【Low-cost stepper motor full servo control technology,

make the stepper motor never lose step】

Stepper motor (real-time compensation type)closed-loop controller，

semi-closed loop encoder version , the user manual

Version 2.10

【In order to use this product , please read this manual carefully】

WARNING

Please pick a standard DC 5V power supply, do not use the mobile phone charger, computer power, or from other control cards to get 5V supply. With industrial-grade, independent, high-quality, small corrugated switching power supply.A closed-loop current less than 300mA.The failure of the power supply will cause many unknown error (including pulse signal lost, crashes, unwarranted alarm or coordinate cleared).Excessive voltage will result in closed loop inside the chip burned, and this has caused a lot of maintenance cases, users Remember.

CONTENTS

Stepper motor (real-time compensation type)closed-loop controller

一 product introduction：

1、Outline:

Stepper motor (real-time compensation type) closed-loop controller is a low cost ,special stepper motor servo control of technology products for industrial automation, It is the product that originated in network technology forum.This controller is the middle strip to fill the traditional servo motor system with open loop stepper motor system, is a low-cost, cost-effective, unique servo controller. The stepper system which used our controller inherited all the advantages of traditional stepper system (for example: static lock, good low-speed performance, big torque (the same base Relatively servo motor Model), the position loop response without delay, cheap, maintenance-free), but also has some of the advantages of the servo system (for example: security, not lose step and overshoot, with the host machine communication, more rapid acceleration or deceleration, high positioning accuracy). The stepper motor which used this controller can fully compared to the traditional servo motor in addition to the high-speed performance and overload performance, and even better than servo motor on some performance (for example: static locking force, with ordinary grating feet with the higher and more reliable positioning accuracy, low-speed stability and does not require gear gearbox will be able to obtain a low speed high torque ...). Because the system is extremely cost-effective, will be provided to the design of industrial automation and users more choices, especially economic CNC machine industry. The controller also has some special additional capacity: display current coordinates on digital tube ,clearing operation ,points in the operating manual machine operator and as a number of significant screen, use the left and right limit and automatic processing ... etc. specifically for economical CNC machine tailored functionality. The commissioning of the controller is quite simple, anyone will be able to set it by using the manual, do not need professional debugging techniques, no difference with the traditional open-loop stepper motor system in use and control, any of the existing stepper motor system can be added to the controller to get performance upgrade. Fully able to adapt to the three-axis or multi-axis CNC machine.

Note: This manual is a semi-closed loop encoder version ,If you need the full closed-loop raster version of the manual, please ask for us.

2、Features

1)safe
2)Can use as a digital screen only

3)Simple parameter setting and commissioning
4)Prevent step stepper motor and overshoot
5)Left and right limit, and can automatically exit the state limit
6)The input and output are differential ports, can be adapted to a common cathode or common anode connection
7)Be able to communicate with the host computer, report motor working state, provided the arrival signal
8)Can dramatically improve the speed and efficiency of the stepper system running
9)Can correct jitter deviation caused by Motor is stopped at Non-integer step at the beginning of power on
10)The displayed value can be cleared, auto check midpoint,and move to zero by the buttons.
11)Lost pulse motor running process, high-speed compensation or anti-compensation
12)Saving energy and resources (the selection of the smaller size of the stepper motor and current to achieve the same effect)
13)Can meet any existing stepper motor and motor drive (two-phase, three-phase, five-phase motor system).
14)The acceleration and deceleration of the stepper motor is more rapid,Lower requirements for external curve speed up/down, or even no requirements.
15)Comes with 8 digital display, can be freely set coefficient ,convert the current coordinate position and dynamic display
16)When stepper motor was stopped by force or limit switch is hit, the external output alarm signal concurrent sound and light tips.
17)Incremental encoder can adapt, but also in conjunction with grating electronic ruler constitute full closed-loop control, better positioning accuracy
18)can set the number of steps for error alarm,0-60000 steps adjustable， When the motor step number is greater than the set value, the alarm and output.
19)can make the Machine into manual operation mode by the buttons,can also be cleared and center part operation.
20)Controller can automatically adjust the motor speed to adapt to the uncertainty resistance point in the mechanical system and it will not let the motor stall
21)Motor is in operation or still, even if the strong intervention by external force ,when the force is removed, the motor will still automatically restore the original Running state and the coordinate position, the zero bit will never be offset
22)Built-perfect acceleration and deceleration curves (adjustable size), can be set to internal or external acceleration and deceleration mode (menu adjustable), external pulse source can have no acceleration and deceleration curves, start the motor at any speed or stop, will not lose step and overshoot
23)Looking for the absolute zero of the machine with Z phase encoder or photoelectric switch, and can be stored in the user coordinate origin, unexpected power outage or other unexpected errors can automatically regain users coordinate and origin.And can be set back to zero or a key to boot automatically returns to zero.

3.application area

Suitable for a variety of stepper motor automation equipment, industrial equipment, machine tools and instruments, such as: CNC machine, engraving machine,The various types of cutting machine tools, plotters, handling devices, robots, medical equipment, the old machine equipment upgrade and renovation. Particular, the user wants to improve the security, accuracy, efficiency and simplification of the motor control device of the stepper motor.And some equipments and places that users expect particularly high-precision positioning and safe (servo system is difficult to meet).

