HCFA

# Installation and Wiring for SV-X3E Series Servo Drive

# Hardware Instruction

| | |
|---|---|
| Manual Number | HPPD0010000EN |
| Manual Version | V5.0 |
| Date | Oct.2021 |

http://www.hcfa.com.cn

Thank you for purchasing this product.
This manual mainly describes the safety use, installation and wiring for SV-X3E series servo drive.
For more details, please refer to <SV-X3E Series Servo Drive User Manual>.

Confirm the following items when unpacking:

| Number | Name | | Quantity |
|---|---|---|---|
| 1 | Servo drive | | 1 |
| 2 | Accessories | Connecting terminal | 3 |
| | | Cold-pressed terminal | 8 |
| | | Crowbar | 1 |
| | | Straight screwdriver | 1 |
| 3 | Installation and Wiring for SV-X3E Series Servo Drive Hardware Instruction | | 1 |
| 4 | Certificate of Quality | | 1 |

◎Check if there are some damage to the products during transportation. Any
◎questions, please contact the HCFA Technology.

## ▶ Safety precautions

Please pay attention to the flowing safety precautions anywhere and any time during acceptance inspection, installation, wiring, operation and maintenance.

■In this manual, the safety precautions are ranked as "DANGER" and "CAUTION"

⚠DANGER Indicates that incorrect handling may result in death or severe injury.

⚠CAUTION Indicates that incorrect handling may result in medium or slight personal injury or physical damage.

Indicates "Prohibitions"(Indicates what must not be done.)

Indicates "Forced".(Indicates what must be done.)

| ⚠DANGER | | |
|---|---|---|
| Installing and wiring | | |
| ⊘ | Do not connect the motor to the commercial power. | To prevent fire or malfunction. |
| | Do not place the combustibles around the servo motor and drive. | To prevent fire. |
| ❗ | Be sure to protect the drives through the case, and leave specified clearances between the case or other equipment and the drive. | To prevent electric shock, fire or malfunction. |
| | Install it at the place free from excessive dust and dirt, water and oil mist | To prevent electric shock, fire , malfunction or damage |
| | Install the equipment to incombustibles, such as metal. | To prevent fire. |
| | Any person who is involved in wiring and inspection should be fully competent to do the work. | To prevent electric shock. |
| | FG terminal of motor and drive must be grounded. | To prevent electric shock. |
| | Perform the wiring correctly after cut off the breaker. | To prevent electric shock, injury, malfunction or damage |
| | Have the insulation processing when connecting cables. | To prevent electric shock, fire or malfunction. |
| Operation and running | | |
| ⊘ | During operation, never touch the internal parts of the drive. | To prevent burns or electric shock. |
| | The cables should not be damaged, stressed loaded, or pinched. | To prevent electric shock, malfunction or damage. |
| | During operation, never touch the rotating parts of the servo motor. | To prevent injury. |
| | Do not install the equipment under the conditions with water, corrosive and flammable gas. | To prevent fire. |
| ⊘ | Do not use it at the location with great vibration and shock. | To prevent electric shock, injury or fire. |
| | Do not use the servo motor with its cable soaked in oil or water. | To prevent electric shock, malfunction or damage |
| | Operate the switches and wiring with dry hand. | To prevent electric shock, injury or fire. |
| | Do not touch the keyway directly when using the motor with shaft-end keyway | To prevent injury. |
| | Do not touch the motor and drive heat sink, asthey are very hot. | To prevent burns or parts damaged. |
| | Do not drive the motor by external drive. | To prevent fire. |
| Other safety instructions | | |
| ❗ | Confirm the equipment's safety after the earthquake happens. | To prevent electric shock, injury or fire. |
| | Installing and setting correctly to prevent the fire and personal injury when earthquake happens. | To prevent injury, electric shock, fire, malfunction or damage. |
| | Provide an external emergency stop circuit to ensure that operation can be stopped and power switched off immediately. | To prevent injury, electric shock, fire, malfunction or damage. |
| | Before wiring or inspection, turn off the power and wait for 5 minutes or more. | To prevent electric shock. |

