Ezi-STEP®

Micro Stepping System

- Micro Stepping
- Software Damping
- Run/Stop Signal Output

MINI

FASTECH

Fast, Accurate, Smooth Motion

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Ezi-STEP® MINI

Micro Stepping System

Ezi-STEP MINI Characteristics

Ezi-STEP MINI is a micro stepping system that incorporates a motor and DSP (Digital Signal Processor) equipped drive that is integrated seamlessly together as a system. This makes it possible to incorporate many functions compared with a conventional stepping motors and drives, such as sensorless detection of loss of synchronization, smooth control over the whole velocity range, higher torque operation and no vibration at the low speed range.

Ezi-STEP MINI's on-board high-performance digital signal processor and proprietary algorithms allow the Ezi-STEP MINI to operate a high speeds with unmatched precision. The unique position estimation algorithm instantaneously detects out-of-synchronization based on the rotor position of the stepping motor, which is not an easy task in a conventional stepping motor and drives. (effective only over 300 [rpm])

Utilizing a software damping and filtering algorithms, high speed operation is realized by the exciting angle control of a step-angle.

The resolution of Ezi-STEP MINI can be selected from basic 1.8° up to 0.0072° (1/250). In addition, Ezi-STEP MINI generates various signals including sensorless stall detection, alarm and running signal. Ezi-STEP MINI is an economical ideal drive for vision systems, nanotech, packaging, semiconductor, pick and place, automation, laboratory testing, wood working and wherever smooth, quiet, precise, high torque operation is a requirement.

1 Microstep and Filtering

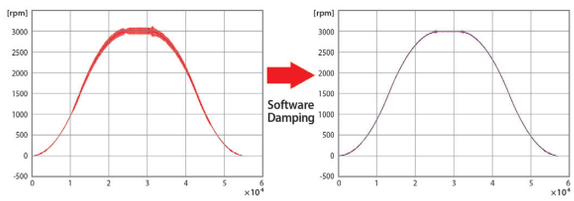
High precision Microstep function and Filtering

The high-performance DSP operates at step resolutions of 1.8° up to maximum 0.0072° (1/250 steps) and Ezi-STEP adjusts PWM control signal in every 25μsec, which makes it possible for more precise current control, resulting in high-precision Microstep operation.

2 Software Damping

Vibration suppression and high-speed operation

Vibration suppression and High-speed operation (Patent pending) Motor vibration is created by magnetic flux variations of the motor, lower current from the drive due to back-emf from the motor at high speeds and lowering of phase voltages from the drive.
Ezi-STEP drive detects these problems and the DSP adjusts the phase of the current according to the pole position of the motor, drastically suppressing vibration.
This allows the smooth operation of the motor at high speeds.



Software Damping OFF　　Software Damping ON

※ This is real measured speed that using 100,000 [pulse/rev] encoder.

3 Drive Output Signal Monitoring

Ezi-STEP MINI provides loss of step, run/stop, over-current, over-heat, over-voltage, power, and motor connection alarms that can be monitored by the controller and visible by a motor-mounted flashing LED indicator.

● Ezi-STEP MINI Part Numbering

Ezi-STEP-MI-20M-BK-□

- **Product Name**
- **Drive Series Type**
  - MI : Mini Type
- **Motor Flange Size**
  - 20 : 20mm
  - 28 : 28mm
  - 42 : 42mm
- **Motor Length**
  - S : Small
  - M : Medium
  - L : Large
  - XL : Extra Large
- **Brake**
  - Blank : Without Brake
  - BK : Brake
- **User Code**

● Standard Combination

Unit Part Number	Motor Model Number	Drive Model Number
Ezi-STEP-MI-20M	BM-20M	EzStep-MI-20M
Ezi-STEP-MI-20L	BM-20L	EzStep-MI-20L
Ezi-STEP-MI-28S	BM-28S	EzStep-MI-28S
Ezi-STEP-MI-28M	BM-28M	EzStep-MI-28M
Ezi-STEP-MI-28L	BM-28L	EzStep-MI-28L
Ezi-STEP-MI-42S	BM-42S	EzStep-MI-42S
Ezi-STEP-MI-42M	BM-42M	EzStep-MI-42M
Ezi-STEP-MI-42L	BM-42L	EzStep-MI-42L
Ezi-STEP-MI-42XL	BM-42XL	EzStep-MI-42XL

