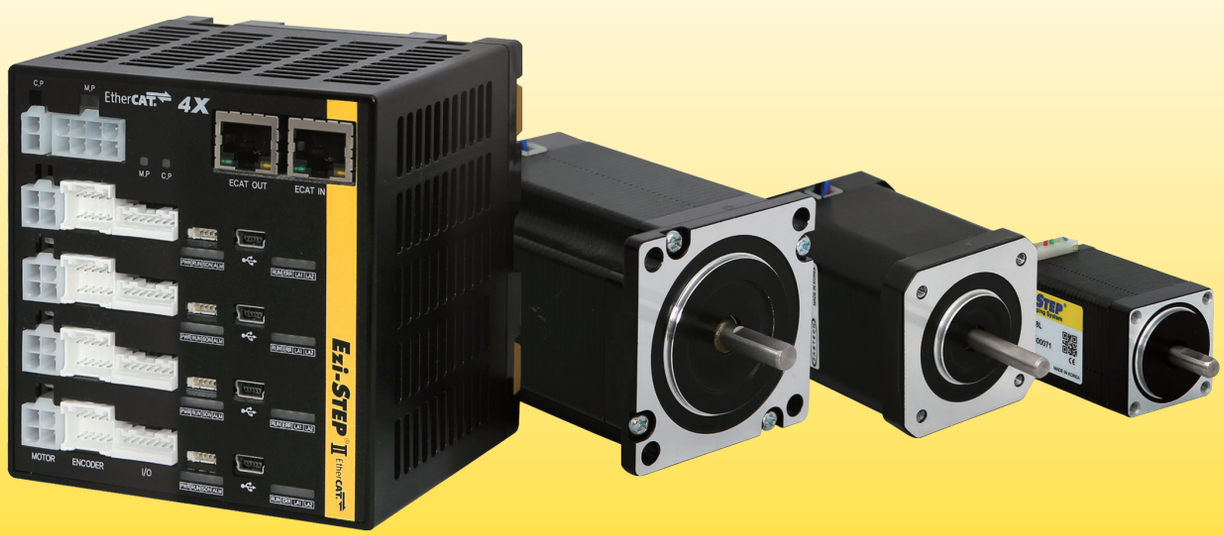
# Ezi-STEP® II

## Micro Stepping System

- CiA402 Drive Profile Support
- Microstepping
- Software Damping
- Compact Multi Axis Stepping Motor Drive
- Space Saving / Reduced Wiring

EtherCAT® 4X




CE

FASTECH

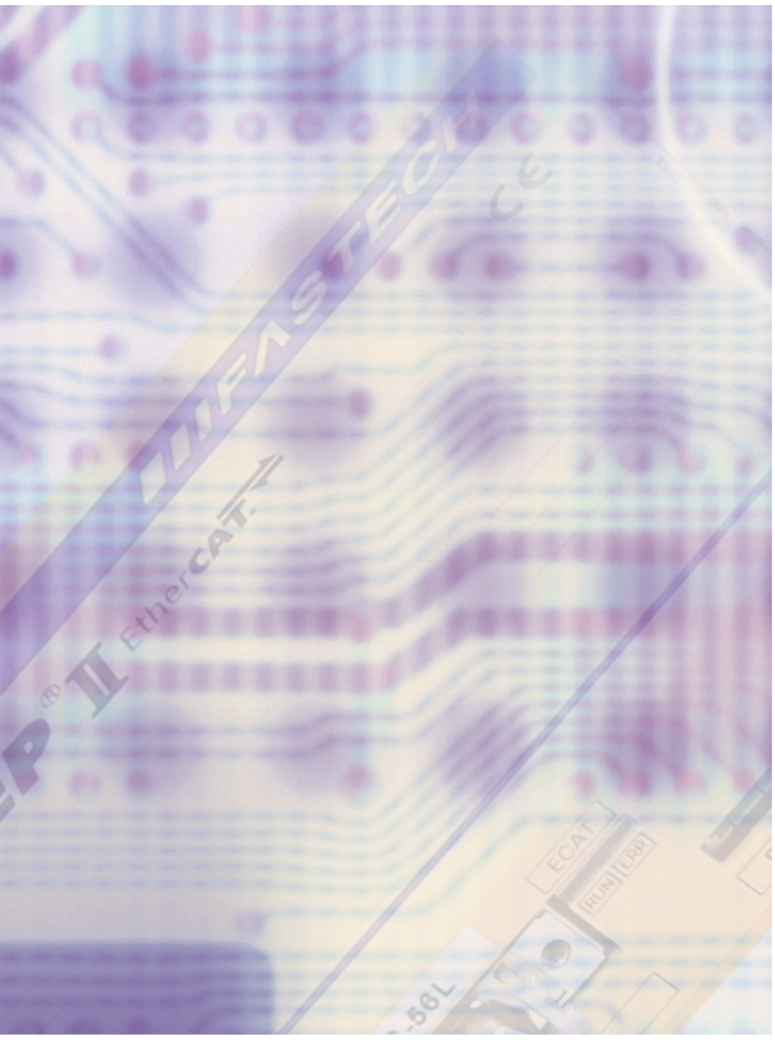
*Fast, Accurate, Smooth Motion*


FASTECH

*Fast, Accurate, Smooth Motion*

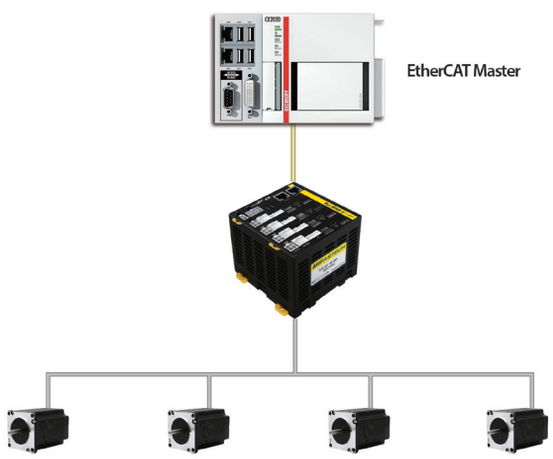
# Ezi-STEP® II EtherCAT® 4X

## Micro Stepping System



## 1 EtherCAT Based Motion Control

Ezi-STEP II EtherCAT 4X is stepping motor control system using EtherCAT, high speed ethernet (100Mbps Full-Duplex) based fieldbus. Ezi-STEP II EtherCAT 4X is EtherCAT slave module which supports CAN application layer over EtherCAT (CoE). It employs CiA 402 Drive Profile and supports Profile Position Mode, Homing Mode, Cyclic Synchronous Position Mode.