| ⚠CAUTION | | |
|---|---|---|
| Installing and wiring | | |
| ❗ | Please follow the specified combination of the motor and drive. | To prevent fire or malfunction. |
| | Do not touch the terminals of connector directly. | To prevent electric shock or malfunction. |
| ❗ | Do not block intake and prevent the foreign matters from entering into the motor and drive. | To prevent electric shock or fire. |
| | Fix the motor and have the test run away from the mechanical system. After confirming the operation, the motor can be securely mounted to mechanical system. | To prevent injury. |
| | The servo motor must be installed in the specified direction. | To prevent injury or malfunction. |
| | Install the equipment correctly in accordance with its weight and rated output. | To prevent injury or malfunction. |
| Operation and running | | |
| ⊘ | Do not climb or stand on servo equipment. Do not put heavy objects on equipment. | To prevent electric shock, injury, fault or damage. |
| | The parameter settings must not be changed excessively. Operation will be instable. | To prevent injury. |
| | When power is restored after an instantaneous power failure, keep away from the machine because the machine may be restarted suddenly (design the machine so that it is secured against hazard if restarted). | To prevent injury. |
| | Keep it away from the direct sunlight. | To prevent malfunction. |
| | Do not put strong impact on the motor, drive and motor shaft. | To prevent malfunction. |
| | The electromagnetic brake on the servo motor is designed to hold the servo motor shaft and should not be used for ordinary braking. | To prevent injury or malfunction. |
| ❗ | Do not install or operate a faulty servo motor or drive. | To prevent injury, electric shock or fire |
| | Check the power specification. | To prevent fault. |
| | The electromagnetic brake may not hold the servo motor shaft. To ensure safety, install a stopper on the machine side. | To prevent injury. |
| | A sudden restart is made if an alarm is reset with the run signal on. | To prevent injury. |
| | Connect the relay for emergency stop and for brake in series. | To prevent injury or malfunction. |
| Transportation and storage | | |
| ⊘ | Do not subject the equipment to the place with rain, waterdrop, poisonous gases or liquids. | To prevent malfunction. |
| | Do not carry the servo motor by the cables, shaft or encoder during transportation. | To prevent injury or malfunction. |
| | Do not drop or dump the motor during transportation and installation. | To prevent injury or malfunction. |
| ❗ | Store the unit in a place in accordance with the instruction manual. | To prevent malfunction. |
| Other safety instructions | | |
| ❗ | Please dispose the battery according to your local laws and regulations. | |
| | When disposing of the product, handle it as industrial waste. | |
| Maintenance and inspection | | |
| ⊘ | Do not disassemble and/or repair the equipment on customer side. | To prevent malfunction. |
| | Do not turn on or switch off the main power frequently. | To prevent malfunction. |
| | Do not touch the servo drive heat sink, regenerative resistor, servo motor etc. Their temperatures may be high while power is on or for some time after power-off. | To prevent burns or electric shock. |
| ❗ | When the drive become faulty, switch off the control circuit and main power. | To prevent fire. |
| | If the servo motor is to be stored for a long time, switch off the power. | To prevent misoperation and injury. |

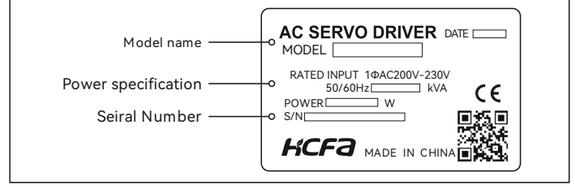


| About maintenance and inspection |
|---|
| < Warranty period><br>The term of warranty for the product is 18 months from the date of manufacture. It's exceptional to brake motors as they are warranted when acceleration /deceleration times is not beyond the specified service life |
| < Warranty coverage ><br>This warranty applies only when the condition, method, environment, etc. of use are in compliance with the terms and conditions and instructions that are stated in the instruction manual and user manual for the Product. However, even during warranty period, the repair cost will be charged on customer in the following cases.<br>1) A failure caused by improper storing or handling, repair and modification.<br>2) A failure caused by the parts which have dropped down or damaged during transportation<br>3) A failure caused when the products have been used beyond the product specification A<br>4) failure caused by external factors such as inevitable accidents, including but not limited to fire, earthquake, lightning stroke, windstorm disaster, flood, salt damage, abnormal fluctuation of voltage and other natural disaster.<br>5) A failure caused by the intrusion of water, oil, metal and other foreign matters.<br>The warranty coverage is only for the product itself. We assume no responsibilities for any losses of opportunity and/or profit incurred by you due to a failure of the product |

