0AEB

[Unit: mm]



Title	Part No.	Manufacturer
Connector	172159-1	Tyco Electronics
Connector Pin	170362-1, 170366-1	
Connector	5557-06R-210	Molex
Connector Pin	5556T	
Cable	ROBO-TOP 600 V 0.75 mm²	Daiden Co.,Ltd.

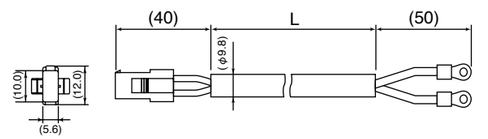
L (m)	Part No.
3	MFMCA0030AEB
5	MFMCA0050AEB
10	MFMCA0100AEB
20	MFMCA0200AEB

Brake Cable (ROBO-TOP® 105 °C 600V . DP)

ROBO-TOP® is a trade mark of DYDEN CORPORATION

Part No.	MFMCB0 ＊ ＊ 0GET

[Unit: mm]



Title	Part No.	Manufacturer
Connector	172157-1	Tyco Electronics
Connector Pin	170362-1, 170366-1	
Nylon insulated round terminal	N1.25-M4	J.S.T Mfg. Co., Ltd.
Cable	ROBO-TOP 600 V 0.75 mm²	Daiden Co.,Ltd.

L (m)	Part No.
3	MFMCB0030GET
5	MFMCB0050GET
10	MFMCB0100GET
20	MFMCB0200GET

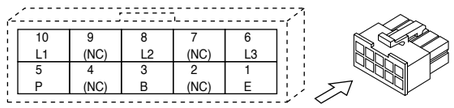
Connector Kit for Power Supply Connection

Part No.	DV0P2870

● Parts composition

Title	Part No.	Number	Manufacturer	Note
Connector (10 pins)	5557-10R-210	1	Molex	For connector, CN X1 (10 pins)
Connector pin	5556PBTL	6		

● Pin configuration of connector CN X1



● Recommended manual crimping tool (to be prepared by customer)

Part No.	Cable material
57026-5000	UL1007
57027-5000	UL1015

<Cautions>

1. The above pin disposition is shown when viewed from the terminal inserting direction. Make a correct wiring by checking the stamped pin numbers on the connector itself.
2. Refer to P.386 for wiring and connection.
3. Do not connect anything to pins marked "NC".

Connector Kit for Motor/Encoder Connection

Part No.	DV0P3670 (Incremental 2500 pulse, 5-wire)

This option is required when you make your own encoder cable and motor cable. (Brake cable is required for brake.)

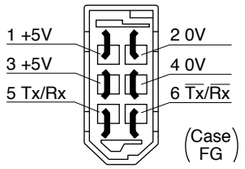
● Parts composition

Title	Part No.	Number	Manufacturer	Note
Connector (Driver side)	3E206-0100 KV	1	3M Japan or equivalent	For connector, CN X4 (6 pins)
Shell kit	3E306-3200-008	1		
Connector (6 pins)	172160-1	1	Tyco Electronics	For junction to encoder cable (6 pins)
Connector pin	170365-1	6		
Connector (4 pins)	172159-1	1	Tyco Electronics	For junction to motor power cable (4 pins)
Connector pin	170366-1	4		
Connector (6 pins)	5557-06R-210	1	Molex	For connector, CN X3 (6 pins)
Connector pin	5556PBTL	4		

<Remarks>

We may use parts equivalent to the above for shell and connector cover.

● Pin configuration of connector CN X4 plug



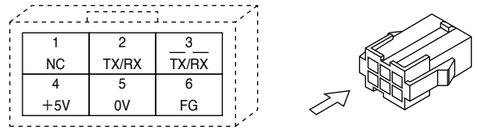
● Recommended manual crimping tool (to be prepared by customer)

Title	Part No.	Manufacturer	Cable material
For encoder cable junction	755330-1	Tyco Electronics	—
For motor power cable junction	755331-1		
For Connector CN X3	57026-5000	Molex	UL1007
	57027-5000		UL1015

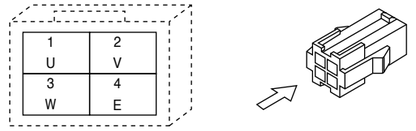
<Remarks>

1. The above pin configuration is shown when viewed from the pin-soldering direction. Make a correct wiring by checking the stamped pin numbers on the connector itself.
2. Connect the shield of the wire to the case (FG) without fail.
3. For wiring and connection, refer to P.386.

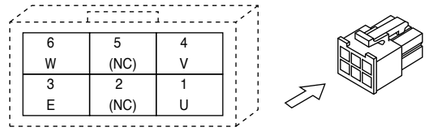
● Pin configuration of encoder cable junction



● Pin configuration of motor power cable junction



● Pin configuration of mating connector to CN X3 connector



<Cautions>

1. The above pin configuration is shown when viewed from the terminal inserting direction. Make a correct wiring by checking the stamped pin numbers on the connector itself.
2. Refer to P.386 for wiring and connection.

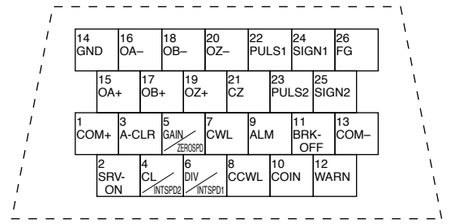
Connector Kit for Interface

Part No.	DV0P0770

● Parts composition

Title	Part No.	Number	Manufacturer	Note
Connector	10126-3000PE	1	3M Japan or equivalent	For connector, CN X5 (26 pins)
Connector cover	10326-52A0-008	1		

● Pin configuration of connector CN X5 (26 pins) (viewed from the soldering side)



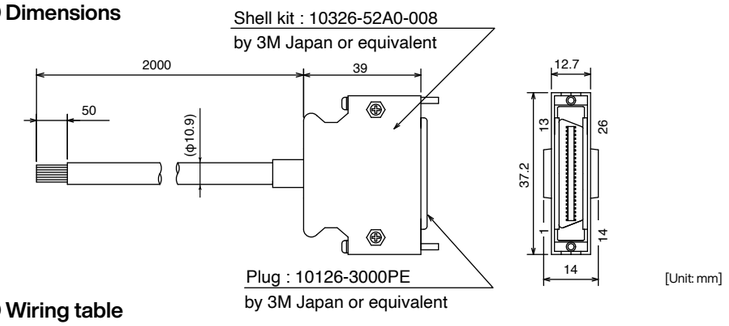
<Cautions>

1. Make a correct wiring by checking the stamped pin numbers on the connector itself.
2. Refer to P.387 for symbols and functions of the above signals.

Interface Cable

Part No.	DV0P0800	Cable of 2 m is connected.

● Dimensions



[Unit: mm]

● Wiring table

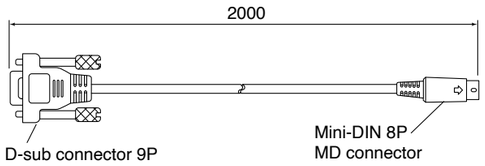
Pin No.	Title of signal	Color or cable	Pin No.	Title of signal	Color or cable	Pin No.	Title of signal	Color or cable
1	COM+	Orange (Red 1)	10	COIN	Pink (Black 1)	19	OZ+	Pink (Red 2)
2	SRV-ON	Orange (Black 1)	11	BRK-OFF	Orange (Red 2)	20	OZ-	Pink (Black 2)
3	A-CLR	Gray (Red 1)	12	WARN	Orange (Black 2)	21	CZ	Orange (Red 3)
4	CL/INTSPD2	Gray (Black 1)	13	COM-	Gray (Red 2)	22	PULS1	Gray (Red 3)
5	GAIN/ZEROSPD	White (Red 1)	14	GND	Gray (Black 2)	23	PULS2	Gray (Black 3)
6	DIV/INTSPD1	White (Black 1)	15	OA+	White (Red 2)	24	SIGN1	White (Red 3)
7	CWL	Yellow (Red 1)	16	OA-	White (Black 2)	25	SIGN2	White (Black 3)
8	CCWL	Yellow (Black 1)	17	OB+	Yellow (Red 2)	26	FG	Orange (Black 3)
9	ALM	Pink (Red 1)	18	OB-	Yellow (Black 2)			

<Notes>
e. g. of Pin No. designation :
Pin No. 1 ... Wire color is orange, and one red dot.
Pin No. 12 ... Wire color is orange, and two black dot.

<Caution>
Cable pin No. 26 is not connected to the connector shell (housing) or shielded wire (net wire).
Pin No. 26 of the Driver is connected to the shell (housing) of the connector.
The shielded wire (net wire) of the cable is connected to the shell (housing) of the connector of the cable, and by connecting the connector of the optional cable to the Driver, pin No. 26 of the cable and the shielded wire (net wire) of the cable gets connected via the Driver.

Communication Cable (For Connection with PC)

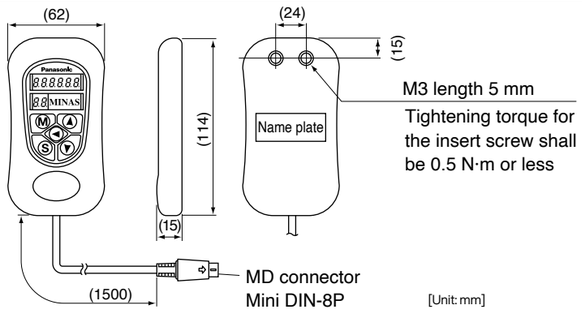
Part No.	DV0P1960



[Unit: mm]

Console

Part No.	DV0P4420

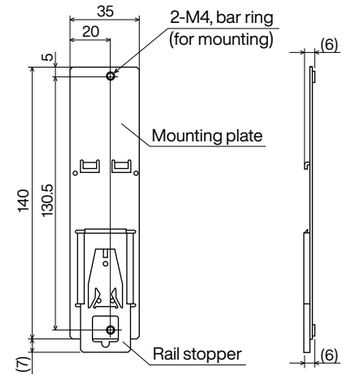


[Unit: mm]

DIN Rail Mounting Unit

Part No.	DV0P3811

● Dimensions

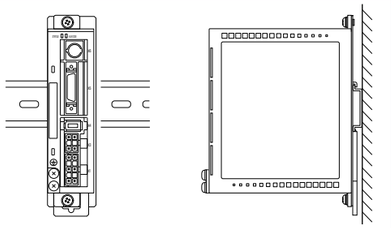


[Unit: mm]

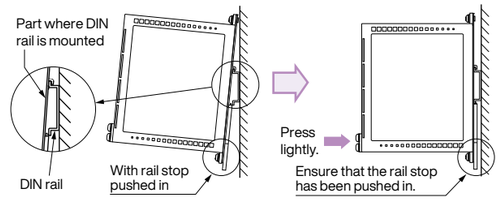
<Notes>
2 mounting screws (M4 X L8, Pan head) are attached.
Rail stopper can be extended to max. 10 mm.

<Cautions>
Please read carefully operation manual before using this product.
In addition, please do not apply excessive stress to the product.

▪ Driver mounted to DIN rail



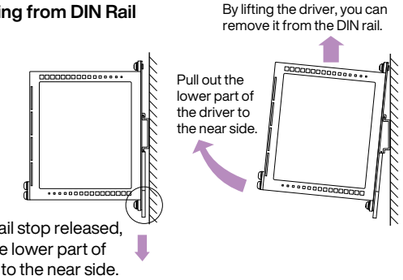
▪ **How to Install**



Hook the upper side of DIN rail mounting part on the DIN rail.

Press lightly the lower part of the main body of driver.

▪ **Removing from DIN Rail**



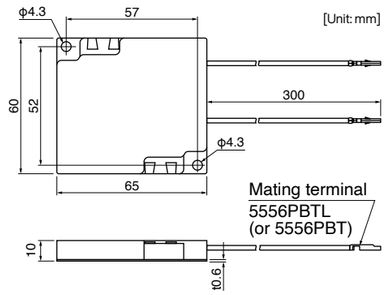
With the rail stop released, pull out the lower part of the driver to the near side.

External Regenerative Resistor

Part No.	Manufacturer's Part No.	Specifications			Note (Input Power of drive)
		Resistance	Rated power	Activation temperature of built-in fuse	
		Ω	W	°C	
DV0P2890	45M03	50	10	137^{+3}_{-2}	Single phase, 100 V
DV0P2891	45M03	100	10	137^{+3}_{-2}	Single/3-phase, 200 V

Manufactured by Iwaki Musen Kenkyuusho Co., Ltd.

● Dimensions



[Unit: mm]

<Caution of when using external regeneration resistor>

Since it becomes high temperature, external regeneration resistor must be installed according to the contents shown below.

- **Attach to incombustibles, such as metal.**
- **Install in the place which cannot touch directly by covering with incombustibles etc.**
- **Do not install near the combustibles.**

Although the thermal cutoff is built in external regeneration resistor, the skin temperature of regeneration resistor may become high exceeding the operating temperature of thermal cutoff by the time the thermal cutoff operates in driver failure.
The thermal cutoff is for preventing ignition of the regeneration resistor in driver failure, and is not for controlling the skin temperature of resistor.

<Remarks>
Thermal fuse is installed for safety.
The thermal fuse may blow due to heat dissipating condition, working temperature, supply voltage or load fluctuation.
Make it sure that the surface temperature of the resistor may not exceed 100 **°C** at the worst running conditions with the machine, which brings large regeneration (such case as high supply voltage, load inertia is large or deceleration time is short) Please carry out air cooling if needed.

Reactor

Frame symbol of driver	Power supply specifications	Rated output	Part No.	Fig.
MKDE	Single phase, 100 V	50 W to 100 W	DV0P227	1
	Single phase, 200 V	50 W to 100 W	DV0P220	2
	3-phase, 200 V	50 W to 200 W		
MLDE	Single phase, 100 V	200 W	DV0P228	1
	Single phase, 200 V	200 W to 400 W	DV0P220	2
	3-phase, 200 V	400 W		

Fig.1

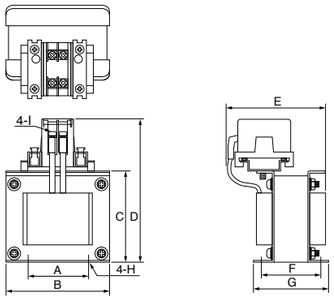
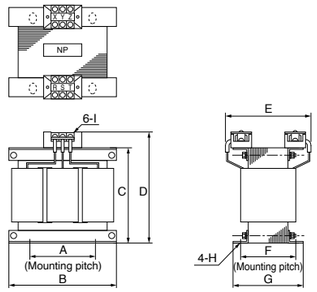
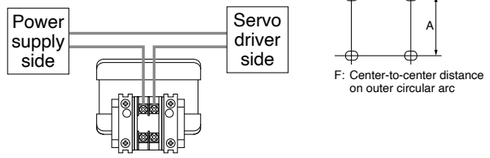


Fig.2

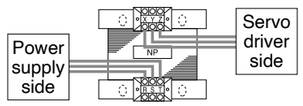


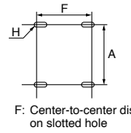
▪ Wiring of the reactor <Single phase>



F: Center-to-center distance on outer circular arc

▪ Wiring of the reactor <3-Phase>





F: Center-to-center distance on slotted hole

[Unit: mm]

	Part No.	A	B	C	D	E (Max)	F	G	H	I	Inductance (mH)	Rated current (A)
Fig.1	**DV0P227**	55±0.7	76.5±1	66.5±1	110 Max	90	43.6±2	56±2	4-5φ×10	M4	4.02	5
	DV0P228	55±0.7	76.5±1	66.5±1	110 Max	95	48.0±2	61±2	4-5φ×10	M4	2	8
Fig.2	**DV0P220**	65±1	125±1	(93)	136 Max	155	70+3/–0	85±2	4-7φ×12	M4	6.81	3

Harmonic restraint

Harmonic restraint measures are not common to all countries. Therefore, prepare the measures that meet the requirements of the destination country.
When installing a product for Japan, refer to the instruction manual available on our website.

【Panasonic Industry Co., Ltd. web site】
industrial.panasonic.com/ac/e/

<Remarks>
When using a reactor, be sure to install one reactor to one servo driver.

■ Recommended devices

Surge Absorber for Motor Brake

Motor	Surge absorber for motor brake	
	Part No. (Manufacturer's)	Manufacturer
MUMA 50 W to 400 W	Z15D151	SEMITEC Corporation

List of Peripheral Devices

Manufacturer	Tel No. / Home Page	Peripheral devices
Iwaki Musen Kenkyusho Co., Ltd.	+81-44-833-4311 http://www.iwakimusen.co.jp/	Regenerative resistor
SEMITEC Corporation	+81-3-3621-2703 http://www.semitec.co.jp/english2/	Surge absorber for motor brake
TDK Corporation	+81-3-5201-7229 http://www.global.tdk.com/	Ferrite core
Okaya Electric Industries Co. Ltd.	+81-3-4544-7040 http://www.okayaelec.co.jp/english/index.html	Surge absorber Noise filter
3M Japan Limited	+81-3-5716-7290 http:/solutions.3m.com/wps/portal/3M/ja_JP/WW2/Country/	Connector
Tyco Electronics Japan G.K.	+81-44-844-8052 http://www.te.com/ja/home.html	
Molex Japan LLC	+81-462-65-2313 http://www.molex.co.jp	
DYDEN CORPORATION	+81-3-5805-5880 http://www.dyden.co.jp/english/index.htm	Cable

* The above list is for reference only. We may change the manufacturer without notice.

MEMO

Information

Contents

EU Directives/ UK Regulation

The EU Directives/ UK Regulation 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 EU Directives for EU Low Voltage Directives/UK Low Voltage Regulation Equipment so that the machine or equipment comprising our AC servos can meet EU Directives.

EU EMC Directives/UK EMC Regulation

MINAS Servo System conforms to relevant standard under EU EMC Directives/UK EMC Regulation 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 EU EMC Directives/UK EMC Regulation, especially for noise emission and noise terminal voltage, it is necessary to examine the machine incorporating our servos.

Conformity to UL Standards

Observe the following conditions of (1) and (2) to make the system conform to UL508C (E164620).

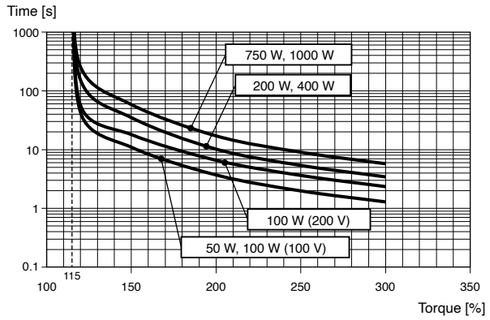
(1) Use the driver in an environment of Pollution Degree 2 or 1 prescribed in IEC60664-1.
(e.g. Install in the control box with IP54 enclosure.)

(2) Make sure to install a circuit breaker or fuse which are UL recognized (Listed Ⓤ marked) between the power supply and the noise filter.
For rated current of circuit breaker and fuse, refer to P.27 “Driver and List of Applicable Peripheral Devices”.
Use a copper cable with temperature rating of 75 ˚C or higher.

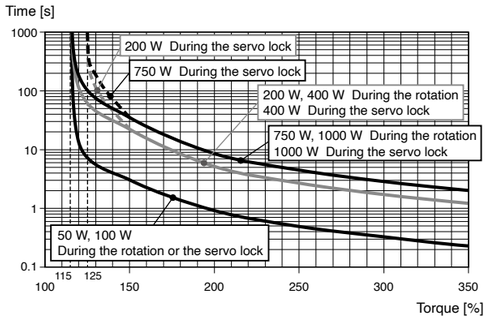
(3) Over-load protection level
Over-load protective function will be activated when the effective current exceeds 115 % or more than the rated current based on the time characteristics (see the graph). Confirm that the effective current of the driver does not exceed the rated current.
Set up the peak permissible current with Pr0.13 (Setup of 1st torque limit) and Pr5.22 (Setup 2nd torque limit).

