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Find the *Fastech EZI-STEP-BM-42L* at our website: *Click HERE*

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 an 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.
- After reading the manual, keep the manual near the Ezi-STEP so that any user can read the manual whenever needed.

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 our company at the address on the last page of the manual.
- Our company 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.
- 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.

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◆ Check the Product

⚠ Attention	**Check if the Product is damaged or missing part.** Otherwise, the machine may get damaged or the user may get injured.

◆ Install

⚠ Attention	**Carefully move the Ezi-STEP.** Otherwise the Product may get damaged or by dropping the Product 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 pan to keep the ambient temperature of the Ezi-STEP 50℃ or lower.** Otherwise, a fire or other kinds of accidents may occur due to overheating.
⚠ Warning	**The process of Installation, Connection, Operation, Checking and Repairing should be done with qualified person.** Otherwise, a fire or other kinds of accidents may occur.

◆ Connect Cables

⚠ Attention	**Keep the rated range of Input Voltage for Ezi-STEP.** Otherwise, a fire or other kinds of accidents may occur. **Cable connection should be follow the wiring diagram.** Otherwise, a fire or other kinds of accidents may occur.
⚠ Warning	**Before connecting cables, check if input power is off.** Otherwise, an electric shock or a fire may occur. **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.

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◆ Operation

⚠ **Attention**	**If a protection function(alarm) occurs, firstly remove its cause and then release(alarm reset) the protection function.** If you are operating continuously without removing its cause, the machine may get damaged or the user may get injured. **Do not make Motor Free input signal to ON during operation.** Motor will stop and stop current will become zero. The machine may get damaged or the user may get injured. **Make all input signals to OFF before supply input voltage to Ezi-STEP.** The machine may get damaged or the user may get injured by motor operation. **All parameter values are set by default factory setting value. Change this value after reading this manual throughly.** Otherwise, the machine may get damaged or other kinds of accidents may occur.

◆ Check and Repair

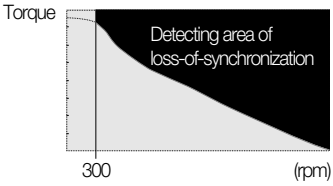
⚠ **Warning**	**Stop supplying power to the main circuit and wait for a while before checking or repairing the Ezi-STEP.** Electricity remaining in the capacitor may cause danger. **Do not change cabling while power is being supplied.** Otherwise, the user may get injured or the step drive may get damaged.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

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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



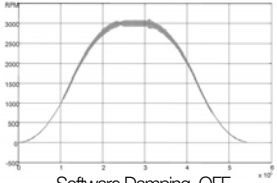
2 Microstep and Filtering(patent pending)

High Precision microstep function and Filtering (Patent pending)
The high-performance DSP resolves the basic resolution of 1.8° up to maximum 0.0072°(1/250 steps). Contrary to a conventional drive, Ezi-STEP adjusts PWM control signal in every 25㎲, which makes it possible to more precise current control and realizes a high-precision microstep operation.

3 Software Damping(patent pending)

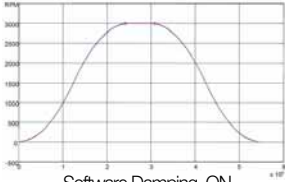
Vibration suppression and High-speed operation (Patent pending)
Ideally the applied currents to a stepping motor are a precise sinusoidal waves. But in practice the magnetic flux nonlinearity of the motor, the lowering of current due to the increase of back emf at high-speed and the lowering of the phase 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 OFF

Software Damping



Software Damping ON

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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. Ezi - STEP Part Numbering

Ezi-STEP-BT-42S-□

- Drive Series Type
- Motor+Drive Unit type
- Motor Flange Size
  - 42 : 42mm
  - 56 : 56mm
  - 86 : 86mm
- Motor Length
  - S : Short
  - M : Middle
  - L : Long
  - XL : eXtra Long
- User Code

Ezi-STEP-BT-42S-□
Ezi-STEP-BT-42M-□
Ezi-STEP-BT-42L-□
Ezi-STEP-BT-42XL-□
Ezi-STEP-BT-56S-□
Ezi-STEP-BT-56M-□
Ezi-STEP-BT-56L-□
Ezi-STEP-BT-56XL-□
Ezi-STEP-BT-86M-□
Ezi-STEP-BT-86L-□
Ezi-STEP-BT-86XL-□

