



VER 1.0

# Technical Manual

**DS-OLF2-FPD**



## Product Warranty

- If a malfunction occurs within one year of purchasing this product due to reasons other than improper operation, you can send the faulty product back to our company via courier or logistics, and you will enjoy free repair service. Repairs usually take several working days, so please understand.
- If a malfunction occurs due to improper operation or after one year of purchase, repair fees will be charged. You can send the faulty product back to our company via courier or logistics as stated above. Repairs usually take several working days.
- If this product is used in a critically important system, please consider purchasing a spare to ensure system stability.
- Our company is not responsible for any damage caused during transportation if you send the product back to us for repair. Please ensure that sufficient cushioning material is included in the packaging before shipping the product and avoid excessive vibration (less than 0.5G).
- The following services are not included in the product price
  - A) Review and judgment of system compatibility (during design)
  - B) Trial operation and adjustment (the original motor cannot be returned if it needs adjustment)
  - C) On-site fault diagnosis and repair

## Usage Precautions

- Please use this product within the specified ratings and in the environment stated in this manual.
- This product is not designed or manufactured for use in life-critical situations or environments. If you need to purchase this product for special purposes, please notify our sales staff for discussion and confirmation.
- We strive for higher quality and customer trust, but please consider multiple backup designs, fire safety designs, and malfunction prevention designs to avoid personal injury, fire accidents, and other societal damage due to system design failures.
- The specifications of this product may change without prior notice to improve its features.

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# 1. Product Overview

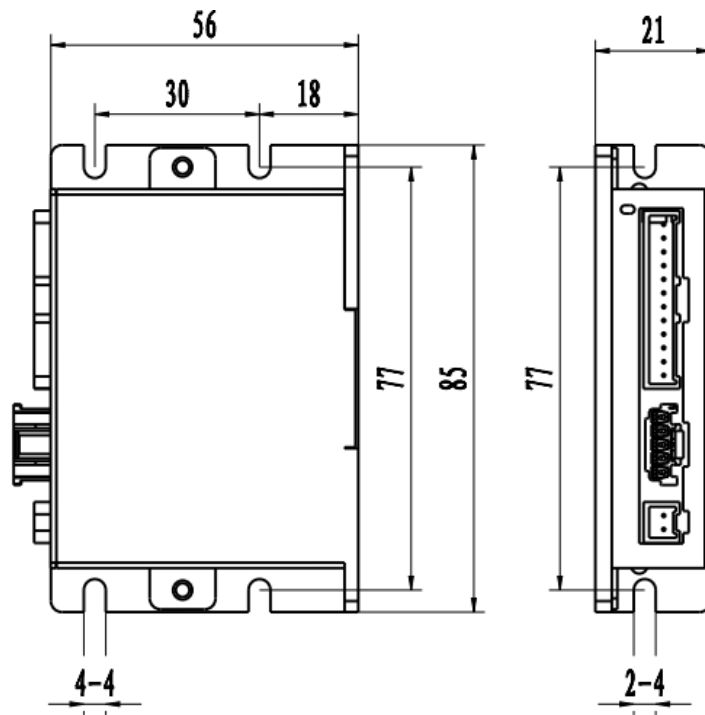
## 1.1 Features

- Input Power : DC 24V - 48V
- Maximum Output Phase Current (peak) : 2.4A
- Eight current selections
- Thirty-two subdivision selections
- Single/dual pulse selection
- Optocoupler input function, 5VDC input
- Compact design, low noise, low vibration

