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Ezi-SERVO[®]

Closed Loop Stepping Systems



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※ Before operating ※

- Thank you for purchasing Ezi-SERVO of FASTech. Ezi-SERVO is a position controllable Servo Systems by fully digital 32bit high-performance DSP chip.
- This manual describes handling, maintenance, repair, diagnosis and troubleshooting of Ezi-SERVO.
- Before operating Ezi-SERVO, thoroughly read this manual.

1. Precautions

◆ General Precautions

ⓘ Contents of this manual are subject to change without prior notice for functional improvement, change of specifications or user's better understanding.
Thoroughly read the manual provided with the purchased step drive.

ⓘ When the manual is damaged or lost, contact agent or Fastech at the address on the last page of the manual.
Fastech is not responsible for a product breakdown due to user's dismantling the product, and such a breakdown is not covered by the warranty.

◆ Put the Safety First.

- ⓘ Before installing, operating and repairing the step drive, thoroughly read the manual and fully understand the contents.
Before operating the step drive, understand the mechanical characteristics of the step drive and related safety information and precautions.
- ⓘ After reading the manual, keep the manual near the step drive so that any user can read the manual whenever needed.
- ⓘ This manual divides safety precautions into 'Warning' and 'Attention'.



Warning

If the user does not properly handle the product, the user may seriously or slightly injured and damages may occur only in the machine.



Attention

If the user does not properly handle the product, a dangerous situation (such as an electric shock) may occur resulting in deaths or serious injuries.

⚠ Although precaution is only a **Warning**, a serious result could be caused depending on the situation. Follow safety precautions.

◆ Check the Status of the Step Drive.



Warning

⚠ Do not install a damaged step drive or a step drive with a missing part. Otherwise, the user may get injured.

◆ Install.



Warning

- ⚠ **Carefully move the step drive.**
Dropping the product on the user's foot may cause an injury.
- ⚠ **Use non-flammable materials such as metal in the place where the step drive is to be installed.**
Otherwise, a fire may occur.
- ⚠ **When installing several drives in a sealed place, install a cooling fan to keep the ambient temperature of the step drive 55°C or lower.**
Otherwise, a fire or other kinds of accidents may occur due to overheating.

◆ Connect Cables.



Warning

- ⚠ **Before connecting cables, check if input power is off.**
Otherwise, an electric shock or a fire may occur.
- ⚠ **All parameters of the step drive were accordingly set in the factory. To change these parameters, read the manual carefully first.**
Otherwise, the machine may get damaged.
- ⚠ **The case of the step drive is insulated from the ground of the internal circuit by the condenser. Ground the step driver.**
Otherwise, an electric shock or a fire may occur.

◆ Check and Repair.



Attention

☞ **Stop supplying power to the main circuit and wait for a while before checking or repairing the step drive.**

Electricity remaining in the condenser may cause danger.

☞ **Do not change cabling while power is being supplied.**

Otherwise, the user may get injured or the step drive may get damaged.

☞ **Do not reconstruct the step drive.**

Otherwise, an electric shock may occur or the user may get injured.

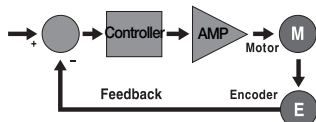
■ Preparation of Motor & Driver

Model of Units	Motor Model	Driver Model
Ezi-SERVO-42S	EzM-42S	EzS-PD-42S
Ezi-SERVO-42M	EzM-42M	EzS-PD-42M
Ezi-SERVO-42L	EzM-42L	EzS-PD-42L
Ezi-SERVO-56S	EzM-56S	EzS-PD-56S
Ezi-SERVO-56M	EzM-56M	EzS-PD-56M
Ezi-SERVO-56L	EzM-56L	EzS-PD-56L

2. Main character

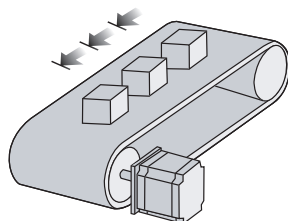
1 Closed Loop System.

Closed loop stepping motor controller that utilizes a high-resolution encoder to constantly monitor the current motor shaft position. With the encoder feedback feature, the Ezi-SERVO keeps updating the current position information every 25 micro seconds. If necessary, the Ezi-SERVO takes a corrective action to compensate the loss of synchronization.