■ Overload protection time characteristics

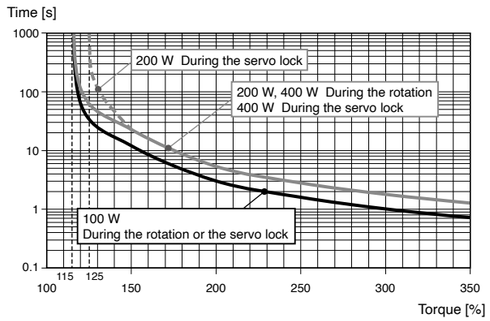
▪ **Motor type: 80 mm sq. or less MSMF**



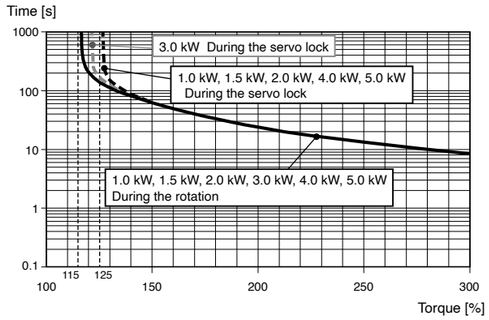
▪ **Motor type: 80 mm sq. or less MHMF**



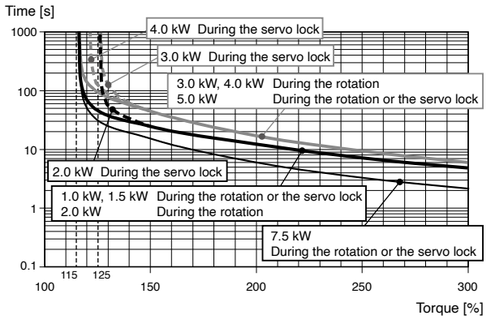
▪ **Motor type: 80 mm sq. or less MQMF**



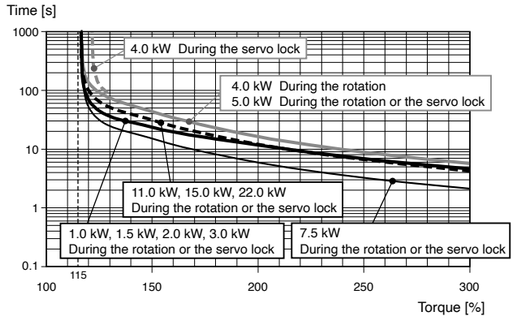
▪ **Motor type: 100 mm sq. or more MSMF**



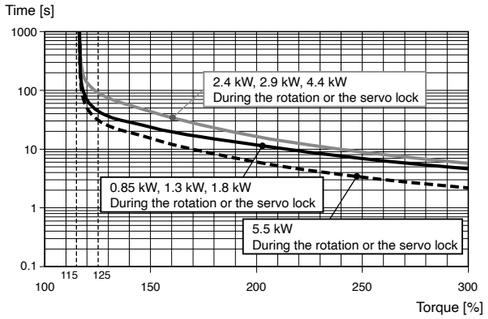
▪ **Motor type: 100 mm sq. or more MHMF**



▪ **Motor type: 100 mm sq. or more MDMF**



▪ **Motor type: 100 mm sq. or more MGMF**



Conformed Standards

		Driver	Motor
EU/UK Standards	**EU EMC Directives/ UK EMC Regulation**	EN55011 EN61000-6-2 EN61000-6-4 EN61800-3	—
	EU Low Voltage Directives/ UK Low Voltage Regulation	EN61800-5-1	EN60034-1 EN60034-5
	Machinery (Functional safety *1)	ISO13849-1(PL e, Cat.3) EN61508(SIL3) EN62061(SILCL 3) EN61800-5-2(SIL3, STO)	—
UL Standards		UL61800-5-1 (E164620)	UL1004-1, UL1004-6 (E327868)
CSA Standards		C22.2 No.14	C22.2 No.100
Radio Waves Act (South Korea) (KC) *2		KN11 KN61000-4-2,3,4,5,6,8,11	—

IEC : International Electrotechnical Commission
EN : Europaischen Normen
EMC : Electromagnetic Compatibility
UL : Underwriters Laboratories
CSA : Canadian Standards Association

Pursuant to the directive 2004/108/EC, article 9(2)

● When export this product, follow statutory provisions of the destination country.

*1 A6SE, A6SG, A6NE, A6BE series doesn't correspond to the functional safety standard.

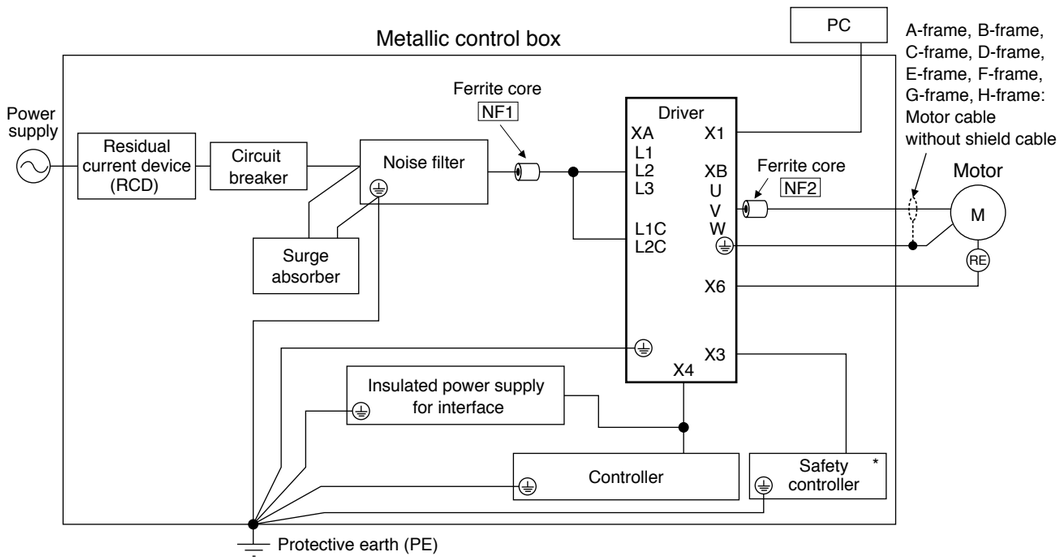
*2 Information related to the Korea Radio Law
This servo driver is a Class A commercial broadcasting radio wave generator not designed for home use. The user and dealer should be aware of this fact.

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

(대상기종 : Servo Driver **)**

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.)



For NF1 to NF2, refer to the Table "Ferrite core" (P.414).

* A6SE, A6SG, A6NE, A6BE is not provided with X3 terminal.

<Caution>

Use options correctly after reading Operating Instructions of the options to better understand the precautions.

Take care not to apply excessive stress to each optional part.

Power Supply

100 V type (A-frame to C-frame)	Single phase, 100 V	+10 % –15 %	to	120 V	+10 % –15 %	50 Hz/60 Hz
200 V type (A-frame to D-frame)	Single/3-phase, 200 V	+10 % –15 %	to	240 V	+10 % –15 %	50 Hz/60 Hz
200 V type (E-frame to H-frame)	3-phase, 200 V	+10 % –15 %	to	240 V	+10 % –15 %	50 Hz/60 Hz

(1) This product is designed to be used in over-voltage category (installation category) III of EN 61800-5-1:2007.

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

Circuit Breaker

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

The short-circuit protection circuit on the product is not for protection of branch circuit.

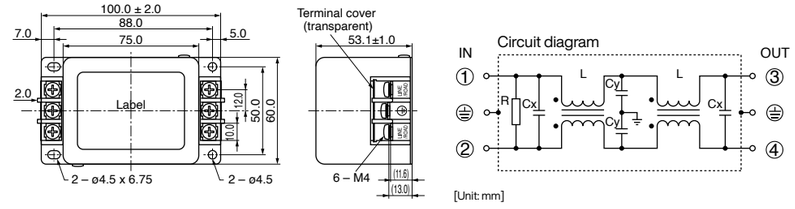
The branch circuit should be protected in accordance with NEC and the applicable local regulations in your area.

Noise Filter

When you install one noise filter at the power supply for multi-axes application, contact the manufacturer of the noise filter. If noise margin is required, connect 2 filters in series to emphasize effectiveness.

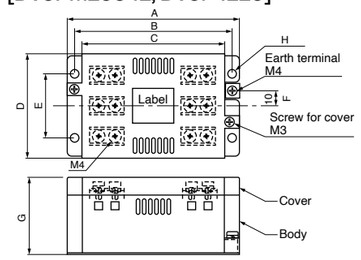
▪ Options

Option part No.	Voltage specifications for driver	Manufacturer's part No.	Applicable driver (frame)	Manufacturer
DV0P4170	Single phase 100 V, 200 V	SUP-EK5-ER-6	A-frame and B-frame	Okaya Electric Ind.

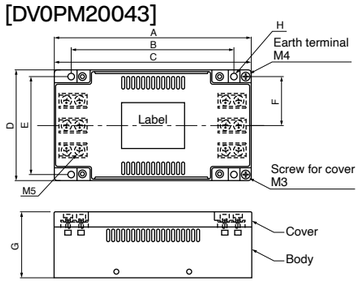


Option part No.	Voltage specifications for driver	Manufacturer's part No.	Applicable driver (frame)	Manufacturer
DV0PM20042	3-phase 200 V	3SUP-HU10-ER-6	A-frame and B-frame	Okaya Electric Ind.
	Single phase 100 V, 200 V 3-phase 200 V		C-frame	
DV0P4220	Single/3-phase 200 V	3SUP-HU30-ER-6	D-frame	
DV0PM20043	3-phase 200 V	3SUP-HU50-ER-6	E-frame	

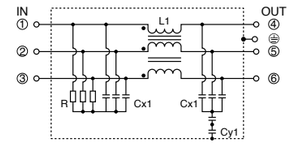
[DV0PM20042, DV0P4220]



[DV0PM20043]



Circuit diagram

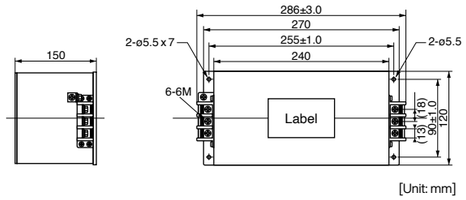


[Size] [Unit: mm]

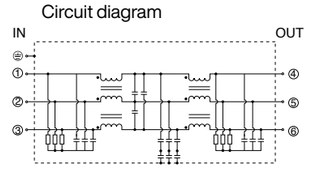
	A	B	C	D	E	F	G	H
DV0PM20042	115	105	95	70	43	10	52	5.5
DV0P4220	145	135	125	70	50	10	52	5.5
DV0PM20043	165	136	165	90	80	40	54	5.5

For single phase application, use 2 terminals among 3 terminals, leaving the remaining terminal unconnected.

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



Circuit diagram



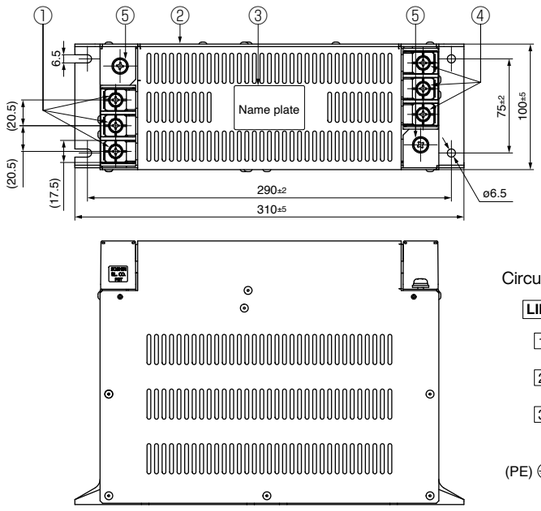
<Remarks>

- Select a noise filter of capacity that exceeds the capacity of the power source (also check for load condition).
- For detailed specification of the filter, contact the manufacturer.

Noise Filter

▪ Recommended components

Part No.	Voltage specifications for driver	Rated current (A)	Applicable driver (frame)	Manufacturer
HF3080C-SZA	3-phase 200 V	80	G	SOSHIN ELECTRIC CO.,LTD.
HF3100C-SZA		100	H	



<Remarks>

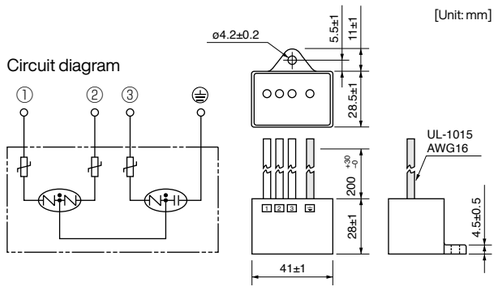
- Select a noise filter of capacity that exceeds the capacity of the power source (also check for load condition).
- For detailed specification of the filter, contact the manufacturer.
- When you install one noise filter at the power supply for multi-axes application, contact the manufacturer of the noise filter.

Surge Absorber

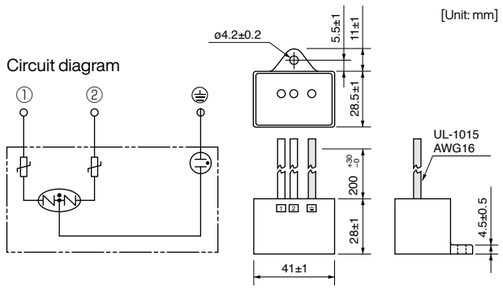
Provide a surge absorber for the primary side of noise filter.

Option part No.	Voltage specifications for driver	Manufacturer's part No.	Manufacturer
DV0P1450	3-phase 200 V	R·A·V-781BXZ-4	Okaya Electric Ind.
DV0P4190	Single phase 100 V, 200 V	R·A·V-781BWZ-4	

[DV0P1450]



[DV0P4190]



<Remarks>

Remove this surge absorber when you perform dielectric test on the machine, or surge absorber might be damaged.

Ferrite core

■Install ferrite core to power cable and motor cable

Symbol*1	Cable Name	Applicable driver (frame)	Option part No.	Manufacturer's part No.	Manufacturer	Required number
NF1	Power cable	A, B, E	DV0P1460	ZCAT3035-1330	TDK Corp.	1
		G, H				3
			—	RJ8095	Konno Kogyosho Co.Ltd	1
NF2	Motor cable	A, B, C, D, E	DV0P1460	ZCAT3035-1330	TDK Corp.	1
		F				2
		G, H				3
			—	T400-61D	MICROMETALS	1

*1 For symbols, refer to the Block Diagram “Installation Environment” (P.411).

- The number of turns is all 1.
- NF1 is not required for C frame, D frame, F frame.

<Remarks>

To connect the ferrite core to the connector XB connection cable, adjust the sheath length at the tip of the cable, as required.

<Caution>

Fix the ferrite core in order to prevent excessive stress to the cables.

Fig.1: DV0P1460 (Option) 4 pieces

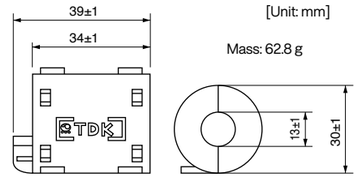


Fig.3: T400-61D (Recommended components) 1 pieces

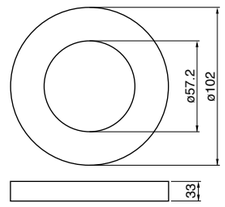
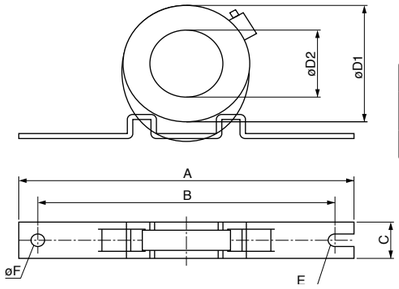


Fig.2: RJ8095 (Recommended components) 1 pieces



Manufacturer's part No.	Current value	100 kHz (μH)	Size [Unit: mm]							
			A	B	C	D1	D2	Core thickness	E	F
RJ8095	95 A	7.9±3	200	180	34	130	107	35	R3.5	7

Residual Current Device

Install a type B Residual current device (RCD) at primary side of the power supply.
Type B: Residual current device which detects a direct-current ingredient.

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 devices, refer to P.27 “Driver and List of Applicable Peripheral Devices”.

Compliance to EU/ UK Regulation and EMC Directives

EU Directives/ UK Regulation

The EU Directives/ UK Regulation 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. MINAS AC Servos conforms to the EU Directives for EU Low Voltage Directives/ UK Low Voltage Regulation Equipment so that the machine incorporating our servos has an easy access to the conformity to relevant EU Directives for the machine.

EU EMC Directives/UK EMC Regulation

MINAS Servo System conform to relevant standard under EU EMC Directives/UK EMC Regulation 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 EU EMC Directives/UK EMC Regulation, 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 EU Low Voltage Directives/UK Low Voltage Regulation
Motor and driver		UL61800-5-1 CSA22.2 No.14	
	EN55011	Radio Disturbance Characteristics of Industrial, Scientific and Medical (ISM) Radio-Frequency Equipment	Conforms to references by EU EMC Directives/ UK EMC Regulation
	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
EN : Europaischen Normen
EMC : Electromagnetic Compatibility
UL : Underwriters Laboratories
CSA : Canadian Standards Association

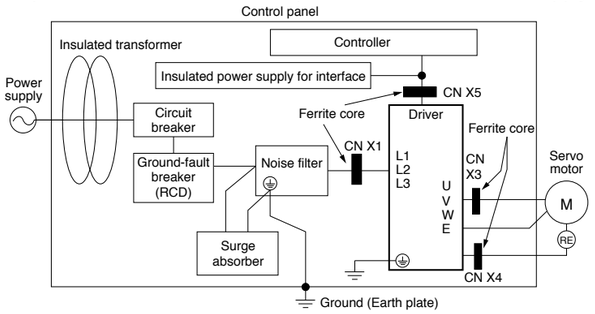
Pursuant to at the directive 2004/108/EC, article 9(2)

Composition of Peripheral Components

<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.

Installation Environment

Use Minas driver in 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

100 V system	Single phase, 100 V	+10 % –15 %	to	115 V	+10 % –15 %	50 Hz/60 Hz
200 V system	Single phase, 200 V	+10 % –15 %	to	240 V	+10 % –15 %	50 Hz/60 Hz
200 V system	3-phase, 200 V	+10 % –15 %	to	240 V	+10 % –15 %	50 Hz/60 Hz

(1) Use the power supply under an environment of Overvoltage Category II specified in IEC60664-1.
(2) For a interface power supply, use the insulated one with 12 VDC to 24 VDC which conforms to CE Marking or EN Standards (EN60950).

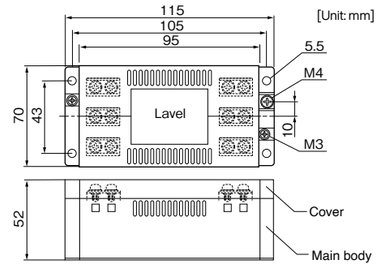
Circuit Breaker

Connect a circuit breaker which conforms to IEC standards and is UL recognized (UL Listed, UL marked), between the power supply and the noise filter.

Noise Filter

When you install one noise filter in the power supply for multi axis application, consult with the manufacture of the filter.

Option part No.	Part No.	Manufacturer
DV0P4160	3SUP-HU10-ER-6	Okaya Electric Industries Co.



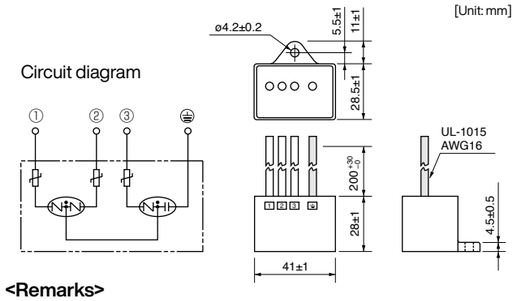
Surge Absorber

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

Option part No.	Driver voltage spec	Part No.	Manufacturer
DV0P1450	3-phase, 200 V	R·A·V-781BXZ-4	Okaya Electric

[Unit: mm]

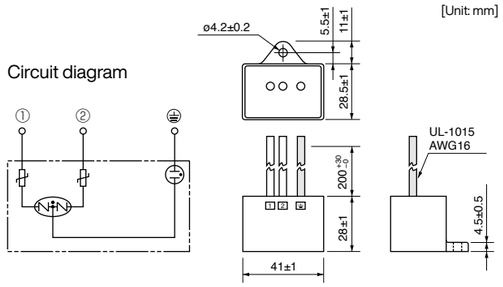
Circuit diagram



Option part No.	Driver voltage spec	Part No.	Manufacturer
DV0P4190	Single phase, 100 V, 200 V	R·A·V-781BWZ-4	Okaya Electric

[Unit: mm]

Circuit diagram



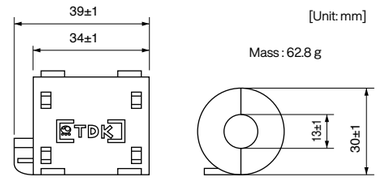
<Remarks>
Remove this surge absorber when you perform dielectric test on the machine, or surge absorber might be damaged.

