

Operating Manual

# **Ezi-STEP**®

Step Motors with Integrated Drive



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## ※ Before operating ※

- Thank you for purchasing Ezi-STEP. Ezi-STEP is an all-in-one Unit. For high-speed and high-precision drive of a stepping motor, Ezi-STEP is a unique drive that adopts a new control scheme owing to an on-board high-performance 32bit digital signal processor.
- This manual describes handling, maintenance, repair, diagnosis and troubleshooting of Ezi-STEP.
- Before operating Ezi-STEP, 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 Ezi-STEP.
- ☞ 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 Ezi-STEP, thoroughly read the manual and fully understand the contents.  
Before operating the Ezi-STEP, understand the mechanical characteristics of the Ezi-STEP and related safety information and precautions.
- ☞ After reading the manual, keep the manual near the Ezi-STEP so that any user can read the manual whenever needed.
- ☞ This manual divides safety precautions into "Warning" and "Attention".




#### Attention

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



#### Warning

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  **Attention**, a serious result could be caused depending on the situation. Follow safety precautions.

## ◆ Check the Status of the Ezi-STEP.



Attention

- ⚠ **Do not install a damaged Ezi-STEP or a Ezi-STEP with a missing part.**  
Otherwise, the user may get injured.

## ◆ Install.



Attention

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

## ◆ Connect Cables.



Attention

- ⚠ **Before connecting cables, check if input power is off.**  
Otherwise, an electric shock or a fire may occur.
- ⚠ **All parameters of the Ezi-STEP 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 Ezi-STEP is insulated from the ground of the internal circuit by the condenser. Ground the Ezi-STEP.**  
Otherwise, an electric shock or a fire may occur.

## ◆ Check and Repair.



Warning

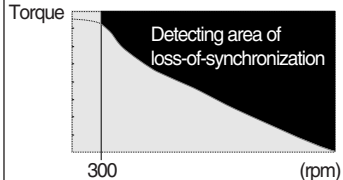
- ⚠ **Stop supplying power to the main circuit and wait for a while before checking or repairing the Ezi-STEP.**  
Electricity remaining in the capacitor may cause danger.
- ⚠ **Do not change cabling while power is being supplied.**  
Otherwise, the user may get injured or the step drive may get damaged.
- ⚠ **Do not reconstruct the Ezi-STEP.**  
Otherwise, an electric shock may occur or the user may get injured.

## 2. Main Characteristics

### 1 Step-Out Detection(patent pending)

Ezi-STEP can detect the loss-of-synchronization of a stepping motor without the addition of an external sensor. By monitoring the voltage, the current, and the back-emf signal, the on-board DSP estimates the current position of a rotor and enables to detect the loss-of-synchronization (so far seemingly impossible task in a conventional stepping motor drive), in turn realizing operation in high-speed region without worrying about loss-of-synchronization\*.

\* effective only over 300 rpm



### 2 Microstep and Filtering(patent pending)

High Precision microstep function and Filtering (Patent pending)

The high-performance DSP resolves the basic resolution of  $1.8^\circ$  up to maximum  $0.0072^\circ$  (1/250 steps). Contrary to a conventional drive, Ezi-STEP adjusts PWM control signal in every 25 usec, which makes it possible to more precise current control and realizes a high-precision microstep operation.

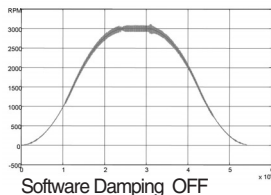
### 3 Software Damping(patent pending)

Vibration suppression and High-speed operation (Patent pending)

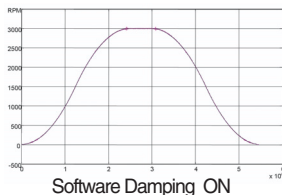
Ideally the applied currents to a stepping motor are a precise sinusoidal waves. But in practice the magnetic flux nonlinearity of the motor, the lowering of current due to the increase of back emf at high-speed and the lowering of the phase voltage are the sources of motor vibration.

For these practice Ezi-STEP detects these nonlinearity with DSP and adjusts the phase of the current according to the pole position of the motor, drastically suppressing vibration. As reducing the vibration of the motor, it is possible to operate in high-speed regime.

