

Ultra Compact Servo Motor & Driver

MINAS **E** Series



1

Best Fit to Small Drives

- Further evolution in down-sizing, by 47% in size (Note)
- Exclusively designed for Positioning Control

2

Easy to Handle, Easy to Use

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

3

High-Speed Positioning with Resonance Suppression Filters

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

4

Smoother operation for Low Stiffness Machine

- Damping control function suppresses vibration during acceleration/deceleration

MINAS E Series

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Remarks : Instruction manual is available as an option as
 Japanese version : DV0P3680 and
 English version : DV0P3700

Details of Features

1. Easy to Handle, East to Use

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

- Offers real automatic gain tuning to 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)

- Easy to mount and easy to dismount.

2. Further Reduction of Vibration

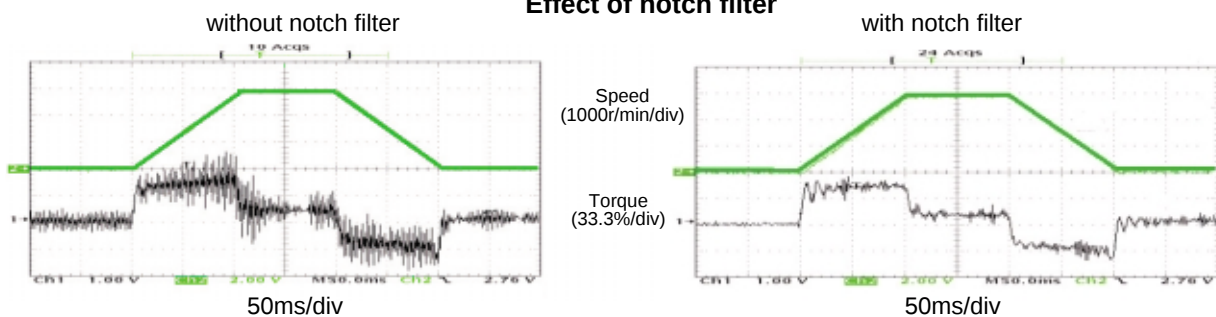
■ Adaptive filter (Note1)

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

■ Notch filter (Note1)

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

Effect of notch filter



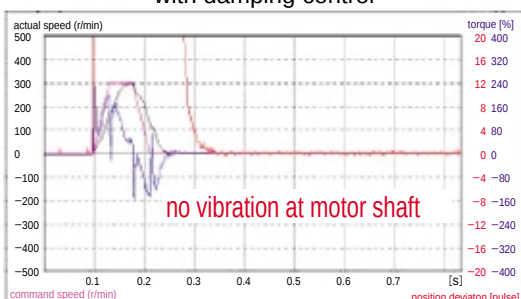
■ Damping control (Note1)

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

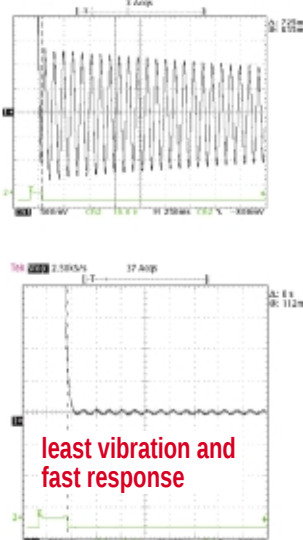
Motor movement without damping control



with damping control



Machine movement



- (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 Page E25, 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.

■ Inrush current suppressing function

- Inrush suppressing resistor is equipped in this driver, which prevent the circuit breaker shutdown of the power supply caused by inrush current at power-on.
- 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 resistor, which 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 set up depending on the machine requirement.

■ Setup support software

- 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 page, F4 for setup support software.

■ Key-way shaft and tapped shaft end

- East 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 page "F4" 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 page "F4" 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
	EN50178	UL508C			
Motor and driver	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 : Europäischen Normen
 EMC : Electromagnetic Compatibility
 UL : Underwriters Laboratories
 CSA : Canadian Standards Association

List of Specifications

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

Model Designation

■ Servo Motor

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

Special specifications

Symbol	Type
MUMA	Ultra low inertia (100W-400W)

Design order 1 : Standard

Motor structure

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

*Motor with oil seal is manufactured by order.
Round shaft is manufactured by order.

Motor rated output

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

Voltage specifications

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

Rotary encoder specifications

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

See page, E11 for motor specifications

■ Motor with gear reducer

M U M A 0 1 1 P 3 1 N

Gear reduction ration, gear type

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

Motor structure

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

Motor rated output

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

Voltage specifications

Symbol	Specifications
1	100 V
2	200 V

Rotary encoder specifications

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

See page, E16 for motor with gear reducer specifications

■ Servo Driver

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

Special specifications

Control mode
P: Pulse train

Frame symbol

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

Power device Max. current rating

Symbol	Power device Max. current rating
T1	10 A
T2	15 A

Supply voltage specifications

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

Current detector current rating

Symbol	Current detector, current rating
05	5A
10	10 A

See page, E20 for driver specifications

Wiring example For details, refer to the Instruction Manual.

●Wiring of main circuit

Circuit Breaker (NFB)

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 Pin-5 and B (Pin-3) of connector, CN X5, when regenerative energy is large. (Refer to page, E31 for regenerative resistor.)

Motor	to page E11
Driver	to page E20
Option	to page E24
Recommended equipments	
Parts customer to prepare	

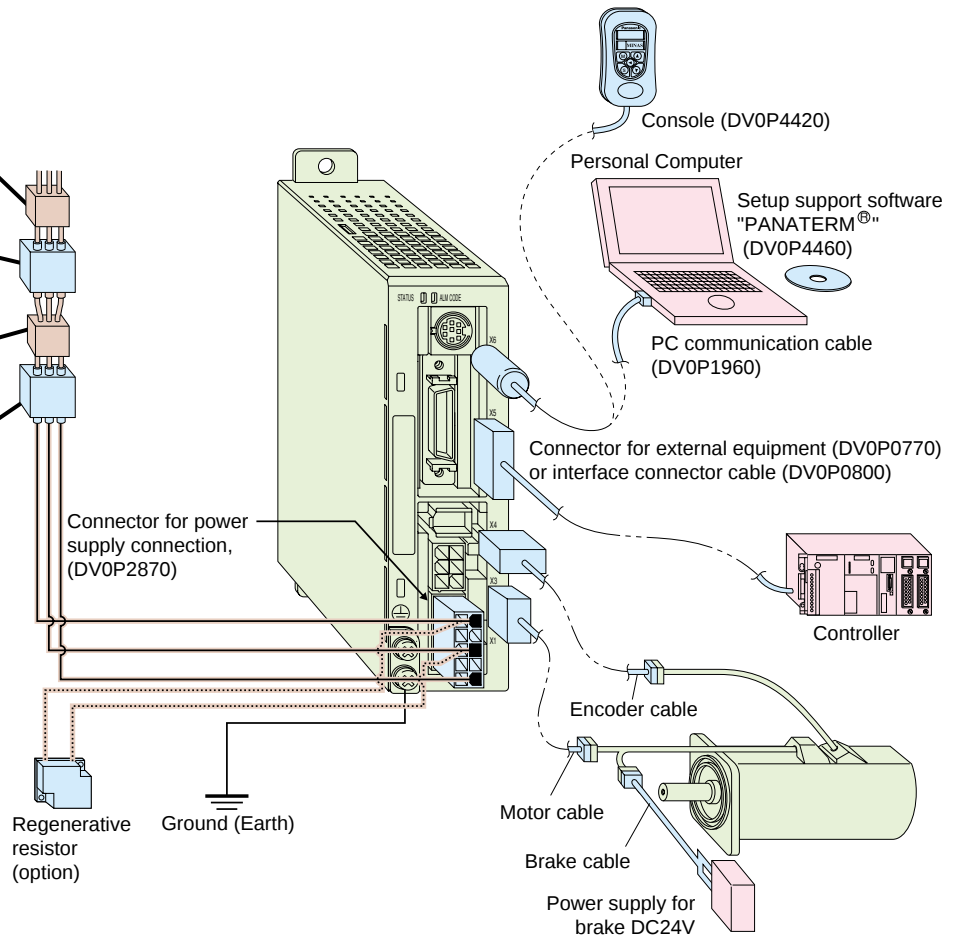


Table of Part Numbers and Options

Power supply	Output (W)	2500P/r, Incremental				Encoder cable Note) 2	Motor cable Note) 2	
		Motor Note) 1	Rating/Spec. (page)	Driver	Dimensions (Frame symbol)			
Single phase 100V	50	MUMA5AZP1□	E11	MKDET1105P	E23 (K)	MFECA0 * * 0EAM	MFMCA0 * * 0AEB	
	100	MUMA011P1□	E11	MKDET1110P	E23 (K)			
	200	MUMA021P1□	E11	MLDET2110P	E23 (L)			
Single phase 200V	50	MUMA5AZP1□	E13	MKDET1505P	E23 (K)			
	100	MUMA012P1□	E13	MKDET1505P	E23 (K)			
	200	MUMA022P1□	E13	MLDET2210P	E23 (L)			
	400	MUMA042P1□	E13	MLDET2510P	E23 (L)			
3-phase 200V	50	MUMA5AZP1□	E13	MKDET1505P	E23 (K)			
	100	MUMA012P1□	E13	MKDET1505P	E23 (K)			
	200	MUMA022P1□	E13	MKDET1310P	E23 (K)			
	400	MUMA042P1□	E13	MLDET2510P MLDET2310P	E23 (L)			

Note 1. Motor model number suffix
S : Key way with center tap, without brake
T : Key way with center tap, with brake
2. ** represents cable length. For details, refer to page, E24

■ List of recommended peripheral equipments

Power supply	Motor		Power capacity (at rated output)	Circuit breaker (Rated current)	Noise filter	Magnetic Contactor (Contact Composition)	Wire diameter (L1, L2, L3, U, V and W)
	Series	Output					
Single phase, 100V	MUMA	50W	0.3kVA	BBC25 (5A)	DV0P4160	BMFT61041N (3P+1a)	0.75mm² - 0.85mm² AWG18
		100W	0.4kVA				
		200W	0.5kVA	BBC2101N (10A)			
Single phase, 200V		50W	0.3kVA	BBC25N (5A)			
		100W					
		200W	0.5kVA			BBC2101N (10A)	
		400W	0.9kVA				
3-phase 200V		50W	0.3kVA	BBC35N (5A)			
		100W					
		200W	0.5kVA				
	400W	0.9kVA	BBC3101N (10A)				

- Select the single and 3-phase common specifications corresponding to the power supplies.
- Circuit breaker and magnetic contactor listed are manufactured by Matsushita Electric Works.
- To conform to EC Directives, install a circuit breaker which conforms to IEC and UL Standards (UL listed and ® marked) between noise filter and power supply.
- For details of the noise filters, refer to page E10.

<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 2.0mm² (AWG14) or larger.

■ Carrying page

Options			Part No.	Carrying page
Instruction manual		Japanese	DV0P3680	—
		English	DV0P3700	—
Console			DV0P4420	E25
Setup support software, PANATERM [®]		Japanese	DV0P4460	E28
		English		
RS232 communication cable (for connection with PC)			DV0P1960	E28
Interface cable			DV0P0800	E28
Connector kit for motor and encoder			DV0P0770	E27
Connector kit for external equipment			DV0P3670	E26
Connector kit for driver power supply			DV0P2870	E26
Encoder cable		MFECA0* *0EAM		E25
Motor cable		MFMC A0* *0AEB		E25
Brake cable		MFMCB0* *0GET		E25
Cable set (3m) (Note 3)		DV0P37300		E25
Cable set (5m) (Note 3)		DV0P39200		E25
DIN-rail unit		DV0P3811		E30
Regenerative resistor	100V	50 Ω 10W	DV0P2890	E29
	200V	100 Ω 10W	DV0P2891	
Reactor		100V	DV0P227	E29
			DV0P228	
		200V	DV0P220	
Noise filter			DV0P4160	E10
Surge absorber		Single phase 100V,200V	DV0P4190	E10
		3-phase 200V	DV0P1450	
Noise filter for signal wire			DV0P1460	E10

- Note) 3. Cable set (3m) contains,
- 1) Interface cable: DV0P0800
 - 2) Encoder cable (3m) : MFECA0030EAM
 - 3) Motor cable (3m) : MFMC A0030AEB
 - 4) Connector kit for driver power supply connection : DV0P2870
- Cable set (5m) contains,
- 1) Interface cable: DV0P0800
 - 2) Encoder cable (5m) : MFECA0050EAM
 - 3) Motor cable (5m) : MFMC A0050AEB
 - 4) Connector kit for driver power supply connection : DV0P2870

Option					
	Brake cable Note) 2	Regenerative resistor	Reactor	Noise filter	
	MFMCB0 * * 0GET	DV0P2890	DV0P227	DV0P4160	
			DV0P228		
		DV0P2891	DV0P220		

Conformity to CE and UL

Compliance to EC and EMC Directives

EC Directives

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

MINAS AC Servos conforms to the EC Directives for Low Voltage Equipment so that the machine incorporating our servos has an easy access to the conformity to relevant EC 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	Conforms to Low-Voltage Directives
	EN50178 UL508C	
Motor and driver	EN55011	Conforms to references by EMC Directives
	Radio Disturbance Characteristics of Industrial, Scientific and Medical (ISM) Radio-Frequency Equipment	
	EN61000-6-2	
	Immunity for Industrial Environments	
	IEC61000-4-2	
	Electrostatic Discharge Immunity Test	
	IEC61000-4-3	
	Radio Frequency Electromagnetic Field Immunity Test	
	IEC61000-4-4	
	Electric High-Speed Transition Phenomenon/Burst Immunity Test	
	IEC61000-4-5	
	Lightening Surge Immunity Test	
	IEC61000-4-6	
	High Frequency Conduction Immunity Test	
	IEC61000-4-11	
	Instantaneous Outage Immunity Test	

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

Composition of peripheral components

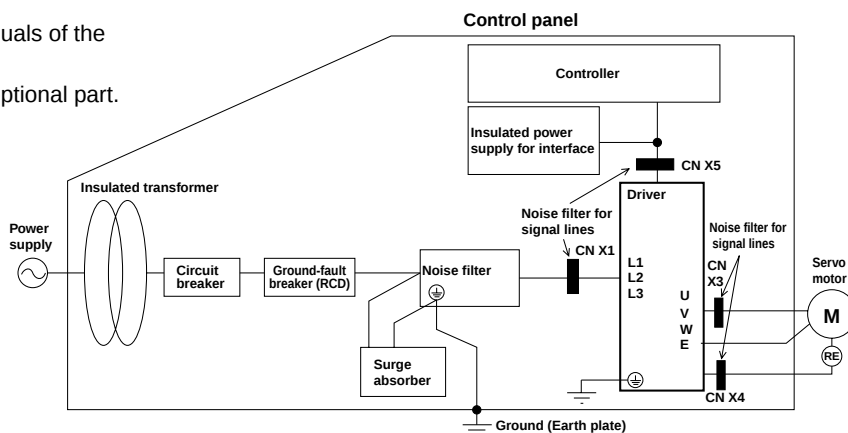
<Precautions in using options>

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

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

(1) Use the power supply under an environment of Overvoltage Category III specified in IEC60664-1.

(2) For a interface power supply, use the insulated one with 12 to 24 VDC which conforms to CE Marking or EN Standards (EN60950).

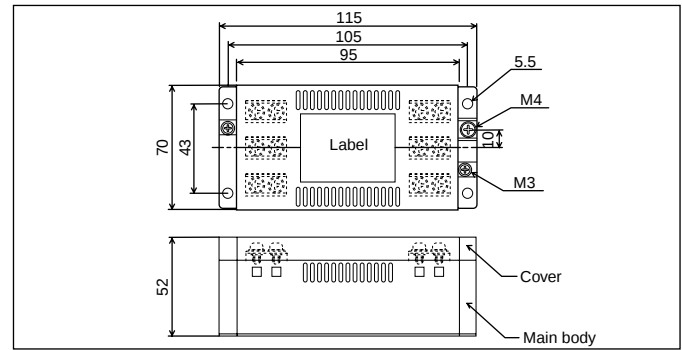
Circuit breaker

Connect a circuit breaker which conforms to IEC standards and is UL recognized (listed and 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.

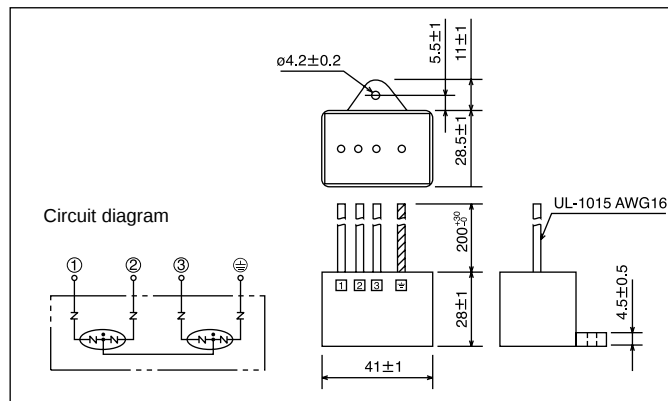
Option part No.	Part No.	Manufacturer
DV0P4160	3SUP-HU10-ER-6	Okaya Electric Industries Co.



Surge absorber

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

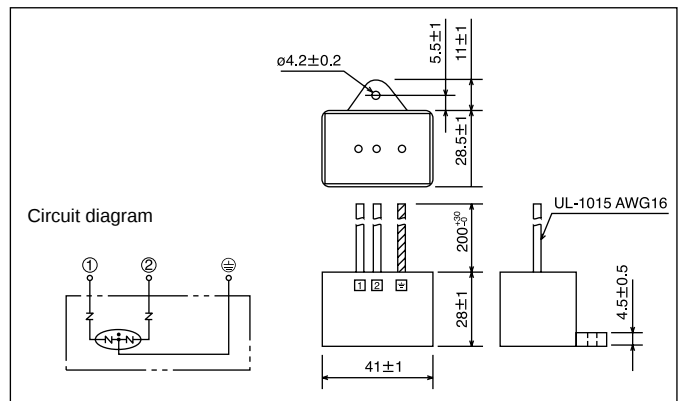
Option part No.	Driver voltage spec	Part No.	Manufacturer
DV0P1450	3-phase, 200V	R · A · V-781BXZ-4	Okaya Electric



<Remarks>

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

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



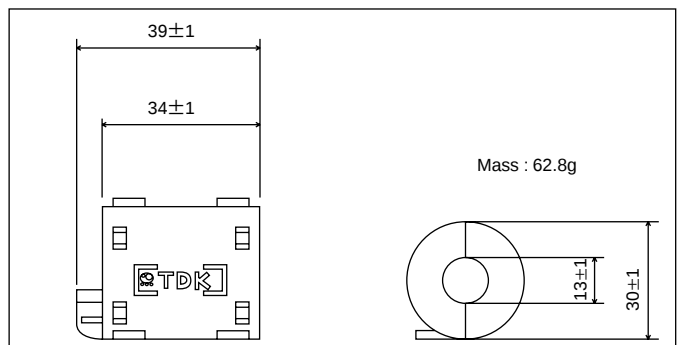
Noise filter for signal lines

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

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

<Caution>

Fix the signal line noise filter in place to eliminate excessive stress to the cables.



Grounding

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

Ground-fault breaker

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

Conformity to UL Standards

Observe the following conditions ((1) and (2)) to make the system to conform to UL508C (File No. E164620).

- (1) Use Minas driver in environment of Pollution Degree 1 or 2 prescribed in IEC-60664-1. (e.g. Install in the control panel with IP54 protective structure)
- (2) Connect the UL recognized (UL Listed, UL marked) circuit breaker or UL recognized (UL Listed, UL marked) fuse between the power supply and noise filter.

Motor Specifications and Ratings 100V MUMA

50W to 200W Low inertia Small drives

			AC100V		
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			Smaller than 30 times		
Rotary encoder specifications			2500P/r Incremental		
	Resolution per single turn		10000		
Protective enclosure rating			IP65 (except shaft through hole and cable end connector)		
Environment	Ambient temperature		0 to 40℃ (free from freezing, Storage : -20 to + 80℃		
	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		1000m or lower		
	Vibration resistance		49m/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 1V or more	
Exciting voltage	DC 24V±10%	

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

For motor dimensions, refer to page E15, and for the diver, refer to page E23.

Model designation MUMA series, 50W to 200W

e.g.)

M U M A 5 A Z P 1 S

Symbol	Type
MUMA	Ultra low inertia (50W~200W)

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

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

Design order
1 : Standard

Motor structure

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

*Motor with oil seal is manufactured by order.
Round shaft is manufactured by order.

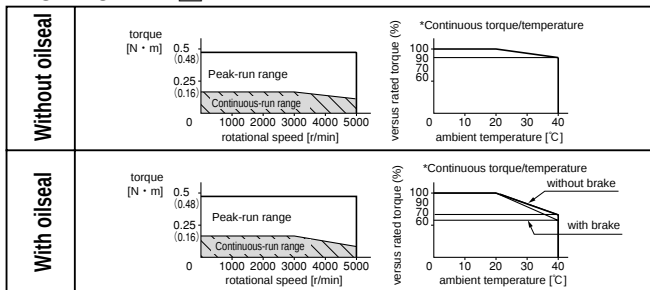
Rotary encoder specifications

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

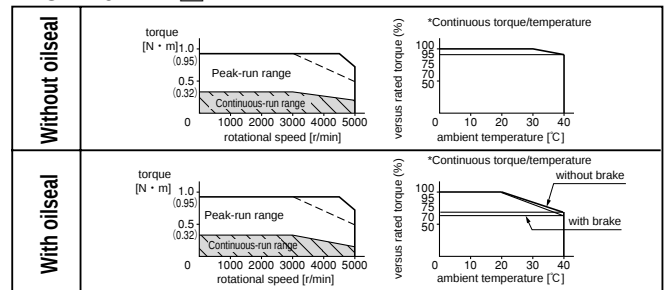
Torque characteristics at AC100V of power voltage

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

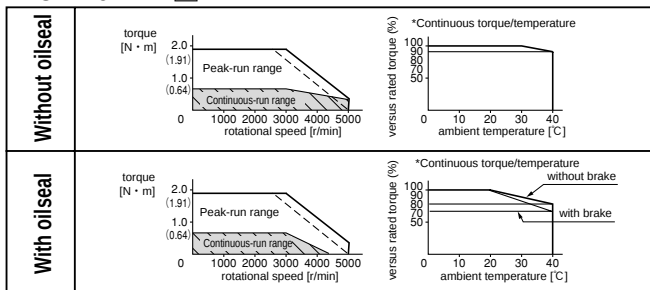
MUMA5AZP1



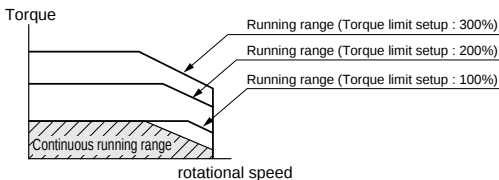
MUMA011P1



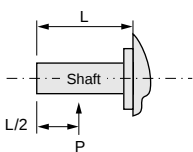
MUMA021P1



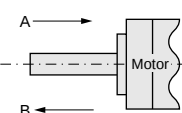
*When you lower the torque limit setup (Pr5E and 5F), running range at high speed might be lowered as well.



Radial load (P) direction



Thrust load (A, B) direction



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 AC115V (at 100V of the main voltage).

If the supply voltage fluctuates, frequency is in inverse proportion to the square of (Running supply voltage/115) relative to the value in the table.

• When regeneration occurs continuously such 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 Ishizuka Electronic or equivalent).

() represents the actually measured value using a diode (200V, 1A or equivalent)

Motor Specifications and Ratings 200V MUMA

50W to 400W Low inertia Small drives

		AC200V					
Motor model		MUMA		5AZP1□	012P1□	022P1□	042P1□
Applicable driver	Model No.	MKDET1505P				MKDET1310P	MLDET2310P
	Frame symbol	Frame K				MKDET2210P	MLDET2510P
						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					
	DV0P2891×1	No limit Note)2					
Rated rotational speed (r/min)		3000					
Max. rotational speed (r/min)		5000					
Moment of inertia of rotor (x10 ⁻⁴ kg・m ²)	Without brake	0.021	0.032	0.10	0.17		
	With brake	0.026	0.036	0.13	0.20		
Recommended moment of inertia ratio of the load and the rotor Note)3		Smaller than 30 times					
Rotary encoder specifications		2500P/r Incremental					
	Resolution per single turn	10000					
Protective enclosure rating		IP65 (except shaft throughhole and cable end connector)					
Environment	Ambient temperature	0 to 40℃ (free from freezing, Storage : -20 to + 80℃					
	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	1000m or lower					
	Vibration resistance	49m/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 1V or more	
Exciting voltage	DC 24V±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 page E15 , and for the diver, refer to page E23.

Note) Driver for 50W and 100W has a common power supply of single phase and 3-phase 200V.

Driver for 200W, the upper row is the power supply of 3-phase 200V, and lower is the power supply of single-phase 200V.

Driver for 400W, the upper row is the power supply of 3-phase 200V, and lower is the common power supply of single-phase and 3-phase 200V.

Model designation MUMA series, 50W to 400W

e.g.)

M U M A 5 A Z P 1 S

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

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

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

Design order
1 : Standard

Motor structure

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

*Motor with oil seal is manufactured by order.
Round shaft is manufactured by order.

Rotary encoder specifications

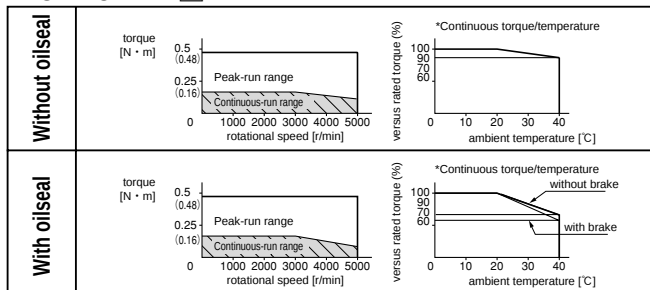
Symbol	Format	Pulse counts	Resolution	Wires
P	Incremental	2500P/r	10000	5

Torque characteristics

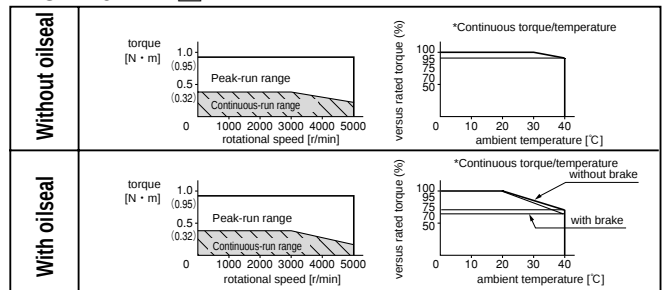
at AC200V of power voltage

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

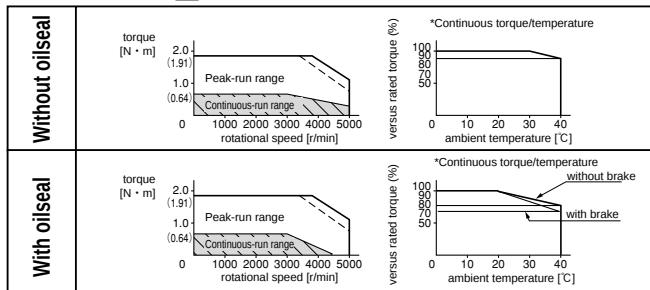
MUMA5AZP1□



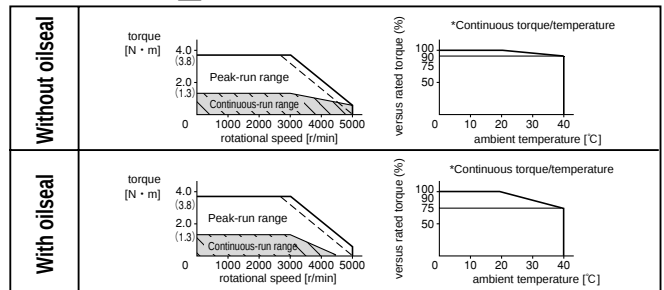
MUMA012P1□



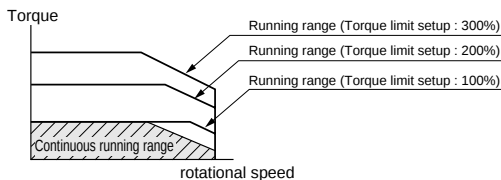
MUMA022P1□



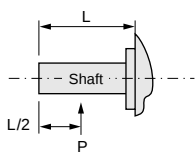
MUMA042P1□



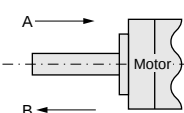
*When you lower the torque limit setup (Pr5E and 5F), running range at high speed might be lowered as well.



Radial load (P) direction



Thrust load (A, B) direction



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 AC240V (at 200V of the main voltage).

If the supply voltage fluctuates, frequency is in inverse proportion to the square of (Running supply voltage/240) relative to the value in the table.

• When regeneration occurs continuously such cases as running speed frequently changes or vertical feeding, consult us or a dealer.

2. If the effective torque is within the rated torque, there is no limit in regenerative brake.

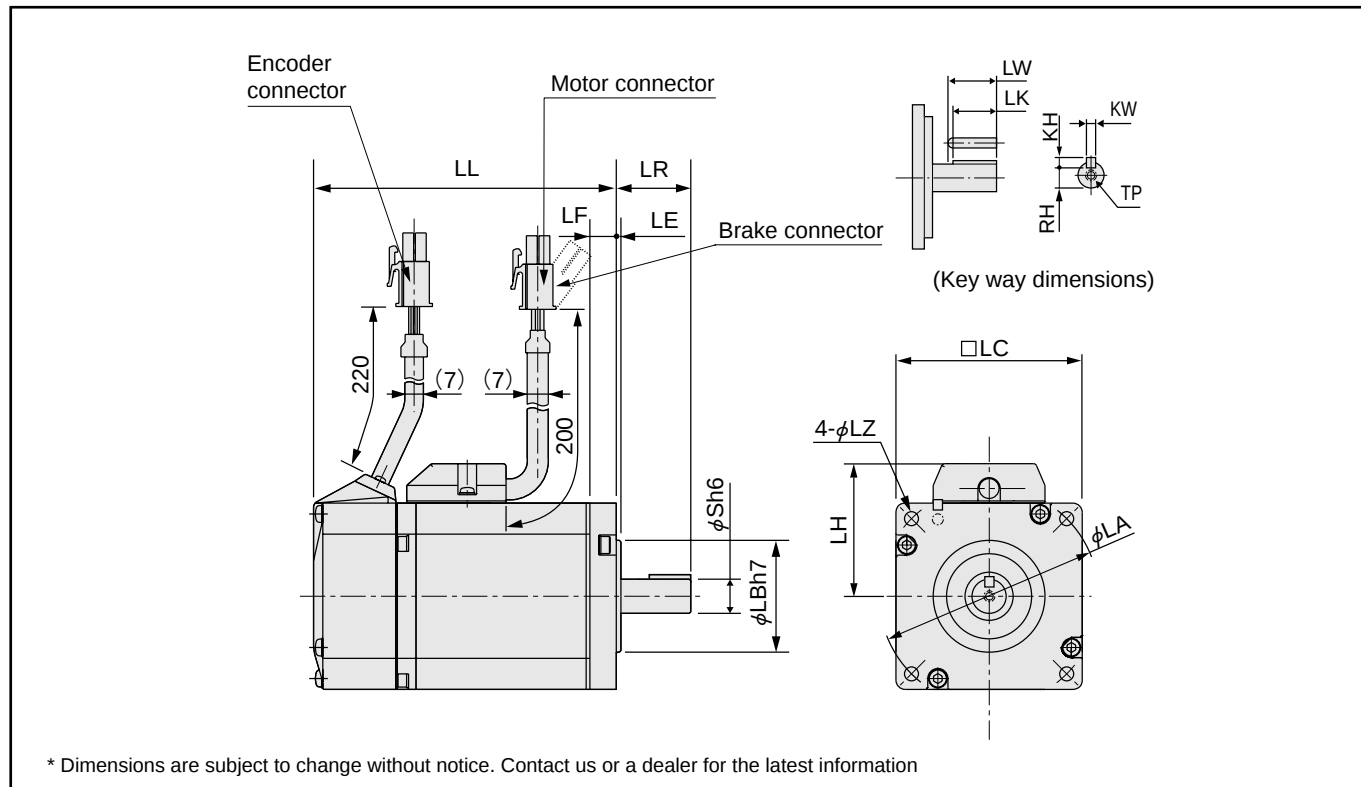
3. Consult us or a dealer if the load moment of inertia exceeds the specified value.