Ferrite core

Install ferrite core to all cables (Power line, motor cable, encoder cable, interface cable)

<Caution>
- Please fix a ferrite core to avoid excessive stress to the cable.
- When using multiple axes, noise generated from each driver might influence driver and peripheral equipment and result to malfunction. Please insert a ferrite core between driver and motor wires (U, V, W but grounding).
(Please refer to P.415 "Composition of Peripheral Components".)

Option part No.	Part No.	Qty.	Manufacturer
DV0P1460	ZCAT3035-1330	4	TDK Corp.



Grounding

(1) Connect the protective earth terminal of the driver (⏚) and protective earth terminal of the control panel (PE) without fail to prevent electrical shocks.
(2) Do not co-clamp to the ground terminals (⏚). Two ground terminals are provided.

Ground-Fault Breaker

Install a ground fault curcuit braker (RCD) to the primary side of the power supply.
Please use B-type (DC sensitive) ground fault circuit breakers defined in IEC60947-2, JISC8201-2-2.

AC Servo Motor Capacity Selection Software

We have prepared PC software "M-SELECT" for AC servo motor capacity selection.
Consult our sales representative or authorized distributor.

▪ Three-step selection

1. Select components and specified values

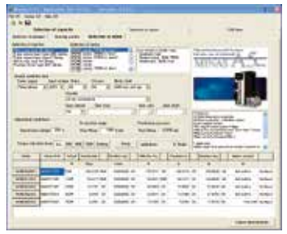
Select appropriate mechanical parameter items and fill them with parameter values derived from the real machine. To simulate the target machine as practical as possible, use maximum number of parameters available.

2. Enter operation pattern

Input the planned operation pattern that will contain [speed and rotation standard] or [absolute position standard] with optional settings such as S-acceleration/deceleration.

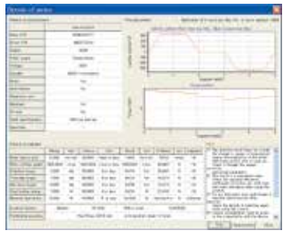
3. Select the motor

When the data required in step 1 and 2 above have been input, the software lists the motors, which will be appropriate to use with your machine. Select the motor that is best suitable for your machine application.



Details of motor

Once the motor is selected, specifications of the motor and driver, and details of reason for determination are displayed and may be printed out.



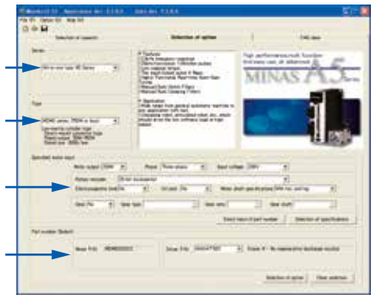
Option Selection Software for AC Servo Motor

We have prepared PC software to enable fast, easy, and correct option selection, a complicated job without the software.

▪ Two procedures for option selection

1. Selection according to driver series and motor type

Suitable option can be selected by selecting driver series, motor type and motor specification through pulldown menu.

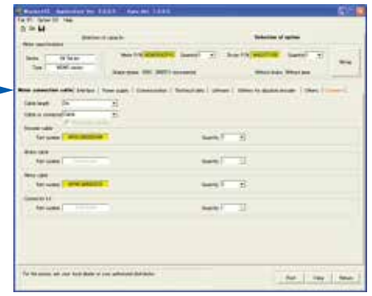


2. Entry of model number

If you know the model number based on the servo motor and driver currently used, enter the model number.

Result of selection

Tab sheet specific to each of option model numbers is used for easier identification of the desired option.



* When you are using the motor capacity selection software, simply press [Option Selection] tab and the screen as shown right will appear.

Please download from our web site and use after install to the PC.
https://industrial.panasonic.com/ww/products/motors-compressors/fa-motors/ac-servo-motors/minas-a5-panaterm

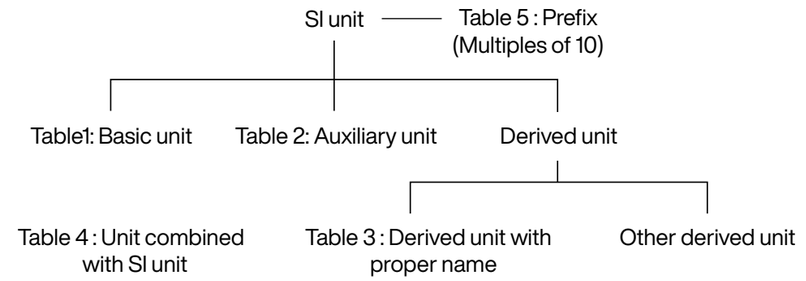


Table1: Basic unit

Quantity	Name of unit	Symbol of unit
Length	meter	m
Weight	kilogram	kg
Time	second	s
Current	ampere	A
Thermodynamic temperature	kelvin	K
Amount of substance	mol	mol
Luminous intensity	candela	cd

Table 2: Auxiliary unit

Quantity	Name of unit	Symbol of unit
Plane angle	radian	rad
Solid angle	steradian	sr

Table 3: Major derived unit with proper name

Quantity	Name	Symbol of unit	Derivation from basic unit, auxiliary unit or other derived unit
Frequency	hertz	Hz	$1\,Hz = 1\,s^{-1}$
Force	newton	N	$1\,N = 1\,kg{\cdot}m/s^2$
Pressure, Stress	pascal	Pa	$1\,Pa = 1\,N/m^2$
Energy, Work, Amount of heat	joule	J	$1\,J = 1\,N{\cdot}m$
Amount of work, Work efficiency, Power, Electric power	watt	W	$1\,W = 1\,J/s$
Electric charge, Amount of electricity	coulomb	C	$1\,C = 1\,A{\cdot}s$
Electric potential, Potential difference, Voltage, Electromotive force	volt	V	$1\,V = 1\,J/C$
Electrostatic capacity, Capacitance	farad	F	$1\,F = 1\,C/V$
Electric resistance	ohm	Ω	$1\,\Omega = 1\,V/A$
Electric conductance	siemens	S	$1\,S = 1\,\Omega^{-1}$
Magnetic flux	weber	Wb	$1\,Wb = 1\,V{\cdot}s$
Magnetic flux density, Magnetic induction	tesla	T	$1\,T = 1\,Wb/m^2$
Inductance	henry	H	$1\,H = 1\,Wb/A$
Degree centigrade (Celsius)	degree centigrade (Celsius) / degree	°C	$t\,°C = (t+273.15)\,K$
Luminous flux	lumen	lm	$1\,lm = 1\,cd{\cdot}sr$
Illuminance	lux	lx	$1\,lx = 1\,lm/m^2$

Table 4: Unit combined with SI unit

Quantity	Name	Symbol of unit
Time	minute	min
	hour	h
	day	d
Plane angle	degree	°
	minute	'
	second	"
Volume	liter	l, L
Weight	ton	t

Table 5: Prefix

Multiples powered to unit	Prefix	
	Name	Symbol
10^{18}	exa	E
10^{15}	peta	P
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{2}	hecto	h
10	deca	da
10^{-1}	deci	d
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p
10^{-15}	femto	f
10^{-18}	atto	a

Major Compatible Unit

Quantity	Symbol of conventional unit	Symbol of SI unit and compatible unit	Conversion value
Length	μ (micron)	μm	1 μ = 1 μm (micrometer)
Acceleration	Gal	m/s^2	1 Gal = 10^{-2} m/s^2
	G	m/s^2	1 G = 9.80665 m/s^2
Frequency	c/s, c	Hz	1 c/s = Hz
Revolving speed, Number of revolutions	rpm	s^{-1} or min^{-1}, r/min	1 rpm = 1 min^{-1}
Weight	kgf	–	Same value
Mass	–	kg	
Weight flow rate	kgf/s	–	Same value
Mass flow rate	–	kg/s	
Specific weight	kgf/m^3	–	Same value
Density	–	kg/m^3	
Specific volume	m^3/kgf	m^3/kg	Same value
Load	kgf	N	1 kgf = 9.80665 N
Force	kgf	N	1 kgf = 9.80665 N
	dyn	N	1 dyn = 10^{-5} N
Moment of force	kgf·m	N·m	1 kgf·m = 9.806 N·m
Pressure	kgf/cm^2	Pa, bar (1) or kgf/cm^2	1 kgf/cm^2 = 9.80665 x 10^4 Pa = 0.980665 bar
	at (Engineering atmospheric pressure)	Pa	1 at = 9.80665 x 10^4 Pa
	atm (Atmospheric pressure)	Pa	1 atm = 1.01325 x 10^5 Pa
	mH_2O, mAq	Pa	1 mH_2O = 9.80665 x 10^3 Pa
	mmHg	Pa or mmHg (2)	1 mmHg = 133.322 Pa
	Torr	Pa	
Stress	kgf/mm^2	Pa or N/m^2	1 kgf/mm^2 = 9.80665 x 10^6 Pa =9.80665 x 10^6 N/m^2
	kgf/cm^2	Pa or N/m^2	1 kgf/cm^2 = 9.80665 x 10^4 Pa = 9.80665 x 10^4 N/m^2
Elastic modulus	kgf/m^2	Pa or N/m^2	1 kgf/m^2 = 9.80665 Pa = 9.80665 N/m^2 1 kgf/cm^2 = 9.80665 x 10^4 N/m^2
Energy, Work	kgf·m	J (joule)	1 kgf·m = 9.80665 J
	erg	J	1 erg = 10^{-7} J
Work efficiency, Power	kgf·m/s	W (watt)	1 kgf·m/s = 9.80665 W
	PS	W	1 PS = 0.7355 kW
Viscosity	PP	Pa·s	1 P = 0.1 Pa·s
Kinetic viscosity	St	mm^2/s	10^{-2} St = 1 mm^2/s
Thermodynamic temperature	K	K (kelvin)	1 K = 1 K
Temperature interval	deg	K (3)	1 deg = 1 K
Amount of heat	cal	J	1 cal = 4.18605 J
Heat capacity	cal/°C	J/K (3)	1 cal/°C = 4.18605 J/K
Specific heat, Specific heat capacity	cal/ (kgf·°C)	cal/ (kgf·K)(3)	1 cal/ (kgf·°C) = 4.18605 J/ (kg·K)
Entropy	cal/K	J/K	1 cal/K = 4.18605 J/K
Specific entropy	cal/ (kgf·K)	J/(kg·K)	1 cal/ (kgf·K) = 4.18605 J/ (kg·K)
Internal energy (Enthalpy)	cal	J	1 cal = 4.18605 J
Specific internal energy (Specific enthalpy)	cal/kgf	J/kg	1 cal/kgf = 4.18605 J/kg
Heat flux	cal/h	W	1 kcal/h = 1.16279 W
Heat flux density	cal/ (h·m^2)	W/m^2	1 kcal/ (h·m^2) = 1.16279 W/m^2
Thermal conductivity	cal/ (h·m·°C)	W/ (m·K) (3)	1 kcal/ (h·m·°C) = 1.16279 W/ (m·K)
Coefficient of thermal conductivity	cal/ (h·m^2·°C)	W/ (m^2·K) (3)	1 kcal/ (h·m^2·°C) = 1.16279 W/ (m^2·K)
Intensity of magnetic field	Oe	A/m	1 Oe = 10^3 / (4π) A/m
Magnetic flux	Mx	Wb (weber)	1 Mx = 10^{-8} Wb
Magnetic flux density	Gs,G	T (tesla)	1 Gs = 10^{-4} T

Note
(1) Applicable to liquid pressure. Also applicable to atmospheric pressure of meteorological data, when “bar” is used in international standard.
(2) Applicable to scale or indication of blood pressure manometers.
(3) “°C” can be substituted for “K”.

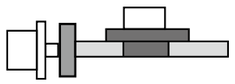
Flow of Motor Selection

Flow of Motor Selection

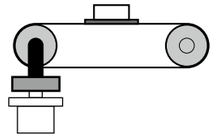
1. Definition of mechanism to be driven by motor.
Define details of individual mechanical components (ball screw length, lead and pulley diameters, etc.)

<Typical mechanism>

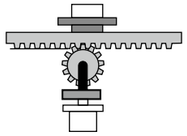
Ball screw mechanism



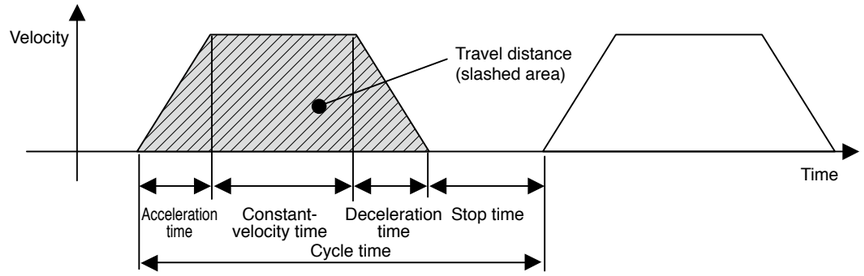
Belt mechanism



Rack & pinion, etc.



2. Definition of operating pattern.
Acceleration/deceleration time, Constant-velocity time, Stop time, Cycle time, Travel distance



Note) Selection of motor capacity significantly varies depending on the operating pattern.
The motor capacity can be reduced if the acceleration/deceleration time and stop time are set as long as possible.

3. Calculation of load inertia and inertia ratio.
Calculate load inertia for each mechanical component. (Refer to "General inertia calculation method" described later.)
Divide the calculated load inertia by the inertia of the selected motor to check the inertia ratio.
For calculation of the inertia ratio, note that the catalog value of the motor inertia is expressed as "× 10^{-4} kg·m^2".

4. Calculation of motor velocity
Calculate the motor velocity from the moving distance, acceleration / deceleration time and constant-velocity time.

5. Calculation of torque
Calculate the required motor torque from the load inertia, acceleration/deceleration time and constant-velocity time.

6. Calculation of motor
Select a motor that meets the above 3 to 5 requirements.

Description on the Items Related to Motor Selection

1. Torque

(1) Peak torque

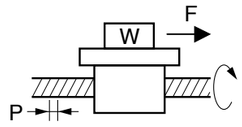
Indicate the maximum torque that the motor requires during operation (mainly in acceleration and deceleration steps). The reference value is 80% or less of the maximum motor torque. If the torque is a negative value, a regenerative discharge resistor may be required.

(2) Traveling torque, Stop holding torque

Indicates the torque that the motor requires for a long time. The reference value is 80% or less of the rated motor torque. If the torque is a negative value, a regenerative discharge resistor may be required.

Traveling torque calculation formula for each mechanism

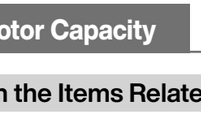
Ball screw mechanism



Traveling torque $T_f = \frac{P}{2\pi\eta}(\mu g W + F)$

W : Weight [kg]
P : Lead [m]
F : External force [N]
η : Mechanical efficiency
μ : Coefficient of friction
g : Acceleration of gravity 9.8[m/s^2]

Belt mechanism



Traveling torque $T_f = \frac{D}{2\pi\eta}(\mu g W + F)$

W : Weight [kg]
P : Pulley diameter [m]
F : External force [N]
η : Mechanical efficiency
μ : Coefficient of friction
g : Acceleration of gravity 9.8[m/s^2]

(3) Effective torque

Indicates a root-mean-square value of the total torque required for running and stopping the motor per unit time. The reference value is approx. 80% or less of the rated motor torque.

$$Trms = \sqrt{\frac{Ta^2 \times ta + Tf^2 \times tb + Td^2 \times td}{tc}}$$

T_a : Acceleration torque [N·m]
T_f : Traveling torque [N·m]
T_d : Deceleration torque [N·m]
t_a : Acceleration time [s]
t_b : Constant-velocity time [s]
t_d : Deceleration time [s]
t_c : Cycle time [s] (Run time + Stop time)

2. Motor velocity

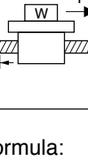
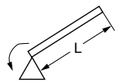
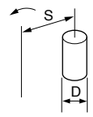
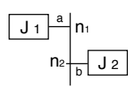
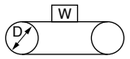
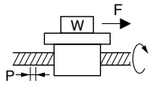
Maximum velocity

Maximum velocity of motor in operation: The reference value is the rated velocity or lower value.
When the motor runs at the maximum velocity, you must pay attention to the motor torque and temperature rise. For actual calculation of motor velocity, see "Example of motor selection" described later.

3. Inertia and inertia ratio

Inertia is like the force to retain the current moving condition.
Inertia ratio is calculated by dividing load inertia by rotor inertia.
Generally, for motors with 750 W or lower capacity, the inertia ratio should be “20” or less. For motors with 1000 W or higher capacity, the inertia ratio should be “10” or less.
If you need quicker response, a lower inertia ratio is required.
(For example, when the motor takes several seconds in acceleration step, the inertia ratio can be further increased.)

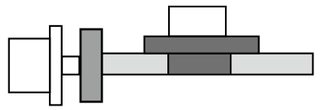
General inertia calculation method

Shape	J calculation formula	Shape	J calculation formula
Disk 	$J = \frac{1}{8} W D^2$ [kg·m^2] W : Weight [kg] D : Outer diameter [m]	**Hollow cylinder** 	$J = \frac{1}{8} W (D^2 + d^2)$ [kg·m^2] W : Weight [kg] D : Outer diameter [m] d : Inner diameter [m]
Prism 	$J = \frac{1}{12} W (a^2 + b^2)$ [kg·m^2] W : Weight [kg] a, b, c : Side length [m]	**Uniform rod** 	$J = \frac{1}{48} W (3D^2 + 4L^2)$ [kg·m^2] W : Weight [kg] D : Outer diameter [m] L : Length [m]
Straight rod 	$J = \frac{1}{3} W L^2$ [kg·m^2] W : Weight [kg] L : Length [m]	**Separated rod** 	$J = \frac{1}{8} W D^2 + W S^2$ [kg·m^2] W : Weight [kg] D : Outer diameter [m] S : Distance [m]
Reduction gear 	Inertia on shaft "a" $J = J_1 + (\frac{n_2}{n_1})^2 J_2$[kg·m^2] n_1 : A rotational speed of a shaft [r/min] n_2 : A rotational speed of b shaft [r/min]		
Conveyor 	$J = \frac{1}{4} W D^2$ [kg·m^2] W : Workpiece weight on conveyor [kg] D : Drum diameter [m] * Excluding drum J	**Ball screw** 	$J = J_B + \frac{W \cdot P^2}{4\pi^2}$ [kg·m^2] W : Weight [kg] P : Lead J_B : J of ball screw

If weight (W [kg]) is unknown, calculate it with the following formula:
Weight W[kg]=Density ρ [kg/m^3] x Volume V[m^3]
Density of each material
Iron ρ =7.9 x 10^3 [kg/m^3] Aluminum ρ =2.8 x 10^3 [kg/m^3]
Brass ρ =8.5 x 10^3 [kg/m^3]

To Drive Ball Screw Mechanism

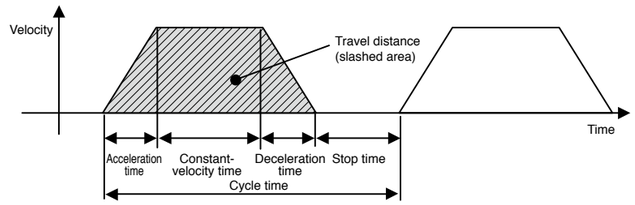
1. Example of motor selection for driving ball screw mechanism



Workpiece weight $W_A = 10\ [kg]$
Ball screw length $B_L = 0.5\ [m]$
Ball screw diameter $B_D = 0.02\ [m]$
Ball screw lead $B_P = 0.02\ [m]$
Ball screw efficiency $B\eta = 0.9$
Travel distance 0.3[m]
Coupling inertia $J_C = 10 \times 10^{-6}\ [kg \cdot m^2]$ (Use manufacturer-specified catalog value, or calculation value.)

