

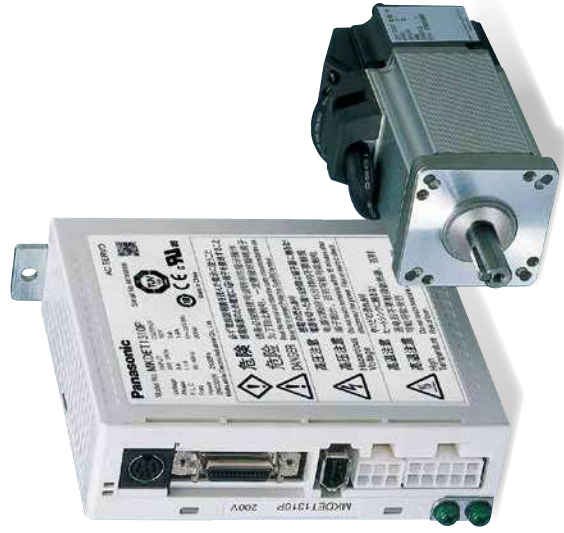
Compact Servo Only for

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.



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

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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.

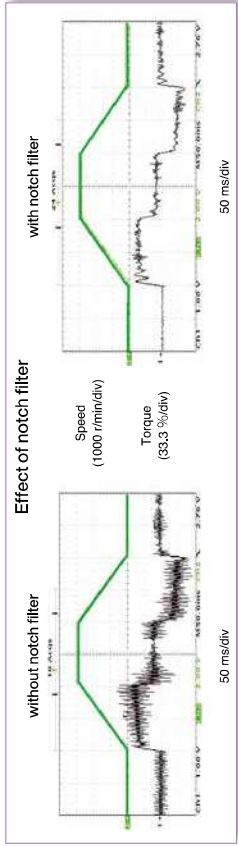
2. Further Reduction of Vibration

Adaptive filter (Note)

- 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 (Note)

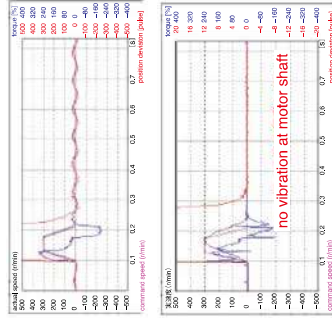
- 1-channel notch filter is equipped in the driver independent from adaptive filter.
- Each of 2 filters can set up frequency and notch width, and frequency in 1Hz unit. Suppression of "Judder" noise of the machine which has multiple resonance points can be expected.



Damping control (Note)

- 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.

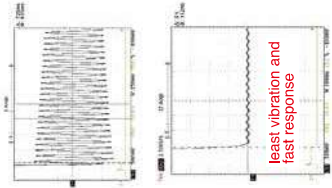
Motor movement



without damping control

with damping control

Machine movement



least vibration and fast response

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 P403, 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



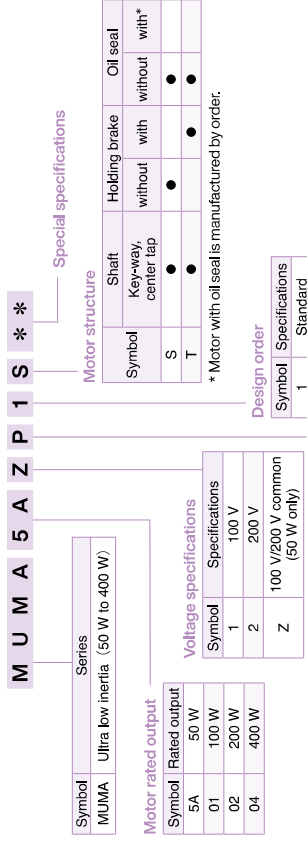
Subject	Standard conformed	Conforms to
Motor	IEC60034-1 IEC60034-5 CSA22.2 No.100	UL 1004 UL 1000 Directives/UK Low Voltage Regulation
EN5011	UL508C CSA22.2 No.14	
EN61000-6-2	Radio Disturbance Characteristics of Industrial, Scientific and Medical (ISM) Radio-Frequency Equipment Immunity for Industrial Environments	Conforms to references by EU EMC Directives/UK EMC Regulation
EN61000-4-2	Electrostatic Discharge Immunity Test	
EN61000-4-3	Radio Frequency Electromagnetic Field Immunity Test	
IEC61000-4-4	Electric High-Speed Transition Phenomenon/Burst Immunity Test	
IEC61000-4-5	Lightning Surge Immunity Test	
IEC61000-4-6	High Frequency Conduction Immunity Test	
IEC61000-4-11	Instantaneous Outage Immunity Test	

EC : International Electrotechnical Commission
EN : Europäischen Normen
EMC : Electromagnetic Compatibility
UL : Underwriters Laboratories
CSA : Canadian Standards Association
 Pursuant to the directive 2004/108/EC article 9(2)

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

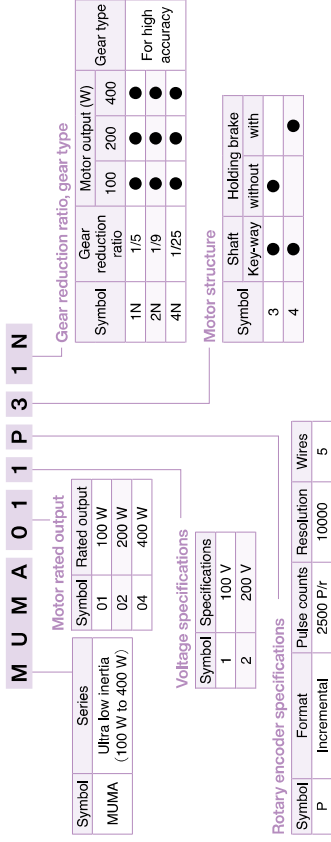
Motor series	Rated output (kW)	Rated rotational speed (Max speed) (r/min)	Rotary encoder		Brake	Gear	UL/CSA	Enclosure	Features	Applications
			2500 P/r incremental	17bit absolute/incremental						
MUMA	0.05 to 0.4	3000 (5000)	○	—	○	○	IP66 Except shaft through-hole and connector	Small capacity Ultra low inertia	SMT machines Inerters High repetitive positioning application	
	0.1									
	0.2									
	0.4									
										
Ultra low inertia										

■ Servo Motor



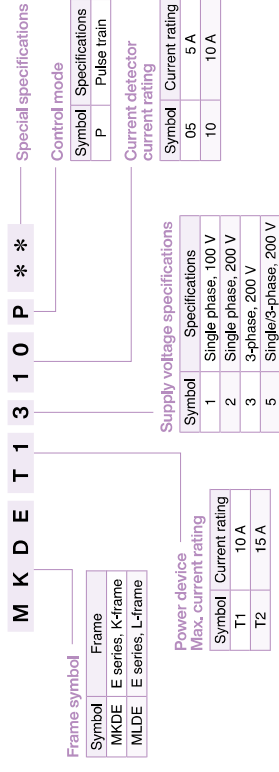
See P.389 for motor specifications

■ Motor with gear reducer



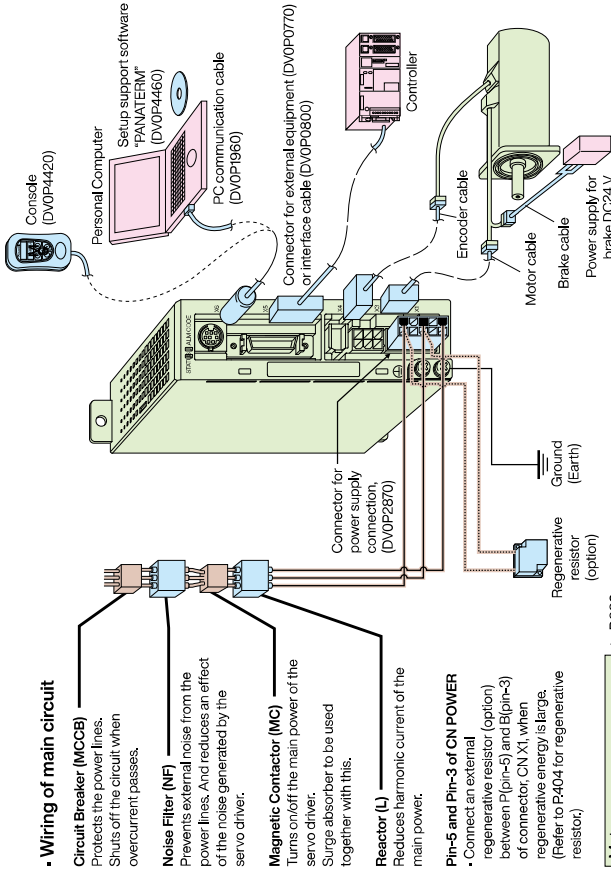
See P.394 for motor with gear reducer specifications

■ Servo Driver



See P.385 for driver specifications

Wiring of main circuit



List of recommended peripheral devices

Power supply	Motor		Power capacity (at rated output)	Circuit Breaker (Rated current)	Noise Filter	Magnetic Contactor (Composition)	Wire diameter (L1, L2, L3, U, V and W)
	Series	Output					
Single phase, 100 V	MUMJA	50 W	0.3 kVA	5 A	DV0P4160	10 A (3P+1a)	0.75 mm ² to 0.85 mm ² AWG18
		100 W	0.4 kVA				
		200 W	0.5 kVA				
Single phase, 200 V	MUMJA	50 W	0.3 kVA	5 A	DV0P4160	15 A (3P+1a)	0.75 mm ² to 0.85 mm ² AWG18
		100 W	0.5 kVA				
		200 W	0.9 kVA				
3-phase 200 V	MUMJA	50 W	0.3 kVA	5 A	DV0P4160	10 A (3P+1a)	0.75 mm ² to 0.85 mm ² AWG18
		100 W	0.5 kVA				
		200 W	0.9 kVA				

- * 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, Ⓢ 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 [X3]
Nominal Fastening torque (N·m) ^(Note 3)	Nominal Fastening torque (N·m) ^(Note 3)
M4	M2.6
0.7 ~ 0.8	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	DV0P4460	398
PANATERM		
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	MFMCA0 * * 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 200 V 100 Ω 10 W	DV0P2890 DV0P2891
Reactor	100 V 200 V	DV0P227 DV0P228 DV0P220
Noise Filter		DV0P4160
Surge Absorber	Single phase 100 V, 200 V 3-phase 200 V	DV0P4190 DV0P1450
Ferrite core		DV0P1460

- (Note 4) Cable set (3 m) contains:
 - Interface cable: DV0P0800
 - Encoder cable (3 m): MFECA000EAM
 - Motor cable (3 m): MFMCA000AEB
 - Connector kit for driver power supply connection: DV0P2870
- Cable set (5 m) contains:
 - Interface cable: DV0P0800
 - Encoder cable (5 m): MFECA000EAM
 - Motor cable (5 m): MFMCA000AEB
 - Connector kit for driver power supply connection: DV0P2870

Table of Part Numbers and Options

Power supply (W)	Output (W)	Motor (Note 1)	Rating/Spec. (page)	Driver	Dimensions (Frame symbol)	Option			
						Brake Cable (Note 2)	External Regenerative Resistor	Reactor	Noise Filter
Single phase 100 V	50	MUMASAZP1 □	389	MKDET110SP	388 (K)				
	100	MUMAO11P1 □	389	MKDET1110P	388 (K)				
	200	MUMAO21P1 □	389	MLDET2110P	388 (L)				
Single phase 200 V	50	MUMASAZP1 □	391	MKDET1505P	388 (K)				
	100	MUMAO12P1 □	391	MLDET2210P	388 (L)				
	200	MUMAO22P1 □	391	MLDET2510P	388 (L)				
3-phase 200 V	50	MUMASAZP1 □	391	MKDET1505P	388 (K)	MFECA0 * * 0EAM	MFMCA0 * * 0AEB		
	100	MUMAO12P1 □	391	MKDET1505P	388 (K)				
	200	MUMAO22P1 □	391	MKDET1310P	388 (K)				
	400	MUMAO42P1 □	391	MLDET2310P	388 (L)				

(Note 1) Motor model number suffix: □

S: Key way with center tap, without brake
T: Key way with center tap, with brake

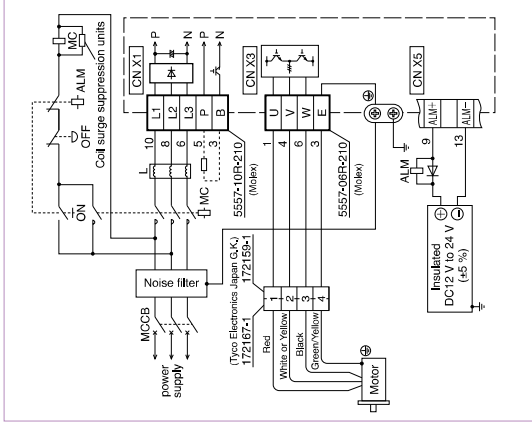
(Note 2) * * represents cable length. For details, refer to P.399.

