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## Background

The applications of 86 and 110,130 hybrid stepping motor (900RPM within the main demand point, high torque, high response, cost-effective positioning control, or variable frequency speed control), the three-phase hybrid stepping motor get the most widely using. However, in some countries (such as India, Turkey, Argentina and so on), and some certain industries (such as large and medium-sized wood carving machine, single-head embroidery machine, pattern machine, etc.), due to habits and development history and other reasons, still use two-phase stepper motor and high-voltage two-phase stepper motor driver. Traditional analog two-phase stepper motor driver, due to control algorithms, heat and other reasons, commonly use AC 110V power supply, but AC 220V power supply will cause more serious motor heating and can not be used. New digital two-phase stepper motor driver has a large improvement in the algorithm, even if it works under AC 220V power supply, it is able to do a good balance on heat, smoothness and stability. Typical application industries of this driver are uses single-head embroidery machine, large format pattern machine, fixed length feeder, medium and large woodworking engraving machine

Introduction

## Overview on DH2722MA

DH2722MA based on the demand from various industries requiring for high-voltage 2-phase stepper motor driver, with industry application experience, and take the purpose of providing cost-effective, high stability product for customers. The entire control program has a deep optimization and refining on the basis of full absorption and mastery of foreign advanced technology. The hardware design takes into account the strong and weak electrical isolation, input signal compatibility, and key material select classic and mature components from internationally renowned manufacturers. Software use our own two-phase stepper motor vector control technology and the fast algorithm. It has self-test operation, single and double pulse mode settings, multiple protection and other functions.

## Features

- Single Power Input, Voltage Range: AC110-240V, compare with traditional 110V power supply drive, save one transformer, big output torque under same speed
- Driving current value: from 1.2A/phase to 7A/phase, 16 levels to adjust;
- 16 levels DIV configuration, MAX resolution 40000 pulse/revolution; when DIV configuration  $\leq 2000$  pulse/revolution, use Micro DIV control mode;
- Highest response frequency is 200KHz;
- Phase Memory Function: Automatic remember motor rotor location when power cut off;
- Protection function: overheat protection/over-current protection、phase to phase short circuit protection、cut off protection、over-voltage protection;
- Self half-current: Input pulse stop for 100ms, current automatic reduce to half, low down motor heating;
- Full isolation: Signal Input/Output isolation; Strong-Weak electric isolation (pwm control signal and current isolate);
- 5V/24V signal input compatible design;
- Optional control mode: pulse/direction mode; or double pulse input mode;
- Self-Test Function: Without external pulse signal to drive motor to rotate at 30 revolution/minute;
- Volume: 83x202x147(mm<sup>3</sup>), installment space 100x230x200(mm<sup>3</sup>); N.W: 1.5kg(G.W.:1.7kg); Color: white;
- Applied industrial chip design, working environment:  $-25^{\circ} \sim +60^{\circ}$  ( $0^{\circ}$  without frozen);
- Applied vector control and micro DIV control technology, has a great improvement on stability, noise, vibration and heat, compared with traditional drive;

## Application

Plastic irrigation machine,wood carving machine,laser cutting machine,CNC machine,packing device,single-head embroidery machine,Pattern machine,Sewing machine,drilling machine

## Drive Setting

### Current Setting

Driver working current IM(short as IM)set by D1-D4 DIP switch(Note: Working current is given by normal operation valid value, shaft holding current is 50% of working current, called self half-current。 When pulse input stop for 100ms,and MF releasing signal is invalid,then driver is self half-current inside),total 16 levels, see details as following format。

**Note: RMS/A on drive shell means current valid value, Peak/A means peak current setting。 Working current support online setting with power**

IM/A	1.2	1.5	2.0	2.3	2.5	3.0	3.2	3.6	4.0	4.5	5.0	5.3	5.8	6.2	6.5	7.0
D1	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON
D2	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON
D3	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF	OFF	OFF	ON	ON	ON	ON
D4	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	ON

### DIV Setting

Drive DIV(short as DIV)is setting by D5-D8 DIP switches, total 16 levels, see details as following format。 Two-phase drive DIV setting definition do as how many pulses needed when motor rotate one round(traditional DIV definition is the pulse numbers in DIV format to minus,for an example,2 DIV correspond to 400 pulse/revolution, applying for pulse/revolution definition replace conversion relationship,more convenient for engineers).There are Pulse/revolution on drive shell 。 Suggestion for using 4000 Pulse/rev or above 。