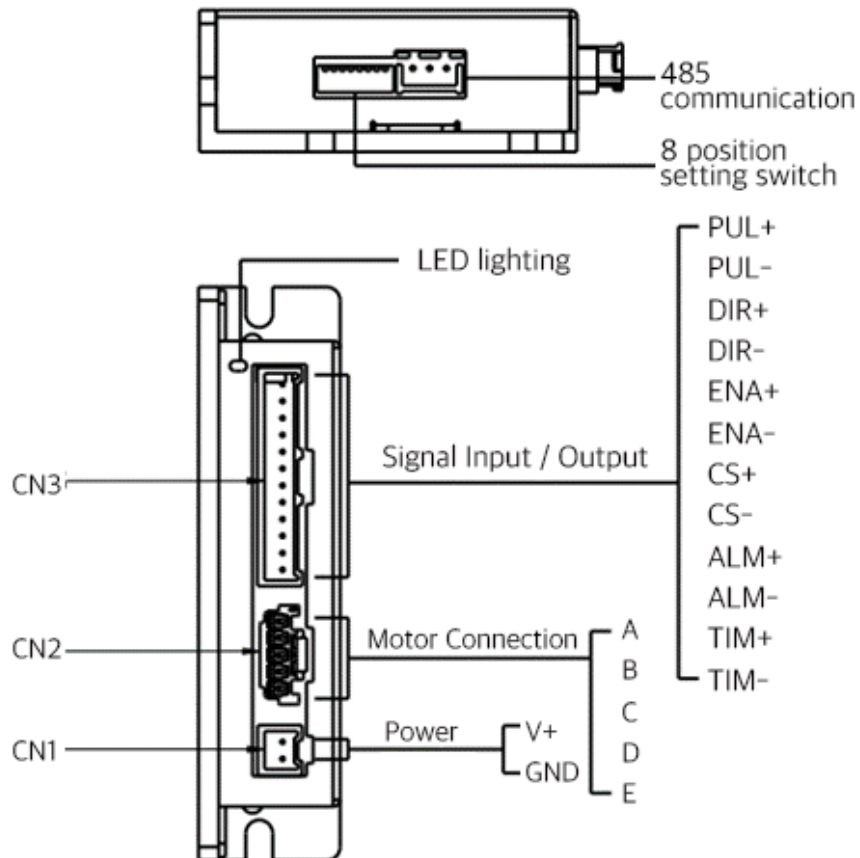
## 1.2 Parameter

Driver Model		DS-OLF2-FPD
Compatible Motor		Five-phase hybrid stepper motor
Power Supply		24 - 48V DC
Output Current		0.20A-2.4A/phase (peak)
Pulse Signal Frequency		MAX 500KHz
Pulse and Direction Signal Width		MIN 1 $\mu$ s
Overvoltage Protection		DC 52V
Undervoltage Protection		DC 18V
Initialization Time		2 sec
Input Signal	Pulse Signal	Optocoupler input voltage H = 3.5 5V, L = 0 0.8V Conduction Current: 5-8mA
	Offline Signal	
	Direction Signal	
	Chip Select Signal	
Output Signal	Alarm Output	Photoelectric isolation output, maximum withstand voltage 30VDC, maximum saturation current 10mA
	TIM Signal	
Dimensions (excluding terminals)		85× 21 × 56 mm
Weight (excluding terminals)		About 96 g
Operating Environment	Usage environment	Avoid dust, oil mist, and corrosive gases
	Humidity	< 85 % RH, no condensation
	Temperature	0°C - +40°C
	Cooling	Install in a ventilated environment

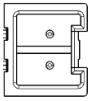
### 1.3 Dimension Drawings (mm)



## 2. Schematic and Interface Definition




## 2.1 Power Interface Definition CN1 (Power)

Terminal number	Diagram	Pin.	Name signal
CN1		1	Power VCC
		2	Power GND

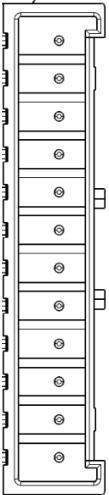
Note 1: The power input terminal uses a 2.5-2PIN connector. Please connect the power correctly and pay attention to the polarity of the power supply. (For specific wiring methods, see [9. Wiring Requirements])

## 2.2 Motor Interface Definition CN2 (Motor)

Terminal number	Diagram	Pin.	Name signal
CN2		1	Motor A
		2	Motor B
		3	Motor C
		4	Motor D
		5	Motor E

Note 2: The motor output terminal uses a 2.5-5PIN connector. Please wire it correctly. (For specific wiring methods, see [8. Motor Connection]).