二 Electrical, mechanical and environmental indicators

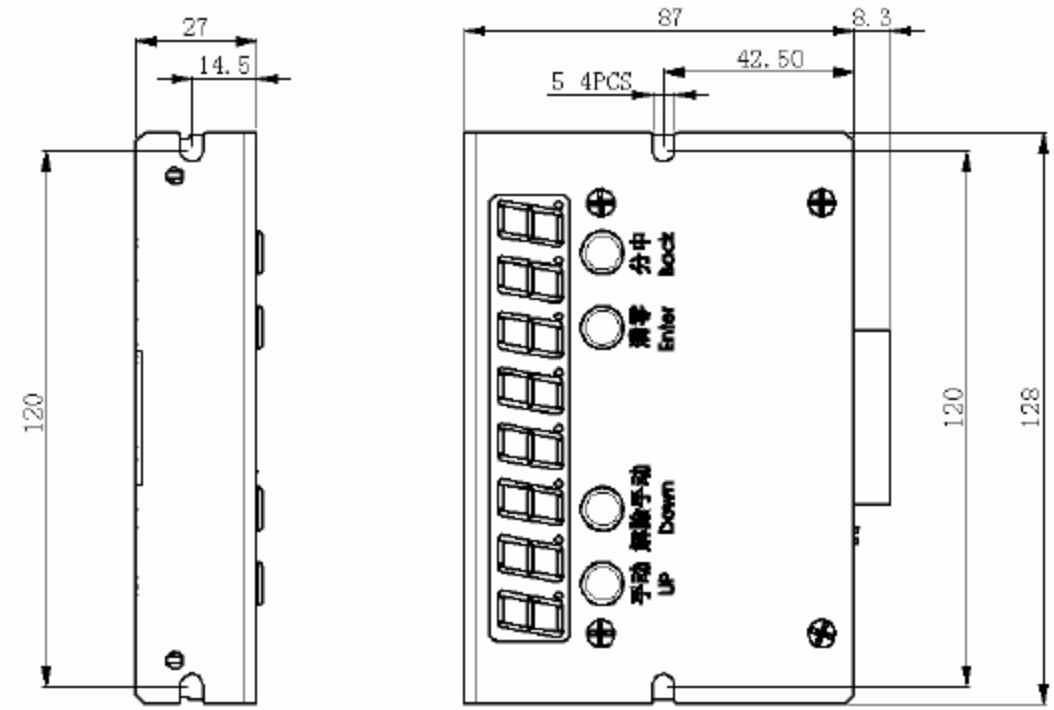
1.Electrical parameters:

Input voltage: DC 5V, Current: <300ma TTL Compatible single input
Output voltage:DC 5V Output pulse and single is TTL
The Maximum pulse input frequence with 400 line encoder is 80K.

2.Environment and Parameters:

Environmental temperature:0℃~60℃
Environment humidity:40-90%(RH9)(No condensing**)**
Occasions: Avoid dust, oil mist and corrosive gases, the absolute prohibition of contact with the liquid.

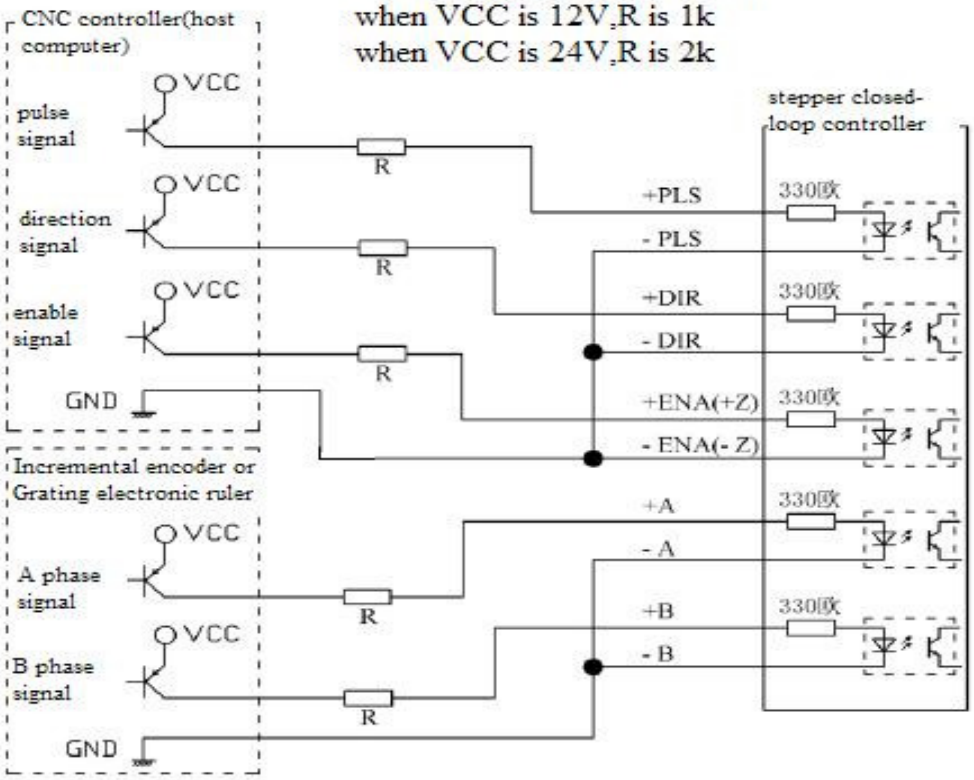
3.Mechanical mounting dimensions:



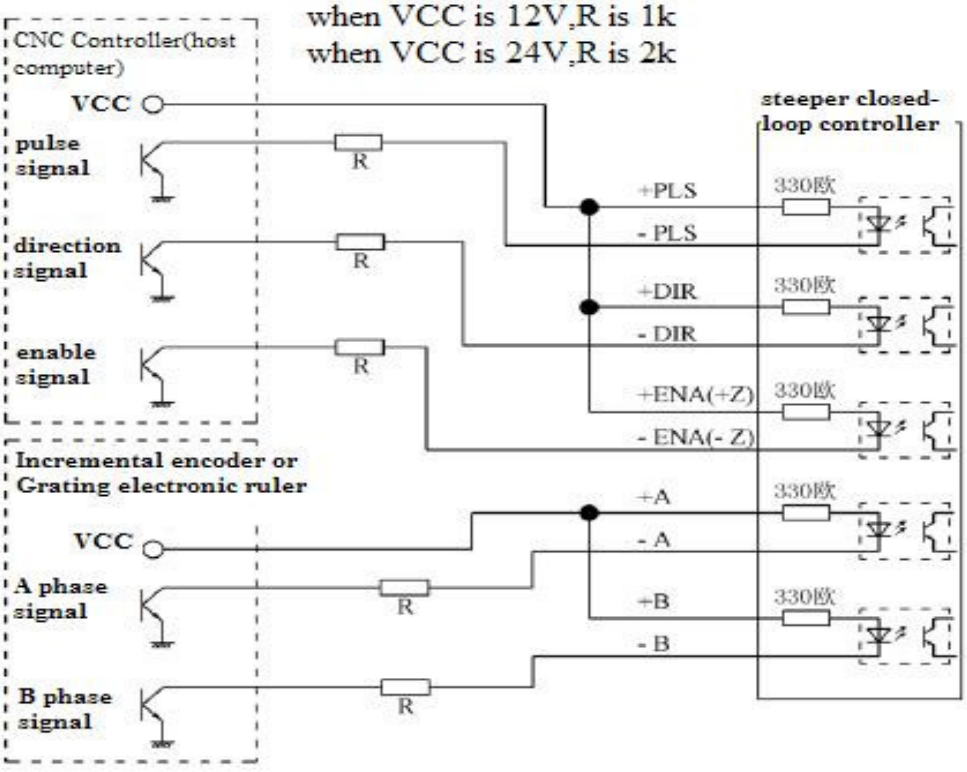
三 Port and Wiring

Input Ports	
Name	Functions
+PLS	External pulse signal input,TTL single,if single is**+12 V or +24 V**, requires a current-limiting resistance
-PLS	
+DIR	External directional signal input,TTL single,if single is **+12 V or +24 V,** requires a current-limiting resistance
-DIR	
+ENA(+Z)	External enable signal input,TTL single,if single is,need a current-limiting resistance. If the pin is suspended or don't provide current, the enable is open, or is closed. OUT EA will change following.this port can no connect. if you open the function of Z phase to find the origin,the port will connect to Z phase on encoder or photoelectric switch**.**
-ENA(-Z)	
+A	Incremental encoder or grating electronic ruler signal A phase input, TTL signal, if the signal is +12 V or +24 V, Requires current limiting series resistors.
-A	
+B	Incremental encoder or grating electronic ruler signal B phase input, TTL signal, if the signal is +12 V or +24 V, Requires current limiting series resistors.
-B	

Common cathode connection
when VCC is 5V, R is shorted
when VCC is 12V,R is 1k
when VCC is 24V,R is 2k

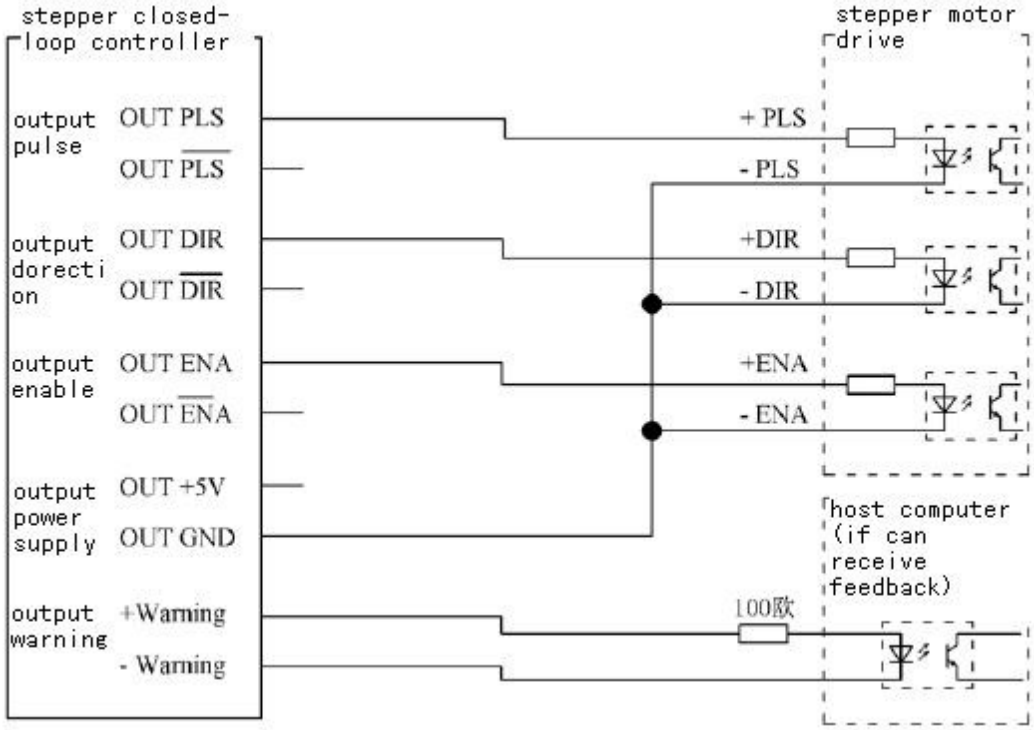


Common anode connection
when VCC is 5V,R is shorted
when VCC is 12V,R is 1k
when VCC is 24V,R is 2k

