

# Ezi-STEP®

## Micro Stepping System

**BT**



*Fast, Accurate, Smooth Motion*  
[www.fastech-motions.com](http://www.fastech-motions.com)



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## ※ Before operation ※

- Thank you for your purchasing Ezi-STEP BT.
- Ezi-STEP BT is an all-in-one Unit. For high-speed and high-precision drive of a stepping motor, Ezi-STEP BT 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 BT.
- Before operating Ezi-STEP BT, thoroughly read this manual.
- After reading the manual, keep the manual near the Ezi-STEP BT 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 BT.
- When the manual is damaged or lost, please contact with Fastech's agents 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 for the product, and such a breakdown is not guaranteed by the warranty.

### ◆ Put the Safety First

- Before installation, operation and repairing the Ezi-STEP BT, thoroughly read the manual and fully understand the contents. Before operating the Ezi-STEP BT please, understand the mechanical characteristics of the Ezi-STEP BT and related safety information and precautions.
- This manual divides safety precautions into Attention and Warning.



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



**Warning :** If 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 Product

 <b>Attention</b>	Check the Product is damaged or parts are missing. Otherwise, the machine may get damaged or the user may get injured.
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## ◆ Installation

 <b>Attention</b>	Carefully move the Ezi-STEP BT. Otherwise the Product may get damaged or User's foot may get injured by dropping the product.  Use non-flammable materials such as metal in the place where the Ezi-STEP BT is to be installed. Otherwise, a fire may occur.  When installing several Ezi-STEP BT in a sealed place, install a cooling fan to keep the ambient temperature of the Ezi-STEP BT as 50°C or lower. Otherwise, a fire or other kinds of accidents may occur due to overheating.
 <b>Warning</b>	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

 <b>Attention</b>	Keep the rated range of Input Voltage for Ezi-STEP BT. Otherwise, a fire or other kinds of accidents may occur.  Cable connection should follow the wiring diagram. Otherwise, a fire or other kinds of accidents may occur.
 <b>Warning</b>	Before connecting cables, check if input power is off. Otherwise, an electric shock or a fire may occur.  The case of the Ezi-STEP BT is insulated from the ground of the internal circuit by the condenser. Ground the Ezi-STEP BT. Otherwise, an electric shock or a fire may occur.

## ◆ Operation



If a protection function(alarm) occurs, firstly remove its cause and then release(alarm reset) the protection function.

If you operate continuously without removing its cause, the machine may get damaged or the user may get injured.

Do not make Motor Free and make 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 BT.

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 thoroughly.

Otherwise, the machine may get damaged or other kinds of accidents may occur.

## ◆ Check and Repair



Stop to supply power to the main circuit and wait for a while before checking or repairing the Ezi-STEP BT.

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 product may get damaged.

Do not reconstruct the Ezi-STEP BT.

Otherwise, an electric shock may occur or the reconstructed product can not get After-Service.

## 2. Main characteristics

### 1 Microstep and Filtering

#### High precision Microstep function and Filtering

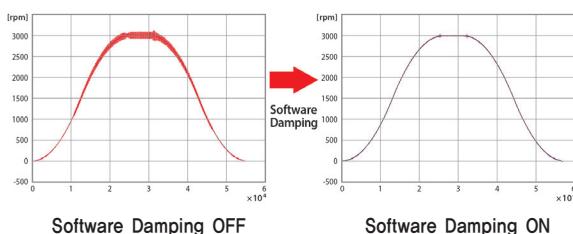
The high-performance MCU operates at step resolutions of  $1.8^\circ$  up to maximum  $0.0072^\circ$  (1/250 steps) and Ezi-STEP adjusts PWM control signal in every  $25\ \mu\text{sec}$ , which makes it possible for more precise current control, resulting in high-precision Microstep operation.

### 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 MCU 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.



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

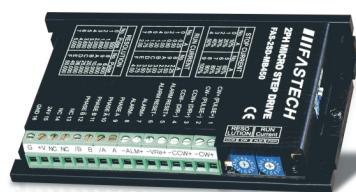
### 3 Drive Output Signal Monitoring

Ezi-STEP 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.

### 4 Improvement 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 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.

## 3. Simple and Compact all-in-one Motor integrated with Drive



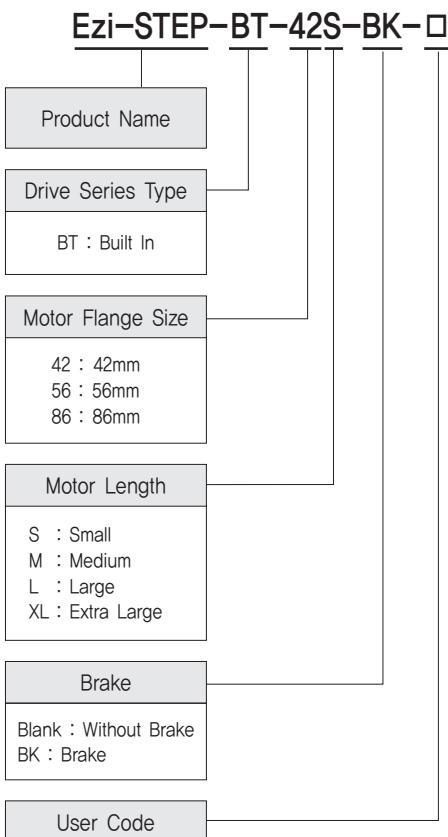
Drive



Motor

Saving installation space and ease of wiring by integrating drive circuits on the back side of a stepping motor.