Basic Specifications	
Input power	Single phase, 100 V 115 V -10% +15% 50 Hz/60 Hz Single phase, 200 V 240 V +10% -15% 50 Hz/60 Hz 3-phase, 200 V 240 V +10% -15% 50 Hz/60 Hz
Environment	Operating: 0 °C to 55 °C, Storage: -20 °C to 65 °C (Max. temperature guarantee 80 °C for 72 hours <Normal temperatures>) Humidity Both operating and storage : 30 %RH or less (free from condensation) Altitude 1000 m or lower Vibration 5.88 mis 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	7 inputs (1) Servo-ON, (2) Alarm clear and other inputs vary depending on the control mode. 4 outputs (1) Servo alarm, (2) Alarm, (3) Release signal of external brake and other outputs vary depending on the control mode. 2 inputs Supports both line driver I/F and open collector I/F. 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.
Pulse signal	1 : 1 communication to a host with RS232 interface is enabled.
Communication function	RS232
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.
Control input	(1) Gain switching, (5) Electronic gear switching
Control output	(1) Positioning complete (In-position)
Max. command pulse frequency	Line driver : 500 kpps, Open collector : 200 kpps
Type of input pulse train	Differential input. Selectable with parameter, ((1) CW/CCW, (2) A and B-phase, (3) Command and Direction)
Electronic gear (Division/multiplication) of command pulse	Setup of electronic gear ratio. Setup range of $(1 \div 10000) \times 2^{(e-17)} / (1 \div 10000)$
Smoothing filter	Primary delay filter or FIR type filter is selectable to the command input.
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 input is enabled.
Auto-gain tuning	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.
Real-time	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.
Normal mode	Masking of the following input signal is enabled. (1) Over-travel inhibition, (2) Speed zero clamp, (3) Torque limit switching
Masking of unnecessary input	Division of encoder feedback pulse
Division of encoder feedback pulse	1 P/r to 2500 P/r (encoder pulses count is the max.).
Protective function	Over-voltage, under-voltage, over-speed over-load, over-heat, over-current and encoder error etc.
Hardware error	Software error
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
Manual	Console
Setup	Setup support software PANATERM (Supporting OS : Windows98, Windows ME, Windows2000, and WindowsXP)
Functions	

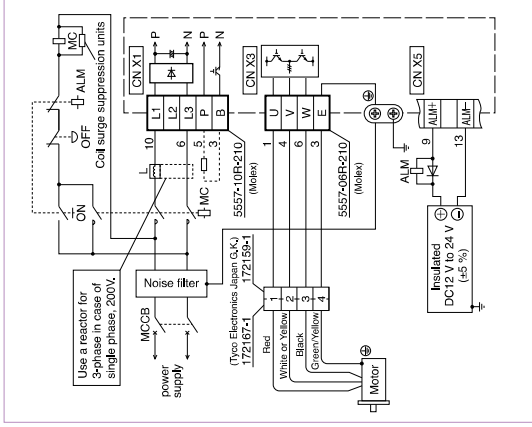
Standard Wiring Example of Main Circuit/
Encoder Wiring Diagram

Standard Wiring Example of Main Circuit

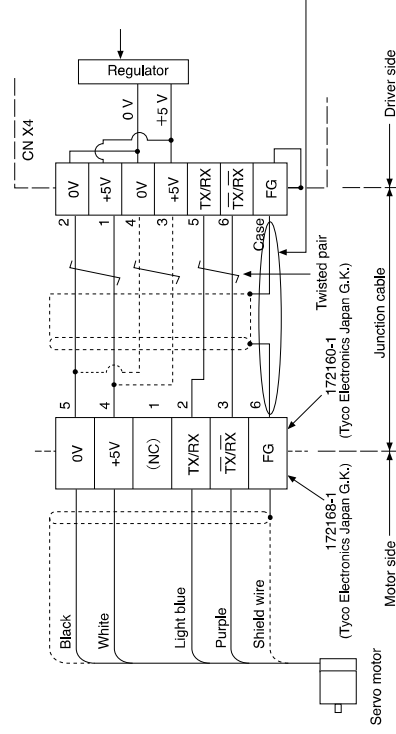
3-Phase, 200 V



Single Phase, 100 V / 200 V



Encoder Wiring Diagram



When you make your own junction cable for encoder (Refer to P401, P402 "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 X5 Wiring Example at Position Control Mode

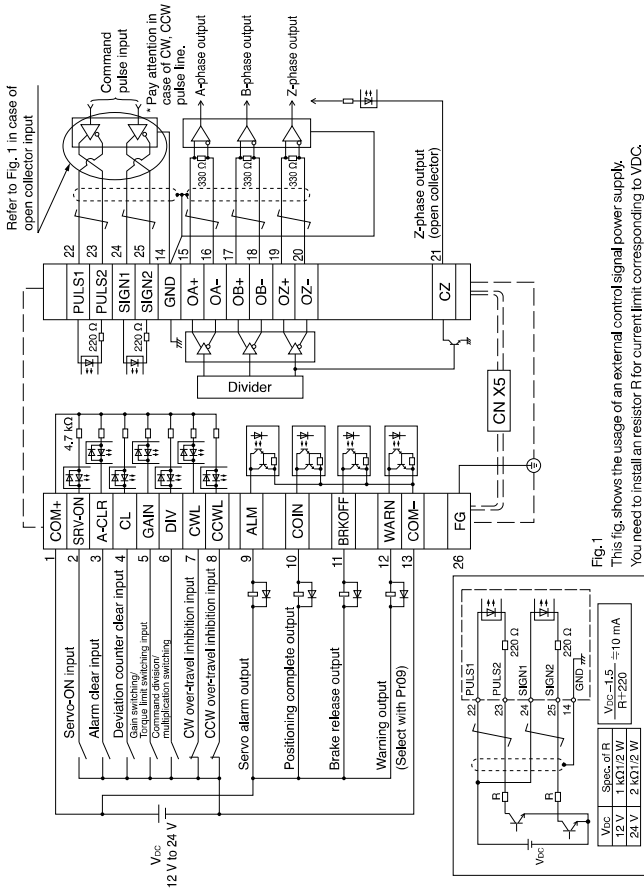
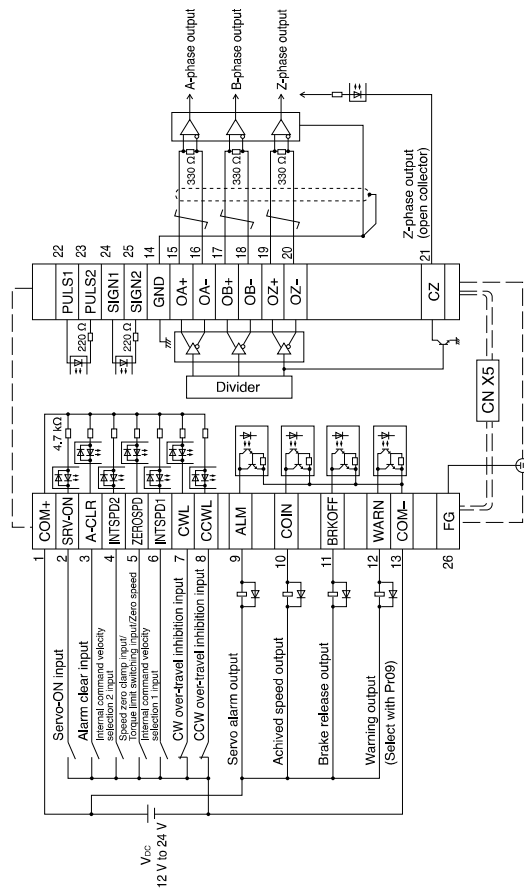
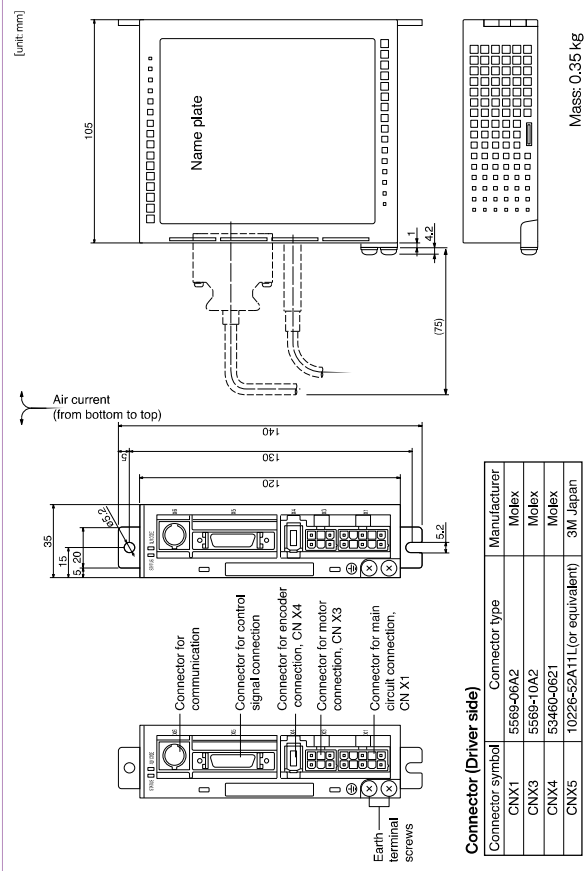


Fig. 1 This fig. shows the usage of an external control signal power supply. You need to install an resistor R for current limit corresponding to VDC.

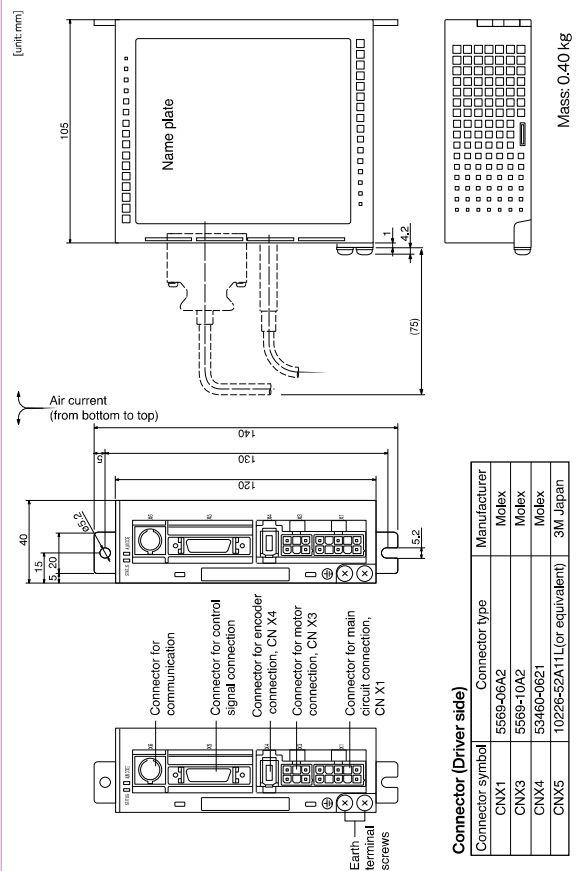
CN X5 Wiring Example at Internal Velocity Control Mode



Frame K



Frame L



		AC100 V			
Motor model	MUMA	5AZP1	011P1	021P1	
Applicable driver	Model No.	MKDET1105P	MKDET1110P	MLDET2110P	Frame L
	Frame symbol	Frame K			
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 (lines/rmin)	Without option Note)1	No limit		Note)2	
Rated rotational speed (r/min)	DV0P2890	No limit		Note)2	
Max. rotational speed (r/min)		3000			
Moment of inertia of rotor	Without brake	0.021	0.032	0.10	
Recommended moment of inertia ratio of the load and the rotor	With brake	0.026	0.036	0.13	
Rotary encoder specifications		30 lines or less			
Resolution per single turn		2500 P/r			
Protective enclosure rating		Incremental			
Ambient temperature		IP65 (except rotating portion of output shaft and lead wire end)			
Ambient humidity		0 °C to 40 °C (free from freezing). Storage: -20 °C to 65 °C (Max. temperature guarantee 80 °C for 72 hours <normal humidity>)			
Installation location		Indoors (no direct sunlight), free from corrosive gas, inflammable gas, oil mist and dust			
Altitude		85 %RH or lower (free from condensing)			
Vibration resistance		1000 m or lower			
Mass (kg), () represents holding brake type		49 m/s ² or less			
		0.4 (0.6)		0.5 (0.7)	0.36 (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)		0.25		0.36	
Releasing voltage		DC 1 V or more			
Exciting voltage		DV 24 V ±10 %			
Permissible load					
Radial load Pd-direction (N)		147		392	
Thrust load Ad-direction (N)		88		147	
Thrust load Bd-direction (N)		117		196	
Radial load Pd-direction (N)		68		245	
Thrust load Ad-direction (N)		53		98	
Thrust load Bd-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)

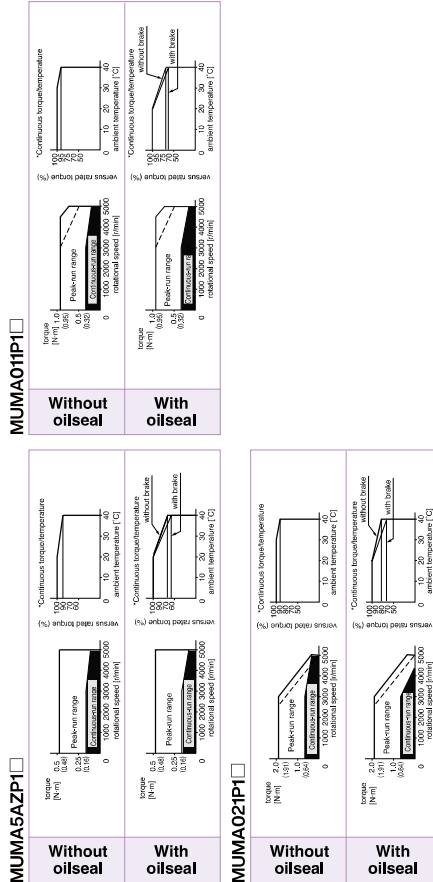
Motor rated output	Specifications
Symbol	Rated output
5A	50 W
01	100 W
02	200 W

Design order 1: Standard	Motor structure
Symbol	Shaft Key-way, center tap
S	without
T	with
	Holding brake
	without
	with
	Oil seal
	without
	with

Rotary encoder specifications

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

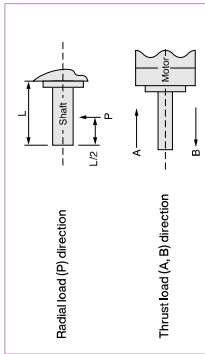
Torque Characteristics (at AC100 V of power voltage (Dotted line represents the torque at 10 % less supply voltage.))



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

Torque

Running range (Torque limit setup: 300%)
Running range (Torque limit setup: 200%)
Running range (Torque limit setup: 100%)
Continuous running range
rotational speed



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 $m = (\text{load moment of inertia}) / (\text{rotor moment of inertia})$.
- 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 continuously such 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 (Z15DH1 by SEMTEC Corporation or equivalent).
() represents the actually measured value using a diode (200 V, 1 A or equivalent)

Motor model		AC200 V			
MUMA		5AZP□	012P□	022P□	042P□
Applicable driver	Model No.	MKDET1505P	MKDET1310P	MLDET2310P	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 (Ac-P)		4.3	4.3	7.5	11.7
Regenerative brake frequency (lines/min)	Without option		No limit	Note)2	
	Note)1	DV0P2891	No limit	Note)2	
Rated rotational speed (r/min)			3000		
Max. rotational speed (r/min)			5000		
Moment of inertia (x10 ⁻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			
	Resolution per single turn	Incremental 10000			
Protective enclosure rating		IP65 (except rotating portion of output shaft and lead wire end)			
Ambient temperature		0 °C to 40 °C (free from freezing). Storage : -20 °C to 65 °C (Max.temperature guarantees 80 °C for 72 hours <normal 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, L)	(L) 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			
Engaging time (ms)		25			
Releasing time (ms)	Note)4	20 (30)			
Exciting current (DC) (A)		0.26			
Releasing voltage		DC 1 V or more			
Exciting voltage		DV 24 V ±10 %			
Permissible load					
During assembly	Radial load P-direction (N)	147			
	Thrust load A-direction (N)	88			
	Thrust load B-direction (N)	117			
During operation	Radial load P-direction (N)	68			
	Thrust load A-direction (N)	58			
	Thrust load B-direction (N)	58			

For motor dimensions, refer to P293, and for the driver, refer to P388.
 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

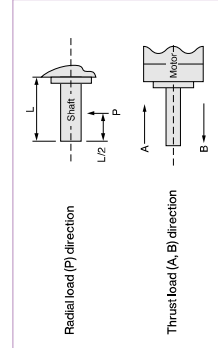
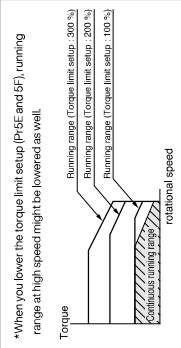
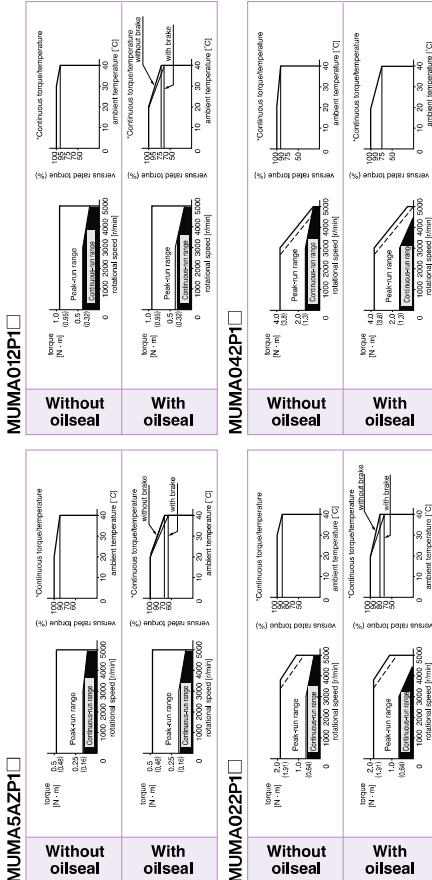
Symbol	Series
MUMA	Ultra low inertia (50 W to 400 W)