● Combination with Brake

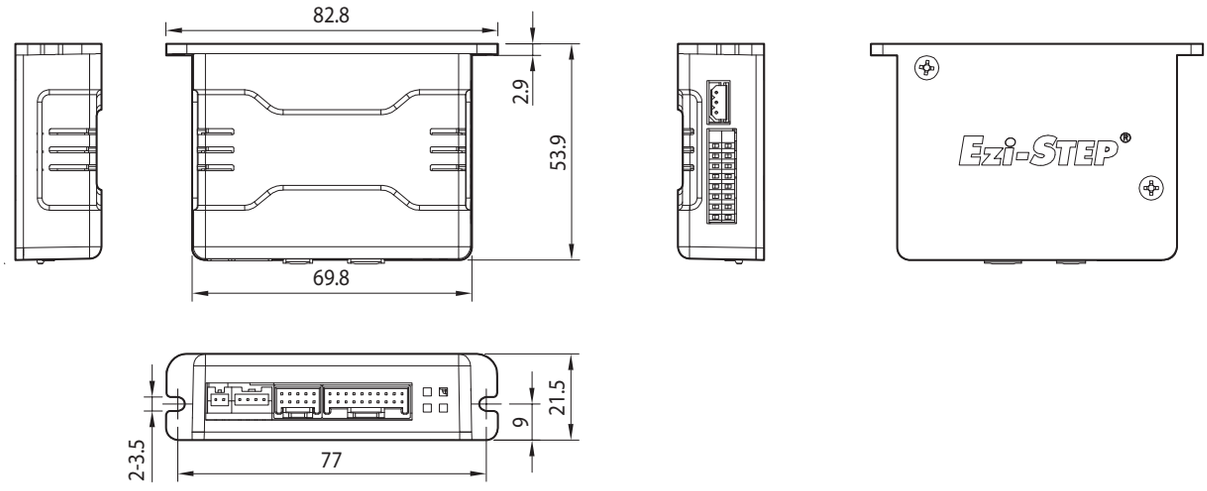
Unit Part Number	Motor Model Number	Drive Model Number
Ezi-STEP-MI-42S-BK	BM-42S-BK	EzStep-MI-42S
Ezi-STEP-MI-42M-BK	BM-42M-BK	EzStep-MI-42M
Ezi-STEP-MI-42L-BK	BM-42L-BK	EzStep-MI-42L
Ezi-STEP-MI-42XL-BK	BM-42XL-BK	EzStep-MI-42XL

Specifications of Drive

Motor Model		BM-20 series	BM-28 series	BM-42 series
Driver Model		EzStep-MI-20 series	EzStep-MI-28 series	EzStep-MI-42 series
Input Voltage		24VDC ±10%		
Control Method		Bipolar PWM drive with 32bit DSP		
Current Consumption		Max 500mA (Except motor current)		
Operating Condition	Ambient Temperature	· In Use: 0~50℃ · In Storage: -20~70℃		
	Humidity	· In Use: 35~85% RH (Non-Condensing) · In Storage: 10~90% RH (Non-Condensing)		
	Vib. Resist.	0.5g		
Function	Rotation Speed	0~3,000 [rpm] *1		
	Resolution [ppr]	500 1,000 1,600 2,000 3,200 3,600 4,000 5,000 6,400 8,000 10,000 20,000 25,000 36,000 40,000 50,000 * Default: 10,000		
	Maximum Frequency	500kHz (Duty 50%)		
	Protection Functions	Over Current Error, Over Speed Error, Step Out Error, Over Temperature Error, Over Regenerated Voltage Error, Motor Connect Error, Motor Voltage Error, System Error, ROM Error		
	LED Display	Power Status(Green), Alarm Status(Red), CW Rotation(Yellow), CCW Rotation(Orange)		
	STOP Current	10%~100% (Selectable with DIP Switch) Be setted to set value of STOP Current after 0.1 second after motor stop. * Default: 50%		
	Pulse Input Method	1 Pulse / 2 Pulse (Selectable with DIP Switch) * Default: 2 Pulse		
	Rotational Direction	CW/CCW (Selectable with DIP Switch) * Default: CW		
	Speed/Position Control Command	Pulse Train Input (Photocoupler Input)		
I/O Signal	Input Signals	Alarm Reset / Motor Free (Photocoupler Input)		
	Output Signals	Alarm, Run/Stop (Photocoupler Output)		

*1 : Up to the resolution of 10,000[ppr], maximum speed can be reached by 3,000[rpm] and with the resolution more than 10,000[ppr], maximum speed shall be reduced accordingly.