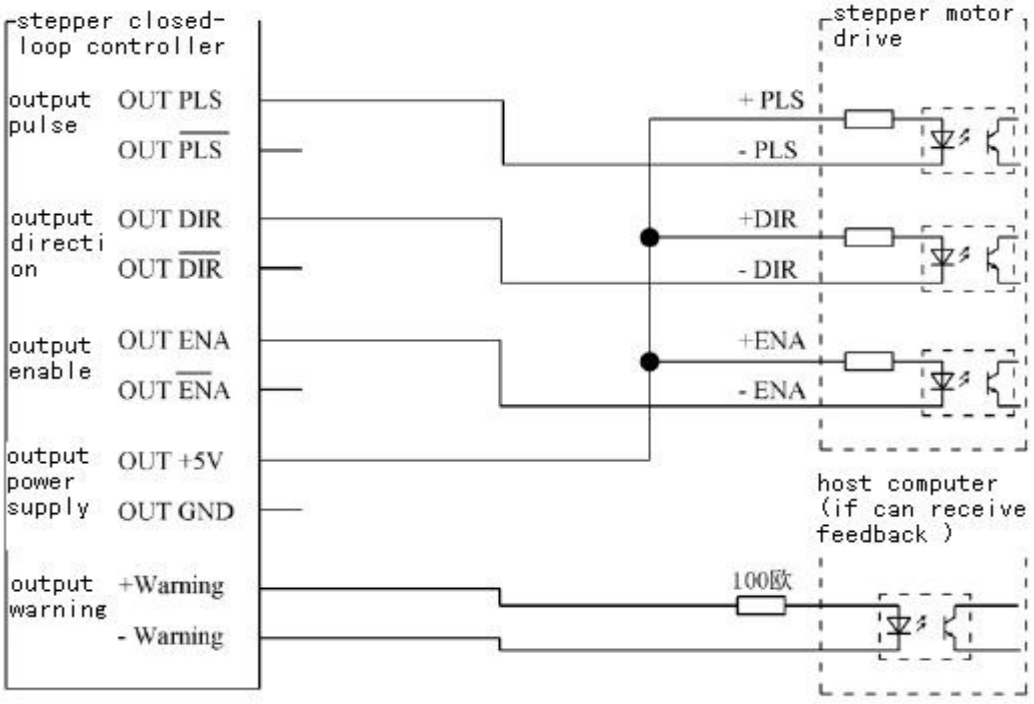


Output Ports	
Name	Functions
OUT PLS	Pulse signal output,TTL signal
OUT PLS	Negate pulse signal output,TTL signal,To adapt to the rising or falling edge of the stepper drive trigger
OUT DIR	Direction signal output,TTL signal,note that the direction signal must be established before 5μs pulse signal
OUT DIR	Negate direction signal output,can change the direction of the motor running,to adapt the different stepper system demands
OUT ENA	Enable signal output,TTL signal,enable port is non-must port ,can be suspended
OUT ENA	Negate enable signal output,TTL signal,to adapt the different stepper system demands
OUT +5V	provide the control signal power supply for optocoupler isolation stepper motor drive
OUT GND	
+WARNING	Serious error alarm output port , a serious error that contains a motor stall error exceeds a set number of steps or left and right Limit is triggered. Output current alarm events , and in normal no output . This port is non- must port .
-WARNING	

