Handheld Motion Controller
For Engraving Machine
DM500

User's Manual

Digital Dream CNC Co,. Ltd.
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1   DM500 Motion Controller Introduction

1.1 Introduction of Product

Digital Dream has a 20 years history in the numerical control industry, specializing in the research, development and production of various CNC (Computer Numerical Control) systems. DigitalDream aims to combine high quality and high reliability with affordability. We produce 1 axis to 6 axes CNC system.

Thank you for choosing digital dream's motion controllers.With a lots of examples and charts,this manual will describe the features,functions and every operations of our controllers.Pls read this manual carefully before any assembling and using.Incorrect handling can result in injury and damage to persons and engraving machine.Pls keep the manual carefully for convenient to read it at any time in need.

DM500 is very professional 4 Axis CNC Motion Controller which is based on embedded system.DM500 operates as a standalone system without the need of a computer,and with a pendant,it makes users very convenient to opreate the machines.Our controller adopts Embedded Operating System,by which the controller will never get virus-infected.And the controller adopts look-ahead algorithm by which the the controller can read more ahead 30-lines G-code than the operating.All the features guarantees high precision,accuracy and reliability.And the size is very small,oepreation is very easy,very suitable for all size of Engraving machines,Milling machines and cutting machines and so on.

1.2 Performance parameter of the DM500

1) Max. 4 Axis;2-4 Axis linear interpolation,any 2 axis circular interpolation;

2) 7 opto isolated digital outputs,8 opto isolated digital inputs;

3) Support every Input and output port definition by users.

4) The controller need 2 power supply,one power supply is for system power,one is for input and output ports power.Both input power is 24V,2A.

5) Open-collector output, Max. output current is 500mA,can power the relay directly;

6) Differential Pulse and direction output signal,Max. 500Khz per axis;

7) Spindle Control: 3 I/O ports control 8 different speeds(3 lines 8 speeds),1 I/O control the Start/Stop;

8) The System Support standard G-code.Also Support the popular CAD/CAM software,such as ArtCam,MasterCam,ProE and so on.

9) USB flash disk support for G code file input;

10) The control system can preview the process path before machining,and it makes the system more steady,working smoothy and precise;

11) Acceleration/Deceleration Mode: S curve;

12) Support un-limited size file for machining;

13) Manual/Automatic machining function;

14) Support the operation to Start a G code from a specific line;

15) Support for "Power Cut" recovery. Data is automatically saved;

16) Support time-lock function;

17) Support 4 kinds operation rights:visitor,operator,admin,super admin;

1.3 Appearance, Structure and Size of Product

The **DM500** motion controller contains the handheld motion controller,circuit switching wiring board,and HDMI digital high-definition transmission cable.

The handheld motion controller and wiring board are communicated by 2 Meter 37 pins HDMI digital high-definition transmission cable which is shielding twisted-pair cable to avoid interference.

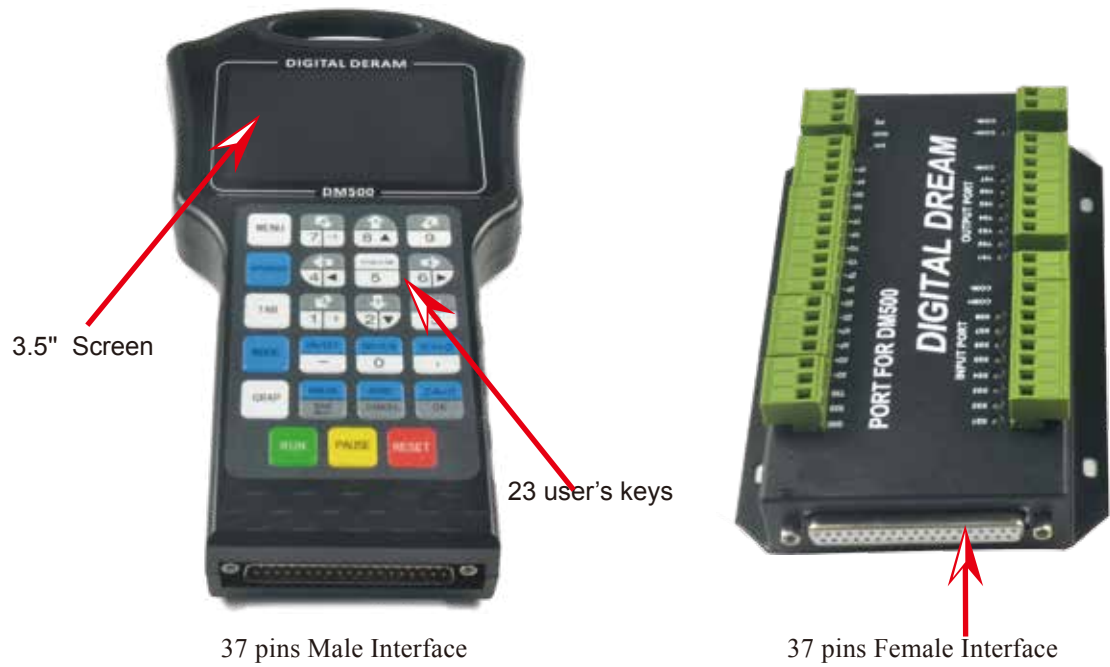The wiring board can be installed by DIN linearguide ways No. C45.

Picture 1-1   DM500 Pendant Size
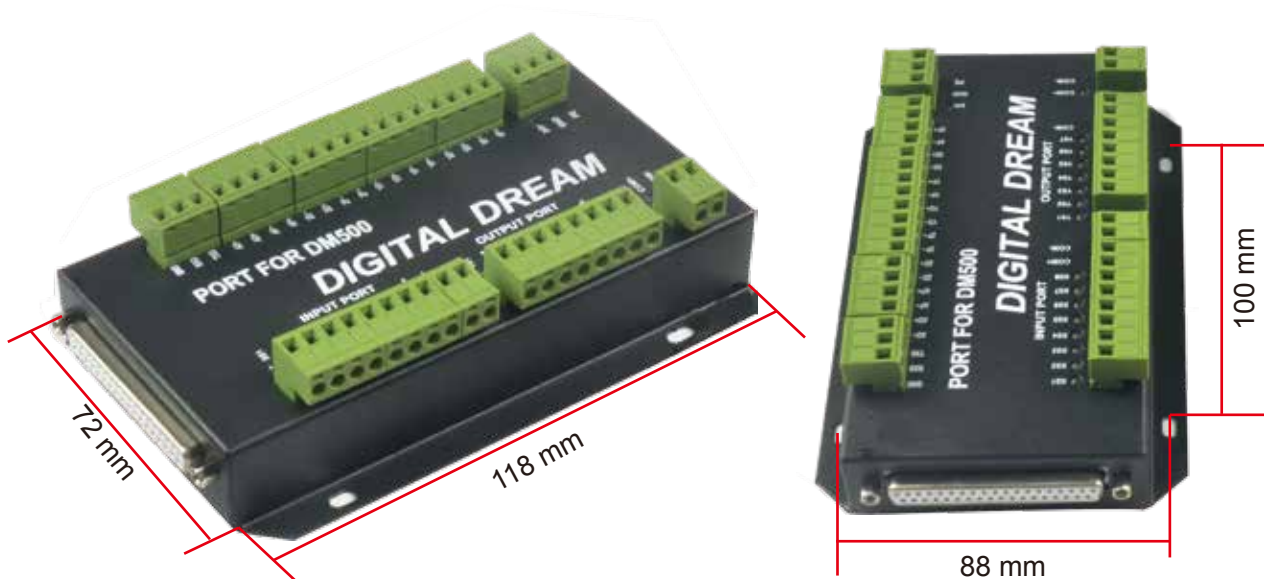
The wiring board Size

The front panel consists of 23 user keys and the 3.5'' (480*320) LCD.

3.5" Screen

23 user's keys

37 pins Male Interface

37 pins Female Interface

1.4 Explanation of Abbreviations

When operating the DM500 Controller, the users will come across some English abbreviations. Here a list with explanations

FRO: Feed Rate Override

SRO: Spindle Rate Override

SRJ: Jog Speed Setting

F: Feed rate, unit is mm/min

S: Spindle Speed, unit rev/min.

X: The coordinate code of the X axis.

Y: The coordinate code of the Y axis.

Z: The coordinate code of the Z axis.

A: The coordinate code of the A axis

BUSY: The system is busy. You still can adjust FRO and SRO

READY: READY mode, any operation can be done

RESET: Reset mode, controller is in "OFF" mode, no operation can be performed

CONT: Continuous mode, each axis can be manually jogged with the arrow keys

Step :Manual Step Mode，each axis can be jogged in defined steps

MPG: MPG mode. Operate the machine with the MPG (Manual Pulse Generator)

AUTO: Run G code. Auto is showing when file is processing

1.5 Notes and Warnings

Keep away from exposure to moisture or water. This product contains sophisticated electronics and must not get wet.

Wiring warning: the IO input terminal of this controller supports equipment with source power (such as Inductive Proximity Switch). When using this kind of equipment, pay attention to the polarity. Avoid the +terminal to be connect with GND. This controllers has analog output for spindle control (0-10V). Please avoid this terminal to ever connect with GND as damage to the controller may occur.

Operation warning. Please observe all security measures when operating the machine. The ESTOP must be connected and properly labelled. In case of a problem, press the E-stop at once to avoid damage to humans, animals and the equipment.
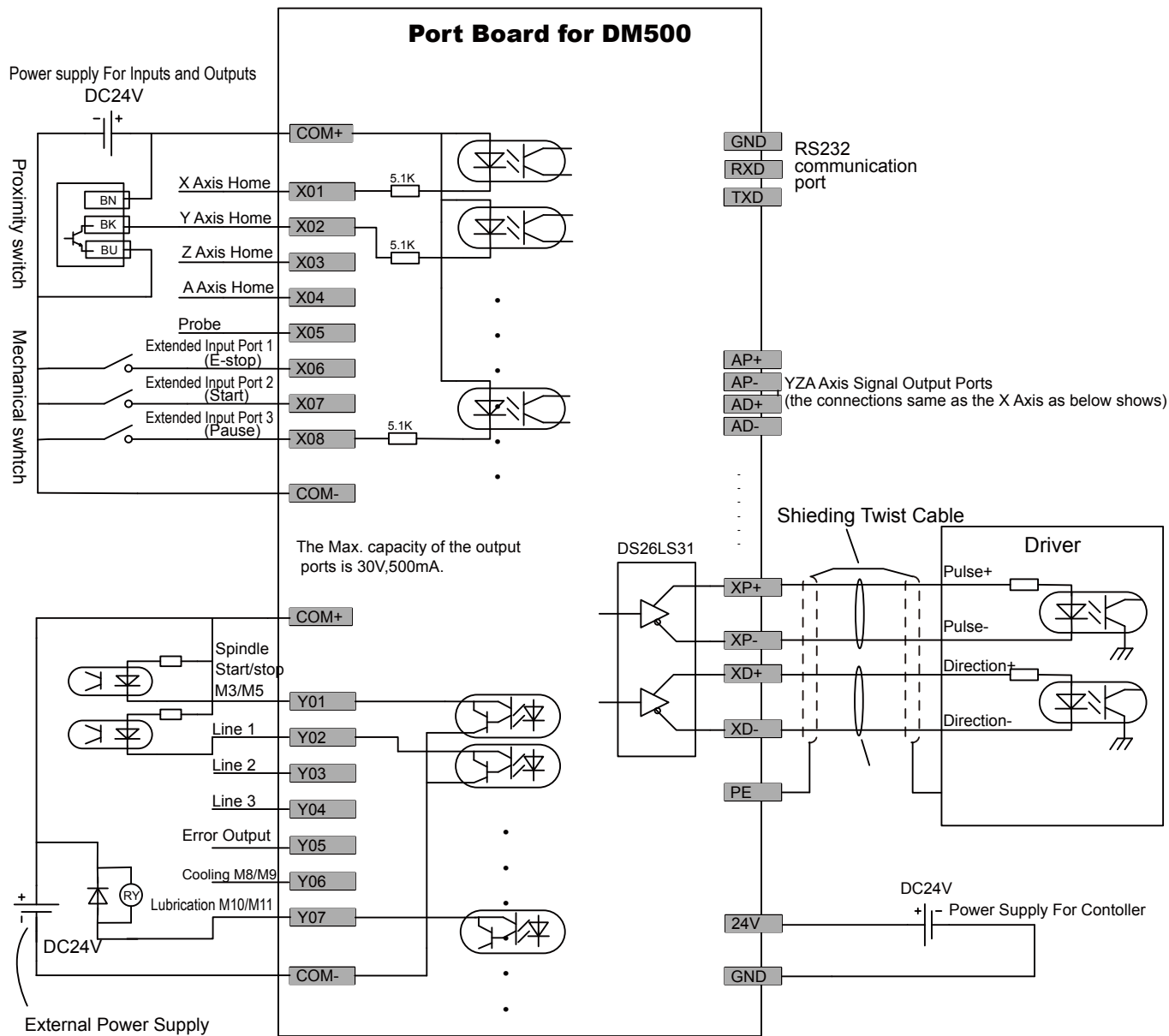
High voltage danger. The DM500 is connected to18-32V DC. Obey and follow the electricity safety rules of your country when connecting this equipment.