4. Specified releasing time is obtained with the use of surge absorber for brake (Z15D151 by Ishizuka Electronic or equivalent).

() represents the actually measured value using a diode (200V, 1A or equivalent)

Motor Dimensions

MUMA 50W to 400W



		MUMA series (Ultra low inertia)			
Motor output		50W	100W	200W	400W
Motor model		5A□P1□	01□P1□	02□P1□	04□P1□
Rotary encoder specifications		2500P/r Incremental	2500P/r Incremental	2500P/r Incremental	2500P/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 X 6 (depth)	M3 X 6 (depth)	M4 X 8 (depth)	M5 X 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, pages E26, 27.			

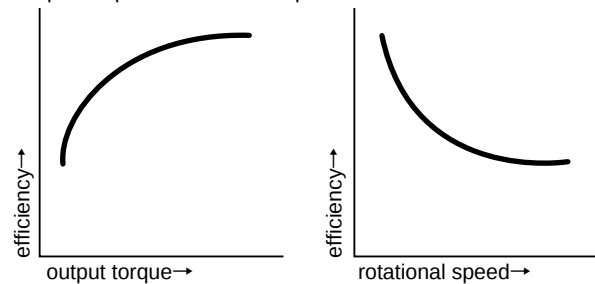
* Cautions : Reduce the moment of inertia ratio if high speed response operation is required.
Read the Instruction Manual carefully and understand all precautions and remarks before using the products.

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.



Specifications of motor with gear reducer

Motor type		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
Environment	Protective structure	IP44 (at gear reducer)
	Ambient temperature	0 to 40°C
	Ambient humidity	85%RH (free from condensation) or less
	Vibration resistance	49m/s ² or less (at motor frame)
	Impact resistance	98m/s ² or less

Ratings and Specifications of Motor with Gear Reducer

Model No. designation

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

Symbol	Type
MUMA	Low inertia (100-400W)

Motor rated output

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

Voltage specifications

Symbol	Specifications
1	100V
2	200V

Rotary encoder specifications

Symbol	Format	Pulse counts	Pulse counts	Wire
P	Incremental	2500P/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	w/without	with
3	●	●	
4	●		●

Table of Specifications

Model	Motor	MUMA with gear reducer											
	Output	Reduction ratio	Output	Rated speed	Max. speed	Rated torque	Peak max. torque	Moment of inertia (motor + reducer/converted to motor shaft)		Mass		Permissible radial load	Permissible thrust load
								w/o brake	w/ brake	w/o brake	w/ brake		
	(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
MUMA04□P□1N	400	1/5	340	600	1000	5.39	16.2	0.533	0.563	3.2	3.6	980	490
MUMA04□P□2N		1/ 9	332	333	555	9.51	28.5	0.438	0.468	3.2	3.6	1180	588
MUMA04□P□4N		1/25	332	120	200	26.4	79.2	0.470	0.500	4.7	5.1	2060	1030

For dimensions, refer to page, E21

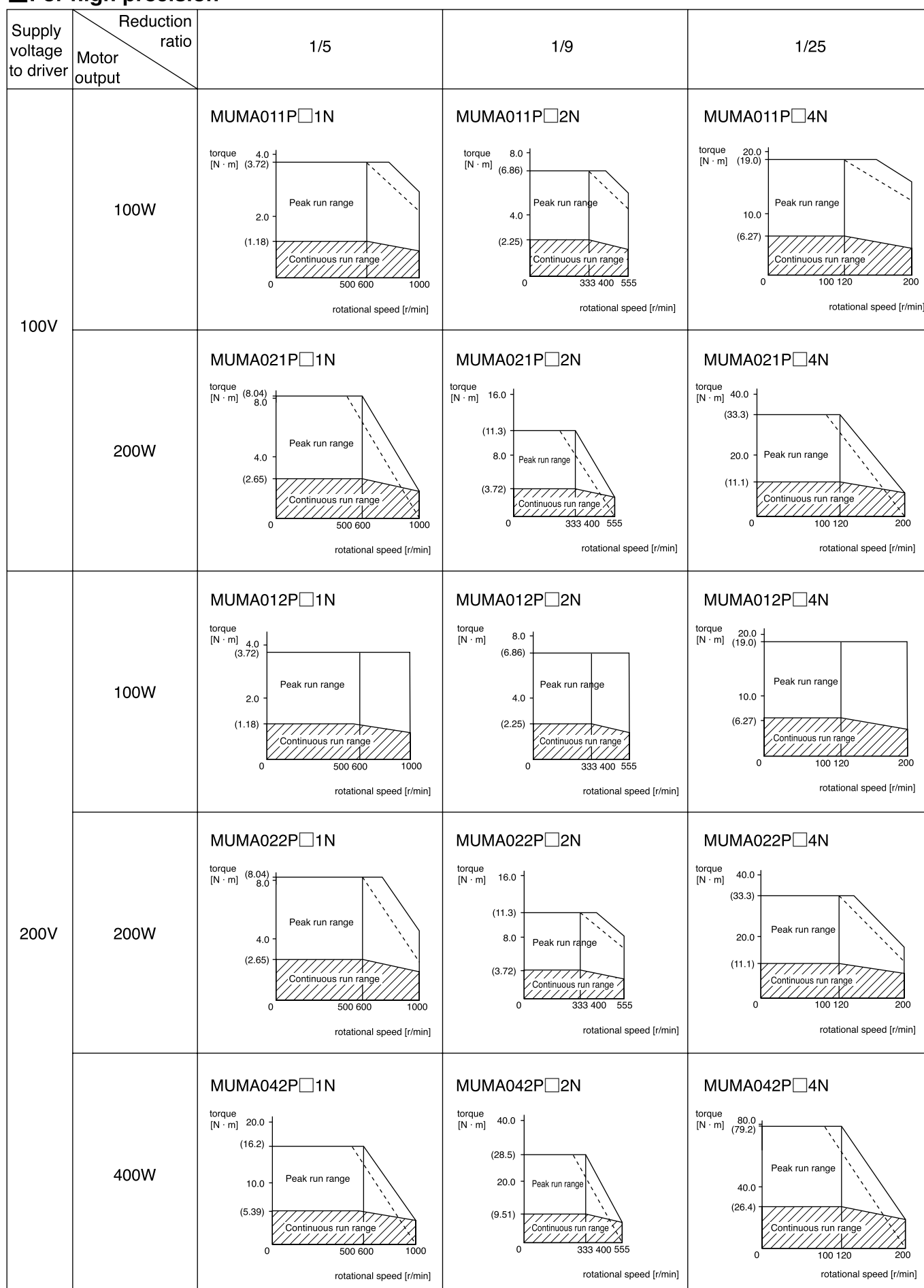
The Combination of the Driver and the Motor

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

For dimensions, refer to page E23

Torque Characteristics of Motor with Gear Reducer

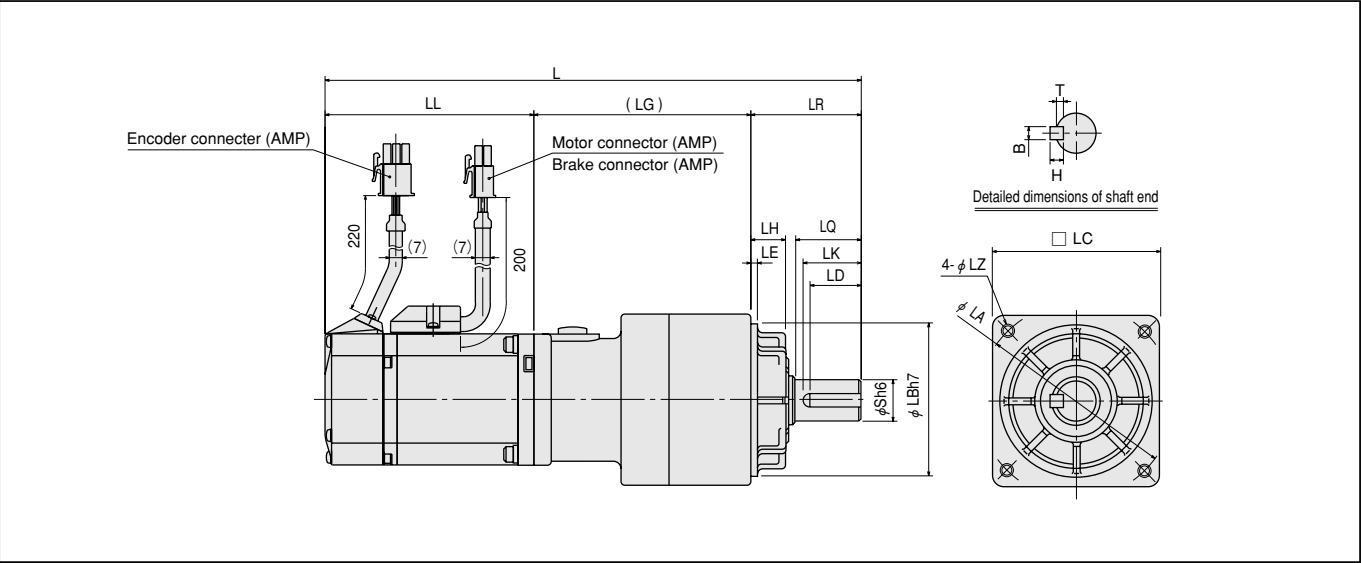
■ For high precision



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

Dimensions of Motor with Gear Reducer

MUMA series with gear reducer



2500P/r encoder

Model	Motor output	Reduction ratio	L	LL	LR	LQ	LC	LB	LA	S	LH	LZ	LK	(LG)	LE	Key way (BxHxD)	T													
MUMA01□P□1N	100W	1 / 5	192	92.5	32	20	52	50	60	12	10	M5 (Depth : 12)	18	67.5	3	4X4X16	2.5													
MUMA01□P□2N			223.5	124																										
MUMA01□P□2N		1 / 9	192	92.5	50	30	78	70	90	19	17	M6 (Depth : 20)	26	92		6X6X22	3.5													
MUMA01□P□4N			223.5	124																										
MUMA01□P□4N	200W	1/25	234.5	92.5	50	30	78	70	90	19	17	M6 (Depth : 20)	26	92		3	6X6X22	3.5												
MUMA02□P□1N			266	124																										
MUMA02□P□1N		1 / 5	200.5	96	32	20	52	50	60	12	10	M5 (Depth : 12)	18	72.5			4X4X16	2.5												
MUMA02□P□2N			233.5	129																										
MUMA02□P□2N	200W	1 / 9	235.5	96	50	30	78	70	90	19	17	M6 (Depth : 20)	26	89.5			3	6X6X22	3.5											
MUMA02□P□2N			268.5	129																										
MUMA02□P□4N		1/25	246	96																										
MUMA02□P□4N			279	129																										
MUMA04□P□1N	400W	1 / 5	263	123.5										50	30					78	70	90	19	17	M6 (Depth : 20)	26	100	3	6X6X22	3.5
MUMA04□P□1N			296	156.5																										
MUMA04□P□2N		1 / 9	263	123.5																										
MUMA04□P□2N			296	156.5																										
MUMA04□P□4N	400W	1/25	288.5	123.5	61	40	98	90	115	24	18	M8 (Depth : 20)	35			104	5	8X7X30	4											
MUMA04□P□4N			321.5	156.5																										

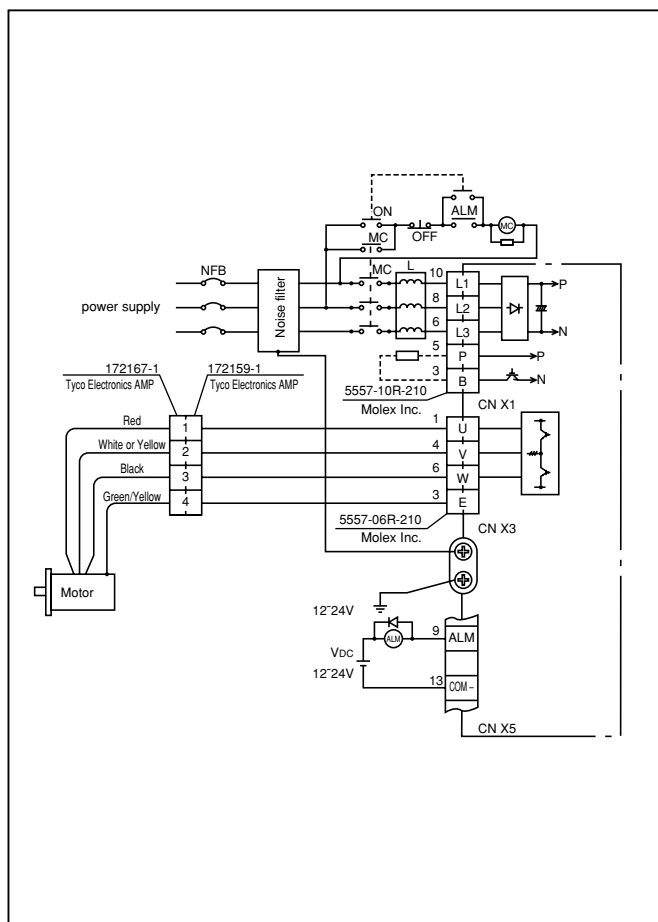
Upper column : without brake
Lower column : with brake

Common Specifications of Driver

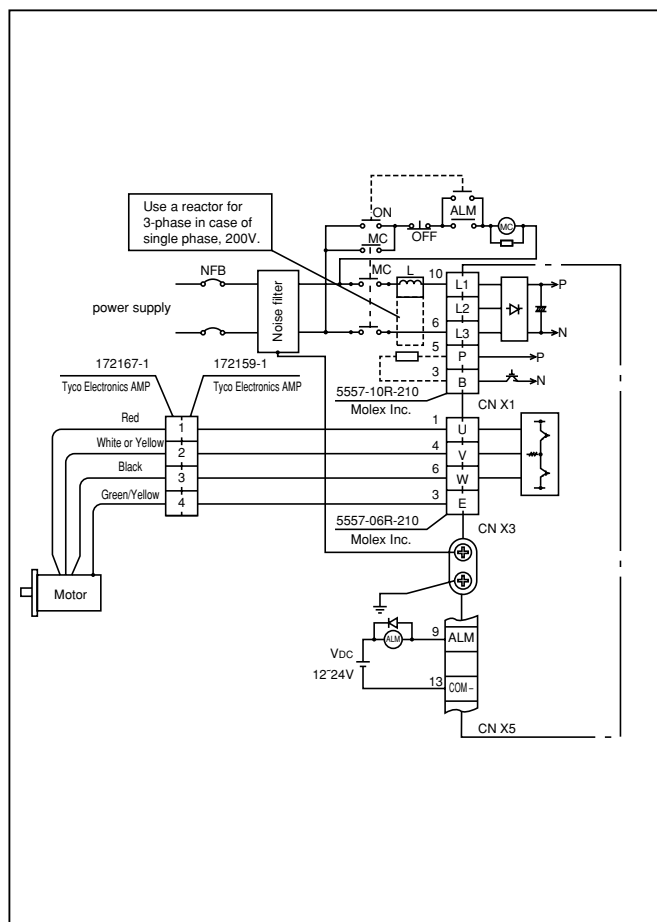
Basic Specifications	Input power	Single phase, 100V		Single phase, 100-115V	+10% -15%	50/60Hz	
		Single phase, 200V		Single phase, 200-240V	+10% -15%	50/60Hz	
		3-phase, 200V		3-phase, 200-240V	+10% -15%	50/60Hz	
	Environment	Temperature		Operating : 0 to 55℃, Storage : -20 to +80℃			
		Humidity		Both operating and storage : 90%RH or less (free from condensation)			
		Altitude		1000m or lower			
		Vibration		5.88m/s ² or less, 10 to 60Hz (No continuous use at resonance frequency)			
	Control method		IGBT PWM Sinusoidal wave drive				
	Encoder feedback		2500P/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 with photo-coupler input.			
		Output		4 outputs Feed out the encoder pulse (A, B and Z-phase) in line driver. Z-phase pulse is also fed 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 : 500kpps, Open collector : 200kpps		
			Type of input pulse train		Differential input. Selectable with parameter, ((1) CW/CCW, (2) A and B-phase, (3) Command and Direction)		
			Electronic gear (Division/Multiplication of) command pulse		Setup of electronic gear ratio Setup range of (1-10000 X 2(0-17))/(1-10000)		
			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 Selection1 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 is enabled, with 0 to 10s/1000r/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.		
			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		1P/r to 2500P/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.		
			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 support software		PANATERM [®] (Supporting OS : Windows98, Windows ME, Windows2000, and WindowsXP)				

Standard Wiring Example of Main Circuit

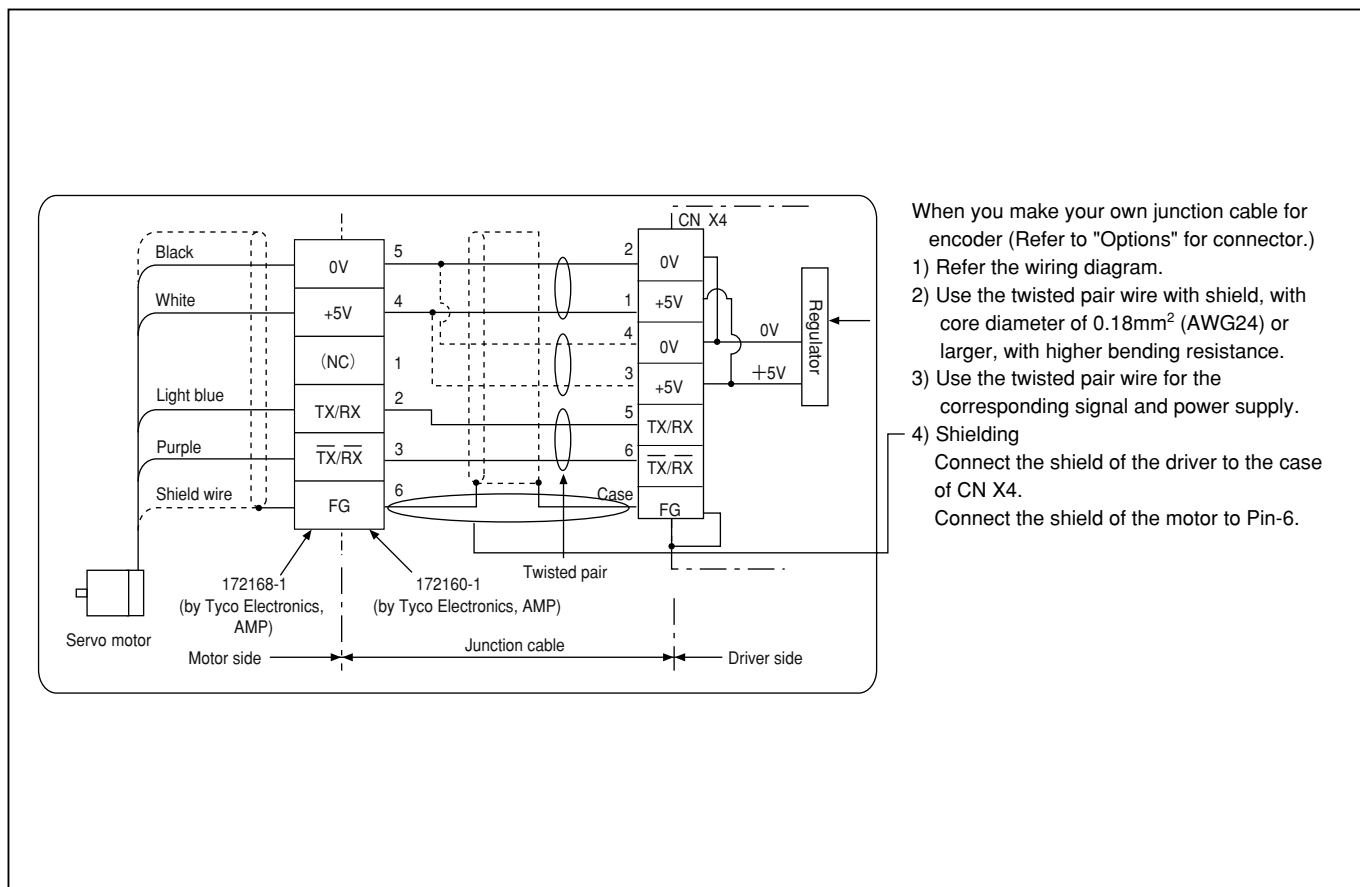
■3-Phase, 200V



■Single Phase, 100V / 200V

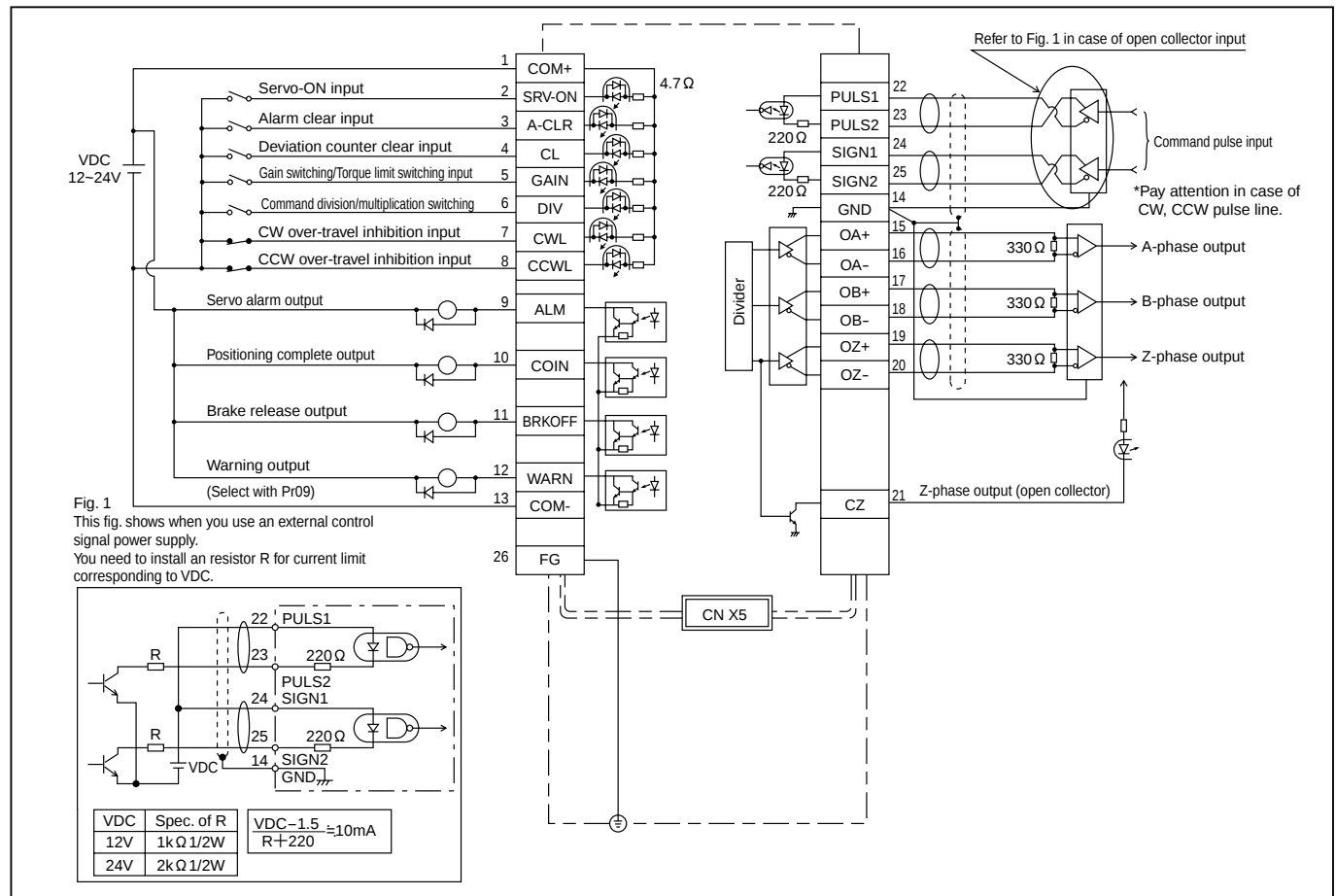


Encoder Wiring Diagram

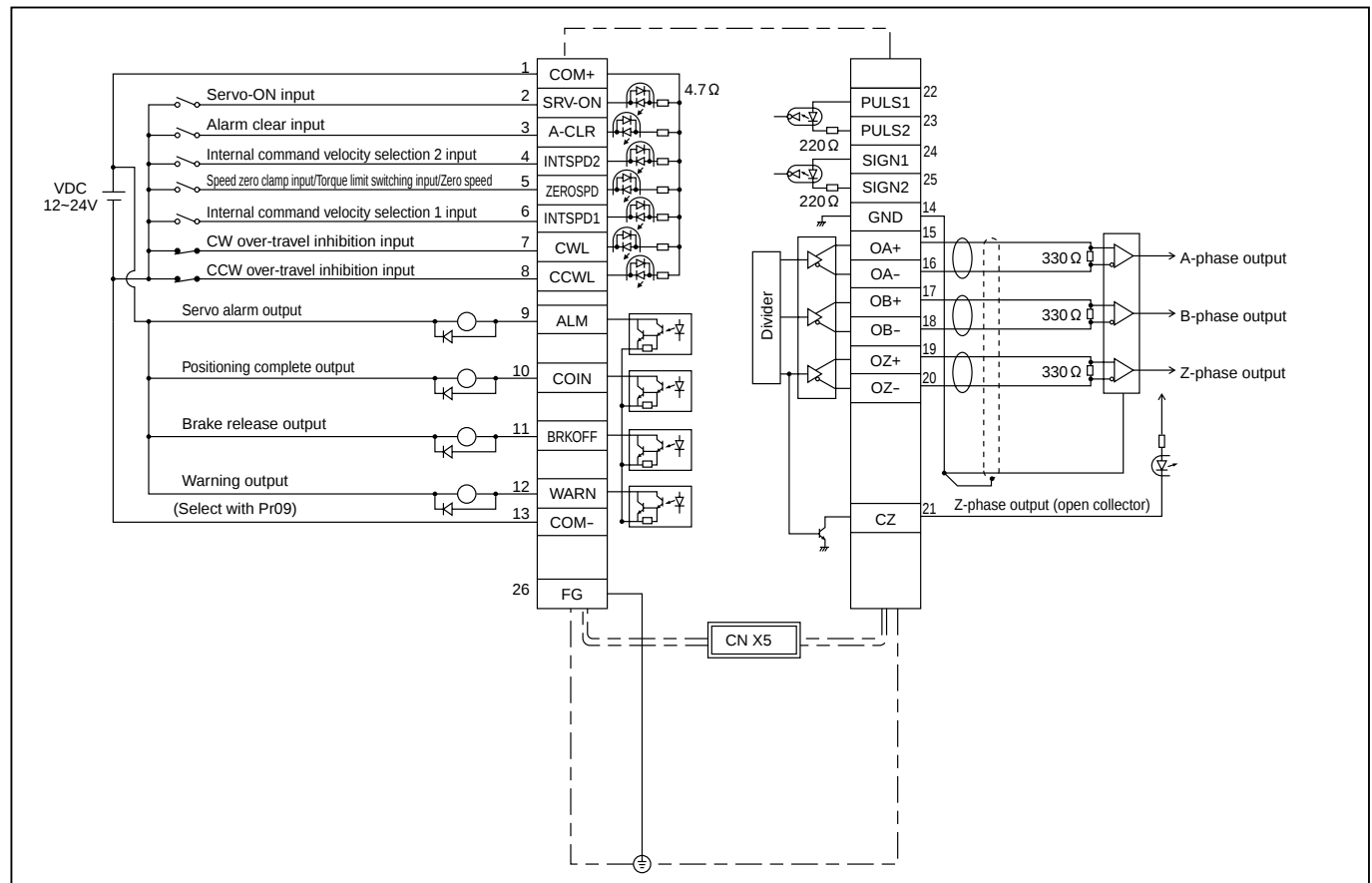


Control Circuit Standard Wiring Example

■ CN X 5 Wiring Example at Position Control Mode

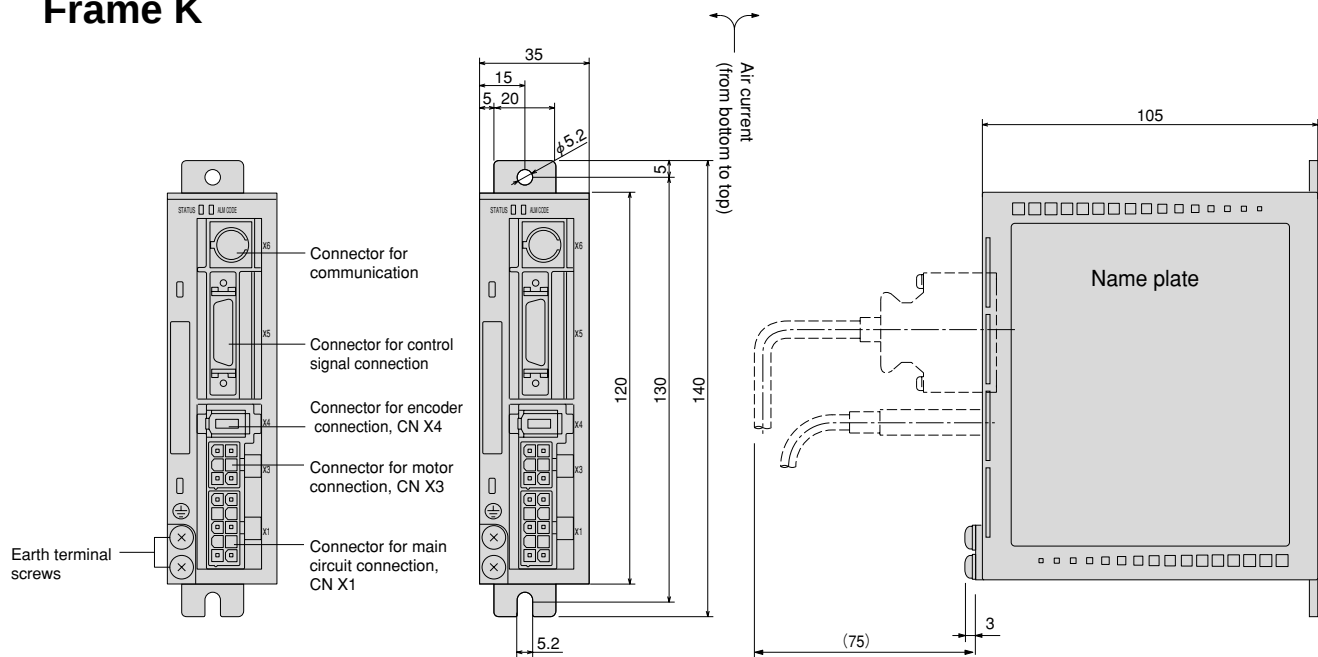


■ CN X 5 Wiring Example at Internal Velocity Control Mode



Dimensions

Frame K

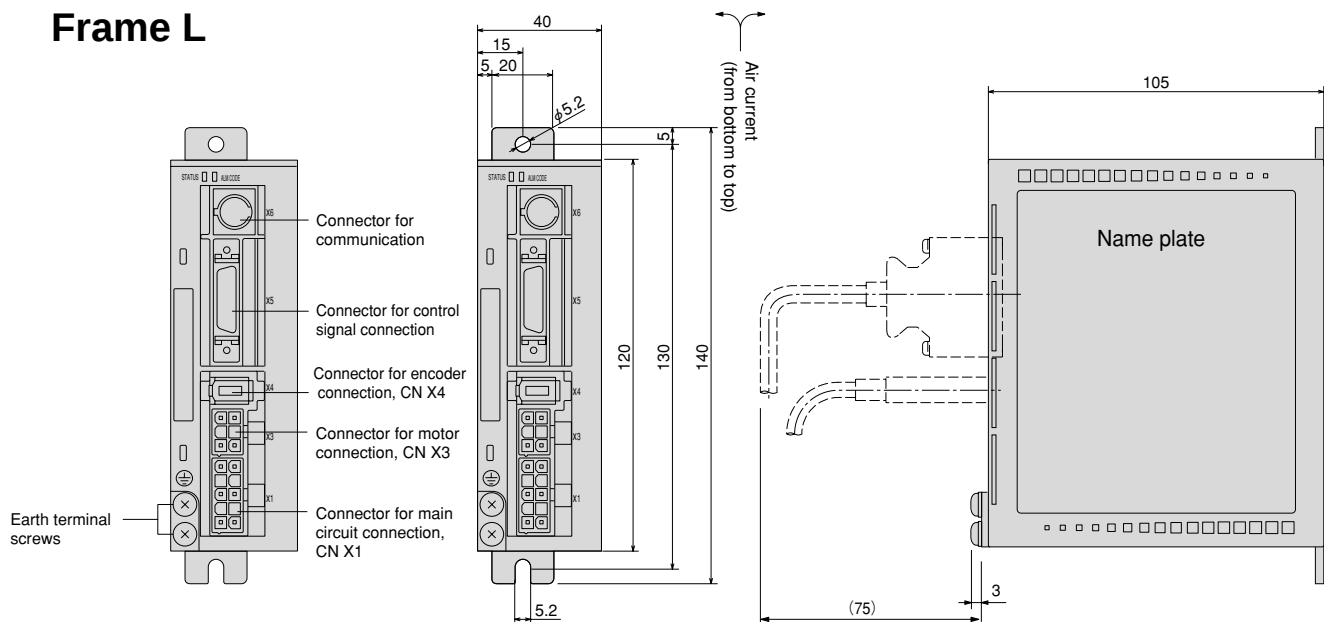


Connector(Driver side)