## 2.3 Signal Input / Output Interface Definition CN3 (Signal Input/Output)

Terminal number	Diagram	Pin.	Name signal
CN3		1	Pulse signal PUL+
		2	Pulse signal PUL-
		3	Direction signal DIR+
		4	Direction signal DIR-
		5	Offline signal ENA+
		6	Offline signal ENA-
		7	Chip selection signal CS+
		8	Chip selection signal CS-
		9	Alarm output ALM+
		10	Alarm output ALM-
		11	Excitation origin TIM+
		12	Excitation origin TIM-

\*Note 3: The signal input and output terminal uses a 2.5-12PIN connector. Please wire it correctly. (For specific wiring methods, see [9. Wiring Requirements])

## 3. Setting Switches



### 3.1 Subdivision Settings

DIP switch				Pulses / Revolution	
SW1	SW2	SW3	SW4	CS : OFF	CS : ON
ON	ON	ON	ON	500	200
ON	ON	ON	OFF	1000	400
ON	ON	OFF	ON	1250	800
ON	ON	OFF	OFF	2000	1000
ON	OFF	ON	ON	2500	1600
ON	OFF	ON	OFF	4000	2000
ON	OFF	OFF	ON	5000	3200
ON	OFF	OFF	OFF	10000	5000
OFF	ON	ON	ON	12500	6400
OFF	ON	ON	OFF	20000	10000
OFF	ON	OFF	ON	25000	12800
OFF	ON	OFF	OFF	40000	20000
OFF	OFF	ON	ON	50000	25000
OFF	OFF	ON	OFF	62500	25600
OFF	OFF	OFF	ON	100000	50000
OFF	OFF	OFF	OFF	125000	51200

### 3.2 Operating Mode (CW/CCW)

SW5	Operation mode
ON	Double pulse
OFF	Pulse + Direction

1) Pulse + Direction: In this mode, the motor rotates in one direction when pulses are input to the pulse input terminal and the direction input terminal's optocoupler is not conducting. It rotates in the opposite direction when the direction input terminal's optocoupler is conducting.

- 2) Double Pulse: In this mode, the motor rotates in one direction when pulses are added to the pulse input terminal, and in the opposite direction when pulses are added to the direction input terminal.
- 3) Self-test function: SW5 is repurposed for the self-test function. The trigger condition is as follows: After powering on, if the dip switch changes from "ON" to "OFF" under half-current status, then back to "ON" after 100ms, the motor rotates back and forth at 1 revolution per second for 1 cycle. There is a 1-second pause for direction change, and then it repeats. Setting the switch to "OFF" disables this feature.

### 3.3 Current Setting

Dip Switch			DS-OLF2-FPD
SW6	SW7	SW8	Phase current (peak)/phase
ON	ON	ON	0.20A
ON	ON	OFF	0.35A
ON	OFF	ON	0.70A
ON	OFF	OFF	0.90A
OFF	ON	ON	1.20A
OFF	ON	OFF	1.40A
OFF	OFF	ON	1.80A
OFF	OFF	OFF	2.40A

- 1) The currents mentioned in this manual are phase currents, applicable only for ring-type connections. For other types of connections, adhere to actual conditions.
- 2) Idle current: In open-loop mode, 500 milliseconds after no pulse input, the driver automatically reduces the current to 30% of the set current to reduce motor heating. When a pulse input is received, the current returns to the set value.

### 3.4 Indicator Light Functions

This product has two surface-mount indicator lights, red and green, showing the status.

#### (1) Status Display

Method: Perform the corresponding number of flashes (0.5 seconds low, 0.5 seconds high) for different states, maintain high for 2 seconds, then recycle.

Status function	Indicator light status	Communication code	Explain
Enable Disconnected	Green light flashes	1	Disabled, drive offline, motor can run freely
Motor Stopped	Green light flashes	2	Enable, no pulse input, motor phase-locked, not running



Motor Running	Green light steady	3	Pulse input present, motor running
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## (2) Alarm Display

Method: Perform the corresponding number of flashes (0.5 seconds low, 0.5 seconds high) for different states, maintain high for 2 seconds, then recycle.