2   Wiring
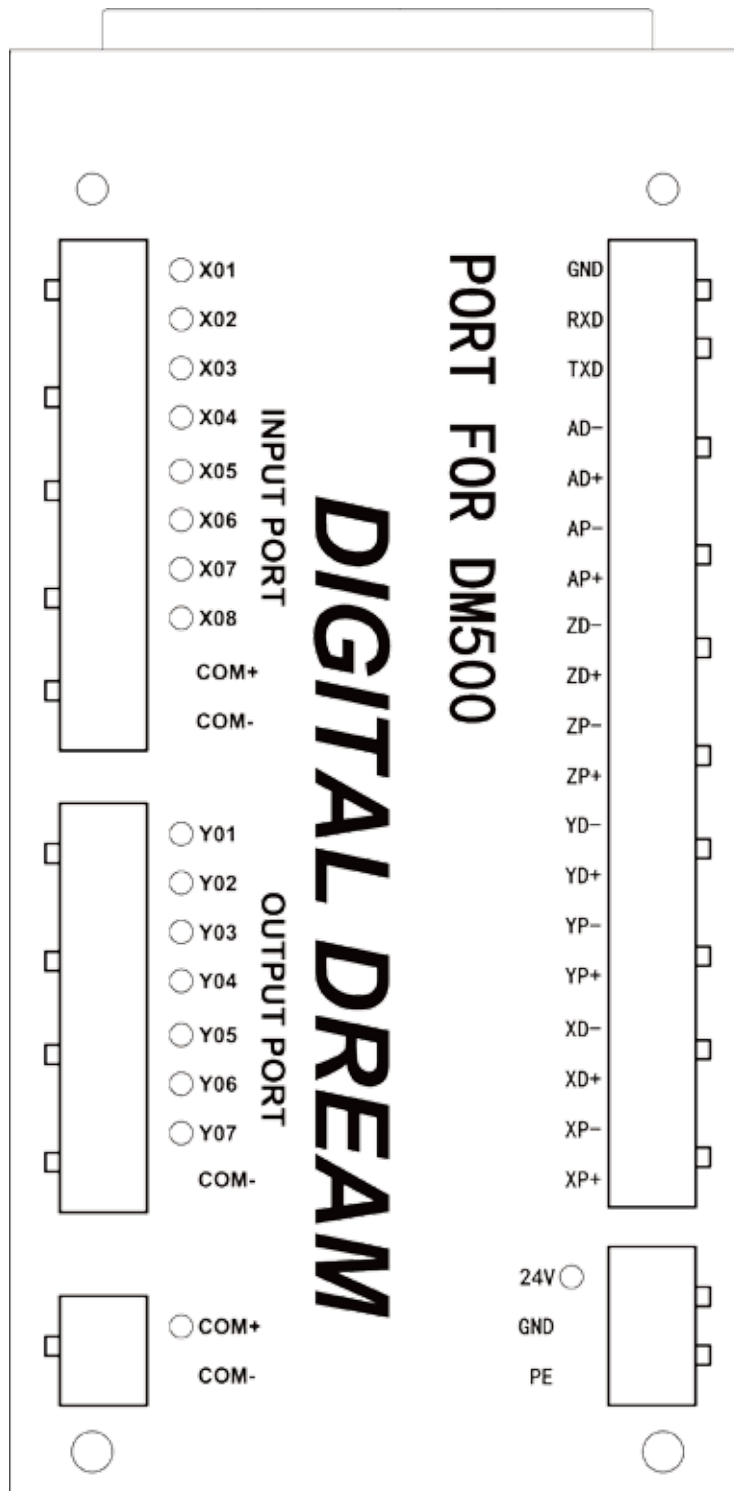
Wiring Board Drawing

2.1 The Wiring Board Interface

Port Board for DM500

Notice:

1. The users should prepare two power supply switch for each controller.One is for the controller system,one is for the Inputs and Output ports.

2. 24V GND is the power supply for the controller,COM+ and COM- is the common terminal for Input and Output ports.

3. The Low voltage for input signal is effective.By default it is the NPN switch.

4. The pulse and direction signal is differential output.

2.2 The Wiring Board Ports definition

| Pin Mark	Definition	Notes
24V	Power supply 24VDC positive side for System power	The Power Supply is for controller system.DC24V,3A.
GND	Power supply 24VDC negative side for system power	
PE	SHELL GROUND	
COM+	Power supply 24VDC positive side for Inputs and Output Ports.	The Power Supply is for Input and Output Ports.DC24V,3A.
COM-	Power supply 24VDC negative side for Inputs and Output Ports.	
XP+	X Axis Pulse signal output +	These Outputs is for Servo Driver/Stepper Driver. Max. output 500Khz for each axis.
XP-	X Axis Pulse signal output -	
XD+	X Axis Direction signal output+	
XD-	X Axis Direction signal output -	
YP+	Y Axis Pulse signal output +	
YP-	Y Axis Pulse signal output -	
YD+	Y Axis Direction signal output+	
YD-	Y Axis Direction signal output -	
ZP+	Z Axis Pulse signal output +	
ZP-	Z Axis Pulse signal output -	
ZD+	Z Axis Direction signal output+	
ZD-	Z Axis Direction signal output -	
AP+	A Axis Pulse signal output +	
AP-	A Axis Pulse signal output -	
AD+	A Axis Direction signal output+	
AD-	A Axis Direction signal output -	
X01	X Axis Limit/Home Signal Input Port	These all Input Ports. Support mechanical/Opto/Proximity Limited Switch Limited Switch Power:24V Mode: NPN Effective Voltage:0V
X02	Y Axis Limit/Home Signal Input Port	
X03	Z Axis Limit/Home Signal Input Port	
X04	A Axis Limit/Home Signal Input Port	
X05	Probe Signal Input Port	
X06	Extended Input Port 1,can be configured as E-STOP	
X07	Extended Input Port 2,can be configured as Start or Probe	
X08	Extended Input Port 3,can be configured as Pause	
Y01	Spindle Start/Stop Output Port	These Output ports for the controls of Spindle. Y02/Y03/Y03 are for settings of spindle 8 different speeds. Open-collector output,installed,Current:500mA,Voltage:30V
Y02	Spindle Speed Setting 1 Output Port	
Y03	Spindle Speed Setting 2 Output Port	
Y04	Spindle Speed Setting 3 Output Port	
Y05	Alarm Output	
Y06	Cooling output Port (M8/M9)	
Y07	Lubrication output Port (M10/M11)	
RXD	Receive Port of communication	RS232
TXD	Send Port of Communication	
GND	Ground of Communication Port	

2.3 The Wiring Board Ports Description

### 2.3.1 The Power Supply Wiring

In general, the power supply of industrial control's equipment products are complex. They have many different ground levels. The internal power structure of this product is as follows:

It's recommended to add a filter to prevent the electric interference.

The power for input/output ports is 24VDC,the power for Main controller system is also 24VDC.Because inside of the controller system,the power design for input/output ports and main controller already isolated,its recommended to give them two independent power supply.
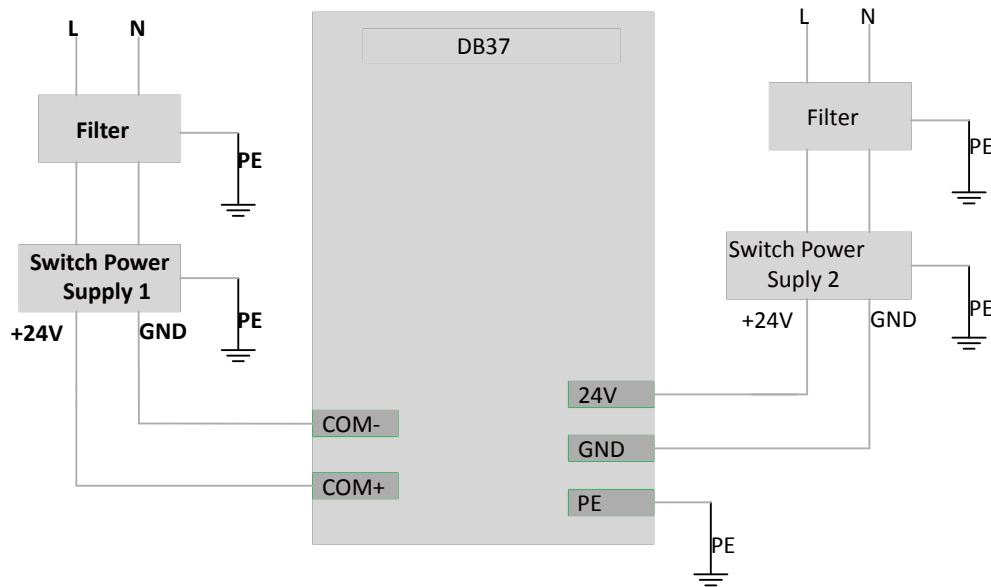
Main controller use the same power supply with Input/output ports.(no recommended).
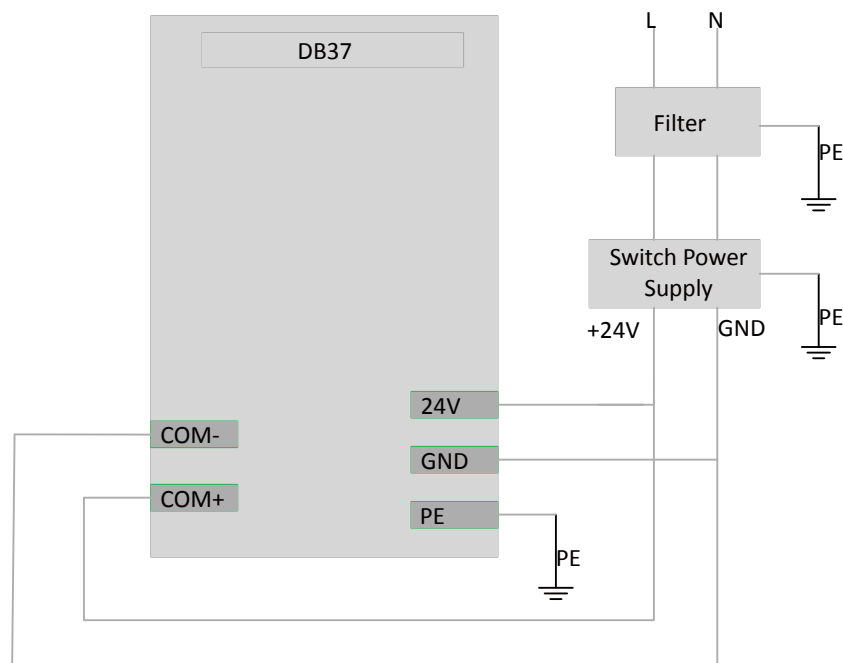
2.3.2 Input Ports Wire Method