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 : 0.35kg

Frame L



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 : 0.40kg

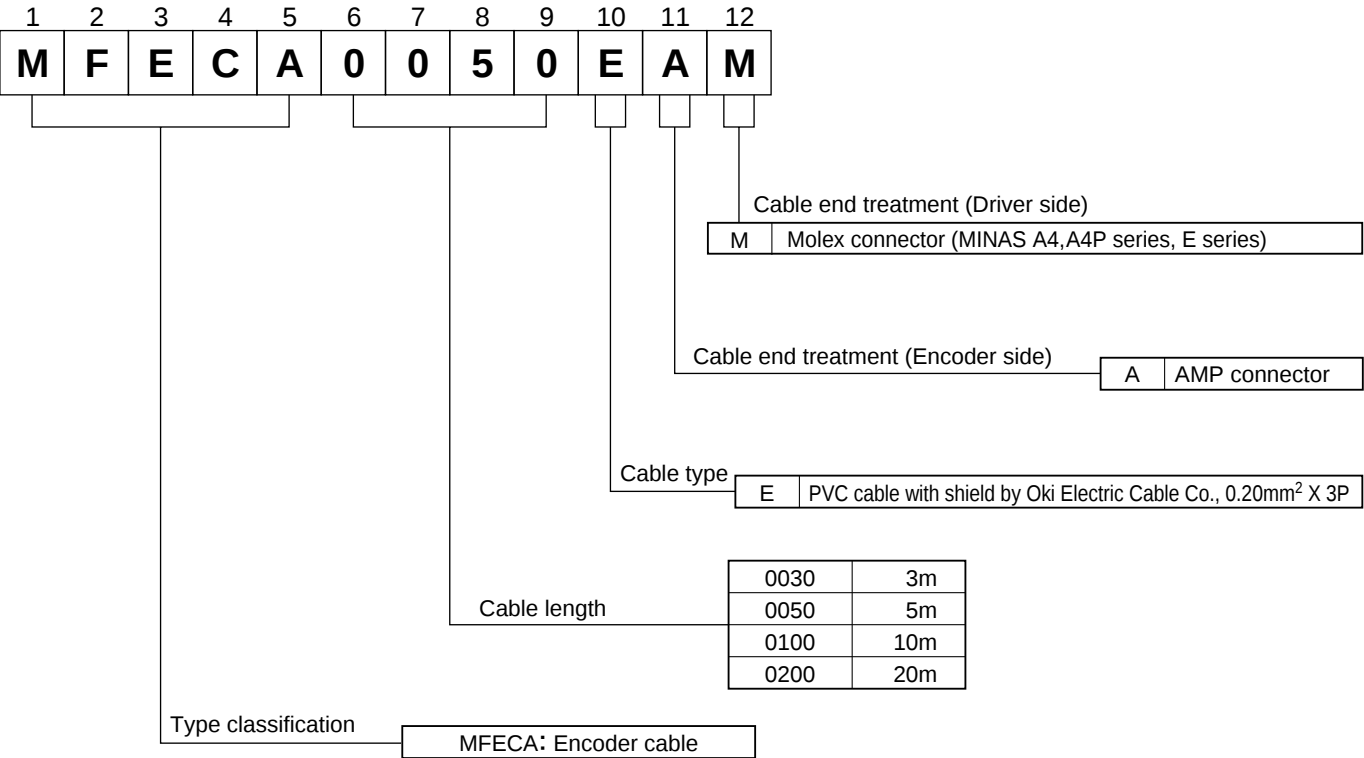
Options

MINAS E

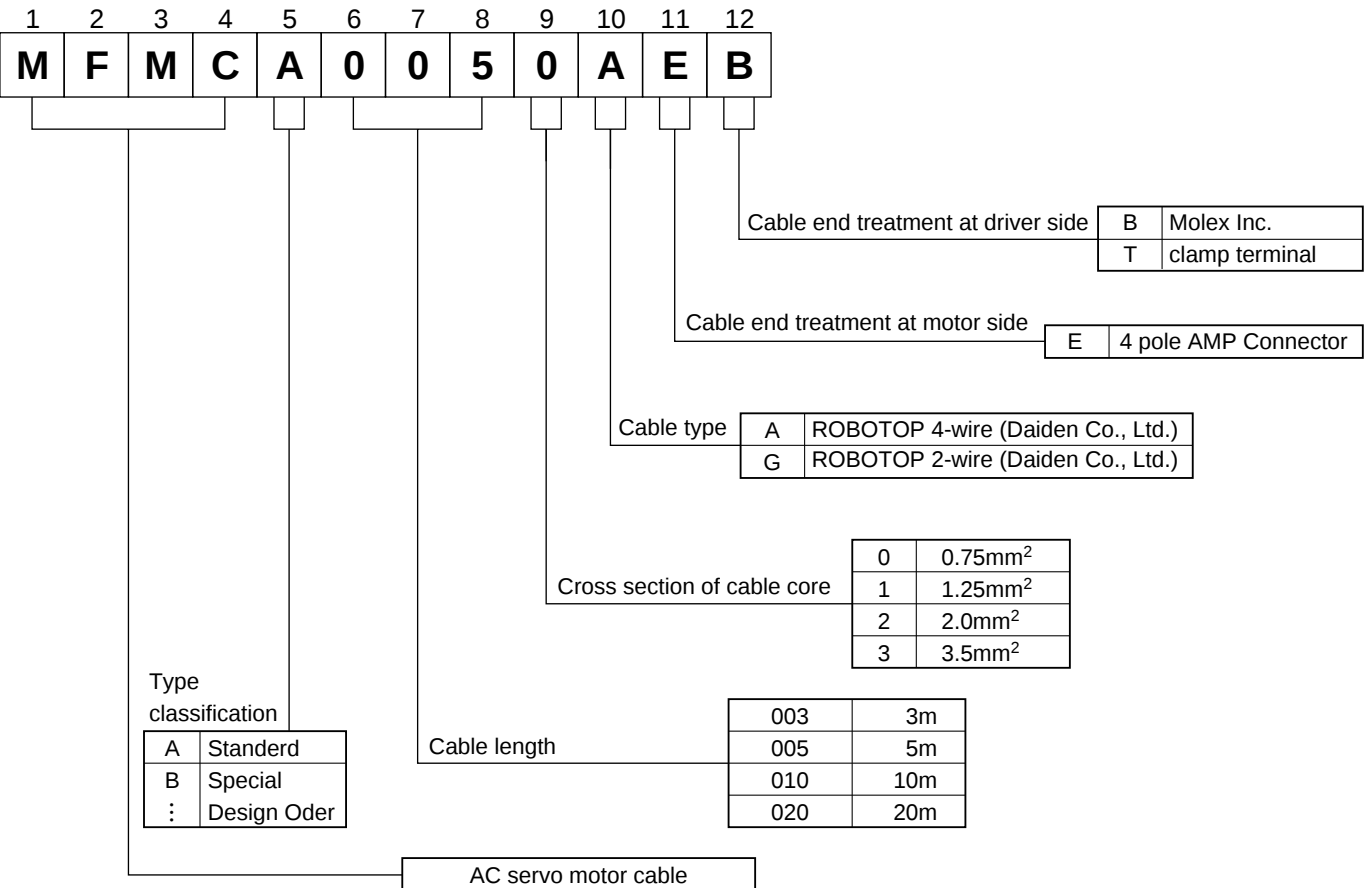
Dimensions Options

Cable part No. designation

Encoder cable



Motor cable



Options

Cable set DV0P37300 (3m)	Cable set DV0P39200 (5m)
---------------------------------	---------------------------------

- 1) Interface cable : DV0P0800

2) Encoder cable (3m) : MFECA0030EAM

3) Motor cable (3m) : MFMCA0030AEB

4) Connector kit for driver power supply connection : DV0P2870
- 1) Interface cable : DV0P0800

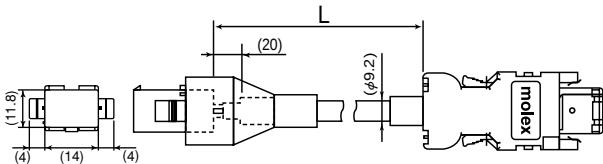
2) Encoder cable (5m) : MFECA0050EAM

3) Motor cable (5m) : MFMCA0050AEB

4) Connector kit for driver power supply connection : DV0P2870

Encoder cable

MFECA0 * * 0EAM



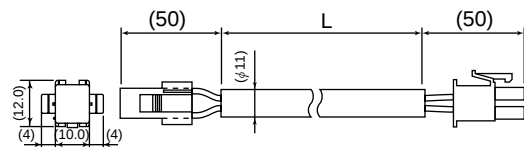
Title	Part No.	Manufacturer
Connector	55100-0600 and 55100-0670	Molex Inc.
Connector	172160-1	Tyco Electronics AMP
Connector Pin	170365-1	
Cable	0.20mm ² X3P	Oki Electric Cable

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

Motor cable (Robotop ® 105℃ · 600V · DP)

MFMCA0 * * 0AEB

Robotop ® is a trade mark of Daiden Co., Ltd.

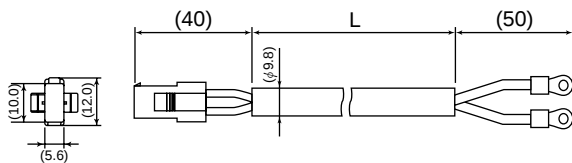


Title	Part No.	Manufacturer
Connector	172159-1	Tyco Electronics AMP
Connector Pin	170362-1,170366-1	
Connector	5557-06R-210	Molex Inc.
Connector Pin	5556T	
Cable	ROBO-TOP 600V 0.75mm ²	Daiden Co., Ltd.

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

Brake cable (Robotop ® 105℃ · 600V · DP)

MFMCB0 * * 0GET



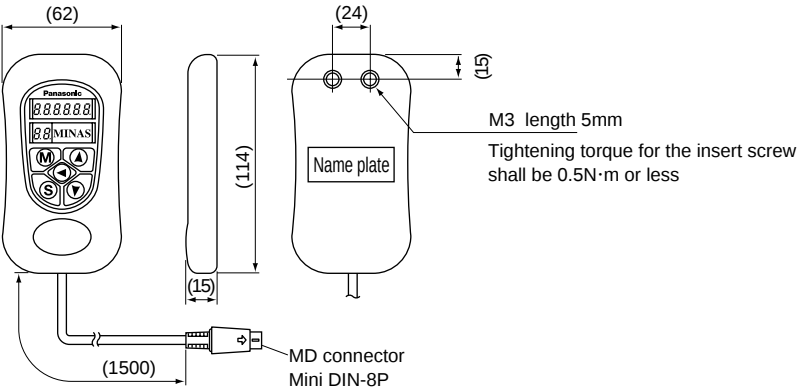
Title	Part No.	Manufacturer
Connector	172157-1	Tyco Electronics AMP
Connector Pin	170362-1,170366-1	
Nylon insulated round terminal	N1.25-M4	JST
Cable	ROBO-TOP 600V 0.75mm ²	Daiden Co., Ltd.

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

Console

1) Part No. : DVOP4420 Caution) An existing console(DV0P3690) cannot be used for the A4P series.

2) Dimensions



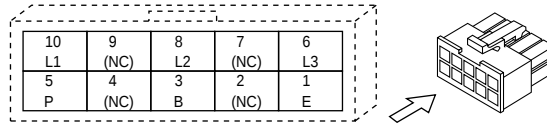
Connector kit for power supply connection

1) Part No. : **DV0P2870**

2) Parts composition

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

3) Pin configuration



4) 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 shows when viewed from the terminal inserting direction. Make a correct wiring by checking the stamped pin numbers on the connector itself.
2. Refer to page E21 for wiring and connection.
3. Do not connect anything to pins marked "NC".

Connector kit for motor/encoder connection

1) Part No. : **DV0P3670**

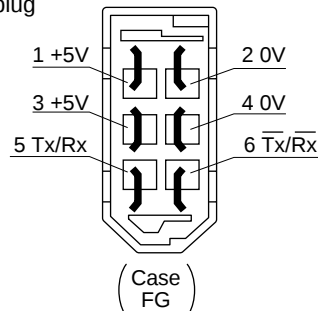
2) Parts composition Incremental
2500 pulse, 5-wire This option is required when you make your own encoder cable and motor cable.
(Brake cable is required for brake.)

Title	Part No.	Number	Manufacturer	Note
Connector	55100-0600	1	Molex Inc.	For connector, CN X4
Connector (6pins)	172160-1	1	Tyco Electronics AMP	For junction to encoder cable
Connector pin	170365-1	6		
Connector (4pins)	172159-1	1	Tyco Electronics AMP	For junction to motor power cable
Connector pin	170366-1	4		
Connector (6 pins)	5557-06R-210	1	Molex Inc.	For connector, CN X3
Connector pin	5556PBTL	4		

<Remarks>

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

3) Pin configuration of connector CN X4 plug



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

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

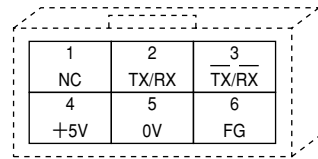
<Remarks>

1. The above pin configuration shows 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 page E21.

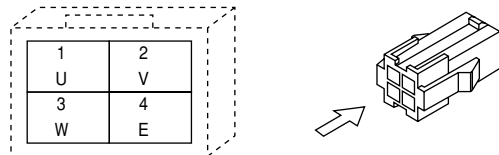
Options

Connector kit for motor/encoder connection

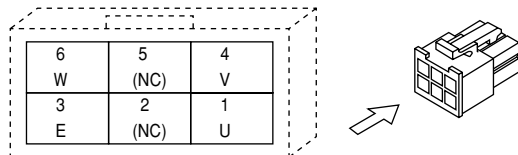
5) Pin configuration of encoder cable junction



6) Pin configuration of motor power cable junction



7) Pin configuration of mating connector to CN X3 connector



<Cautions>

1. The above pin configuration shows when viewed from the terminal inserting direction. Make a correct wiring by checking the stamped pin numbers on the connector itself.
2. Refer to page E21 for wiring and connection.

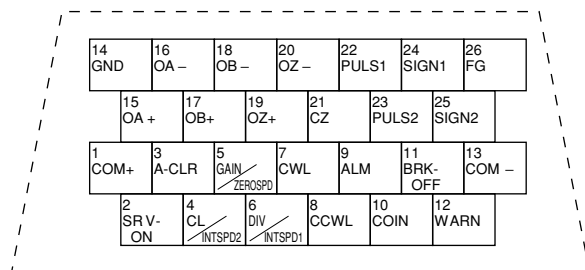
Connector kit for external peripheral equipment

1) Part No. : **DV0P0770**

2) Parts composition

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

3) Pin configuration of connector CN X5



<Cautions>

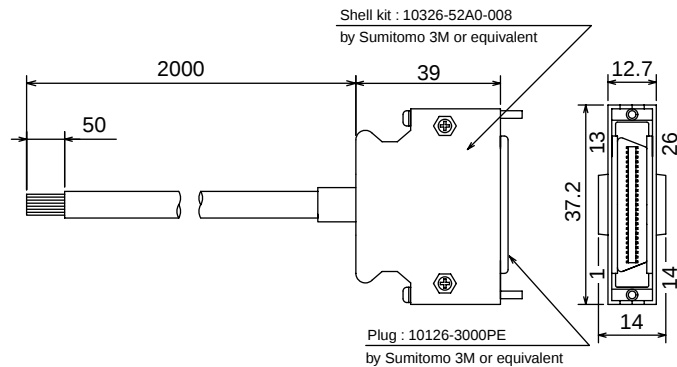
1. Make a correct wiring by checking the stamped pin numbers on the connector itself.
2. Refer to page E22 for symbols and functions of the above signals.

Interface cable

Cable of 2m is connected.

1) Part No. : **DV0P0800**

2) Dimensions



3) 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. w ...Wire color is orange, and two black dot.

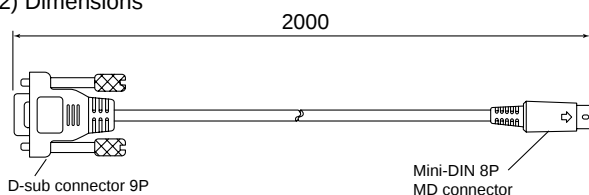
<Remarks>

The shield of this cable is not connected to a connector pin. To connect the shield to FG or GND at the driver side, use a connector kit for external device connection.

Communication cable

1) Part No. : **DV0P1960**

2) Dimensions



Setup support software 「PANATERM®」

1) Part No. : **DV0P4460** (for Japanese / English version)

2) Supply media : CD-ROM

<Caution>

For action environment other details, refer to the Instruction Manual of 「PANATERM®」

Options

External regenerative resistor

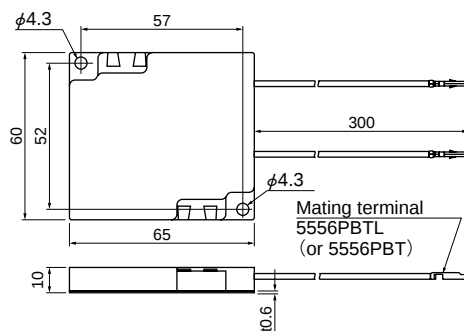
Part No.	Manufacturer's Part No.	Specifications			Note (Input Power of drive)
		Resistance	Rated power	Activation temperature of built-in fuse	
DV0P2890	45M03	50Ω	10W	130±2°C	Single phase, 100V
DV0P2891	45M03	100Ω	10W	130±2°C	Single/3-phase, 200V

Manufactured by Iwaki Musen Kenkyusho Co., Ltd.

<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)



<Caution>

Regenerative resistor gets very hot.

Take preventive measures for fire and burns.
Avoid the installation near inflammable objects, and easily accessible place by hand.

Reactor

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

Fig.1

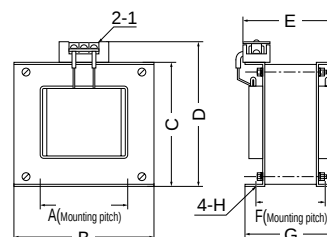


Fig.2

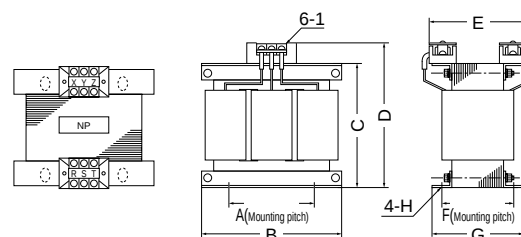


Fig.	Part No.	A	B	C	D	E	F	G	H	I	Inductance (mH)	Rated current (A)
1	DV0P227	55	80	68	90	90	41	55	φ 7	M4	4.02	5
	DV0P228										2	8
2	DV0P220	65	125	83	118	145	70	85	7 (w) X 12 (L)	M4	6.81	3

• Harmonic restraint on general-purpose inverter and servo driver

On September, 1994, Guidelines for harmonic restraint on heavy consumers who receive power through high voltage system or extra high voltage system and Guidelines for harmonic restraint on household electrical appliances and general-purpose articles established by the Agency for Natural Resources and Energy of the Ministry of Economy, Trade and Industry (the ex-Ministry of International Trade and Industry). According to those guidelines, the Japan Electrical Manufacturers Association (JEMA) have prepared technical documents (procedure to execute harmonic restraint: JEM-TR 198, JEM-TR 199 and JEM-TR 201) and have been requesting the users to understand the restraint and to cooperate with us. On January, 2004, it has been decided to exclude the general-purpose inverter and servo driver from the Guidelines for harmonic restraint on household electrical appliances and general-purpose articles". After that, the Guidelines for harmonic restraint on household electrical appliances and general-purpose articles was abolished on September 6, 2004.

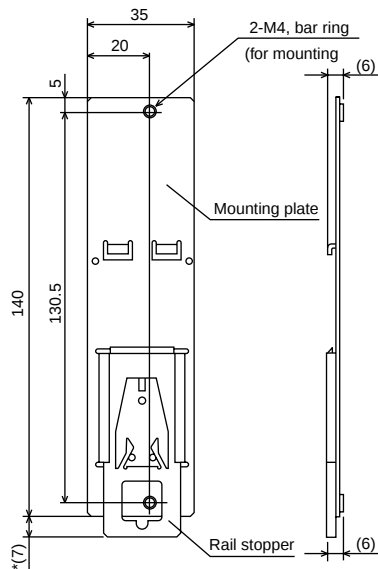
We are pleased to inform you that the procedure to execute the harmonic restraint on general-purpose inverter and servo driver will be modified as follows.

1. All types of the general-purpose inverters and servo drivers used by specific users are under the control of the Guidelines for harmonic restraint on heavy consumers who receive power through high voltage system or extra high voltage system". The users who are required to apply the guidelines must calculate the equivalent capacity and harmonic current according to the guidelines and must take appropriate countermeasures if the harmonic current exceeds a limit value specified in a contract demand. (Refer to JEM-TR 210 and JEM-TR 225.)
2. The Guidelines for harmonic restraint on household electrical appliances and general-purpose articles was abolished on September 6, 2004. However, based on conventional guidelines, JEMA applies the technical documents JEM-TR 226 and JEM-TR 227 to any users who do not fit into the Guidelines for harmonic restraint on heavy consumers who receive power through high voltage system or extra high voltage system from a perspective on enlightenment on general harmonic restraint. The purpose of these guidelines is the execution of harmonic restraint at every device by a user as usual to the utmost extent.

DIN rail mounting unit

1) Part No. : **DV0P3811**

2) Dimensions



<Notes>

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

<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.

Recommended components

Surge absorber for motor brake

Motor	Surge absorber for motor brake
MUMA 50W~400W	Z15D151 Ishizuka Electronics Co.

List of peripheral components

(Reference only)

Peripheral components	Manufacturer	Tel No./Web site
Non-fuse breaker, Magnetic contactor, Surge absorber	Automation Controls Company Matsushita Electric Works, Ltd.	81-6-6908-1131 http://www.mew.co.jp
Regenerative resistor	Iwaki Musen Kenkyusho Co., Ltd.	81-44-833-4311 http://www.iwakimusen.co.jp/
Surge absorber for holding brake	Ishizuka Electronics Corp.	81-3-3621-2703 http://www.semitec.co.jp/
Noise filter for signal lines	TDK Corp.	81-3-5201-7229 http://www.tdk.co.jp/
Surge absorber / Noise filter	Okaya Electric Industries Co. Ltd.	1-3-4544-7030 http://www.okayatec.co.jp/
Connector	Sumitomo 3M	81-3-5716-7290 http://www.mmmco.jp
	Tyco Electronics AMP k.k,	81-44-844-8111 http://www.tycoelectronics.com/japan/amp
	Japan Molex Inc.	81-462-65-2313 http://www.molex.co.jp
Cable	Daiden Co., Ltd.	81-3-5805-5880 http://www.dyden.co.jp/

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

Information

Index

Motor capacity selection software	F2
Option selection software	F3
Setup support software	F4
Guide to the International System of Units (SI)	F5
Selecting Motor Capacity	F7
Request Sheet for Motor Selection	F13
Connection between driver and controller	F21
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Sales Office	F49

Motor capacity selection software

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.

Example of capacity calculation screen

Mselect3E Application Ver. 3.0.0.2 Data Ver. 1.0.0.3

Selection of capacity | Selection of option

Selection of element | Running pattern | Selection of motor

Element to be selected

Parameter | Value | Unit

Ball screw density	Ball screw horizontal	79 kg/cm³
Lead of the ball screw	10 mm	
Diameter of the ball screw	10 mm	
Length of the ball screw	500 mm	
Mass of the table	0 kg	
Transmission efficiency	0.9	
Coefficient of friction	0.1	
Remarks		
Ball screw inertia	0.000 kg-cm²	

Mselect3E Application Ver. 3.0.0.2 Data Ver. 1.0.0.3

Selection of capacity | Selection of option

Selection of element | Running pattern | Selection of motor

Element to be selected

Parameter | Value | Unit

Ball screw density	Ball screw vertical	79 kg/cm³
Lead of the ball screw	10 mm	
Diameter of the ball screw	10 mm	
Length of the ball screw	500 mm	
Mass of the table	0 kg	
Transmission efficiency	0.9	
Coefficient of friction	0.1	
Remarks		
Ball screw inertia	0.000 kg-cm²	

Mselect3E Application Ver. 3.0.0.2 Data Ver. 1.0.0.3

Selection of capacity | Selection of option

Selection of element | Running pattern | Selection of motor

Element to be selected

Parameter | Value | Unit

Table density	Index table	79 kg/cm³
Outside diameter of the table	0 mm	
Thickness of the table	0 mm	
Diameter of the table support	0 mm	
Coefficient of friction	0.1	
Outside diameter of the work load	0 mm	
Mass of the work load	0 kg	
Positional eccentricity of the work load	0 mm	
Number of work loads	1 Place	
Remarks		
Mass of the table	0.000 kg	
Table inertia	0.000 kg-cm²	
Work inertia (kg-cm²)	0.000 kg-cm²	
Work inertia (including eccentricity)	0.000 kg-cm²	

Mselect3E Application Ver. 3.0.0.2 Data Ver. 1.0.0.3

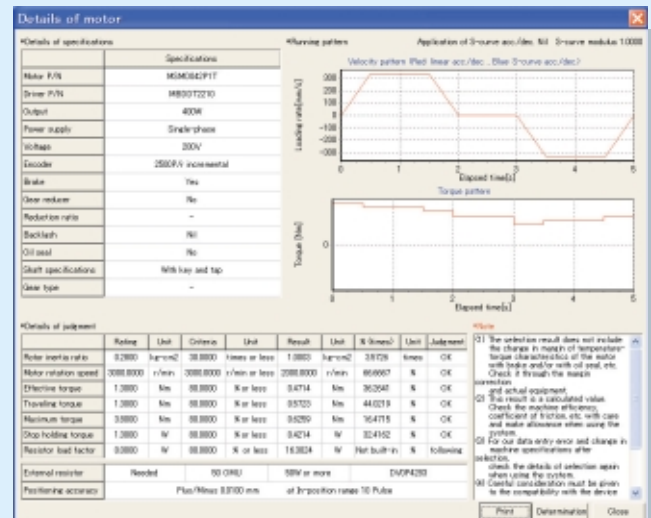
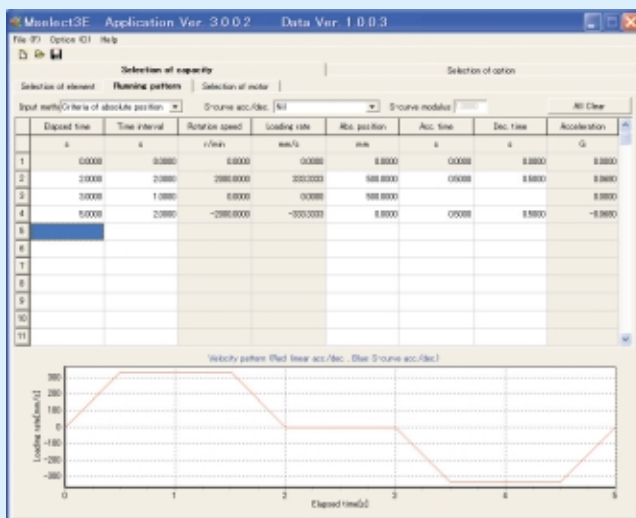
Selection of capacity | Selection of option

Selection of element | Running pattern | Selection of motor

Element to be selected

Parameter | Value | Unit

Drive pulley density	Belt conveyor horizontal	79 kg/cm³
Drive pulley diameter	40 mm	
Diameter of the drive pulley	20 mm	
Thickness of the drive pulley	20 mm	
Mass of the table	0 kg	
Mass of the belt	0 kg	
Transmission efficiency	0.9	
Coefficient of friction	0.1	
Remarks		
Height of the drive pulley	0.190 kg	
Drive pulley inertia	0.197 kg-cm²	
Height of the drive pulley	0.190 kg	



Option selection software

Option selection software for AC servo motor MINAS series

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

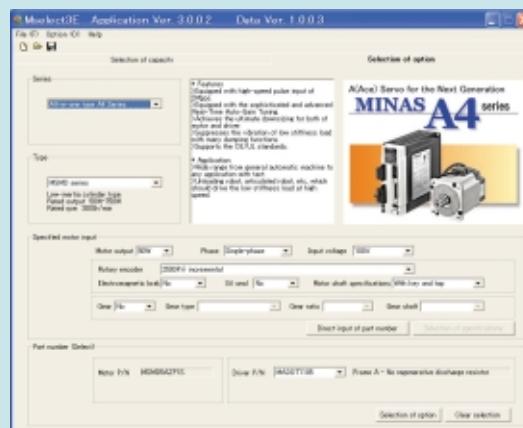
Option Selection Method

Selection based on series and type

- Options are selected by motor series and type based on motor specifications such as motor output and power requirements.

Direct selection based on a part number of motor and driver

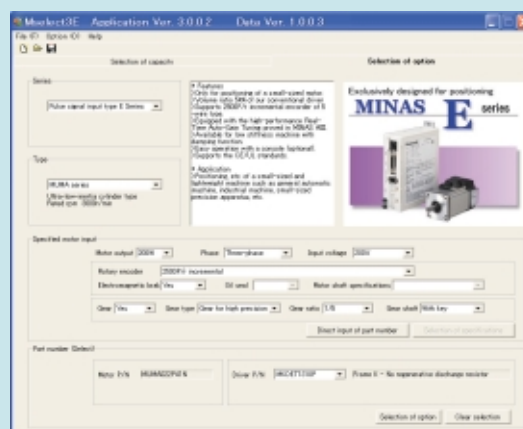
- Options can be selected directly based on a part number of motor and driver if it is already determined.



Part Number Search Function

One-shot search for a part number of motor and driver

- One-shot search is possible to search for a part number of motor and driver based on motor specifications such as motor output, power used, presence of brake and gear, and encoder type.



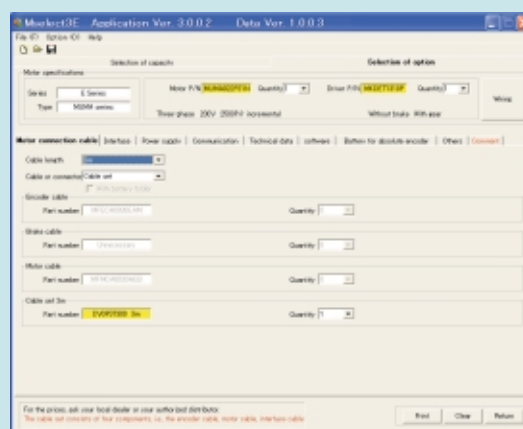
Display of All Dedicated Options

Total elimination of incorrect selection

- Only necessary options can be selected without fail.

Storage of selection results

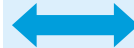
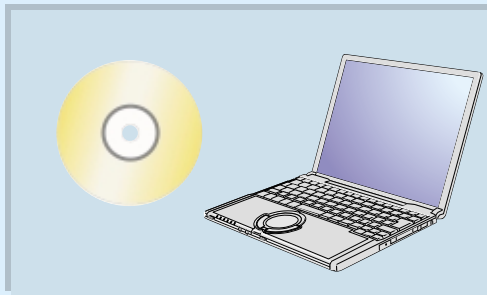
- Selection results can be printed and stored with comments.



Setup support software

Setup support software PANATERM® for MINAS series AC servo motor & Driver

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 series through the RS232 serial interface.



