Ezi-SERVO® CC-Link IE TSN

Closed Loop Stepping System

- CC-Link IE TSN-compatible Closed Loop Stepper System
- CiA402 Drive Profile
- Torque-Off Function
- Tuning Not Required, No Hunting
- High Resolution Encoder, Fast Response
- Low Heat Generation, High Torque

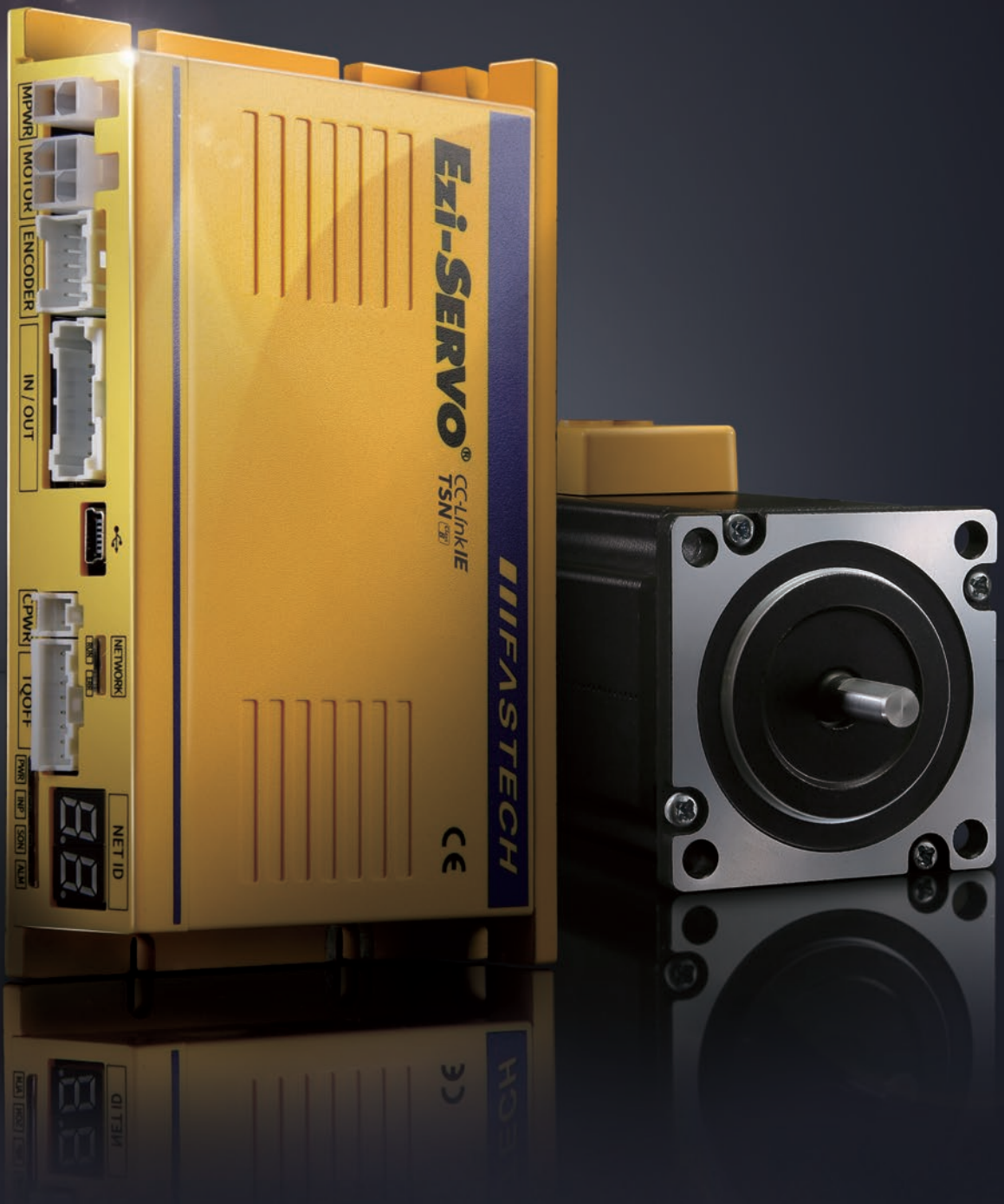
[Draft ver.]

FASTECH

Fast Accurate Smooth Motion

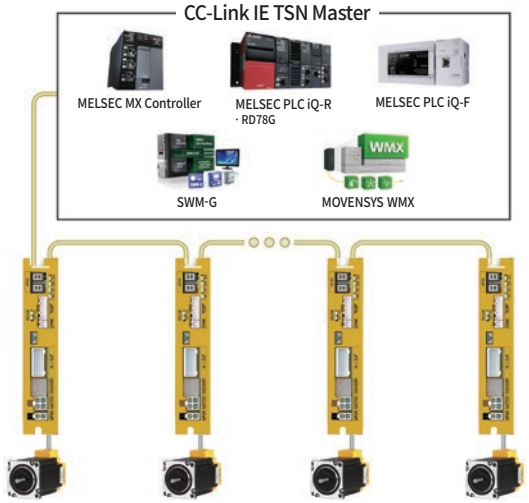
Ezi-SERVO® CC-Link IE TSN

Closed Loop Stepping System



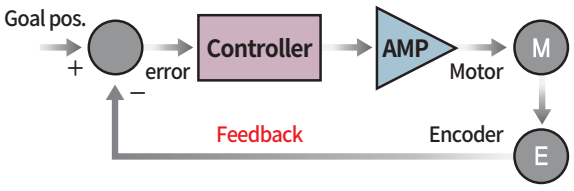
CC-Link IE TSN-compatible Motion Control

Ezi-SERVO CC-Link IE TSN is stepper motor control system using CC-Link IE TSN, high speed Ethernet (1 Gbps Full-Duplex) based industrial network.
Ezi-SERVO CC-Link IE TSN employs CiA402 drive profile and supports Profile Position Mode (PP Mode), Homing Mode (HM Mode) and Cyclic Synchronous Position Mode (CSP Mode).



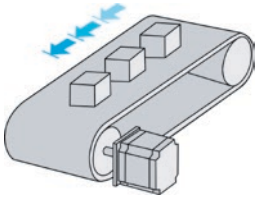
Closed-Loop System

Ezi-SERVO is an innovative Closed-Loop System that utilizes a high-resolution motor mounted encoder constantly to monitor the current position. The encoder feedback allows the Ezi-SERVO to update the current position every 50 µs. It allows the Ezi-SERVO drive to compensate for the loss of position, ensuring accurate positioning. For example, due to a sudden load change, a conventional stepper motor and drive could lose a step but Ezi-SERVO automatically correct the position by encoder feedback.



Tuning Not Required

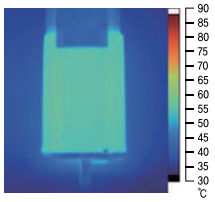
To ensure machine performance, conventional servo systems require the adjustment of its servo's gains as an initial crucial step. Even systems that employ auto-tuning require manual tuning after the system is installed.
Ezi-SERVO employs the best characteristics of the stepper motor to eliminate the need of tedious gain tuning required for conventional closed-loop servo systems.
Ezi-SERVO is especially well suited for low-rigidity loads (e.g., a belt and pulley system) that sometimes require conventional servo systems to use the additional bulky and expensive gearbox.



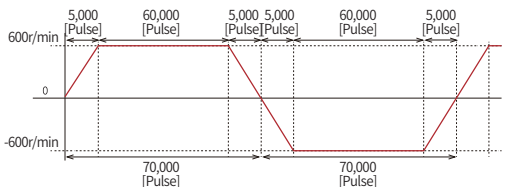
Low Heat Generation / Energy Savings

(Motor Current Control according to load)

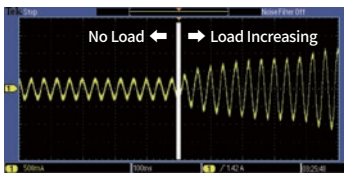
Ezi-SERVO automatically controls motor current according to load.
Ezi-SERVO reduces motor current when motor load is low and increases motor current when load is high. By optimizing the motor current, motor heat can be minimized and energy can be saved.



Motor temperature [Measured by Thermal Imaging Camera]



Condition to measure the motor temperature
[4 hours operation, Motor surface temperature saturation]

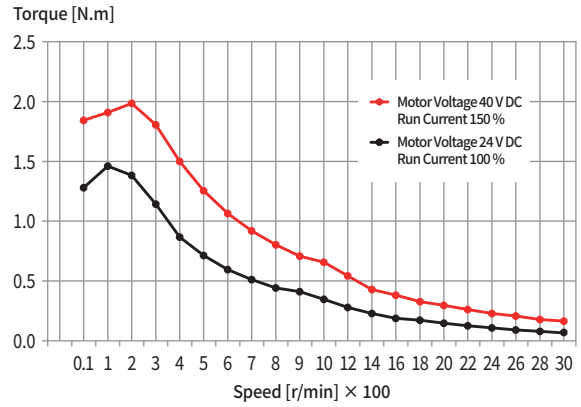


Motor Current
[Example of the Motor Current Control according to load]

High Torque

(Motor Voltage Increasing and Motor Current Setting)

Ezi-SERVO boosts the voltage supplied to the motor by internal DC-DC Converter. The torque at the high speed is increased. In addition, it is possible to set the Run Current up to 150 %, whereby the torque at low speed is increased.
Torque can be improved by about 30 % over the entire speed range.

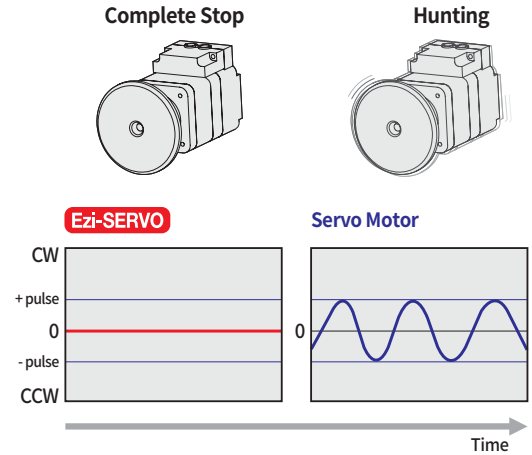


※ The torque at low speed and high speed is improved about 30 %.

Measured Condition :
· Drive = Ezi-SERVO-CT-56L
· Motor Voltage = 40 V DC
· Input Voltage = 24 V DC

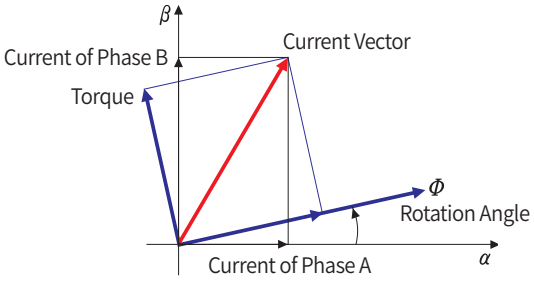
No Hunting

Ezi-SERVO utilizes the unique characteristics of stepper motors and locks itself into the desired target position, preventing vibration and eliminating Null Hunt which happens to the conventional servo systems.
This feature is especially useful in applications such as vision systems in which system oscillation and vibration could be a problem.



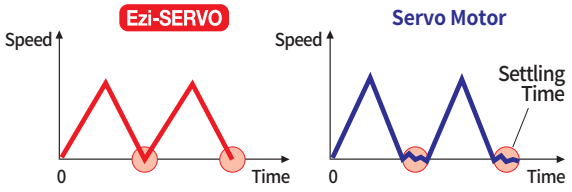
Smooth and Accurate Operation

Ezi-SERVO is a high-precision servo drive, using a high-resolution encoder with 20,000 pulse/revolution. Unlike a conventional Microstep drive, the on-board high performance MCU (Micro Controller Unit) performs vector control and filtering, producing a smooth rotational control with minimum ripples.



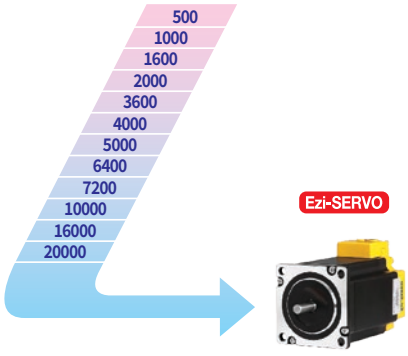
Fast Response

Similar to conventional stepper motors, Ezi-SERVO instantly synchronizes with command pulses providing fast positional response. Ezi-SERVO is the optimum choice when zero-speed stability and rapid motions within a short distance are required. Traditional servo motor systems have a natural delay called settling time between the command input signals and the resultant motion because of the constant monitoring of the current position.



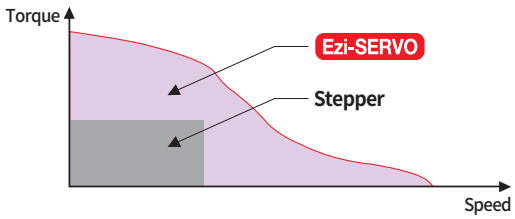
High Resolution

The unit of the position command can be divided precisely. (Max. 20,000 pulse/revolution)



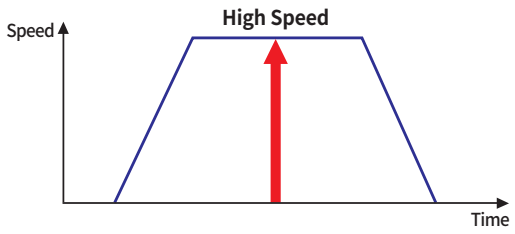
High Torque / Continuous Operation

Compared with common stepper motors and drives, Ezi-SERVO motion control systems can maintain a high torque state over relatively long period of time. This means that Ezi-SERVO continuously operates without loss of position under 100 % of the load. Unlike conventional Microstep drives, Ezi-SERVO exploits continuous high torque operation during high speed motion due to its innovative optimum current phase control.



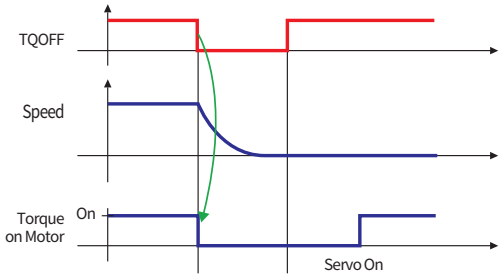
High Speed

The Ezi-SERVO operates well at high speed without the loss of synchronism or positioning error. Ezi-SERVO 's ability to monitor current position continuously enables the stepper motor to generate high torque, even under a 100 % load condition.