2 No Gain Tuning

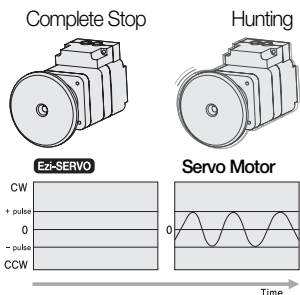
In order to improve a control performance, tuning the gains of a servo system is the most crucial step. Depending on the source of a load change, this is a long, tedious, troublesome, and time-consuming job for an application field engineer. Especially, Ezi-SERVO is well suited for low stiffness loads (for example, a belt and pulley system) that are common problems experienced in a most servo system, while still maintaining the best performance in all situations.



Belt and Pulley System

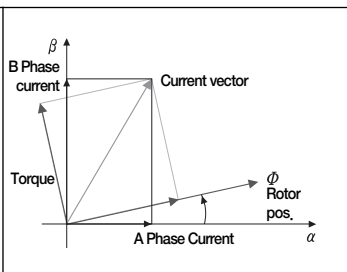
3 No Hunting

Contrary to a traditional servo motor drive, there is no problem of hunting in the Ezi-SERVO that utilizes the unique feature of stepping motors. After reaching a desired target position, Ezi-SERVO does not experience a fluctuation of motion. This feature is especially useful in an application such as vision systems in which vibration could be a problem.



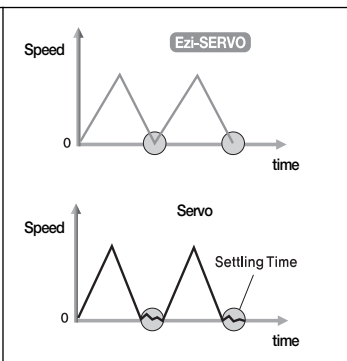
4 Smooth and Accurate

Ezi-SERVO is a high-precision servo drive, using a high-resolution encoder with 10,000 pulses/revolution. Further, unlike a conventional microstep drive, the on-board high performance DSP(Digital Signal Processor) performs a vector control and filtering, realizing a smooth rotational control with minimum ripples.



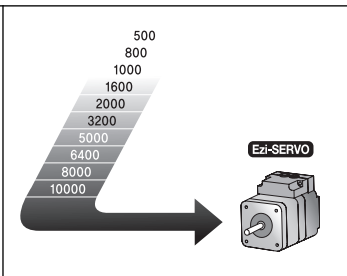
5 Fast Response

Similar to conventional stepping motors, Ezi-SERVO shows good synchronization with commanding pulses and realizes a short and fast response in a positioning action. Thus, it is a great feature of Ezi-SERVO when rapid motions with a short distance are required. For the case of traditional servo motor systems, there is a considerable delay between the commanding input signals and the resultant motion because of the constant monitor of the current position, necessitating a waiting time until it settles, called settling time.



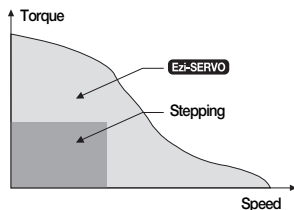
6 High Resolution

The unit of the position command can be divided Precisely.
(max. 10,000 pulses/revolution)



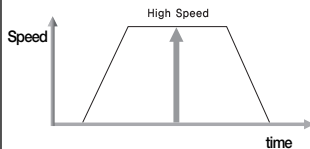
7 High Torque

Compared with common step motors, Ezi-SERVO can maintain a high torque state over relatively long time periods. Since it is possible for the drive to continuously operate without loss of synchronism under 100% load, there is no need to concern the load-tolerance, opposing to conventional microstep drives. Ezi-SERVO exploits high-torque in high-speed regime owing to the innovative optimum current phase control in accordance with rotational speeds.



8 High Speed

The Ezi-SERVO behaves equally well at high speed without loss of synchronism. The ability of continuous monitor of current positions enables a stepping motor to generate high-torque even under a 100% load condition.



9 Load-Dependent Current Control

Since the drive controls the operating current depending on the variation of a load condition, it is possible to reduce the heat generation, in turn improving the efficiency.



