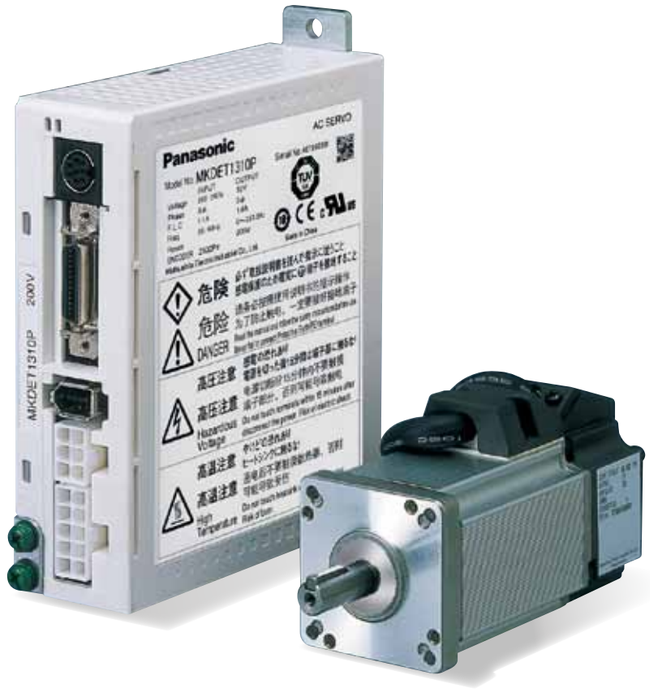
# Compact Servo Only for Position Control.

**Ultra compact position control type**

## MINAS E Series




### 1 Best Fit to Small Drives

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

(Note) Compared to MUDS043A1

### 2 Easy to Handle, Easy to Use

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

Console
Option

### 3 High-Speed Positioning with Resonance Suppression Filters

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

### 4 Smoother operation for Low Stiffness Machine

- Damping control function suppresses vibration during acceleration/deceleration





**Contents**

# 1. Easy to Handle, Easy to Use

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

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

## DIN-rail mounting unit (option)

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

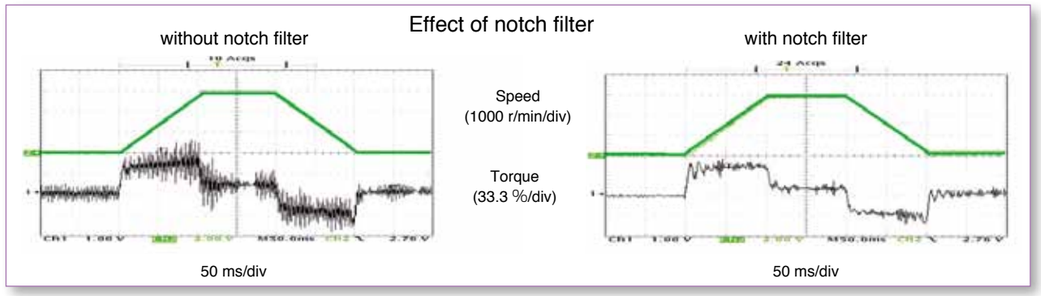
# 2. Further Reduction of Vibration

## Adaptive filter (Note1)

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

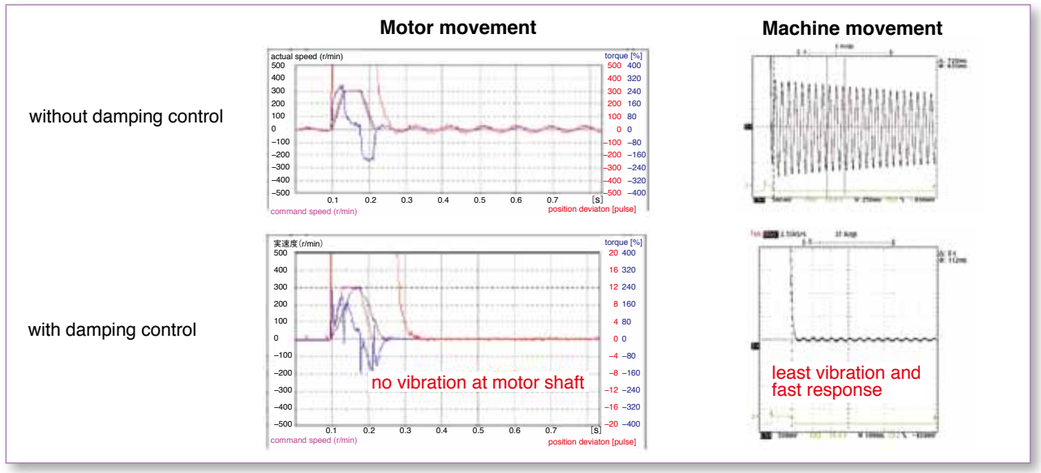
## Notch filter (Note1)

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




## Damping control (Note1)

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




(Note1) Select at positioning action mode.
- At high speed positioning mode (Pr02=0) Select either one of notch filter, damping control or high-functionality real-time auto- gain tuning. Not possible to use them all at the same time. Adaptive filter cannot be used.
- At high-functionality positioning mode (Pr02=1) All of notch filter, damping control, high-functionality real-time auto-gain tuning and adaptive filter can be used at the same time.





# 3. Further Flexibility and Multiplicity

## Console (Option)

- You can set up parameters, copy and make a JOG run.
- Convenient for maintenance at site.
- Refer to P.357, 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.352 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.352 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.352 for setup support software.

## Torque limit switching function

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

## Conformity to CE and UL Standards

| Subject | Standard conformed | | |
|---|---|---|---|
| Motor | IEC60034-1 | IEC60034-5 UL1004 CSA22.2 No.100 | Conforms to Low-Voltage Directives |
| Motor and driver | EN50178 | UL508C CSA22.2 No.14 | |
| | EN55011 | Radio Disturbance Characteristics of Industrial, Scientific and Medical (ISM) Radio-Frequency Equipment | Conforms to references by EMC Directives |
| | EN61000-6-2 | Immunity for Industrial Environments | |
| | EC61000-4-2 | Electrostatic Discharge Immunity Test | |
| | IEC61000-4-3 | Radio Frequency Electromagnetic Field Immunity Test | |
| | IEC61000-4-4 | Electric High-Speed Transition Phenomenon/Burst Immunity Test | |
| | IEC61000-4-5 | Lightening Surge Immunity Test | |
| | IEC61000-4-6 | High Frequency Conduction Immunity Test | |
| | IEC61000-4-11 | Instantaneous Outage Immunity Test | |

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

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

Panasonic Testing Centre
Panasonic Service Europe,
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* When exporting this product, follow statutory provisions of the destination country.

# Motor Line-up

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



# Model Designation

## Servo Motor

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

Special specifications

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

**Motor rated output**

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

**Voltage specifications**

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

**Motor structure**

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

* Motor with oil seal is manufactured by order.

**Design order**

| Symbol | Specifications |
|---|---|
| 1 | Standard |

**Rotary encoder specifications**

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

See P.343 for motor specifications

## Motor with gear reducer

M U M A 0 1 1 P 3 1 N

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

**Motor rated output**

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

**Voltage specifications**

| Symbol | Specifications |
|---|---|
| 1 | 100 V |
| 2 | 200 V |

**Rotary encoder specifications**

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

**Gear reduction ratio, gear type**

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

**Motor structure**

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

See P.348 for motor with gear reducer specifications

## Servo Driver

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

Special specifications

**Frame symbol**

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

**Power device Max. current rating**

| Symbol | Current rating |
|---|---|
| T1 | 10 A |
| T2 | 15 A |

**Supply voltage specifications**

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

**Control mode**

| Symbol | Specifications |
|---|---|
| P | Pulse train |

**Current detector current rating**

| Symbol | Current rating |
|---|---|
| 05 | 5 A |
| 10 | 10 A |

See P.339 for driver specifications

## • Wiring of main circuit

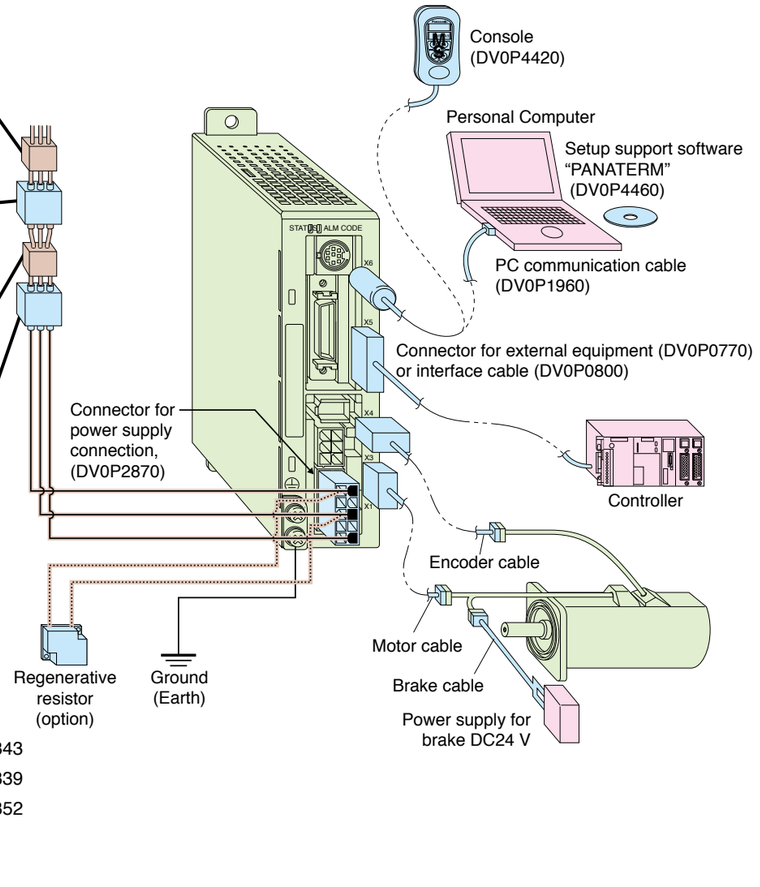
**Circuit Breaker (MCCB)**
Protects the power lines.
Shuts off the circuit when overcurrent passes.

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

**Magnetic Contactor (MC)**
Turns on/off the main power of the servo driver.
Surge absorber to be used together with this.

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

**Pin-5 and Pin-3 of CN POWER**
• Connect an external regenerative resistor (option) between P(pin-5) and B(pin-3) of connector, CN X1, when regenerative energy is large. (Refer to P.358 for regenerative resistor.)




Motor to P.343
Driver to P.339
Option to P.352
Recommended equipments
Parts customer to prepare

## List of recommended peripheral equipments

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

∗ Select the single and 3-phase common specifications corresponding to the power supplies.
● To conform to EC Directives, 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 370.

**<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.

## Carrying page

| Options | | Part No. | Carrying page |
|---|---|---|---|
| Console | | DV0P4420 | 357 |
| Setup Support Software, PANATERM | Japanese | DV0P4460 | 352 |
| | English | | |
| RS232 Communication Cable (for Connection with PC) | | DV0P1960 | 357 |
| Interface Cable | | DV0P0800 | 357 |
| Connector Kit for Interface | | DV0P0770 | 356 |
| Connector Kit for Motor and Encoder | | DV0P3670 | 355 |
| Connector Kit for Driver Power Supply | | DV0P2870 | 355 |
| Encoder Cable | MFECA0 ∗ ∗ 0EAM | | 354 |
| Motor Cable | MFMCA0 ∗ ∗ 0AEB | | 354 |
| Brake Cable | MFMCB0 ∗ ∗ 0GET | | 354 |
| Cable Set (3 m) (Note 3) | DV0P37300 | | 354 |
| Cable Set (5 m) (Note 3) | DV0P39200 | | 354 |
| DIN Rail Mount Unit | DV0P3811 | | 358 |
| External Regenerative Resistor | 100 V | 50 Ω 10 W DV0P2890 | 358 |
| | 200 V | 100 Ω 10 W DV0P2891 | |
| Reactor | 100 V | DV0P227 | 359 |
| | | DV0P228 | |
| | 200 V | DV0P220 | |
| Noise Filter | | DV0P4160 | 370 |
| Surge Absorber | Single phase 100 V, 200 V | DV0P4190 | 370 |
| | 3-phase 200 V | DV0P1450 | |
| Ferrite core | | DV0P1460 | 370 |

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

## Table of Part Numbers and Options

| Power supply | Output (W) | 2500P/r, Incremental Motor Note) 1 | Rating/Spec. (page) | Driver | Dimensions (Frame symbol) | Option Encoder Cable Note) 2 | Motor Cable Note) 2 | | Brake Cable Note) 2 | External Regenerative Resistor | Reactor | Noise Filter |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Single phase 100 V | 50 | MUMA5AZP1 □ | 343 | MKDET1105P | 342 (K) | MFECA0∗∗0EAM | MFMCA0∗∗0AEB | | MFMCB0∗∗0GET | DV0P2890 | DV0P227 | DV0P4160 |
| | 100 | MUMA011P1 □ | 343 | MKDET1110P | 342 (K) | | | | | | | |
| | 200 | MUMA021P1 □ | 343 | MLDET2110P | 342 (L) | | | | | | DV0P228 | |
| Single phase 200 V | 50 | MUMA5AZP1 □ | 345 | MKDET1505P | 342 (K) | | | | | DV0P2891 | DV0P220 | |
| | 100 | MUMA012P1 □ | 345 | MKDET1505P | 342 (K) | | | | | | | |
| | 200 | MUMA022P1 □ | 345 | MLDET2210P | 342 (L) | | | | | | | |
| | 400 | MUMA042P1 □ | 345 | MLDET2510P | 342 (L) | | | | | | | |
| 3-phase 200 V | 50 | MUMA5AZP1 □ | 345 | MKDET1505P | 342 (K) | | | | | | | |
| | 100 | MUMA012P1 □ | 345 | MKDET1505P | 342 (K) | | | | | | | |
| | 200 | MUMA022P1 □ | 345 | MKDET1310P | 342 (K) | | | | | | | |
| | 400 | MUMA042P1 □ | 345 | MLDET2510P | 342 (L) | | | | | | | |
| | | | | MLDET2310P | | | | | | | | |

Note) 1 Motor model number suffix: □
S : Key way with center tap, without brake
T : Kew way with center tap, with brake
Note) 2 ∗∗ represents cable length. For details, refer to P.353.

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

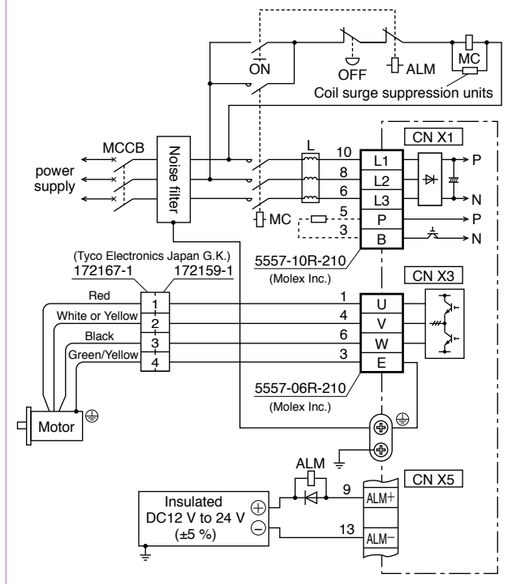




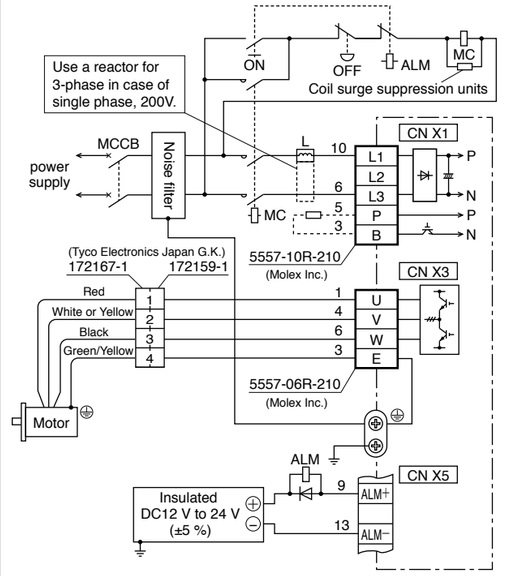


## Standard Wiring Example of Main Circuit

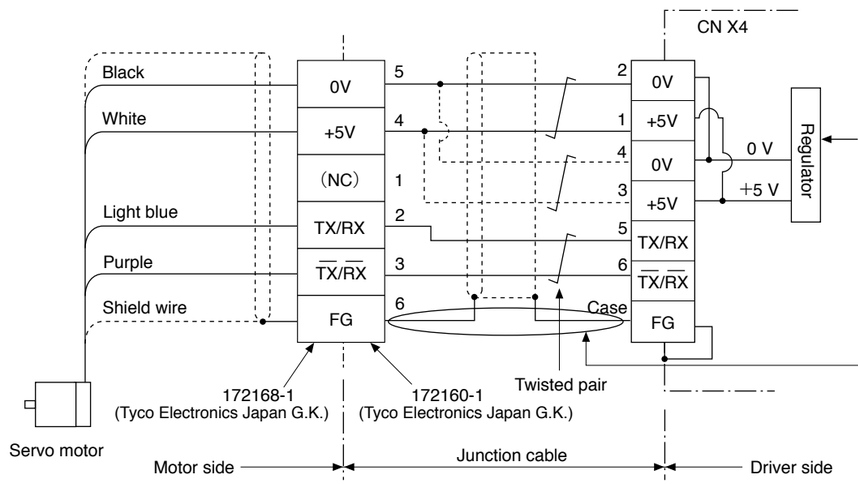
### 3-Phase, 200 V




### Single Phase, 100 V / 200 V




## Encorder Wiring Diagram




**When you make your own junction cable for encoder (Refer to P.355, P.356 "Options" for connector.)**

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

## CN X 5 Wiring Example at Position Control Mode

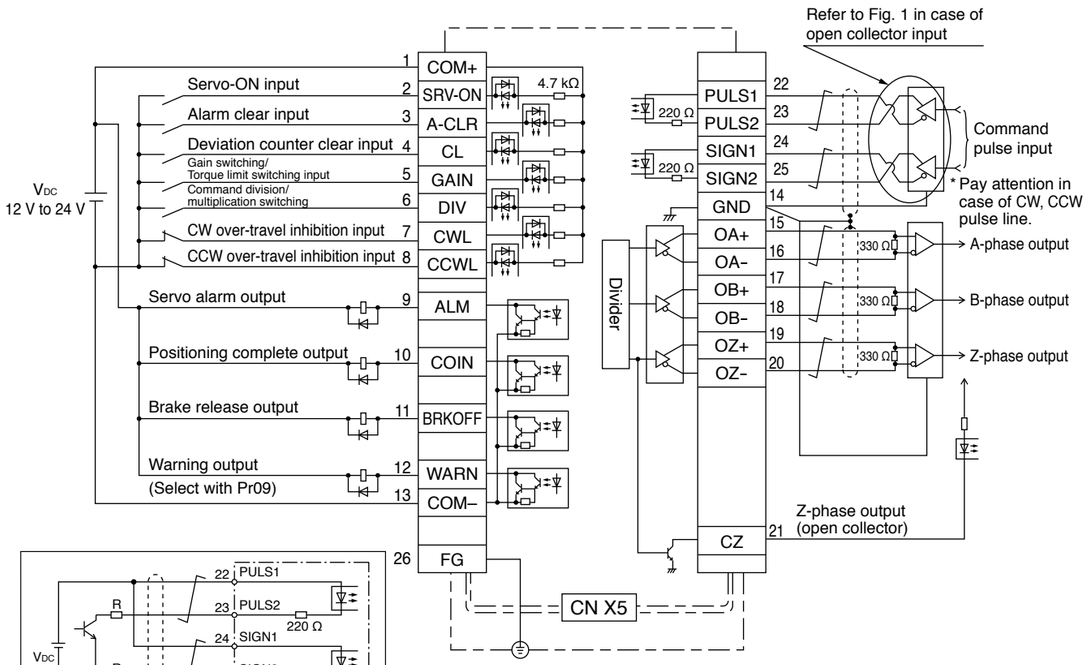
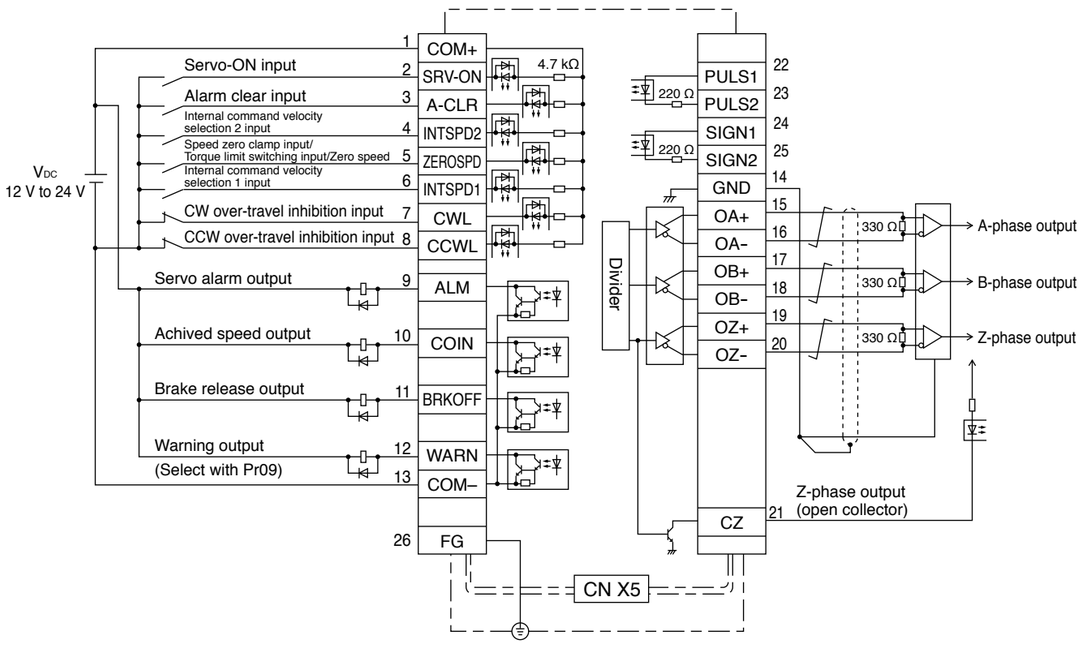



Fig. 1
This fig. shows the usage of an external control signal power supply.
You need to install an resistor R for current limit corresponding to VDC.