2. Running pattern :

Acceleration time $t_a = 0.1\ [s]$
Constant-velocity time $t_b = 0.8\ [s]$
Deceleration time $t_d = 0.1\ [s]$
Cycle time $t_c = 2\ [s]$
Travel distance 0.3[m]



3. Ball screw weight

$$B_W = \rho \times \pi \times \left(\frac{B_D}{2}\right)^2 \times B_L = 7.9 \times 10^3 \times \pi \times \left(\frac{0.02}{2}\right)^2 \times 0.5$$
$$= 1.24\ [kg]$$

4. Load inertia

$$J_L = J_C + J_B = J_C + \frac{1}{8} B_W \times B_D^2 + \frac{W_A \cdot B_P^2}{4\pi^2}$$
$$= 0.00001 + (1.24 \times 0.02^2) / 8 + 10 \times 0.02^2 / 4\pi^2$$
$$= 1.73 \times 10^{-4}\ [kg \cdot m^2]$$

5. Provisional motor selection

In case of MSMF 200 W motor : $J_M = 0.14 \times 10^{-4}\ [kg \cdot m^2]$

6. Calculation of inertia ratio

$J_L / J_M = 1.73 \times 10^{-4} / 0.14 \times 10^{-4}$ Therefore, the inertia ratio is "12.3" (less than "30")
(In case of MSMF 100 W motor: $J_M = 0.048 \times 10^{-4}$ Therefore, the inertia ratio is "36.0".)

7. Calculation of maximum velocity (Vmax)

$$\frac{1}{2} \times \text{Acceleration time} \times \text{Vmax} + \text{Constant-velocity time} \times \text{Vmax} + \frac{1}{2} \times \text{Deceleration time} \times \text{Vmax} = \text{Travel distance}$$
$$\frac{1}{2} \times 0.1 \times \text{Vmax} + 0.8 \times \text{Vmax} + \frac{1}{2} \times 0.1 \times \text{Vmax} = 0.3$$
$$0.9 \times \text{Vmax} = 0.3$$
$$\text{Vmax} = 0.3 / 0.9 = 0.334\ [m/s]$$

8. Calculation of motor velocity (N [r/min]) Ball screw lead per resolution: $B_P = 0.02$ [m]

$N = 0.334 / 0.02 = 16.7\ [r/s]$
$= 16.7 \times 60 = 1002\ [r/min] < 3000\ [r/min]$ (Rated velocity of MSMF 200 W motor)

9. Calculation of torque

Traveling torque $T_f = \frac{B_P}{2\pi B\eta} (\mu g W_A + F) = \frac{0.02}{2\pi \times 0.9} (0.1 \times 9.8 \times 10 + 0)$
$= 0.035\ [N \cdot m]$

Acceleration torque $T_a = \frac{(J_L + J_M) \times 2\pi N[r/s]}{\text{Acceleration time}\ [s]} + \text{Traveling torque}$
$= \frac{(1.73 \times 10^{-4} + 0.14 \times 10^{-4}) \times 2\pi \times 16.7}{0.1} + 0.035$
$= 0.196 + 0.035 = 0.231\ [N \cdot m]$

Deceleration torque $T_d = \frac{(J_L + J_M) \times 2\pi N[r/s]}{\text{Deceleration time}\ [s]}$ – Traveling torque
$= \frac{(1.73 \times 10^{-4} + 0.14 \times 10^{-4}) \times 2\pi \times 16.7}{0.1} - 0.035$
$= 0.196 - 0.035 = 0.161\ [N \cdot m]$

10. Verification of maximum torque

Acceleration torque = $T_a = 0.231\ [N \cdot m] < 1.91\ [N \cdot m]$ (Maximum torque of MSMF 200 W motor)

11. Verification of effective torque

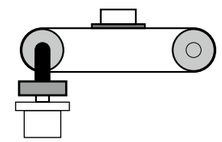
$$T_{rms} = \sqrt{\frac{T_a^2 \times t_a + T_f^2 \times t_b + T_d^2 \times t_d}{t_c}}$$
$$= \sqrt{\frac{0.231^2 \times 0.1 + 0.035^2 \times 0.8 + 0.161^2 \times 0.1}{2}}$$
$$= 0.067\ [N \cdot m] < 0.64\ [N \cdot m]$$ (Rated torque of MSMF 200 W motor)

12. Judging from the inertia ratio calculated above, selection of 200 W motor is preferable, although the torque margin is significantly large.

Example of Motor Selection

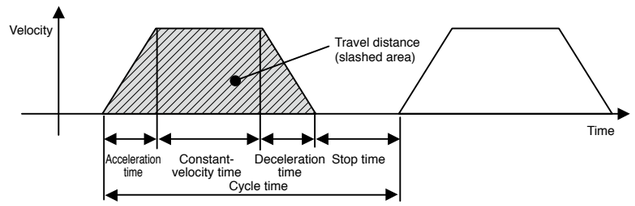
Example of motor selection for timing belt mechanism

1.Mechanism
Workpiece weight $W_A = 2[kg]$ (including belt)
Pulley diameter $P_D = 0.05[m]$
Pulley weight $W_P = 0.5[kg]$ (Use manufacturer-specified catalog value, or calculation value.)
Mechanical efficiency $B\eta = 0.8$
Coupling inertia $J_C = 0$ (Direct connection to motor shaft)
Belt mechanism inertia J_B
Pulley inertia J_P



2. Running pattern

Acceleration time $t_a = 0.1[s]$
Constant-velocity time $t_b = 0.8[s]$
Deceleration time $t_d = 0.1[s]$
Cycle time $t_c = 2[s]$
Travel distance 1[m]



3. Load inertia $J_L = J_C + J_B + J_P$

$= J_C + \frac{1}{4} W_A \times P_D^2 + \frac{1}{8} W_P \times P_D^2 \times 2$
$= 0 + \frac{1}{4} \times 2 \times 0.05^2 + \frac{1}{8} \times 0.5 \times 0.05^2 \times 2$
$= 0.00156 = 15.6 \times 10^{-4}\ [kg \cdot m^2]$

4. Provisional motor selection

In case of MSMF 750 W motor : $J_M = 0.96 \times 10^{-4}\ [kg \cdot m^2]$

5. Calculation of inertia ratio

$J_L / J_M = 15.6 \times 10^{-4} / 0.96 \times 10^{-4}$ Therefore, the inertia ratio is "16.3" (less than "20")

6. Calculation of maximum velocity (Vmax)

$\frac{1}{2}$ × Acceleration time × Vmax + Constant-velocity time × Vmax + $\frac{1}{2}$ × Deceleration time × Vmax = Travel distance

$$\frac{1}{2} \times 0.1 \times Vmax + 0.8 \times Vmax + \frac{1}{2} \times 0.1 \times Vmax = 1$$

$$0.9 \times Vmax = 1$$

$$Vmax = 1 / 0.9 = 1.111[m/s]$$

7. Calculation of motor velocity (N [r/min])

A single rotation of pulley : $\pi \times P_D = 0.157[m]$

$N = 1.111 / 0.157 = 7.08[r/s]$

$= 7.08 \times 60 = 424.8[r/min] < 3000[r/min]$ (Rated velocity of MSMF 750 W motor)

8. Calculation of torque

Traveling torque

$$T_f = \frac{P_D}{2\eta}(\mu g W_A + F) = \frac{0.05}{2 \times 0.8}(0.1 \times 9.8 \times 3 + 0)$$

$$= 0.061[N \cdot m]$$

Acceleration torque

$$T_a = \frac{(J_L + J_M) \times 2\pi N[r/s]}{\text{Acceleration time}[s]} + \text{Traveling torque}$$

$$= \frac{(15.6 \times 10^{-4} + 0.96 \times 10^{-4}) \times 2\pi \times 7.08}{0.1} + 0.061$$

$$= 0.736 + 0.061 = 0.797[N \cdot m]$$

Deceleration torque

$$T_d = \frac{(J_L + J_M) \times 2\pi N[r/s]}{\text{Deceleration time}[s]} - \text{Traveling torque}$$

$$= \frac{(15.6 \times 10^{-4} + 0.96 \times 10^{-4}) \times 2\pi \times 7.08}{0.1} - 0.061$$

$$= 0.736 - 0.061 = 0.675[N \cdot m]$$

9. Verification of maximum torque

Acceleration torque $T_a = 0.797[N \cdot m] < 7.1[N \cdot m]$ (Maximum torque of MSMF 750 W motor)

10. Verification of effective torque

$$T_{rms} = \sqrt{\frac{T_a^2 \times t_a + T_f^2 \times t_b + T_d^2 \times t_d}{t_c}}$$

$$= \sqrt{\frac{0.797^2 \times 0.1 + 0.061^2 \times 0.8 + 0.675^2 \times 0.1}{2}}$$

$= 0.237[N \cdot m] < 2.4[N \cdot m]$ (Rated torque of MSMF 750 W motor)

11. Judging from the above calculation result, selection of MSMF 750W motor is acceptable.

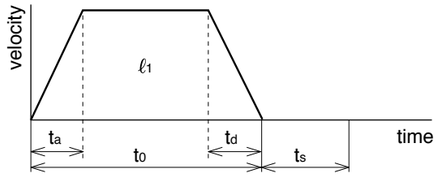
Request Sheet for Motor Selection

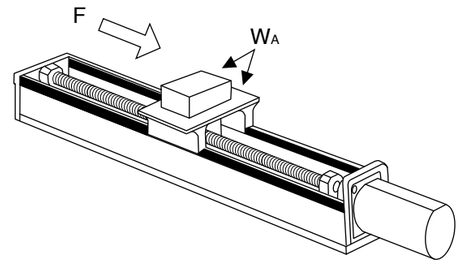
Request for motor selection Ⅰ : Ball screw drive

1. Driven mechanism and running data

1)	Travel distance of the work load per one cycle	ℓ_1:	mm
2)	Cycle time	t_0:	s
	(Fill in items 3) and 4) if required.)		
3)	Acceleration time	t_a:	s
4)	Deceleration time	t_d:	s
5)	Stopping time	t_s:	s
6)	Max. velocity	V:	mm/s
7)	External force	F:	N
8)	Positioning accuracy of the work load	±	mm
9)	Total weight of the work load and the table	W_A:	kg
10)	Power supply voltage		V
11)	Diameter of the ball screw		mm
12)	Total length of the ball		mm
13)	Lead of the ball screw		mm
14)	Traveling direction (horizontal, vertical etc.)		

Running pattern





2. Other data (Fill the details on specific mechanism and its configurations in the following blank.)

	Company name :
	Department/Section :
	Name :
	Address :
	Tel :
	Fax :
	E-mail address:

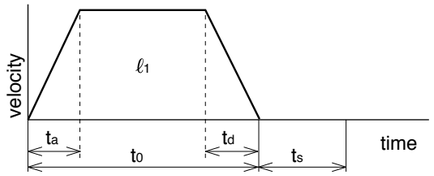
Request Sheet for Motor Selection

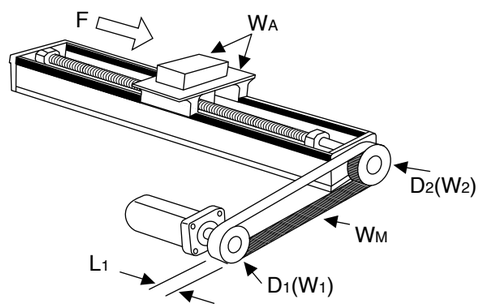
Request for motor selection Ⅱ : Timing pulley + Ball screw drive

1. Driven mechanism and running data

				Motor side	Ball screw side
1)	Travel distance of the work load per one cycle	ℓ_1: mm	15) Diameter of the pulley	D_1: mm	D_2: mm
2)	Cycle time	to: s	16) Weight of the pulley	W_1: kg	W_2: kg
	(Fill in items 3) and 4) if required.)		(or item 17) and 18))		
3)	Acceleration time	ta: s	17) Width of the pulley	L1: mm	
4)	Deceleration time	td: s	18) Material of the pulley		
5)	Stopping time	ts: s	19) Weight of the belt	W_M: kg	
6)	Max. velocity	V: mm/s			
7)	External force	F: N			
8)	Positioning accuracy of the work load	± mm			
9)	Total weight of the work load and the table	W_A: kg			
10)	Power supply voltage	V			
11)	Diameter of the ball screw	mm			
12)	Total length of the ball screw	mm			
13)	Lead of the ball screw	mm			
14)	Traveling direction (horizontal, vertical etc.)				

Running pattern





2. Other data (Fill the details on specific mechanism and its configurations in the following blank.)

	Company name :
	Department/Section :
	Name :
	Address :
	Tel :
	Fax :
	E-mail address:

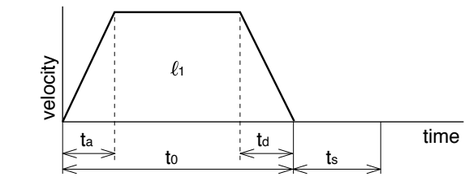
Request Sheet for Motor Selection

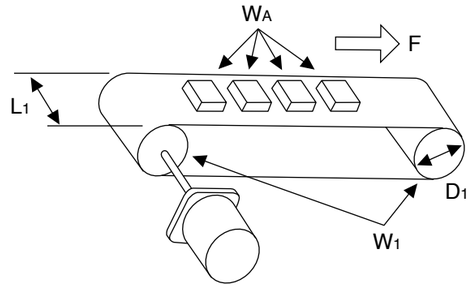
Request for motor selection Ⅲ : Belt drive

1. Driven mechanism and running data

1)	Travel distance of the work load per one cycle	ℓ_1: mm		
2)	Cycle time	to: s		
	(Fill in items 3) and 4) if required.)			
3)	Acceleration time	ta: s		
4)	Deceleration time	td: s		
5)	Stopping time	ts: s		
6)	Max. velocity	V: mm/s		
7)	External force	F: N		
8)	Positioning accuracy of the work load	± mm		
9)	Total weight of the work load	W_A: kg		
10)	Power supply voltage	V		
11)	Weight of the belt	W_M: kg	14) Width of the pulley	L_1: mm
12)	Diameter of the driving pulley	D_1: mm	15) Material of the pulley	
13)	Total weight of the pulley	W_1: kg	16) Traveling direction (horizontal, vertical etc.)	

Running pattern





(or item 14) and 15))

2. Other data (Fill the details on specific mechanism and its configurations in the following blank.)

	Company name :
	Department/Section :
	Name :
	Address :
	Tel :
	Fax :
	E-mail address:

Request Sheet for Motor Selection

Request for motor selection Ⅳ : Timing pulley + Belt drive

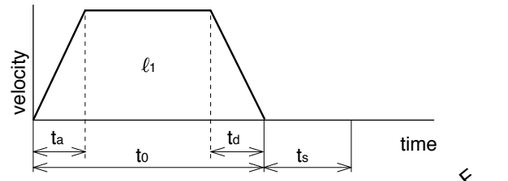
1. Driven mechanism and running data

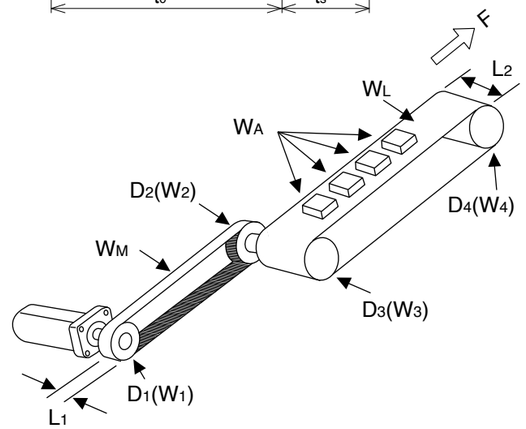
1)	Travel distance of the work load per one cycle	ℓ_1:	mm		
2)	Cycle time	t_0:	s		
	(Fill in items 3) and 4) if required.)				
3)	Acceleration time	t_a:	s		
4)	Deceleration time	t_d:	s		
5)	Stopping time	t_s:	s		
6)	Max. velocity	V:	mm/s		
7)	External force	F:	N		
8)	Positioning accuracy of the work load	±	mm		
9)	Total weight of the work load	W_A:	kg		
10)	Power supply voltage		V		
11)	Weight of motor side belt	W_M:	kg		

		Motor side		Belt side	
12)	Diameter of the pulley	D_1:	mm	D_2:	mm
13)	Weight of the pulley	W_1:	kg	W_2:	kg
	(or item 14) and 15))				
14)	Width of the belt	L_1:	mm		
15)	Material of the pulley				

		Motor side		Belt side	
16)	Diameter of the pulley	D_3:	mm	D_4:	mm
17)	Weight of the pulley	W_3:	kg	W_4:	kg
	(or item 18) and 19))				
18)	Width of the pulley	L_2:	mm		
19)	Material of the pulley				
20)	Weight of the belt	W_L:	kg		
21)	Traveling direction (horizontal, vertical etc.)				

Running pattern





2. Other data (Fill the details on specific mechanism and its configurations in the following blank.)

Company name :
Department/Section :
Name :
Address :
Tel :
Fax :
E-mail address:

Request Sheet for Motor Selection

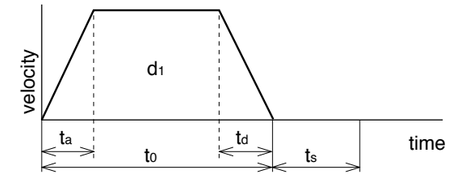
Request for motor selection Ⅴ : Turntable drive

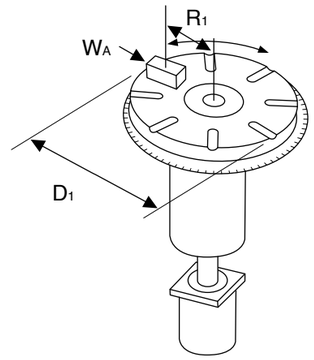
1. Driven mechanism and running data

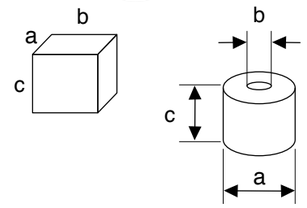
1)	Travel distance of the work load per one cycle	d_1:	deg
2)	Cycle time	t_0:	s
	(Fill in items 3) and 4) if required.)		
3)	Acceleration time	t_a:	s
4)	Deceleration time	t_d:	s
5)	Stopping time	t_s:	s
6)	Max. rotational speed of the table	v:	deg/s
	(or)	V:	r/s
7)	Positioning accuracy of the work load	±	deg
8)	Weight of one work load	W_A:	kg
9)	Driving radius of the center of gravity of the work	R_1:	mm
10)	Diameter of the table	D_1:	mm
11)	Mass of the table	W_1:	kg
12)	Diameter of the table support	T_1:	mm
13)	Power supply voltage		V

		Prism		Cylinder	
14)	Dimensions of the work load	a:	mm	a:	mm
		b:	mm	b:	mm
		c:	mm	c:	mm
15)	Number of work loads		pcs		

Running pattern







2. Other data (Fill the details on specific mechanism and its configurations in the following blank.)

Company name :
Department/Section :
Name :
Address :
Tel :
Fax :
E-mail address:

Request Sheet for Motor Selection

Request for motor selection Ⅵ : Timing pulley + Turntable drive

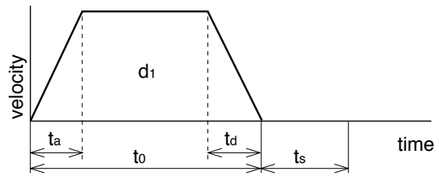
1. Driven mechanism and running data

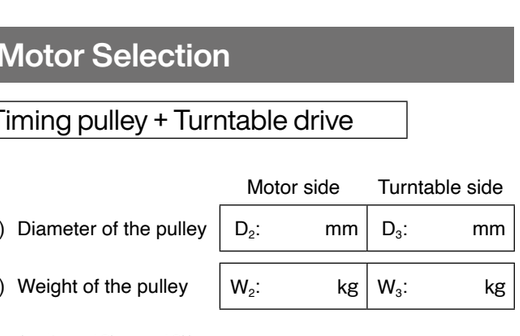
1)	Travel distance of the work load per one cycle	d_1:	deg		
2)	Cycle time	t_0:	s		
	(Fill in items 3) and 4) if required.)				
3)	Acceleration time	t_a:	s		
4)	Deceleration time	t_d:	s		
5)	Stopping time	t_s:	s		
6)	Max. rotational speed of the table	v:	deg/s		
	(or)	V:	r/s		
7)	Positioning accuracy of the work load	±	deg		
8)	Weight of one work load	W_A:	kg		
9)	Driving radius of the center of gravity of the work	R_1:	mm		
10)	Diameter of the table	D_1:	mm		
11)	Mass of the table	W_1:	kg		
12)	Diameter of the table support	T_1:	mm		
13)	Power supply voltage		V		