When the Inputs and Output Ports (COM+ COM-) use the independent Power supply:

Proximity Switch
NPN Normal Open Mode

When the Inputs and Output Ports (COM+ COM-) share the same Power supply with the controller:
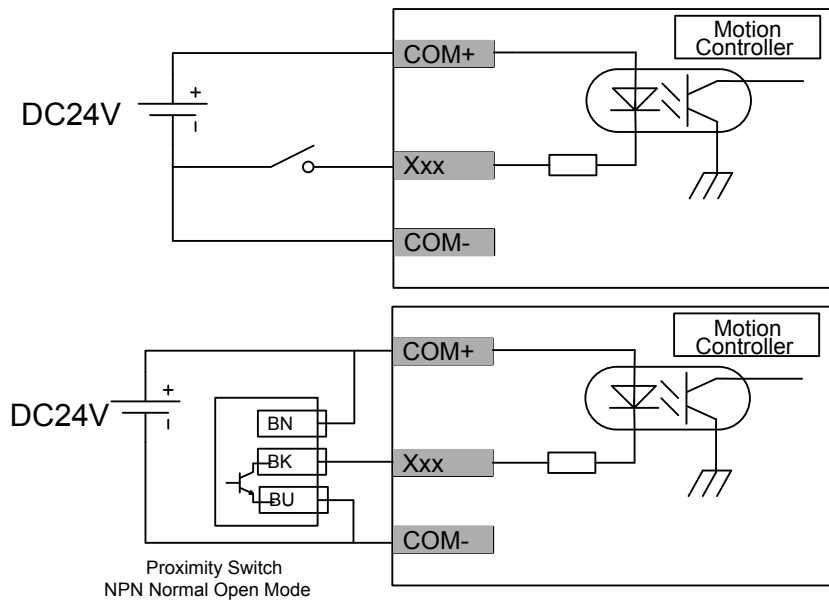
Proximity Switch
NPN
Normal Open Mode
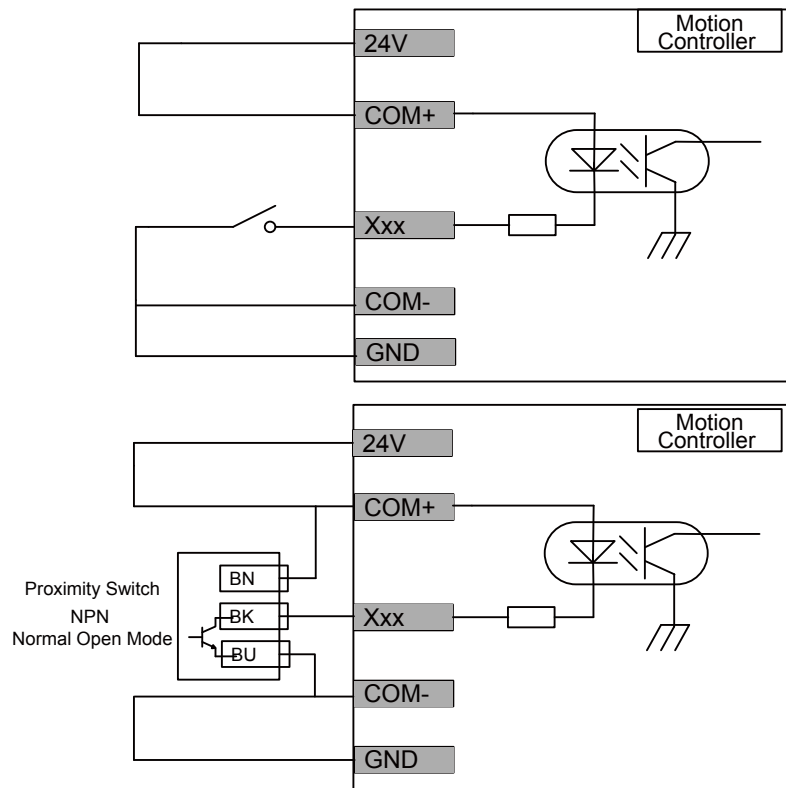
It's the best to use the first independent power supply method.Logic low Effective.NPN normal open proximity switch.

2.3.3 Output Ports Wire Method

When the Inputs and Output Ports (COM+ COM-) use the independent Power supply:(Recommended)
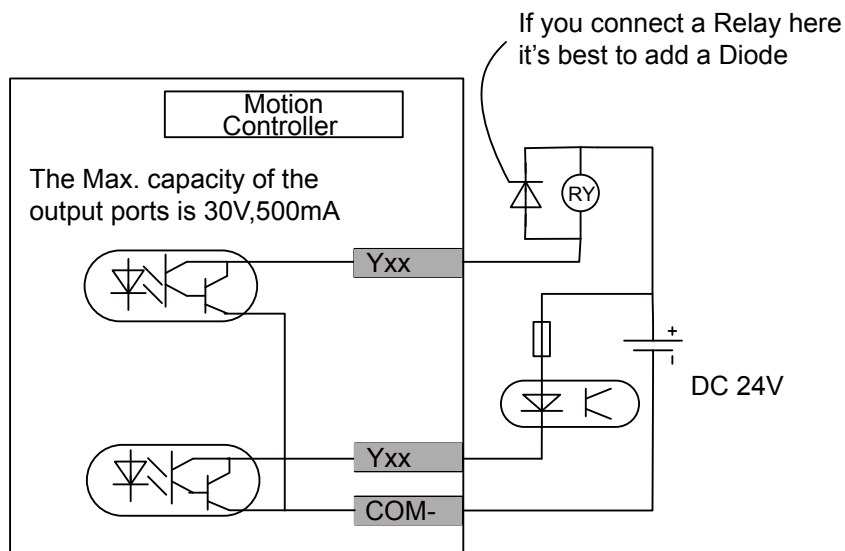
When the Inputs and Output Ports (COM+ COM-) share the same Power supply with the controller:
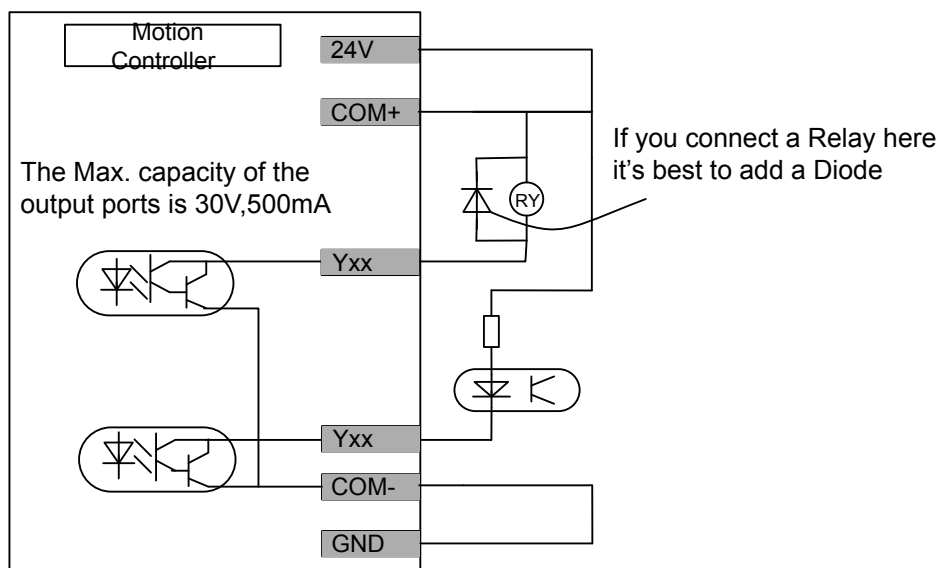
There is 7 output pins,the electric circuit just as the above file showing.

When you connect the relay,pls install a fly-wheel diode as the drawing showing.

The first Independent power supply method is recommended.

2.3.4 Pulse and Direction signal Output wiring

Take X axis for example:
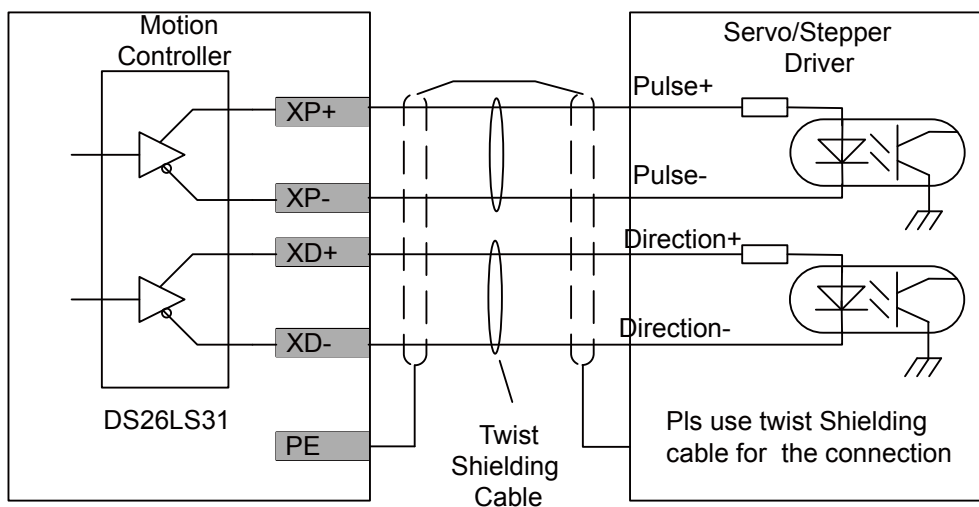
Y,Z,A axis wiring are same as X axis;

The controller use differencial output methods,And The Max. Output Frequency is 500Khz;
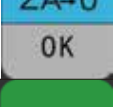
Cannot connect as Common anode and cathode;

3. Definition of keys

3.1 The Panel Keys showed as the photo below:

3.2 Definition of keys

| Keys Icon	Definition	Keys Icon	Definition
MENU	Main control page,files display page and Parameter page Shift.	MODE	"CONT MODE" and "STEP MODE" shift.
A 7 +%	1: Positive movement of A Axis; 2: Data 7 input; 2: 3: Parameter value increases	ON/OFF —	1: Spindle manual Start/Close 2: Sign "-" input.
Y 8 ▲	1: Positive movement of Y Axis; 2: Data 7 input; 3: Cursor moves up.	ORIGIN O	1: Go To workpiece origin. 2: Data 0 input
Z 9	1: Z Axis up; 2: Data 9 input	XY→O .	1: X and Y Zero Clearing. 2: Sign "." input
ADVANCED	Go to Operation Page	GRAP	Toolpath display switch
X 4 ◄	1: X Axis move left; 2: Data 4 input; 3: Cursor moves left; 4: Page up in menu.	BREAK BAK	1: Continue working from Break point; 2: Backspace.
HIGH/LOW 5	1: High/low speed shift; 2: Data 5 input.	HOME CANCEL	1: Find Machine Zero; 2: Cancel.
X 6 ►	1: X Axis moves right; 2: Data 6 input; 3: Cursor moves right; 4: Page down in menu.	ZA→O OK	1: Z and A Zero Clearing. 2: Enter/Select.
TAB	Shift to the function,such as feeding ratio, Jog distance,spindle speed,coordination selection and so on.	RUN	Start operation
Z 1 -%	1: Z Axis down; 2: Data 1 input; 3: Parameter value decreases	PAUSE	Pause operation
Y 2 ▼	1: Negative movement of Y Axis; 2: Data 2 input; 3: Cursor moves down.	RESET	Reset and E-STOP. Shift between Reset and Ready
A 3	1: Negative movements for A Axis; 2: Data 3 Input.		