Torque-Off Function

Ezi-SERVO CC-Link IE TSN has an input connector(TQOFF) that can cut off the motor power through an external hardware signal, regardless of CC-Link IE TSN communication.
When the TQOFF signal is detected, the drive immediately becomes 'SERVO Off', and the motor stops.



CAUTION

DO NOT use the Torque-Off function to stop or decelerate motors.

Advantages over Open-Loop Stepper Systems

1. Reliable Positioning Control Control without loss of synchronism.
2. Excellent holding torque at standstill and automatically recovering to the original position even after experiencing positioning error due to external forces, such as mechanical vibration or vertical positional holding.
3. Ezi-SERVO utilizes 100 % of the full range of rated motor torque, contrary to a conventional open-loop stepper drive that can use up to 50 % of the rated motor torque due to the loss of synchronism.
4. Capability to operate at high speed due to load-dependent current control, open-loop stepper drives use a constant current control at all speed ranges without considering load variations. (Max. Speed : 3,000 r/min)

Advantages over Servo Motor Controller

1. No gain tuning. (Automatic gain adjustment in response to a load change)
2. Maintains the stable holding position without oscillation after completion of positioning.
3. Fast positioning due to the independent control by on-board MCU.
4. Continuous operation during rapid short-stroke movement due to instantaneous positioning.

Ezi-SERVO CC-Link IE TSN Part Numbering

Ezi-SERVO-CT-56L-A-BK-PN5

Product Name

Drive Series

CT : CC-Link IE TSN

Motor Flange Size

20 : 20 mm
28 : 28 mm
35 : 35 mm
42 : 42 mm
56 : 56 mm
60 : 60 mm

Motor Length

S : Small
M : Medium
L : Large
XL : Extra Large

Encoder Resolution

A : 10,000 P/R
B : 20,000 P/R
D : 16,000 P/R
F : 4,000 P/R

Brake

Blank : Without Brake
BK : Brake

Gear Ratio

Blank : Without Gear
PN3 : 1:3
PN5 : 1:5
PN8 : 1:8
PN10 : 1:10
PN15 : 1:15
PN25 : 1:25
PN40 : 1:40
PN50 : 1:50

Standard Combination

Unit Part Number	Motor Model Number	Drive Model Number
Ezi-SERVO-CT-20M-F	EzM2-20M-F	EzS2-CT-20M-F
Ezi-SERVO-CT-20L-F	EzM2-20L-F	EzS2-CT-20L-F
Ezi-SERVO-CT-28S-D	EzM2-28S-D	EzS2-CT-28S-D
Ezi-SERVO-CT-28SM-D	EzM2-28SM-D	EzS2-CT-28S-D
Ezi-SERVO-CT-28M-D	EzM2-28M-D	EzS2-CT-28M-D
Ezi-SERVO-CT-28MM-D	EzM2-28MM-D	EzS2-CT-28M-D
Ezi-SERVO-CT-28L-D	EzM2-28L-D	EzS2-CT-28L-D
Ezi-SERVO-CT-28LM-D	EzM2-28LM-D	EzS2-CT-28L-D
Ezi-SERVO-CT-35M-D	EzM2-35M-D	EzS2-CT-35M-D
Ezi-SERVO-CT-35MM-D	EzM2-35MM-D	EzS2-CT-35M-D
Ezi-SERVO-CT-35L-D	EzM2-35L-D	EzS2-CT-35L-D
Ezi-SERVO-CT-35LM-D	EzM2-35LM-D	EzS2-CT-35L-D
Ezi-SERVO-CT-42S-A	EzM2-42S-A	EzS2-CT-42S-A
Ezi-SERVO-CT-42S-B	EzM2-42S-B	EzS2-CT-42S-B
Ezi-SERVO-CT-42M-A	EzM2-42M-A	EzS2-CT-42M-A
Ezi-SERVO-CT-42M-B	EzM2-42M-B	EzS2-CT-42M-B
Ezi-SERVO-CT-42L-A	EzM2-42L-A	EzS2-CT-42L-A
Ezi-SERVO-CT-42L-B	EzM2-42L-B	EzS2-CT-42L-B
Ezi-SERVO-CT-42XL-A	EzM2-42XL-A	EzS2-CT-42XL-A
Ezi-SERVO-CT-42XL-B	EzM2-42XL-B	EzS2-CT-42XL-B
Ezi-SERVO-CT-56S-A	EzM2-56S-A	EzS2-CT-56S-A
Ezi-SERVO-CT-56S-B	EzM2-56S-B	EzS2-CT-56S-B
Ezi-SERVO-CT-56M-A	EzM2-56M-A	EzS2-CT-56M-A
Ezi-SERVO-CT-56M-B	EzM2-56M-B	EzS2-CT-56M-B
Ezi-SERVO-CT-56L-A	EzM2-56L-A	EzS2-CT-56L-A
Ezi-SERVO-CT-56L-B	EzM2-56L-B	EzS2-CT-56L-B
Ezi-SERVO-CT-60S-A	EzM2-60S-A	EzS2-CT-60S-A
Ezi-SERVO-CT-60S-B	EzM2-60S-B	EzS2-CT-60S-B
Ezi-SERVO-CT-60M-A	EzM2-60M-A	EzS2-CT-60M-A
Ezi-SERVO-CT-60M-B	EzM2-60M-B	EzS2-CT-60M-B
Ezi-SERVO-CT-60L-A	EzM2-60L-A	EzS2-CT-60L-A
Ezi-SERVO-CT-60L-B	EzM2-60L-B	EzS2-CT-60L-B

※ When places an order for Stopper type 28 mm, 35 mm motor, please write “M” additionally after motor length of unit product number. (e.g., Ezi-SERVO-CT-28LM-D, Ezi-SERVO-CT-35LM-D)

Combination with Brake

Unit Part Number	Motor Model Number	Drive Model Number
Ezi-SERVO-CT-42S-A-BK	EzM2-42S-A-BK	EzS2-CT-42S-A
Ezi-SERVO-CT-42S-B-BK	EzM2-42S-B-BK	EzS2-CT-42S-B
Ezi-SERVO-CT-42M-A-BK	EzM2-42M-A-BK	EzS2-CT-42M-A
Ezi-SERVO-CT-42M-B-BK	EzM2-42M-B-BK	EzS2-CT-42M-B
Ezi-SERVO-CT-42L-A-BK	EzM2-42L-A-BK	EzS2-CT-42L-A
Ezi-SERVO-CT-42L-B-BK	EzM2-42L-B-BK	EzS2-CT-42L-B
Ezi-SERVO-CT-42XL-A-BK	EzM2-42XL-A-BK	EzS2-CT-42XL-A
Ezi-SERVO-CT-42XL-B-BK	EzM2-42XL-B-BK	EzS2-CT-42XL-B
Ezi-SERVO-CT-56S-A-BK	EzM2-56S-A-BK	EzS2-CT-56S-A
Ezi-SERVO-CT-56S-B-BK	EzM2-56S-B-BK	EzS2-CT-56S-B
Ezi-SERVO-CT-56M-A-BK	EzM2-56M-A-BK	EzS2-CT-56M-A
Ezi-SERVO-CT-56M-B-BK	EzM2-56M-B-BK	EzS2-CT-56M-B
Ezi-SERVO-CT-56L-A-BK	EzM2-56L-A-BK	EzS2-CT-56L-A
Ezi-SERVO-CT-56L-B-BK	EzM2-56L-B-BK	EzS2-CT-56L-B
Ezi-SERVO-CT-60S-A-BK	EzM2-60S-A-BK	EzS2-CT-60S-A
Ezi-SERVO-CT-60S-B-BK	EzM2-60S-B-BK	EzS2-CT-60S-B
Ezi-SERVO-CT-60M-A-BK	EzM2-60M-A-BK	EzS2-CT-60M-A
Ezi-SERVO-CT-60M-B-BK	EzM2-60M-B-BK	EzS2-CT-60M-B
Ezi-SERVO-CT-60L-A-BK	EzM2-60L-A-BK	EzS2-CT-60L-A
Ezi-SERVO-CT-60L-B-BK	EzM2-60L-B-BK	EzS2-CT-60L-B

Combination with Gearbox

Unit Part Number	Motor Model Number	Drive Model Number	Gear Ratio
Ezi-SERVO-CT-42S-A-PN3	EzM2-42S-A-PN3	EzS2-CT-42S-A	1:3
Ezi-SERVO-CT-42S-B-PN3	EzM2-42S-B-PN3	EzS2-CT-42S-B	
Ezi-SERVO-CT-42S-A-PN5	EzM2-42S-A-PN5	EzS2-CT-42S-A	1:5
Ezi-SERVO-CT-42S-B-PN5	EzM2-42S-B-PN5	EzS2-CT-42S-B	
Ezi-SERVO-CT-42S-A-PN8	EzM2-42S-A-PN8	EzS2-CT-42S-A	1:8
Ezi-SERVO-CT-42S-B-PN8	EzM2-42S-B-PN8	EzS2-CT-42S-B	
Ezi-SERVO-CT-42S-A-PN10	EzM2-42S-A-PN10	EzS2-CT-42S-A	1:10
Ezi-SERVO-CT-42S-B-PN10	EzM2-42S-B-PN10	EzS2-CT-42S-B	
Ezi-SERVO-CT-42S-A-PN15	EzM2-42S-A-PN15	EzS2-CT-42S-A	1:15
Ezi-SERVO-CT-42S-B-PN15	EzM2-42S-B-PN15	EzS2-CT-42S-B	
Ezi-SERVO-CT-42S-A-PN25	EzM2-42S-A-PN25	EzS2-CT-42S-A	1:25
Ezi-SERVO-CT-42S-B-PN25	EzM2-42S-B-PN25	EzS2-CT-42S-B	
Ezi-SERVO-CT-42S-A-PN40	EzM2-42S-A-PN40	EzS2-CT-42S-A	1:40
Ezi-SERVO-CT-42S-B-PN40	EzM2-42S-B-PN40	EzS2-CT-42S-B	
Ezi-SERVO-CT-42S-A-PN50	EzM2-42S-A-PN50	EzS2-CT-42S-A	1:50
Ezi-SERVO-CT-42S-B-PN50	EzM2-42S-B-PN50	EzS2-CT-42S-B	
Ezi-SERVO-CT-42M-A-PN3	EzM2-42M-A-PN3	EzS2-CT-42M-A	1:3
Ezi-SERVO-CT-42M-B-PN3	EzM2-42M-B-PN3	EzS2-CT-42M-B	
Ezi-SERVO-CT-42M-A-PN5	EzM2-42M-A-PN5	EzS2-CT-42M-A	1:5
Ezi-SERVO-CT-42M-B-PN5	EzM2-42M-B-PN5	EzS2-CT-42M-B	
Ezi-SERVO-CT-42M-A-PN8	EzM2-42M-A-PN8	EzS2-CT-42M-A	1:8
Ezi-SERVO-CT-42M-B-PN8	EzM2-42M-B-PN8	EzS2-CT-42M-B	
Ezi-SERVO-CT-42M-A-PN10	EzM2-42M-A-PN10	EzS2-CT-42M-A	1:10
Ezi-SERVO-CT-42M-B-PN10	EzM2-42M-B-PN10	EzS2-CT-42M-B	
Ezi-SERVO-CT-42M-A-PN15	EzM2-42M-A-PN15	EzS2-CT-42M-A	1:15
Ezi-SERVO-CT-42M-B-PN15	EzM2-42M-B-PN15	EzS2-CT-42M-B	
Ezi-SERVO-CT-42M-A-PN25	EzM2-42M-A-PN25	EzS2-CT-42M-A	1:25
Ezi-SERVO-CT-42M-B-PN25	EzM2-42M-B-PN25	EzS2-CT-42M-B	
Ezi-SERVO-CT-42M-A-PN40	EzM2-42M-A-PN40	EzS2-CT-42M-A	1:40
Ezi-SERVO-CT-42M-B-PN40	EzM2-42M-B-PN40	EzS2-CT-42M-B	
Ezi-SERVO-CT-42M-A-PN50	EzM2-42M-A-PN50	EzS2-CT-42M-A	1:50
Ezi-SERVO-CT-42M-B-PN50	EzM2-42M-B-PN50	EzS2-CT-42M-B	

