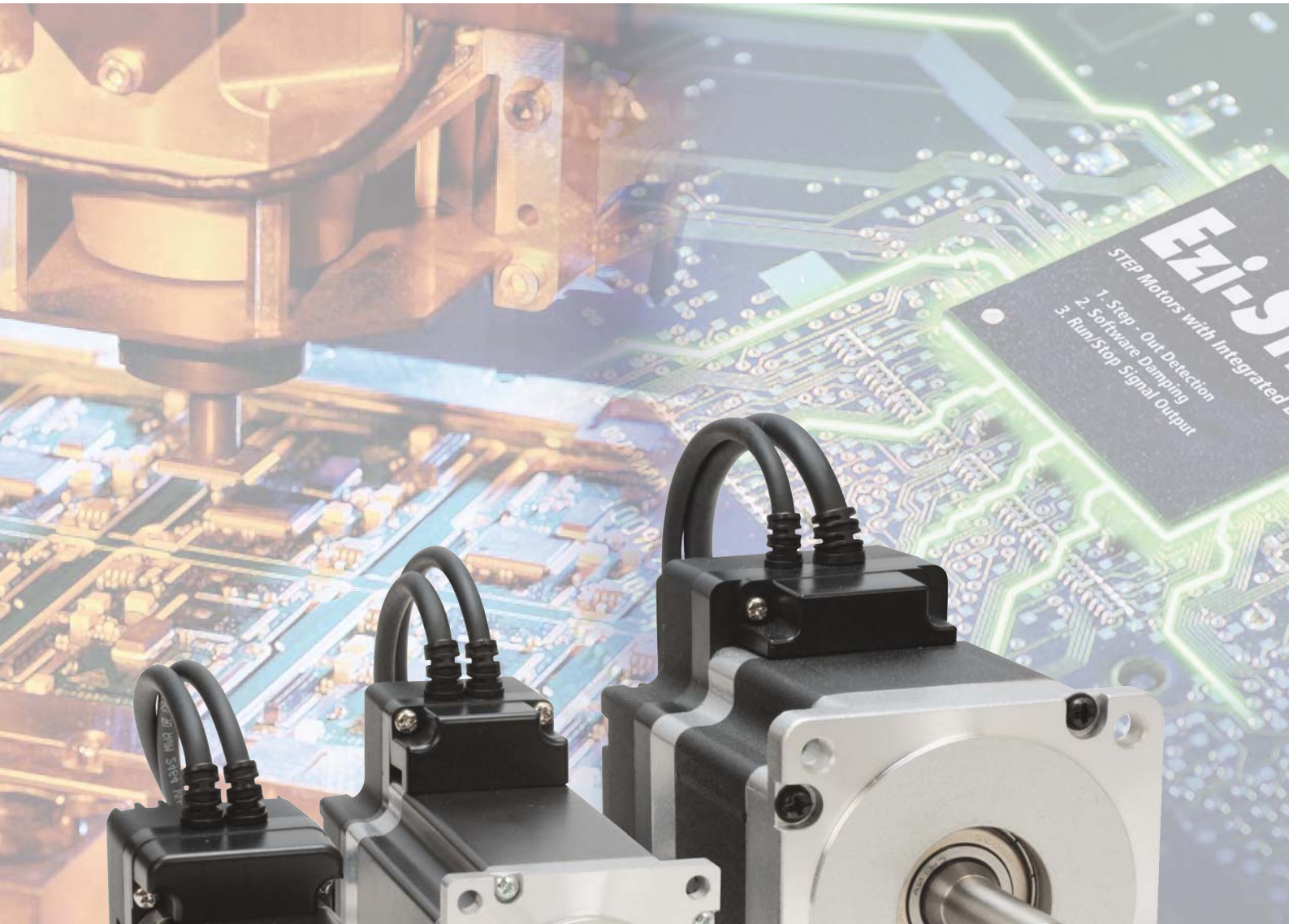


# **Ezi-STEP**<sup>®</sup>

Step Motors with Integrated Drive

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

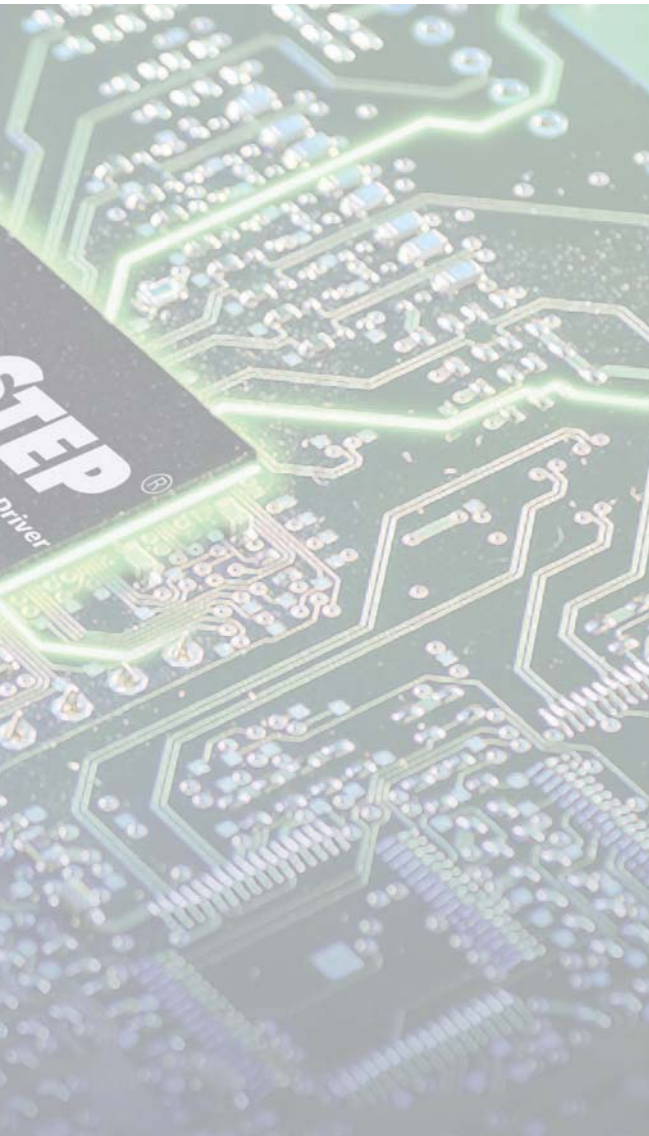




**FASTECH**

**Ezi-STEP**®

Step Motors with Integrated Drive



## ● Ezi-STEP Characteristics

Ezi-STEP is an all-in-one unit. In other words, a motor and a drive are integrated seamlessly together. Because it is an all-in-one unit product, Ezi-STEP makes it possible to apply many functions compared with a conventional stepping motor, such as the sensorless detection of the loss of synchronization, smooth control over the whole velocity range by software damping control, and no vibration at the low speed range.

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 digital signal processor. With a unique position estimation algorithm it instantaneously detects an out-of-synchronization based on the rotor position of the stepping motor, which is not an easy task in a conventional stepping motor and drive (effective only over 300 rpm).

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

The resolution of Ezi-STEP can be improved from basic  $1.8^\circ$  up to  $0.0072^\circ$  (1/250). In addition it generates various signals including sensorless stall detection alarm and running signal.

1. Sensorless Stall Detection
2. Software Damping
3. Run/Stop Signal Output

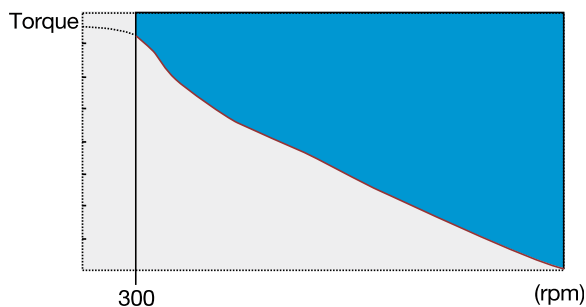


## 1 Sensorless Stall Detection

Detecting the loss-of-synchronization with on-board DSP(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

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).