\* This is real measured speed that using 100000[pulse/rev]encoder.



Software Damping



## 4 Drive Output Signal Monitoring

Besides alarming loss-of-synchronization, there are various warning signals depending on the alarm issued. Also, Ezi-STEP provides an easy interface to communicate with an upper controller by issuing RUN/STOP signal.

(The type of alarm issued can be identified by LED indicator)

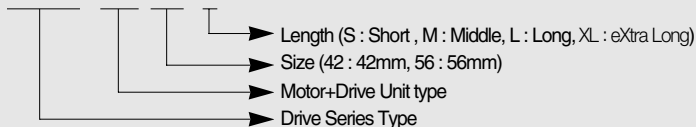
## 5 Improve of High-Speed Driving

Depending on the speed of a stepping motor, Ezi-STEP automatically increases the supply voltage and prevents the torque lowering due to the low effective operating voltage on a motor from the back emf voltage, in turn enabling a high-speed operation. Also, the software damping algorithm minimizes the vibration and prevents the loss-of-synchronization at high-speed.

## 3. Model Naming

### ■ Part Numbering

**EzStep - BT - 42 - S**



## 4. Specifications

### 4.1 Drive Specifications

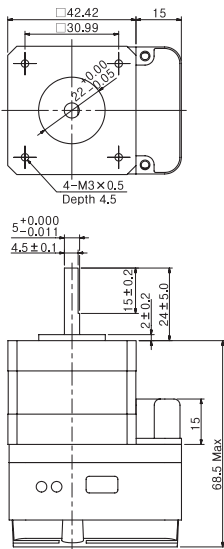
Type		EzStep-BT-42-S/M/L	EzStep-BT-56-S/M/L/XL
Drive Method		Bipolar PWM drive with 32bit DSP	
Input Voltage		24 VDC $\pm$ 10%	
Condition	Temp.	Operate	0 ~ +50℃
		Reserve	-20 ~ +70 ℃
	Humidity	Operate	35~85% RH (Non condensing)
		Reserve	10~90% RH (Non condensing)
	Vib. Resist.	0.5G	
Function	Resolution(P/R)	500, 1000, 1600, 2000, 3200, 3600, 4000, 5000, 6400, 8000, 10000, 20000, 25000,36000, 40000, 50000 (Set by RS232C Communication) *Default : 10000	
	Max. Frequency	500 KHz (Duty 50%)	
	Alarm Function	Step-Out, Over-Current, Over-Heat, Over-Voltage, Power, Motor Connection	
	LED Display	Power Status(Green), Alarm Status(Red)	
	STOP Current	10% ~ 100% (Set by RS-232C Communication) Be setted to set value of STOP current after 0.1 second after motor stop. *Default : 50%	
	Pulse Input Method	1 Pulse / 2 Pulse (Set by RS-232C Communication) 1 Pulse: Pulse / Direction, 2 Pulse: CW / CCW *Default : 2 Pulse	
	Rotational Dir.	CW / CCW (Set by RS232C Communication) Used when changing the direction of motor rotate. *Default : CW	
	Speed/Position Command	Pulse train input (Photocoupler Input)	
I/O	Input Signals	Photocoupler Input : Motor Free/Alarm Reset	
	Output Signals	Photocoupler Output : Alarm, Run/Stop	

## 4.2 Motor Specifications

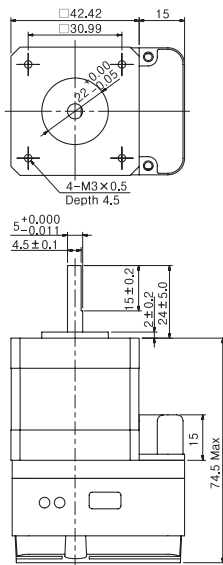
### 4.2.1 EzSTEP-BT-42 Series

Drive Type	No. of phase	Excitation method	Rated Torque(A/ph)	Max. Holding Torque mN · m (kgf · cm)	Rotor Inertia g · cm <sup>2</sup>	Power Supply(DC)	Shaft Size (mm)
EzStep - BT - 42 - S	2	Micro Step (Max. 50,000 P/R)	1.5	270(2.8)	38	24V, 2.0A	5.0
EzStep - BT - 42 - M			1.5	400(4.1)	54	24V, 2.0A	5.0
EzStep - BT - 42 - L			1.5	490(5.0)	76	24V, 2.0A	5.0

