

# TC55H Instruction Manual



**TOPCNC Automation Technology Co., Ltd.**

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## **1. Product Introduction**

TC55H is an upgrading version of TC55. It can control 4 feeding axis, 1 analog spindle. It is equipped with 16 input port and 8 output port, supporting importing files from USB stick.

## **2. Technical Specifications**

Minimum data unit 0.001 mm

Maximum data size  $\pm 99999.999$ mm

Maximum Speed: 9000mm/min (pulse is 0.001mm)

Maximum pulse output frequency 150KHz

Axis 1-4 (X,Y, Z,C)

X,Y,Z,C axis can conduct linear interpolation, X,Y can do circular interpolation.

Electric Gear: numerator :1-99999 denominator: 1-99999

USB: Importing program and boot picture

Isolated I/O port

Maximum Program Line: 5000

Maximum Program: 100

RAM: 128M

External Manual Operation: motor clockwise and counter clockwise spinning, start, pause, alert and stop

G code and M code

One panel MPG

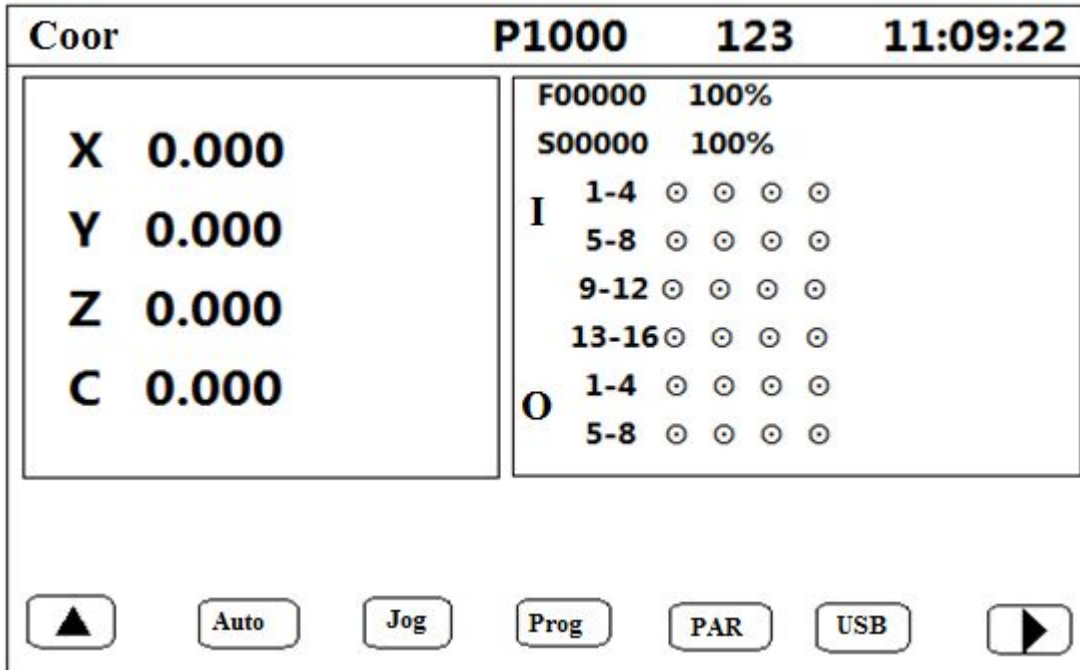
3.5 inch color LCD, pixel 320\*240

Analog Spindle Output: 1 0-10v analog spindle

Definition of external Switch

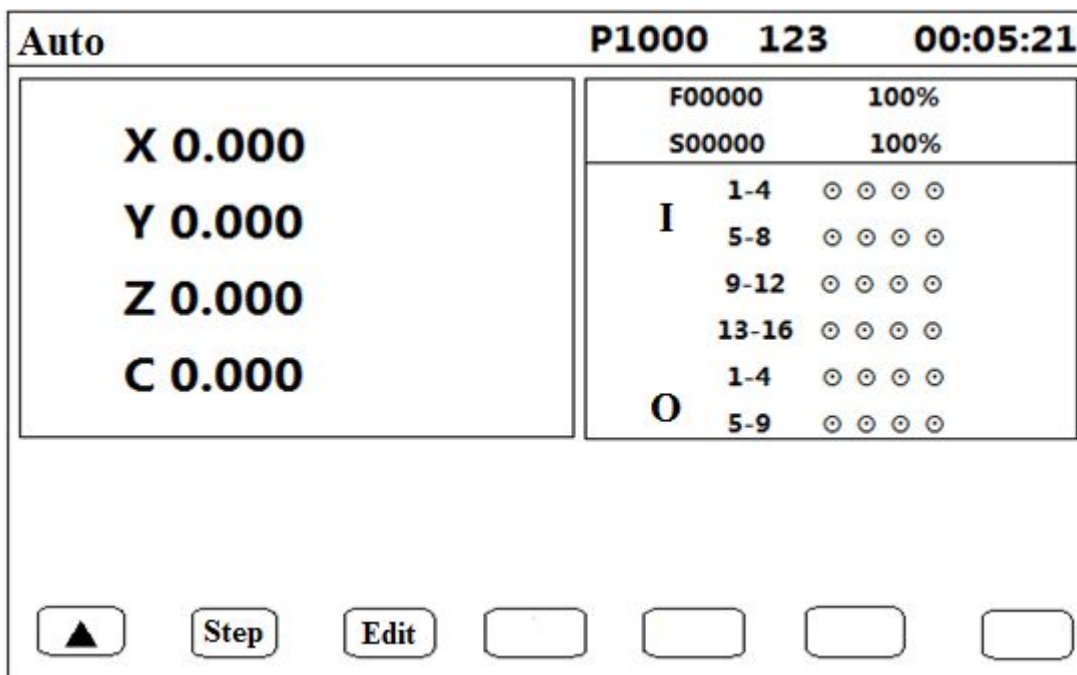
## Operation

### 1. Main Interface



This is the interface showing after booting without boot picture. It shows the coordinates of each axis, F speed and rate, S speed and rate, as well as condition of input and output port. P1000 means the program currently running; 123 means the input method. You can get into the AUTO, JOG, PROG, PAR, USB as well as password interface from here.

### 2.Auto

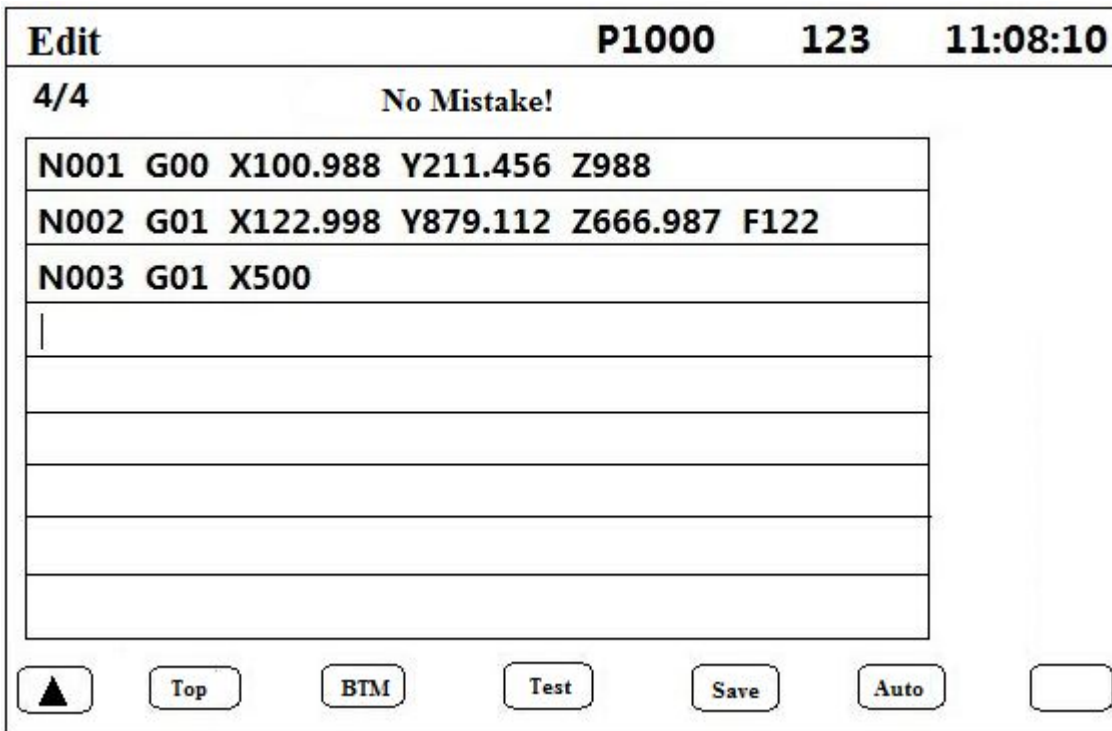


In Auto Interface, Press start to run the last read program, Press Pause to Stop.