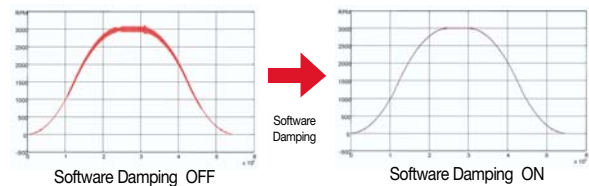
Contrary to a conventional drive, Ezi-STEP adjusts PWM control signal in every 25 usec, which makes it possible to more precise current control and realizes a high-precision microstep operation.

## 3 Software Damping

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 practices Ezi-STEP detects these nonlinearities 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.

## 4 Diverse Output Signal Monitoring

Besides alarming loss-of-synchronization, there are various warning signals depending on an 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 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 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.

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



Ezi-STEP



Drive

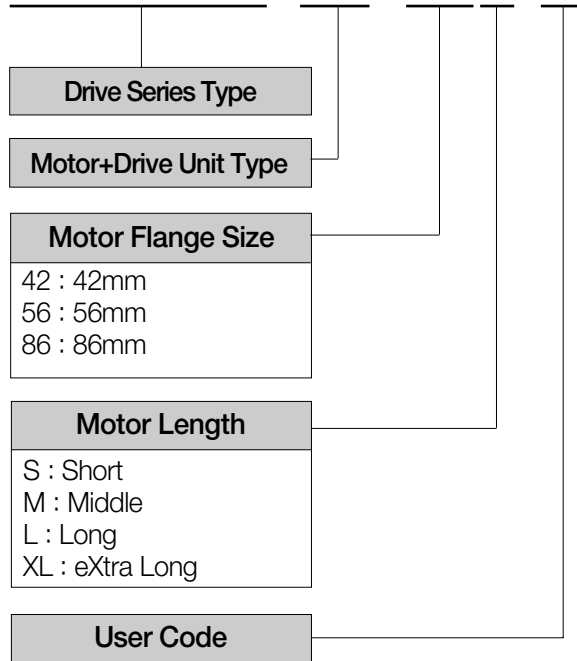


Motor

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

## ● Ezi - STEP Part Numbering

# Ezi-STEP-BT-42S-□



- 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-□

## ● Drive Specifications

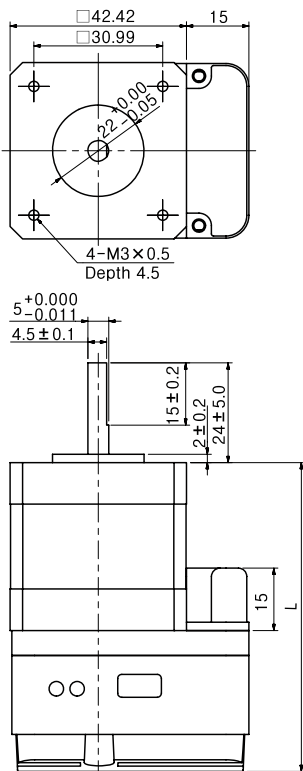
Ezi-STEP Model	BT-42 Series	BT-56 Series	BT-86 Series
Input Voltage	24 VDC ± 10%	24 VDC ± 10%	40~70VDC
Drive Method	Bipolar PWM drive with 32bit DSP		
Current Consumption	Max : 500mA(Except motor current)		
Operating Condition	Temperature	In Use : 0 ~ 50℃ In Storage : -20 ~ 70℃	
	Humidity	In Use : 35~85%RH (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 blinking times of status monitor LED)	
	LED Display	Power Status(Green), Alarm Status(Red)	
	STOP Current	10% ~ 100% (Set by RS-232C Communication) Be settled 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 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)	

