

# Ezi-STEP<sup>®</sup>

## Micro Stepping System

- Micro Stepping
- Sensorless Stall Detection
- Software Damping
- Run / Stop Signal Output

# MINI



Fast, Accurate, Smooth Motion



*Fast, Accurate, Smooth Motion*

# **Ezi-STEP**<sup>®</sup> **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.)

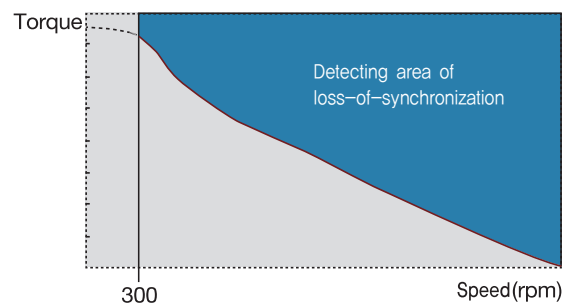
Utilizing a software damping and filtering algorithms, high speed operation is realized by the exciting angle control of a step-angle. The resolution of Ezi-STEP MINI can be selected from basic  $1.8^\circ$  up to  $0.0072^\circ$  (1/250). In addition, Ezi-STEP MINI generates various signals including 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 Sensorless Stall Detection

Detecting the loss-of-synchronization with on-board DSP (patent pending)

Ezi-STEP MINI can detect the loss-of-synchronization of a stepping motor without the addition of an external sensor. By monitoring the voltage, current, and back-emf signal, the on-board DSP estimates the current position of a rotor and enables it to detect the loss-of-synchronization (an impossible task for a conventional stepping motor drive), this allows for high-speed operation at 100% torque rating without loss-of-synchronization\*.

\*Effective only over 300 rpm



### 2 Microstep and Filtering

High precision Microstep function and Filtering (Patent pending)

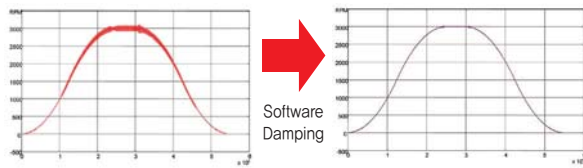
The high-performance DSP operates at step resolutions of  $1.8^\circ$  up to maximum  $0.0072^\circ$  (1/250 steps) and Ezi-STEP MINI adjusts PWM control signal in every  $25\mu$  sec, which makes it possible for more precise current control, resulting in high-precision Microstep operation.

### 3 Software Damping

Vibration suppression and high-speed operation (Patent pending)

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 MINI 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 100000[pulse/rev] encoder.

### 4 Drive Output Signal Monitoring

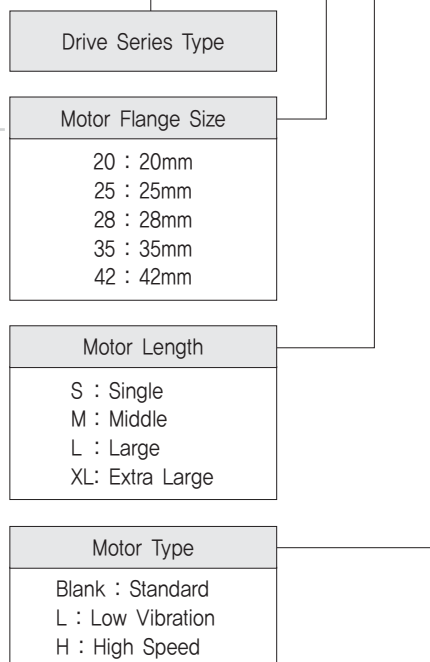
Ezi-STEP MINI provides loss of step, run/stop, over-current, over-heat, over-voltage, power, and motor connection alarms that can be monitored by the controller and visible by a motor-mounted flashing LED indicator.

### 5 Improvement of High-Speed Driving

Depending on the speed of a stepping motor, Ezi-STEP MINI automatically increases the supply voltage and prevents the torque lowering due to the low operating voltage to the motor caused by back-emf voltage, this enables high-speed operation. Additionally, the software damping algorithm minimizes the vibration and prevents the loss-of-synchronization at high-speed.