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.

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.

Setup

Auto tuning

- Gain adjustment and inertia ratio measurement

Graphic waveform display

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

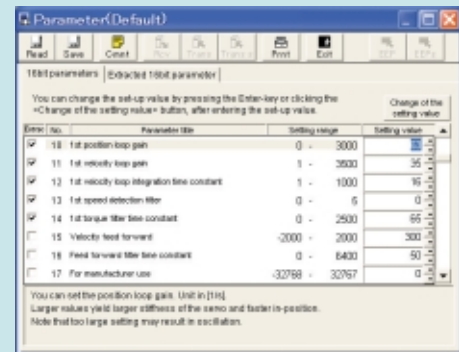
Absolute encoder setup

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

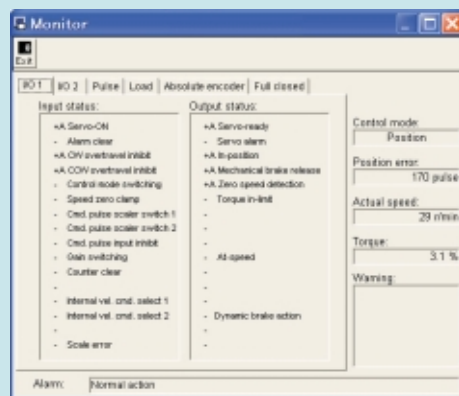
Analysis of mechanical operation data

Frequency analysis

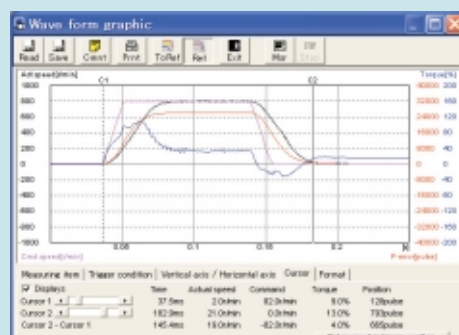
- Measures frequency characteristics of the machine, and displays Bode diagram.



Parameter



Monitor



Graphic waveform display

Guide to the International System of Units (SI)

Organization of the system of units

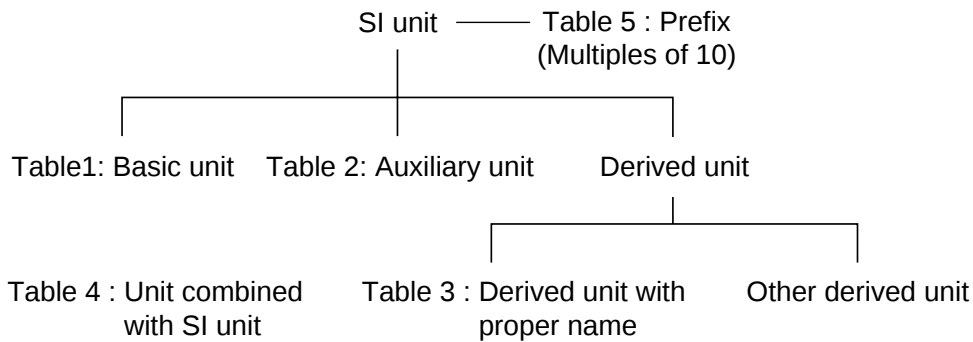


Table 1: Basic unit

Quantity	Name of unit	Symbol of unit
Length	meter	m
Weight	kilogram	kg
Time	second	s
Current	ampere	A
Thermodynamic temperature	kelvin	K
Amount of substance	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	1Hz=1s ⁻¹
Force	newton	N	1N=1kg·m/s ²
Pressure, Stress	pascal	Pa	1Pa=1N/m ²
Energy, Work, Amount of heat	joule	J	1J=1N·m
Amount of work, Work efficiency, Power, Electric power	watt	W	1W=1J/s
Electric charge, Amount of electricity	coulomb	C	1C=1A·s
Electric potential, Potential difference, Voltage, Electromotive force	volt	V	1V=1J/C
Electrostatic capacity, Capacitance	farad	F	1F=1C/V
Electric resistance	ohm	Ω	1Ω=1V/A
Electric conductance	siemens	S	1S=1Ω ⁻¹
Magnetic flux	weber	Wb	1Wb=1V·s
Magnetic flux density, Magnetic induction	tesla	T	1T=1Wb/m ²
Inductance	henry	H	1H=1Wb/A
Degree centigrade (Celsius)	degree centigrade (Celsius) / degree	°C	t°C=(t+273.15)K
Luminous flux	lumen	lm	1lm=1cd·sr
Illuminance	lux	lx	1lx=1lm/m ²

Table 4: Unit combined with SI unit

Quantity	Name	Symbol of unit
Time	minute	min
	hour	h
	day	d
Plane angle	degree	°
	minute	'
	second	"
Volume	liter	l, L
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)	μ m	$1\mu=1\mu\text{m}$ (micrometer)
Acceleration	Gal	m/s^2	$1\text{Gal}=10^{-2}\text{m/s}^2$
	G	m/s^2	$1\text{G}=9.806\,65\text{m/s}^2$
Frequency	c/s, c	Hz	$1\text{c/s}=\text{Hz}$
Revolving speed, Number of revolutions	rpm	s^{-1} or min^{-1} , r/min	$1\text{rpm}=1\text{min}^{-1}$
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	$1\text{kgf}=9.806\,65\text{N}$
Force	kgf	N	$1\text{kgf}=9.806\,65\text{N}$
	dyn	N	$1\text{dyn}=10^{-3}\text{N}$
Moment of force	kgf-m	N-m	$1\text{kgf-m}=9.806\,65\text{N}\cdot\text{m}$
Pressure	kgf/ cm^2	Pa, bar ⁽²⁾ or kgf/ cm^2	$1\text{kgf/cm}^2=9.806\,65 \times 10^4\text{Pa}=0.980\,665\text{bar}$
	at (Engineering atmospheric pressure)	Pa	$1\text{at}=9.806\,65 \times 10^4\text{Pa}$
	atm (Atmospheric pressure)	Pa	$1\text{atm}=1.013\,25 \times 10^5\text{Pa}$
	mH ₂ O, mAq	Pa	$1\text{mH}_2\text{O}=9.806\,65 \times 10^3\text{Pa}$
	mmHg	Pa or mmHg ⁽²⁾	$1\text{mmHg}=133.322\text{Pa}$
	Torr	Pa	$1\text{mmHg}=133.322\text{Pa}$
Stress	kgf/ mm^2	Pa or N/ m^2	$1\text{kgf/mm}^2=9.806\,65 \times 10^4\text{Pa}$ $=9.806\,65 \times 10^6\text{N/m}^2$
	kgf/ cm^2	Pa or N/ m^2	$1\text{kgf/cm}^2=9.806\,65 \times 10^4\text{Pa}$ $=9.806\,65 \times 10^4\text{N/m}^2$
Elastic modulus	kgf/ m^2	Pa or N/ m^2	$1\text{kgf/m}^2=9.806\,65\text{Pa}=9.806\,65\text{N/m}^2$ $1\text{kgf/cm}^2=9.806\,65 \times 10^4\text{N/m}^2$
Energy, Work	kgf-m	J (joule)	$1\text{kgf-m}=9.806\,65\text{J}$
	erg	J	$1\text{erg}=10^{-7}\text{J}$
Work efficiency, Power	kgf-m/s	W (watt)	$1\text{kgf-m/s}=9.806\,65\text{W}$
	PS	W	$1\text{PS}=0.735\,5\text{kW}$
Viscosity	PP	Ps-s	$1\text{P}=0.1\text{Pa-s}$
Kinetic viscosity	St	mm^2/s	$10^{-2}\text{St}=1\text{mm}^2/\text{s}$
Thermodynamic temperature	K	K (kelvin)	$1\text{K}=1\text{K}$
Temperature interval	deg	K ⁽³⁾	$1\text{deg}=1\text{K}$
Amount of heat	cal	J	$1\text{cal}=4.186\,05\text{J}$
Heat capacity	cal/ $^{\circ}\text{C}$	J/K ⁽³⁾	$1\text{cal}/^{\circ}\text{C}=4.186\,05\text{J/K}$
Specific heat, Specific heat capacity	cal/ (kgf $\cdot^{\circ}\text{C}$)	cal/ (kgf $\cdot\text{K}$) ⁽³⁾	$1\text{cal}/(\text{kgf}\cdot^{\circ}\text{C})=4.186\,05\text{J}/(\text{kg}\cdot\text{K})$
Entropy	cal/K	J/K	$1\text{cal/K}=4.186\,05\text{J/K}$
Specific entropy	cal/ (kgf $\cdot\text{K}$)	J/(kg $\cdot\text{K}$)	$1\text{cal}/(\text{kgf}\cdot\text{K})=4.186\,05\text{J}/(\text{kg}\cdot\text{K})$
Internal energy (Enthalpy)	cal	J	$1\text{cal}=4.186\,05\text{J}$
Specific internal energy (Specific enthalpy)	cal/kgf	J/kg	$1\text{cal/kgf}=4.186\,05\text{J/kg}$
Heat flux	cal/h	W	$1\text{kcal/h}=1.162\,79\text{W}$
Heat flux density	cal/ ($\text{h}\cdot\text{m}^2$)	W/m^2	$1\text{kcal}/(\text{h}\cdot\text{m}^2)=1.162\,79\text{W/m}^2$
Thermal conductivity	cal/ ($\text{h}\cdot\text{m}\cdot^{\circ}\text{C}$)	W/ ($\text{m}\cdot\text{K}$) ⁽³⁾	$1\text{kcal}/(\text{h}\cdot\text{m}\cdot^{\circ}\text{C})=1.162\,79\text{W}/(\text{m}\cdot\text{K})$
Coefficient of thermal conductivity	cal/ ($\text{h}\cdot\text{m}^2\cdot^{\circ}\text{C}$)	W/ ($\text{m}^2\cdot\text{K}$) ⁽³⁾	$1\text{kcal}/(\text{h}\cdot\text{m}^2\cdot^{\circ}\text{C})=1.162\,79\text{W}/(\text{m}^2\cdot\text{K})$
Intensity of magnetic field	Oe	A/m	$1\text{Oe}=10^2/(4\pi)\text{A/m}$
Magnetic flux	Mx	Wb (weber)	$1\text{Mx}=10^{-3}\text{Wb}$
Magnetic flux density	Gs, G	T (tesla)	$1\text{Gs}=10^{-4}\text{T}$

Note

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

Selecting Motor Capacity

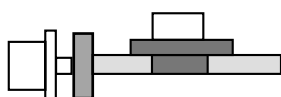
Flow of motor selection

1. Definition of mechanism to be driven by motor.

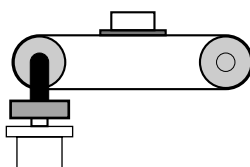
Define details of individual mechanical components (ball screw length, lead and pulley diameters, etc.)

<Typical mechanism>

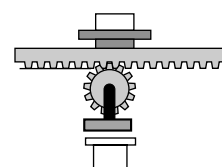
Ball screw mechanism



Belt mechanism

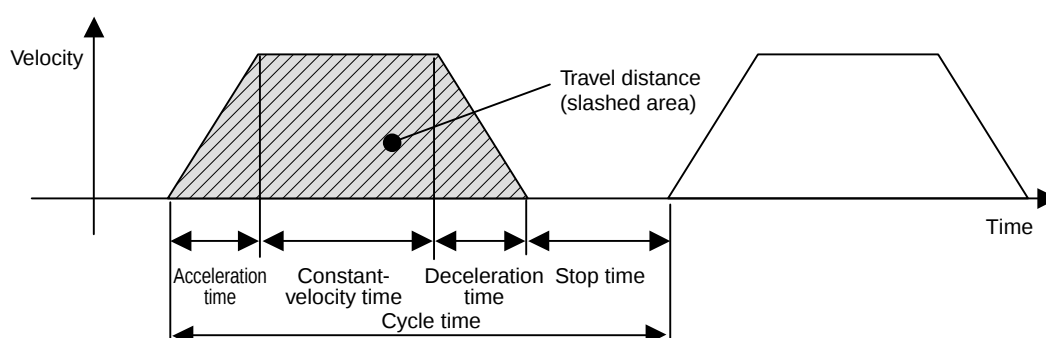


Rack & pinion, etc.



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 " $\times 10^{-4} \text{kg}\cdot\text{m}^2$ ".

4. Calculation of motor velocity

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

5. Calculation of torque

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

6. Calculation of motor

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

Description on the items related to motor selection

1. Torque

(1) Peak torque

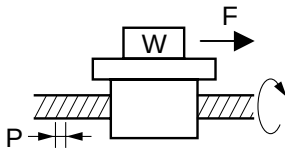
Indicate the maximum torque that the motor requires during operation (mainly in acceleration and deceleration steps). The reference value is 80% or less of the maximum motor torque. If the torque is a negative value, a regenerative discharge resistor may be required.

(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

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

W : Weight [kg]

η : Mechanical efficiency

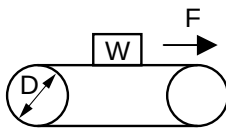
P : Lead [m]

μ : Coefficient of friction

F : External force [N]

g : Acceleration of gravity 9.8[m/s²]

Belt mechanism



Traveling torque

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

W : Weight [kg]

η : Mechanical efficiency

P : Pulley diameter [m]

μ : Coefficient of friction

F : External force [N]

g : Acceleration of gravity 9.8[m/s²]

(3) Effective torque

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

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

T_a : Acceleration torque [N·m]

t_a : Acceleration time [s]

t_c : Cycle time [s]

T_f : Traveling torque [N·m]

t_b : Constant-velocity time [s]

(Run time + Stop time)

T_d : Deceleration torque [N·m]

t_d : Deceleration time [s]

2. Motor velocity

Maximum velocity

Maximum velocity of motor in operation: The reference value is the rated velocity or lower value.

When the motor runs at the maximum velocity, you must pay attention to the motor torque and temperature rise.

For actual calculation of motor velocity, see "Example of motor selection" described later.

Selecting Motor Capacity

3. Inertia and inertia ratio

Inertia is like the force to retain the current moving condition.

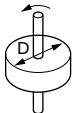
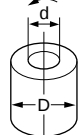
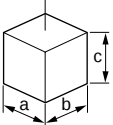
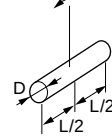
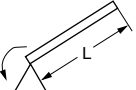
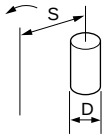
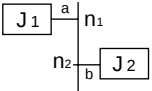
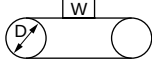
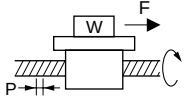
Inertia ratio is calculated by dividing load inertia by rotor inertia.

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

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

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

Density of each material

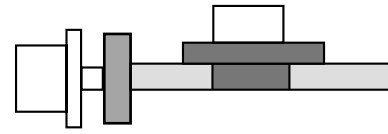
Iron $\rho = 7.9 \times 10^3 \text{ [kg/m}^3]$ Aluminum $\rho = 2.8 \times 10^3 \text{ [kg/m}^3]$

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

To drive ball screw mechanism

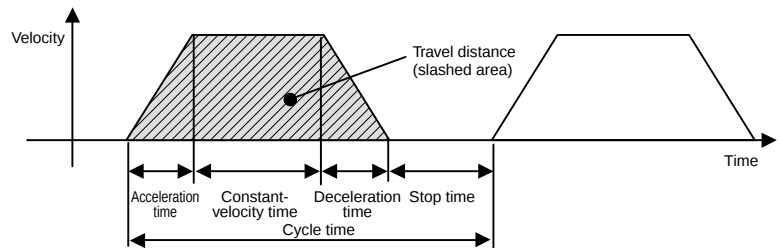
1. Example of motor selection for driving ball screw mechanism

Workpiece weight $W_A = 10$ [kg]
 Ball screw length $B_L = 0.5$ [m]
 Ball screw diameter $B_D = 0.02$ [m]
 Ball screw pitch $B_P = 0.02$ [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 $BW = \rho \times \pi \times \left(\frac{B_D}{2}\right)^2 \times B_L = 7.9 \times 10^3 \times \pi \times \left(\frac{0.02}{2}\right)^2 \times 0.5$
 $= 1.24$ [kg]

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

5. Provisional motor selection

In case of 200 W motor : $J_M = 0.17 \times 10^{-4}$ [kg·m²]

6. Calculation of inertia ratio

$J_L / J_M = 1.73 \times 10^{-4} / 0.17 \times 10^{-4}$ Therefore, the inertia ratio is "10.2" (less than "20")

(In case of 100 W motor: $J_M = 0.064 \times 10^{-4}$ Therefore, the inertia ratio is "27.0".)

7. Calculation of maximum velocity (Vmax)

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

$$\frac{1}{2} \times 0.1 \times V_{\max} + 0.8 \times V_{\max} + \frac{1}{2} \times 0.1 \times V_{\max} = 0.3$$

$$0.9 \times V_{\max} = 0.3$$

$$= 0.3 / 0.9 = 0.334$$
 [m/s]

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

$$N = 0.334 / 0.02 = 16.7$$
 [r/s]

$$= 16.7 \times 60 = 1002$$
 [min⁻¹] < 3000 [min⁻¹] (Rated velocity of 200W 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 $T_a = \frac{(J_L + J_M) \times 2\pi N [\text{r/s}]}{\text{Acceleration time [s]}} + \text{Traveling torque}$
 $= \frac{(1.73 \times 10^{-4} + 0.17 \times 10^{-4}) \times 2\pi \times 16.7}{0.1} + 0.035$
 $= 0.199 + 0.035 = 0.234$ [N·m]

Selecting Motor Capacity

$$\begin{aligned}
 \text{Deceleration torque } T_d &= \frac{(J_L + J_M) \times 2\pi N[\text{r/s}]}{\text{Deceleration time [s]}} - \text{Traveling torque} \\
 &= \frac{(1.73 \times 10^{-4} + 0.17 \times 10^{-4}) \times 2\pi \times 16.7}{0.1} - 0.035 \\
 &= 0.199 - 0.035 = 0.164 \text{ [N}\cdot\text{m]}
 \end{aligned}$$

10. Verification of maximum torque

$$\text{Acceleration torque} = T_a = 0.234 \text{ [N}\cdot\text{m]} < 1.91 \text{ [N}\cdot\text{m]} \text{ (Maximum torque of 200 W motor)}$$

11. Verification of effective torque

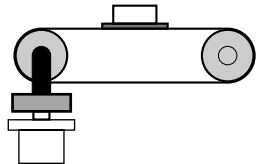
$$\begin{aligned}
 T_{\text{rms}} &= \sqrt{\frac{T_a^2 \times t_a + T_f^2 \times t_b + T_d^2 \times t_d}{t_c}} \\
 &= \sqrt{\frac{0.234^2 \times 0.1 + 0.035^2 \times 0.8 + 0.164^2 \times 0.1}{2}} \\
 &= 0.065 \text{ [N}\cdot\text{m]} < 0.64 \text{ [N}\cdot\text{m]} \text{ (Rated torque of 200 W motor)}
 \end{aligned}$$

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

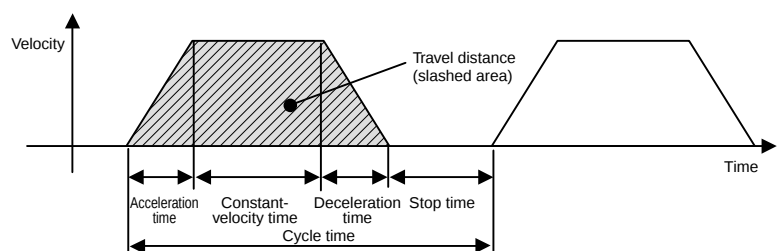
Example of motor selection for timing belt mechanism

1. Mechanism	Workpiece weight	$W_A = 3[\text{kg}]$ (including belt)
	Pulley diameter	$P_D = 0.05[\text{m}]$
	Pulley weight	$W_P = 0.5[\text{kg}]$ (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	$t_a = 0.1[\text{s}]$
Constant-velocity time	$t_b = 0.8[\text{s}]$
Deceleration time	$t_d = 0.1[\text{s}]$
Cycle time	$t_c = 2[\text{s}]$
Travel distance	$1[\text{m}]$



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

$$\begin{aligned}
 &= J_C + \frac{1}{4} W_A \times P_D^2 + \frac{1}{8} W_P \times P_D^2 \times 2 \\
 &= 0 + \frac{1}{4} \times 3 \times 0.05^2 + \frac{1}{8} \times 0.5 \times 0.05^2 \times 2 \\
 &= 0.00219 = 21.9 \times 10^{-4} \text{ [kg}\cdot\text{m}^2]
 \end{aligned}$$

4. Provisional motor selection

$$\text{In case of 750 W motor : } J_M = 1.31 \times 10^{-4} \text{ [kg}\cdot\text{m}^2]$$

5. Calculation of inertia ratio

$$J_L / J_M = 21.9 \times 10^{-4} / 1.31 \times 10^{-4} \text{ Therefore, the inertia ratio is "16.7" (less than "20")}$$

6. Calculation of maximum velocity (Vmax)

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

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

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

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

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

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

$$N = 1.11 / 0.157 = 7.08[\text{r/s}]$$

$$= 7.08 \times 60 = 424.8[\text{min}^{-1}] < 3000[\text{min}^{-1}] \text{ (Rated velocity of 750 W motor)}$$

8. Calculation of torque

$$\begin{aligned} \text{Traveling torque} \quad T_f &= \frac{PD}{2\eta} (\mu gWA + F) = \frac{0.05}{2 \times 0.8} (0.1 \times 9.8 \times 3 + 0) \\ &= 0.092[\text{N}\cdot\text{m}] \end{aligned}$$

$$\begin{aligned} \text{Acceleration torque} \quad T_a &= \frac{(J_L + J_M) \times 2\pi N[\text{r/s}]}{\text{Acceleration time}[\text{s}]} + \text{Traveling torque} \\ &= \frac{(21.9 \times 10^{-4} + 1.31 \times 10^{-4}) \times 2\pi \times 7.08}{0.1} + 0.092 \\ &= 1.032 + 0.092 = 1.124[\text{N}\cdot\text{m}] \end{aligned}$$

$$\begin{aligned} \text{Deceleration torque} \quad T_d &= \frac{(J_L + J_M) \times 2\pi N[\text{r/s}]}{\text{Deceleration time}[\text{s}]} - \text{Traveling torque} \\ &= \frac{(21.9 \times 10^{-4} + 1.31 \times 10^{-4}) \times 2\pi \times 7.08}{0.1} - 0.092 \\ &= 1.032 - 0.092 = 0.94[\text{N}\cdot\text{m}] \end{aligned}$$

9. Verification of maximum torque

$$\text{Acceleration torque} \quad T_a = 1.124[\text{N}\cdot\text{m}] < 7.1[\text{N}\cdot\text{m}] \text{ (Maximum torque of 750 W motor)}$$

10. Verification of effective torque

$$\begin{aligned} T_{\text{rms}} &= \sqrt{\frac{T_a^2 \times t_a + T_f^2 \times t_b + T_d^2 \times t_d}{t_c}} \\ &= \sqrt{\frac{1.124^2 \times 0.1 + 0.092^2 \times 0.8 + 0.94^2 \times 0.1}{2}} \\ &= 0.333 [\text{N}\cdot\text{m}] < 2.4 [\text{N}\cdot\text{m}] \text{ (Rated torque of 750 W motor)} \end{aligned}$$

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

Request for Motor Selection I : Ball screw drive

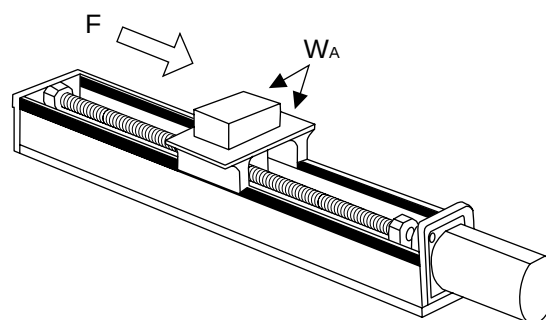
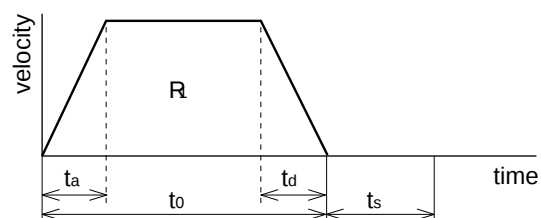
1. Driven mechanism and running data

1) Travel distance of the work load per one cycle 2) Cycle time

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

3) Acceleration time 4) Deceleration time 5) Stopping time 6) Max. velocity 7) External force 8) Positioning accuracy of the work load 9) Total weight of the work load and the table 10) Power supply voltage 11) Diameter of the ball screw 12) Total length of the ball 13) Lead of the ball screw

Running pattern

14) Traveling direction
(horizontal, vertical etc.)

2. Other data

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

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

Request for Motor Selection II : Timing pulley + Ball screw drive

1. Driven mechanism and running data

1) Travel distance of the work load per one cycle 2) Cycle time

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

3) Acceleration time 4) Deceleration time 5) Stopping time 6) Max. velocity 7) External force 8) Positioning accuracy of the work load 9) Total weight of the work load and the table 10) Power supply voltage 11) Diameter of the ball screw 12) Total length of the ball screw 13) Lead of the ball screw 14) Traveling

15) Diameter of the pulley

Motor side

Motor side

16) Weight of the pulley

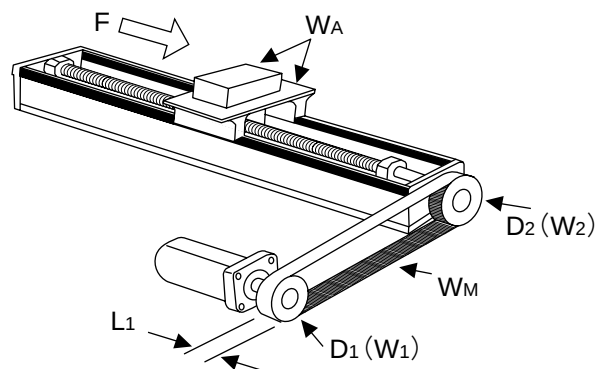
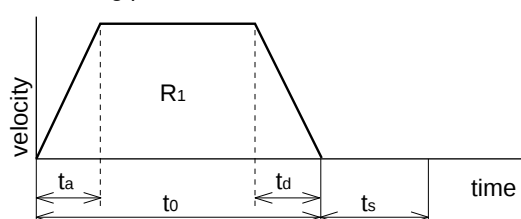
(or item 17) and 18))

17) Width of the pulley

18) Material of the pulley

19) Weight of the belt

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 for Motor SelectionⅢ : Belt drive

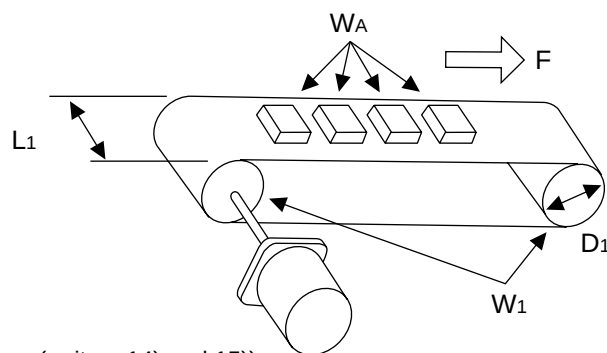
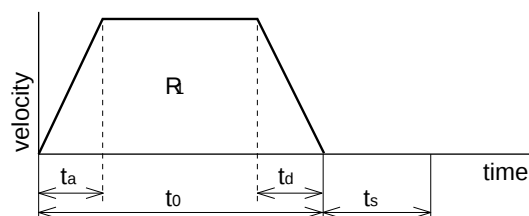
1. Driven mechanism and running data

1) Travel distance of the work load per one cycle 2) Cycle time

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

3) Acceleration time 4) Deceleration time 5) Stopping time 6) Max. velocity 7) External force 8) Positioning accuracy of the work load 9) Total weight of the work load 10) Power supply voltage 11) Weight of the belt 12) Diameter of the driving pulley 13) Total weight of the pulley

Running pattern



(or item 14) and 15))

14) Width of the pulley 15) Material of the pulley 16) Traveling direction
(horizontal, vertical etc.)