## ● Motor Specifications [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
		oz · in	38	57	69	106
DETENT TORQUE		mN · m	11	14	23	31
		oz · in	1.6	2.0	3.2	4.3
ROTOR INERTIA		g · cm <sup>2</sup>	36	54	76	114
		oz · in <sup>2</sup>	0.20	0.30	0.42	0.63
WEIGHTS		kg	0.32	0.38	0.48	0.62
		lb	0.70	0.85	1.06	1.39
LENGTH(L)		mm	68.5	74.5	82.5	93.0
ALLOWABLE OVERHUNG LOAD (DISTANCE FROM END OF SHAFT)	3mm	N (lb)	22(4.94)	22(4.94)	22(4.94)	22(4.94)
	8mm	N (lb)	26(5.84)	26(5.84)	26(5.84)	26(5.84)
	13mm	N (lb)	33(7.41)	33(7.41)	33(7.41)	33(7.41)
	18mm	N (lb)	46(10.3)	46(10.3)	46(10.3)	46(10.3)
ALLOWABLE THRUST LOAD		N	Lower than MOTOR weight			
INSULATION RESISTANCE		Mohm	100 min. (at 500VDC)			
DELECTRIC STRENGTH		V/mm	500 (at 50Hz 1min)			
TEMPERATURE CLASS		-	CLASS B (130℃)			
OPERATING TEMPERATURE		℃	0 to 50			
ALLOWABLE TEMPERATURE		℃	70 max			

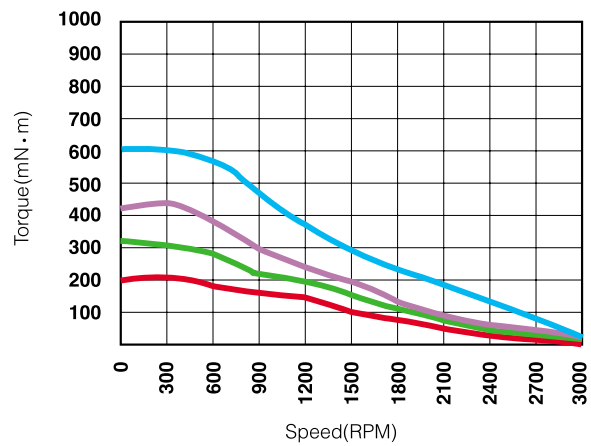
## ● Motor Dimension[mm] and Torque Characteristics

FASTECH Ezi-STEP



### BT-42 series

- BT-42S —
- BT-42M —
- BT-42L —
- BT-42XL —

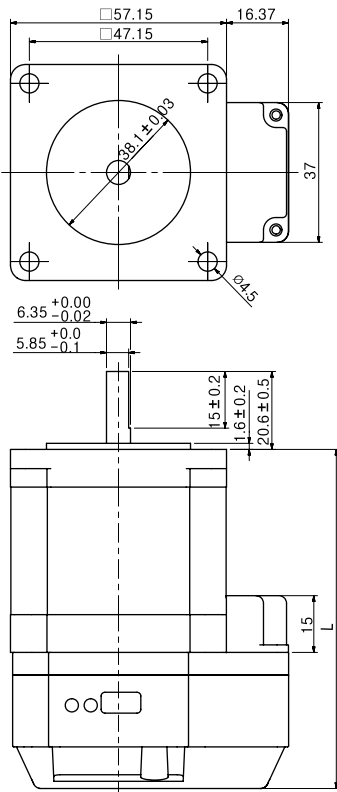


※: Measured Condition  
 Input Voltage = 24VDC  
 Motor Current = Rated Current (Refer to Motor Specifications)  
 Drive = Ezi-STEP