### ● Part Numbering

**Ezi-STEP-MI-20S-□**



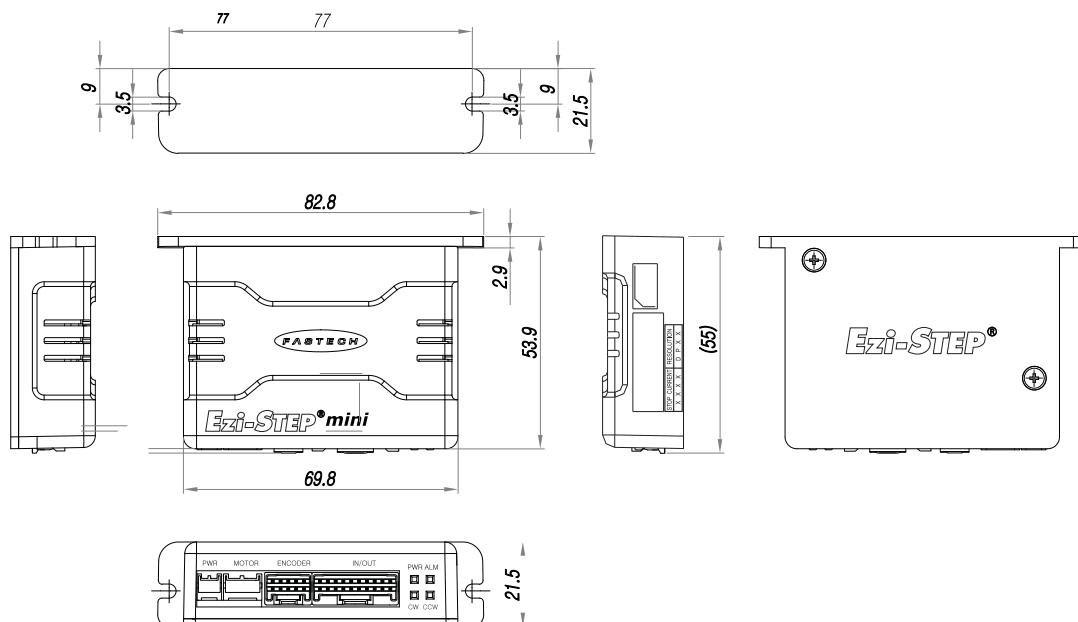
### ● Combination List

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-25S	BM-25S	EzStep-MI-25S
Ezi-STEP-MI-25M	BM-225M	EzStep-MI-25M
Ezi-STEP-MI-25L	BM-25L	EzStep-MI-25L
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-35S	BM-35S	EzStep-MI-35S
Ezi-STEP-MI-35M	BM-35M	EzStep-MI-35M
Ezi-STEP-MI-35L	BM-35L	EzStep-MI-35L
Ezi-STEP-MI-35XL	BM-35XL	EzStep-MI-35XL
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

## ● Drive Specifications

Motor Model	BM-20 series	BM-25 series	BM-28 series	BM-35 series	BM-42 series
Driver Model	EzStep-MI-20 series	EzStep-MI-25 series	EzStep-MI-28 series	EzStep-MI-35 series	EzStep-MI-42 series
Input Voltage	24VDC $\pm 10\%$				
Control Method	Closed loop control with 32bit DSP				
Current Consumption	Max : 500mA (Except motor current)				
Operating Condition	Ambient Temperature	In Use : 0~50°C In Storage : -20~70°C			
	Humidity	In Use : 35~85%RH (Non-Condensing) In Storage : 10~90%RH (Non-Condensing)			
	Vib. Resist.	0,5G			
Function	Rotation Speed	0~3,000rpm			
	Resolution (P/R)	500, 1000, 1600, 2000, 3200, 3600, 4000, 5000, 6400, 8000, 10000, 20000, 25000, 36000, 40000, 50000, *Default : 10,000			
	Max. Input Pulse Frequency	500KHz (Duty 50%)			
	Protection Functions	Over Current Error, Over Speed Error, Position Tracking Error, Over Load Error, Over Temperature Error, Over Regenerated Voltage Error, Motor Connect Error, Encoder Connect Error, Motor Voltage Error, Inposition Error, System Error, ROM Error, Input Voltage Error, Position Overflow Error			
	LED Display	Power, Alarm, CW Rotation, CCW Rotation			
	STOP Current	10%~100% (Set by 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			
I/O Signal	Input Signal	Alarm reset (Photocoupler input)			
	Output Signal	Alarm, Run/stop (Photocoupler)			

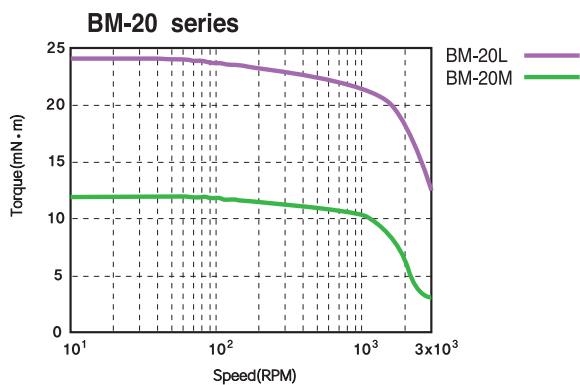
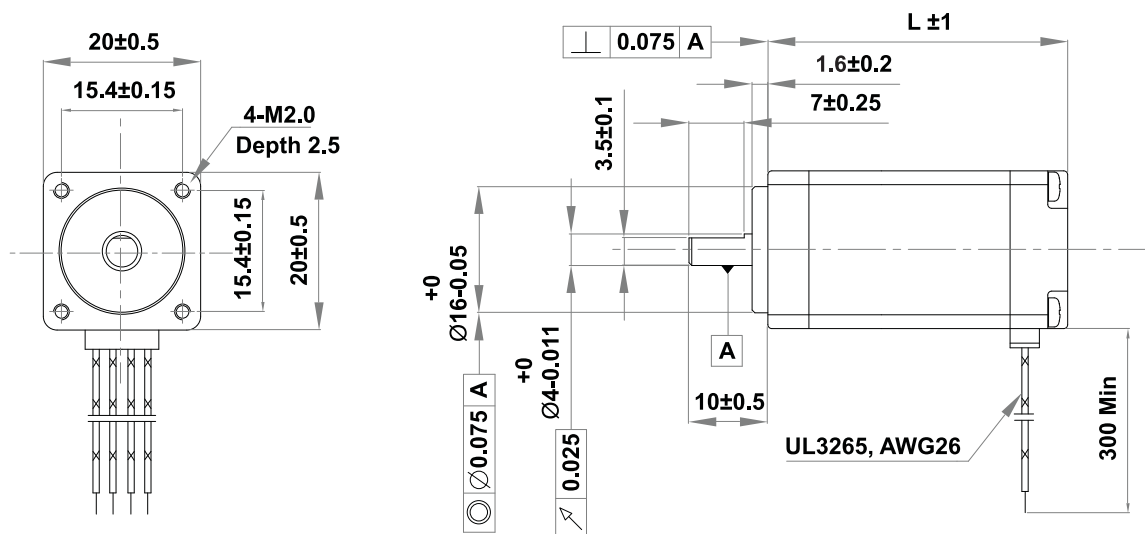
## ● Drive Size [mm]