Dimensions of Drive [mm]

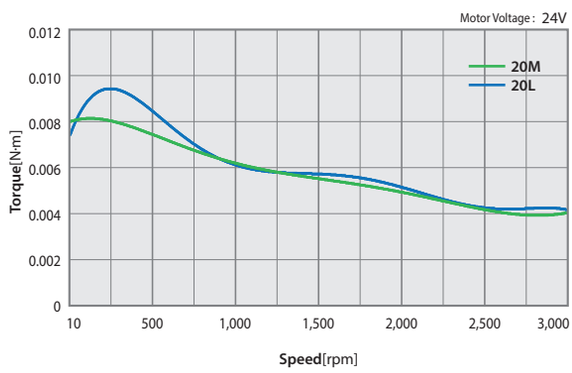


Specifications of Motor

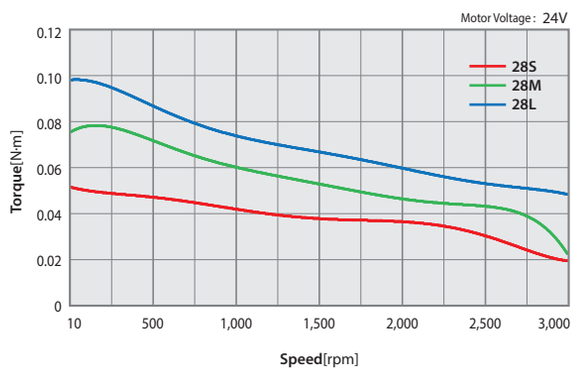
MODEL			BM-20 series		BM-28 series			BM-42 series			
		UNIT	20M	20L	28S	28M	28L	42S	42M	42L	42XL
DRIVE METHOD		-	BI-POLAR								
NUMBER OF PHASES		-	2	2	2	2	2	2	2	2	2
VOLTAGE		VDC	2.75	3.0	3.0	3.0	3.0	3.36	4.32	4.56	7.2
CURRENT per PHASE		A	0.5	0.5	0.95	0.95	0.95	1.2	1.2	1.2	1.2
RESISTANCE per PHASE		Ohm	5.5	6.0	3.2	3.2	3.2	2.8	3.6	3.8	6.0
INDUCTANCE per PHASE		mH	2.0	2.6	2.0	2.7	3.2	5.4	7.2	8.0	15.6
HOLDING TORQUE		N·m	0.016	0.025	0.069	0.098	0.118	0.32	0.44	0.5	0.65
ROTOR INERTIA		$g \cdot cm^2$	2.5	3.3	9.0	13	18	35	54	77	114
WEIGHTS		g	50	80	110	140	200	250	280	350	500
LENGTH(L)		mm	28	38	32	45	50	34	40	48	60
PERMISSIBLE OVERHUNG LOAD (DISTANCE FROM END OF SHAFT)	3mm	N	18	18	30	30	30	22	22	22	22
	8mm		30	30	38	38	38	26	26	26	26
	13mm		-	-	53	53	53	33	33	33	33
	18mm		-	-	-	-	-	46	46	46	46
PERMISSIBLE THRUST LOAD		N	Lower than motor weight								
INSULATION RESISTANCE		Mohm	100 MIN.(at 500VDC)								
INSULATION CLASS		-	CLASS B(130℃)								
OPERATING TEMPERATURE		℃	0 to 55								

Torque Characteristics of Motor

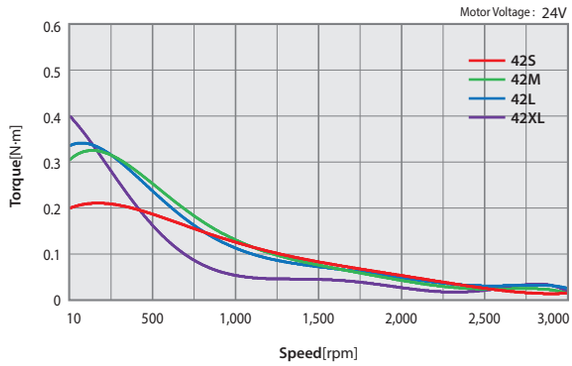
Ezi-STEP-MI-20 series



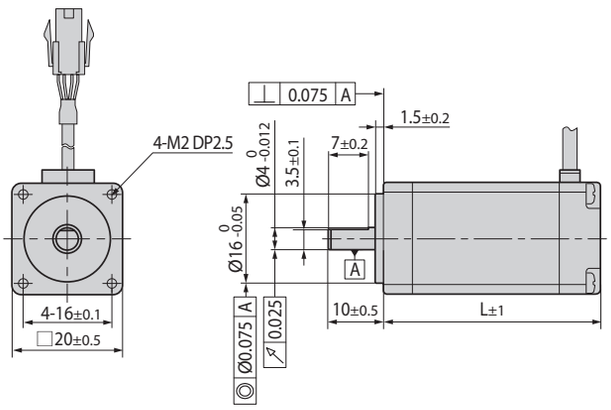
Ezi-STEP-MI-28 series



Ezi-STEP-MI-42 series

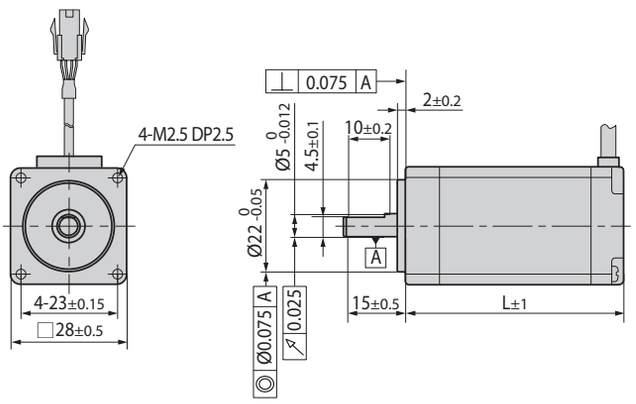


● Dimensions of Motor [mm]