		(Prism)		(Cylinder)	
14)	Dimension of the work load	a:	mm	a:	mm
		b:	mm	b:	mm
		c:	mm	c:	mm
15)	Number of work loads		pcs		

		Motor side		Turntable side	
16)	Diameter of the pulley	D_2:	mm	D_3:	mm
17)	Weight of the pulley	W_2:	kg	W_3:	kg
	(or item 18) and 19))				
18)	Width of the pulley	L_1:	mm		
19)	Material of the pulley				
20)	Weight of the belt	W_M:	kg		

Running pattern





2. Other data (Fill the details on specific mechanism and its configurations in the following blank.)

	Company name :
	Department/Section :
	Name :
	Address :
	Tel :
	Fax :
	E-mail address:

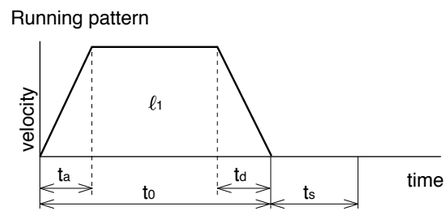
Request Sheet for Motor Selection

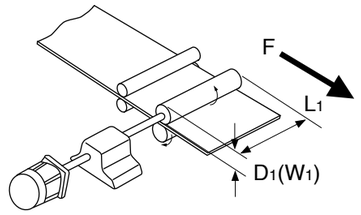
Request for motor selection Ⅶ : Roller feed drive

1. Driven mechanism and running data

1)	Travel distance of the work load per one cycle	ℓ_1:	mm		
2)	Cycle time	t_0:	s		
	(Fill in items 3) and 4) if required.)				
3)	Acceleration time	t_a:	s		
4)	Deceleration time	t_d:	s		
5)	Stopping time	t_s:	s		
6)	Max. velocity	v:	mm/s		
7)	External pulling force	F:	N		
8)	Positioning accuracy of the work load	±	mm		
9)	Number of rollers		pcs		
10)	Power supply voltage		V		
11)	Diameter of the roller	D_1:	mm		
12)	Mass of the roller	W_1:	kg		
	(or item 13) and 14))				
13)	Width of the roller	L_1:	mm		
14)	Material of the roller				

Running pattern





2. Other data (Fill the details on specific mechanism and its configurations in the following blank.)

	Company name :
	Department/Section :
	Name :
	Address :
	Tel :
	Fax :
	E-mail address:

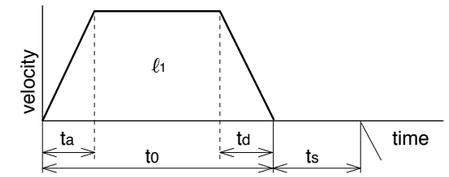
Request Sheet for Motor Selection

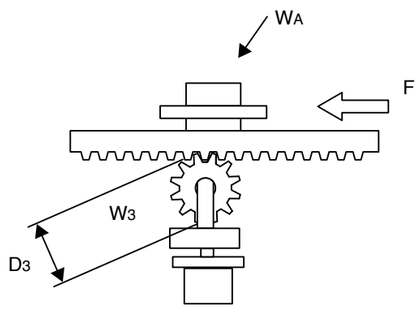
Request for motor selection Ⅷ : Driving with Rack & Pinion

1. Driven mechanism and running data

1)	Travel distance of the work load per one cycle	ℓ_1:	mm
2)	Cycle time	to:	s
	(Fill in items 3) and 4) if required.)		
3)	Acceleration time	ta:	s
4)	Deceleration time	td:	s
5)	Stopping time	ts:	s
6)	Max. velocity	V:	mm/s
7)	External force	F:	N
8)	Positioning accuracy of the work load	±	mm
9)	Total weight of the work load	W_A:	kg
10)	Power supply voltage		V
11)	Diameter of the pinion	D_3:	mm
12)	Mass of the pinion	W_3:	kg
13)	Traveling direction (horizontal, vertical, etc.)		

Running pattern

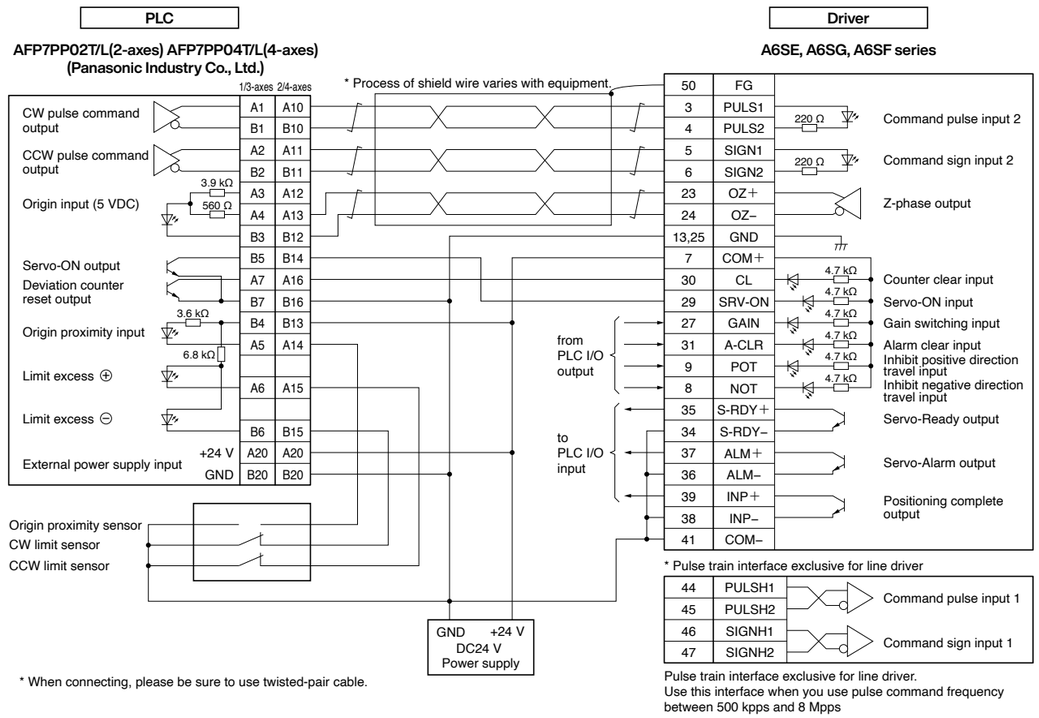




2. Other data (Fill the details on specific mechanism and its configurations in the following blank.)

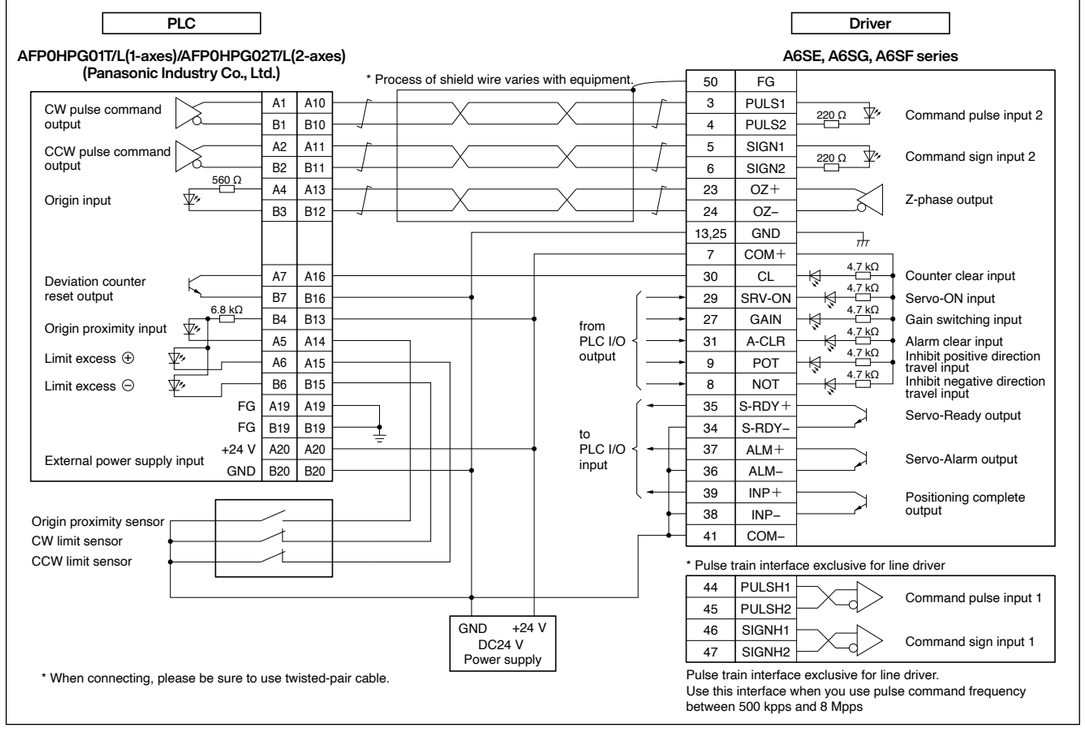
	Company name :
	Department/Section :
	Name :
	Address :
	Tel :
	Fax :
	E-mail address:

FP7 AFP7PPL02T/L (2 axes) Connection with AFP7PP04T/L (4 axes)



CW pulse command output	A1	A10	50	FG	
	B1	B10	3	PULS1	Command pulse input 2
CCW pulse command output	A2	A11	4	PULS2	
	B2	B11	5	SIGN1	Command sign input 2
Origin input (5 VDC)	A3	A12	6	SIGN2	
	A4	A13	23	OZ+	Z-phase output
	B3	B12	24	OZ–	
	B5	B14	13,25	GND	
Servo-ON output	A7	A16	7	COM+	
Deviation counter reset output	B7	B16	30	CL	Counter clear input
	B4	B13	29	SRV-ON	Servo-ON input
Origin proximity input	A5	A14	27	GAIN	Gain switching input
			31	A-CLR	Alarm clear input
Limit excess ⊕	A6	A15	9	POT	Inhibit positive direction travel input
Limit excess ⊖			8	NOT	Inhibit negative direction travel input
	B6	B15	35	S-RDY+	Servo-Ready output
External power supply input +24 V	A20	A20	34	S-RDY–	
GND	B20	B20	37	ALM+	Servo-Alarm output
			36	ALM–	
			39	INP+	Positioning complete output
			38	INP–	
			41	COM–	
			44	PULSH1	Command pulse input 1
			45	PULSH2	
			46	SIGNH1	Command sign input 1
			47	SIGNH2	

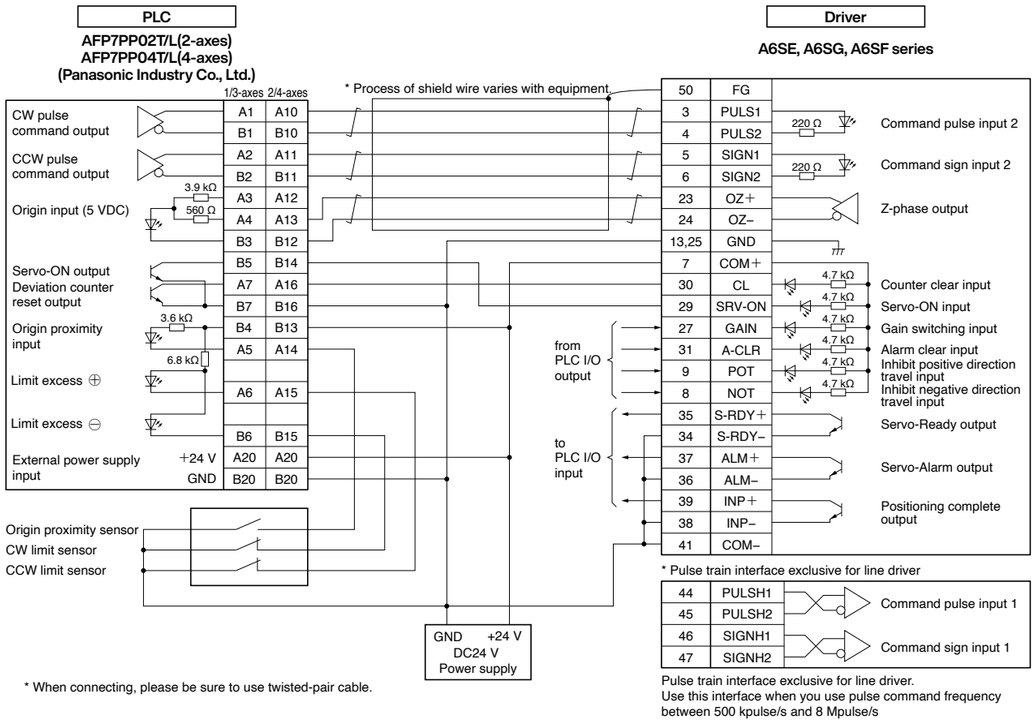
FP0H AFP0HPG01T/L (1 axis) Connection with AFP0HPG02T/L (2 axes)



CW pulse command output	A1	A10	50	FG	
	B1	B10	3	PULS1	Command pulse input 2
CCW pulse command output	A2	A11	4	PULS2	
	B2	B11	5	SIGN1	Command sign input 2
Origin input	A4	A13	6	SIGN2	
	B3	B12	23	OZ+	Z-phase output
			24	OZ–	
			13,25	GND	
Deviation counter reset output	A7	A16	7	COM+	
	B7	B16	30	CL	Counter clear input
Origin proximity input	B4	B13	29	SRV-ON	Servo-ON input
	A5	A14	27	GAIN	Gain switching input
Limit excess ⊕	A6	A15	31	A-CLR	Alarm clear input
Limit excess ⊖	B6	B15	9	POT	Inhibit positive direction travel input
FG	A19	A19	8	NOT	Inhibit negative direction travel input
FG	B19	B19	35	S-RDY+	Servo-Ready output
+24 V	A20	A20	34	S-RDY–	
External power supply input GND	B20	B20	37	ALM+	Servo-Alarm output
			36	ALM–	
			39	INP+	Positioning complete output
			38	INP–	
			41	COM–	
			44	PULSH1	Command pulse input 1
			45	PULSH2	
			46	SIGNH1	Command sign input 1
			47	SIGNH2	

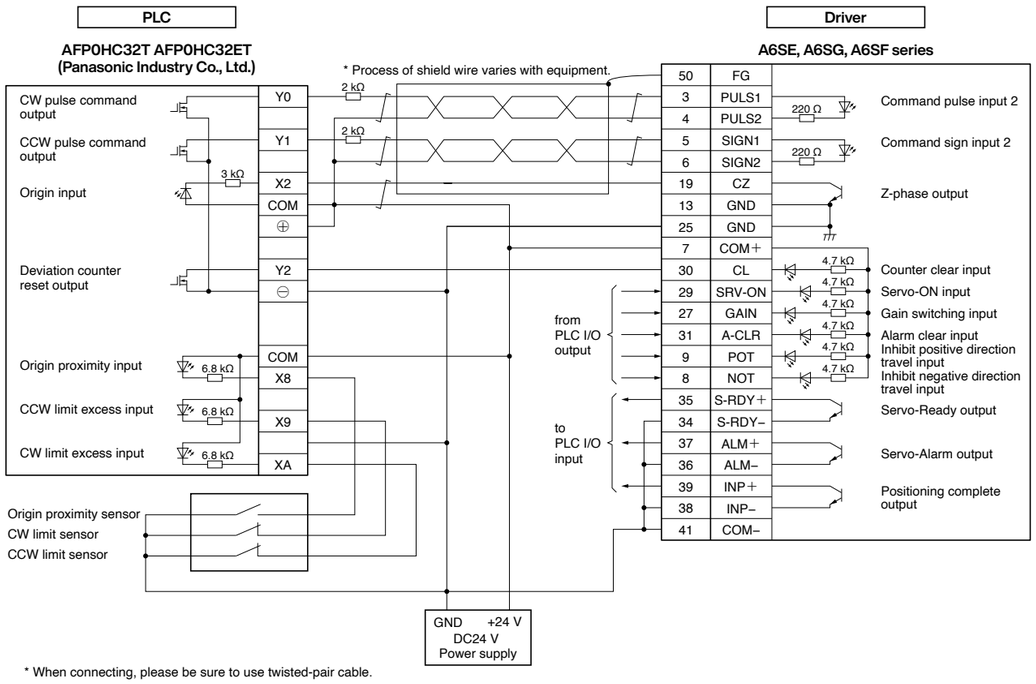
Connection Between Driver and Controller

FP7 AFP7PG02T/L (2 axes) Connection with AFP7PG04T/L (4 axes)



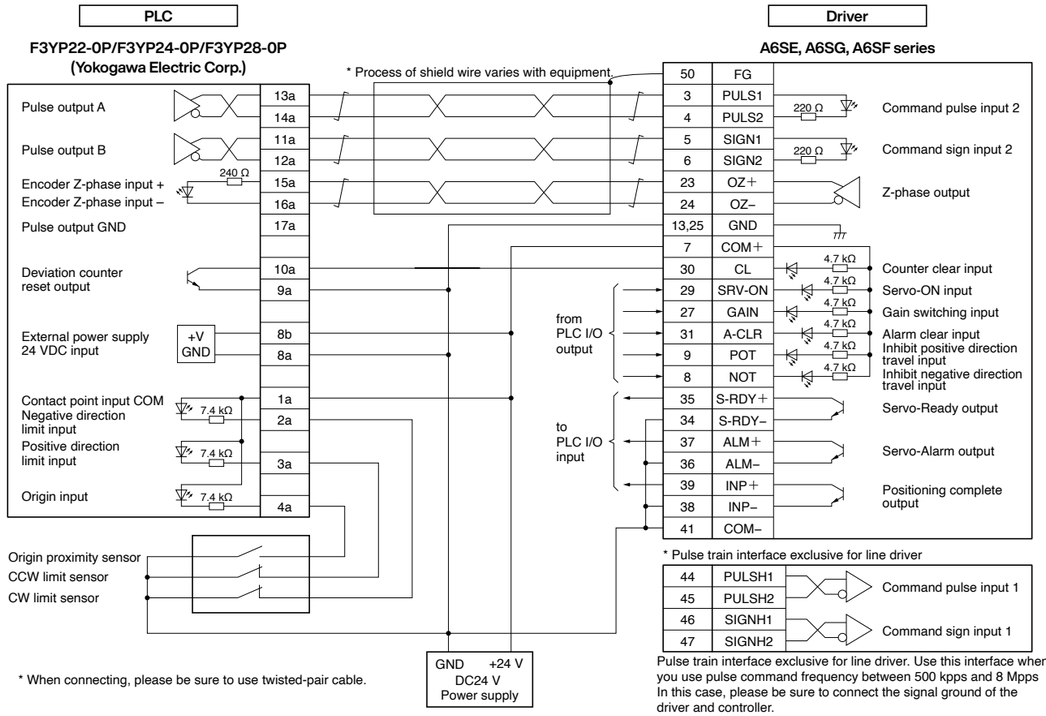
		A1	A10	50	FG
		B1	B10	3	PULS1
		A2	A11	4	PULS2
		B2	B11	5	SIGN1
		A3	A12	6	SIGN2
		A4	A13	23	OZ+
		B3	B12	24	OZ–
		B5	B14	13,25	GND
		A7	A16	7	COM+
		B7	B16	30	CL
		B4	B13	29	SRV-ON
		A5	A14	27	GAIN
				31	A-CLR
		A6	A15	9	POT
				8	NOT
		B6	B15	35	S-RDY+
+24 V		A20	A20	34	S-RDY–
GND		B20	B20	37	ALM+
				36	ALM–
				39	INP+
				38	INP–
				41	COM–
				44	PULSH1
				45	PULSH2
				46	SIGNH1
				47	SIGNH2

FP0H AFP0HC32T Connection with AFP0HC32ET



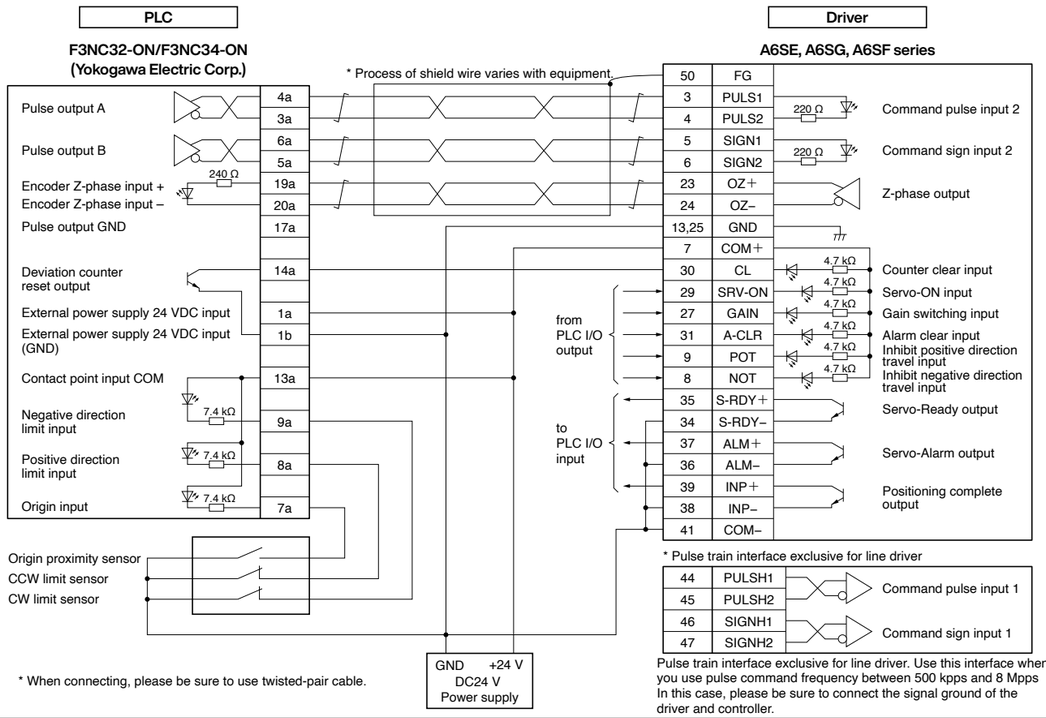
		Y0		50	FG
		Y1		3	PULS1
		X2		4	PULS2
		COM		5	SIGN1
		⊕		6	SIGN2
				19	CZ
		Y2		13	GND
		⊖		25	GND
				7	COM+
		COM		30	CL
		X8		29	SRV-ON
				27	GAIN
		X9		31	A-CLR
				9	POT
		XA		8	NOT
				35	S-RDY+
				34	S-RDY–
				37	ALM+
				36	ALM–
				39	INP+
				38	INP–
				41	COM–

F3YP22-0P/F3YP24-0P/F3YP28-0P Connection with the Yokogawa Electric Corp.