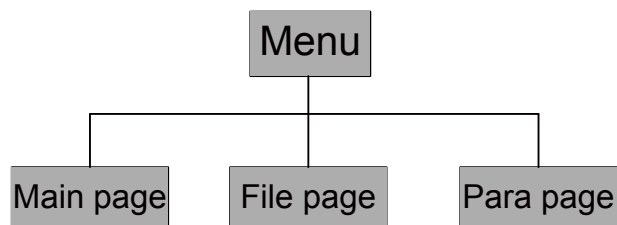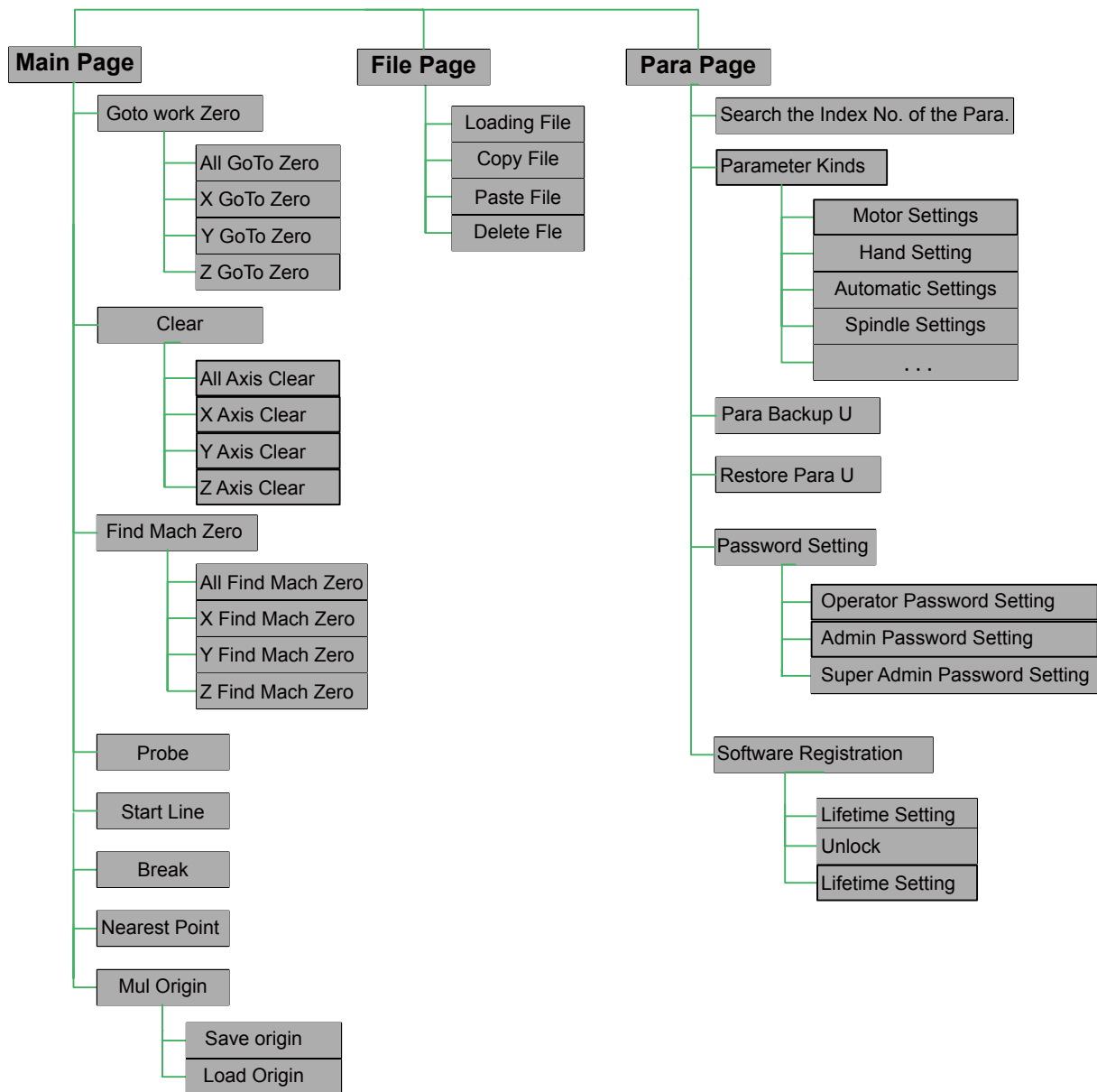# 4. Motion Controller System Description

4.1 Main Page Description
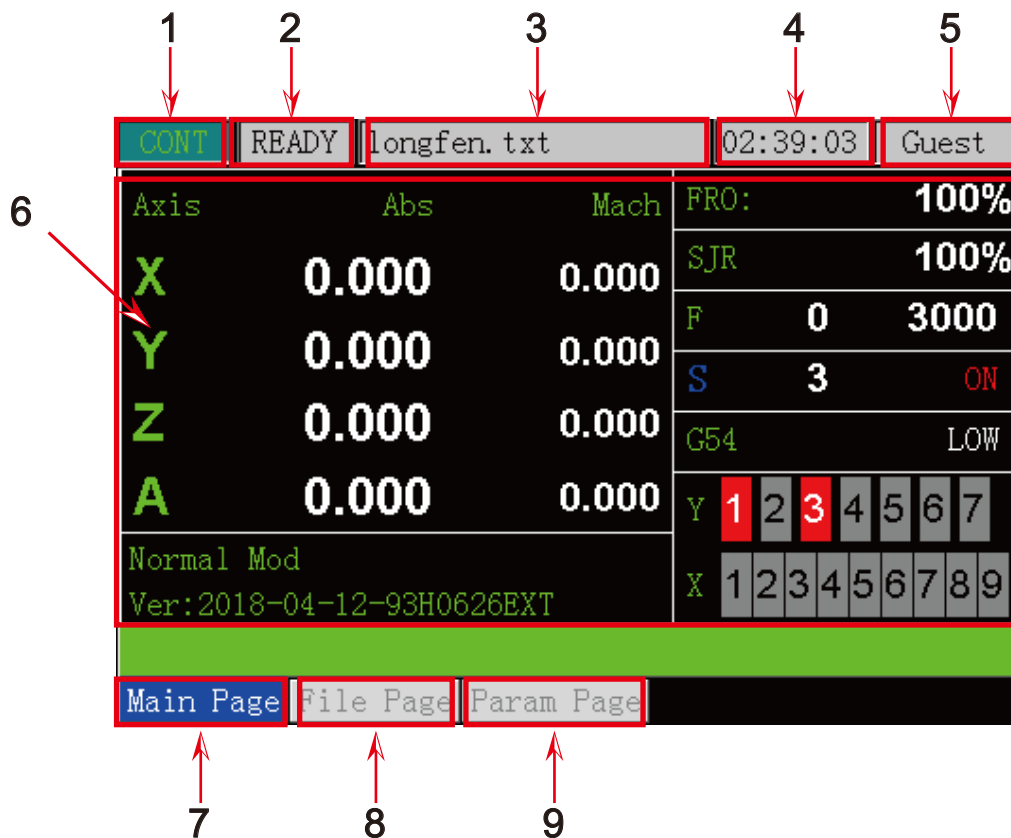
1: Controller Current Mode

2: Controlller Working Status

3: Current machining file.(if the files name in red background color,means the controller cannot read the U-disk)

4: Total working time

5: Current operation Rights

6: The information page

7: Main Page

8: File Page

9: Parameter Page

4.2 Menu tree structure

Main Page

- Goto work Zero
  - All GoTo Zero
  - X GoTo Zero
  - Y GoTo Zero
  - Z GoTo Zero
- Clear
  - All Axis Clear
  - X Axis Clear
  - Y Axis Clear
  - Z Axis Clear
- Find Mach Zero
  - All Find Mach Zero
  - X Find Mach Zero
  - Y Find Mach Zero
  - Z Find Mach Zero
- Probe
- Start Line
- Break
- Nearest Point
- Mul Origin
  - Save origin
  - Load Origin

File Page

- Loading File
- Copy File
- Paste File
- Delete Fle

Para Page

- Search the Index No. of the Para.
- Parameter Kinds
  - Motor Settings
  - Hand Setting
  - Automatic Settings
  - Spindle Settings
  - . . .
- Para Backup U
- Restore Para U
- Password Setting
  - Operator Password Setting
  - Admin Password Setting
  - Super Admin Password Setting
- Software Registration
  - Lifetime Setting
  - Unlock
  - Lifetime Setting

4.3 Main Page Description
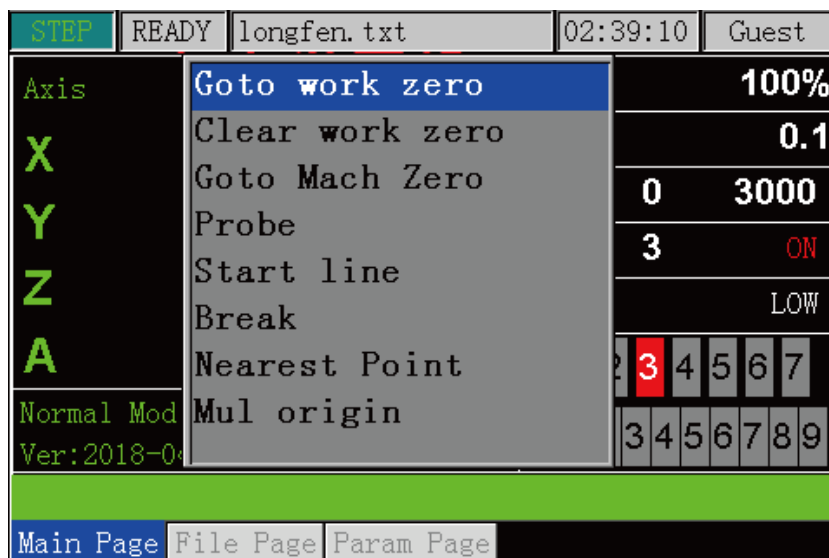
4.3.1 Page description of Main Page

Press the key [MENU] ,the Screen goes to Main Page.

The Page discription:

1. Coordinate display: Here you can see the absolute coordinate and mechanical coordinate;

2. FRO: FRO controls the Feed Speed. The range is 0%-300%,"+%" and "-%" adjust the speed in 10% increments;

3. SJR: SJR controls the jogging of the machine;

When in Cont Mode, "+%" and "-%" can adjust the speed in 10% increments;

When in Step Mode, "+%" and "-%" can change from 0.01mm to 0.1mm to 1mm and to 10mm;

4. F: F is the Feeding Speed.It shows the current machining speed;It shows the fixed feeding speed;

5. S: S is the spindle speed.It shows the current spindle speed;It also display the spindle status of STOP/START;

6. Current workpiece Coordination: G54/G55/G56/G57/G58/G59 workpiece coordination;Mach Coordination;

7. Manually High/low speed;

8. Output signal status;

9. Input signal status;

10. Version information and Programming date;

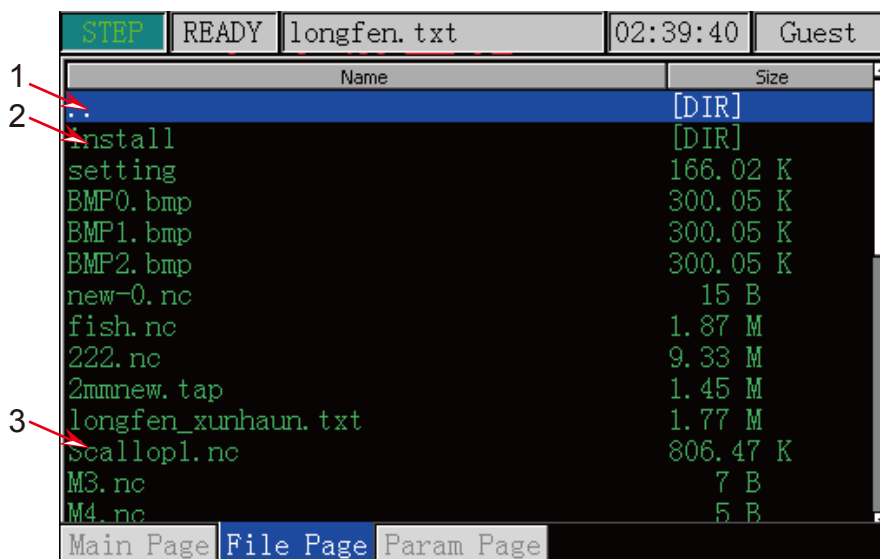11. Machining information: G code information when automatically machining;Errors.