Stepper

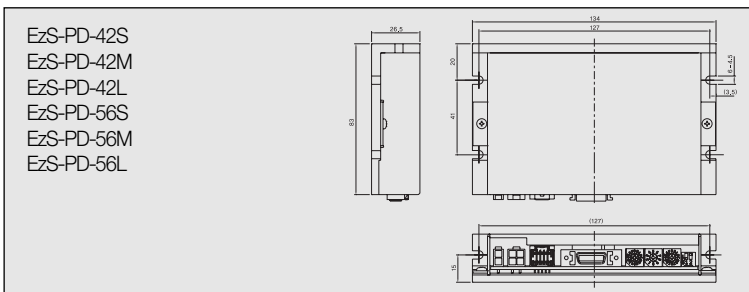


3. Specifications

3.1 Driver spec

Driver Model			EzS-PD-42S	EzS-PD-42M	EzS-PD-42L	EzS-PD-56S	EzS-PD-56M	EzS-PD-56L
Motor Model			EzM-42S	EzM-42M	EzM-42L	EzM-56S	EzM-56M	EzM-56L
Control Method			Closed loop control with 32bit DSP					
Input voltage			24VDC ± 10% (Main circuit)					
C o n d. n	Te mp.	Operate	0~55℃					
		Reserve	-20~70℃					
	Humidity		90%RH (Non-condensing)					
	Vib. Resist.		0.5G					
Dimensions			W134 x H26,5 x D83(mm)					
F u n c t i o n	Rotation speed		0~3000rpm					
	Resolution(P/R)		500, 800, 1000, 1600, 2000, 3200, 5000, 6400, 8000, 10000(with rotary switch)					
	Max Freq.		500KHz					
	Protection		Overcurrent, Overspeed, Speed error, Overheat, Overvoltage					
	LED display		Power status, Alarm status, In-Position status, Servo On status					
	In-Position		0-F(with rotary switch)					
	Position Gain		0-F(with rotary switch)					
	Pulse Input Method		1Pulse / 2Pulse (with DIP switch)					
	Rotational Dir,		CW/ CCW (with DIP switch)					
	Speed/Position Command		Pulse train input					
I / O	Input signal		Photocoupler input : Position command pulse, Servo On/Off, Alarm reset					
	Output signal		Photocoupler output: In-Position, Alarm Line drive output : Encoder signal(A+, A-, B+, B-, Z+, Z-, AM26C31 or equivalent)					

3.2 Driver dimension(mm)



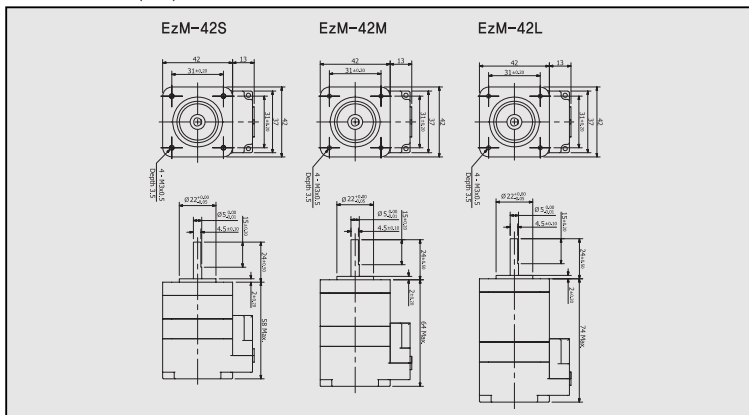
4. Motor spec and Size

4.1 EzM-42 Series

4.1.1 Motor Spec

MODEL	Unit	EzM-42S	EzM-42M	EzM-42L
DRIVE METHOD	---	BI-POLAR	BI-POLAR	BI-POLAR
NUMBER OF PHASES	---	2	2	2
VOLTAGES	V	3,10	4,59	2,76
CURRENT	A/PHASE	1,0	0,85	1,2
WINDING	Ω /PHASE	3,1	5,4	2,3
INDUCTION	mH/PHASE	4,3	9,3	4,0
HOLDING TORQUE	mN·m	197	314	403
	oz·in	20	44	57
DETENT TORQUE	mN·m	11,8	14,7	19,6
	oz·in	1,7	2,1	2,8
ROTOR INERTIA	g·cm ²	38	56	85
	oz·in ²	0,21	0,3	0,46
WEIGHTS	g	200	260	360
	lb	0,44	0,57	0,79
INSULATION CLASS	---	(UL VALUE : CLASS B 130°C 266°F)		
INSULATION RESISTANCE	---	500VDC 100M Ω min.		
DIELECTRIC STRENGTH	---	500VAC 50HZ 1min.		
OPERATING TEMP. RANGE	°C	0 to 55		
ALLOWABLE TEMP. RISE	°C	70		
TOLERANCE LOAD	OVERHUNG	Kgf	5,2	
	THRUST	Kgf	Lower than MOTOR weight	