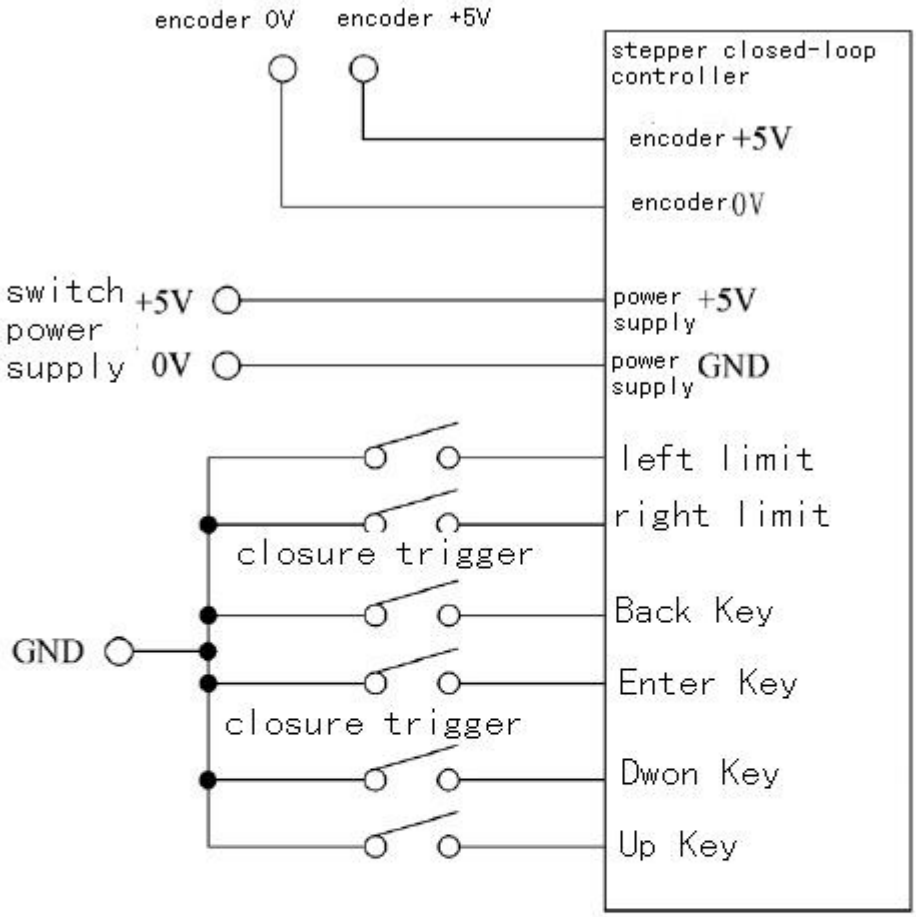
common cathode connection

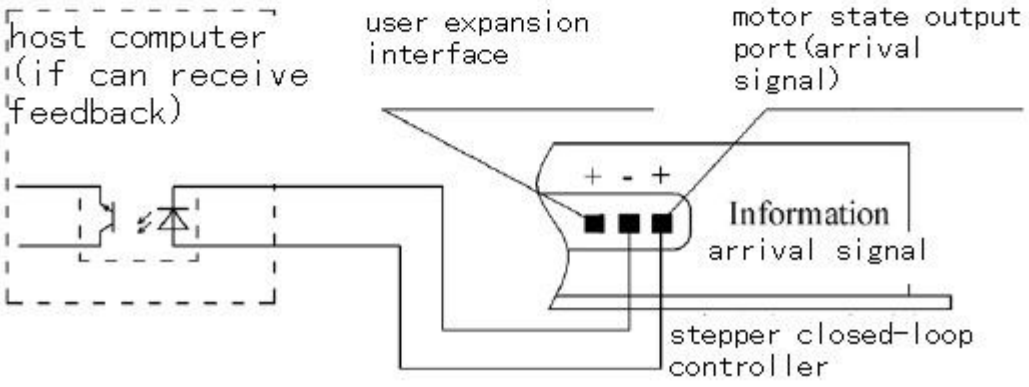


common anode connection

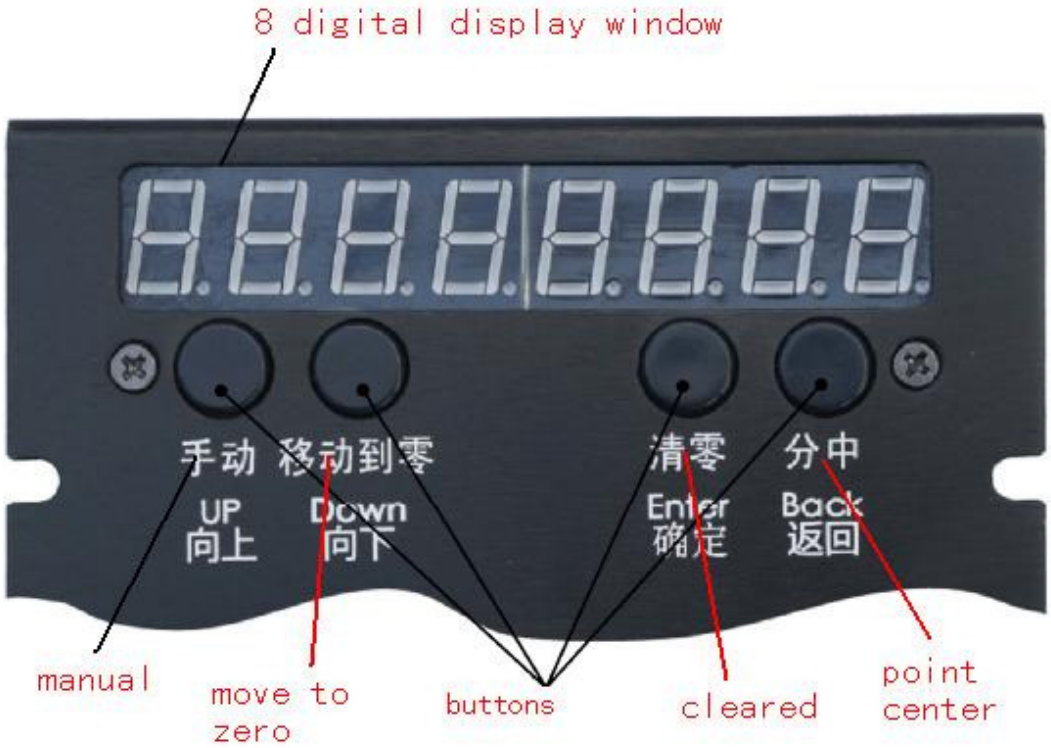


Other ports	
Name	Functions
Encoder +5V	Provide power supply for 5V encoder,don’t reverse polarity,otherwise burn down encoder
Encoder 0V	
Power supply +5V	Controller power supply input,better use a DC power supply with small corrugated and interference(DC 5V)
Power supply GND	
Left limit	Left,right limit input,Trigger this port then the limit function is activated,the motor will reverse operation till the itinerary switching is out of the trigger state.Left and right are relative , attention the motor should be done away from the trip switch movement after triggered, rather than impact the trip switch.This port is non- must port.
Right limit	
Back key	Control panel keys , external button function to facilitate the automatic control of the operation or procedure.This port is non-must port.
Enter key	
Down key	
Up key	
Arrival signal	Stepper motor state output port,when stepper motor lose step or overshoot and when controller is on real-time compensation and calibration,this port output current .when the motor is normal, this port is no output.this port can be as arrival signal.


encoder 0V
encoder +5V
stepper closed-loop controller
encoder +5V
encoder 0V
switch power supply +5V
0V
power supply +5V
power supply GND
left limit
right limit
closure trigger
GND
Back Key
Enter Key
closure trigger
Dwon Key
Up Key


host computer (if can receive feedback)
user expansion interface
motor state output port(arrival signal)
+ - +
Information arrival signal
stepper closed-loop controller

四 Display ,Control Panel and key functions



1 Display window:

A The display window is composed by eight seven-segment bit digital tube,dynamic display the axis coordinate when normal working,coordinate values accurate to three decimal,the display range is -9999.999-9999.999.The display value is measured based on the pulses that received from the encoder,not based on the pulse from the host computer.