2. Other data

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

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

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	d1: deg	16) Diameter of the pulley	Motor side D3: mm	Belt side D4: mm
2) Cycle time	to: s	17) Weight of the pulley	W3: kg	W4: kg
(Fill in items 3) and 4) if required.)		(or item 18) and 19))		
3) Acceleration time	ta: s	18) Width of the pulley	L2: mm	
4) Deceleration time	td: s	19) Material of the pulley		
5) Stopping time	ts: s	20) Weight of the belt	WL: kg	
6) Max. velocity	V: mm/s	21) Traveling direction (horizontal, vertical etc.)		
7) External force	F: kg	Running pattern		
8) Positioning accuracy of the work load	± mm			
9) Total weight of the work load and the table	WA: kg			
10) Power supply voltage	V			
11) Weight of motor site belt	WM: kg			

	Motor side	Belt side
12) Diameter of the pulley	D1: mm	D2: mm
13) Weight of the pulley	W1: kg	W2: kg
(or item 14) and 15))		
14) Weight of the belt	L1: mm	
15) Material of the pulley		

2. Other data

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

Company name :

Department/Section :

Name :

Address :

Tel :

Fax :

E-mail address:

Request for Motor Selection **V** : Turntable drive

1. Driven mechanism and running data

1) Travel distance of the work load per one cycle

d₁: deg

2) Cycle time

t₀: 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

R₁: mm

10) Diameter of the table

D₁: mm

11) Mass of the table

W₁: kg

12) Diameter of the table support

T₁: mm

13) Power supply voltage

V

14) Dimensions of the work load

Prism

Cylinder

a: mm

a: mm

b: mm

b: mm

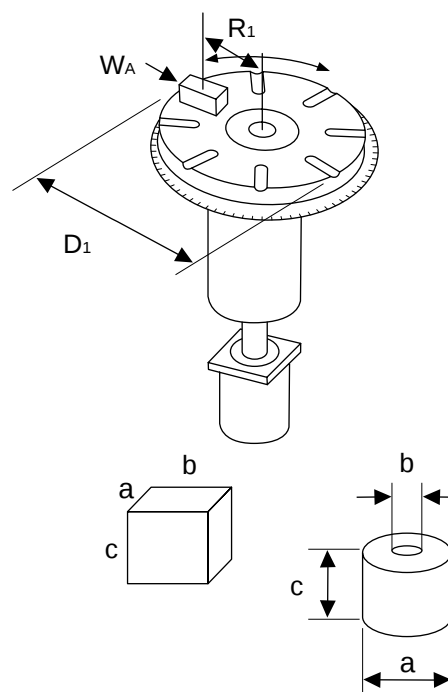
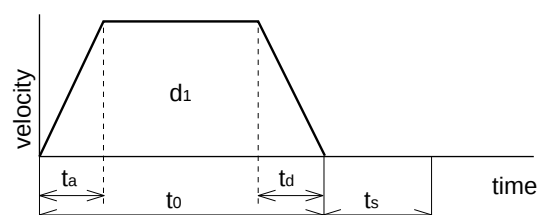
c: mm

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 for Motor Selection VI : Timing pulley + Turntable drive

1. Driven mechanism and running data

1) Travel distance of the work load per one cycle 2) Cycle time

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

3) Acceleration time 4) Deceleration time 5) Stopping time 6) Max. rotating speed of the table

(or)

 7) Positioning accuracy of the work load 8) Weight of one work load 9) Driving radius of the center of gravity of the 10) Diameter of the table 11) Mass of the table 12) Diameter of the table support 13) Power supply voltage

(Prism)

(Cylinder)

14) Dimension of the work load 15) Number of work loads 16) Diameter of the pulley

Motor side	Turntable side
D2: mm	D3: mm

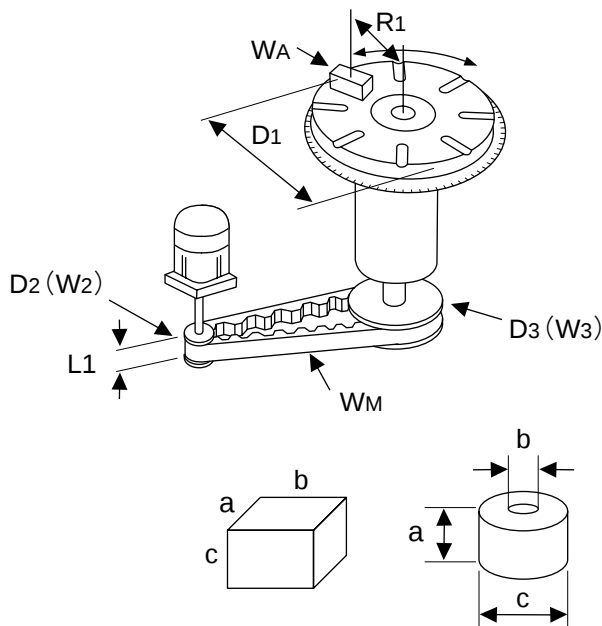
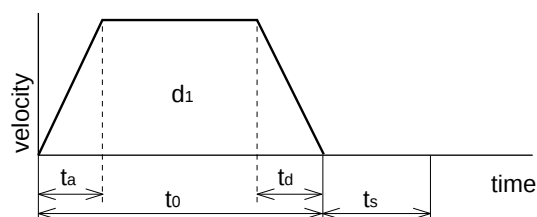
17) Weight of the pulley

W2: kg	W3: kg
--	--

(or item 18) and 19))

18) Width of the pulley 19) Material of the pulley 20) Weight of the belt

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 for Motor Selection VII : Roller feed drive

1. Driven mechanism and running data

1) Travel distance of the work load per one cycle

 ℓ_1 : mm

2) Cycle time

 t_0 : s

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

3) Acceleration time

 t_a : s

4) Deceleration time

 t_d : s

5) Stopping time

 t_s : s

6) Max. velocity

 v : mm/s

7) External pulling force

 F : kg

8) Positioning accuracy of the work load

 $\pm$ mm

9) Total weight of the work load

pcs

10) Power supply voltage

V

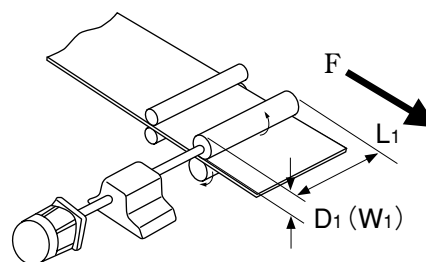
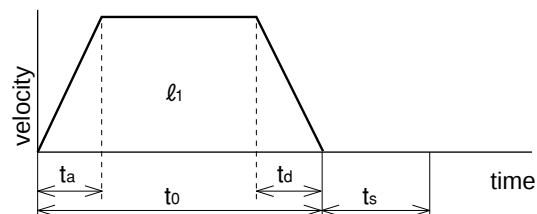
11) Diameter of the roller

 D_1 : mm

12) Mass of the roller

 W_1 : kg

Running pattern



(or item 13) and 14))

13) Width of the roller

 L_1 : mm

14) Material of the roller

2. Other data

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

Company name :

Department/Section :

Name :

Address :

Tel :

Fax :

E-mail address:

Request for Motor Selection **VIII** : Driving with Rack & Pinion

1. Driven mechanism and running data

1) Travel distance of the work load per one cycle

 ℓ_1 : mm

2) Cycle time

to: s

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

3) Acceleration time

ta: s

4) Deceleration time

td: s

5) Stopping time

ts: s

6) Max. velocity

V: mm/s

7) External force

F: kg

8) Positioning accuracy of the work load

 $\pm$ mm

9) Total weight of the work load

WA: kg

10) Power supply voltage

V

11) Diameter of the pinion

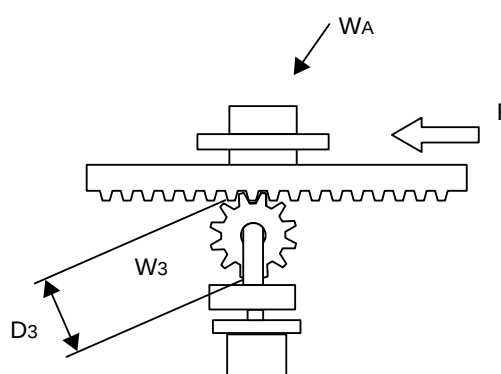
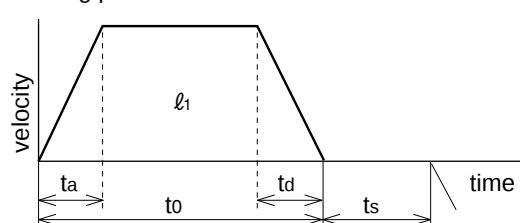
D3: mm

12) Mass of the pinion

W3: 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 :

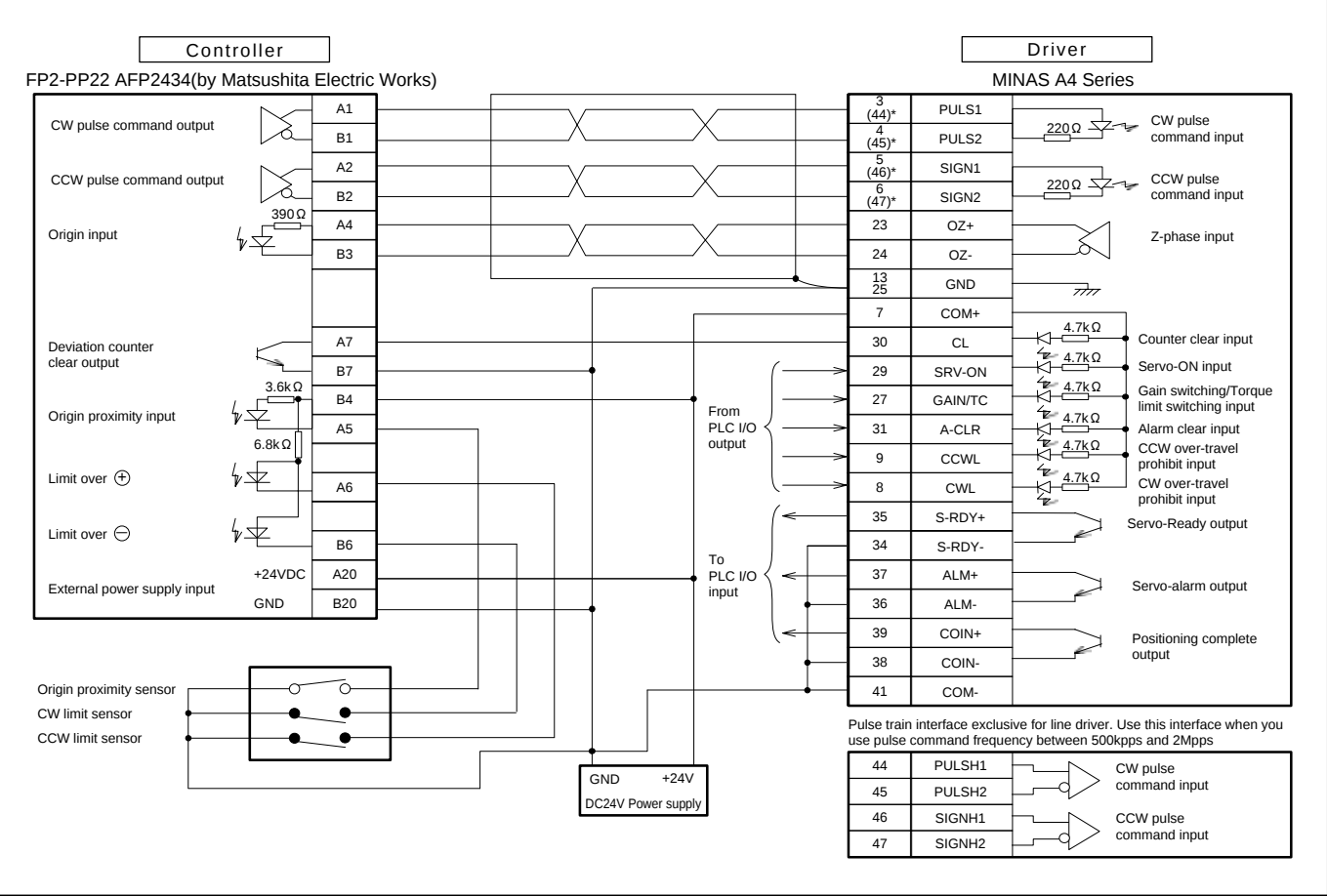
Tel :

Fax :

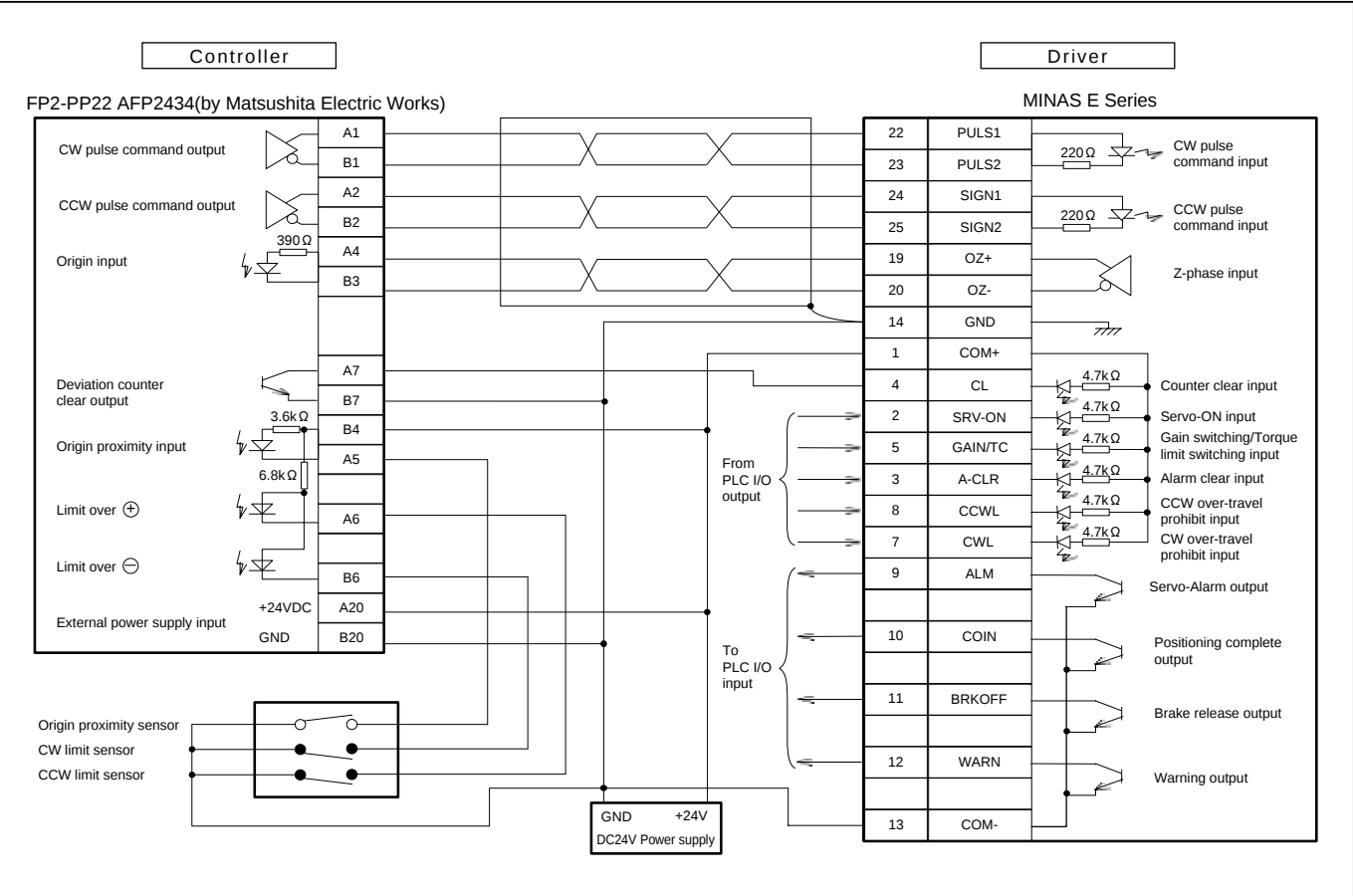
E-mail address:

Connection between Driver and Controller

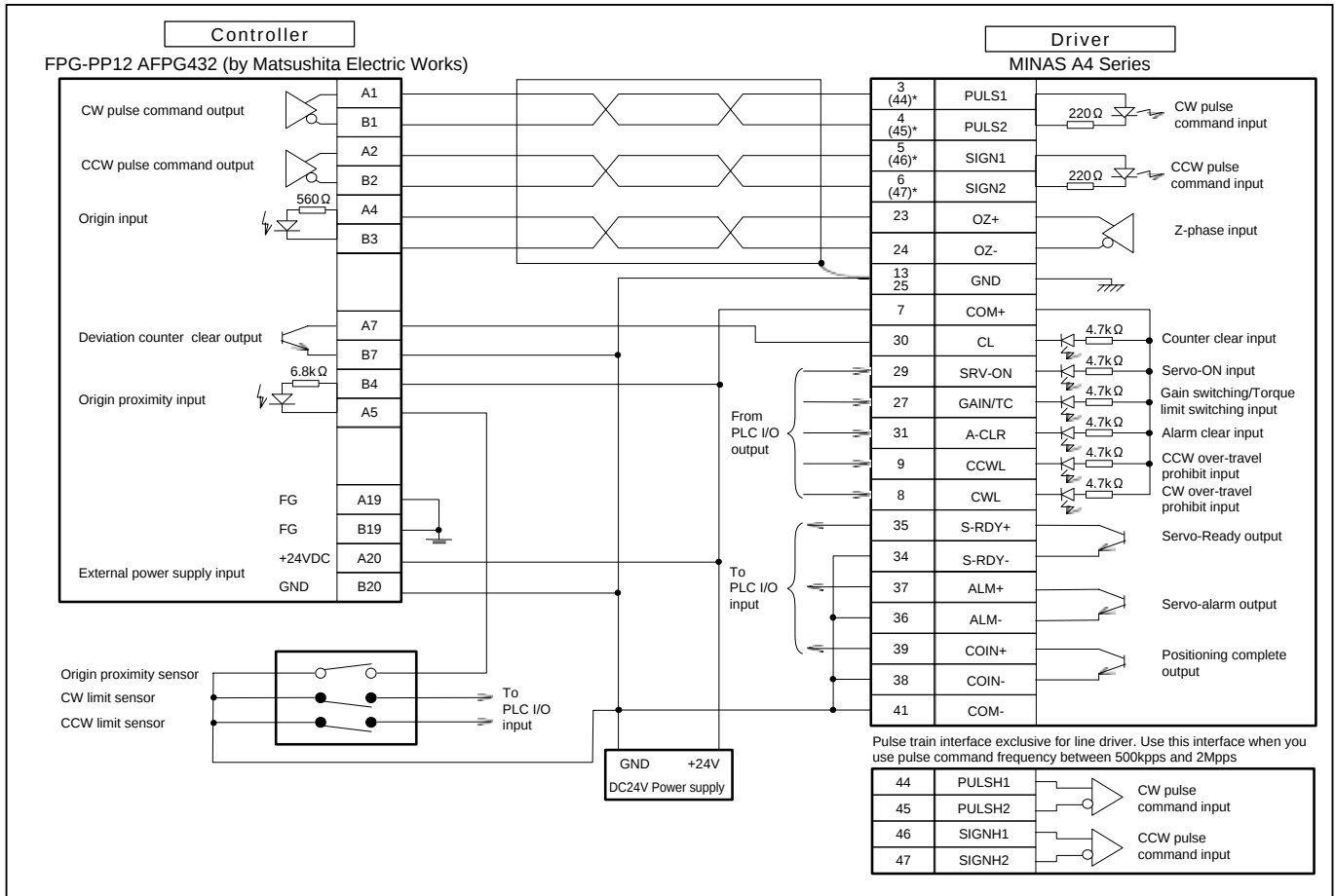
Connection between MINAS A4 and FP2-PP22 AFP2434 (Matsushita Electric Works)



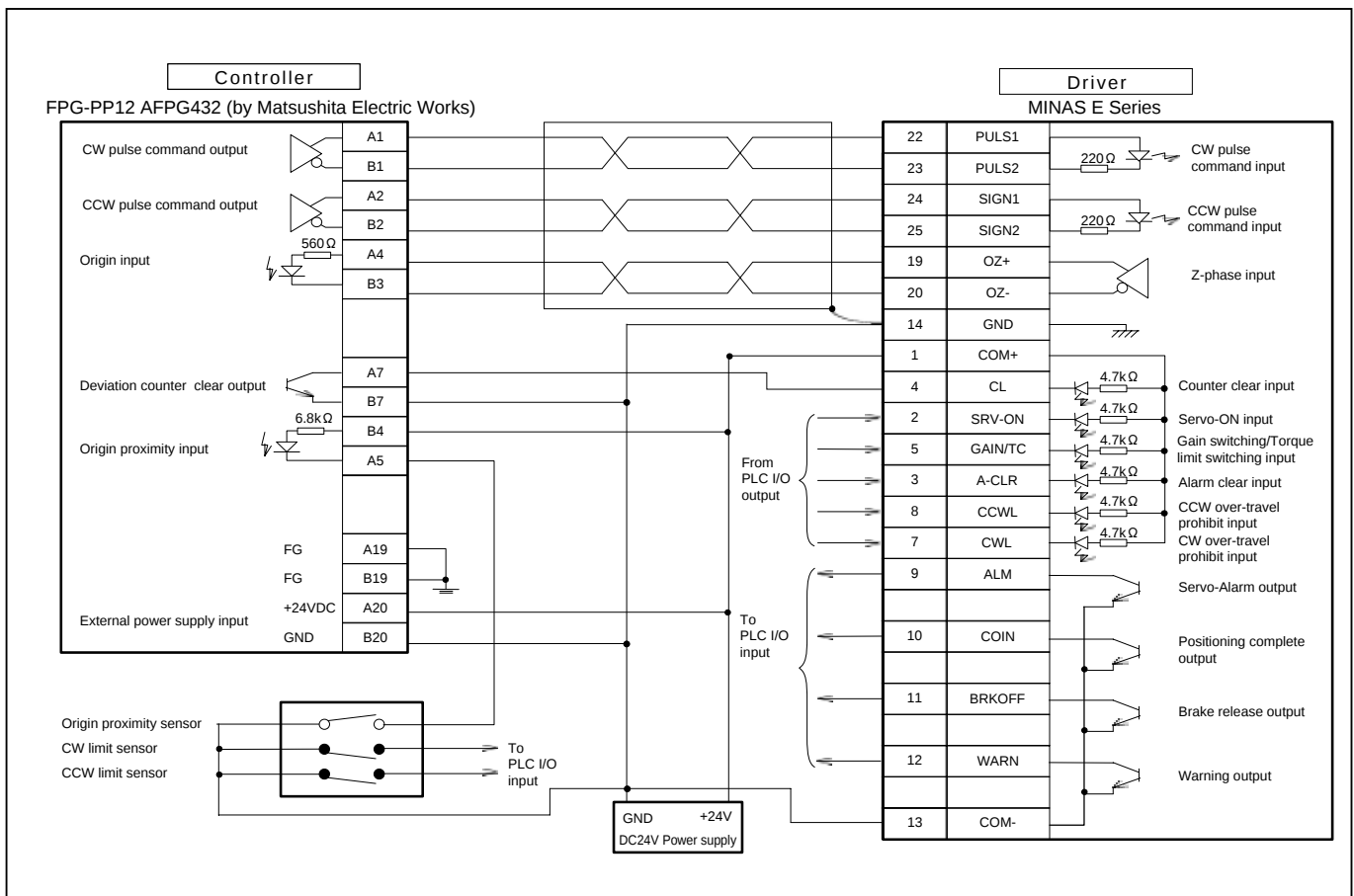
Connection between MINAS E and FP2-PP22 AFP2434 (Matsushita Electric Works)



Connection between MINAS A4 and FPG-PP12 AFPG432 (Matsushita Electric Works)

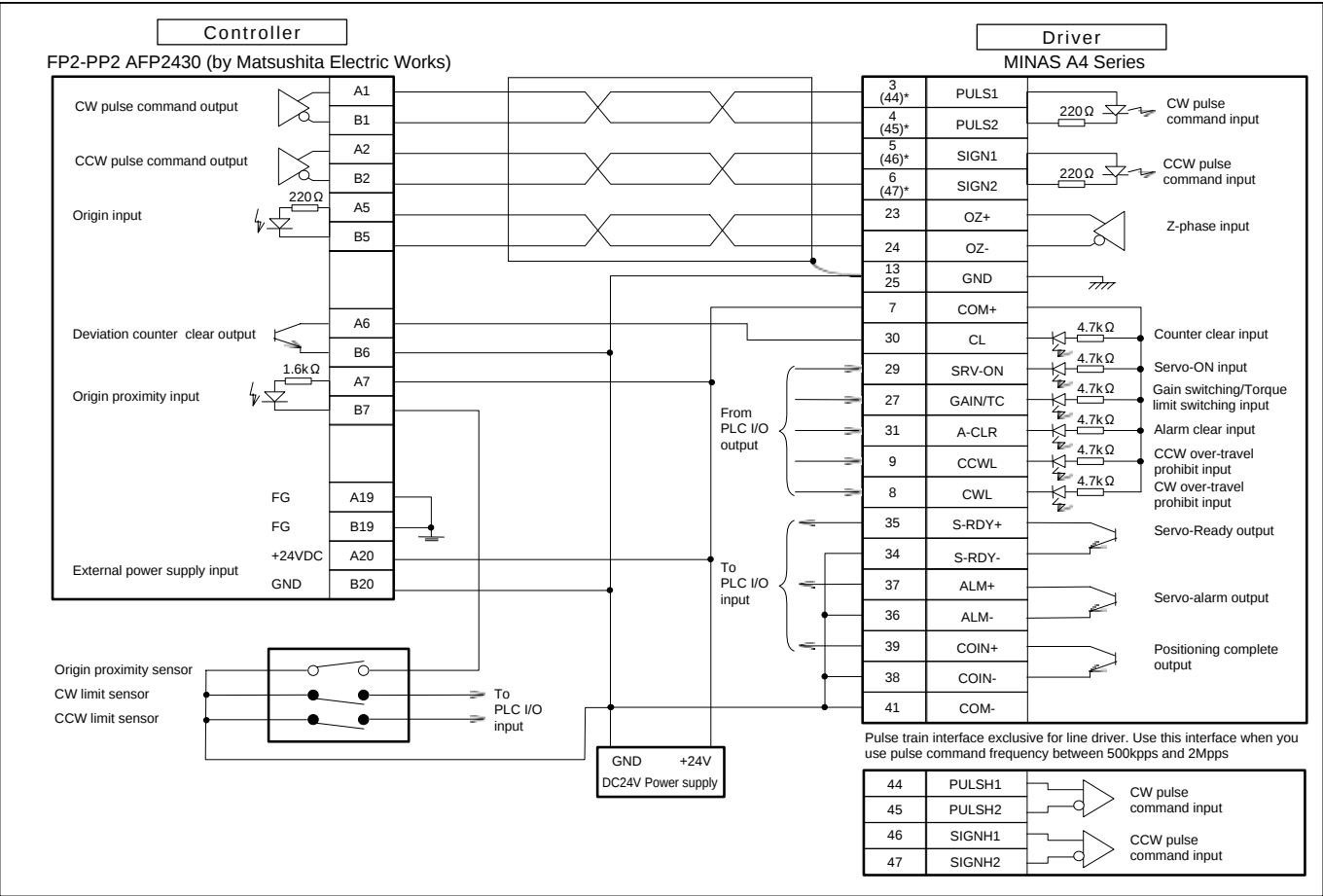


Connection between MINAS E and FPG-PP12 AFPG432 (Matsushita Electric Works)

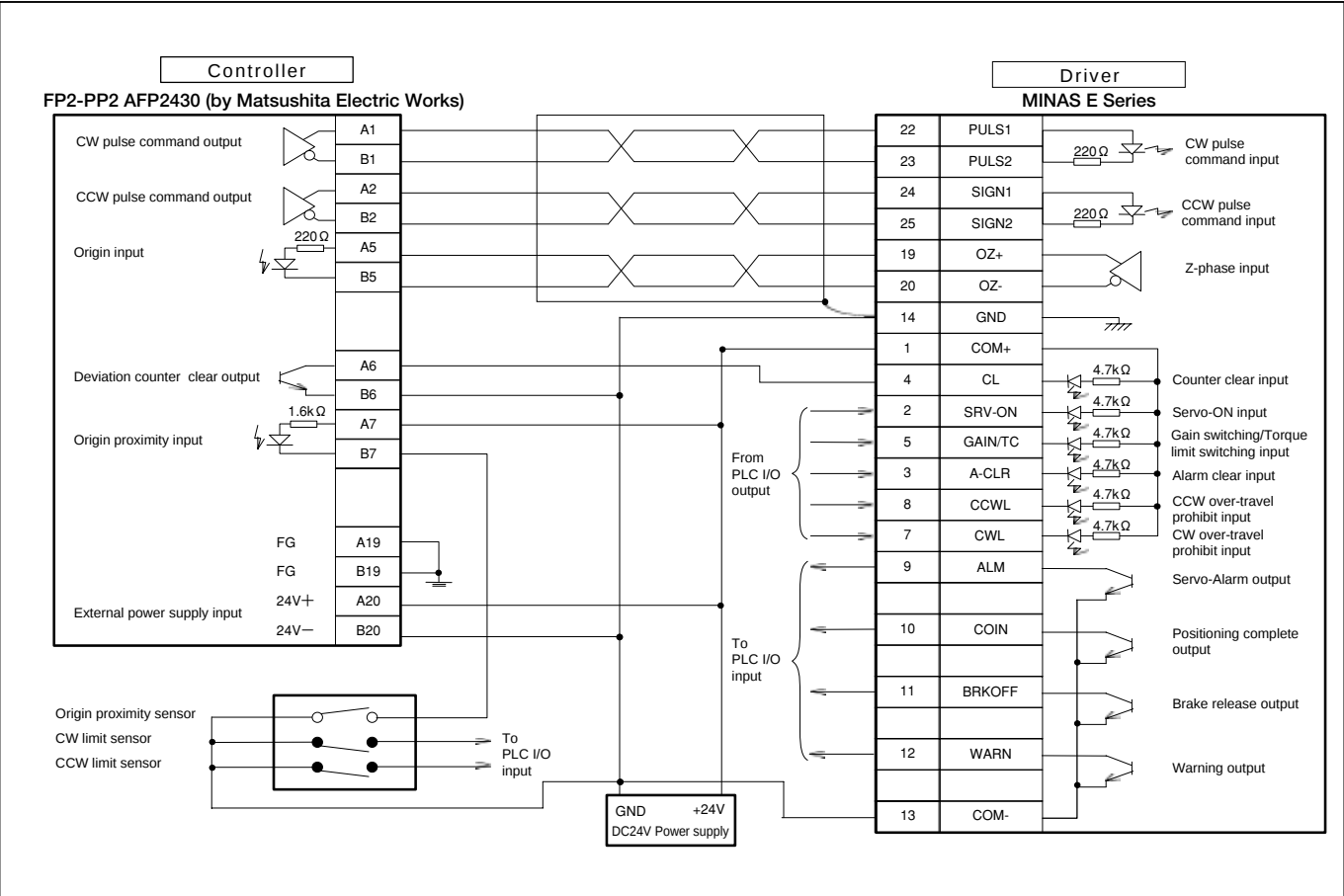


Connection between Driver and Controller

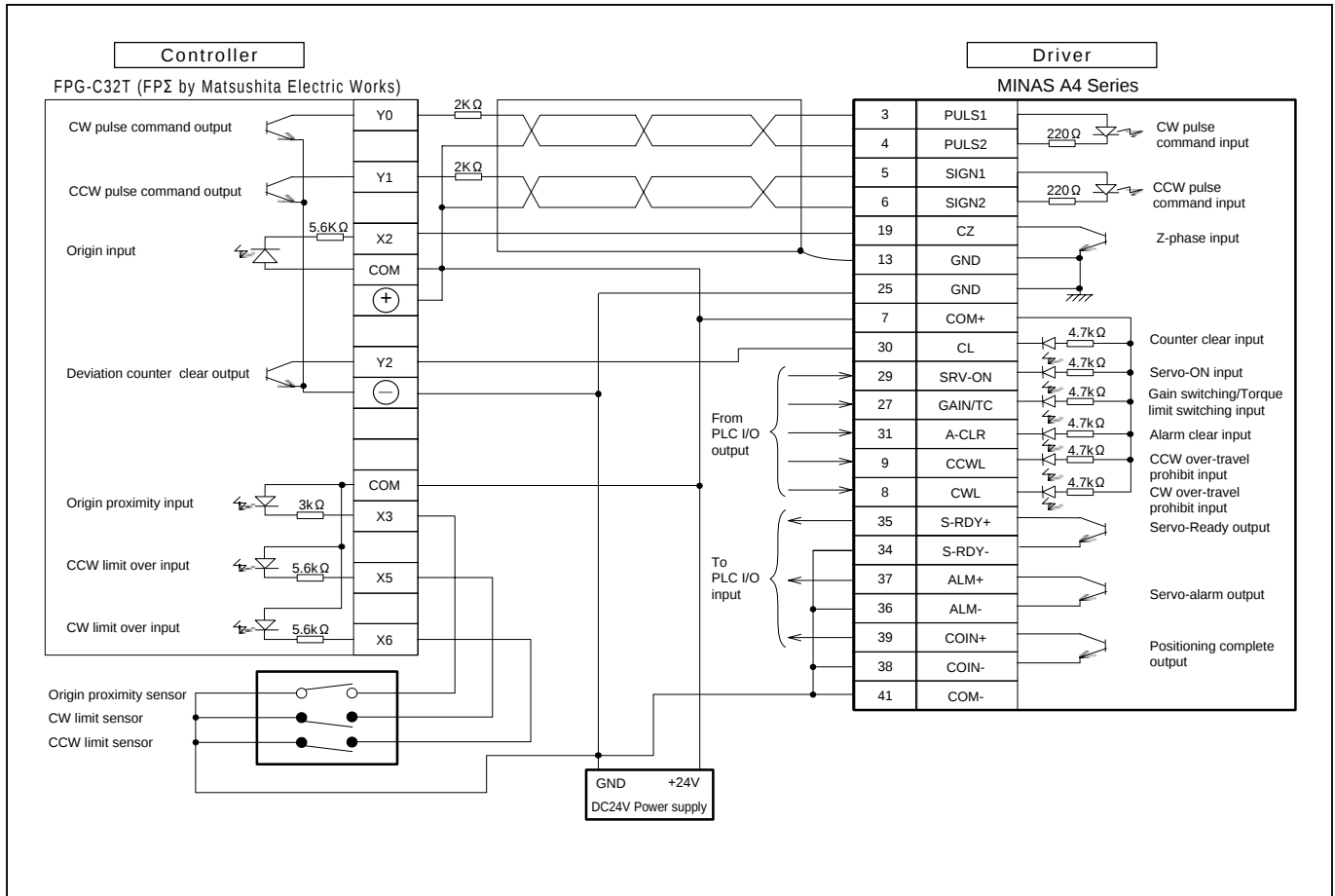
Connection between MINAS A4 and FP2-PP2 AFP2430 (Matsushita Electric Works)