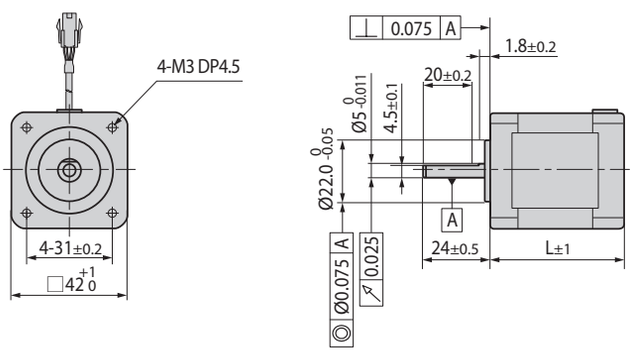
20mm

Model name	Length(L)
BM-20M	28
BM-20L	38



28mm

Model name	Length(L)
BM-28S	32
BM-28M	45
BM-28L	50



42mm

Model name	Length(L)
BM-42S	34
BM-42M	40
BM-42L	48
BM-42XL	60

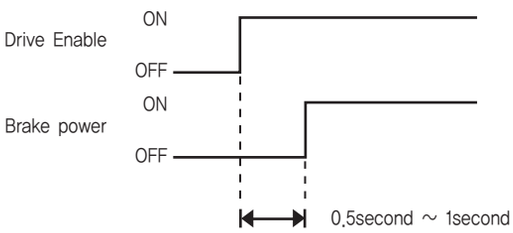
● Specifications of Motor with Brake

Unit Part Number	Motor Model Number	Electronic Brake					Motor Unit Weight [g]	Permitted Overhung Load [N]				Permitted Thrust Load [N]
		Type	Voltage Input [V]	Rated Current [A]	Power Consumption [W]	Statical Friction Torque [N·m]		Length from Motor Point [mm]				
								3	8	13	18	
Ezi-STEP-MI-42S-BK	BM-42S-BK	Non-excitation run Type	24VDC ±10%	0.2	5	0.2	440	22	26	33	46	Must be Lower than Unit's Weight
Ezi-STEP-MI-42M-BK	BM-42M-BK						510					
Ezi-STEP-MI-42L-BK	BM-42L-BK						580					
Ezi-STEP-MI-42XL-BK	BM-42XL-BK						700					

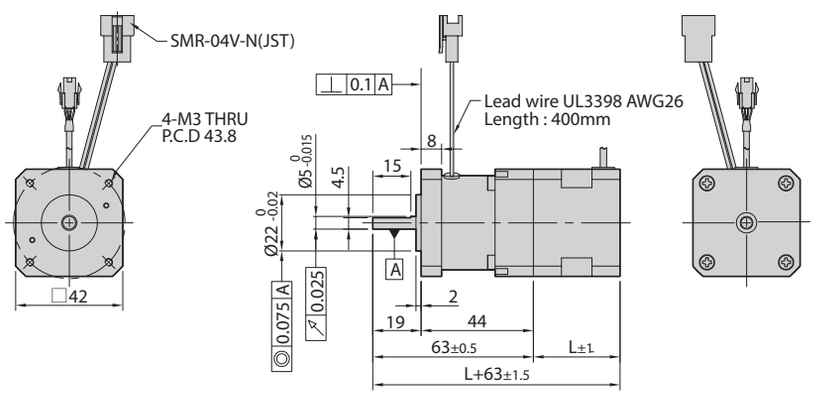
* Electronic Brake cannot be used for braking. Position hold purpose only when power OFF.
* The weight means Motor Unit Weight including Motor and Electronic Brake.
* Motor Model Number is combined model name of Motor and Brake.
* Motor specification and torque characteristic are same as Standard Motor.

* Brake Operation Timing Chart

Ezi-STEP MINI has no brake control function.
Brake must be controlled by the host controller.
Please refer to below Timing Chart when control Brake from upper controller.
Otherwise, drive malfunctioning and loads can be fall down.
Also, please do not operate Brake while motor operation to prevent damage.