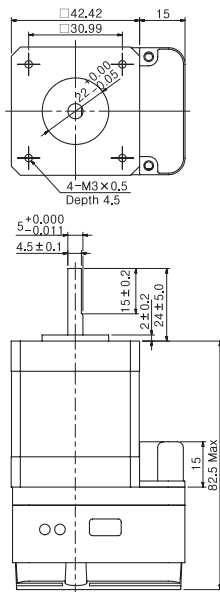
EzStep-BT-42-S



EzStep-BT-42-M



EzStep-BT-42-L



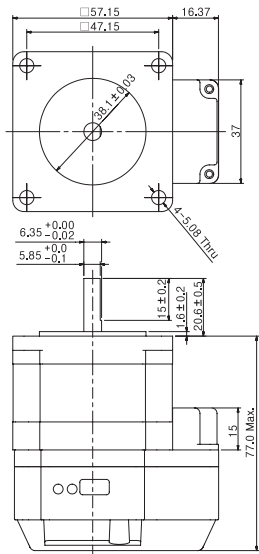
Unit : mm



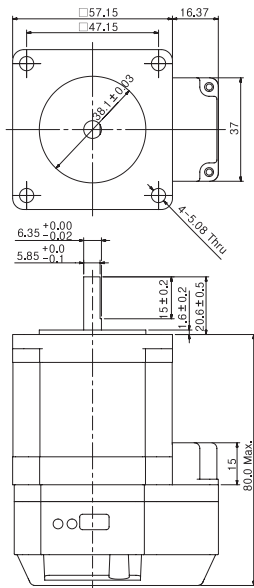
## 4.2.2 EzSTEP-BT-56 Series

Drive Type	No. of phase	Excitation method	Rated Torque(A/ph)	Max. Holding Torque mN · m (kgf · cm)	Rotor Inertia g · cm <sup>2</sup>	Power Supply(DC)	Shaft Size (mm)
EzStep - BT - 56 - S	2	Micro Step (Max. 50,000 P/R)	3.0	810(8.3)	189	24V, 3.5A	6.35
EzStep - BT - 56 - M			3.0	1300(13.3)	250	24V, 3.5A	6.35

EzStep-BT-56-S



EzStep-BT-56-M

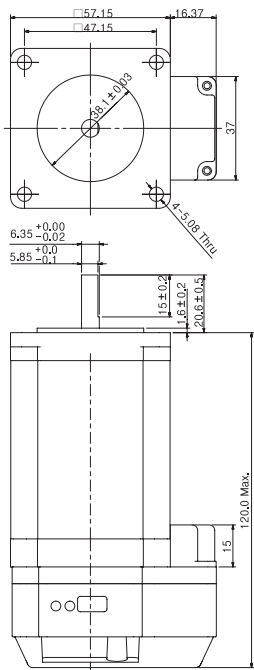


Unit : mm

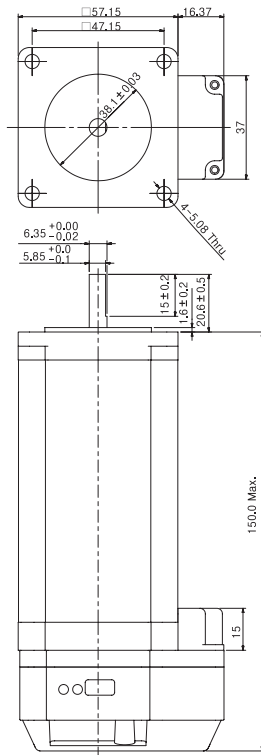
## 4.2.2 EzSTEP-BT-56 Series

Drive Type	No. of phase	Excitation method	Rated Torque(A/ph)	Max. Holding Torque mN · m (kgf · cm)	Rotor Inertia g · cm <sup>2</sup>	Power Supply(DC)	Shaft Size (mm)
EzStep - BT - 56 - L	2	Micro Step (Max. 50,000 P/R)	3.0	2490(25.4)	493	24V, 3.5A	6.35
EzStep - BT - 56 - XL			3.0	3540(36.1)	737	24V, 3.5A	6.35