4.3.2 The Operation of Main Page

When at the Main Page,and Press the key [ADVANCED] and the page pop up the list as above.

4.4   File Page Description

4.4.1 Page description of File Page

Press the key [MENU] , and press the key [6 ►] ,the screen goes to File Page as above.

By default the page shows the root of U-disk,by pressing other keys you can organize the files.The displays will show all folders and files in the root directory. The Name of folders and files, the size of files and the time and date of manipulation. The blue strip indicates the current valid target location.

Press to move up

Press to move down

Press to quit the file management page

Press If the blue bar is at " . ." (as 1), the Enter button will change to the last directory. If the blue bar highlights a folder(as 2), it will open the folder. If the blue bar highlights a G code file(as 3),press , this button will load the G code and go back to the Main Page for processing the G-code file.

4.4.2 The Operation of the File Page

When at the File Page,and Press the key and the page pop up the list as below:

4.5   Parameter Page Description

4.5.1 Page description of Parameter Page

Press the key [MENU], and press the key [6], the screen goes to Parameter Page as below:

2 →

1 →

→ 3

| STEP | READY | longfen.txt | | 02:40:24 | Guest |

No.	Param Name	Value
103	A axis manual control HIGH speed	3000.000
140	X axis manual control LOW speed	1000.000
141	Y axis manual control LOW speed	1000.000
142	Z axis manual control LOW speed	1000.000
143	A axis manual control LOW speed	1000.000
263	X axis stop Acc in M_Ctrl mode	600.000
264	Y axis stop Acc in M_Ctrl mode	600.000
265	Z axis stop Acc in M_Ctrl mode	600.000
266	A axis stop Acc in M_Ctrl mode	600.000
---	[Automatic control parameters]	-------------
15	Speed Selection	default
76	default operation speed	3000.000

[0~1] 0:set by G code, 1:use default speed

Main Page File Page Param Page

The Page discription:

1. Parameter Name;

2. Current Parameter Information,as the photo shows,103 is the Index No;"A axis Manually high speed" is the parameter name,and "3000" is the parameter Value.

3. Current selected parameter value range and unit.

Press [8] to move up

Press [2] to move down,to move the cursor and select the right Index No.

Press [ZA-0 OK] to select the parameter and start to write it.Press the data keys and press [ZA-0 OK] to save the values;if press the key [HOME CANCEL] then cancelled saving.

4.5.2 The Operation of the Parameter Page

When at the Parameter Page,and Press the key [ADVANCED] and the page pop up the list as above.

About the File management,we will describe it in next chapter.

5. The Motion Controller DM500 Operation

5.1 System status

The Motion Controller will have some different status,now we explain the different status:

5.1.1 System Status: Reset

Conditions:
- when e-stop switch is triggered;
- when reset key is pressed;
- Error occured (Hard-limited switch or soft limited switches are triggered.)

At the conditons,the system will shift the status to "Reset",and stop running,to make sure the savety of the operators and the machines.

5.1.2 System Status:Ready

Conditions:
- The E-stop switch is released and no any errors.the system shift from "RESET" to "READY";

At "Ready" Status the controller can work normally.

5.1.3 System Status: Busy

Conditions:
- When in the Ready status,and select a G-code file and run it,the controller status will shift to "Busy" status.The machine is processing a G-code file.

5.1.4 System Status: Pause

Press this key   to Pause the Operation.

5.2 The preparation of the controller system

5.2.1 Axis Direction and Pulse equivalent adjustment

5.2.1.1 Axis Direction

When we debug the machine,firstly we must confirm the every axis direction based on right-hand rule in coordination.If the direction is reverse,you can change the Index No. 390-393 values,change to 1 to 0 or 1 to 0.

5.2.1.2 Pulse equivalent adjustment

The unit of the Pulse equivalent is "p/mm",it means that when the machine run 1mm how many pulses the controller must send.

For example,if it is 1000p/mm,the machine running 1mm,then the controller should send 1000 pulses.

The Precision: 1/1000mm=0.001mm=1um

When the pulse equivalent is big,the machining precision is high.And pulse equivalent determin the Max. feed speed,the relationship is:

Max feed speed(mm/min)=(1/pulse equivalent(p/m)) x frequency(p/s) x 60

When the controller Max. frequency is 500Khz,and the pulse equivalent is 1000p/mm,the machine Max. feed speed is 30m/min.

5.2.2 The Hard Limit and Soft Limit Function

The Hard Limit and Soft Limit determin the machine running size of X/Y/Z Axis.

5.2.2.1 Soft Limit Setting

The set value will trigger the limit signal.

The limit values refer to the machine coordinates, not the work piece coordinate.So only when the Machine coordinates fixed,the soft limit can be effective.There are two soft limits on positive and negative direction each axis.

Operation:

• Fix the Limit/Home Position of Machine coordinate.

• On the Positive direction users can set a Soft Limit;

• On the Negative direction users can set a Soft Limit.

5.2.2.1 Hard Limit Setting

There is one hard limit on one axis,the hard limit share the same limited-switch(Home switch) with Home/Limit of Machine Coordinate on one direction.At the reverse direction,there can be set as the soft-limit.

Operation:

• Configure the home swich as the drawing shows at 2.3.2 (Page 9);

• Set the Index No. 116 value set as 2,set it as "Negative limit signal(LIMIT--)"

Notice: The Input voltage level of limit signal setting is Para Index No. 400-403 and 408-411.

5.2.3 Manually Operation of the Controller

The handheld controller can supply us 3 kinds manually positioning function,these are:Continuously low speed feeding;Continuously high speed feeding;Manual Step Mode.

5.2.3.1 Continuously low speed feeding

Feeding to one direction at low speed.

Condition:

• Controller is in READY status;

• Operate mode is CONT.

Operation:

• Press the key ![HIGH/LOW 5] and shift into low speed mode

• Select and press the axis key (X+、 X-、 Y+、 Y-、 Z+、 Z-、 A+、 A-),then the controller feed in low speed continuously.

• keep on pressing the axis direction key,that can make it moving continuously at low speed;

• The speed can be set at "SJR" or parameter adjustment.

5.2.3.2 Continuously High speed feeding

Feeding to one direction at high speed.

Condition:

• Controller is in READY status;

• Operate mode is CONT.

Operation:

• Press the key and shift into high speed mode

• Select and press the axis key (X+、 X-、 Y+、 Y-、 Z+、 Z-、 A+、 A-),then the controller feed in high speed continuously.

  • keep on pressing the axis direction key,that can make it moving continuously at high speed;

  • The speed can be set at "SJR" or parameter adjustment.

Notice:

Normally the high feeding speed is faster then the low feeding speed,pls confirm the axis direction before opretation,be sure the safety for the operator and machine.

5.2.3.3   Step Mode

Manual Step Mode,each axis can be jogged in defined steps

Conditions:

• Controller is in READY status;

• Operate mode is STEP

Operation:

• Select and press a key(X+、 X-、 Y+、 Y-、 Z+、 Z-、 A+、 A-) the machine jog at the certain direction and axis;

  • press one time and jog at a defined step;

  • In STEP MODE,the distance of one jog is 0.01mm/0.1mm/1mm/10mm

• Press combination keys and or to change the STEP distance;

• The STEP jogging speed is same as the ones when in CONT Mode.

5.2.4 Running a G Code File

5.2.4.1   Start running G code

Conditions:

• Controller is in READY status;

• The operation mode shift to "CONT" or "STEP" mode

Operation:

• Press the start key;

• the controller will start to process the G-code file selected;

• The controller status shift from "READY" to "BUSY"

• When the work finished,the controller status back to "READY".

5.2.5 Fine Machine Zero

Becasue the G54 to G59 Coordiantes are all refers to Mach (Machine) Coordinate,every time the users start the controller,should check the origin position and find the machine zero of each axis to confirm the position.

5.2.5.1   All axis Find Machine Zero

Conditions:

• Controller is in READY status;
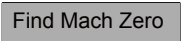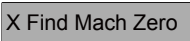
• The screen go to "Main page".

Operation:

• Press the key   ;

• all the axis move to the limited switch position on the order;

• after homing,each axis moves away from home switch for a certain distance.(can be set at parameter setting);

• By default the Homing Sequence is Z-XY-A

5.2.5.2   Single axis Find Machine Zero

Conditions:

• Controller is in READY status;

• The screen go to "Main page".

Operation (Take Example as X axis):

• Press the key   and   Find Mach Zero   X Find Mach Zero   ,then Press   To Confirm.

• after homing,X axis moves away from home switch for a certain distance.(Parameter setting).

Notice:

When homing(GoTO find Mach Zero),the soft-limit is invalid.The soft limit can only become effective after the machine coordination built up.

The related Index No. is 49/50/51-55/60-61/64-67/56-59/83-86/116-119.

5.3   Preparation of the workpiece

5.3.1 Choose Workpiece Coordinate

The controller supplies G54-G59 6 kinds workpiece coordination and one MACH machine coordination.Before running a G code file,the users need to decide one work piece coordinate.

Conditions:

• Controller is in READY status;

• The screen go to "Main page".

Operation:

• Continuously Press the Key [TAB] until the cursor is on coordinate G54-G59 is highlighted;

• Keep on pressing [7 +%] until your coordinate is selected; The current position always refers to the current coordinate.
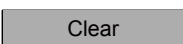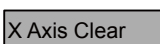
5.3.2 Set a Zero(Origin) Point for workpiece

5.3.2.1 XY axis and ZA Axis Zero Clearing

After the workpeice coordinate seleted and before running a G-code,the users should adjust the position the workpiece and the cutter(Z axis position) manually.

Firstly move the X and Y axis to the origin position manually,Press the Key to [XY→0] make X and Y

axis Zero-clearing.Then Move the Z (and A) axis to the origin position manully and press the [ZA→0 OK] key

to make Z (and A) axis Zero-Clearing.

5.3.2.2 Single Axis Zero Clearing (Take X Axis as example)
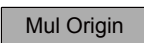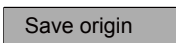
When the controller is at READY status.Move X Axis to the origin position manually.Press the Key [ADVANCED]

and then press [Clear] and [X Axis Clear] ,then write into "0" and press the key [ZA→0 OK] .
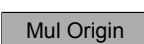
5.3.2.3 Workpiece origin position save and load

Conditions:

• Controller is in READY status;

• The screen go to "Main page".

Operation (Take Example as X axis):

• Press the key [ADVANCED] and then [Mul Origin] and [Save origin] ,then Press [ZA→0 OK] to confirm

to save the Origin Position

• Successively press the Key [ADVANCED] and then [Mul Origin] and [Load Origin] ,then press [ZA→0 OK]

to load the origin position.

5.4 About Tools

5.4.1 Automatical Probe

Automatical Probe function is to Meansure the different kinds cutter's position on Z Axis by the tool sensor.As the origin position of the workpiece and thickness of the tool sensor already fixed,its very easy to measure out the position of the cutters.