Status function	Indicator light status	Communication code	Explain
Motor overcurrent	1 Green + 1 Red	10	Motor phase current overcurrent or driver fault
Motor Disconnected	1 Green + 2 Red	11	Motor not connected
Undervoltage	1 Green + 3 Red	14	Power input greater than 52V
Overvoltage	1 Green + 4 Red	13	Power input less than 18V
Other Faults	1 Green + 5 Red	Other	

## 4. Power Supply

### 4.1 Voltage

The chopper driver continuously changes the magnitude and direction of the motor winding terminal voltage during operation, while detecting the current to obtain accurate phase current. If both high efficiency and low noise are to be ensured, the driver supply voltage should be at least 5 times the rated phase voltage of the motor (the rated phase current of the motor × Phase resistance).

If you need the motor to achieve better high-speed performance, you need to increase the driver supply voltage.

If using a regulated power supply, it is required that the power supply voltage should not exceed 48V. If using a non regulated power supply, the voltage must not exceed 34V.

Because the rated current of non regulated power supply is full load current. When the load is very light, such as when the motor is not running, the actual voltage can reach 1.4 times the rated voltage of the power supply. If you want the motor to run smoothly and quietly, choose low voltage

### 4.2 Current

The maximum power supply current should be the sum of the two phase currents. Usually, the current you need depends on the motor model, voltage, speed, and load conditions. The actual power supply current value is significantly lower than this maximum current value because the driver uses a switching amplifier to convert high voltage and low current into low voltage and high current. The more the power supply voltage exceeds the motor voltage, the less power supply current is required.

### 4.3 Regenerative Discharge

When the motor slows down, it converts the kinetic energy of the load into electrical energy like a generator. Some energy will be consumed by the driver and motor. If your application has a large load running at high speed, a considerable amount of kinetic energy will be converted into electrical energy. It is easy to cause driver alarms (overvoltage) and may even cause damage to the driver.

## 5. Signal Input

### 5.1 Pulse Signal : PUL

The driver's port contains an optocoupler that can accept a 5VDC single-ended or differential signal. The transition from off to on is interpreted as receiving a valid pulse edge command. For common anode configuration, low level is active (common cathode is high level active); the driver then drives the motor to step according to the timing. For normal operation of the driver, the duty cycle of the effective level signal should be below 50%. To ensure reliable response of the pulse signal, the duration of the effective level of the subdivided driver should not be less than 1 $\mu$ s. The signal response frequency of the subdivided driver is 500KHz, and higher input frequencies may result in incorrect responses.

### 5.2 Direction Signal : DIR

Can accept a 5VDC single-ended or differential signal. The internal optocoupler's on/off state is interpreted as two directions of motor operation, and a change in the direction signal will cause the motor's direction of operation to change. The terminal floating is considered as inputting a high level. Note that the subdivided driver should ensure that the direction signal is established at least 10 $\mu$ s before the pulse signal to avoid incorrect responses from the driver. When changing direction, ensure the motor decelerates to a stop and reaches the starting frequency before changing direction. The direction signal must change after the last PUL pulse of the previous direction signal and before the first PUL pulse of the next direction.

### 5.3 Offline Signal : ENA

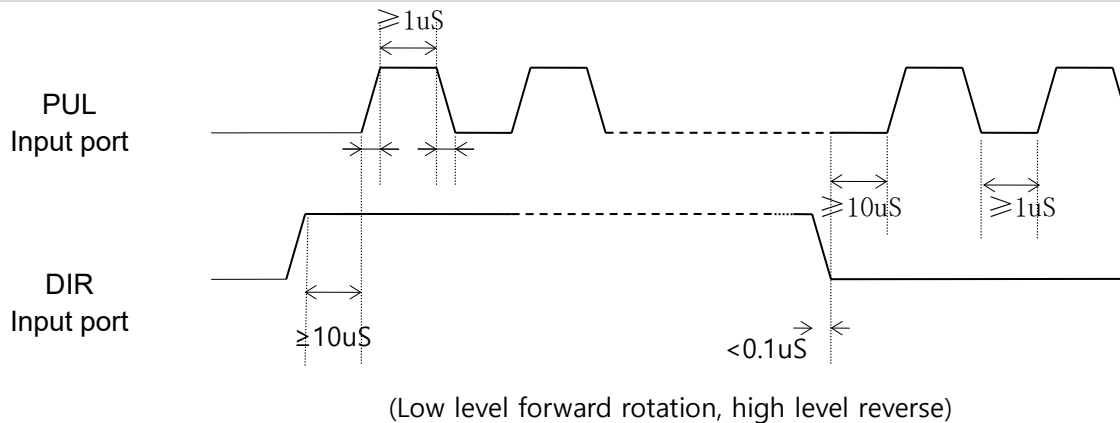
Can accept a 5VDC single-ended or differential signal. When the built-in optocoupler is conducting, the phase current of the motor is cut off, and the rotor is in a free state (offline). When this function is not needed, the offline signal terminal can be left floating.