## 4. Ezi-STEP BT Part Numbering



## 5. Standard Combination

Unit Part Number	Motor Model Number	Drive Model Number
Ezi-STEP-BT-42S	Motor & Drive Integrated	
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-86M		
Ezi-STEP-BT-86L		
Ezi-STEP-BT-86XL		

## 6. Combination with Brake

Unit Part Number	Motor Model Number	Drive Model Number
Ezi-STEP-BT-42S-BK	Motor & Drive Integrated	
Ezi-STEP-BT-42M-BK		
Ezi-STEP-BT-42L-BK		
Ezi-STEP-BT-42XL-BK		
Ezi-STEP-BT-56S-BK		
Ezi-STEP-BT-56M-BK		
Ezi-STEP-BT-56L-BK		
Ezi-STEP-BT-86M-BK		
Ezi-STEP-BT-86L-BK		
Ezi-STEP-BT-86XL-BK		

## 7. Specifications of Drive

Motor Model		BT-42 series	BT-56 series	BT-86 series
Input Voltage		24VDC ±10%		40~70VDC
Control Method		Bipolar PWM drive with 32bit MCU		
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	0~3,000 [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 (Selectable by parameter) * 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)		
	STOP Current	20%~100% (Selectable by parameter) 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 by parameter) 1 Pulse: Pulse/Direction, 2 Pulse: CW/CCW * Default: 2 Pulse		
	Rotational Direction	CW/CCW (Selectable by parameter) Used when changing the direction of motor rotate. * Default: CW		
	Speed/Position Control Command	Pulse Train Input (Photocoupler Input)		
	I/O Signal	Input Signals: Motor Free / Alarm Reset (Photocoupler Input) Output Signals: Alarm, Run/Stop (Photocoupler Output)		

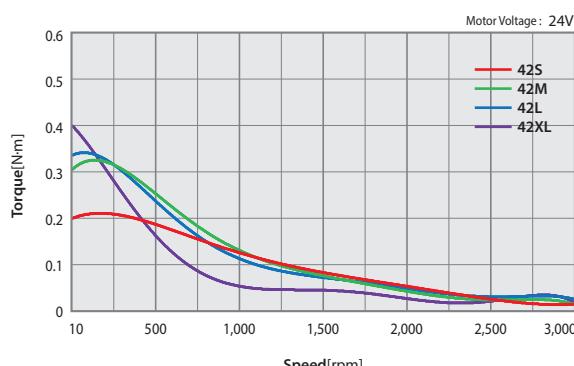
\*1 : Up to the resolution of 10,000[ppr], maximum speed can be reached by 3,000[rpm] and with the resolution more than 10,000[ppr], maximum speed shall be reduced accordingly.

## 8. Specifications of Motor

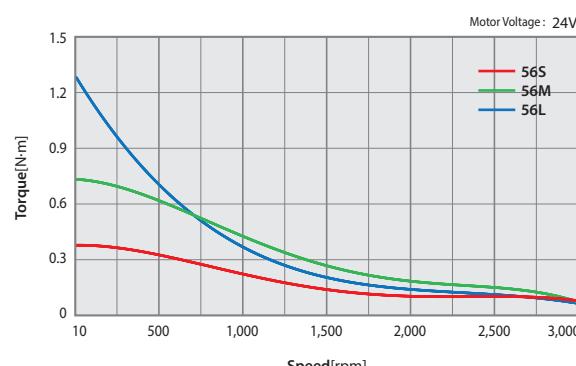
MODEL	UNIT	Ezi-STEP-BT-42 series				Ezi-STEP-BT-56 series			Ezi-STEP-BT-86 series		
		42S	42M	42L	42XL	56S	56M	56L	86M	86L	86XL
DRIVE METHOD	-	BI-POLAR									
NUMBER OF PHASES	-	2	2	2	2	2	2	2	2	2	2
VOLTAGE	VDC	3.36	4.32	4.56	7.2	1.56	1.62	2.64	2.34	3.6	4.8
CURRENT per PHASE	A	1.2	1.2	1.2	1.2	3.0	3.0	3.0	6.0	6.0	6.0
RESISTANCE per PHASE	Ohm	2.8	3.6	3.8	6.0	0.52	0.54	0.88	0.39	0.6	0.8
INDUCTANCE per PHASE	mH	5.4	7.2	8.0	15.6	1.2	2.0	4.0	3.0	6.5	8.68
HOLDING TORQUE	N·m	0.32	0.44	0.5	0.65	0.64	1.0	1.5	4.5	8.5	12
ROTOR INERTIA	g·cm <sup>2</sup>	35	54	77	114	180	280	520	1800	3600	5400
WEIGHTS	g	250	280	350	500	500	720	1150	2300	3800	5300
LENGTH(L)	mm	34	40	48	60	46	55	80	78	117	155
PERMISSIBLE OVERHUNG LOAD (DISTANCE FROM END OF SHAFT)	3mm	N	22	22	22	52	52	52	270	270	270
	8mm		26	26	26	65	65	65	300	300	300
	13mm		33	33	33	85	85	85	350	350	350
	18mm		46	46	46	123	123	123	400	400	400
PERMISSIBLE THRUST LOAD	N	Lower than motor weight									
INSULATION RESISTANCE	Mohm	100 MIN.(at 500VDC)									
INSULATION CLASS	-	CLASS B(130°C)									
OPERATING TEMPERATURE	°C	0 to 55									