5.4.1.1 Fixed Position of Tool Sensor
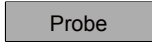
Firstly we fixed the the Tool sensor,and measure out the relative distance between the tool sensor and work piece.
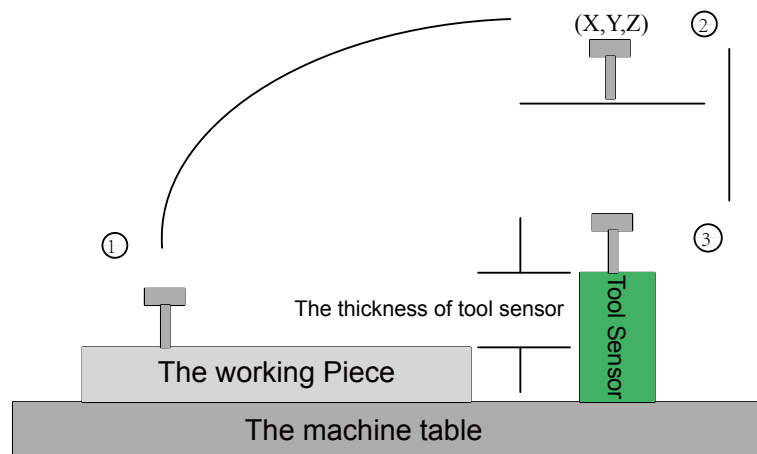
Condition:

• Controller is in READY status;

• The screen go to "Main page"

Operation:

1) Set the Para Index No.68 value to 1;(The Parameter 68 value is 1,means Probe function enabled);

2) By Para Index No.70,Set the probe port effective electric level.Normally Open is default;

3) Set Para Index No. 71 value to 1.Fix the tool sensor.(The parameter 71 value is 1,means Initial tool's position is fixed position.)

4) Set the tool sensor position,as the above drawing no.2 shows,enter the XYA position at parameter 72,73,74;

5) Probe at the first time.(Measure the thickness of the tool sensor.)

6) Move the Z axis to the surface of work piece,press key [ZA-0 OK] to zero-clearing;

7) Press [ADVANCED] and [Probe] to measure the thickness of tool sensor;

8) Save the thickness of the tool sensor into the controller system;

9) If the user don't change the origin positon of the work piece,and when the user changed different length cutters,just measure the thickness of the tool sensor and take the new data.

10） If the Z Axis Origin(Zero) position is changed,just repeat the action from 6-9.

5.4.1.2 Floating Tool Sensor

If use the floating tool sensor,means the X and Y axis positon of the tool sensor is not fixed.We need to move the cutter above the tool sensor manually.
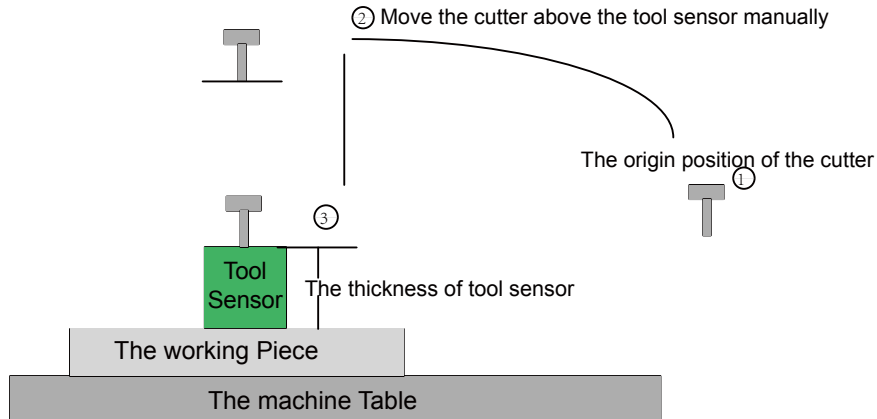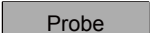
The probe processing of floating tool sensor

Condition:

* Controller is in READY status;

* The screen go to "Main page"

Operation

1) Set the Index No.68 value to 1;(The Parameter 68 value is 1,means Probe function enabled);

2) By Index No.70,Set the probe port effective electric level.Normally Open is default;

3) Set the probe way.Set Index No. 71 value to 0.(The parameter 71 value is 0,means Initial tool's position is current position.)

4) Go to Parameter 69 and type in the thickness of the tool sensor.You should know it in advance.

5) Move the cutter above the tool sensor manually;

6) Press the key [ADVANCED] and [Probe] ,the press [ZA-0 OK] to probe.

5.5 Running a G code file

5.5.1 Load a G Code File

Pls Insert the U-disk into the interface of the controller.The G-code files are in the U-disk.

Conditions:

• Controller is in READY status;

Operations:

• Insert a U-disk;

• Press the Key of Menu and shift to the "File Page",the screen will pop up the files list of U-disk.

• Use the key of and to move the cursor up and down,and press the keys and to page left and right,to find the G-code file you want to run.

• Press the key to load the G-code file,the then screen goes to the control page,and the selected file is the current running file.

5.5.2 Run a G-code file

By previewing and simulating toolpath Function,you can check if the G code file is correct.

Conditions:

• Controller is in READY status;

Operations:

• Press MENU key and shift to File Page.The screen popup the files list from U-disk.

• Use the key of and to move the cursor up and down,and press the keys and to page left and right,to find the G-code file you want to run.

• Press the key to load the G-code file,the then screen goes to the control page,and the selected file is the current running file.

• Press the Key of start and the contoller start to run the file you selected.

5.5.3 The Operation of running a G-code File

5.5.3.1 Breakpoint Operation

When there is Power-cutoff,Reset,E-stop,Limted-switch alarm and U-disk disconnected happened,that will produce a breakpoints.But,our system can automatically record the breakpoints and continue to process from the breakpoint.

Conditions:

• Controller is in READY status;

• The screen go to "Main page"

Operation:

- Press the key ,and the controller will start to work again from the breakpoint line.

Notice:
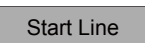
Only when you can find out the right origin positon after power cutoff,then you can work again from the breakpoint,or the position is no right.

5.5.3.2   Start a G code from a specific line

Conditions:

- Controller is in READY status;
- The screen go to "Main page"

Operation:

- Press the key ,and press `Start Line` and enter into it to press

- Enter into the specific line No.s.Then Press the key to confirm.The controller will run the

G-code from this line.

Notice:

If the line No. is very big,then the system may need more time to find the line.

5.5.3.3   Start a G code from the nearest position

Conditions:

- Controller is in READY status;
- The screen go to "Main page"

Operation:

- Move the cutter near the workpeice.Press the key ,and press `Nearest Point` ,then controller

will find a nearest point from the position of the cutter and start to process from this nearest point.

Notice:

The Controller only can find the nearest point from X and Y axis of the coordinate.

5.5.3.4   Feed Rate Override(FRO)

FRO controls the the machine real time Feed Speed.Use A+ and Z- to adjust the Feed Speed in 10% increments.The relationship betwen the real time feed speed and the F value is:

Real time feed speed=F(Feeding Value) x FRO

Conditions:

- Controller is in READY status;
- The screen go to "Main page"

Operation:

• Click [TAB] till SRO is highlighted;

• Everytime press [7 +%] or [1 -%] to increase or decrease at 10% increments.

Notice:

It's recommended the rate is not more than 100%,if you want high speed you can change the F value.

5.5.3.5 Spindle Speed Setting

Conditions:

• Controller is in READY status;

• The screen go to "Main page"

Operation:

• Click [TAB] till S is highlighted;

• As we used 3 output pins to define 8 spindle speeds.Here the S Value is from 1-8.For example if the Max spindle speed is 24000RPM,and the S value is 3,then the spindle speed is 24000*3/8=9000RPM.

Press the key or [7 +%] to [1 -%] change the value of S.

Press the Key [ON/OFF] to Start or Stop Spindle

5.5.3.6 Input and Output Ports Inspection and electric level Control

"Y" is for Output Port Signal,"X" is for Input Ports Signal.

Here the users not only can inspect the signal is active or not,also can change the voltage level. Conditions:

• Controller is in READY status;

• The screen go to "Main page"

Operation:

• Click   TAB   till Y is highlighted;

• Press the key   [4 ◄]   or   [6 ►]   to Select the Pin No.

• Then Press the key   [7 +%]   and   [1 -%]   to control the electric level of the selected pin.

5.5.3.7 Extended Input and Output Ports

The controller has 8 common input and 7 common output ports,which can be defined as M code.By default the factory setting pls check Parameter List in next chapter.

OUTPUT PORTS				INPUT PORTS			
Pin No	Extended M Code	Definition By Default	Para No.	Pin No	Extended M Code	Definition By Default	Para No.
Y01	M501/M601	M3/M5	222	X01	M701/M801	X Home	52
Y02	M502/M602	Spindle Speed Pin 1	222	X02	M702/M802	Y Home	53
Y03	M503/M603	Spindle Speed Pin 2	222	X03	M703/M803	Z Home	54
Y04	M504/M604	Spindle Speed Pin 3	222	X04	M704/M804	A Home	55
Y05	M505/M605	Alarm Output	216	X05	M705/M805	Probe	
Y06	M506/M606	M506/M606	223	X06	M706/M806	E-Stop	423
Y07	M507/M607	M507/M607	223	X07	M707/M807	Start/Probe	446
				X08	M708/M808	Pause	447

Notice:

1) One extended port only can be used as one function;

2) The parameter setting when we use the M-Code of the Output Ports:

Para# 108,Enable of M Bus IO Command:Enable;

Para# 222,Activate M3/M4/M5:No Active;

Para# 223,Activate M code (M8/M9,M10/M1: No Active;

Para# 216,Alarm output enable:Disable.

For Example:

(Y01 and Y02 open&close alternately)

M501   (Y01 Open)

G04 P1000   (delay)

M601   (Y01 Close)

G04 P1000   (Delay)

M502   (Y02 Open)

G04 P1000   (Delay)

M602   (Y02 Close)

G04 P1000   (Delay)

3) If you don't want use the M-code,the setting is different from above setting.

4) About the External Input Port,for example if the X06 port is used for the M-code,the setting is as below:

Para# 108,Enable of M Bus IO Command:Enable;

Para# 423,Define the External input 1 or not: No

For Example:

M706:   Wait for X06 input connection

G60 G01 X100:   Run to X100 position

M806:   Wait for X06 disconnection

G90 G01 X200:   Run to X200 position
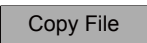
5.6　Files Management

5.6.1　Copy, and Paste File

Conditions:

• Controller is in READY status;

• The screen go to "File page"

Operation:

• Press the key ⬆ and ⬇ to move the cursor up and down to selet the file

•　Press the key [ADVANCED] and then press [Copy File] to confirm the coping;

• Go to file that you want to paste,then　press the key [ADVANCED] again and [Paste File] to paste the

file into the folder.

5.6.2　Delete a File

Conditions:

• Controller is in READY status;

• The screen go to "File page"

Operation:

• Press the key ⬆ and ⬇ to move the cursor up and down to selet the file

•　Press the key [ADVANCED] and [Delete Fle] then press [ZA-0 OK] and　to delete the file.

5.7　System update

Operation:

• Cope the updating file into the U-disk root directory.

• Insert the U-disk into the controller and restart it.

• The system will search out the updating file automatically and process the updating.The updating will last about 10 seconds time and the screen remain at opening page.Pls be patient and don't power-off.

• Pls check the version date after the controller restart,to confirm the updating is successful or not.

Notice：

• The updating file must be at root directory of U-disk.

• The updating file's name should be INSTALL

• At the subdirectory of the INSTALL file,there is no file which can named as "INSTALL"

• After updating successfully,delete the INSTALl file from U-disk,or everytime restart the controller, it will update automatically.

5.8 Parameter Management

5.8.1 Parameter revise

Conditions:

• Controller is in READY status;

• The screen go to "Para page"

Operation:

• Press the key [ADVANCED] and [Parameter Kinds] then you will enter into the Parameter Page.

• Use the up and down keys to select the parameter you want,and press key [ZA-O OK] to type in the

new data.After that press the key [ZA-O OK] to save the new value.

• Before changing the value,if the system need you to type in the passport just do it.