4.1.2 Motor Size(mm)

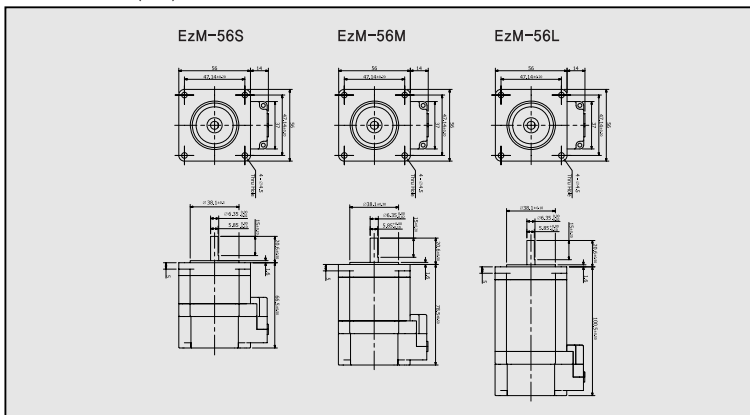


4.2 EzM-56 Series

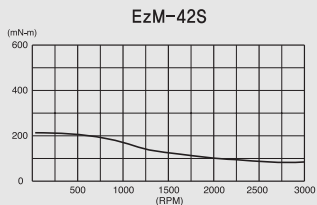
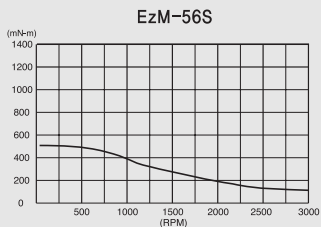
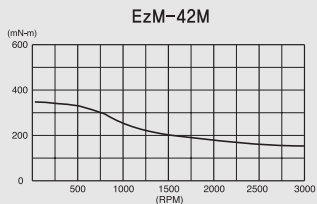
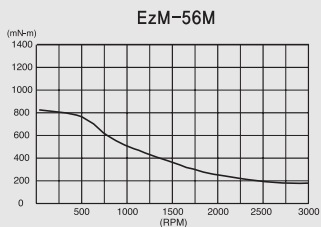
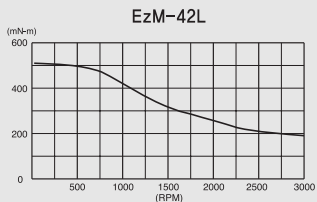
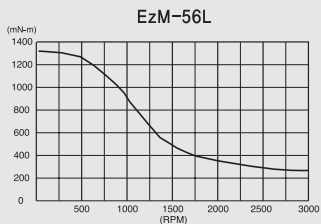
4.2.1 Motor Spec

MODEL	단위	EzM-56S	EzM-56M	EzM-56L
DRIVE METHOD	—	BI-POLAR	BI-POLAR	BI-POLAR
NUMBER OF PHASES	—	2	2	2
VOLTAGES	V	1,96	2,4	4,0
CURRENT	A/PHASE	2,0	2,0	2,0
WINDING	Ω /PHASE	0,98	1,32	2,0
INDUCTION	mH/PHASE	2,27	3,19	7,35
HOLDING TORQUE	mN · m	490	932	1373
	oz · in	69	132	194
DETENT TORQUE	mN · m	25	37	69
	oz · in	3,5	5,2	9,8
ROTOR INERTIA	g · cm ²	115	188	269
	oz · in ²	0,62	1,0	1,47
WEIGHTS	g	400	650	1000
	lb	0,88	1,4	2,2
INSULATION CLASS	—	(UL VALUE : CLASS B 130℃ 266°F)		
INSULATION RESISTANCE	—	500VDC 100M Ω min.		
DIELECTRIC STRENGTH	—	500VAC 50HZ 1min.		
OPERATING TEMP. RANGE	℃	0 to 55		
ALLOWABLE TEMP. RISE	℃	70		
TOLERANCE	OVERHUNG	kgf	13	
LOAD	THRUST	Kgf	Lower than MOTOR weight	

4.2.2 Motor Size(mm)



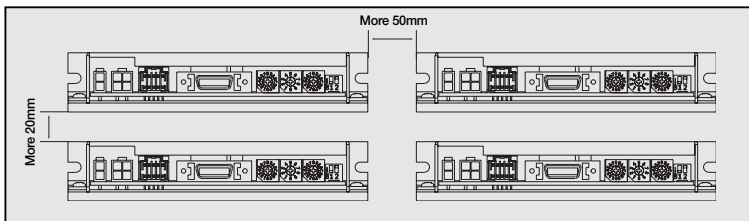
5. Motor Torque Characteristics



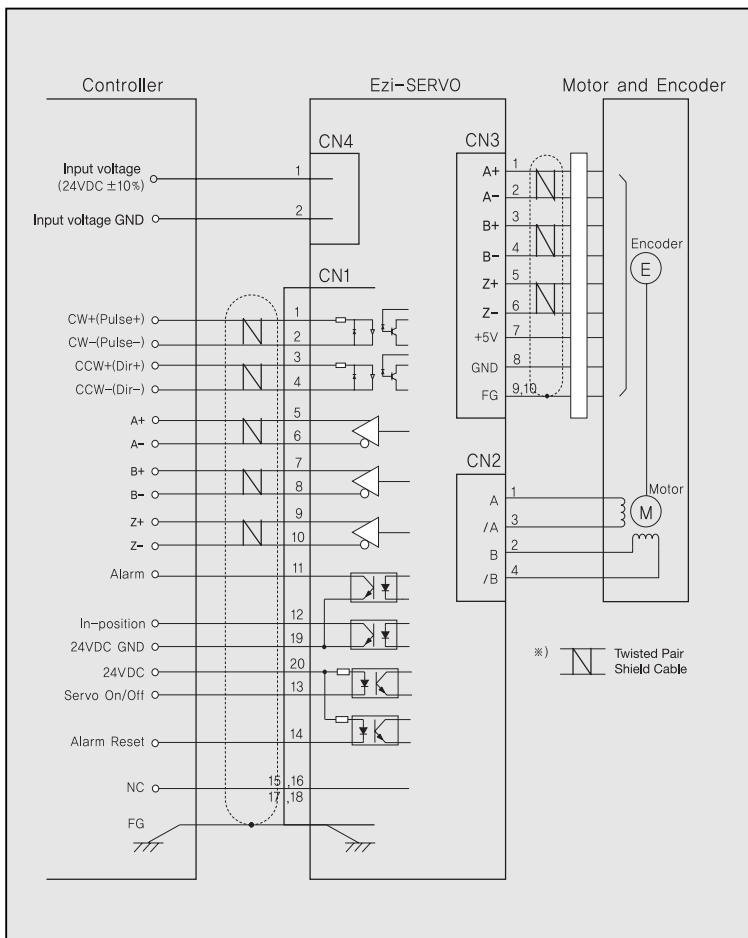
6. Installation and Cabling

6.1 Notes on Installation

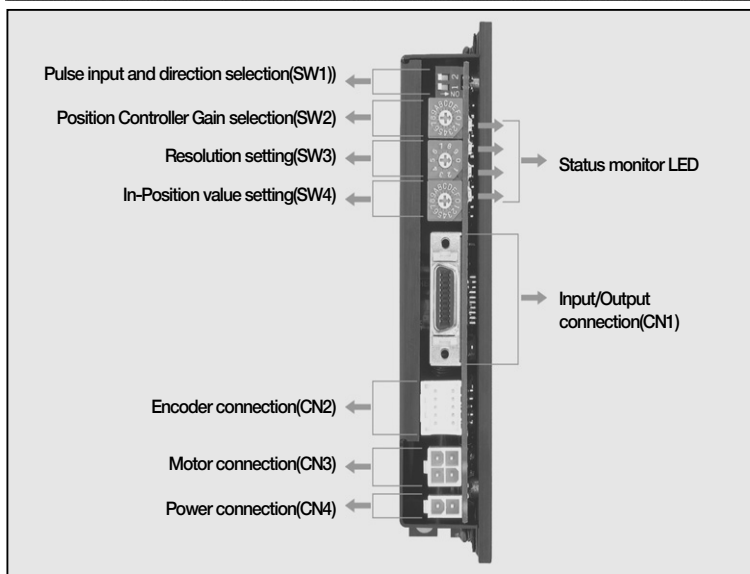
- 1) Ezi-SERVO has been designed for indoor uses.
- 2) The ambient temperature of the room should be 0°C ~55°C.
- 3) If the temperature of the case is higher than 50°C, radiate heat of the outside to cool down the case.
- 4) Do not install Ezi-SERVO under direct rays, near magnetic or radioactive objects.
- 5) If you set more than 2 drives, you must set over 20mm horizontally and over 50mm vertically as shown below.



6.2 Connection Diagram



7. Setting and Operating



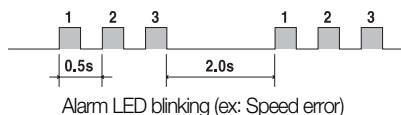
7.1 Status monitor LED

7.1.1 Status LED Function and Condition

Status	Color	Function	Blinking Condition
Power	Green	Power input indication	Lights when power is ON
In-Position	Yellow	Complete position motion	Lights ON when positioning error reaches within the preset pulse selected by rotary switch
Servo On	Orange	Servo On/Off indication	Servo On : Lights ON Servo Off : Lights OFF
Alarm	Red	Alarm indication	Blinking when protection function is activated (Identifiable which protection mode is activated by counting the blinking times)

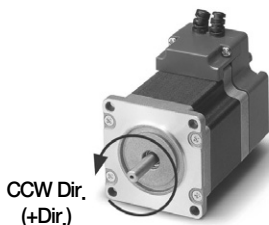
7.1.2 Protection functions and LED blinking times

Blinking Times	Protection	Conditions
1	Overcurrent	The current through power devices in inverter exceeds the limit value
2	Overspeed	Motor speed exceed 3000rpm
3	Speed error	The motor can not follow the command pulses
4	Overload	Continuously operated more than 5 sec.
5	Overheat	Inside temperature of drive exceed 50 °c
6	Over regenerative voltage	Back EMF more than 70V
7	Motor Connection	Power is ON without connection of motor cable to drive
8	Encoder Connection	Cable connection error with Encoder connector in drive

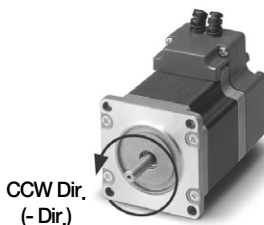


7.2 Pulse input and motor direction selection switch(SW1)

Blinking	Switch Name	Pulse Input Selection Switch Function
1P/2P (pin #1)	Selecting pulse input mode	Switch pulse input modes 1P : 1-Pulse input mode(ON) 2P : 2-Pulse input mode(OFF) ※ Default
Rotation Dir. Select (pin #2)	Switching Rotational Direction	CCW(+Direction) : OFF ※ Default CW(+Direction) : ON Based on looking at the motor shaft



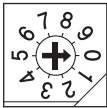
Direction selection : OFF



Direction selection: ON

7.3 Resolution selection switch(SW3)

The number of pulse per revolution,

Indication	Pulse/Rotation	Indication	Pulse/Rotation	
0	500	5	3200	
1	800	6	5000	
2	1000	7	6400	
3	1600	8	8000	
4	1600	9	10000	

7.4 Position Controller Gain Switch(SW2)

The purpose of the Position Controller is to correct motor position deviation after stopping caused by load and friction. Depending on the motor load, the user have to select position of the switch because the system to be stable and to correct the error as fast as possible.

To turn the controller

- 1, Set the switch to '0' position
- 2, Start to rotate the switch until system becomes stable.
- 3, Rotate the switch +/- 1~2 position to reach better performance.

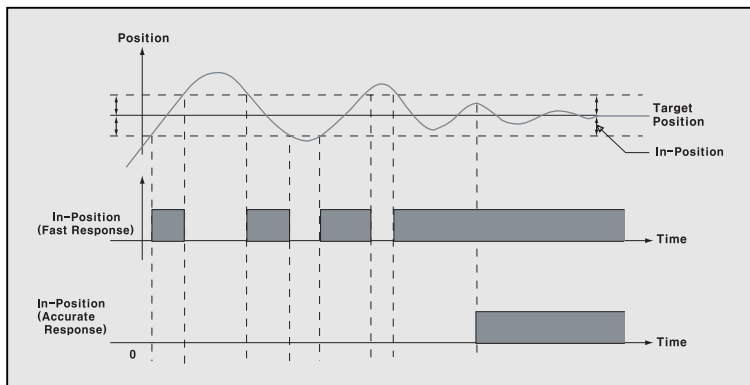
Indication	Time constant of integral part*	Proportional Gain*	Indication	Time constant of integral part*	Proportional Gain*	
0	1	1	8	2	3	
1	1	2	9	2	4	
2	1	3	A	2	5	
3	1	4	B	2	1	
4	1	5	C	3	2	
5	1	6	D	3	3	
6	2	1	E	3	4	
7	2	2	F	3	5	

* Values in the columns are in relative units. They only show the parameter changes depending on the switch's position.