## 9. Torque Characteristics of Motor

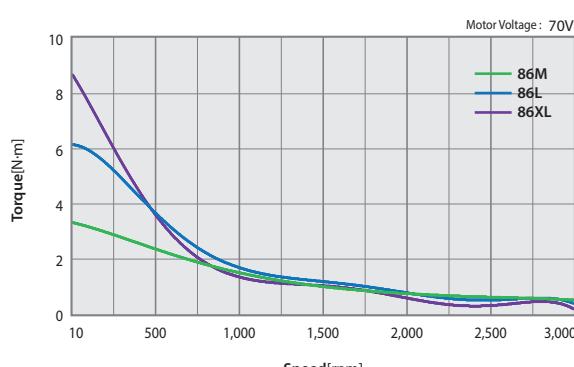
Ezi-STEP-BT-42 series



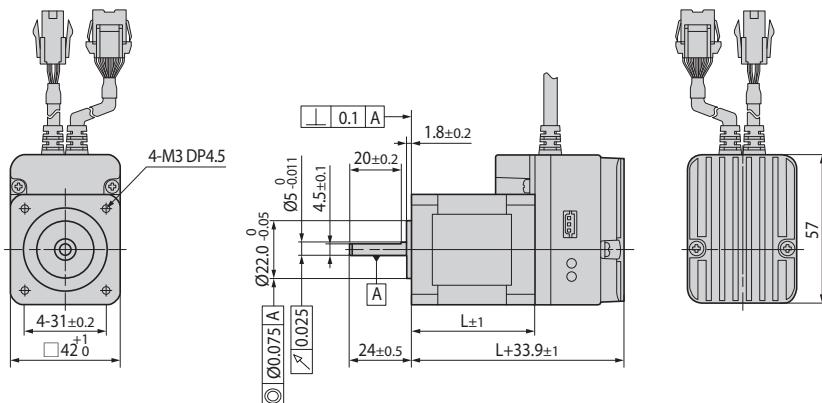
Ezi-STEP-BT-56 series



Ezi-STEP-BT-86 series

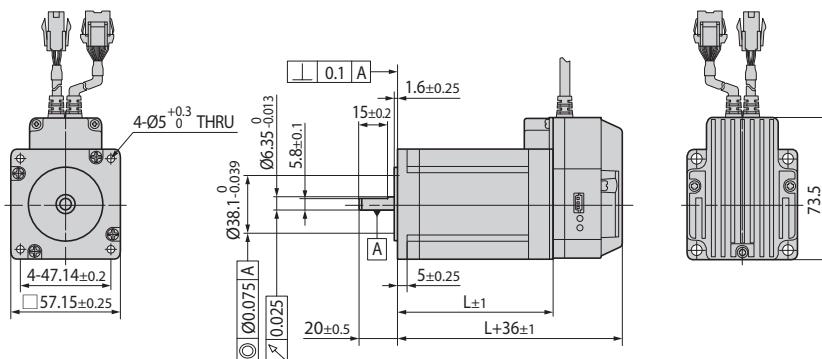


## 10. Dimensions of Motor [mm]



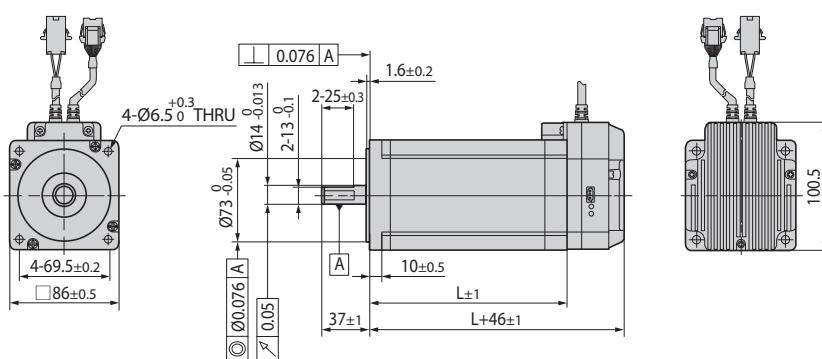
**42mm**

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



**56mm**

Model name	Length(L)
56S	46
56M	55
56L	80



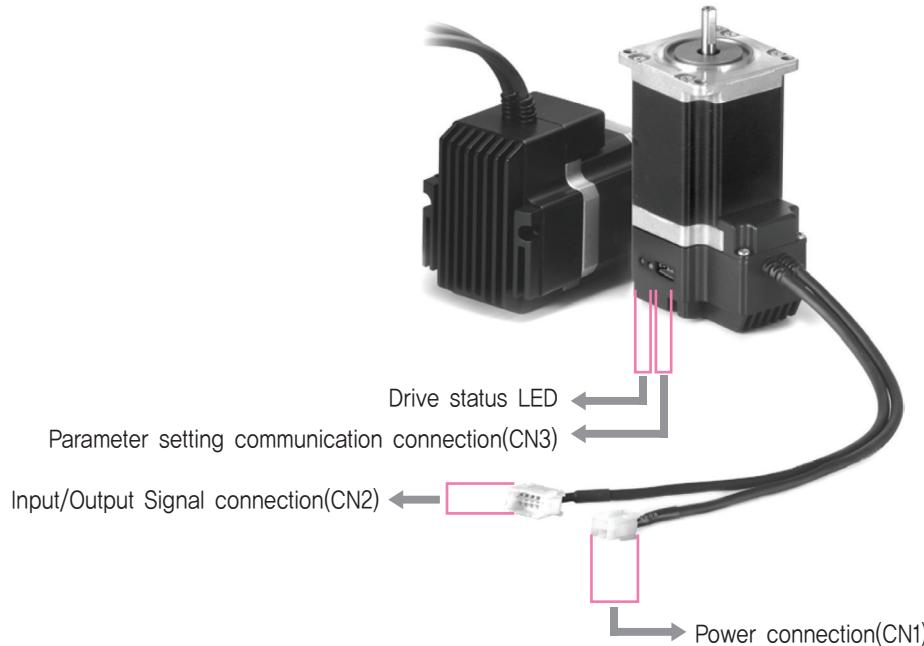
**86mm**

Model name	Length(L)
86M	78
86L	117
86XL	155

## 11. Notes on Installation

- 1) Ezi-STEP BT is designed for indoor use only.
- 2) The ambient temperature of the room should be  $0^\circ\text{C} \sim 50^\circ\text{C}$ .
- 3) If the temperature of the product case is higher than  $50^\circ\text{C}$ , radiate heat of the outside to cool down.
- 4) Do not install Ezi-STEP BT under direct rays, near magnetic or radioactive objects.

## 12. Settings and Operation

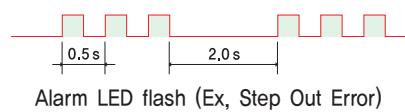


### 12.1 Drive Status LED

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 blinking times)

### ◆ 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 exceed 3,000 [rpm]
3	Step Out Error	Abnormally motor do not followed pulsed input