# 1.Product introduction and model selection

## ▶ Introduction for drive nameplate

Servo drive nameplate




## ▶ Model name identification

SV-X3E A 075 A 2 2-00000

| Series Name |
|---|
| X2/X3/X6/Y5 |

| Power specifications | |
|---|---|
| 005A | 50w |
| 010A | 100w |
| 020A | 200w |
| 040A | 400w |
| 075A | 750w |
| 100A | 1kw |
| 150A | 1.5kw |
| 200A | 2kw |

| Voltage pecifications | |
|---|---|
| A | AC220v |
| T | AC380V |
| B | AC110v |
| L | DC48V |
| M | DC24V |

| Type | |
|---|---|
| A | Standard type |
| B | EtherCAT type |
| N | CANOpen type |

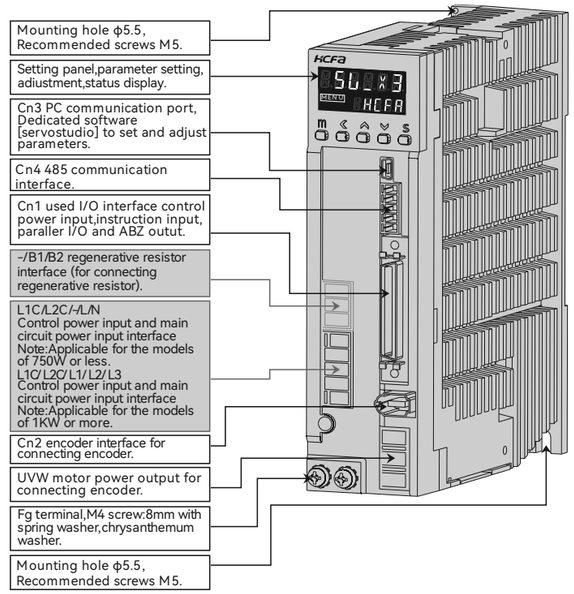
| Software customized mark | |
|---|---|
| 0 | NIA |

| Hardware customized mark | |
|---|---|
| 00 | N/A |
| AO | Analog |
| PG | Encoder |
| Q | Full-closed |

Products updates no

| Control power | |
|---|---|
| A | AC power |
| T | 24V power |

## ▶ Drive parts name




## ▶ Model selection of peripheral braking resistor

| Rated output | 50W | 100W | 200W | 400W | 750W | 1kW | 15kW | 2kW |
|---|---|---|---|---|---|---|---|---|
| Resistance | 40 ~ 50Ω | 40 ~ 50Ω | 40 ~ 50Ω | 40 ~ 50Ω | 40 ~ 50Ω | 30Ω | 30Ω | 20Ω |
| Capacity | 40W | 40W | 40W | 40W | 40W | 50W | 60W | 80W |