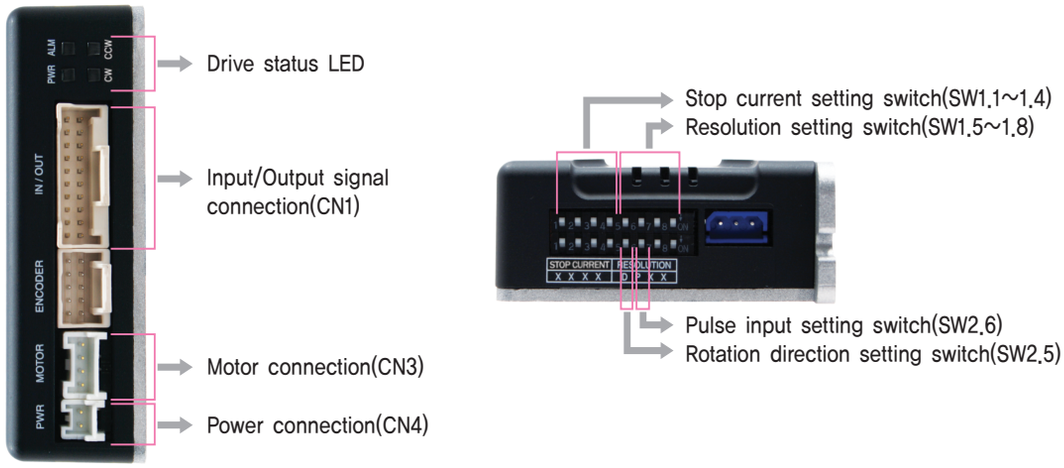
● Dimensions of Motor with Brake [mm]



42mm

Model Name	Length(L)	Weight(kg)
BM-42S	34	0.44
BM-42M	40	0.51
BM-42L	48	0.58
BM-42XL	60	0.70

● Settings and Operation

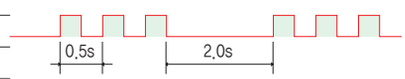


1. Drive Status LED

Indication	Color	Function	ON/OFF Condition
PWR	Green	Power Input Indication	Lights when power is ON Flashes when motor is Free status
ALM	Red	Alarm Indication	Flash when protection function is activated (Identifiable which protection mode is activated by counting the flash times)
CW	Yellow	Motor Rotation Direction	Lights when motor rotate CW direction
CCW	Orange	Motor Rotation Direction	Lights when motor rotate CCW direction

◆ Protection functions and LED flash times

Times	Protection	Conditions
1	Over Current Error	The current through power devices in drive exceeds the limit value*1
2	Over Speed Error	Motor speed exceeded 3,000 [rpm]
3	Step Out Error	Abnormally motor do not followed pulsed input
5	Over Temperature Error	Internal temperature of a motor drive exceeded 85℃
6	Over Regenerative Voltage Error	Back EMF more than 50V
7	Motor Connect Error	Power is ON without connection of motor cable to drive
9	Motor Voltage Error	Motor voltage is below 20V
11	System Error	Error occurs in drive system
12	ROM Error	Error occurs in Parameter storage Device(ROM)



Alarm LED flash
(Ex, Step Out Error)

*1 : Limit value depends on motor model (Refer to the Manual)

2. Stop Current Setting Switch(SW1.1~1.4)

Stop Current means the motor current value automatically set in 0.1 sec after motor stops. This is to prevent the overheat of a motor when the motor is under long time idling. The unit of the selection value is a percentage.

Switch Position				STOP Current (%)	Switch Position				STOP Current (%)
4	3	2	1		4	3	2	1	
ON	ON	ON	ON	10	OFF	ON	ON	ON	90
ON	ON	ON	OFF	20	OFF	ON	ON	OFF	100
ON	ON	OFF	ON	30	OFF	ON	OFF	ON	10
ON	ON	OFF	OFF	40	OFF	ON	OFF	OFF	10
ON	OFF	ON	ON	50*1	OFF	OFF	ON	ON	10
ON	OFF	ON	OFF	60	OFF	OFF	ON	OFF	10
ON	OFF	OFF	ON	70	OFF	OFF	OFF	ON	10
ON	OFF	OFF	OFF	80	OFF	OFF	OFF	OFF	10

*1 : Default : 50%

3. Resolution Setting Switch(SW1.5~1.8)

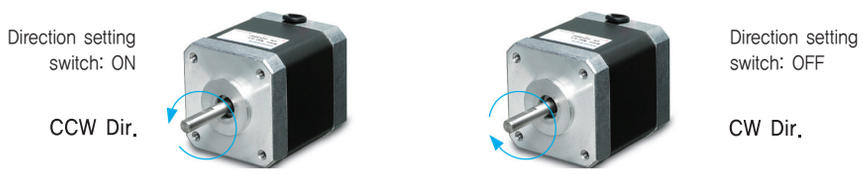
The Number of pulse per revolution.

Switch Position				Pulse/ Revolution	Switch Position				Pulse/ Revolution
8	7	6	5		8	7	6	5	
ON	ON	ON	ON	500	OFF	ON	ON	ON	6,400
ON	ON	ON	OFF	1,000	OFF	ON	ON	OFF	8,000
ON	ON	OFF	ON	1,600	OFF	ON	OFF	ON	10,000*1
ON	ON	OFF	OFF	2,000	OFF	ON	OFF	OFF	20,000
ON	OFF	ON	ON	3,200	OFF	OFF	ON	ON	25,000
ON	OFF	ON	OFF	3,600	OFF	OFF	ON	OFF	36,000
ON	OFF	OFF	ON	4,000	OFF	OFF	OFF	ON	40,000
ON	OFF	OFF	OFF	5,000	OFF	OFF	OFF	OFF	50,000

*1 : Default: 10,000

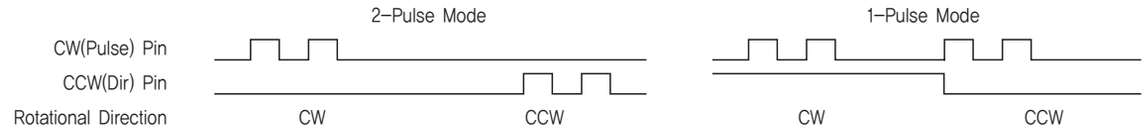
4. Rotational Direction Setting Switch(SW2.5)

Indication	Switch Name	Functions
D	Rotational Direction Select Switch	Based on CW(+Dir signal) input to driver. ON: CCW(−Direction) OFF: CW(+Direction) ※ Default: CW mode



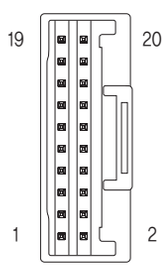
5. Pulse Input Setting Switch(SW2.6)

Indication	Switch Name	Functions
P	Pulse input mode Select Switch	Selectable 1−Pulse input mode or 2−Pulse input mode as Pulse input signal. ON: 1−Pulse mode OFF: 2−Pulse mode ※ Default: 2−Pulse mode



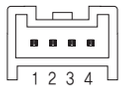
6. Signal Connector(CN1)

NO.	Function	I/O
1	CW+(Pulse+)	Input
2	CW−(Pulse−)	Input
3	CCW+(Dir+)	Input
4	CCW−(Dir−)	Input
11	ALARM	Output
12	RUN/STOP	Output
14	ALARM RESET	Input
19	EXT_GND	Input
20	EXT_24VDC	Input



7. Motor Connector(CN3)

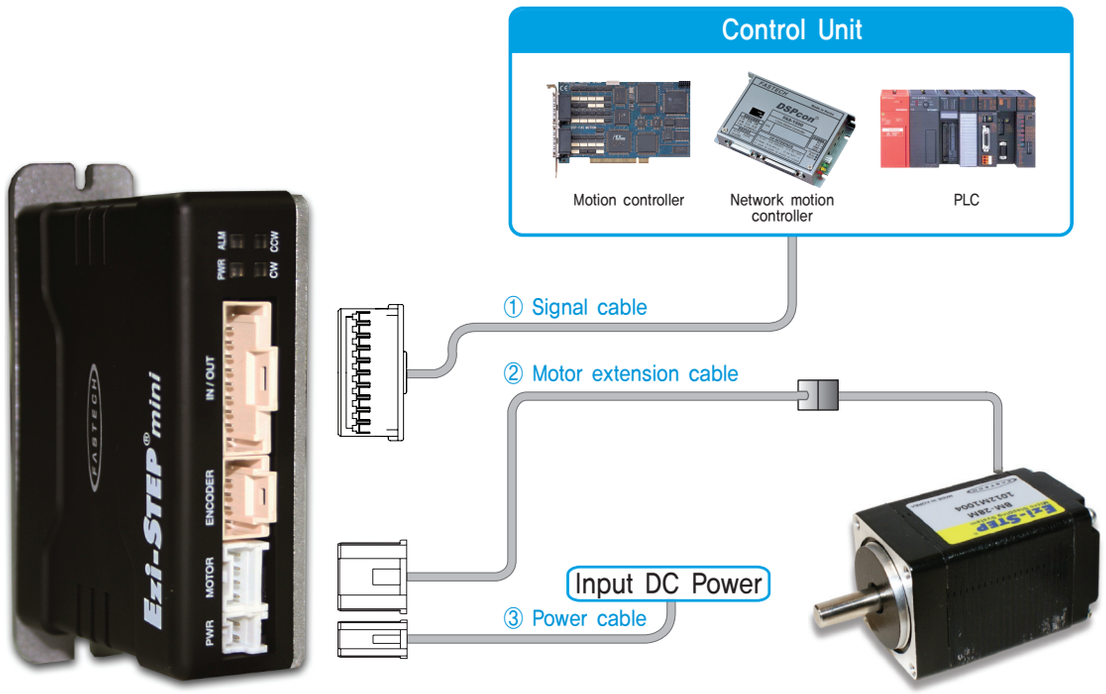
NO.	Function	I/O
1	B Phase	Output
2	/B Phase	Output
3	/A Phase	Output
4	A Phase	Output



8. Power Connector(CN4)

NO.	Function	I/O
1	24VDC	Input
2	GND	Input

System Configuration



Type	Signal Cable	Motor Cable	Power Cable
Length supplied	–	30cm	–
Max. Length	20m	20m	2m

1. Options

① Signal Cable

Available to connect between Input/Output Control System and Ezi-STEP MINI.