EzStep-BT-56-L



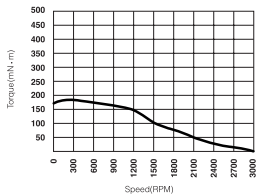
EzStep-BT-56-XL



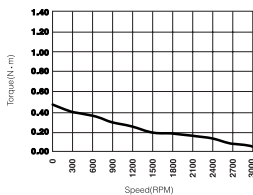
Unit : mm

## 5. Motor Torque Characteristics

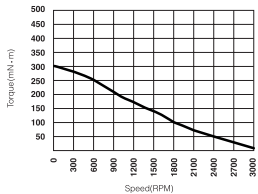
EzStep - BT - 42 - S



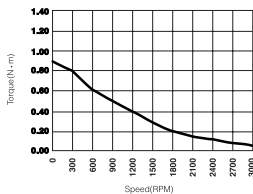
EzStep - BT - 56 - S



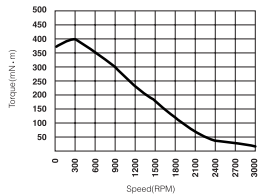
EzStep - BT - 42 - M



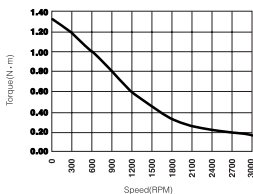
EzStep - BT - 56 - M



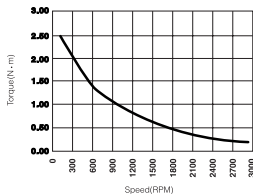
EzStep - BT - 42 - L



EzStep - BT - 56 - L



EzStep - BT - 56 - XL

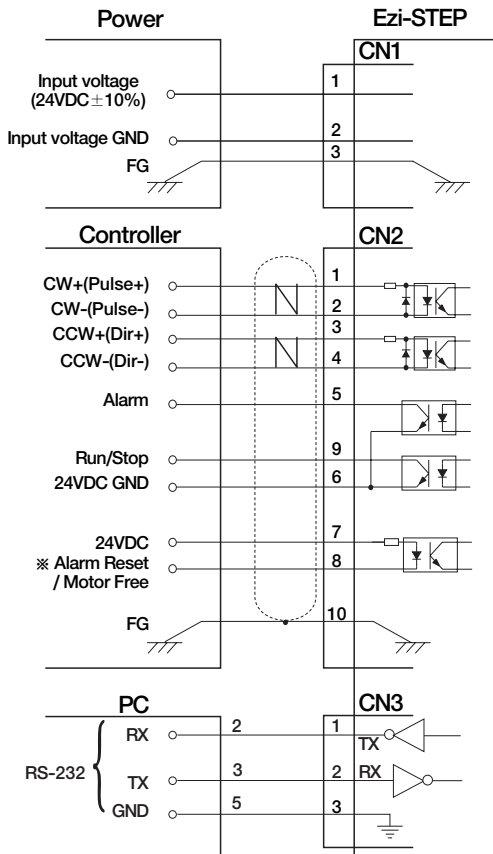


## 6. Installation and Cabling

### 6.1 Notes on Installation

- 1) Ezi-STEP has been designed for indoor uses.
- 2) The ambient temperature of the room should be 0°C~50°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-STEP under direct rays, near magnetic or radioactive objects.