Combination with Gearbox

Unit Part Number	Motor Model Number	Drive Model Number	Gear Ratio
Ezi-SERVO-CT-42L-A-PN3	EzM2-42L-A-PN3	EzS2-CT-42L-A	1:3
Ezi-SERVO-CT-42L-B-PN3	EzM2-42L-B-PN3	EzS2-CT-42L-B	
Ezi-SERVO-CT-42L-A-PN5	EzM2-42L-A-PN5	EzS2-CT-42L-A	1:5
Ezi-SERVO-CT-42L-B-PN5	EzM2-42L-B-PN5	EzS2-CT-42L-B	
Ezi-SERVO-CT-42L-A-PN8	EzM2-42L-A-PN8	EzS2-CT-42L-A	1:8
Ezi-SERVO-CT-42L-B-PN8	EzM2-42L-B-PN8	EzS2-CT-42L-B	
Ezi-SERVO-CT-42L-A-PN10	EzM2-42L-A-PN10	EzS2-CT-42L-A	1:10
Ezi-SERVO-CT-42L-B-PN10	EzM2-42L-B-PN10	EzS2-CT-42L-B	
Ezi-SERVO-CT-42L-A-PN15	EzM2-42L-A-PN15	EzS2-CT-42L-A	1:15
Ezi-SERVO-CT-42L-B-PN15	EzM2-42L-B-PN15	EzS2-CT-42L-B	
Ezi-SERVO-CT-42L-A-PN25	EzM2-42L-A-PN25	EzS2-CT-42L-A	1:25
Ezi-SERVO-CT-42L-B-PN25	EzM2-42L-B-PN25	EzS2-CT-42L-B	
Ezi-SERVO-CT-42L-A-PN40	EzM2-42L-A-PN40	EzS2-CT-42L-A	1:40
Ezi-SERVO-CT-42L-B-PN40	EzM2-42L-B-PN40	EzS2-CT-42L-B	
Ezi-SERVO-CT-42L-A-PN50	EzM2-42L-A-PN50	EzS2-CT-42L-A	1:50
Ezi-SERVO-CT-42L-B-PN50	EzM2-42L-B-PN50	EzS2-CT-42L-B	
Ezi-SERVO-CT-42XL-A-PN3	EzM2-42XL-A-PN3	EzS2-CT-42XL-A	1:3
Ezi-SERVO-CT-42XL-B-PN3	EzM2-42XL-B-PN3	EzS2-CT-42XL-B	
Ezi-SERVO-CT-42XL-A-PN5	EzM2-42XL-A-PN5	EzS2-CT-42XL-A	1:5
Ezi-SERVO-CT-42XL-B-PN5	EzM2-42XL-B-PN5	EzS2-CT-42XL-B	
Ezi-SERVO-CT-42XL-A-PN8	EzM2-42XL-A-PN8	EzS2-CT-42XL-A	1:8
Ezi-SERVO-CT-42XL-B-PN8	EzM2-42XL-B-PN8	EzS2-CT-42XL-B	
Ezi-SERVO-CT-42XL-A-PN10	EzM2-42XL-A-PN10	EzS2-CT-42XL-A	1:10
Ezi-SERVO-CT-42XL-B-PN10	EzM2-42XL-B-PN10	EzS2-CT-42XL-B	
Ezi-SERVO-CT-42XL-A-PN15	EzM2-42XL-A-PN15	EzS2-CT-42XL-A	1:15
Ezi-SERVO-CT-42XL-B-PN15	EzM2-42XL-B-PN15	EzS2-CT-42XL-B	
Ezi-SERVO-CT-42XL-A-PN25	EzM2-42XL-A-PN25	EzS2-CT-42XL-A	1:25
Ezi-SERVO-CT-42XL-B-PN25	EzM2-42XL-B-PN25	EzS2-CT-42XL-B	
Ezi-SERVO-CT-42XL-A-PN40	EzM2-42XL-A-PN40	EzS2-CT-42XL-A	1:40
Ezi-SERVO-CT-42XL-B-PN40	EzM2-42XL-B-PN40	EzS2-CT-42XL-B	
Ezi-SERVO-CT-42XL-A-PN50	EzM2-42XL-A-PN50	EzS2-CT-42XL-A	1:50
Ezi-SERVO-CT-42XL-B-PN50	EzM2-42XL-B-PN50	EzS2-CT-42XL-B	
Ezi-SERVO-CT-56S-A-PN3	EzM2-56S-A-PN3	EzS2-CT-56S-A	1:3
Ezi-SERVO-CT-56S-B-PN3	EzM2-56S-B-PN3	EzS2-CT-56S-B	
Ezi-SERVO-CT-56S-A-PN5	EzM2-56S-A-PN5	EzS2-CT-56S-A	1:5
Ezi-SERVO-CT-56S-B-PN5	EzM2-56S-B-PN5	EzS2-CT-56S-B	
Ezi-SERVO-CT-56S-A-PN8	EzM2-56S-A-PN8	EzS2-CT-56S-A	1:8
Ezi-SERVO-CT-56S-B-PN8	EzM2-56S-B-PN8	EzS2-CT-56S-B	
Ezi-SERVO-CT-56S-A-PN10	EzM2-56S-A-PN10	EzS2-CT-56S-A	1:10
Ezi-SERVO-CT-56S-B-PN10	EzM2-56S-B-PN10	EzS2-CT-56S-B	
Ezi-SERVO-CT-56S-A-PN15	EzM2-56S-A-PN15	EzS2-CT-56S-A	1:15
Ezi-SERVO-CT-56S-B-PN15	EzM2-56S-B-PN15	EzS2-CT-56S-B	
Ezi-SERVO-CT-56S-A-PN25	EzM2-56S-A-PN25	EzS2-CT-56S-A	1:25
Ezi-SERVO-CT-56S-B-PN25	EzM2-56S-B-PN25	EzS2-CT-56S-B	
Ezi-SERVO-CT-56S-A-PN40	EzM2-56S-A-PN40	EzS2-CT-56S-A	1:40
Ezi-SERVO-CT-56S-B-PN40	EzM2-56S-B-PN40	EzS2-CT-56S-B	
Ezi-SERVO-CT-56S-A-PN50	EzM2-56S-A-PN50	EzS2-CT-56S-A	1:50
Ezi-SERVO-CT-56S-B-PN50	EzM2-56S-B-PN50	EzS2-CT-56S-B	
Ezi-SERVO-CT-56M-A-PN3	EzM2-56M-A-PN3	EzS2-CT-56M-A	1:3
Ezi-SERVO-CT-56M-B-PN3	EzM2-56M-B-PN3	EzS2-CT-56M-B	
Ezi-SERVO-CT-56M-A-PN5	EzM2-56M-A-PN5	EzS2-CT-56M-A	1:5
Ezi-SERVO-CT-56M-B-PN5	EzM2-56M-B-PN5	EzS2-CT-56M-B	
Ezi-SERVO-CT-56M-A-PN8	EzM2-56M-A-PN8	EzS2-CT-56M-A	1:8
Ezi-SERVO-CT-56M-B-PN8	EzM2-56M-B-PN8	EzS2-CT-56M-B	
Ezi-SERVO-CT-56M-A-PN10	EzM2-56M-A-PN10	EzS2-CT-56M-A	1:10
Ezi-SERVO-CT-56M-B-PN10	EzM2-56M-B-PN10	EzS2-CT-56M-B	
Ezi-SERVO-CT-56M-A-PN15	EzM2-56M-A-PN15	EzS2-CT-56M-A	1:15
Ezi-SERVO-CT-56M-B-PN15	EzM2-56M-B-PN15	EzS2-CT-56M-B	
Ezi-SERVO-CT-56M-A-PN25	EzM2-56M-A-PN25	EzS2-CT-56M-A	1:25
Ezi-SERVO-CT-56M-B-PN25	EzM2-56M-B-PN25	EzS2-CT-56M-B	
Ezi-SERVO-CT-56M-A-PN40	EzM2-56M-A-PN40	EzS2-CT-56M-A	1:40
Ezi-SERVO-CT-56M-B-PN40	EzM2-56M-B-PN40	EzS2-CT-56M-B	
Ezi-SERVO-CT-56M-A-PN50	EzM2-56M-A-PN50	EzS2-CT-56M-A	1:50
Ezi-SERVO-CT-56M-B-PN50	EzM2-56M-B-PN50	EzS2-CT-56M-B	

Combination with Gearbox

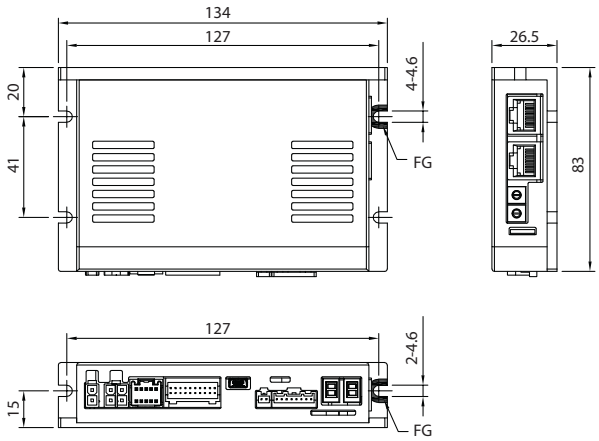
Unit Part Number	Motor Model Number	Drive Model Number	Gear Ratio
Ezi-SERVO-CT-56L-A-PN3	EzM2-56L-A-PN3	EzS2-CT-56L-A	1:3
Ezi-SERVO-CT-56L-B-PN3	EzM2-56L-B-PN3	EzS2-CT-56L-B	
Ezi-SERVO-CT-56L-A-PN5	EzM2-56L-A-PN5	EzS2-CT-56L-A	1:5
Ezi-SERVO-CT-56L-B-PN5	EzM2-56L-B-PN5	EzS2-CT-56L-B	
Ezi-SERVO-CT-56L-A-PN8	EzM2-56L-A-PN8	EzS2-CT-56L-A	1:8
Ezi-SERVO-CT-56L-B-PN8	EzM2-56L-B-PN8	EzS2-CT-56L-B	
Ezi-SERVO-CT-56L-A-PN10	EzM2-56L-A-PN10	EzS2-CT-56L-A	1:10
Ezi-SERVO-CT-56L-B-PN10	EzM2-56L-B-PN10	EzS2-CT-56L-B	
Ezi-SERVO-CT-56L-A-PN15	EzM2-56L-A-PN15	EzS2-CT-56L-A	1:15
Ezi-SERVO-CT-56L-B-PN15	EzM2-56L-B-PN15	EzS2-CT-56L-B	
Ezi-SERVO-CT-56L-A-PN25	EzM2-56L-A-PN25	EzS2-CT-56L-A	1:25
Ezi-SERVO-CT-56L-B-PN25	EzM2-56L-B-PN25	EzS2-CT-56L-B	
Ezi-SERVO-CT-56L-A-PN40	EzM2-56L-A-PN40	EzS2-CT-56L-A	1:40
Ezi-SERVO-CT-56L-B-PN40	EzM2-56L-B-PN40	EzS2-CT-56L-B	
Ezi-SERVO-CT-56L-A-PN50	EzM2-56L-A-PN50	EzS2-CT-56L-A	1:50
Ezi-SERVO-CT-56L-B-PN50	EzM2-56L-B-PN50	EzS2-CT-56L-B	
Ezi-SERVO-CT-60S-A-PN3	EzM2-60S-A-PN3	EzS2-CT-60S-A	1:3
Ezi-SERVO-CT-60S-B-PN3	EzM2-60S-B-PN3	EzS2-CT-60S-B	
Ezi-SERVO-CT-60S-A-PN5	EzM2-60S-A-PN5	EzS2-CT-60S-A	1:5
Ezi-SERVO-CT-60S-B-PN5	EzM2-60S-B-PN5	EzS2-CT-60S-B	
Ezi-SERVO-CT-60S-A-PN8	EzM2-60S-A-PN8	EzS2-CT-60S-A	1:8
Ezi-SERVO-CT-60S-B-PN8	EzM2-60S-B-PN8	EzS2-CT-60S-B	
Ezi-SERVO-CT-60S-A-PN10	EzM2-60S-A-PN10	EzS2-CT-60S-A	1:10
Ezi-SERVO-CT-60S-B-PN10	EzM2-60S-B-PN10	EzS2-CT-60S-B	
Ezi-SERVO-CT-60S-A-PN15	EzM2-60S-A-PN15	EzS2-CT-60S-A	1:15
Ezi-SERVO-CT-60S-B-PN15	EzM2-60S-B-PN15	EzS2-CT-60S-B	
Ezi-SERVO-CT-60S-A-PN25	EzM2-60S-A-PN25	EzS2-CT-60S-A	1:25
Ezi-SERVO-CT-60S-B-PN25	EzM2-60S-B-PN25	EzS2-CT-60S-B	
Ezi-SERVO-CT-60S-A-PN40	EzM2-60S-A-PN40	EzS2-CT-60S-A	1:40
Ezi-SERVO-CT-60S-B-PN40	EzM2-60S-B-PN40	EzS2-CT-60S-B	
Ezi-SERVO-CT-60S-A-PN50	EzM2-60S-A-PN50	EzS2-CT-60S-A	1:50
Ezi-SERVO-CT-60S-B-PN50	EzM2-60S-B-PN50	EzS2-CT-60S-B	
Ezi-SERVO-CT-60M-A-PN3	EzM2-60M-A-PN3	EzS2-CT-60M-A	1:3
Ezi-SERVO-CT-60M-B-PN3	EzM2-60M-B-PN3	EzS2-CT-60M-B	
Ezi-SERVO-CT-60M-A-PN5	EzM2-60M-A-PN5	EzS2-CT-60M-A	1:5
Ezi-SERVO-CT-60M-B-PN5	EzM2-60M-B-PN5	EzS2-CT-60M-B	
Ezi-SERVO-CT-60M-A-PN8	EzM2-60M-A-PN8	EzS2-CT-60M-A	1:8
Ezi-SERVO-CT-60M-B-PN8	EzM2-60M-B-PN8	EzS2-CT-60M-B	
Ezi-SERVO-CT-60M-A-PN10	EzM2-60M-A-PN10	EzS2-CT-60M-A	1:10
Ezi-SERVO-CT-60M-B-PN10	EzM2-60M-B-PN10	EzS2-CT-60M-B	
Ezi-SERVO-CT-60M-A-PN15	EzM2-60M-A-PN15	EzS2-CT-60M-A	1:15
Ezi-SERVO-CT-60M-B-PN15	EzM2-60M-B-PN15	EzS2-CT-60M-B	
Ezi-SERVO-CT-60M-A-PN25	EzM2-60M-A-PN25	EzS2-CT-60M-A	1:25
Ezi-SERVO-CT-60M-B-PN25	EzM2-60M-B-PN25	EzS2-CT-60M-B	
Ezi-SERVO-CT-60M-A-PN40	EzM2-60M-A-PN40	EzS2-CT-60M-A	1:40
Ezi-SERVO-CT-60M-B-PN40	EzM2-60M-B-PN40	EzS2-CT-60M-B	
Ezi-SERVO-CT-60M-A-PN50	EzM2-60M-A-PN50	EzS2-CT-60M-A	1:50
Ezi-SERVO-CT-60M-B-PN50	EzM2-60M-B-PN50	EzS2-CT-60M-B	
Ezi-SERVO-CT-60L-A-PN3	EzM2-60L-A-PN3	EzS2-CT-60L-A	1:3
Ezi-SERVO-CT-60L-B-PN3	EzM2-60L-B-PN3	EzS2-CT-60L-B	
Ezi-SERVO-CT-60L-A-PN5	EzM2-60L-A-PN5	EzS2-CT-60L-A	1:5
Ezi-SERVO-CT-60L-B-PN5	EzM2-60L-B-PN5	EzS2-CT-60L-B	
Ezi-SERVO-CT-60L-A-PN8	EzM2-60L-A-PN8	EzS2-CT-60L-A	1:8
Ezi-SERVO-CT-60L-B-PN8	EzM2-60L-B-PN8	EzS2-CT-60L-B	
Ezi-SERVO-CT-60L-A-PN10	EzM2-60L-A-PN10	EzS2-CT-60L-A	1:10
Ezi-SERVO-CT-60L-B-PN10	EzM2-60L-B-PN10	EzS2-CT-60L-B	
Ezi-SERVO-CT-60L-A-PN15	EzM2-60L-A-PN15	EzS2-CT-60L-A	1:15
Ezi-SERVO-CT-60L-B-PN15	EzM2-60L-B-PN15	EzS2-CT-60L-B	
Ezi-SERVO-CT-60L-A-PN25	EzM2-60L-A-PN25	EzS2-CT-60L-A	1:25
Ezi-SERVO-CT-60L-B-PN25	EzM2-60L-B-PN25	EzS2-CT-60L-B	
Ezi-SERVO-CT-60L-A-PN40	EzM2-60L-A-PN40	EzS2-CT-60L-A	1:40
Ezi-SERVO-CT-60L-B-PN40	EzM2-60L-B-PN40	EzS2-CT-60L-B	
Ezi-SERVO-CT-60L-A-PN50	EzM2-60L-A-PN50	EzS2-CT-60L-A	1:50
Ezi-SERVO-CT-60L-B-PN50	EzM2-60L-B-PN50	EzS2-CT-60L-B	