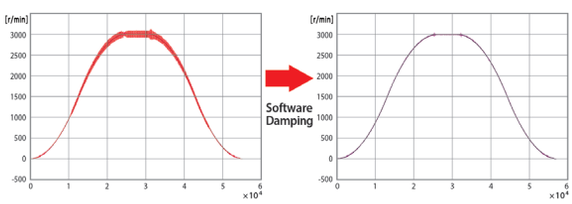



## 2 Microstep and Filtering

The high-performance MCU operates at step resolutions of 1.8° up to maximum 0.0072° (1/250 steps) and Ezi-STEP II adjusts PWM control signal in every 50μsec, which makes it possible for more precise current control, resulting in high-precision Microstep operation. In addition, Ezi-STEP II applies filtering control to enable smooth operation even at very low-speed.

## 3 Software Damping

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 II 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.

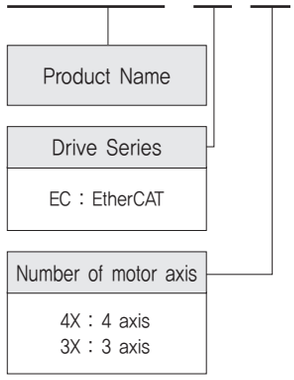



Software Damping OFF　　Software Damping ON

※ This is real measured speed that using 100,000 P/R encoder.

## ● Ezi-STEP II EtherCAT 4X Part Numbering

**Ezi-STEP II - EC - 4X**




* Ezi-STEPII EtherCAT 4X can connect up to 4 motors to one drive. Standard motors, motors with brake, and motors with gearbox can be connected, and different types of motors can be connected to each axis.

## ● Standard Motor

| Motor Model Number |
|---|
| BM-20M |
| BM-20L |
| BM-28S |
| BM-28M |
| BM-28L |
| BM-42S |
| BM-42M |
| BM-42L |
| BM-42XL |
| BM-56S |
| BM-56M |
| BM-56L |
| BM-60S |
| BM-60M |
| BM-60L |

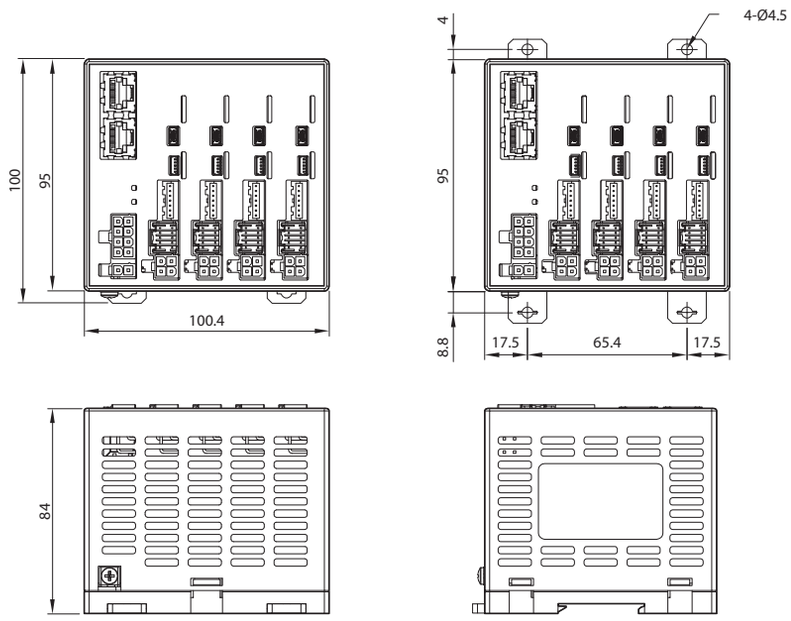
## ● Combination with Brake

| Motor Model Number with Brake |
|---|
| BM-42S-BK |
| BM-42M-BK |
| BM-42L-BK |
| BM-42XL-BK |
| BM-56S-BK |
| BM-56M-BK |
| BM-56L-BK |
| BM-60S-BK |
| BM-60M-BK |
| BM-60L-BK |

## Specifications of Drive

| Motor Model | | BM-20 series | BM-28 series | BM-42 series | BM-56 series | BM-60 series |
|---|---|---|---|---|---|---|
| Driver Model | | EzT2-EC-4X, 3X series | | | | |
| Input Voltage | | DC24V±10% | | | | |
| Control Method | | Bipolar PWM drive with 32bit MCU | | | | |
| Current Consumption | | Max. 500mA/axis (Except motor current) | | | | |
| Operating Condition | Ambient Temperature | · In Use: 0~50℃<br>· In Storage: -20~70℃ | | | | |
| | Humidity | · In Use: 35~85% RH (Non-Condensing)<br>· In Storage: 10~90% RH (Non-Condensing) | | | | |
| | Vib. Resist. | 0.5g | | | | |
| Function | Rotation Speed | 0~3,000r/min | | | | |
| | Resolution | Configurable Resolution [P/R]<br>500 1,000 1,600 2,000 3,200 3,600 4,000 5,000 6,400 8,000 10,000<br>20,000 25,000 36,000 40,000 50,000<br>(Selectable with Parameter) | | | | |
| | Protection Functions | Over Current Error, Over Speed Error, Over Temperature Error, Over Regenerated Voltage Error, Motor Connect Error, ROM Error | | | | |
| | LED Display | Power Status, Alarm Status, Run Status, STEP On Status | | | | |
| EtherCAT | Supported Protocol | CoE (CiA 402 Drive Profile), FoE (Firmware Download) | | | | |
| | Supported Mode | Profile Position Mode, Homing Mode, Cyclic Synchronous Position Mode | | | | |
| | Synchronization | Free Run, SM Event, DC SYNC Event | | | | |
| I/O Signal | Input Signals | 3 dedicated inputs (LIMIT+, LIMIT-, ORIGIN) for each axis | | | | |
| | Output Signals | 1 Brake output for each axis | | | | |

## Dimensions of Drive [mm]




※ Can be installed on DIN Rail. (35mm)

※ Outer dimension of Ezi-STEPII EtherCAT 3X drive is the same as EtherCAT 4X drive.