Note:In order to prevent the system jitter caused by Mechanical inertia,Stationary positioning will allow a one pulse error,when your machine every pulse displacement is 0.003,the controller display value may be related to the host computer 's display value difference of ± 0.003.And the error value is not cumulative , please rest assured that use.

B when you enter the menu settings,display information menu and project value

C "Error" warning message is displayed when the motor is locked-rotor by external force

2 buttons

A This controller have 4 buttons,when the controller run normal,this four buttons means “manual control”,“Moving to zero (released manually)”,“clearly”“center part”

Note:The operation of these features , stepper motor should be in the state of no operation , otherwise keystroke will not respond.

1) press “manual control” button,the controller will close the motor enable,the motor will power-down,then you can operate the machine by handle wheel,the encoder will continue to display and refresh the values,at this time,the controller is only a display screen.and you can use “clearly”and”auto check midpoint”.

Note: If you want use “manual control”,OUT EA port must correct wiring,can’t be vacant.when you enter “manual control”,The letter “H” will be display on left.

2)-1,After you enter “manual control”, press “Moving to zero(released manually)”, the controller will restart stepper motor enable and be back to the real-time compensation and calibration status.At the time, can’t manual control your machine,and the letter “H” disappear.

2)-2 , In normal working,press “moving to zero”,the machine will be back to zero coordinate position.

3) press “clearly”,all coordinate values will be cleared,the motor will not work.when the motor stall and display “ERROR”, press this button can exit from warning.

4) press “auto check midpoint”, the current value will divided by 2 and display.but the motor don’t run.when the motor stall and display “ERROR”, press this button can exit from warning.

NOTE: “IN EA**”** port close or start enable port**,**also can enter manual control and release manual function.

B when controller is in menu setting,the four buttons are “UP””DOWN””ENTER””BACK” function.

五. stepper motor,motor drive and encoder adapter

1 this controller can match 2-phase,3-phase,and 5-phase stepper system.

2 this controller can match rotary incremental encoder of 2-phase 90 degrees phase difference output signal or Grating linear displacement electronic ruler.The user can set and choose 1,2,4 software segment by menu.

3 Note that the RPM of the motor drive must be equal or must be an integer multiple greater than the RPM of encoder.

For example:

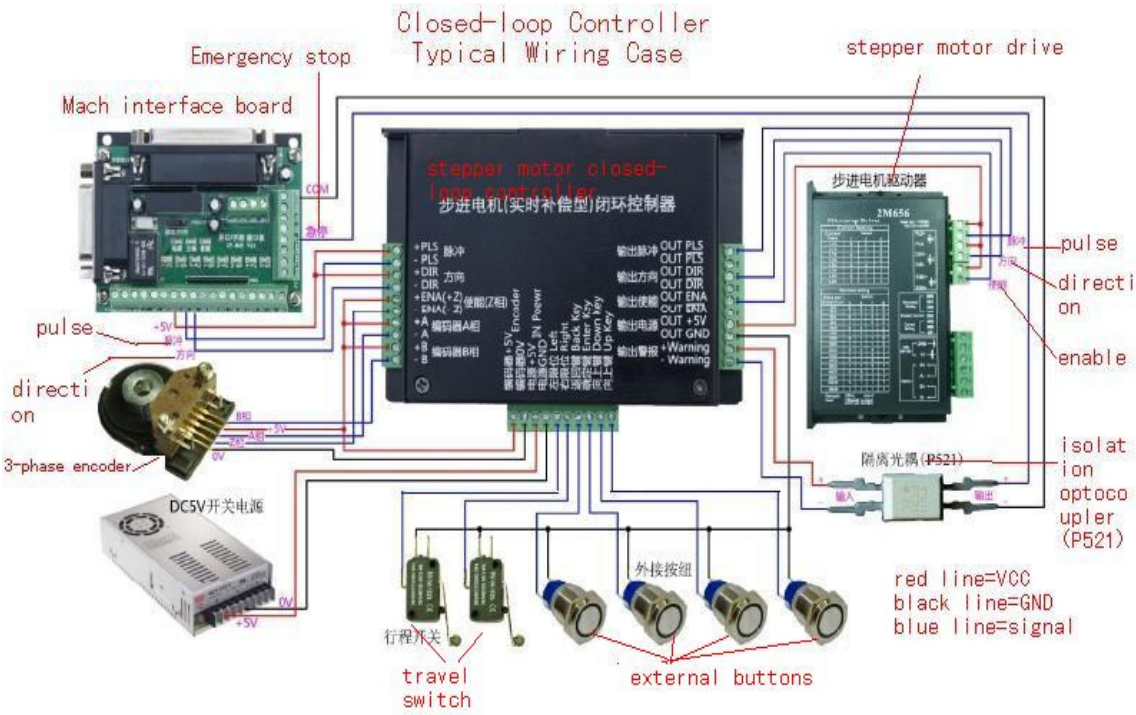
(1)If you chosen 400 line encoder,the software subdivision is set to 4 subdivision, The RPM of encoder will be 400X4=1600,then the RPM of the motor drive should be setted to 1600,3200 and 6400. If 2-phase stepper motor drive ,should choose 8,16 or 32 subdivision.

(2)If you chosen 500 line encoder,the software subdivision is set to 1 subdivision, The RPM of encoder will be 500X1=500,then the RPM of the motor drive should be setted to 500,1000 and 2000. If 2-phase stepper motor drive ,should choose 5 or 10 subdivision.