## ● Motor Specifications [Ezi-STEP-BT-56 Series]

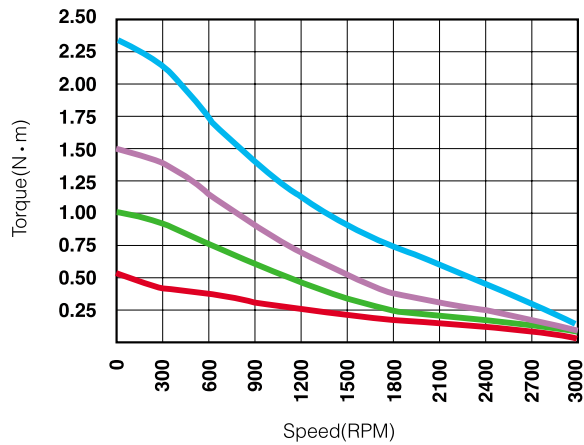
MODEL		Unit	BT-56S	BT-56M	BT-56L	BT-56XL
DRIVE METHOD		-	BI-POLAR	BI-POLAR	BI-POLAR	BI-POLAR
NUMBER OF PHASE		-	2	2	2	2
CURRENT per PHASE		A	3.0	3.0	3.0	3.0
HOLDING TORQUE		mN · m	810	1320	2490	3540
		oz · in	115	187	352	502
DETENT TORQUE		mN · m	70	90	180	280
		oz · in	10	13	26	39
ROTOR INERTIA		g · cm <sup>2</sup>	189	249	493	737
		oz · in <sup>2</sup>	1.03	1.36	2.70	4.04
WEIGHTS		kg	0.60	0.80	1.27	1.73
		lb	1.33	1.77	2.78	3.55
LENGTH(L)		mm	77.0	80.0	120.0	150.0
ALLOWABLE OVERHUNG LOAD (DISTANCE FROM END OF SHAFT)	3mm	N (lb)	52(11.7)	52(11.7)	52(11.7)	52(11.7)
	8mm	N (lb)	65(14.6)	65(14.6)	65(14.6)	65(14.6)
	13mm	N (lb)	85(19.1)	85(19.1)	85(19.1)	85(19.1)
	18mm	<b>N (lb)</b>	123(27.7)	123(27.7)	123(27.7)	123(27.7)
ALLOWABLE THRUST LOAD		N	Lower than MOTOR weight			
INSULATION RESISTANCE		Mohm	100 min. (at 500VDC)			
DELECTRIC STRENGTH		V/mm	500 (at 50Hz 1min)			
TEMPERATURE CLASS		-	CLASS B (130°C)			
OPERATING TEMPERATURE		°C	0 to 50			
ALLOWABLE TEMPERATURE		°C	70 max			

## ● Motor Dimension [mm] and Torque Characteristics



### BT-56 series

- BT-56S ———
- BT-56M ———
- BT-56L ———
- BT-56XL ———



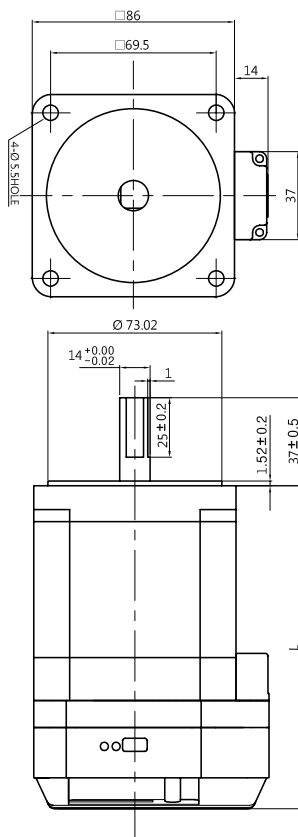
※Measured Condition  
 Input Voltage = 24VDC  
 Motor Current = Rated Current(Refer to Motor Specifications)  
 Drive =Ezi-STEP

## ● Motor Specifications [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	
	oz · in	665	1204	1728	
DETENT TORQUE	mN · m	133	240	360	
	oz · in	18.8	34	51	
ROTOR INERTIA	g · cm <sup>2</sup>	1400	2700	4000	
	oz · in <sup>2</sup>	7.67	14.8	21.9	
WEIGHTS	kg	2.3	3.8	5.3	
	lb	4.7	8.4	11.7	
LENGTH(L)	mm	125.5	163.5	201.5	
ALLOWABLE OVERHUNG LOAD (DISTANCE FROM END OF SHAFT)	3mm	N (lb)	270(60.6)	270(60.6)	270(60.6)
	8mm	N (lb)	300(67.5)	300(67.5)	300(67.5)
	13mm	N (lb)	350(78.7)	350(78.7)	350(78.7)
	18mm	N (lb)	400(89.9)	400(89.9)	400(89.9)
ALLOWABLE THRUST LOAD	N	Lower than MOTOR weight			
INSULATION RESISTANCE	Mohm	100 min. (at 500VDC)			
DELECTRIC STRENGTH	V/mm	500 (at 50Hz 1min)			
TEMPERATURE CLASS	-	CLASS B (130℃)			
OPERATING TEMPERATURE	℃	0 to 50			
ALLOWABLE TEMPERATURE	℃	70 max			