Specifications of Drive

Motor Model		EzM2-20 Series	EzM2-28 Series	EzM2-35 Series	EzM2-42 Series	EzM2-56 Series	EzM2-60 Series
Drive Model		EzS2-CT-20 Series	EzS2-CT-28 Series	EzS2-CT-35 Series	EzS2-CT-42 Series	EzS2-CT-56 Series	EzS2-CT-60 Series
Input Voltage		24 V DC ± 10 %					
Control Method		Closed loop control with 32 bit MCU					
Current Consumption		Max. 500 mA (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.	0.5 g					
Function	Rotation Speed	0 ~ 3,000 r/min *1					
	Resolution	Encoder Resolution [P/R] / Configurable Resolution [P/R]					
		4,000 / 500, 1,000, 1,600, 2,000, 3,600, 4,000, 5,000, 6,400, 7,200, 10,000					
		10,000 / 500, 1,000, 1,600, 2,000, 3,600, 5,000, 6,400, 7,200, 10,000					
		16,000 / 500, 1,000, 1,600, 2,000, 3,600, 5,000, 6,400, 7,200, 10,000, 16,000					
		20,000 / 500, 1,000, 1,600, 2,000, 3,600, 5,000, 6,400, 7,200, 10,000, 20,000					
		(Selectable by parameter)					
	Error Type	Over Current Error, Over Speed Error, Position Tracking Error, Over Load Error, Over Temperature Error, Over Regenerated Voltage Error, Motor Connect Error, Encoder Connect Error, Main Power Voltage Error, In-Position Error, ROM Error, Position Overflow Error, Torque-Off Circuit Error					
	LED Display	Power status, In-Position status, Servo On status, Alarm status					
CC-Link IE TSN	Communication Protocol	CC-Link IE TSN Class B					
	Operation Mode	CiA402 Drive Profile: Cyclic Synchronous Position Mode(CSP), Profile Position Mode(PP), Homing Mode(HM)					
	Synchronization	Minimum Cycle Time: 250 µs / Synchronous Comm. (CSP, PP, HM) / Asynchronous Comm. (PP, HM)					
I/O Signal	Input Signals	3 dedicated inputs (LIMIT+, LIMIT-, ORIGIN), 6 user inputs (photocoupler inputs), 2 Torque-Off signal inputs (TQOFF)					
	Output Signals	5 user outputs (photocoupler outputs), 1 Brake signal output, 1 Torque-Off status output (TQMON)					

*1. Up to the resolution of 10,000 P/R, maximum speed can be reached by 3,000 r/min and with the resolution more than 10,000 P/R, maximum speed shall be reduced accordingly.

Dimensions of Drive [mm]



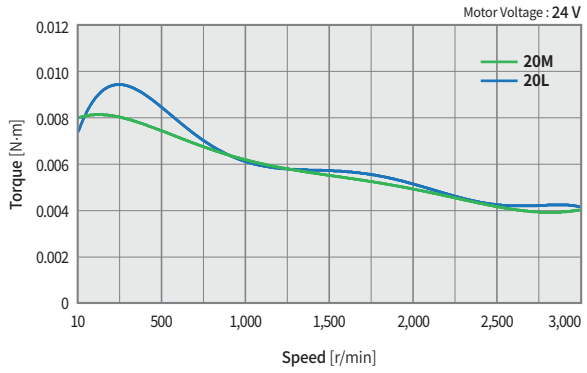
Specifications of Motor

MODEL				EzM2-20 Series		EzM2-28 Series			EzM2-35 Series		EzM2-42 Series			
			UNIT	20M	20L	28S	28M	28L	35M	35L	42S	42M	42L	42XL
Drive method			-	Bipolar										
Number of phase			-	2 Phase										
Current per Phase			A/Phase	0.5	0.5	0.95	0.95	0.95	1.5	1.5	1.2	1.2	1.2	1.2
Maximun Holding Torque			N·m	0.016	0.025	0.069	0.098	0.118	0.13	0.23	0.32	0.44	0.5	0.65
Rotor Inertia			g·cm²	2.5	3.3	9.0	13	18	15	20	35	54	77	114
Weight			kg	0.080	0.104	0.147	0.204	0.232	0.194	0.226	0.294	0.357	0.426	0.564
Length (L)			mm	28	38	32	45	50	32	36	34	40	48	60
Permissible Radial Load	Distance From End of Shaft	3 mm	N	18	18	30	30	30	22	22	22	22	22	22
		8 mm		30	30	38	38	38	26	26	26	26	26	26
		13 mm		-	-	53	53	53	33	33	33	33	33	33
		18 mm		-	-	-	-	-	46	46	46	46	46	46
Permissible Axial Load			N	Lower than motor unit's weight										
Insulation Resistance			MΩ	Min. 100 (When measured with a 500 V DC insulation resistance meter)										
Insulation Class			-	Class B (130 °C)										
Operating Temperature			°C	0 ~ 55										

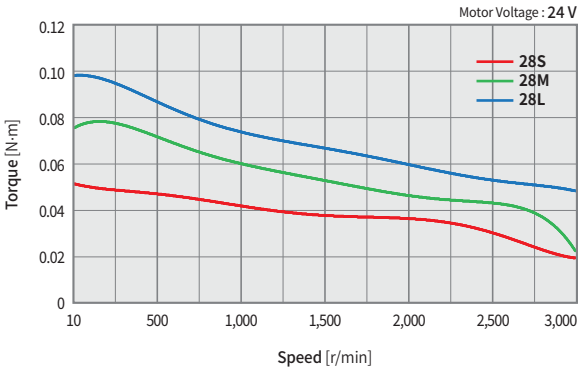
MODEL				EzM2-56 Series			EzM2-60 Series		
			UNIT	56S	56M	56L	60S	60M	60L
Drive method			-	Bipolar					
Number of phase			-	2 Phase					
Current per Phase			A/Phase	3.0	3.0	3.0	4.0	4.0	4.0
Maximun Holding Torque			N·m	0.64	1.0	1.5	0.88	1.28	2.4
Rotor Inertia			g·cm²	180	280	520	240	490	690
Weight			kg	0.608	0.784	1.230	0.693	0.856	1.419
Length (L)			mm	46	55	80	47	56	85
Permissible Radial Load	Distance From End of Shaft	3 mm	N	52	52	52	70	70	70
		8 mm		65	65	65	87	87	87
		13 mm		85	85	85	114	114	114
		18 mm		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 500 V DC insulation resistance meter)					
Insulation Class			-	Class B (130 °C)					
Operating Temperature			°C	0 ~ 55					

Torque Characteristics of Motor

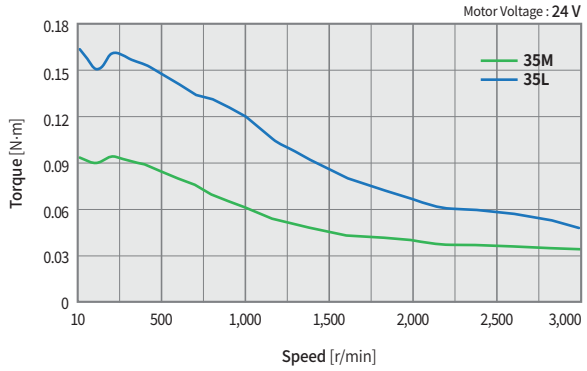
Ezi-SERVO-CT-20 Series



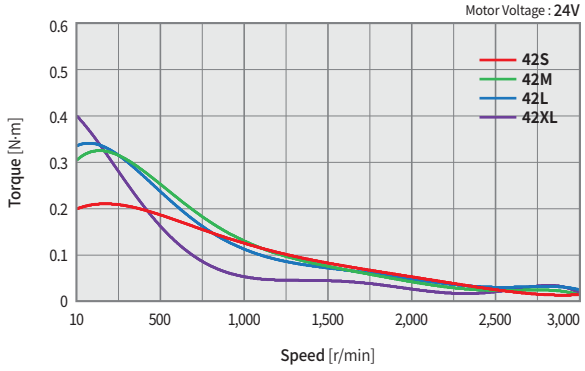
Ezi-SERVO-CT-28 Series



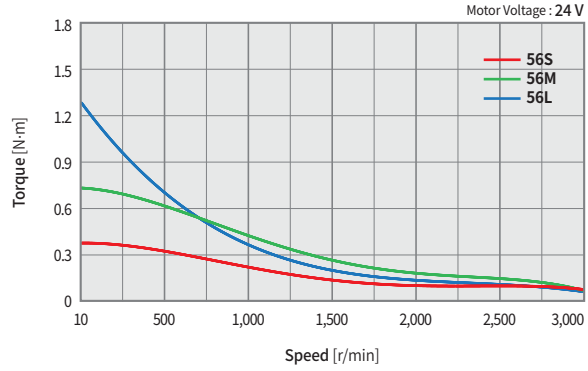
Ezi-SERVO-CT-35 Series



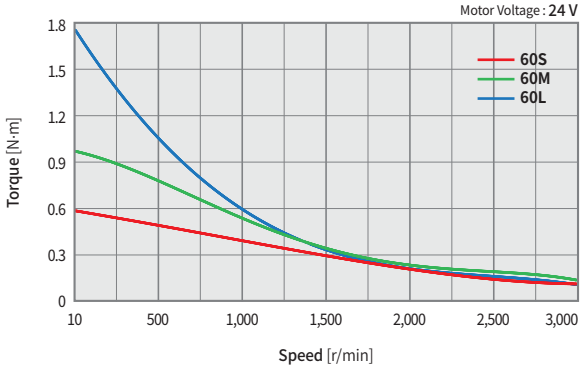
Ezi-SERVO-CT-42 Series



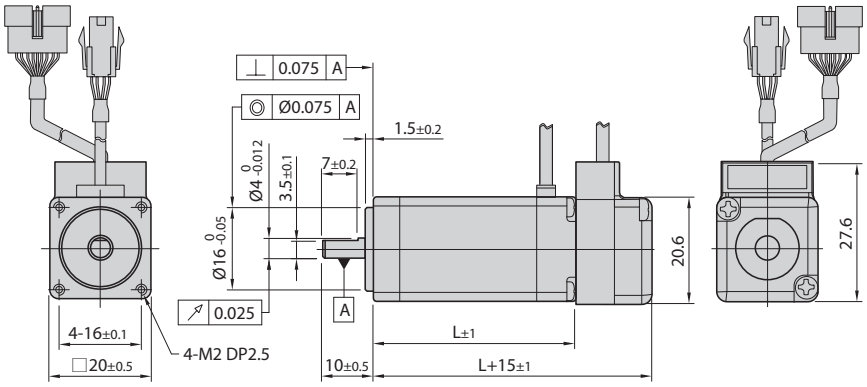
Ezi-SERVO-CT-56 Series



Ezi-SERVO-CT-60 Series

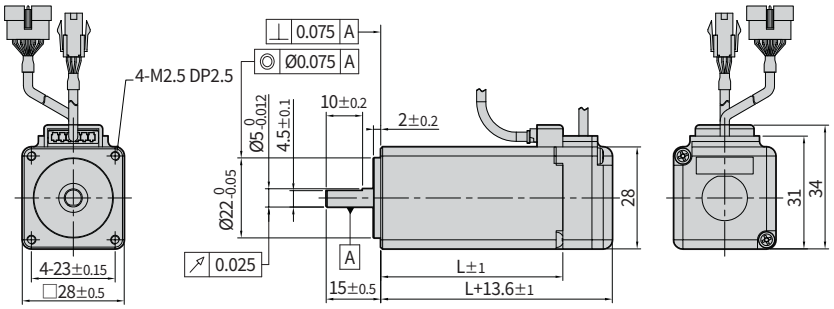


Dimensions of Motor [mm]



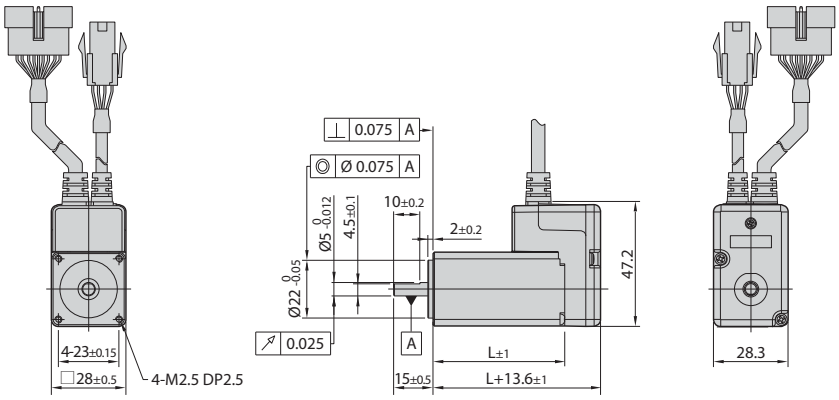
20 mm

Model name	Length (L)
EzM2-20M	27.3
EzM2-20L	37.6



28 mm

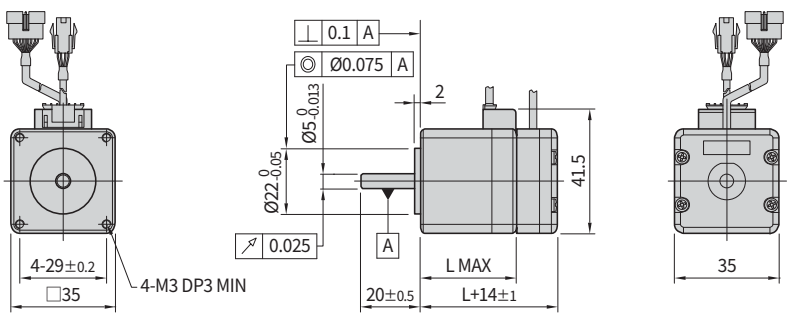
Model name	Length (L)
EzM2-28S	32
EzM2-28M	45
EzM2-28L	50



28 mm
(Stopper type)

Model name	Length (L)
EzM2-28SM	32
EzM2-28MM	45
EzM2-28LM	50

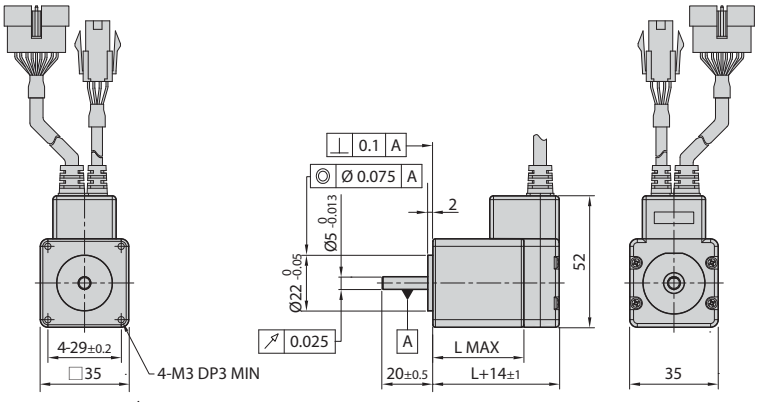
※ When ordering 28 mm Stopper type of motor, please add“M”after standard motor model number.