### 5.4 Select Signal : CS

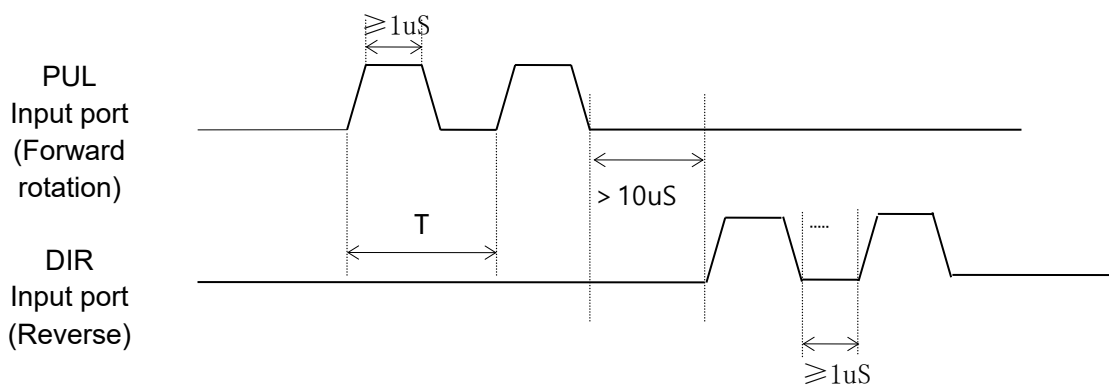
Can accept a 5VDC single-ended or differential signal. The chip select signal CS controls the on/off of the built-in optocoupler for subdivision switching. When using the CS input signal for subdivision switching, ensure that the TIM output is ON and the motor is stopped. Otherwise, even if the motor rotates 0.72°, the TIM signal may still output as OFF.

## 5.5 Pulse / Direction Input Timing Diagram

### Input signal waveform and timing (single pulse mode)



### Input signal waveform and timing (dual pulse mode)



## 6. Signal Output

Two-way output signals, using photoelectric isolation output, can withstand a maximum voltage of 30VDC and a maximum saturation current of 10mA.

### 6.1 Alarm Output: ALM

The ALM output is normally closed. In the event of an ALARM, the ALM output will switch to OFF, and the motor will be de-energized. At the same time, the driver's PWR/ALM LED will flash red.