## ● Motor Specifications

M O D E L		UNIT	BM-20M	BM-20L
DRIVE METHOD		----	BI-POLAR	BI-POLAR
NUMBER OF PHASES		----	2	2
VOLTAGE		VDC	2.9	3.25
CURRENT per PHASE		A	0.5	0.5
RESISTANCE per PHASE		Ohm	5.8	6.5
INDUCTANCE per PHASE		mH	2.5	5.0
HOLDING TORQUE		N · m	0.013	0.025
ROTOR INERTIA		g · cm <sup>2</sup>	2.5	5.0
WEIGHTS		g	50	80
LENGTH (L)		mm	28	38
ALLOWABLE OVERHUNG LOAD (DISTANCE FROM END OF SHAFT)	3mm	N	18	18
	8mm			
ALLOWABLE THRUST LOAD		N	Lower than motor weight	
INSULATION RESISTANCE		MOhm	100min. (at 500VDC)	
INSULATION CLASS		----	CLASS B (130°C)	
OPERATING TEMPERATURE		°C	0 to 55	

## ● Motor Dimension [mm] and Torque Characteristics



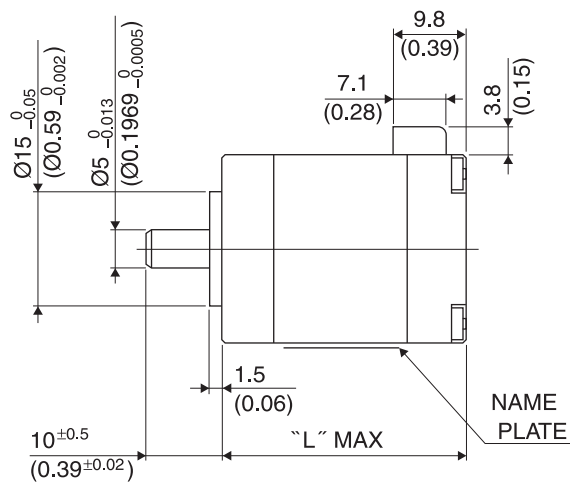
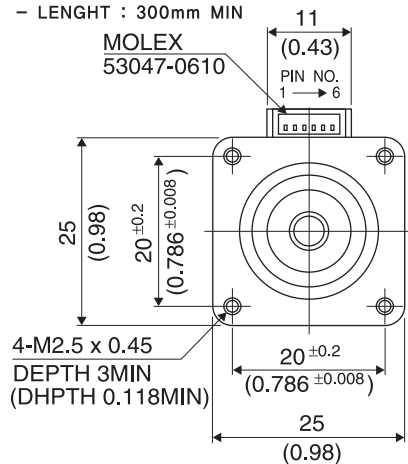
※ Measured Condition  
 Motor Voltage = 24VDC  
 Motor Current = Rated Current(Refer to Motor Specification)  
 Drive = Ezi-STEP MINI

## ● Motor Specifications

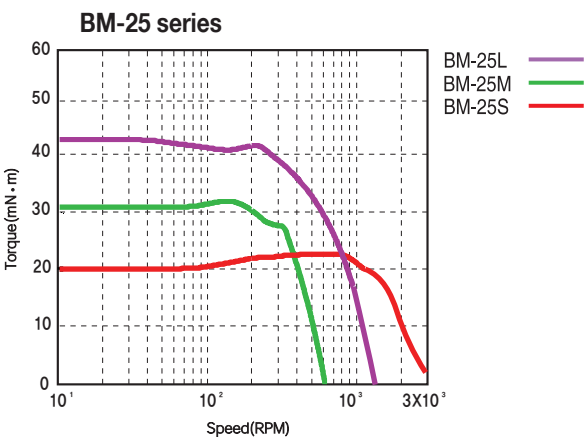
M O D E L		UNIT	BM-25S	BM-25M	BM-25L
DRIVE METHOD		----	BI-POLAR	BI-POLAR	BI-POLAR
NUMBER OF PHASES		----	2	2	2
VOLTAGE		VDC	2.66	9.87	3.654
CURRENT per PHASE		A	0.7	0.21	0.63
RESISTANCE per PHASE		Ohm	3.8	47	5.8
INDUCTANCE per PHASE		mH	2.0	30	5.4
HOLDING TORQUE		N · m	0.033	0.049	0.062
ROTOR INERTIA		g · cm <sup>2</sup>	2	3	7
WEIGHTS		g	55	70	90
LENGTH (L)		mm	23.5	27.5	33
ALLOWABLE OVERHUNG LOAD (DISTANCE FROM END OF SHAFT)	3mm	N	30	30	30
	8mm		38	38	38
ALLOWABLE THRUST LOAD		N	Lower than motor weight		
INSULATION RESISTANCE		MOhm	100min. (at 500VDC)		
INSULATION CLASS		----	CLASS B (130°C)		
OPERATING TEMPERATURE		°C	0 to 55		

## ● Motor Dimension [mm] and Torque Characteristics

- LEAD WIRE
  - HOUSING : 51021-0600
  - PIN : 50079-8000
  - LENGHT : 300mm MIN



FASTECH Ezi-STEP MINI



※ Measured Condition

Motor Voltage = 24VDC

Motor Current = Rated Current (Refer to Motor Specification)