5	Over Temperature Error	Inside temperature of drive exceeds 85°C
6	Over Regeneratived Voltage Error	Back-EMF more high limit value BT-42/56 series: 50V, BT-86 series: 90V
7	Motor Connect Error	The power is ON without connection of the motor cable to drive
9	Motor Voltage Erroe	Motor voltage is out of limited value BT-42/56 series: 20V, BT-86 series: 36V
11	System Error	Error occurs in drive system
12	ROM Error	Error occurs in parameter storage device(ROM)

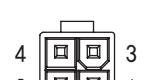


\*1 : Limit value depends on motor model

### 12.2 Power Connector(CN1)

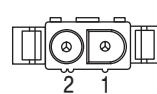
NO.	Function	I/O
1	24VDC	Input
2	GND	Input
3	F,GND	Input
4	NC	-----

※ BT-42, BT-56 series.



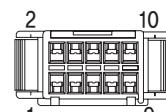
NO.	Function	I/O
1	40~70VDC	Input
2	GND	Input

※ BT-86 series.



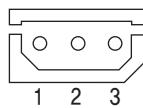
### 12.3 Input/Output Signal Connector(CN2)

NO.	Function	I/O
1	CW+(Pulse+)	Input
2	CW-(Pulse-)	Input
3	CCW+(Dir+)	Input
4	CCW-(Dir-)	Input
5	Alarm	Output
6	EXT_GND	Input
7	EXT_24VDC	Input
8	Alarm Reset	Input
9	Run/Stop	Output
10	F,GND	-----