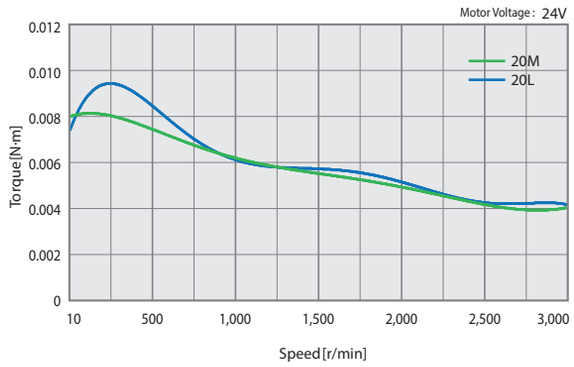
## ● Specifications of Motor

| MODEL | | | | BM-20 series | | BM-28 series | | | BM-42 series | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | UNIT | 20M | 20L | 28S | 28M | 28L | 42S | 42M | 42L | 42XL |
| DRIVE METHOD | | | – | Bipolar | | | | | | | | |
| NUMBER OF PHASES | | | – | 2 Phase | | | | | | | | |
| CURRENT per PHASE | | | A/Phase | 0.5 | 0.5 | 0.95 | 0.95 | 0.95 | 1.2 | 1.2 | 1.2 | 1.2 |
| MAXIMUM HOLDING TORQUE | | | N·m | 0.016 | 0.025 | 0.069 | 0.098 | 0.118 | 0.32 | 0.44 | 0.5 | 0.65 |
| ROTOR INERTIA | | | $g \cdot cm^2$ | 2.5 | 3.3 | 9.0 | 13 | 18 | 35 | 54 | 77 | 114 |
| WEIGHTS | | | kg | 0.053 | 0.078 | 0.115 | 0.174 | 0.202 | 0.238 | 0.303 | 0.374 | 0.508 |
| LENGTH(L) | | | mm | 28 | 38 | 32 | 45 | 50 | 34 | 40 | 48 | 60 |
| PERMISSIBLE RADIAL LOAD | DISTANCE FROM END OF SHAFT | 3mm | N | 18 | 18 | 30 | 30 | 30 | 22 | 22 | 22 | 22 |
| | | 8mm | | 30 | 30 | 38 | 38 | 38 | 26 | 26 | 26 | 26 |
| | | 13mm | | – | – | 53 | 53 | 53 | 33 | 33 | 33 | 33 |
| | | 18mm | | – | – | – | – | – | 46 | 46 | 46 | 46 |
| PERMISSIBLE AXIAL LOAD | | | N | Lower than motor Unit's Weight | | | | | | | | |
| INSULATION RESISTANCE | | | MΩ | Min. 100(When measured with a DC500V insulation resistance meter) | | | | | | | | |
| INSULATION CLASS | | | – | CLASS B(130℃) | | | | | | | | |
| OPERATING TEMPERATURE | | | ℃ | 0 ~ 55 | | | | | | | | |

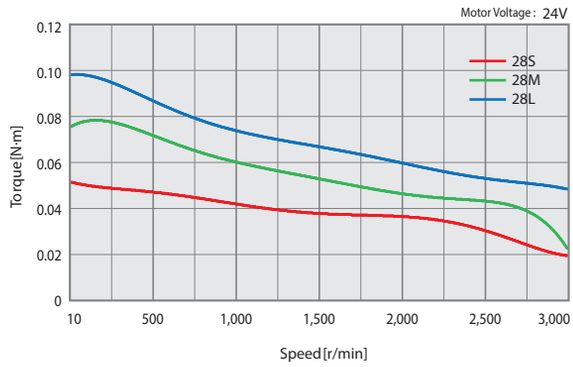
| MODEL | | | | BM-56 series | | | BM-60 series | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | UNIT | 56S | 56M | 56L | 60S | 60M | 60L |
| DRIVE METHOD | | | – | Bipolar | | | | | |
| NUMBER OF PHASES | | | – | 2 Phase | | | | | |
| CURRENT per PHASE | | | A/Phase | 3.0 | 3.0 | 3.0 | 4.0 | 4.0 | 4.0 |
| MAXIMUM HOLDING TORQUE | | | N·m | 0.64 | 1.0 | 1.5 | 0.88 | 1.28 | 2.4 |
| ROTOR INERTIA | | | $g \cdot cm^2$ | 180 | 280 | 520 | 240 | 490 | 690 |
| WEIGHTS | | | kg | 0.548 | 0.726 | 1.159 | 0.616 | 0.793 | 1.349 |
| LENGTH(L) | | | mm | 46 | 55 | 80 | 47 | 56 | 85 |
| PERMISSIBLE RADIAL LOAD | DISTANCE FROM END OF SHAFT | 3mm | N | 52 | 52 | 52 | 70 | 70 | 70 |
| | | 8mm | | 65 | 65 | 65 | 87 | 87 | 87 |
| | | 13mm | | 85 | 85 | 85 | 114 | 114 | 114 |
| | | 18mm | | 123 | 123 | 123 | 165 | 165 | 165 |
| PERMISSIBLE AXIAL LOAD | | | N | Lower than motor Unit's Weight | | | | | |
| INSULATION RESISTANCE | | | MΩ | Min. 100(When measured with a DC500V insulation resistance meter) | | | | | |
| INSULATION CLASS | | | – | CLASS B(130℃) | | | | | |
| OPERATING TEMPERATURE | | | ℃ | 0 ~ 55 | | | | | |