### 2.1 Step

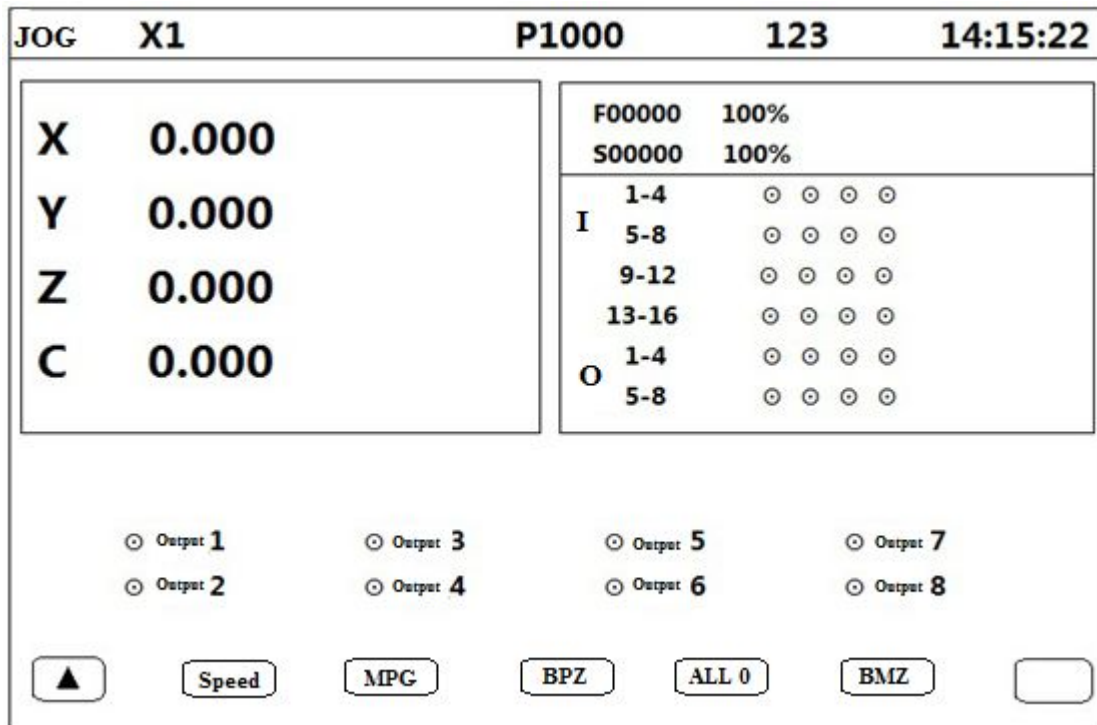
Positive display means consecutive operation. Negative display means operate command by command. When it is negative display, press Start once, one program line will be executed.

### 3.4.2 Edit



- Press Enter to insert new line.
- Long press DEL to delete a line.
- Press ← → ↑ ↓ to move the cursor
- Top: To the first line
- BTM: to the last line
- Test: See if there are any mistake
- Save: Save program
- Auto: Into Auto Interface.

### 3. Jog



- Press X, Y, Z and C to choose relevant axis.
- S for feeding rate gaining, N for feeding rate decreasing. (10%-150%)
- G for spindle rate gaining, M for spindle rate decreasing. (10%-150%)
- Press **Shift** to change output port, press **Enter** to change from ON or OFF.
- Press ← and → for consecutive running.
- Press ↑ and ↓ for jogging, define the jog distance in PAR-Ctrl-Jog+Distance; define jog speed in PAR-Speed-Jog.

#### 3.1 Speed

**Speed** : Negative display means manual high speed, positive display means manual low speed. Press ← and → for consecutive running.

### 3.2 MPG

Press **MPG**, then move the wheel up, the axis chosen move positively, move the wheel down, the chosen axis move negatively. Press **X10X100** to change the cardinal number which shown on the top of the screen.

Status	Cardinal Number
X1	0.001mm
X10	0.01mm
X100	0.1mm

### 3.3 BPZ

Press this key the chosen axis go back to reference point at highest speed. Define the highest speed in Parameters-Speed.

### 3.4 All 0

Press this key the chosen axis go back to reference point at highest speed. Define the highest speed in Parameters-Speed. F is the combination speed of all axis.

### 3.5 BMZ

Return to machine zero. The chosen axis will move at BMZ High Speed to go back to machine zero, then touch the switch and move at BMZ Low Speed, finally stop on the switch. In order to use this function, the X 0/Y 0/Z 0/C 0 has to be set as “On” in Parameters-Ctrl; Set BMZ High and BMZ Low in Parameters-Speed; Set the direction in Parameters-Ctrl-X BMZ Dir

## 4. PAR

### 4.1 Ctrl

Control parameters setting area, Long press ↑ and ↓ to change page.

- X/Y/Z/C Numerator: Electric gear ratio (1-99999)
- X/Y/Z/C Denominator: Electric gear ratio(1-99999)
- X/Y/Z/C Reference:In manual operation, long press X/Y/Z/C to clear the coordinates and show this value; or in machine zero, after hit the switch, it will show this value.
- X/Y/Z/C Backlash: Backlash to make it more precise
- X/Y/Z/C Boot Zero: 0 means the axis will not go back to machine zero after booting; 1 means the axis will go back to machine zero after booting
- X/Y/Z/C BMZ Dir: 0 means the axis go back to machine zero towards negative direction; 1 means the axis go back to machine zero towards positive direction

- Speed+Time(ms): time use for motor to reach F speed
- Jog+Distance: in manual operation, increment for jogging. Unit of it is depended on electric gear ratio.
- Language: English (0)or Chinese(1)

#### 4.1.1 Setting of Electronic Gear Ratio

Setting the electronic gear is to set different data unit for different machines. Different axis of the same machine can be set based on different unit. For example, axis A can be set as mm, axis B can be set as angle, and axis C can be set as round.