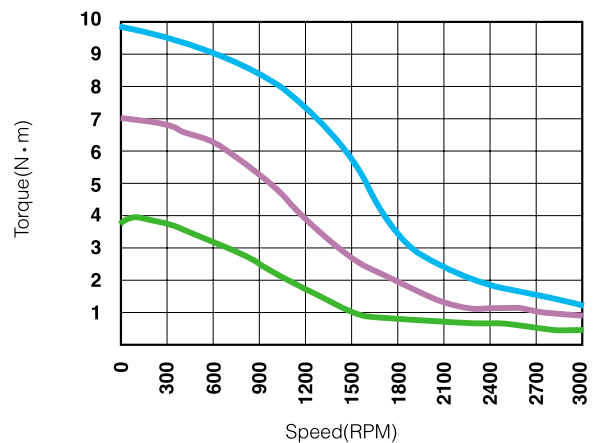
## ● Motor Dimension[mm] and Torque Characteristics

FASTECH Ezi-STEP



### BT-86 series

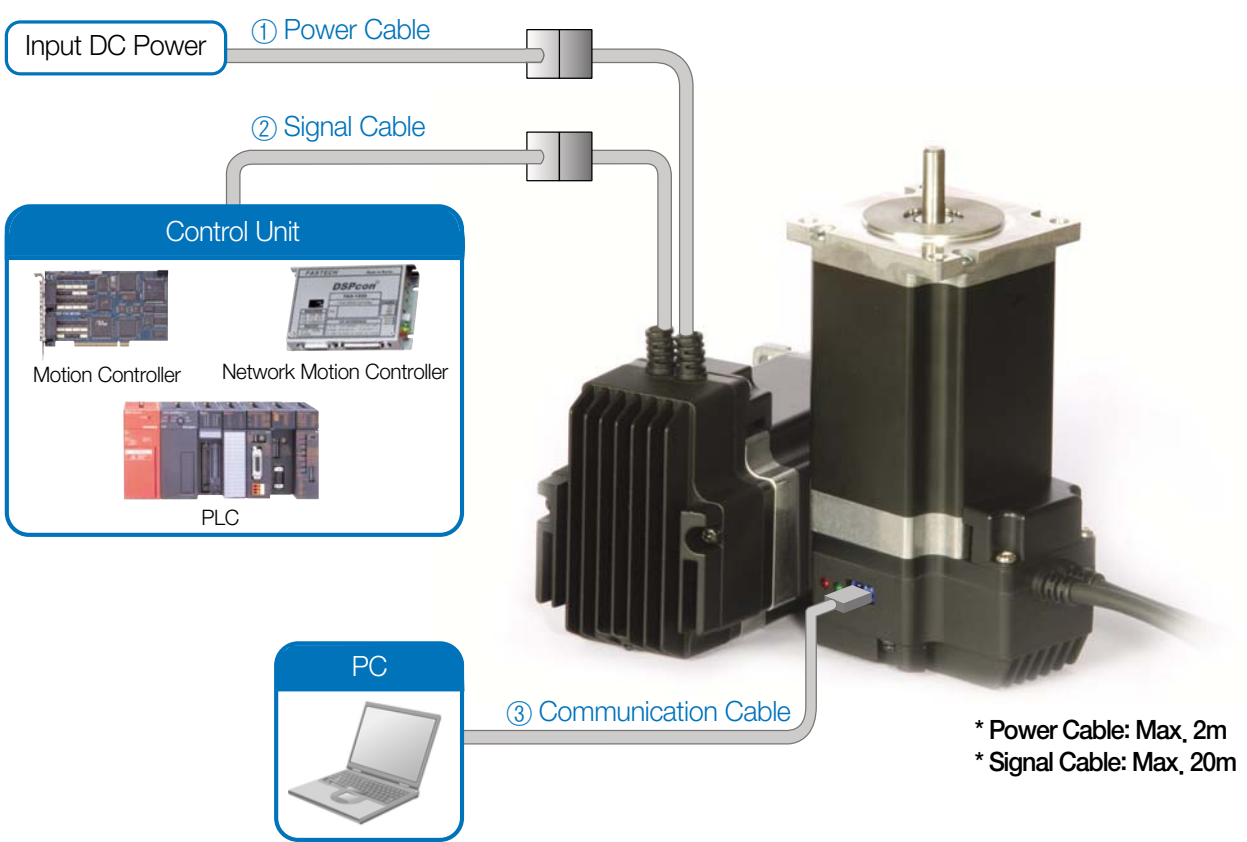
BT-86M —  
 BT-86L —  
 BT-86XL —



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



# ● System Configuration



## ● 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

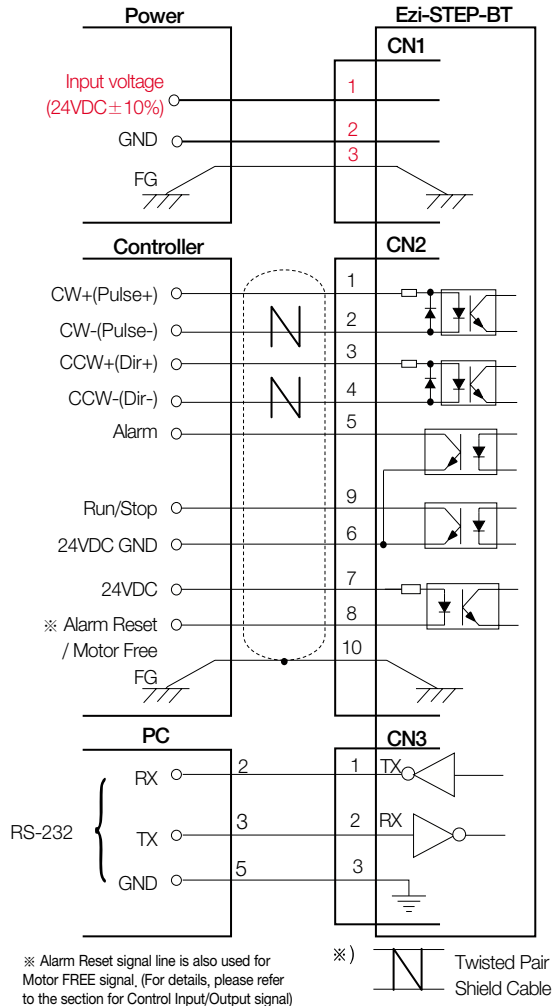
Available to connect between PC and Ezi-STEP-BT. This is used for change setting value of Resolution and Stop Current etc.