7.5 In-Position value setting switch(SW4)

Indication	In-position [Pulse]	Indication	In-position[Pulse] Accurate Response	
0	0	8	0	
1	1	9	1	
2	2	A	2	
3	3	B	3	
4	4	C	4	
5	5	D	5	
6	6	E	6	
7	7	F	7	

7.5.1 Setting method of Fast Response and Accurate Response



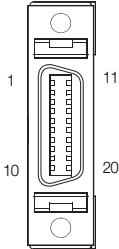
7.6 Power Connector(CN4)

Indication	Function	
1	Input Power : 24VDC $\pm$ 10%	
2	Input Power Ground	

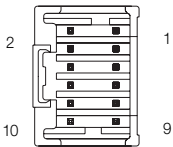
7.7 Motor Connector(CN3)

Indication	Function	
1	A	
2	B	
3	/A	
4	/B	

7.8 Control signal Input/Output Connector(CN1)

Indication	Function	I/O	
1	CW+(Pulse+)	Input	
2	CW-(Pulse-)	Input	
3	CCW+(Dir+)	Input	
4	CCW-(Dir-)	Input	
5	A+	Output	
6	A-	Output	
7	B+	Output	
8	B-	Output	
9	Z+	Output	
10	Z-	Output	
11	Alarm	Output	
12	In-Position	Output	
13	Servo On/Off	Input	
14	Alarm Reset	Input	
15	NC	----	
16	NC	----	
17	NC	----	
18	NC	----	
19	24VDC GND	Input	
20	24VDC	Input	

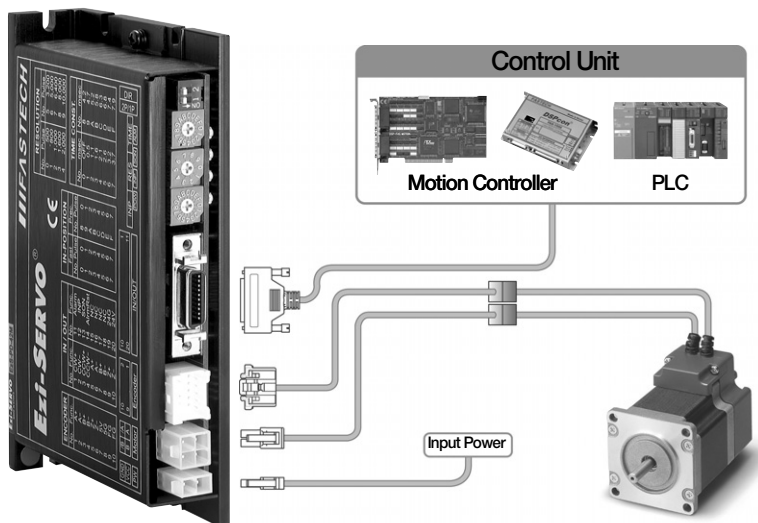
7.9 Encoder Connector(CN2)

Indication	Function	I/O	
1	A+	Input	
2	A-	Input	
3	B+	Input	
4	B-	Input	
5	Z+	Input	
6	Z-	Input	
7	5VCD	Output	
8	5VDC GND	Output	
9	Frame GND	----	
10	Frame GND	----	

7.10 Run Current

There's no need to adjust because the run current is set compare to the kind of motor. But, the run current when motor is stopped is 50%.

8. External Wiring Diagram

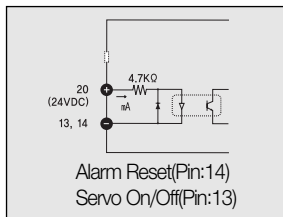
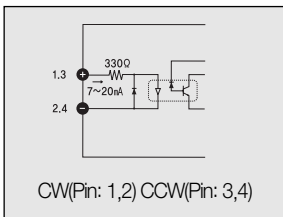


Type	Power Cable	Motor Power Cable	Encoder Cable	Control Cable
Standard Length	-	30cm	30cm	-
Max. Length	2m	20m	20m	20m

9. Control signal Input/Output Description

1 Input Signal

Input signals of the drive are all photocoupler inputs. The signal shows the status of internal photocouplers [ON:conduction],[OFF:Non-conduction], not displaying the voltage levels of the signal.