How to set the numerator and denominator of electronic gear ratio:

Pulse needed for the motor to turn one round to the same direction

Distance moved when the motor turn one round to the same direction( $\mu\text{m}$ )

Numerator and denominator both should be integer between 1 and 99999.

Ex. 1 Screw Transmission

Stepper motor stepping is 5000, or servo motor 5000 pulse/round, screw pitch is 6mm, reduction ratio is 1:1, then,

$$5000 \rightarrow 5$$

$$6*1000*1.0 \rightarrow 6$$

Ex. 2 Rack and Pinion

Stepper motor stepping is 6000, or servo motor 6000 pulse/round, gear teeth number is 20,  $m=p/\pi=2$ , then

$$6000 \rightarrow 1 \rightarrow 107 \rightarrow 107$$

$$1000*20*2*3.14159265 \rightarrow 20.943951 \rightarrow 2241.00276 \rightarrow 2241$$

Ex. 3 Rotary Angle

Stepper motor stepping is 5000, or servo motor 5000 pulse/round, reduction ratio is 1:30, then,

$$5000*30 \rightarrow 5$$

$$360*1000 \rightarrow 12$$

#### 4.2 Speed

- X/Y/Z/C Highest: The highest speed of x axis motor. When the system is operating, speed will not exceed this number no matter what F you set.
- Start(mm/min)Speed during Spd+Time
- Man High: Manual high speed
- Man Low: Manual low speed

- BMZ High: Go to machine zero at high speed.
- BMZ low: Go back to machine zero first at high speed, through zero switch and move back at low speed. Finally slider will stop on the switch.
- BMZ Mode: two modes to go back to machine zero, trough switch or not. Through switch(0): slider will stop on switch. Not trough switch(1): Slider will stop before the switch.
- S High Speed: The highest speed of spindle

### 4.3 Input







This function unable user to set various kind of switch easily. Define the I/O port according following form. External Big switch is needed to finish external control. External switch is connected in the way of normal open. Press R to change *off* into *on*, and S to choose N.O.(Normal Open). Then choose the IO Port number in the blank.

Note: For safety consideration, limit and emergency stop input is usually set as N.C.(Normal Close).

Function	Explanation
Alert	Alert Input
Stop	Emergency Stop Input
Run	Outside(External) Run Switch Setting
Pause	Outside(External) Pause Switch Setting
Speed+	Feed rate increase Switch Setting
Speed-	Feed rate decrease Switch Setting
X Lim+	X axis Positive limit setting
X Lim-	X axis Negative limit setting
X 0	X axis zero switch setting
Man X+	X axis clockwise spinning outside manual switch
Man X-	X axis counter clockwise spinning outside manual switch
X Boot Zero	X axis go back to Machine zero after booting external manual switch
Y Lim+	Y axis Positive limit setting
Y Lim-	Y axis Negative limit setting
Y 0	Y axis zero switch setting
Man Y+	Y axis clockwise spinning outside manual switch
Man Y-	Y axis counter clockwise spinning outside manual switch
Y Boot Zero	Y axis go back to Machine zero after booting external manual switch
Z Lim+	Z axis Positive limit setting

Z Lim-	Z axis Negative limit setting
Z 0	Z axis zero switch setting
Man Z+	Z axis clockwise spinning outside manual switch
Man Z-	Z axis counter clockwise spinning outside manual switch
Z Boot Zero	Z axis go back to Machine zero after booting external manual switch
C Lim+	C axis Positive limit setting
C Lim-	C axis Negative limit setting
C 0	C axis zero switch setting
Man C+	C axis clockwise spinning outside manual switch
Man C-	C axis counter clockwise spinning outside manual switch
C Boot Zero	C axis go back to Machine zero after booting external manual switch

#### 4.4 Output

PAR	P1000	123
M51: Output 0 Off	M59: Output 0 Off	
M52: Output 0 Off	M60: Output 0 Off	
M53: Output 0 Off	M61: Output 0 Off	
M54: Output 0 Off	M62: Output 0 Off	
M55: Output 0 Off	M63: Output 0 Off	
M56: Output 0 Off	M64: Output 0 Off	
M57: Output 0 Off	M65: Output 0 Off	
M58: Output 0 Off	M66: Output 0 Off	
M03: Output 0 Off		
M04: Output 0 Off		
Press Enter to choose on/off		
		1/1
		
		
		<input type="checkbox"/>

In this interface to define the open and close of 1-8 output port, then you can directly use in programming. M03-M04 is spindle interlock.

#### 4.5 FTY

Go back to factory value.

#### 4.6 Operation

- Press ←→↑↓to move the cursor
- Long Press ↑↓to change page
- After changing the parameters, press **ESC**, here appears the window ask whether save the parameters or not, press **Enter** and save, press **ESC** or **Not** to give up saving.