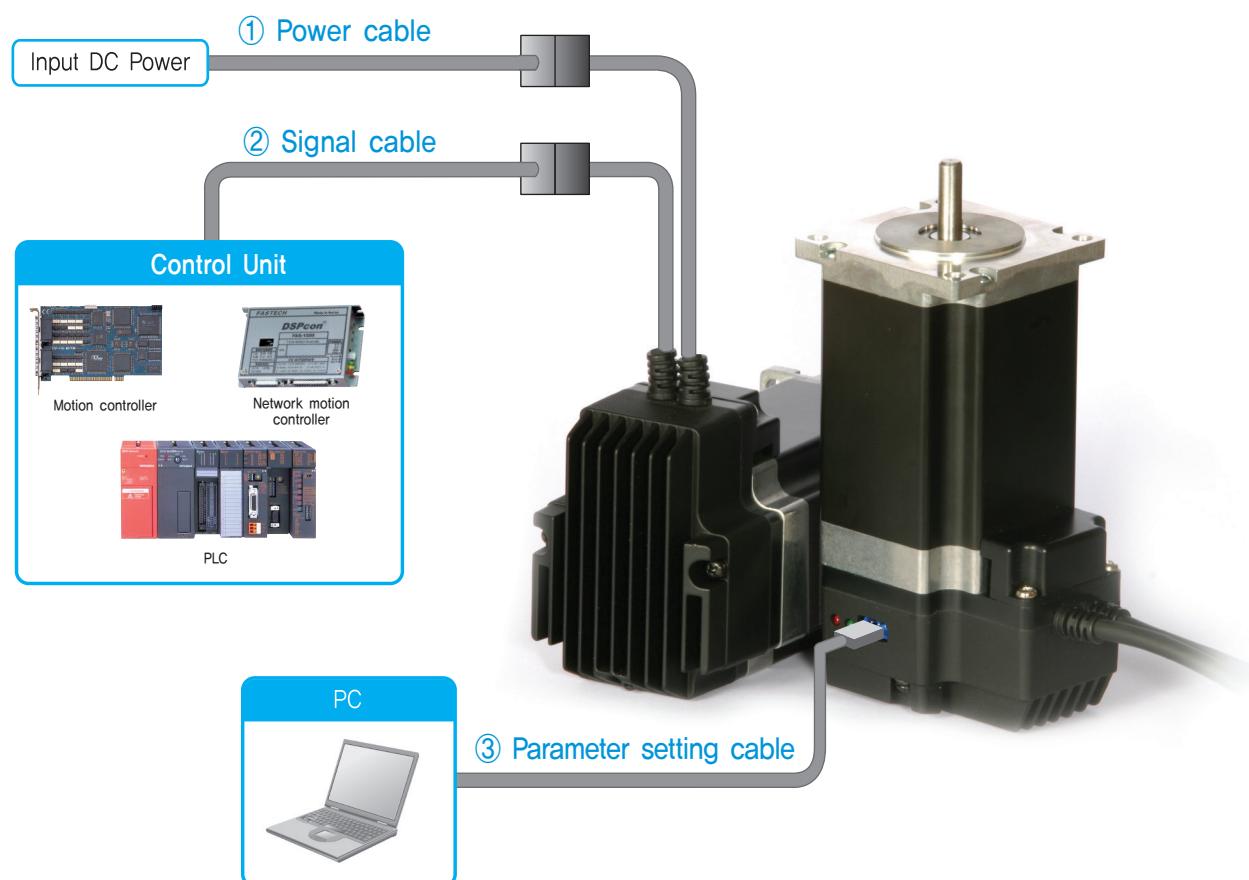


## 12.4 Parameter Setting Connector(CN3)

NO.	Function	I/O
1	Tx	Output
2	Rx	Input
3	GND	----



## 13. System Configuration



Type	Power Cable	Signal Cable	Parameter Setting Cable
Length supplied	30m	30cm	-
Max. Length	2m	20m	3m

## 13.1 Options

### ① Power Cable

Available to connect between Power and Ezi-STEP BT.

Item	Length [m]	Remark
CBTS-P-□□□F *1	□□□	Normal Cable
CBTS-P-□□□M *1	□□□	Robot Cable
CBTL-P-□□□F *2	□□□	Normal Cable
CBTL-P-□□□M *2	□□□	Robot Cable

\*1 : Ezi-STEP-BT-42/56 series

\*2 : Ezi-STEP-BT-86 series

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

### ③ Parameter Setting 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. 3m length.

### ② Signal Cable

Available to connect between Input/Output 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.