## 6.2 Connection Diagram

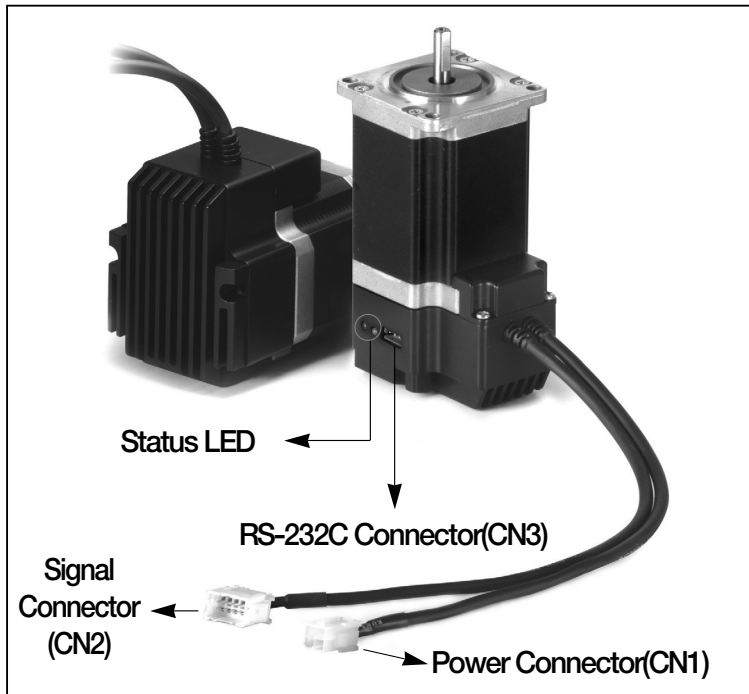


※ Alarm Reset signal line is also used for Motor FREE signal.

(For details, please refer to the section for Control Input/Output signal)

※)  Twisted Pair Shield Cable

## 7. Setting and Operating



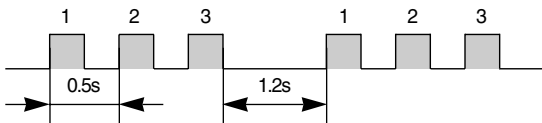
### 7.1 Status monitor LED

#### 7.1.1 Status LED Function and Condition

Status	Color	Function	Flash Condition
Power	Green	Power input indication	Lights when power is ON Flash in Motor Free mode
Alarm	Red	Alarm indication	Flash when protection function is activated (Identifiable which protection mode is activated by counting the flash times)

## 7.1.2 Protection functions and LED flash times

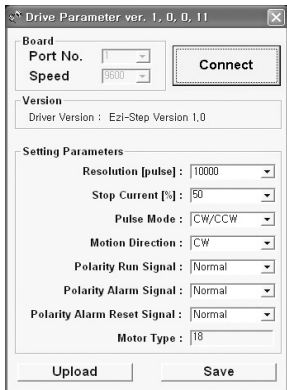
Flash Times	Protection	Conditions
1	<b>Overcurrent</b>	Excessive current flowed into a motor
2	<b>Overspeed</b>	Motor speed exceeded 3000 rpm
3	<b>Out of Synchronization</b>	Abnormally, motor did not followed pulsed inputs
5	<b>Overheat</b>	Internal temperature of a motor drive exceeded 55℃
6	<b>Over regenerative Voltage</b>	Back EMF more than 70V
7	<b>Motor Connection</b>	Power is ON without connection of motor cable to drive
9	<b>Lowpower</b>	Power source voltage is below 20 volts




Alarm LED flash (ex: Speed error)


## 7.2 Setting Up Parameters


RS-232C serial communication port of a computer is used to set up various parameters of the motor drive. The set-up program is supplied with the product on a companion CD. It is recommended to make a copy of the program in any folder on your computer. Then please execute the program, named "EzStep Setup.exe", from the folder.



Please select an appropriate Prot No. and press

 button. Then it will display the various parameter values previously stored in the drive.

 : Display the parameter values stored in the drive

 : Store the parameter values displayed on the screen into the drive

## 7.2.1 Resolution

Resolution means the number of pulses per one rotation of a motor.

Select a desired resolution by pressing  in **Resolution [pulse] :**   button on EzStep Setup screen. The possible resolution values are 500, 1000, 1600, 2000, 3200, 3600, 4000, 5000, 6400, 8000, 10000, 20000, 25000, 36000, 40000, 50000.

Press  button to store the value selected into the drive.

\* The default factory setting is 10,000 [Pulses/Revolution].

## 7.2.2 Stop Current

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. Select a desired Stop Current by pressing  in **Stop Current [%] :**   button on EzStep Setup screen. The unit of the selection values is a percentage.

Press  button to store the value selected into the drive.

\* The default factory setting is 50%.

## 7.2.3 Pulse Mode

As the pulsed inputs, a user can choose One-pulse-mode (Pulse/Dir) or two-pulse-mode(CW/CCW). Select a desired pulse mode by pressing  in **Pulse Mode :**   button on EzStep Setup screen.

Press  button to store the value selected into the drive.