### 6.2 Excitation Origin Output: TIM

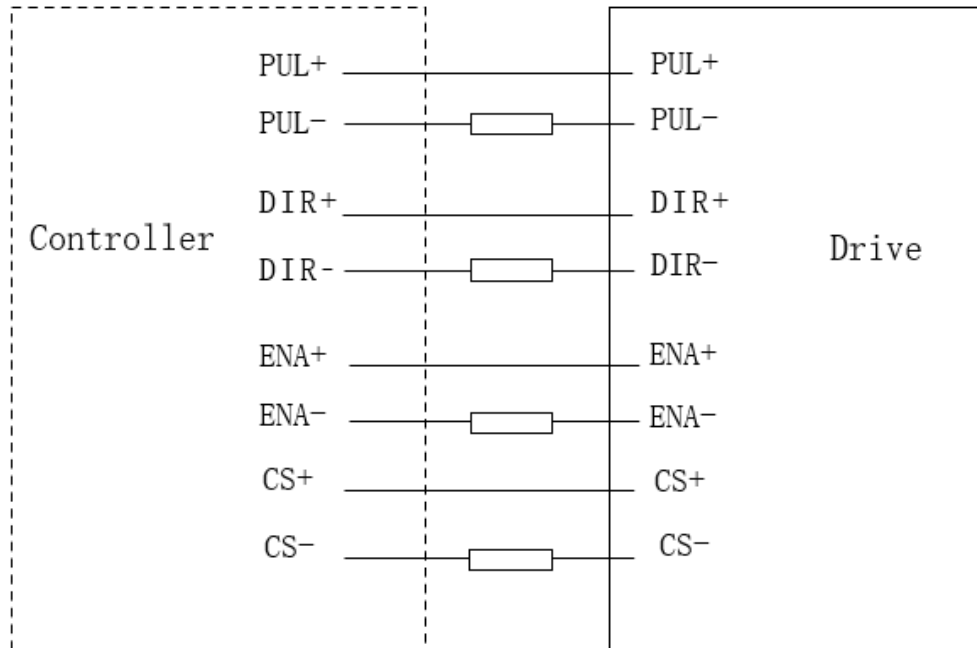
The TIM output signal synchronizes with the motor's rotational angle. For every 7.2° rotation of the motor output shaft, the motor's excitation state returns to the excitation home, and the TIM outputs an ON signal once. If the input pulse count is set to an integer multiple of 7.2°, it is easy to detect the TIM output signal, thereby confirming that the driver is operating normally.

When using the TIM output signal, set the motor rotation pulse count to an integer multiple of 7.2°.