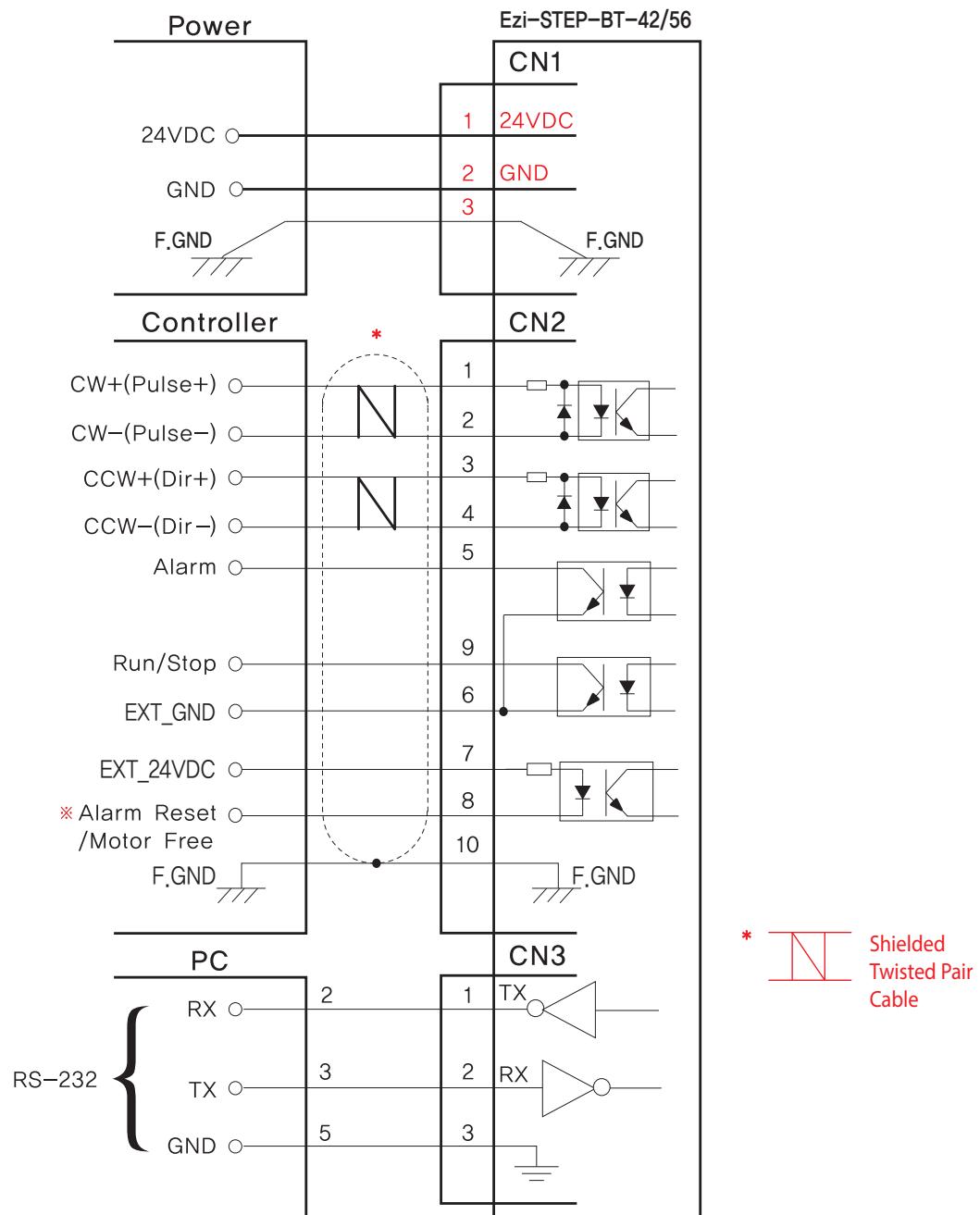
## 13.2 Connector Specifications

Connector specifications for cabling to drive.

Purpose		Item	Part Number	Manufacturer
Power (CN1)	BT-42/56 series	Housing Terminal	5557-04R 5556T	MOLEX
	BT-86 series	Housing Terminal	3191-2R 1381T	MOLEX
Signal (CN2)		Housing Terminal	XADRP-10V SXA-001T-P0.6	JST
Parameter Setting	Drive Side (CN3)	Housing Terminal	5264-03 5263	MOLEX
	PC Side	D-SUB Connector Terminal	717SD-ESD9S 7E-1675-09	AMPHENOL