5.8.2 Parameter Backup

Conditions:

• Controller is in READY status;

• The screen go to "Para page"

Operation:

• Insert U-disk to the controller

• Press [ADVANCED] and [Para Backup U] ,type in the admin password,and enter.
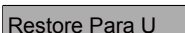
Pls note the backup data all saved into the "setting" file at the root directory of U-disk.

5.8.3 Data Recovery

Conditions:

• Controller is in READY status;

• The screen go to "Para page"

Operation:

• The Backup data should be save into the Setting file of the root directory of U-disk

• Press [ADVANCED] and [Restore Para U] ,type in the admin password,and enter [ZA-O OK]

Pls note the backup data should be saved into the "setting" file at the root directory of U-disk in Advance.

5.8.4 Define the Opening Page (LOGO)

Operation:

• Pls save the opening photo at the "install" file which is at the root dictionary of the U-disk；

• Insert the U-disk and restart the controller；

• The system will search the logo file and load into the controller automatically.

Notice:

• The opening photo file's name should be logo.bmp;

• The Logo.bmp file size is 480*320 dpi;

• The parameter index no. 249 can define the logo display time.

5.9   The detailed definition of parameters

In next Pages,there are the parameter list.

The parameter file can be edited, but it needs to follow the definite standards, the standards are as follows:

a、One line can only be edited one parameter.

b、The parameter format is #parameter mark= value. Among them, # must be the first character of each line.# should closely be followed by the parameter mar and the following mark is=, and the make= will be followed by the actual value.

c、After the parameter has assignment and equation, the part of parameter interpretation can have any format without constraint.

d、Each parameter is regulated with assignment scope. Please do the assignment in strict accordance with the assignment scope.

e、Each parameter is set with default value in advance. Please use the setting value of default parameter under the situation of not understanding the actual function of this parameter.

5.8.4 Password Setting

There are 4 operation rights of this system:Visitor,Operator,admin,super admin.

By default the password for them are:

Operator:666666

admin:777777

super admin:888888

5.8.4.1 Operation Permission Table
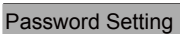
User	Permission	Workers
Operator	Revise some parameter value,operation on machining.	Operator
Admin	Change password of the admin and operator,data recover,revise parameters.	Factory administrator
Super Admin	All above and installment payment	Machine Manufacturer

5.8.4.2 Modification of the password

Conditions:

• Controller is in READY status;

• The screen go to "Para page"

Operation:

• Press [ADVANCED] and [Password Setting] ,type in the old password and new password,click "YES".

Pls note the window as below:
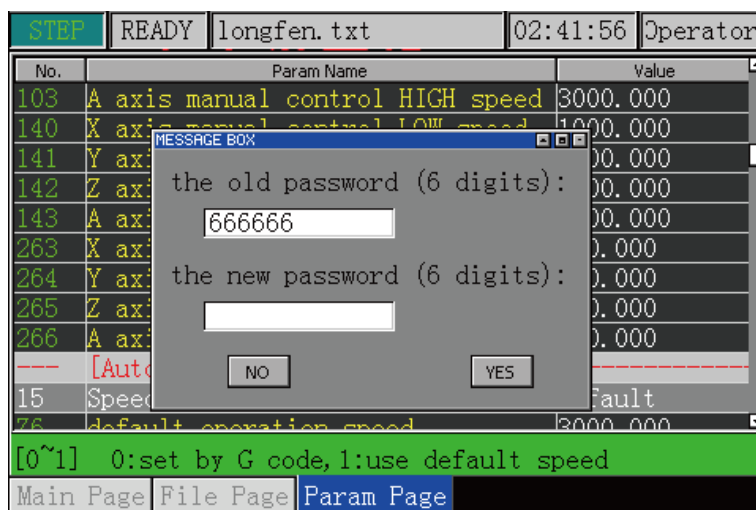
1) Configuration parameter of A Axis(13in total)

Para Index	Parameter definition	Default value	Parameter Unit	Parameter Scope	Notes
#5	Min radius of rotation of A axis	5	mm	3~999	
#6	A axis rotate reference axis	0	Pulse/mm	0~3	0:X axis; 1:Y axis; 2:Z axis; 3:not rotate
#104	A axis optimal path when G0	0	BOOL	1/0	

2) Configuration parameter of motor (16 in total)

Para Index	Parameter definition	Default value	Parameter Unit	Parameter Scope	Notes
#33	Speed of motor start running	50	mm/min	0~200	Speed ofmotor start running's first step
#34	Pulse /mm X axis	1000	Pulse/mm	100~10000	
#35	Pulse /mm Y axis	1000	Pulse/mm	100~10000	
#36	Pulse /mm Z axis	1000	Pulse/mm	100~10000	
#38	Pulse /mm A axis	1000	Pulse/degree	100~10000	
#39	A axis pulse unit	1000	BOOL	1/0	0: Pulse/Deg; 1: Pulse/Revolution
#40	AB axis Selection	1000	BOOL	1/0	0: A axis; 1: B axis
#390	level of X axis DIR signal	0	BOOL	1/0	
#391	level of Y axis DIR signal	0	BOOL	1/0	1=high,0=low
#392	level of Z axis DIR signal	0	BOOL	1/0	
#393	level of A axis DIR signal	0	BOOL	1/0	
#416	time between DIR & pulse	300	ns	0~#417	Differential between direction and pulse
#418	level of X axis pulse signal	0	BOOL	1/0	
#419	level of Y axis pulse signal	0	BOOL	1/0	axis pulse signal of X,Y,Z,A as well as the Pulse signal value when there is no pulse.
#420	level of Z axis pulse signal	1	BOOL	1/0	
#421	level of A axis pulse signal	1	BOOL	1/0	

3) Parameter of manual control motion(20 in total)

Para. Index	Parameter definition	Default value	Parameter Unit	Parameter Scope	Notes
#41	max speed of X in M_Ctrl mode	16000	mm/min	0~20000	The parameter value of this group has set a upper limit for the SJR
#42	max speed of Y in M_Ctrl mode	16000	mm/min	0~20000	
#43	max speed of Z in M_Ctrl mode	16000	mm/min	0~20000	
#44	max speed of A in M_Ctrl mode	16000	degree/min	0~20000	
#45	start Acceleration of X in M_Ctrl mode	600	mm/s^2	0~2000	4 axis of X,Y,Z,A manual start acceleration
#46	start Acceleration of Y in M_Ctrl mode	600	mm/s^2	0~2000	
#47	start Acceleration of Z in M_Ctrl mode	600	mm/s^2	0~2000	
#48	start Acceleration of A in M_Ctrl mode	600	$degree/s^2$	0~2000	
#100	manual high speed of X axis	3000	mm/min	0~20000	Panel keys operation the X,Y,Z,A axis on High speed
#101	manual high speed of Y axis	3000	mm/min	0~20000	
#102	manual high speed of Z axis	3000	mm/min	0~20000	
#103	manual high speed of A axis	3000	degree/min	0~20000	
#140	manual Low speed of A axis	1000	mm/min	0~20000	Panel keys operation the X,Y,Z,A axis on Low speed
#141	manual Low speed of A axis	1000	mm/min	0~20000	
#142	manual Low speed of A axis	1000	mm/min	0~20000	
#143	manual Low speed of A axis	1000	degree/min	0~20000	
#263	stop Acceleration of X in M_Ctrl mode	1200	mm/s^2	0~2000	4 axis of X,Y,Z,Amanually stop acceleration, the stop acceleration can be set appropriately larger
#264	stop Acceleration of Y in M_Ctrl mode	1200	mm/s^2	0~2000	
#265	stop Acceleration of Z in M_Ctrl mode	1200	mm/s^2	0~2000	
#266	stop Acceleration of A in M_Ctrl mode	1200	$degree/s^2$	0~2000	

4) Automatic processing parameter(11 in total)

Para. Mark	Parameter definition	Default value	Parameter Unit	Parameter Scope	Notes
#15	Speed selection for Gcode file	1	BOOL	1/0	0:set by G code; 1:use default speed
#76	Default operation speed	1500	mm/min	0~20000	
#77	Max operation speed	8000	mm/min	0~30000	
#78	Max speed of Z+	3000	mm/min	0~20000	
#79	Max speed of Z-	3000	mm/min	0~20000	
#80	Speed of G0	5000	mm/min	0~20000	
#82	Safe height of Z axis	5	mm	0~500	Retract height of Z
#89	Z retract distance	5	mm	0~99	This value cannot be negative value
#99	Operation acceleration	500	mm/min^2	0~2000	
#113	Arc interpolation selection	0	BOOL	0/1	
#123	accuracy of arc resolution	0.001	mm	0.001~0.1	
#124	Circular centrifugal acceleration	0	mm/S^2	0~9999	
#125	Circular speed adjustment factor	0	-	0~2	
#435	Max speed of X axis for Protection	8000	mm/min	0~20000	
#436	Max speed of Y axis for Protection	8000	mm/min	0~20000	

5 Parameter of coordinate system(1 in total)

Para. Mark	Parameter definition	Default value	Parameter Unit	Parameter Scope	Notes
#16	Current coordinate system	1	BOOL	0~6	0~5: G54~G59, 6: Machine

6) Parameter of spindle(8 in total)

Para. Mark	Parameter definition	Default value	Parameter Unit	Parameter Scope	Notes
#98	Max spindle speed	24000	rpm	0~50000	Spindle PWM or voltage signal full range is corresponding to speed value
#220	Spindle speed selection	1	BOOL	1/0	0: G code,1:Default
#221	Initial spindle speed	1		1~8	8 different speeds
#222	Activate M3/M5	1	BOOL	1/0	1: Yes; 0:No
#224	Delay time of M3/M4/M5	3	s	0~9	Spare enough time for spindle response
#227	active level of spindle	1	BOOL	1/0	Corresponding output electrical level when the spindle starting
#422	definition of PWM level	0	BOOL	1/0	The output voltage value is 0,the spindle is 0,voltage is 10V,speed is full.
#433	Max. Different speeds of Spindle	8	Time equivalent	1~8	At Max. the users can set 8 different speeds.

7) Parameters of extended functions (13 in total)

Para. Mark	Parameter definition	Default value	Parameter Unit	Parameter Scope	Notes
#216	Alarm output enable	1	BOOL	1/0	0:Disable; 1:Enable
#223	Activate M code (M8/M9,M10/M11)	1	BOOL	1/0	1: Yes; 0:No
#225	Delay time of M8/M9	1	S	1~20	Delay time after M8/M9/M10/M11 code
#226	Delay time of M10/M11	1	S	1~20	
#228	Active level of M8/M9	1	BOOL	1/0	1: Yes; 0:No
#229	Active level of M10/M11	1	BOOL	1/0	1: Yes; 0:No
#423	Definition of the External Input 2	1	BOOL	1/0	0:Null,1: E-STOP
#424	Level of External Input 1	0	BOOL	1/0	1: High; 0:Low
#428	Enable of the E-stop Signal on Box	1	BOOL	1/0	0: Disable,1: Enable
#429	Electric Level of E-stop On Box	0	BOOL	1/0	1: High; 0:Low
#446	Definition of the External Input 2	0	BOOL	2/1/0	0:Null,1:Start; 2:Probe
#447	Definition of the External Input 3	0	BOOL	1/0	0:Null,1: Pause

8） 0-point function parameter(28 in total)