Drive = Ezi-STEP MINI

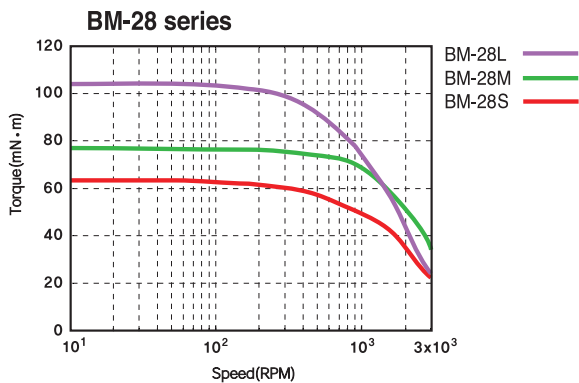
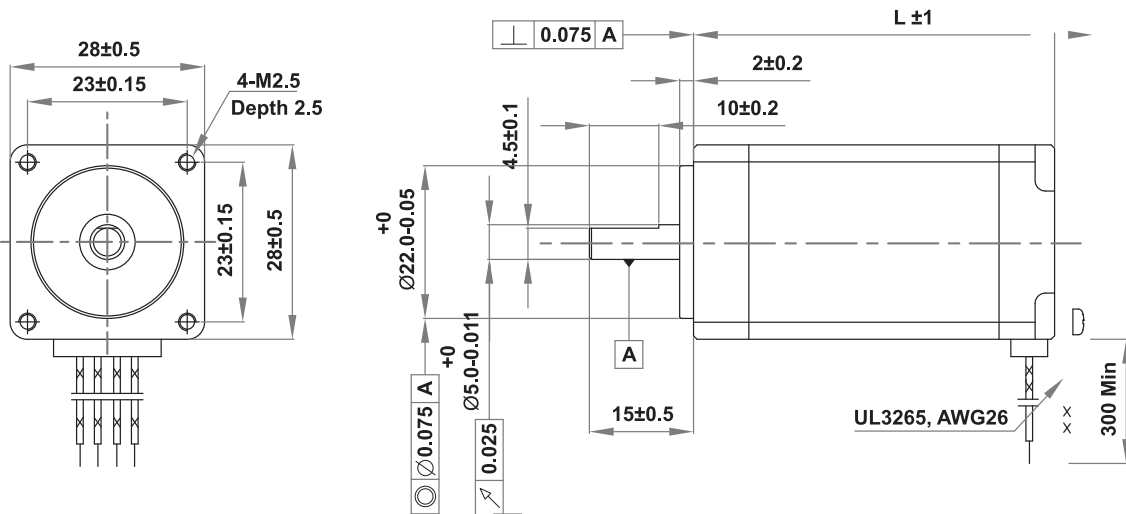


## ● Motor Specifications

M O D E L		UNIT	BM-28S	BM-28M	BM-28L
DRIVE METHOD		----	BI-POLAR	BI-POLAR	BI-POLAR
NUMBER OF PHASES		----	2	2	2
VOLTAGE		VDC	3.04	3.04	3.42
CURRENT per PHASE		A	0.95	0.95	0.95
RESISTANCE per PHASE		Ohm	3.2	3.2	3.6
INDUCTANCE per PHASE		mH	2.0	5.0	5.8
HOLDING TORQUE		N · m	0.065	0.08	0.11
ROTOR INERTIA		g · cm <sup>2</sup>	9	13	18
WEIGHTS		g	110	140	200
LENGTH (L)		mm	32	45	52
ALLOWABLE OVERHUNG LOAD (DISTANCE FROM END OF SHAFT)	3mm	N	30	30	30
	8mm		38	38	38
	13mm		53	53	53
	18mm		84	84	84
ALLOWABLE THRUST LOAD		N	Lower than motor weight		
INSULATION RESISTANCE		MOhm	100min. (at 500VDC)		
INSULATION CLASS		----	CLASS B (130°C)		
OPERATING TEMPERATURE		°C	0 to 55		

## ● Motor Dimension [mm] and Torque Characteristics

FASTECH Ezi-STEP MINI



※ Measured Condition  
 Motor Voltage = 24VDC  
 Motor Current = Rated Current (Refer to Motor Specification)  
 Drive = Ezi-STEP MINI