DIV	200	400	800	1600	3200	6400	12800	25600	1000	2000	4000	5000	8000	10000	20000	40000
D5	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF
D6	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF
D7	ON	ON	ON	ON	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF	OFF	OFF
D8	ON	ON	ON	ON	ON	ON	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

**Note:DIV setting will be valid after restart the drive**

## Single/Double Pulse Operating Mode Selection Setting

Single/double pulse working mode selection set by D9 DIP switch.

D9:ON is double pulse working mode(Forward input forward pulse by PU+/- signal, reverse input reversal pulse by DR+/DR-);

D9:OFF is pulse+ direction working mode(pulse signal input by PU+/PU- signal port,direction signal input by DR+/DR- port);

**Note:single and double pulse working mode change need to restart the drive to valid**

## Self-checking operating mode setting

D10 DIP switch set self-checking running mode selection

D10: When D10 is ON,then it is self-test operating mode,before self-test,just connect power and motor cable,do not need to connect pulse control signal(need to pull off pulse input signal terminal or make sure that no pulse signal input), at this time,DIV DIP is invalid,but current DIP selection is valid, motor runs as 0.5r/s(30RPM)。 This function is to test drive's internal function.

D10:When D10 is OFF,then it is normal running mode,need to connect pulse control signal to make motor running.

**Note: 1.when D10 is ON, make sure that no pulse signal input to drive;if has pulse send to drive to make drive work,then can not turn D10 to ON,or will cause over-current alarm.**

**2.Similar as self-test function,can customize self acceleration or deceleration program for customers,under low speed running occasion(in 600RPM-900RPM)use stepper drive or motor to replace VFD or VFD motor;**

## Description for Control Signal Connector and Main Circuit lines

All input signals are through by optocoupler to isolate input and output signals. In order to ensure built-in high-speed optocoupler reliable conduction, require to provide the driving current at least 10mA of input control signal .As the driver has internalized current limiting resistor,so when the input signal voltage is 5V, it is directly connected to 5PU + / PU-, 5DR + / DR-, 5MF + / MF-;When the input signal is 24V, the control signal is directly connected to 24PU + / PU-, 24DR + / DR-, 24MF + / MF-. If the input signal voltage is 12V, please explain in advance before order the drive,then engineers will make changes of drives. It can also series into 510 ohm current limiting resistor at 5PU + / 5DR + / 5MF + port .

Input signal connection usually has Positive Connection,Negative Connection,and Differential Connection.See Appendix for details. The following table shows the function of the I / O pins.

Port	Remark Symbol		Function	Description	
DB15 signal connection port	Input signal	13pin	24PU+	Pulse input(5V/24V optional) ; double pulse is forward signal	For details,check single/double pulse working mode selection setting and appendix input signal connection description,please note that timing must be in the drawing parameter of “input signal timing” at appendix
		1pin	5PU+		
		2pin	PU-		
		14pin	24DR+	Direction input(5V/24V optional), double pulse is reversal	
		3pin	5DR+		
		4pin	DR-		

				signal	
		15pin	24MF+	Motor enable signal (5V/24V optional) ; Enable signal is valid,then motor is in free status,invalid then shaft holding or running status	For details,please check the Input signal Timing drawing description in appendix
		7pin	5MF+		
		8pin	MF-		
	Output signal	11pin	RDY+	Drive ready for signal,corresponded to Optocoupler C and E	For details,check output signal connection in Appendix , when drive is power on,self-test program will make optocoupler on for 0.5s,at this time,ALM light will flash,means ALM light is normal,and send a status indicator to PC,means self-test is normal
		12pin	RDY-		
Barrier type connection Terminal CON6	Motor cable	1、 2、 3、 4 pin	A+ 、 A-、B+、 B-	Connect two phase motor cable A+、 A-、 B+、 B-	Normally,86 motor is 4 lead or 8 lead , 110 and 130 motor have one shell grounding cable,this grounding cable connect to the M4 screw that locate on shell,shell side PE->indicate the location is the motor shell place.Motor cable is as close as drive(normally do not over 3m).For 8 lead motor,to achieve high speed,to connect in parallel;if for low speed but big torque,connect in series(See Motor wiring in Appendix)
	Power input	5、 6 pin	~AC 、 ~AC	AC power input , AC:110-220V	Highest voltage can not over 250V , if voltage is too high or power supply is not stable,please add one isolation transformer,ratio about 220:180 , power about 0.5-1.5KW(refer to current).Generally,CNC machine add isolation transformer to improve operating stability