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

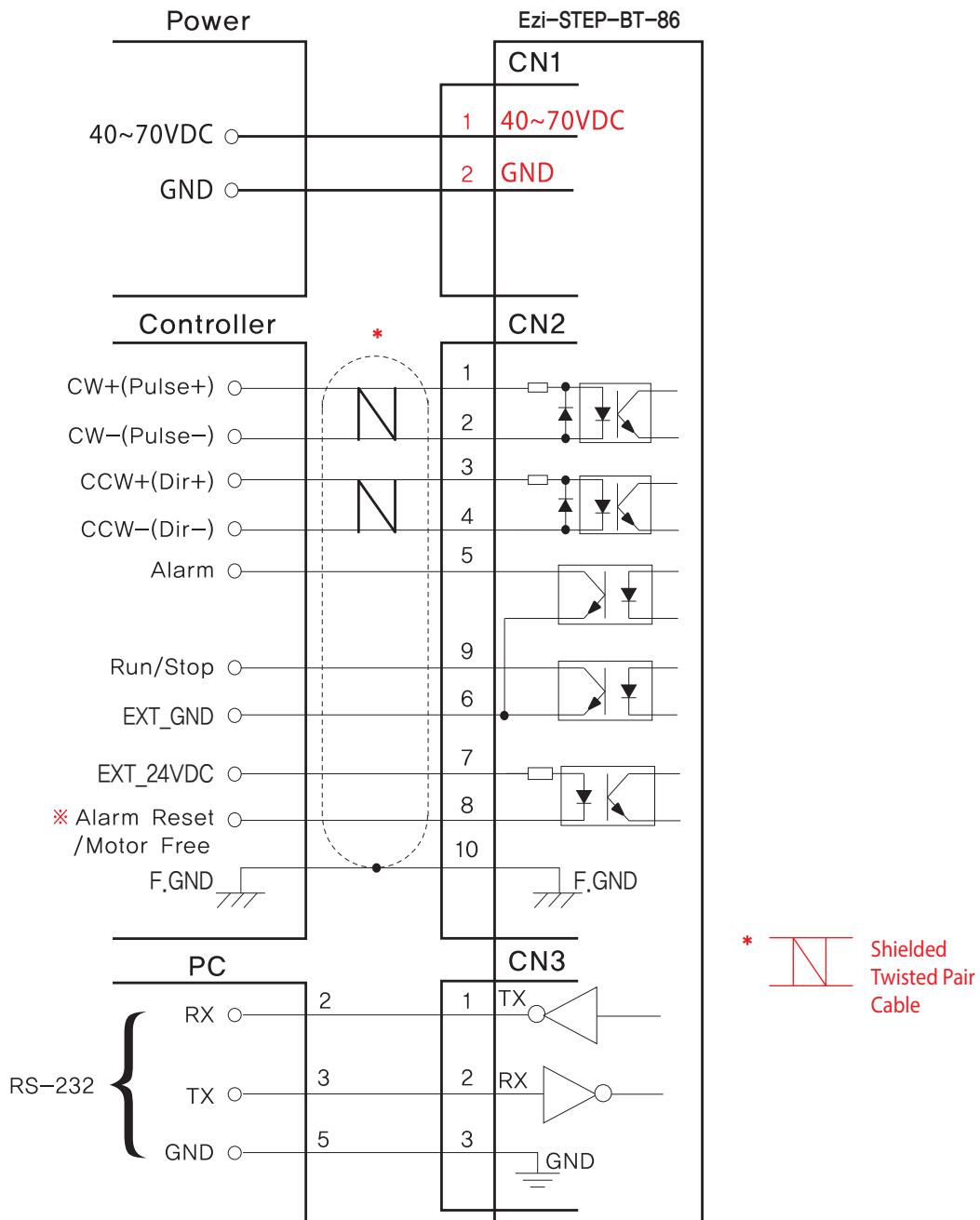
## 14. External Wiring Diagram [Ezi-STEP-BT-42/56 series]



※ 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.

## 15. External Wiring Diagram [Ezi-STEP-BT-86 series]



\*  Shielded Twisted Pair Cable

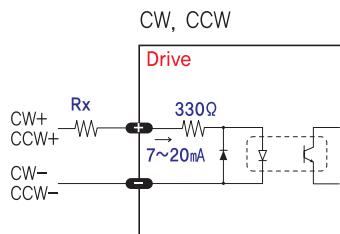
※ Alarm Reset signal line is also used for Motor Free signal.  
(For details, please refer to Control Signal Input/Output Description)

※ 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.

## 16. Control Signal Input/Output Description

### 1 Input Signal

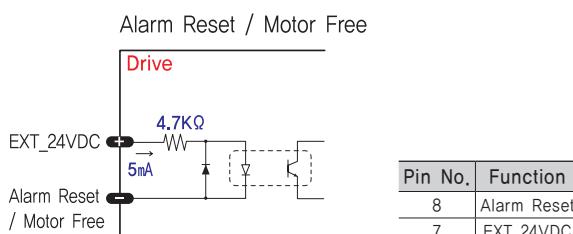
Input signals of the drive are all photocoupler protected. The signal shows the status of internal photocouplers [ON: conduction], [OFF: Non-conduction], not displaying the voltage levels of the signal.



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 (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.



Pin No.	Function
8	Alarm Reset
7	EXT_24VDC

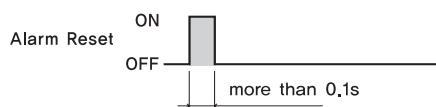
Alarm Reset signal line is also used for Motor Free signal.

#### ◆ 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

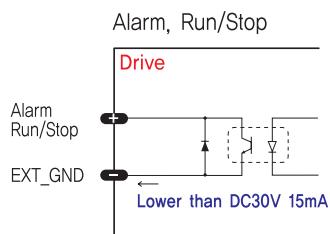
When a protection mode has been activated, a signal to this Alarm Reset input cancels the Alarm output. By setting the alarm reset input signal [ON], cancel Alarm output. Before cancel the Alarm output, have to remove the source of alarm.



[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
5	Alarm
9	Run/Stop
6	EXT_GND

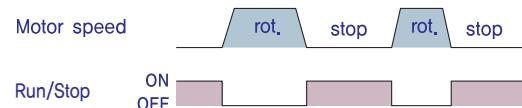
#### ◆ Alarm Output

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 needs 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.