# 2. Product specification

## ▶ Servo drive specification

| Items | | | Specification | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Name SV-X3DA □□□A | | | 005 | 010 | 020 | 040 | 075 | 100 | 150 | 200 |
| Applicable motor | | | 50W | 100W | 200W | 400W | 750W | 1kW | 1. 5kW | 2kW |
| Dimension W(mm) | | | 42 | | | 49 | | 84 | | |
| H(mm) | | | 160 | | | 160 | | 160 | | |
| D(mm) | | | 135 | | | 135 | | 135 | | |
| Weight(Kg) | | | 0.7 | | | 0.8 | | 1.6 | | |
| Input powe | Main | Frame A | Single-phase 200~240V±10% 50/60Hz | | | | | | | |
| | | Frame B | Three-phase 200~240V±10% 50/60Hz | | | | | | | |
| | Control power | | Single-phase 200~240V±10% 50/60Hz | | | | | | | |
| Dielectric strength | | | 1 minute at 1500 VAC across the primary and FG | | | | | | | |
| Control type | | | Three-phase PWM inverting sine-wave | | | | | | | |
| Encoder feedback | | | Single-turn absolute 17-bit (multi-turn absolute with battery) | | | | | | | |
| Digital signal | Input | | 9 inputs (24VDC, photo-coupler insulation) Switch by control mode | | | | | | | |
| | output | | 9 outputs (24VDC, photo-coupler insulation, open-collector output) Switch by control mode | | | | | | | |
| Digital signal | Input | | 2 inputs (±10V) Switch by control mode | | | | | | | |
| Pulse signal | Input | | 2 inputs (photo-coupler insulation, RS-422 differential, open-collector) | | | | | | | |
| | output | | 4 outputs (A/B/Z-phase RS-422 differential, Z-phase open collector output) | | | | | | | |
| Commu-nication function | USB | | Connection with PC (with "Servostudio" software) | | | | | | | |
| | RS-485 | | Remote communication(1: n) | | | | | | | |
| Regeneration function | | | External regenerative resistor possible | | | | | | | |
| Dynamic brake | | | Not built-in | | | | | | | |
| Control mode | | | 7 control modes: Position control, speed control, torque control, position/speed control, position/torque control, speed/torque control, fully closed-loop control (optional part needed) | | | | | | | |
| Specifications — Position control | Digital input signals | | Servo ON, alarm reset, deviation counter clear, positive/ negative direction over-travel, internal command selection, homing start etc. | | | | | | | |
| | Digital output signals | | Alarm state, servo ready, brake off, homing complete, position reached, servo state, torque limiting, speed limiting zero-speed output, etc. | | | | | | | |
| | Pulse input | Max input pulse frequency | Differential input: Up to 2Mpps, pulse width larger than 0.25us; Open-collector input: Up to 200Kpps, pulse width larger than 2.5us | | | | | | | |
| | | Input pulse type | Differential input; open-collector | | | | | | | |
| | | Input pulse form | Pulse+ direction, A-Phase + B-Phase, CW+CCW | | | | | | | |
| | | Electronic gear | A/B A: 1~1073741824 B: 1~1073741824, Encoder resolution/10000000 < A/B <Encoder resolution/2.5 | | | | | | | |
| | | Smoothing | Smoothing filter, FIR filter. | | | | | | | |
| | Pulse output | Output pulse form | A-Phase, B-Phase: Differential output Z-Phase: Differential output or open collector output | | | | | | | |
| | | Division ratio | Arbitrary frequency division. | | | | | | | |
| | | Output pulse | Encoder pulse or position Pulse instruction(can be set). | | | | | | | |
| Speed control | Digital input signals | | Servo ON, alarm reset, speed instruction negation, zero-speed clamp, internal speed control, external forward/ reverse torque limit etc. | | | | | | | |
| | Digital output signals | | Alarm state, servo ready, brake off, speed reached, torque limiting, speed limiting, zero-speed output, etc. | | | | | | | |
| | Analog input | Speed input | Input voltage -10V to +10V (Maximum speed at ±10V). | | | | | | | |
| | | Torque limit source | 1) Internal torque limit by P03.09, P03.10<br>2) External torque limit by P03.11, P03.12 enabled by P_CL/ N_CL signals<br>3) TLMTP i.e. AI1 or AI2 as external forward/reverse torque limit<br>4) TLMTP as forward limit; TLMTN as reverse limit | | | | | | | |
| | | Torque feedforward | 1) Internal torque feedforward<br>2) TFFD, AI1 or AI2 | | | | | | | |
| Torque control | Digital input signals | | Servo ON, alarm reset, torque instruction negation, zero-speed clamp etc. | | | | | | | |
| | Digital output signals | | Alarm state, servo ready, brake off, speed reached, torque limiting etc. | | | | | | | |
| | Analog input | Torque input | DC±10V as to rated torque(adjustable by function codes) | | | | | | | |
| | Speed limit | | 1) Positive/ negative speed limit P03.27, P03.28<br>2) SPL i.e. AI input | | | | | | | |

| Items | | | Specification |
|---|---|---|---|
| Functions | Common | Speed monitoring | Provided |
| | | Vibration control | Provided |
| | | Adaptive notch filter | Provided |
| | | Auto-tuning | Provided |
| | | Encoder output division and multiplication | Provided |
| | | Internal position control | Provided |
| | | PC setting | Servostudio software |
| | | Protective functions | Overvoltage, power supply error, overcurrent, overheat, overload, encoder error, over speed, position deviation too large, parameter error |
| Environmental specifications | Temperature | Ambient temperature for use | 0~55℃ |
| | | Ambient temperature for storage | -20~65℃ |
| | Humidity | Ambient humidity for use | 20~85% RH or less (Without condensation) |
| | | Ambient humidity for storage | 20~85% RH or less (Without condensation) |
| | Atmosphere for use & storage | | Indoors (Not subject to direct sunlight); free from corrosive gas, flammable gas, oil mist, or dust. |
| | Altitude | | 1000m or less above sea level |
| | Vibration | | 5.8m/s2 (0.6G) or less, 10~60Hz (No continuous operation allowed at frequency of resonance) |