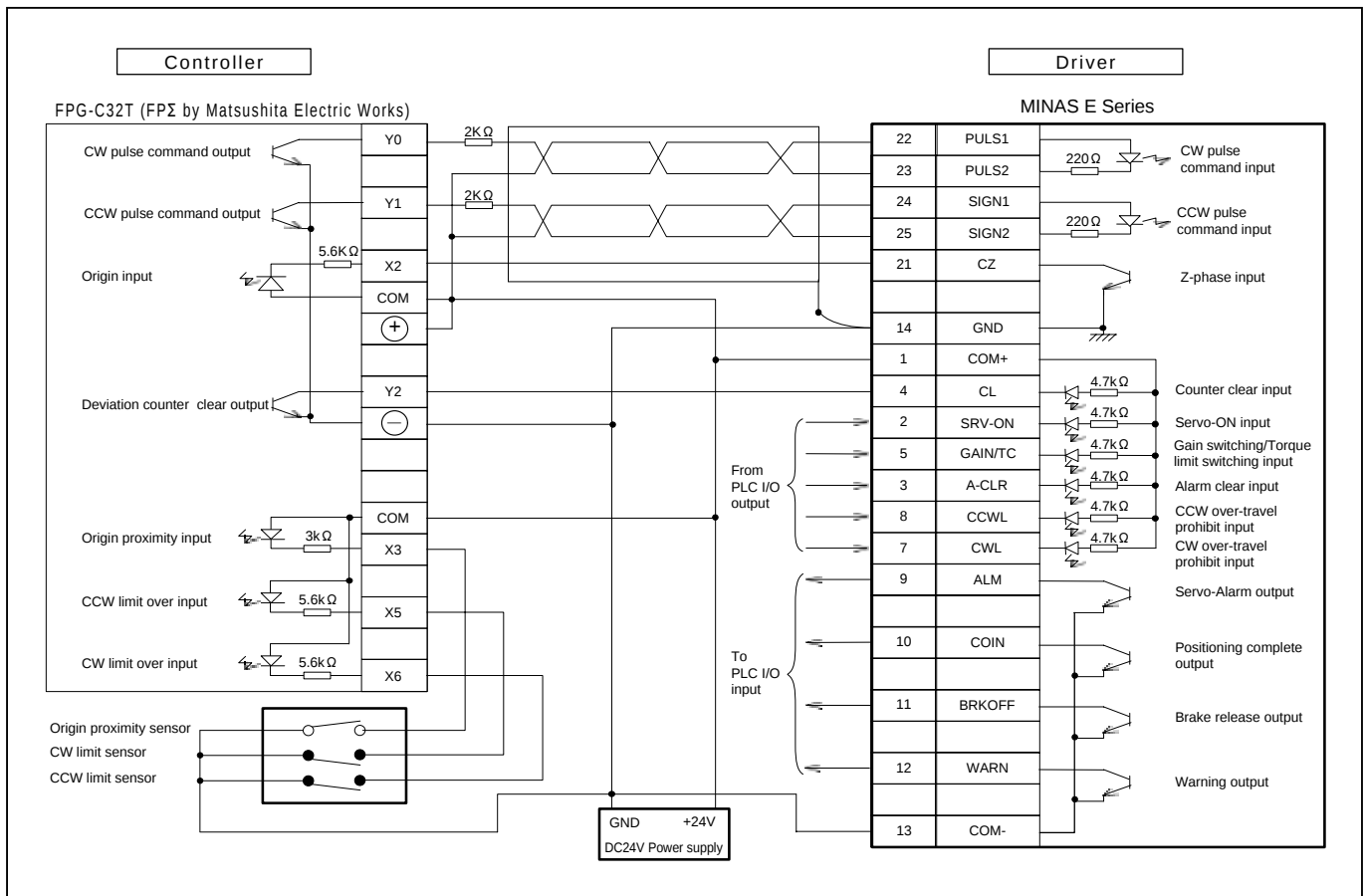
Connection between MINAS E and FP2-PP2 AFP2430 (Matsushita Electric Works)



Connection between MINAS A4 and FPG-C32T (FPΣ, Matsushita Electric Works)

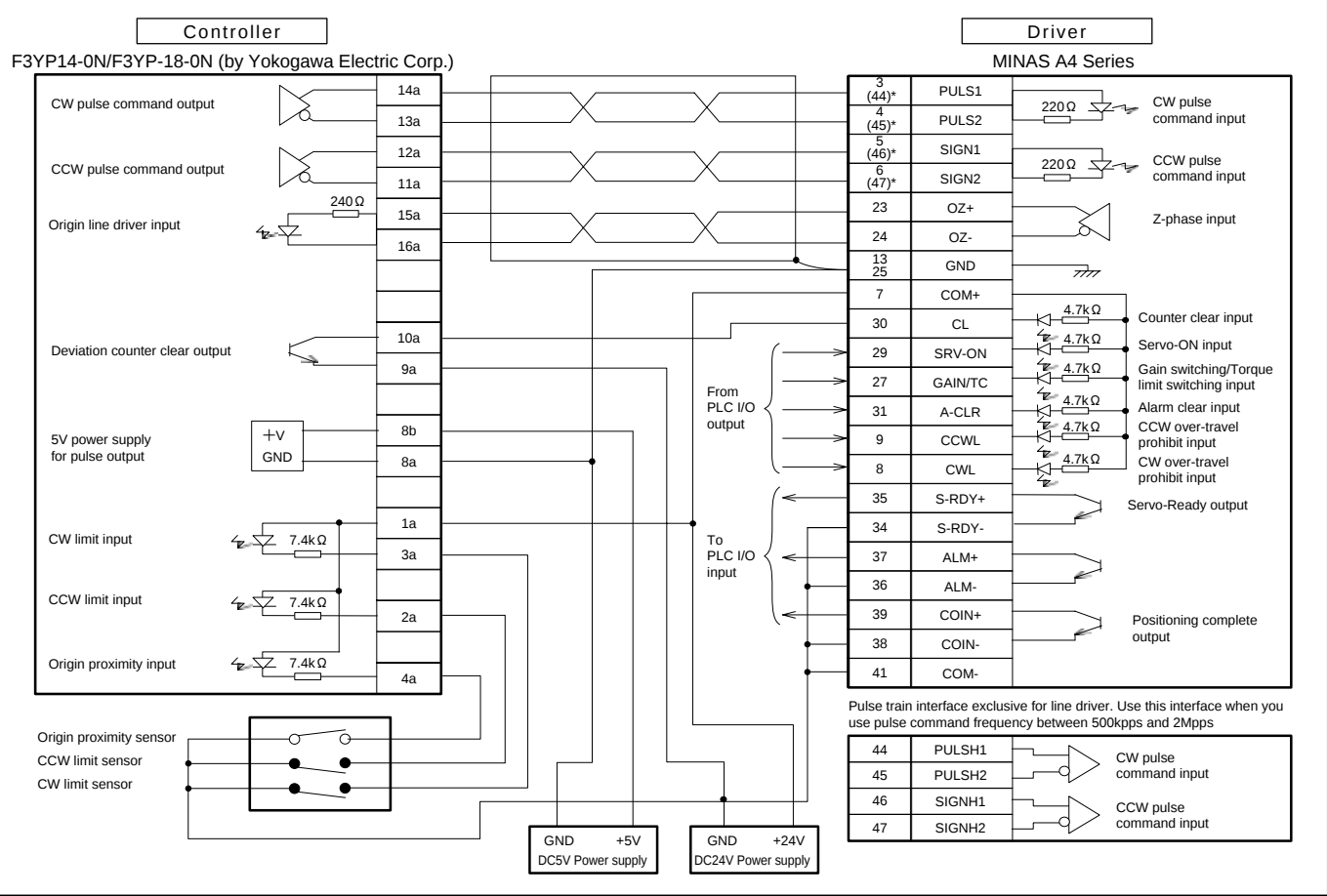


Connection between MINAS E and FPG-C32T (FPΣ, Matsushita Electric Works)

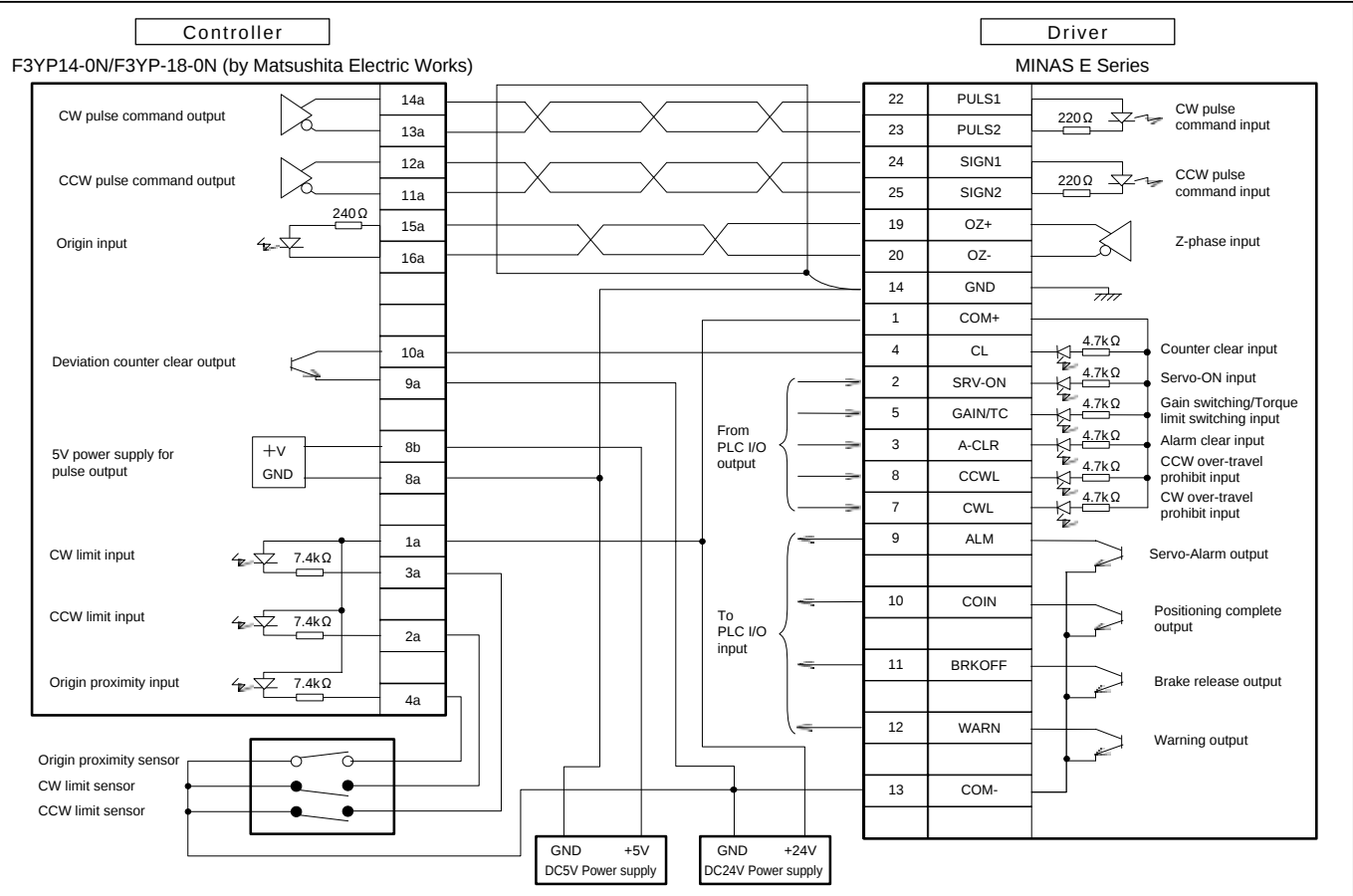


Connection between Driver and Controller

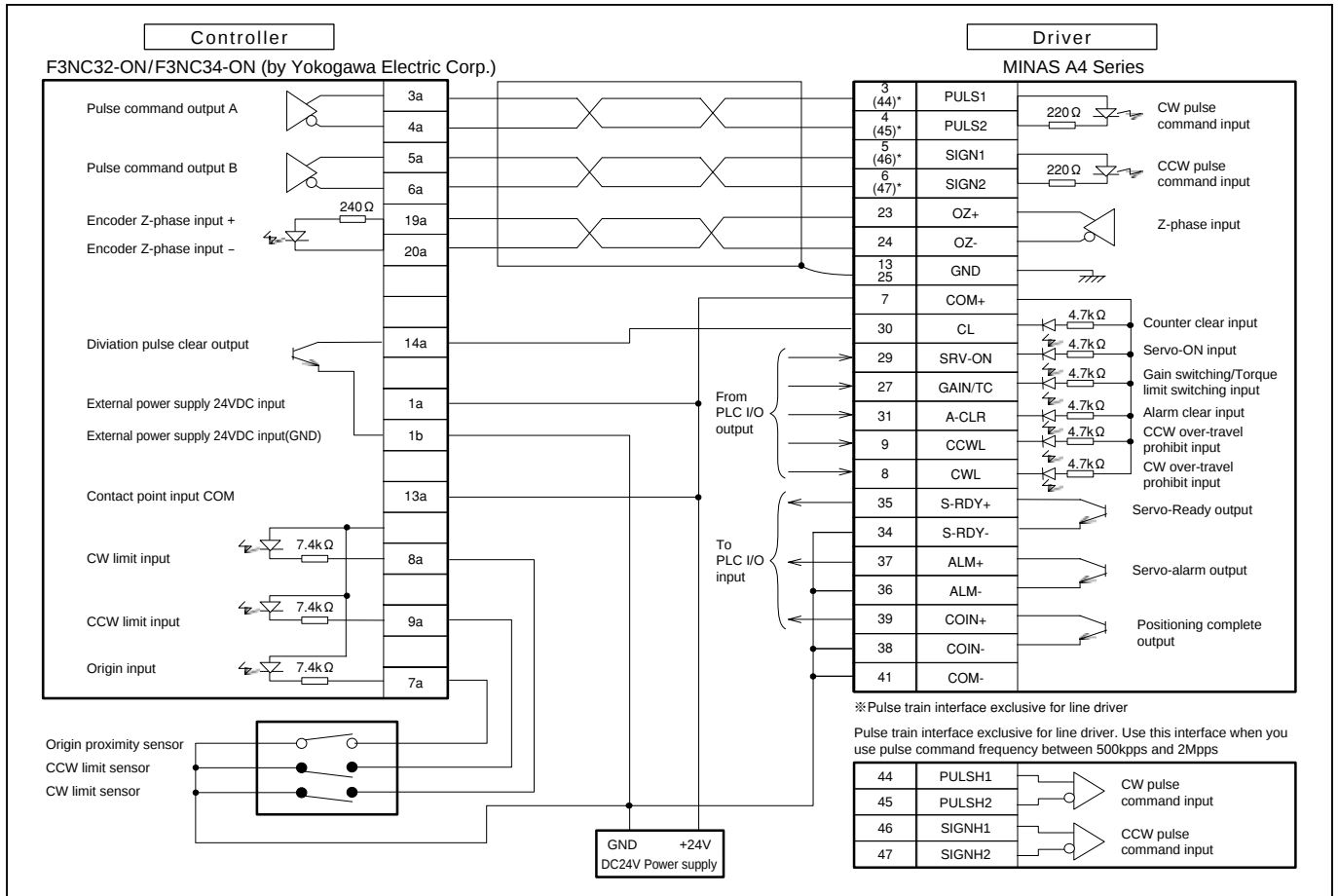
Connection between MINAS A4 and F3YP14-0N/F3YP18-0N (Yokogawa Electric Corp.)



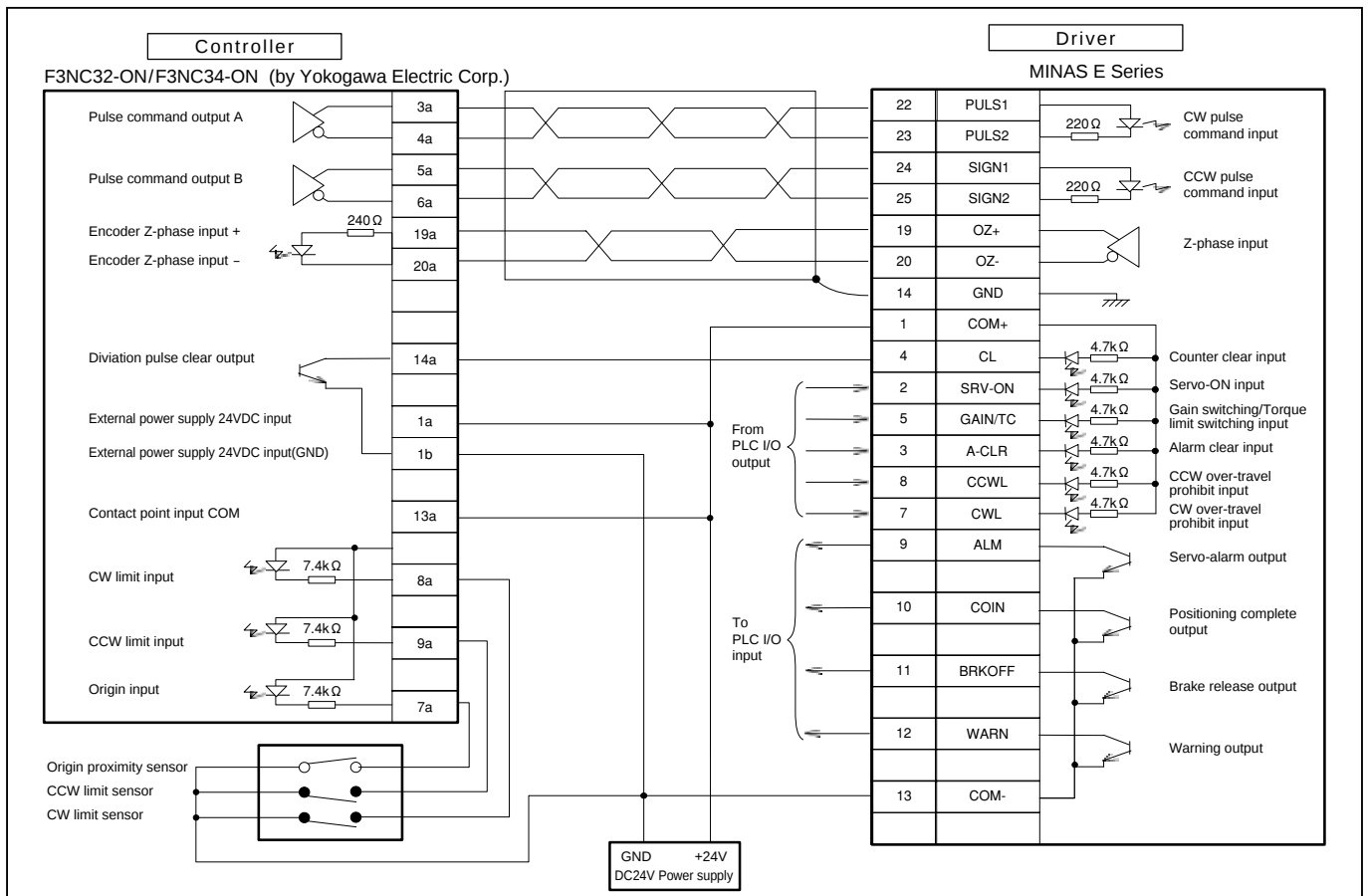
Connection between MINAS E and F3YP14-0N/F3YP18-0N (Yokogawa Electric Corp.)



Connection between MINAS A4 and F3NC32-ON/F3NC34-ON (Yokogawa Electric Corp.)

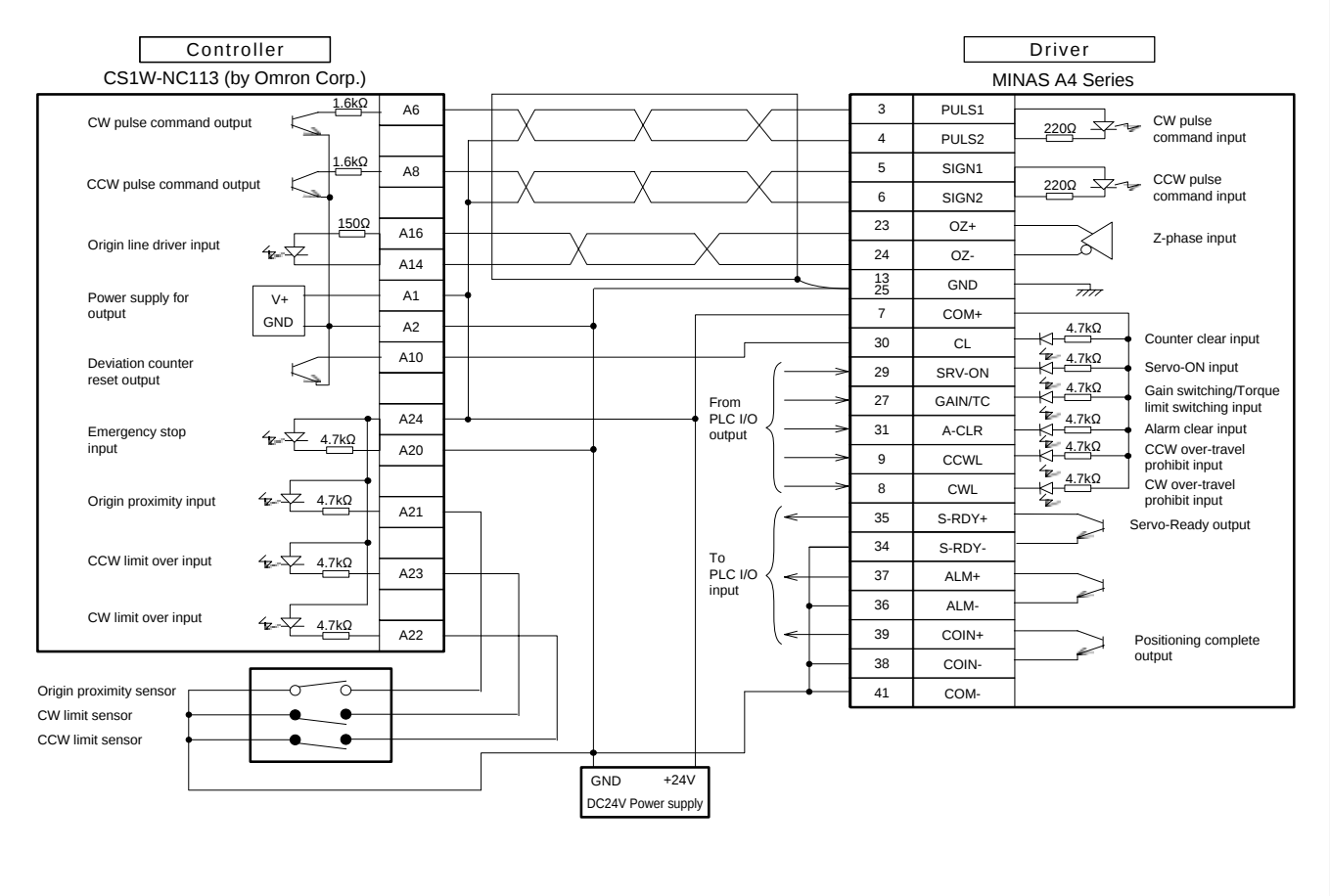


Connection between MINAS E and F3NC32-ON/F3NC34-ON (Yokogawa Electric Corp.)

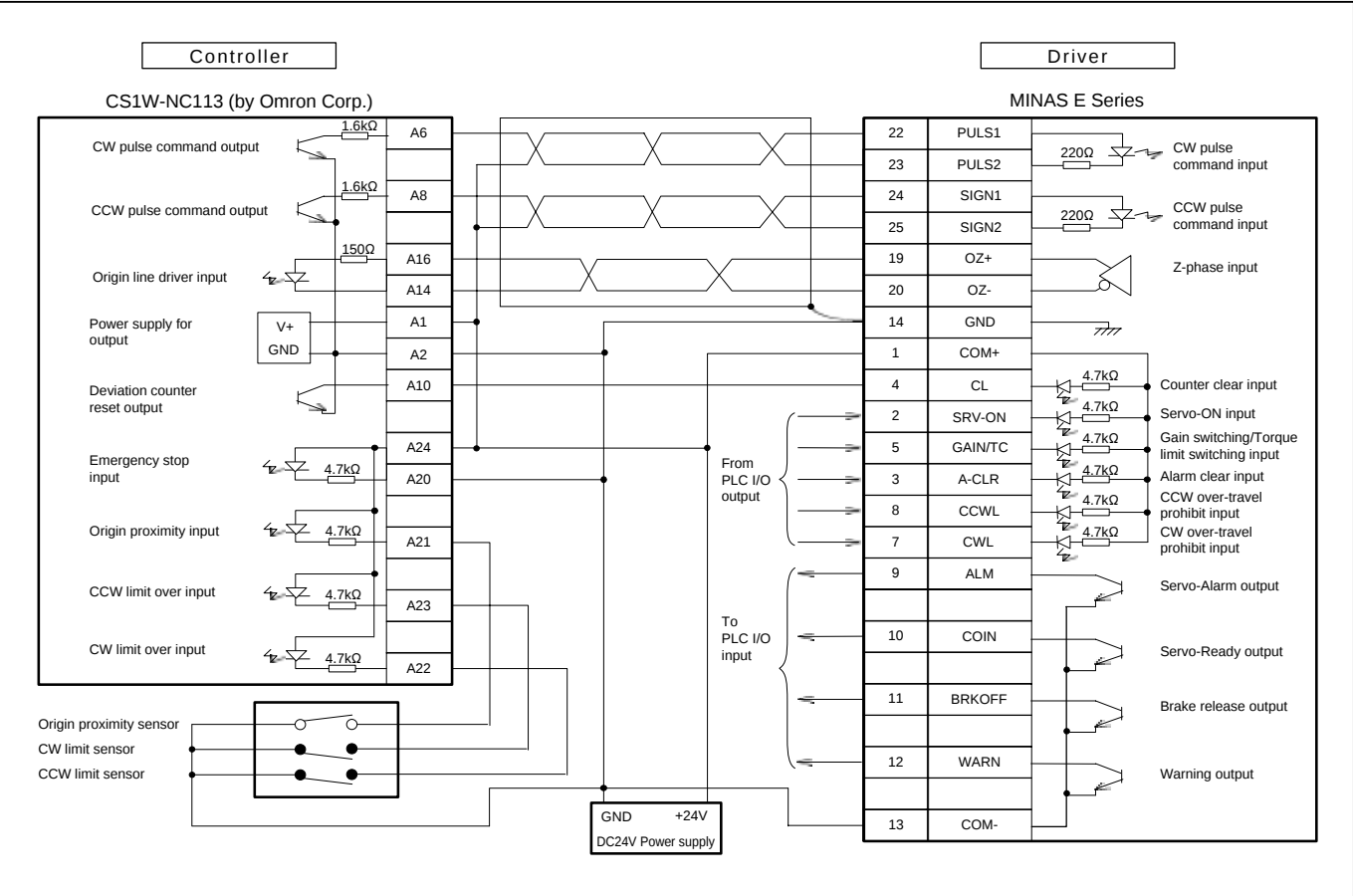


Connection between Driver and Controller

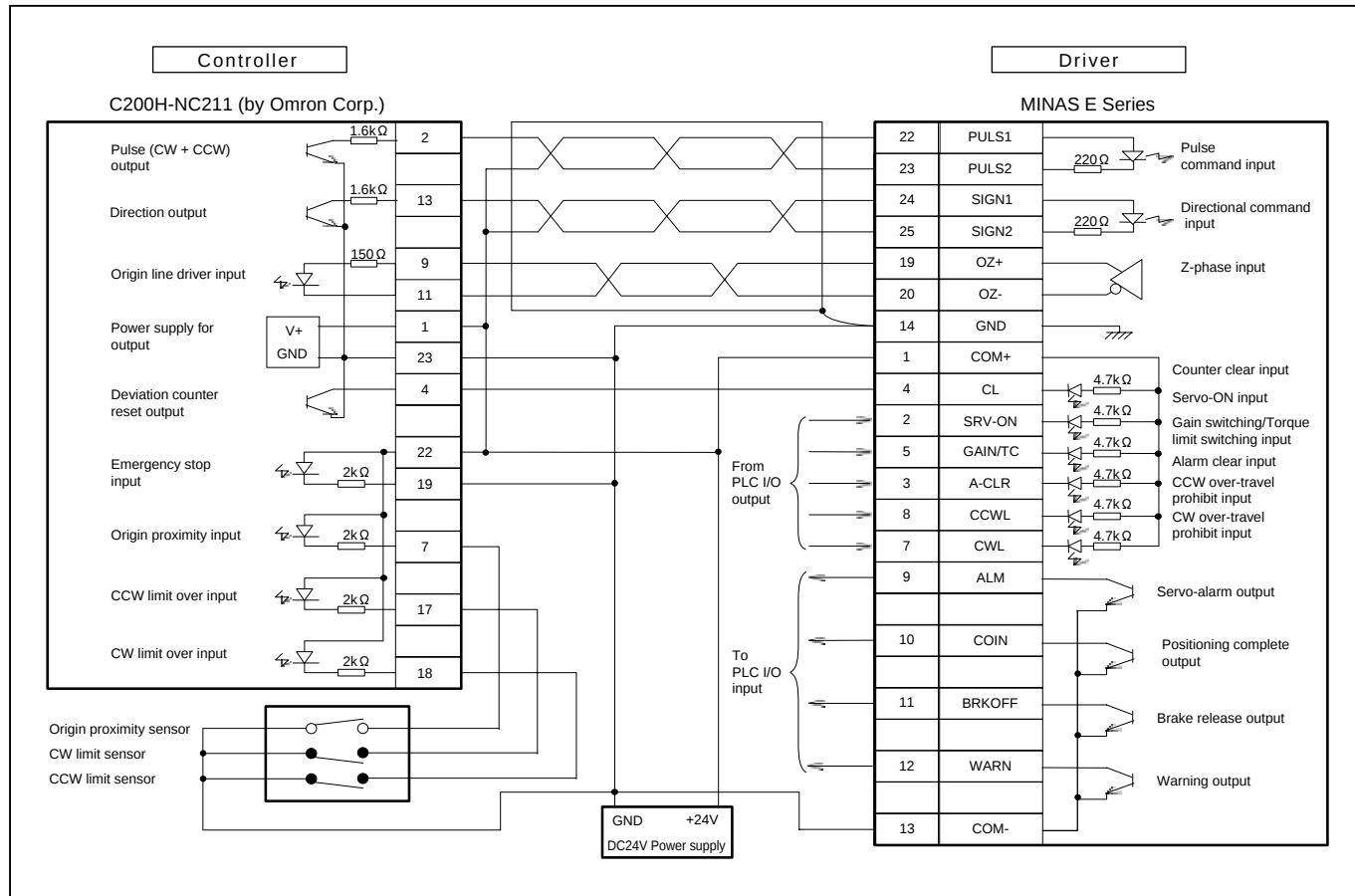
Connection between MINAS A4 and CS1W-NC113(Omron Corp.)



Connection between MINAS E and CS1W-NC113(Omron Corp.)

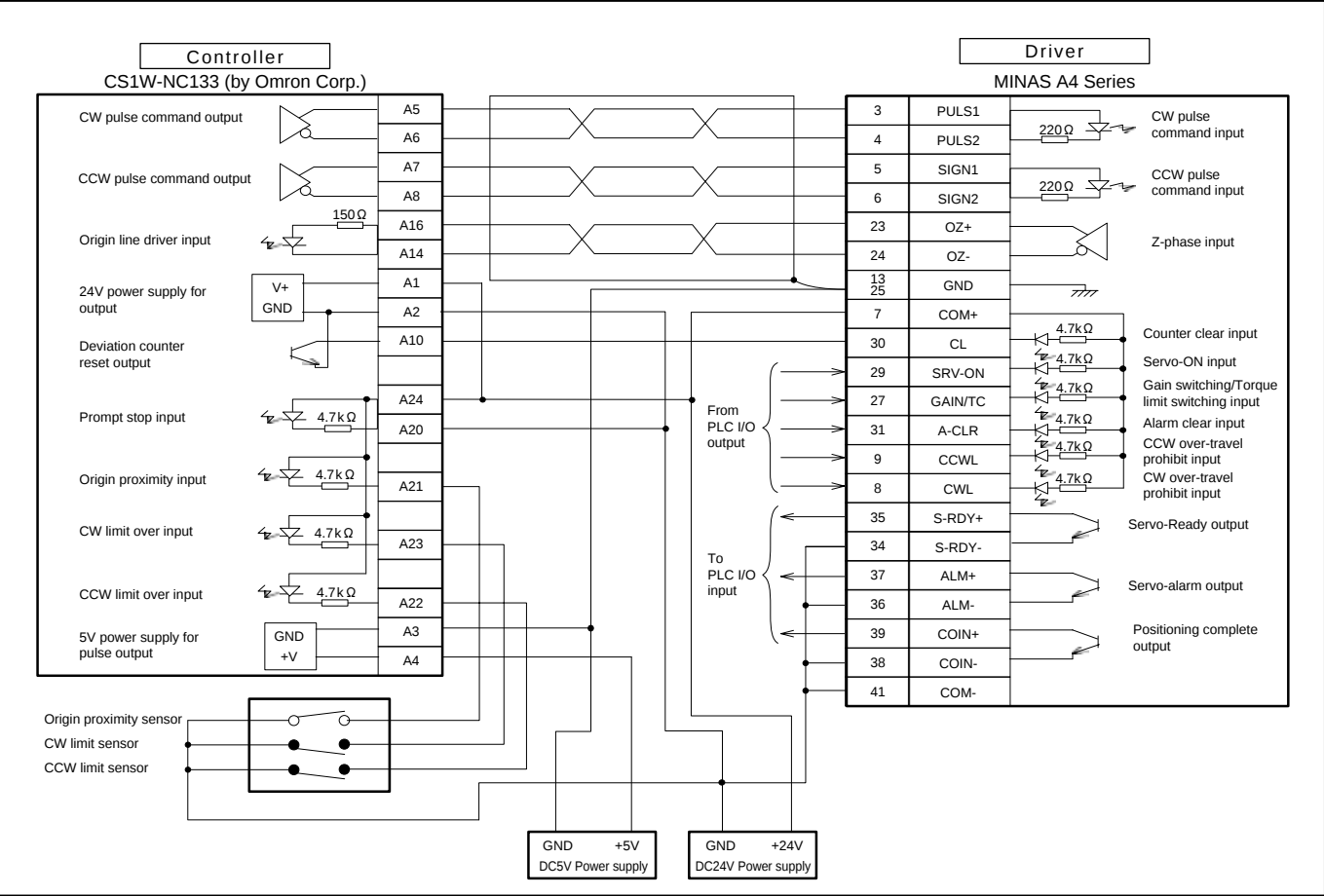


Connection between MINAS E and C200H-NC211 (Omron Corp.)