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4. Specifications

4.1 Drive Specifications

Ezi-STEP Model		BT-42 Series	BT-56 Series	BT-86 Series
Input Voltage		24 VDC ±10%	24 VDC ±10%	40~70VDC
Drive Method		Bipolar PWM drive with 32bit DSP		
Current		Max : 500mA(Except motor current)		
Operating Condition	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	Resolution(P/R)	500, 1000, 1600, 2000, 3200, 3600, 4000, 5000, 6400, 8000, 10000, 20000, 25000,36000, 40000, 50000 (Set by RS-232C Communication) *Default : 10000		
	Maximum Frequency	500 KHz (Duty 50%)		
	Alarm Function	Step-Out, Over-Current, Over-Heat, Over-Voltage, Power, Motor Connection(Identifiable which alarm is activated by counting the flashing times of status monitor LED)		
	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 Direction	CW / CCW (Set by RS-232C Communication) Used when changing the direction of motor rotate. *Default : CW		
	Speed/Position Command	Pulse train input (Photocoupler Input)		
I/O	Input Signals	Motor Free / Alarm Reset (Photocoupler Input)		
	Output Signals	Alarm, Run/Stop (Photocoupler Output)		

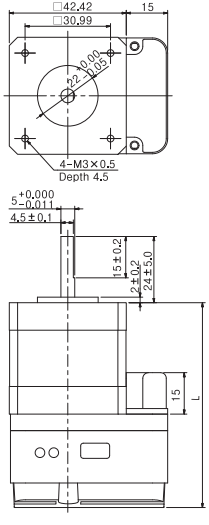
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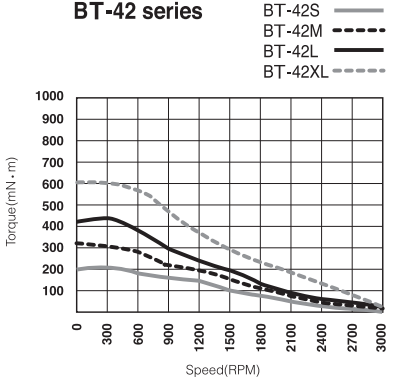
4.2 Motor Specifications

4.2.1 Ezi-STEP-BT-42 Series

MODEL	Unit	BT-42S	BT-42M	BT-42L	BT-42XL
Drive method	-	Bi-polar	Bi-polar	Bi-polar	Bi-polar
Number of phase	-	2	2	2	2
Current per phase	A	1.5	1.5	1.5	1.2
Holding torque	mN • m	270	400	490	750
Detent torque	mN • m	11	14	23	31
Rotor inertia	g • cm^2	36	54	76	114
Weights	kg	0.32	0.38	0.48	0.62
LENGTH(L)	mm	68.5	74.5	82.5	93.0

◎ Motor Dimension[mm] and Torque Characteristics





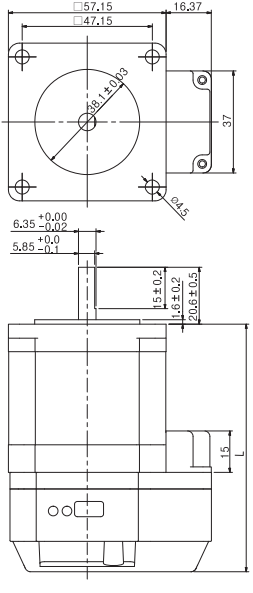
※Measured Condition
Input Voltage = 24VDC
Motor Current = Rated Current(Refer to Motor Specifications)
Drive = Ezi-STEP

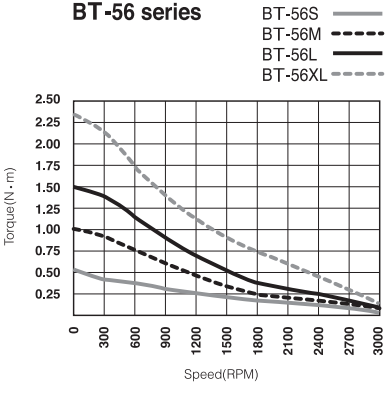
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4.2.2 Ezi-STEP-BT-56 Series