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

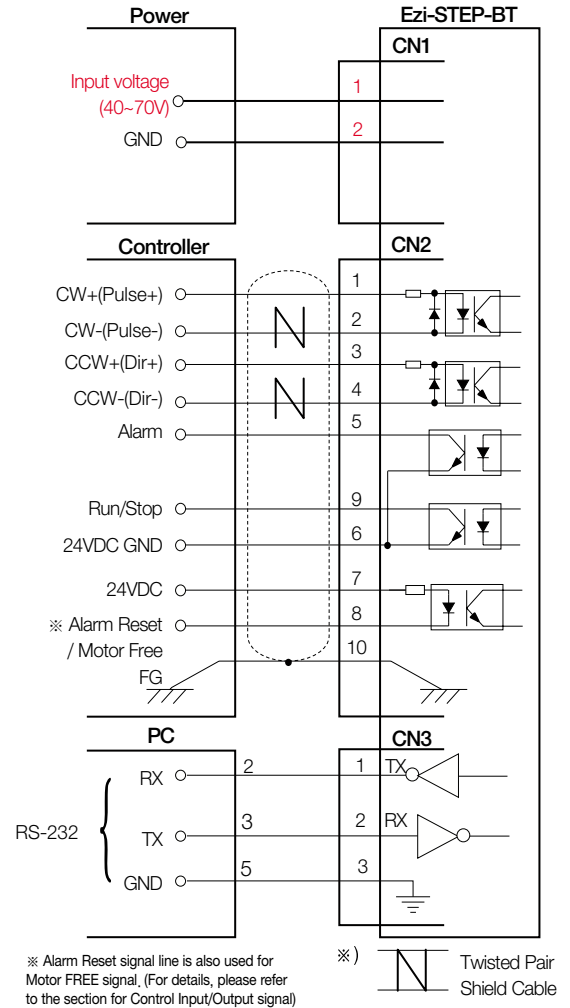
□□□ is for Cable Length, The Unit is 1m and Max 15m Length,

## External Wiring

### Ezi-STEP-BT-42/56 Series



### Ezi-STEP-BT-86 Series

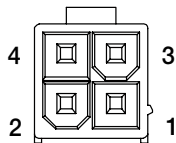


## Ezi-STEP-BT Series Connector

### Power Connector(CN1)

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

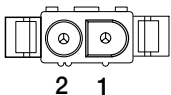
※ Only for BT-42, BT-56 Series.



### Power Connector(CN1)

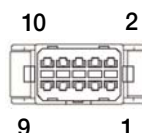
Number	Function
1	Power Input : 40~70VDC
2	Power Input Ground

※ Only for BT-86 Series.



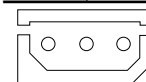
### Signal Connector(CN2)

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	



### Communication Connector(CN3)

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

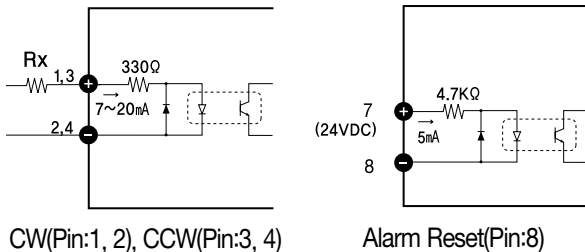


1 2 3

## Control signal input/output Description

### 1 Input Signals

Input signals of the drive are all photocoupler inputs. 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-side host motion controller. A user can select 1-pulse input mode or 2-pulse input mode.

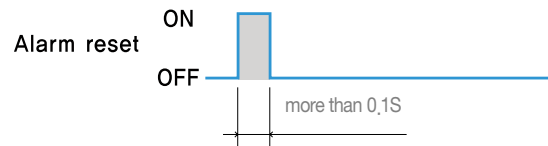
The input schematic of CW, CCW is designed for 5V TTL level. When using 5V level as an input signal, the resistor Rx is used and connect to the drive directly. When the level of input signal is more than 5V, have to add Rx. If this resistor is absent, the inner schematic can be broken. In input signal 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

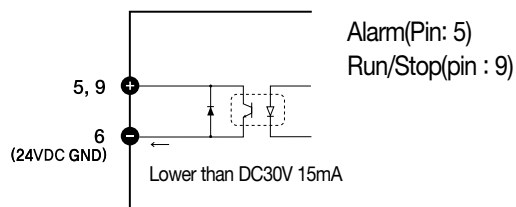
When a protection mode has been activated, a signal to this Alarm Reset input cancels the Alarm output. By setting the alarm reset input signal [ON], cancel Alarm output. Before cancel the Alarm output, have to remove the source of alarm.



**[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.

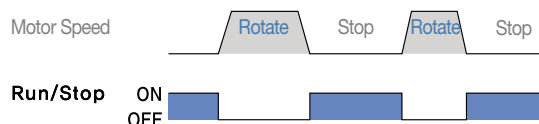
### 2 Output Signals

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.



#### ◆ 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.



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

#### ◆ 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.



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