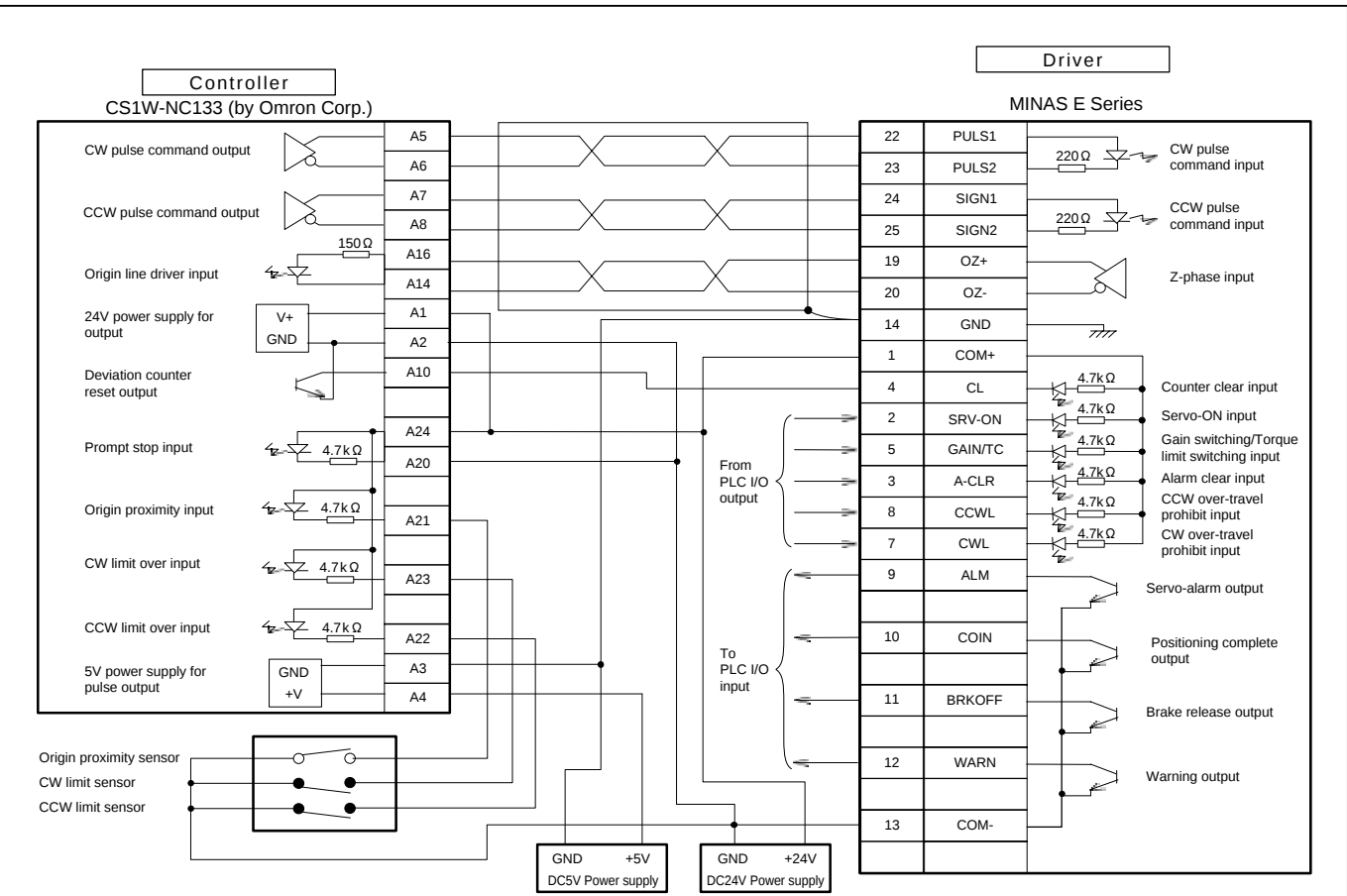


Connection between Driver and Controller

Connection between MINAS A4 and CS1W-NC133(Omron Corp.)



Connection between MINAS E and CS1W-NC133(Omron Corp.)



Controller
QD75D1(by Mitsubishi Electric Corp.)

Driver
MINAS A4 Series

The diagram illustrates the electrical connections between the QD75D1 Controller and the MINAS A4 Series Driver. The Controller side includes terminals for CW/CCW pulse command outputs, origin signal, deviation counter clear output, drive unit ready, common, proximity signal, and upper/lower limits. The Driver side includes terminals for PULS1/PULS2, SIGN1/SIGN2, Z-phase input, COM+, CL, SRV-ON, GAIN/TC, A-CLR, CCWL/CWL, S-RDY+, S-RDY-, ALM+, ALM-, COIN+, COIN-, and COM-. A pulse train interface is also shown for line driver use. Power supply connections for GND and +24V DC24V are indicated at the bottom.

Connections:

- Pulse Command Inputs:**
 - Controller CW pulse command output (15) → Driver PULS1 (3)
 - Controller CCW pulse command output (17) → Driver SIGN1 (5)
 - Controller CCW pulse command output (18) → Driver SIGN2 (6)
- Origin Signal:**
 - Controller Origin signal (9) → Driver OZ+ (23)
 - Controller Origin signal (10) → Driver OZ- (24)
- Counter Clear:**
 - Controller Deviation counter clear output (13) → Driver CL (30)
- Drive Unit Ready:**
 - Controller Drive unit ready (12) → Driver SRV-ON (29)
- Common:**
 - Controller Common (6) → Driver GAIN/TC (27)
- Proximity Signal:**
 - Controller Proximity signal (7) → Driver A-CLR (31)
- Upper Limit:**
 - Controller Upper limit (3) → Driver CCWL (9)
- Lower Limit:**
 - Controller Lower limit (1) → Driver CWL (8)
- Servo-Ready:**
 - Controller Proximity signal (7) → Driver S-RDY+ (35)
 - Controller Proximity signal (7) → Driver S-RDY- (34)
- Servo-Alarm:**
 - Controller Upper limit (3) → Driver ALM+ (37)
 - Controller Lower limit (1) → Driver ALM- (36)
- Positioning Complete:**
 - Controller Upper limit (3) → Driver COIN+ (39)
 - Controller Lower limit (1) → Driver COIN- (38)
- Power Supply:**
 - Controller Common (6) → Driver COM+ (7)
 - Controller Common (6) → Driver COM- (41)

※Pulse train interface exclusive for line driver

Pulse train interface exclusive for line driver. Use this interface when you use pulse command frequency between 500kpps and 2Mpps

Connections:

- Controller CW pulse command output (15) → Driver PULSH1 (44)
- Controller CCW pulse command output (17) → Driver PULSH2 (45)
- Controller CCW pulse command output (18) → Driver SIGNH1 (46)
- Controller CCW pulse command output (18) → Driver SIGNH2 (47)

The diagram illustrates the electrical connections between the **Controller** (QD75D1) and the **Driver** (MINAS E Series).

Controller (QD75D1) Pins:

- 15: CW pulse command output
- 16: CCW pulse command output
- 17: Origin signal
- 18: Deviation counter clear output
- 9: Proximity signal
- 10: Upper limit
- 13: Lower limit
- 6: Origin proximity sensor
- 7: CW limit sensor
- 3: CCW limit sensor
- 1: GND
- 2: +24V

Driver (MINAS E Series) Pins:

- 22: PULS1
- 23: PULS2
- 24: SIGN1
- 25: SIGN2
- 19: OZ+
- 20: OZ-
- 14: GND
- 1: COM+
- 4: CL
- 2: SRV-ON
- 5: GAIN/TC
- 3: A-CLR
- 8: CCWL
- 7: CWL
- 9: ALM
- 10: COIN
- 11: BRKOFF
- 12: WARN
- 13: COM-

Connections:

- Pulse Commands:** Controller pins 15 and 16 connect to Driver pins 22 and 23 respectively.
- Signs:** Controller pins 17 and 18 connect to Driver pins 24 and 25 respectively.
- Origin Signal:** Controller pin 9 connects to Driver pin 19.
- Deviation Counter Clear:** Controller pin 13 connects to Driver pin 20.
- Proximity Signal:** Controller pin 10 connects to Driver pin 14.
- Limit Signals:** Controller pins 13 and 14 connect to Driver pins 1 and 4 respectively.
- Sensors:** Controller pins 6, 7, and 3 connect to Driver pins 2, 5, and 3 respectively.
- Power:** Controller pins 1 and 2 connect to Driver pins 14 and 1 respectively.
- PLC I/O:** Controller pins 15, 16, 17, 18, 9, 10, 13, 14, 6, 7, 3, 1, 2 connect to Driver pins 22, 23, 24, 25, 19, 20, 14, 1, 4, 2, 5, 3, 8, 7, 9, 10, 11, 12, 13 respectively.
- Outputs:** Driver pins 19, 20, 14, 1, 4, 2, 5, 3, 8, 7, 9, 10, 11, 12, 13 connect to Controller pins 15, 16, 17, 18, 9, 10, 13, 14, 6, 7, 3, 1, 2 respectively.

Index (Alphabetical order)

● : Standard stock item

▲ : Build order item

DV0P							
Part No.	A4		Carrying page A4P		E		Delivery
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension	
DV0P0770					E27	E27	●
DV0P0800					E28	E28	●
DV0P1450	A4-110	A4-110	A4-110	A4-110	E10	E10	●
DV0P1460	A4-111	A4-111	A4-111	A4-111	E10	E10	●
DV0P1960	A4-119	A4-119	A4-119	A4-119	E28	E28	●
DV0P1970	A4-119	A4-119	A4-119	A4-119			●
DV0P1971	A4-119	A4-119	A4-119	A4-119			●
DV0P1972	A4-119	A4-119	A4-119	A4-119			●
DV0P220	A4-124	A4-124	A4-124	A4-124	E29	E29	●
DV0P221	A4-124	A4-124	A4-124	A4-124			●
DV0P222	A4-124	A4-124	A4-124	A4-124			●
DV0P223	A4-124	A4-124	A4-124	A4-124			●
DV0P224	A4-124	A4-124	A4-124	A4-124			●
DV0P225	A4-124	A4-124	A4-124	A4-124			●
DV0P227	A4-124	A4-124	A4-124	A4-124	E29	E29	●
DV0P228	A4-124	A4-124	A4-124	A4-124	E29	E29	●
DV0P2870					E26	E26	●
DV0P2890					E29	E29	●
DV0P2891					E29	E29	●
DV0P2990	A4-126	A4-126	A4-126	A4-126			●
DV0P3410	A4-110	A4-110	A4-110	A4-110			●
DV0P3470	A4-122	A4-122	A4-122	A4-122			●
DV0P3480	A4-122	A4-122	A4-122	A4-122			●
DV0P3670					E26	E26	●
DV0P3680					-	-	●
DV0P3700					-	-	●
DV0P37300					E25	E25	●
DV0P3811					E30	E30	●
DV0P39200					E25	E25	●
DV0P4160					E10	E10	●
DV0P4170	A4-110	A4-110	A4-110	A4-110			●
DV0P4180	A4-110	A4-110	A4-110	A4-110			●
DV0P4190	A4-110	A4-110	A4-110	A4-110	E10	E10	●
DV0P4200	-	-					●
DV0P4210	-	-					●
DV0P4220	A4-110	A4-110	A4-110	A4-110			●
DV0P4271	A4-123	A4-123	A4-123	A4-123			●
DV0P4272	A4-123	A4-123	A4-123	A4-123			●
DV0P4273	A4-123	A4-123	A4-123	A4-123			●
DV0P4274	A4-123	A4-123	A4-123	A4-123			●
DV0P4280	A4-125	A4-125	A4-125	A4-125			●
DV0P4281	A4-125	A4-125	A4-125	A4-125			●
DV0P4282	A4-125	A4-125	A4-125	A4-125			●
DV0P4283	A4-125	A4-125	A4-125	A4-125			●
DV0P4284	A4-125	A4-125	A4-125	A4-125			●
DV0P4285	A4-125	A4-125	A4-125	A4-125			●
DV0P4290	A4-120	A4-120	A4-120	A4-120			●
DV0P4310	A4-120	A4-120	A4-120	A4-120			●

● : Standard stock item

▲ : Build order item

DV0P							
Part No.	A4		Carrying page A4P		E		Delivery
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension	
DV0P4320	A4-121	A4-121	A4-121	A4-121			●
DV0P4330	A4-121	A4-121	A4-121	A4-121			●
DV0P4340	A4-121	A4-121	A4-121	A4-121			●
DV0P4350	A4-118	A4-118	A4-118	A4-118			●
DV0P4360	A4-119	A4-119	A4-119	A4-119			●
DV0P4380	A4-120	A4-120	A4-120	A4-120			●
DV0P4420	A4-124	A4-124	A4-124	A4-124	E25	E25	●
DV0P4460	A4-123	A4-123	A4-123	A4-123	E28	E28	●
DV0P4480			-	-			●
DV0P4490			-	-			●
DV0P4500	A4-118	A4-118	A4-118	A4-118			●
DV0P4510	A4-119	A4-119	A4-119	A4-119			●

● : Standard stock item

▲ : Build order item

MADDT							
Part No.	A4		Carrying page A4P		E		Delivery
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension	
MADDT1105	A4-15	A4-22					●
MADDT1105P			A4-39	A4-45			●
MADDT1107	A4-15	A4-22					●
MADDT1107P			A4-39	A4-45			●
MADDT1205	A4-15	A4-22					●
MADDT1205P			A4-39	A4-45			●
MADDT1207	A4-15	A4-22					●
MADDT1207P			A4-39	A4-45			●

● : Standard stock item

▲ : Build order item

MAMA							
Part No.	A4		Carrying page A4P		E		Delivery
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension	
MAMA012P1A	A4-49	A4-87	A4-49	A4-87			▲
MAMA012P1B	A4-49	A4-87	A4-49	A4-87			▲
MAMA012P1E	A4-49	A4-87	A4-49	A4-87			▲
MAMA012P1F	A4-49	A4-87	A4-49	A4-87			▲
MAMA012S1A	A4-49	A4-87	A4-49	A4-87			▲
MAMA012S1B	A4-49	A4-87	A4-49	A4-87			▲
MAMA012S1E	A4-49	A4-87	A4-49	A4-87			▲
MAMA012S1F	A4-49	A4-87	A4-49	A4-87			▲
MAMA022P1A	A4-49	A4-87	A4-49	A4-87			▲
MAMA022P1B	A4-49	A4-87	A4-49	A4-87			▲
MAMA022P1E	A4-49	A4-87	A4-49	A4-87			▲
MAMA022P1F	A4-49	A4-87	A4-49	A4-87			▲
MAMA022S1A	A4-49	A4-87	A4-49	A4-87			▲
MAMA022S1B	A4-49	A4-87	A4-49	A4-87			▲
MAMA022S1E	A4-49	A4-87	A4-49	A4-87			▲
MAMA022S1F	A4-49	A4-87	A4-49	A4-87			▲

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● : Standard stock item

▲ : Build order item

MAMA						
Part No.	A4		Carrying page A4P		E	
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension
MAMA042P1A	A4-49	A4-87	A4-49	A4-87		▲
MAMA042P1B	A4-49	A4-87	A4-49	A4-87		▲
MAMA042P1E	A4-49	A4-87	A4-49	A4-87		▲
MAMA042P1F	A4-49	A4-87	A4-49	A4-87		▲
MAMA042S1A	A4-49	A4-87	A4-49	A4-87		▲
MAMA042S1B	A4-49	A4-87	A4-49	A4-87		▲
MAMA042S1E	A4-49	A4-87	A4-49	A4-87		▲
MAMA042S1F	A4-49	A4-87	A4-49	A4-87		▲
MAMA082P1A	A4-49	A4-87	A4-49	A4-87		▲
MAMA082P1B	A4-49	A4-87	A4-49	A4-87		▲
MAMA082P1E	A4-49	A4-87	A4-49	A4-87		▲
MAMA082P1F	A4-49	A4-87	A4-49	A4-87		▲
MAMA082S1A	A4-49	A4-87	A4-49	A4-87		▲
MAMA082S1B	A4-49	A4-87	A4-49	A4-87		▲
MAMA082S1E	A4-49	A4-87	A4-49	A4-87		▲
MAMA082S1F	A4-49	A4-87	A4-49	A4-87		▲

● : Standard stock item

▲ : Build order item

MBDDT						
Part No.	A4		Carrying page A4P		E	
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension
MBDDT2110	A4-15	A4-22				●
MBDDT2110P			A4-39	A4-45		●
MBDDT2210	A4-15	A4-22				●
MBDDT2210P			A4-39	A4-45		●

● : Standard stock item

▲ : Build order item

MCDDT						
Part No.	A4		Carrying page A4P		E	
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension
MCDDT3120	A4-15	A4-23				●
MCDDT3120P			A4-39	A4-46		●
MCDDT3520	A4-15	A4-23				●
MCDDT3520P			A4-39	A4-46		●

● : Standard stock item

▲ : Build order item

MDDDT						
Part No.	A4		Carrying page A4P		E	
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension
MDDDT3530	A4-15	A4-23				●
MDDDT3530P			A4-39	A4-46		●
MDDDT5540	A4-15	A4-23				●
MDDDT5540P			A4-39	A4-46		●

● : Standard stock item

▲ : Build order item

MDMA						
Part No.	A4		Carrying page A4P		E	
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension
MDMA102P1C	A4-67	A4-93	A4-67	A4-93		▲
MDMA102P1D	A4-67	A4-93	A4-67	A4-93		▲
MDMA102P1G	A4-67	A4-93	A4-67	A4-93		●
MDMA102P1H	A4-67	A4-93	A4-67	A4-93		●
MDMA102S1C	A4-67	A4-93	A4-67	A4-93		▲
MDMA102S1D	A4-67	A4-93	A4-67	A4-93		▲
MDMA102S1G	A4-67	A4-93	A4-67	A4-93		●
MDMA102S1H	A4-67	A4-93	A4-67	A4-93		●
MDMA152P1C	A4-67	A4-93	A4-67	A4-93		▲
MDMA152P1D	A4-67	A4-93	A4-67	A4-93		▲
MDMA152P1G	A4-67	A4-93	A4-67	A4-93		●
MDMA152P1H	A4-67	A4-93	A4-67	A4-93		●
MDMA152S1C	A4-67	A4-93	A4-67	A4-93		▲
MDMA152S1D	A4-67	A4-93	A4-67	A4-93		▲
MDMA152S1G	A4-67	A4-93	A4-67	A4-93		●
MDMA152S1H	A4-67	A4-93	A4-67	A4-93		●
MDMA202P1C	A4-69	A4-94	A4-69	A4-94		▲
MDMA202P1D	A4-69	A4-94	A4-69	A4-94		▲
MDMA202P1G	A4-69	A4-94	A4-69	A4-94		●
MDMA202P1H	A4-69	A4-94	A4-69	A4-94		●
MDMA202S1C	A4-69	A4-94	A4-69	A4-94		▲
MDMA202S1D	A4-69	A4-94	A4-69	A4-94		▲
MDMA202S1G	A4-69	A4-94	A4-69	A4-94		●
MDMA202S1H	A4-69	A4-94	A4-69	A4-94		●
MDMA302P1C	A4-69	A4-94	A4-69	A4-94		▲
MDMA302P1D	A4-69	A4-94	A4-69	A4-94		▲
MDMA302P1G	A4-69	A4-94	A4-69	A4-94		●
MDMA302P1H	A4-69	A4-94	A4-69	A4-94		●
MDMA302S1C	A4-69	A4-94	A4-69	A4-94		▲
MDMA302S1D	A4-69	A4-94	A4-69	A4-94		▲
MDMA302S1G	A4-69	A4-94	A4-69	A4-94		●
MDMA302S1H	A4-69	A4-94	A4-69	A4-94		●
MDMA402P1C	A4-71	A4-95	A4-71	A4-95		▲
MDMA402P1D	A4-71	A4-95	A4-71	A4-95		▲
MDMA402P1G	A4-71	A4-95	A4-71	A4-95		●
MDMA402P1H	A4-71	A4-95	A4-71	A4-95		●
MDMA402S1C	A4-71	A4-95	A4-71	A4-95		▲
MDMA402S1D	A4-71	A4-95	A4-71	A4-95		▲
MDMA402S1G	A4-71	A4-95	A4-71	A4-95		●
MDMA402S1H	A4-71	A4-95	A4-71	A4-95		●
MDMA502P1C	A4-71	A4-95	A4-71	A4-95		▲
MDMA502P1D	A4-71	A4-95	A4-71	A4-95		▲
MDMA502P1G	A4-71	A4-95	A4-71	A4-95		●
MDMA502P1H	A4-71	A4-95	A4-71	A4-95		●
MDMA502S1C	A4-71	A4-95	A4-71	A4-95		▲
MDMA502S1D	A4-71	A4-95	A4-71	A4-95		▲
MDMA502S1G	A4-71	A4-95	A4-71	A4-95		●
MDMA502S1H	A4-71	A4-95	A4-71	A4-95		●

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▲ : Build order item

MDMA							
Part No.	A4		Carrying page A4P		E		Delivery
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension	
MDMA752P1C	A4-71	A4-95					▲
MDMA752P1D	A4-71	A4-95					▲
MDMA752P1G	A4-71	A4-95					▲
MDMA752P1H	A4-71	A4-95					▲
MDMA752S1C	A4-71	A4-95					▲
MDMA752S1D	A4-71	A4-95					▲
MDMA752S1G	A4-71	A4-95					▲
MDMA752S1H	A4-71	A4-95					▲

● : Standard stock item
▲ : Build order item

MEDDT							
Part No.	A4		Carrying page A4P		E		Delivery
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension	
MEDDT7364	A4-15	A4-24					●
MEDDT7364P			A4-39	A4-47			●

● : Standard stock item
▲ : Build order item

MFDDT							
Part No.	A4		Carrying page A4P		E		Delivery
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension	
MFDDTA390	A4-15	A4-24					●
MFDDTA390P			A4-39	A4-47			●
MFDDTB3A2	A4-15	A4-24					●
MFDDTB3A2P			A4-39	A4-47			●

● : Standard stock item
▲ : Build order item

MFECA							
Part No.	A4		Carrying page A4P		E		Delivery
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension	
MFECA0030EAD	A4-115	A4-115	A4-115	A4-115			●
MFECA0030EAE	A4-115	A4-115	A4-115	A4-115			●
MFECA0030EAM	A4-115	A4-115	A4-115	A4-115	E25	E25	●
MFECA0030ESD	A4-115	A4-115	A4-115	A4-115			●
MFECA0030ESE	A4-115	A4-115	A4-115	A4-115			●
MFECA0050EAD	A4-115	A4-115	A4-115	A4-115			●
MFECA0050EAE	A4-115	A4-115	A4-115	A4-115			●
MFECA0050EAM	A4-115	A4-115	A4-115	A4-115	E25	E25	●
MFECA0050ESD	A4-115	A4-115	A4-115	A4-115			●
MFECA0050ESE	A4-115	A4-115	A4-115	A4-115			●
MFECA0100EAD	A4-115	A4-115	A4-115	A4-115			●
MFECA0100EAE	A4-115	A4-115	A4-115	A4-115			●
MFECA0100EAM	A4-115	A4-115	A4-115	A4-115	E25	E25	●
MFECA0100ESD	A4-115	A4-115	A4-115	A4-115			●
MFECA0100ESE	A4-115	A4-115	A4-115	A4-115			●
MFECA0200EAD	A4-115	A4-115	A4-115	A4-115			●

● : Standard stock item

▲ : Build order item

MFECA							
Part No.	A4		Carrying page A4P		E		Delivery
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension	
MFECA0200EAE	A4-115	A4-115	A4-115	A4-115			●
MFECA0200EAM	A4-115	A4-115	A4-115	A4-115	E25	E25	●
MFECA0200ESD	A4-115	A4-115	A4-115	A4-115			●
MFECA0200ESE	A4-115	A4-115	A4-115	A4-115			●

● : Standard stock item

▲ : Build order item

MFMA							
Part No.	A4		Carrying page A4P		E		Delivery
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension	
MFMA042P1C	A4-77	A4-99	A4-77	A4-99			▲
MFMA042P1D	A4-77	A4-99	A4-77	A4-99			▲
MFMA042P1G	A4-77	A4-99	A4-77	A4-99			▲
MFMA042P1H	A4-77	A4-99	A4-77	A4-99			▲
MFMA042S1C	A4-77	A4-99	A4-77	A4-99			▲
MFMA042S1D	A4-77	A4-99	A4-77	A4-99			▲
MFMA042S1G	A4-77	A4-99	A4-77	A4-99			▲
MFMA042S1H	A4-77	A4-99	A4-77	A4-99			▲
MFMA152P1C	A4-77	A4-99	A4-77	A4-99			▲
MFMA152P1D	A4-77	A4-99	A4-77	A4-99			▲
MFMA152P1G	A4-77	A4-99	A4-77	A4-99			▲
MFMA152P1H	A4-77	A4-99	A4-77	A4-99			▲
MFMA152S1C	A4-77	A4-99	A4-77	A4-99			▲
MFMA152S1D	A4-77	A4-99	A4-77	A4-99			▲
MFMA152S1G	A4-77	A4-99	A4-77	A4-99			▲
MFMA152S1H	A4-77	A4-99	A4-77	A4-99			▲
MFMA252P1C	A4-79	A4-100	A4-79	A4-100			▲
MFMA252P1D	A4-79	A4-100	A4-79	A4-100			▲
MFMA252P1G	A4-79	A4-100	A4-79	A4-100			▲
MFMA252P1H	A4-79	A4-100	A4-79	A4-100			▲
MFMA252S1C	A4-79	A4-100	A4-79	A4-100			▲
MFMA252S1D	A4-79	A4-100	A4-79	A4-100			▲
MFMA252S1G	A4-79	A4-100	A4-79	A4-100			▲
MFMA252S1H	A4-79	A4-100	A4-79	A4-100			▲
MFMA452P1C	A4-79	A4-100	A4-79	A4-100			▲
MFMA452P1D	A4-79	A4-100	A4-79	A4-100			▲
MFMA452P1G	A4-79	A4-100	A4-79	A4-100			▲
MFMA452P1H	A4-79	A4-100	A4-79	A4-100			▲
MFMA452S1C	A4-79	A4-100	A4-79	A4-100			▲
MFMA452S1D	A4-79	A4-100	A4-79	A4-100			▲
MFMA452S1G	A4-79	A4-100	A4-79	A4-100			▲
MFMA452S1H	A4-79	A4-100	A4-79	A4-100			▲

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MFMCA							
Part No.	A4		Carrying page A4P		E		Delivery
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension	
MFMCA0030AEB					E25	E25	●
MFMCA0030EED	A4-116	A4-116	A4-116	A4-116			●
MFMCA0032ECD	A4-116	A4-116	A4-116	A4-116			●
MFMCA0032FCD	A4-117	A4-117	A4-117	A4-117			●
MFMCA0032FCT	A4-117	A4-117	A4-117	A4-117			●
MFMCA0033ECT	A4-116	A4-116	A4-116	A4-116			●
MFMCA0033FCT	A4-117	A4-117	A4-117	A4-117			●
MFMCA0050AEB					E25	E25	●
MFMCA0050EED	A4-116	A4-116	A4-116	A4-116			●
MFMCA0052ECD	A4-116	A4-116	A4-116	A4-116			●
MFMCA0052FCD	A4-117	A4-117	A4-117	A4-117			●
MFMCA0052FCT	A4-117	A4-117	A4-117	A4-117			●
MFMCA0053ECT	A4-116	A4-116	A4-116	A4-116			●
MFMCA0053FCT	A4-117	A4-117	A4-117	A4-117			●
MFMCA0100AEB					E25	E25	●
MFMCA0100EED	A4-116	A4-116	A4-116	A4-116			●
MFMCA0102ECD	A4-116	A4-116	A4-116	A4-116			●
MFMCA0102FCD	A4-117	A4-117	A4-117	A4-117			●
MFMCA0102FCT	A4-117	A4-117	A4-117	A4-117			●
MFMCA0103ECT	A4-116	A4-116	A4-116	A4-116			●
MFMCA0103FCT	A4-117	A4-117	A4-117	A4-117			●
MFMCA0200AEB					E25	E25	●
MFMCA0200EED	A4-116	A4-116	A4-116	A4-116			●
MFMCA0202ECD	A4-116	A4-116	A4-116	A4-116			●
MFMCA0202FCD	A4-117	A4-117	A4-117	A4-117			●
MFMCA0202FCT	A4-117	A4-117	A4-117	A4-117			●
MFMCA0203ECT	A4-116	A4-116	A4-116	A4-116			●
MFMCA0203FCT	A4-117	A4-117	A4-117	A4-117			●

● : Standard stock item

▲ : Build order item

MFMCB							
Part No.	A4		Carrying page A4P		E		Delivery
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension	
MFMCB0030GET	A4-117	A4-117	A4-117	A4-117	E25	E25	●
MFMCB0050GET	A4-117	A4-117	A4-117	A4-117	E25	E25	●
MFMCB0100GET	A4-117	A4-117	A4-117	A4-117	E25	E25	●
MFMCB0200GET	A4-117	A4-117	A4-117	A4-117	E25	E25	●

● : Standard stock item

▲ : Build order item

MFMCD							
Part No.	A4		Carrying page A4P		E		Delivery
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension	
MFMCD0032ECD	A4-116	A4-116	A4-116	A4-116			●
MFMCD0032ECT	A4-116	A4-116	A4-116	A4-116			●
MFMCD0033ECT	A4-116	A4-116	A4-116	A4-116			●
MFMCD0052ECD	A4-116	A4-116	A4-116	A4-116			●

● : Standard stock item

▲ : Build order item

MFMCD						
Part No.	A4		Carrying page A4P		E	
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension
MFMCD0052ECT	A4-116	A4-116	A4-116	A4-116		●
MFMCD0053ECT	A4-116	A4-116	A4-116	A4-116		●
MFMCD0102ECD	A4-116	A4-116	A4-116	A4-116		●
MFMCD0102ECT	A4-116	A4-116	A4-116	A4-116		●
MFMCD0103ECT	A4-116	A4-116	A4-116	A4-116		●
MFMCD0202ECD	A4-116	A4-116	A4-116	A4-116		●
MFMCD0202ECT	A4-116	A4-116	A4-116	A4-116		●
MFMCD0203ECT	A4-116	A4-116	A4-116	A4-116		●

● : Standard stock item

▲ : Build order item

MGDDT						
Part No.	A4		Carrying page A4P		E	
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension
MGDDTC3B4	A4-15	A4-25				