MODEL	Unit	BT-56S	BT-56M	BT-56L	BT-56XL
Drive method	-	Bi-polar	Bi-polar	Bi-polar	Bi-polar
Number of phase	-	2	2	2	2
Current per phase	A	3.0	3.0	3.0	3.0
Holding torque	mN • m	810	1320	2490	3540
Detent torque	mN • m	70	90	180	280
Rotor inertia	g • cm^2	189	249	493	737
Weights	kg	0.60	0.80	1.27	1.73
LENGTH(L)	mm	77.0	80.0	120.0	150.0

◎ Motor Dimension[mm] and Torque Characteristics





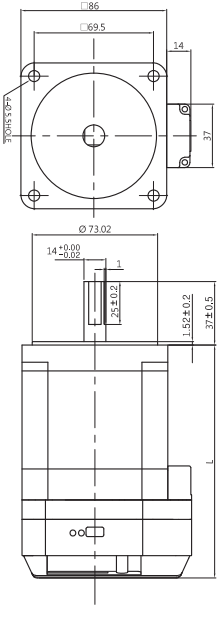
※Measured Condition
Input Voltage = 24VDC
Motor Current = Rated Current(Refer to Motor Specifications)
Drive = Ezi-STEP

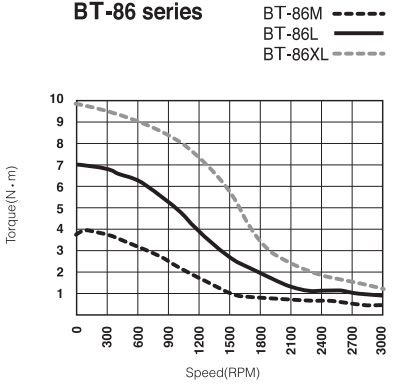
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4.2.3 Ezi-STEP-BT-86 Series

MODEL	Unit	BT-86M	BT-86L	BT-86XL
Drive method	-	Bi-polar	Bi-polar	Bi-polar
Number of phase	-	2	2	2
Current per phase	A	6.0	6.0	6.0
Holding torque	mN • m	4700	8500	12200
Detent torque	mN • m	133	240	360
Rotor inertia	g • cm^2	1400	2700	4000
Weights	kg	2.3	3.8	5.3
LENGTH(L)	mm	125.5	163.5	201.5

◎ Motor Dimension[mm] and Torque Characteristics

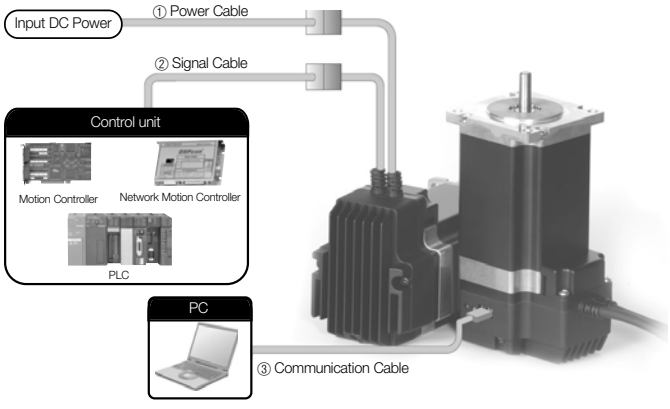




※Measured Condition
Input Voltage = 70V
Motor Current = Rated Current(Refer to Motor Specifications)
Drive = Ezi-STEP

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5. System Configuration



※ Standard cable length of Power and Signal is 30cm. Extension Cable is needed to extend this limitation.

● Option

① Power Cable

Available to connect power of Ezi-STEP-BT

Item	Length[m]	Remark
CBTS-P-□□□F	□□□	Normal Cable for BT-42/BT-56
CBTS-P-□□□M	□□□	Robot Cable for BT-42/BT-56
CBTL-P-□□□F	□□□	Normal Cable for BT-86
CBTL-P-□□□M	□□□	Robot Cable for BT-86

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

② Signal Cable

Available to connect between Control System and Ezi-STEP-BT.