Item	Length [m]	Remark
CSVI-S-□□□F	□□□	Normal Cable
CSVI-S-□□□M	□□□	Robot Cable

□ is for Cable Length. The unit is 1m and Max. 20m length.

② Motor Extension Cable

Available to extended connection between motor and Ezi-STEP MINI.

Item	Length [m]	Remark
CMNB-M-□□□F	□□□	Normal Cable
CMNB-M-□□□M	□□□	Robot Cable

□ is for Cable Length. The unit is 1m and Max. 20m length.

③ Power Cable

Available to connect between Power and Ezi-STEP MINI.

Item	Length [m]	Remark
CMNB-P-□□□F	□□□	Normal Cable
CMNB-P-□□□M	□□□	Robot Cable

□ is for Cable Length. The unit is 1m and Max. 2m length.

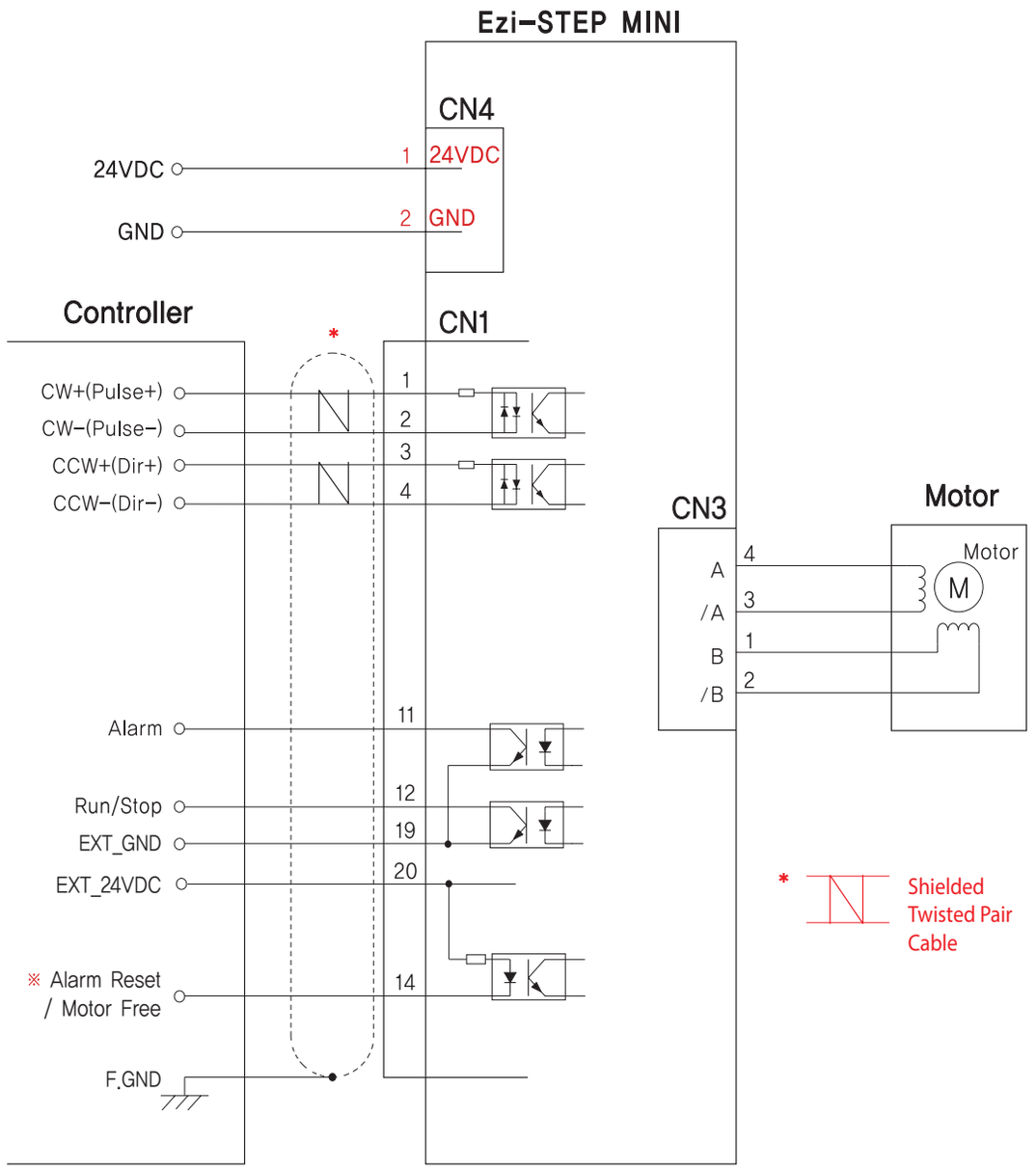
2. Connector Specifications

Connector specifications for cabling to drive.