\* The default factory setting is two pulse input mode (CW/CCW).

## 7.2.4 Rotation Direction

The direction of the motor rotation can be selected either in CW(clockwise) or in CCW(Counter Clockwise). Select a desired rotation direction by pressing  in **Motion Direction :**   button on EzStep Setup screen.

Press  button to store the value selected into the drive.

\* The default factory setting is CW(clockwise).





## 7.2.5 Polarity Run Signal

Run/Stop output method can be selected that indicate the motor running status. Select a desired method by pressing  in **Polarity Run Signal** :  button on EzStep Setup screen.

Press  button to store the value selected into the drive.

\* The default factory setting is Normal.



## 7.2.6 Polarity Alarm Signal

Alarm signal output method can be selected when error happens. Select a desired method by pressing  in **Polarity Alarm Signal** :  button on EzStep Setup screen.

Press  button to store the value selected into the drive.

\* The default factory setting is Normal.

## 7.2.7 Polarity Alarm Reset Signal

Input Method of Motor Free / Alarm reset can be selected. Select a desired method by pressing  in **Polarity Alarm Reset Signal** :  button on EzStep Setup screen.

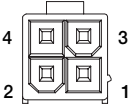
Press  button to store the value selected into the drive.

\* The default factory setting is Normal.

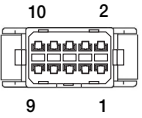
[CAUTION] : When you select 'Inverse' : It can be 'Motor Free' status when power is applied to EzStep during Signal Connector(CN2) is not connected. The power led(green) is flash to show the status of 'Motor Free'.

## 8. Connectors

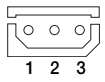
### Power Connector(CN1)

Number	Function	
1	Power Input : +24VDC	
2	Power Input : GND	
3	Frame Ground	
4	NC	

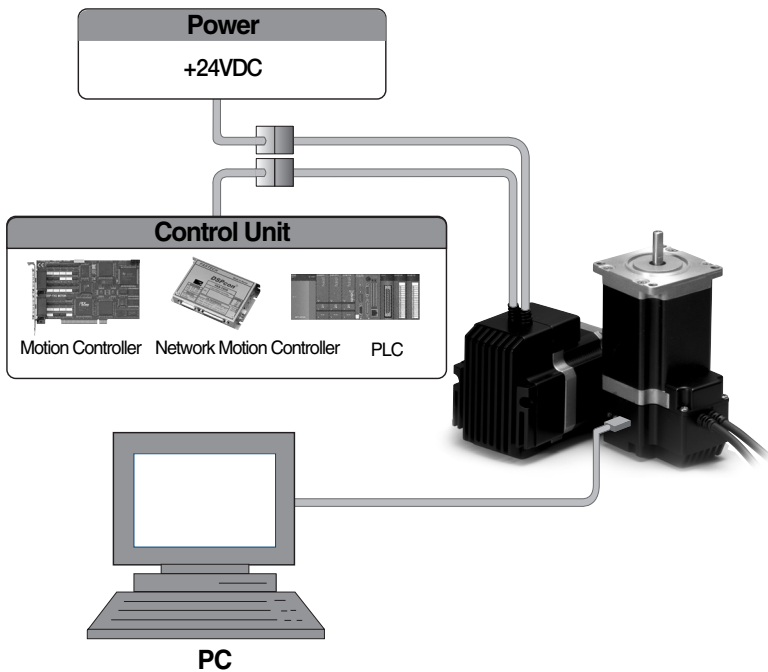
### Signal Connector(CN2)

Number	Function	Input/Output	
1	CW+(PULSE+)	Input	
2	CW-(PULSE-)	Input	
3	CCW+(DIR+)	Input	
4	CCW-(DIR-)	Input	
5	ALARM	Output	
6	GND	Input	
7	+24VDC	Input	
8	ALARM RESET	Input	
9	RUN / STOP	Output	
10	Frame Ground		

### RS232C Connector(CN3)

Number	Function	
1	Tx	
2	Rx	
3	GND	

## 9. External Wiring Diagram



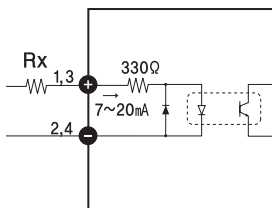
Type	Power Cable	Control Cable
Standard Length	30cm	30cm
Maximum Length	2m	20m

※ For enlarging the length, have to use the extension cable,

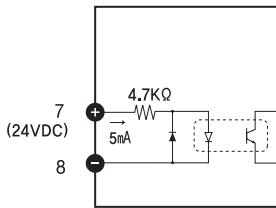
## 10. Control signal input/output Description

### 10.1 Input signals

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



CW(Pin:1, 2), CCW(Pin:3, 4)



Alarm Reset(Pin:8)

#### ◆ 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.

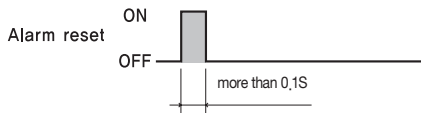
The input schematic of CW, CCW is designed for 5V TTL level. When using 5V level as an input signal, the resistor Rx is used and connect to the driver directly. When the level of input signal is more than 5V, have to add Rx. If this resistor is absent, the inner schematic can be broken. In input signal level is 12V case, Rx value is 2,2kohm and in 24V case, 4,7kohm is suitable for Rx value.

#### ◆ 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 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 operations set the signal [OFF] or disconnect a wire to the signal. It operates reversely compare to Normal mode, when you set Inverse mode.

#### ◆ Alarm Reset Input

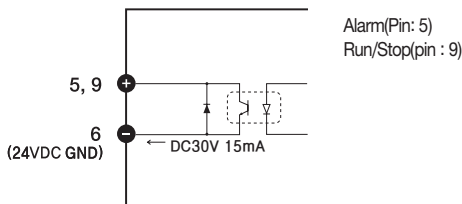
When a protection mode has been activated, a signal to this Alarm Reset input cancels the Alarm output. By setting the alarm reset input signal [ON], cancel Alarm output. Before cancel the Alarm output, have to remove the source of alarm.



[Caution] If Alarm Reset input signal still remains [ON], motor will be Free state. Keep in mind to change [ON]→ [OFF] state. It operates reversely compare to Normal mode, when you set Inverse mode.

## 10.2 Output signals

As the output signal from the driver, 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.



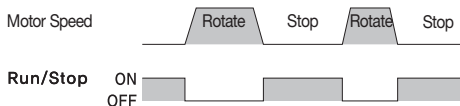
### ◆ Alarm Output

The Alarm output indicates [OFF] when the driver is in a normal operation. If a protection mode has been activated, it goes [ON]. 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 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.

It operates reversely compare to Normal mode, when you set Inverse mode.

### ◆ Run/Stop Output

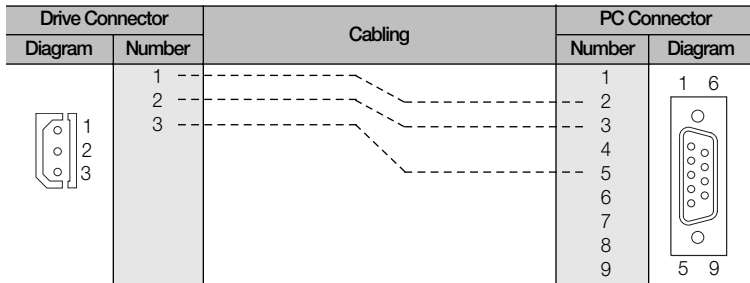
Run/Stop Output state is[ON] when motor positioning is completed. It operates reversely compare to Normal mode, when you set Inverse mode.



## Appendix

### ■ RS-232C Cabling Diagram

For connecting cable between PC and Ezi-STEP drive.



### ■ Connector

Connector specifications for cabling to Ezi-STEP

ITEM	Part Number	Maker
<b>Power (CN 1)</b>	Connector Housing Terminal 5557-04 5556	MOLEX MOLEX
<b>Signal (CN 2)</b>	Connector Housing Terminal XADRP-10V SXA-001T-P0,6	JST JST
<b>RS-232C (CN 3 : Drive)</b>	Connector Housing Terminal 5264-03 5263	MOLEX MOLEX
<b>RS-232C (CN 3 : PC)</b>	D-SUB(9PIN) Connector Backshell 717SD-ESD9S 17E-1657-09	AMPHENOL AMPHENOL



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