35 mm

Model name	Length (L)
EzM2-35M	32
EzM2-35L	36

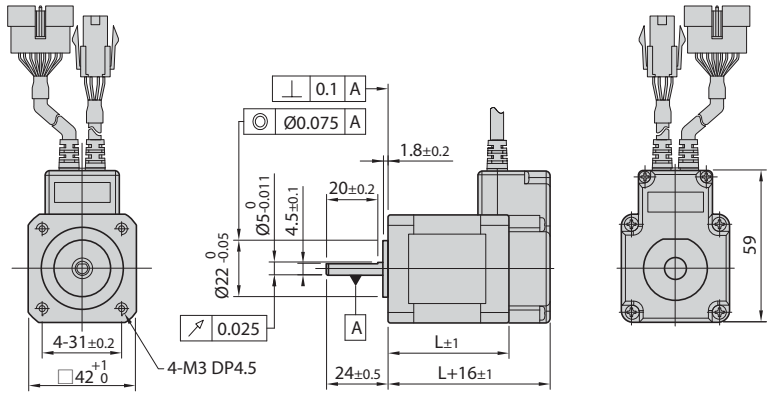
Dimensions of Motor [mm]



35 mm
(Stopper type)

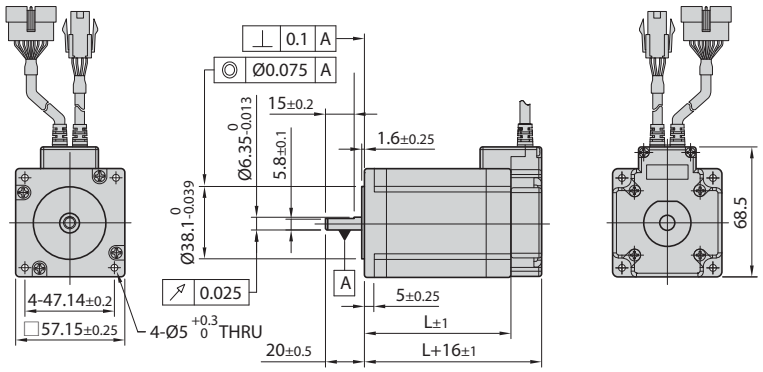
Model name	Length (L)
EzM2-35MM	32
EzM2-35LM	36

※ When ordering 35 mm Stopper type of motor, please add“M”after standard motor model number.



42 mm

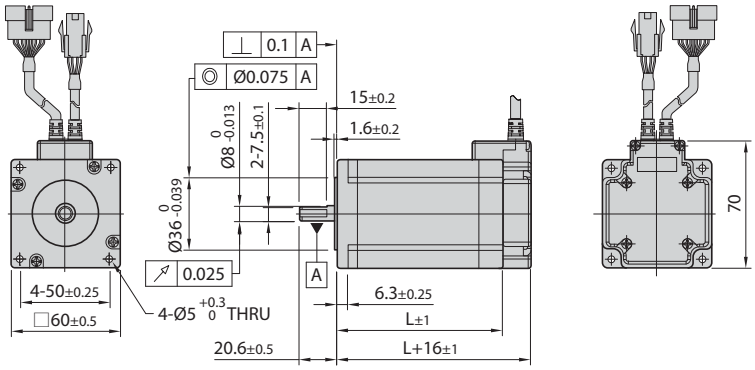
Model name	Length (L)
EzM2-42S	34
EzM2-42M	40
EzM2-42L	48
EzM2-42XL	60



56 mm

Model name	Length (L)
EzM2-56S	46
EzM2-56M	55
EzM2-56L	80

※ There are 2 kinds of size of front shaft diameter for EzM2-56 series as Ø 6.35 and Ø 8.0



60 mm

Model name	Length (L)
EzM2-60S	47
EzM2-60M	56
EzM2-60L	85

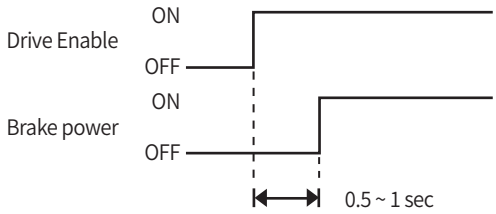
Specifications of Motor with Brake

Unit Part Number	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	
Ezi-SERVO-CT-42S-■-BK	EzM2-42S-■-BK	Non-excitation run Type	24 V DC ± 10 %	0.2	5	0.2	0.55	22	26	33	46	Must be Lower than Motor Unit Weight
Ezi-SERVO-CT-42M-■-BK	EzM2-42M-■-BK						0.62					
Ezi-SERVO-CT-42L-■-BK	EzM2-42L-■-BK						0.69					
Ezi-SERVO-CT-42XL-■-BK	EzM2-42XL-■-BK						0.82					
Ezi-SERVO-CT-56S-■-BK	EzM2-56S-■-BK			0.27	6.6	0.7	1.03	52	65	85	123	
Ezi-SERVO-CT-56M-■-BK	EzM2-56M-■-BK						1.20					
Ezi-SERVO-CT-56L-■-BK	EzM2-56L-■-BK						1.65					
Ezi-SERVO-CT-60S-■-BK	EzM2-60S-■-BK						1.11	70	87	114	165	
Ezi-SERVO-CT-60M-■-BK	EzM2-60M-■-BK						1.30					
Ezi-SERVO-CT-60L-■-BK	EzM2-60L-■-BK						1.86					

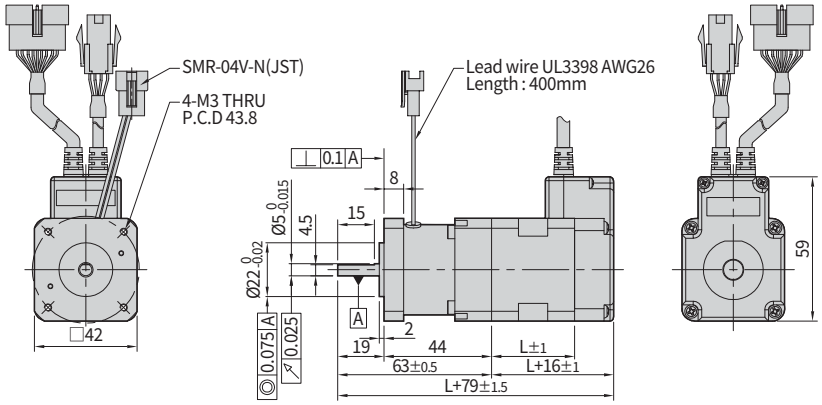
* The code of encoder resolution is marked in "■".
* Electromagnetic Brake cannot be used for braking. Position hold purpose only when power OFF.
* The weight means Motor Unit Weight including Motor and Electromagnetic Brake.
* Motor Model Number is combined model name of Motor and Brake.
* Motor specification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

* Brake Operation Timing Chart

Ezi-SERVO CC-Link IE TSN controls Brake by Drive automatically. Please refer to timing chart on the right when Brake is controlled by the upper controller other than using Ezi-SERVO CC-Link IE TSN Brake control. Otherwise, Drive might malfunction and loads might fall down. Also, please do not operate Brake during motor operation to prevent damage.

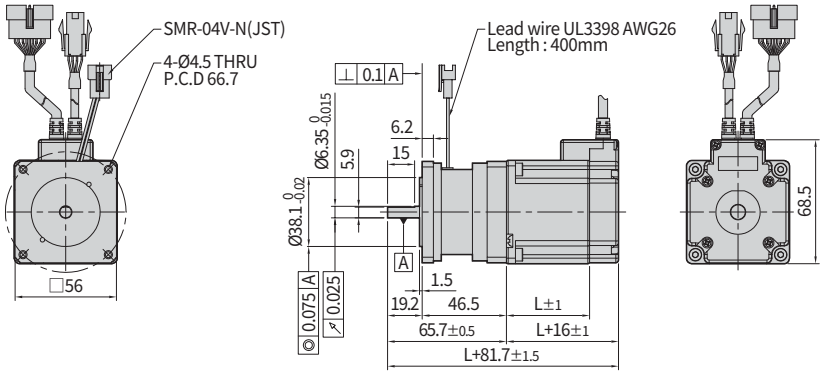


Dimensions of Motor with Brake [mm]



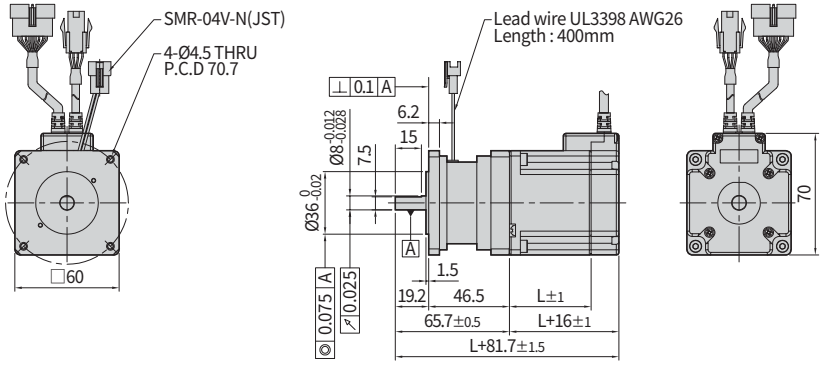
42 mm

Model name	Length (L)
EzM2-42S	34
EzM2-42M	40
EzM2-42L	48
EzM2-42XL	60



56 mm

Model name	Length (L)
EzM2-56S	46
EzM2-56M	55
EzM2-56L	80



60 mm

Model name	Length (L)
EzM2-60S	47
EzM2-60M	56
EzM2-60L	85

How to Read Specifications

Unit Part Number	① Maximum Holding Torque [N·m]	② Rotor Inertia Moment [kg·m²]	③ Backlash [arcmin]	④ Angle Transmission Error [arcmin]	⑤ Gear Ratio	⑥ Resolution (10,000 P/R Standard)	⑦ Permissible Torque [N·m]	⑧ Instantaneous Maximum Torque [N·m]	⑨ Permissible Speed Range [r/min]	⑩ Unit Weight [kg]	⑪ Permissible Radial Load (At Center of Axis) [N]	⑫ Permissible Axial Load [N]
Ezi-SERVO-CT-42S-■-PN3	0.57	35×10^{-7}	3	5	3	0.012 °	6	12	0 ~ 1000	0.76	240	270
Ezi-SERVO-CT-42S-■-PN5	0.95				5	0.0072 °	9	18	0 ~ 600		290	330
Ezi-SERVO-CT-42S-■-PN8	1.52				8	0.0045 °	9	18	0 ~ 375		340	410
Ezi-SERVO-CT-42S-■-PN10	1.90				10	0.0036 °	6	12	0 ~ 300		360	450
Ezi-SERVO-CT-42S-■-PN15	2.76		5	7	15	0.0024 °	6	12	0 ~ 200	0.91	410	540
Ezi-SERVO-CT-42S-■-PN25	4.60				25	0.00144 °	9	18	0 ~ 120		490	640
Ezi-SERVO-CT-42S-■-PN40	7.36				40	0.0009 °	9	18	0 ~ 75		570	640
Ezi-SERVO-CT-42S-■-PN50	9.00				50	0.00072 °	9	18	0 ~ 60		620	640

Description of Specification Items

No.	Item	Description
①	Maximum Holding Torque	This is the maximum torque that can be exerted through the gearbox when the motor is stopped. (Based on 100 % of stop current) Use the torque below the permissible torque of the gearbox.
②	Rotor Inertia Moment	It is the value of the moment of inertia of the motor.
③	Backlash	It is the gap between the gear and the gear, and it is the angle at which the gearbox shaft moves without external force when stopped.
④	Angle Transmission Error	This is the transmission characteristic of the gearbox, which means the difference between the theoretical rotation angle and the actual rotation angle of the output shaft.
⑤	Gear Ratio	It is the value obtained by dividing the number of output rotation by the number of input rotation.
⑥	Resolution	This is the angle at which the gearbox output shaft moves when the motor is driven by 1 pulse.
⑦	Permissible Torque	It refers to the maximum value of the torque that can be continuously applied to the output shaft of the gearbox during constant speed operation. (When the input rotation speed is 3,000 r/min and the lifetime of the motor becomes 20,000 hours)
⑧	Instantaneous Maximum Torque	This is the maximum torque allowed to the output shaft of the gearbox during acceleration/deceleration.
⑨	Permissible Speed Range	It is the range of rotation speed based on the output shaft of the gearbox.
⑩	Unit Weight	It is the sum of the weight of the gearbox and the motor.
⑪	Permissible Radial Load	It is the maximum value of the load applied in the direction perpendicular to the gearbox output shaft.
⑫	Permissible Axial Load	It is the maximum value of the load applied in the axial direction to the gearbox output shaft.

Specifications of Motor with Gearbox

42 mm

Unit Part Number	Maximum Holding Torque [N·m]	Rotor Inertia Moment [kg·m²]	Backlash [arcmin]	Angle Transmission Error [arcmin]	Gear Ratio	Resolution (10,000 P/R Standard)	Permissible Torque [N·m]	Instantaneous Maximum Torque [N·m]	Permissible Speed Range [r/min]	Unit Weight [kg]	Permissible Radial Load (At Center of Axis) [N]	Permissible Axial Load [N]
Ezi-SERVO-CT-42S-■-PN3	0.57	35 x 10^{-7}	3	5	3	0.012 °	6	12	0 ~ 1000	0.76	240	270
Ezi-SERVO-CT-42S-■-PN5	0.95				5	0.0072 °	9	18	0 ~ 600		290	330
Ezi-SERVO-CT-42S-■-PN8	1.52				8	0.0045 °	9	18	0 ~ 375		340	410
Ezi-SERVO-CT-42S-■-PN10	1.90				10	0.0036 °	6	12	0 ~ 300		360	450
Ezi-SERVO-CT-42S-■-PN15	2.76		5	7	15	0.0024 °	6	12	0 ~ 200	0.91	410	540
Ezi-SERVO-CT-42S-■-PN25	4.60				25	0.00144 °	9	18	0 ~ 120		490	640
Ezi-SERVO-CT-42S-■-PN40	7.36				40	0.0009 °	9	18	0 ~ 75		570	640
Ezi-SERVO-CT-42S-■-PN50	9.00				50	0.00072 °	9	18	0 ~ 60		620	640
Ezi-SERVO-CT-42M-■-PN3	0.85	54 x 10^{-7}	3	5	3	0.012 °	6	12	0 ~ 1000	0.81	240	270
Ezi-SERVO-CT-42M-■-PN5	1.42				5	0.0072 °	9	18	0 ~ 600		290	330
Ezi-SERVO-CT-42M-■-PN8	2.28				8	0.0045 °	9	18	0 ~ 375		340	410
Ezi-SERVO-CT-42M-■-PN10	2.85				10	0.0036 °	6	12	0 ~ 300		360	450
Ezi-SERVO-CT-42M-■-PN15	4.14		5	7	15	0.0024 °	6	12	0 ~ 200	0.97	410	540
Ezi-SERVO-CT-42M-■-PN25	6.90				25	0.00144 °	9	18	0 ~ 120		490	640
Ezi-SERVO-CT-42M-■-PN40	9.00				40	0.0009 °	9	18	0 ~ 75		570	640
Ezi-SERVO-CT-42M-■-PN50	9.00				50	0.00072 °	9	18	0 ~ 60		620	640
Ezi-SERVO-CT-42L-■-PN3	0.92	77 x 10^{-7}	3	5	3	0.012 °	6	12	0 ~ 1000	0.89	240	270
Ezi-SERVO-CT-42L-■-PN5	1.54				5	0.0072 °	9	18	0 ~ 600		290	330
Ezi-SERVO-CT-42L-■-PN8	2.47				8	0.0045 °	9	18	0 ~ 375		340	410
Ezi-SERVO-CT-42L-■-PN10	3.09				10	0.0036 °	6	12	0 ~ 300		360	450
Ezi-SERVO-CT-42L-■-PN15	4.49		5	7	15	0.0024 °	6	12	0 ~ 200	1.04	410	540
Ezi-SERVO-CT-42L-■-PN25	7.49				25	0.00144 °	9	18	0 ~ 120		490	640
Ezi-SERVO-CT-42L-■-PN40	9.00				40	0.0009 °	9	18	0 ~ 75		570	640
Ezi-SERVO-CT-42L-■-PN50	9.00				50	0.00072 °	9	18	0 ~ 60		620	640
Ezi-SERVO-CT-42XL-■-PN3	1.45	114 x 10^{-7}	3	5	3	0.012 °	6	12	0 ~ 1000	1.03	240	270
Ezi-SERVO-CT-42XL-■-PN5	2.42				5	0.0072 °	9	18	0 ~ 600		290	330
Ezi-SERVO-CT-42XL-■-PN8	3.87				8	0.0045 °	9	18	0 ~ 375		340	410
Ezi-SERVO-CT-42XL-■-PN10	4.84				10	0.0036 °	6	12	0 ~ 300		360	450
Ezi-SERVO-CT-42XL-■-PN15	6.00		5	7	15	0.0024 °	6	12	0 ~ 200	1.18	410	540
Ezi-SERVO-CT-42XL-■-PN25	9.00				25	0.00144 °	9	18	0 ~ 120		490	640
Ezi-SERVO-CT-42XL-■-PN40	9.00				40	0.0009 °	9	18	0 ~ 75		570	640
Ezi-SERVO-CT-42XL-■-PN50	9.00				50	0.00072 °	9	18	0 ~ 60		620	640

* The code of encoder resolution will be marked in "■"

Specifications of Motor with Gearbox

56 mm

Unit Part Number	Maximum Holding Torque [N·m]	Rotor Inertia Moment [kg·m^2]	Backlash [arcmin]	Angle Transmission Error [arcmin]	Gear Ratio	Resolution (10,000 P/R Standard)	Permissible Torque [N·m]	Instantaneous Maximum Torque [N·m]	Permissible Speed Range [r/min]	Unit Weight [kg]	Permissible Radial Load (At Center of Axis) [N]	Permissible Axial Load [N]
Ezi-SERVO-CT-56S-■-PN3	1.1	180 x 10^{-7}	3	5	3	0.012 °	18	35	0 ~ 1000	1.75	430	310
Ezi-SERVO-CT-56S-■-PN5	1.9				5	0.0072 °	27	50	0 ~ 600		510	390
Ezi-SERVO-CT-56S-■-PN8	3.0				8	0.0045 °	27	50	0 ~ 375		600	480
Ezi-SERVO-CT-56S-■-PN10	3.8				10	0.0036 °	18	35	0 ~ 300		640	530
Ezi-SERVO-CT-56S-■-PN15	5.5				15	0.0024 °	18	35	0 ~ 200	2.05	740	630
Ezi-SERVO-CT-56S-■-PN25	9.3				25	0.00144 °	27	50	0 ~ 120		870	790
Ezi-SERVO-CT-56S-■-PN40	14.9				40	0.0009 °	27	50	0 ~ 75		1000	970
Ezi-SERVO-CT-56S-■-PN50	18.6				50	0.00072 °	27	50	0 ~ 60		1100	1100
Ezi-SERVO-CT-56M-■-PN3	2.0	280 x 10^{-7}	3	5	3	0.012 °	18	35	0 ~ 1000	1.92	430	310
Ezi-SERVO-CT-56M-■-PN5	3.4				5	0.0072 °	27	50	0 ~ 600		510	390
Ezi-SERVO-CT-56M-■-PN8	5.4				8	0.0045 °	27	50	0 ~ 375		600	480
Ezi-SERVO-CT-56M-■-PN10	6.8				10	0.0036 °	18	35	0 ~ 300		640	530
Ezi-SERVO-CT-56M-■-PN15	9.9				15	0.0024 °	18	35	0 ~ 200	2.23	740	630
Ezi-SERVO-CT-56M-■-PN25	16.6				25	0.00144 °	27	50	0 ~ 120		870	790
Ezi-SERVO-CT-56M-■-PN40	27.0				40	0.0009 °	27	50	0 ~ 75		1000	970
Ezi-SERVO-CT-56M-■-PN50	27.0				50	0.00072 °	27	50	0 ~ 60		1100	1100
Ezi-SERVO-CT-56L-■-PN3	4.0	520 x 10^{-7}	3	5	3	0.012 °	18	35	0 ~ 1000	2.37	430	310
Ezi-SERVO-CT-56L-■-PN5	6.8				5	0.0072 °	27	50	0 ~ 600		510	390
Ezi-SERVO-CT-56L-■-PN8	10.8				8	0.0045 °	27	50	0 ~ 375		600	480
Ezi-SERVO-CT-56L-■-PN10	13.6				10	0.0036 °	18	35	0 ~ 300		640	530
Ezi-SERVO-CT-56L-■-PN15	18.0				15	0.0024 °	18	35	0 ~ 200	2.67	740	630
Ezi-SERVO-CT-56L-■-PN25	27.0				25	0.00144 °	27	50	0 ~ 120		870	790
Ezi-SERVO-CT-56L-■-PN40	27.0				40	0.0009 °	27	50	0 ~ 75		1000	970
Ezi-SERVO-CT-56L-■-PN50	27.0				50	0.00072 °	27	50	0 ~ 60		1100	1100

* The code of encoder resolution will be marked in "■"

Specifications of Motor with Gearbox

60 mm

Unit Part Number	Maximum Holding Torque [N·m]	Rotor Inertia Moment [kg·m²]	Backlash [arcmin]	Angle Transmission Error [arcmin]	Gear Ratio	Resolution (10,000 P/R Standard)	Permissible Torque [N·m]	Instantaneous Maximum Torque [N·m]	Permissible Speed Range [r/min]	Unit Weight [kg]	Permissible Radial Load (At Center of Axis) [N]	Permissible Axial Load [N]
Ezi-SERVO-CT-60S-■-PN3	1.5	240×10^{-7}	3	5	3	0.012°	18	35	0~1000	1.84	430	310
Ezi-SERVO-CT-60S-■-PN5	2.5				5	0.0072°	27	50	0~600		510	390
Ezi-SERVO-CT-60S-■-PN8	4.0				8	0.0045°	27	50	0~375		600	480
Ezi-SERVO-CT-60S-■-PN10	5.1				10	0.0036°	18	35	0~300		640	530
Ezi-SERVO-CT-60S-■-PN15	7.4				15	0.0024°	18	35	0~200	2.13	740	630
Ezi-SERVO-CT-60S-■-PN25	12.3				25	0.00144°	27	50	0~120		870	790
Ezi-SERVO-CT-60S-■-PN40	19.8				40	0.0009°	27	50	0~75		1000	970
Ezi-SERVO-CT-60S-■-PN50	24.7				50	0.00072°	27	50	0~60		1100	1100
Ezi-SERVO-CT-60M-■-PN3	2.6	490×10^{-7}	3	5	3	0.012°	18	35	0~1000	1.20	430	310
Ezi-SERVO-CT-60M-■-PN5	4.4				5	0.0072°	27	50	0~600		510	390
Ezi-SERVO-CT-60M-■-PN8	7.0				8	0.0045°	27	50	0~375		600	480
Ezi-SERVO-CT-60M-■-PN10	8.8				10	0.0036°	18	35	0~300		640	530
Ezi-SERVO-CT-60M-■-PN15	12.8				15	0.0024°	18	35	0~200	2.30	740	630
Ezi-SERVO-CT-60M-■-PN25	21.4				25	0.00144°	27	50	0~120		870	790
Ezi-SERVO-CT-60M-■-PN40	27.0				40	0.0009°	27	50	0~75		1000	970
Ezi-SERVO-CT-60M-■-PN50	27.0				50	0.00072°	27	50	0~60		1100	1100
Ezi-SERVO-CT-60L-■-PN3	5.2	690×10^{-7}	3	5	3	0.012°	18	35	0~1000	2.61	430	310
Ezi-SERVO-CT-60L-■-PN5	8.7				5	0.0072°	27	50	0~600		510	390
Ezi-SERVO-CT-60L-■-PN8	13.9				8	0.0045°	27	50	0~375		600	480
Ezi-SERVO-CT-60L-■-PN10	18.0				10	0.0036°	18	35	0~300		640	530
Ezi-SERVO-CT-60L-■-PN15	18.0				15	0.0024°	18	35	0~200	2.86	740	630
Ezi-SERVO-CT-60L-■-PN25	27.0				25	0.00144°	27	50	0~120		870	790
Ezi-SERVO-CT-60L-■-PN40	27.0				40	0.0009°	27	50	0~75		1000	970
Ezi-SERVO-CT-60L-■-PN50	27.0				50	0.00072°	27	50	0~60		1100	1100

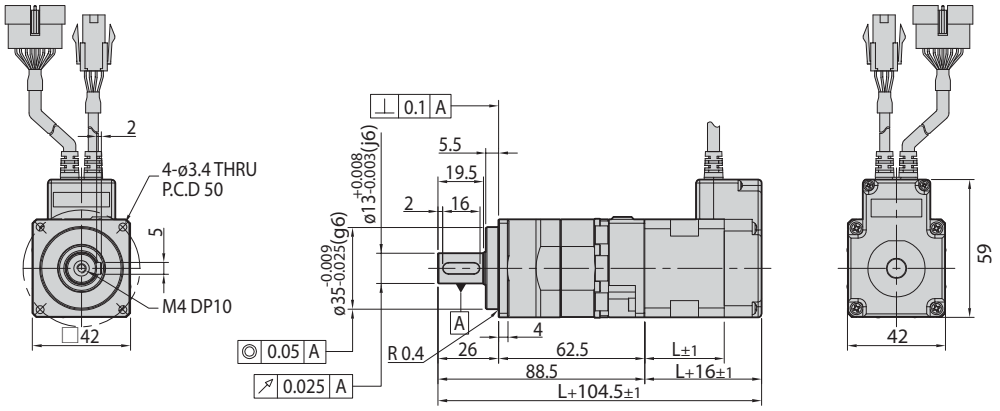
* The code of encoder resolution will be marked in "■"

Dimensions of Motor with Gearbox [mm]

42 mm

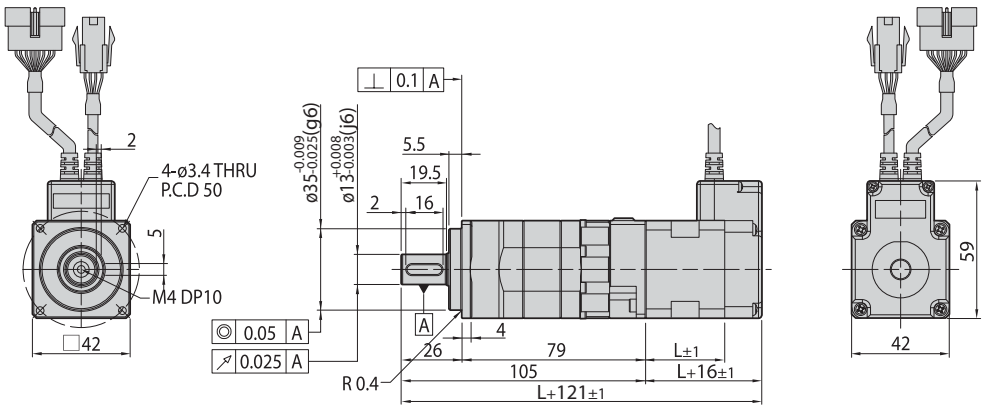
Unit Part Number	Motor	Stage	□Gear Ratio	L [mm]
Ezi-SERVO-CT-42S-■-PN□	EzM2-42S-■-PN□	Single Stage	3, 5, 8, 10	34
Ezi-SERVO-CT-42M-■-PN□	EzM2-42M-■-PN□		3, 5, 8, 10	40
Ezi-SERVO-CT-42L-■-PN□	EzM2-42L-■-PN□		3, 5, 8, 10	48
Ezi-SERVO-CT-42XL-■-PN□	EzM2-42XL-■-PN□		3, 5, 8, 10	60