Motor rated output	Voltage specifications
Symbol	Symbol
5A	200 V
01	100/200 V
02	100/200 V (50 W only)
04	400 W

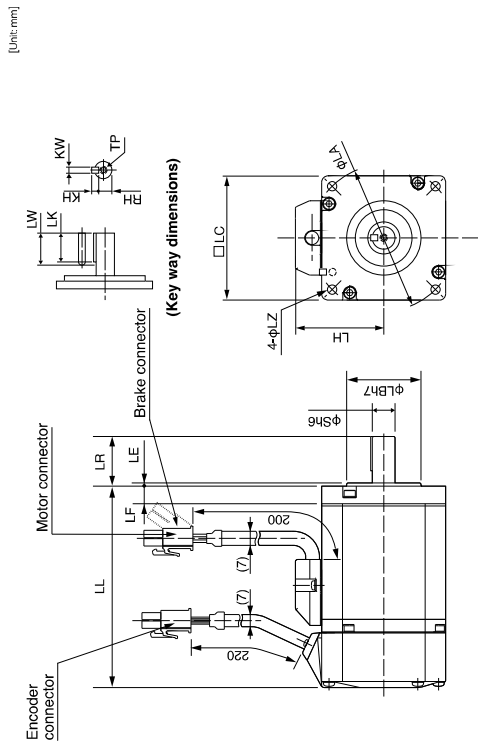
Design order	1: Standard
Motor structure	Shaft
Symbol	Key-way, center tap
S	●
T	●
	Oil seal
	without
	with
	●
	●

Rotary encoder specifications	Format	Pulse counts	Resolution	Wires
Symbol	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).]



- 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 $\frac{1}{m} \cdot n$, where m = (load moment of inertia) / (motor 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.
1. If the effective torque is within the rated torque, there is no limit in regenerative brake.
 2. Consult us or a dealer if the load moment of inertia exceeds the specified value.
 3. Specified releasing time is obtained with the use of surge absorber for brake (Z15D15) by SEMITEC Corporation or equivalent.
 4. () represents the actually measured value using a diode (200 V, 1A or equivalent)



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

[Unit:mm]

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	123.5	
	With brake	107	124	156.5	
	LR	24	30	30	
	S	8	11	14	
	LA	48	48	70	
	LB	22	22	50	
	LC	42	42	60	
	LE	2	2	3	
	LF	7	7	7	
	LH	34	34	43	
Key way	LZ	3.4	3.4	4.5	
	LW	14	14	20	
	LK	12.5	12.5	18	
	KW	319	319	419	
	KH	3	3	4	
	RH	6.2	6.2	8.5	
	TP	M3 × 6 (depth)	M3 × 6 (depth)	M4 × 8 (depth)	M5 × 10 (depth)
	Mass (kg)	Without brake	0.40	0.50	0.96
		With brake	0.60	0.70	1.36
	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.

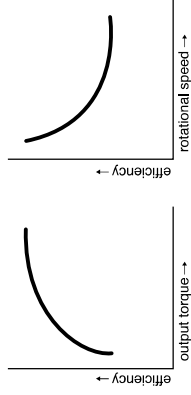
MINAS E Series Motors with Gear Reducer

Motor Types with Gear Reducer

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

For high precision

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)

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

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

Symbol	Key-way	without	with
3	●	●	●
4	●	●	●

Symbol	Shaft	Holding brake
3	●	●
4	●	●

Symbol	Reduction ratio	Motor output	Type of reducer
1N	1/5	●	●
2N	1/9	●	●
4N	1/25	●	●

Specifications of Motor with Gear Reducer

Motor series	MUMA
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)
Ambient temperature	0 °C to 40 °C
Ambient humidity	85 %RH (free from condensation) or less
Vibration resistance	49 m/s ² or less (at motor frame)
Impact resistance	98 m/s ² or less

Table of Motor with Gear Reducer Specifications

Model	Output (W)	Reduction ratio	MUMA with gear reducer				Permissible radial load (N)	Permissible thrust load (N)				
			Output (W)	Rated speed (r/min)	Max. speed (r/min)	Peak max. torque (N·m)			Moment of inertia (motor + reducer/gearmotor to motor shaft) (J (x 10 ⁻⁴ kg·m ²))	Mass (kg)		
MUMA01□P□1N	75	1/5	600	1000	1.18	3.72	0.072	0.076	1.05	1.25	490	245
MUMA01□P□2N	80	1/9	333	555	2.25	6.86	0.0663	0.0703	1.05	1.25	588	294
MUMA01□P□4N	80	1/25	170	200	6.27	19.0	0.0645	0.0685	2.20	2.40	1670	833
MUMA02□P□1N	132	1/5	600	1000	2.65	8.04	0.218	0.248	1.68	2.08	490	245
MUMA02□P□2N	140	1/25	140	120	200	11.1	0.368	0.398	2.66	3.06	1180	588
MUMA02□P□4N	140	1/25	140	120	200	11.1	0.368	0.418	2.66	3.06	1670	833
MUMA042P□1N	340	1/5	600	1000	5.39	16.2	0.533	0.563	3.2	3.6	980	490
MUMA042P□2N	332	1/9	333	555	9.51	28.5	0.438	0.468	3.2	3.6	1180	588
MUMA042P□4N	332	1/25	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	
	Part No. of motor with gear reducer	Part No. of driver	Part No. of motor with gear reducer	Part No. of driver
100 W	MUMA01P□□□	MKDET110P	MUMA012P□□□	MKDET150GP
200 W	MUMA02P□□□	MLDET110P	MUMA022P□□□	MKDET1310P
400 W	-	-	MUMA042P□□□	MLDET2510P
				MLDET2310P

For dimensions of driver, refer to P.388.

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

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

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

Connector Kit for Power Supply Connection

Part No.	DV0P2870			
Parts composition				
Title	Part No.	Number	Manufacturer	Note
Connector (10 pins) Connector pin	5557-10R-210 5556PBTL	1 6	Molex	For connector, CN X1 (10 pins)

- Pin configuration of connector CN X1
(to be prepared by customer)



<Cautions>

- 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.
- Refer to P.386 for wiring and connection.
- 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).

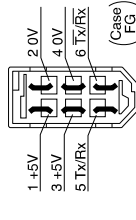
<Parts composition

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

<Remarks>

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

- Pin configuration of connector CN X4 plug



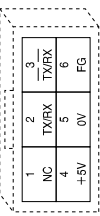
- Recommended manual crimping tool (to be prepared by customer)

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

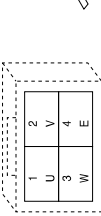
<Remarks>

- 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.
- Connect the shield of the wire to the case (FG) without fail.
- For wiring and connection, refer to P.386.

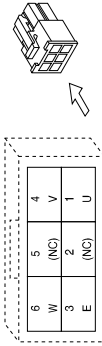
- Pin configuration of encoder cable junction



- Pin configuration of motor power cable junction



- Pin configuration of mating connector to CN X3 connector



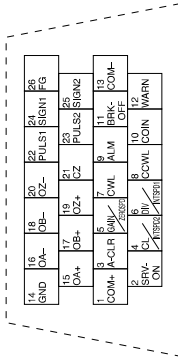
<Cautions>

- 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.
- 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-S2A0-008	1		

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



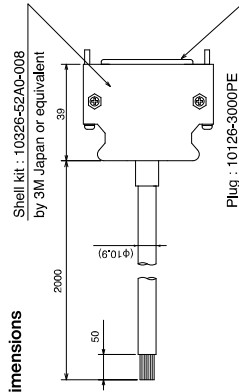
<Cautions>

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

Interface Cable

Part No. DVOP0800

Cable of 2 m is connected.



● Dimensions

Shell kit : 1032B-52AO-008
by 3M Japan or equivalent

Plug : 10126-3000PE
by 3M Japan or equivalent

[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	COM	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	CLINTSPD2	Gray (Black 1)	13	COM+	Gray (Red 2)	22	PULS1	Gray (Red 3)
5	GAINZEROSPD	White (Red 1)	14	GND	Gray (Black 2)	23	PULS2	Gray (Black 3)
6	DWINTSPD1	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	COML	Yellow (Black 1)	17	OB+	Yellow (Red 2)	26	FG	Orange (Black 3)
9	ALM	Pink (Red 1)	18	OB-	Yellow (Black 2)			

<Notes>

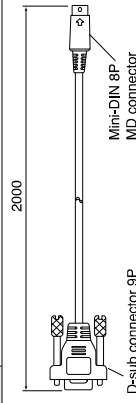
- e. g. of Pin No. designation.
- Pin No. 1 ... Wire color is orange, and one red dot.
- Pin No. 12 ... Wire color is orange, and two black dot.

<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, 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)

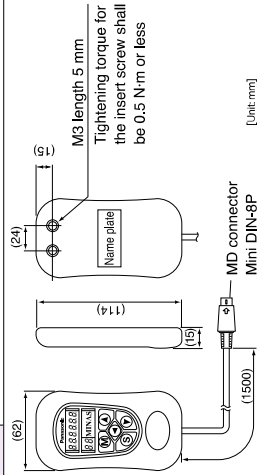
Part No. DVOP1960



[Unit: mm]

Console

Part No. DVOP4420

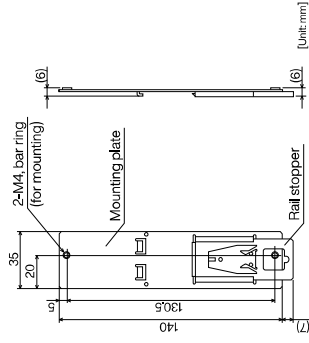


[Unit: mm]

DIN Rail Mounting Unit

Part No. DVOP3811

● Dimensions



[Unit: mm]

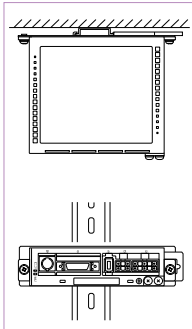
<Notes>

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

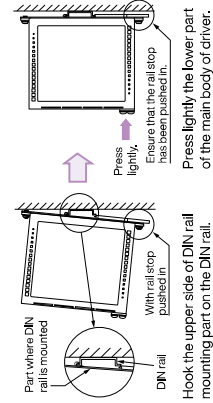
<Cautions>

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

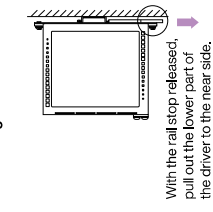


● How to Install



By lifting the driver, you can remove it from the DIN rail.

● Removing from DIN Rail

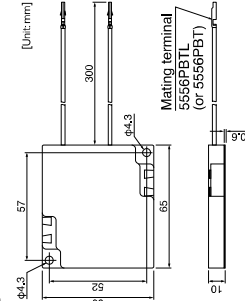


External Regenerative Resistor

Part No.	Manufacturer's Part No.	Specifications		Note (Input Power of drive)
		Resistance Ω	Rated power W	
DVOP2890	45M03	50	10	Single phase, 100 V
DVOP2891	45M03	100	10	Single/3-phase, 200 V

Manufactured by Iwaki Musen Kenkyusho 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>

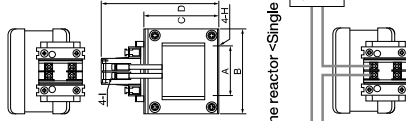
Thermal fuse is installed for safety.

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

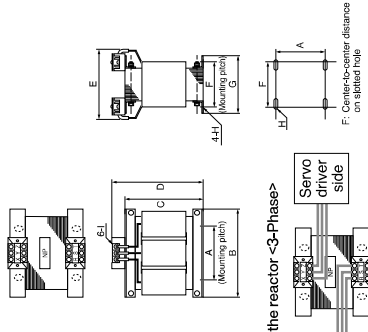
Frame symbol of driver	Power supply specifications	Rated output	Part No.	Fig.
MKDE	Single phase, 100 V	50 W to 100 W	DV0P227	1
	Single phase, 200 V	50 W to 100 W	DV0P220	2
	3-phase, 200 V	50 W to 200 W		
MLDE	Single phase, 100 V	200 W	DV0P228	1
	Single phase, 200 V	200 W to 400 W	DV0P220	2
	3-phase,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

Fig.1



• Wiring of the reactor <Single phase>

Fig.2



• Wiring of the reactor <3-Phase>

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

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	Connector
Molex Japan LLC	+81-462-65-2313 http://www.molex.co.jp	Cable
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

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A6 Series

A6N Series

A6B Series
[Special Order Product]

E Series

Information

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 P27 "Driver and List of Applicable Peripheral Devices". Use a copper cable with temperature rating of 75 °C or higher.

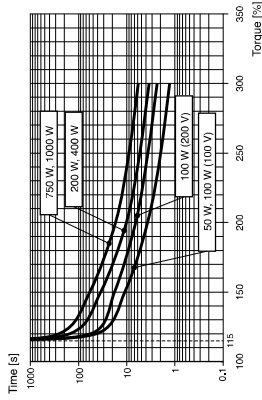
- (3) Over-load protection level

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.

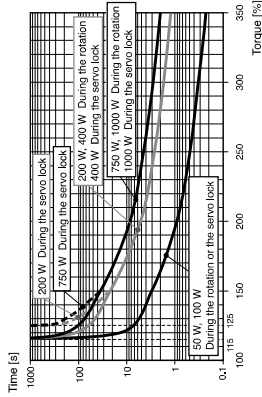
Set up the peak permissible current with Pr0.13 (Setup of 1st torque limit) and Pr5.22 (Setup 2nd torque limit).