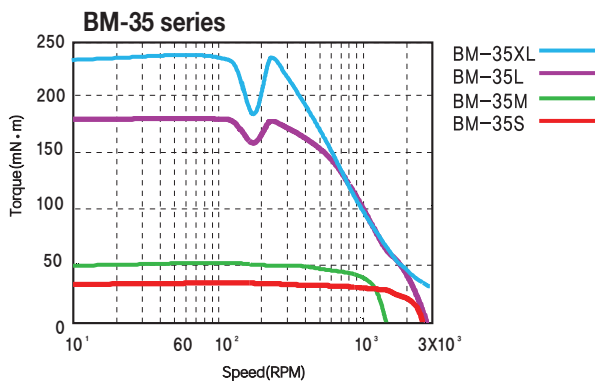
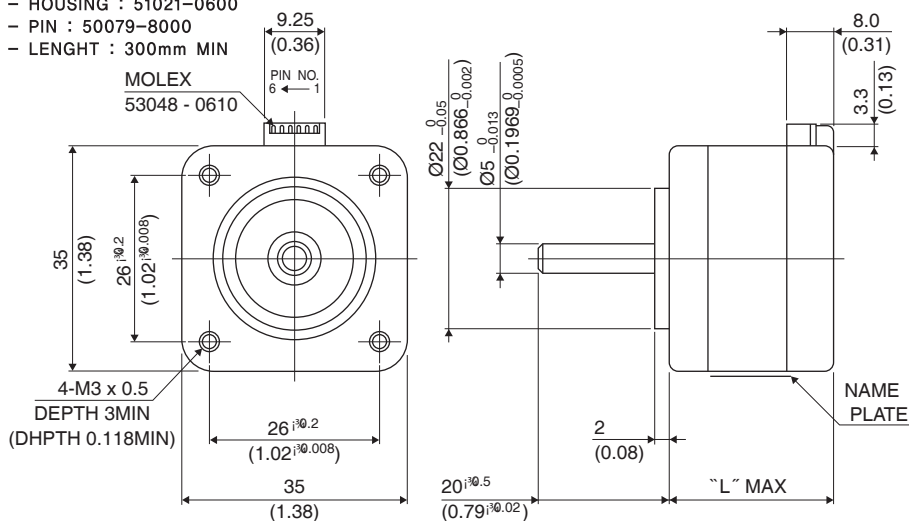


## ● Motor Specifications

M O D E L		UNIT	BM-35S	BM-35M	BM-35L	BM-35XL
DRIVE METHOD		----	BI-POLAR	BI-POLAR	BI-POLAR	BI-POLAR
NUMBER OF PHASES		----	2	2	2	2
VOLTAGE		VDC	2.28	2.88	4.59	5.39
CURRENT per PHASE		A	0.6	0.6	0.85	0.7
RESISTANCE per PHASE		Ohm	3.8	4.8	5.4	7.7
INDUCTANCE per PHASE		mH	3.2	6.1	6.5	8.4
HOLDING TORQUE		N · m	0.034	0.050	0.176	0.225
ROTOR INERTIA		g · cm <sup>2</sup>	5	8	11	32
WEIGHTS		g	105	120	200	300
LENGTH (L)		mm	22	26	38	535
ALLOWABLE OVERHUNG LOAD (DISTANCE FROM END OF SHAFT)	3mm	N	22	22	22	22
	8mm		26	26	26	26
	13mm		33	33	33	33
	18mm		46	46	46	46
ALLOWABLE THRUST LOAD		N	Lower than motor weight			
INSULATION RESISTANCE		MOhm	100min, (at 500VDC)			
INSULATION CLASS		----	CLASS B (130°C)			
OPERATING TEMPERATURE		°C	0 to 55			

## ● Motor Dimension [mm] and Torque Characteristics

- LEAD WIRE
- HOUSING : 51021-0600
- PIN : 50079-8000
- LENGHT : 300mm MIN



※ Measured Condition

Motor Voltage = 24VDC

Motor Current = Rated Current(Refer to Motor Specification)

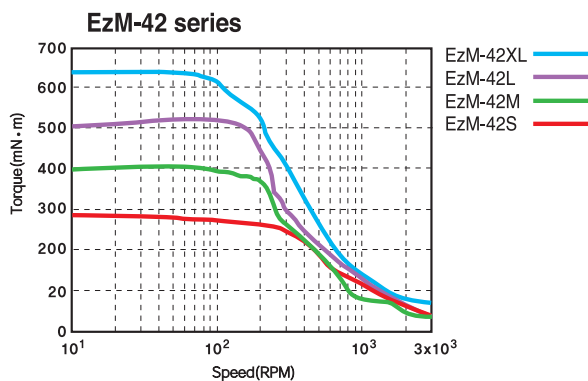
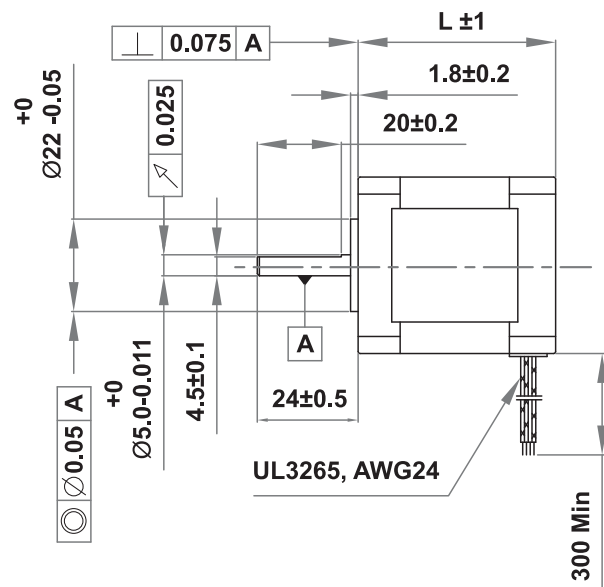
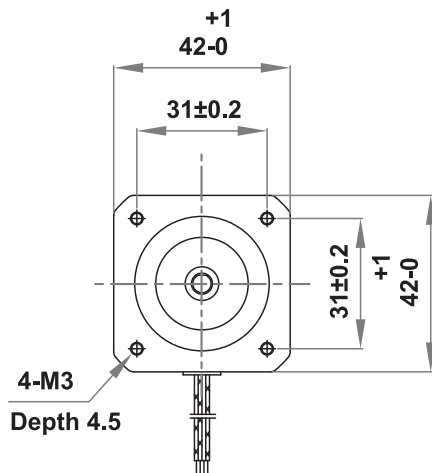
Drive = Ezi-STEP MINI

## ● Motor Specifications

M O D E L	UNIT	EzM-42S-A	EzM-42M-A	EzM-42L-A	EzM-42XL-A	
		EzM-42S-B	EzM-42M-B	EzM-42L-B	EzM-42XL-B	
		EzM-42S-C	EzM-42M-C	EzM-42L-C	EzM-42XL-C	
DRIVE METHOD	----	BI-POLAR	BI-POLAR	BI-POLAR	BI-POLAR	
NUMBER OF PHASES	----	2	2	2	2	
VOLTAGE	VDC	3,36	4,32	4,56	7,2	
CURRENT per PHASE	A	1,2	1,2	1,2	1,2	
RESISTANCE per PHASE	Ohm	2,8	3,6	3,8	6,0	
INDUCTANCE per PHASE	mH	2,5	7,2	8,0	15,6	
HOLDING TORQUE	N · m	0,32	0,44	0,5	0,65	
ROTOR INERTIA	g · cm <sup>2</sup>	35	54	77	114	
WEIGHTS	g	220	280	350	500	
LENGTH (L)	mm	33	39	47	59	
ALLOWABLE OVERHUNG LOAD (DISTANCE FROM END OF SHAFT)	3mm	N	22	22	22	22
	8mm		26	26	26	26
	13mm		33	33	33	33
	18mm		46	46	46	46
ALLOWABLE THRUST LOAD	N	Lower than motor weight				
INSULATION RESISTANCE	MOhm	100min. (at 500VDC)				
INSULATION CLASS	----	CLASS B (130°C)				
OPERATING TEMPERATURE	°C	0 to 55				

## ● Motor Dimension [mm] and Torque Characteristics

FASTECH Ezi-STEP MINI



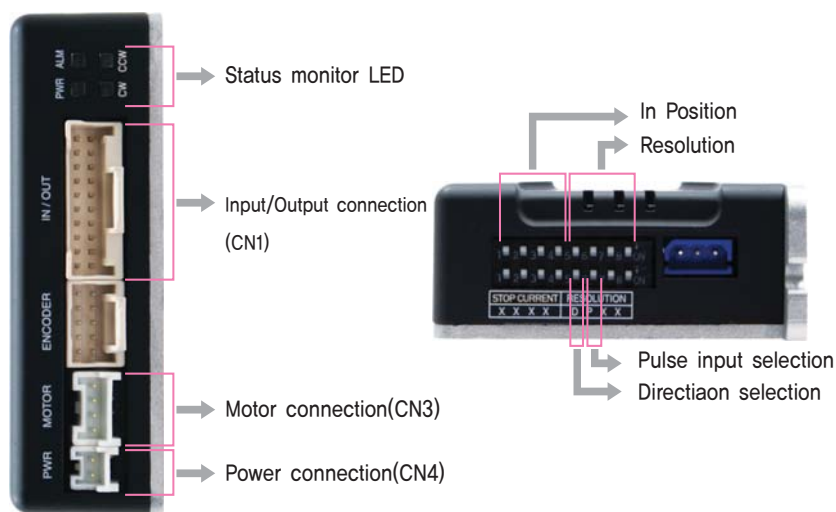
※ Measured Condition

Motor Voltage = 24VDC

Motor Current = Rated Current (Refer to Motor Specification)

Drive = Ezi-STEP MINI

## ● Setting and Operating

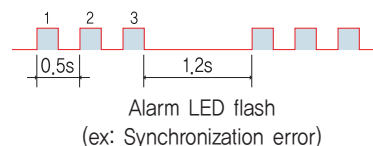


### 1. Status Monitor LED

Indication	Color	Function	Flash 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	Excessive current flowed into a motor
2	Over Speed Error	Motor speed exceeded 3000 rpm
3	Step Out Error	Abnormally motor do not followed pulsed input
5	Over Temperature Error	Internal temperature of a motor drive exceeded 55°C
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)
14	Input voltage Error	Power source voltage is out of limited value [20V~28V]



### 2. Stop Current Selection

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(SW1)				STOP Current(%)	Switch Position(SW1)				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	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

### 3. Resolution Selection Switch

The number of pulse per revolution.

Switch Position(SW1)				Pulse/ Revolution	Switch Position(SW1)				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
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

※The default factory setting is 10,000

### 4. Rotational Direction Selection Switch

Indication	Switch Name	Functions
DIR	Rotational Direction Select Switch	Based on CW(+Dir signal) input to drive. ON : CCW(-Direction) OFF : CW(-Direction) ※The default factory setting is CW(clockwise).

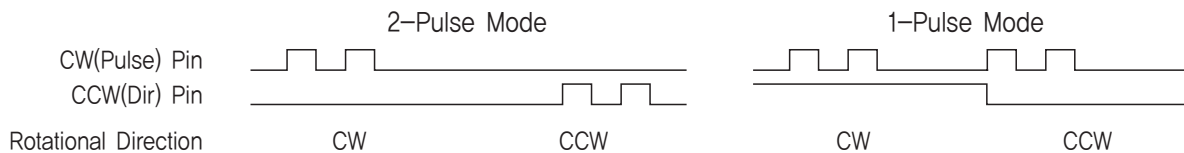
Direction selection switch :  
1  
CCW Dir.



Direction selection switch :  
0  
CW Dir.

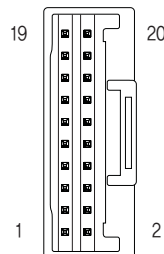
### 5. Pulse Input Selection Switch

Indication	Switch Name	Functions
1P/2P	Pulse input mode Select Switch	Selectable 1-Pulse input mode of 2-Pulse input mode as pulse input signal. ON : 1-Pulse mode OFF : 2-Pulse mode ※The default factory setting is 2-Pulse mode



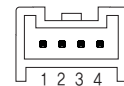
### 6. Signal Connector(CN1)

NO.	Function	Input/Output
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	24VDC GND	Input
20	24VDC	Input



### 7. Motor Connector(CN3)

NO.	Function
1	B
2	/B
3	/A
4	A



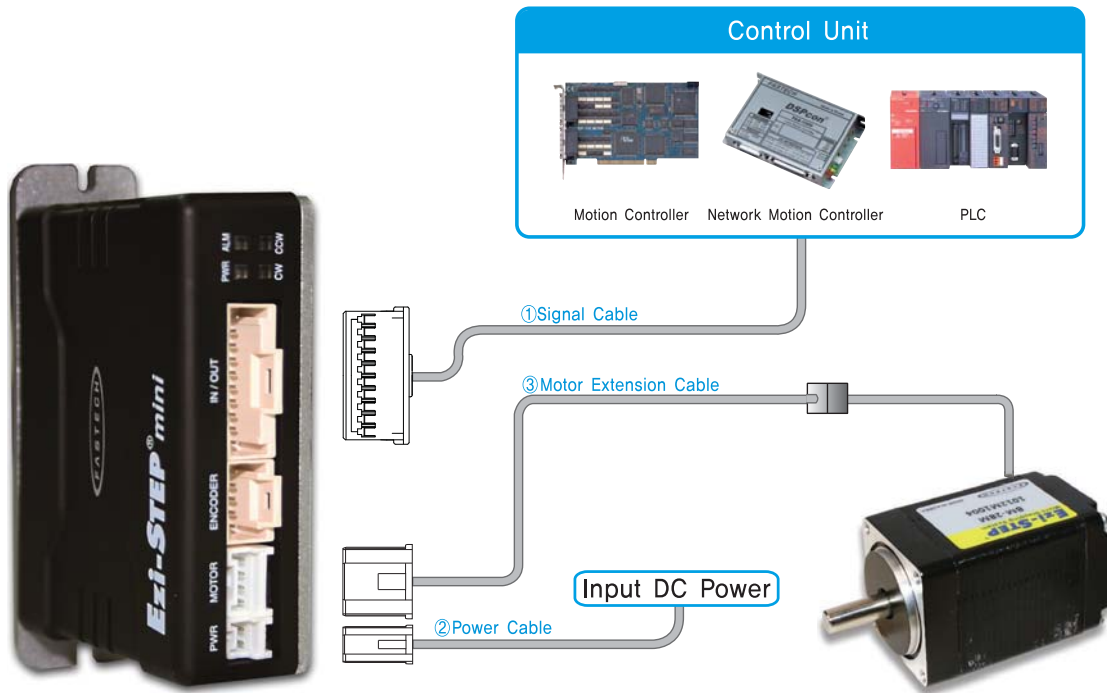
### 8. Power Connector(CN4)

NO.	Function
1	24VDC ±10%
2	GND





# ● System Configuration



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

## 1. Cable Option

### ① Signal Cable

Available to connect between 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.

### ③ 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.

### ② Power Cable

Available to connect between Power and Ezi-STEP MINI.

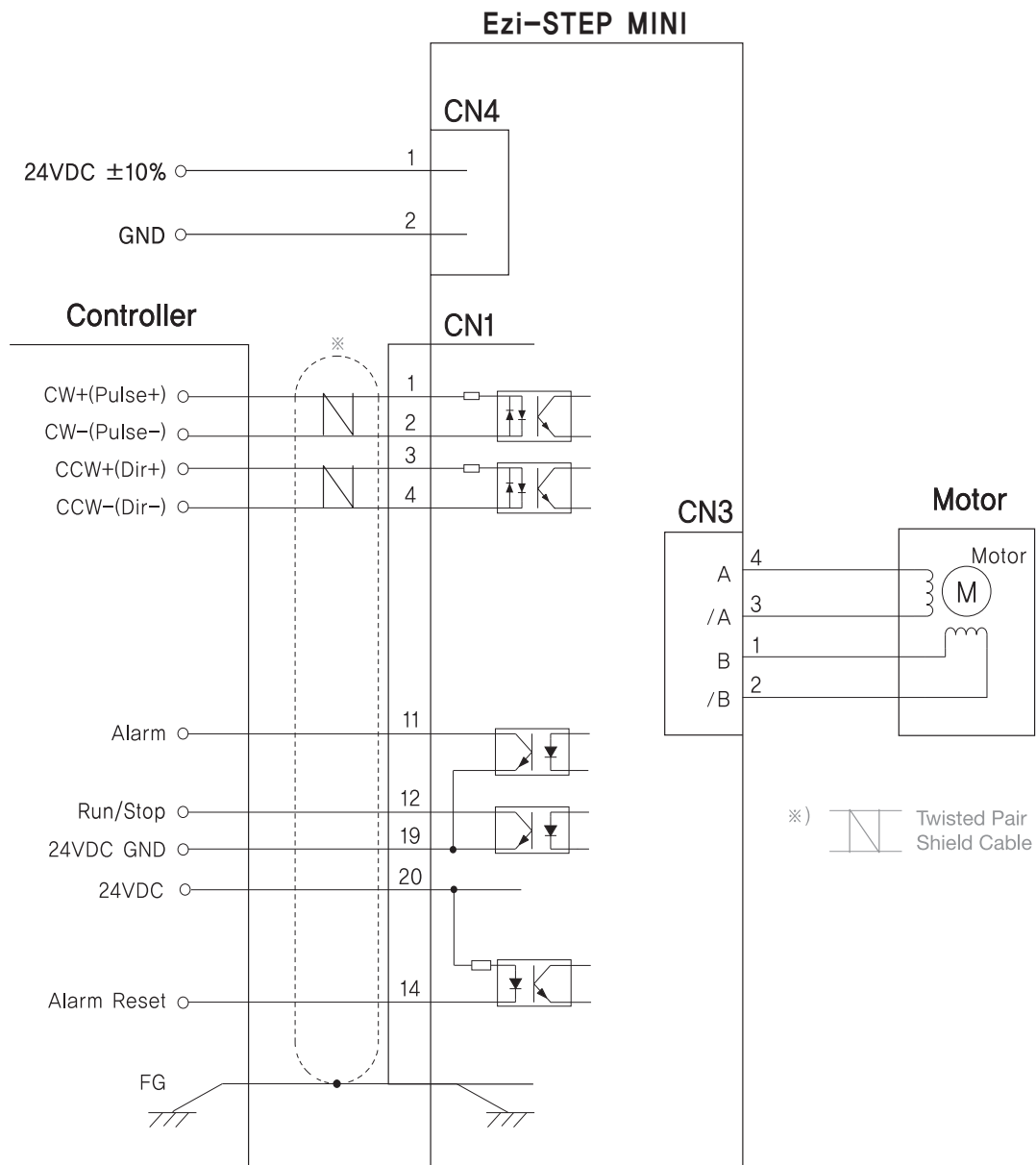
Item	Length[m]	Remark
CMNB-P-□□□F	□□□	Normal Cable
CMNB-P-□□□M	□□□	Robot Cable

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

## ● Connector for Cabling

ITEM		Specification	Marker
	Signal Connector (CN1)	Housing	501646-2000
		Terminal	501648-1000(AWG 26~28)
		Connector	10120-3000VE
		Backshell	10320-52AO-008
Motor	Motor Connector (CN3)	Housing	PAP-04V-S
		Terminal	SPHD-001T-P0,5
	Motor Side	Housing	5557-04R
		Terminal	5556T
Power Connector (CN4)	Housing	PAP-02V-S	
	Terminal	SPHD-001T-P0,5	

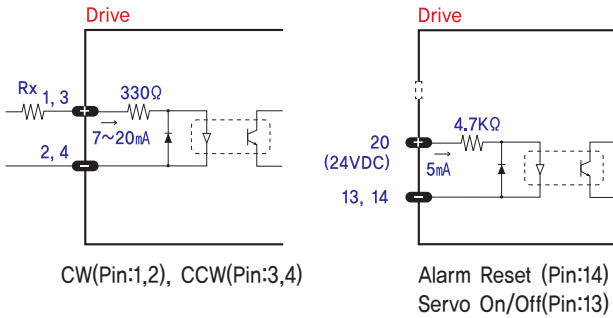
## ● External Wiring Diagram



# 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.



### ◆ CW, CCW Input

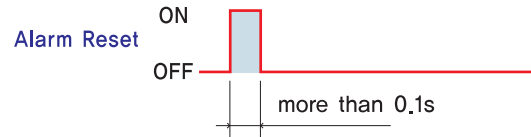
This signal can be used to receive a positioning pulse command from a user host motion controller. The user can select 1-pulse input mode or 2-pulse input mode (refer to switch No.1, SW1). The input schematic of CW, CCW is designed for 5V TTL level. When using 5V level as an input signal, the resistor 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.

### ◆ Servo On/Off 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 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 to the motor and recovers the holding torque. When driving a motor, one needs to set the signal [OFF].

### ◆ Alarm Reset Input

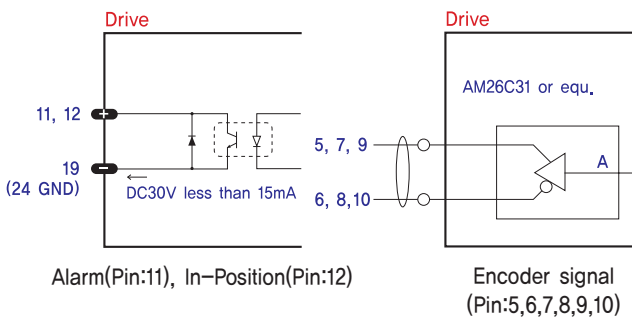
When a protection mode has been activated, a signal to this alarm reset input cancels the Alarm output.



※ By setting the alarm reset input signal [ON], cancel the Alarm output. Before cancel the Alarm output, have to remove the source of alarm.

## 2 Output Signal

Output signals from the driver are photocoupler protected: 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.



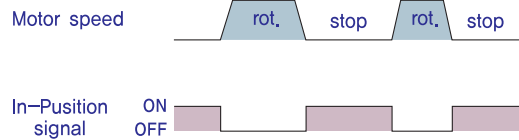
### ◆ Alarm Output

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 this signal and stop sending a motor driving command. When the driver detects an abnormal operation such as overload or over current of the motor, it sets the Alarm output to [OFF], flashes the Alarm LED, disconnect the power to a motor and stops the motor simultaneously.

[Caution] Only at the Alarm output port, the photocoupler isolation is in reverse. When the driver is in normal operation the Alarm output is [ON]. On the contrary when the driver is in abnormal operation that start protection mode, the Alarm output is [OFF].

### ◆ In-Position Output

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



### ◆ Encoder Signal Output

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



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