Para. Mark	Parameter definition	Default value	Parameter Unit	Parameter Scope	Notes
#49	Home times	1	BOOL	1-5	The times of Home
#50	Enable of All Axis Home	1	BOOL	1/0	1: Yes; 0:No
#51	Enable of Limited signal	1	BOOL	1/0	
#52	Enable X home	1	BOOL	1/0	
#53	Enable Y home	1	BOOL	1/0	
#54	Enable of Z home	1	BOOL	1/0	
#55	Enable of A home	1	BOOL	1/0	
#56	Home speed of X	8000	mm/s	1~20000	
#57	Home speed of Y	8000	mm/s	1~20000	
#58	Home speed of Z	8000	mm/s	1~20000	
#59	Home speed of A	8000	mm/s	1~20000	
#60	Signal Level X Home	0	BOOL	1/0	1: High; 0:Low
#61	Signal Level Y Home	0	BOOL	1/0	
#62	Signal Level Z Home	0	BOOL	1/0	
#63	Signal Level A Home	0	BOOL	1/0	
#64	direction of X home	0	BOOL	1/0	0:reverse direction home(--) 1:forward direction home(++)
#65	direction of Y home	0	BOOL	1/0	
#66	direction of Z home	0	BOOL	1/0	
#67	direction of A home	0	BOOL	1/0	
#83	back off distance of X after home	10	mm	0~1000	After homing, each axis needs to move away from the home switch for a certain distance. The parameter of this group is this back off distance
#84	back off distance of Y after home	10	mm	0~1000	
#85	back off distance of Z after home	10	mm	0~1000	
#86	back off distance of A after home	10	mm	0~1000	
#108	Enable of M Bus IO Command	1	BOOL	0/1	0：disable 1：enable
#116	Definition of X Axis Limited signal	0	BOOL	0/1/2	0: Home 1: LIMIT++ 2: LIMIT--
#117	Definition of Y Axis Limited signal	0	BOOL	0/1/2	
#118	Definition of Z Axis Limited signal	0	BOOL	0/1/2	
#119	Definition of A Axis Limited signal	0	BOOL	0/1/2	

9） Parameter of Probe function (8 in total)

Para. Mark	Parameter definition	Default value	Parameter Unit	Parameter Scope	Notes
#68	enable Probe	1	BOOL	1/0	0：disable 1：enable
#69	thickness of tool sensor	20	mm	0~200	
#70	level of probe signal	0	BOOL	1/0	1: High; 0:Low active
#71	initial tool's position	0	BOOL	1/0	0: current position; 1:fixed position mode
#72	initial X axis in fixed mode	0	mm	0-9999	Tools position X coordinate in the Mach(ine) coordinate system
#73	initial Y axis in fixed mode	0	mm	0-9999	Tools position Y coordinate in the Mach(ine) coordinate system
#74	initial Z axis in fixed mode	0	mm	0-9999	Height of Z axis before the XY move under the Mach(ine) coordinate system
#75	Back off distance after probing	10	mm	0~200	

10) Parameter of hard limit function(16 in total)

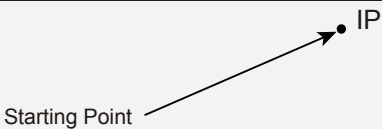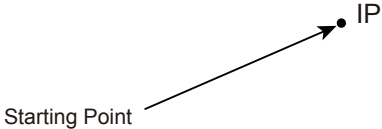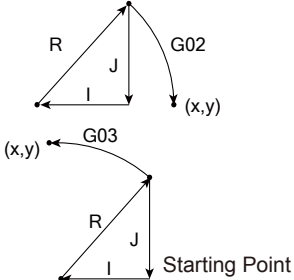| Para. Mark	Parameter definition	Default value	Parameter Unit	Parameter Scope	Notes
#400	enable X-- limit	1	BOOL	1/0	0: Disable 1: Enable
#401	enable Y-- limit	1	BOOL	1/0	0: Disable 1: Enable
#402	Enable Z-- limit	1	BOOL	1/0	0: Disable 1: Enable
#403	enable A-- limit	1	BOOL	1/0	0: Disable 1: Enable
#404	enable X++ limit	1	BOOL	1/0	0: Disable 1: Enable
#405	enable Y++ limit	1	BOOL	1/0	0: Disable 1: Enable
#406	enable Z++ limit	1	BOOL	1/0	0: Disable 1: Enable
#407	enable A++ limit	1	BOOL	1/0	0: Disable 1: Enable
#408	Electric level X-- limit	0	BOOL	1/0	1: High; 0:Low
#409	Electric level Y-- limit	0	BOOL	1/0	1: High; 0:Low
#410	Electric level Z-- limit	0	BOOL	1/0	1: High; 0:Low
#411	Electric level A-- limit	0	BOOL	1/0	1: High; 0:Low
#412	Electric level X++ limit	0	BOOL	1/0	1: High; 0:Low
#413	Electric level Y++ limit	0	BOOL	1/0	1: High; 0:Low
#414	Electric level Z++ limit	0	BOOL	1/0	1: High; 0:Low
#415	Electric level A++ limit	0	BOOL	1/0	1: High; 0:Low

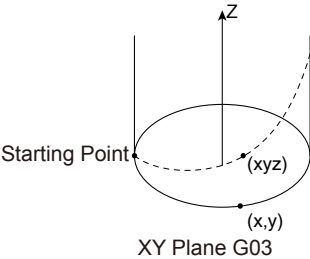11) Parameter of hard and soft limit function (9 in total)
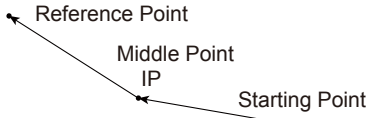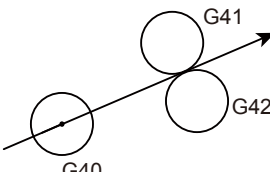
Para. Mark	Parameter definition	Default value	Parameter Unit	Parameter Scope	Notes
#374	enable Soft Limit	0	BOOL	1/0	0:Disable, 1:Enable
#375	value of X-- Soft Limit	-400	BOOL	-2000~0	The set value will trigger the limit signal. The limit values refer to the machine coordinates, not the work piece coordinate.
#376	value of Y-- Soft Limit	-400	BOOL	-2000~0	
#377	value of Z-- Soft Limit	-400	BOOL	-2000~0	
#378	value of A-- Soft Limit	-400	BOOL	-2000~0	
#379	value of X++ Soft Limit	400	BOOL	0~2000	The set value will trigger the limit signal. The limit values refer to the machine coordinates, not the work piece coordinate.
#380	value of ++ Soft Limit	400	BOOL	0~2000	
#381	value of Z++ Soft Limit	400	BOOL	0~2000	
#382	value of A++ Soft Limit	400	BOOL	0~2000	
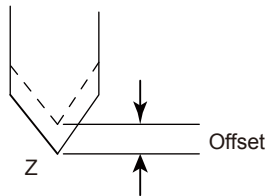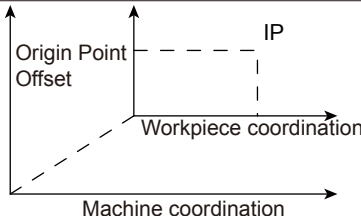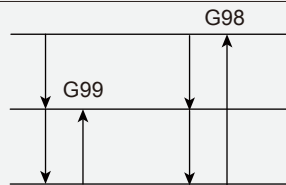
12) System parameter(11 in total)

Para. Mark	Parameter definition	Default value	Parameter Unit	Parameter Scope	Notes
#2	Interface response speed while processing	400	BOOL	400-10000	Note: For general G-code file, the parameter can be set as 400. If the file has many small segments, adjust the parameter to be larger.
#88	Enable of beep	1	BOOL	1/0	0:Disable,1:Enable
#114	Enable of Cont and Step Mode	0	BOOL	1/0	0:Enable,1:Disable
#115	Coordinate unit selection	0	BOOL	1/0	0:Metric; 1:Imperical
#120	U disk partition type	0	BOOL	1/0	0: partitions; 1: no partitions
#218	Cycle Start key mode selection	0	BOOL	1/0	0: pause&start; 1: restart
#249	Time of the Logo Display	2	s	0.1-10	
#495	circle of interpolation	0.002	s	0.002-0.01	circle of interpolation
#250	enable of draw tool road	1	BOOL	1/0	0:disable 1: enable
#253	mode of draw	0	BOOL	1/0	0:statue mode 1:line mode
#495	Interpolation period	0.005	s	0.002~0.01	

6. The Programming

6.1 The G-Code

Function	Description	G-code Format
Positioning (G00)	IP Starting Point	G00 IP_ ;
Linear Interpolation(G01)	IP Starting Point	G01 IP_ F_ ;
Circular Interpolation (G02、G03)	R J G02 I (x,y) (x,y) G03 R J I Starting Point	$G17 \begin{Bmatrix} G02 \\ G03 \end{Bmatrix} X\_Y\_ \begin{Bmatrix} R\_ \\ I\_ J\_ \end{Bmatrix} F\_ ;$ $G18 \begin{Bmatrix} G02 \\ G03 \end{Bmatrix} X\_Z\_ \begin{Bmatrix} R\_ \\ I\_ K\_ \end{Bmatrix} F\_ ;$ $G19 \begin{Bmatrix} G02 \\ G03 \end{Bmatrix} Y\_Z\_ \begin{Bmatrix} R\_ \\ J\_ K\_ \end{Bmatrix} F\_ ;$
Helix Interpolation (G02、G03)	Z Starting Point (xyz) (x,y) XY Plane G03	$G17 \begin{Bmatrix} G02 \\ G03 \end{Bmatrix} X\_Y\_ \begin{Bmatrix} R\_ \\ I\_ J\_ \end{Bmatrix} a\_F\_ ;$ $G18 \begin{Bmatrix} G02 \\ G03 \end{Bmatrix} X\_Z\_ \begin{Bmatrix} R\_ \\ I\_ K\_ \end{Bmatrix} a\_F\_ ;$ $G19 \begin{Bmatrix} G02 \\ G03 \end{Bmatrix} Y\_Z\_ \begin{Bmatrix} R\_ \\ J\_ K\_ \end{Bmatrix} a\_F\_ ;$ a is the axis beside the circular interpolation axis.
Pause (G04)		G04 P_ ;
Plane Selection (G17,G18,G19)		G17：Xp Yp Plane selection G18：Xp Zp Plane Selection G19：Yp Zp Plane Selection
Inch/Metric Shift (G20、G21)		Inch Input: G20； Metric Input: G21
Return To Reference Point	Reference Point Middle Point IP Starting Point	G28 IP_;
Tool Radius compensation (G40~G42)	G41 G42 G40	$\begin{bmatrix} G17 \\ G18 \\ G19 \end{bmatrix} \begin{Bmatrix} G41 \\ G42 \end{Bmatrix} D\_ ;$ D: Offset No. of Tool; G40: Cancel;

Function	Description	G-code Format
Tool length compensation (G43、G44、G49)	Z Offset	$\begin{Bmatrix} G43 \\ G44 \end{Bmatrix}$ Z_ H_ ; $\begin{Bmatrix} G43 \\ G44 \end{Bmatrix}$ H_ ; H: Offset No. of Tool; G49: Cancel;
Machine coordination selection (G53)		(G53) IP_;
Workpiece coordination selection (G54~G59)	Origin Point Offset, IP, Workpiece coordination, Machine coordination	$\begin{Bmatrix} G54 \\ \sim \\ G59 \end{Bmatrix}$ IP_;
Drilling Position Circulation (G80~G89)		$\begin{Bmatrix} G81 \\ G82 \\ G83 \end{Bmatrix}$ X_Y_Z_P_Q_R_F_K ; G80: Cancel
Absolute/Increment Command (G90/G91)		G90_: Absolute Command G91_: Increment Command
Return to the Start Point/R Point (G98,G99)	G98 G99	G98_: Return to the Starting Point; G99_: Return to the R Point

6.2 The M-Code

M-Code	Function
M03	Spindle start(Y01)
M05	Spindle stop(Y01)
M08	Cooling open (Y06)
M09	Cooling close (Y06)
M10	Lubrication open(Y07)
M11	Lubrication close(Y07)
M30	Finished program and return to the beginning
M47	Program circulation
M98	Subroutine start
M99	Subroutine finished
M507-M507(The detail see the Page 32)	Y01-Y07 Output Open
M601-M607(The detail see the Page 32)	Y01-Y07 Output Close
M701-M708(The detail see the Page 32)	X01-X08 Input connection and delay
M801-M809(The detail see the Page 32)	X01-X08 Input disconnection and delay