# Torque Characteristics of Motor

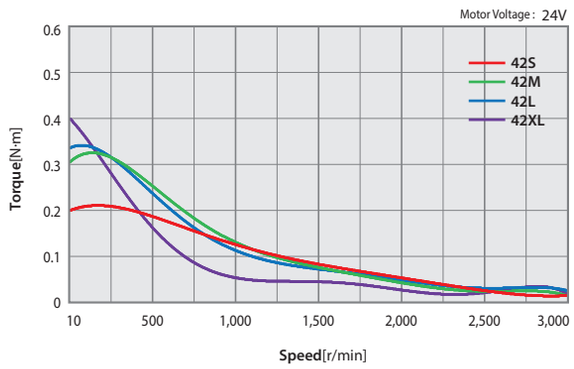
## Ezi-STEP II-EC-4X-20 series



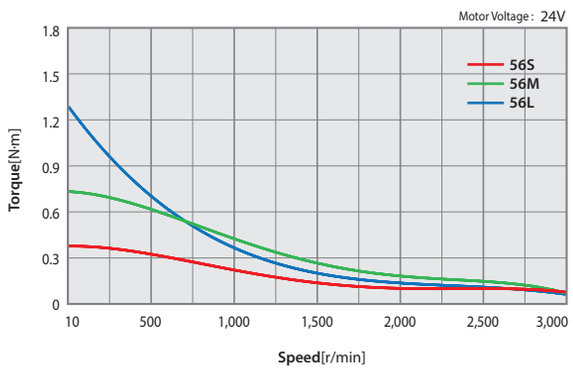

## Ezi-STEP II-EC-4X-28 series



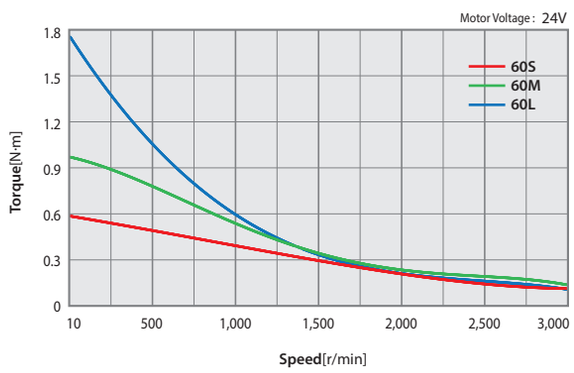

## Ezi-STEP II-EC-4X-42 series



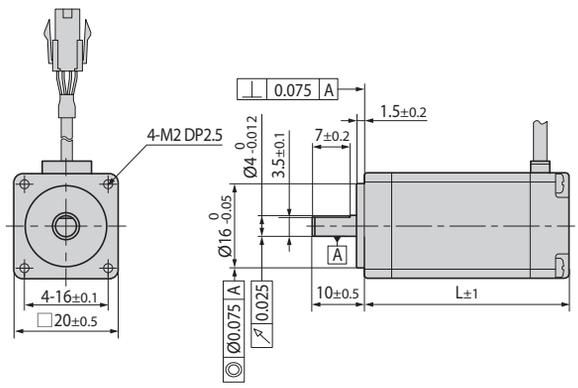

## Ezi-STEP II-EC-4X-56 series




## Ezi-STEP II-EC-4X-60 series

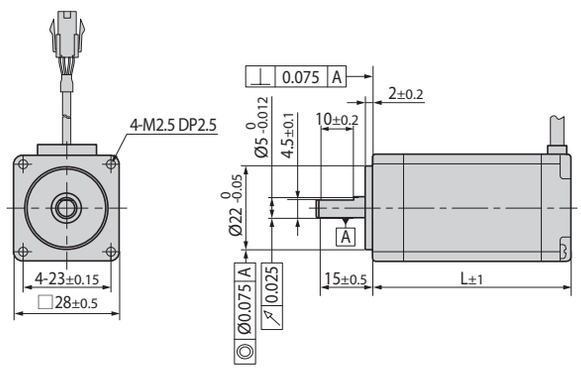


## ● Dimensions of Motor [mm]



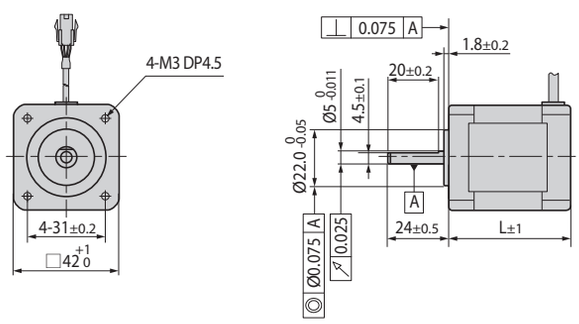

### 20mm

| Model name | Length(L) |
|---|---|
| BM-20M | 28 |
| BM-20L | 38 |



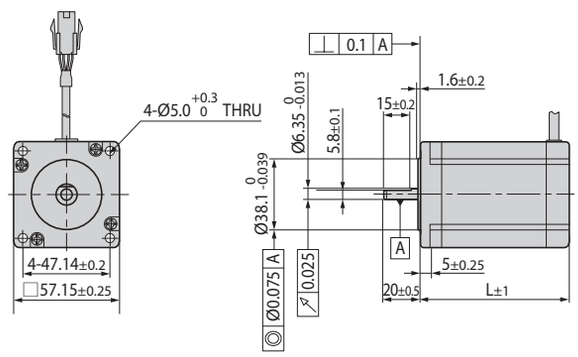

### 28mm

| Model name | Length(L) |
|---|---|
| BM-28S | 32 |
| BM-28M | 45 |
| BM-28L | 50 |




### 42mm

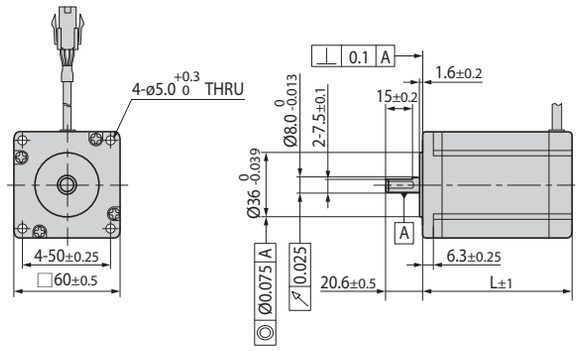
| Model name | Length(L) |
|---|---|
| BM-42S | 34 |
| BM-42M | 40 |
| BM-42L | 48 |
| BM-42XL | 60 |




### 56mm

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

## ● Dimensions of Motor [mm]




**60mm**

| Model name | Length(L) |
|---|---|
| BM-60S | 47 |
| BM-60M | 56 |
| BM-60L | 85 |

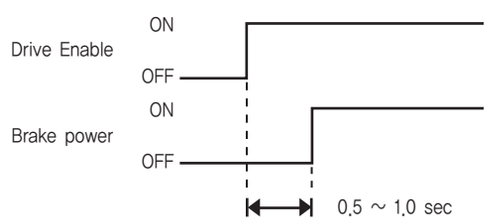
## ● Specifications of Motor with Brake

| Motor Model Number | Electromagnetic Brake | | | | | Motor Unit Weight [kg] | Permissible Radial Load [N] | | | | Permissible Axial Load [N] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Type | Voltage Input [V] | Rated Current [A] | Power Consumption [W] | Static Friction Torque [N·m] | | Distance from End of Shaft [mm] | | | | |
| | | | | | | | 3 | 8 | 13 | 18 | |
| BM-42S-BK | Non-excitation run Type | DC24V ±10% | 0.2 | 5 | 0.2 | 0.500 | 22 | 26 | 33 | 46 | Must be Lower than Unit Weight |
| BM-42M-BK | | | | | | 0.560 | | | | | |
| BM-42L-BK | | | | | | 0.630 | | | | | |
| BM-42XL-BK | | | | | | 0.770 | | | | | |
| BM-56S-BK | | | 0.27 | 6.6 | 0.7 | 0.970 | 52 | 65 | 85 | 123 | |
| BM-56M-BK | | | | | | 1.150 | | | | | |
| BM-56L-BK | | | | | | 1.580 | | | | | |
| BM-60S-BK | | | | | | 1.060 | 70 | 87 | 114 | 165 | |
| BM-60M-BK | | | | | | 1.230 | | | | | |
| BM-60L-BK | | | | | | 1.790 | | | | | |

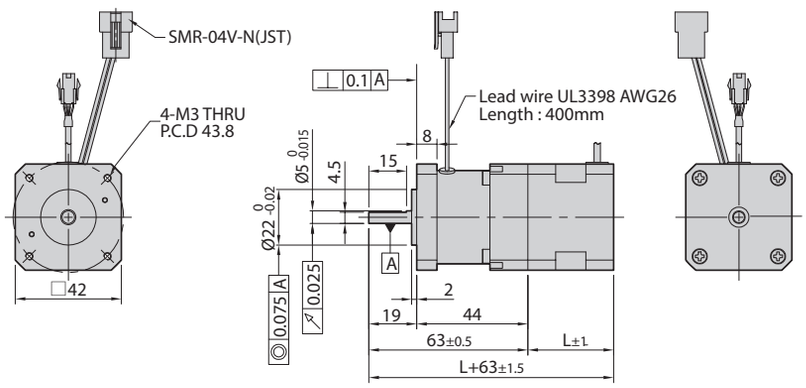
* Electronic Brake cannot be used for braking. Position hold purpose only when power OFF.
* The weight means Motor Unit Weight including Motor and Electronic Brake.
* Motor Model Number is combined model name of Motor and Brake.
* Motor specification and torque characteristic are same as Standard Motor.