**Note: 1. DB15 terminal “N” is empty terminal;**

**2.The signal input line should use a shielded wire and ensure be grounded. Power lines (motor and power lines) should also be shielded and securely grounded (especially for using multiple stepping drives, or multiple stepper drives with multiple inverters, servo drive at the same time, as well as long power lines of the system ,should ensure be reliable grounded). Generally the signal line shield layer, power line shield layer connect to the drive chassis ground and then to the earth**

**3.Short-circuit protection, that the normal operation has winding short circuit, the drive immediately start protection and enable the photoelectric isolation electronic switches RDY +, RDY- closed, this feature can simulate by a boat-shaped switch. Disconnection protection,that is the normal operation has a phase winding disconnection,**

**drive will start protection and enable the photoelectric isolation electronic switches RDY +, RDY- closed, this function can also simulate by a ship-shaped switch; usually RDY + external connect a 2.7K / 0.5W pull-up resistor to the PLC's 24V +, RDY- connect to PLC's 24V-, RDY + connect to PLC's IO input port**

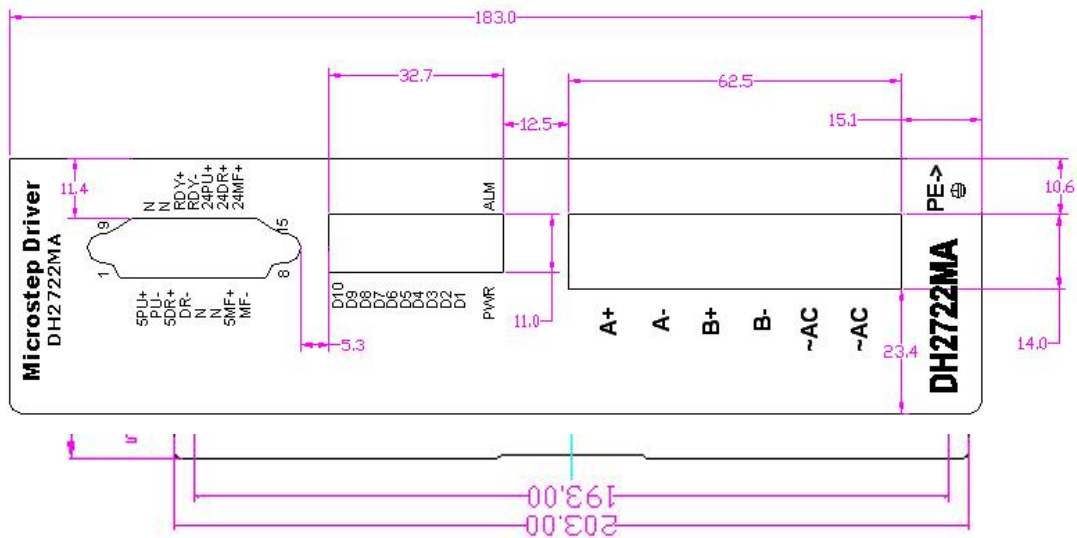
### Indicator Light Description

**PWR:** Green, power indicator, means drive's working power is normal. If drive's power is abnormal, this light will flash or die

**ALM:** Drive ready indicator light (or fault indicator), when drive is power on, self-test program will make ALM light lit for 0.5s, means ALM light is normal. In working, ALM light is not bright. If drive's internal is abnormal (like over-current/over-voltage protection, short-circuit protection, break wire protection, power module fault, ect) the ALM light will lit, and means abnormal happens.

### Terminals Layout on driver Shell And Installation Dimension Drawing

Remark :unit(mm)



### Common Problem and Solving Method

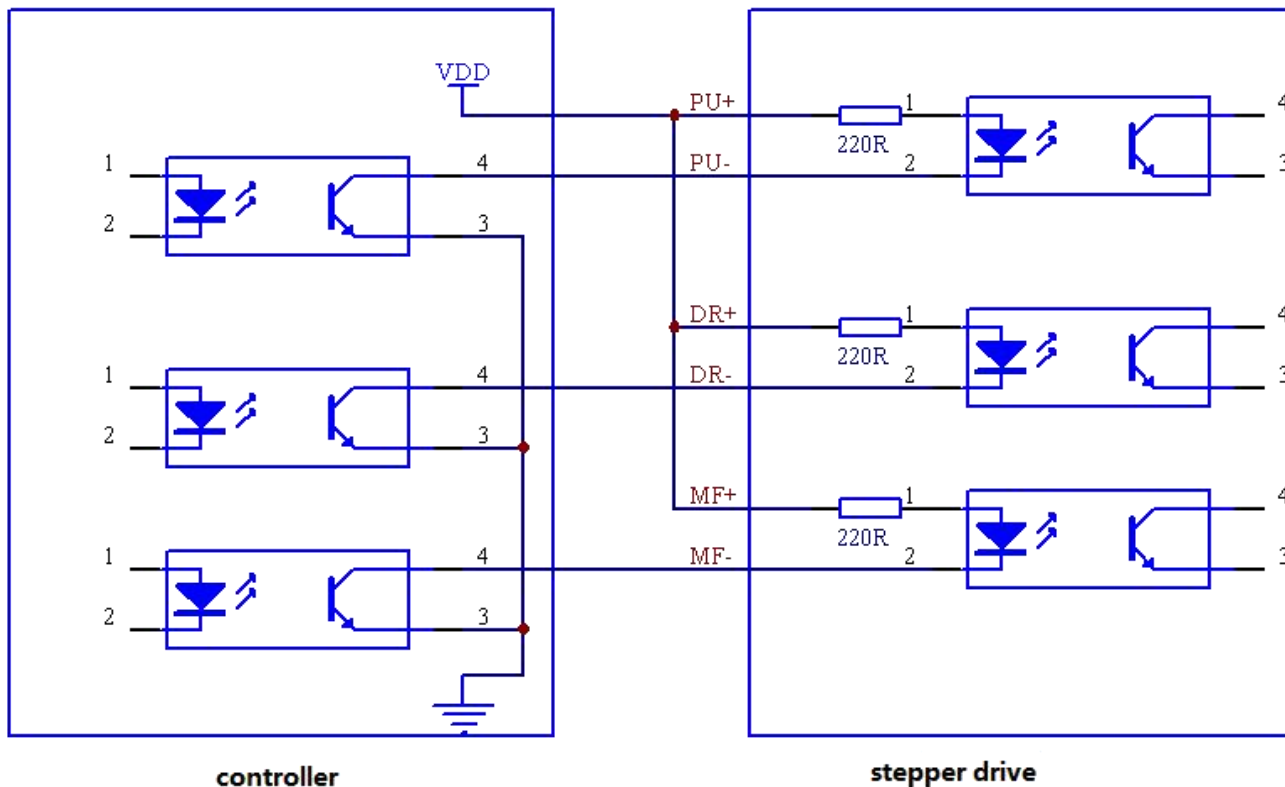
Problem	Possible Cause	Method
Motor does not rotate	power indicator light(green) is off	Check power supply is ok, if power supply is ok, means internal circuit is abnormal (maybe the fuse is burned or other reasons)