* The code of encoder resolution will be marked in "■"



Unit Part Number	Motor	Stage	□Gear Ratio	L [mm]
Ezi-SERVO-CT-42S-■-PN□	EzM2-42S-■-PN□	Double Stage	15, 25, 40, 50	34
Ezi-SERVO-CT-42M-■-PN□	EzM2-42M-■-PN□		15, 25, 40, 50	40
Ezi-SERVO-CT-42L-■-PN□	EzM2-42L-■-PN□		15, 25, 40, 50	48
Ezi-SERVO-CT-42XL-■-PN□	EzM2-42XL-■-PN□		15, 25, 40, 50	60

* The code of encoder resolution will be marked in "■"

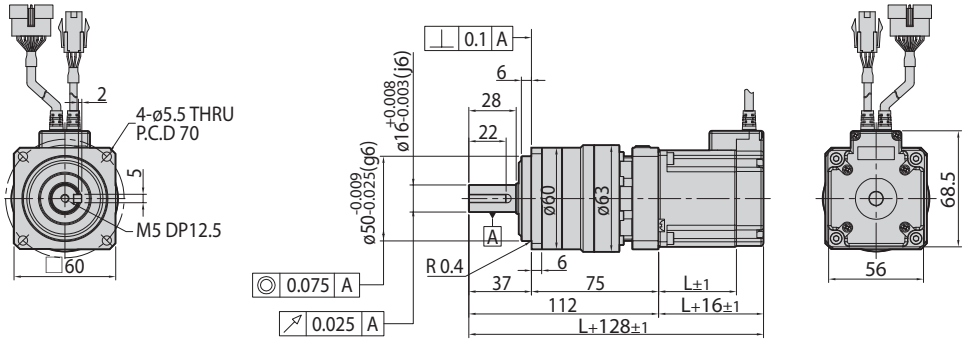


Dimensions of Motor with Gearbox [mm]

56 mm

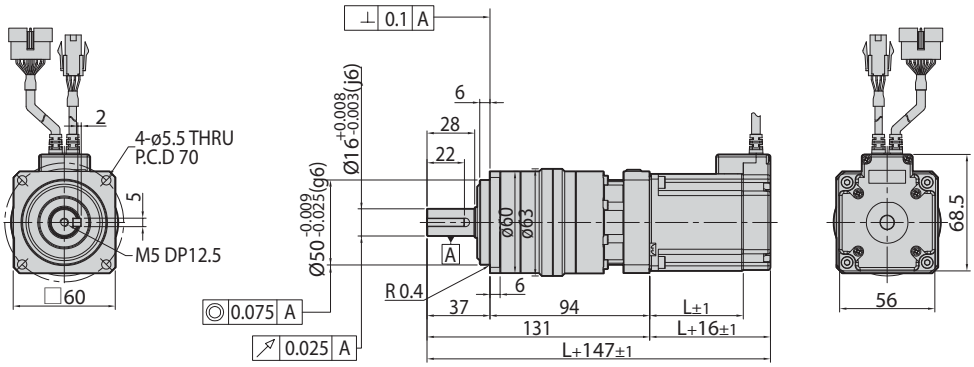
Unit Part Number	Motor	Stage	□Gear Ratio	L [mm]
Ezi-SERVO-CT-56S-■-PN□	EzM2-56S-■-PN□	Single Stage	3, 5, 8, 10	46
Ezi-SERVO-CT-56M-■-PN□	EzM2-56M-■-PN□		3, 5, 8, 10	55
Ezi-SERVO-CT-56L-■-PN□	EzM2-56L-■-PN□		3, 5, 8, 10	80

* The code of encoder resolution will be marked in "■"



Unit Part Number	Motor	Stage	□Gear Ratio	L [mm]
Ezi-SERVO-CT-56S-■-PN□	EzM2-56S-■-PN□	Double Stage	15, 25, 40, 50	46
Ezi-SERVO-CT-56M-■-PN□	EzM2-56M-■-PN□		15, 25, 40, 50	55
Ezi-SERVO-CT-56L-■-PN□	EzM2-56L-■-PN□		15, 25, 40, 50	80

* The code of encoder resolution will be marked in "■"

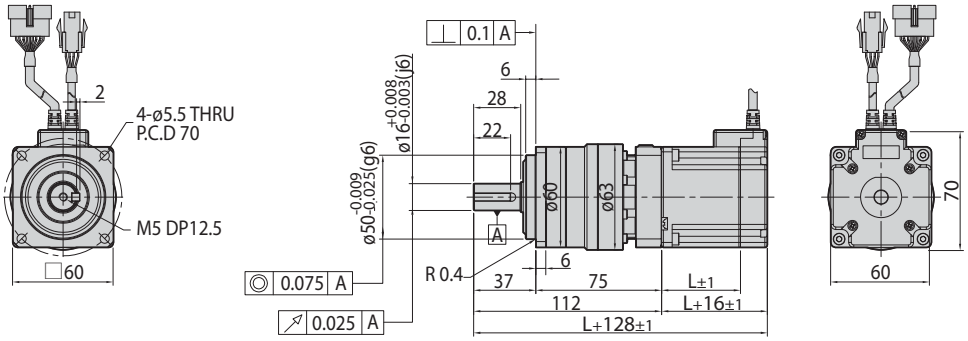


Dimensions of Motor with Gearbox [mm]

60 mm

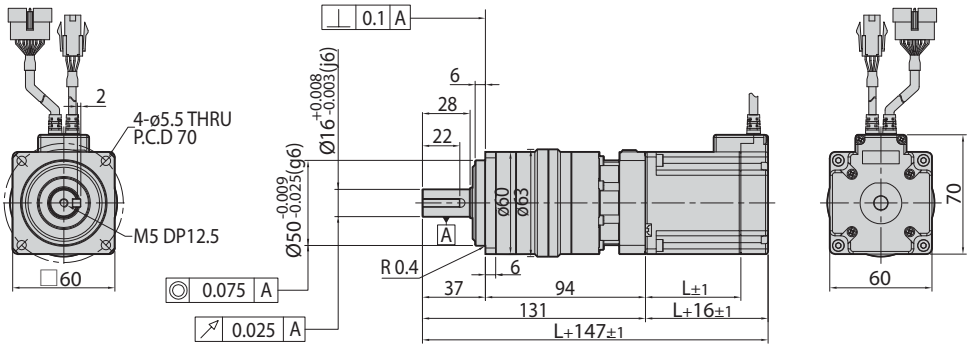
Unit Part Number	Motor	Stage	□Gear Ratio	L [mm]
Ezi-SERVO-CT-60S-■-PN□	EzM2-60S-■-PN□	Single Stage	3, 5, 8, 10	47
Ezi-SERVO-CT-60M-■-PN□	EzM2-60M-■-PN□		3, 5, 8, 10	56
Ezi-SERVO-CT-60L-■-PN□	EzM2-60L-■-PN□		3, 5, 8, 10	85

* The code of encoder resolution will be marked in "■"

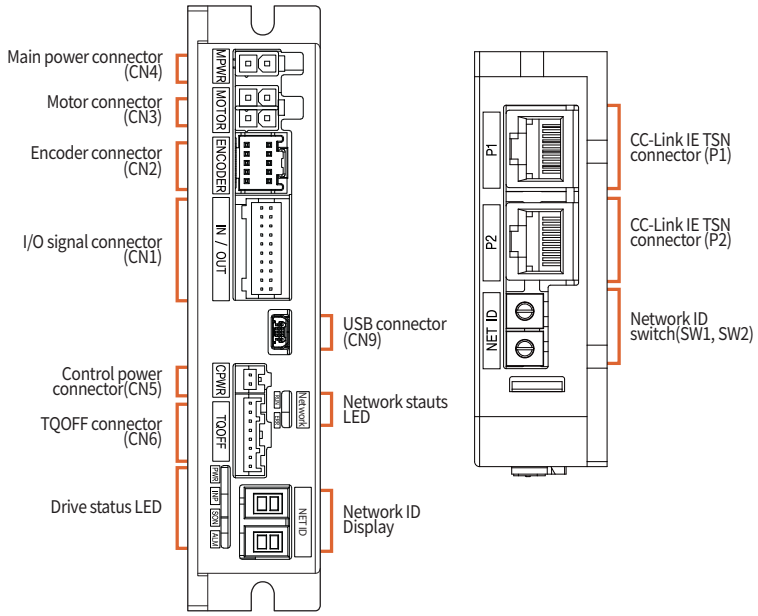


Unit Part Number	Motor	Stage	□Gear Ratio	L [mm]
Ezi-SERVO-CT-60S-■-PN□	EzM2-60S-■-PN□	Double Stage	15, 25, 40, 50	47
Ezi-SERVO-CT-60M-■-PN□	EzM2-60M-■-PN□		15, 25, 40, 50	56
Ezi-SERVO-CT-60L-■-PN□	EzM2-60L-■-PN□		15, 25, 40, 50	85

* The code of encoder resolution will be marked in "■"

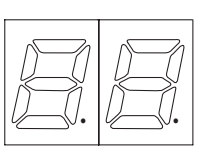


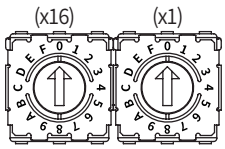
Names and Functions of Each Part



1. Network ID Display and Switch (SW1, SW2)

These switches are used to configure the fourth octet of the IP address. The value is displayed on the 7-segment LED in hexadecimal format. SW1 sets the X16 digit, and SW2 sets the X1 digit.
(For more details, please refer to the relevant user manual.)



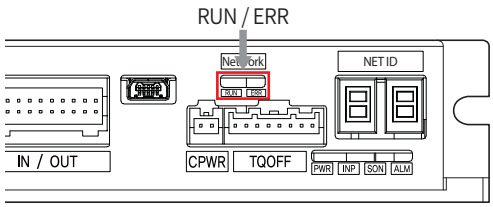


For example, if SW1 is set to 5 and SW2 is set to 7,
the value is calculated as follows:
(5 × 16) + (7 × 1) = 87
Accordingly, the IP address is set to 192.168.0.87.

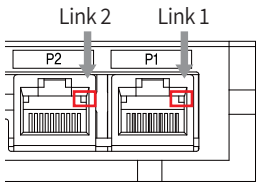
2. Network Status LED

These LEDs indicate the communication status of CC-Link IE TSN.
Link1/Link2 LEDs are located at the upper right corner of CC-Link IE TSN ports(P1, P2).

Indication	Color	Status	Description
RUN	Green	OFF	Power OFF
		Single Flash	Not Connected to Master
		Double Flash	Pre-Operational Status
		Blinking	Safe-Operational Status
		Interval Off	Operational Status



Indication	Color	Status	Description
ERR	Red	OFF	No Error or Power OFF
		Blinking	Drive Error
		Single Flash	CC-Link IE TSN Communication Error
		Double Flash	IP Address Conflict Error



Indication	Color	Status	Description
LINK1/ LINK2	Green	OFF	Link Inactive
		ON	Link Active

3. Drive Status LED

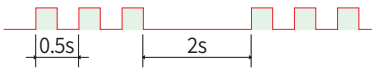
LED informs operation status of the drive.

Indication	Color	Function	Description
PWR	Green	Power Input Indication	LED is turned ON when power is applied.
INP	Yellow	Complete Positioning Motion	LED is turned ON when Positioning error reaches within the preset pulse after the positioning is complete.
SON	Orange	Servo On / Off Indication	Servo ON: Lights ON, Servo 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 Code *4	Error Type	Causes
1	E-001	Over Current Error	The current through power devices in drive exceeds the limit. *1
2	E-002	Over Speed Error	The motor speed exceeds 3,000r/min
3	E-003	Position Tracking Error	Position error value is greater than the reference value while the motor is running *2
4	E-004	Over Load Error	The motor is continuously operated more than 5 seconds under a load exceeding the Max. torque.
5	E-005	Over Temperature Error	Internal temperature of the drive exceeds 85 °C
6	E-006	Over Regenerative Voltage Error	Back-EMF is higher than limit value *3
7	E-007	Motor Connect Error	There is a problem with the connection between the drive and the motor
8	E-008	Encoder Connect Error	There is a problem with the connection between the drive and the encoder
9	E-009	Main Power Voltage Error	The Main Power Voltage Drops Below Approximately 18 V
10	E-010	In-Position Error	After operation is finished, position error larger than 1 pulse is continued for more than 3 seconds
12	E-012	ROM Error	Error occurs in parameter storage device(ROM)
15	E-015	Position Overflow Error	Position error value is greater than the reference value while the motor is stopped *2
16	E-016	Abnormal Safety State Error	Input states of TQOFF1 and TQOFF2 are different from each other.

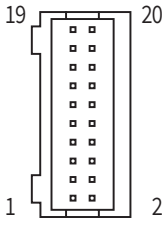
*1. : Limit value depends on motor model. (Refer to the Manual)
*2. : The default setting value is 180 °, and it can be changed by parameter. (Refer to the Manual)
*3. : Voltage limit of Back-EMF depends on motor model. (Refer to the Manual)
*4. : When an alarm occurs, error code is displayed on the 7-segment LED display instead of IP Address.
※ Please refer to user Manual for the details of Error Type .