### * Brake Operation Timing Chart

Ezi-STEP II EtherCAT 4X controls Brake by Drive automatically.
Please refer to below Timing Chart when Brake is controlled by the upper controller other than using Ezi-STEP II EtherCAT 4X Brake control.
Otherwise, Drive might malfunction and loads might fall down.
Also, please do not operate Brake during motor operation to prevent damage.

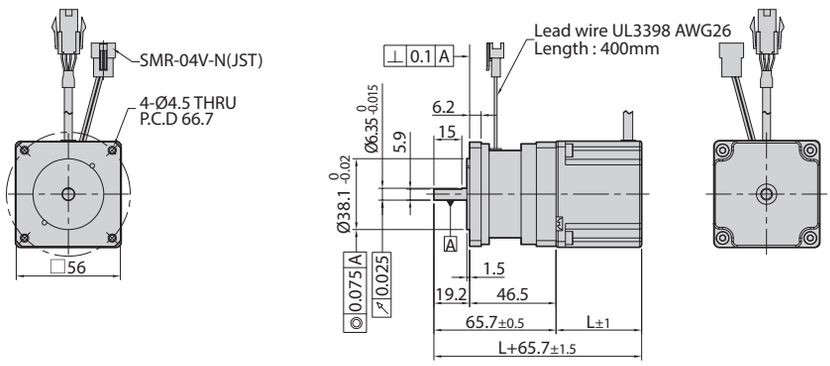


## ● Dimensions of Motor with Brake [mm]



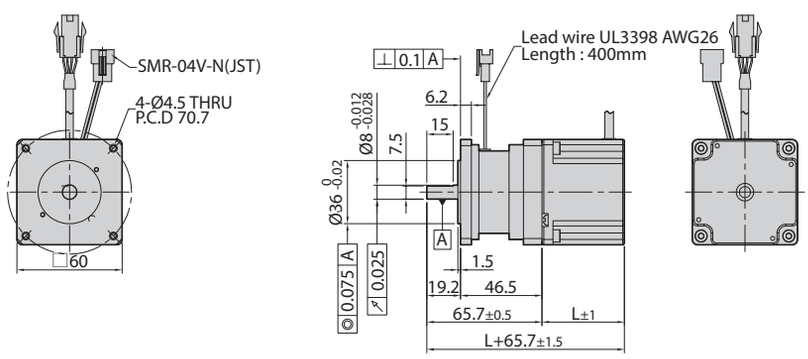

### 42mm

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




### 56mm

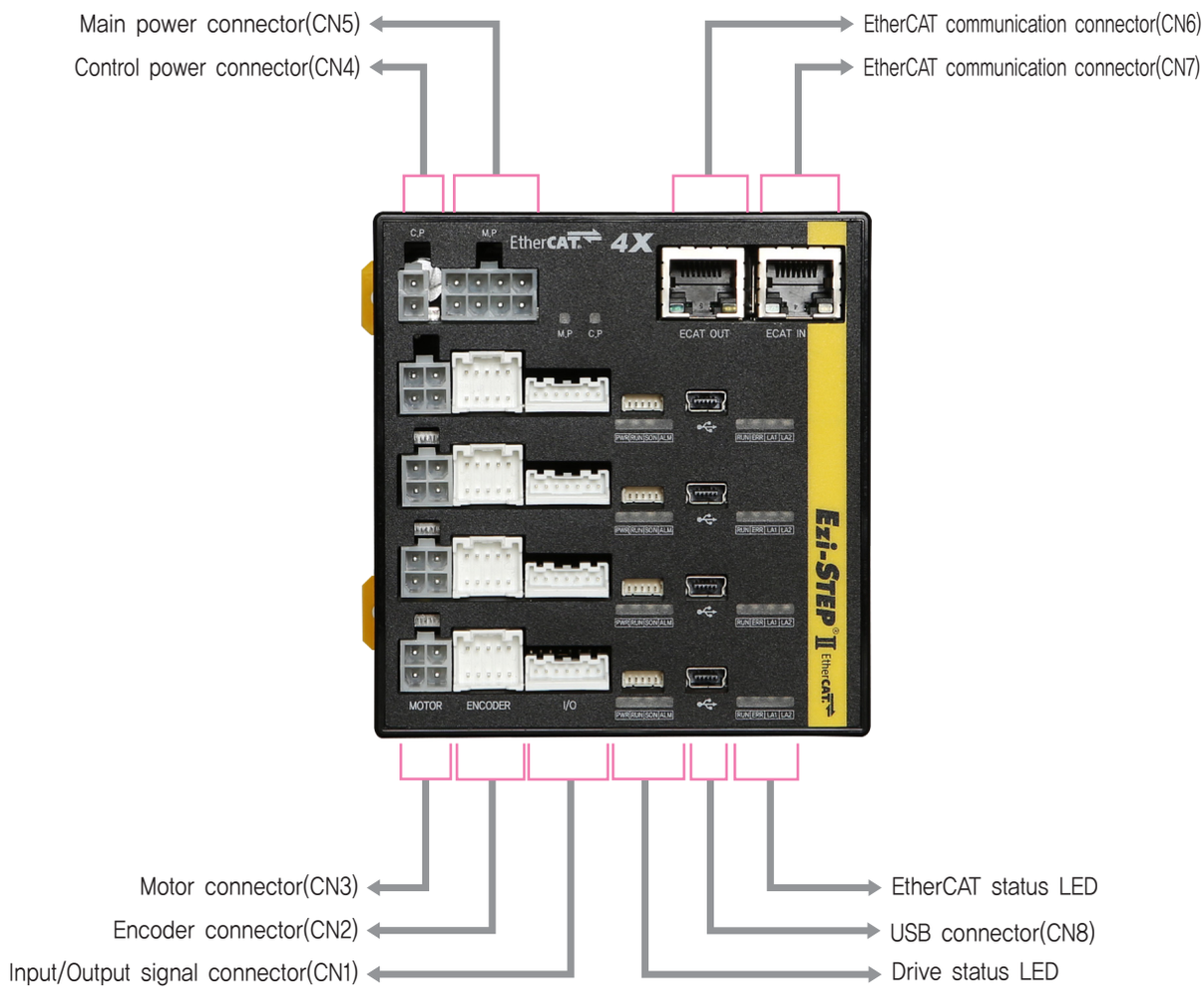
| Model name | Length(L) |
|---|---|
| BM-56S | 46 |
| BM-56M | 55 |
| BM-56L | 80 |