◆ CW, CCW Input

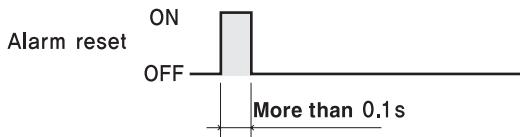
This signal can be used to receive a positioning pulse command from a user-side host motion controller. A user can select 1-pulse input mode or 2-pulse input mode (refer to switch No.1, SW1)

◆ Servo On/Off

This input can be used only to adjust the position by manually moving the motor shaft from the load-side. By setting the signal [ON], the driver cuts off the power supply to the motor. Then, one can manually adjust output position. When setting the signal back to [OFF], the driver resumes the power supply to the motor and recovers the holding torque. When driving a motor, one needs to set the signal[OFF]. In normal operation set the signal [OFF] or disconnect a wire to the signal.

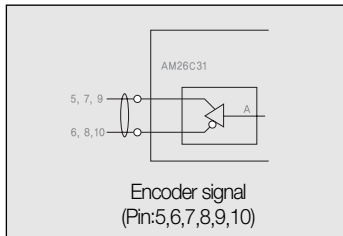
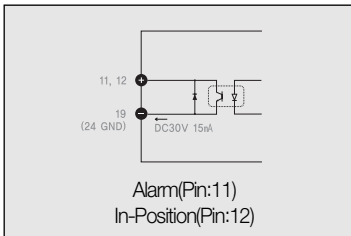
◆ Alarm Reset

When a protection mode has been activated, a signal to this alarm reset input cancels the Alarm output.



2 Output Signal

As the output signal from the driver, there are the photocoupler outputs (Alarm, In-Position) and the line driver outputs(encoder signal). In the case of photocoupler outputs, the signal indicates the status of internal photocouplers[ON:conduction], [OFF:Non-conduction], not displaying the voltage levels of the signal.

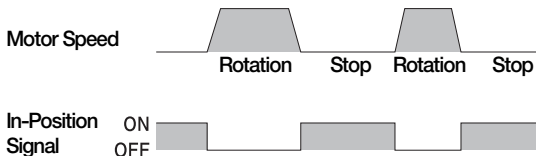


◆ Alarm

The Alarm output indicates [ON] when the driver is in a normal operation. If a protection mode has been activated, it goes [OFF]. A host controller needs to detect that signal and stop sending a motor driving command. When the driver detects an abnormal operation such as overload or overcurrent of the motor, it sets the Alarm output to [OFF], blinks the Alarm LED, disconnect the power to a motor and stop the motor simultaneously.

◆ In-Position

In-Position state is [ON] when positioning is completed. This signal is output when the motor position error is within the value set by the switch SW4.



◆ Encoder signal

The encoder signal is a line drive output. This can be used to confirm the stop position.

Advantages over Open-loop Control Stepping Driver

1. Reliable positioning without loss of synchronism.
2. Holding stable position and automatically recovering to the original position even after experiencing positioning error due to a external force, such as mechanical vibration.
3. Ezi-SERVO covers 100% full range of the rated torque, contrary to a conventional open-loop stepping driver that can use only up to 50% of the rated torque by considering loss of synchronism.
4. Capability to cooperate at high speed owing to a load-dependent current control, whereas open-loop drivers use a constant current control at all speed range without considering load variations.

Advantages over servo motor controller

1. No gain tuning (Automatic adjustment of gain in response to a load change)
2. Maintain the stable holding position without fluctuation after completing positioning.
3. Possible to fast positioning owing to the independent control by on-board DSP.
4. Favorable continuous operation at short-stroke rapid movement process thanks to short positioning time.

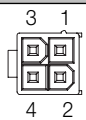
Appendix

Option

■ Relay cable for Motor

For extending Relay cable between Motor and Driver.

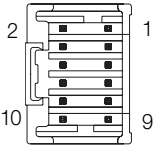
Item	Length	
CEM-1M-MD	1m	
CEM-2M-MD	2m	
CEM-3M-MD	3m	
CEM-5M-MD	5m	
CEM-7M-MD	7m	
CEM-10M-MD	10m	

No.	Indication	Color	
1	A	White	
2	B	Yellow	
3	/A	Blue	
4	/B	Red	

■ Relay cable for Encoder

For extending Relay cable between Encoder and Driver.

Item	Length	
CEM-1M-ED	1m	
CEM-2M-ED	2m	
CEM-3M-ED	3m	
CEM-5M-ED	5m	
CEM-7M-ED	7m	
CEM-10M-ED	10m	

No.	Function	Color	
1	A+	Brown	
2	A-	Orange	
3	B+	White	
4	B-	Grey	
5	Z+	Blue	
6	Z-	Purple	
7	5VDC	Red	
8	5VDC GND	Black	
9	Frame GND	Shield	

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.