#### 5. Prog

In this interface to edit, read, delete, save and create program files.

<b>PROG</b>			<b>P1000</b>	<b>123</b>	<b>00:01:21</b>
			<b>SD Volume</b>		
<b>Name</b>	<b>Size</b>	<b>Time</b>			
<b>P1000</b>	<b>5581</b>	<b>2014-03-21</b>	<b>Left : 233104KB</b>		
<b>P1234</b>	<b>17882</b>	<b>2014-09-28</b>			
<div style="display: flex; justify-content: space-between; align-items: center;"> <span style="border: 1px solid black; border-radius: 10px; padding: 5px 15px;">▲</span> <span style="border: 1px solid black; border-radius: 10px; padding: 5px 15px;">Edit</span> <span style="border: 1px solid black; border-radius: 10px; padding: 5px 15px;">Read</span> <span style="border: 1px solid black; border-radius: 10px; padding: 5px 15px;">DEL</span> <span style="border: 1px solid black; border-radius: 10px; padding: 5px 15px;">Save.As</span> <span style="border: 1px solid black; border-radius: 10px; padding: 5px 15px;">New</span> <span style="border: 1px solid black; border-radius: 10px; width: 40px; height: 20px; display: flex; align-items: center; justify-content: center;"> </span> </div>					

## 6. USB

<b>USB</b>	<b>P1000</b>	<b>123</b>	<b>13 : 10 : 08</b>
------------	--------------	------------	---------------------

<b>USB Prog</b>	
Name	Size
<b>P123.TXT</b>	<b>51</b>

<b>Boot Pic</b>	
Name	Size
<b>K0004.BMP</b>	<b>230454</b>
<b>K0005.BMP</b>	<b>230454</b>
<b>K0006.BMP</b>	<b>230454</b>

▲ Import Prog Pic

- Boot Picture Name: K123.bmp or K1234.bmp Pixel: 320\*240
- Program Name: P123.TXT or P1234. TXT

## Programming

### 1. Introduction

#### 1.1 Program Name

The name of a Program in USB or in system has to be P+ number,

Like P1, P123, P1234

#### 1.2 Code Explanation

Same Code might means differently in different place.

Code	Number Range	Meaning
N	0~9999	Sub program name
N	0~99999	Program Name
G	0~99	G code
X	+0.001~	X axis
Y	+99999.999	Y axis
Z	(mm)	Z axis
C		C axis
R	+0.001~ +99999.999mm	Radius
K	0.001~99999.999s	Delay Time
F	0~99999	Feeding speed
S	0~99999r/min	Spindle speed
M	00~99	M code

### 2.G Code

Non Modal G code: Valid only in this Program line

Modal G code: Valid until another G code of the same Group is used.

G Code	Modal	Format	Function
G00	Modal	G00 X_ Y_ Z_ C_	Fast Positioning
G01		G00 X_ Y_ Z_ C_ F_	Linear Interpolation
G02		G02/G03 X_ Y_ R_ F_	Clock wise Interpolation
G03			Counter Clockwise Interpolation
G04		G04 Kxxxxx.xxx	Delay Time: s
G20		G20 Nxxxx.xxx Numbers after N: subprogram name and repeat times	Subprogram Call
G22		G22 Nxxxx Numbers after N: subprogram name	Subprogram Start

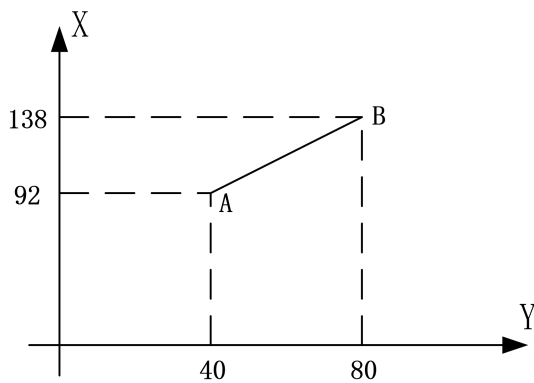
G24		G24 Note: G22 and G44 used in pair	Subprogram End
G25		G25 Nxxxxx	Skip
G90	Modal	G90	Absolute Programming
G91		G91	Incremental Programming
G92		G92 X_Y_Z_C_	Set Coordinates

### 2.1 G00——Fast Positioning

Formula: G00 X\_Y\_Z\_C\_

Note: Set the speed in **Parameters-Speed**.

Ex.: Tool move from A to B at fast speed.