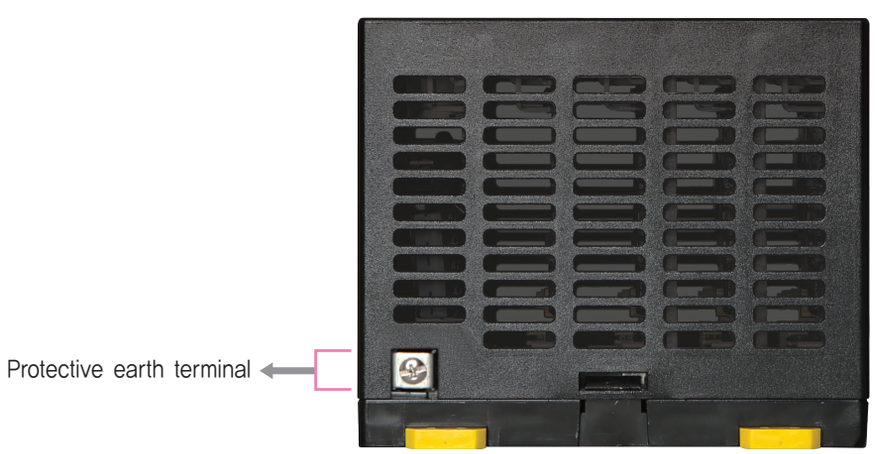



### 60mm

| Model name | Length(L) |
|---|---|
| BM-60S | 47 |
| BM-60M | 56 |
| BM-60L | 85 |

## Settings and Operation




※ Basic configuration of 3X drive is the same as 4X and only difference is number of axis.

## 1. EtherCAT Status LED

LED indicates communication status of EtherCAT.

| Name | Indication | Color | Status | Description |
|---|---|---|---|---|
| Run | RUN | Green | OFF | State INIT or Power OFF |
| | | | Blinking | State PRE-OPERATIONAL |
| | | | Single Flash | State SAFE-OPERATIONAL |
| | | | ON | State OPERATIONAL |
| | | | Flickering | State BOOTSTRAP |


| Name | Indication | Color | Status | Description |
|---|---|---|---|---|
| Error | ERR | Red | OFF | No Error or Power OFF |
| | | | Blinking | Invalid Configuration |
| | | | Single Flash | Local Error |
| | | | Double Flash | Watchdog Time Out |

| Name | Indication | Color | Status | Description |
|---|---|---|---|---|
| Link/ Activity | LA1 LA2 | Green | OFF | Link not Established |
| | | | ON | Link Established |
| | | | Flickering | Link Established and in Operation |

## 2. Drive Status LED

LED informs operation status of the drive.

| Indication | Color | Function | Description |
|---|---|---|---|
| PWR | Green | Power Input Indication | LED is turned ON when power is applied |
| RUN | Yellow | Motor Running Indication | LED is turned ON while motor is rotating |
| SON | Orange | STEP ON / OFF Indication | STEP ON: Lights ON, STEP OFF: Lights OFF |
| ALM | Red | Alarm Indication | LED blinks when an error occurs. |

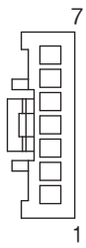

### ◆ List of error types by the the number of LED blinking

| No. | Error Type | Causes |
|---|---|---|
| 1 | Over Current Error | The current through power devices in drive exceeds 4.8A |
| 2 | Over Speed Error | The motor speed exceeds 3,000r/min |
| 5 | Over Temperature Error | Internal temperature of the drive exceeds 85℃ |
| 6 | Over Regenerative Voltage Error | Back-EMF is higher than 48V |
| 7 | Over Regenerative Voltage Error | There is a problem with the connection between the drive and the motor |
| 9 | Motor Power Error | The input voltage of the motor power is too low or disconnected |
| 12 | ROM Error | Error occurs in parameter storage device(ROM) |


Alarm LED flash
(e.g., Over Speed error)

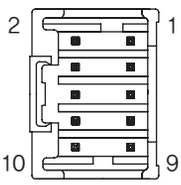
### 3. Input/Output Signal Connector (CN1)

| No. | Function | I/O |
|---|---|---|
| 1 | EXT_DC24V | Input |
| 2 | EXT_GND | Input |
| 3 | LIMIT+ | Input |
| 4 | LIMIT− | Input |
| 5 | ORIGIN | Input |
| 6 | BRAKE+ | Output |
| 7 | BRAKE− | Output |



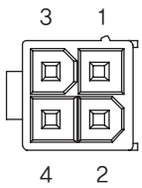

### 4. Encoder Connector (CN2)

| No. | Function | I/O |
|---|---|---|
| 1 | A+ | Input |
| 2 | A− | Input |
| 3 | B+ | Input |
| 4 | B− | Input |
| 5 | Z+ | Input |
| 6 | Z− | Input |
| 7 | DC5V | Output |
| 8 | GND | Output |
| 9 | F.GND | ---- |
| 10 | F.GND | ---- |



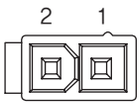

### 5. Motor Connector (CN3)

| No. | Function | I/O |
|---|---|---|
| 1 | A Phase | Output |
| 2 | B Phase | Output |
| 3 | $\overline{A}$ Phase | Output |
| 4 | $\overline{B}$ Phase | Output |



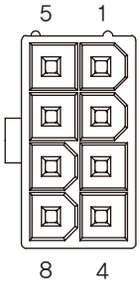

### 6. Control Power Connector (CN4)

| No. | Function | I/O |
|---|---|---|
| 1 | DC24V | Input |
| 2 | GND | Input |



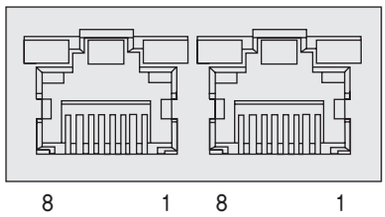

### 7. Main Power Connector (CN5)

| No. | Function | I/O |
|---|---|---|
| 1 | DC24V | Input |
| 2 | DC24V | Input |
| 3 | DC24V | Input |
| 4 | F.GND | ---- |
| 5 | GND | Input |
| 6 | GND | Input |
| 7 | GND | Input |
| 8 | F.GND | ---- |



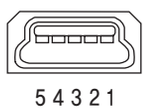

### 8. EtherCAT Communication Connector(CN6, CN7)

| No. | Function | No. | Function |
|---|---|---|---|
| 1 | TD+ | 6 | RD− |
| 2 | TD− | 7 | ---- |
| 3 | RD+ | 8 | ---- |
| 4 | ---- | Connector hood | F.GND |
| 5 | ---- | | |

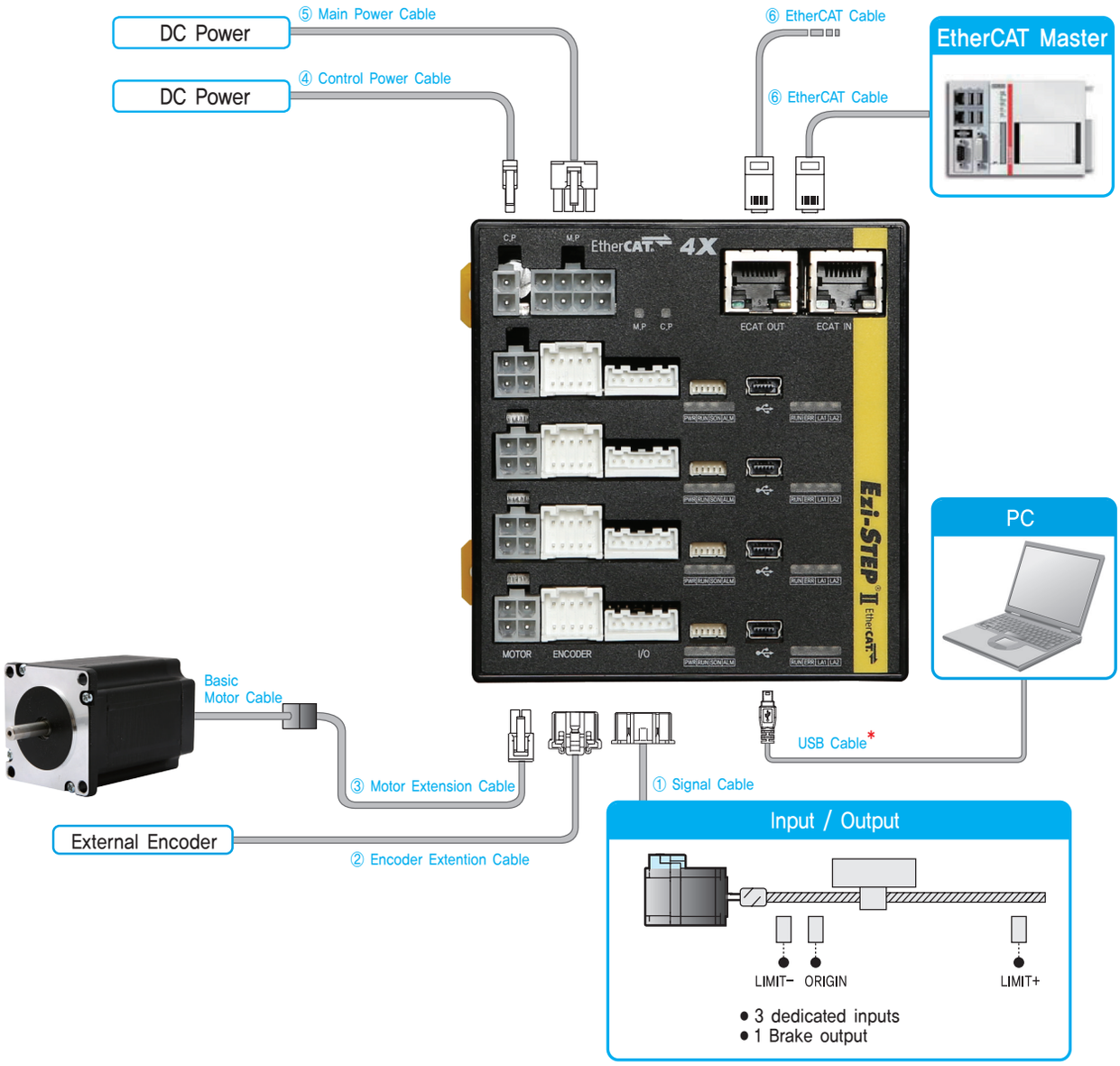



### 9. USB Connector (CN8)

| No. | Function |
|---|---|
| 1 | $V_{BUS}$ |
| 2 | D− |
| 3 | D+ |
| 4 | --- |
| 5 | GND |



## System Configuration




| Cable Type | Max. Length | Remarks |
|---|---|---|
| ① Signal Cable | 20m | Options (Sold separately) |
| ② Encoder Extension Cable | 20m | |
| ③ Motor Extension Cable | 20m | |
| ④ Control Power Cable | 2m | |
| ⑤ Main Power Cable | 2m | |
| ⑥ EtherCAT Cable | 100m | |
| Basic Motor Cable | 0.3m (Basic length) | Basic cables are attached to motors. |
| USB Cable | 5m | * USB cables are not provided by FASTECH. We recommend using a standard USB cable (USB 2.0 Mini Type B). |

※ Basic configuration of 3X drive is the same as 4X and only difference is number of axis.

## 1. Accessories

### Connectors

These are connector specifications for drive cabling.

| Purpose | | Item | Part Number | Manufacturer |
|---|---|---|---|---|
| Main Power (CN5) | | Housing | 5557-08R | MOLEX |
| | | Terminal | 5556T | |
| Control Power (CN4) | | Housing | 5557-02R | MOLEX |
| | | Terminal | 5556T | |
| Motor | Drive Side (CN3) | Housing | 5557-04R | MOLEX |
| | | Terminal | 5556T | |
| | Motor Side | Housing | 5557-04R | MOLEX |
| | | Terminal | 5556T | |
| Encoder | Drive Side (CN2) | Housing | 51353-1000 | MOLEX |
| | | Terminal | 56134-9000 | |
| Signal (CN1) | | Housing | PAP-07V-S | JST |
| | | Terminal | SPHD-001T-P0.5 | |

※ The connectors above are supplied with the product. If you are using other parts, please make sure they meet the specifications.

## 2. Options

### ① Signal Cable

These are the cables to connect Ezi-STEPII EtherCAT 4X drive and other input/output devices.

| Purpose | Part Number | Length [m] | Cable Type | Remarks |
|---|---|---|---|---|
| Drive – I/O Device Connection | CECM-S-001F | 1 | Normal Cable | Maximum Length: 20m |
| | CECM-S-002F | 2 | | |
| | CECM-S-003F | 3 | | |
| | CECM-S-005F | 5 | | |
| | CECM-S-001M | 1 | Robot Cable | |
| | CECM-S-002M | 2 | | |
| | CECM-S-003M | 3 | | |
| | CECM-S-005M | 5 | | |

* If you need cables with length(in units of 1m) not listed on the table, please contact FASTECH for more information.

### ② Encoder Extension Cable

These are the cables to connect Ezi-STEP II EtherCAT 4X drive and the encoder

| Purpose | Part Number | Length [m] | Cable Type | Remarks |
|---|---|---|---|---|
| Drive – External Encoder Connection | CTPR-E-001F | 1 | Normal Cable | Maximum Length: 20m |
| | CTPR-E-002F | 2 | | |
| | CTPR-E-003F | 3 | | |
| | CTPR-E-005F | 5 | | |
| | CTPR-E-001M | 1 | Robot Cable | |
| | CTPR-E-002M | 2 | | |
| | CTPR-E-003M | 3 | | |
| | CTPR-E-005M | 5 | | |

* If you need cables with length(in units of 1m) not listed on the table, please contact FASTECH for more information.

### ③ Motor Extension Cable

These are the cables to connect Ezi-STEP II EtherCAT 4X drive and the motor.

| Purpose | Part Number | Length [m] | Cable Type | Remarks |
|---|---|---|---|---|
| Drive – Basic Motor Cable Connection | CSVO-M-001F | 1 | Normal Cable | Maximum Length: 20m |
| | CSVO-M-002F | 2 | | |
| | CSVO-M-003F | 3 | | |
| | CSVO-M-005F | 5 | | |
| | CSVO-M-001M | 1 | Robot Cable | |
| | CSVO-M-002M | 2 | | |
| | CSVO-M-003M | 3 | | |
| | CSVO-M-005M | 5 | | |

* If you need cables with length(in units of 1m) not listed on the table, please contact FASTECH for more information.

### ④ Control Power Cable

These are the cables to connect Ezi-STEP II EtherCAT 4X drive and the control power.

| Purpose | Part Number | Length [m] | Cable Type | Remarks |
|---|---|---|---|---|
| Drive – Control Power Connection | CSVO-P-001F | 1 | Normal Cable | Maximum Length: 2m |
| | CSVO-P-002F | 2 | | |
| | CSVO-P-001M | 1 | Robot Cable | |
| | CSVO-P-002M | 2 | | |

### ⑤ Main Power Cable

These are the cables to connect Ezi-STEP II EtherCAT 4X drive and the main power.

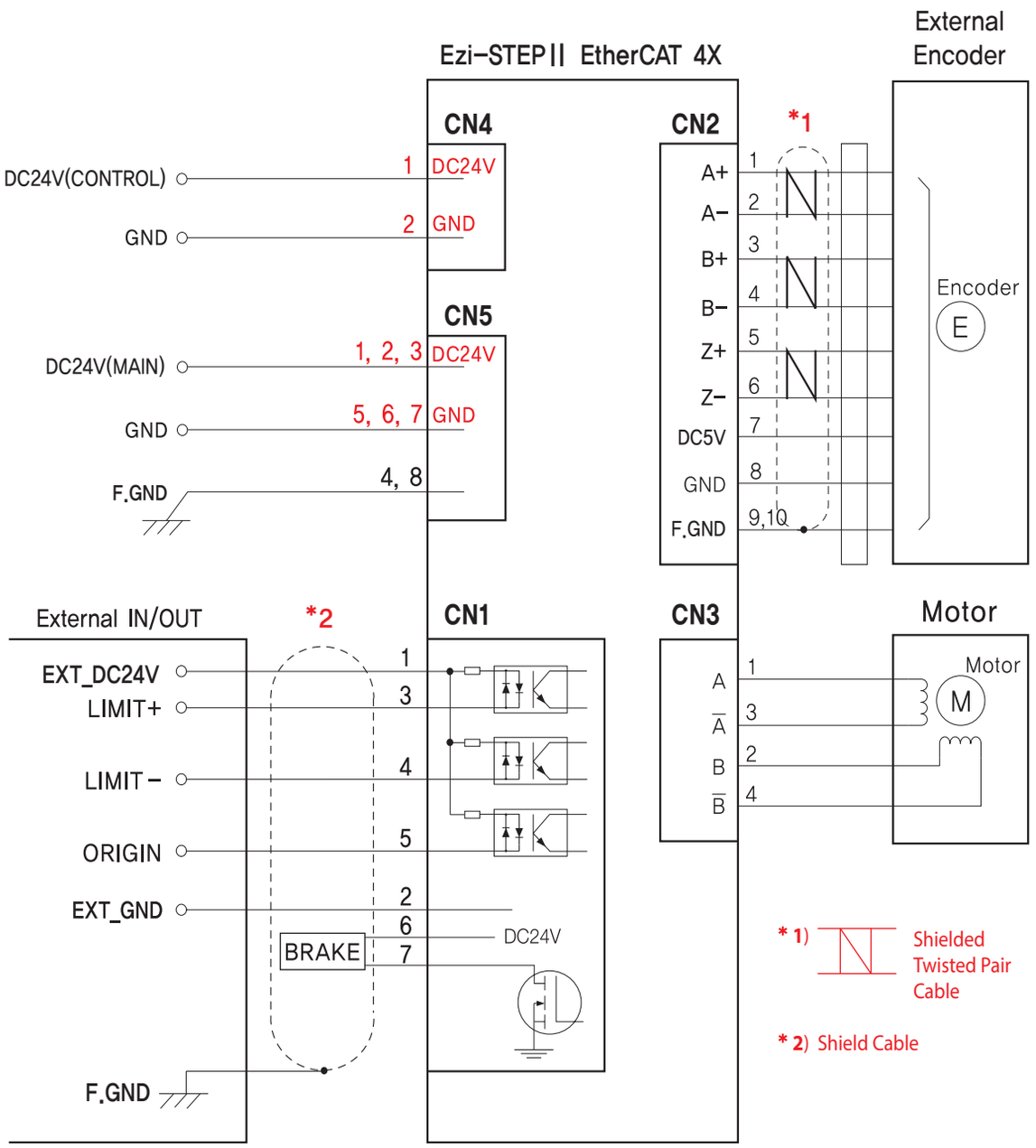
| Purpose | Part Number | Length [m] | Cable Type | Remarks |
|---|---|---|---|---|
| Drive – Main Power Cable Connection | CECM-P-001F | 1 | Normal Cable | Maximum Length: 2m |
| | CECM-P-002F | 2 | | |
| | CECM-P-001M | 1 | Robot Cable | |
| | CECM-P-002M | 2 | | |

### ⑥ EtherCAT Cable

| Purpose | Part Number | Length [m] | Remarks |
|---|---|---|---|
| EtherCAT Connection | CGNR-EC-001F | 1 | · STP(Shielded Twisted Pair) Cable<br>· Category 5e or higher<br>· Maximum Length: 100m<br>· Normal Cable |
| | CGNR-EC-002F | 2 | |
| | CGNR-EC-003F | 3 | |
| | CGNR-EC-005F | 5 | |

* If you need cables with length(in units of 1m) not listed on the table or robot cables, please contact FASTECH for more information.

## External Wiring Diagram




※ When connects I/O cable between controller and drive, please turn of the power of both controller and drive to prevent electric shock or to protect the drive from any damage.

**CAUTION**

In order to use the products listed in this catalog safely and correctly, be sure to read the instruction manual before using the product.

# MEMO

FASTECH

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