Note 1) The installation of regenerative resistor is decided by setting panel. For details, refer to 「selection of external regenerative resistors」. Please select the resistor with higher resistance and power when the temperature is too high.
Note 2) For input pulse forms, refer to the User Manual.

## 3. Installation and size of servo motor and drive

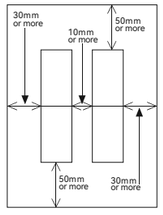
### Installation environment conditions

About the environmental conditions, make sure to follow the company's instructions. If you need to use the product outside the scope of the environmental conditions, please consult HCFA Corporation in advance.

1. Keep it away from the direct sunlight.
2. Drive must be installed in the cabinet.
3. Keep it away from the water, oil (cutting oil, oil mist) and moisture.
4. Do not install the equipment under the conditions with water, corrosive and flammable gas.
5. Free from the dust, iron powder, cutting powder and so on.
6. Keep it away from the area with high temperature, excessive vibration and shock.

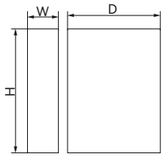
### Installation direction and space

Leave sufficient space around the drive to ensure the heat dissipation and convection in the cabinet when installing the drive.




- Install the drives in the vertical direction. Please use two M5 screws to fix the drive of 750W or less respectively. Use three M5 screws to fix the drive and master drive of 1kW or more respectively.
- In order to ensure that surrounding temperature between internal boards is not more than 55℃, cooling fan or cooler is needed to reduce the temperature, when the drives are installed in the sealed cabinet.
- The temperature on the surface of cooling plate would be 30℃higher than the surrounding temperature.
- Use heat-resistant material for the wiring and isolate wiring from the achine and other cables which are easily affected by the temperature. The service life of servo drive depends on the temperature around t he electrolytic capacitor. When the electrolytic capacitor is close to the service life, the static capacity will decrease and internal resistance will increase. Consequently, it will lead to overvoltage alarm, malfunction caused by noise and components damage.
- The s ervice life of electrolytic capacitor is approx. 5 to 6 years under the condition 「average annual temperature 30℃, load rate 80% and operation of less than 20 hours a day on average」.

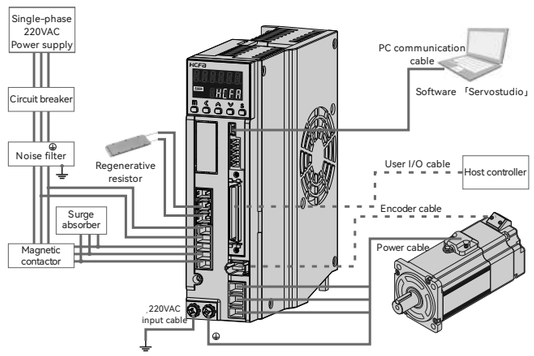
### Drive dimension




| ModelSV-X3DA□□□A | Dimension W(mm) | H(mm) | D(mm) | Weight (kg) |
|---|---|---|---|---|
| 005 010 020 | 42 | 160 | 135 | 0.7 |
| 040 075 | 49 | 160 | 135 | 08 |
| 100 150 200 | 84 | 160 | 135 | 16 |

## 4. Wiring explanation for servo motor and drive

### Wiring diagram




[Points for correct wiring]

※ Control power input (L1C, L2C) and main circuit power supply (L, N or L1, L2, L3) should be wired from the same 200VAC main power supply.
※ A twisted-pair shielded cable should be used when I/O cable length is over 50cm.
※ The encoder cable should be less than 20m.

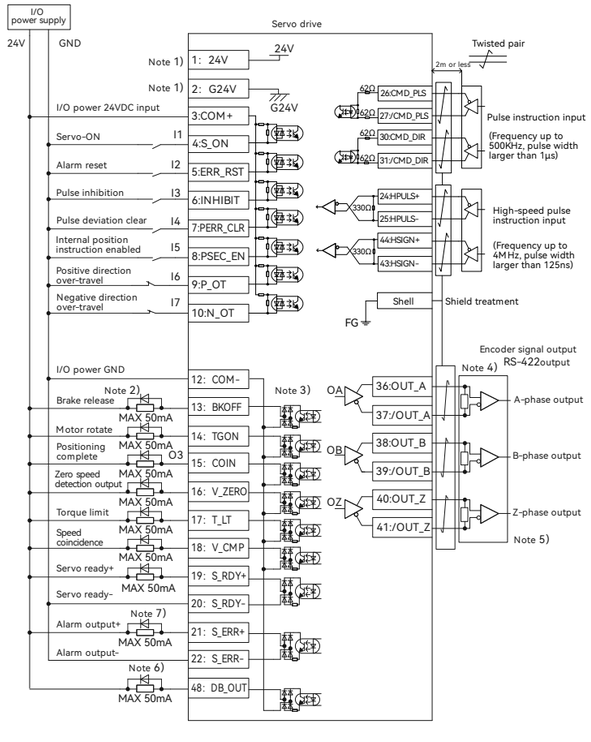
Caution

① Please note that there is high voltage in the solid line of wiring diagram when wiring and using.
② The broken lines in the wiring diagram indicates the non-dangerous voltage circuit.

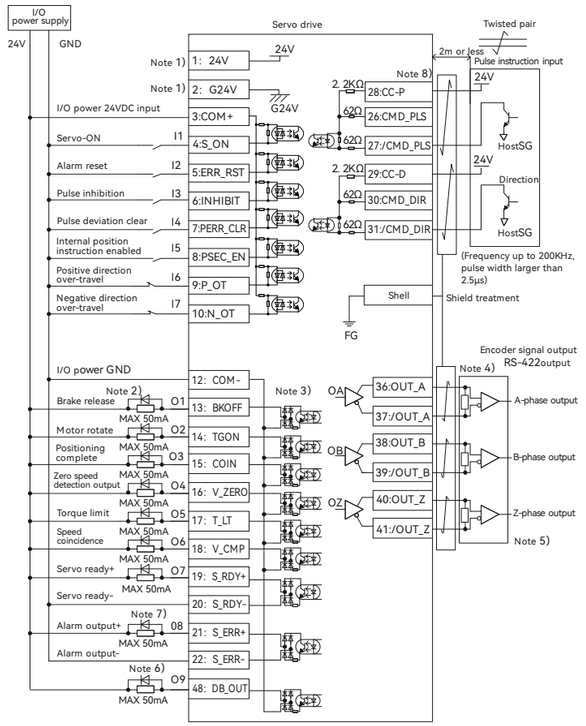
## 5. Wiring

### Wiring for user I/O connector (CN1)

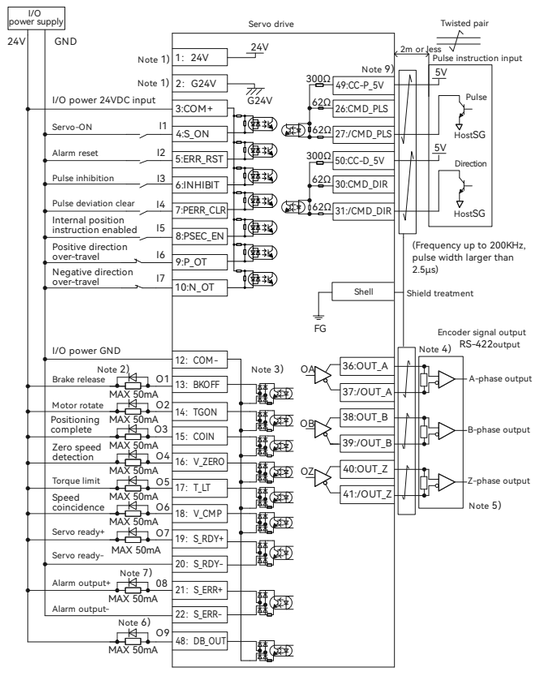
#### Pulse instruction differential input




#### Pulse instruction 24V open collector input

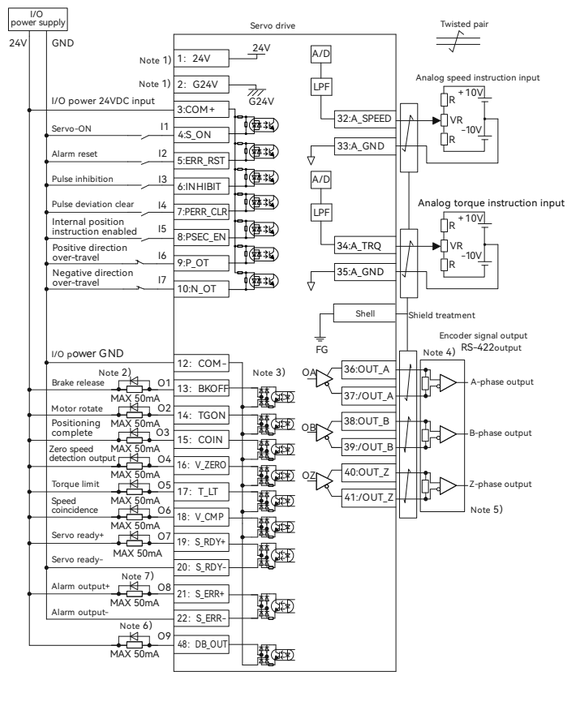



#### Pulse instruction 5V open collector input






#### Analog instruction input




Note 1: Control power output (24V, G24V) can be used as I/O power (COM+, COM-). But the maximum output current is 150mA, and when driving the output such as relay and brake, please use external independent power.
Note 2: Please connect protective circuit (diode) when driving load with inductive component such as relay.
Note 3: The output circuit is the transistor output mode of the Darlington-connected method of the collector open circuit, which is connected with relay or optocoupler. Please don't connect transistor directly because the voltage VCE (SAT) between collector and emitter is about 1V which cannot meet the required voltage VIL of TTL IC when transistor is ON.
Note 4: The differential pulse output and 485 communication circuits need to connect the terminal resistor.
Note 5: Connect the signal ground on the host control device of output signal of the encoder. The connection of signal ground and power supply GND may cause malfunction.
Note 6: O9 does not configure any functions by default, but can be used as the DO output and the OC output of Z-pulse. In this case, do not configure any DO function to O9 that is P04. 29 is set to 0, and P04. 54 is set to 1.
Note 7: The default function of O8 is the fault output, and the default output logic state is normally closed output.
Note8: Two types according to the pulse generation method :NPN and PNP.
Note9: Two types according to the pulse generation method :NPN and PNP.

※ DI function can be configured by function code flexibly. DI becomes valid when connected and the positive/ negative logic can be changed by function code.
※ DO function can be configured by function code flexibly. DO becomes valid when connected and the positive/ negative logic can be changed by function code.

### Description of User I/O connector (CN1) terminal arrangements

Terminal arrangements

| | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 CMD_PLS | 28 CC-P | 30 CMD_DIR | 32 A_SPEED | 34 A_TRQ | 36 OUT_A | 38 OUT_B | 40 OUT_Z | 42 SG | 44 HSIGN+ | 46 G24 | 48 O9 | 50 CC-D_5V | | | | | | | | | | | | |
| | 27 /CMD_PLS | 29 CC-D | 31 /CMD_DIR | 33 A_GND | 35 A_GND | 37 OUT_/A | 39 OUT_/B | 41 OUT_/Z | 43 HSIGN- | 45 SG | 47 I9 | 49 CC-P_5V | | | | | | | | | | | | |
| 1 VCC | 3 COM1 | 5 I2 | 7 I4 | 9 I6 | 11 I8 | 13 O1 | 15 O3 | 17 O5 | 19 07+ | 21 08+ | 23 | 25 HPULS- | | | | | | | | | | | | |
| | 2 G24 | 4 I1 | 6 I3 | 8 I5 | 10 I7 | 12 COM2 | 14 O2 | 16 O4 | 18 O6 | 20 07- | 22 08- | 24 HPULS+ | | | | | | | | | | | | |

Connector