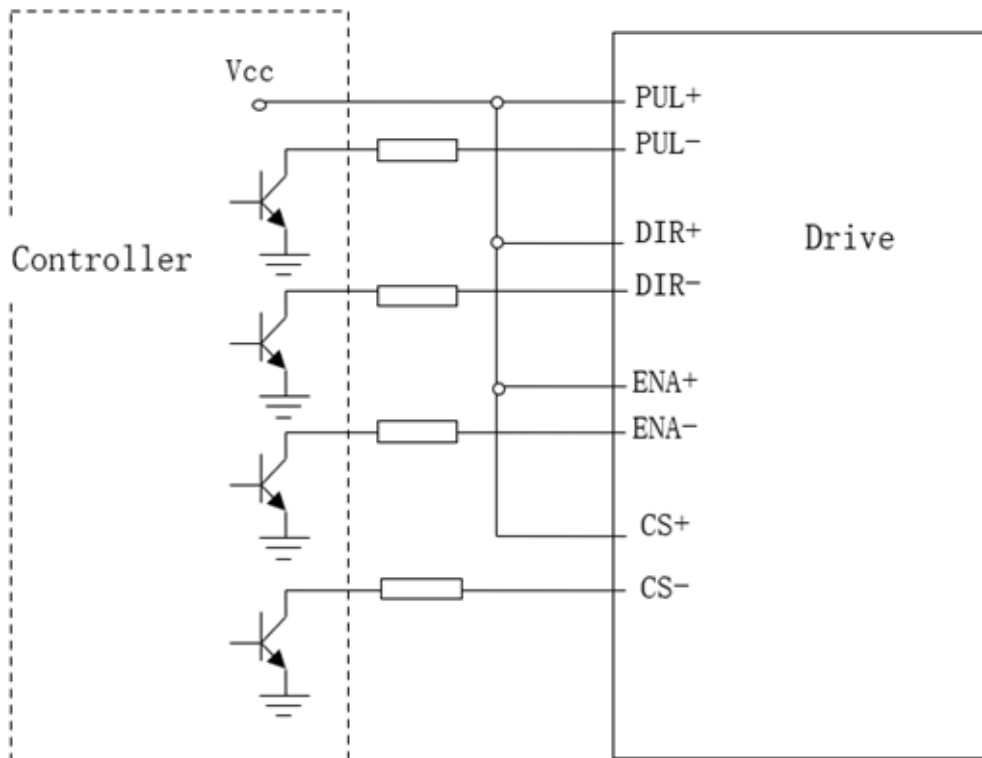
## 7. Typical Signal Connection Method

### 7.1 Signal Input Circuit

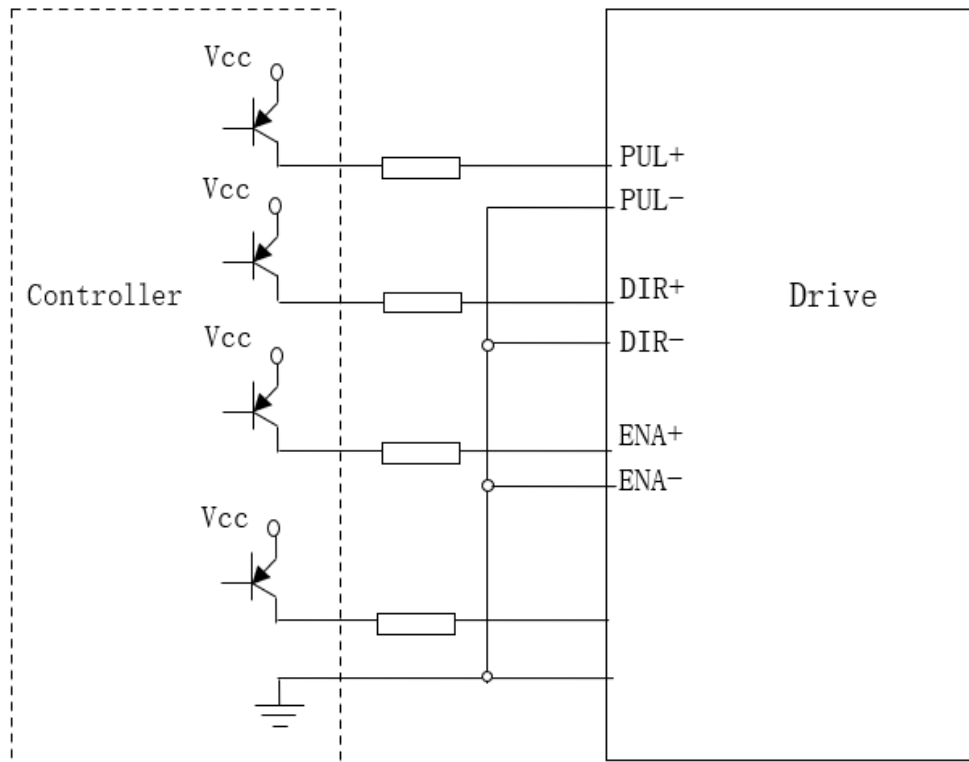
#### (1) Differential connection method



#### (2) Common positive connection method

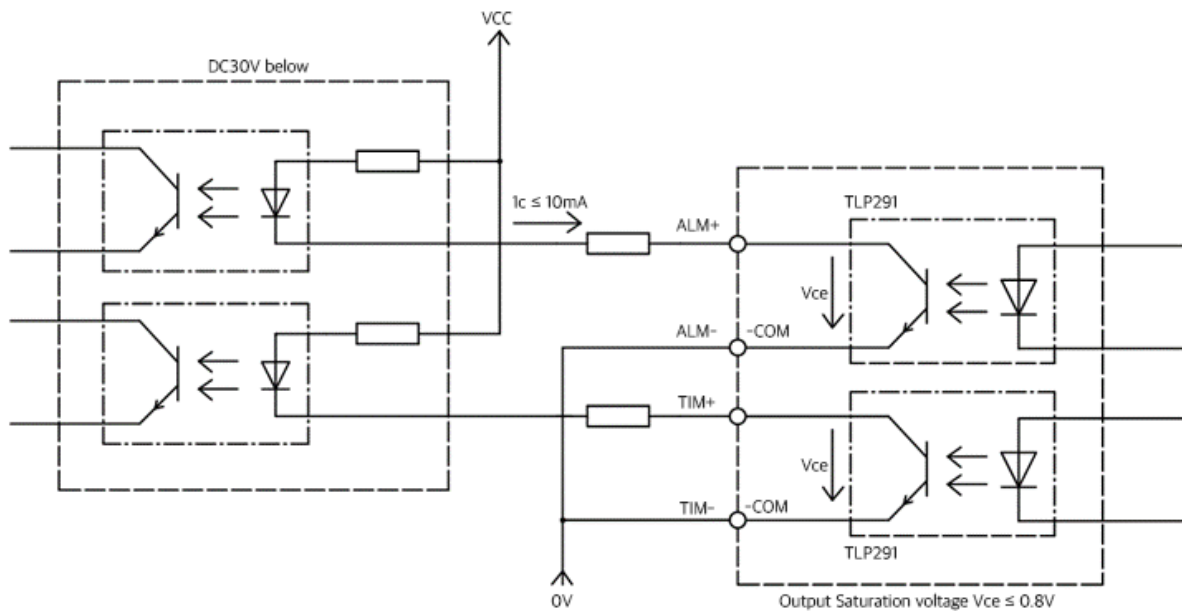


**(3) Common negative connection method**



Note : VCC 3.5-5 VDC R =0Ω      VCC 12VDC R =1KΩ      VCC 24VDC R =2.2KΩ

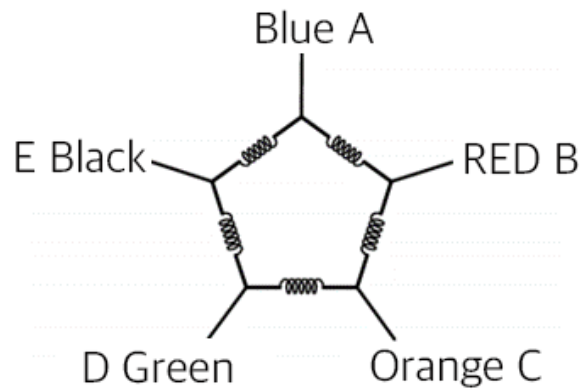
**7.2 Signal Output Circuit**



- The alarm output uses photoelectric isolation, can withstand a maximum voltage of 30VDC, and a maximum saturation current of 10mA.
- Under normal operation, the output is closed.
- When there is an error in the driver, the output is left floating.

## 8. Motor Connection

When connecting the motor to the driver, ensure the driver's power is turned off first. Ensure that any unused motor leads are not short-circuited with other objects. Do not disconnect the motor during the power phase of the driver.



Five-phase motor ring wiring diagram

- (1) Ensure correct motor connection to prevent damage to the driver.
- (2) Typically, five-phase motor wiring colors are: A-blue, B-red, C-orange, D-green, E-black.
- (3) This driver can only drive five-phase hybrid stepper motors, not other types of stepper motors.
- (4) Current specifications in this manual are phase currents, applicable only for ring-type connections. Other connection methods should be adjusted according to actual situations.
- (5) Motor connection wire colors are for general guidance and should be referenced against the motor's specification manual.

## 9. Wiring Requirements

- (1) Correctly connect the power supply and motor, paying attention to the polarity of the power supply.