Overload protection time characteristics

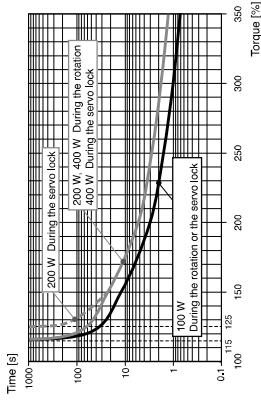
• Motor type: 80 mm sq. or less MSMF



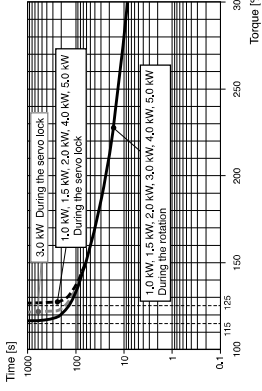
• Motor type: 80 mm sq. or less MHMF



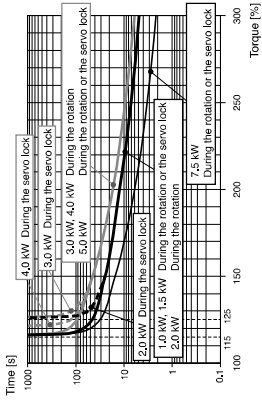
• Motor type: 80 mm sq. or less MQMF



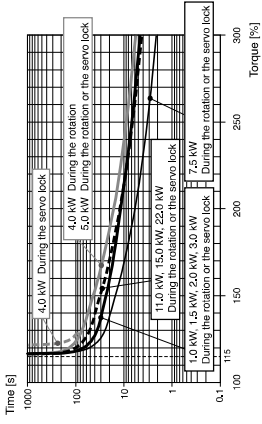
• Motor type: 100 mm sq. or more MSMF



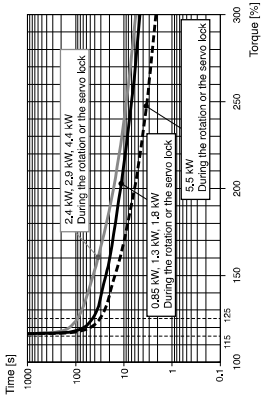
• Motor type: 100 mm sq. or more MHMF



• Motor type: 100 mm sq. or more MDMF



• Motor type: 100 mm sq. or more MGMF



Confirmed Standards

	Driver	Motor
EU/UK Standards	EN55011 EN61000-6-2 EN61000-6-4 EN61800-3	—
EU/UK Standards	EN61800-5-1	EN60034-1 EN60034-5
UL Standards	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	—

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

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

● 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.

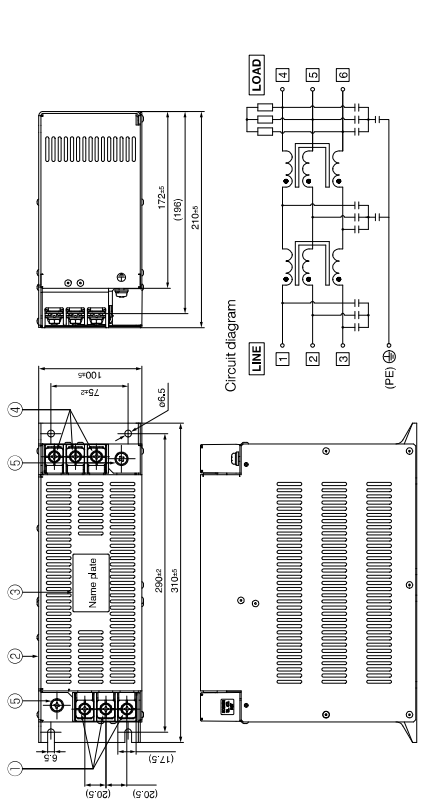
*2 Information related to the Korea Radio Law
This servo driver is a Class A commercial broadcasting radio wave generator not designed for home use. The user and dealer should be aware of this fact.

A 급 기기 (업무용 방송통신기자재)
이 기기는 업무용(A 급) 전자파합격기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.
(적합기준 : Servo Driver)

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>

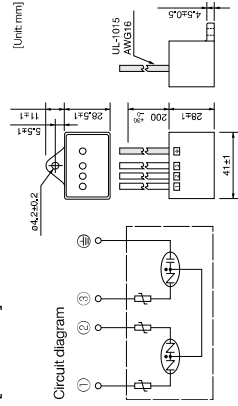
- Select a noise filter of capacity that exceeds the capacity of the power source (also check for load condition).
- For detailed specification of the filter, contact the manufacturer.
- When you install one noise filter at the power supply for multi-axes application, contact the manufacturer of the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

Surge Absorber

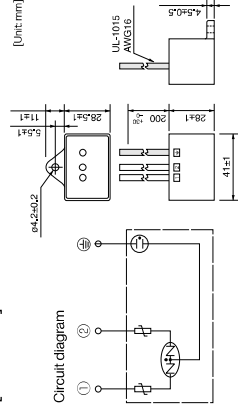
Provide a surge absorber for the primary side of noise filter.

Option part No.	Voltage specifications for driver	Manufacturer's part No.	Manufacturer
DVOP1450	3-phase 200 V	R · A · V-781BXZ-4	Okaya Electric Ind.
DVOP4190	Single phase 100 V, 200 V	R · A · V-781BWZ-4	

[DVOP1450]



[DVOP4190]



<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 G, H	DVOP1460	ZCAT3035-1330 RJ8095	TDK Corp. Konno Kogyosho Co.Ltd	1 3
[NF2]	Motor cable	A, B, C, D, E F G, H	DVOP1460	ZCAT3035-1330 T400-61D	TDK Corp. MICROMETALS	1 2 3 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: DVOP1460 (Option) 4 pieces

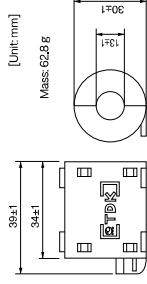


Fig.3: T400-61D (Recommended components) 1 pieces

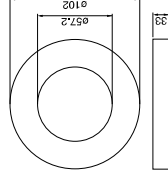
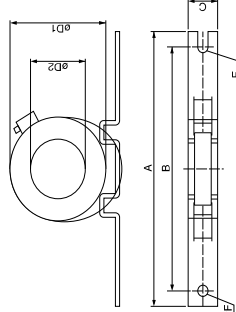


Fig.2: RJ8095 (Recommended components) 1 pieces



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

- Connect the protective earth terminal (PE) of the driver and the protective earth terminal (PE) of the control box without fail to prevent electrical shocks.
- Do not make a joint connection to the protective earth terminals (PE). 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 modal 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	IEC Standard	Conformed Standard
Motor	IEC60034-5 UL1004 CSA222 No.100	Conforms to EU Low Voltage Directives/UK Low Voltage Regulation
EN55011	UL1600-5-1 CSA222 No.14	Radio Disturbance Characteristics of Industrial, Scientific and Medical (ISM) Radio-Frequency Equipment
EN61000-6-2	Immunity for Industrial Environments	
IEC61000-4-2	Electrostatic Discharge Immunity Test	Conforms to references by EU EMC Directives/UK EMC Regulation
IEC61000-4-3	Radio Frequency Electromagnetic Field Immunity Test	
IEC61000-4-4	Electric High-Speed Transition Phenomenon/Burst Immunity Test	
IEC61000-4-5	Lightning 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)

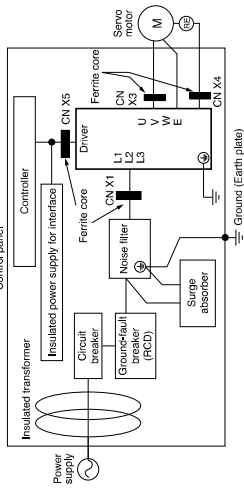
Composition of Peripheral Components

<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 (eg. Install the driver in control panel with IP54 protection structure.)



Power Supply

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

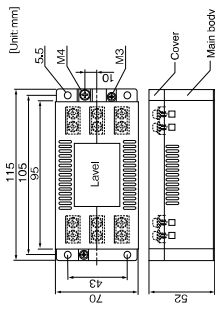
Circuit Breaker

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.

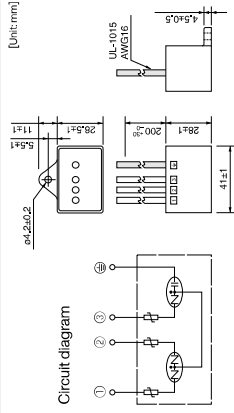
Option part No.	Part No.	Manufacturer
DV0P1460	3SUP-HU10-ER-6	Okaya Electric Industries Co.



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-781 BXZ-4	Okaya Electric
DV0P1490	Single phase, 100 V, 200 V	R-A-V-781 BWZ-4	Okaya Electric



<Remarks>

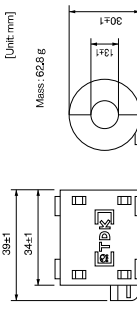
Remove this surge absorber when you perform dielectric test on the machine, or surge absorber might be damaged.

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")



Grounding

(1) Connect the protective earth terminal of the driver (PE) and protective earth terminal of the control panel (PE) without fail to prevent electrical shocks.

(2) Do not co-clamp to the ground terminals (PE). Two ground terminals are provided.

Ground-Fault Breaker

Install a ground fault circuit breaker (GFCI) 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 pull-down menu.



Driver series

Motor type

Motor specification

Model number input area

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.



Tab

* 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/www/products/motors-compressors/fa-motors/ac-servo-motors/minas-a5-panamترم>

SI unit ——— Table 5: Prefix (Multiples of 10)



Table1: Basic unit

Table 4: Unit combined with SI unit

Table 1: 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	mole	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	1Hz = 1s ⁻¹
Force	newton	N	1N = 1kg/m/s ²
Pressure, Stress	pascal	Pa	1Pa = 1N/m ²
Energy, Work, Amount of heat	joule	J	1J = 1Nm
Amount of work, Work efficiency, Power, Electric power	watt	W	1W = 1J/s
Electric charge, Amount of electricity	coulomb	C	1C = 1As
Electric potential, Potential difference, Voltage, Electromotive force	volt	V	1V = 1J/C
Electrostatic capacity, Capacitance	farad	F	1F = 1C/V
Electric resistance	ohm	Ω	1Ω = 1VA
Electric conductance	siemens	S	1S = 1Ω ⁻¹
Magnetic flux	weber	Wb	1Wb = 1Vs
Magnetic flux density, Magnetic induction	tesla	T	1T = 1Wb/m ²
Inductance	henry	H	1H = 1Wb/A
Degree centigrade (Celsius)	degree centigrade (Celsius) / degree	°C	t °C = (t+273.15) K
Luminous flux	lumen	lm	1lm = 1cdsr
Illuminance	lux	lx	1lx = 1lm/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
	ton	t

Table 5: Prefix

Multiples powered to unit	Name	Symbol	Prefix
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 ¹	deca	da	
10 ⁰	deci	d	
10 ⁻¹	centi	c	
10 ⁻²	milli	m	
10 ⁻³	micro	μ	
10 ⁻⁶	nano	n	
10 ⁻⁹	pico	p	
10 ⁻¹²	femto	f	
10 ⁻¹⁵	atto	a	

Quantity	Symbol of conventional unit	Symbol of SI unit and compatible unit	Conversion value
Length	μ (micron)	μm	$1\mu = 1\mu\text{m}$ (micrometer)
Acceleration	Gal G	ms^{-2} ms^{-2}	$1\text{Gal} = 10^{-2} \text{ms}^{-2}$ $1\text{G} = 9.80665 \text{ms}^{-2}$
Frequency	c/s, c	Hz	$1\text{c/s} = 1\text{Hz}$
Revolving speed, Number of revolutions	rpm	s^{-1} or min^{-1} , r/min	$1\text{rpm} = 1\text{min}^{-1}$
Weight	kgf	kg	Same value
Weight flow rate	kgf/s	kg/s	
Mass flow rate	kgf/m ³	kg/m ³	
Specific weight	kgf/m ³	kg/m ³	Same value
Density	m ² /kgf	m ² /kg	
Specific volume	kgf	N	Same value
Load	kgf	N	$1\text{kgf} = 9.80665\text{N}$
Force	dyn	N	$1\text{kgf} = 9.80665\text{N}$ $1\text{dyn} = 10^{-5}\text{N}$
Moment of force	kgf·m	N·m	$1\text{kgf·m} = 9.806\text{N·m}$
Pressure	kgf/cm ²	Pa, bar ⁽¹⁾ or kgf/cm ²	$1\text{kgf/cm}^2 = 9.80665 \times 10^4 \text{Pa}$ $= 0.980665 \text{bar}$
Stress	at (Engineering atmospheric pressure) atm (Atmospheric pressure) mm-H ₂ O, mAq mmHg Torr	Pa	$1\text{at} = 9.80665 \times 10^4 \text{Pa}$
		Pa	$1\text{atm} = 1.01325 \times 10^5 \text{Pa}$
		Pa	$1\text{mmH}_2\text{O} = 9.80665 \times 10^1 \text{Pa}$
		Pa or mmHg ⁽²⁾	$1\text{mmHg} = 133.322 \text{Pa}$
Elastic modulus	kgf/mm ²	Pa or N/mm ²	$1\text{kgf/mm}^2 = 9.80665 \times 10^6 \text{Pa}$ $= 9.80665 \times 10^6 \text{N/m}^2$
	kgf/cm ²	Pa or N/mm ²	$1\text{kgf/cm}^2 = 9.80665 \times 10^4 \text{Pa}$ $= 9.80665 \times 10^4 \text{N/m}^2$
Energy, Work	kgf·m	Pa or N/m ²	$1\text{kgf·m} = 9.80665 \text{J}$
	erg	J (joule)	$1\text{erg} = 10^{-7} \text{J}$
Work efficiency, Power	kgf·m/s	W (watt)	$1\text{kgf·m/s} = 9.80665 \text{W}$
	PS	W	$1\text{PS} = 0.7355 \text{KW}$
Viscosity	PP	Pa·s	$1\text{P} = 0.1\text{Pa·s}$
	St	mm ² /s	$10^{-2} \text{St} = 1\text{mm}^2/\text{s}$
Thermodynamic temperature	K	K (kelvin)	$1\text{K} = 1\text{K}$
	deg	deg	$1\text{deg} = 1\text{K}$
Amount of heat	cal	J	$1\text{cal} = 4.18605 \text{J}$
	cal/°C	J/K ⁽³⁾	$1\text{cal}/^\circ\text{C} = 4.18605 \text{J/K}$
Specific heat, Specific heat capacity	cal/(kgf·°C)	cal/(kgf·K) ⁽³⁾	$1\text{cal}/(\text{kgf}\cdot^\circ\text{C}) = 4.18605 \text{J}/(\text{kg}\cdot\text{K})$
	cal/K	J/K	$1\text{cal/K} = 4.18605 \text{J/K}$
Specific entropy	cal/(kgf·K)	J/(kgf·K)	$1\text{cal}/(\text{kgf}\cdot\text{K}) = 4.18605 \text{J}/(\text{kg}\cdot\text{K})$
	cal	J	$1\text{cal} = 4.18605 \text{J}$
Specific internal energy (Specific enthalpy)	cal/kgf	J/kg	$1\text{cal}/\text{kgf} = 4.18605 \text{J/kg}$
	cal/h	W	$1\text{cal/h} = 1.16279 \text{W}$
Heat flux density	cal/(h·m ²)	W/m ²	$1\text{cal}/(\text{h}\cdot\text{m}^2) = 1.16279 \text{W/m}^2$
	cal/(h·m ² ·°C)	W/(h·m ² ·°C)	$1\text{cal}/(\text{h}\cdot\text{m}^2\cdot^\circ\text{C}) = 1.16279 \text{W}/(\text{m}^2\cdot\text{K})$
Coefficient of thermal conductivity	cal/(h·m ² ·°C)	W/(m ² ·K) ⁽³⁾	$1\text{cal}/(\text{h}\cdot\text{m}^2\cdot^\circ\text{C}) = 1.16279 \text{W}/(\text{m}^2\cdot\text{K})$
	cal/(h·m ² ·°C)	W/(m ² ·K) ⁽³⁾	
Intensity of magnetic field	Oe	A/m	$1\text{Oe} = 10^3/4\pi \text{A/m}$
	Mx	Wb (weber)	$1\text{Mx} = 10^{-8} \text{Wb}$
Magnetic flux density	Gs	T (tesla)	$1\text{Gs} = 10^{-4} \text{T}$

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

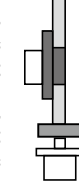
Flow of Motor Selection

1. Definition of mechanism to be driven by motor.

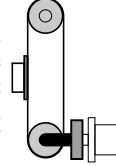
Define details of individual mechanical components (ball screw length, lead and pulley diameters, etc.)

<Typical mechanism>

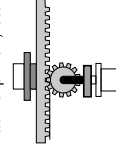
Ball screw mechanism



Belt mechanism

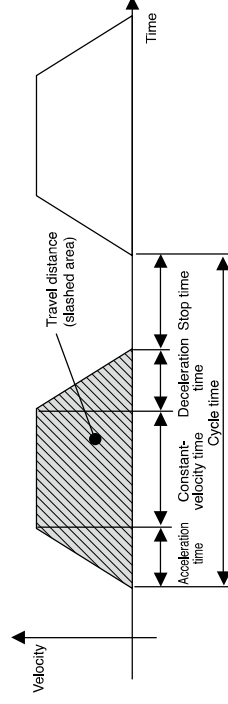


Rack & pinion, etc.



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 $\text{kg}\cdot\text{m}^2$.

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.

Selecting Motor Capacity

Description on the Items Related to Motor Selection

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

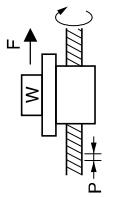
Indicates the torque that the motor requires for a long time. The reference value is 80% or less of the rated motor torque. If the torque is a negative value, a regenerative discharge resistor may be required.

Traveling torque calculation formula for each mechanism

Ball screw mechanism

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

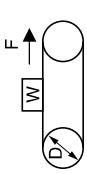
W : Weight [kg]
P : Lead [m]
F : External force [N]
 η : Mechanical efficiency
 μ : Coefficient of friction
g : Acceleration of gravity 9.8[m/s²]



Belt mechanism

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

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/s²]



(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.

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

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

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 	$J = \frac{1}{8} WD^2$ [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 	$J = \frac{1}{3} WL^2$ [kg·m ²] W : Weight [kg] L : Length [m]	Separated rod 	$J = \frac{1}{8} WD^2 + WS^2$ [kg·m ²] W : Weight [kg] D : Outer diameter [m] S : Distance [m]
Reduction gear 	Inertia on shaft "a" $J = J_1 + \left(\frac{n_2}{n_1}\right)^2 J_2$ [kg·m ²] n ₁ : A rotational speed of a shaft [r/min] n ₂ : A rotational speed of b shaft [r/min]	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
Conveyor 	$J = \frac{1}{4} WD^2$ [kg·m ²] W : Workpiece weight on conveyor [kg] D : Drum diameter [m] * Excluding drum J		

If weight (W [kg]) is unknown, calculate it with the following formula:

$$\text{Weight } W[\text{kg}] = \text{Density } \rho [\text{kg}/\text{m}^3] \times \text{Volume } V[\text{m}^3]$$

Density of each material

$$\text{Iron } \rho = 7.9 \times 10^3 [\text{kg}/\text{m}^3]$$

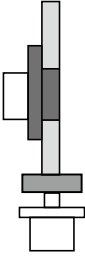
$$\text{Aluminum } \rho = 2.8 \times 10^3 [\text{kg}/\text{m}^3]$$

$$\text{Brass } \rho = 8.5 \times 10^3 [\text{kg}/\text{m}^3]$$

To Drive Ball Screw Mechanism

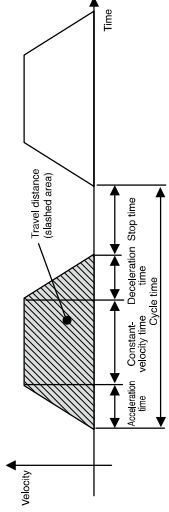
1. Example of motor selection for driving ball screw mechanism

- Workpiece weight WA = 10 [kg]
- Ball screw length BL = 0.5 [m]
- Ball screw diameter BD = 0.02 [m]
- Ball screw lead BP = 0.02 [m]
- Ball screw efficiency B_η = 0.9
- Travel distance 0.3[m]
- Coupling inertia Jc = 10 X 10⁻⁶ [kg·m²] (Use manufacturer-specified catalog value, or calculation value.)



2. Running pattern :

- Acceleration time ta = 0.1 [s]
- Constant-velocity time tb = 0.8 [s]
- Deceleration time td = 0.1 [s]
- Cycle time tc = 2 [s]
- Travel distance 0.3[m]



3. Ball screw weight $BW = \rho \times \pi \times \left(\frac{BD}{2}\right)^2 \times BL = 7.9 \times 10^3 \times \pi \times \left(\frac{0.02}{2}\right)^2 \times 0.5 = 1.24$ [kg]

4. Load inertia $JL = Jc + JB + \frac{1}{8}BW \times BD^2 + \frac{WA \cdot BP^2}{4\pi^2} = 0.00001 + (1.24 \times 0.02^2) / 8 + 10 \times 0.02^2 / 4\pi^2 = 1.73 \times 10^{-4}$ [kg·m²]

5. Provisional motor selection

In case of MSMF 200 W motor : JM = 0.14 x 10⁻⁴ [kg·m²]

6. Calculation of inertia ratio

JL / JM = 1.73 x 10⁻⁴ / 0.14 x 10⁻⁴ Therefore, the inertia ratio is "12.3" (less than "30")
(In case of MSMF 100 W motor: JM = 0.048 x 10⁻⁴ Therefore, the inertia ratio is "36.0")

7. Calculation of maximum velocity (Vmax)

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

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

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

9. Calculation of torque

Traveling torque Tf = $\frac{BP}{2\pi B_{\eta}} (\mu gWA + F) = \frac{0.02}{2\pi \times 0.9} (0.1 \times 9.8 \times 10 + 0) = 0.035$ [N·m]

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

Deceleration torque Td = $\frac{(JL + JM) \times 2\pi N [r/s]}{\text{Deceleration time [s]}} - \text{Traveling torque}$
 = $\frac{(1.73 \times 10^{-4} + 0.14 \times 10^{-4}) \times 2\pi \times 16.7}{0.1} - 0.035$
 = 0.196 - 0.035 = 0.161 [N·m]

10. Verification of maximum torque

Acceleration torque = Ta = 0.231 [N·m] < 1.91 [N·m] (Maximum torque of MSMF 200 W motor)

11. Verification of effective torque

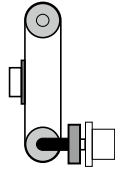
$T_{rms} = \sqrt{\frac{Ta^2 \times ta + Td^2 \times td + Tc^2 \times tc}{tc}}$
 = $\sqrt{\frac{0.231^2 \times 0.1 + 0.035^2 \times 0.8 + 0.161^2 \times 0.1}{2}}$
 = 0.067 [N·m] < 0.64 [N·m] (Rated torque of MSMF 200 W motor)

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

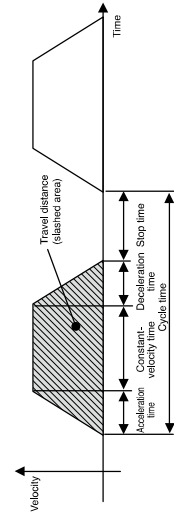
Example of motor selection for timing belt mechanism

- 1. Mechanism Workpiece weight WA = 2 [kg] (including belt)
- Pulley diameter Pd = 0.05 [m]
- Pulley weight Wp = 0.5 [kg] (Use manufacturer-specified catalog value, or calculation value.)
- Mechanical efficiency B_η = 0.8
- Coupling inertia Jc = 0 (Direct connection to motor shaft)
- Belt mechanism inertia JB
- Pulley inertia JP



2. Running pattern

- Acceleration time ta = 0.1 [s]
- Constant-velocity time tb = 0.8 [s]
- Deceleration time td = 0.1 [s]
- Cycle time tc = 2 [s]
- Travel distance 1 [m]



3. Load inertia JL = Jc + JB + JP

= $Jc + \frac{1}{4}WA \times Pd^2 + \frac{1}{8}Wp \times Pd^2 \times 2$
 = $0 + \frac{1}{4} \times 2 \times 0.05^2 + \frac{1}{8} \times 0.5 \times 0.05^2 \times 2$
 = 0.00156 = 15.6 x 10⁻⁴ [kg·m²]

4. Provisional motor selection

In case of MSMF 750 W motor : JM = 0.96 x 10⁻⁴ [kg·m²]

5. Calculation of inertia ratio

JL / JM = 15.6 x 10⁻⁴ / 0.96 x 10⁻⁴ Therefore, the inertia ratio is "16.3" (less than "20")

6. Calculation of maximum velocity (Vmax)

$$\frac{1}{2} \times \text{Acceleration time} \times V_{\text{max}} + \text{Constant-velocity time} \times V_{\text{max}} + \frac{1}{2} \times \text{Deceleration time} \times V_{\text{max}} = \text{Travel distance}$$

$$\frac{1}{2} \times 0.1 \times V_{\text{max}} + 0.8 \times V_{\text{max}} + \frac{1}{2} \times 0.1 \times V_{\text{max}} = 1$$

$$0.9 \times V_{\text{max}} = 1$$

$$V_{\text{max}} = 1 / 0.9 = 1.111 [\text{m/s}]$$

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

A single rotation of pulley : $\pi \times \text{Pd} = 0.157 [\text{m}]$

$$N = 1.111 / 0.157 = 7.08 [\text{r/s}]$$

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

8. Calculation of torque

Traveling torque

$$T_f = \frac{P_D}{2.7} (\mu g W_A + F) = \frac{0.05}{2} \times 0.8 (0.1 \times 9.8 \times 3 + 0)$$

$$= 0.061 [\text{N} \cdot \text{m}]$$

Acceleration torque

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

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

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

Deceleration torque

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

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

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

9. Verification of maximum torque

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

10. Verification of effective torque

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

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

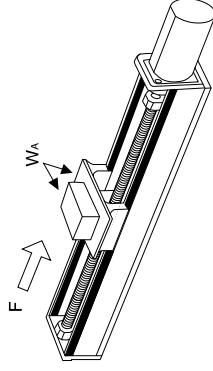
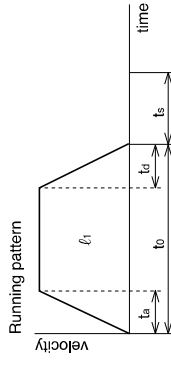
$$= 0.237 [\text{N} \cdot \text{m}] < 2.4 [\text{N} \cdot \text{m}] \text{ (Rated torque of MSMF 750 W motor)}$$

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

Request for motor selection I : Ball screw drive

1. Driven mechanism and running data

- 1) Travel distance of the work load per one cycle
 - 2) Cycle time
- (Fill in items 3) and 4) if required.)
- 3) Acceleration time
 - 4) Deceleration time
 - 5) Stopping time
 - 6) Max. velocity
 - 7) External force
 - 8) Positioning accuracy of the work load
 - 9) Total weight of the work load and the table
 - 10) Power supply voltage
 - 11) Diameter of the ball screw
 - 12) Total length of the ball
 - 13) Lead of the ball screw
 - 14) Travelling direction (horizontal, vertical etc.)



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

(Blank area for other data)	Company name : _____ Department/Section : _____ Name : _____ Address : _____ Tel : _____ Fax : _____ E-mail address : _____
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Request Sheet for Motor Selection

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

1. Driven mechanism and running data

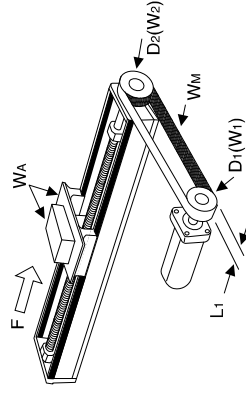
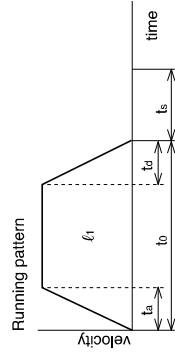
- | | | | | | | | | |
|---|------------|----|------------------|------------------|------------------|-----------------|------------------|----|
| 1) Travel distance of the work load per one cycle | ℓ_1 : | mm | Motor side | D ₁ : | mm | Ball screw side | D ₂ : | mm |
| 2) Cycle time | to: | s | W ₁ : | kg | W ₂ : | kg | | |

(Fill in items 3) and 4) if required.)

- | | | | | |
|----------------------|-----|---|------------------|----|
| 3) Acceleration time | ta: | s | L ₁ : | mm |
| 4) Deceleration time | td: | s | | |
| 5) Stopping time | ts: | s | W _W : | kg |

(or item 17) and 18)

- | | | | | |
|--|------------------|------|----|---|
| 6) Max. velocity | V: | mm/s | F: | N |
| 7) External force | ± | mm | | |
| 8) Positioning accuracy of the work load and the table | W _A : | kg | | |



1. Driven mechanism and running data

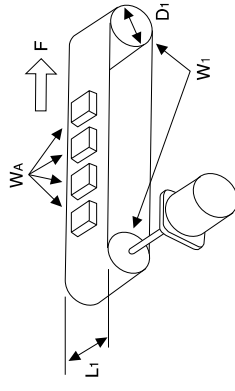
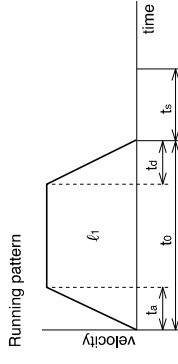
- | | | | | | | |
|---|------------|----|------------|------------------|----|---|
| 1) Travel distance of the work load per one cycle | ℓ_1 : | mm | Motor side | L ₁ : | mm | |
| 2) Cycle time | to: | s | V: | mm/s | F: | N |

(Fill in items 3) and 4) if required.)

- | | | | | |
|----------------------|-----|---|------------------|----|
| 3) Acceleration time | ta: | s | F: | N |
| 4) Deceleration time | td: | s | ± | mm |
| 5) Stopping time | ts: | s | W _A : | kg |

(or item 14) and 15))

- | | | | | |
|--|------------------|----|------------------|----|
| 6) Max. velocity | W _W : | kg | D ₁ : | mm |
| 7) External force | W ₁ : | kg | | |
| 8) Positioning accuracy of the work load | D ₂ : | mm | | |



(or item 14) and 15))

- | | | | | |
|------------------------------------|------------------|----|------------------|----|
| 9) Total weight of the work load | W _W : | kg | D ₁ : | mm |
| 10) Power supply voltage | V: | V | | |
| 11) Weight of the belt | W _W : | kg | | |
| 12) Diameter of the driving pulley | D ₁ : | mm | | |
| 13) Total weight of the pulley | W ₁ : | kg | | |

(or item 14) and 15))

- | | | | | |
|--|------------------|----|--|--|
| 14) Width of the pulley | L ₁ : | mm | | |
| 15) Material of the pulley | | | | |
| 16) Travelling direction (horizontal, vertical etc.) | | | | |

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 :

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	Motor side	D ₃ : mm	Belt side	D ₄ : mm
	2) Cycle time	ts : s	W ₃ : kg	W ₄ : kg	

(Fill in items 3) and 4) if required.)

3) Acceleration time	ta : s	L2 : mm
4) Deceleration time	td : s	
5) Stopping time	ts : s	W _L : kg
6) Max. velocity	V : mm/s	
7) External force	F : N	

8) Positioning accuracy of the work load

9) Total weight of the work load

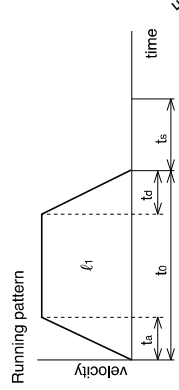
10) Power supply voltage

11) Weight of motor side belt

12) Diameter of the pulley	D ₁ : mm	Belt side	D ₂ : mm
13) Weight of the pulley	W ₁ : kg	W ₂ : kg	

(or item 14) and 15)

14) Width of the belt	L1 : mm
15) Material of the pulley	



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	d1 : deg	Prism	a : mm	Cylinder	mm
	2) Cycle time	ts : s	b : mm	b : mm	mm

(Fill in items 3) and 4) if required.)

3) Acceleration time	ta : s	Number of work loads	pcs
4) Deceleration time	td : s		
5) Stopping time	ts : s		
6) Max. rotational speed of the table	v : deg/s		
7) Positioning accuracy of the work load	±		
8) Weight of one work load	W _k : 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 _t : kg		
12) Diameter of the table support	T ₁ : mm		
13) Power supply voltage	V		

14) Dimensions of the work load

15) Number of work loads

16) Positioning accuracy of the work load

17) Weight of one work load

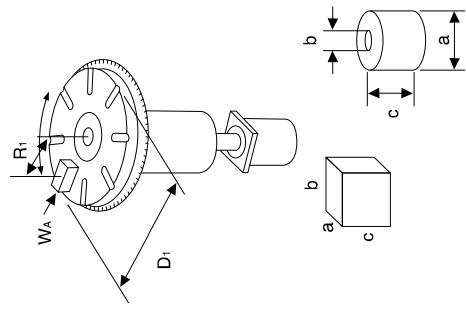
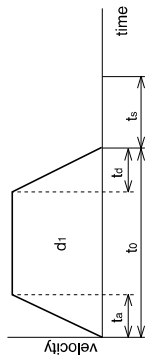
18) Driving radius of the center of gravity of the work

19) Diameter of the table

20) Mass of the table

21) Diameter of the table support

22) Power supply voltage



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

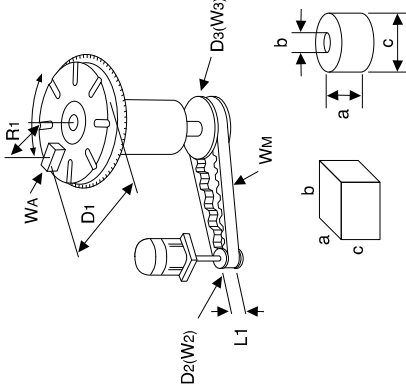
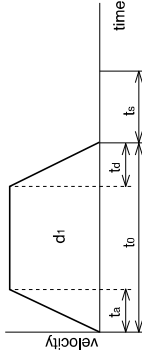
1. Driven mechanism and running data

1) Travel distance of the work load per one cycle	d_1 :	deg		Motor side	Turntable side
2) Cycle time	to:	s		D_2 :	D_3 :
				mm	mm
				W_2 :	W_3 :
				kg	kg

(Fill in items 3) and 4) if required.)

3) Acceleration time	t_a :	s		L1:	mm
4) Deceleration time	td:	s			
5) Stopping time	ts:	s		W_w :	kg
6) Max. rotational speed of the table	V:	deg/s			
	V:	r/s			
7) Positioning accuracy of the work load	\pm	deg			
8) Weight of one work load	W_k :	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			

(or)



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

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:	Company name : Department/Section : Name : Address : Tel : Fax : E-mail address:
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Request Sheet for Motor Selection

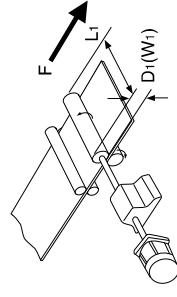
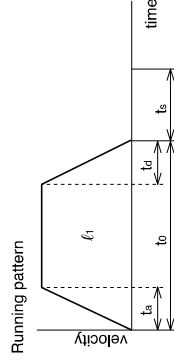
Request for motor selection **VII** : Roller feed drive

1. Driven mechanism and running data

1) Travel distance of the work load per one cycle	ℓ_1 :	mm			
2) Cycle time	to:	s			

(Fill in items 3) and 4) if required.)

3) Acceleration time	t_a :	s			
4) Deceleration time	td:	s			
5) Stopping time	ts:	s			
6) Max. velocity	V:	mm/s			
7) External pulling force	F:	N			
8) Positioning accuracy of the work load	\pm	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			
				L1:	mm
				13) Width of the roller	
				14) Material of the roller	



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

Request Sheet for Motor Selection

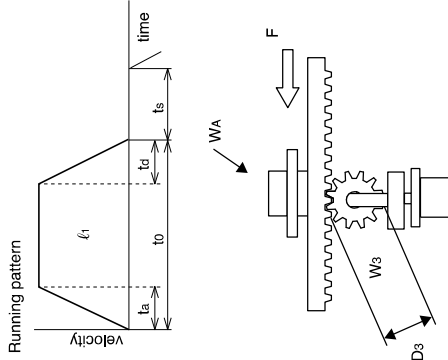
Request for motor selection VIII : Driving with Rack & Pinion

1. Driven mechanism and running data

- Travel distance of the work load per one cycle

ℓ_1 :	mm
t_c :	s
- Cycle time

t_a :	s
t_d :	s
t_s :	s
V :	mm/s
F :	N
\pm :	mm
W_k :	kg
D_p :	mm
W_p :	kg
- Acceleration time
- Deceleration time
- Stopping time
- Max. velocity
- External force
- Positioning accuracy of the work load
- Total weight of the work load
- Power supply voltage
- Diameter of the pinion
- Mass of the pinion
- Traveling direction (horizontal, vertical, etc.)



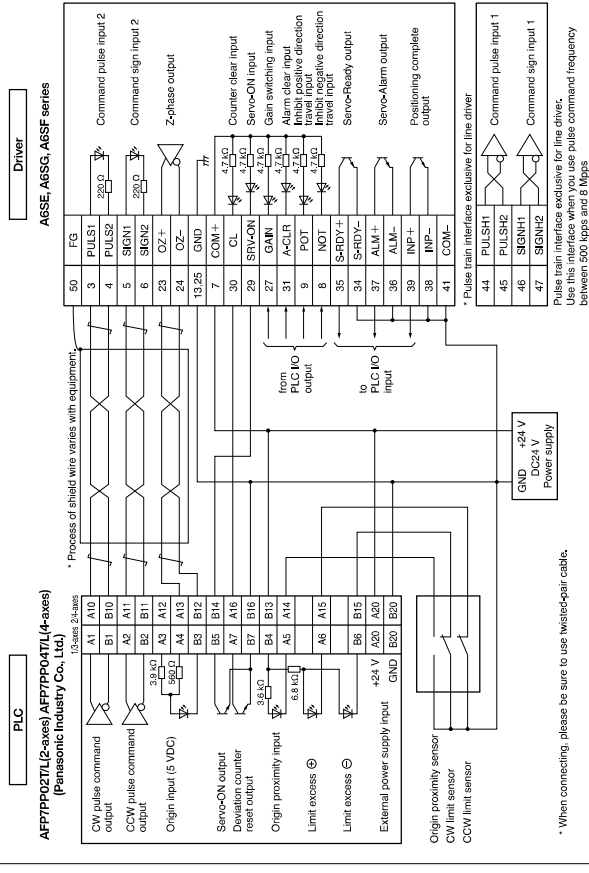
2. Other data (Fill the details on specific mechanism and its configurations in the following blank.)

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

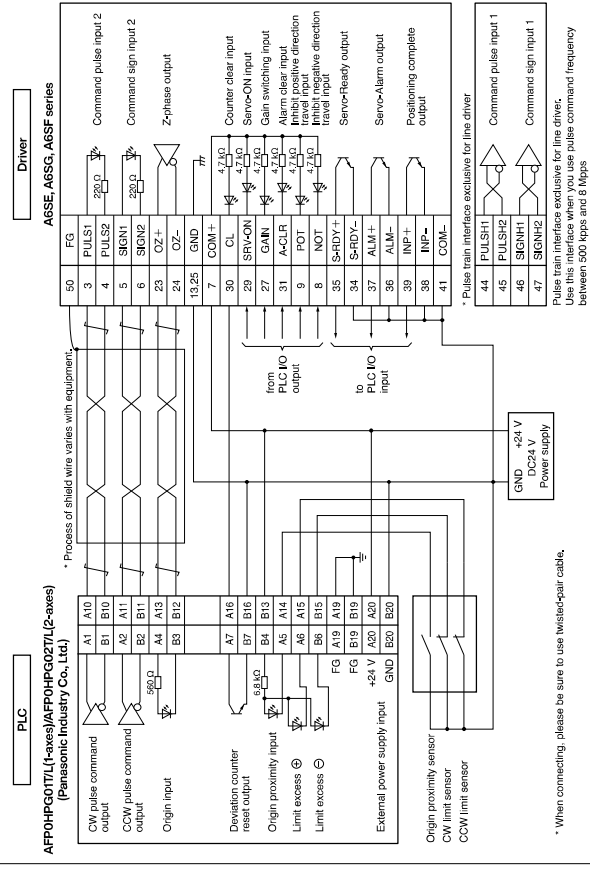
Connection Between Driver and Controller

A6 Series

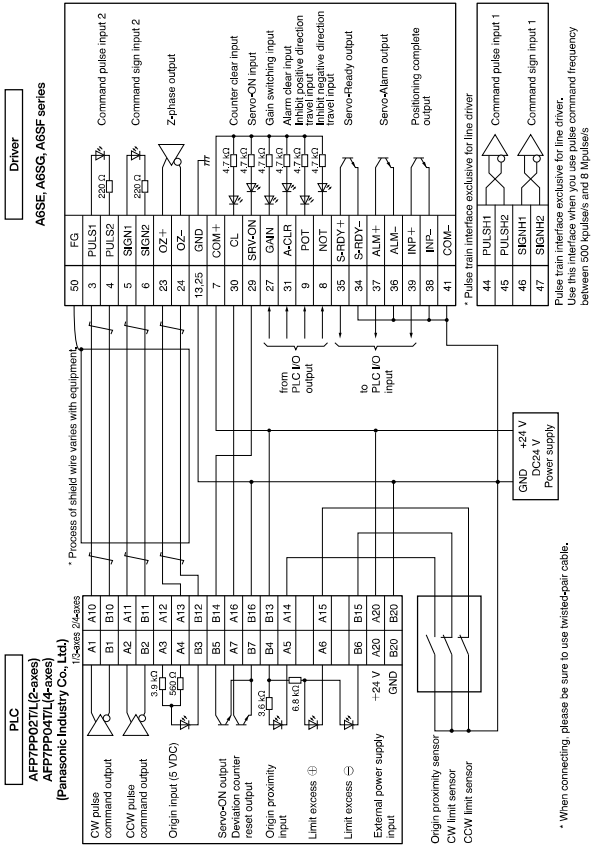
FP7 AFP7PPL027/L (2 axes) Connection with AFP7PP047/L (4 axes)



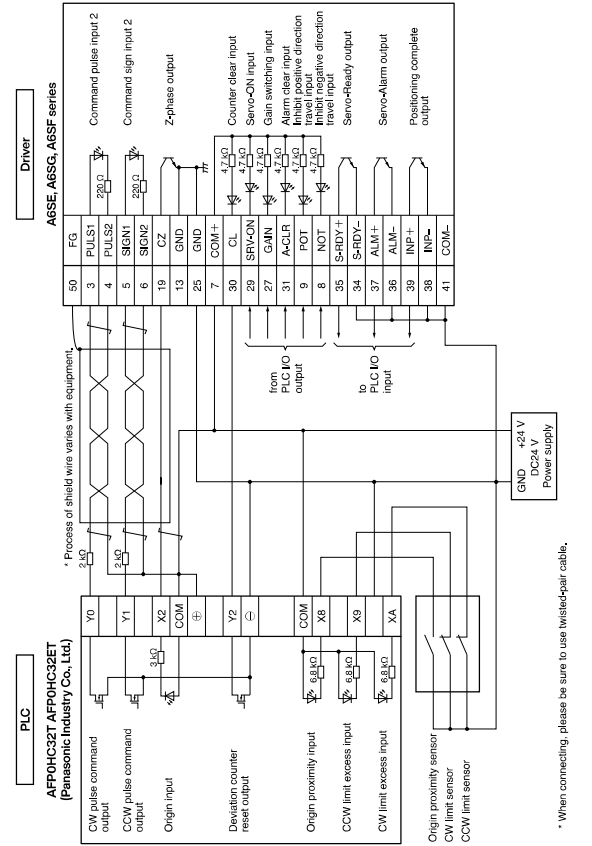
FPOH AFPOHFG017/L (1 axis) Connection with AFPOHGG027/L (2 axes)



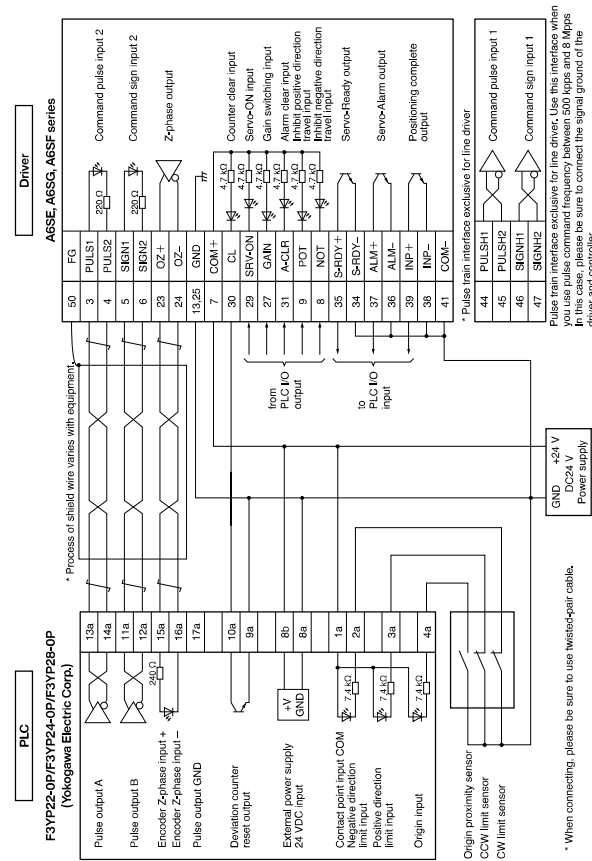
FP7 AFP/PG027L (2 axes) Connection with AFP7PG047L (4 axes)



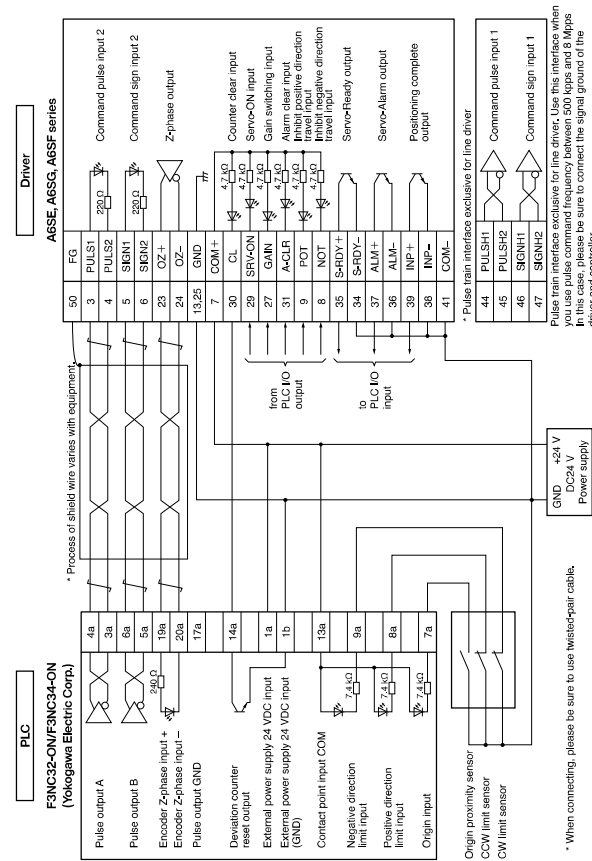
FPOH AFP0HC32T Connection with AFP0HC32E1



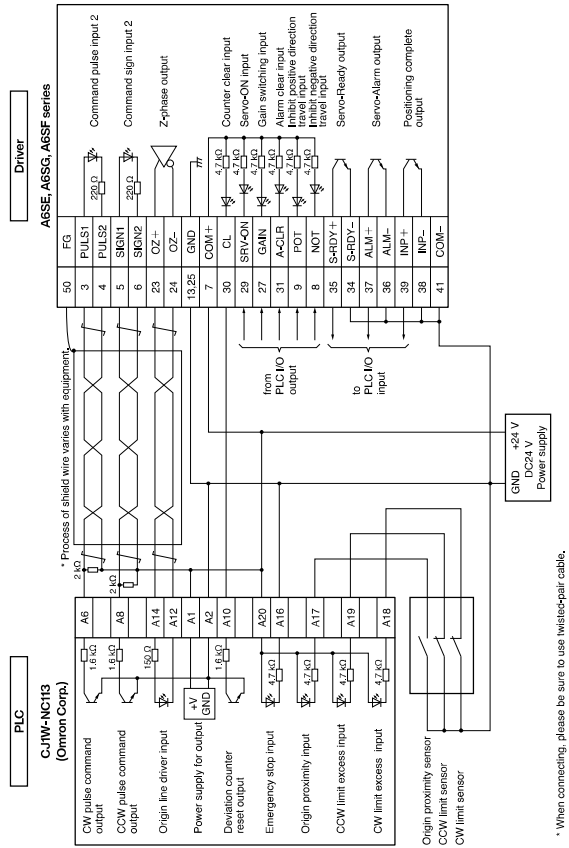
F3YP22-0P/F3YP24-0P/F3YP28-0P Connection with the Yokogawa Electric Corp.



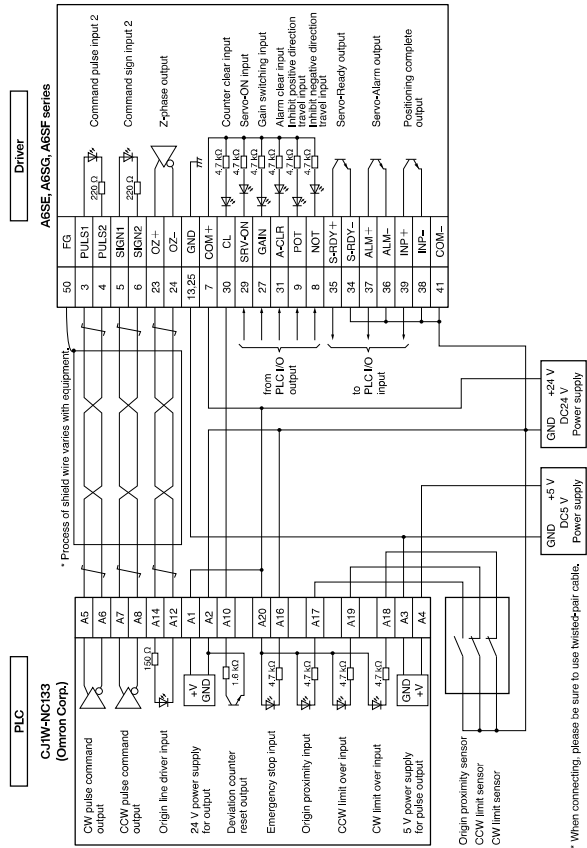
F3NC32-0N/F3NC34-0N Connection with the Yokogawa Electric Corp.



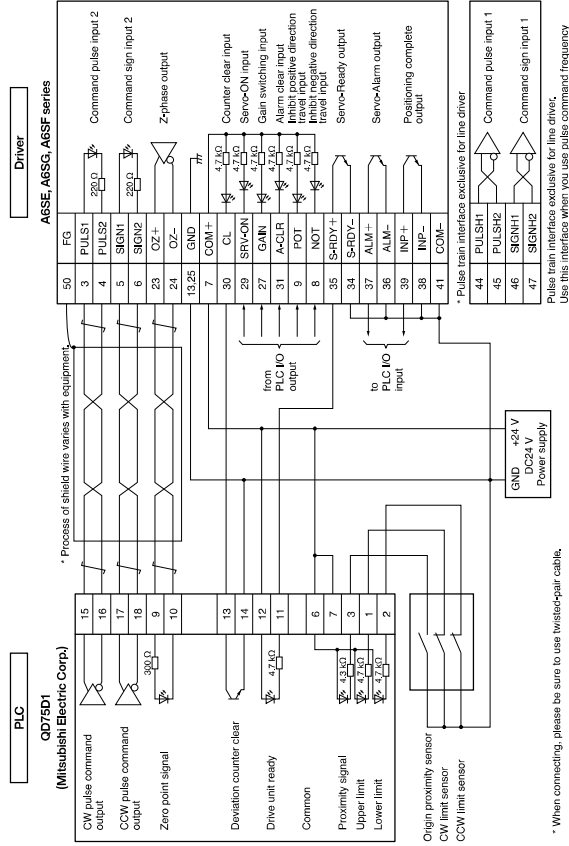
CJ1W-NC113 Connection with the Omron Corp.



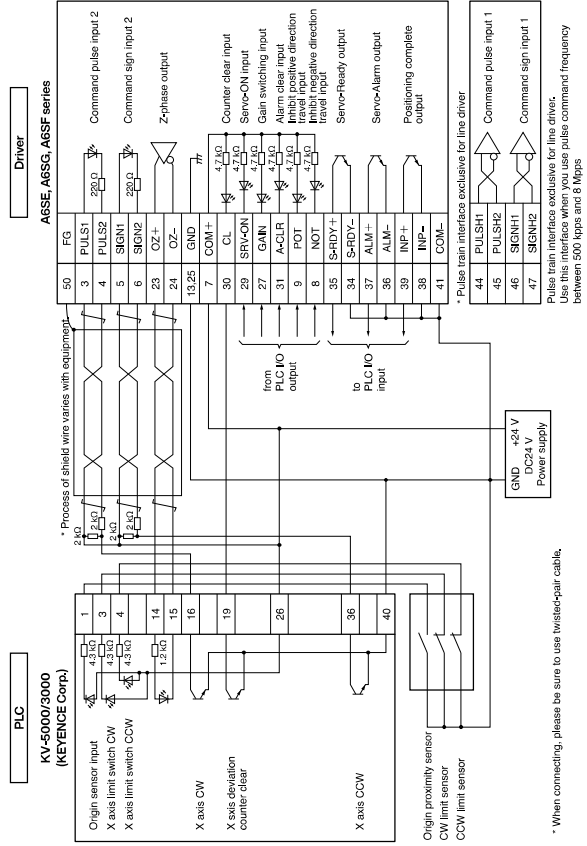
CJ1W-NC133 Connection with the Omron Corp.



QD75D1 Connection with the Mitsubishi Electric Corp.



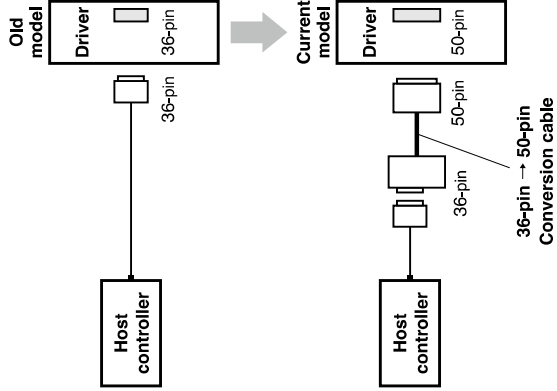
KV-5000/3000 Connection with the KEYENCE Corp.



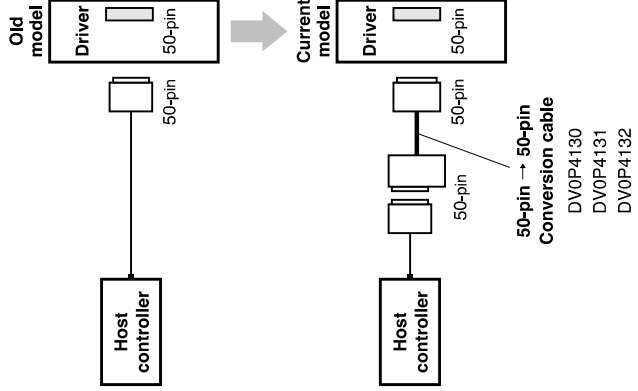
Replacing Old Model Servo Driver with MINAS A6 series

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

<36-pin → 50-pin>



<50-pin → 50-pin>



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	

* For external dimensions, refer to P.322.

Conversion Wiring Table

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

* "NC" is no connect.

Replacing Old Model Servo Driver with MINAS A6 series

Connection Between Driver and Controller

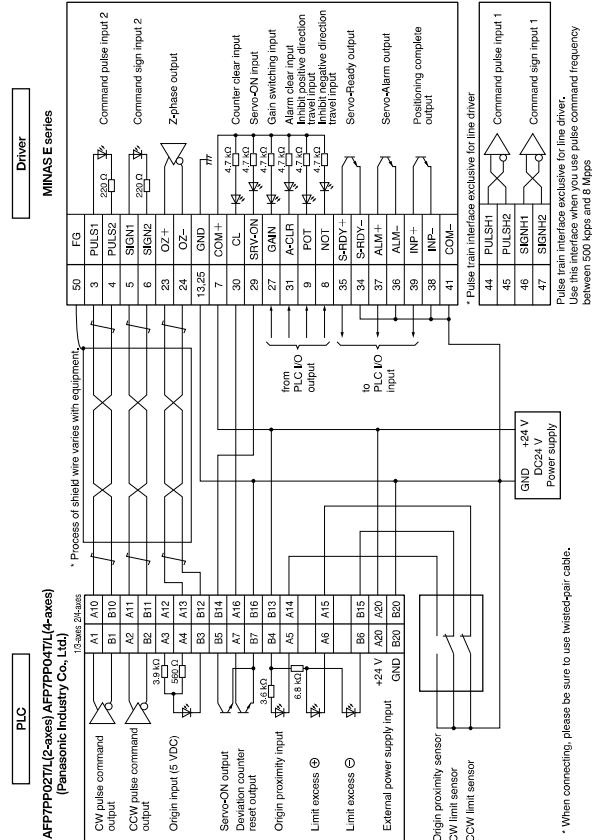
Pin No. on Old Model	Pin No. on Current Model	DV0P4130		DV0P4131	
		Signal Name	Symbol	Signal Name	Symbol
1	8	CW over-travel inhibit input	CWL	CW over-travel inhibit input	CWL
2	9	CCW over-travel inhibit input	CCWL	CCW over-travel inhibit input	CCWL
3	3	Command pulse input 2	PULS1		
4	4	Command pulse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

* "NC" is no connect.

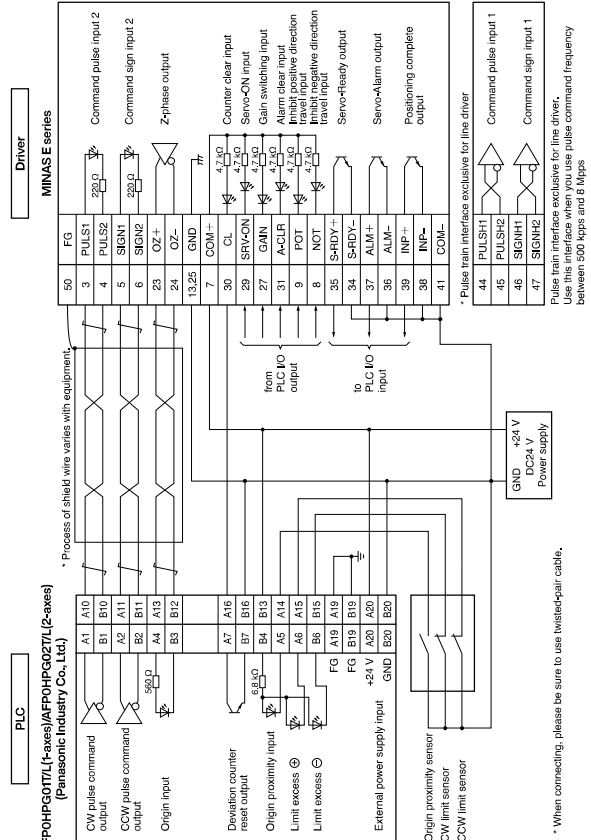
Pin No. on Old Model	Pin No. on Current Model	DV0P4132	
		Signal Name	Symbol
1	8	CW over-travel inhibit input	CWL
2	9	CCW over-travel inhibit input	CCWL
3	NC		
4	NC		
5	NC		
6	NC		
7	7	Power supply for control signal (+)	COM+
8	NC		
9	NC		
10	NC		
11	11	External brake release signal	BRK-OFF+
12	12	Zero-speed detection output signal	ZSP
13	13	Torque in-limit signal output	TLC
14	NC		
15	15	Signal ground	GND
16	16	Torque command input	TRQIR
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
	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.