(3)If rotary incremental encoder is replaced by Grating electric ruler,you have to consider the pitch of screw in the mechanical system,then according to(1)(2) to choose. The linear displacement caused by stepper motor must be equal or must be an integer multiple greater than the resolution of Grating electric ruler.You must consider

the sensitivity of the grating electric ruler.

六 Typical wiring Case

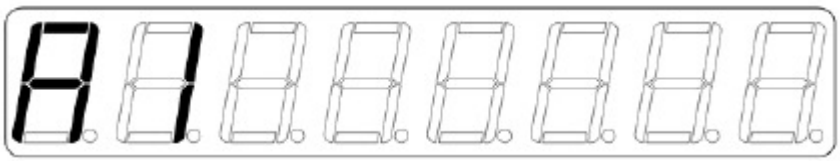


七 Menu and system settings

1. Enter main menu and outline

This chapter is the key of the manual,If you didn't set well,the controller will not work.please read carefully and be sure all the wiring (including the stepper motor)is well.

Start the controller power,the display window will display some moving website text. Press "UP" and "DOWN" keys at the same time before the website text didn't complete its display.The controller will enter menu setting after the text display and will display "A1", If only display number,it means failed to enter menu setting. It has been in working status,will can't enter menu setting,only restart the power.If success to enter the menu setting, will display "A1" like the following picture.



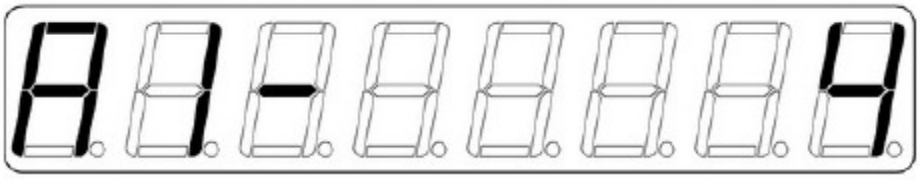
Now you press "UP" and "DOWN" ,will display "A1-C4" thirteen setting projects.

MENU NAME	FUNCTION
A1	Set the software segment of the encoder, 1,2,or 4 option
A2	Set the line number of encoder
A3	Test the encoder,check connection and function ,especially for finding encoder line value
A4	Set the RPM of the stepper motor and drive
A5	Set or look for the starting speed of the stepper motor with load working condition(Unit:RPM)
A6	Set or look for the Max. speed of the stepper motor load working condition(Unit:RPM)
A7	Set internal acceleration,deceleration curve size class.
A8	The controller automatic parameter analysis.
A9	Set the coefficient of the coordination value in normal working status.
C1	Set whether or not to display the negated coordinate values
C2	Set the number of error alarm step
C3	Set to use internal acceleration/deceleration mode or external acceleration/deceleration mode
C4	Set whether or not to use with the Z phase encoder or photoelectric switch to find absolute zero and the user coordinates and automatically returns to zero

2. Detailed Menu Settings

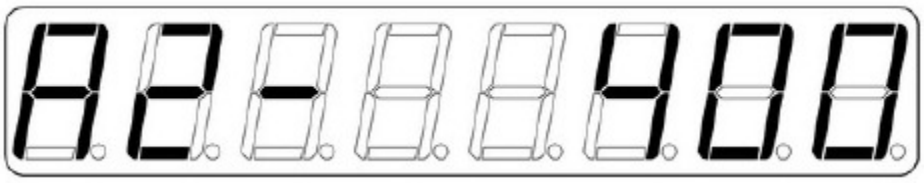
When main menu display any one of “A1-C4”,press “Enter” will enter the submenu setting.

A1. When enter this menu,will display the following pic,the right number will be flashing displayed.This menu is to set the software segment.



Then press “UP” or “DOWN’,the right number will be chosen among 1,2 or 4, selected value and then press “Enter” to save the setting and exit the menu.Press “Back” will not save the setting and exit the menu.

A2. When enter this menu,will display the following pic,the right number will be flashing displayed.This menu is to set the line number of encoder.

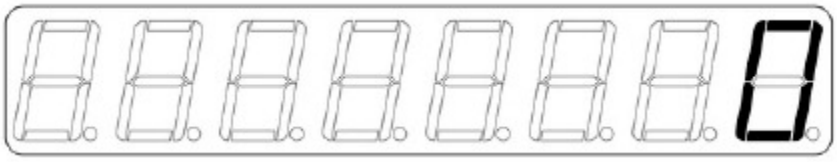


Then press “UP” or “DOWN’ ， the right number will increase or decrease,selected value and press “Enter” to save the setting and exit the menu.Press

“Back” will not save the setting and exit the menu.

NOTE:If you want to change the value by a wide margin, long press “UP” or “DOWN”.

A3. When enter this menu,will display the following pic.This menu is to test and check the encoder connection and function.



Now manual rotation encoder a circle,will dynamically display pulse value that received from encoder,then we can deduce the encoder line number and whether the correct connection.If the motor and drive already correctly connect to closed-loop controller,press “UP” or “DOWN”,the motor will forward or reverse a circle slowly,and display the pulse value that received from encoder or Grating.when run automatically,the value of A4 must be equal to the step number per lap of the motor drive,otherwise the motor is not necessarily turn a lap,then cause the inaccurate feedback information.

NOTE:Now the encoder is working with the software subdivision that setted by user,that is A1 value has been at work.Encoder turn a circle display value=A1*the line value of encoder.This is used to test the encoder,and is not necessary.