● : Standard stock item

▲ : Build order item

MGMA						
Part No.	A4		Carrying page A4P		E	
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension
MGMA092P1C	A4-73	A4-96	A4-73	A4-96		▲
MGMA092P1D	A4-73	A4-96	A4-73	A4-96		▲
MGMA092P1G	A4-73	A4-96	A4-73	A4-96		▲
MGMA092P1H	A4-73	A4-96	A4-73	A4-96		▲
MGMA092S1C	A4-73	A4-96	A4-73	A4-96		▲
MGMA092S1D	A4-73	A4-96	A4-73	A4-96		▲
MGMA092S1G	A4-73	A4-96	A4-73	A4-96		▲
MGMA092S1H	A4-73	A4-96	A4-73	A4-96		▲
MGMA202P1C	A4-73	A4-96	A4-73	A4-96		▲
MGMA202P1D	A4-73	A4-96	A4-73	A4-96		▲
MGMA202P1G	A4-73	A4-96	A4-73	A4-96		▲
MGMA202P1H	A4-73	A4-96	A4-73	A4-96		▲
MGMA202S1C	A4-73	A4-96	A4-73	A4-96		▲
MGMA202S1D	A4-73	A4-96	A4-73	A4-96		▲
MGMA202S1G	A4-73	A4-96	A4-73	A4-96		▲
MGMA202S1H	A4-73	A4-96	A4-73	A4-96		▲
MGMA302P1C	A4-75	A4-97	A4-75	A4-97		▲
MGMA302P1D	A4-75	A4-97	A4-75	A4-97		▲
MGMA302P1G	A4-75	A4-97	A4-75	A4-97		▲
MGMA302P1H	A4-75	A4-97	A4-75	A4-97		▲
MGMA302S1C	A4-75	A4-97	A4-75	A4-97		▲
MGMA302S1D	A4-75	A4-97	A4-75	A4-97		▲
MGMA302S1G	A4-75	A4-97	A4-75	A4-97		▲
MGMA302S1H	A4-75	A4-97	A4-75	A4-97		▲
MGMA452P1C	A4-75	A4-97	A4-75	A4-97		▲
MGMA452P1D	A4-75	A4-97	A4-75	A4-97		▲
MGMA452P1G	A4-75	A4-97	A4-75	A4-97		▲

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▲ : Build order item

MGMA						
Part No.	A4		Carrying page A4P		E	
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension
MGMA452P1H	A4-75	A4-97	A4-75	A4-97		▲
MGMA452S1C	A4-75	A4-97	A4-75	A4-97		▲
MGMA452S1D	A4-75	A4-97	A4-75	A4-97		▲
MGMA452S1G	A4-75	A4-97	A4-75	A4-97		▲
MGMA452S1H	A4-75	A4-97	A4-75	A4-97		▲
MGMA602P1C	A4-75	A4-98				▲
MGMA602P1D	A4-75	A4-98				▲
MGMA602P1G	A4-75	A4-98				▲
MGMA602P1H	A4-75	A4-98				▲
MGMA602S1C	A4-75	A4-98				▲
MGMA602S1D	A4-75	A4-98				▲
MGMA602S1G	A4-75	A4-98				▲
MGMA602S1H	A4-75	A4-98				▲

● : Standard stock item

▲ : Build order item

MHMA						
Part No.	A4		Carrying page A4P		E	
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension
MHMA052P1C	A4-81	A4-101	A4-81	A4-101		▲
MHMA052P1D	A4-81	A4-101	A4-81	A4-101		▲
MHMA052P1G	A4-81	A4-101	A4-81	A4-101		▲
MHMA052P1H	A4-81	A4-101	A4-81	A4-101		▲
MHMA052S1C	A4-81	A4-101	A4-81	A4-101		▲
MHMA052S1D	A4-81	A4-101	A4-81	A4-101		▲
MHMA052S1G	A4-81	A4-101	A4-81	A4-101		▲
MHMA052S1H	A4-81	A4-101	A4-81	A4-101		▲
MHMA102P1C	A4-81	A4-101	A4-81	A4-101		▲
MHMA102P1D	A4-81	A4-101	A4-81	A4-101		▲
MHMA102P1G	A4-81	A4-101	A4-81	A4-101		▲
MHMA102P1H	A4-81	A4-101	A4-81	A4-101		▲
MHMA102S1C	A4-81	A4-101	A4-81	A4-101		▲
MHMA102S1D	A4-81	A4-101	A4-81	A4-101		▲
MHMA102S1G	A4-81	A4-101	A4-81	A4-101		▲
MHMA102S1H	A4-81	A4-101	A4-81	A4-101		▲
MHMA152P1C	A4-81	A4-101	A4-81	A4-101		▲
MHMA152P1D	A4-81	A4-101	A4-81	A4-101		▲
MHMA152P1G	A4-81	A4-101	A4-81	A4-101		▲
MHMA152P1H	A4-81	A4-101	A4-81	A4-101		▲
MHMA152S1C	A4-81	A4-101	A4-81	A4-101		▲
MHMA152S1D	A4-81	A4-101	A4-81	A4-101		▲
MHMA152S1G	A4-81	A4-101	A4-81	A4-101		▲
MHMA152S1H	A4-81	A4-101	A4-81	A4-101		▲
MHMA202P1C	A4-83	A4-102	A4-83	A4-102		▲
MHMA202P1D	A4-83	A4-102	A4-83	A4-102		▲
MHMA202P1G	A4-83	A4-102	A4-83	A4-102		▲
MHMA202P1H	A4-83	A4-102	A4-83	A4-102		▲
MHMA202S1C	A4-83	A4-102	A4-83	A4-102		▲

▲ : Build order item

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MLDET							
Part No.	A4		Carrying page A4P		E		Delivery
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension	
MLDET2110P					E20	E23	●
MLDET2210P					E20	E23	●
MLDET2310P					E20	E23	●
MLDET2510P					E20	E23	●

● : Standard stock item
▲ : Build order item

MQMA							
Part No.	A4		Carrying page A4P		E		Delivery
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension	
MQMA011P1A	A4-59	A4-90	A4-59	A4-90			▲
MQMA011P1B	A4-59	A4-90	A4-59	A4-90			▲
MQMA011P1S	A4-59	A4-90	A4-59	A4-90			▲
MQMA011P1T	A4-59	A4-90	A4-59	A4-90			▲
MQMA011S1A	A4-59	A4-90	A4-59	A4-90			▲
MQMA011S1B	A4-59	A4-90	A4-59	A4-90			▲
MQMA011S1S	A4-59	A4-90	A4-59	A4-90			▲
MQMA011S1T	A4-59	A4-90	A4-59	A4-90			▲
MQMA012P1A	A4-61	A4-90	A4-61	A4-90			▲
MQMA012P1B	A4-61	A4-90	A4-61	A4-90			▲
MQMA012P1S	A4-61	A4-90	A4-61	A4-90			▲
MQMA012P1T	A4-61	A4-90	A4-61	A4-90			▲
MQMA012S1A	A4-61	A4-90	A4-61	A4-90			▲
MQMA012S1B	A4-61	A4-90	A4-61	A4-90			▲
MQMA012S1S	A4-61	A4-90	A4-61	A4-90			▲
MQMA012S1T	A4-61	A4-90	A4-61	A4-90			▲
MQMA021P1A	A4-59	A4-90	A4-59	A4-90			▲
MQMA021P1B	A4-59	A4-90	A4-59	A4-90			▲
MQMA021P1S	A4-59	A4-90	A4-59	A4-90			▲
MQMA021P1T	A4-59	A4-90	A4-59	A4-90			▲
MQMA021S1A	A4-59	A4-90	A4-59	A4-90			▲
MQMA021S1B	A4-59	A4-90	A4-59	A4-90			▲
MQMA021S1S	A4-59	A4-90	A4-59	A4-90			▲
MQMA021S1T	A4-59	A4-90	A4-59	A4-90			▲
MQMA022P1A	A4-61	A4-90	A4-61	A4-90			▲
MQMA022P1B	A4-61	A4-90	A4-61	A4-90			▲
MQMA022P1S	A4-61	A4-90	A4-61	A4-90			▲
MQMA022P1T	A4-61	A4-90	A4-61	A4-90			▲
MQMA022S1A	A4-61	A4-90	A4-61	A4-90			▲
MQMA022S1B	A4-61	A4-90	A4-61	A4-90			▲
MQMA022S1S	A4-61	A4-90	A4-61	A4-90			▲
MQMA022S1T	A4-61	A4-90	A4-61	A4-90			▲
MQMA041P1A	A4-59	A4-90	A4-59	A4-90			▲
MQMA041P1B	A4-59	A4-90	A4-59	A4-90			▲
MQMA041P1S	A4-59	A4-90	A4-59	A4-90			▲
MQMA041P1T	A4-59	A4-90	A4-59	A4-90			▲
MQMA041S1A	A4-59	A4-90	A4-59	A4-90			▲
MQMA041S1B	A4-59	A4-90	A4-59	A4-90			▲

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MQMA						
Part No.	A4		Carrying page A4P		E	
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension
MQMA041S1S	A4-59	A4-90	A4-59	A4-90		
MQMA041S1T	A4-59	A4-90	A4-59	A4-90		
MQMA042P1A	A4-61	A4-90	A4-61	A4-90		
MQMA042P1B	A4-61	A4-90	A4-61	A4-90		
MQMA042P1S	A4-61	A4-90	A4-61	A4-90		
MQMA042P1T	A4-61	A4-90	A4-61	A4-90		
MQMA042S1A	A4-61	A4-90	A4-61	A4-90		
MQMA042S1B	A4-61	A4-90	A4-61	A4-90		
MQMA042S1S	A4-61	A4-90	A4-61	A4-90		
MQMA042S1T	A4-61	A4-90	A4-61	A4-90		

● : Standard stock item

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MSMA						
Part No.	A4		Carrying page A4P		E	
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension
MSMA102P1C	A4-63	A4-91	A4-63	A4-91		
MSMA102P1D	A4-63	A4-91	A4-63	A4-91		
MSMA102P1G	A4-63	A4-91	A4-63	A4-91		
MSMA102P1H	A4-63	A4-91	A4-63	A4-91		
MSMA102S1C	A4-63	A4-91	A4-63	A4-91		
MSMA102S1D	A4-63	A4-91	A4-63	A4-91		
MSMA102S1G	A4-63	A4-91	A4-63	A4-91		
MSMA102S1H	A4-63	A4-91	A4-63	A4-91		
MSMA152P1C	A4-63	A4-91	A4-63	A4-91		
MSMA152P1D	A4-63	A4-91	A4-63	A4-91		
MSMA152P1G	A4-63	A4-91	A4-63	A4-91		
MSMA152P1H	A4-63	A4-91	A4-63	A4-91		
MSMA152S1C	A4-63	A4-91	A4-63	A4-91		
MSMA152S1D	A4-63	A4-91	A4-63	A4-91		
MSMA152S1G	A4-63	A4-91	A4-63	A4-91		
MSMA152S1H	A4-63	A4-91	A4-63	A4-91		
MSMA202P1C	A4-63	A4-91	A4-63	A4-91		
MSMA202P1D	A4-63	A4-91	A4-63	A4-91		
MSMA202P1G	A4-63	A4-91	A4-63	A4-91		
MSMA202P1H	A4-63	A4-91	A4-63	A4-91		
MSMA202S1C	A4-63	A4-91	A4-63	A4-91		
MSMA202S1D	A4-63	A4-91	A4-63	A4-91		
MSMA202S1G	A4-63	A4-91	A4-63	A4-91		
MSMA202S1H	A4-63	A4-91	A4-63	A4-91		
MSMA302P1C	A4-65	A4-92	A4-65	A4-92		
MSMA302P1D	A4-65	A4-92	A4-65	A4-92		
MSMA302P1G	A4-65	A4-92	A4-65	A4-92		
MSMA302P1H	A4-65	A4-92	A4-65	A4-92		
MSMA302S1C	A4-65	A4-92	A4-65	A4-92		
MSMA302S1D	A4-65	A4-92	A4-65	A4-92		
MSMA302S1G	A4-65	A4-92	A4-65	A4-92		
MSMA302S1H	A4-65	A4-92	A4-65	A4-92		

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MSMA							
Part No.	A4		Carrying page A4P		E		Delivery
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension	
MSMA402P1C	A4-65	A4-92	A4-65	A4-92			▲
MSMA402P1D	A4-65	A4-92	A4-65	A4-92			▲
MSMA402P1G	A4-65	A4-92	A4-65	A4-92			●
MSMA402P1H	A4-65	A4-92	A4-65	A4-92			●
MSMA402S1C	A4-65	A4-92	A4-65	A4-92			▲
MSMA402S1D	A4-65	A4-92	A4-65	A4-92			▲
MSMA402S1G	A4-65	A4-92	A4-65	A4-92			●
MSMA402S1H	A4-65	A4-92	A4-65	A4-92			●
MSMA502P1C	A4-65	A4-92	A4-65	A4-92			▲
MSMA502P1D	A4-65	A4-92	A4-65	A4-92			▲
MSMA502P1G	A4-65	A4-92	A4-65	A4-92			●
MSMA502P1H	A4-65	A4-92	A4-65	A4-92			●
MSMA502S1C	A4-65	A4-92	A4-65	A4-92			▲
MSMA502S1D	A4-65	A4-92	A4-65	A4-92			▲
MSMA502S1G	A4-65	A4-92	A4-65	A4-92			●
MSMA502S1H	A4-65	A4-92	A4-65	A4-92			●

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MSMD							
Part No.	A4		Carrying page A4P		E		Delivery
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension	
MSMD011P1A	A4-51	A4-88	A4-51	A4-88			●
MSMD011P1B	A4-51	A4-88	A4-51	A4-88			●
MSMD011P1S	A4-51	A4-88	A4-51	A4-88			●
MSMD011P1T	A4-51	A4-88	A4-51	A4-88			●
MSMD011P31N	A4-105	A4-108	A4-105	A4-108			▲
MSMD011P32N	A4-105	A4-108	A4-105	A4-108			▲
MSMD011P33N	A4-105	A4-108	A4-105	A4-108			▲
MSMD011P34N	A4-105	A4-108	A4-105	A4-108			▲
MSMD011P41N	A4-105	A4-108	A4-105	A4-108			▲
MSMD011P42N	A4-105	A4-108	A4-105	A4-108			▲
MSMD011P43N	A4-105	A4-108	A4-105	A4-108			▲
MSMD011P44N	A4-105	A4-108	A4-105	A4-108			▲
MSMD011S1A	A4-51	A4-88	A4-51	A4-88			●
MSMD011S1B	A4-51	A4-88	A4-51	A4-88			●
MSMD011S1S	A4-51	A4-88	A4-51	A4-88			●
MSMD011S1T	A4-51	A4-88	A4-51	A4-88			●
MSMD011S31N	A4-105	A4-108	A4-105	A4-108			▲
MSMD011S32N	A4-105	A4-108	A4-105	A4-108			▲
MSMD011S33N	A4-105	A4-108	A4-105	A4-108			▲
MSMD011S34N	A4-105	A4-108	A4-105	A4-108			▲
MSMD011S41N	A4-105	A4-108	A4-105	A4-108			▲
MSMD011S42N	A4-105	A4-108	A4-105	A4-108			▲
MSMD011S43N	A4-105	A4-108	A4-105	A4-108			▲
MSMD011S44N	A4-105	A4-108	A4-105	A4-108			▲
MSMD012P1A	A4-55	A4-88	A4-55	A4-88			●
MSMD012P1B	A4-55	A4-88	A4-55	A4-88			●

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MSMD						
Part No.	A4		Carrying page A4P		E	
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension
MSMD012P1S	A4-55	A4-88	A4-55	A4-88		●
MSMD012P1T	A4-55	A4-88	A4-55	A4-88		●
MSMD012P31N	A4-105	A4-108	A4-105	A4-108		▲
MSMD012P32N	A4-105	A4-108	A4-105	A4-108		▲
MSMD012P33N	A4-105	A4-108	A4-105	A4-108		▲
MSMD012P34N	A4-105	A4-108	A4-105	A4-108		▲
MSMD012P41N	A4-105	A4-108	A4-105	A4-108		▲
MSMD012P42N	A4-105	A4-108	A4-105	A4-108		▲
MSMD012P43N	A4-105	A4-108	A4-105	A4-108		▲
MSMD012P44N	A4-105	A4-108	A4-105	A4-108		▲
MSMD012S1A	A4-55	A4-88	A4-55	A4-88		●
MSMD012S1B	A4-55	A4-88	A4-55	A4-88		●
MSMD012S1S	A4-55	A4-88	A4-55	A4-88		●
MSMD012S1T	A4-55	A4-88	A4-55	A4-88		●
MSMD012S31N	A4-105	A4-108	A4-105	A4-108		▲
MSMD012S32N	A4-105	A4-108	A4-105	A4-108		▲
MSMD012S33N	A4-105	A4-108	A4-105	A4-108		▲
MSMD012S34N	A4-105	A4-108	A4-105	A4-108		▲
MSMD012S41N	A4-105	A4-108	A4-105	A4-108		▲
MSMD012S42N	A4-105	A4-108	A4-105	A4-108		▲
MSMD012S43N	A4-105	A4-108	A4-105	A4-108		▲
MSMD012S44N	A4-105	A4-108	A4-105	A4-108		▲
MSMD021P1A	A4-53	A4-89	A4-53	A4-89		●
MSMD021P1B	A4-53	A4-89	A4-53	A4-89		●
MSMD021P1S	A4-53	A4-89	A4-53	A4-89		●
MSMD021P1T	A4-53	A4-89	A4-53	A4-89		●
MSMD021P31N	A4-105	A4-108	A4-105	A4-108		▲
MSMD021P32N	A4-105	A4-108	A4-105	A4-108		▲
MSMD021P33N	A4-105	A4-108	A4-105	A4-108		▲
MSMD021P34N	A4-105	A4-108	A4-105	A4-108		▲
MSMD021P41N	A4-105	A4-108	A4-105	A4-108		▲
MSMD021P42N	A4-105	A4-108	A4-105	A4-108		▲
MSMD021P43N	A4-105	A4-108	A4-105	A4-108		▲
MSMD021P44N	A4-105	A4-108	A4-105	A4-108		▲
MSMD021S1A	A4-53	A4-89	A4-53	A4-89		●
MSMD021S1B	A4-53	A4-89	A4-53	A4-89		●
MSMD021S1S	A4-53	A4-89	A4-53	A4-89		●
MSMD021S1T	A4-53	A4-89	A4-53	A4-89		●
MSMD021S31N	A4-105	A4-108	A4-105	A4-108		▲
MSMD021S32N	A4-105	A4-108	A4-105	A4-108		▲
MSMD021S33N	A4-105	A4-108	A4-105	A4-108		▲
MSMD021S34N	A4-105	A4-108	A4-105	A4-108		▲
MSMD021S41N	A4-105	A4-108	A4-105	A4-108		▲
MSMD021S42N	A4-105	A4-108	A4-105	A4-108		▲
MSMD021S43N	A4-105	A4-108	A4-105	A4-108		▲
MSMD021S44N	A4-105	A4-108	A4-105	A4-108		▲
MSMD022P1A	A4-57	A4-89	A4-57	A4-89		●
MSMD022P1B	A4-57	A4-89	A4-57	A4-89		●

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MSMD							
Part No.	A4		Carrying page A4P		E		Delivery
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension	
MSMD022P1S	A4-57	A4-89	A4-57	A4-89			●
MSMD022P1T	A4-57	A4-89	A4-57	A4-89			●
MSMD022P31N	A4-105	A4-108	A4-105	A4-108			▲
MSMD022P32N	A4-105	A4-108	A4-105	A4-108			▲
MSMD022P33N	A4-105	A4-108	A4-105	A4-108			▲
MSMD022P34N	A4-105	A4-108	A4-105	A4-108			▲
MSMD022P41N	A4-105	A4-108	A4-105	A4-108			▲
MSMD022P42N	A4-105	A4-108	A4-105	A4-108			▲
MSMD022P43N	A4-105	A4-108	A4-105	A4-108			▲
MSMD022P44N	A4-105	A4-108	A4-105	A4-108			▲
MSMD022S1A	A4-57	A4-89	A4-57	A4-89			●
MSMD022S1B	A4-57	A4-89	A4-57	A4-89			●
MSMD022S1S	A4-57	A4-89	A4-57	A4-89			●
MSMD022S1T	A4-57	A4-89	A4-57	A4-89			●
MSMD022S31N	A4-105	A4-108	A4-105	A4-108			▲
MSMD022S32N	A4-105	A4-108	A4-105	A4-108			▲
MSMD022S33N	A4-105	A4-108	A4-105	A4-108			▲
MSMD022S34N	A4-105	A4-108	A4-105	A4-108			▲
MSMD022S41N	A4-105	A4-108	A4-105	A4-108			▲
MSMD022S42N	A4-105	A4-108	A4-105	A4-108			▲
MSMD022S43N	A4-105	A4-108	A4-105	A4-108			▲
MSMD022S44N	A4-105	A4-108	A4-105	A4-108			▲
MSMD041P1A	A4-53	A4-89	A4-53	A4-89			●
MSMD041P1B	A4-53	A4-89	A4-53	A4-89			●
MSMD041P1S	A4-53	A4-89	A4-53	A4-89			●
MSMD041P1T	A4-53	A4-89	A4-53	A4-89			●
MSMD041P31N	A4-105	A4-108	A4-105	A4-108			▲
MSMD041P32N	A4-105	A4-108	A4-105	A4-108			▲
MSMD041P33N	A4-105	A4-108	A4-105	A4-108			▲
MSMD041P34N	A4-105	A4-108	A4-105	A4-108			▲
MSMD041P41N	A4-105	A4-108	A4-105	A4-108			▲
MSMD041P42N	A4-105	A4-108	A4-105	A4-108			▲
MSMD041P43N	A4-105	A4-108	A4-105	A4-108			▲
MSMD041P44N	A4-105	A4-108	A4-105	A4-108			▲
MSMD041S1A	A4-53	A4-89	A4-53	A4-89			●
MSMD041S1B	A4-53	A4-89	A4-53	A4-89			●
MSMD041S1S	A4-53	A4-89	A4-53	A4-89			●
MSMD041S1T	A4-53	A4-89	A4-53	A4-89			●
MSMD041S31N	A4-105	A4-108	A4-105	A4-108			▲
MSMD041S32N	A4-105	A4-108	A4-105	A4-108			▲
MSMD041S33N	A4-105	A4-108	A4-105	A4-108			▲
MSMD041S34N	A4-105	A4-108	A4-105	A4-108			▲
MSMD041S41N	A4-105	A4-108	A4-105	A4-108			▲
MSMD041S42N	A4-105	A4-108	A4-105	A4-108			▲
MSMD041S43N	A4-105	A4-108	A4-105	A4-108			▲
MSMD041S44N	A4-105	A4-108	A4-105	A4-108			▲
MSMD042P1A	A4-57	A4-89	A4-57	A4-89			●
MSMD042P1B	A4-57	A4-89	A4-57	A4-89			●

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MSMD						
Part No.	A4		Carrying page A4P		E	
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension
MSMD042P1S	A4-57	A4-89	A4-57	A4-89		
MSMD042P1T	A4-57	A4-89	A4-57	A4-89		
MSMD042P31N	A4-105	A4-108	A4-105	A4-108		
MSMD042P32N	A4-105	A4-108	A4-105	A4-108		
MSMD042P33N	A4-105	A4-108	A4-105	A4-108		
MSMD042P34N	A4-105	A4-108	A4-105	A4-108		
MSMD042P41N	A4-105	A4-108	A4-105	A4-108		
MSMD042P42N	A4-105	A4-108	A4-105	A4-108		
MSMD042P43N	A4-105	A4-108	A4-105	A4-108		
MSMD042P44N	A4-105	A4-108	A4-105	A4-108		
MSMD042S1A	A4-57	A4-89	A4-57	A4-89		
MSMD042S1B	A4-57	A4-89	A4-57	A4-89		
MSMD042S1S	A4-57	A4-89	A4-57	A4-89		
MSMD042S1T	A4-57	A4-89	A4-57	A4-89		
MSMD042S31N	A4-105	A4-108	A4-105	A4-108		
MSMD042S32N	A4-105	A4-108	A4-105	A4-108		
MSMD042S33N	A4-105	A4-108	A4-105	A4-108		
MSMD042S34N	A4-105	A4-108	A4-105	A4-108		
MSMD042S41N	A4-105	A4-108	A4-105	A4-108		
MSMD042S42N	A4-105	A4-108	A4-105	A4-108		
MSMD042S43N	A4-105	A4-108	A4-105	A4-108		
MSMD042S44N	A4-105	A4-108	A4-105	A4-108		
MSMD082P1A	A4-57	A4-89	A4-57	A4-89		
MSMD082P1B	A4-57	A4-89	A4-57	A4-89		
MSMD082P1S	A4-57	A4-89	A4-57	A4-89		
MSMD082P1T	A4-57	A4-89	A4-57	A4-89		
MSMD082P31N	A4-105	A4-108	A4-105	A4-108		
MSMD082P32N	A4-105	A4-108	A4-105	A4-108		
MSMD082P33N	A4-105	A4-108	A4-105	A4-108		
MSMD082P34N	A4-105	A4-108	A4-105	A4-108		
MSMD082P41N	A4-105	A4-108	A4-105	A4-108		
MSMD082P42N	A4-105	A4-108	A4-105	A4-108		
MSMD082P43N	A4-105	A4-108	A4-105	A4-108		
MSMD082P44N	A4-105	A4-108	A4-105	A4-108		
MSMD082S1A	A4-57	A4-89	A4-57	A4-89		
MSMD082S1B	A4-57	A4-89	A4-57	A4-89		
MSMD082S1S	A4-57	A4-89	A4-57	A4-89		
MSMD082S1T	A4-57	A4-89	A4-57	A4-89		
MSMD082S31N	A4-105	A4-108	A4-105	A4-108		
MSMD082S32N	A4-105	A4-108	A4-105	A4-108		
MSMD082S33N	A4-105	A4-108	A4-105	A4-108		
MSMD082S34N	A4-105	A4-108	A4-105	A4-108		
MSMD082S41N	A4-105	A4-108	A4-105	A4-108		
MSMD082S42N	A4-105	A4-108	A4-105	A4-108		
MSMD082S43N	A4-105	A4-108	A4-105	A4-108		
MSMD082S44N	A4-105	A4-108	A4-105	A4-108		
MSMD5AZP1A	A4-51,55	A4-88	A4-51,55	A4-88		
MSMD5AZP1B	A4-51,55	A4-88	A4-51,55	A4-88		

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MSMD						
Part No.	A4		Carrying page A4P		E	
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension
MSMD5AZP1S	A4-51,55	A4-88	A4-51,55	A4-88		
MSMD5AZP1T	A4-51,55	A4-88	A4-51,55	A4-88		
MSMD5AZS1A	A4-51,55	A4-88	A4-51,55	A4-88		
MSMD5AZS1B	A4-51,55	A4-88	A4-51,55	A4-88		
MSMD5AZS1S	A4-51,55	A4-88	A4-51,55	A4-88		
MSMD5AZS1T	A4-51,55	A4-88	A4-51,55	A4-88		

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MUMA						
Part No.	A4		Carrying page A4P		E	
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension
MUMA011P1S					E11	E15
MUMA011P1T					E11	E15
MUMA011P31N					E17	E19
MUMA011P32N					E17	E19
MUMA011P34N					E17	E19
MUMA011P41N					E17	E19
MUMA011P42N					E17	E19
MUMA011P44N					E17	E19
MUMA012P1S					E13	E15
MUMA012P1T					E13	E15
MUMA012P31N					E17	E19
MUMA012P32N					E17	E19
MUMA012P34N					E17	E19
MUMA012P41N					E17	E19
MUMA012P42N					E17	E19
MUMA012P44N					E17	E19
MUMA021P1S					E11	E15
MUMA021P1T					E11	E15
MUMA021P31N					E17	E19
MUMA021P32N					E17	E19
MUMA021P34N					E17	E19
MUMA021P41N					E17	E19
MUMA021P42N					E17	E19
MUMA021P44N					E17	E19
MUMA022P1S					E13	E15
MUMA022P1T					E13	E15
MUMA022P31N					E17	E19
MUMA022P32N					E17	E19
MUMA022P34N					E17	E19
MUMA022P41N					E17	E19
MUMA022P42N					E17	E19
MUMA022P44N					E17	E19
MUMA042P1S					E13	E15
MUMA042P1T					E13	E15
MUMA042P31N					E17	E19
MUMA042P32N					E17	E19

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MUMA							
Part No.	A4		Carrying page A4P		E		Delivery
	Specifications	Dimension	Specifications	Dimension	Specifications	Dimension	
MUMA042P34N					E17	E19	▲
MUMA042P41N					E17	E19	▲
MUMA042P42N					E17	E19	▲
MUMA042P44N					E17	E19	▲
MUMA5AZP1S					E11,13	E15	●
MUMA5AZP1T					E11,13	E15	●

Sales Office

[Panasonic Sales Office of Motors]

(Jun. 25. 2006)

Country	Company Name	City	Address	TEL
				FAX
U.S.A.	Panasonic Industrial Company(PIC)	New Jersey	Two Panasonic Way Secaucus, New Jersey 07094 U.S.A.	1-201-348-5356
				1-201-392-4888
		California	2033 Gateway Place, Suite 200 San Jose, CA 95110, U.S.A.	1-408-487-9536
				1-408-436-8037
Europe	Panasonic Industrial Europe Ltd.(PIEL)	Bracknell	Panasonic House,Willoughby Road Brecknell, Berks, RG12 8FP,U.K.	44-1344-476-523
				44-1344-476-579
	Panasonic Industrial Europe GmbH(PIEG)	Munich	Hans-Pinsel-Str. 2, 85540 Haar, Gemany	49-89-46159-230
				49-89-46159-212
		Milano	Via Lucini 19, 20125 Milano, ITALY	39-02-6788-413
				39-02-6788-207
		Barcelona	Avda. Josep Tarradellas. 20-30 Reception 5 Plantas4,5Y6 08029 Barcelona, SPAIN	34-93-494-9240
				34-93-419-8931
Taiwan	Panasonic Industrial Sales (Taiwan) Co., Ltd.(PIST)	Taipei	6F, 550, Sec.4, Chung Hsiao E.RD. Taipei, 110, TAIWAN, R.O.C	886-2-2757-1899
				886-2-2757-1977
Singapore	Panasonic Industrial Singapore(PICS)	Singapore	300 Beach Road #16-01 The Concourse Singapore 199555	65-6390-8384
				65-6390-3834
China	Panasonic Shun Hing Industrial Sales (Hong kong) Co., Ltd.	Hong kong	Level 33, Office Tower, Langham Place, 8 Argyle Street, Mongkok, Kin.,Hong Kong	852-2529-7322
				852-2598-9743
	Panasonic Industrial (China) Co.,Ltd. (PICH)	Shanghai	Floor 5, China Insurance Building, 166 East Road LuJiaZui PuDong New District, Shanghai, China, 200120	86-21-6841-9651
				86-21-6841-9249
India	Panasonic Industrial Asia Pte Ltd. (PIAI)	New Delhi	510, E-Block, International Trade Tower, Nehru Place, New Delhi	91-11-26292870
				91-11-26292878

[Distributor]

Country	Company Name	City	Address	TEL
				FAX
Korea	YOUNG IL Electric Co.,Ltd.	Seoul	982-4, 3 Dong, Shiheung, Keumcheon-Ku, Seoul	82-2-805-2471
				82-2-805-2475
	Soonhan Engineering Co.,Ltd.	Sunnam	333-11, Sangdaewon-Dong, Jungwon-Ku, Sunnam-Si, Gyunggi-Do, Korea	82-31-737-9188
				82-31-732-9188
	Zeus Co.,Ltd.	Osan	163-1, Busan-Dong, Osan-City, Kyunggi-Do, Korea	82-31-377-9500
				82-31-378-8660

Cautions for Proper Use

- This product is intended to be used with a general industrial product, but not designed or manufactured to be used in a machine or system that may cause personal death when it is failed.
- Install a safety equipments or apparatus in your application, when a serious accident or loss of property is expected due to the failure of this product.
- Consult us if the application of this product is under such special conditions and environments as nuclear energy control, aerospace, transportation, medical equipment, various safety equipments or equipments which require a least air contamination.
- We have been making the best effort to ensure the highest quality of the products, however, application of exceptionally larger external noise disturbance and static electricity, or failure in input power, wiring and components may result in unexpected action. It is highly recommended that you make a fail-safe design and secure the safety in the operative range.
- If the motor shaft is not electrically grounded, it may cause an electrolytic corrosion to the bearing, depending on the condition of the machine and its mounting environment, and may result in the bearing noise. Checking and verification by customer is required.
- Failure of this product depending on its content, may generate smoke of about one cigarette. Take this into consideration when the application of the machine is clean room related.
- Please be careful when using in an environment with high concentrations of sulphur or sulphuric gases, as sulphuration can lead to disconnection from the chip resistor or a poor contact connection.
- Take care to avoid inputting a supply voltage which significantly exceeds the rated range to the power supply of this product. Failure to heed this caution may result in damage to the internal parts, causing smoking and/or a fire and other trouble.
- Read and observe the instruction manual without fail for proper usage of the products.

Repair

Consult to the dealer from whom you have purchased this product for details of repair work.
When the product is incorporated to the machine you have purchased, consult to the machine manufacturer or its dealer.

URL

Electric data of this product (Instruction Manual, CAD data) can be download from the following web site;
<http://industrial.panasonic.com/ww/i_e/25000/motor_fa_e/motor_fa_e.html>

Contact to :

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