## CN X 5 Wiring Example at Internal Velocity Control Mode



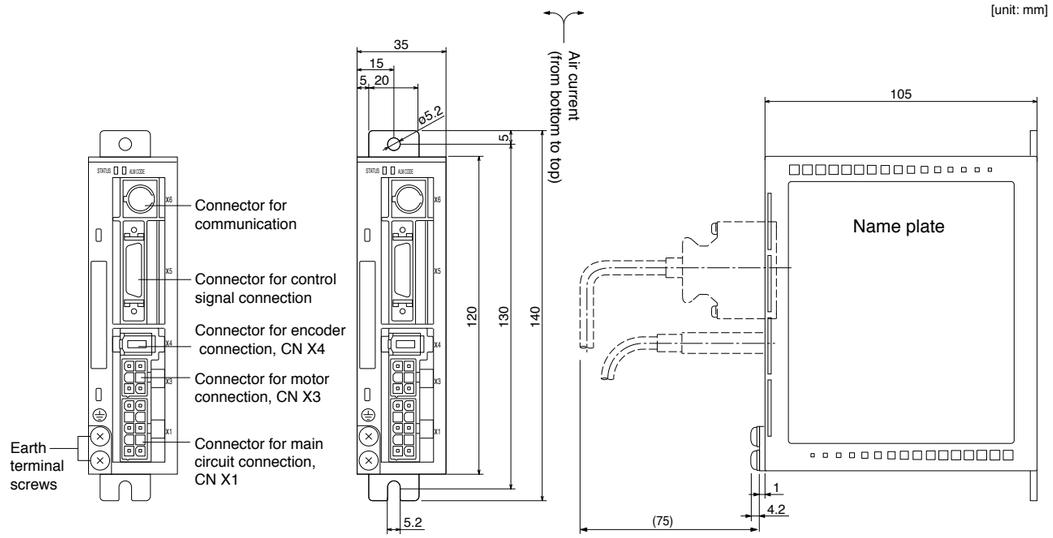







## Frame K

[unit: mm]



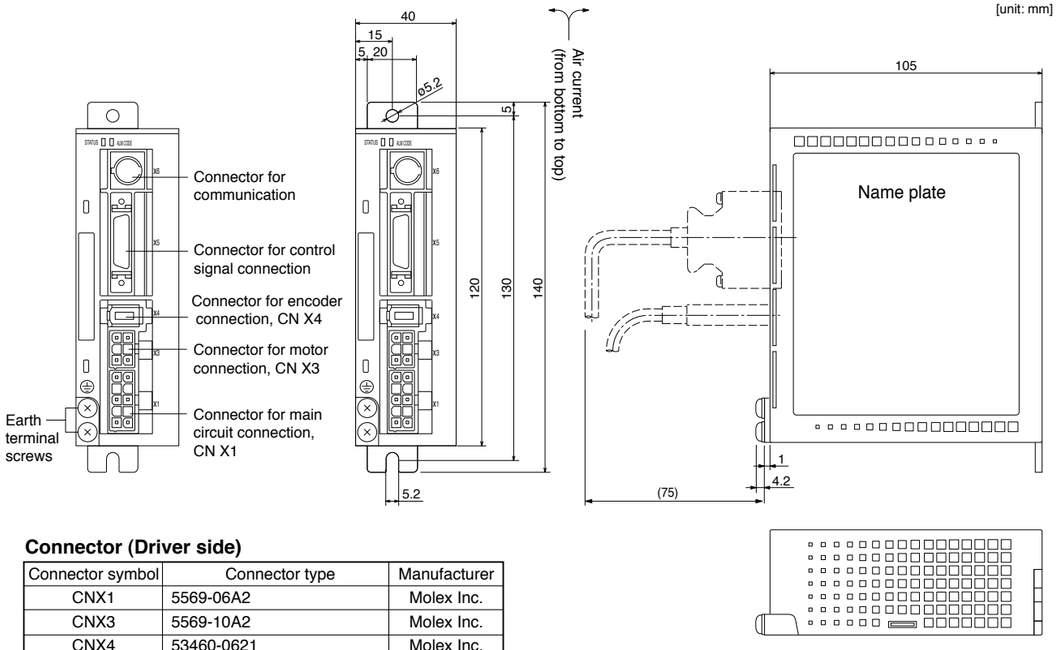

**Connector (Driver side)**

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

Mass: 0.35 kg

## Frame L

[unit: mm]




**Connector (Driver side)**

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

Mass: 0.40 kg

| | | AC100 V | | |
|---|---|---|---|---|
| Motor model | MUMA | 5AZP1□ | 011P1□ | 021P1□ |
| Applicable driver | Model No. | MKDET1105P | MKDET1110P | MLDET2110P |
| | Frame symbol | Frame K | | Frame L |
| Power supply capacity (kVA) | | 0.3 | 0.4 | 0.5 |
| Rated output (W) | | 50 | 100 | 200 |
| Rated torque (N·m) | | 0.16 | 0.32 | 0.64 |
| Momentary Max. peak torque (N·m) | | 0.48 | 0.95 | 1.91 |
| Rated current (Arms) | | 1.0 | 1.6 | 2.5 |
| Max. current (Ao-p) | | 4.3 | 6.9 | 11.7 |
| Regenerative brake frequency (times/min) Note)1 | Without option | No limit Note)2 | | |
| | DV0P2890 | No limit Note)2 | | |
| Rated rotational speed (r/min) | | 3000 | | |
| Max. rotational speed (r/min) | | 5000 | | |
| Moment of inertia of rotor (×10⁻⁴ kg·m²) | Without brake | 0.021 | 0.032 | 0.10 |
| | With brake | 0.026 | 0.036 | 0.13 |
| Recommended moment of inertia ratio of the load and the rotor Note)3 | | 30 times or less | | |
| Rotary encoder specifications | | 2500 P/r Incremental | | |
| | Resolution per single turn | 10000 | | |
| Protective enclosure rating | | IP65 (except rotating portion of output shaft and lead wire end) | | |
| Environment | Ambient temperature | 0 ˚C to 40 ˚C (free from freezing), Storage : –20 ˚C to 65 ˚C (Max.temperature guarantee 80 ˚C for 72 hours <nomal humidity>) | | |
| | Ambient humidity | 85 %RH or lower (free from condensing) | | |
| | Installation location | Indoors (no direct sunlight), free from corrosive gas, inflammable gas, oil mist and dust | | |
| | Altitude | 1000 m or lower | | |
| | Vibration resistance | 49 m/s² or less | | |
| Mass (kg), ( ) represents holding brake type | | 0.4 (0.6) | 0.5 (0.7) | 0.96 (1.36) |

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

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

For motor dimensions, refer to P.347, and for the diver, refer to P.342.

## Model Designation

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

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

Motor rated output

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

Voltage specifications

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

Design order
1 : Standard

Motor structure

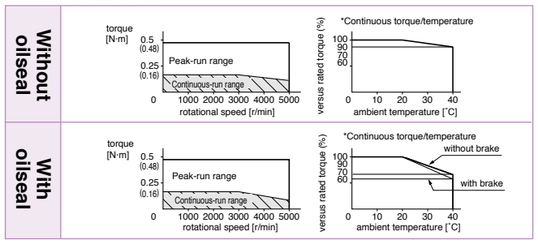
| Symbol | Shaft | Holding brake | | Oil seal | |
|---|---|---|---|---|---|
| | Key-way, center tap | without | with | without | with |
| S | ● | ● | | ● | |
| T | ● | | ● | ● | |

Rotary encoder specifications

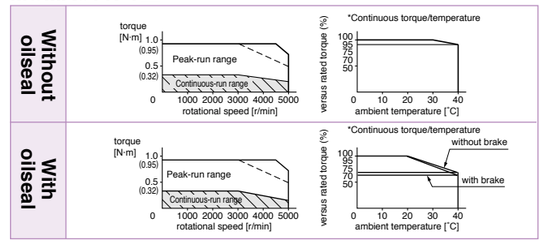
| Symbol | Format | Pulse counts | Resolution | Wires |
|---|---|---|---|---|
| P | Incremental | 2500 P/r | 10000 | 5 |

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

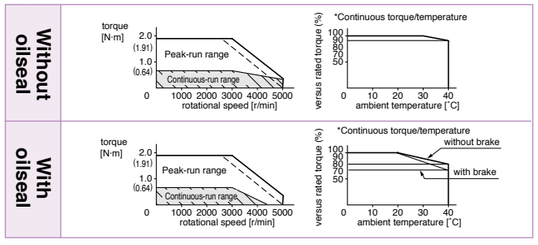
**MUMA5AZP1□**



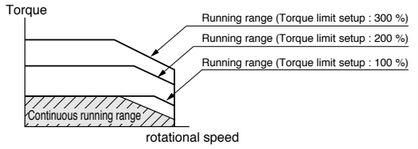

**MUMA011P1□**

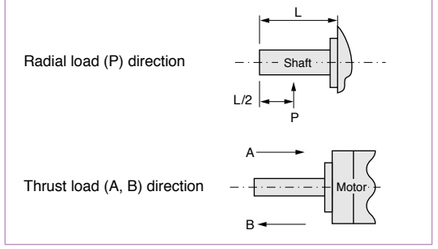



**MUMA021P1□**




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




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

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

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

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

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

For motor dimensions, refer to P.347, and for the driver, refer to P.342.

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

## Model Designation

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

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

Motor rated output

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

Voltage specifications

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

Design order
1 : Standard

Motor structure

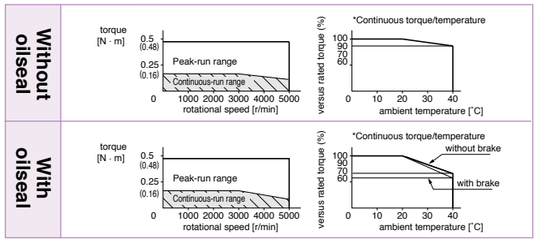
| Symbol | Shaft | Holding brake | | Oil seal | |
|---|---|---|---|---|---|
| | Key-way, center tap | without | with | without | with |
| S | ● | ● | | ● | |
| T | ● | | ● | ● | |

Rotary encoder specifications

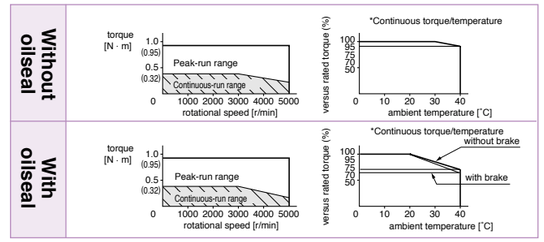
| Symbol | Format | Pulse counts | Resolution | Wires |
|---|---|---|---|---|
| P | Incremental | 2500 P/r | 10000 | 5 |

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

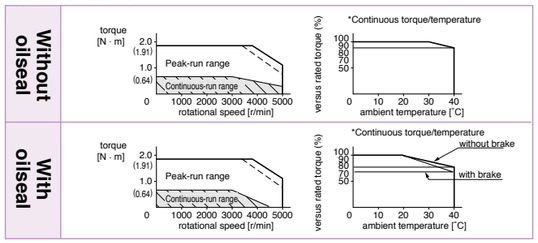
**MUMA5AZP1□**



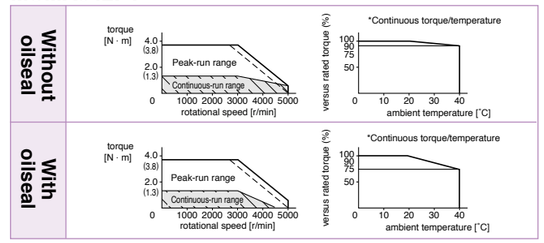

**MUMA012P1□**



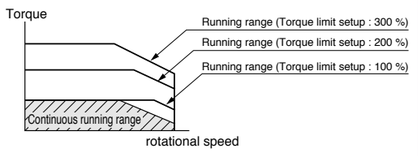

**MUMA022P1□**

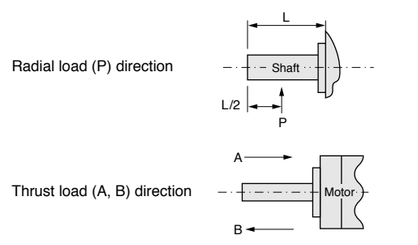



**MUMA042P1□**




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

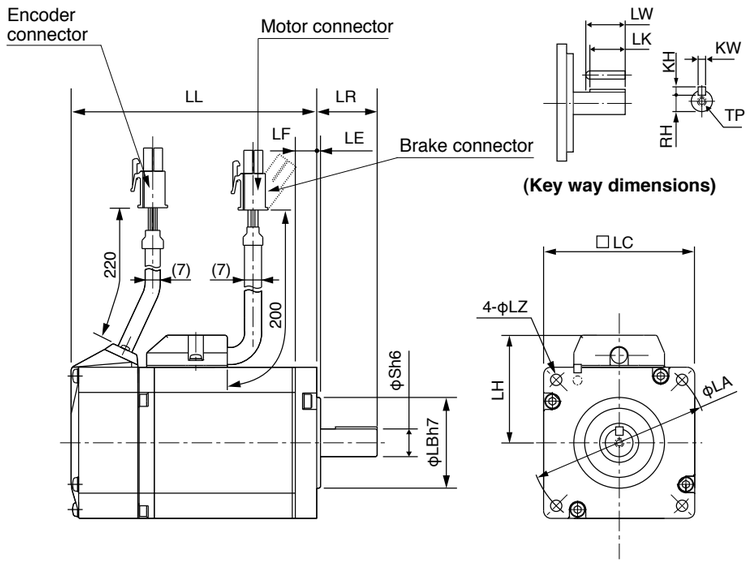



Note) 1. Regenerative brake frequency represents the frequency of the motor's stops from the rated speed with deceleration without load.
- If the load is connected, frequency will be defined as 1/(m+1), where m = (load moment of inertia) / (rotor moment of inertia).
- When the motor speed exceeds the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

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

[Unit: mm]




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

[Unit: mm]

| | | MUMA series (Ultra low inertia) | | | |
|---|---|---|---|---|---|
| Motor output | | 50 W | 100 W | 200 W | 400 W |
| Motor model | MUMA | 5A□P1□ | 01□P1□ | 02□P1□ | 04□P1□ |
| Rotary encoder specifications | | 2500 P/r Incremental | 2500 P/r Incremental | 2500 P/r Incremental | 2500 P/r Incremental |
| LL | Without brake | 75.5 | 92.5 | 96 | 123.5 |
| | With brake | 107 | 124 | 129 | 156.5 |
| LR | | 24 | 24 | 30 | 30 |
| S | | 8 | 8 | 11 | 14 |
| LA | | 48 | 48 | 70 | 70 |
| LB | | 22 | 22 | 50 | 50 |
| LC | | 42 | 42 | 60 | 60 |
| LE | | 2 | 2 | 3 | 3 |
| LF | | 7 | 7 | 7 | 7 |
| LH | | 34 | 34 | 43 | 43 |
| LZ | | 3.4 | 3.4 | 4.5 | 4.5 |
| Key way | LW | 14 | 14 | 20 | 25 |
| | LK | 12.5 | 12.5 | 18 | 22.5 |
| | KW | 3h9 | 3h9 | 4h9 | 5h9 |
| | KH | 3 | 3 | 4 | 5 |
| | RH | 6.2 | 6.2 | 8.5 | 11 |
| | TP | M3 × 6 (depth) | M3 × 6 (depth) | M4 × 8 (depth) | M5 × 10 (depth) |
| Mass (kg) | Without brake | 0.40 | 0.50 | 0.96 | 1.5 |
| | With brake | 0.60 | 0.70 | 1.36 | 1.9 |
| Connector/Plug specifications | | refer to Options, P.355, P.356. | | | |

**<Cautions>**
Reduce the moment of inertia ratio if high speed response operation is required.
Read the Instruction Manual carefully and understand all precautions and remarks before using the products.





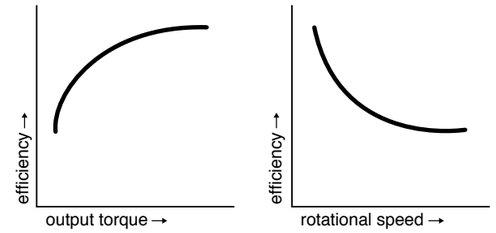


# MINAS E Series Motors with Gear Reducer

## Motor Types with Gear Reducer

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

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




## Model No. Designation

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

| Symbol | Series |
|---|---|
| MUMA | Low inertia (100 to 400 W) |

Motor rated output

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

Voltage specifications

| Symbol | Specifications |
|---|---|
| 1 | 100 V |
| 2 | 200 V |

Rotary encoder specifications

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

Motor types with gear reducer

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

Motor structure

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

## Specifications of Motor with Gear Reducer

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

## Table of Motor with Gear Reducer Specifications

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

For dimensions, refer to P.351.

## The Combination of the Driver and the Motor with Gear Reducer

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

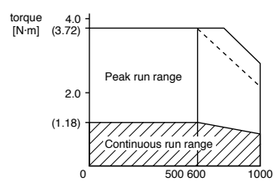
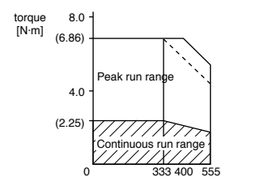
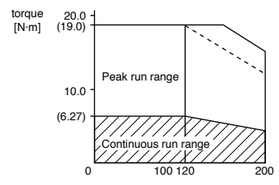
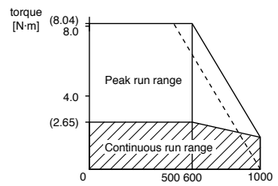
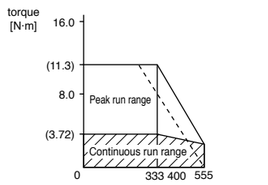
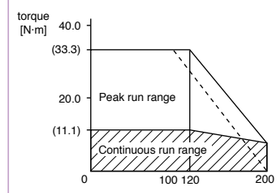
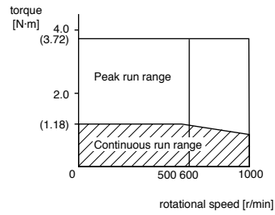
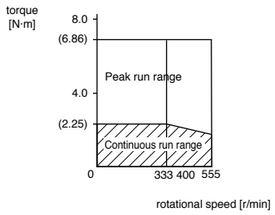
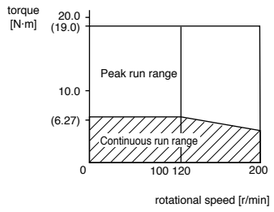
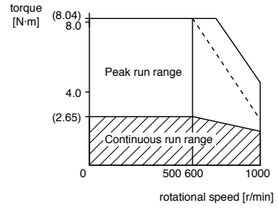
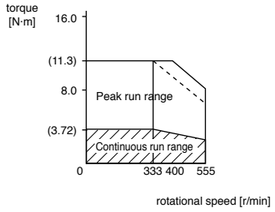
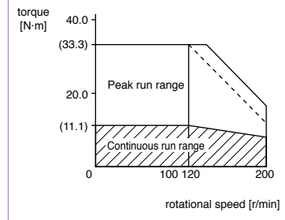
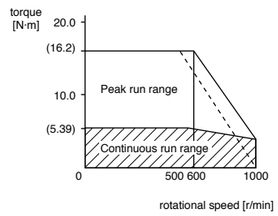
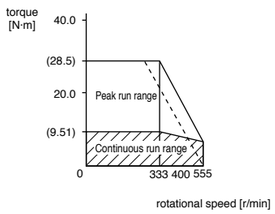
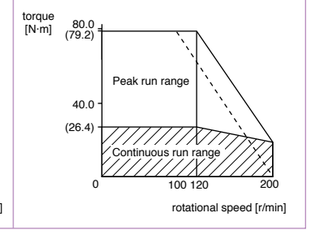
For dimensions, refer to P.342.







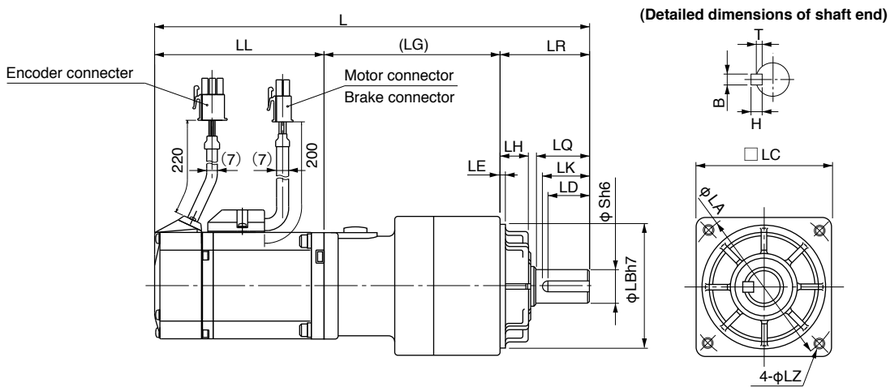
## For High Precision (MUMA Series 100 W to 400 W)

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

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

## MUMA series with Gear Reducer

[Unit: mm]




## 2500 P/r Encoder

[Unit: mm]

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

Upper column : without brake
Lower column : with brake



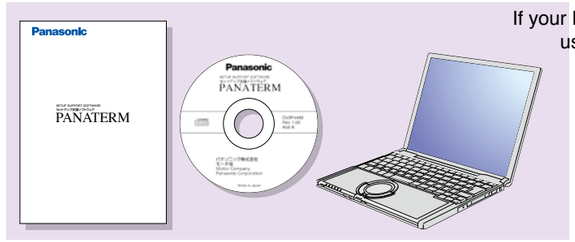




## Setup Support Software “PANATERM” for MINAS series AC Servo Motor & Driver

| Part No. | **DV0P4460** (Japanese/English version) |
|---|---|

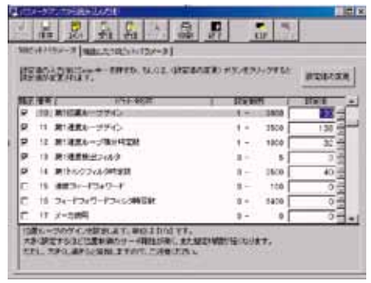
The PANATERM assists users in setting parameters, monitoring control conditions, setup support, and analyzing mechanical operation data on the PC screen, when installed in a commercially available personal computer, and connected to the MINAS A4 series, E series through the RS232 serial interface.




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

### Basic Function

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

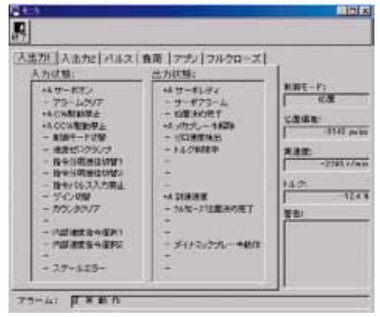


Parameter

### Monitoring Control Conditions

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

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



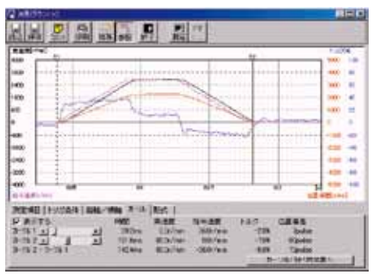
Monitor

### Setup

**Auto tuning**
- Gain adjustment and inertia ratio measurement

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

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



Graphic waveform display

### Analysis of Mechanical Operation Data

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

**■ Can not use with A5, A6 family.**

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

## Encoder Cable

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

Cable end (Driver side)

| | |
|---|---|
| M | Connector (MUMA) |

Cable end (Encoder side)

| | |
|---|---|
| A | Tyco Electronics Japan G.K. connector |

Cable type

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

Cable length

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

Type classification

| |
|---|
| MFECA: Encoder cable |

## Motor Cable, Brake Cable

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

Cable end at driver side

| | |
|---|---|
| B | Molex Inc. |
| T | Clamp terminal |

Cable end at motor side

| | |
|---|---|
| E | Tyco Electronics Japan G.K. connector |

Cable type

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

Cross section of cable core

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

Type classification

| | |
|---|---|
| A | Standard |
| B | Special |
| ⋮ | Design Oder |

Cable length

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

AC servo motor cable

ROBO-TOP® is a trade mark of DYDEN CORPORATION







## Cable Set (3 m)

| Part No. | DV0P37300 |
|---|---|

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

## Cable Set (5 m)

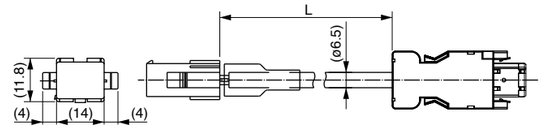
| Part No. | DV0P39200 |
|---|---|

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

## Encoder Cable

| Part No. | MFECA0 ＊ ＊ 0EAM |
|---|---|

[Unit: mm]




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

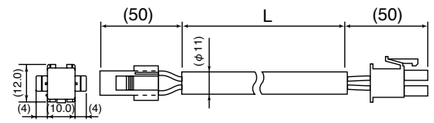
| L (m) | Part No. |
|---|---|
| 3 | MFECA0030EAM |
| 5 | MFECA0050EAM |
| 10 | MFECA0100EAM |
| 20 | MFECA0200EAM |

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

ROBO-TOP® is a trade mark of DYDEN CORPORATION

| Part No. | MFMCA0 ＊ ＊ 0AEB |
|---|---|

[Unit: mm]




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

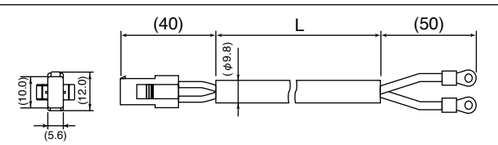
| L (m) | Part No. |
|---|---|
| 3 | MFMCA0030AEB |
| 5 | MFMCA0050AEB |
| 10 | MFMCA0100AEB |
| 20 | MFMCA0200AEB |

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

ROBO-TOP® is a trade mark of DYDEN CORPORATION

| Part No. | MFMCB0 ＊ ＊ 0GET |
|---|---|

[Unit: mm]




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

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

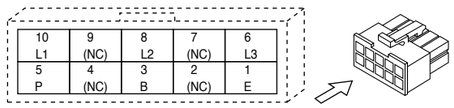
## Connector Kit for Power Supply Connection

**Part No.** DV0P2870

● Parts composition

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

● Pin configuration of connector CN X1




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

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

**<Cautions>**

1. The above pin disposition is shown when viewed from the terminal inserting direction. Make a correct wiring by checking the stamped pin numbers on the connector itself.
2. Refer to P.340 for wiring and connection.
3. Do not connect anything to pins marked "NC".

## Connector Kit for Motor/Encoder Connection

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

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

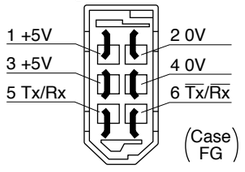
● Parts composition

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

**<Remarks>**

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

● Pin configuration of connector CN X4 plug




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

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

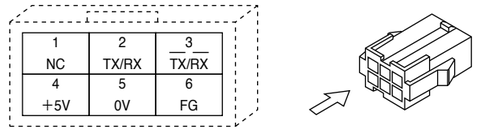
**<Remarks>**

1. The above pin configuration is shown when viewed from the pin-soldering direction. Make a correct wiring by checking the stamped pin numbers on the connector itself.
2. Connect the shield of the wire to the case (FG) without fail.
3. For wiring and connection, refer to P.340.

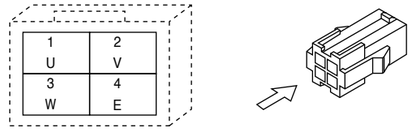




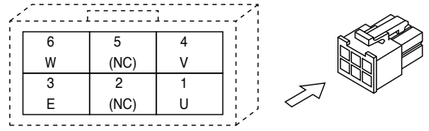
● Pin configuration of encoder cable junction




● Pin configuration of motor power cable junction




● Pin configuration of mating connector to CN X3 connector




**<Cautions>**

1. The above pin configuration is shown when viewed from the terminal inserting direction. Make a correct wiring by checking the stamped pin numbers on the connector itself.
2. Refer to P.340 for wiring and connection.

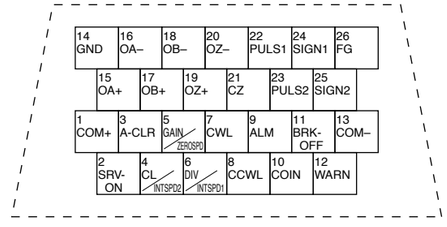
## Connector Kit for Interface

**Part No.** DV0P0770

● Parts composition

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

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



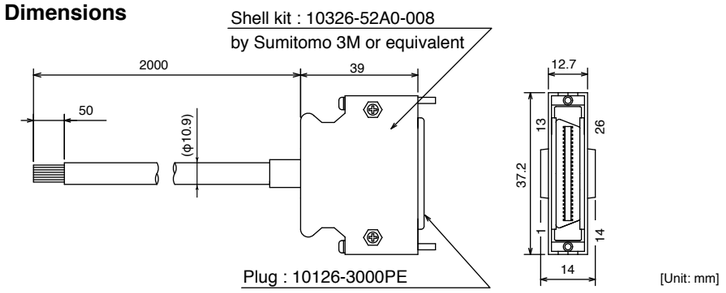

**<Cautions>**

1. Make a correct wiring by checking the stamped pin numbers on the connector itself.
2. Refer to P.341 for symbols and functions of the above signals.

## Interface Cable

| Part No. | DV0P0800 | Cable of 2 m is connected. |
|---|---|---|

### ● Dimensions




[Unit: mm]

### ● Wiring table

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

**<Notes>**

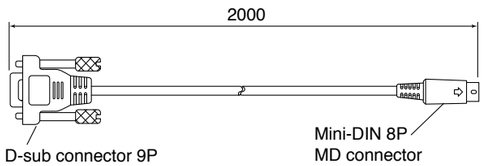
e. g. of Pin No. designation : Pin No. 1 ..... Wire color is orange, and one red dot.
Pin No. 12 ... Wire color is orange, and two black dot.

**<Remarks>**

Pin No.26 (FG) is connected to the shell (housing) of the connector, but the braided wire of this cable is not connected to the shell (housing) of the connector. When connecting the shield to FG or GND on the driver side, please use the interface connector Kit DV0P0770.

## Communication Cable (For Connection with PC)

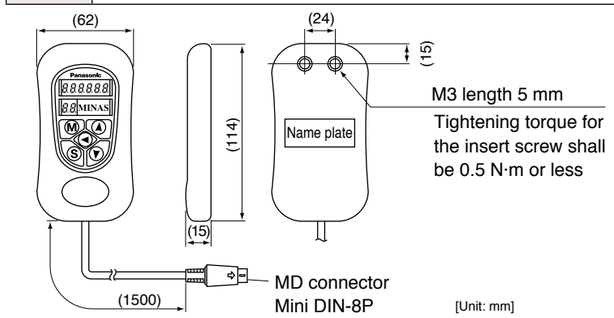
| Part No. | DV0P1960 |
|---|---|




[Unit: mm]

## Console

| Part No. | DV0P4420 |
|---|---|




[Unit: mm]



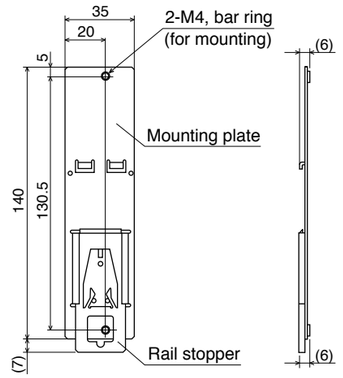




## DIN Rail Mounting Unit

| Part No. | DV0P3811 |
|---|---|

### ● Dimensions




[Unit: mm]

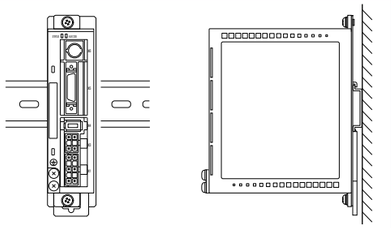
**<Notes>**

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

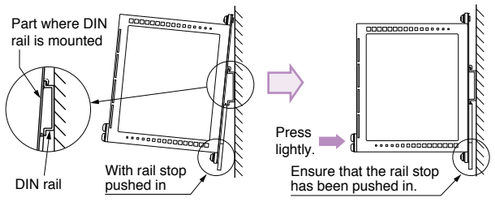
**<Cautions>**

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

• Driver mounted to DIN rail



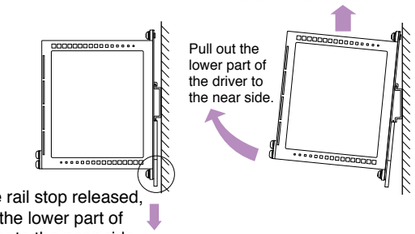
**• How to Install**




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

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

**• Removing from DIN Rail**

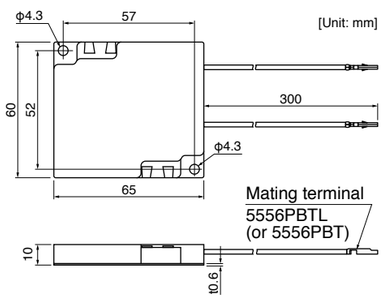



## External Regenerative Resistor

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

Manufactured by Iwaki Musen Kenkyuusho Co., Ltd.

### ● Dimensions




[Unit: mm]

**<Caution of when using external regeneration resistor>**

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

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

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

**<Remarks>**

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

## Reactor

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

Fig.1

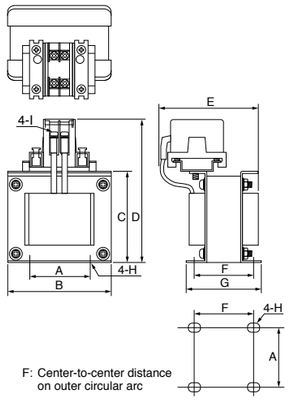
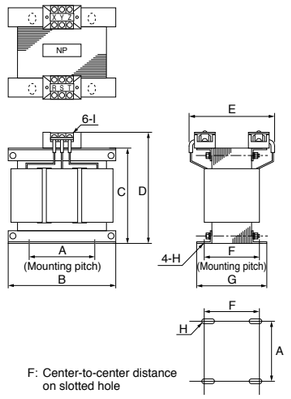



Fig.2




[Unit: mm]

| | Part No. | A | B | C | D | E (Max) | F | G | H | I | Inductance (mH) | Rated current (A) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fig.1 | **DV0P227** | 55±0.7 | 80±1 | 66.5±1 | 110 Max | 90 | 41±2 | 55±2 | 4-5φ×10 | M4 | 4.02 | 5 |
| | **DV0P228** | 55±0.7 | 80±1 | 66.5±1 | 110 Max | 95 | 46±2 | 60±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 Corporation, Motor Business Unit web site】
industrial.panasonic.com/ac/e/

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

■ **Recommended components**

## 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 Components

| Manufacturer | Tel No. / Home Page | Peripheral components |
|---|---|---|
| Panasonic Corporation Eco Solutions Company | http://panasonic.net/es/ | Circuit breaker |
| Panasonic Corporation Automotive & Industrial Systems Company | http://panasonic.net/id/ | Surge absorber Switch, Relay |
| 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 |
| Sumitomo 3M | +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 | |
| Japan Molex Inc. | +81-462-65-2313 http://www.molex.co.jp | |
| DYDEN CORPORATION | +81-3-5805-5880 http://www.dyden.co.jp/english/index.htm | Cable |

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

MEMO

# Information



## Contents

## EU Directives

The EU Directives apply to all such electronic products as those having specific functions and have been exported to EU and directly sold to general consumers. Those products are required to conform to the EU unified standards and to furnish the CE marking on the products.
However, our AC servos meet the relevant EU Directives for Low Voltage Equipment so that the machine or equipment comprising our AC servos can meet EU Directives.

## EMC Directives

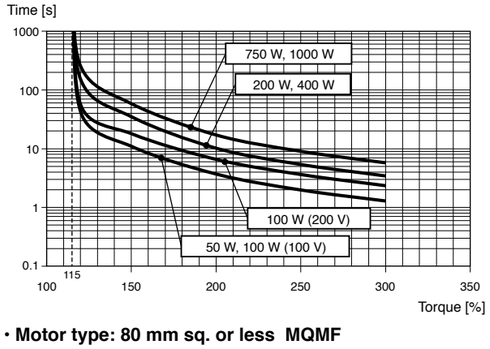
MINAS Servo System conforms to relevant standard under EMC Directives setting up certain model (condition) with certain locating distance and wiring of the servo motor and the driver. And actual working condition often differs from this model condition especially in wiring and grounding. Therefore, in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

## Conformity to UL Standards

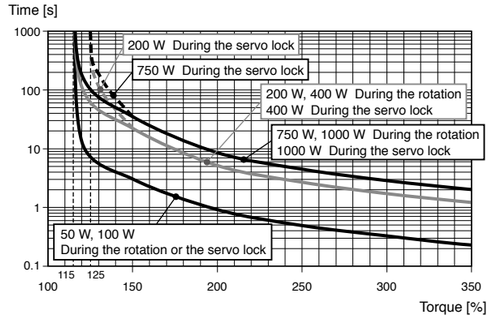
Observe the following conditions of (1) and (2) to make the system conform to UL508C (E164620).
(1) Use the driver in an environment of Pollution Degree 2 or 1 prescribed in IEC60664-1.
(e.g. Install in the control box with IP54 enclosure.)
(2) Make sure to install a circuit breaker or fuse which are UL recognized (Listed Ⓤ marked) between the power supply and the noise filter.
For rated current of circuit breaker and fuse, refer to P.21 “Driver and List of Applicable Peripheral Equipments”.
Use a copper cable with temperature rating of 75 ˚C or higher.
(3) Over-load protection level
Over-load protective function will be activated when the effective current exceeds 115 % or more than the rated current based on the time characteristics (see the graph). Confirm that the effective current of the driver does not exceed the rated current.
Set up the peak permissible current with Pr0.13 (Setup of 1st torque limit) and Pr5.22 (Setup 2nd torque limit).

### ■ Overload protection time characteristics

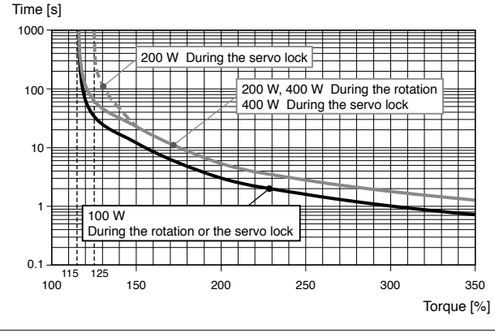
**• Motor type: 80 mm sq. or less MSMF**



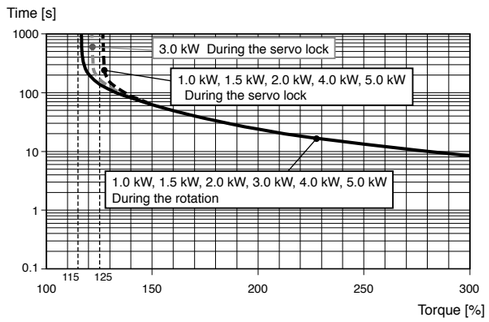

**• Motor type: 80 mm sq. or less MHMF**



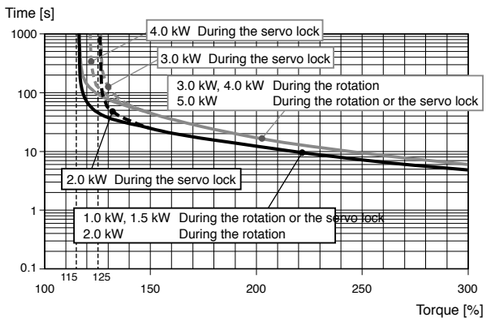

**• Motor type: 80 mm sq. or less MQMF**



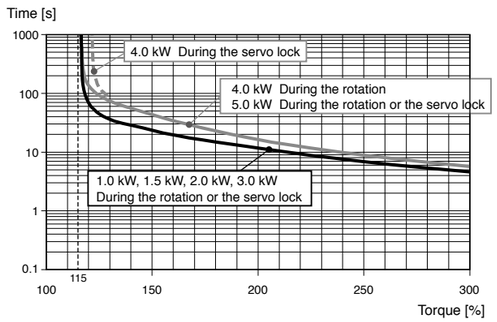

**• Motor type: 100 mm sq. or more MSMF**



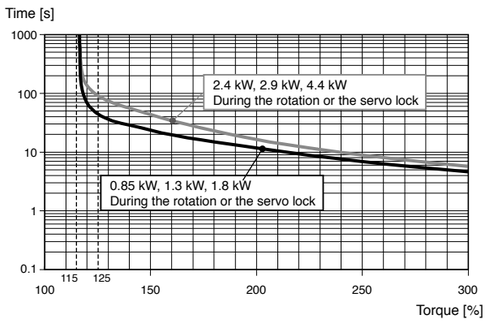

**• Motor type: 100 mm sq. or more MHMF**




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




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




## Conformed Standards

| | | Driver | Motor |
|---|---|---|---|
| EU Directives | EMC Directives | EN55011<br>EN61000-6-2<br>EN61000-6-4<br>EN61800-3 | – |
| | Low-Voltage Directives | EN61800-5-1<br>EN50178 | EN60034-1<br>EN60034-5 |
| | Machinery Directives<br>Functional safety *1 | ISO13849-1(PL e, Cat.3) EN61508(SIL3)<br>EN62061(SILCL 3)<br>EN61800-5-2(SIL3, STO) IEC61326-3-1<br>IEC60240-1 | – |
| UL Standards | | UL508C<br>(E164620) | UL1004-1, UL1004-6<br>(E327868) |
| CSA Standards | | C22.2 No.14 | C22.2 No.100-4 |
| Radio Waves Act (South Korea) (KC) *2 | | KN11<br>KN61000-4-2,3,4,5,6,8,11 | – |

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

Pursuant to the directive 2004/108/EC, article 9(2)
Panasonic Testing Centre
Panasonic Service Europe, a division of
Panasonic Marketing Europe GmbH
Winsbergring 15, 22525 Hamburg, F.R. Germany

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

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

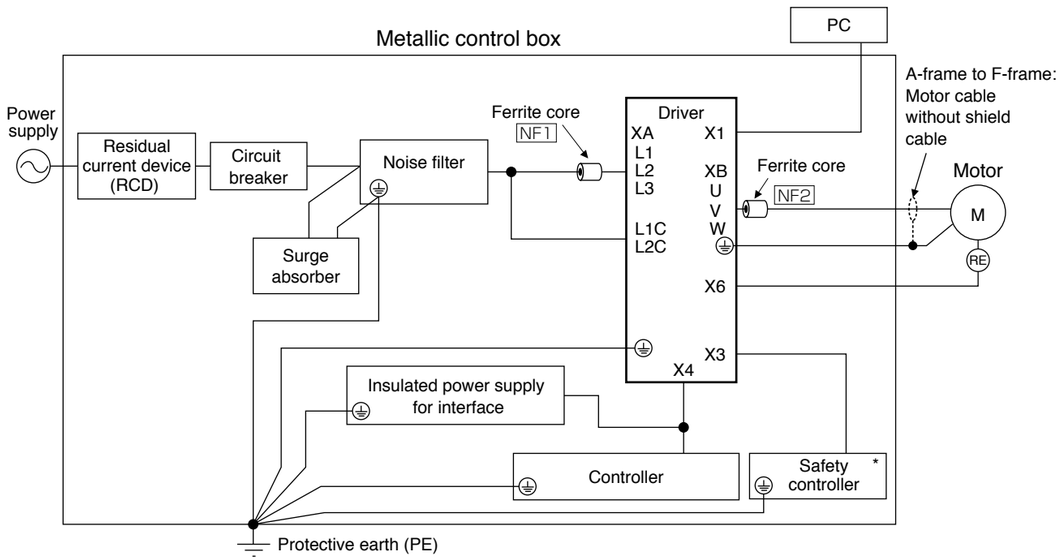
*2 Information related to the Korea Radio Law
This servo driver is a Class A commercial broadcasting radio wave generator not designed for home use. The user and dealer should be aware of this fact.

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

**( 대상기종 :** Servo Driver **)**

## Installation Environment

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




For NF1 to NF2 , refer to the Table “Ferrite core” (P.368).

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

**<Caution>**

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

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

## Power Supply

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

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

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

## Circuit Breaker

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

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

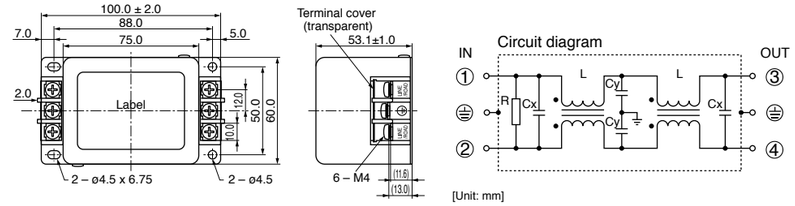
The branch circuit should be protected in accordance with NEC and the applicable local regulations in your area.

## Noise Filter

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

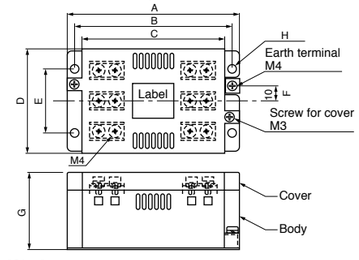
### • Options

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

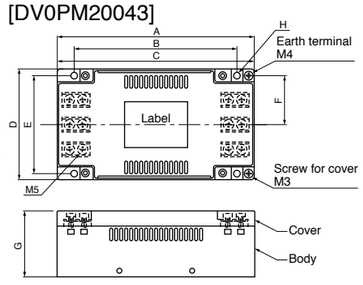



| Option part No. | Voltage specifications for driver | Manufacturer's part No. | Applicable driver (frame) | Manufacturer |
|---|---|---|---|---|
| DV0PM20042 | 3-phase 200 V | 3SUP-HU10-ER-6 | A-frame and B-frame | Okaya Electric Ind. |
| | Single phase 100 V, 200 V 3-phase 200 V | | C-frame | |
|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

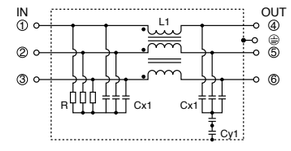
[DV0PM20042, DV0P4220]




[DV0PM20043]




Circuit diagram

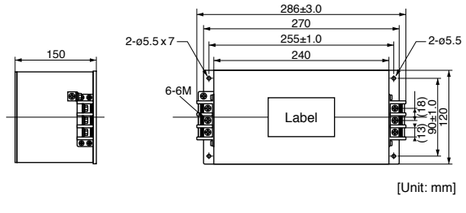



[Size] [Unit: mm]

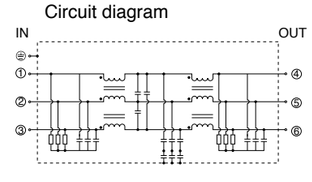
| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| DV0PM20042 | 115 | 105 | 95 | 70 | 43 | 10 | 52 | 5.5 |
| DV0P4220 | 145 | 135 | 125 | 70 | 50 | 10 | 52 | 5.5 |
| DV0PM20043 | 165 | 136 | 165 | 90 | 80 | 40 | 54 | 5.5 |

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

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




Circuit diagram




**<Remarks>**

• Select a noise filter of capacity that exceeds the capacity of the power source (also check for load condition).

• For detailed specification of the filter, contact the manufacturer.

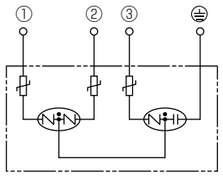
## Surge Absorber

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

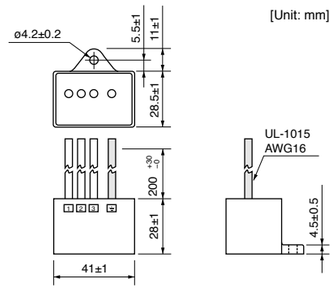
| Option part No. | Voltage specifications for driver | Manufacturer's part No. | Manufacturer |
|---|---|---|---|
| DV0P1450 | 3-phase 200 V | R·A·V-781BXZ-4 | Okaya Electric Ind. |
| DV0P4190 | Single phase 100 V, 200 V | R·A·V-781BWZ-4 | |

[DV0P1450]

Circuit diagram

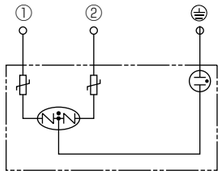



[Unit: mm]

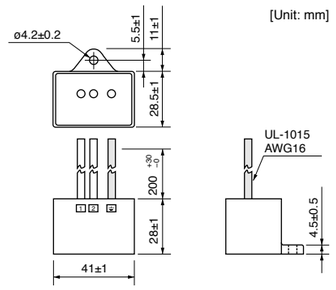



[DV0P4190]

Circuit diagram




[Unit: mm]




**<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 | Option part No. | Manufacturer's part No. | Manufacturer | Qty. |
|---|---|---|---|---|---|
| NF1 | Power cable | DV0P1460 | ZCAT3035-1330 | TDK Corp. | 4 |
| NF2 | Motor cable | | | | |

*1 For symbols, refer to the Block Diagram “Installation Environment” (P.365).

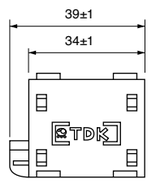
**<Remarks>**

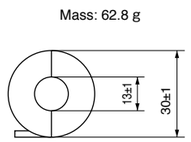
To connect the ferrite core to the connector XB connection cable, adjust the sheath length at the tip of the cable, as required.

**<Caution>**

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

Fig.1: DV0P1460




[Unit: mm]

## Residual Current Device

Install a type B Residual current device (RCD) at primary side of the power supply.

Type B: Residual current device which detects a direct-current ingredient.

## Grounding

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

(2) Do not make a joint connection to the protective earth terminals (⏚). 2 terminals are provided for protective earth.

**<Note>**

For driver and applicable peripheral equipments, refer to P.21 “Driver and List of Applicable Peripheral Equipments”.

# Compliance to EU and EMC Directives

## EU Directives

The EU Directives apply to all such electronic products as those having specific functions and have been exported to EU and directly sold to general consumers. Those products are required to conform to the EU unified standards and to furnish the CE marking on the products. MINAS AC Servos conforms to the EU Directives for Low Voltage Equipment so that the machine incorporating our servos has an easy access to the conformity to relevant EU Directives for the machine.

## EMC Directives

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

## Conformed Standards

| Subject | Conformed Standard | | |
|---|---|---|---|
| Motor | IEC60034-1 | IEC60034-5 UL1004 CSA22.2 No.100 | Conforms to Low- Voltage Directives |
| Motor and driver | EN50178 | UL508C CSA22.2 No.14 | |
| | EN55011 | Radio Disturbance Characteristics of Industrial, Scientific and Medical (ISM) Radio-Frequency Equipment | Conforms to references by EMC Directives |
| | EN61000-6-2 | Immunity for Industrial Environments | |
| | IEC61000-4-2 | Electrostatic Discharge Immunity Test | |
| | IEC61000-4-3 | Radio Frequency Electromagnetic Field Immunity Test | |
| | IEC61000-4-4 | Electric High-Speed Transition Phenomenon/Burst Immunity Test | |
| | IEC61000-4-5 | Lightening Surge Immunity Test | |
| | IEC61000-4-6 | High Frequency Conduction Immunity Test | |
| | IEC61000-4-11 | Instantaneous Outage Immunity Test | |

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

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

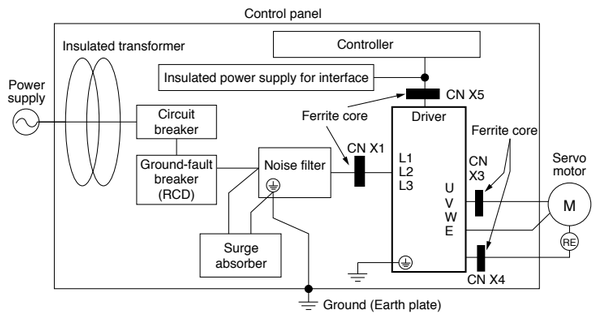
Panasonic Testing Centre
Panasonic Service Europe,
a division of Panasonic Marketing Europe GmbH
Winsbergring 15,22525 Hamburg,F.R.Germany

# Composition of Peripheral Components

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

## Installation Environment

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




## Power Supply

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

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

## Circuit Breaker

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



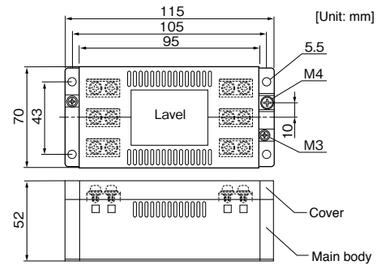




## Noise Filter

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

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



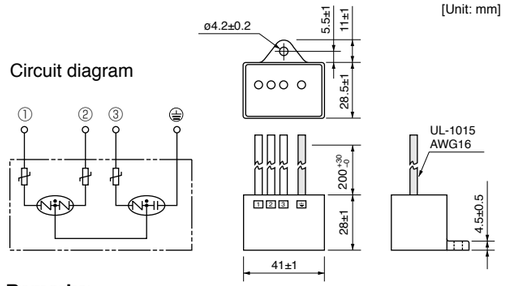

## Surge Absorber

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

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

[Unit: mm]

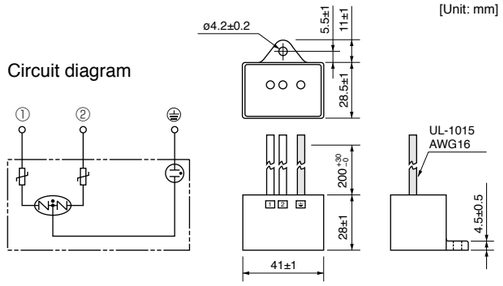
Circuit diagram




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

[Unit: mm]

Circuit diagram



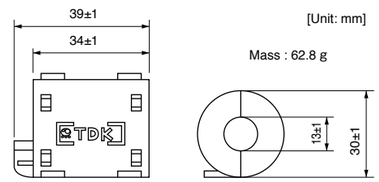

**<Remarks>**
Remove this surge absorber when you perform dielectric test on the machine, or surge absorber might be damaged.

## Ferrite core

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

**<Caution>**
- Please fix a ferrite core to avoid excessive stress to the cable.
- When using multiple axes, noise generated from each driver might influence driver and peripheral equipment and result to malfunction.
  Please insert a ferrite core between driver and motor wires (U, V, W but grounding).
  (Please refer to P.369 "Composition of Peripheral Components".)

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




## Grounding

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

## Ground-Fault Breaker

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

# Conformity to UL Standards

Observe the following conditions of (1) and (2) to make the system conform to UL508C (File No. E164620).
(1) Use the driver in an environment of Pollution Degree 2 or 1 prescribed in IEC60664-1. (e.g. Install in the control box with IP54 enclosure.)
(2) Install a circuit breaker or fuse which are UL recognized (LISTED Ⓤ marked) between the power supply and the noise filter without fail.

## AC Servo Motor Capacity Selection Software

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

### • Three-step selection

**1. Select components and specified values**

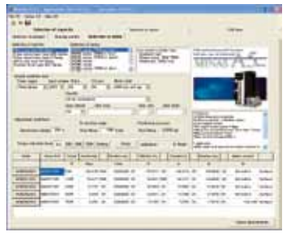
Select appropriate mechanical parameter items and fill them with parameter values derived from the real machine. To simulate the target machine as practical as possible, use maximum number of parameters available.

**2. Enter operation pattern**

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

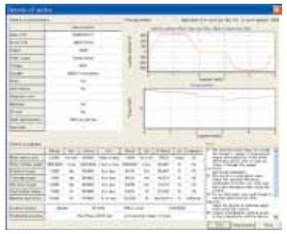
**3. Select the motor**

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



**Details of motor**

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



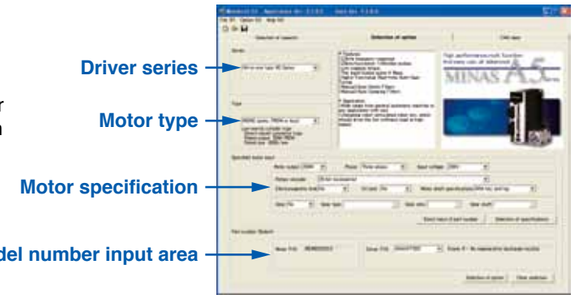
## Option Selection Software for AC Servo Motor

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

### • Two procedures for option selection

**1. Selection according to driver series and motor type**

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

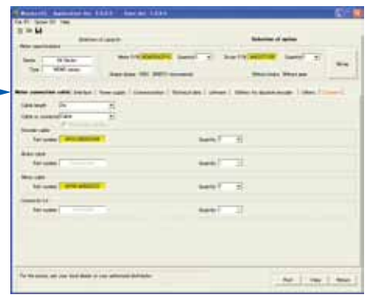



**2. Entry of model number**

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

**Result of selection**

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



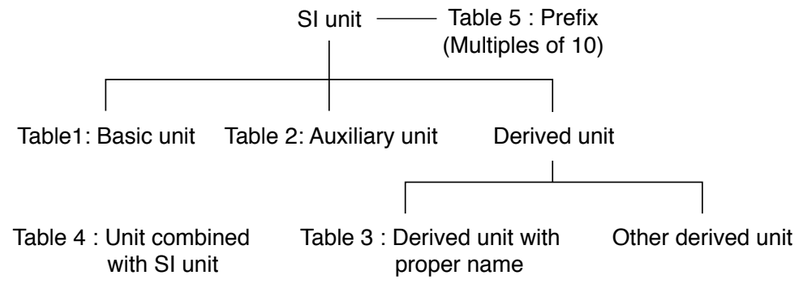

* When you are using the motor capacity selection software, simply press [Option Selection] tab and the screen as shown right will appear.

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










## Table1: Basic unit

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

## Table 2: Auxiliary unit

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

## Table 3: Major derived unit with proper name

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

## Table 4: Unit combined with SI unit

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

## Table 5: Prefix

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

## Major Compatible Unit

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

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





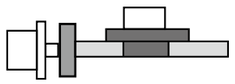


## Flow of Motor Selection

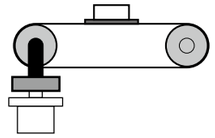
**1. Definition of mechanism to be driven by motor.**
Define details of individual mechanical components (ball screw length, lead and pulley diameters, etc.)

**<Typical mechanism>**

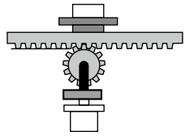
Ball screw mechanism



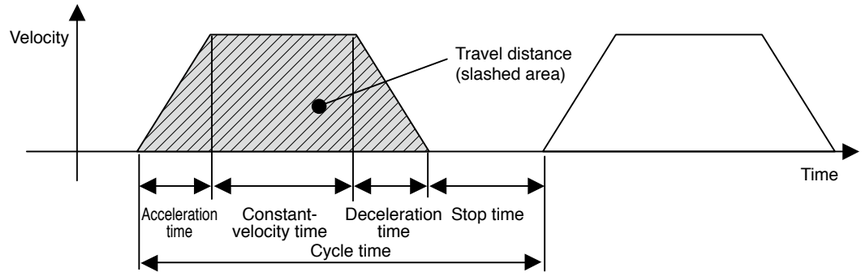
Belt mechanism



Rack & pinion, etc.



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




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

**3. Calculation of load inertia and inertia ratio.**
Calculate load inertia for each mechanical component. (Refer to "General inertia calculation method" described later.)
Divide the calculated load inertia by the inertia of the selected motor to check the inertia ratio.
For calculation of the inertia ratio, note that the catalog value of the motor inertia is expressed as "× $10^{-4}$ kg·m²".

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

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

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

## Description on the Items Related to Motor Selection

### 1. Torque

**(1) Peak torque**

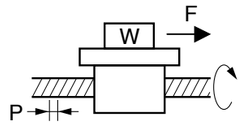
Indicate the maximum torque that the motor requires during operation (mainly in acceleration and deceleration steps). The reference value is 80% or less of the maximum motor torque. If the torque is a negative value, a regenerative discharge resistor may be required.

**(2) Traveling torque, Stop holding torque**

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

**Traveling torque calculation formula for each mechanism**

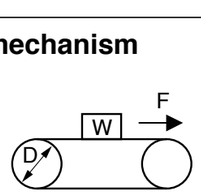
**Ball screw mechanism**




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

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

**Belt mechanism**




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

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

**(3) Effective torque**

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

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

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

### 2. Motor velocity

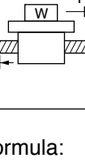
**Maximum velocity**

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

### 3. Inertia and inertia ratio

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

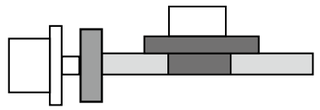
**General inertia calculation method**

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

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

## To Drive Ball Screw Mechanism

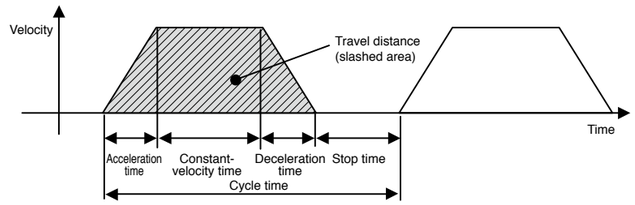
**1. Example of motor selection for driving ball screw mechanism**



Workpiece weight $W_A = 10$ [kg]
Ball screw length $B_L = 0.5$ [m]
Ball screw diameter $B_D = 0.02$ [m]
Ball screw lead $B_P = 0.02$ [m]
Ball screw efficiency $B\eta = 0.9$
Travel distance 0.3[m]
Coupling inertia $J_C = 10 \times 10^{-6}$ [kg·m²] (Use manufacturer-specified catalog value, or calculation value.)

**2. Running pattern :**

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




**3. Ball screw weight**

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

**4. Load inertia**

$$J_L = J_C + J_B = J_C + \frac{1}{8} B_W \times B_D^2 + \frac{W_A \cdot B_P^2}{4\pi^2}$$
$$= 0.00001 + (1.24 \times 0.02^2) / 8 + 10 \times 0.02^2 / 4\pi^2$$
$$= 1.73 \times 10^{-4} \text{ [kg·m²]}$$

**5. Provisional motor selection**

**In case of MSMF 200 W motor :** $J_M = 0.14 \times 10^{-4}$ [kg·m²]

**6. Calculation of inertia ratio**

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

**7. Calculation of maximum velocity (Vmax)**

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

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

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

**9. Calculation of torque**

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

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







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

**10. Verification of maximum torque**

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

**11. Verification of effective torque**

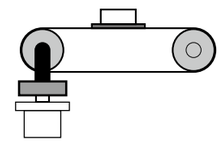
$$T_{rms} = \sqrt{\frac{T_a^2 \times t_a + T_f^2 \times t_b + T_d^2 \times t_d}{t_c}}$$
$$= \sqrt{\frac{0.231^2 \times 0.1 + 0.035^2 \times 0.8 + 0.161^2 \times 0.1}{2}}$$
$$= 0.067 \text{ [N·m]} < 0.64 \text{ [N·m]} \text{ (Rated torque of MSMF 200 W motor)}$$

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

## Example of Motor Selection

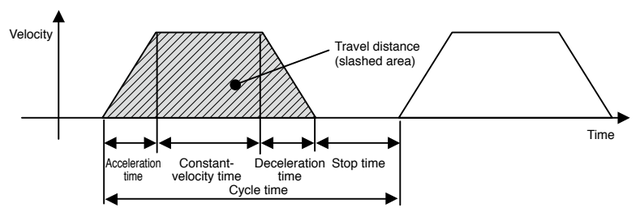
**Example of motor selection for timing belt mechanism**

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



**2. Running pattern**

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




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

$= J_C + \frac{1}{4} W_A \times P_D^2 + \frac{1}{8} W_P \times P_D^2 \times 2$
$= 0 + \frac{1}{4} \times 2 \times 0.05^2 + \frac{1}{8} \times 0.5 \times 0.05^2 \times 2$
$= 0.00156 = 15.6 \times 10^{-4}$ [kg·m²]

**4. Provisional motor selection**

**In case of MSMF 750 W motor :** $J_M = 0.96 \times 10^{-4}$ [kg·m²]

**5. Calculation of inertia ratio**

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

## Example of Motor Selection

**6. Calculation of maximum velocity (Vmax)**

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

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

$$0.9 \times Vmax = 1$$

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

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

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

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

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

**8. Calculation of torque**

Traveling torque

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

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

Acceleration torque

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

$$= \frac{(15.6 \times 10^{-4} + 0.87 \times 10^{-4}) \times 2\pi \times 7.08}{0.1} + 0.061$$

$$= 0.751 + 0.061 = 0.812[N \cdot m]$$

Deceleration torque

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

$$= \frac{(15.6 \times 10^{-4} + 0.87 \times 10^{-4}) \times 2\pi \times 7.08}{0.1} - 0.061$$

$$= 0.751 - 0.061 = 0.69[N \cdot m]$$

**9. Verification of maximum torque**

Acceleration torque $T_a = 0.812[N \cdot m] < 7.1[N \cdot m]$ (Maximum torque of MSMF 750 W motor)

**10. Verification of effective torque**

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

$$= \sqrt{\frac{0.812^2 \times 0.1 + 0.061^2 \times 0.8 + 0.69^2 \times 0.1}{2}}$$

$= 0.241[N \cdot m] < 2.4[N \cdot m]$ (Rated torque of MSMF 750 W motor)

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





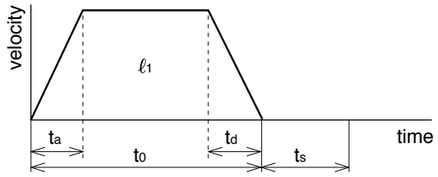
# Request Sheet for Motor Selection

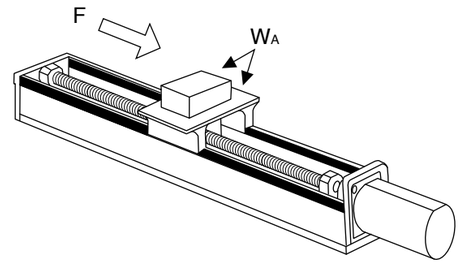
Request for motor selection Ⅰ : Ball screw drive

## 1. Driven mechanism and running data

| | | | |
|---|---|---|---|
| 1) | Travel distance of the work load per one cycle | $\ell_1$: | mm |
| 2) | Cycle time | $t_0$: | s |
| | (Fill in items 3) and 4) if required.) | | |
| 3) | Acceleration time | $t_a$: | s |
| 4) | Deceleration time | $t_d$: | s |
| 5) | Stopping time | $t_s$: | s |
| 6) | Max. velocity | V: | mm/s |
| 7) | External force | F: | N |
| 8) | Positioning accuracy of the work load | ± | mm |
| 9) | Total weight of the work load and the table | $W_A$: | kg |
| 10) | Power supply voltage | | V |
| 11) | Diameter of the ball screw | | mm |
| 12) | Total length of the ball | | mm |
| 13) | Lead of the ball screw | | mm |
| 14) | Traveling direction (horizontal, vertical etc.) | | |

Running pattern




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

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

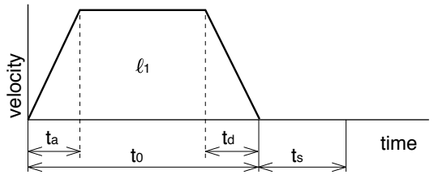
# Request Sheet for Motor Selection

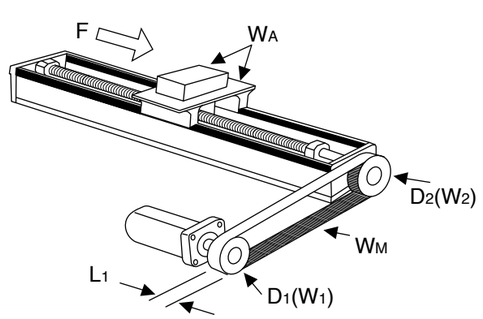
## Request for motor selection Ⅱ : Timing pulley + Ball screw drive

### 1. Driven mechanism and running data

| | | | | Motor side | Ball screw side |
|---|---|---|---|---|---|
| 1) | Travel distance of the work load per one cycle | $\ell_1$: mm | 15) Diameter of the pulley | $D_1$: mm | $D_2$: mm |
| 2) | Cycle time | $t_0$: s | 16) Weight of the pulley | $W_1$: kg | $W_2$: kg |
| | (Fill in items 3) and 4) if required.) | | (or item 17) and 18)) | | |
| 3) | Acceleration time | $t_a$: s | 17) Width of the pulley | $L_1$: mm | |
| 4) | Deceleration time | $t_d$: s | 18) Material of the pulley | | |
| 5) | Stopping time | $t_s$: s | 19) Weight of the belt | $W_M$: kg | |
| 6) | Max. velocity | V: mm/s | | | |
| 7) | External force | F: N | | | |
| 8) | Positioning accuracy of the work load | ± mm | | | |
| 9) | Total weight of the work load and the table | $W_A$: kg | | | |
| 10) | Power supply voltage | V | | | |
| 11) | Diameter of the ball screw | mm | | | |
| 12) | Total length of the ball screw | mm | | | |
| 13) | Lead of the ball screw | mm | | | |
| 14) | Traveling direction (horizontal, vertical etc.) | | | | |

Running pattern




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

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





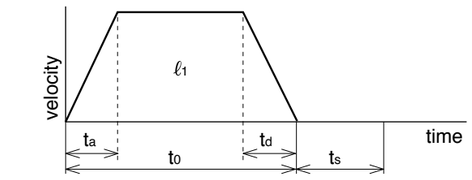
# Request Sheet for Motor Selection

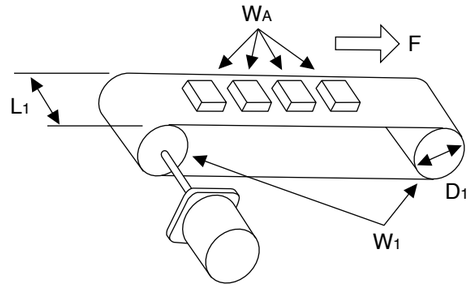
## Request for motor selection Ⅲ : Belt drive

### 1. Driven mechanism and running data

| | | | | |
|---|---|---|---|---|
| 1) | Travel distance of the work load per one cycle | $\ell_1$: mm | | |
| 2) | Cycle time | $t_0$: s | | |
| | (Fill in items 3) and 4) if required.) | | | |
| 3) | Acceleration time | $t_a$: s | | |
| 4) | Deceleration time | $t_d$: s | | |
| 5) | Stopping time | $t_s$: s | | |
| 6) | Max. velocity | V: mm/s | | |
| 7) | External force | F: N | | |
| 8) | Positioning accuracy of the work load | ± mm | | |
| 9) | Total weight of the work load | $W_A$: kg | | |
| 10) | Power supply voltage | V | | |
| 11) | Weight of the belt | $W_M$: kg | 14) Width of the pulley | $L_1$: mm |
| 12) | Diameter of the driving pulley | $D_1$: mm | 15) Material of the pulley | |
| 13) | Total weight of the pulley | $W_1$: kg | 16) Traveling direction (horizontal, vertical etc.) | |

Running pattern




(or item 14) and 15))

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

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

# Request Sheet for Motor Selection

## Request for motor selection Ⅳ : Timing pulley + Belt drive

### 1. Driven mechanism and running data

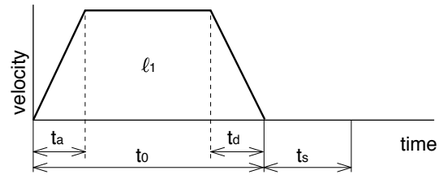
| | | | | | |
|---|---|---|---|---|---|
| 1) | Travel distance of the work load per one cycle | $\ell_1$: | mm | | |
| 2) | Cycle time | $t_0$: | s | | |
| | (Fill in items 3) and 4) if required.) | | | | |
| 3) | Acceleration time | $t_a$: | s | | |
| 4) | Deceleration time | $t_d$: | s | | |
| 5) | Stopping time | $t_s$: | s | | |
| 6) | Max. velocity | V: | mm/s | | |
| 7) | External force | F: | N | | |
| 8) | Positioning accuracy of the work load | ± | mm | | |
| 9) | Total weight of the work load | $W_A$: | kg | | |
| 10) | Power supply voltage | | V | | |
| 11) | Weight of motor side belt | $W_M$: | kg | | |

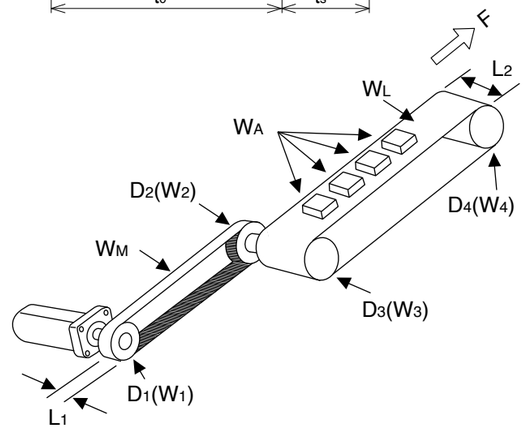
| | | Motor side | | Belt side | |
|---|---|---|---|---|---|
| 12) | Diameter of the pulley | $D_1$: | mm | $D_2$: | mm |
| 13) | Weight of the pulley | $W_1$: | kg | $W_2$: | kg |
| | (or item 14) and 15)) | | | | |
| 14) | Width of the belt | $L_1$: | mm | | |
| 15) | Material of the pulley | | | |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

| | | Motor side | | Belt side | |
|---|---|---|---|---|---|
| 16) | Diameter of the pulley | $D_3$: | mm | $D_4$: | mm |
| 17) | Weight of the pulley | $W_3$: | kg | $W_4$: | kg |
| | (or item 18) and 19)) | | | | |

| | | | |
|---|---|---|---|
| 18) | Width of the pulley | $L_2$: | mm |
| 19) | Material of the pulley | | |
| 20) | Weight of the belt | $W_L$: | kg |
| 21) | Traveling direction (horizontal, vertical etc.) | | |

Running pattern




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

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





# Request Sheet for Motor Selection

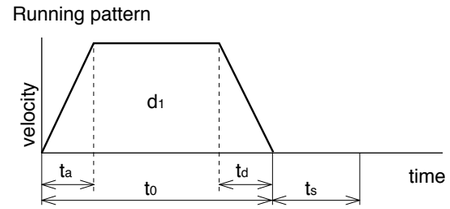
## Request for motor selection Ⅴ : Turntable drive

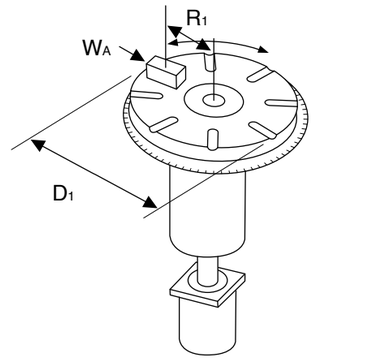
### 1. Driven mechanism and running data

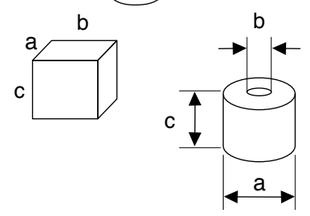
| | | | |
|---|---|---|---|
| 1) | Travel distance of the work load per one cycle | $d_1$: | deg |
| 2) | Cycle time | $t_0$: | s |
| | (Fill in items 3) and 4) if required.) | | |
| 3) | Acceleration time | $t_a$: | s |
| 4) | Deceleration time | $t_d$: | s |
| 5) | Stopping time | $t_s$: | s |
| 6)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