Absolute Programming:

N001 G90

N002 G00 X138 Y80

Or

N001 G90 G00 X138 Y80

Incremental Programming

N001 G91

N002 G00 X46 Y40

Or

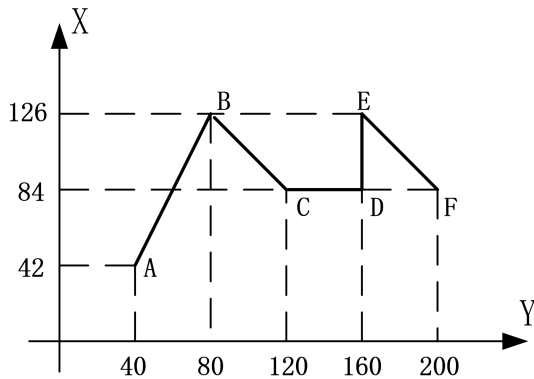
N001 G91 G00 X46 Y40

### 2.2 G01——Linear Interpolation

Formula: G01 X\_Y\_Z\_C\_F\_

Note: If F is not set, then axis will move at speed of starting speed, set the highest speed in Parameters-Speed.

Ex.:



Absolute Programming:

```
N001 G90
N002 G00 X126 Y80      A→B
N003 G01 X84 Y120  F500  B→C
N004 G01 X84 Y160  F500  C→D
N005 G01 X126 Y160 F500  D→E
N006 G01 X84 Y200  F500  E→F
```

Incremental Programming:

```
N001 G91
N002 G00 X84 Y40      A→B
N003 G01 X-42 Y40  F500  B→C
N004 G01 Y40  F500      C→D
N005 G01 X42  F500      D→E
N006 G01 X-42 Y40  F500  E→F
```

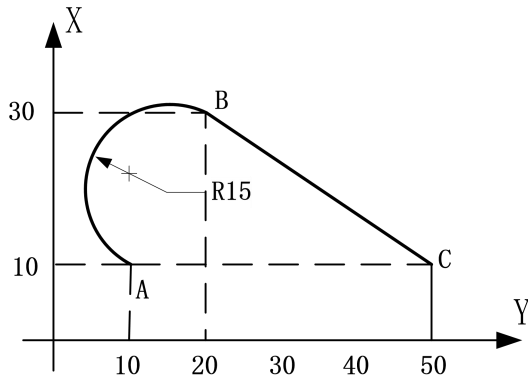
### 2.3 G02—Clock wise Interpolation

Formula: G02 X\_ Y\_ R\_ F\_

Note:

- (1) F is the speed
- (2) Whole circle can not be finished one time
- (3) R is the radius, "+R" used when  $<180^\circ$ , "-R" used when  $>180^\circ$
- (4) The distance between starting point and end point has to be smaller than  $2R$ , otherwise it will not be operated.

Ex.



Absolute Programming:

```
N001 G90
N002 G02 X30 Y20 R15 F800 A→B
N003 G00 X10 Y50      B→C
```

Incremental Programming:

```
N001 G91
N002 G02 X20 Y10 R15 F800  A→B
N003 G00 X-20 Y30      B→C
```

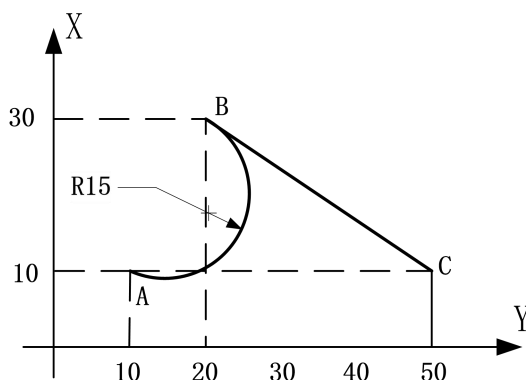
### 2.4 G03—Counter Clockwise Interpolation

Format: G03 X\_ Y\_ R\_ F\_

Note:

- (1) F is the speed
- (2) Whole circle can not be finished one time
- (3) R is the radius, “+R” used when  $<180^\circ$ , “-R” used when  $>180^\circ$
- (4) The distance between starting point and end point has to be smaller than  $2R$ , otherwise it will not be operated.

Ex:



Absolute Programming:

```
N001 G90
N002 G03 X30 Y20 R15 F800 A→B
N003 G00 X10 Y50          B→C
```

Incremental Programming:

```
N001 G91
N002 G03 X20 Y10 R15 F800 A→B
N003 G00 X-20 Y30        B→C
```

### 2.5 G04—Delay Time

Format: G04 Kxxxxx.xxx

Note: 0.001~99999.999s

Ex: G04 K5

### 2.6 G20—Subprogram Call

Format: G20 Nxxxx.xxx

Note:

- (1) xxxx means subprogram name, xxx means repeat times.
- (2) Repeat time: 1~999
- (3) If repeat time is 0 or not filled, G04 will be repeat once.

EX:

```
N010 G20 N234.10      Call the subprogram named 234, repeat 10 times
N100 G22 N234        Subprogram start, name as 234
N101 G91              Incremental Programming
N102 G01 X10 Y10 F500 Linear Interpolation
N103 G24              Subprogram End
```

### 2.7 G25—Skip

Format: G25 Nxxxxx

Note: number after N means the line skip to

Ex:

```
N001 G00 X10 Y10      Fast Positioning
N002 G01 X800 Y300 F1500 Linear Interpolation
N003 G25 N001         Skip to N001
```

## 2.8 G92——Set Coordinates

Format: G92 X\_ Y\_ Z\_ C\_

Note: Set current location as new coordinates

## 3.M Code

**M code is used to control input and output.**

Code	Functions
M02	Program End
M03	Spindle clockwise spinning
M04	Spindle counter clockwise spinning
M05	Spindle Stop
M51~M66	Corresponding output port open or close

EX:

- (1) First find **PAR-Output**, input Output 1 for M51; then press **Enter** to turn “Off” to “On”; Press **ESC**, Then press **Enter** to save.
- (2) Press **PROG**, then **New**, type in a name, then press **ENTER**, and then you can start to edit;
 

N001 M03 S200	Spindle spin clockwise at 200r/min
N002 G04 K5	Delay 5s
N003 G01 X100 Y100 F1500	Linear Interpolation
N004 M04 S200	Spindle spin counter clockwise at 200r/min
N005 G04 K5	Delay 5s
N006 G01 X50 F1500	Linear Interpolation
N007 M05	Spindle stop
N008 M51	Output port 1 is connected
N009 M02	Program End
- (3) After finishing edition, press **Save**, then press **AUTO** and **Start** to run.

## 4.Spindle

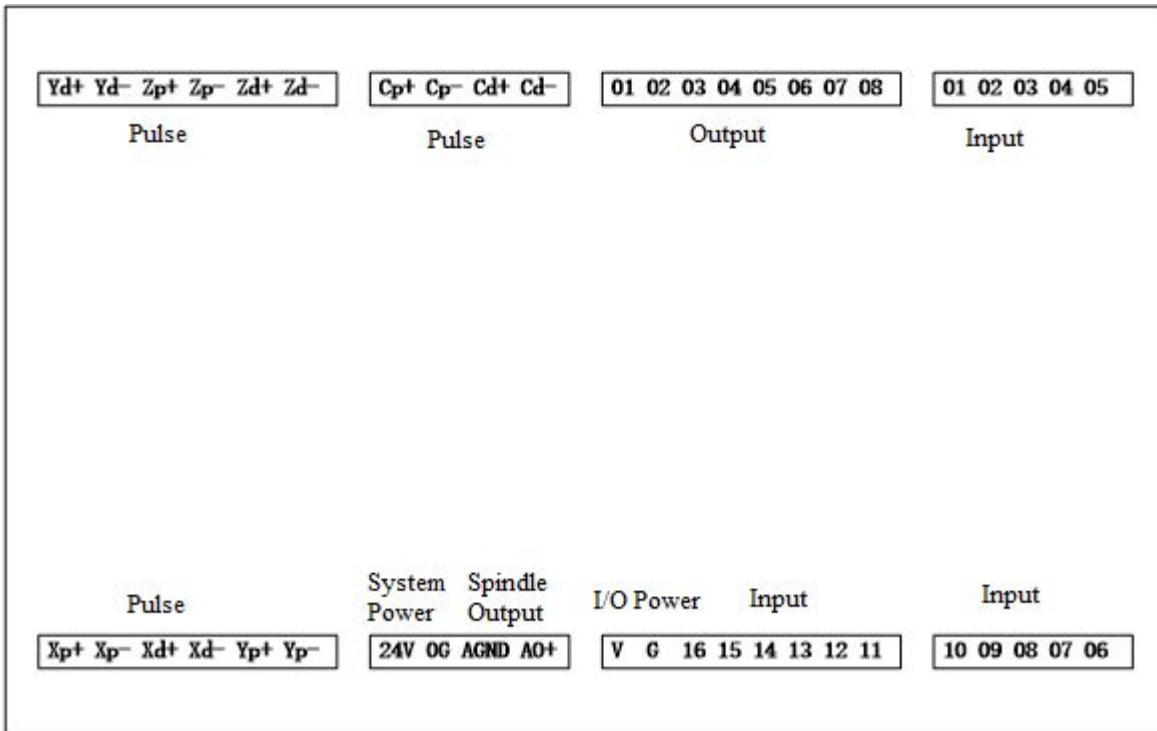
S code is used to control the speed of the spindle, this controller use analog voltage controlling method to control spindle speed.

Note: S code can not support power off memory.

EX: N001 M03 S1000 Spindle spin clockwise at 1000r/min

## Wiring Diagram

### 1. TC55H Back View

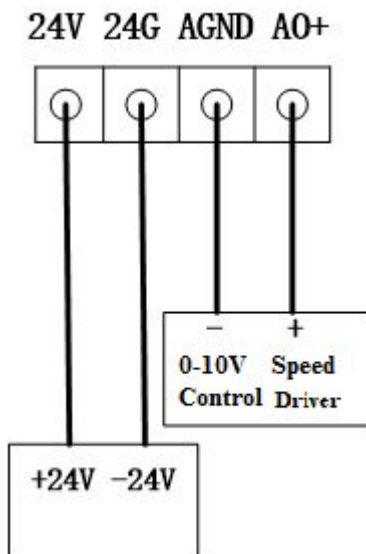
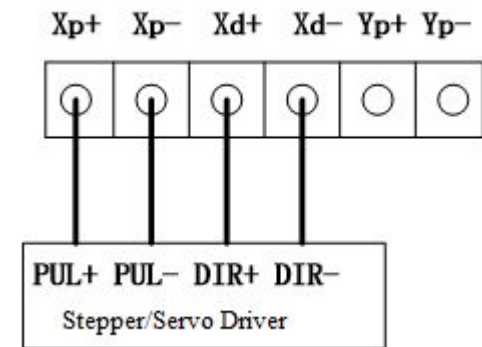


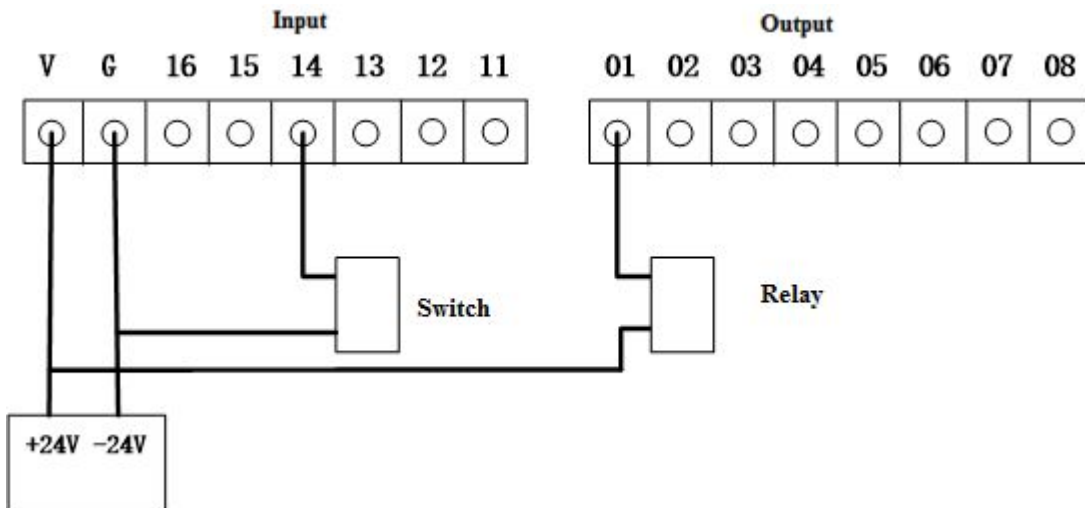
### 2. Wiring Instruction

Xp+	X axis pulse positive output
Xp -	X axis pulse negative output
Xd+	X axis direction positive output
Xd-	X axis direction negative output
Yp+	Y axis pulse positive output
Yp -	Y axis pulse negative output
Yd+	Y axis direction positive output
Yd-	Y axis direction negative output
Zp+	Z axis pulse positive output
Zp -	Z axis pulse negative output
Zd+	Z axis direction positive output
Zd-	Z axis direction negative output
Cp+	C axis pulse positive output
Cp -	C axis pulse negative output
Cd+	C axis direction positive output
Cd-	C axis direction negative output
01~08 (Output)	Output 01-08,Connect to power 24V+ through Relay or solenoid valve

01~16 (Input)	Connect to power 24V- through machine or switch
AGND	Analog Spindle Output 0-10V Positive
AO+	Analog Spindle Output 0-10V Negative
24V	System Power Positive
24G	System Power Negative
V	I/O Power Positive
G	I/O Power Negative


### 3. Connection





# Four Reference

## How to use TC55H correctly?

1. Wiring according to instruction
2. After booting, press  and find the button for code and log in.
3. Press **PAR**, then choose **Output**; Set M51, Output 1, Press **Enter** to turn the output port On; Set M52, Output 1, maintain Off; Set M53, Output 2, Press **Enter** to turn On; Set M54, Output 2, stay Off; Press **ESC**, then **Enter** to save.
4. Press **PROG**, then **New**, type in a name, then press **ENTER**, and then you can start to edit;

<b>Program Line</b>	<b>Explanation</b>
N001 G90	Absolute Programming
N002 G00 X10 Y10	Fast Positioning
N003 G02 X30 Y20 R15 F800	Clockwise Interpolation
N004 M03 S500	Spindle Clockwise Spin
N005 M51	Output
N006 G04 K5	Delay
N007 M52	Output
N008 M04 S800	Spindle Counter Clockwise Spin
N009 M53	Output
N010 G04 K5	Delay
N011 M54	Output
N012 M05	Spindle Stop
N013 M02	End

5. Press **Test**, if there is no mistake, press **Save**, Then press **Auto**, and **Start**.