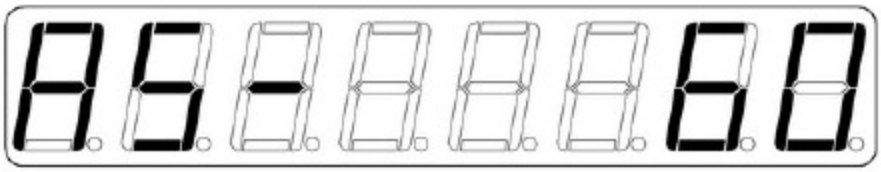
After testing,press the “BACK” button exit A3,press “ENTER” to enter again,will restore the initial value is zero.

A4. When enter this menu,will display the following pic,the right number will be flashing displayed.This menu is to set the pulse number of the stepper motor per lap.

Then press “UP” or “DOWN’ ， the right number will increase or decrease,selected value and press “Enter” to save the setting and exit the menu.Press “Back” will not save the setting and exit the menu.

NOTE:Every time this setting project after any change,you must run the following A8 menu.

A5. When enter this menu,will display the following pic,this menu is to set the starting speed of the stepper motor with load working condition.

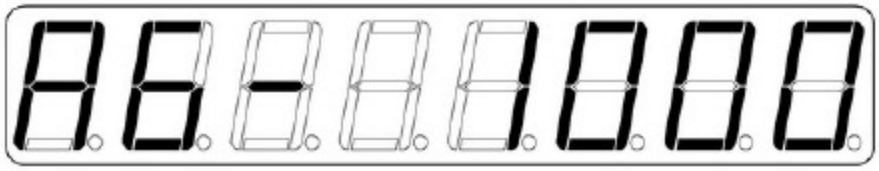


Then press “UP” or “DOWN’ ， the right number will increase or decrease,selected value and press “Enter” to save the setting and exit the menu.Press

“Back” will not save the setting and exit the menu.(UNIT:RPM)

NOTE:The starting speed is refers to the initial speed before motor acceleration.

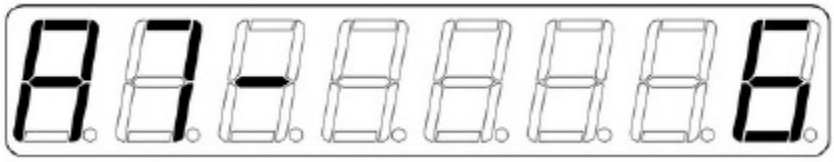
A6. When enter this menu,will display the following pic,this menu is to set the Max. speed of the stepper motor with load working condition.



Then press “UP” or “DOWN’，the right number will increase or decrease,selected value and press “Enter” to save the setting and exit the menu.Press “Back” will not save the setting and exit the menu.(UNIT:RPM)

NOTE:More than the speed,the motor will be stall.

A7. When enter this menu,will display the following pic,this menu is to set the internal acceleration.



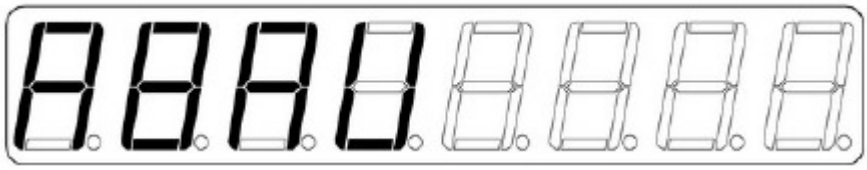
Then press “UP” or “DOWN’，the right number will increase or decrease,selected value and press “Enter” to save the setting and exit the menu.Press “Back” will not save the setting and exit the menu.

NOTE:the numerical is in 1 ~ 100 between, the smaller the numerical speed faster, the greater the numerical accelerating the slower. General set to 6-8 or so.

A8. When enter this menu,will display the following pic,this menu is the controller automatic parameter analysis.

Then press “DOWN”,will display the following pic,press “UP” will be back to the above pic.

With any above pic,press “ENTER” will display the following pic and flashing.



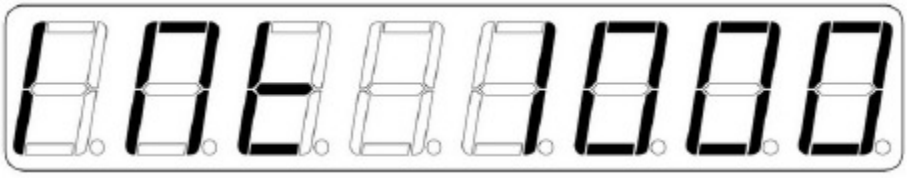
Now don't need any artificial operation, the system will automatically to analysis all input parameters and stored in the internal controller. This process will need different time according to your motor system, generally take a few minutes, until the scintillation stop and go back to the main menu, parameter analysis completed, please be patient.

NOTE:

1**.** Every time after A4,A5,A6 settings, must need parameter analysis, otherwise the controller will probably serious mistakes to will not work.

2. If the motor and drive correctly connect to closed loop controller,and on the motor power,In the "A8-2" screen to press "ENTER",the motor will be from slow to fast in different rotation;If the motor has been connected to machine,the machine may be damaged.In the "A8-1" screen to press "ENTER",the motor will not run. **So if your motor have been connected to the machine,pls run parameter analysis in the "A8-1" screen. If you want the motor to run and check the motor rotation, can run parameter analysis in the "A8-2" screen.**

A9. When enter this menu,will display the following pic,this menu is to set the coefficient of the coordination value in normal working status.



Then press "DOWN",will display the following pic,press "UP" will be back to the above pic.The above pic shows the integral part of the coefficient,the following pic shows decimal part of the coefficient.

Press "ENTER" in any screen,the right number will be flashing,now press "UP" or "DOWN'， the right number will increase or decrease,selected value and press "Enter" to save the setting and exit the menu.Press "Back" will not save the setting and exit the menu.If no decimal part,the decimal part all set to zero.after setting integral and decimal part, press "BACK" to exit.

NOTE: