# FV5 Series Rotary Pulse Servo Drive

# Installation Guide

**Document Version: 01**

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# Revision History

| Date | Version | Revision History |
|---|---|---|
| 2025-02-25 | 01 | Initial publication |

# Contents

# Preface

## Overview

Thank you for choosing Flexem products. The FV5 series rotary pulse servo drive is an essential component of servo systems. By receiving and responding to commands from the host controller, it accurately controls the position, speed, and output torque of the rotary motor, meeting the application needs of customers in various production scenarios. The FV5 series rotary pulse servo drive is rich in features, excellent in performance, has a high control bandwidth, and supports various command forms such as pulse command and analog input. It supports user-friendly functions such as automatic adjustment, adaptive vibration suppression, inertia recognition, low-frequency jitter suppression, error compensation, etc. It can also be optimized through servo commissioning software, making it widely applicable in fields such as consumer electronics, semiconductors, lithium batteries, photovoltaics, and more.

This manual provides detailed instructions to the hardware specifications and installation methods of the FV5 series rotary pulse servo drive.

The content provided in this manual only serves as general guidance and does not guarantee coverage of all usage scenarios for all product models. Due to reasons such as version upgrades, different device models and configuration files, the content provided in the manual may not match the actual device interface used by the user. Please refer to the actual information displayed on the user's device interface. The manual will not provide a detailed explanation of the differences caused by the aforementioned situations.

For the purpose of functional introduction and configuration examples, the manual may use IP addresses, URLs, domain names, etc. Unless otherwise specified, the aforementioned content is for illustration only and does not represent any actual significance.

## Intended Audience

This document is primarily intended for readers who wish to understand the usage of the FV5 series rotary pulse servo drive, including electrical engineers, mechanical engineers, etc. It is assumed that readers have a certain level of knowledge in the following areas:

- Principles of automatic control
- Basic electrical knowledge
- Principles of servo system’s functionalities
- Applications of sensors

## Getting Help

If you encounter any problems during use, please dial the service hotline at 4008-033-022.

For more documents, please visit https://www.flexem.com/info_download.html.

**Contact Information**

Address: 9th Floor, Building A, INNO Business Park, No. 386 Guo'an Road, Yangpu District, Shanghai

Zip Code: 200043

Website: https://www.flexem.com

# Safety Precautions

## Safety Disclaimer

To ensure the safety of personnel and equipment, please read and follow these safety precautions carefully before installing, operating, and maintaining the product. It is strictly prohibited for non-professionals to perform equipment installation, wiring, maintenance, inspection, or component replacement. This product should be used in an environment that meets the design specifications; otherwise, malfunctions may occur. Any abnormal function or component damage caused by failure to comply with relevant regulations is not covered by the product quality guarantee. Flexem shall not be liable for any personal injury accidents or property damage caused by unauthorized operation of the product.

## Safety Symbols

| Symbol | Meaning | Description |
|---|---|---|
|  | Warning | Content following this icon requires special attention; failure to do so may result in personal injury or equipment damage. |
|  | Hazardous Voltage | Indicates a potential hazard of high voltage. |
|  | Protective Earthing | Connection provides protection against electric shock in case of external conductor failure or protects ground electrode terminals. |
|  | Warning, Hot Surface | Indicates that the marked object is hot; caution should be exercised when touching. |

## Safety Precautions

### Safety Guidelines

Servo drives must be used in accordance with all applicable safety regulations, directives, and all technical specifications!

Servo drives use voltage at the hazardous level and must be properly grounded.

Only qualified personnel who have received sufficient technical training and possess adequate knowledge are allowed to perform installation, operation, maintenance, and repair procedures.

### Storage and Transportation Handling Precautions

- Avoid storing or transporting the equipment in environments with water splash, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.
- Avoid storing the equipment for more than three months. Long-term storage requires stricter protection and necessary inspections.
- Never transport the equipment with other equipment or materials that may harm or have negative impacts on this equipment.
- Handle the equipment with care during transportation and mind your steps to prevent personal injuries or equipment damage.

- Pack the equipment strictly before transportation. Use a sealed box for long-distance transportation.
- Large-scale or heavy equipment must be transported by qualified professionals using specialized hoisting equipment. Failure to comply may result in personal injuries or equipment damage.
- Before hoisting the equipment, ensure the equipment components such as the front cover and terminal blocks are secured firmly with screws. Loosely-connected components mayfall off and result in personal injuries or equipment damage.
- Never stand or stay below the equipment when the equipment is being hoisted by the hoisting equipment.
- When hoisting the equipment with a steel rope, ensure the equipment is hoisted at a constant speed without suffering from vibration or shock. Do not turn the equipment over or let the equipment stay hanging in the air. Failure to comply may result in personal injuries or equipment damage.

## Unpacking Precautions

- Do not install the equipment if you find damage, rust, or signs of use on the equipment or accessories upon unpacking.
- Do not install the equipment if you find water seepage or missing or damaged components upon unpacking.
- Do not install the equipment if you find the packing list does not conform to the equipment you received.
- Unpack the package by following the unpacking sequence. Do not strike the package violently.

Installation PrecautionsPlease install in strict accordance with the precautions to avoid personal and property damage.

- It is strictly prohibited to power the servo drive using an IT network. Use only TN/TT grid power.
- The servo drive must be grounded through the AC mains ground wire.
- The ground wire of the upper unit connected to the servo drive must be the same as the servo drive's ground wire.
- The equipment must be operated only by professionals with electrical knowledge.
- Read through the guide and safety instructions before installation.
- Wiring with the power on is prohibited. Wait at least 15 minutes after disconnecting the power before making contact.
- Wear an anti-static wrist strap during wiring and other operations to prevent damage to internal electronic components.
- The cables used for wiring must meet the required wire diameter and shielding specifications. The shielding layer of shielded cables must be reliably grounded at one end.

## Handling Precautions

- Before powering up, ensure that the supply voltage matches the rated voltage and that the wiring is secure to prevent injury to personnel or damage to the equipment.
- Before powering up, verify that the wiring sequence is correct. Pay special attention to avoid misconnecting the input cable to the output, as this could damage the device.
- When the unit is powered up, the mechanism may activate suddenly. Stay clear of the mechanism to avoid injury.

- Do not touch the terminals or disassemble any parts while the equipment is energized to prevent electric shock.
- Do not touch the equipment casing, discharge resistors, or other components to avoid burns from high temperatures.
- Avoid dropping objects or metal into the unit, as this may cause damage.
- The machine owner and operator must ensure the machine is energized and prevent unauthorized personnel from entering the hazardous area.

## Maintenance Precautions

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- It is strictly prohibited to conduct equipment maintenance while the equipment is powered on. Otherwise, there is a risk of electric shock.
- Before maintenance, cut off all the power supplies of the equipment and wait for at least the time designated on the equipment warning label.
- In case of a permanent magnet motor, do not touch the motor terminals immediately after power-off because the motor terminals will generate induced voltage during rotation even after the equipment power supply is off. Failure to comply will result in an electric shock.
- Perform routine and periodic inspection and maintenance on the equipment according to maintenance requirements and keep a maintenance record.

## Repair Precautions

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- It is strictly prohibited to conduct equipment maintenance while the equipment is powered on. Otherwise, there is a risk of electric shock.
- Before inspection and repair, cut off all the power supplies of the equipment and wait for at least the time designated on the equipment warning label.
- When the equipment is faulty or damaged, the troubleshooting and repair work must be performed by professionals that follow the repair instructions, with repair records kept properly.
- Do not use damaged equipment. Failure to comply may result in death, personal injuries, or severe equipment damage.
- After the equipment is replaced, check the wiring and set parameters again.
- Recycle retired equipment by observing industry waste disposal standards to avoid environmental pollution.

# 1 Product Information

## 1.1 Servo Drive

### 1.1.1 Drive Model Description

FV5 – R1 – P A 2R8

Drive code

| Symbol | Descripton |
|---|---|
| FV5 | High-performance servo drive |

Series

| Symbo | Product series |
|---|---|
| R1 | Rotary R1 series |
| R3 | Rotary R3 series |

Control mode

| Symbol | Description |
|---|---|
| P | Pulse |

Power supply voltage

| Symbol | Input voltage |
|---|---|
| A | 220V 1 phase |
| C | 220V 3 phase |
| T | 380V 3 phase |

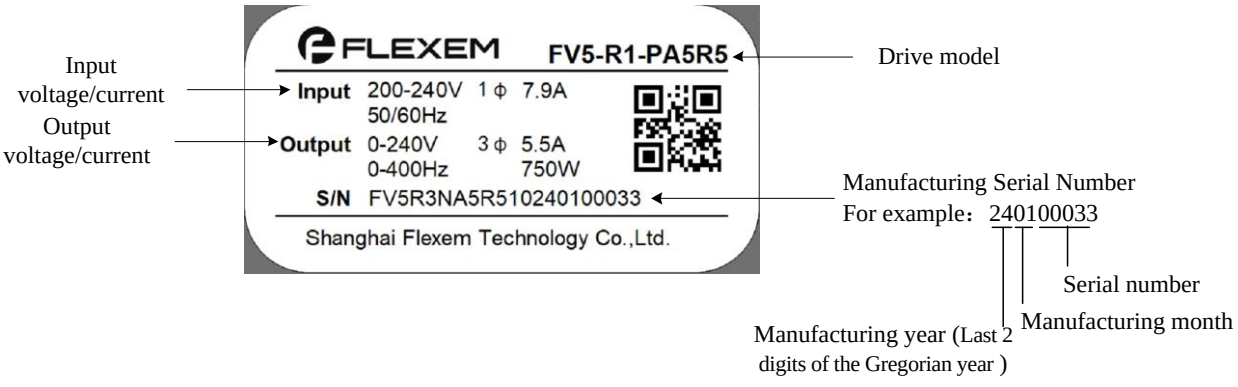
Output current

| Symbol | Rated output current |
|---|---|
| **220V** | |
| 1R1 | 1.1A |
| 1R6 | 1.6A |
| 2R8 | 2.8A |
| 5R5 | 5.5A |
| 7R6 | 7.6A |
| 012 | 12A |
| **380V** | |
| 3R5 | 3.5A |
| 5R4 | 5.4A |
| 8R4 | 8.4A |
| 012 | 12A |
| 017 | 17A |
| 021 | 21A |
| 026 | 26A |

Notice: The suffix of the drive model is either A00 or absent, indicating that the drive is a standard model.

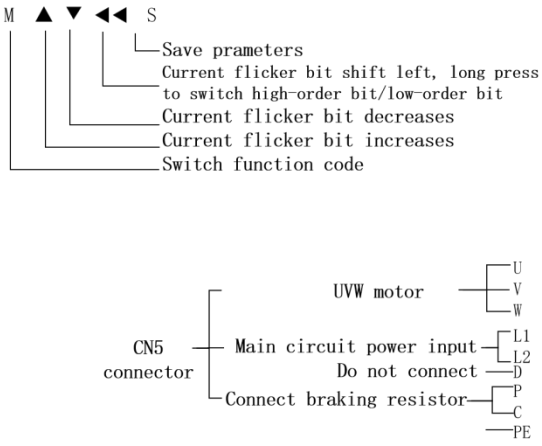
The main difference between the R1 series and R3 series lies in the supported encoder types. The R1 series drive supports a 17-bit absolute encoder, while the R3 series drive supports a 17-bit absolute encoder, a 23-bit absolute encoder, and an ABZ encoder.

### 1.1.2 Drive Nameplate Description



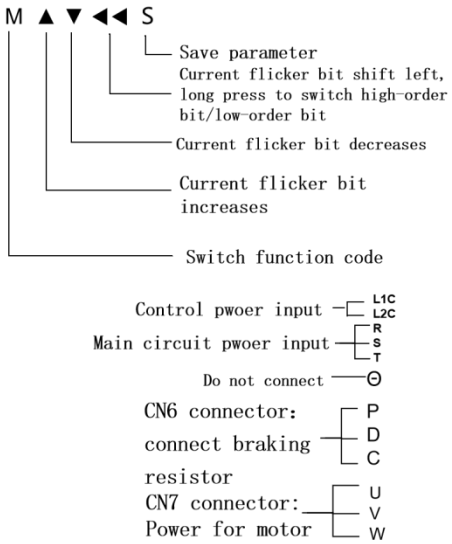
# 1.1.3 Product Appearance

## 1.1.3.1 SIZE-A/SIZE-B Type




① CN8 connector:RS485 interface
② Digital display panel
③ Key operator
④ CN1 connector:Control signal connecting terminal
⑤ CN2 connector:USB Type-C interface
⑥ CN3 connector:communication encoder connecting terminal
⑦ CN4 connector:Incremental encoder connecting terminal
⑧ CN5 connector
⑨ CHARGE:Bus voltage indicator
⑩ Nameplate
⑪ PE terminal ⏚

## 1.1.3.2 SIZE-C/SIZE-D Type




① CN8 connector:RS485 interface
② Digital display panel
③ Key operator
④ CN2 connector:USB Type-C interface
⑤ CN1 connector:Control signal connecting terminal
⑥ CN3 connector:Communication encoder connecting terminal
⑦ CN4 connector:Incremental encoder connecting terminal
⑧ CN5 connector
⑨ CN6 connector
⑩ CN7 connector
⑪ PE terminal ⏚
⑫ CHARGE:Bus voltage indicator
⑬ Nameplate

### 1.1.3.3 SIZE-E Type


### 1.1.3.4 Indicator Status Description

| Indicator | Status | Meaning |
|---|---|---|
| RUN | Off | Servo is disabled |
| | On | Servo is enabled |
| ERR | Off | In normal state |
| | On | In fault state |
| FUN1 | Off | Homing operation is not completed |
| | On | Homing operation is completed |
| FUN2 | Off | No brake output |
| | On | Brake output |
| LINK | Off | Bluetooth is not connected |
| | On | Bluetooth is connected |

## 1.1.4 Product Specifications

### 1.1.4.1 Electrical Specifications

| Model | FV5-R*-PA1R1-*** | FV5-R*-PA1R6-*** | FV5-R*-PA2R8-*** | FV5-R*-PA5R5-*** | FV5-R*-PC7R6-*** | FV5-R*-PC012-*** |
|---|---|---|---|---|---|---|
| Input power | Single-phase/Three-phase AC 200V~240V，-10%~+10%，50/60Hz | | | | | |
| Rated output current (ARMS) | 1.1 | 1.6 | 2.8 | 5.5 | 7.6 | 12 |
| Peak output current | 3.9 | 5.9 | 10.1 | 16.9 | 23 | 32 |

| Model | FV5-R*-PA1R1-*** | FV5-R*-PA1R6-*** | FV5-R*-PA2R8-*** | FV5-R*-PA5R5-*** | FV5-R*-PC7R6-*** | FV5-R*-PC012-*** |
|---|---|---|---|---|---|---|
| (ARMS) | | | | | | |
| Output power (W) | 100 | 200 | 400 | 750 | 1000 | 1500 |
| Heat dissipation Method | Natural cooling | | | Fan cooling | | |
| Dynamic braking | Built-in | | | | | |
| Braking resistor | Externally connected brake resistor | | | Built-in braking resistor, can be connected externally | | |
| Minimum resistance of external braking resistor (Ω) | 40 | 40 | 40 | 40 | 20 | 15 |
| Installation dimensions | SIZE-A | | | SIZE-B | SIZE-C | SIZE-D |

Note: FV5-R1-PA5R5 has no built-in brake resistor.

| Model | FV5-R*-PT3R5-*** | FV5-R*-PT5R4-*** | FV5-R*-PT8R4-*** | FV5-R*-PT012-*** | FV5-R*-PT017-*** | FV5-R*-PT021-*** | FV5-R*-PT026-*** |
|---|---|---|---|---|---|---|---|
| Input power | Three phase AC 380V~440V，-10%~10%，50/60Hz | | | | | | |
| Rated output current(ARMS) | 3.5 | 5.4 | 8.4 | 12 | 17 | 21 | 26 |
| Peak output current(ARMS) | 11 | 14 | 20 | 30 | 42.5 | 52.5 | 65 |
| Output power(W) | 1000 | 1500 | 2000 | 3000 | 5000 | 6000 | 7500 |
| Heat dissipation Method | Fan cooling | | | | | | |
| Dynamic braking | Built-in | | | | | | |
| Braking resistor | Built-in braking resistor, can be connected externally | | | | | | |
| Minimum resistance of external braking resistor (Ω) | 80 | 60 | 45 | 40 | 35 | 25 | 25 |

| Model | FV5-R*-PT3R5-*** | FV5-R*-PT5R4-*** | FV5-R*-PT8R4-*** | FV5-R*-PT012-*** | FV5-R*-PT017-*** | FV5-R*-PT021-*** | FV5-R*-PT026-*** |
|---|---|---|---|---|---|---|---|
| Installation dimensions | SIZE-C | | SIZE-D | | SIZE-E | | |

## 1.1.4.2 Basic Specifications

| Item | | | Description |
|---|---|---|---|
| Basic speific ations | Control method | | IGBT PWM control, sine wave current driving method |
| | Rotary servo motor encoder feedback | | ◆ R1 series:17-bit absolute(Tamagawa)<br>◆ R3 Series: Bus-type serial encoder: 17-bit absolute, 23-bit absolute, ABZ , BISS-C, Endat |
| | Control singnal | DI | 8 general-purpose inputs<br>General-purpose input functions are selectable via parameters |
| | | DO | 5 general-purpose inputs<br>General-purpose input functions are selectable via parameters |
| | Analog Signal | Input | 1 channel 12 Bit A/D input |
| | Commun ication functions | USB | Connect to a computer, etc. |
| | | RS485 | Up to a maximum of 247 axes in a 1:n communication |
| | | Axis address setting | As set by the user |
| | Dynamic brake | | Built-in |
| | Control mode | | Velocity mode, torque mode, position mode, position/velocity/torque hybrid mode.<br>The above 4 control modes can be switched by setting parameters |
| Perfor mance | Velocity change rate *1 | Load change rate | Within ±0.1% of rated velocity (load fluctuation: 0~100%) |
| | | Voltage change rate | 0.1% of rated velocity (voltage fluctuation: ±10%) |
| | | Temperature change rate | Within ±0.1% of rated velocity (temperature fluctuation: 0~50°C) |
| | Velocity control range | | 1~6000RPM |
| | Velocity loop frequency response range | | 3.5kHz |
| | Torque control accuracy | | ±1% |
| Velocit y mode | Soft start time setting | | 0～60s（can separately set acceleration and deceleration） |
| | Control input | | Enable switch, overtravel switch, command prohibition switch, internal mode switch, internal command switch, etc. |

| Item | | | Description | |
|---|---|---|---|---|
| | Control output | | Servo ready, positioning completed, brake output, velocity reached, torque reached, etc. | |
| | Analog command input | Command voltage | Maximum input voltage: ±12V (motor rotates forward when positive voltage command is applied)<br>3000RPM at DC 10 V, corresponding velocity can be set freely | |
| | | Input impedance | Approximately 9kΩ | |
| | | Circuit time parameter | Approximately 47μs | |
| Torque mode | Analog command input | Command voltage | Maximum input voltage: Maximum ±12V (motor outputs torque when positive voltage command is applied)<br>100% torque at DC 10V , corresponding torque can be set freely | |
| | | Input impedance | Approximately 9kΩ | |
| | | Circuit time parameter | Approximatelys 47μs | |
| Position mode | Filtering setting | | Various command processing such as smoothing filtering, low-pass filtering, low-frequency jitter suppression, etc. | |
| | Feedforward compensation | | 0～100.0% | |
| | Position deviation is within the set range, determined for positioning completed | | Command unit and encoder unit can be set independently | |
| | Input signal | Pulse command | Input pulse form | Select any of the following:<br>"Direction + Pulse", "90° Phase A/B quadrature Pulse", "CW+CCW Pulse" |
| | | | Input form | Differential input, open collector |
| | | | Input pulse frequency | ◆ Differential input: Maximum 5 Mpps, pulse width cannot be less than 0.1 μs;<br>◆ Open collector: Maximum 200 Kpps, pulse width cannot be less than 2.5 μs. |
| | | Electronic gear ratio | $\frac{\text{Encoder resolution}}{10^8} \le \frac{\text{Electronic gear ratio numerator}}{\text{Electronic gear ratio denominator}} \le \frac{\text{Encoder resolution}}{2.5}$ | |
| | | Power supply for built-in open | +24V（built-in 2.4 kΩ resistor） | |

| Item | | | Description |
|---|---|---|---|
| | | collector *2 | |
| | | Clear signal | Clear position deviation<br>Supports linear drive, open collector |
| | Encoder frequency division pulse output | Output form | Phase A, Phase B: Differential output<br>Phase Z: Differential output or open collector output |
| | | Frequency division ratio | Any |
| Input and ouput signal | Digital input signal | Changeable signal assignments | 8-channel DI<br>DI functions:<br>Servo enablement, alarm reset, gain switching, zero position fixed function enable, position command inhibit, positive over-travel switch, negative over-travel switch, positive jog, negative jog, electronic gear selection, home position switch, homing enable, clear position deviation , internal velocity limit selection, inhibit pulse |
| | Digital output signal | Changeable signal assignments | 5-channel DO<br>DO functions:<br>Servo ready, motor rotation, zero velocity signal, velocity consistent, positioning completed, torque litmit, velocity limitation, brake output, warning output, fault output, hoiming complted, torque reached, velocity reached. |
| Built-in function | Overtravel (OT) prevention function | | Stop immediately when P-OT or N-OT occurs. |
| | Protection function | | Overcurrent, overvoltage, undervoltage, overload, main circuit detection abnormality, heatsink overheating, power phase loss, overspeed, encoder abnormality, CPU abnormality, parameter abnormality, etc. |
| | LED display function | | Main power CHARGE, 5-digit LED display |
| | Analog monitoring function for observation | | Built-in analog monitoring connector for observing velocity, torque command signals, etc. |
| | Vibration suppression | | Supports 0~100Hz low-frequency suppression<br>Supports 100~5000Hz mid-to-high-frequency suppression |
| | Other | | Gain adjustment, alarm logs, JOG operation |

Note*1: The velocity variation rate is defined by the following equation:

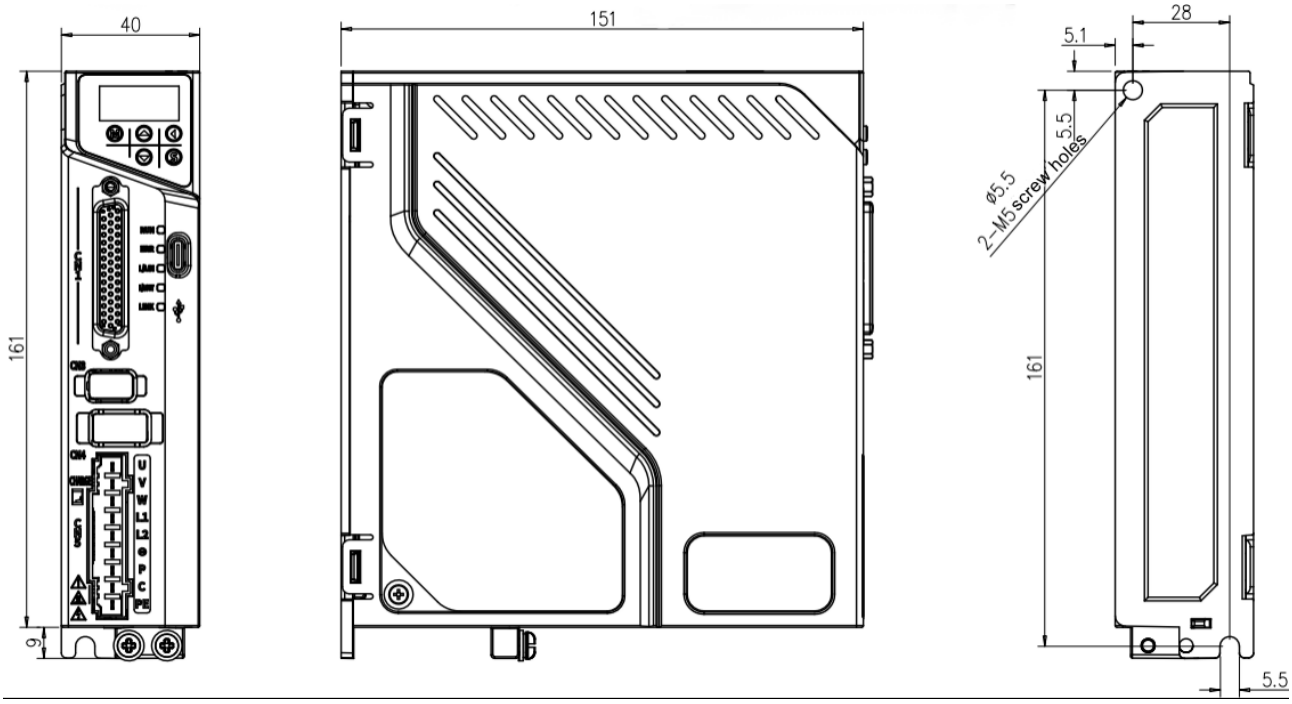
Velocity variation rate = (No-load velocity - Full-load velocity) / Rated velocity * 100%

In fact, amplifier deviation due to voltage and temperature changes can cause changes in the hydrochloric resistance. Therefore, this effect will manifest as velocity changes. The velocity changes are expressed as a ratio of the rated velocity, representing the velocity change rates caused by voltage and temperature changes.