		13a		50	FG
		14a		3	PULS1
		11a		4	PULS2
		12a		5	SIGN1
		15a		6	SIGN2
		16a		23	OZ+
		17a		24	OZ–
				13,25	GND
		10a		7	COM+
		9a		30	CL
				29	SRV-ON
		8b		27	GAIN
		8a		31	A-CLR
				9	POT
		1a		8	NOT
		2a		35	S-RDY+
				34	S-RDY–
		3a		37	ALM+
				36	ALM–
		4a		39	INP+
				38	INP–
				41	COM–
				44	PULSH1
				45	PULSH2
				46	SIGNH1
				47	SIGNH2

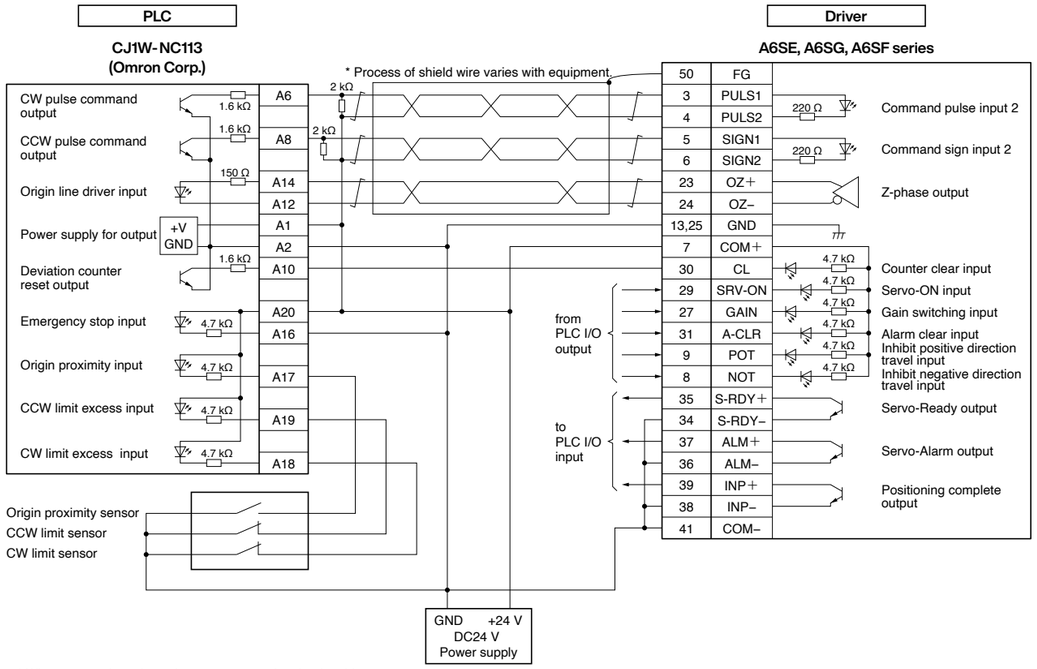
F3NC32-ON/F3NC34-ON Connection with the Yokogawa Electric Corp.



		4a		50	FG
		3a		3	PULS1
		6a		4	PULS2
		5a		5	SIGN1
		19a		6	SIGN2
		20a		23	OZ+
		17a		24	OZ–
				13,25	GND
		14a		7	COM+
				30	CL
		1a		29	SRV-ON
		1b		27	GAIN
				31	A-CLR
		13a		9	POT
				8	NOT
		9a		35	S-RDY+
				34	S-RDY–
		8a		37	ALM+
				36	ALM–
		7a		39	INP+
				38	INP–
				41	COM–
				44	PULSH1
				45	PULSH2
				46	SIGNH1
				47	SIGNH2

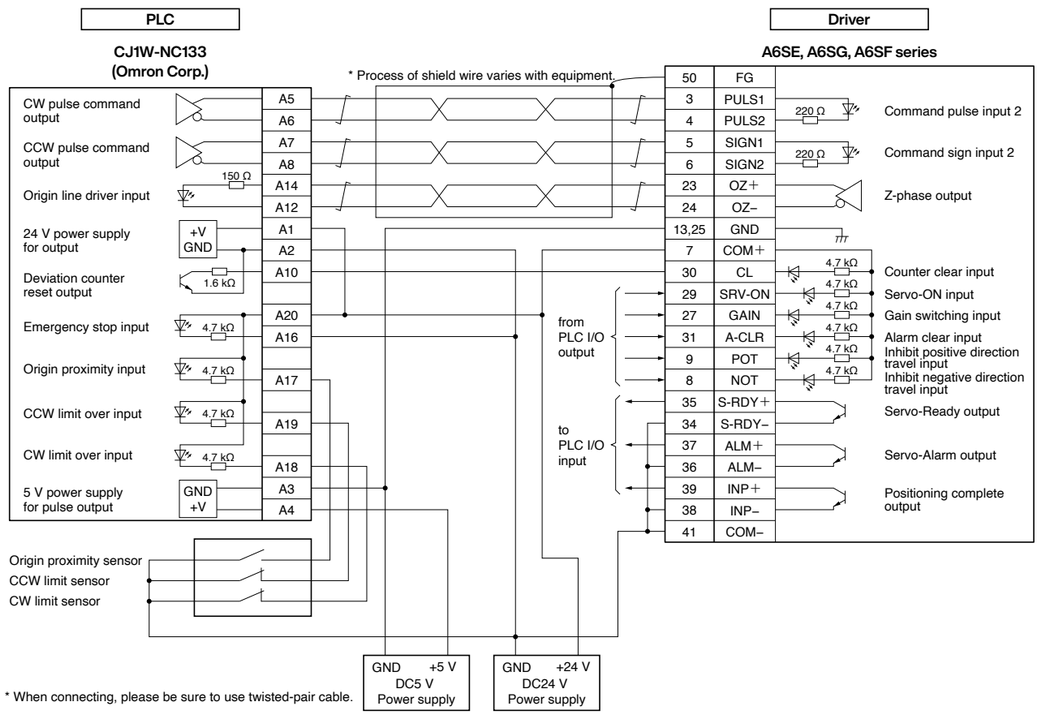
Connection Between Driver and Controller

CJ1W-NC113 Connection with the Omron Corp.



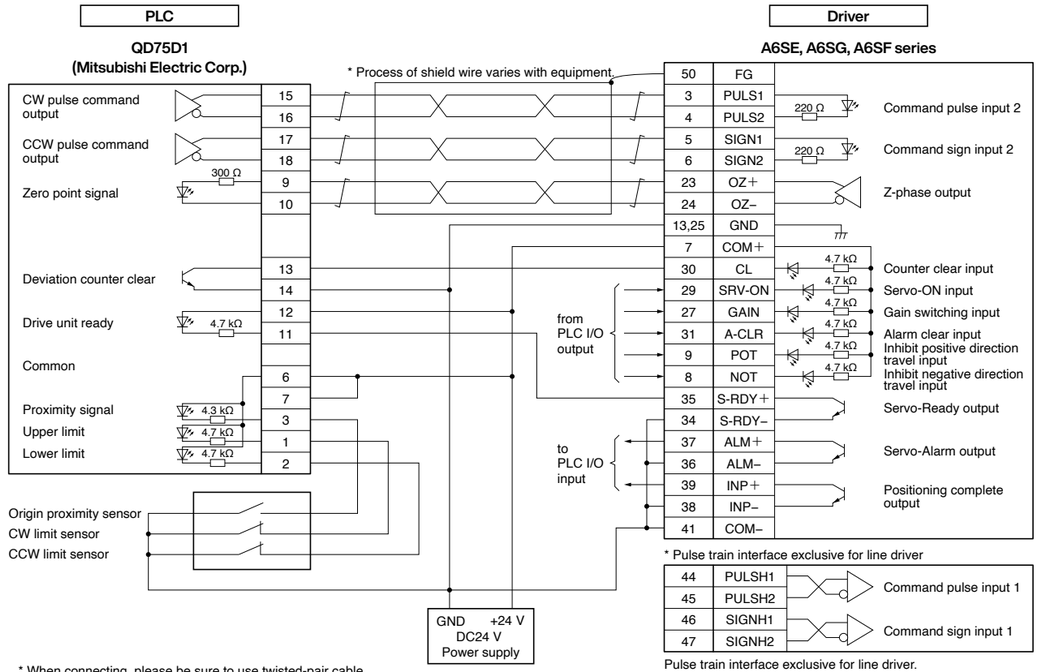
* When connecting, please be sure to use twisted-pair cable.

CJ1W-NC133 Connection with the Omron Corp.



* When connecting, please be sure to use twisted-pair cable.

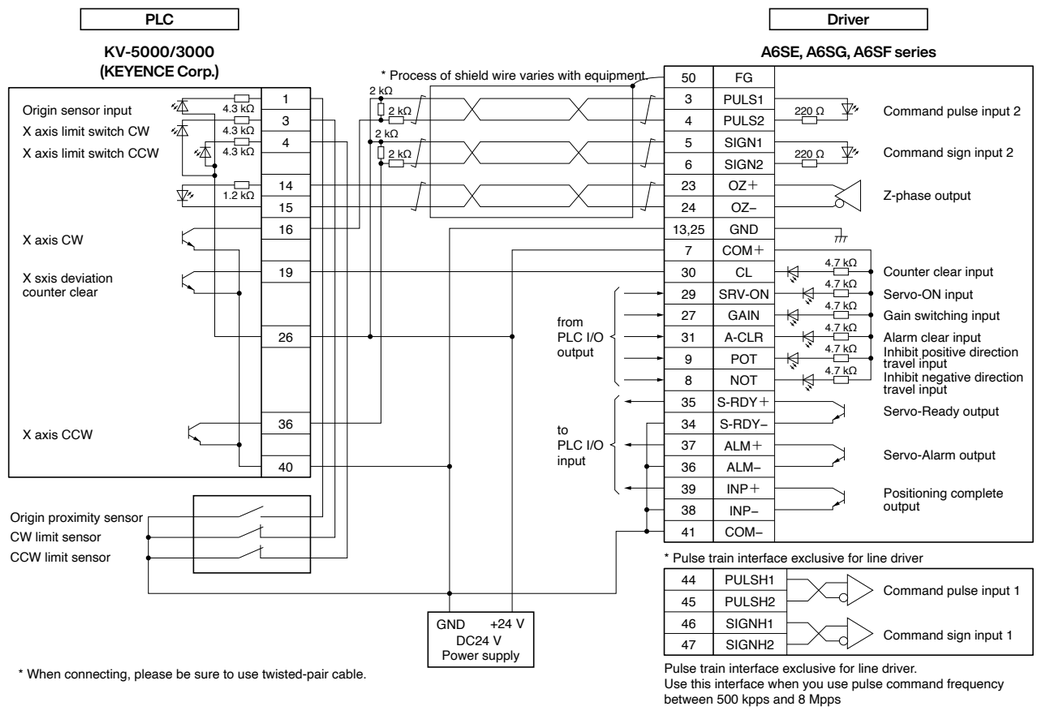
QD75D1 Connection with the Mitsubishi Electric Corp.



* When connecting, please be sure to use twisted-pair cable.

Pulse train interface exclusive for line driver.
Use this interface when you use pulse command frequency between 500 kpps and 8 Mpps

KV-5000/3000 Connection with the KEYENCE Corp.



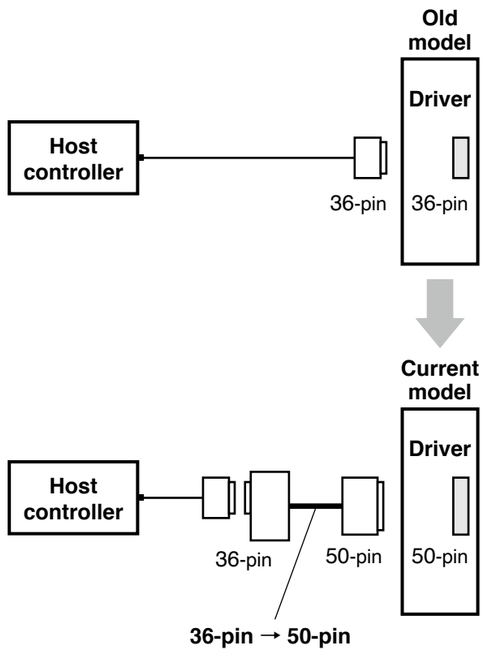
* When connecting, please be sure to use twisted-pair cable.

Pulse train interface exclusive for line driver.
Use this interface when you use pulse command frequency between 500 kpps and 8 Mpps

Replacing Old Model Servo Driver with MINAS A6 series

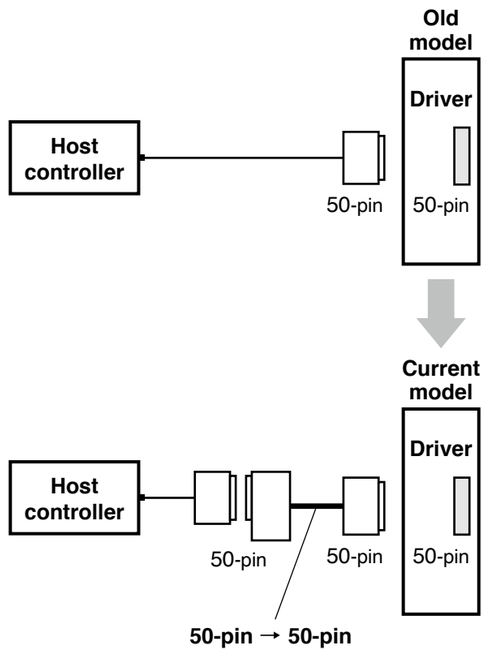
For easier replacement of old driver (MINAS X/XX/V series) with A6 series, use the interface conversion connector.

〈36-pin → 50-pin〉



36-pin → 50-pin
Conversion cable
DV0P4120
DV0P4121

〈50-pin → 50-pin〉



50-pin → 50-pin
Conversion cable
DV0P4130
DV0P4131
DV0P4132

When selecting the cable, refer to the table below because the part number of the cable is specific to the control mode of the old model.

Old model	Control mode	Conversion cable part No.	Conversion wiring table
X series XX series (36-pin)	Position/velocity control	DV0P4120	P.440
	Torque control	DV0P4121	
V series (50-pin)	Position control	DV0P4130	P.441
	Velocity control	DV0P4131	
	Torque control	DV0P4132	P.442

* For external dimensions, refer to P.322.

Conversion Wiring Table

Pin No. on Old Model	DV0P4120			DV0P4121		
	Pin No. on Current Model	Signal Name	Symbol	Pin No. on Current Model	Signal Name	Symbol
1	23	Z-phase output	OZ+	23	Z-phase output	OZ+
2	24	Z-phase output	OZ–	24	Z-phase output	OZ–
3	13	Signal ground	GND	13	Signal ground	GND
4	19	Z-phase output	CZ	19	Z-phase output	CZ
5	4	Command pulse input 2	PULS2	4	Command pulse input 2	PULS2
6	3	Command pulse input 2	PULS1	3	Command pulse input 2	PULS1
7	6	Command pulse sign input 2	SIGN2	6	Command pulse sign input 2	SIGN2
8	5	Command pulse sign input 2	SIGN1	5	Command pulse sign input 2	SIGN1
9	33	Command pulse inhibition input	INH	33	Command pulse inhibition input	INH
10	26	Speed zero clamp input	ZEROSPD	26	Speed zero clamp input	ZEROSPD
11	7	Power supply for control signal (+)	COM+	7	Power supply for control signal (+)	COM+
12	29	Servo-ON input	SRV-ON	29	Servo-ON input	SRV-ON
13	30	Deviation counter clear input	CL	30	Deviation counter clear input	CL
14	14	Speed command input	SPR	NC		
15	15	Signal ground	GND	15	Signal ground	GND
16	43	Speed monitor output	SP	43	Speed monitor output	SP
17	25	Signal ground	GND	25	Signal ground	GND
18	50	Frame ground	FG	50	Frame ground	FG
19	21	A-phase output	OA+	21	A-phase output	OA+
20	22	A-phase output	OA-	22	A-phase output	OA-
21	48	B-phase output	OB+	48	B-phase output	OB+
22	49	B-phase output	OB–	49	B-phase output	OB–
23	NC			NC		
24	NC			NC		
25	39	Positioning complete output Speed arrival output	COIN+ AT-SPEED+	39	Positioning complete output Speed arrival output	COIN+ AT-SPEED+
26	37	Servo-Alarm output	ALM+	37	Servo-Alarm output	ALM+
27	35	Servo-Ready output	S-RDY+	35	Servo-Ready output	S-RDY+
28	34	Positioning complete output (–) Speed arrival output (–)	COIN– AT-SPEED–	34	Positioning complete output (–) Speed arrival output (–)	COIN– AT-SPEED–
	36	Servo-Alarm output (–)	ALM–	36	Servo-Alarm output (–)	ALM–
	38	Servo-Ready output (–)	S-RDY–	38	Servo-Ready output (–)	S-RDY–
	41	Power supply for control signal (–)	COM–	41	Power supply for control signal (–)	COM–
29	8	CW over-travel inhibit input	CWL	8	CW over-travel inhibit input	CWL
30	9	CCW over-travel inhibit input	CCWL	9	CCW over-travel inhibit input	CCWL
31	31	Alarm clear input	A-CLR	31	Alarm clear input	A-CLR
32	32	Control mode switching input	C-MODE	32	Control mode switching input	C-MODE
33	18	CW direction torque limit input	CWTL	18	CW direction torque limit input	CWTL
34	16	CCW direction torque limit input	CCWTL	14	Torque command input	TRQR
35	17	Signal ground	GND	17	Signal ground	GND
36	42	Torque monitor output	IM	42	Torque monitor output	IM

* “NC” is no connect.