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

Running pattern




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

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

# Request Sheet for Motor Selection

## Request for motor selection Ⅵ : Timing pulley + Turntable drive

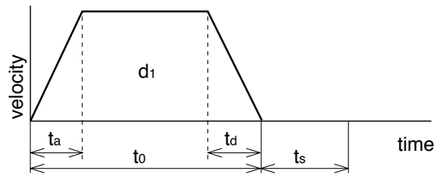
### 1. Driven mechanism and running data

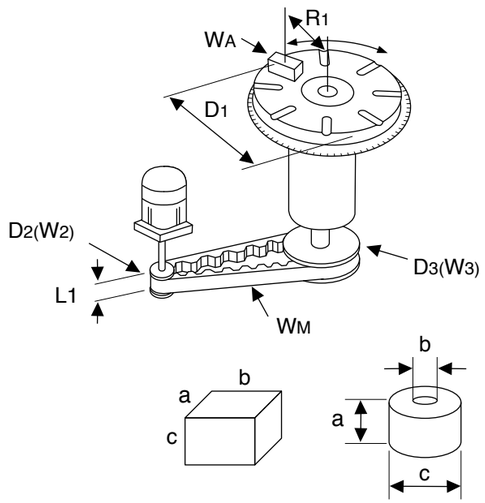
| | | | | | |
|---|---|---|---|---|---|
| 1) | Travel distance of the work load per one cycle | $d_1$: | deg | | |
| 2) | Cycle time | $t_0$: | s | | |
| | (Fill in items 3) and 4) if required.) | | | | |
| 3) | Acceleration time | $t_a$: | s | | |
| 4) | Deceleration time | $t_d$: | s | | |
| 5) | Stopping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

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

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

Running pattern




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

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





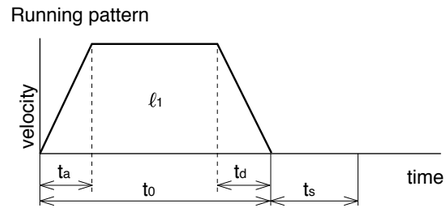
# Request Sheet for Motor Selection

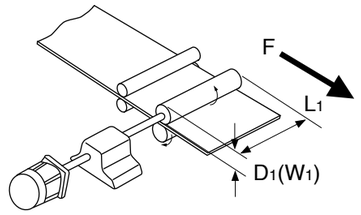
## Request for motor selection Ⅶ : Roller feed drive

### 1. Driven mechanism and running data

| | | | | | |
|---|---|---|---|---|---|
| 1) | Travel distance of the work load per one cycle | $\ell_1$: | mm | | |
| 2) | Cycle time | $t_0$: | s | | |
| | (Fill in items 3) and 4) if required.) | | | | |
| 3) | Acceleration time | $t_a$: | s | | |
| 4) | Deceleration time | $t_d$: | s | | |
| 5) | Stopping time | $t_s$: | s | | |
| 6) | Max. velocity | v: | mm/s | | |
| 7) | External pulling force | F: | N | | |
| 8) | Positioning accuracy of the work load | ± | mm | | |
| 9) | Number of rollers | | pcs | | |
| 10) | Power supply voltage | | V | | |
| 11) | Diameter of the roller | $D_1$: | mm | | |
| 12) | Mass of the roller | $W_1$: | kg | | |
| | (or item 13) and 14)) | | | | |
| 13) | Width of the roller | $L_1$: | mm | | |
| 14) | Material of the roller | | | | |

Running pattern




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

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

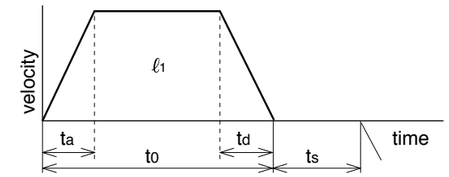
# Request Sheet for Motor Selection

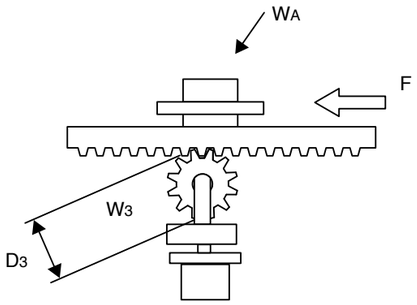
Request for motor selection Ⅷ : Driving with Rack & Pinion

## 1. Driven mechanism and running data

| | | | |
|---|---|---|---|
| 1) | Travel distance of the work load per one cycle | $\ell_1$: | mm |
| 2) | Cycle time | to: | s |
| | (Fill in items 3) and 4) if required.) | | |
| 3) | Acceleration time | ta: | s |
| 4) | Deceleration time | td: | s |
| 5) | Stopping time | ts: | s |
| 6) | Max. velocity | V: | mm/s |
| 7) | External force | F: | N |
| 8) | Positioning accuracy of the work load | ± | mm |
| 9) | Total weight of the work load | $W_A$: | kg |
| 10) | Power supply voltage | | V |
| 11) | Diameter of the pinion | $D_3$: | mm |
| 12) | Mass of the pinion | $W_3$: | kg |
| 13) | Traveling direction (horizontal, vertical, etc.) | | |

Running pattern




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

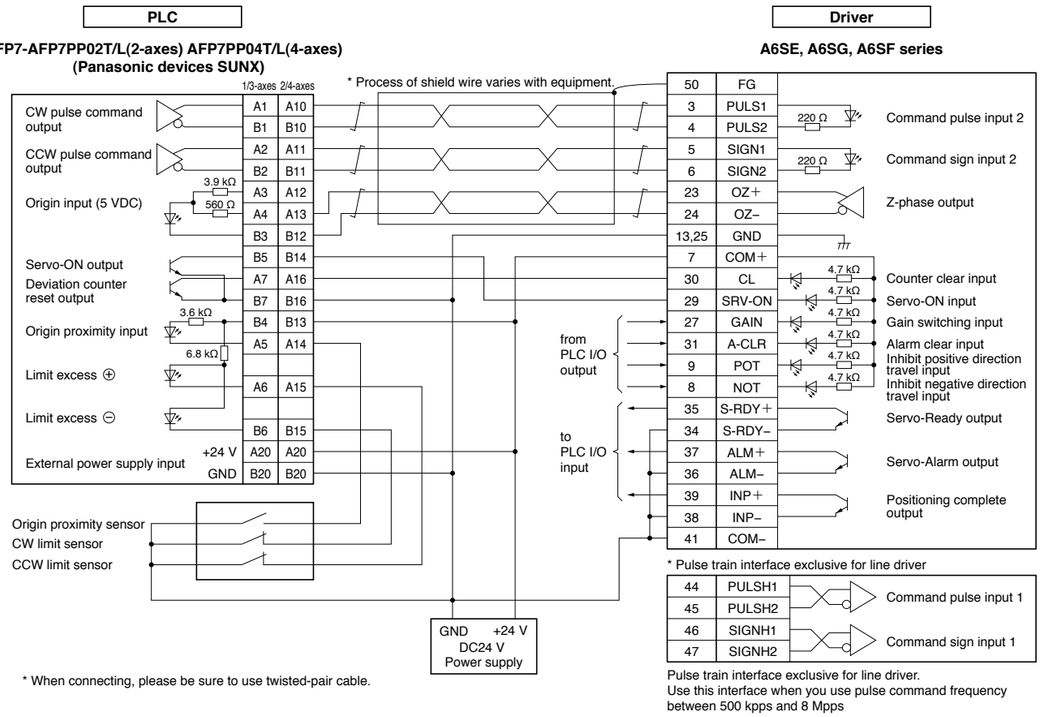
| |
|---|
| Company name : |
| Department/Section : |
| Name : |
| Address : |
| Tel : |
| Fax : |
| E-mail address: |



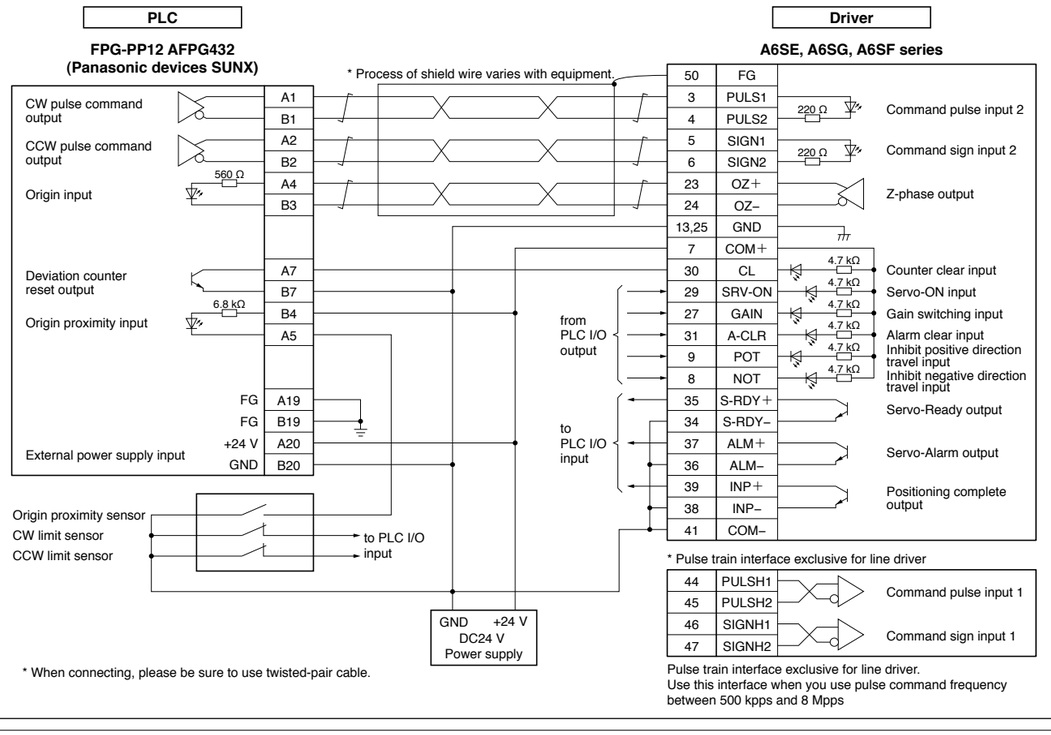




## FP7-AFP7PP02T/L(2-axes) AFP7PP04T/L(4-axes) Connection with the Panasonic devices SUNX.

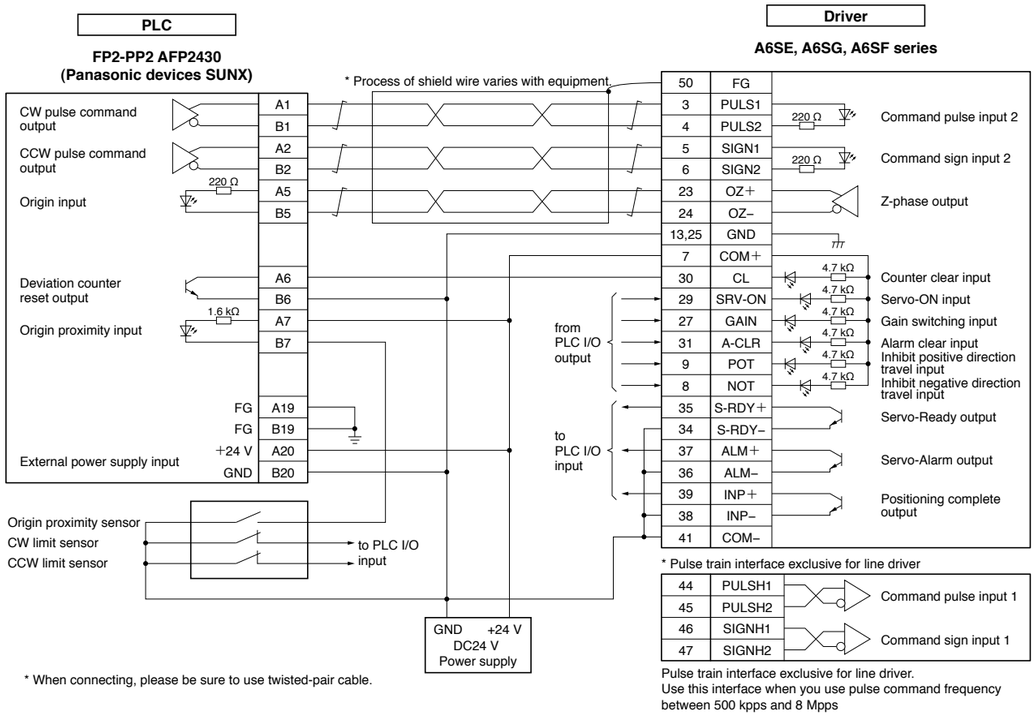



## FPG-PP12 AFPG432 Connection with the Panasonic devices SUNX.



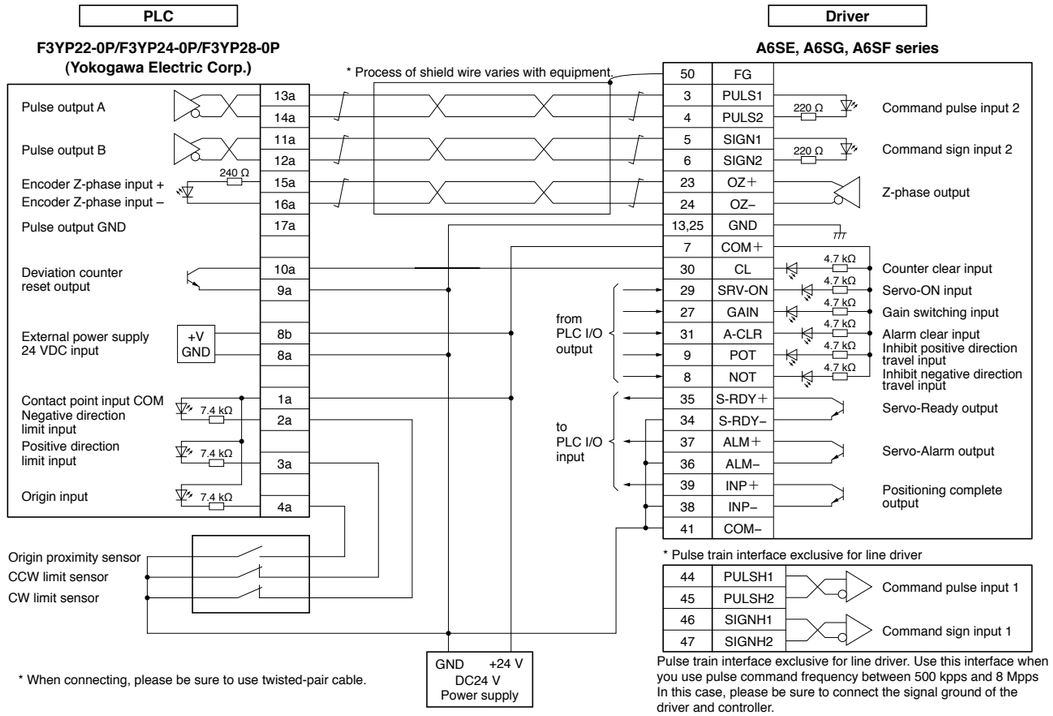
# Connection Between Driver and Controller

## FP2-PP2 AFP2430 Connection with the Panasonic devices SUNX.



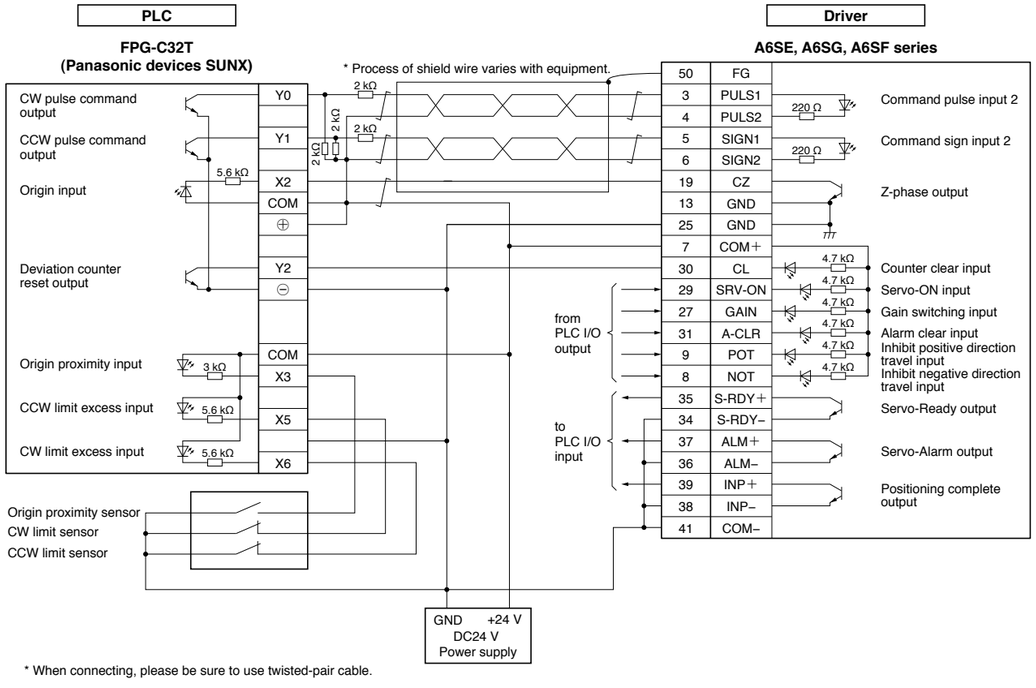

* When connecting, please be sure to use twisted-pair cable.

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



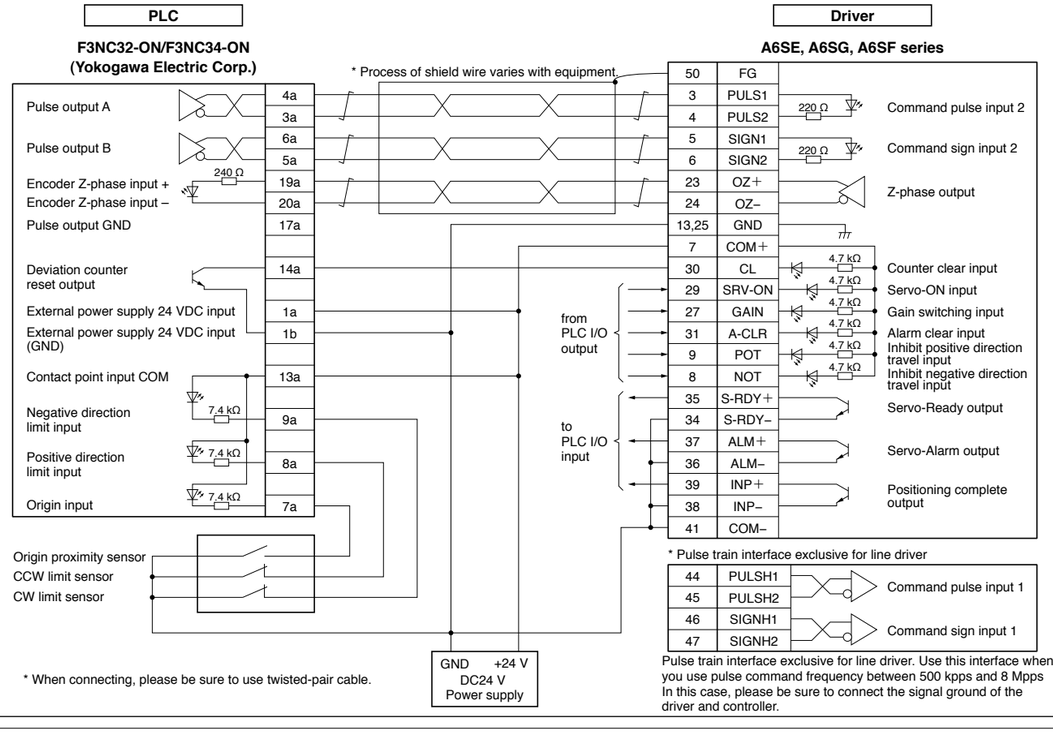

* When connecting, please be sure to use twisted-pair cable.

## FPG-C32T Connection with the Panasonic devices SUNX.




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

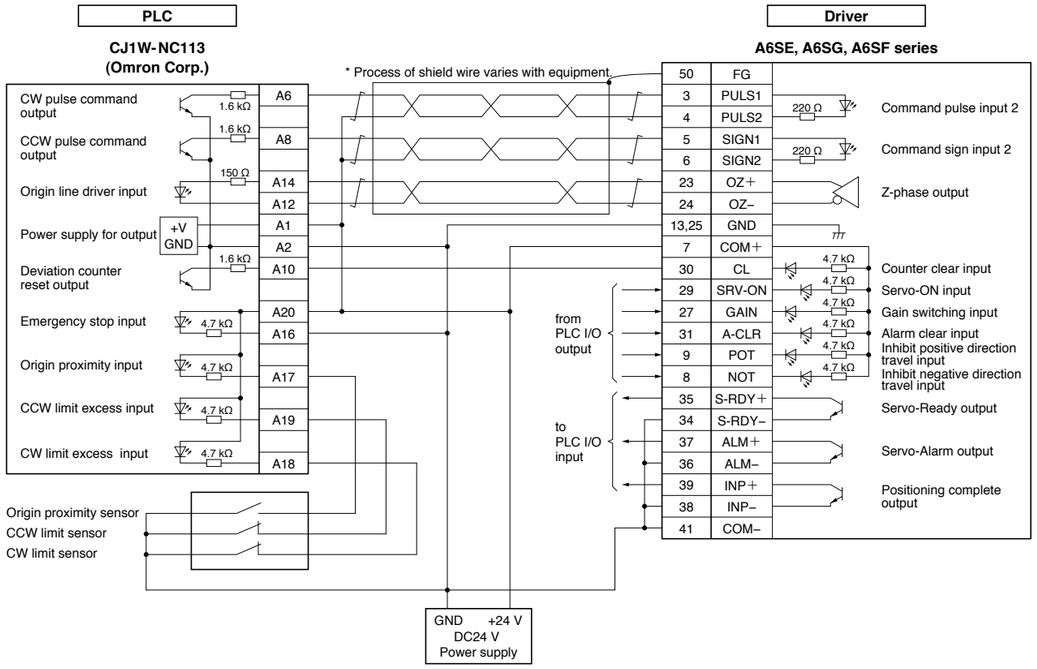
## F3NC32-ON/F3NC34-ON Connection with the Yokogawa Electric Corp.




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

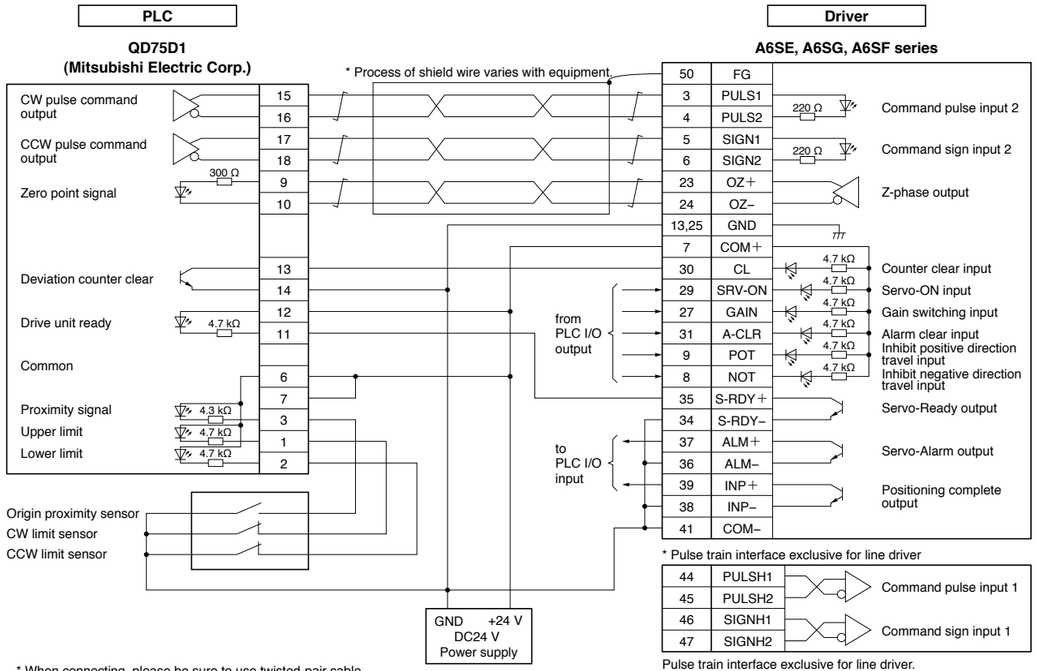
# Connection Between Driver and Controller

## CJ1W-NC113 Connection with the Omron Corp.




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

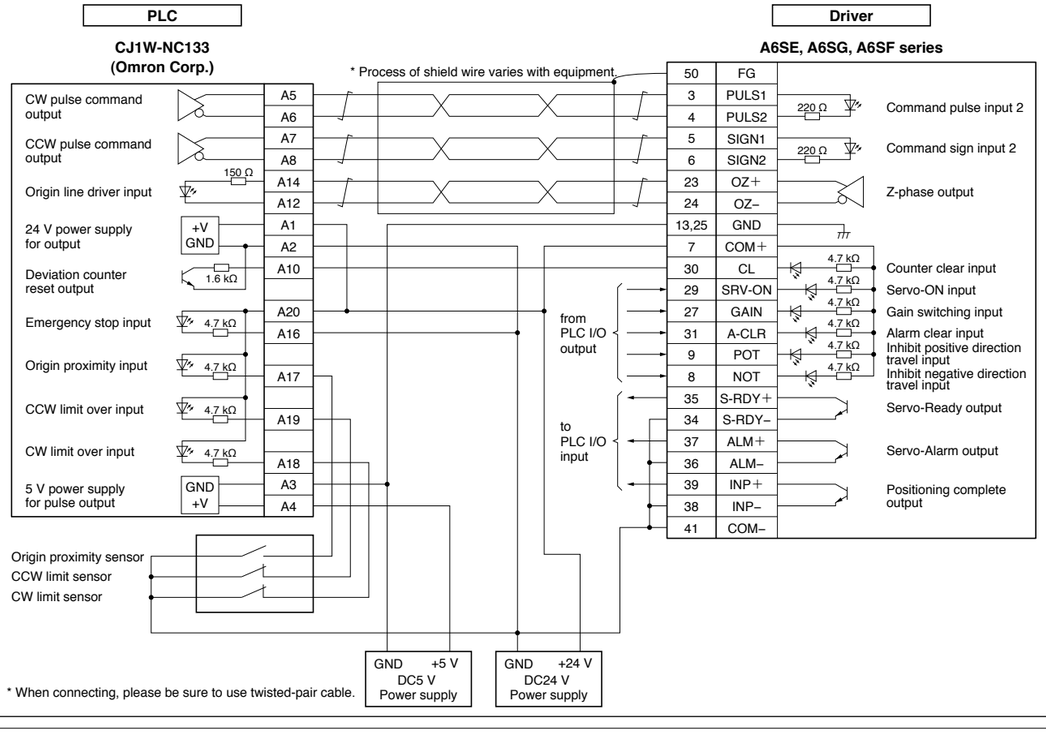
## QD75D1 Connection with the Mitsubishi Electric Corp.




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

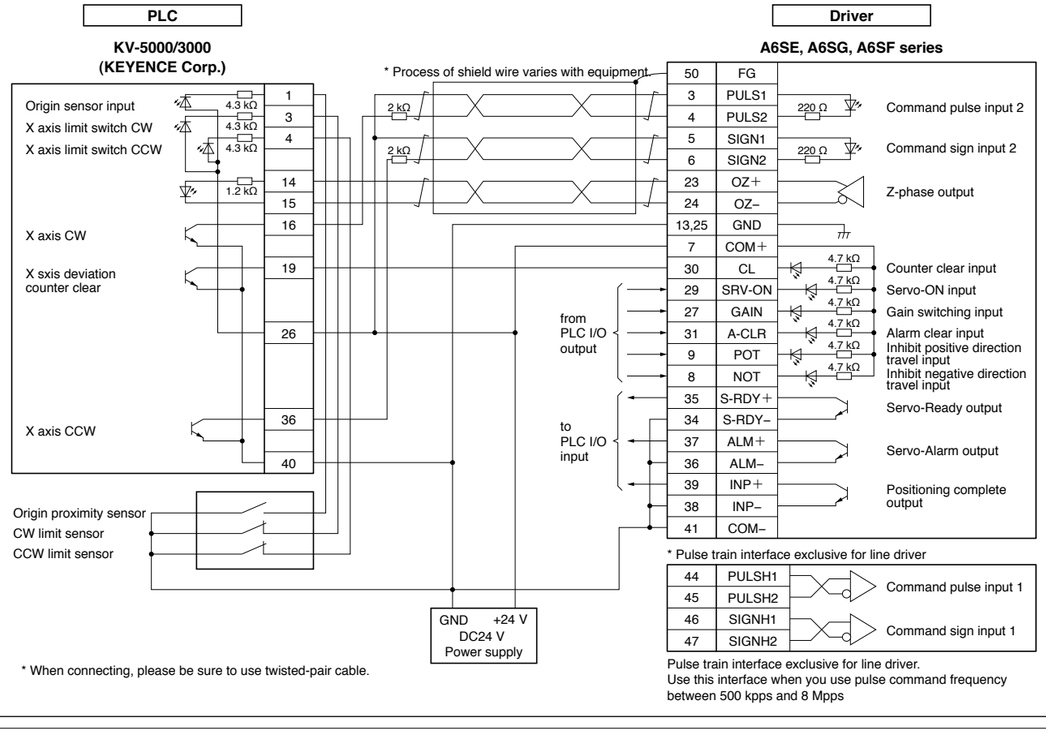
Pulse train interface exclusive for line driver.
Use this interface when you use pulse command frequency between 500 kpps and 8 Mpps

## CJ1W-NC133 Connection with the Omron Corp.




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

## KV-5000/3000 Connection with the KEYENCE Corp.



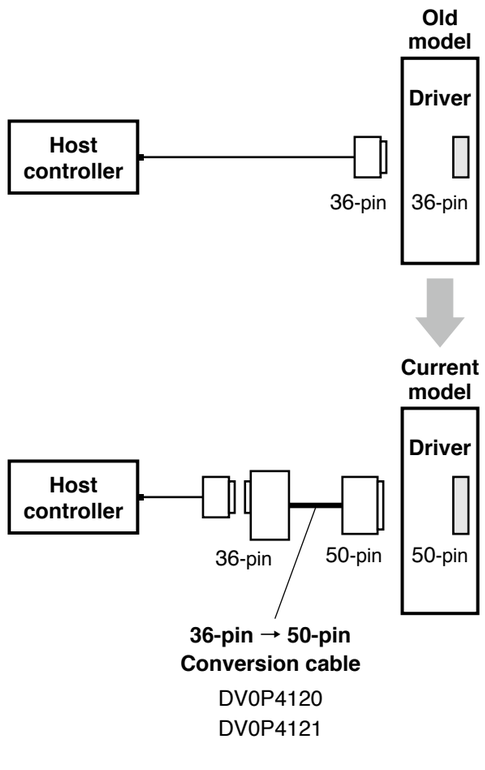

* When connecting, please be sure to use twisted-pair cable.

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

# Replacing Old Model Servo Driver with MINAS A6 series

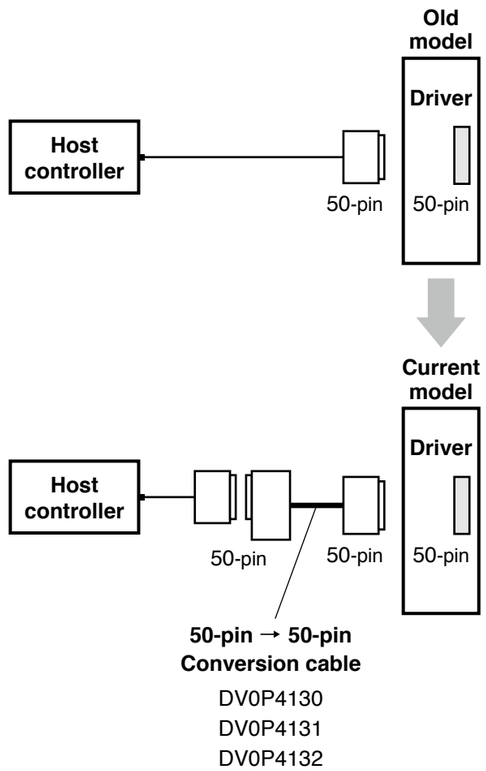
For easier replacement of old driver (MINAS X/XX/V series) with A6 series, use the interface conversion connector.

〈36-pin → 50-pin〉




**36-pin → 50-pin**
**Conversion cable**
DV0P4120
DV0P4121

〈50-pin → 50-pin〉




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

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

| Old model | Control mode | Conversion cable part No. | Conversion wiring table |
|---|---|---|---|
| X series<br>XX series<br>(36-pin) | Position/velocity control | DV0P4120 | P.394 |
| | Torque control | DV0P4121 | |
| V series<br>(50-pin) | Position control | DV0P4130 | P.395 |
| | Velocity control | DV0P4131 | |
| | Torque control | DV0P4132 | P.396 |

* For external dimensions, refer to P.290.

## Conversion Wiring Table

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

* "NC" is no connect.

# Replacing Old Model Servo Driver with MINAS A6 series

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

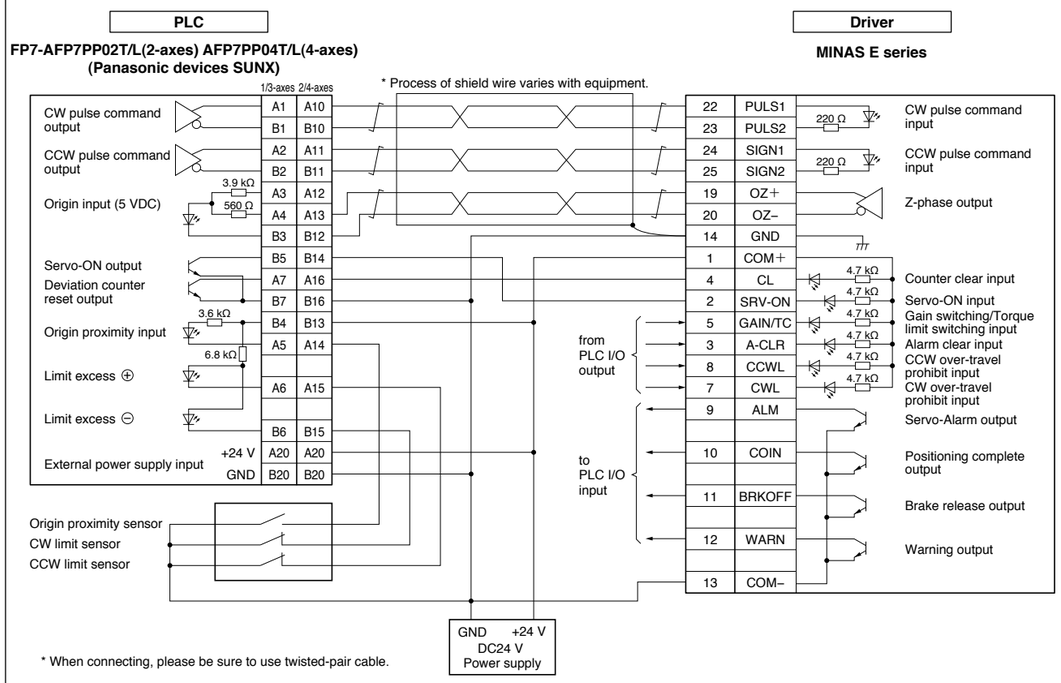
* “NC” is no connect.

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

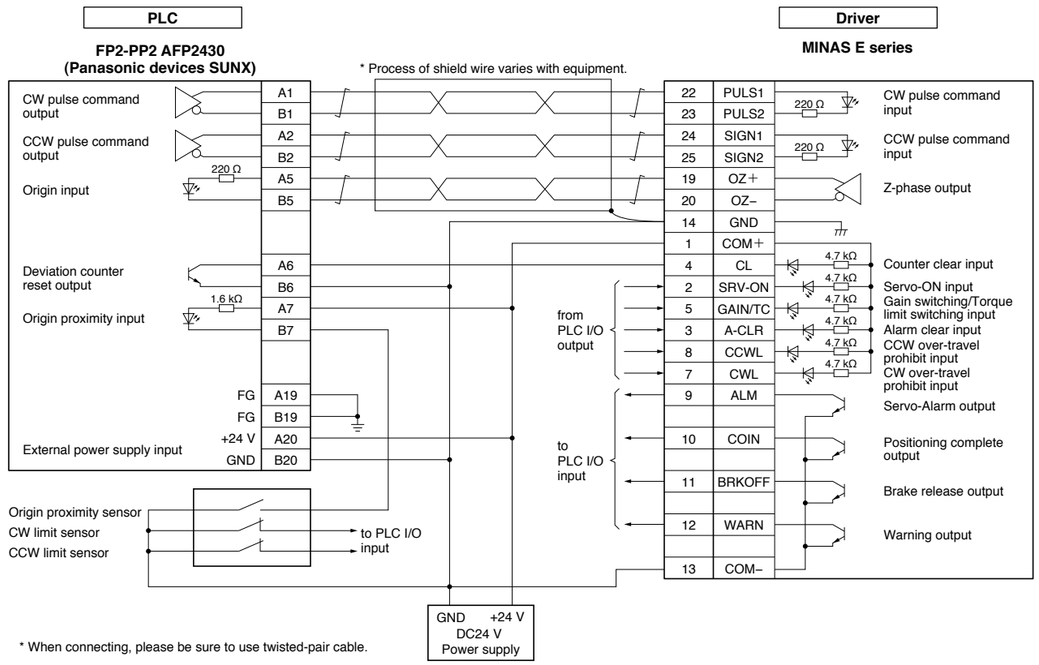
* “NC” is no connect.