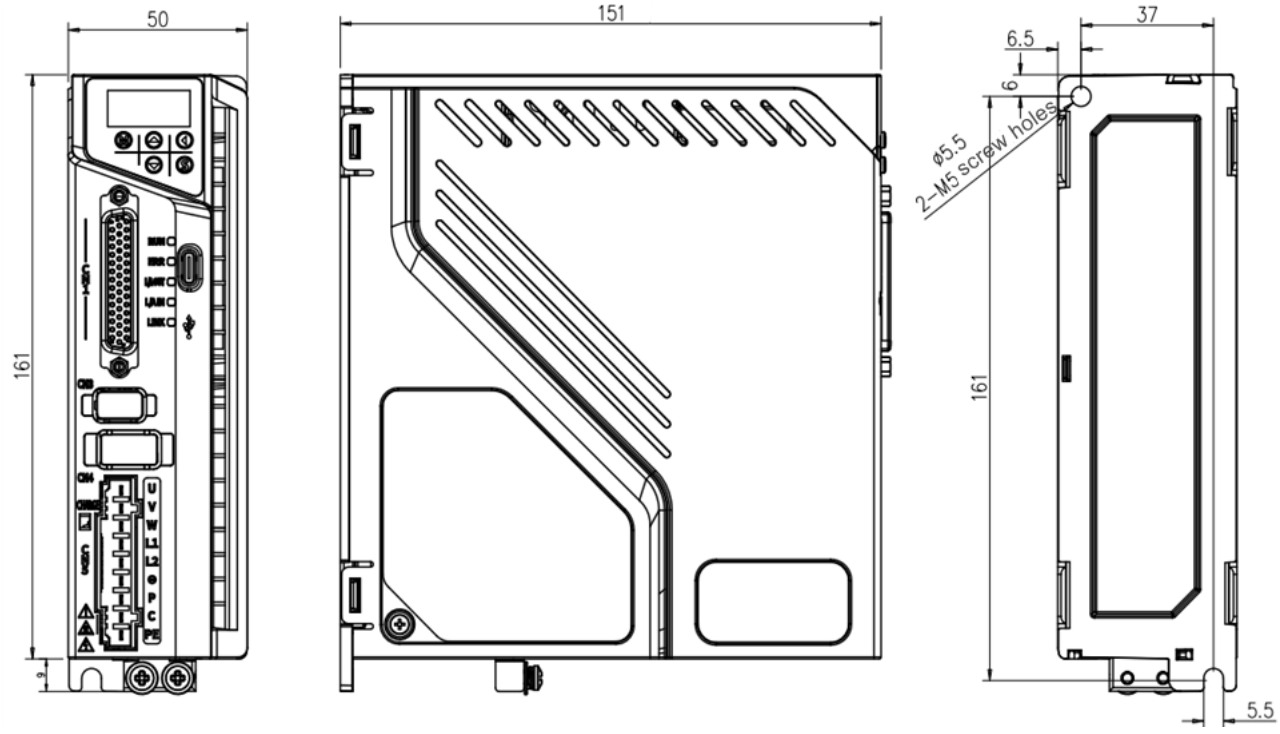
Note *2: The built-in open collector power supply is not electrically insulated from the control circuitry inside the servo drive.

## 1.1.4.3 Servo Drive Installation Dimensions

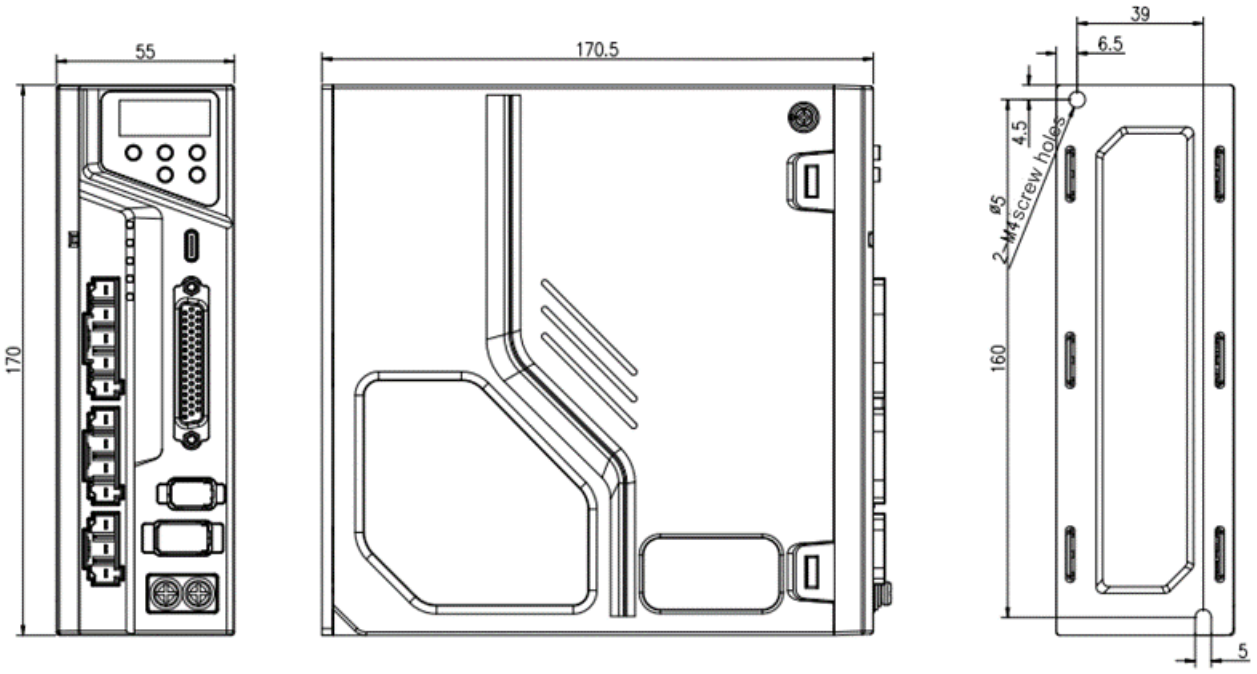
◆ The installation dimensions of Size -A (in mm) are shown below. It weighs 0.8 kg.



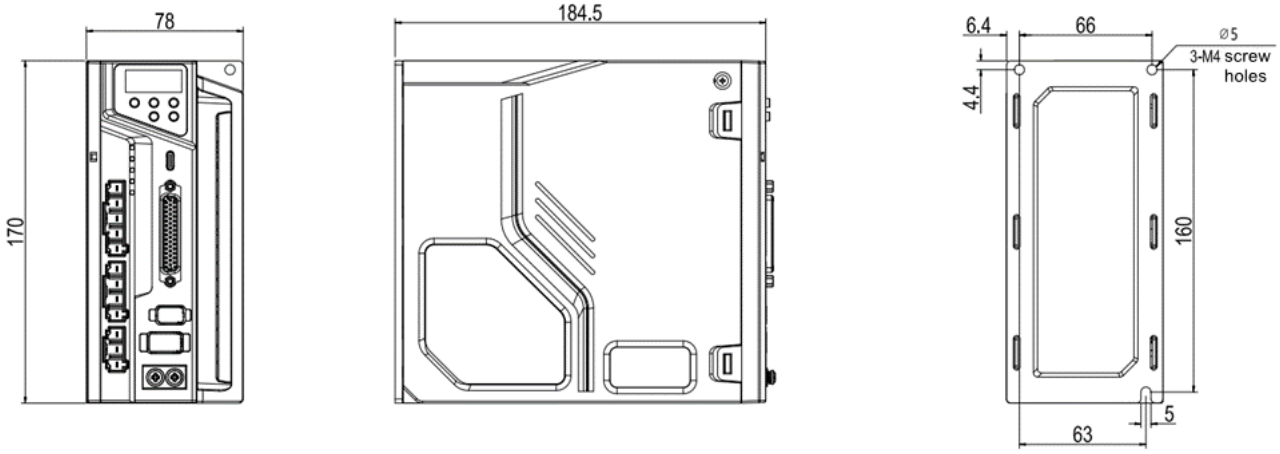

◆ The installation dimensions of Size-B (in mm) are shown below. It weighs 1 kg.



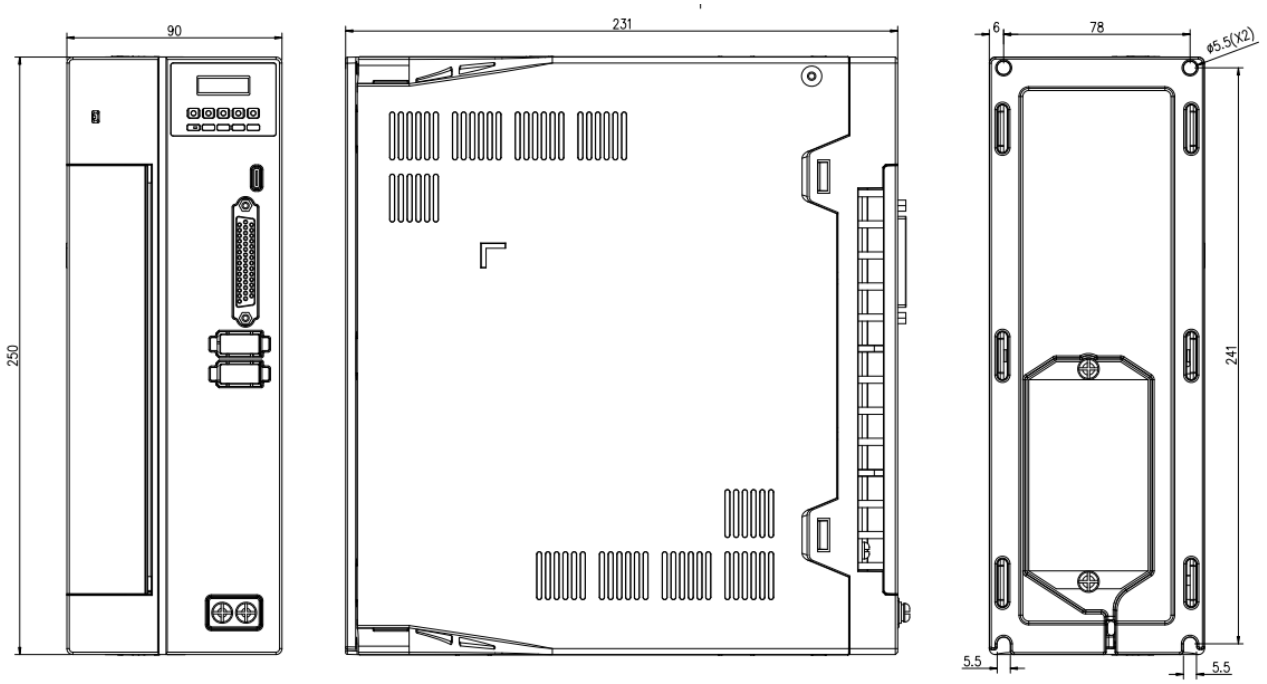

◆ The installation dimensions of Size-C (in mm) are shown below. It weighs 1.3 kg.




◆ The installation dimensions of Size-D (in mm) are shown below. It weighs 1.8 kg.




◆ The installation dimensions for Size-E (in mm) are shown below. It weighs 3.6 kg.




# 1.2 Servo Motors

## 1.2.1 Servo Motor Model Description

EAM – W H – 04 30 A - U 3 0 – X X

| Code | Series code |
|---|---|
| EAM | Rotary motor |

| Code | Motor series |
|---|---|
| W | W series |

| Code | Inertia |
|---|---|
| F | Small inertia |
| G | Mid-level inertia |
| H | High inertia |

| Code | Rated power(W) |
|---|---|
| A5 | 50 |
| 01 | 100 |
| 02 | 200 |
| 04 | 400 |
| 06 | 600 |
| 08 | 750 |
| 09 | 850 |
| 10 | 1000 |
| 13 | 1300 |
| 15 | 1500 |
| 18 | 1800 |
| 20 | 2000 |
| 25 | 2500 |
| 29 | 2900 |
| 30 | 3000 |
| 44 | 4400 |
| 55 | 5500 |
| 75 | 7500 |

| Code | Rated velocity(RPM) |
|---|---|
| 15 | 1500 |
| 20 | 2000 |
| 25 | 2500 |
| 30 | 3000 |

| Code | Voltage |
|---|---|
| A | AC 220V |
| T | AC 380V |

| Code | Encoder type |
|---|---|
| 1 | 20 bit multi-turn absolute magneticl encoder |
| 2 | 17 bit multi-turn absolute magnetic encoder |
| 3 | 17 bit single-turn absolute magnetic encoder |
| U | 23 bit multi-turn absolute optical encoder |

| Code | Shaft connection |
|---|---|
| 1 | Plain shaft |
| 2 | Solid,with keying |
| 3 | Solid，with keying<br>With threaded hole |
| 4 | Solid,with threaded hole |

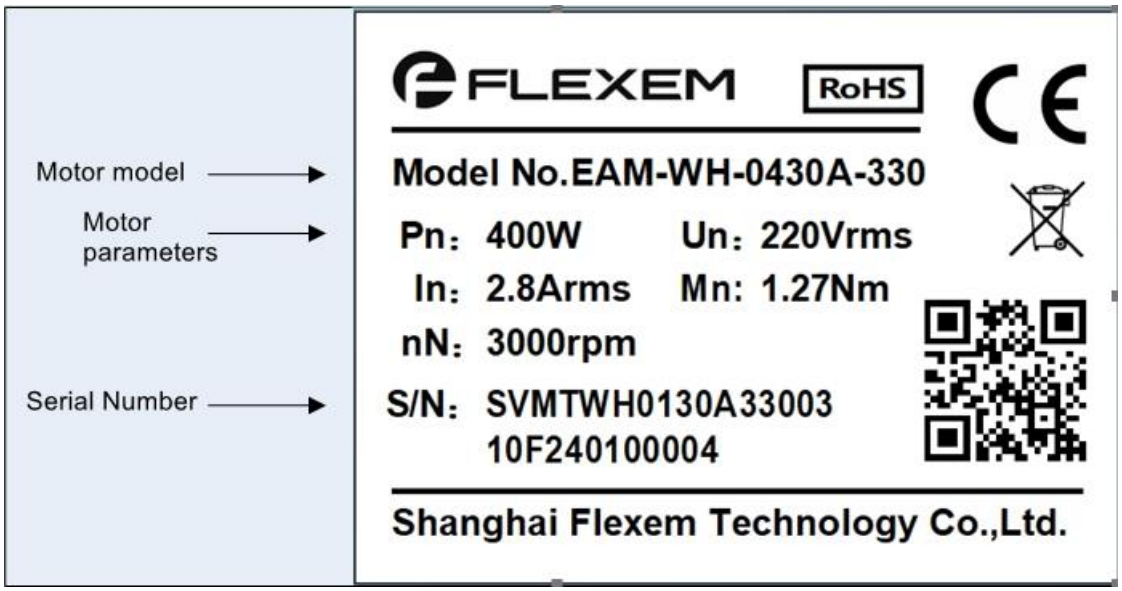
| Code | Oil seal，brake |
|---|---|
| 0 | Oil seal+ No brake |
| 1 | No oil seal+No brake |
| 2 | Oil seal+Brake |
| 4 | No oil seal+Brake |

| Code | Description |
|---|---|
| XX | Non-standard |
| None | Standard |

Note: If the servo motor model code has no suffix, the servo motor is a standard model.

## 1.2.2 EAM-W Series Servo Motors

### 1.2.2.1 EAM-W Series Servo Motors Nameplate Description




### 1.2.2.2 EAM-W EAM-W Series Servo Motor Mechanical Characteristics

| Item | Desciption |
|---|---|
| Work mode | Continuous duty |
| Vibration level | V15 |
| Insulation Resistance | DC500V, ≥10MΩ |
| Operating ambient temperature | -20~50℃ |
| Excitation method | Permanent magnet |
| Installation method | Flange mounting |
| Thermal class | F |
| Insulation voltage | AC1500V for 1minute(200V rating)<br>AC1800V for 1minute(400V rating) |
| Enclosure protection level | IP65 |
| Ambient humidity | <90%（non-condensing） |
| Wiring method | Direct connection |
| Rotation direction | Counterclockwise (CCW) rotation when viewed from the load side under positive rotation command |

## 1.2.2.3 EAM-W Series Servo Motors Specifications

| Model | Flange size（mm） | Rated power (kW) | Rated torque (N • m) | Maximum torque (N • m) | Rated current (ARMS) | Rated velocity (RPM) | Maximum velocity(RPM) | Rotor rotation inertia($10^{-4}$ kg • $m^2$) | Voltage (V) |
|---|---|---|---|---|---|---|---|---|---|
| EAM-WH-A530A-□3▲ | 40 | 50 | 0.16 | 0.48 | 0.6 | 3000 | 6000 | 0.035（0.038） | 220 |
| EAM-WH-0130A-□3▲ | 40 | 100 | 0.32 | 0.96 | 1 | 3000 | 6000 | 0.0.53（0.056） | 220 |
| EAM-WH-0230A-□3▲ | 60 | 200 | 0.64 | 1.92 | 1.4 | 3000 | 6000 | 0.29（0.32） | 220 |
| EAM-WH-0430A-□3▲ | 60 | 400 | 1.27 | 3.81 | 2.8 | 3000 | 6000 | 0.53(0.56) | 220 |
| EAM-WH-0830A-□3▲ | 80 | 750 | 2.4 | 7.2 | 3.8 | 3000 | 6000 | 1.62(1.72) | 220 |
| EAM-WH-1030A-□3▲ | 80 | 1000 | 3.2 | 9.6 | 5.5 | 3000 | 6000 | 2.1(2.2) | 220 |
| EAM-WG-1230A-□3▲ | 110 | 1200 | 4 | 12 | 5 | 3000 | 3500 | 7.3(7.4) | 220 |
| EAM-WH-1530A-□3▲ | 110 | 1500 | 5 | 15 | 6 | 3000 | 3500 | 9.2(9.3) | 220 |
| EAM-WH-1830A-□3▲ | 110 | 1800 | 6 | 18 | 7.7 | 3000 | 3500 | 10.8(10.9) | 220 |
| EAM-WG-0915A-□3▲ | 130 | 850 | 5.39 | 16.17 | 6.9 | 1500 | 3000 | 10.9(12.13) | 220 |
| EAM-WG-1315A-□3▲ | 130 | 1300 | 8.34 | 25.02 | 10.7 | 1500 | 3000 | 16.9(18.13) | 220 |
| EAM-WG-1515A-□3▲ | 130 | 1500 | 10 | 25 | 6 | 1500 | 2000 | 18.8(20.28) | 220 |
| EAM-WG-1815A-□3▲ | 130 | 1800 | 11.5 | 28.7 | 13.8 | 1500 | 3000 | 21.4(22.63) | 220 |
| EAM-WG-0915T-□3▲ | 130 | 850 | 5.39 | 16.17 | 4 | 1500 | 3000 | 10.9(12.13) | 380 |

| Model | Flange size（mm） | Rated power (kW) | Rated torque (N • m) | Maximum torque (N • m) | Rated current (ARMS) | Rated velocity (RPM) | Maximum velocity( RPM) | Rotor rotation inertia($10^{-4}$ kg • $m^2$) | Voltage (V) |
|---|---|---|---|---|---|---|---|---|---|
| EAM-WG-1315T-□3▲ | 130 | 1300 | 8.34 | 25.02 | 6 | 1500 | 3000 | 16.9(18.13) | 380 |
| EAM-WG-1515T-□3▲ | 130 | 1500 | 10 | 25 | 4 | 1500 | 2000 | 18.8(20.28) | 380 |
| EAM-WG-1815T-□3▲ | 130 | 1800 | 11.5 | 34.5 | 8.5 | 1500 | 3000 | 21.4(22.63) | 380 |
| EAM-WG-3030T-□3▲ | 130 | 3000 | 10 | 23 | 8 | 3000 | 3500 | 25.5(27) | 380 |
| EAM-WG-2915T-O3▲ | 180 | 2900 | 18.6 | 55.8 | 11.9 | 1500 | 3000 | 62.5(69.5) | 380 |
| EAM-WG-4415T-O3▲ | 180 | 4400 | 28.4 | 85.2 | 16.5 | 1500 | 3000 | 88.5(94.5) | 380 |
| EAM-WG-5515T-□3▲ | 180 | 5500 | 35 | 105 | 20.8 | 1500 | 3000 | 114.4(120.4) | 380 |
| EAM-WG-7515T-□3▲ | 180 | 7500 | 48 | 120 | 26 | 1500 | 3000 | 136.6(142.6) | 380 |

Note: When □ is U: Supports 23-bit optical encoder, requires matching FV5-R3 drive

When □ is 3: Supports 17-bit magnetic encoder, requires matching FV5-R1 or FV5-R3 drive

When ▲ is 0: The motor without brake

When▲ is 2: The Motor with brake

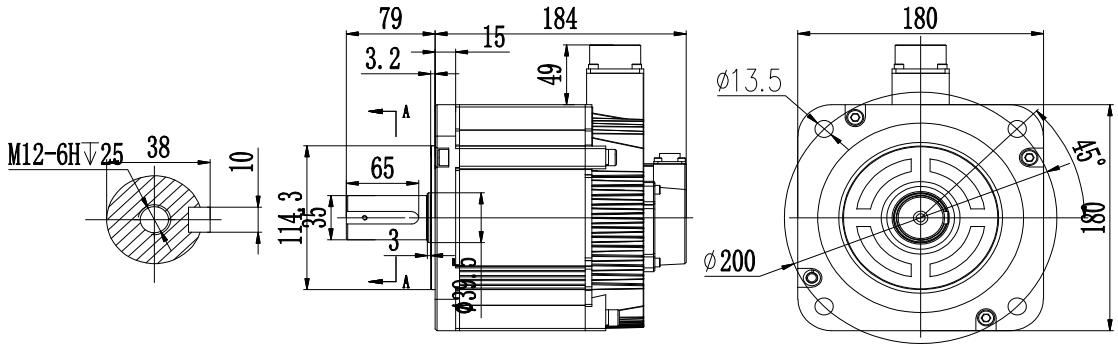
Flange size is 40mm, indicating the mounting panel size as 40mm*40mm; Flange size is 60mm, indicating the mounting panel size as 60mm*60mm; Other sizes follow this pattern

The data in parentheses in the inertia column is for motors with brake, and the data outside the parentheses is for motors without brake

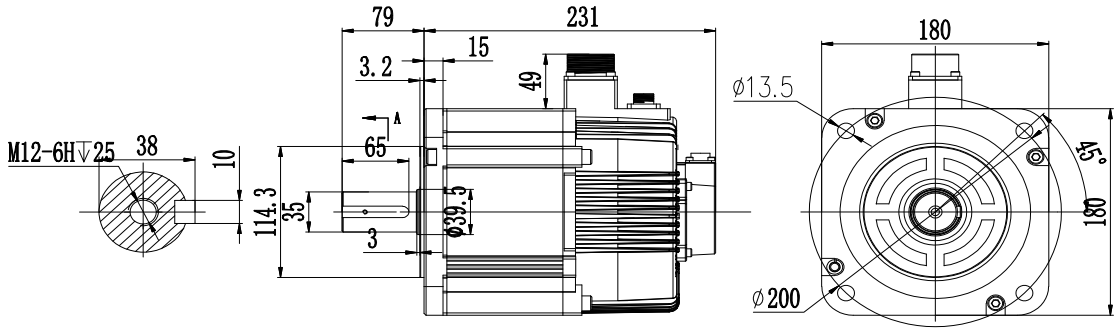
For specifications of other servo motor models, please consult Flexem technical support engineers

## 1.2.2.4 EAM-W Series Servo Motors Installation Dimensions

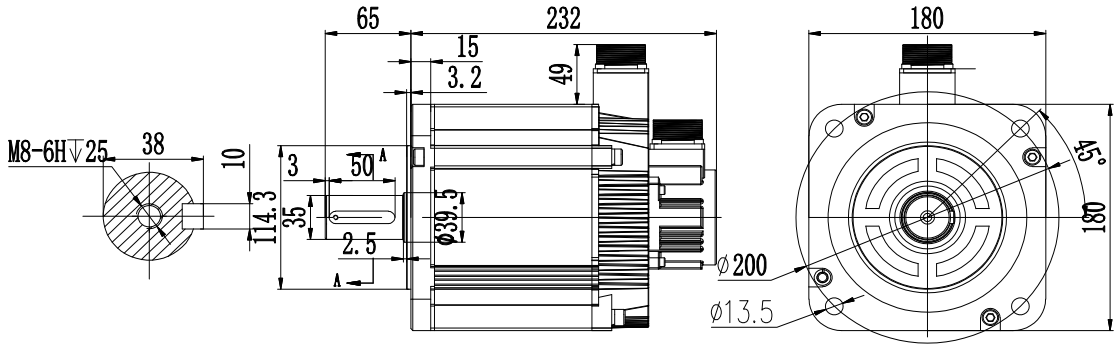
◆ EAM-WG-2915T-U30 2.9kW Servo motor without brake installation dimension(unit: mm)



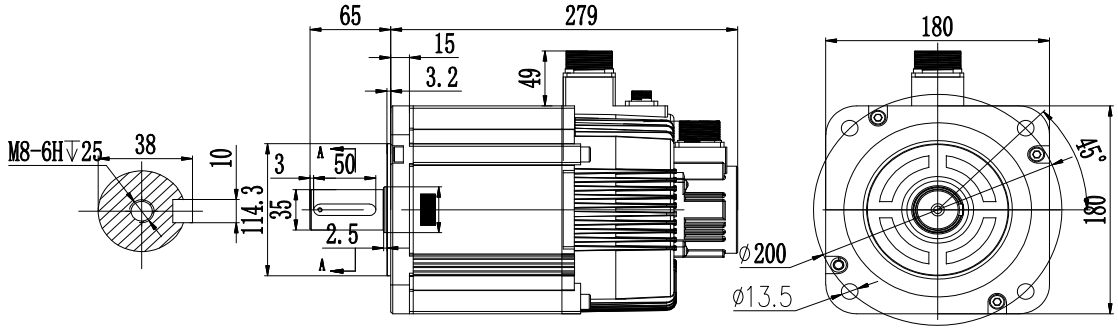

◆ EAM-WG-2915T-U32 2.9kW Servo motor with brake installation dimension(unit: mm)



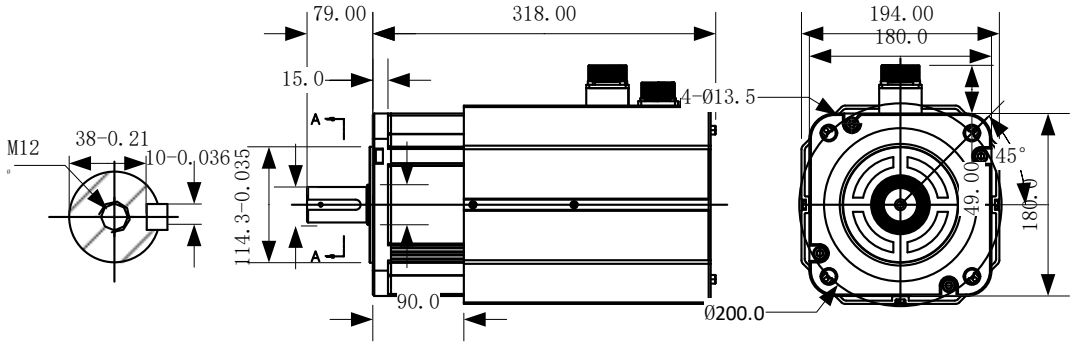

◆ EAM-WG-4315T-U30 4.3kW Servo motor without brake installation dimension(unit: mm)




◆ EAM-WG-4315T-U32 4.3kW Servo motor with brake installation dimension(unit: mm)



◆ EAM-WH-7515T-U30 7.5kW Servo motor with brake installation dimension(unit: mm)




Note: For installation dimensions of other models of servo motors, please consult Flexem technical support engineers.

## 1.3 Matching Instructions for Servo Drive and Servo Motor

| Flange size（mm） | Motor power | Motor model | Drive model |
|---|---|---|---|
| 40 | 50 | EAM-WH-A530A-□3▲ | FV5-R*-*A1R1 |
| 40 | 100 | EAM-WH-0130A-□3▲ | FV5-R*-*A1R1 |
| 60 | 200 | EAM-WH-0230A-□3▲ | FV5-R*-*A1R6 |
| 60 | 400 | EAM-WH-0430A-□3▲ | FV5-R*-*A2R8 |
| 80 | 750 | EAM-WH-0830A-□3▲ | FV5-R*-*A5R5 |
| 80 | 1000 | EAM-WH-1030A-□3▲ | FV5-R*-*A6R0 |
| 110 | 1200 | EAM-WG-1230A-□3▲ | FV5-R*-*C7R6 |
| 110 | 1500 | EAM-WH-1530A-□3▲ | FV5-R*-*C012 |
| 110 | 1800 | EAM-WH-1830A-□3▲ | FV5-R*-*C012 |
| 130 | 850 | EAM-WG-0915A-□3▲ | FV5-R*-*C7R6 |
| 130 | 1300 | EAM-WG-1315A-□3▲ | Fv5-R*-*C012 |
| 130 | 1500 | EAM-WG-1515A-□3▲ | FV5-R*-*C7R6 |
| 130 | 1800 | EAM-WG-1815A-□3▲ | FV5-R*-*C012 |
| 130 | 850 | EAM-WG-0915T-□3▲ | FV5-R*-*T5R4 |
| 130 | 1300 | EAM-WG-1315T-□3▲ | FV5-R*-*T5R4 |
| 130 | 1500 | EAM-WG-1515T-□3▲ | FV5-R*-*T5R4 |
| 130 | 1800 | EAM-WG-1815T-□3▲ | FV5-R*-*T8R4 |
| 130 | 3000 | EAM-WG-3030T-□3▲ | FV5-R*-*T012 |
| 180 | 2900 | EAM-WG-2915T-□3▲ | FV5-R*-*T012 |
| 180 | 4400 | EAM-WG-4415T-□3▲ | FV5-R*-*T017 |
| 180 | 5500 | EAM-WG-5515T-□3▲ | Fv5-R*-*T021 |
| 180 | 7500 | EAM-WG-7515T-□3▲ | Fv5-R*-*T026 |

Note: When □ is U: Supports 23-bit optical encoder, requires matching FV5-R3 drive

When □ is 3: Supports 17-bit magnetic encoder, requires matching FV5-R1 or FV5-R3 drive

When ▲ is 0: The motor with brake

When ▲ is 2：The motor without brake

# 2 Installation Operation

## 2.1 Install the Servo Drive

Carefully read the safety instructions in the Safety Precautions chapter to avoid personal injury and equipment damage.

### 2.1.1 Installation Location

- Please install inside control box that are protected from rain and direct sunlight, and ensure that no flammable materials are placed around. This unit does not have waterproof construction.
- Do not use this product in environments with corrosive gases or liquids.
- Do not use this product near flammable gas environments or combustible materials.
- Do not install in high-temperature, humid, dusty, cutting fluid, oil mist, metal dust environments, etc.
- Install in a well-ventilated, dry, and dust-free location.
- Install in a place without vibration.
- Do not use gasoline, diluent, alcohol, acidic or alkaline cleaners to prevent discoloration or damage to the housing.

### 2.1.2 Installation Environmental Conditions

| Item | Description |
|---|---|
| Altitude | Altitude below 1000m, please derate when above 1000m (10% derating for every additional 500 meters in altitude) |
| Atmospheric pressure | 86kPa ~ 106kPa |
| Operating temperature | 0°C ~ 55°C (ambient temperature from 40°C ~ 55°C, average load rate should not exceed 80%) (non-condensing*2) |
| Storage temperature *1 | -20~85℃（non-condensing*2） |
| Humidity | Below 90%RH（non-condensing*2） |
| Vibration Resistance | 5.88 m/s² (0.6G) at 10~60 Hz |
| Shock Resistance | 19.6m/s$^2$ |
| Protection level | IP20 |
| Pollution level | PD2 |

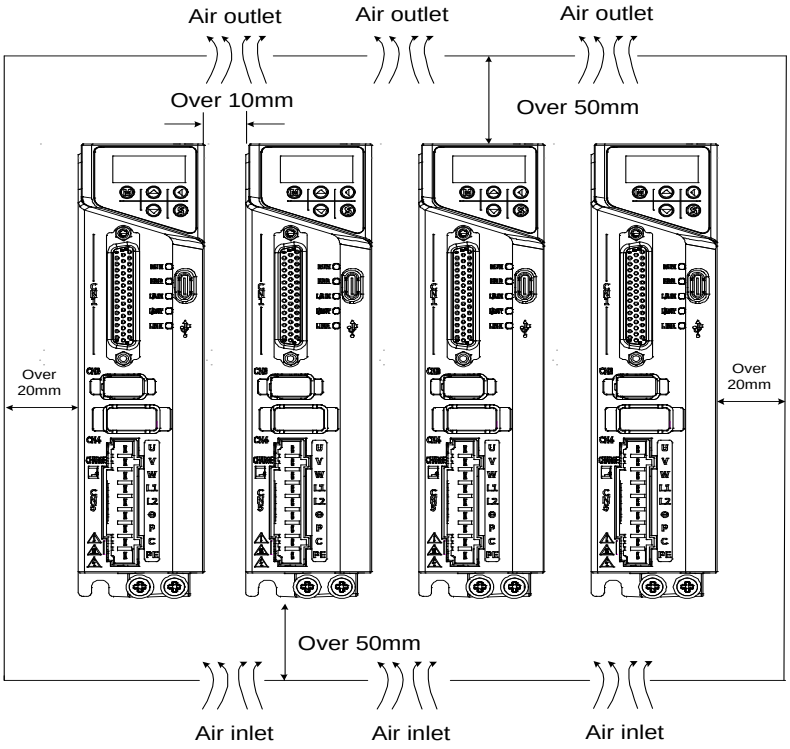
*1：Short-term permissible temperature including transportation factors.

*2：Please note that condensation may occur when temperature decreases and humidity rises.

# 2.1.3 Installation Methods and Precautions

## 2.1.3.1 Installation Methods

- This drive has a vertical structure, please ensure that the drive is installed vertically.
- Securely fasten the drive to the mounting surface using the circular mounting hole at the top and the semi-elliptical mounting hole at the bottom (use M4 screws(SIZE-C/SIZE-D) or M5 screws (SIZE-A/SIZE-B/SIZE-E) for installation , recommended torque is 1.7~2N*m)




## 2.1.3.2 Heat Dissipation

- Ensure there is sufficient space around the drive for effective cooling. Refer to the diagram above: maintain a spacing of at least 50mm above and below; when installing side by side, maintain a lateral spacing of at least 10mm.
- Using the drive in a sealed control box may cause abnormal temperature rise inside the box. To meet the operating temperature range around the drive, consider installing cooling devices.

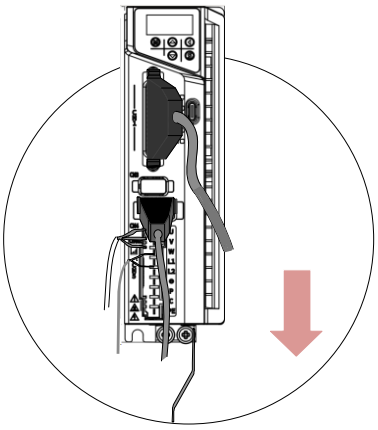
## 2.1.3.3 Grounding

- Ensure the grounding terminal is properly grounded. Incorrect grounding may not only prevent the drive from fully functioning but may also result in safety issues such as electric shock or interference-related errors.
- When installing the drive in a location with coatings, remove the coatings before installation to help prevent noise.

## 2.1.3.4 Wiring

- Ensure correct wiring. wrong wiring can result in motor loss of control or burnout. Also, during installation and wiring work, do not let conductive debris such as wire scraps fall into the drive.
- When bundling wires into a metal conduit, note that the allowable current of the wires decreases as temperature rises, potentially causing burns. Select wires after confirming the allowable current.
- When using twisted wires, neatly arrange the wires with insulated rod terminals or insulated round terminals. Using them in an unorganized state may lead to unexpected accidents or injuries such as electric shock or leakage.

- When wiring the drive, bend the cables downwards (refer to the following figure) to prevent liquid from flowing into the drive along with the cables, which could damage the drive.



### 2.1.3.5 Precautions

- Do not subject to vibrations or impacts exceeding 5.88 $m/s^2$. Do not place in areas where dust, metal scraps, oil mist, or other foreign objects accumulate. Avoid placing in water, oil, cutting fluids, etc. Do not place near combustible materials, corrosive gases ( $H_2S$, $SO_2$, $NO_2$, $Cl_2$ , etc. ), and avoid storing or using in environments with combustible gases.
- Do not block the servo drive's suction or exhaust ports, or allow foreign objects to enter the product, as this may cause fire or product failure.
- The power supply must be equipped with a molded case circuit breaker (MCCB) . Additionally, the ground terminal or ground wire must be grounded.
- Errors may occur when the power is turned on, so do not approach the motor or the machine driven by the drive.
- During high-speed operation with the dynamic brake in operation, set a stopping time of about 10 minutes.
- Ensure that the terminal block screws and ground screws are tightly fastened.

## 2.2 Install the Servo Motor

### 2.2.1 Installation Location

The lifespan of the motor depends on the quality of the installation location. Please install in places that meet the following conditions.

- Install indoors, keep away from rain and direct sunlight.
- Do not use this product in environments with corrosive gases or liquids.
- Do not use this product near combustible gases or combustible materials.
- Do not install in high-temperature places, places with cutting fluids, oil mist, metal dust, etc.
- Ensure good ventilation, no moisture, oil, or water ingress, and keep away from heat sources.
- Place in an environment easily accessible for inspection and cleaning.
- Place not subject to vibration.

### 2.2.2 Environmental Conditions

| Item | Parameters |
|---|---|
| Altitude | Altitude below 1000m, please derate when above 1000m. |
| Operating temperature | 0°C to 40°C (Non condensing*1) |

| Item | Parameters |
|---|---|
| Storage temperature | -20°C ~ 60°C (Maximum temperature guaranteed: 80°C, 72 hours, Non Condensing*2) |
| Humidity | Below 90% RH (Non condensing*2) |
| Vibration resistance | During rotation: below 49m/s$^2$ (5G), during stop: below 24.5m/s$^2$ (2.5G) |
| Shock resistance | Below 98m/s$^2$ （10G） |
| Protection level | IP67 (shaft through part, exclude the the motor connector terminal part) |

- *1：The ambient temperature refers to the temperature at a distance of 5cm from the motor.
- *2：Short-term permissible temperature, including transportation factors.

## 2.2.3 Installation Precautions

### 2.2.3.1 Installation Direction

The motor can be installed vertically or horizontally, but the following requirements must be met.

- Horizontal installation

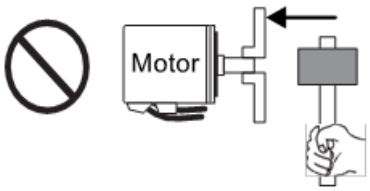
Mount the cable outlet facing downwards to prevent oil or water from entering the motor.

- Vertical installation

When installing a motor with a reducer oil, please use a motor with oil seals to prevent reducer oil from entering the motor.

### 2.2.3.2 Mechanical Connection

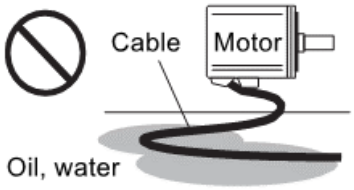
- When installing or removing a coupling at the motor shaft end, do not use a hammer to directly strike the shaft end (doing so may damage the encoder, especially when installed on the load side of the shaft).




- Ensure proper coaxial alignment (otherwise it may cause vibration or damage to bearings and encoders)
- When the motor shaft is operating without being grounded, depending on the motor and installation environment, it may cause electrical corrosion of the motor bearings and excessive bearing noise. Please verify and inspect accordingly.

### 2.2.3.3 Oil-Water Protection

- Do not use cables that have been immersed in oil or water.




- Bend the cable outlet downwards.
- Avoid using the motor in environments where oil and water frequently splash onto the motor body.
- When used in conjunction with a reducer, use a motor with oil seals to prevent oil from penetrating into the motor from the extended part of the shaft.

### 2.2.3.4 Cable Stress

- Avoid applying stress to the outlet and connection parts of the cable due to bending and its own weight.
- When moving the motor, use relay cables that can be stored in the cable reel to minimize bending stress on the cable.
- Increase the bending radius of the cable as much as possible, ensuring it is at least 10 times the outer diameter of the cable during processing.

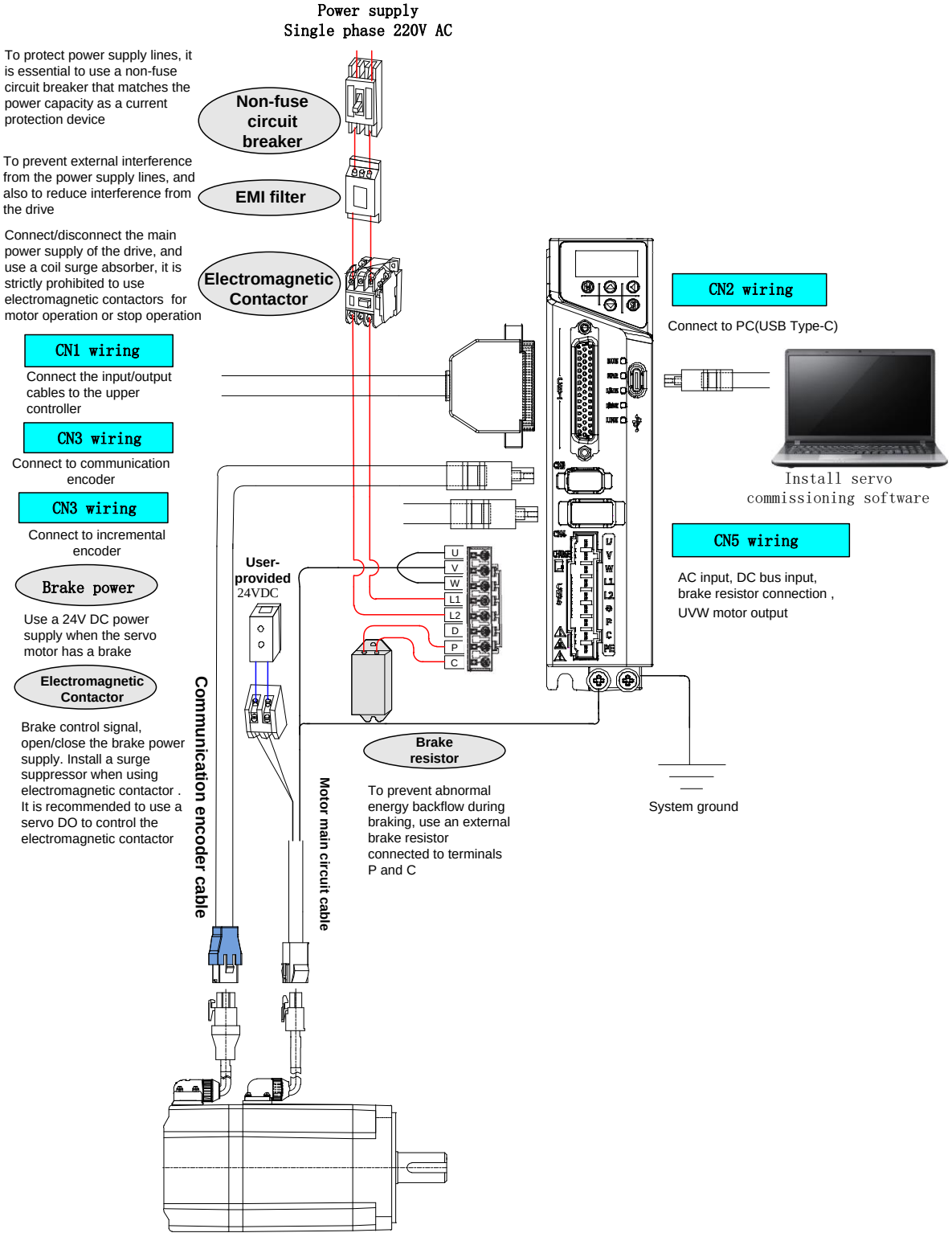
### 2.2.3.5 Wiring

- During installation and wiring, avoid letting conductive particles such as wire chips fall into the connector.
- When wiring, ensure that the connector pins are arranged correctly.
- Avoid applying stress to the connector portion due to cable bending, otherwise, it may cause connector damage.
- Ensure that the motor grounding is reliably connected to the drive to prevent safety issues such as noise or erroneous actions due to electric shock.

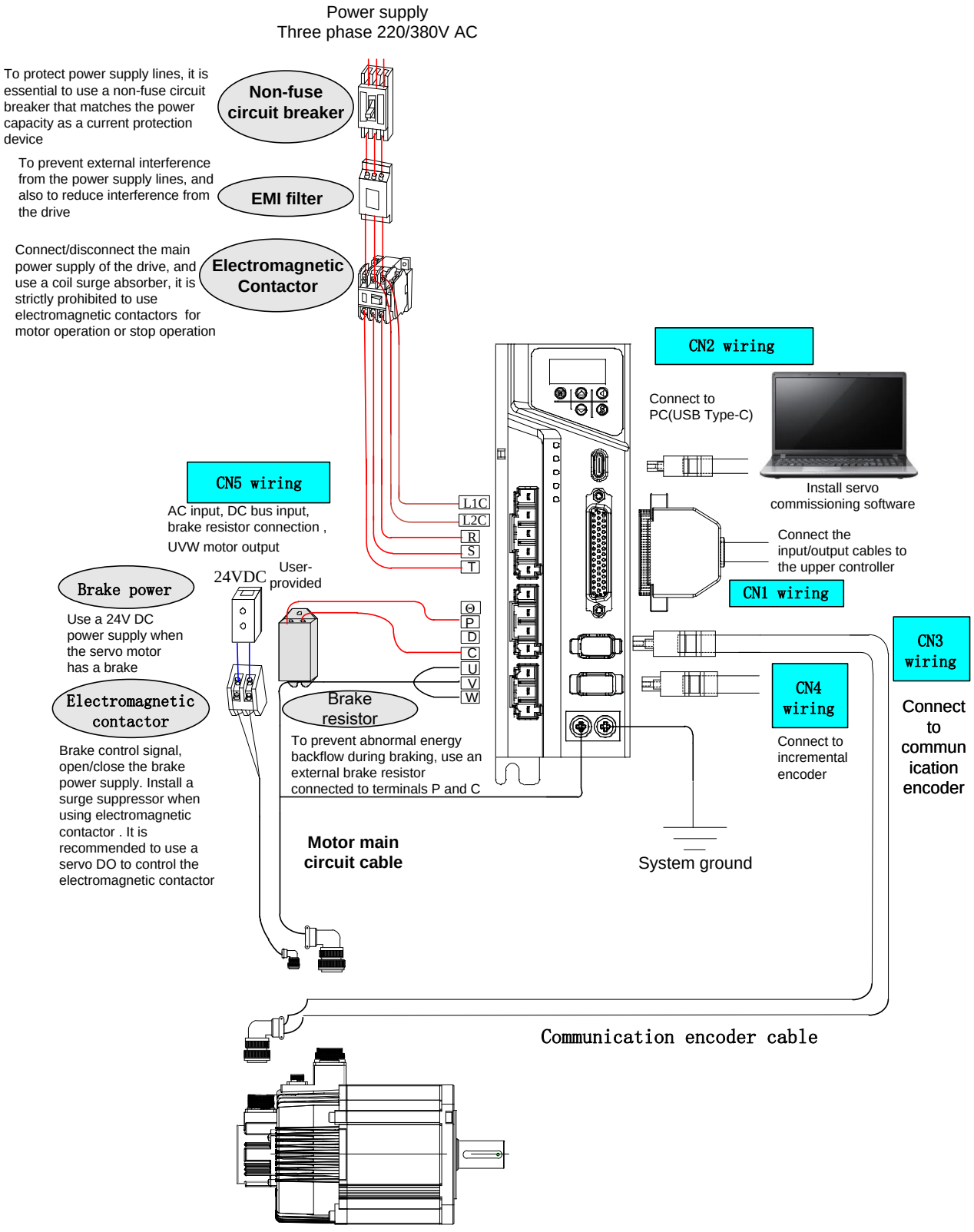
# 3 Peripheral Devices and Wiring

## 3.1 Peripheral Device Wiring Illustration

### 3.1.1 SIZE-A/SIZE-B Type



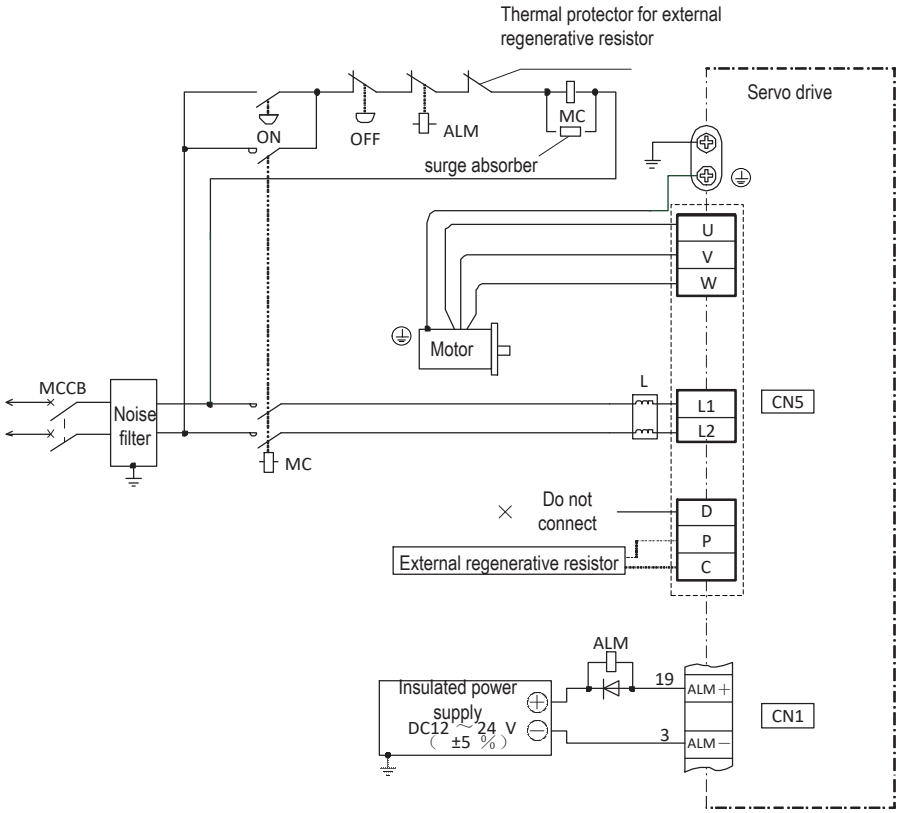
## 3.1.2 SIZE-C/SIZE-D/SIZE-E Type



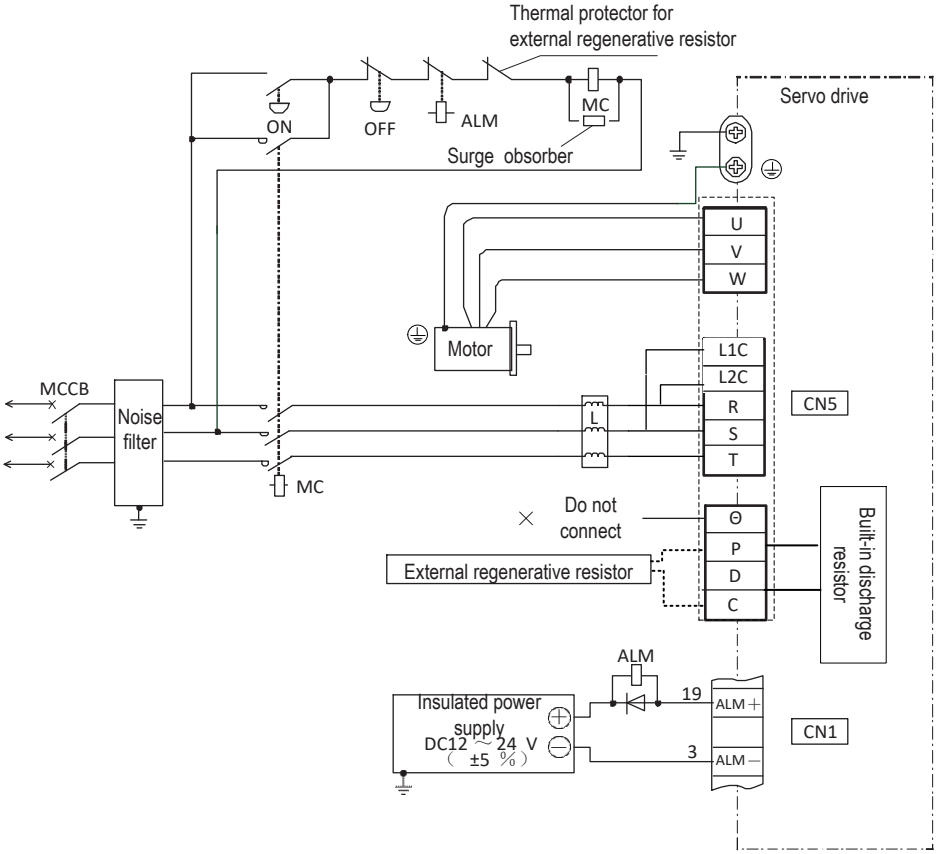

Note: The figure above showcases the wiring for SIZE-C/SIZE-D drives as an example. The wiring method for SIZE-E is the same as for SIZE-C/SIZE-D, but there may be differences in the appearance and positioning of the terminals.

# 3.1.3 System Wiring and Key Points Explanation

## 3.1.3.1 SIZE-A/SIZE-B Type Main Circuit Wiring



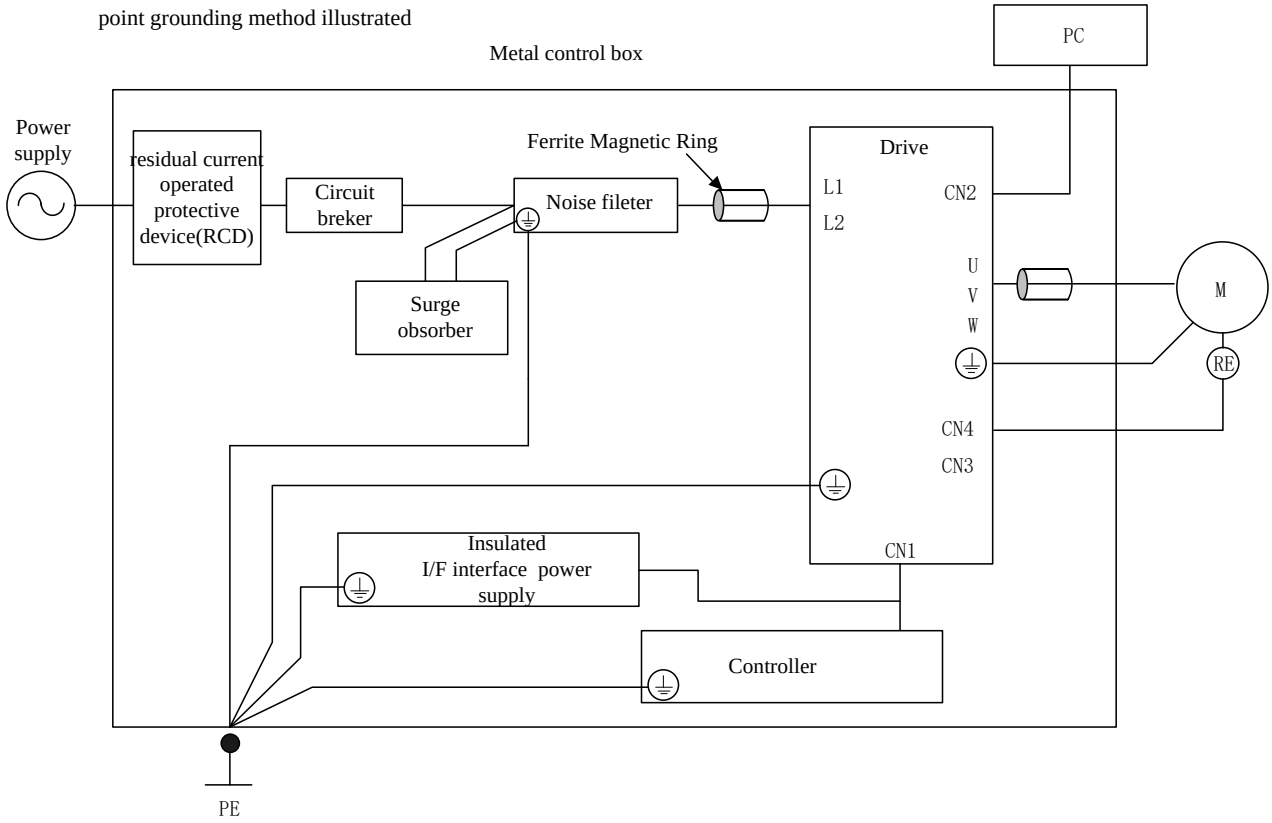
### 3.1.3.2 SIZE-C/SIZE-D/SIZE-E Type Main Circuit Wiring

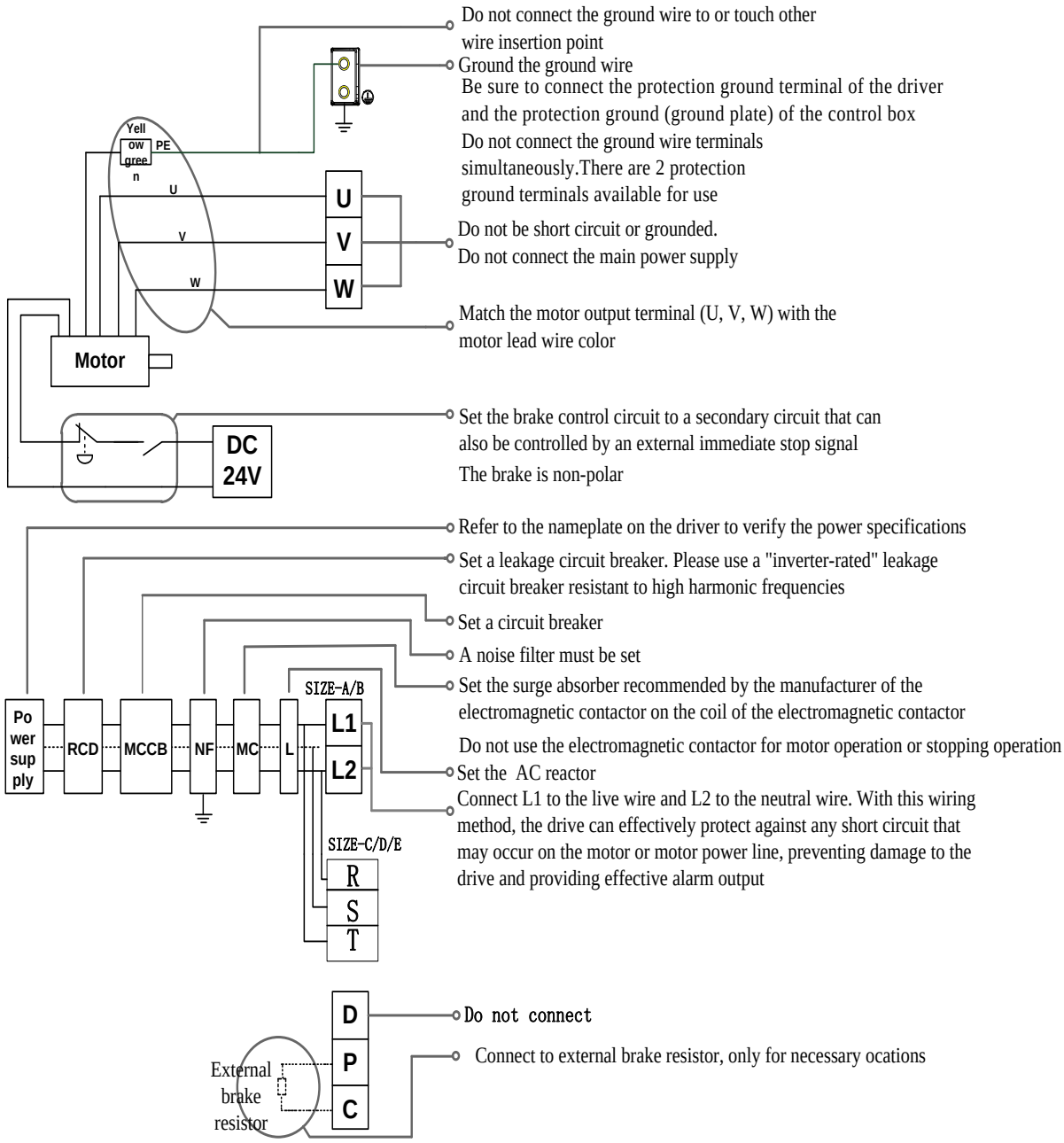



## 3.1.4 Wiring Key Points

- Wiring tasks should be carried out by electrical engineering experts.
- Do not power on the system until the wiring is complete to prevent electrical accidents.
- Note that connector CN5 carries high voltage. Do not touch it to avoid electrical accidents.
- Ensure that connector plug is inserted until a clicking sound is heard.

To ensure a good electromagnetic compatibility environment, ground the system using the single-point grounding method illustrated






Note: Dashed lined parts are used when three-phase input is used.

# 3.2 Cable and Peripheral Accessories Selection

## 3.2.1 List of Matching Cables for Drives and Motors

| Flange size(mm) | Motor | Name | Motor type | Length | Cable model |
|---|---|---|---|---|---|
| 40/60/80 | EAM-WH-A530A-□3▲<br>EAM-WH-0130A-□3▲ | Power cable | Motor with brake | 3m | FVL-MBA00-03-E(-T) |
| | | | | 5m | FVL-MBA00-05-E(-T) |
| | | | | 10m | FVL-MBA00-10-E(-T) |

| Flange size(mm) | Motor | Name | Motor type | Length | Cable model |
|---|---|---|---|---|---|
| 110/130 | EAM-WH-0230A-□3▲<br>EAM-WH-0430A-□3▲<br>EAM-WH-0830A-□3▲<br>EAM-WH-1030A-□3▲ | | Motor without brake | 3m | FVL-MMAD0-03-E(-T) |
| | | | | 5m | FVL-MMA00-05-E(-T) |
| | | | | 10m | FVL-MMA00-10-E(-T) |
| | | Encoder cable | Single-turn absolute encoder | 3m | FVL-P1720-03-E(-T) connect to CN3 |
| | | | | 5m | FVL-P1720-05-E(-T) connect to CN3 |
| | | | | 10m | FVL-P1720-10-E(-T) connect to CN3 |
| | | | Multi-turn absolute encoder(with battery) | 3m | FVL-PA720-03-E(-T) connect to CN3 |
| | | | | 5m | FVL-PA720-05-E(-T) connect to CN3 |
| | | | | 10m | FVL-PA720-10-E(-T) connect to CN3 |
| | EAM-WG-1230A-□3▲<br>EAM-WH-1530A-□3▲<br>EAM-WH-1830A-□3▲<br>EAM-WG-1515A-□3▲<br>EAM-WG-3030A-□3▲<br>EAM-WH-1515T-□3▲<br>EAM-WG-3030T-□3▲ | Power cable | Motor with brake | 3m | FVL-MMC01-03-E(-T) power cable |
| | | | | | FVL-MSA02-03-E(-T) brake cable |
| | | | | 5m | FVL-MMC01-05-E(-T) power cable |
| | | | | | FVL-MSA02-05-E(-T) brake cable |
| | | | | 10m | FVL-MMC01-10-E(-T) power cable |
| | | | | | FVL-MSA02-10-E(-T) brake cable |
| | | | Motor without brake | 3m | FVL-MMC01-03-E(-T) |
| | | | | 5m | FVL-MMC01-05-E(-T) |

| Flange size(mm) | Motor | Name | Motor type | Length | Cable model |
|---|---|---|---|---|---|
| | | | | 10m | FVL-MMC01-10-E(-T) |
| 110/130 | EAM-WG-0915A-□3▲<br>EAM-WG-1315A-□3▲<br>EAM-WG-1815A-□3▲<br>EAM-WG-0915T-□3▲<br>EAM-WG-1315T-□3▲<br>EAM-WG-1815T-□3▲ | Power cable | Motor with brake | 3m | FVL-MBC01-03-E(-T) |
| | | | | 5m | FVL-MBC01-05-E(-T) |
| | | | | 10m | FVL-MBC01-10-E(-T) |
| | | | Motor without brake | 3m | FVL-MMC01-03-E(-T) |
| | | | | 5m | FVL-MMC01-05-E(-T) |
| | | | | 10m | FVL-MMC01-10-E(-T) |
| | EAM-WG-1230A-□3▲<br>EAM-WH-1530A-□3▲<br>EAM-WH-1830A-□3▲<br>EAM-WG-0915A-□3▲<br>EAM-WG-1315A-□3▲<br>EAM-WG-1515A-□3▲<br>EAM-WG-1815A-□3▲<br>EAM-WG-0915T-□3▲<br>EAM-WG-1315T-□3▲<br>EAM-WG-1515T-□3▲ | Encoder cable | Single-turn absolute encoder | 3m | FVL-PI721-03-E(-T) connect to CN3 |
| | | | | 5m | FVL-PI721-05-E(-T) connect to CN3 |
| | | | | 10m | FVL-P1721-10-E(-T) connect to CN3 |
| | | | Multi-turn absolute encoder(with battery) | 3m | FVL-PA721-03-E(-T) connect to CN3 |
| | | | | 5m | FVL-PA721-05-E(-T) connect to CN3 |
| | | | | 10m | FVL-PA721-10-E(-T) connect to CN3 |

| Flange size(mm) | Motor | Name | Motor type | Length | Cable model |
|---|---|---|---|---|---|
| | EAM-WG-1815T-□3▲<br>EAM-WG-3030T-□3▲ | | | | |
| 180 | EAM-WG-2915T-□3▲<br>EAM-WG-4415T-□3▲<br>EAM-WG-5515T-□3▲<br>EAM-WG-7515T-□3▲ | Power cable | Motor with brake | 3m | FVL-MMC02-03-E(-T) power cable |
| | | | | | FVL-MSA01-03-E(-T) brake cable |
| | | | | 5m | FVL-MMC02-05-E(-T) power cable |
| | | | | | FVL-MSA01-05-E(-T) brake cable |
| | | | | 10m | FVL-MMC02-10-E(-T) power cable |
| | | | | | FVL-MSA01-10-E(-T) brake cable |
| | | | Motor without brake | 3m | FVL-MMC02-03-E(-T) |
| | | | | 5m | FVL-MMC02-05-E(-T) |
| | | | | 10m | FVL-MMC02-10-E(-T) |
| | | Encoder cable | Single-turn absolute encoder | 3m | FVL-PI721-03-E(-T) connect to CN3 |
| | | | | 5m | FVL-PI721-05-E(-T) connect to CN3 |
| | | | | 10m | FVL-PI721-10-E(-T) connect to CN3 |
| | | | Multi-turn absolute encoder(with battery) | 3m | FVL-PA721-03-E(-T) connect to CN3 |
| | | | | 5m | FVL-PA721-05-E(-T) connect to CN3 |
| | | | | 10m | FVL-PA721-10-E(-T) |

| Flange size(mm) | Motor | Name | Motor type | Length | Cable model |
|---|---|---|---|---|---|
| | | | | | connect to CN3 |

Refer to the Matching Instructions for Servo Drive and Servo Motor for drive and motor selection.

## 3.2.2 Servo Accessories

| Flange size (mm) | Accessory type | | Accessory model |
|---|---|---|---|
| 40/60/80 | Combined accessory for motor without brake | FVU-T10 | FVU-M00 |
| | | | FVU-P00 |
| | Combined accessory for motor with brake | FVU-T11 | FVU-M00 |
| | | | FVU-P00 |
| | | | FVU-M01 |
| | Power cable connector | | FVU-M00 |
| | Brake cable connector | | FVU-M01 |
| | Encoder cable AMP-9P connector | | FVU-P00 |
| | Encoder cable 1394-10P connector | | FVU-P02 |
| | Encoder cable 1394-6P connector | | FVU-P03 |
| 110/130 | Power cable connector | | FVU-M02 |
| 180 | Power cable connector | | FVU-M03 |
| 180 | Brake cable connector | | FVU-M04 |
| 110/130 | Brake cable connector | | FVU-M05 |
| 110/130/180 | Encoder cable aviation connector | | FVU-P01 |
| Applicable to all motor models | Battery accessory | | FVU-B00 |

| Flange size (mm) | Accessory type | Accessory model |
|---|---|---|
| Only applicable to 130 Flange size motor with brake(WG-0915, WG-1315, and WG-1815) | Power cable connector (7 pin with brake) | FVU-M06 |

## 3.2.3 Communication Cable Accessories

| Model | Description |
|---|---|
| FVL-CN702-01-E | Communication cable between servo drive and PC |
| FVL-CN701-A3-E | Multi-machine parallel communication cable for servo drive(0.3m) |
| FVL-PE700-01-E | Connect to CN4 of Servo drive, ABZ feedback adapter cable(1m) |

## 3.2.4 Control Cable Accessories

| Model | Description |
|---|---|
| FVL-CA701P-01-E | Servo drive CN1 input/output signal adapter cable (1m) |
| FVU-C01 | Servo drive CN1 terminal accessory |

## 3.2.5 Options for Peripheral Electrical Components

### 3.2.5.1 Fuse Selection Guide

To comply with the EU safety standard EN 61800-5-1, ensure that a fuse or circuit breaker is installed on the input side to prevent accidents caused by internal short circuits.

The recommended fuses are shown as the table below.

| Size | Servo Drive Model | Rated Input Current（A） | Recommended Fuse | | |
|---|---|---|---|---|---|
| | | | Manufacturer | Rated Current（A） | Model |
| Single phase 220V | | | | | |
| A | FV5-R*-PA1R1 | 1.6 | Eaton | 5 | FWP-5B |
| | FV5-R*-PA1R6 | 2.3 | | 5 | FWP-5B |
| | FV5-R*-PA2R8 | 4.0 | | 10 | FWP-10B |
| B | FV5-R*-PA5R5 | 7.9 | Eaton | 20 | FWP-20B |
| Three phase 220V | | | | | |

| Size | Servo Drive Model | Rated Input Current（A） | Recommended Fuse | | |
|---|---|---|---|---|---|
| | | | Manufacturer | Rated Current（A） | Model |
| C | FV5-R*-PC7R6 | 5.7 | Eaton | 15 | FWP-15B |
| D | FV5-R*-PC012 | 7.3 | Eaton | 20 | FWP-20B |
| Three phase 380V | | | | | |
| C | FV5-R*-PT3R5 | 2.5 | Eaton | 5 | FWP-5B |
| | FV5-R*-PT5R4 | 3.8 | | 10 | FWP-10B |
| D | FV5-R*-PT8R4 | 5.4 | Eaton | 15 | FWP-15B |
| | FV5-R*-PT012 | 7.9 | | 20 | FWP-20B |
| E | FV5-R*-PT017 | 12 | Eaton | 35 | FWP-35B |
| | FV5-R*-PT021 | 16 | | 35 | FWP-35B |
| | FV5-R*-PT026 | 21 | | 40 | FWP-40B |

## 3.2.5.2 Electromagnetic Contactor Selection Guide

Refer to the peripheral unit wiring diagram for electromagnetic contactor installation details.

Refer to the table below for electromagnetic contactor selection:

| Size | Servo Drive Model | Rated Input current（A） | Recommended Electromagnetic Contactor | | |
|---|---|---|---|---|---|
| | | | Manufacturer | Rated Current（A） | Model |
| Single phase 220V | | | | | |
| A | FV5-R*-PA1R1 | 1.6 | Schneider | 9 | LC1 D09 |
| | FV5-R*-PA1R6 | 2.3 | | 9 | LC1 D09 |
| | FV5-R*-PA2R8 | 4.0 | | 9 | LC1 D09 |
| B | FV5-R*-PA5R5 | 7.9 | Schneider | 9 | LC1 D09 |
| Three phase 220V | | | | | |
| C | FV5-R*-PC7R6 | 5.7 | Schneider | 9 | LC1 D09 |
| D | FV5-R*-PC012 | 7.3 | Schneider | 9 | LC1 D09 |
| Three phase 380V | | | | | |
| C | FV5-R*-PT3R5 | 2.5 | Schneider | 9 | LC1 D09 |
| | FV5-R*-PT5R4 | 3.8 | | 9 | LC1 D09 |
| D | FV5-R*-PT8R4 | 5.4 | Schneider | 9 | LC1 D09 |

| Size | Servo Drive Model | Rated Input current（A） | Recommended Electromagnetic Contactor | | |
|---|---|---|---|---|---|
| | | | Manufacturer | Rated Current（A） | Model |
| | FV5-R*-PT012 | 7.9 | | 9 | LC1 D09 |
| E | FV5-R*-PT017 | 12 | Schneider | 12 | LC1 D12 |
| | FV5-R*-PT021 | 16 | | 18 | LC1 D18 |
| | FV5-R*-PT026 | 21 | | 25 | LC1 D25 |

### 3.2.5.3 Circuit Breaker Selection Guide

Refer to the peripheral unit wiring diagram for breaker installation details.

Refer to the table below for Circuit Breaker Selection Recommendations:

| Size | Servo Drive Model | Rated Input Current（A） | Recommended Circuit Breaker | | |
|---|---|---|---|---|---|
| | | | Manufacture | Rated Current（A） | Model |
| Single phase 220V | | | | | |
| A | FV5-R*-PA1R1 | 1.6 | Schneider | 4 | OSMC32N2D4 |
| | FV5-R*-PA1R6 | 2.3 | | 4 | OSMC32N2D4 |
| | FV5-R*-PA2R8 | 4.0 | | 6 | OSMC32N2D6 |
| B | FV5-R*-PA5R5 | 7.9 | Schneider | 16 | OSMC32N2D16 |
| Single phase 220V | | | | | |
| C | FV5-R*-PC7R6 | 5.7 | Schneider | 10 | OSMC32N2D10 |
| D | FV5-R*-PC012 | 7.3 | Schneider | 16 | OSMC32N2D16 |
| Single phase 380V | | | | | |
| C | FV5-R*-PT3R5 | 2.5 | Schneider | 4 | OSMC32N2D4 |
| | FV5-R*-PT5R4 | 3.8 | | 6 | OSMC32N2D6 |
| D | FV5-R*-PT8R4 | 5.4 | Schneider | 10 | OSMC32N2D10 |
| | FV5-R*-PT012 | 7.9 | | 16 | OSMC32N2D16 |
| E | FV5-R*-PT017 | 12 | Schneider | 20 | OSMC32N2D20 |
| | FV5-R*-PT021 | 16 | | 25 | OSMC32N2D25 |
| | FV5-R*-PT026 | 21 | | 32 | OSMC32N2D32 |

If the equipment requires a residual current device (RCD), follow the selection criteria below:

- The drive may generate DC leakage current in the protective conductor. Be sure to use a Type B Residual Current Device (RCD).

- A certain amount of high-frequency leakage current will be generated during drive operation. To prevent RCD malfunction, select an RCD with an operating current of at least 100mA for each drive.
- When multiple drives are connected in parallel to share an RCD, select an RCD with an operating current of at least 300mA.
- It is recommended to use RCDs from brands such as Chint, Schneider, and others.

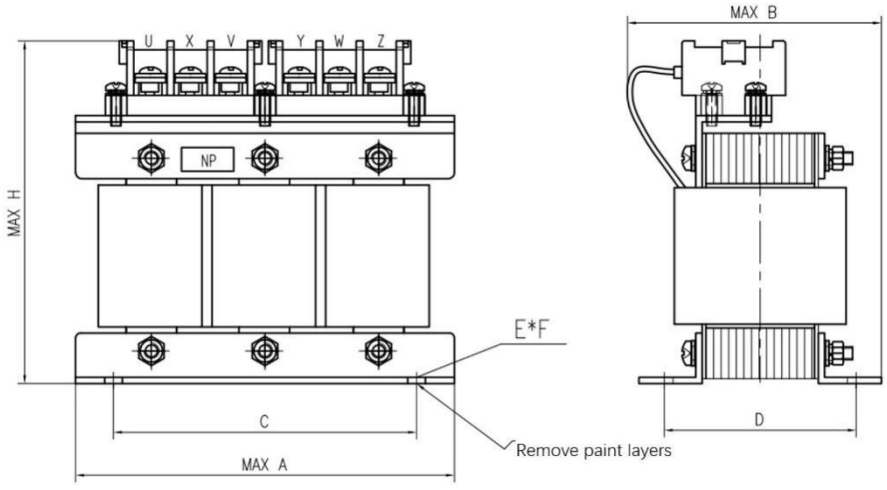
## 3.2.5.4 AC Input Reactor Selection Guide

The AC input reactor is primarily designed to reduce harmonics in the input current and is configured as an option. When the application environment requires higher levels of harmonic reduction, an external reactor can be installed.

The recommended AC input reactors are shown in the table below:

| Size | Servo Drive Model | Rated Input Current（A） | Recommended AC Input Reactor | | |
|---|---|---|---|---|---|
| | | | Manufacture | Inductance (mH) | Model |
| Three phase 220V | | | | | |
| C | FV5-R*-PC7R6 | 5.7 | Huayin (Shanghai) | 5 | SHD-800-9 |
| D | FV5-R*-PC012 | 7.3 | Huayin (Shanghai) | 5 | SHD-800-9 |
| Three phase 380V | | | | | |
| C | FV5-R*-PT3R5 | 2.5 | Huayin (Shanghai) | 5 | SHD-800-9 |
| | FV5-R*-PT5R4 | 3.8 | | 5 | SHD-800-9 |
| D | FV5-R*-PT8R4 | 5.4 | Huayin (Shanghai) | 5 | SHD-800-9 |
| | FV5-R*-PT012 | 7.9 | | 5 | SHD-800-9 |
| E | FV5-R*-PT017 | 12 | Huayin (Shanghai) | 3 | SHD-800-10 |
| | FV5-R*-PT021 | 16 | | 1.45 | SHD-800-13 |
| | FV5-R*-PT026 | 21 | | 1.45 | SHD-800-13 |

The size specifications for AC input reactors are shown in the table below.



| Model | Input Current（A） | Inductance (mH) | A (mm) | B (mm) | H (mm) | C×D (mm) | ΦE×F (mm) |
|---|---|---|---|---|---|---|---|
| SHD-800-9 | 8 | 5 | 175 | 150 | 175 | 120×90 | 8×12 |
| SHD-800-10 | 12 | 3 | 175 | 150 | 175 | 120×90 | 8×12 |
| SHD-800-13 | 21 | 1.45 | 230 | 180 | 220 | 150×110 | 8×12 |

## 3.2.5.5 EMC Input Filters

In order to make the product meet the requirements of the ENIEC 61800-3 standard for radiated and conducted emissions, an external EMC filter is required.

The EMC filters available for this product are Schaffner's FN2090 and FN3258 series, and the EMC filter profiles are as follows:

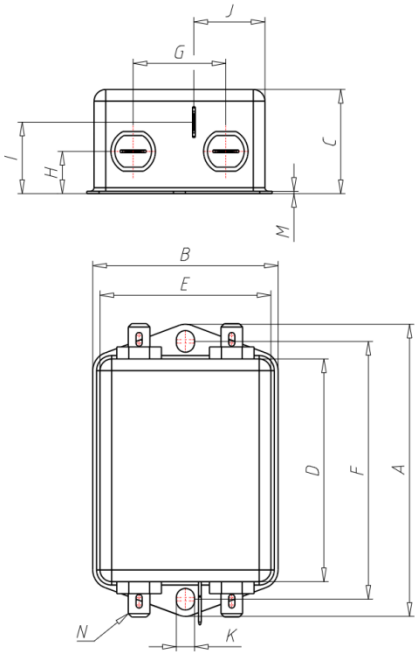
| Model | | Appearances |
|---|---|---|
| Schaffner | FN2090 Series |  |
| | FN3258 Series |  |

Please select according to the rated input current of this product as the table below:

| Size | Servo Drive Model | Rated Input Current（A） | Recommended EMC Input Filters | |
|---|---|---|---|---|
| | | | Manufacture | Model |
| Single phase 220V | | | | |
| A | FV5-R*-PA1R1 | 1.6 | Schaffner | FN2090-3-06 |
| | FV5-R*-PA1R6 | 2.3 | | FN2090-3-06 |
| | FV5-R*-PA2R8 | 4.0 | | FN2090-4-06 |
| B | FV5-R*-PA5R5 | 7.9 | Schaffner | FN2090-8-06 |

| Size | Servo Drive Model | Rated Input Current（A） | Recommended EMC Input Filters | |
|---|---|---|---|---|
| | | | Manufacture | Model |
| Three phase 220V | | | | |
| C | FV5-R*-PC7R6 | 5.7 | Schaffner | FN3258-7-44 |
| D | FV5-R*-PC012 | 7.3 | Schaffner | FN3258-16-44 |
| Three phase 380V | | | | |
| C | FV5-R*-PT3R5 | 2.5 | Schaffner | FN3258-7-44 |
| | FV5-R*-PT5R4 | 3.8 | | FN3258-7-44 |
| D | FV5-R*-PT8R4 | 5.4 | Schaffner | FN3258-7-44 |
| | FV5-R*-PT012 | 7.9 | | FN3258-16-44 |
| E | FV5-R*-PT017 | 12 | Schaffner | FN3258-16-44 |
| | FV5-R*-PT021 | 16 | | FN3258-16-44 |
| | FV5-R*-PT026 | 21 | | FN3258-30-44 |

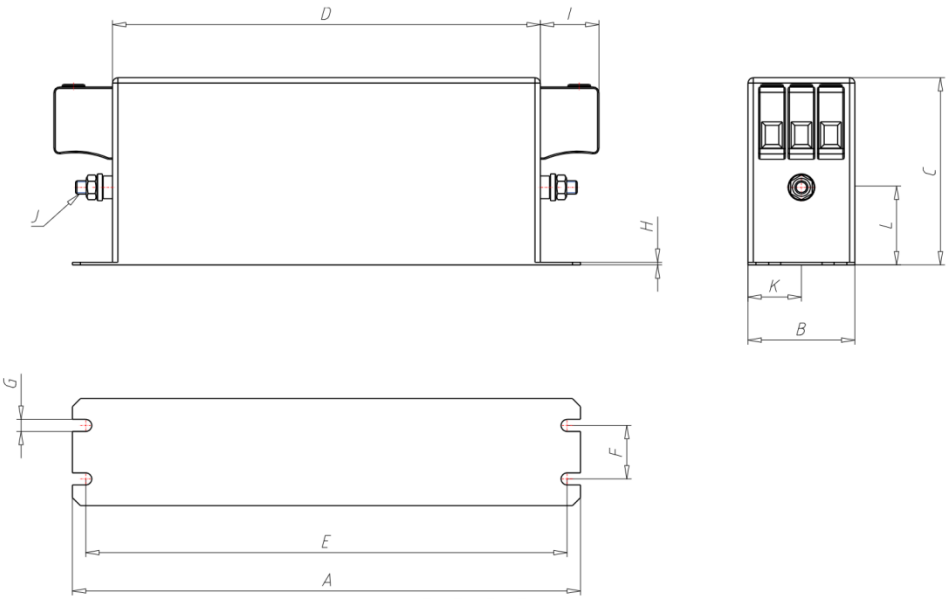
Schaffner FN 2090 Series Filter Dimensions Description:




Unit：mm

| Input Current（A） | A | B | C | D | E | F | G | H | I | J | K | M | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 85 | 54 | 30.3 | 64.8 | 49.8 | 75 | 27 | 12.3 | 20.8 | 19.9 | 5.3 | 0.7 | 6.3 × 0.8 |
| 6 | 85 | 54 | 30.3 | 64.8 | 49.8 | 75 | 27 | 12.3 | 20.8 | 19.9 | 5.3 | 0.7 | 6.3 × 0.8 |
| 8 | 113.5 | 57.5 | 45.4 | 94 | 56 | 103 | 25 | 12.4 | 32.4 | 15.5 | 4.4 | 1 | 6.3 × 0.8 |

Schaffner FN 3258 Series Filter Dimensions Description:




| Input Current （A） | A (mm) | B (mm) | C (mm) | D (mm) | E (mm) | F (mm) | G (mm) | H (mm) | I (mm) | J | K (mm) | L (mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | 190 | 40 | 70 | 160 | 180 | 20 | 4.5 | 1 | 22 | M5 | 20 | 29.5 |
| 16 | 250 | 45 | 70 | 220 | 235 | 25 | 5.4 | 1 | 22 | M5 | 22.5 | 29.5 |
| 30 | 270 | 50 | 85 | 240 | 255 | 30 | 5.4 | 1 | 25 | M5 | 25 | 39.5 |

## 3.2.5.6 Magnetic rings

Magnetic rings installed on the input side can suppress the noise entering the drive in the power supply system, while magnetic rings installed on the output side are mainly used to reduce the electromagnetic interference from the drive to the outside world, and can also reduce the bearing current, please try to place them as close as possible to the drive when installing magnetic rings.

For leakage current problems and other signal line interference problems in some applications, it is recommended to use amorphous magnetic rings for suppression. Amorphous magnetic rings have a very high permeability below 1 MHz and are particularly effective in suppressing drive interference.

Two sizes of amorphous magnetic rings are available for user selection:

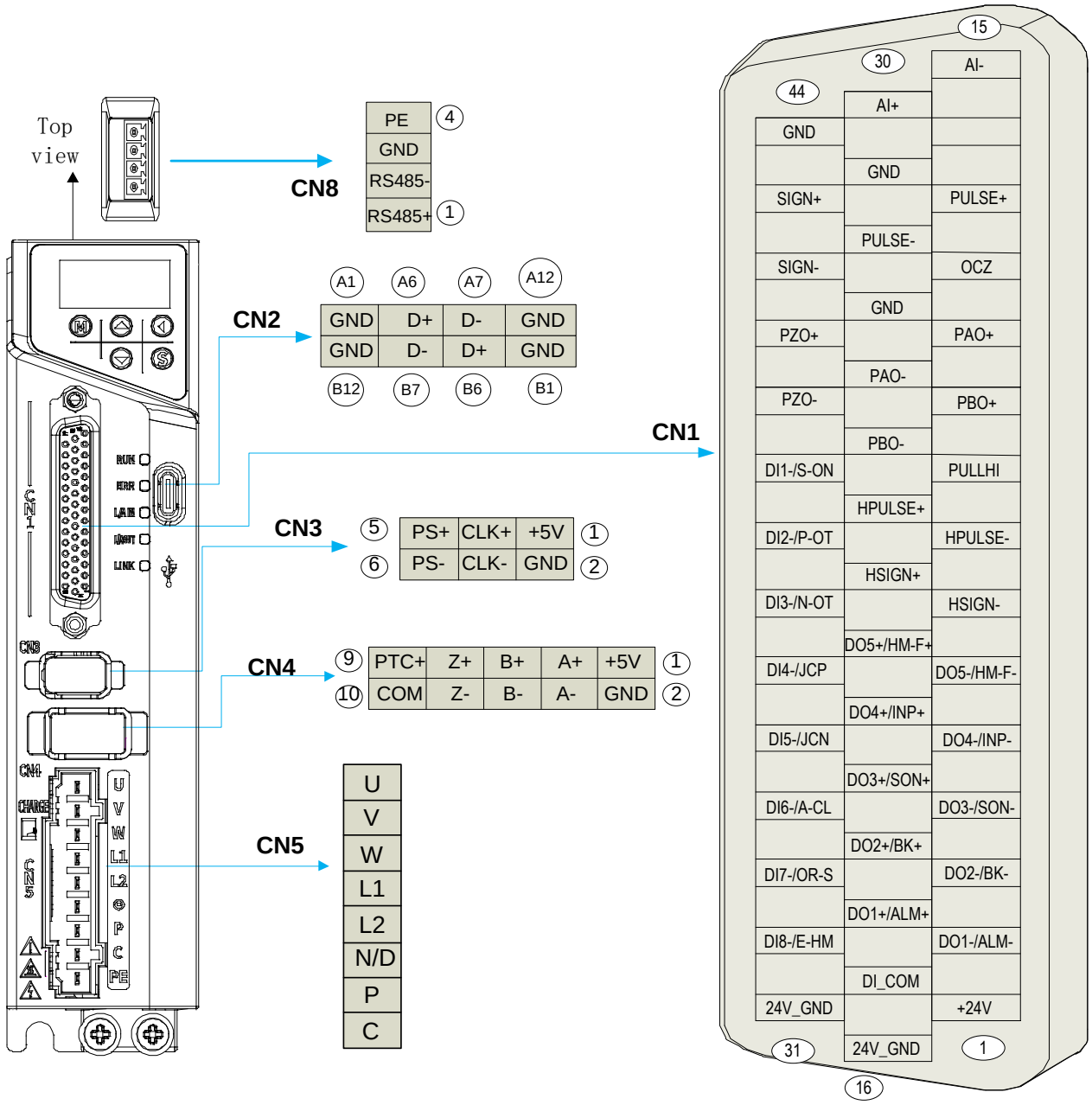
| Material | Size（OD*ID*HT）（mm） | Appearance |
|---|---|---|
| Amorphous alloys | 50×80×20 |  |

| Material | Size（OD*ID*HT）（mm） | Appearance |
|---|---|---|
| Amorphous alloys | 64×40×20 |  |

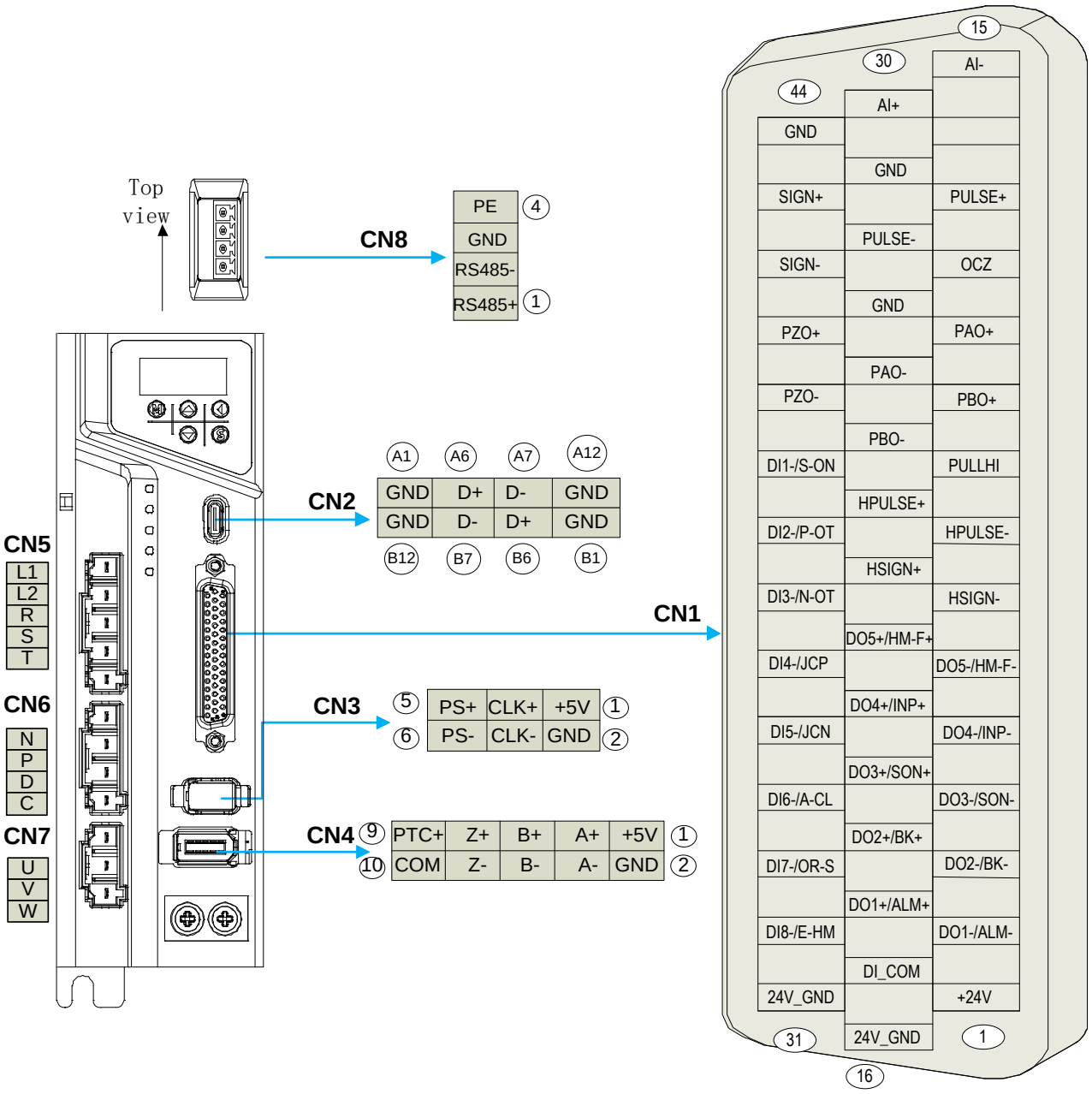
# 3.3 Wiring of Connector CN1

## 3.3.1 Definitions of Connector CN1 Terminals

◆ Terminals of SIZE-A/SIZE-B Types


Top view
CN8
PE
GND
RS485-
RS485+
4
1
CN2
A1
A6
A7
A12
GND
D+
D-
GND
GND
D-
D+
GND
B12
B7
B6
B1
CN1
CN3
5
6
PS+
CLK+
+5V
PS-
CLK-
GND
1
2
CN4
9
10
PTC+
Z+
B+
A+
+5V
COM
Z-
B-
A-
GND
1
2
CN5
U
V
W
L1
L2
N/D
P
C
15
30
44
AI-
AI+
GND
GND
SIGN+
PULSE+
PULSE-
SIGN-
OCZ
GND
PZO+
PAO+
PAO-
PZO-
PBO+
PBO-
DI1-/S-ON
PULLHI
HPULSE+
DI2-/P-OT
HPULSE-
HSIGN+
DI3-/N-OT
HSIGN-
DO5+/HM-F+
DI4-/JCP
DO5-/HM-F-
DO4+/INP+
DI5-/JCN
DO4-/INP-
DO3+/SON+
DI6-/A-CL
DO3-/SON-
DO2+/BK+
DI7-/OR-S
DO2-/BK-
DO1+/ALM+
DI8-/E-HM
DO1-/ALM-
DI_COM
24V_GND
+24V
31
24V_GND
1
16

◆ Terminals of SIZEC/SIZE-D/SIZE-E Types




Note: The illustration above takes SIZE-C/SIZE-D as an example. The pin names and definitions for SIZE-E are the same as for SIZE-C/SIZE-D, but the appearance and position may differ.

Please refer to the table below for the pins of CN1.

| Pin number | Name | Abbreviation | Description |
|---|---|---|---|
| 1 | Internal 24V power supply positive | +24V | Only for internal DI and pulse input pull-up use, cannot be used to power external relays, brakes, etc. |
| 2 | Digital output 1 (negative) | DO1- | Digital outputs can be freely configured for functions and output logic according to user requirements. When wiring, if relays need to be |
| 3 | Digital output | DO2- | |

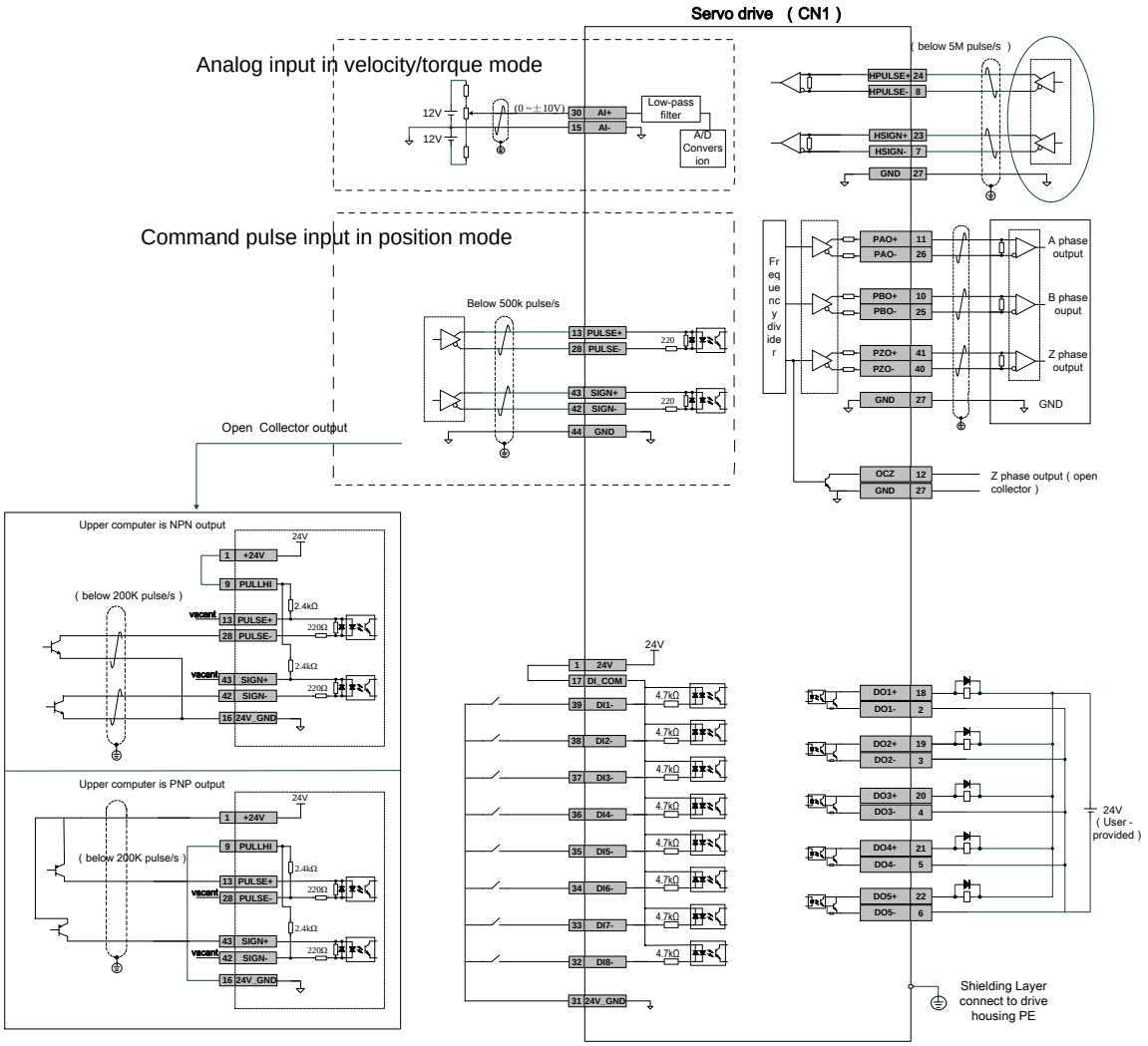
| Pin number | Name | Abbreviation | Description |
|---|---|---|---|
| | 2(negative) | | added, freewheeling diodes should be included. Similarly, if optocouplers are used for reception, current-limiting resistors should be connected. Wiring errors can result in hardware damage to the DO port |
| 4 | Digital output 3 (negative） | DO3- | |
| 5 | Digital output 4 (negative） | DO4- | |
| 6 | Digital output 5 (negative） | DO5- | |
| 7 | High-Speed Pulse Direction Signal (Negative) | HSIGN- | Differential inputs, with a maximum frequency of 5 MHz |
| 8 | High-Speed Pulse Counting Signal (Negative) | HPULSE- | |
| 9 | Pulse Command Input Built-in Resistor Common Terminal | PULLHI | Used for open collector, connect to 24V_GND(pin 16) when open collector type is PNP, connect to 24V when open collector type is NPN |
| 10 | Frequency Divided Output Phase B (Positive) | PBO+ | The number of pulses output per motor revolution is set by P02.03. Set the number of divided output pulses to 4 times the original frequency |
| 11 | Frequency Divided Output Phase A (Positive) | PAO+ | |
| 12 | Z Phase Open Collector Output | OCZ | Z phase Outputs one pulse per revolution, level set by P02.05, output is open collector |
| 13 | Low-Speed Pulse Counting Signal (Positive) | PULSE+ | Low-speed pulse direction signal, supports two modes:<br>◆ Differential mode, maximum frequency is 500kHz<br>◆ Open collector input modes, maximum frequency is 200kHz |
| 15 | Analog Input(Negative) | AI- | The analog input reference ground |
| 16 | 24V Reference Ground | 24V_GND | Internal 24V power supply reference ground |
| 17 | DI Common Input Terminal | DI_COM | When DI uses the internal 24V power supply, short this pin to the internal 24V pin (1) |
| 18 | Digital Output 1 (Positive) | DO1+ | Digital outputs can be freely configured for functions and output logic according to user requirements. When wiring, if relays are used, include freewheeling diodes. Similarly, if optocouplers are used, include current-limiting resistors. Incorrect wiring can result in hardware damage to the DO port |
| 19 | Digital Output 2 (Positive) | DO2+ | |
| 20 | Digital Output 3 (Positive) | DO3+ | |

| Pin number | Name | Abbreviation | Description |
|---|---|---|---|
| 21 | Digital Output 4 (Positive) | DO4+ | |
| 22 | Digital Output 5 (Positive) | DO5+ | |
| 23 | High-Speed Pulse Direction Signal (Positive) | HSIGN+ | Differential inputs, with a maximum frequency of 5M Hz |
| 24 | High-Speed Pulse Counting Signal (Positive) | HPULSE+ | |
| 25 | Frequency Division Output Phase B (Negative) | PBO- | The number of pulses output per motor revolution is set by P02.03. Set the number of divided output pulses to 4 times the original frequency |
| 26 | Frequency Division Output Phase A (Negative) | PAO- | |
| 27 | Signal ground | GND | When the pulse command input is in differential mode, connect this signal ground to the upper computer signal ground. For pulse frequency output signal ground, connect this signal ground to the upper computer signal ground. |
| 28 | Low-Speed Pulse Counting Signal (Negative) | PULSE- | Low-speed pulse direction signal, supports two modes:<br>◆ Differential mode, maximum frequency is 500kHz<br>◆ Open collector input mode, maximum frequency is 200kHz |
| 29 | Signal Reference Ground | GND | Signal reference ground |
| 30 | Analog Input(Positive) | AI+ | Analog input channel, connect the other end to pin 15 |
| 31 | Internal 24V Power Supply Reference Ground | 24V_GND | Internal 24V power supply reference ground |
| 32 | Digital Input 8 | DI8- | Digital Input can be freely configured for functionality and input logic levels. When wiring, different operating conditions may require selecting either the internal 24V or external 24V option, and can also be divided into PNP and NPN types, selecting different wiring methods |
| 33 | Digital Input 7 | DI7- | |
| 34 | Digital Input 6 | DI6- | |
| 35 | Digital Input 5 | DI5- | |
| 36 | Digital Input 4 | DI4- | |
| 37 | Digital Input 3 | DI3- | |
| 38 | Digital Input 2 | DI2- | |

| Pin number | Name | Abbreviation | Description |
|---|---|---|---|
| 39 | Digital Input 1 | DI1- | |
| 40 | Frequency Division Output Z Phase (Negative) | PZO- | The Z phase outputs one pulse per revolution, with the level set by P02.05 and outputting a differential 5V signal |
| 41 | Frequency Division Output Z Phase (Positive) | PZO+ | |
| 42 | Low-speed Pulse Direction Signal (Negative) | SIGN- | Low-speed pulse direction signal, supports two modes:<br>◆ Differential mode, maximum frequency is 500kHz<br>◆ Open collector input modes, maximum frequency is 200kHz |
| 43 | Low-speed Pulse Direction Signal (Positive) | SIGN+ | Low-speed pulse direction signal, supports two modes:<br>◆ Differential mode, maximum frequency is 500kHz<br>◆ Open collector input modes, maximum frequency is 200kHz |
| 44 | Signal Reference Ground | GND | Signal reference ground |

## 3.3.2 Connect to the Upper Controller

For typical wiring examples of connector CN1, please refer to the diagram below.



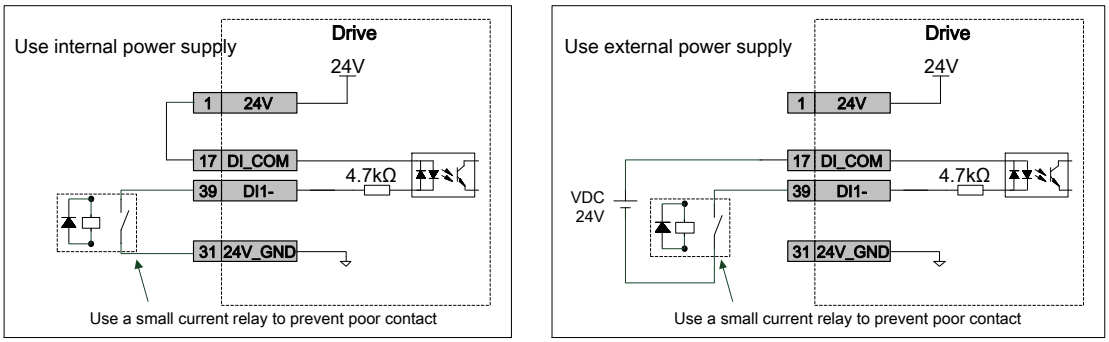

## 3.3.3 Control Input Signal Connection

| Symbol | Function | Pin | Description |
|---|---|---|---|
| DI1 | Enablement (default) | 39 | Servo enabled |
| DI2 | Positive over travel (default) | 38 | Positive over travel |
| DI3 | Negative over travel (default) | 37 | Negative over travel |
| DI4 | None(default) | 36 | None by default, function can be configured by P04.0A |
| DI5 | None (default) | 35 | None by default, function can be configured by P04.0C |
| DI6 | Fault reset (default) | 34 | Fault reset |
| DI7 | Home position signal(default) | 33 | Home position signal |
| DI8 | Enable homing(default) | 32 | Trigger homing enabled |
| +24V | +24V | 1 | Internal 24V power supply, voltage range |

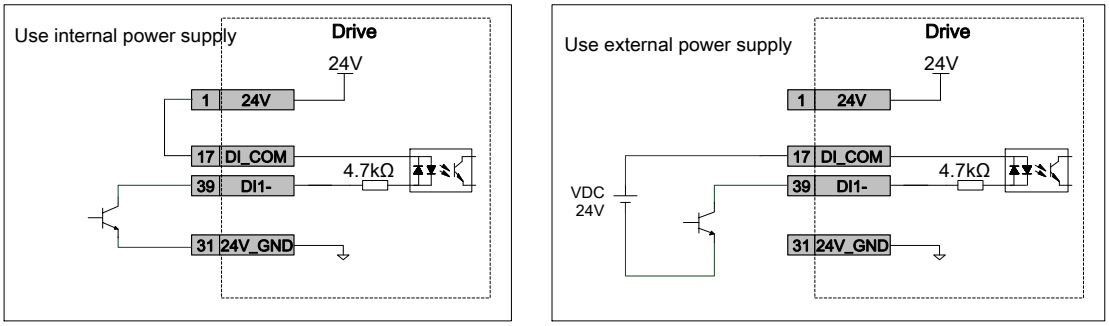
| Symbol | Function | Pin | Description |
|---|---|---|---|
| 24V_GND | Reference ground for 24V | 31 or 16 | +20~28V, maximum output current 200mA |
| DI_COM | COM for DIs | 17 | Power supply input terminal (12V~24V) |

Taking DI1 as an example, the connection method for other DIs is the same.

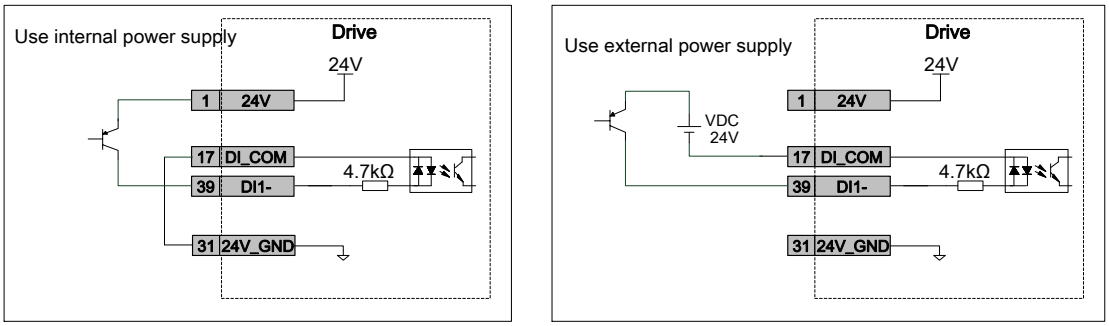
◆ When the upper-level device is a relay output




◆ When the upper-level device is NPN open collector output




◆ When the upper-level device is PNP open collector output




Note: PNP and NPN inputs cannot be mixed.

## 3.3.4 Pulse Command Input Signal Connection

Refer to the table below for the pulse pin definitions.

| Symbol | Connector pin number | Description |
|---|---|---|
| PULLHI | 9 | Collector input built-in resistor common terminal |
| PULSE+ | 13 | Low-speed pulse input + |
| PULSE- | 28 | Low-speed pulse input - |

| Symbol | Connector pin number | Description |
|---|---|---|
| SIGN+ | 43 | Low-speed direction input + |
| SIGN- | 42 | Low-speed direction input - |
| GND | 44 | Signal ground |
| HPULSE+ | 24 | High-speed pulse input + |
| HPULSE- | 8 | High-speed pulse input - |
| HSIGN+ | 23 | High-speed direction input + |
| HSIGN- | 7 | High-speed direction input - |
| GND | 27 | Signal ground |

The drive supports two input modes: high-speed and low-speed. The high-speed input port only supports high-speed differential outputs from the upper device. The low-speed input port supports both differential and collector outputs from the upper device. The maximum frequency and minimum pulse width for each input mode are shown in the following table:

Function code Pn0305 for selecting high or low-speed pulses:

When it is 0: High-speed pulse

When it is 1: Low-speed pulse

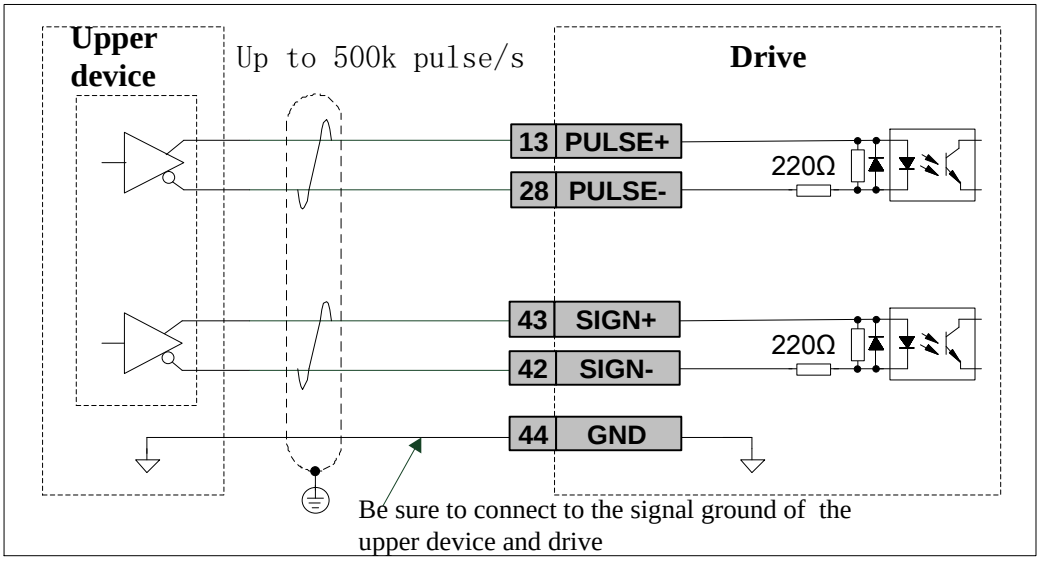
| PULSE/SIGN Signal Pulse Input Method | Maximum Allowed Input Frequency | Minimum Necessary Pulse Width (μs) |
|---|---|---|
| Low-speed Input Port | ◆ 500k pulse/s (differential input)<br>◆ 200k pulse/s (Collector input) | ◆ 1 (differential input)<br>◆ 2.5 (Collector input) |
| High-speed Differential Input Port | 5M pulse/s | 0.1 |

Note: If the pulse width output by the upper-level device is less than the minimum pulse width value, it will cause the drive to receive wrong pulse. To reduce the impact of noise, please use double twisted shielded cables, and keep the wiring length within 1m.

## 3.3.4.1 Low-speed Pulse Input

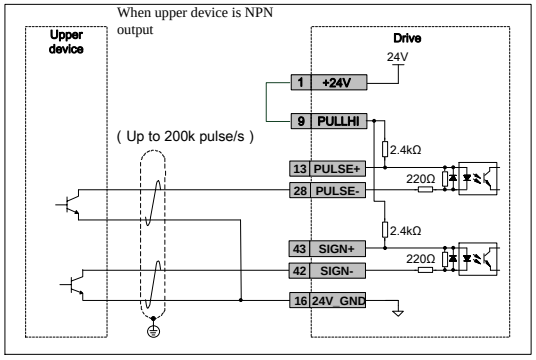
◆ When the upper-level device is set to four-channel differential signal output

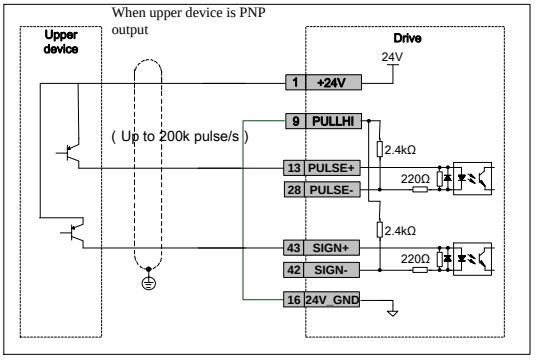
For a less susceptible to noise signal transmission method, this method is recommended for improving signal transmission accuracy.



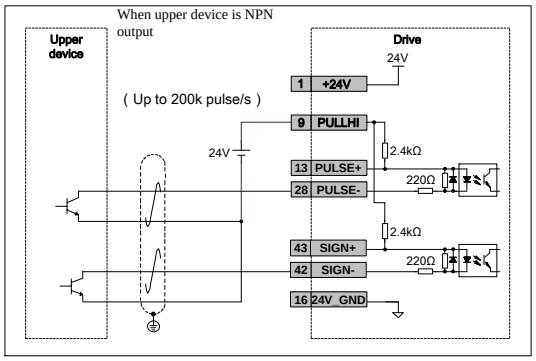

◆ When the upper-level device is set to open collector output

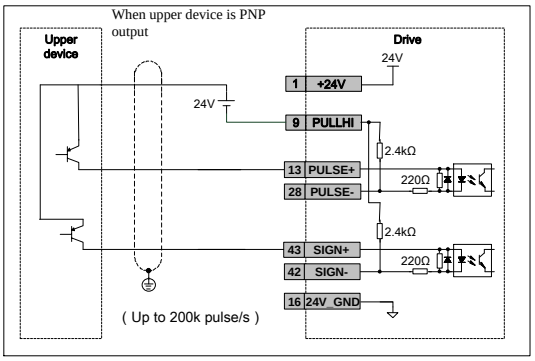
- When using the internal 24V power supply of the drive



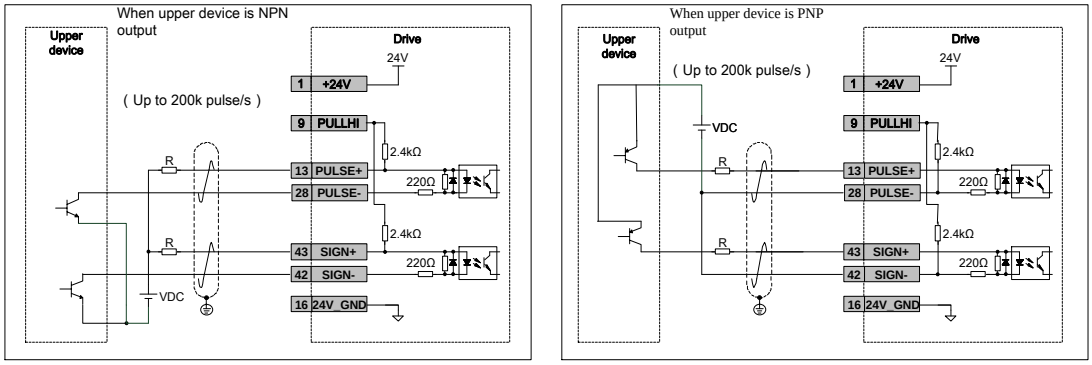




- When using an external 24V power supply and the internal resistor of the drive



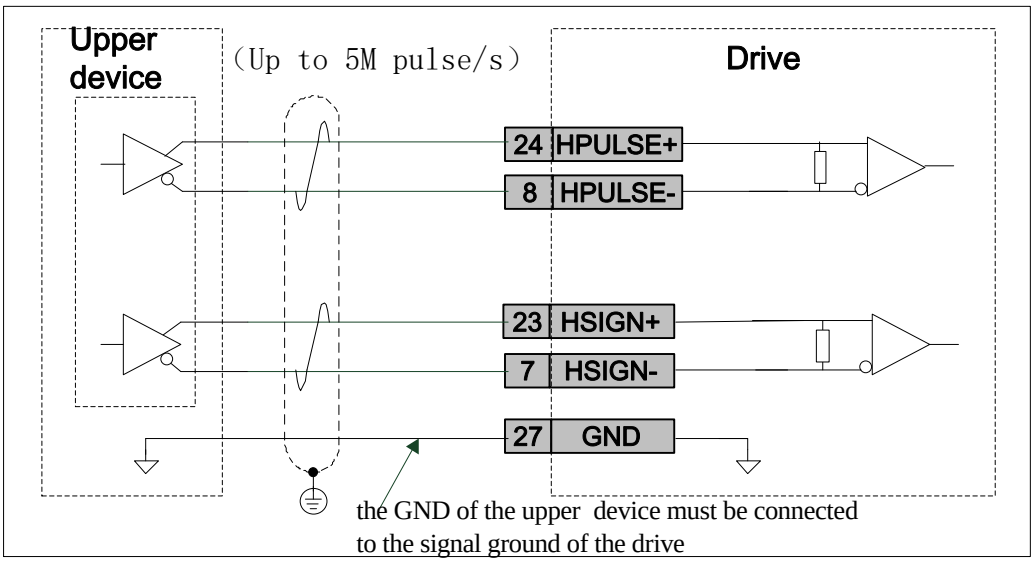

- When using external 12V, 24V power supply and external resistor




| VDC | R | $\frac{VDC-1.5}{R+220} = 10mA$ |
|---|---|---|
| 12V | 820Ω0.5W | |
| 24V | 2kΩ0.5W | |

## 3.3.4.2 High-speed Pulse Input

When the upper-level device outputs high-speed pulses, please output them to the high-speed pulse input of the servo drive in differential output mode.




Note: It is essential to ensure that the differential output is within a 5V system; the GND of the upper device must be connected to the signal ground of the drive.

# 3.3.5 Analog Command Input Signal Connection

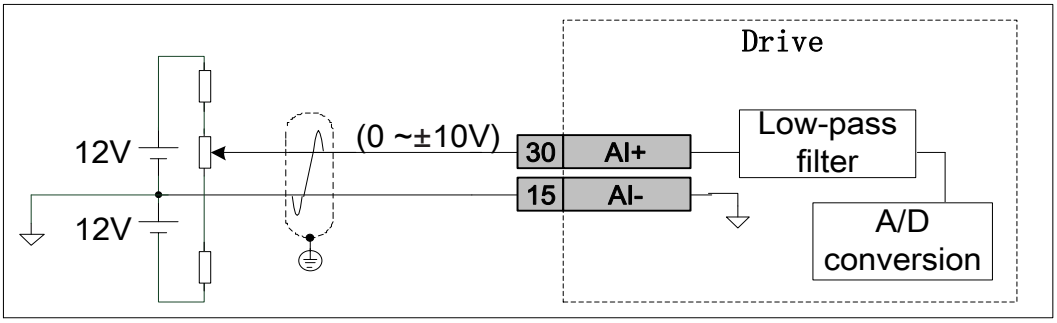
| Symbol | Connector Pin Number | Description |
|---|---|---|
| AI+ | 30 | Common analog input signal, 12-bit resolution, input voltage: -10V~+10V |
| AI- | 15 | Analog input signal ground |

The voltage value corresponding to the analog input command is set by P03.47 and P03.4C.

The maximum allowable input voltage range is -10V to +10V;

A/D conversion resolution: 12-bit;

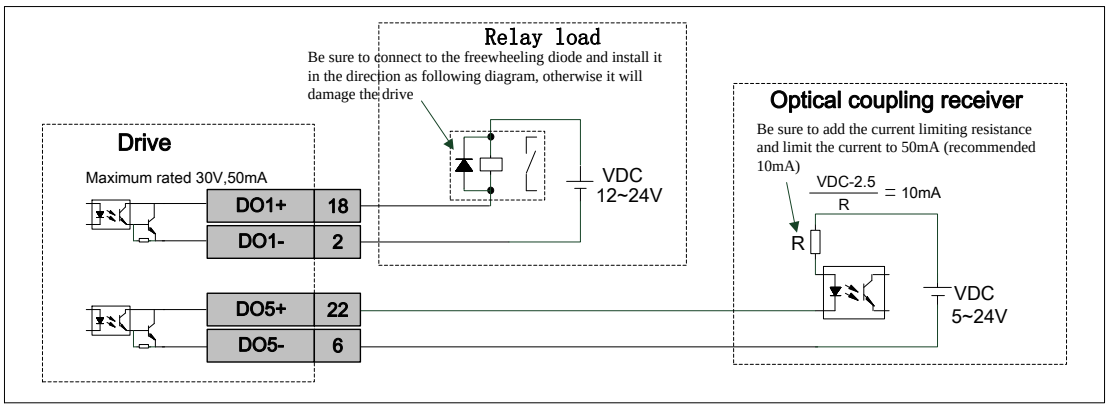
Input impedance: approximately 9kΩ.




## 3.3.6 Control Output Signal Connection

| Symbol | Function | Connector Pin Number | Description |
|---|---|---|---|
| DO1+ | Alm+ | 18 | Fault output signal |
| DO1- | Alm- | 2 | |
| DO2+ | Blk+ | 19 | Brake signal |
| DO2- | Blk- | 3 | |
| DO3+ | Son + | 20 | Servo enabled status output |
| DO3- | Son - | 4 | |
| DO4+ | INP+ | 21 | Positioning completed output |
| DO4- | INP- | 5 | |
| DO5+ | HomeOK+ | 22 | Homing completed output |
| DO5- | HomeOK- | 6 | |

Taking DO1 and DO5 as an example, other DO connections are the same.




## 3.3.7 Wiring of Frequency Division Pulse Output Signal

| Symbol | Connector Pin number | Function |
|---|---|---|
| PAO+ | 11 | A Phase Frequency Division Output Signal+ |
| PAO- | 26 | A Phase Frequency Division Output Signal- |

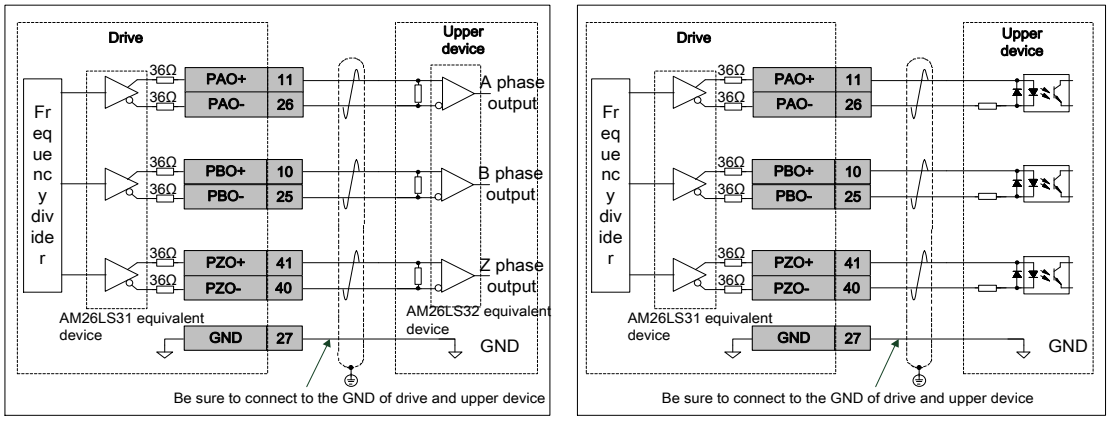
| Symbol | Connector Pin number | Function |
|---|---|---|
| PBO+ | 10 | B Phase Frequency Division Output Signal+ |
| PBO- | 25 | B Phase Frequency Division Output Signal- |
| PZO+ | 41 | Z Phase Frequency Division Output Signal+ |
| PZO- | 40 | Z Phase Frequency Division Output Signal- |
| OCZ | 12 | Z Phase Frequency Division Open Collector Output Signal |
| GND | 27 | Z Phase Frequency Division Open Collector Output Signal Ground |

The drive provides two types of interfaces: the differential drive interface and the Z-phase pulse open collector output interface.

## 3.3.7.1 Differential Drive Output

The output signals (phase A, phase B, and phase Z) of the encoder after frequency division processing are differentially output through the long-line driver.

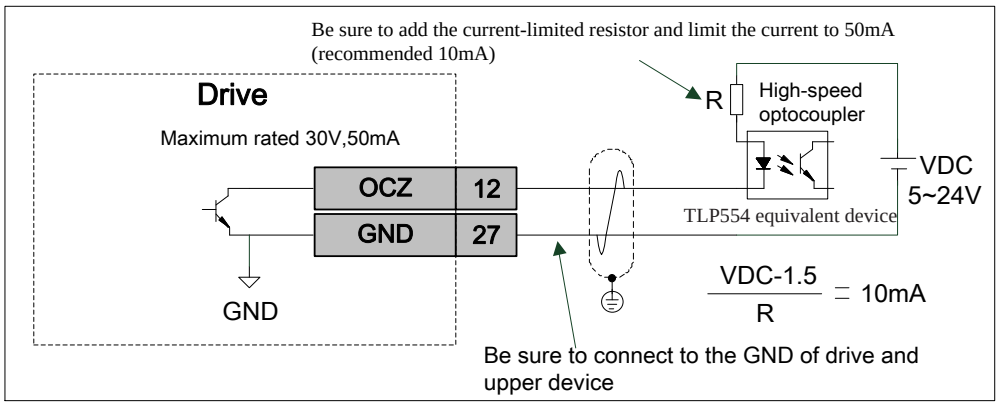
When using a receiver on the upper device side, be sure to install terminal resistors (recommended around 330 Ω) at the inputs of the long-line receiver. When using an optocoupler circuit for reception, use a high-speed optocoupler and limit the line current to within 20mA.




## 3.3.7.2 Open Collector Output

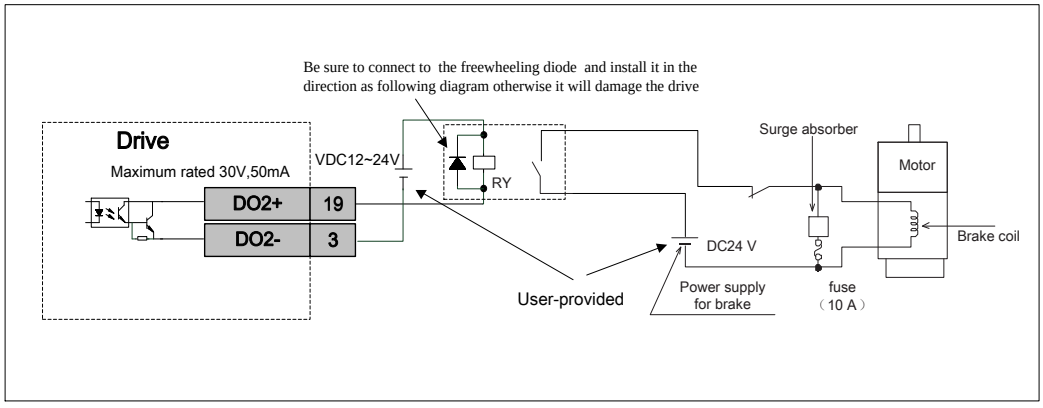
This interface serves as the open collector interface for the Z-phase frequency division output signal of the encoder and is a non-insulated interface.

Due to the narrow pulse width of the Z-phase signal, use a high-speed optocoupler to receive the signal on the upper device side.




## 3.3.8 Wiring of Brake Signal

| Symbol | Function | Connector pin number | Description |
|---|---|---|---|
| DO2+ | Blk+ | 19 | Brake signal |
| DO2- | Blk- | 3 | |




Note: User should provide 24V power supply

Brake usage and wiring precautions:

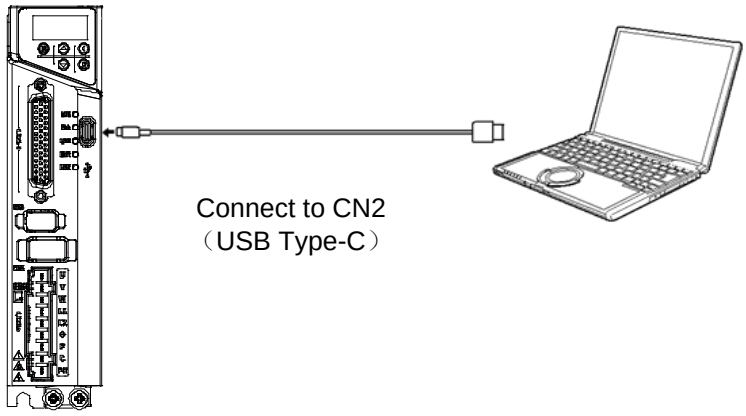
- The length of the motor brake cable should consider the voltage drop caused by cable resistance. The brake operation needs to ensure that the input voltage is at least 21.6V.
- It is preferable not to share the brake with other appliances to prevent voltage or current reduction due to the operation of other appliances, ultimately leading to brake misoperation.
- It is recommended to use cables with a cross-sectional area of 0.5mm² or above.
- For the timing diagram of the brake enable sequence and related function code settings, please refer to the *FV5 Series Rotary Pulse Servo Drive User Manual*.
- The built-in brake mechanism in the servo motor is a fixed dedicated mechanism that operates without electricity and should not be used for braking purposes. It should only be used when the servo motor is stayed in stop state.
- After the servo motor stops, the servo enablement (S-ON) should be disabled.
- When the motor with the built-in brake is running, the brake may make a clicking sound, which has no effect on its function.
- When the brake coil is powered up (brake open state), magnetic flux leakage may occur at the shaft end and other parts. Pay attention when using magnetic sensors or other instruments near the motor.

## 3.4 Wiring of Connector CN2

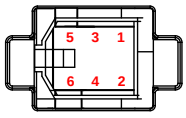
CN2 is the communication interface between the drive and the PC, using a USB cable to connect the drive and PC for parameter setting and monitoring.

PC side communication cable: standard USB Type-C cable

| Symbol | Connector pin number | Description |
|---|---|---|
| GND | A1、B1、A12、B12 | Signal ground |
| D+ | A6、B6 | Data signal line |
| D- | A7、B7 | |



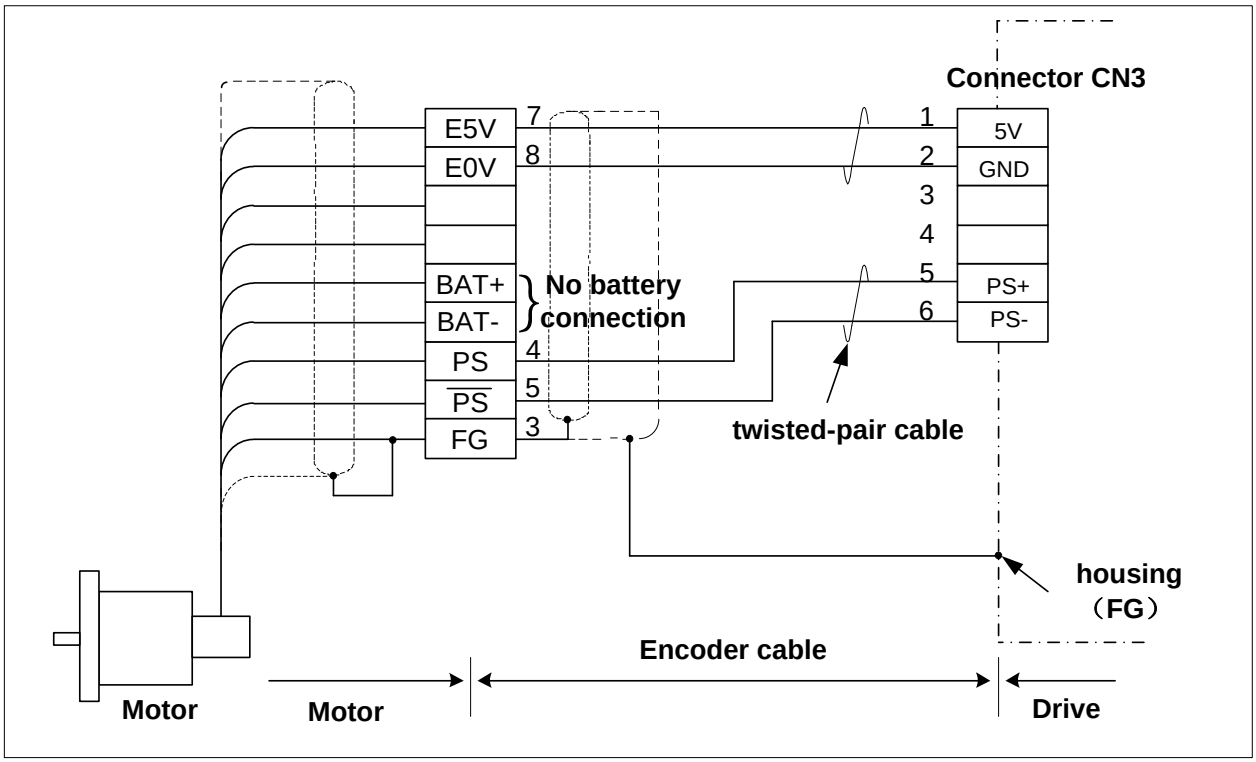

## 3.5 Wiring of Connector CN3

| Connector | Connector pin number | Symbol | Description |
|---|---|---|---|
| CN3  | 1 | 5V | Encoder +5V power supply |
| | 2 | GND | |
| | 3 | | |
| | 4 | | |
| | 5 | PS+ | Serial data sending/reception signal |
| | 6 | PS- | |
| | Enclosure | PE | Connection between the drive's internal and PE terminals |

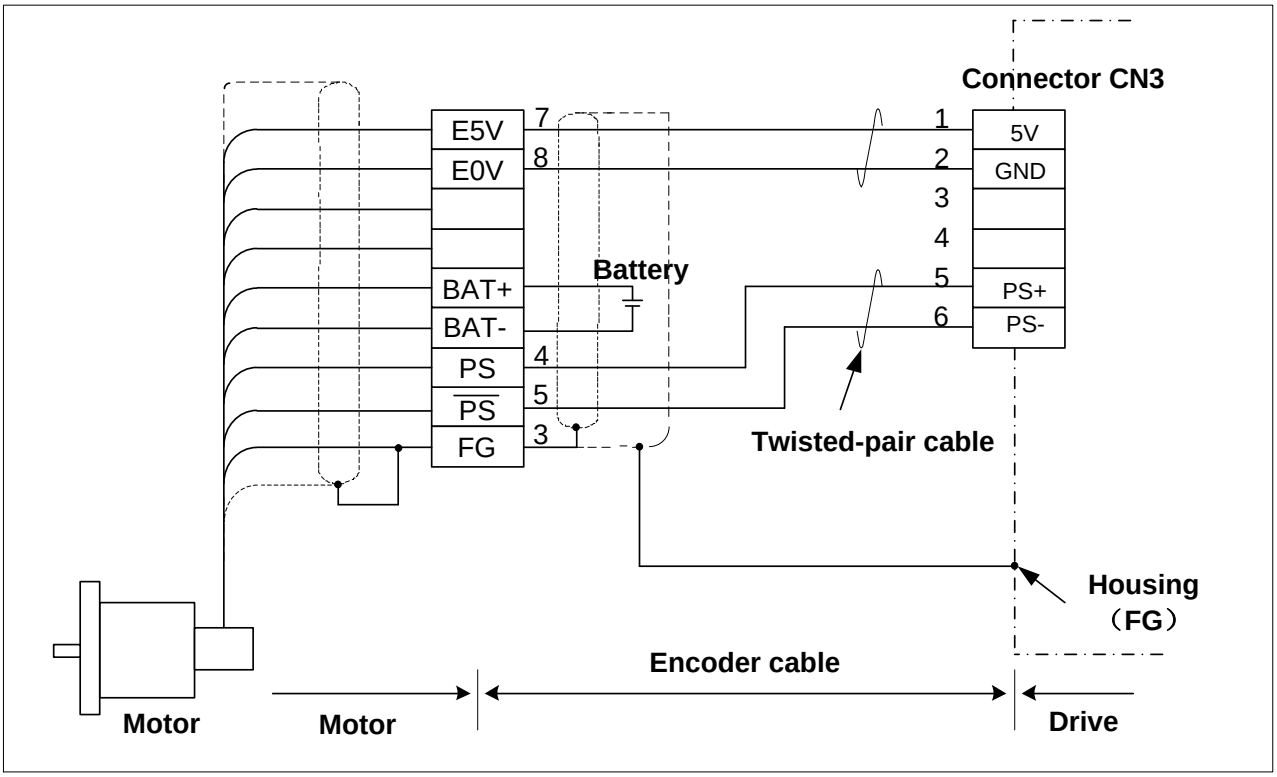


### 3.5.1 Wiring of Communication Encoder

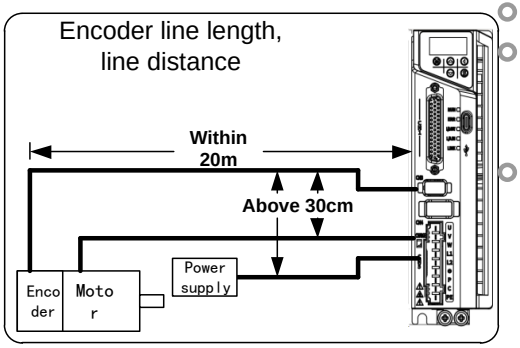
◆ When using a single-turn absolute position encoder




◆ When using a multi-turn absolute position encoder



## 3.5.2 Communication Type Encoder Wiring Key Points



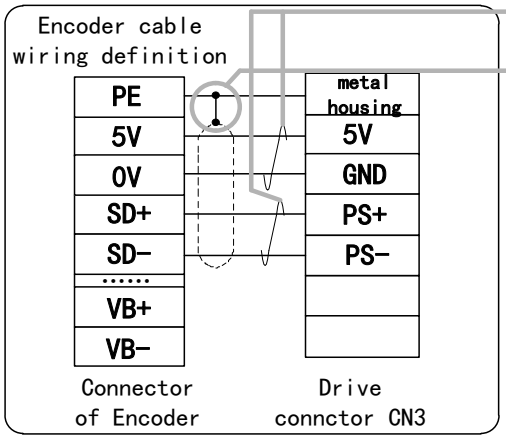

The cable length between the driver and the motor should be within 20 meters

Keep a distance of at least 30cm from the main circuit wiring. Do not bundle it together with conduit.

Tips for making encoder cables

① Refer to the wiring illustration

② Material: Use wires with a core diameter of at least 0.18mm² (AWG 24) and configure them with shielded twisted pair cables that are resistant to bending.




③ Use twisted-pair cables for wiring relative signals/power

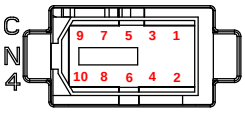
④ Shield layer handling

Shield layer on the driver side: solder to the enclosure of connector CN3

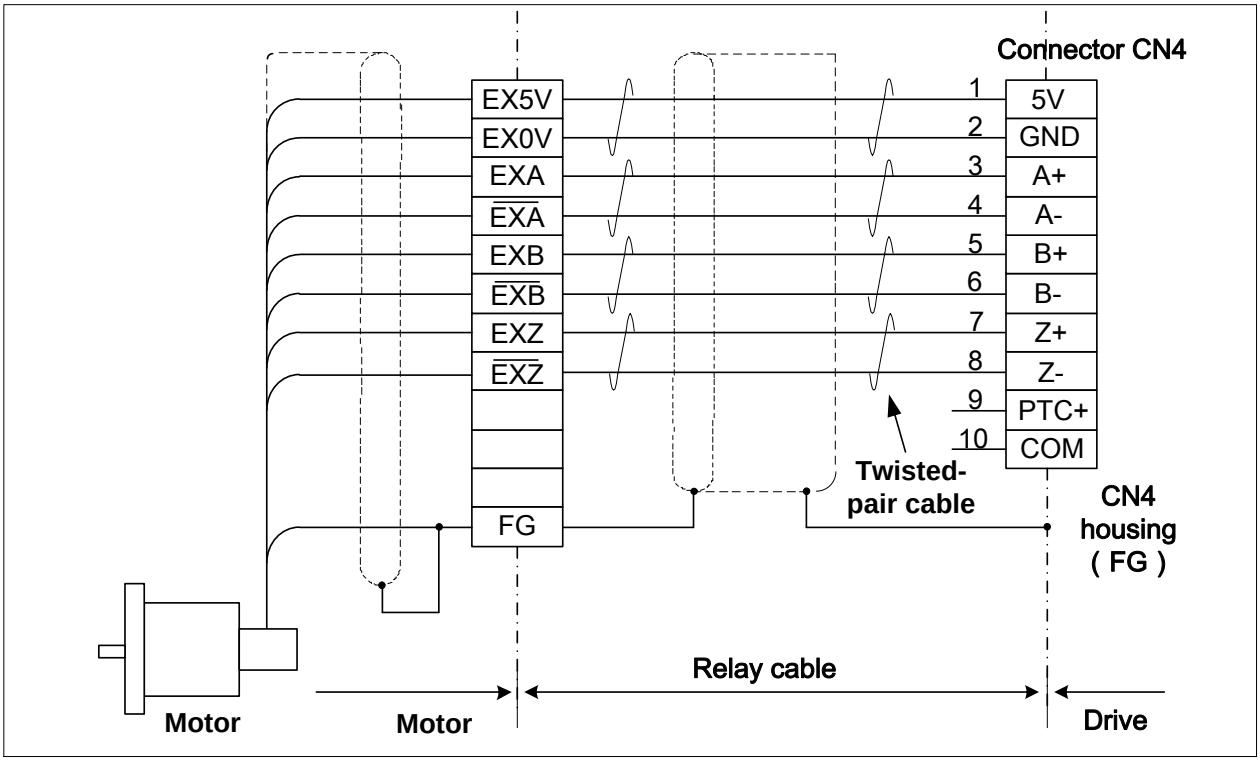
⑤ Do not make any connections to the unused terminals of each connector

# 3.6 Wiring of Connector CN4

## 3.6.1 Connect to Incremental Encoder

| Connector | Connector pin number | Symbol | Description |
|---|---|---|---|
|   | 1 | 5V | Encoder power supply |
| | 2 | GND | Power and encoder signal ground connected to the internal signal ground of the drive |
| | 3 | A+ | Encoder A phase signal (twisted-pair) |
| | 4 | A- | |
| | 5 | B+ | Encoder B phase signal (twisted-pair) |
| | 6 | B- | |
| | 7 | Z+ | Z phase zero pulse signal (twisted-pair) |
| | 8 | Z- | |
| | 9 | PTC+ | Temperature sampling signal (not necessary if no PTC signal) |
| | 10 | COM | Temperature sampling signal reference ground (not necessary if no PTC signal) |

| Connector | Connector pin number | Symbol | Description |
|---|---|---|---|
| | Housing | PE | The housing of CN4 is connected to the PE of the drive |



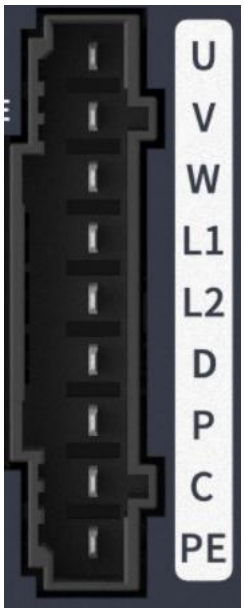

# 3.7 Wiring of Main Circuit

## 3.7.1 Main Circuit Terminal Connection Cable Recommendations

| SIZE | Servo Drive Model | Rated Input Current （A） | L1C、L2C | | L1 、 L2 、 L3/R、S、T | | P、D、C、⊖ | | U、V、W、PE | | Grounding Terminal | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | $mm^2$ | AWG | $mm^2$ | AWG | $mm^2$ | AWG | $mm^2$ | AWG | $mm^2$ | AWG |
| A | FV5-R*-PA1R1 | 1.6 | - | - | 2 × 0.52 | 20 | 2 × 0.52 | 20 | 4 × 0.52 | 20 | 0.52 | 20 |
| | FV5-R*-PA1R6 | 2.3 | - | - | 2 × 0.52 | 20 | 2 × 0.52 | 20 | 4 × 0.52 | 20 | 0.52 | 20 |
| | FV5-R*-PA2R8 | 4.0 | - | - | 2 × 0.52 | 20 | 2 × 0.52 | 20 | 4 × 0.52 | 20 | 0.52 | 20 |
| B | FV5-R*-PA5R5 | 7.9 | - | - | 2 × 0.52 | 20 | 2 × 0.52 | 20 | 4 × 0.52 | 20 | 0.52 | 20 |
| C | FV5-R*-PC7R6 | 5.7 | 2 × 0.52 | 20 | 2 × 0.52 | 20 | 2 × 0.52 | 20 | 4 × 0.81 | 18 | 0.52 | 20 |

| SIZE | Servo Drive Model | Rated Input Current （A） | L1C、L2C | | L1 、 L2 、 L3/R、S、T | | P、D、C、⊖ | | U、V、W、PE | | Grounding Terminal | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | FV5-R*-PT3R5 | 2.5 | 2 × 0.52 | 20 | 3 × 0.52 | 20 | 2 × 0.52 | 20 | 4 × 0.52 | 20 | 0.52 | 20 |
| | FV5-R*-PT5R4 | 3.8 | 2 × 0.52 | 20 | 3 × 0.52 | 20 | 2 × 0.52 | 20 | 4 × 0.52 | 20 | 0.52 | 20 |
| D | FV5-R*-PC012 | 7.3 | 2 × 1.31 | 16 | 3 × 1.31 | 16 | 2 × 1.31 | 16 | 4 × 1.31 | 16 | 0.81 | 18 |
| | FV5-R*-PT8R4 | 5.4 | 2 × 0.52 | 20 | 3 × 0.52 | 20 | 2 × 0.52 | 20 | 4 × 0.81 | 18 | 0.52 | 20 |
| | FV5-R*-PT012 | 7.9 | 2 × 1.31 | 16 | 3 × 1.31 | 16 | 2 × 1.31 | 16 | 4 × 1.31 | 16 | 0.81 | 18 |
| E | FV5-R*-PT017 | 12 | 2 × 2.08 | 14 | 3 × 2.08 | 14 | 2 × 2.08 | 14 | 4 × 2.08 | 14 | 1.31 | 16 |
| | FV5-R*-PT021 | 16 | 2 × 2.08 | 14 | 3 × 2.08 | 14 | 2 × 2.08 | 14 | 4 × 2.08 | 14 | 1.31 | 16 |
| | FV5-R*-PT026 | 21 | 2 × 3.33 | 12 | 3 × 3.33 | 12 | 2 × 3.33 | 12 | 4 × 3.33 | 12 | 2.08 | 14 |

## 3.7.2 Interface Definition of SIZE-A/SIZE-B Connector CN5



| Symbol | Name | Function |
|---|---|---|
| U、V、W | Servo Motor Connection Terminals | Connect to the U, V, W phases of the motor |
| L1、L2 | Main Circuit Power Input Terminals | Main circuit single-phase power input, connect AC 220V power supply between L1 and L2. |
| D | - | Do not connect |
| P、C | External brake resistor connection terminal | Connect to the external brake resistor. |
| PE | Grounding | Two grounding terminals, connect to the power supply grounding terminal and motor grounding terminal.<br>Please ensure that the entire system is grounded. |

## 3.7.3 Interface Definition of SIZE-C/SIZE-D Connector CN5/CN6/CN7


◆ CN5 connector terminals

| Symbol | Name | Function |
|---|---|---|
| L1C、L2C | Auxiliary power input terminal | Refer to nameplate information to connect to the corresponding voltage level auxiliary power supply. |

| Symbol | Name | Function |
|---|---|---|
| | | If the input level is 220V, access 220V power supply(line voltage), if the input level is 380V, access 380V power supply(line voltage). |
| R、S、T | Main circuit power input terminal | Refer to nameplate information to connect to the corresponding voltage level main circuit power supply. |

◆ CN6 connector terminals

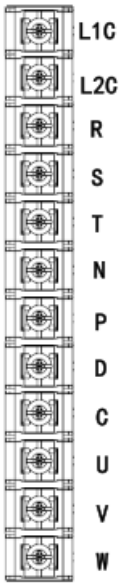
| Symbol | Name | Function |
|---|---|---|
| ⊖ | DC bus negative voltage terminal | DC bus terminal of the drive, do not connect when the unit operates standalone. |
| P、D | Built-in brake resistor connection terminals | When P and D is short circuit, connect the built-in brake resistor. |
| C | External brake resistor connection terminal | When the external brake is connected, connect the resistor to P and C. |

◆ CN7 connector terminals

| Symbol | Name | Function |
|---|---|---|
| U、V、W | Servo motor connection terminal | Servo motor connection terminal, connects to the U, V, and W phases of the motor. |

Main circuit wiring and precautions, please refer to the System Wiring and Key Points Explanation.

## 3.7.4 Interface Definition of SIZE-E Connector CN5




The definition of the terminals of the CN5 connector for SIZE-E is the same as that of the CN5/CN6/CN7 connectors for SIZE-C/SIZE-D. Please refer to Interface Definition of SIZE-C/SIZE-D Connector CN5/CN6/CN7.

### 3.7.5 Brake Resistor Selection and Wiring Precautions

- Do not directly connect the external brake resistor to the positive and negative terminals P and N of the bus bar, as it may cause machine explosions and fires.
- Before using the drive, please ensure that the brake resistor parameters P02.20, P02.23, and P02.24 are correctly set.
- Install the external brake resistor on a non-flammable material such as metal.

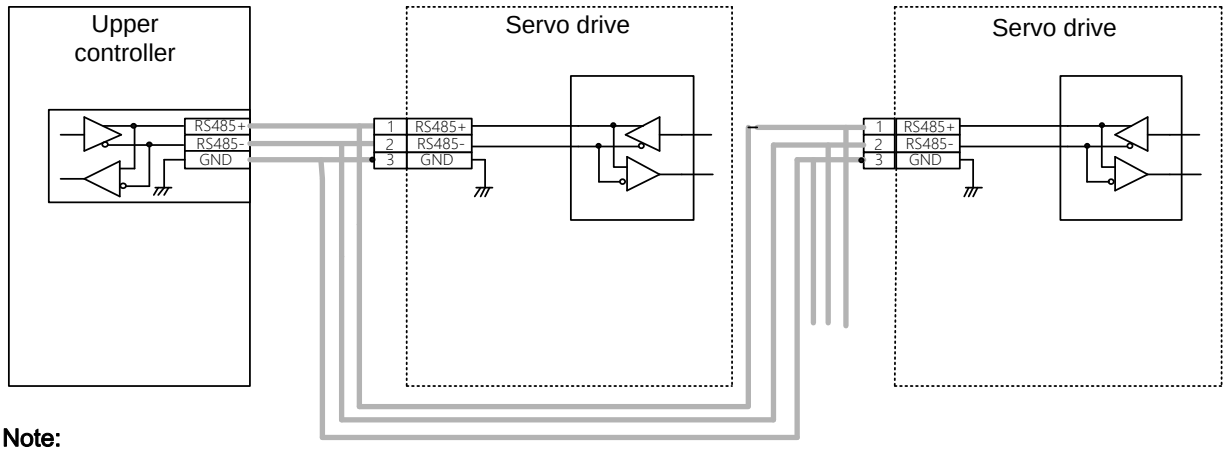
## 3.8 Wiring of Connector CN8

### 3.8.1 Connect to RS485 Communication Signal

RS485 communication signals are connected via the RS485 interface on CN8, with pin definitions as follows.


| Symbol | Connector pin number | Function |
|---|---|---|
| 485+ | 1 | RS485 input/output signal |
| 485- | 2 | |
| GND | 3 | RS485 communication signal ground |
| PE | 4 | Shield ground PE |

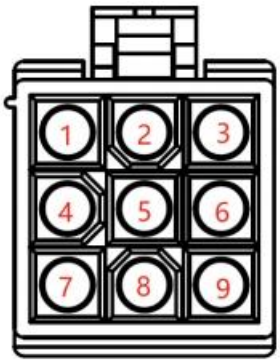
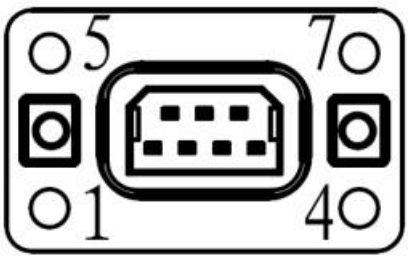
Using the RS485 interface to connect one master station and multiple servo drives(act as slave stations), set the P08.00 parameter of each servo drive to a value from 1 to 127.

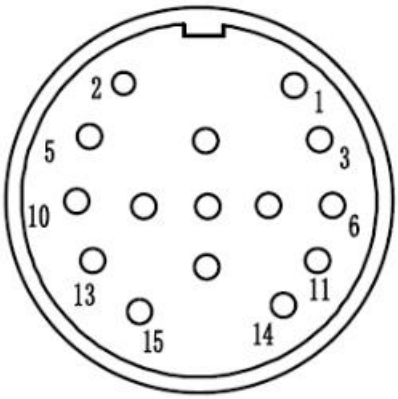


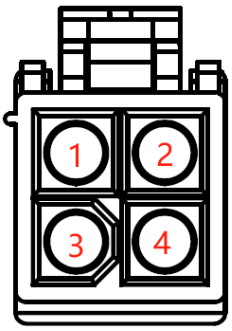
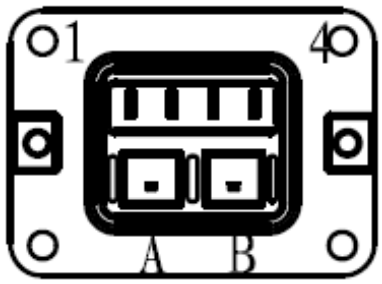

**Note:**

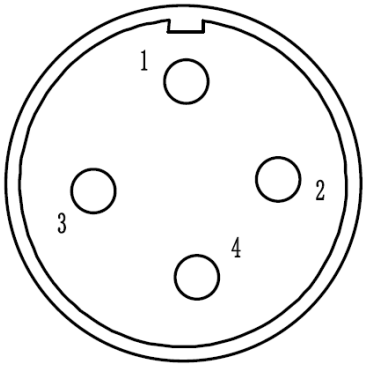
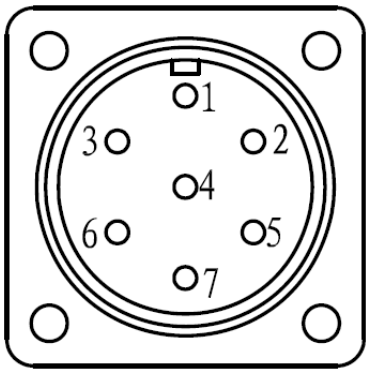
To verify the potential of the signal between drives, connect the GND of each drive.

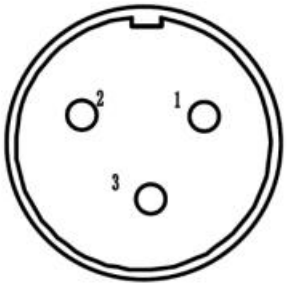
# 3.9 Wiring of Motor-side Connector

| **Definition of motor encoder cable connector** | | | |
|---|---|---|---|
| Motor model | Pins of motor encoder connector | Definition of pins | |
| | | SN | Definition |
| EAM-W series motor leaded connector type motor(flange size: 40)<br>leaded connector type motor(flange size: 60)<br>leaded connector type motor(flange size: 80) |  | 1 | E+ |
| | | 2 | E- |
| | | 3 | PE |
| | | 4 | PS+ |
| | | 5 | PS- |
| | | 6 | - |
| | | 7 | 5V |
| | | 8 | 0V |
| | | 9 | - |
| EAM-W series motor Terminal connector type motor(flange size: 40)<br>Terminal connector type motor (flange size: 60)<br>Terminal connector type motor (flange size:80) |  | SN | Definition |
| | | 1 | PS+ |
| | | 2 | PS- |
| | | 3 | E+ |
| | | 4 | E- |
| | | 5 | 5V |
| | | 6 | 0V |
| | | 7 | PE |
| W series standard motor aviation plug type motor(flange size: 100) | | SN | Definition |
| | | 1 | PE |
| | | 2 | 5V |

| | | | |
|---|---|---|---|
| aviation plug type motor(flange size: 110)<br>aviation plug type motor(flange size: 130)<br>aviation plug type motor(flange size: 180) |  | 3 | 0V |
| | | 4 | - |
| | | 5 | - |
| | | 6 | - |
| | | 7 | - |
| | | 8 | - |
| | | 9 | - |
| | | 10 | PS+ |
| | | 11 | - |
| | | 12 | E+ |
| | | 13 | PS- |
| | | 14 | - |
| | | 15 | E- |

| **Definition of motor power cable connector** | | | |
|---|---|---|---|
| Motor model | Pins of motor connector | Definition of pins | |
| | | SN | Definition |
| EAM-W series motor<br>Leaded connector type motor (flange size: 40)<br>Leaded connector type motor (flange size: 60)<br>Leaded connector type motor (flange size: 80) |  | 1 | U |
| | | 2 | V |
| | | 3 | W |
| | | 4 | PE |
| EAM-W series motor<br>Terminal connector type motor (flange size:40)<br>Terminal connector type motor (flange size:60)<br>Terminal connector type motor (flange size:40)<br>Terminal connector type motor (flange size:80) |  | SN | Definition |
| | | 1 | V |
| | | 2 | U |
| | | 3 | W |
| | | 4 | PE |
| | | A | 24V |
| | | B | 0V |
| EAM-W series motor<br>Aviation plug type motor(flange size: 100)<br>Aviation plug type motor(flange size: 110) | | SN | Definition |
| | | 1 | PE |
| | | 2 | U |

| | | | |
|---|---|---|---|
| Aviation plug type motor(flange size: 130)<br>Aviation plug type motor(flange size: 180) |  | 3 | V |
| | | 4 | W |
| EAM-W series motor with brake<br>Aviation plug type motor(flange size: 100)<br>Aviation plug type motor(flange size: 110)<br>Aviation plug type motor(flange size: 130)<br>Aviation plug type motor(flange size: 180) |  | SN | Definition |
| | | 1 | PE |
| | | 2 | U |
| | | 3 | V |
| | | 4 | W |
| | | 5 | 24V |
| | | 6 | 0V |
| | | 7 | - |

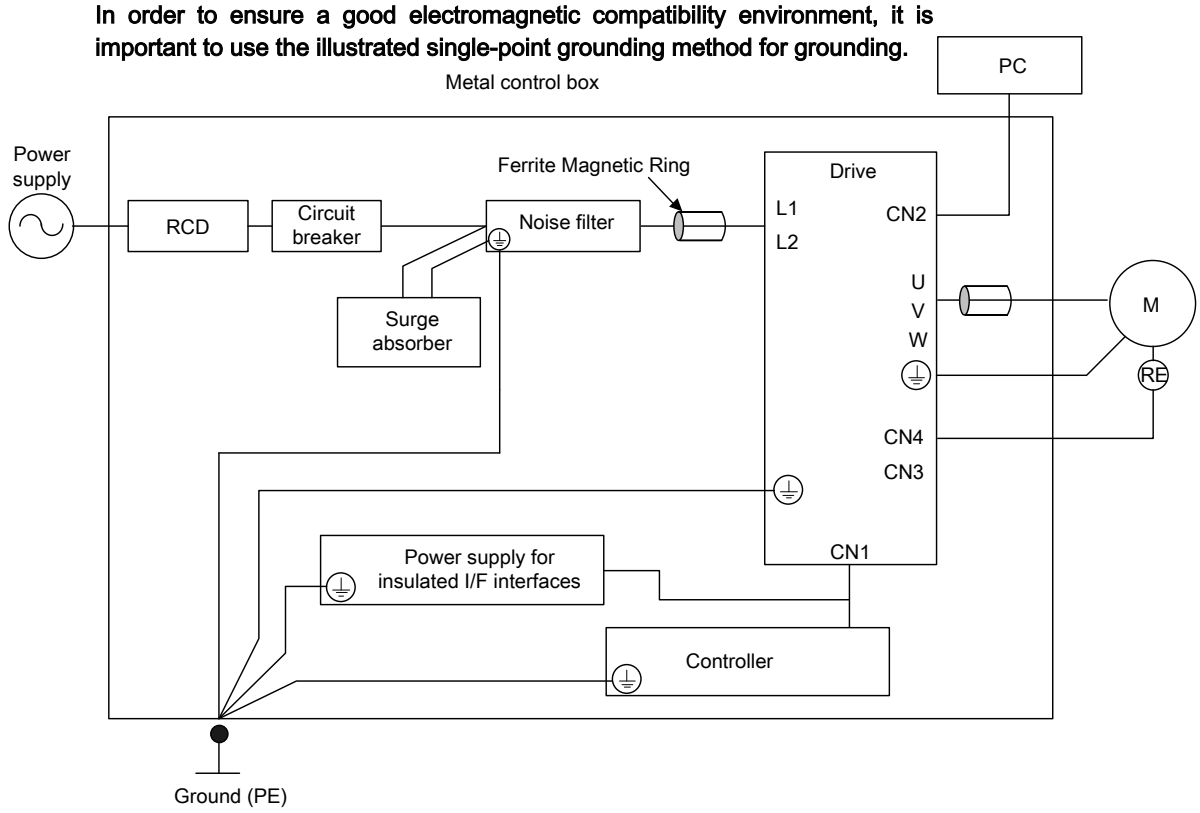
| **Defition of motor brake cable connector** | | | |
|---|---|---|---|
| Motor model | Pins of motor connector | Definition of pins | |
| | | SN | Definition |
| EAM-W series motor<br>Leaded connector type motor (flange size: 40, 60, and 80) |  | 1 | 24V |
| | | 2 | 0V |
| EAM-W series motor<br>Aviation plug type motor (flange size: 100, 110, and 130) |  | SN | Definition |
| | | 1 | 24V |
| | | 2 | 0V |
| | | 3 | - |
| EAM-W series motor with | | SN | Definition |

| | | | |
|---|---|---|---|
| brake<br>Aviation plug type motor (flange size: 180) |  | 1 | 24V |
| | | 2 | 0V |
| | | 3 | / |
| | | 4 | / |

# 3.10 Electromagnetic Interference Suppression

## 3.10.1 Example of Anti-interference Wiring

The main circuit of this servo drive uses "high-speed switching elements". Depending on the peripheral wiring of the servo drive and local processing, it may cause switch noise to affect the normal operation of the system. Therefore, the correct grounding method and local processing must be adopted, and noise filters must be added when necessary.




## 3.10.2 Grounding

To avoid potential electromagnetic interference issues, please ground as follows:

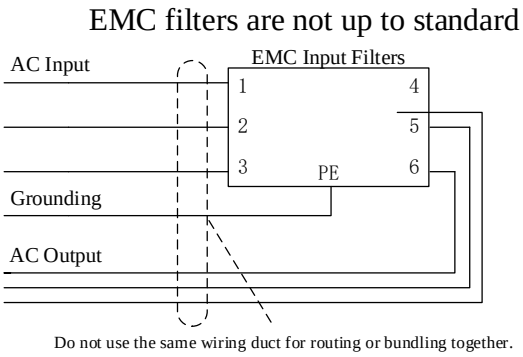
- Ensure that the servo drive is reliably grounded with the grounding cable of the main power supply, and tighten the grounding screws.

- The grounding wire of the controller connected to the servo drive must ultimately connect to the same grounding point as the servo drive's grounding wire.
- Connect the ground of the servo motor to the grounding screw of the servo drive and ensure reliable grounding to reduce potential electromagnetic interference issues.
- Ground the shield metal conduit at both ends of the motor's main circuit. It is recommended to use crimping to ensure a good connection.

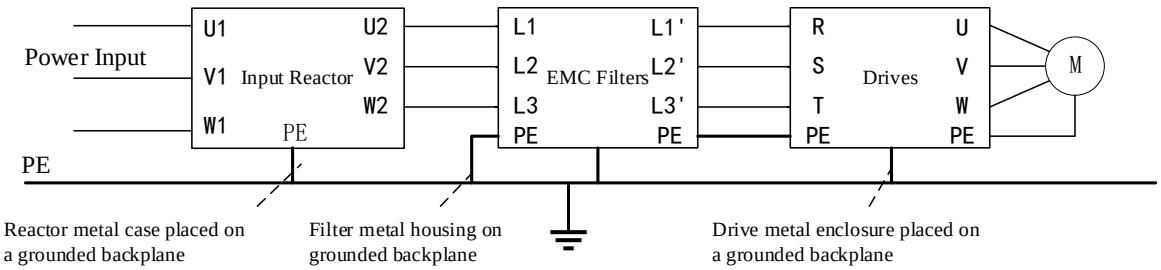
## 3.10.3 How to Use Input Power Filter and Noise Filter

To prevent interference from the power cable, add an EMC filter to the input power cable of the servo drive. Choose an appropriate EMC filter at the power input end based on the input current. When installing and wiring the EMC filter, please observe the following precautions.

- Separate the input and output wiring of the EMC filter and avoid bundling them or placing them in the same cable slot.
- Separate the ground wire of the EMC filter from its output power cable.
- It is recommended to mount the EMC filter on the same metal plate as the servo drive and ensure good electrical contact with the metal plate. Ground the metal plate separately with thick wires as much as possible, and place the filter near the drive as close as possible to prevent coupling noise.
- If multiple Servo Drives are used and a noise filter is to be shared in the power supply section, consult with the noise filter manufacturer.
- When using the same wiring duct for routing, the noise resistance function is reduced. As shown in the figure below:




The AC input reactor and EMC filter installation schematic is shown below:



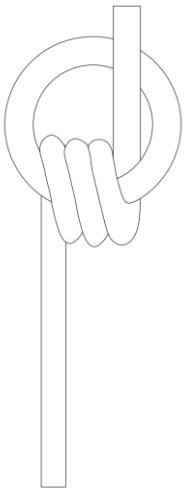

## 3.10.4 Magnetic Rings

To ensure that the magnetic ring is effective in suppressing electromagnetic interference (EMI) at the input and output of the drive, follow the installation guidelines below to fully utilize the magnetic ring:

- The magnetic ring should be mounted on the input or output side of the drive and as close to the drive as possible, up to a maximum of 30cm.

- The number of turns should not be too few or too many when winding the magnetic ring, usually 3 to 5 turns are recommended.
- Ensure that the cable is wrapped evenly and tightly around the magnetic ring, avoiding loose or cross-winding.
- When winding the magnetic ring for the RST cable or UVW cable, make sure that all three wires for RST or all three wires for UVW pass through the ring at the same time. Note that the PE wire (ground wire) should not be wound into the magnetic ring.
- Magnetic rings are fragile. Avoid violent impacts on the rings during use.

The following figure shows an example of winding of a magnetic ring：



## 3.10.5 Other Recommendations for Electromagnetic Interference Suppression

To suppress electromagnetic interference, take the following measures:

- Keep power and control cables separate. It is recommended to maintain a distance of at least 30cm to improve interference resistance.
- If power supply and wires need to cross, ensure they cross at a 90° angle.
- Keep wiring as short as possible to prevent shield interruption and potential signal interference.
- Use thick wires for grounding (2.0mm² or above).
- Ensure single-point grounding.
- Avoid sharing power sources with welding machines, discharge processing equipment, etc.

# 4 Appendix

## 4.1 Compliance with Certifications and Standards

| Certification | Directive Name | | Standard |
|---|---|---|---|
| CE certification | EMC directive | 2014/30/EU | EN IEC 61800-3 |
| | LVD directive | 2014/35/EU | EN 61800-5-1 |

The drive complies with the latest version of directives and standards for CE certifications.

### 4.1.1 CE Certification

- The CE mark indicates compliance with the Low Voltage Directive (LVD), Electromagnetic Compatibility (EMC), and Restriction of Hazardous Substances (RoHS) directives.
- The CE mark is required for engaging in commercial business (production, importation, and distribution) in Europe.
- The drive complies with LVD, EMC, and RoHS directives and carries the CE mark.
- Machines and devices integrated with this drive must also comply with CE requirements for distribution in Europe.
- The integrator who integrates this drive into other products and attaches CE mark to the final assembly has the responsibility of ensuring compliance with CE certification

#### 4.1.1.1 Requirement for Compliance with EMC Directive

The SV660P series servo drive, which is applicable to second environment, complies with EMC Directive 2014/30/EU and standard EN IEC 61800-3. As required by EMC Directive 2014/30/EU and standard EN IEC 61800-3, install an EMC filter on the input side of the drive and use shielded cables on the output side. Ensure the filter is grounded properly and the shield of the output cable is grounded 360 degrees

#### Introduction to EMC standards

Electromagnetic compatibility (EMC) describes the ability of electrical and electronic devices to work properly in the electromagnetic environment without introducing electromagnetic interferences that disturb the operation of other local devices or systems. In other words, EMC includes two aspects: 1) The electromagnetic interference generated by a device during normal operation cannot exceed a certain limit. 2) The device must have sufficient immunity to the electromagnetic interference in the environment.

ENIEC 61800-3 defines the following two types of environments.

- Category I environment: Environment that includes domestic premises, and establishments directly connected without intermediate transformers to a low voltage power supply network which supplies buildings used for domestic purposes.
- Category II environment: Environment that includes all establishments other than those directly connected to a low-voltage power supply network which supplies buildings used for domestic purposes.

Drives are divided into the following four categories based on the intended application environment.

- Category C1 drive: Power drive system (PDS) with rated voltage less than 1000 V, intended for use in the Category I environment

- Category C2 drive: PDS with rated voltage less than 1000 V, which is neither a plug in device nor a movable device and, when used in the Category I environment, is intended to be installed and commissioned only by professionals.
- Category C3 drive: PDS with rated voltage less than 1000 V, intended for use in the Category II environment and not intended for use in the Category I environment.
- Category C4 drive: PDS with rated voltage equal to or above 1000 V, or rated current equal to or above 400 A, or intended for use in complex systems in the Category II environment.

### 4.1.1.2 Requirements for Compliance with LVD

The drive has been tested in accordance with EN61800-5-1 to determine compliance with LVD. Observe the following requirements to enable machines and devices integrated with this drive to comply with LVD.

- Installation location
  Install the drive in a place with overvoltage category III and pollution degree 1 or 2 as specified by IEC 60664-1.
- Installation environment
  For requirements of the installation environment, see Installation Environmental Conditions.
- Protective requirements of installation
  The drive must be installed in a fireproof cabinet with doors that provide effective electrical and mechanical protection. The installation must conform to local and regional laws and regulations and relevant IEC standards. Drives (IP20) intended to be installed inside the cabinet must be installed in a structure that prevents intrusion of unwanted objects from the top and the front.
- Main circuit wiring requirements
  For wiring requirements of main circuit terminals, see Wiring of Main Circuit.
- Requirements of protective devices
  To comply with EN61800-5-1, install a fuse/circuit breaker on the input side of the drive to prevent accidents caused by short circuit in the internal circuit.