Replacing Old Model Servo Driver with MINAS A6 series

Pin No. on Old Model	DV0P4130			DV0P4131		
	Pin No. on Current Model	Signal Name	Symbol	Pin No. on Current Model	Signal Name	Symbol
1	8	CW over-travel inhibit input	CWL	8	CW over-travel inhibit input	CWL
2	9	CCW over-travel inhibit input	CCWL	9	CCW over-travel inhibit input	CCWL
3	3	Command pulse input 2	PULS1	NC		
4	4	Command pulse input 2	PULS2	NC		
5	5	Command pulse sign input 2	SIGN1	NC		
6	6	Command pulse sign input 2	SIGN2	NC		
7	7	Power supply for control signal (+)	COM+	7	Power supply for control signal (+)	COM+
8	NC			NC		
9	NC			NC		
10	NC			NC		
11	11	External brake release signal	BRK-OFF+	11	External brake release signal	BRK-OFF+
12	12	Zero-speed detection output signal	ZSP	12	Zero-speed detection output signal	ZSP
13	13	Torque in-limit signal output	TLC	13	Torque in-limit signal output	TLC
14	NC			14	Speed command input	SPR
15	15	Signal ground	GND	15	Signal ground	GND
16	16	CCW direction torque limit input	CCWTL	16	CCW direction torque limit input	CCWTL
17	17	Signal ground	GND	17	Signal ground	GND
18	18	CW direction torque limit input	CWTL	18	CW direction torque limit input	CWTL
19	19	Z-phase output	CZ	19	Z-phase output	CZ
20	NC			NC		
21	21	A-phase output	OA+	21	A-phase output	OA+
22	22	A-phase output	OA-	22	A-phase output	OA-
23	23	Z-phase output	OZ+	23	Z-phase output	OZ+
24	24	Z-phase output	OZ-	24	Z-phase output	OZ-
25	50	Frame ground	FG	50	Frame ground	FG
26	26	Speed zero clamp input	ZEROSPD	26	Speed zero clamp input	ZEROSPD
27	27	Gain switching input	GAIN	27	Gain switching input	GAIN
28	NC			33	Selection 1 input of internal command speed	INTSPD1
29	29	Servo-ON input	SRV-ON	29	Servo-ON input	SRV-ON
30	30	Deviation counter clear input	CL	NC		
31	31	Alarm clear input	A-CLR	31	Alarm clear input	A-CLR
32	32	Control mode switching input	C-MODE	32	Control mode switching input	C-MODE
33	33	Command pulse inhibition input	INH	NC		
34	NC			NC		
35	35	Servo-Ready output	S-RDY+	35	Servo-Ready output	S-RDY+
36	NC			NC		
37	37	Servo-Alarm output	ALM+	37	Servo-Alarm output	ALM+
38	NC			NC		
39	39	Positioning complete output	COIN+	39	Speed arrival output	AT-SPEED+
40	40	Torque in-limit signal output	TLC	40	Torque in-limit signal output	TLC
41	10	External brake release signal (–)	BRK-OFF–	10	External brake release signal (–)	BRK-OFF–
	34	Positioning complete output (–)	COIN–	34	Speed arrival output (–)	AT-SPEED–
	36	Servo-Alarm output (–)	ALM–	36	Servo-Alarm output (–)	ALM–
	38	Servo-Ready output (–)	S-RDY–	38	Servo-Ready output (–)	S-RDY–
	41	Power supply for control signal (–)	COM–	41	Power supply for control signal (–)	COM–
42	42	Torque monitor output	IM	42	Torque monitor output	IM
43	43	Speed monitor output	SP	43	Speed monitor output	SP
44	25	Signal ground	GND	25	Signal ground	GND
45	25	Signal ground	GND	25	Signal ground	GND
46	25	Signal ground	GND	25	Signal ground	GND
47	NC			NC		
48	48	B-phase output	OB+	48	B-phase output	OB+
49	49	B-phase output	OB–	49	B-phase output	OB–
50	50	Frame ground	FG	50	Frame ground	FG

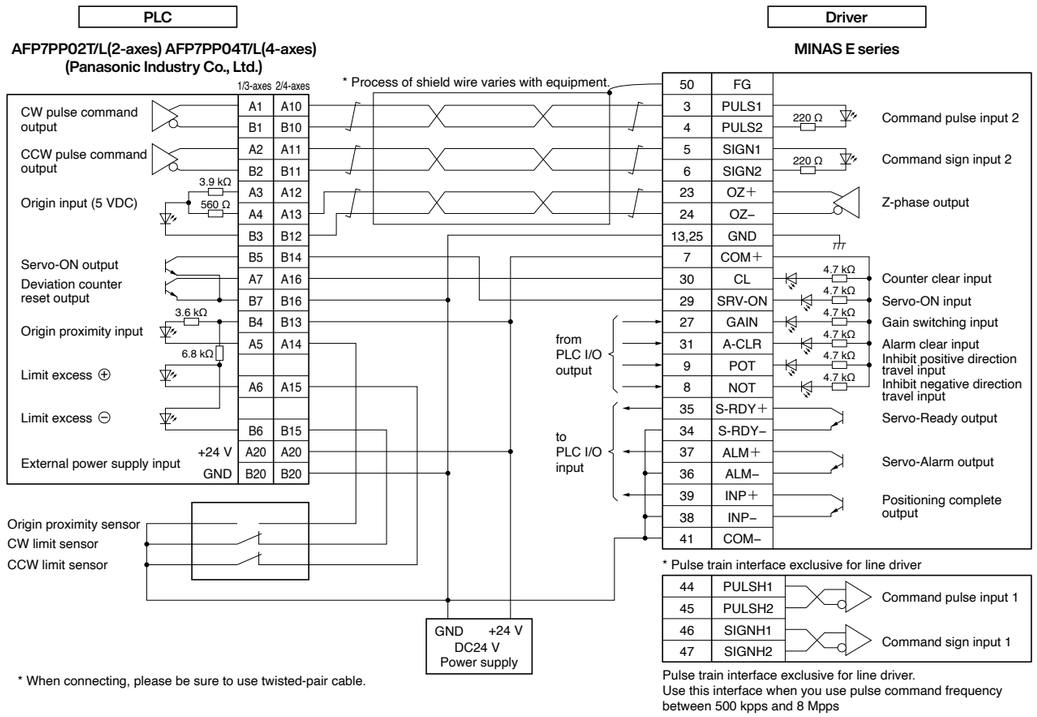
* “NC” is no connect.

Pin No. on Old Model	DV0P4132		
	Pin No. on Current Model	Signal Name	Symbol
1	8	CW over-travel inhibit input	CWL
2	9	CCW over-travel inhibit input	CCWL
3	NC		
4	NC		
5	NC		
6	NC		
7	7	Power supply for control signal (+)	COM+
8	NC		
9	NC		
10	NC		
11	11	External brake release signal	BRK-OFF+
12	12	Zero-speed detection output signal	ZSP
13	13	Torque in-limit signal output	TLC
14	NC		
15	15	Signal ground	GND
16	16	Torque command input	TRQR
17	17	Signal ground	GND
18	18	CW direction torque limit input	CWTL
19	19	Z-phase output	CZ
20	NC		
21	21	A-phase output	OA+
22	22	A-phase output	OA-
23	23	Z-phase output	OZ+
24	24	Z-phase output	OZ-
25	50	Frame ground	FG
26	26	Speed zero clamp input	ZEROSPD
27	27	Gain switching input	GAIN
28	NC		
29	29	Servo-ON input	SRV-ON
30	NC		
31	31	Alarm clear input	A-CLR
32	32	Control mode switching input	C-MODE
33	NC		
34	NC		
35	35	Servo-Ready output	S-RDY+
36	NC		
37	37	Servo-Alarm output	ALM+
38	NC		
39	39	Speed arrival output	AT-SPEED+
40	40	Torque in-limit signal output	TLC
41	10	External brake release signal (–)	BRK-OFF–
	34	Speed arrival output (–)	AT-SPEED–
	36	Servo-Alarm output (–)	ALM–
	38	Servo-Ready output (–)	S-RDY–
	41	Power supply for control signal (–)	COM–
42	42	Torque monitor output	IM
43	43	Speed monitor output	SP
44	25	Signal ground	GND
45	25	Signal ground	GND
46	25	Signal ground	GND
47	NC		
48	48	B-phase output	OB+
49	49	B-phase output	OB–
50	50	Frame ground	FG

* “NC” is no connect.

Connection Between Driver and Controller

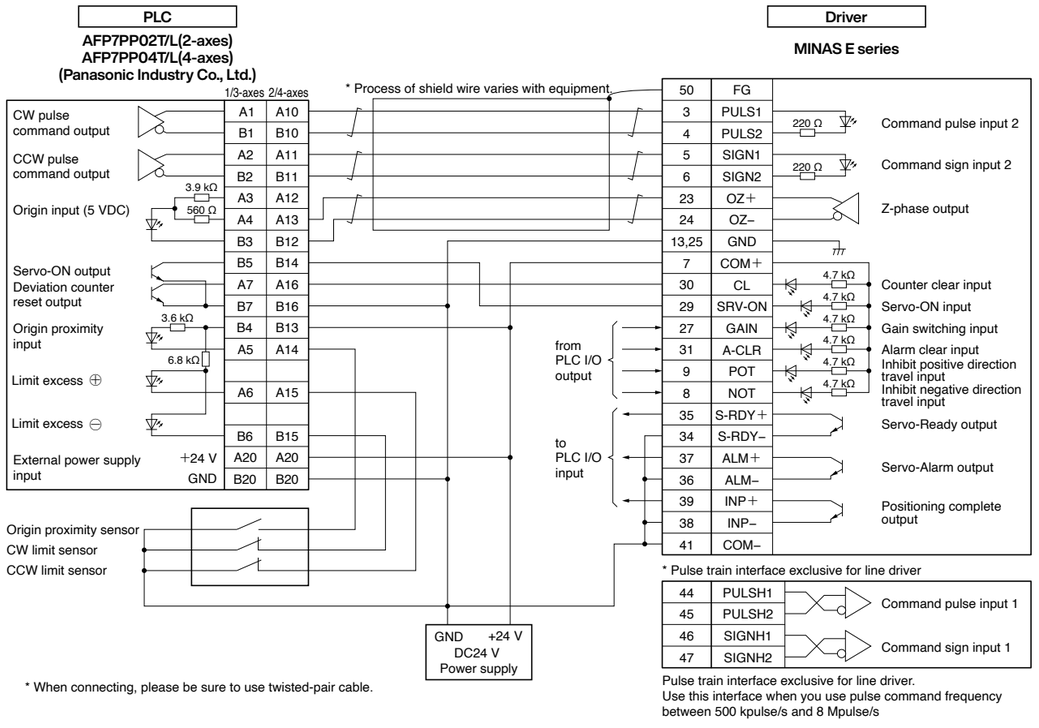
FP7 AFP7PPL02T/L (2 axes) Connection with AFP7PP04T/L (4 axes)



* When connecting, please be sure to use twisted-pair cable.

Pulse train interface exclusive for line driver.
Use this interface when you use pulse command frequency between 500 kpps and 8 Mpps

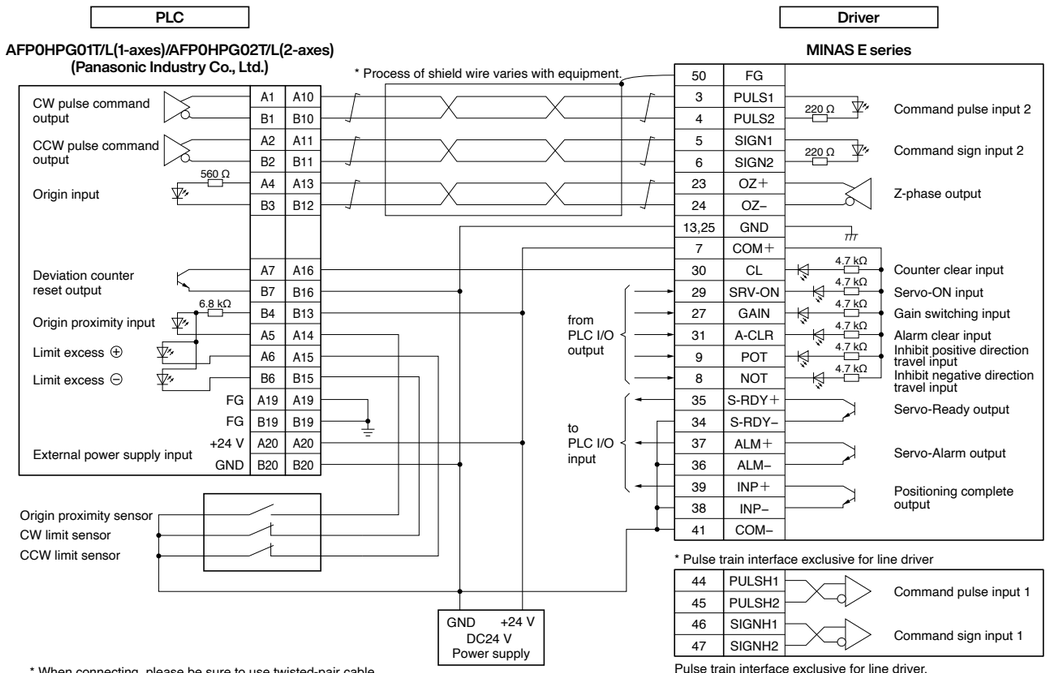
FP7 AFP7PG02T/L (2 axes) Connection with AFP7PG04T/L (4 axes)



* When connecting, please be sure to use twisted-pair cable.

Pulse train interface exclusive for line driver.
Use this interface when you use pulse command frequency between 500 kpulse/s and 8 Mpulse/s

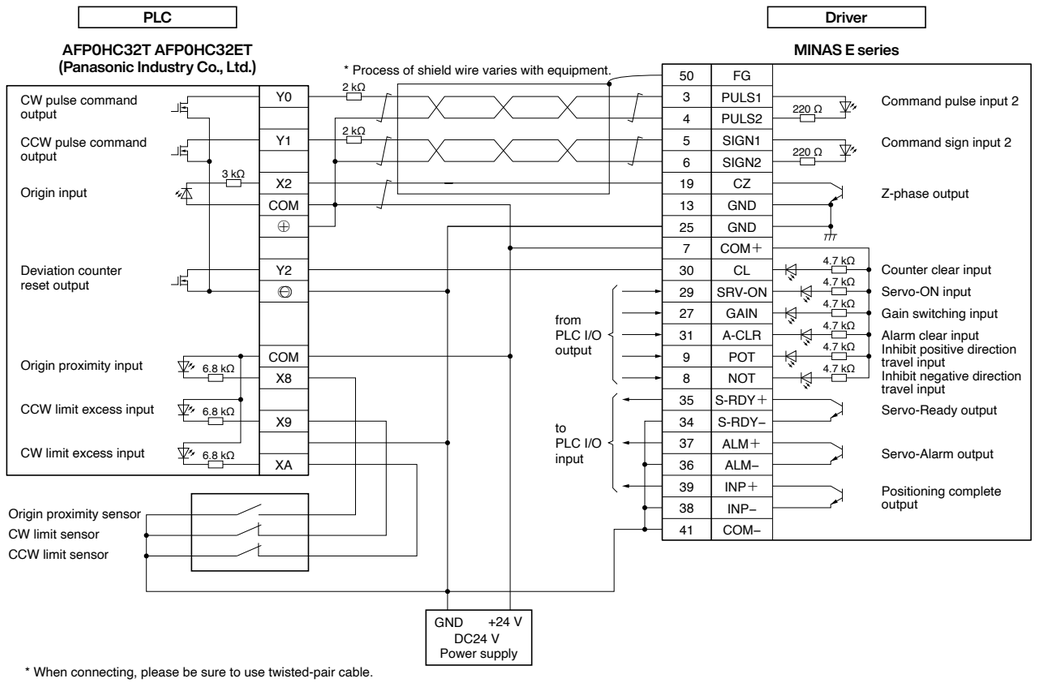
FP0H AFP0HPG01T/L (1 axis) Connection with AFP0HPG02T/L (2 axes)



* When connecting, please be sure to use twisted-pair cable.

Pulse train interface exclusive for line driver.
Use this interface when you use pulse command frequency between 500 kpps and 8 Mpps

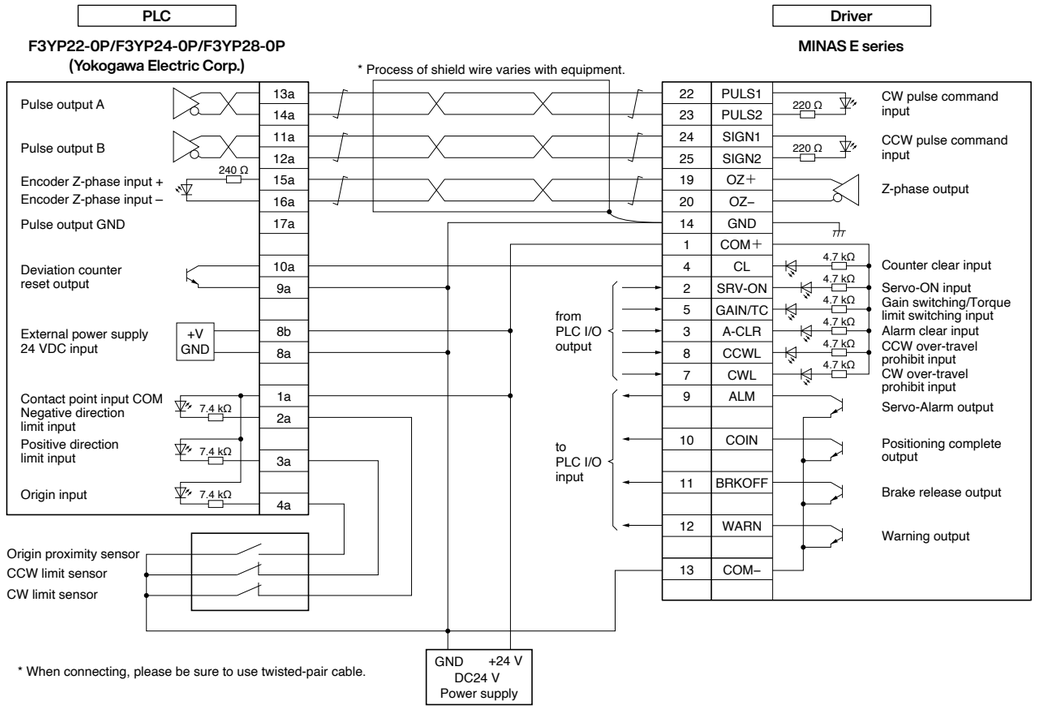
FP0H AFP0HC32T Connection with AFP0HC32ET



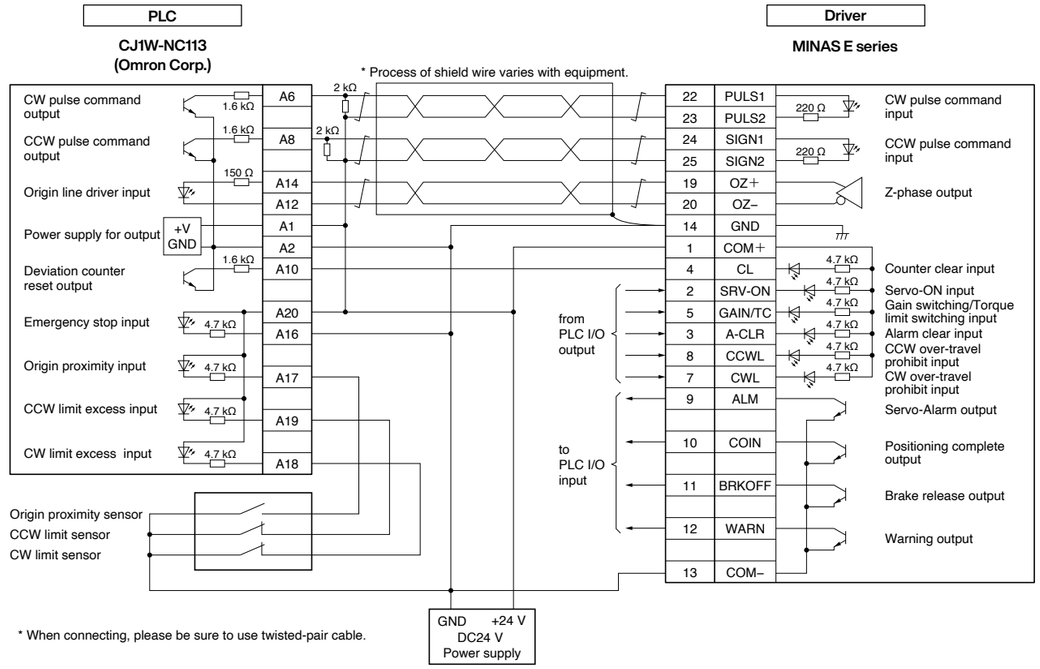
* When connecting, please be sure to use twisted-pair cable.