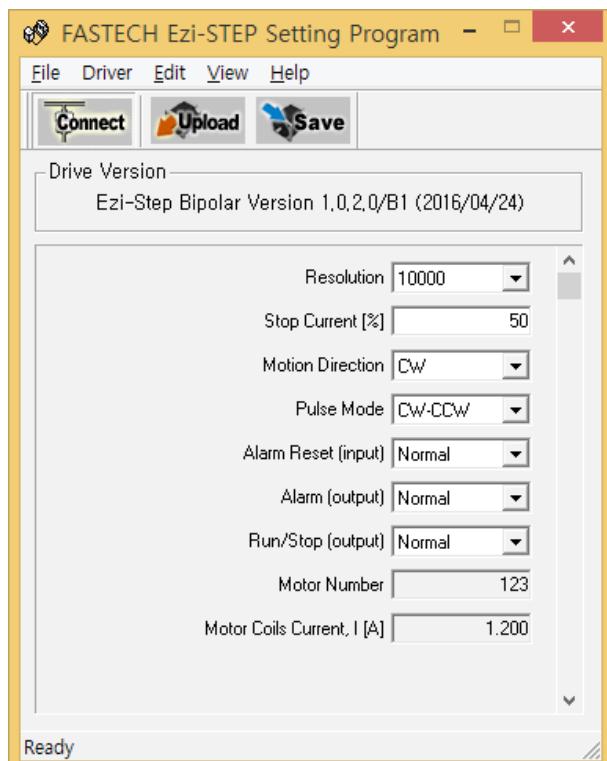
#### ◆ Run/Stop Output

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



## 17. Parameter Settings GUI [User Interface]

Ezi-STEP BT drive utilizes various parameters for operation and some parameters can be changed upon the needs of the user. Ezi-STEP BT provides Drive Setting Program for more convenient use. The screen shot in right side is the sample of Drive Setting Program which is used for drive setting and parameter change. User can change and set the parameter such as Resolution, Stop Current, level of Alarm Reset, Alarm, Motion Direction and so on. By using this drive setting program, user can find the optimal condition to Ezi-STEP BT to fit with the user's own system. Please be noticed that connection for drive setting program shall be done when the Ezi-STEP BT is disable staus for safety reason.



- ※ Parameter setting program can be downloaded from website. ([www.fastech-motions.com](http://www.fastech-motions.com))
- ※ Parameter setting program can support Window 7/8/10.
- ※ Parameter setting program(GUI) can be updated without notice to improve the performance and convenience of user.

## 18. Setting Up Parameters

### 18.1 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 "Ezi-STEP BT Setting.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.

※ 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.



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

### 18.2 Resolution Selection

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

Select a desired resolution by pressing in button on Ezi-STEP BT Setting screen. The possible resolution values are 500~50,000.



Press button to save the value selected into the drive.

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

### 18.3 Stop Current Selection

Stop Current means the motor current value automatically set in 0.1 sec after motor stops. This is to prevent the overheating of a motor when the motor is under long time idling. Select a desired Stop Current by pressing in button on Ezi-STEP BT Setting 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%.

### 18.4 Rotational Direction Selection

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 button on Ezi-STEP BT Setting screen.



Press button to save the value selected into the drive.

※ The default factory setting is CW(Clockwise).

## 18.5 Pulse Input Selection

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 Ezi-STEP BT Setting screen.



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

## 18.6 Alarm Reset Input Selection

Input method of Motor Free/Alarm Reset can be selected. Select a desired method by pressing  in **Alarm Reset (input)** [Normal]  button on Ezi-STEP BT Setting screen.



Press button to save the value selected into the drive.  
※ The default factory setting is Nomal.  
  
※ Caution : When you select 'Inverse' :  
It can be 'Motor Free' status when power is applied to Ezi-STEP BT during Signal Connector(CN2) is not connected. The power LED(green) is flash to show the status of 'Motor Free'

## 18.7 Alarm Output Selection

Alarm signal output method can be selected when error happens. Select a desired method by pressing  in **Alarm (output)** [Normal]  button on Ezi-STEP BT Setting screen.



Press button to save the value selected into the drive.  
※ The default factory setting is Nomal.

## 18.8 Run/Stop Output Selection

Run/Stop output method can be selected that indicate the motor running status. Select a desired method by pressing  in **Run/Stop (output)** [Normal]  button on Ezi-STEP BT Setting screen.



Press button to save the value selected into the drive.  
※ The default factory setting is Nomal.

## 18.9 Motor Number, Motor Coils Current

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

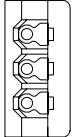
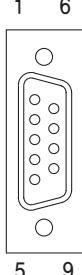
Motor Number	21
Motor Coils Current, I [A]	1.500

## Appendix

### ■ Cable for RS-232C

For cable extension between PC and Ezi-STEP BT drive.

### WIRING DIAGRAM

Connector of Drive		wiring	Connector of Motor	
Pin layout	Pin number		Pin number	Pin layout
	1 2 3	1 ----- 2 ----- 3 -----	1 2 3 4 5 6 7 8 9	

# **MEMO**



*Fast, Accurate, Smooth Motion*

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