Purpose		Item	Part Number	Manufacturer
Power (CN4)		Housing Terminal	PAP-02V-S SPHD-001T-P0.5	JST
Motor	Drive Side (CN3)	Housing Terminal	PAP-04V-S SPHD-001T-P0.5	JST
	Motor Side	Housing Terminal	5557-04R 5556T	MOLEX
Signal (CN1)		Housing Terminal	501648-1000(AWG 26~28)	MOLEX

※ Above connector is the most suitable product for the drive applied. Another equivalent connector can be used.

External Wiring Diagram



※ Alarm Reset signal line is also used for Motor Free signal.
(For details, please refer to Control Signal Input/Output Description)

※ When connects I/O cable between controller and drive, please turn off the power of both controller and drive, in order to protect the drive from any damage.

CAUTION

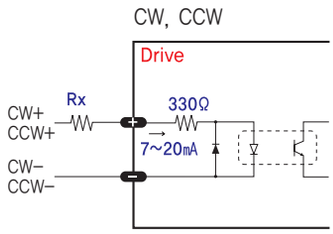
Please refer to the Manual when connects motor extension cable.

Careful connection will be required to protect the drive from any damages.

Control Signal Input/Output Description

1 Input Signal

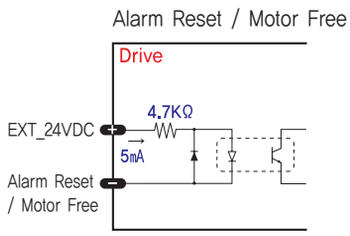
Input signals of the drive are all photocoupler protected. The signal shows the status of internal photocouplers [ON: conduction], [OFF: Non-conduction], not displaying the voltage levels of the signal.



Pin No.	Function
1	CW+
2	CW-
3	CCW+
4	CCW-

◆ CW, CCW Input

This signal can be used to receive a positioning pulse command from a user host motion controller. The user can select 1-pulse input mode or 2-pulse input mode. The input schematic of CW, CCW is designed for 5V TTL level. When using 5V level as an input signal, the resistor Rx is not used and connect to the driver directly. When the level of input signal is more than 5V, Rx resistor is required. If the resistor is absent, the drive will be damaged. If the input signal level is 12V, Rx value is 680ohm and 24V, Rx value is 1.8Kohm.



Pin No.	Function
14	Alarm Reset/ Motor Free
20	EXT_24VDC

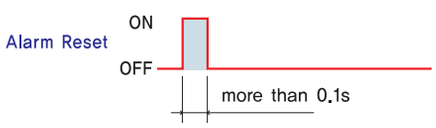
Alarm Reset signal line is also used for Motor Free signal.

◆ Motor Free Input

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 drive cuts off the power supply to the motor. Then, one can manually adjust output position. When setting the signal back to [OFF], the drive 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 operations set the signal [OFF] or disconnect a wire to the signal.

◆ Alarm Reset Input

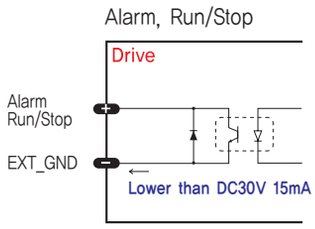
When a protection mode has been activated, a signal to this Alarm Reset input cancels the Alarm output. By setting the alarm reset input signal [ON], cancel Alarm output. Before cancel the Alarm output, have to remove the source of alarm.



[Caution] If Alarm Reset input signal still remains [ON], motor will be Free state. Keep in mind to change [ON]→[OFF] state.

2 Output Signal

As the output signal from the drive, there are the photocoupler outputs (Alarm, Run/Stop). The signal status operate as [ON : conduction], [OFF : Non-conduction] of photocoupler not as the voltage level of signal.



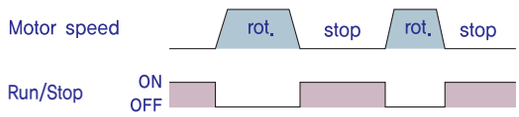
Pin No.	Function
11	Alarm
12	Run/Stop
19	EXT_GND

◆ Alarm Output

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

◆ Run/Stop Output

Run/Stop Output state is [ON] when motor positioning is completed. It operates reversely compare to Normal mode, when you set inverse mode.



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Fast, Accurate, Smooth Motion

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