- (2) When stripping wires, do not pre-solder the tips as it might lead to improper connections.
- (3) To prevent interference with the driver, use shielded control signal cables, and short the shielding layer with the ground. Except for special requirements, shield the control signal cable on one end only: ground the control end of the shield at the host machine, and leave the driver end floating. Within the same machine, grounding should only occur at one point to avoid severe interference; otherwise, do not connect the shielding layer.
- (4) Pulse and direction signal wires should not be bundled together with motor wires; maintain a distance of at least 10 cm to prevent motor noise from interfering with pulse direction signals, leading to inaccurate motor positioning and system instability.

- (5) If one power source supplies multiple drivers, use a parallel connection at the power source. Do not connect in a daisy-chain fashion from one unit to another.
- (6) It is strictly forbidden to plug or unplug the power terminals (motor and power) when energized. Disconnecting while the motor is still energized can cause large currents to flow through the coils, and plugging or unplugging power terminals can cause a large instantaneous induced electromotive force that could damage the driver.
- (7) It is strictly forbidden to solder wire ends before connecting to terminals, as this might increase contact resistance and cause terminal overheating and damage.
- (8) Wiring leads should not be exposed outside the terminals to prevent accidental short-circuits and damage to the driver.
- (9) Use specialized tools to tighten terminal connections.

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