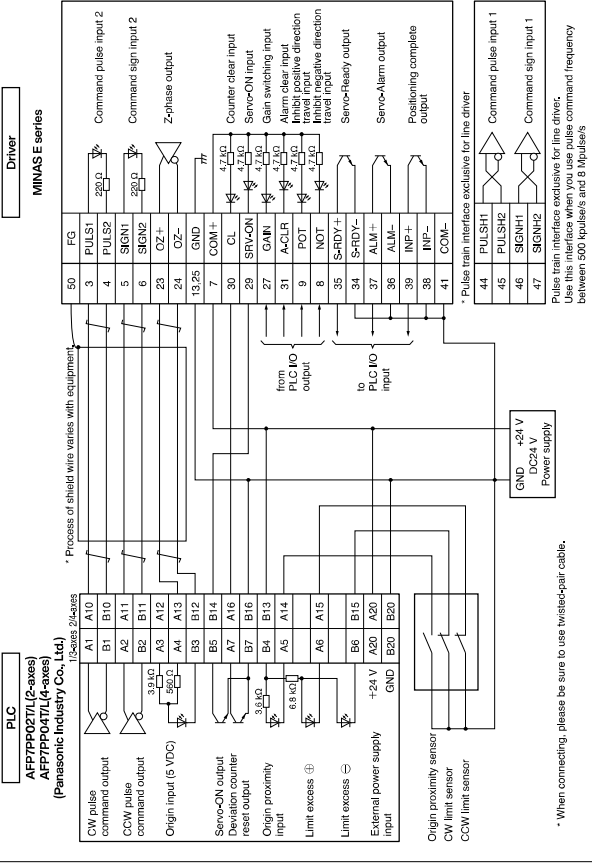
FP7 AFP7PPL027/L (2 axes) Connection with AFP7PP047/L (4 axes)



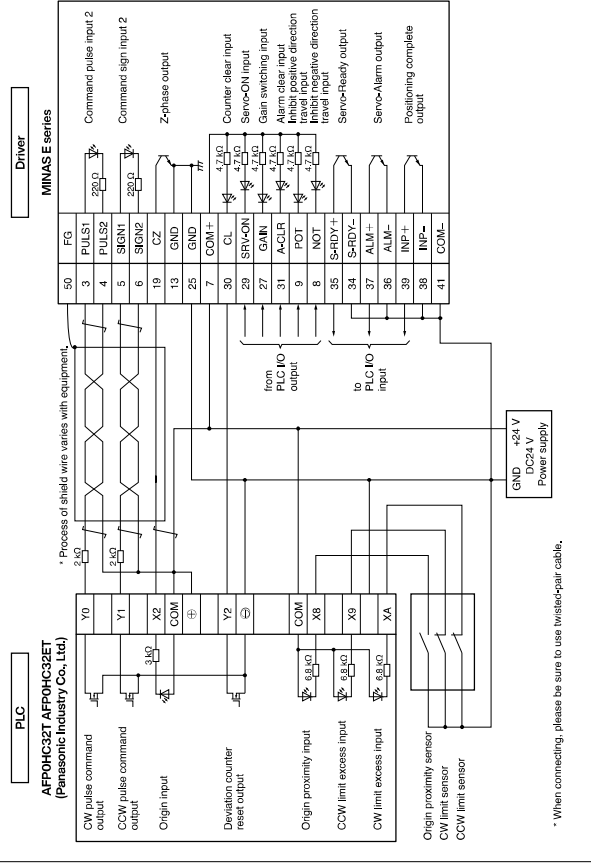
FP0H AFPOH017/L (1 axis) Connection with AFPOH027/L (2 axes)



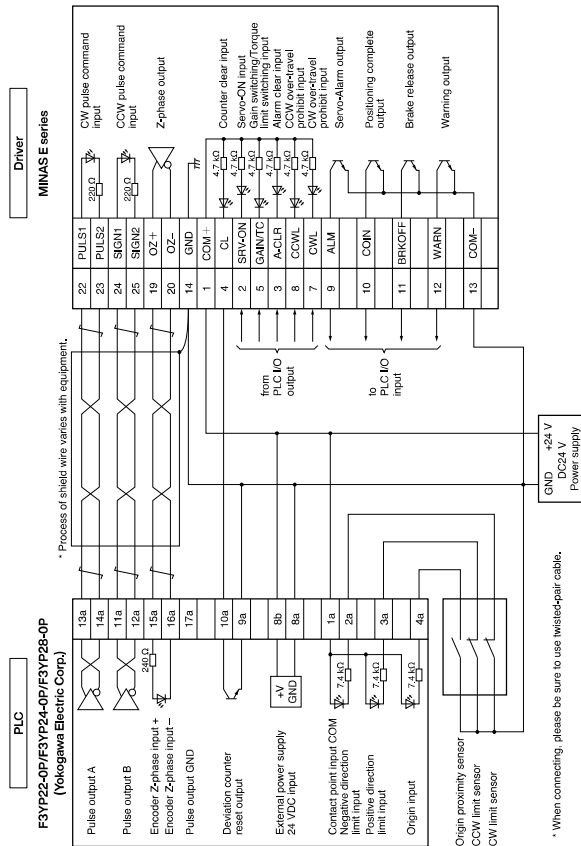
FP7 AFP7PG027/L (2 axes) Connection with AFP7PG047/L (4 axes)



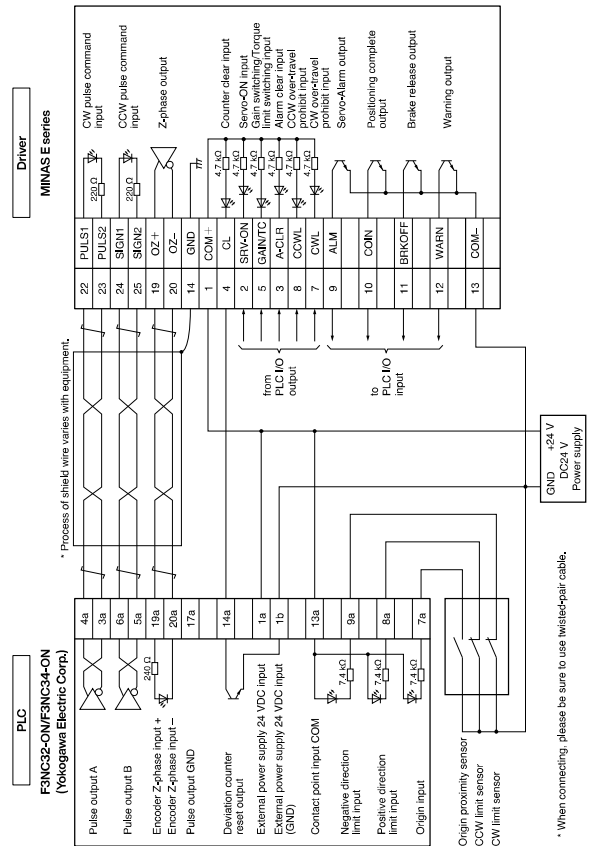
FP0H AFPOHC327 Connection with AFPOHC327



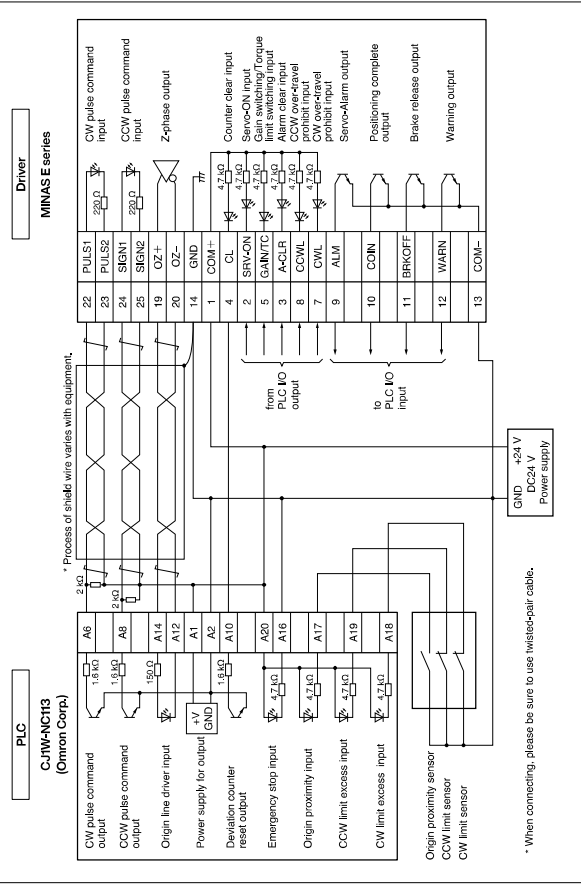
F3YP22-0P/F3YP24-0P/F3YP28-0P Connection with the Yokogawa Electric Corp.



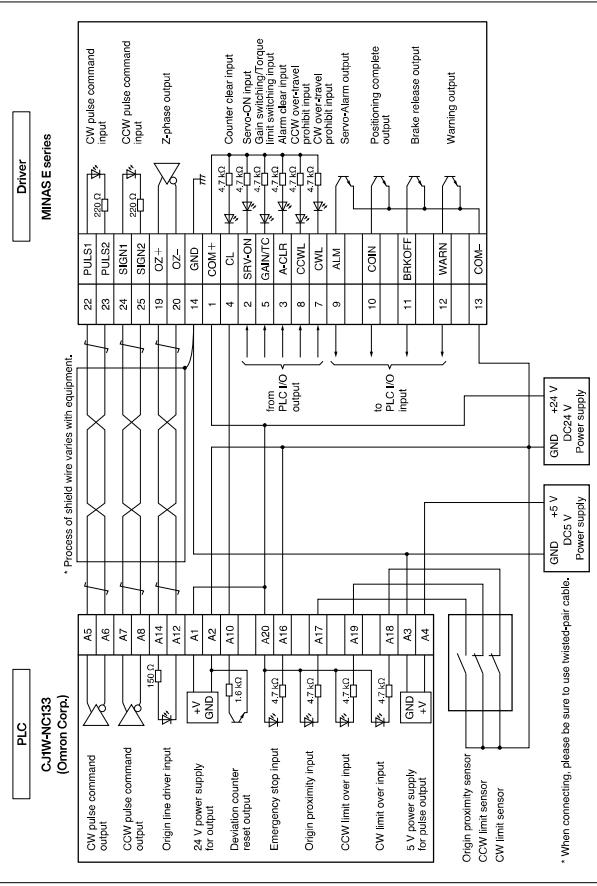
F3NC32-0N/F3NC34-0N Connection with the Yokogawa Electric Corp.



CJ1W-NC113 Connection with the Omron Corp.



CJ1W-NC133 Connection with the Omron Corp.



Sales Office

Region	Company Name [Category]	City	Address	TEL FAX
Hungary	Panasonic Electric Works Europe AG Hungarian Representative Office	Budapest	Neumann Janos, u. 1, 117 Budapest, Hungary	+43 2236 26846-25 +43 2236 46133
	Panasonic Industry Switzerland AG	Rotkreuz	Grundstraße 8, 6343 Rotkreuz ZG, Switzerland Web site http://www.panasonic-electric-works.ch	+41(0)7997054 +41(0)41797055
Turkey	Panasonic Elektronik Satış A.Ş., P.T.R. (Turkey)	Istanbul	Ruzgarbağçe Mah. Sehit Yzb. Sinan Eroglu Cad. No:6 Akel Is Merkezi A Blok Baykoz Kav- cuk Isikbuldu, Turkey	+90-216-681-400 +90-216-681-401
	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	+852-2367-0161 +852-2885-3697
China	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 Kele Road, Nanshan District, Shenzhen, 518057, China Web site https://industrial.panasonic.com/ea/	+86-755-22074488 +86-755-22074498
China	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, Leatco 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 +86-411-83668602
	Panasonic Industry (China) Co., Ltd.	Xian	Room 04-05, 7th Floor, Zhong Hai Building, No.3 South Furoing Road, Yanta District, Xian, 710061, China	+86-29-87607961 +86-29-87607960
	Panasonic Industry (China) Co., Ltd.	Wuhan	04-7F, Zhongshan Jiangnan District Road No.1627, Wuhan, Hubei, 430030, China	+86-27-86668837 +86-27-86668837
	Panasonic Industry (China) Co., Ltd.	Chongqing	Room 1601-11, Metropolitan Oriental Plaza, NO. 88 Zhourong Road, Yuzhong District, Chongqing, 400010, China	+86-23-63803502 +86-23-63803503
	Panasonic Life Solutions India Private Limited/INDD - Industrial Devices Division- Sales & Marketing (Gurgaon/IND)	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, Sejar Plaza Complex, JB Nagar Anandhi Kuria Road, Andheri(E) Mumbai - 400069, India	+91-22-6196-8480 M-91-9004229452 -

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 exs, 6th Floor, No.88, Mount Road, Guindy, Chennai - 600032, Tamilnadu	+91-44-6106-8300 -
	Panasonic Life Solutions India Private Limited/INDD - Industrial Devices Division- Sales & Marketing (Pune Office)	Pune	Office No. 401 & 402, Godrej Eleria, Above At Home Centre, Next to Shoppers Stop, Shivaji Nagar, Mumbai Pune Road, Pune - 411005, Maharashtra India	+91-20-67449907 -
	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 +82-2-2092-1053
Korea	Panasonic Industrial Devices Sales Korea Co., Ltd.	Daegu	Sales Facility 101-210, Worldmark Westend, 169, Waryong-ro, Dalseo-gu, Daegu, 42868, Korea	+82-10153-710-2301 +82-10153-710-2300
	Panasonic Industrial Devices Sales Korea Co., Ltd.	Cheonan	M-408 MFAE ACE-HIGH TECH-CITY, 10, Baekseokgongdan H-ro, Seobuk-gu, Cheonan, 31094, Korea	+82-1041-622-9128 +82-1041-622-9129
Taiwan	Panasonic Industrial Devices Sales Taiwan Co., Ltd.	Taipei	12F, No. 9, SongGao Rd., Taipei 110, Taiwan	+886-2-2757-1900 +886-2-2756-7602
Malaysia	Panasonic Industrial Devices Sales (M) Sdn. Bhd.	Singapore	No.3 Bedok South Road, Singapore 469269	+65-6299-9181 +65-6390-3801
	Panasonic Industrial Devices Sales (M) Sdn. Bhd.	Pinang	13th Floor, Menara IGB, Mid Valley City, Lingkaran Syed Putra, 59200 Kuala Lumpur, Malaysia	+60-3-2297-6688 +60-3-2297-6798
Thailand	Panasonic Industrial Devices Sales (Thailand) Co., Ltd.	Bangkok	Lebuh Sq, Phang 5, Promenade 28, 11600 Penang, Malaysia	+60-4-6531-888 +60-4-6531-899
	Panasonic Industrial Devices Sales (Thailand) Co., Ltd.	Bangkok	252/133 Muang Thai-Phatra Complex Building, 3rd Floor, Ratchadaphisek Road, Huaykwang, Bangkok 10320, Thailand	+66-2693-3403-21 +66-2693-3422-27
	Panasonic Solutions (Thailand) Co., Ltd.	Bangkok	252/133 Muang Thai-Phatra Complex Building, 3rd Floor, Ratchadaphisek Road, Huaykwang, Bangkok 10320, Thailand	+66-2-693-1970 +66-2-693-1972
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	+84-8-3813-4695 +84-24-3955-111
	Panasonic Vietnam	Ha Noi	Plot J1-02, Thanh Long Industrial Zone, Dong Anh, Ha Noi, Vietnam	-
Philippines	Panasonic Manufacturing Philippines Corporation (Sales Division of PMPC)	Makati	14th Floor, 6788 Ayala Avenue, 1226 Makati City, Philippines	+632-866-6291 +632-866-6295

Southeast Asia