Connection Between Driver and Controller

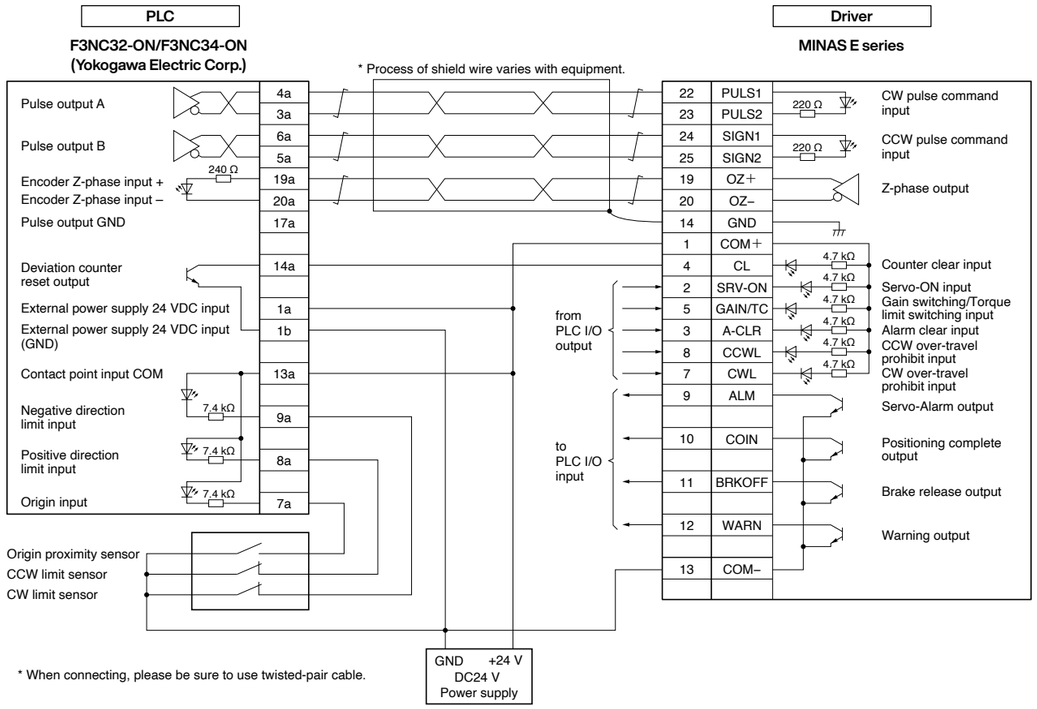
F3YP22-0P/F3YP24-0P/F3YP28-0P Connection with the Yokogawa Electric Corp.



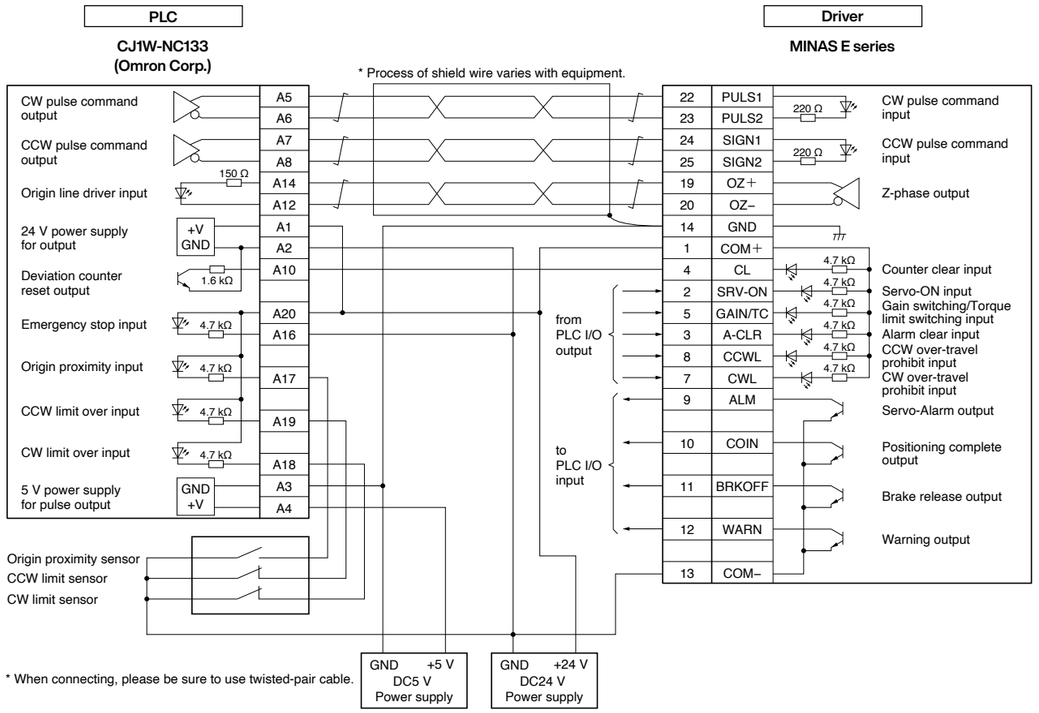
CJ1W-NC113 Connection with the Omron Corp.



F3NC32-ON/F3NC34-ON Connection with the Yokogawa Electric Corp.

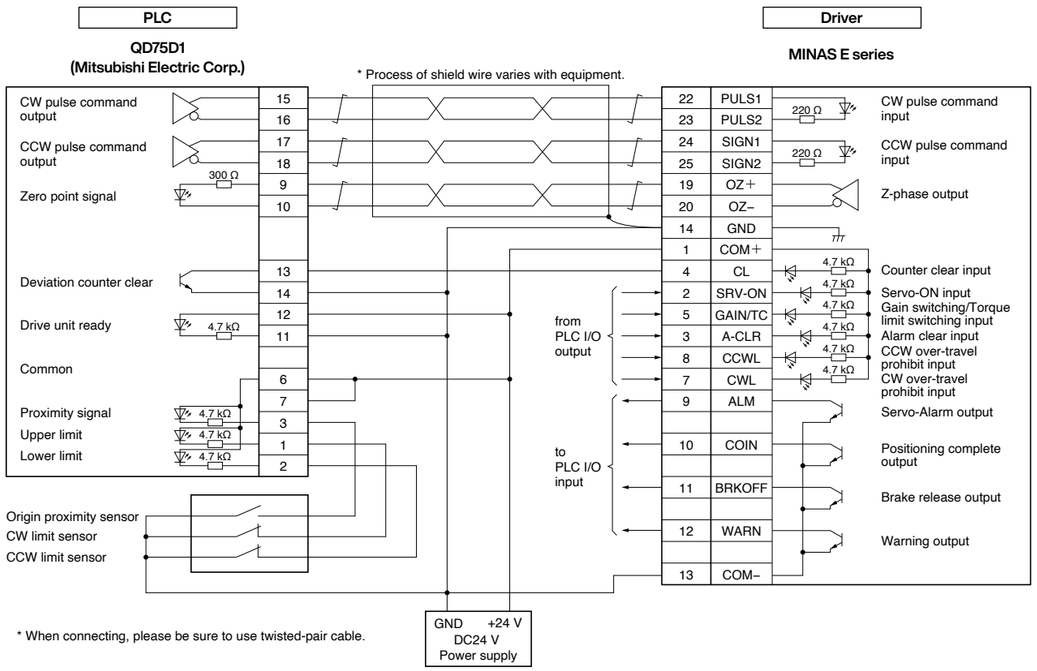


CJ1W-NC133 Connection with the Omron Corp.



Connection Between Driver and Controller

QD75D1 Connection with the Mitsubishi Electric Corp.



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Sales Office

[Panasonic Industry Co., Ltd. Sales Office of Motors]

(November 01, 2023)

Region	Company Name [Category]	City	Address	TEL / FAX
U.S.A	Panasonic Industrial Devices Sales Company of America	New Jersey	Two Riverfront Plaza, 10th Floor Newark, NJ 07102-5490 U.S.A	+1-877-624-7872 / —
			Web site: http://na.industrial.panasonic.com/	
	Component Sales Division		Two Riverfront Plaza, 10th Floor Newark, NJ 07102-5490 U.S.A	+1-800-344-2112 / —
	Energy Sales Division		1701 Golf Road, Suite 3-1100 Rolling Meadows, IL 60008, U.S.A	1-877-PANABAT: +1-877-726-2228 Parts & Accessories: +1-800-332-5368 / —
	Industrial Automation Division		Two Riverfront Plaza, 10th Floor Newark, NJ 07102-5490 U.S.A	Sales Support : +1-800-228-2350, Customer & Technical: +1-877-624-7872 / —
	Food Chain & Building Products Division		Two Riverfront Plaza, 10th Floor Newark, NJ 07102-5490 U.S.A	— / —
Canada	Panasonic Canada Inc	Ontario	5770 Ambler Drive 27, Mississauga, Ontario, L4W 2T3, Canada	+1-905-624-5010 / +1-905-238-4057
Brazil	Panasonic Do Brasil Limitada	São Paulo	Rua Alexandre Dumas, 1711 - 8 Andar torre 11 , Chácara Santo Antônio, São Paulo SP Brazil	— / —
Germany	Panasonic Electric Works Europe AG European Headquarters	Munich	Caroline-Herschel-Straße 100, 85521 Ottobrunn, Germany	+49-89-45354-1000 / +49-89-45354-2111
			Web site: http://www.panasonic-electric-works.com/	
France	French Branch Office	Verrières-Le-Buisson	10, rue des petits ruisseaux, 91370 Verrières-Le-Buisson, France	+ 33 (0) 1-60-13-5757 / + 33 (0) 1-60-13-5758
			Web site: http://www.panasonic-electric-works.fr/	
Italy	Panasonic Industry Italia s.r.l	Verona	Via del Commercio 3-5, 37012 Bussolengo-Ferlina, Italy	+39-45-6752711 / +39-45-6700444
			Web site: http://www.panasonic-electric-works.it/	
Great Britain	Panasonic Electric Works UK Ltd.	Milton Keynes	Sunrise Parkway, Linford Wood, Milton Keynes MK14 6LF, United Kingdom	+44-1908-231-555 / +44-1908-231-599
			Web site: http://www.panasonic-electric-works.co.uk/	
Austria	Panasonic Electric Industry Austria GmbH	Biedermannsdorf	Josef Madersperger Straße 2, 2362 Biedermannsdorf, Austria	+43-2236-26846-7 / +43-2236-46133
			Web site: http://www.panasonic-electric-works.at/	
Poland	Panasonic Industry Poland	Warszawa	Ul. Dowborczykow 25, 90-019 Lodz, Poland	+48-422309633 / —
			Web site: http://www.panasonic-electric-works.pl/	
Benelux	Panasonic Electric Works Sales Western Europe B.V.	PJ Best	De Rijn 4, 5684 PJ Best, Netherlands	+31(0)499-37-27-27 / +31(0)499-37-21-85
			Web site: http://www.panasonic-electric-works.nl/	
Sweden	Sweden Branch Office	Kista	Knarrarnäsgatan 15, 164 40 Kista, Sweden	+46-8-5947-6680 / +46-8-5947-6690
Czech Republic	Panasonic Electric Works Europe AG Czech Representative Office	Brno	Veveri 3163/111, 61600 Brno, Czech Republic	+420-541-217-001 / +420-541-217-101
			Web site: http://www.panasonic-electric-works.cz/	
Spain	Panasonic Industry Iberia S.A.	Madrid	Barajas Park, San Severo 20, 28042 Madrid, Spain	+34-913293875 / +34-913292976
			Web site: http://www.panasonic-electric-works.es/	
Portugal	Portuguese Branch Office	Cascais	Avda Adelino Amaro da Costa, 728-R/C J, 2750-277 Cascais, Portugal	+351-2148-12520 / +351-21-4812529

Sales Office

Region	Company Name [Category]	City	Address	TEL / FAX
Hungary	Panasonic Electric Works Europe AG Hungarian Representative Office	Budapest	Neumann Janos. u. 1., 1117 Budapest, Hungary	+43 2236 26846-25 / +43 2236 46133
Switzerland	Panasonic Industry Switzerland AG	Rotkreuz	Grundstraße 8, 6343 Rotkreuz ZG, Switzerland Web site http://www.panasonic-electric-works.ch/	+41(0)417997054 / +41(0)417997055
Turkey	Panasonic Elektronik Satis A.S., PTR. (Turkey)	Istanbul	Ruzgarlibahce Mah. Sehit Yzb. Sinan Eroglu Cad. No:6 Akel Is Merkezi A Blok Beykoz Kavacik Istanbul, Turkey	+90-216-681-400 / +90-216-681-401
China	Panasonic Hong Kong Co., Limited (PHK) Panasonic Industrial Devices Sales (Hong Kong) Co., Ltd.	Hong Kong	Level 9, Tower II, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong	+852-2367-0181 / +852-2865-3697
	Panasonic Industry (China) Co.,Ltd.	Shanghai	15F, 1601-02, No.18, Lane 666, Haiyang West Road, Pudong New District, Shanghai, 200126, China Web site https://industrial.panasonic.com/ea/	+86-21-38552000 / +86-21-38552370
	Panasonic Industry (China) Co.,Ltd.	Shenzhen	10F, Tower D, China Resources Land Building, No.91 Kefa Road, Nanshan District, Shenzhen, 518057, China Web site https://industrial.panasonic.com/ea/	+86-755-22074488 / +86-755-22074498
	Panasonic Industry (China) Co.,Ltd.	Tianjin	Room 1001, No.75 Nanjing Road, Tianjin 300050, China	+86-22-58969100 / +86-22-58969111
	Panasonic Industry (China) Co.,Ltd.	Guangzhou	17F, Leatop Plaza, 32 Zhujiang East Road, Zhujiang New Town, Guangzhou, 510627, China	+86-20-87130888 / +86-20-87130987
	Panasonic Industry (China) Co.,Ltd.	Qingdao	2108-2109, No.1 Excellence Century Center, 31 Longcheng Road, Shibei District, Qingdao, Shandong Province, 266000, China	+86-532-85971288 / +86-532-85757230
	Panasonic Industry (China) Co.,Ltd.	Dalian	1601C, ShenMao Building, No. 147 Zhongshan Road, Xigang District, Dalian, 116011, China	+86-411-88008676 / 8696 / +86-411-83686802
	Panasonic Industry (China) Co.,Ltd.	Xian	Room 04-05, 7th Floor, Zhong Hai Buliding, No.3 South Furong Road, Yanta District, Xian, 710061, China	+86-29-87607961 / +86-29-87607960
	Panasonic Industry (China) Co.,Ltd.	Wuhan	04-7F, Zhongshan Jiangan District Road No.1627, Wuhan, Hubei, 430030, China	+86-27-85711665 / 6896 / +86-27-86668837
	Panasonic Industry (China) Co.,Ltd.	Chongqing	Room 1610-11, Metropolitan Oriental Plaza, NO. 68 Zhourong Road, YuZhong District, Chongqing, 400010, China	+86-23-63803502 / +86-23-63803503
India	Panasonic Life Solutions India Private Limited INDD - Industrial Devices Division- Sales & Marketing (Gurgaon(HQ))	Delhi	12th Floor, Ambience Corporate Office, Tower-2, Ambience Island, NH-8, Gurgaon-122002, Haryana, India	+91-124-4871300 / +91-124-4751333
	Panasonic Life Solutions India Private Limited INDD - Industrial Devices Division- Sales & Marketing (Bangalore Office)	Bengaluru	"J.P. Chambers" 2nd Floor, #276/22-1, 46th Cross, 5th Block, Jayanagar, Bangalore - 560041	+91-124-6676-311 / —
	Panasonic Life Solutions India Private Limited INDD - Industrial Devices Division- Sales & Marketing (Mumbai Office)	Mumbai	502 / 503, Windfall, Sahar Plaza Complex, JB Nagar Andheri Kurla Road, Andheri (E) Mumbai - 400059, India	+91-22-6196-8480 M: -919004229452 / —

Region	Company Name [Category]	City	Address	TEL / FAX
India	Panasonic Life Solutions India Private Limited INDD - Industrial Devices Division- Sales & Marketing (Chennai Office)	Chennai	Spic House Ann exe, 6th Floor, No.88, Mount Road, Guindy, Chennai - 600032, Tamilnadu	+91-44-6108-9300 / —
	Panasonic Life Solutions India Private Limited INDD - Industrial Devices Division- Sales & Marketing (Pune Office)	Pune	Office No. 401 & 402, Godrej Eternia, Above At Home Centre, Next to Shopper's Stop, Shivaji Nagar, Mumbai Pune Road, Pune - 411005, Maharashtra India	+91-20-67449907 / —
Korea	Panasonic Industrial Devices Sales Korea Co., Ltd.	Seoul	114-38 Teheran-ro, Gangnam-gu, Seoul, 06176, Korea (1004 Daechi dong, DONGIL Tower 5-6F) Web site https://industrial.panasonic.com/kr/	+82-2-795-9600 / +82-2-2052-1053
	Panasonic Industrial Devices Sales Korea Co., Ltd.	Daegu	Sales Facility 101-210, Worldmark Westend, 169, Waryong-ro, Dalseo-gu, Daegu, 42688, Korea	+82-(0)53-710-2301 / +82-(0)53-710-2300
	Panasonic Industrial Devices Sales Korea Co., Ltd.	Cheonan	M-408 MIRAE ACE-HIGHTECHCITY, 10, Baekseokgongdan 1-ro, Seobuk-gu, Cheonan, 31094, Korea	+82-(0)41-622-9128 / +82-(0)41-622-9129
Taiwan	Panasonic Industrial Devices Sales Taiwan Co.,Ltd.	Taipei	12F, No. 9, SongGao Rd. , Taipei 110, Taiwan	+886-2-2757-1900 / +886-2-2758-7502
Southeast Asia	Panasonic Industry Sales Asia Pacific	Singapore	No.3 Bedok South Road, Singapore 469269	+65-6299-9181 / +65-6390-3801
	Malaysia Panasonic Industrial Devices Sales (M) Sdn. Bhd.	Kuala Lumpur	13th Floor, Menara IGB, Mid Valley City, Lingkaran Syed Putra, 59200 Kuala Lumpur, Malaysia	+60-3-2297-6888 / +60-3-2297-6798
	Malaysia Panasonic Industrial Devices Sales (M) Sdn. Bhd.	Pinang	Lebuh Sg. Pinang 5, Promenade 28, 11600 Penang, Malaysia	+60-4-6531-888 / +60-4-6531-899
	Thailand Panasonic Industrial Devices Sales (Thailand) Co., Ltd.	Bangkok	252/133 Muang Thai-Phatra Complex Building, 31st Floor, Ratchadaphisek Road, Huaykwang, Bangkok 10320, Thailand	+66-2693-3403-21 / +66-2693-3422-27
	Thailand Panasonic Solutions (Thailand) Co., Ltd.	Bangkok	252/133 Muang Thai-Phatra Complex Building, 31st Floor, Ratchadaphisek Road, Huaykwang, Bangkok 10320, Thailand	+66-2-693-1870 / +66-2-693-1872
	Indonesia PT. Panasonic Gobel Life Solutions Sales Indonesia	Jakarta	Summitmas 1 Bldg. 8th Floor, Jl. Jend. Sudirman Kav. 61-62, Jakarta 12190 Indonesia	+62-21-252-1616 / +62-21-252-1686
	Vietnam Panasonic Vietnam	Ho Chi Minh	Floor 7, E-Town Building, 364 Cong Hoa, Ward 13, Tan Binh District, Ho Chi Minh City, Vietnam	+84-2838130613-3004 / +84-8-3813-4595
	Vietnam Panasonic Vietnam	Ha Noi	Plot J1-J2, Thang Long Industrial Zone, Dong Anh, Ha Noi, Vietnam	+84-24-3955-111 / —
	Philippines Panasonic Manufacturing Philippines Corporation (Sales Division of PMPC)	Makati	14th Floor, 6788 Ayala Avenue, 1226 Makati City, Philippines	+632-886-6291 / +632-886-6295