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

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

③ Communication Cable

Available to connect between PC and Ezi-STEP-BT. This is used for change setting value of Resolution and Stop Current etc.

Item	Length[m]	Remark
CBTS-C-□□□F	□□□	Normal Cable

□is for Cable Length. The Unit is 1m and Max 15m Length.

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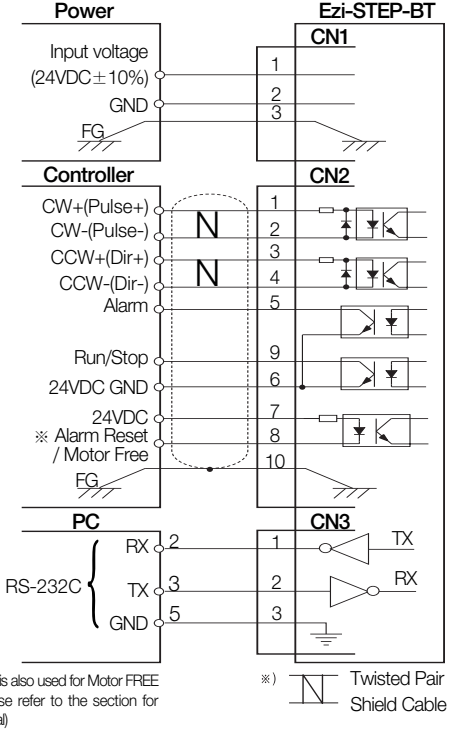
6. Installation and Cabling

6.1 Notes on Installation

1) Ezi-STEP has been designed for indoor uses.
2) The ambient temperature of the room should be 0℃~50℃.
3) If the temperature of the case is higher than 50℃, 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

Ezi-STEP-BT-42/56 Series

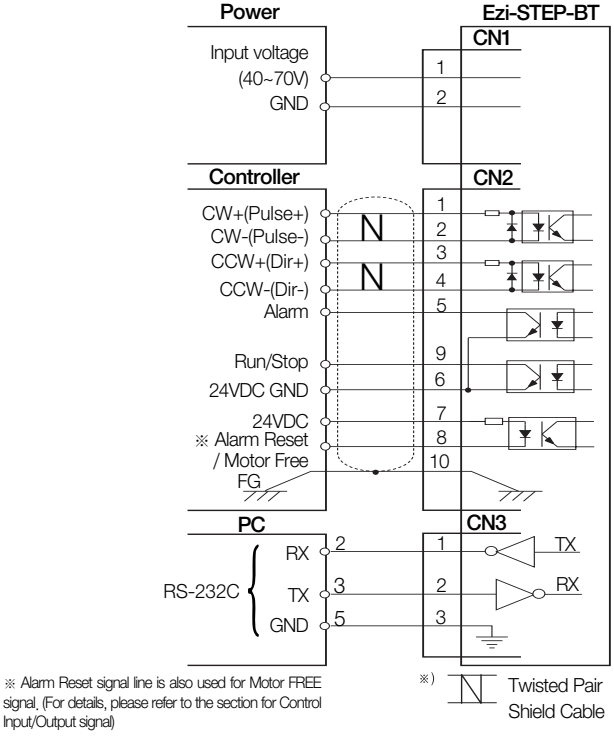


※ Alarm Reset signal line is also used for Motor FREE signal. (For details, please refer to the section for Control Input/Output signal)

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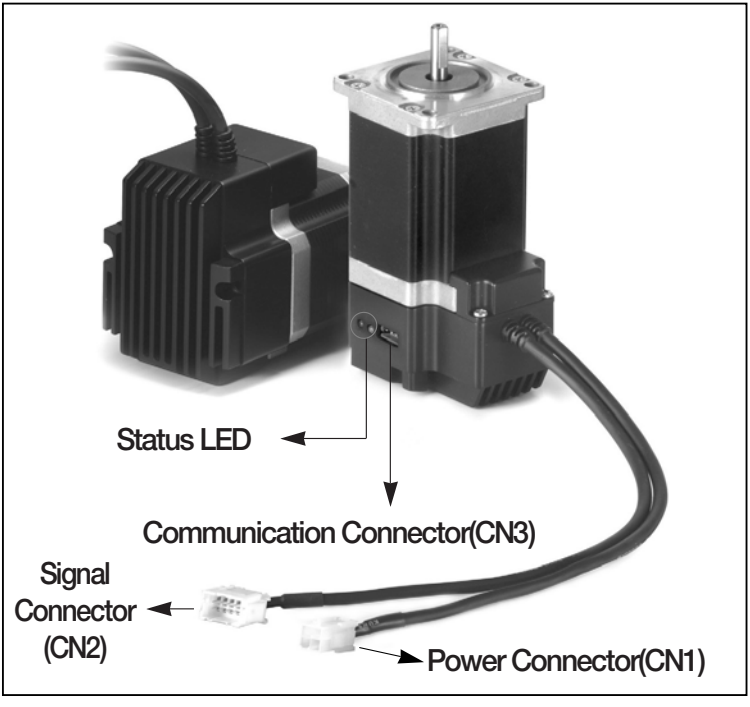
6.3 Connection Diagram

Ezi-STEP-BT-86 Series



※ Alarm Reset signal line is also used for Motor FREE signal. (For details, please refer to the section for Control Input/Output signal)

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7.1 Status monitor LED

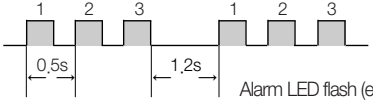
7.1.1 Status LED Function and Condition

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

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7.1.2 Protection functions and LED flash times

Flash Times	Protection	Conditions
1	Overcurrent	Excessive current flowed into a motor
2	Overspeed	Motor speed exceeded 3000 rpm
3	Out of Synchronization	Abnormally, motor did not followed pulsed inputs
5	Overheat	Internal temperature of a motor drive exceeded 50° C
6	Over regenerative Voltage	Back EMF more than 50V
7	Motor Connection	Power is ON without connection of motor cable to drive
9	Low Input Voltage	Ezi-STEP-BT-42/56 Series : Power source voltage is below 20 volts Ezi-STEP-BT-86 Series : Power source voltage is below 40 volts
11	System error	Error occurs in drive system
12	ROM error	Error occurs in Parameter Storage Device(ROM)
14	High Input Voltage	Ezi-STEP-BT-42/56 Series : Power source voltage is higher than 32 volts. Ezi-STEP-BT-86 Series : Power source voltage is higher than 70 volts.



Alarm LED flash (ex: Synchronization error)

7.2 Setting Up Parameters

7.2.1 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 "EziSTEPSetting.exe", from the folder.





: Please select an appropriate Prot No. and press Connect button. Then it will display the various parameter values previously stored in the drive.

※ Error Message
There is no response.(You may select wrong baudrate or wrong port no.) : ① Select wrong Port No.
② Select already used Port No. in other program.
③ Communication cable is not connected.
④ Power is not supplied to drive.



: Display the parameter values stored in the drive

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

7.2.2 Resolution

Resolution means the number of pulses per one rotation of a motor.
Select a desired resolution by pressing ▾ in Resolution 10000 ▾ button on EziSTEPSetting 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 save the value selected into the drive.
* The default factory setting is 10,000 [Pulses/Revolution].

7.2.3 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 [%] 50 button on EziSTEPSetting screen.
The range of this value is 10~100 and the unit is a percentage.



Press button to save the value selected into the drive.
* The default factory setting is 50%.

7.2.4 Motion 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 CW ▾ button on EziSTEPSetting screen.



Press button to save the value selected into the drive.
* The default factory setting is CW(Clockwise).

7.2.5 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 CW-CCW ▾ button on EziSTEPSetting screen.



Press button to save the value selected into the drive.
* The default factory setting is two pulse input mode (CW/CCW).

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7.2.6 Alarm Reset(Input)

Input method of Motor Free / Alarm Reset can be selected. Select a desired method by pressing in 

button on EziSTEPSetting screen.



Press button to save 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 Ez-Step during Signal Connector(CN2)is not connected. The power LED(green)is flash to show the status of 'Motor Free'.