# Connection Between Driver and Controller

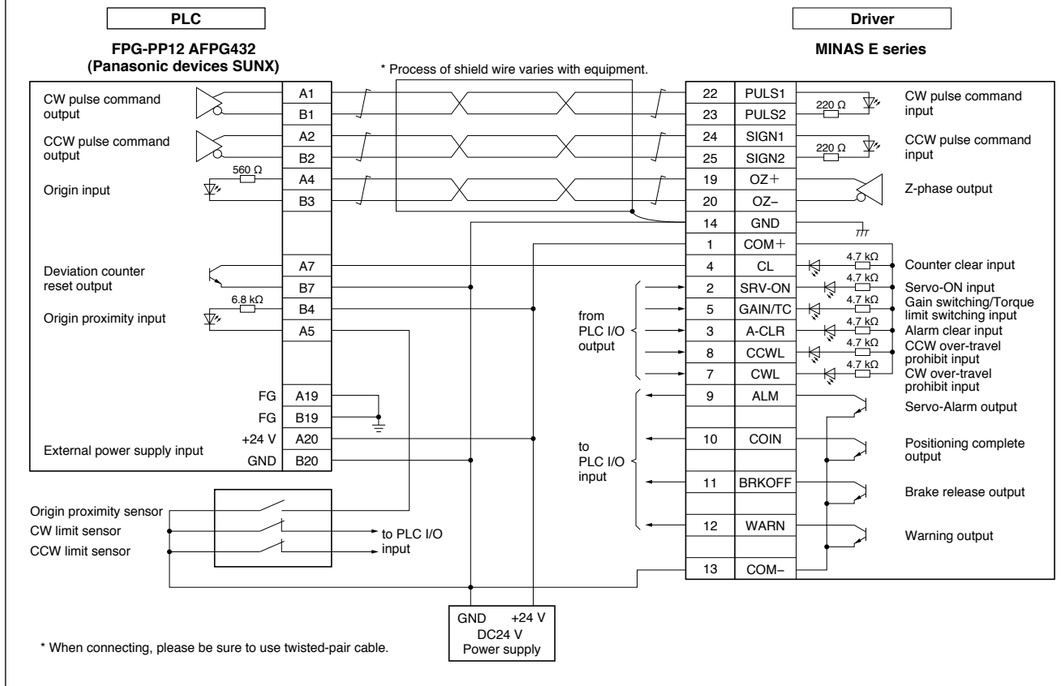
## FP7-AFP7PP02T/L(2-axes) AFP7PP04T/L(4-axes) Connection with the Panasonic devices SUNX.



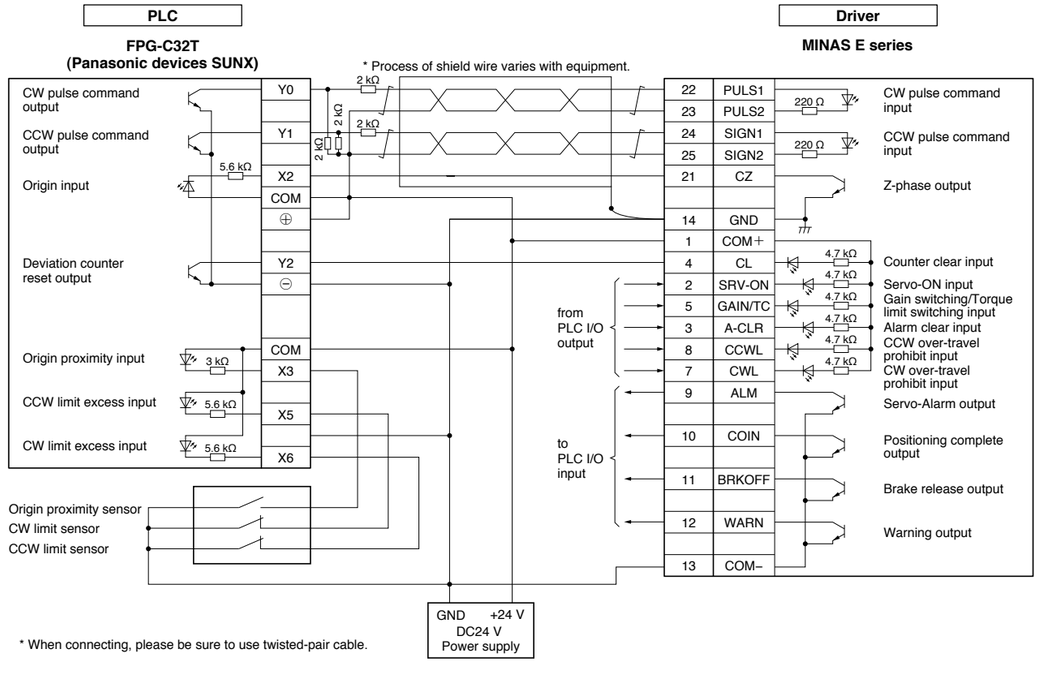

## FP2-PP2 AFP2430 Connection with the Panasonic devices SUNX.




## FPG-PP12 AFPG432 Connection with the Panasonic devices SUNX.

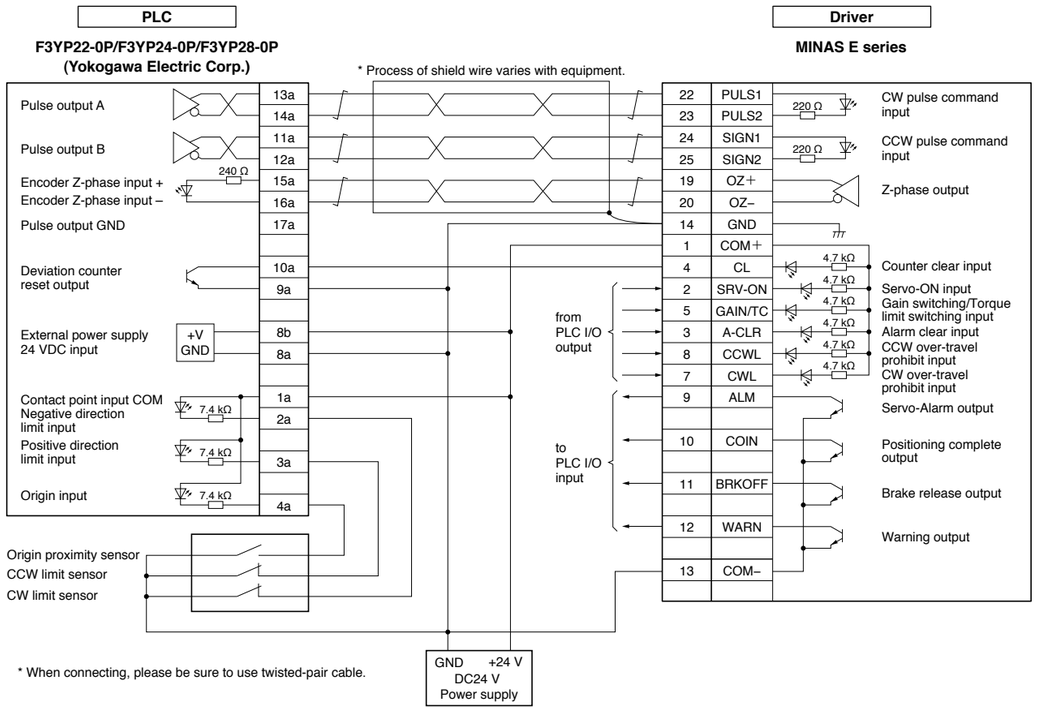



## FPG-C32T Connection with the Panasonic devices SUNX.

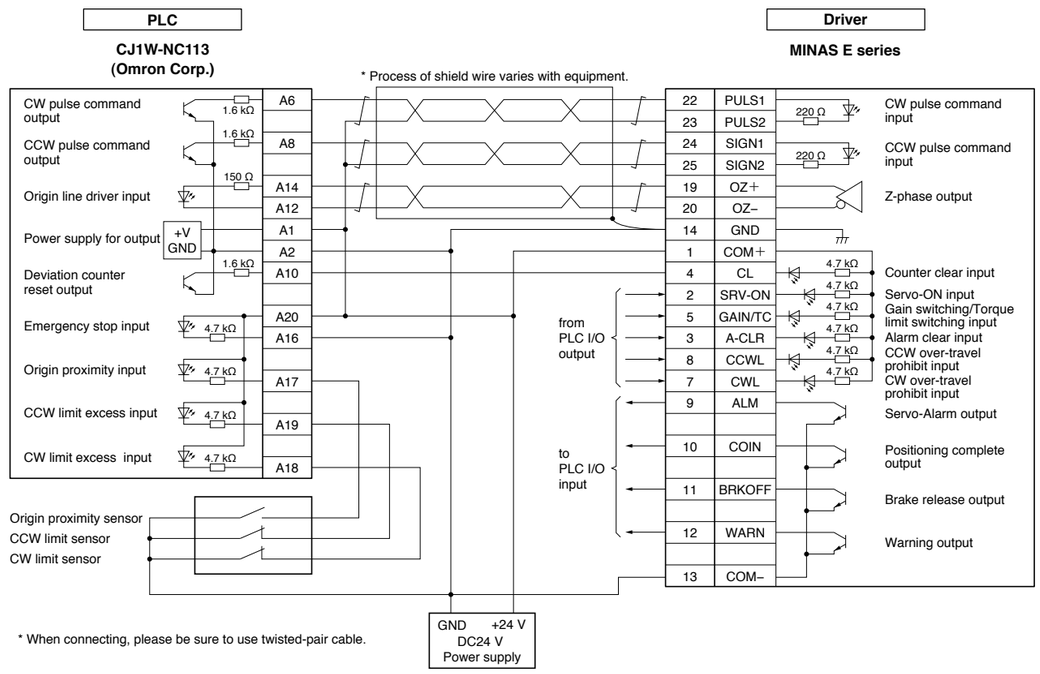


# Connection Between Driver and Controller

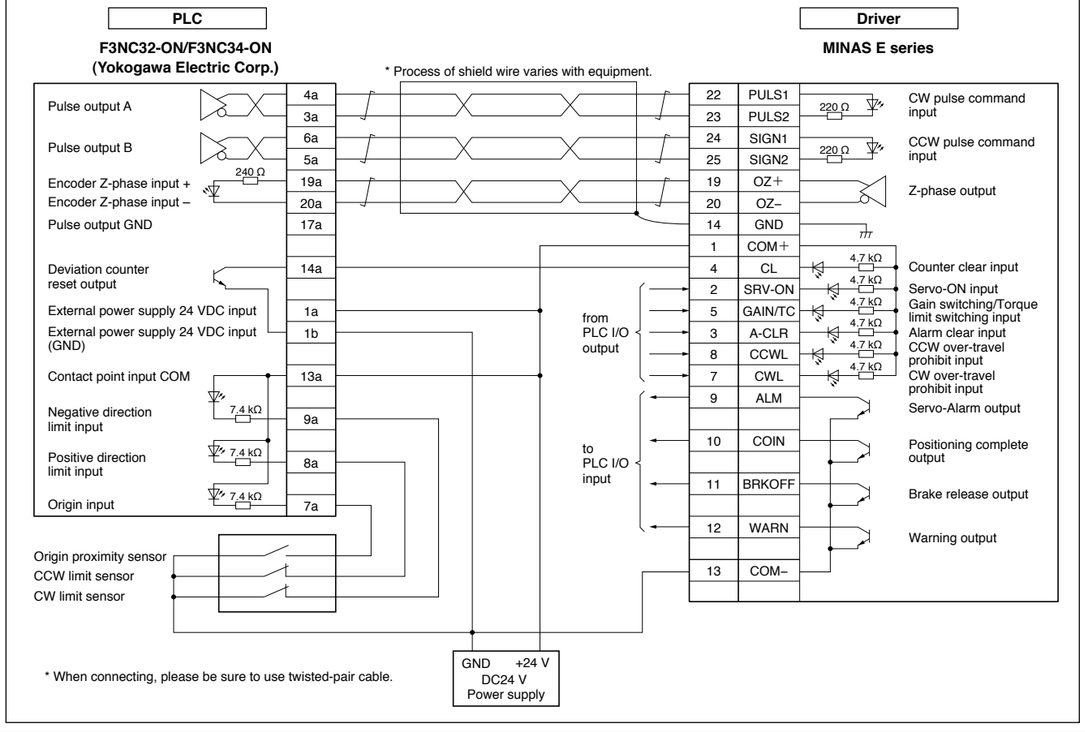
## F3YP22-0P/F3YP24-0P/F3YP28-0P Connection with the Yokogawa Electric Corp.



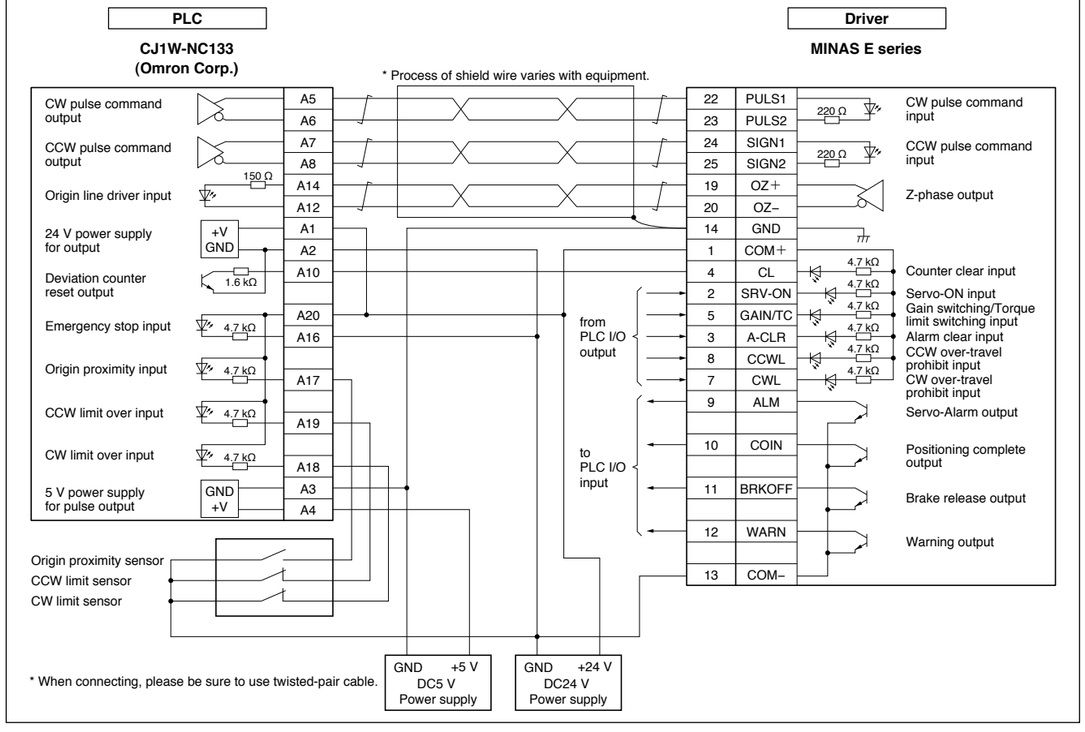

## CJ1W-NC113 Connection with the Omron Corp.




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

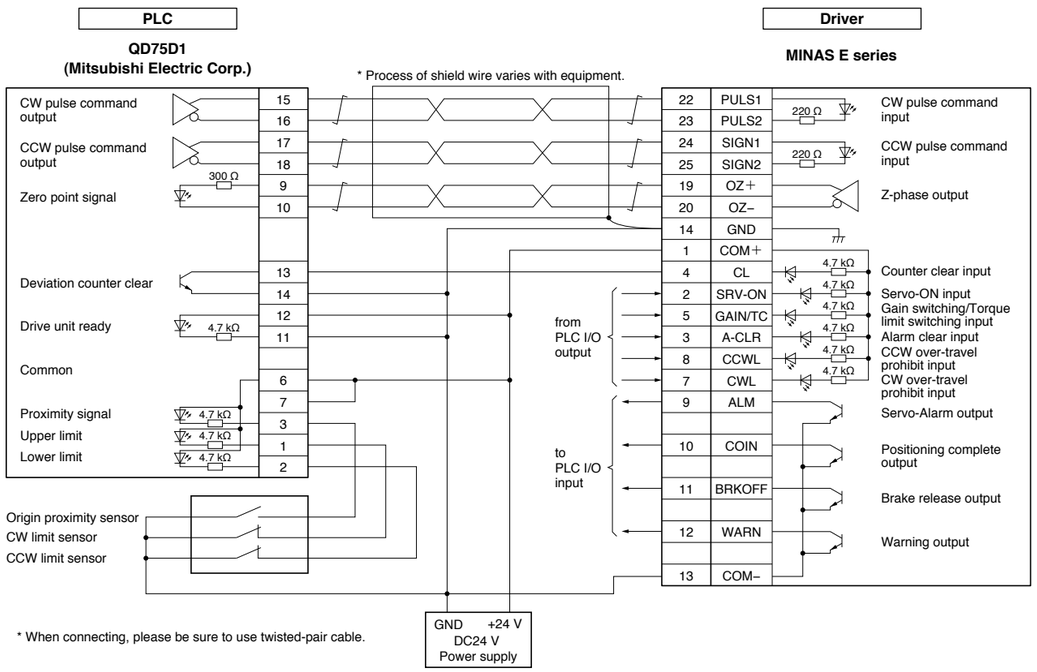



## CJ1W-NC133 Connection with the Omron Corp.



# Connection Between Driver and Controller

## QD75D1 Connection with the Mitsubishi Electric Corp.




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

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# Sales Office

## [Panasonic Sales Office of Motors]

(February.01.2018)

| Country | Company Name [Category] | City | Address | TEL / FAX |
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| **U.S.A** | Panasonic Industrial Devices Sales Company of America [Sales office] | New Jersey | Two Riverfront Plaza, 7th Floor Newark, NJ 07102-5490 U.S.A | +1-800-228-2350 / — |
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| | | | e-mail | https://eu.industrial.panasonic.com/about-us/contact-us |
| | | | Web site | https://eu.industrial.panasonic.com/products/motors-compressors-pumps |
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| | | | e-mail | info.peweu@eu.panasonic.com |
| | | | Web site | https://panasonic-electric-works.com/de/servoantriebe-servomotoren.htm |
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| | | | Web site | https://www.ghv.de/ |
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| | | | Web site | http://www.lenze.com/it-it |
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| | | | Web site | https://www.panasonic-electric-works.com/uk/servo-drives-and-motors.htm |
| | Lenze Limited [Distributors] | Bedford | Priory Business Park, Bedford, MK44 3WH. | +44-1234-7532-00 / +44-1234-7532-20 |
| | | | e-mail | uk.sales@lenze.com |
| | | | Web site | http://www.lenze.com/en-gb/about-lenze/lenze-in-united-kingdom |
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| | | | Web site | https://www.panasonic-electric-works.com/at/servoantriebe-servomotoren.htm |
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| | | | Web site | https://www.panasonic-electric-works.com/pl/serwonapedy.htm |
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| | | | Web site | https://panasonic-electric-works.com/be/servosystemes-et-servomoteurs.htm |

# Sales Office

| Country | Company Name [Category] | City | Address | TEL / FAX |
|---|---|---|---|---|
| **Czech Republic** | Panasonic Electric Works Czech s.r.o. [Sales office] | Brno | Veveří 3163/111, 616 00 Brno, Czech | TEL +420(0)541217001 |
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| | | | Web site: https://www.panasonic-electric-works.com/es/servoaccionamientos-y-motores.htm | |
| **Romania** | C.I.T. Automatizari SRL [Distributors] | Bucuresti | sos. Bucuresti, nr.63, Ciorogirla, Ilfov, RO-077055, ROMANIA | TEL +40-21-255-0543 |
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| | | | | FAX +36(0)19998927 |
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| | | | Web site: https://www.panasonic-electric-works.com/eu/servo-drives-and-motors.htm | |
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| | | | | FAX +31(0)417997055 |
| | | | e-mail: info.pewch@eu.panasonic.com | |
| | | | Web site: https://www.panasonic-electric-works.com/ch/fr/servosystemes-et-servomoteurs.htm | |
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| | | | Web site: http://www.efo.ru | |
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| | | | Web site: http://www.savior.com.tr | |
| | BOSTEK TEKNOLOJI GELISTIRME VE ROBOT SIST.SAN.TIC.A.S [Distributors] | Izmir | 10042 SOK.NO:10 A.O.S.B CIGLI-IZMIR, TURKEY | TEL +90 232 433 8515 |
| | | | | FAX +90 232 433 8881 |
| | | | e-mail: sales@bostek.com.tr | |
| | | | Web site: http://www.bostek.com.tr | |
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| | | | e-mail: info@lubielectronics.com | |
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