Alarm LED flash (e.g., Position tracking error)

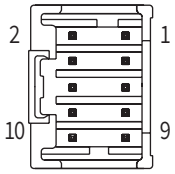
4. I/O Signal Connector (CN1)

No.	Function	I/O	No.	Function	I/O
1	LIMIT+	Input	11	Digital Out2	Output
2	LIMIT-	Input	12	Digital Out3	Output
3	ORIGIN	Input	13	Digital Out4	Output
4	Digital In1	Input	14	Digital Out5	Output
5	Digital In2	Input	15	BRAKE+	Output
6	Digital In3	Input	16	BRAKE-	Output
7	Digital In4	Input	17	EXT_GND	Input
8	Digital In5	Input	18	EXT_24 V DC	Input
9	Digital In6	Input	19	F.GND	----
10	Digital Out1	Output	20	F.GND	----



5. 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	5 V DC	Output
8	GND	Output
9	F.GND	----
10	F.GND	----



6. Motor Connector (CN3)

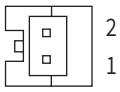
No.	Function	I/O
1	A Phase	Output
2	B Phase	Output
3	$\overline{A}$ Phase	Output
4	$\overline{B}$ Phase	Output

7. Main Power Connector (CN4)

No.	Function	I/O
1	24 V DC	Input
2	GND	Input

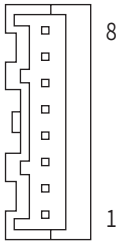
8. Control Power Connector (CN5)

No.	Function	I/O
1	24 V DC	Input
2	GND	Input



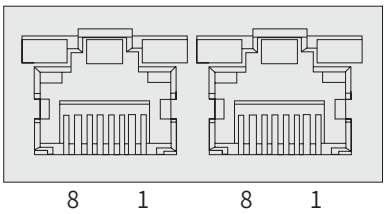
9. TQOFF Connector (CN6)

No.	Function	I/O
1	TQOFF1_P	Input
2	TQOFF1_N	Input
3	TQOFF2_P	Input
4	TQOFF2_N	Input
5	TQMON_P	Output
6	TQMON_N	Output
7	OVRTQ	Input
8	GND	Output

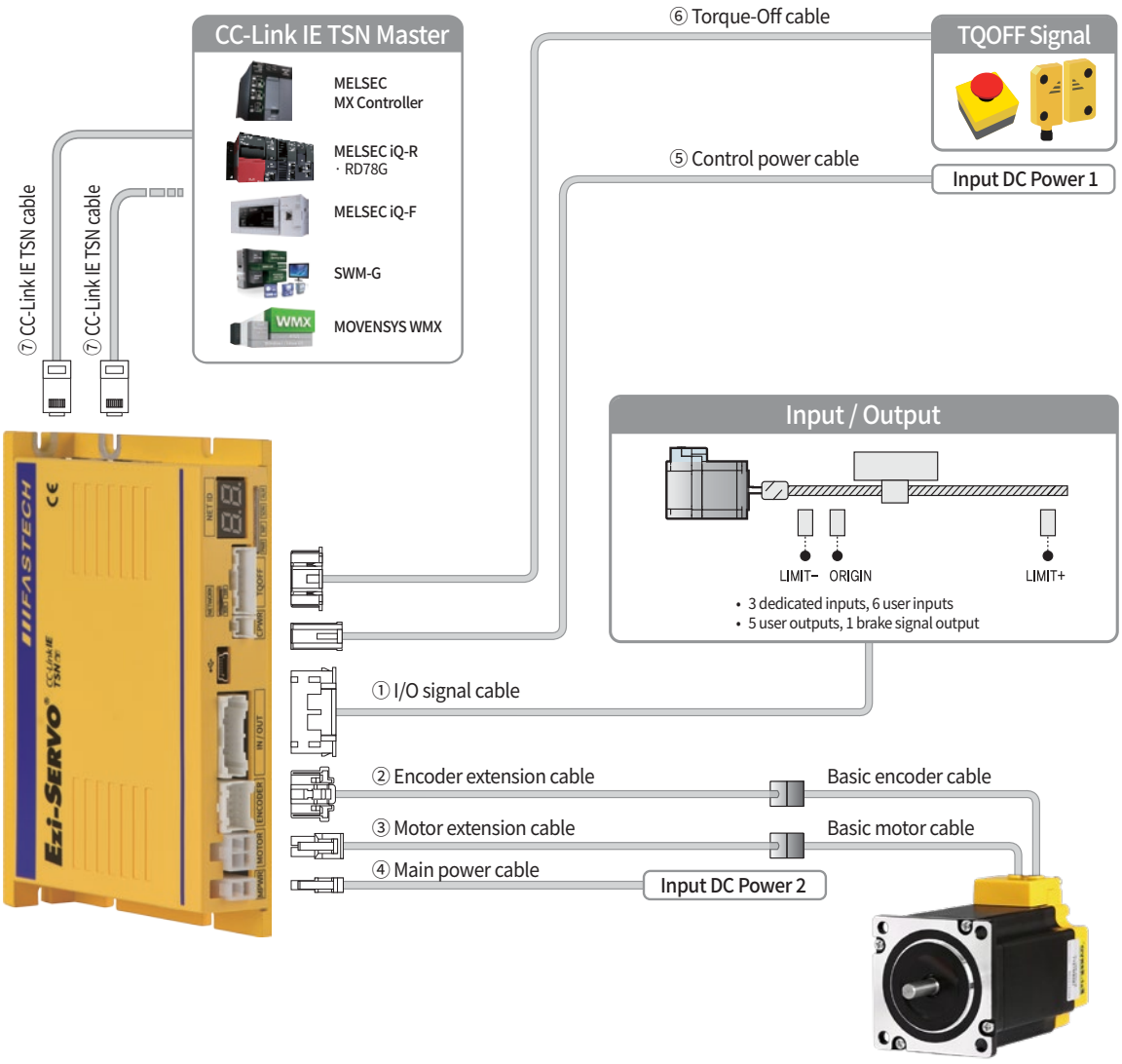


10. CC-Link IE TSN Connector (P1, P2)

No.	Function	No.	Function
1	DA+	6	DB-
2	DA-	7	DD+
3	DB+	8	DD-
4	DC+	Connector hood	F.GND
5	DC-		



System Configuration



Cable Type	Max. Cable Length	Remarks
① I/O Signal Cable	20 m	Options (Sold separately)
② Encoder Extension Cable	20 m	
③ Motor Extension Cable	20 m	
④ Main Power Cable	2 m	
⑤ Control Power Cable	2 m	
⑥ Torque-Off Cable	20 m	
⑦ CC-Link IE TSN Cable	100 m	
Basic Encoder Cable	0.3 m (Basic length)	Basic cables are attached to motors.
Basic Motor Cable	0.3 m (Basic length)	

1. Accessories

Connectors
These are connector specifications for drive cabling.

Purpose		Item	Part Number	Manufacturer
Main Power (CN4)		Housing	5557-02R	MOLEX
		Terminal	5556T	
Control Power (CN5)		Housing	PAP-02V-S	JST
		Terminal	SPHD-001T-P0.5	
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	
	Encoder Side	Housing	SMP-09V-NC	JST
		Terminal	SHF-001T-0.8BS	
I/O Signal (CN1)		Housing	PADP-20V-1-S	JST
		Terminal	SPH-002T-P0.5L	
Torque-Off Signal (CN6)		Housing	PAP-08V-S	JST
		Terminal	SPHD-001T-P0.5 or SPHD-002T-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 I/O Signal Cable
These are the cables to connect Ezi-SERVO CC-Link IE TSN drive and other input / output devices.

Purpose	Part Number	Length [m]	Cable Type	Remarks
Drive - I/O Device Connection	CSVN-S-001F	1	Fixed Cable	Max. Cable Length: 20 m
	CSVN-S-002F	2		
	CSVN-S-003F	3		
	CSVN-S-005F	5		
	CSVN-S-001M	1	Flexible Cable	
	CSVN-S-002M	2		
	CSVN-S-003M	3		
	CSVN-S-005M	5		

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

② Encoder Extension Cable

These are the cables to connect Ezi-SERVO CC-Link IE TSN drive and the encoder.

Purpose	Part Number	Length [m]	Cable Type	Remarks
Drive - Basic Encoder Cable Connection	CSVO-E-001F	1	Fixed Cable	Max. Cable Length: 20 m
	CSVO-E-002F	2		
	CSVO-E-003F	3		
	CSVO-E-005F	5		
	CSVO-E-001M	1	Flexible Cable	
	CSVO-E-002M	2		
	CSVO-E-003M	3		
	CSVO-E-005M	5		

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

③ Motor Extension Cable

These are the cables to connect Ezi-SERVO CC-Link IE TSN drive and the motor.

Purpose	Part Number	Length [m]	Cable Type	Remarks
Drive - Basic Motor Cable Connection	CSVO-M-001F	1	Fixed Cable	Max. Cable Length: 20 m
	CSVO-M-002F	2		
	CSVO-M-003F	3		
	CSVO-M-005F	5		
	CSVO-M-001M	1	Flexible Cable	
	CSVO-M-002M	2		
	CSVO-M-003M	3		
	CSVO-M-005M	5		

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

④ Main Power Cable

These are the cables to connect Ezi-SERVO CC-Link IE TSN drive and the main power.

Purpose	Part Number	Length [m]	Cable Type	Remarks
Drive - Power Connection	CSVO-P-001F	1	Fixed Cable	Max. Cable Length: 2 m
	CSVO-P-002F	2		
	CSVO-P-001M	1	Flexible Cable	
	CSVO-P-002M	2		

⑤ Control Power Cable

These are the cables to connect Ezi-SERVO CC-Link IE TSN drive and the control power.

Purpose	Part Number	Length [m]	Cable Type	Remarks
Drive - Control Power Connection	CMNB-P-001F	1	Fixed Cable	Max. Cable Length: 2 m
	CMNB-P-002F	2		
	CMNB-P-001M	1	Flexible Cable	
	CMNB-P-002M	2		

⑥ Torque-Off Cable

These are the cables to connect Ezi-SERVO CC-Link IE TSN drive and sensors or switches for Torque-Off signal.

Purpose	Part Number	Length [m]	Cable Type	Remarks
Drive - Torque-Off Signal Connection	CSVT-S-001F	1	Fixed Cable	Max. Cable Length: 20 m
	CSVT-S-002F	2		
	CSVT-S-003F	3		
	CSVT-S-005F	5		
	CSVT-S-001M	1	Flexible Cable	
	CSVT-S-002M	2		
	CSVT-S-003M	3		
	CSVT-S-005M	5		

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

⑦ CC-Link IE TSN Cable

Purpose	Part Number	Length [m]	Remarks
CC-Link IE TSN Connection	CGNR-EC-001F	1	• STP(Shielded Twisted Pair) Cable • Category 5e or higher • Max. Cable Length: 100 m • Fixed Cable
	CGNR-EC-002F	2	
	CGNR-EC-003F	3	
	CGNR-EC-005F	5	

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

[Option] TB-Plus Interface Board

This is an interface board to connect Ezi-SERVO CC-Link IE TSN drive and I/O signals more conveniently.

Purpose	Part Number	Product Image
Interface Board between Drive and I/O Signals	TB-Plus	

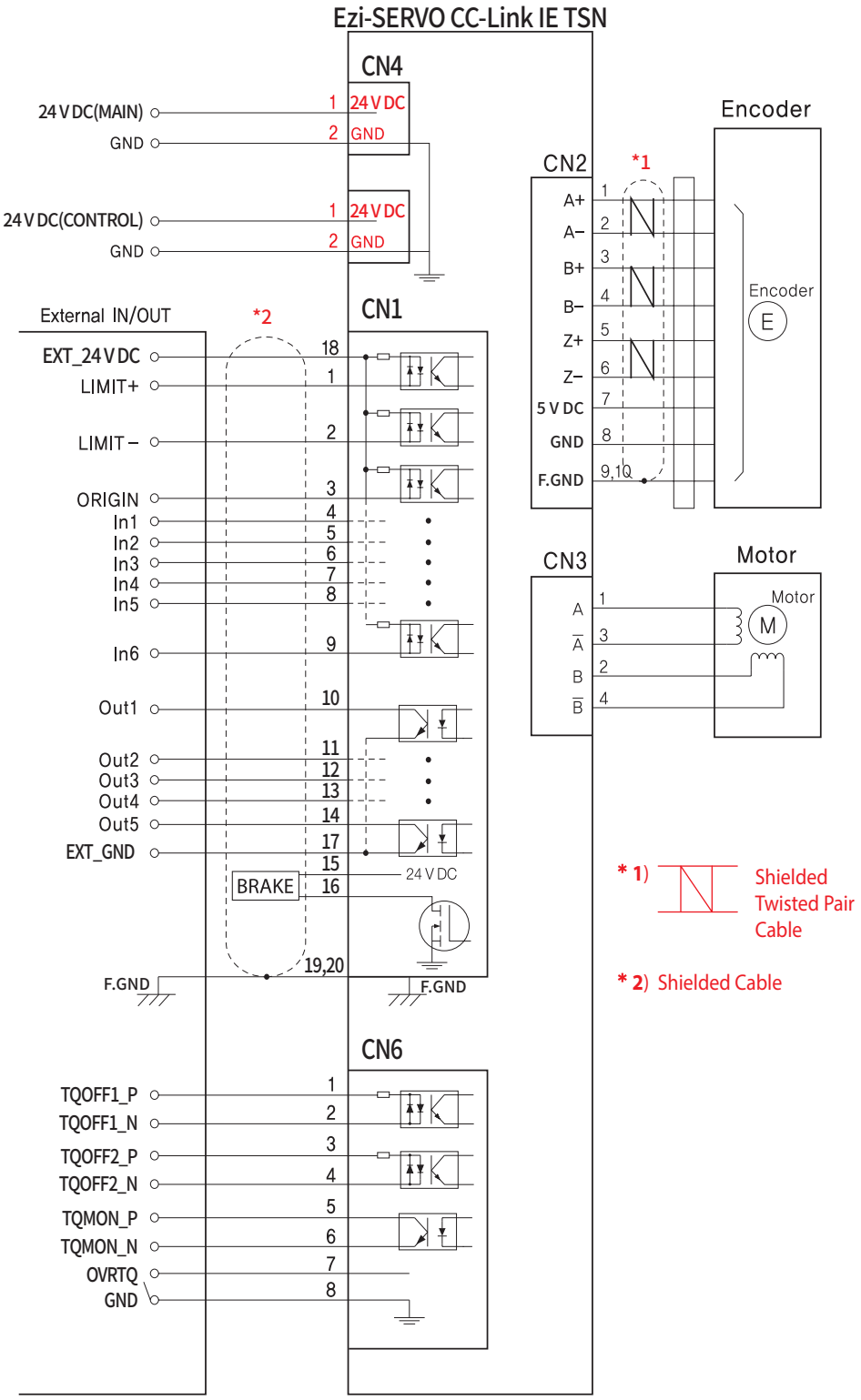
[Option] TB-Plus Interface Cable

These are the cables to connect Ezi-SERVO CC-Link IE TSN and TB-Plus interface board.

Purpose	Part Number	Length [m]	Cable Type	Remarks
Drive - Interface(TB-Plus) Connection	CIFT-S-001F	1	Fixed Cable	Max. Cable Length: 20 m
	CIFT-S-002F	2		
	CIFT-S-003F	3		
	CIFT-S-005F	5		
	CIFT-S-001M	1	Flexible Cable	
	CIFT-S-002M	2		
	CIFT-S-003M	3		
	CIFT-S-005M	5		

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

External Wiring Diagram



※ When connects I/O cable between controller and drive, please turn off 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

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