7.2.7 Alarm(Output)

Alarm signal output method can be selected when error happens. Select a desired method by pressing in 

button on EziSTEPSetting screen.



Press button to save the value selected into the drive.
* The default factory setting is Normal.

7.2.8 Run/Stop(Output)

Run/Stop output method can be selected that indicate the motor running status. Select a desired method by pressing in 

button on EziSTEPSetting screen.



Press button to save the value selected into the drive.
* The default factory setting is Normal.

7.2.9 Motor Number, Motor Coils Current

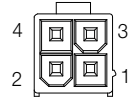
This parameter can not be changable. The information of Motor Number is needed for A/S of drive



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8. Connectors

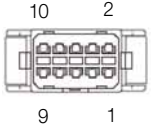
Power Connector(CN1): BT-42/56 Series

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

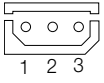
Power Connector(CN1): BT-86 Series

Number	Function	Diagram
1	Power Input : 40~70VDC	
2	Power Input Ground	

Signal Connector(CN2)

Number	Function	Input/Output	Diagram
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		

Communication Connector(CN3)

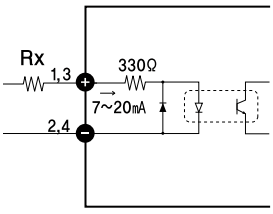
Number	Function	Input/Output	Diagram
1	Tx	Output	
2	Rx	Input	
3	GND		

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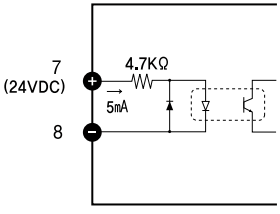
9. Control signal Input/Output Description

9.1 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 drive 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.

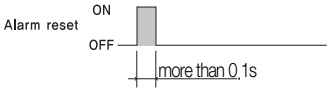
◆ **Motor Free Input**

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 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. 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.

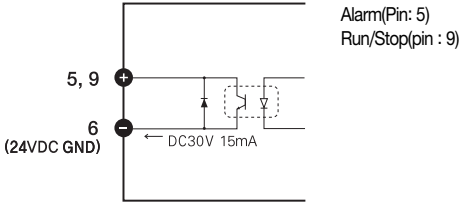
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[Caution] If Alarm Reset input signal still remains [ON], motor will be Free state. Keep in mind to change [ON]→ [OFF] state. It operates reversely compare to Normal mode, when you set Inverse mode.

9.2 Output signals

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.

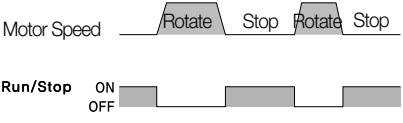


◆ **Alarm Output**

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 needs to detect this signal and stop sending a motor driving command. When the drive 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.

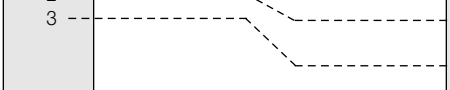


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Appendix

■ Communication Cabling Diagram

For connecting cable between PC and Ezi-STEP drive.

Drive Connector		Cabling	PC Connector	
Diagram	Number		Number	Diagram
	1 2 3		1 2 3 4 5 6 7 8 9	

■ Connector

Connector specifications for cabling to Ezi-STEP

ITEM			Part Number	Maker
Power (CN 1)	BT-42 Series BT-56 Series	Connector Housing Terminal	5557-04R 5556T	MOLEX MOLEX
	BT-86 Series	Connector Housing Terminal	3191-2R 1381T	MOLEX MOLEX
Signal (CN 2)		Connector Housing Terminal	XADRP-10V SXA-001T-P0.6	JST JST
RS-232C (CN 3 : Drive)		Connector Housing Terminal	5264-03 5263	MOLEX MOLEX
RS-232C (CN 3 : PC)		D-SUB(9PIN) Connector Backshell	717SD-ESD9S 17E-1657-09	AMPHENOL AMPHENOL

※ These connectors are serviced together with Ezi-STEP except when purchasing option cables.
※ Above connector is the most suitable product for Ezi-STEP. Another equivalent connector can be used.

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