	Fault indicator light is lit	Check motor cable connecting whether occur short circuit(or motor fault) 、 current setting whether is correct; if all is correct,means the internal circuit of drive is abnormal
	Drive's internal circuit is abnormal,DB15 terminal control signal input abnormal	1.Turn switch D10 to ON,current setting to rated current,check motor whether rotate,if motor can rotate,means the drive most is normal,drive signal port circuit is possible abnormal or external input signal is abnormal;if can not rotate,means motor or drive is abnormal; 2.When self-test can rotate,check DB15 signal input loop wiring whether is correct,single/double pulse mode setting whether is correct,ect; 3.If self-test is normal,DB15 signal loop wiring is normal,change another drive or motor to test,then can find out the reason.
Motor howling	Drive running current is not match with motor rated current	Set drive's running current to motor's rated current(normally,low current will cause howling)
	Acceleration time too short	extend acceleration time
	DIV configuration is wrong	Set DIV configuration to the correct value(normally,too small will cause motor howling or stalling)
	Input pulse step is too large	1.Acceleration and deceleration curve configuration is not correct, or acceleration, deceleration is too high in the acceleration and deceleration curve, or there are most glitches or pulse fall in the pulse transmission 2.Interference is too big, multi step drives or inverters and servo use at the same time without using reliable shield grounding, the situation can often be found when the motor hold shaft, the motor shaft has small peristalsis
Inaccurate location	DIV is not correct	Select the correct segments value, pay attention to subdivision changes in valid need to restart
	motor overload is too heavy	change the motor or increase the running current of the drive
	running speed is too high	Appropriate to reduce motor's running speed to see if there are still inaccurate location phenomenon occurred. Due to high speed, the motor load capacity drop, cause step losing.
		Running current is too high ,causing severe motor

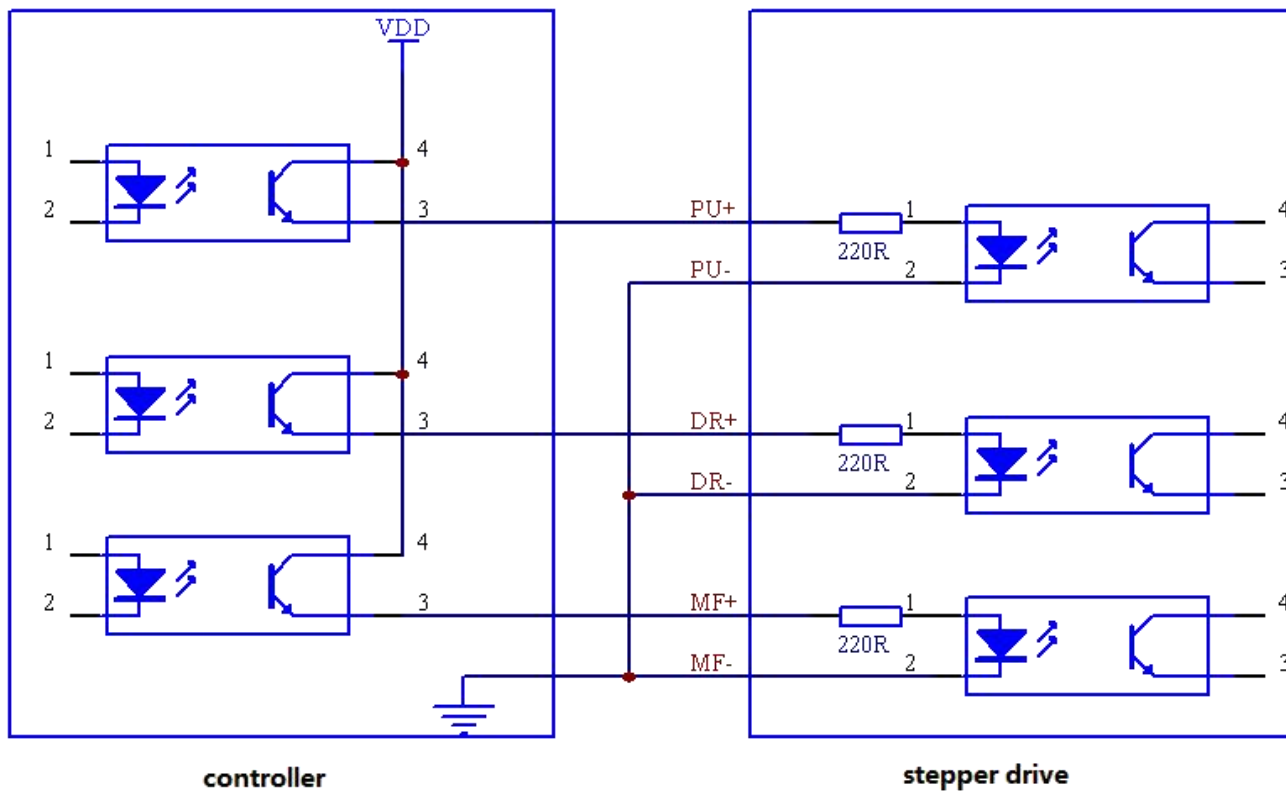
	Current setting is too high	heat, then will lead to lost step. The current should be adjusted to the rated current or less (after the motor temperature dropped down,have a test), check whether the occur step losing
	Motor fault	change another motor to have a test
	Slightly step losing(especially circular interpolation in CNC system)	<p>1.The timing for pulse and direction may not meet the requirements, see the Appendix &lt;input signal timing diagram&gt;, pay attention to at least 2.5us timing interval (or greater)</p> <p>2.Signal line and strong line (motor line and power line) do not use shield line to connect the ground and lead to interference for pulse input</p> <p>3.Motor line is too long, generally,the line between drive and the stepper motor do not over 3 meters, and use quality wire;</p>
Leakage	Drive and motor is not securely connected to the earth	<p>1.Drive and motor securely connect to the earth,not just connect motor ground wire to drive's shell; 2.For some of the occasions where the ground wire is not provided, the motor、 drive and platen can be isolated from the places where they are touched by hand with an insulating rubber pad or other measures, and make a WARNING sign;3.For more than one drive using occasion, can communicate with the power supply department to solve the ground wire problem, or find a professional company to make ground pile.</p>
Drive& Motor heating	Drive runs big current,motor abnormal or poor external cooling condition	<p>1.Reduce the running current of drive ; 2.change a motor; 3.Increase the ventilation of the drive and the motor</p>

# Appendix:Input/output signal connection and control timing description

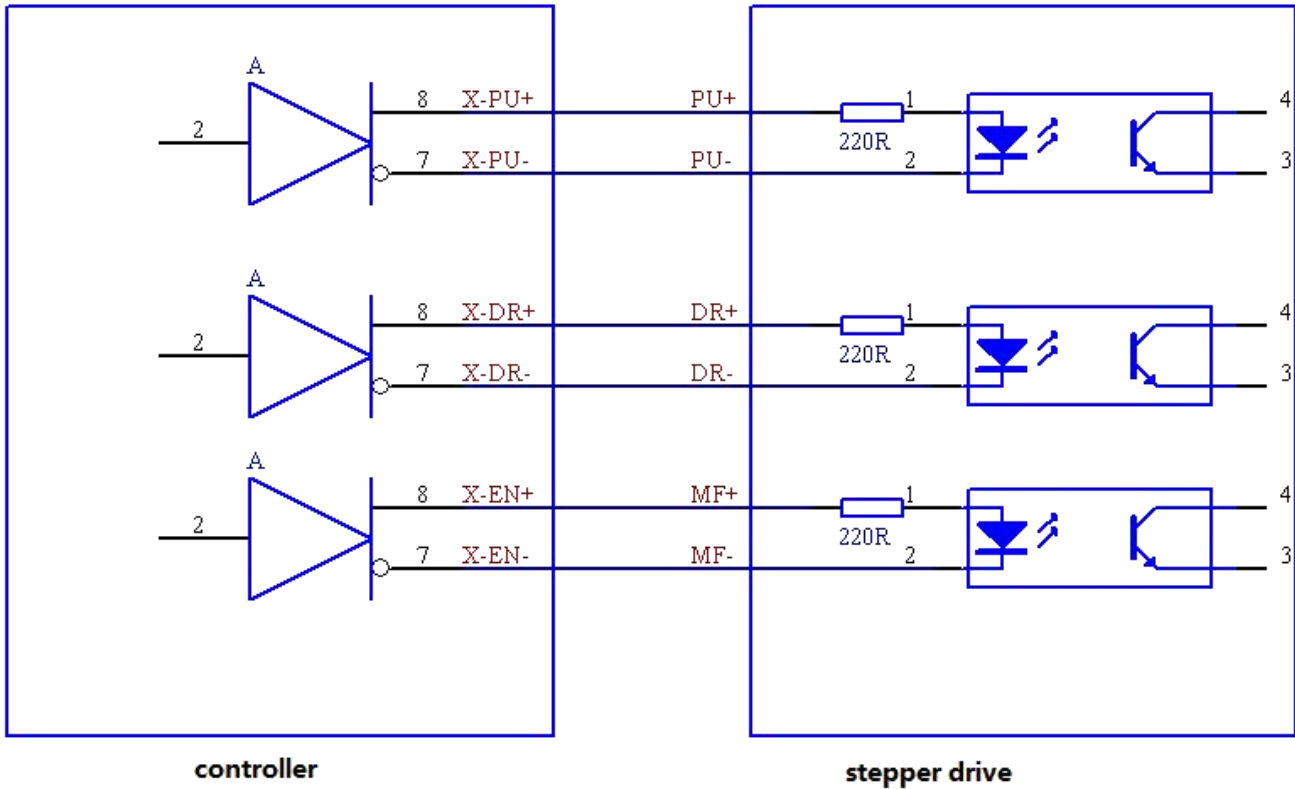
## ➤ Input signal positive connection



### ➤ Input signal negative connection



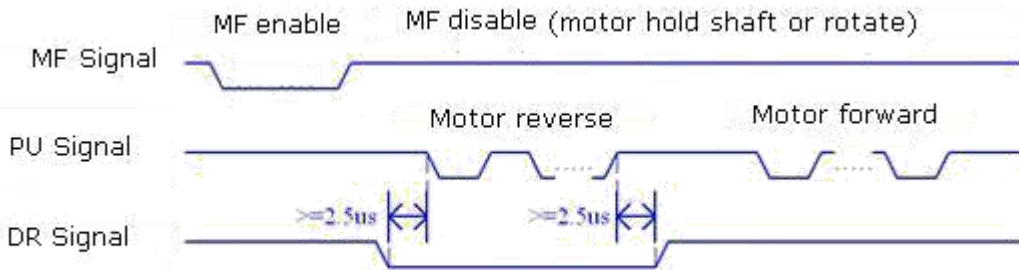
### ➤ Input signal differential connection



**Note: Differential connection must connect to the differential output of controller or motion control card, and can not connect the positive port or negative port of differential signal as control signal (This connection will cause imprecise control location or lose step)**

### ➤ Input signal timing drawing

Below is the positive connection timing drawing: MF-, PU-, DR-

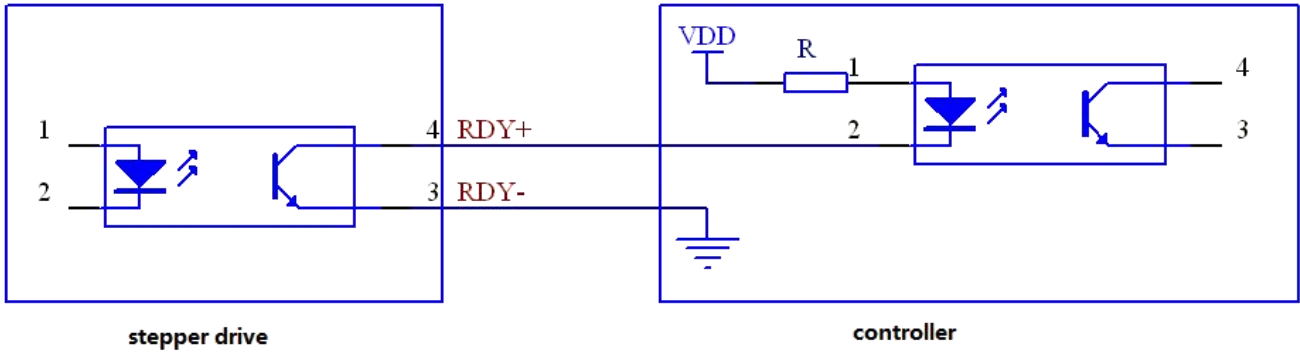


Note: above timing drawing take positive connection as example

### ➤ Output signal connection

The output signal output through the optocoupler isolation, general as indicator for drive working status (whether drive is

fault indication), interface signal provide to controller or host computer. The connection is similar to the input signal of the positive or negative connection. The following example is one of the connections. For PLC and other equipment 24V signal input, the pull-up resistor is usually around 2.7K. For devices with 5V signal inputs such as control cards, the pull-up resistor is typically chosen to be about 270 ohms



➤ **Two-Phase motor 8 leads connect in series or in parallel**

86frame size motor normally has 8 leads , normally connect in series or in parallel.If motor runs in high speed,take connection in parallel;for low speed but big torque occasion,take connection in series.Below are the connection drawing:

