



Control System Manual V3.0



detzo

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➤ Axis Mapping / Axis Configuration

Control Card	System	Definition
AXIS 1	-X	Front-Back / Longitudinal
AXIS 2	-Y	Left-Right / Lateral
AXIS 3	-Z	Up-Down / Vertical
AXIS 4	-S	Winding Spindle / Main Spindle
AXIS 5	-A	Spare
AXIS 6	-B	Spare
AXIS 7	-C	Spare
AXIS 8	-D	Spare
AXIS 9	-E	Spare
AXIS 10	-F	Spare
AXIS 11	-G	Spare
AXIS 12	-H	Spare
AXIS 13	-I	Spare
AXIS 14	-J	Spare
AXIS 15	-K	Spare
AXIS 16	-L	Spare

1. Interface Overview

1.1 Welcome Interface

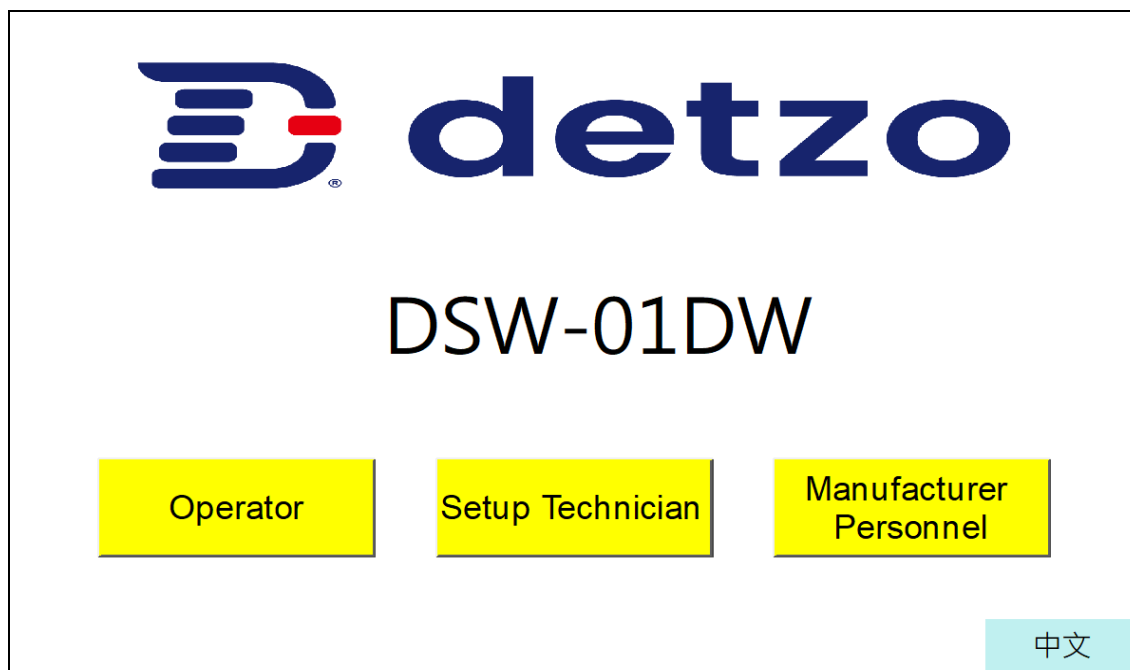


Figure 1.1.1

- ✧ **Login** : Tap the Login button and enter the password associated with your access level to enter the system.
- There are three distinct authorization levels to choose from : **Operator**, **Setup Technician**, and **Manufacturer Personnel**.
 - 【Operator】** : Log in with Operator privileges to access the basic control interface. This allows for manual operations, I/O monitoring, and starting or stopping the machine.
 - 【Setup Technician】** : Log in as a Setup Technician to access the system. On top of all Operator functions, this level grants authorization to view and edit the program list.
 - 【Manufacturer Personnel】** : This is the highest level of authorization. In addition to all **Setup Technician** functions, admins can configure core system parameters. Notably, this level allows direct access to the program editing page without requiring a machine homing (reset) procedure.
 - 【中文 / English】** : Simply tap the Language button to toggle between **Chinese** and **English** based on your preference.

2. Main Interface Overview

2.1 Function Descriptions

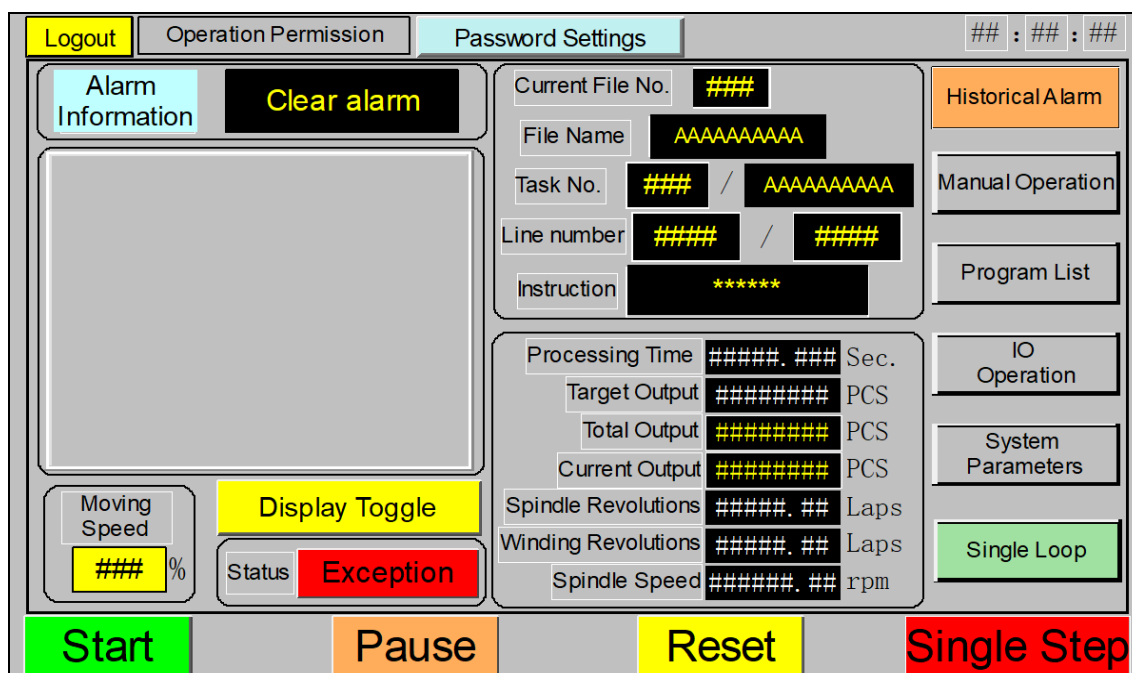


Figure 2.1.1

Upon entering the **Main Interface**, the [**Single Loop**], [**Single Step**], [**Start**], [**Pause**] and [**Reset**] buttons are used to control machine operations.

- When powering on a brand-new machine for the first time, you **must** log in with **Manufacturer Personnel** privileges to configure the **System Parameters** before commissioning. Failure to do so may cause the machine to operate in an incorrect mode or result in critical errors.

【Single Loop】 / 【Continuous Loop】 :

- In **【Single Loop】** mode : The machine completes one full production cycle and stops.
- In **【Continuous Loop】** mode : The machine will produce units continuously based on the preset target quantity.

【Single Step】 / 【Automatic】 / 【Continuous】 :

- In **【Single Step】** mode : The program executes only one line of instruction each time the Start button is pressed. Conversely.
- In **【Automatic】** / **【Continuous】** mode : The program will execute the entire programmed sequence from start to finish.

【Start】 :

- In **【Single Step】** mode : Executes a single line of instruction per press.
- In **【Automatic】** / **【Continuous】** mode : Starts the program and executes it from the first line to the last.

【Pause】 : Pressing this button during operation will immediately put the machine into a paused state.

【Reset】 : Press and hold the button for **3 seconds** to return all axes and pneumatic cylinders to their home positions. (**Note** : Homing can only be performed while the machine is in Standby mode) .

【Logout】 : Logs out of the current authorization level and returns to the Login page.

【Password Settings】 : This button is only visible when logged in with **Engineer / Admin** privileges. It allows you to set passwords for different access levels :

- Setting a password to "0" disables the restriction, meaning no password is required for that level.
- **Recommendation** : Always set secure passwords after commissioning to prevent unauthorized operation.

【Alarm Information】 : If an alarm is triggered, tap here to view the cause of the fault (primarily related to servo errors or system configuration issues) .

【Clear Alarm】 : Clears fault messages once the underlying issue has been resolved.

【Historical Alarm】 : Displays a log of previous alarms, including input detection errors, equipment abnormalities, servo faults, and limit switch triggers. It also tracks keypress history.

【Manual Operation】 : Enters the page for manual control of servo movements.

【Program List】 : Allows you to view and manage all edited program files.

【I / O Operation】 : Enters the manual I / O interface to monitor input statuses or manually toggle output states.

【System Parameters】 : Essential settings that must be configured upon the initial power-up of a new machine to ensure correct and safe operation.

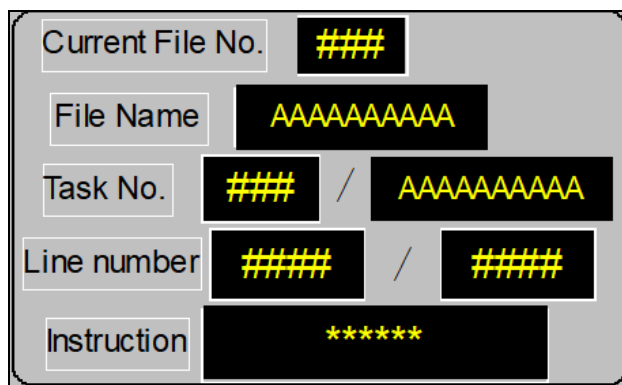


Figure2.1.2

This page allows you to view the file details and step information of the currently selected program. You can also change the active file by tapping the file selection area in the top-left corner. (**Note** : File switching is only permitted while the equipment is in **Standby** mode) . (Refer to Figure 2.1.2)

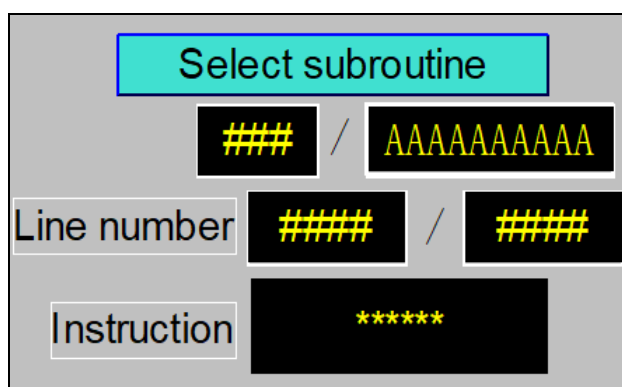


Figure 2.1.3

This section is used to monitor the **status and data** of the currently active **sub-program**. You can also change the selected sub-program using the selection menu at the top. (**Note** : Sub-program switching is only permitted while the equipment is in **Standby** mode) . (Refer to Figure 2.1.3)

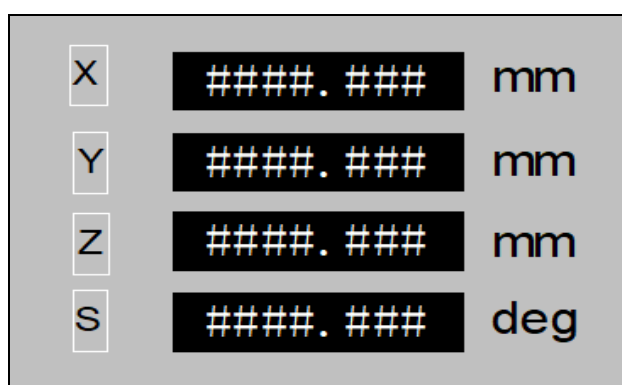


Figure 2.1.4

This section is used to monitor the **positioning data** for each axis during movement. (Refer to Figure 2.1.4)

Processing Time	#####.###	Sec.
Target Output	#####	PCS
Total Output	#####	PCS
Current Output	#####	PCS
Spindle Revolutions	#####.##	Laps
Winding Revolutions	#####.##	Laps
Spindle Speed	#####.##	rpm

Figure 2.1.5

This section displays various **production metrics**. Please pay close attention to the relationship between **Target Quantity** and **Current Yield** :

- **Production Control** : The equipment will continue to operate as long as the **Current Yield** is below the **Target Quantity**. Once the target is reached, the machine will automatically stop and trigger an alarm notification.
- **Disabled Mode** : If the **Target Quantity** is set to 0, the production management feature is disabled. In this case, the **Current Yield** will not be restricted, and the machine will run without a target limit.
(Refer to Figure 2.1.5)

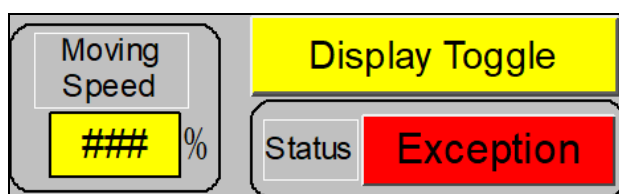


Figure 2.1.6

【Moving Speed】 : This setting is one of the key variables affecting the overall production speed. The adjustable range is from **1% to 100%**. (Refer to Figure 2.1.6)

【Status】 : Used to monitor the current operational state of the machine. Common status indicators include **Exception, Standby, Single Step, and Run**. (Refer to Figure 2.1.6)

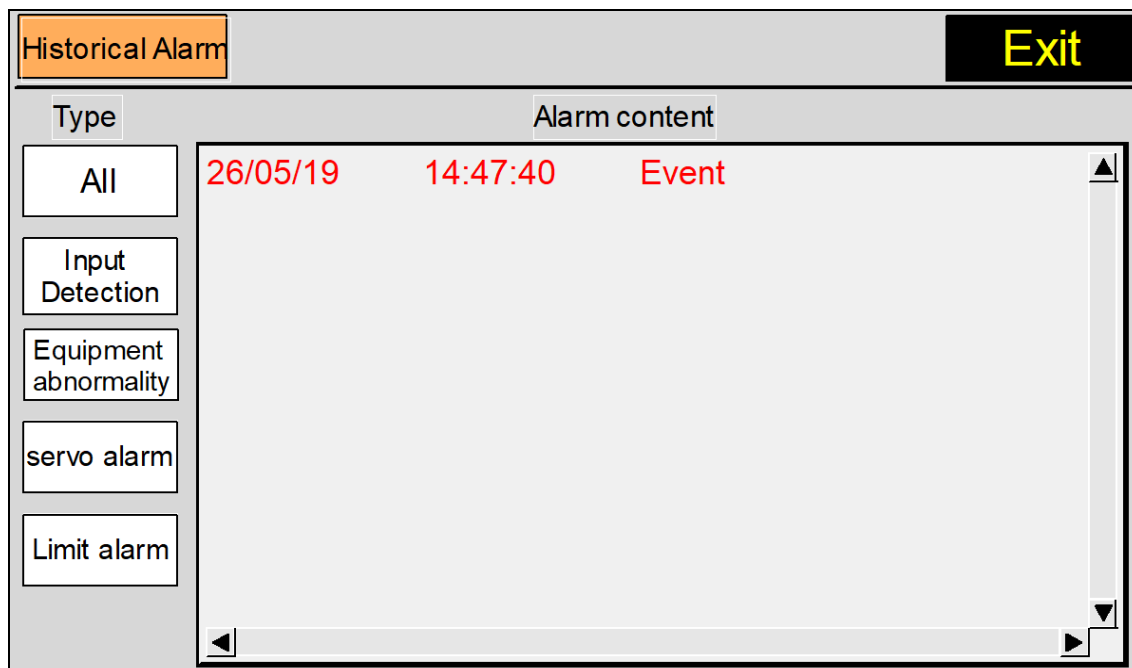


Figure 2.1.7

【 Alarm History 】 : This section allows you to review past alarm logs, including **Input Detection**, **Equipment Abnormality**, **Servo Alarm** and **Limit Alarm**. Additionally, you can access the Keypress Log to review operational history. (Refer to Figure 2.1.7)

2.2 Manual Operation

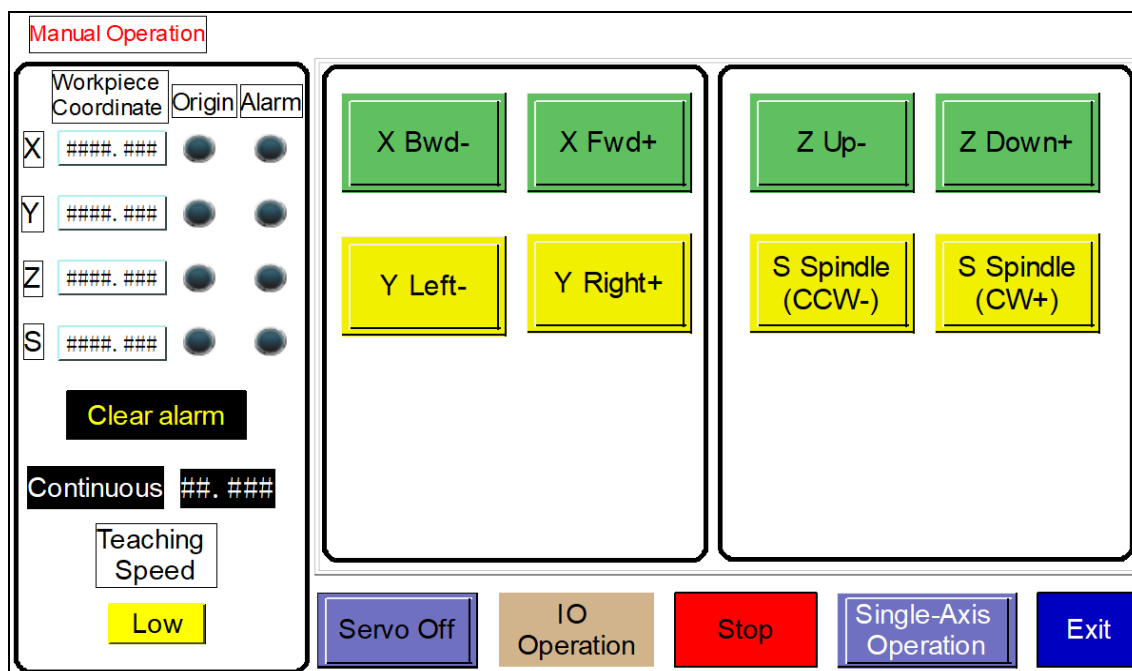


Figure 2.2.1

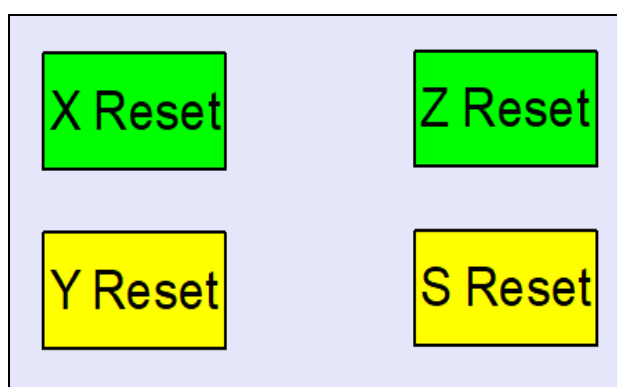


Figure 2.2.2

【X+, X-, Y+, Y-, etc.】 : These teaching buttons are used for **bi-directional JOG debugging** of the corresponding axes. (Refer to Figure 2.2.1)

【Teaching Speed】 : This setting adjusts the movement speed of a single axis. You can select from three speed presets—**Low, Medium, and High**—and toggle between **Continuous** movement or **Jog** mode.

【Servo ON / OFF】 : Tap this to toggle the Servo Enable status. (**Note** : This function requires the physical servo enable signal wiring to be properly connected) .

【I / O Operation】 : Enters the manual I / O interface to monitor input statuses or manually control output states.

【Stop】 : Immediately halts the movement of the currently active axis. Use this button if any incorrect or unexpected movement occurs.

【Single - Axis Operation】 : Commands a single axis to return to its mechanical home position. Before performing this action, ensure that the axis origin settings are correctly configured. (Refer to Figure 2.2.2)

【Exit】 : Returns to the Main Operating Interface.

2.3 Program List

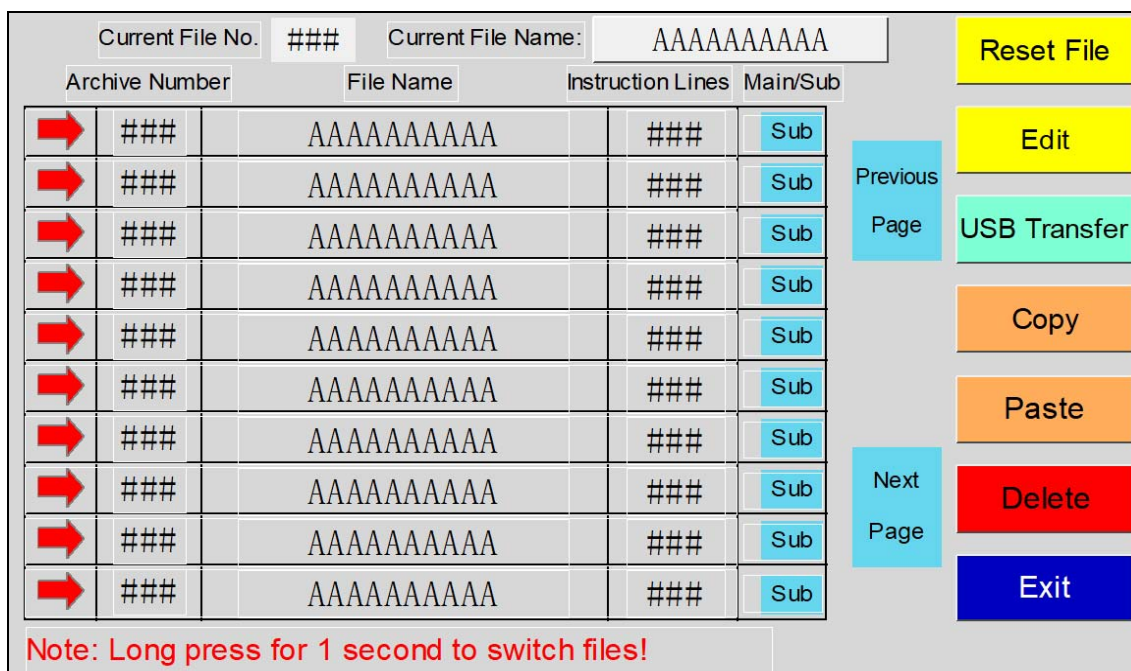


Figure 2.3.1

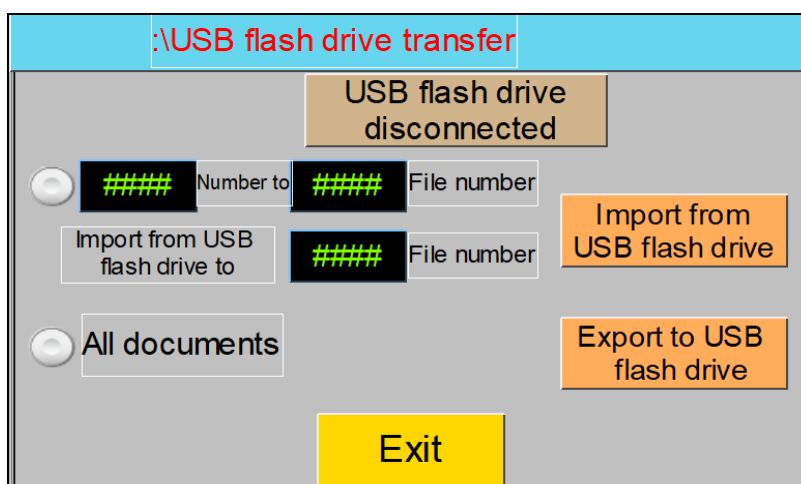


Figure 2.3.2

The interface shown in **Figure 2.3.1** is primarily used for file management, including deleting programs, naming files, and renaming existing programs. The program list is located on the left side of the screen; the file indicated by the **red arrow** is the target for editing or other management tasks.

【Edit】 : Tap the **Edit** button to enter the command editing interface.

- Ensure the red arrow is pointing to the specific file you wish to modify before taping.

【USB Transfer】 : Once a USB flash drive is inserted and successfully recognized by the controller, the status at the top will change from " **USB Disconnected** " to " **USB Connected** " , You may then export edited files to the USB drive or import existing files from the USB drive into the controller. (Refer to Figure 2.3.2)

【Copy】 : Copies the file currently indicated by the red arrow.

【Paste】 : Pastes all content from the copied file into the file currently indicated by the red arrow.

【Delete】 : Deletes the file indicated by the red arrow.

【Exit】 : Returns to the **Main Operating Interface**.

【Current File No.】 : Allows for quick selection of a file for editing or management.

【Current File Name】 : Used to name or rename the file indicated by the red arrow.

【Reset File】 : Tap this to enter the command editing interface specifically for the **Homing sequence** file.

【Main / Sub】 : Toggles the file type between a **Main Program** and a **Sub-program**.

2.4 I / O Operation

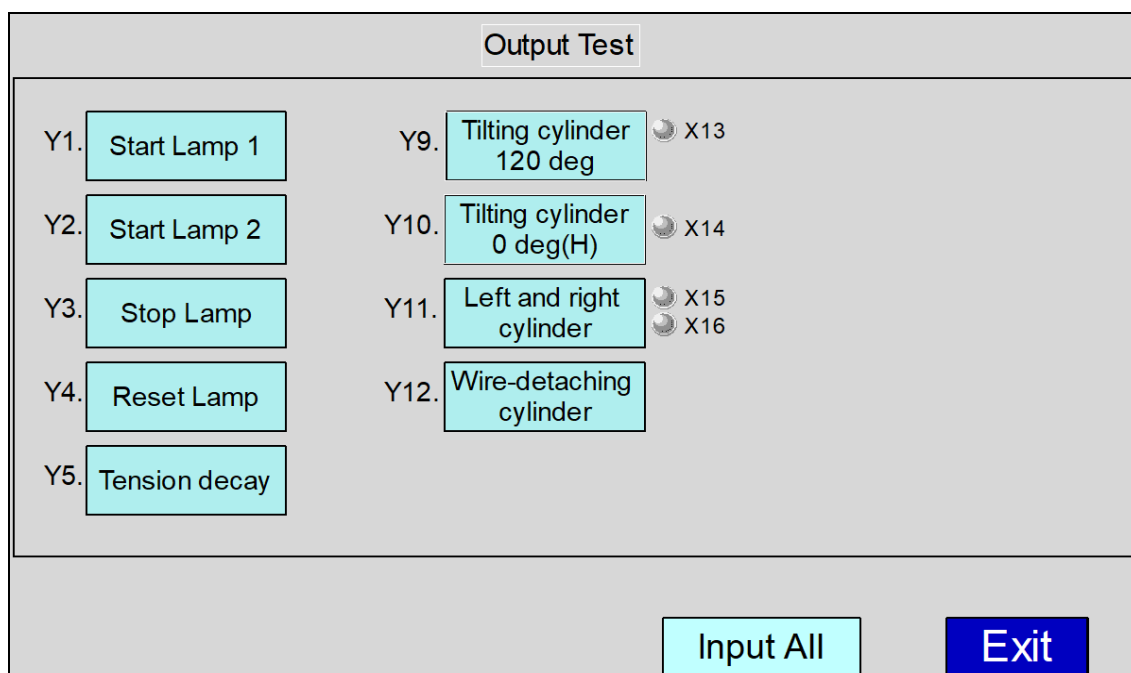


Figure 2.4.1

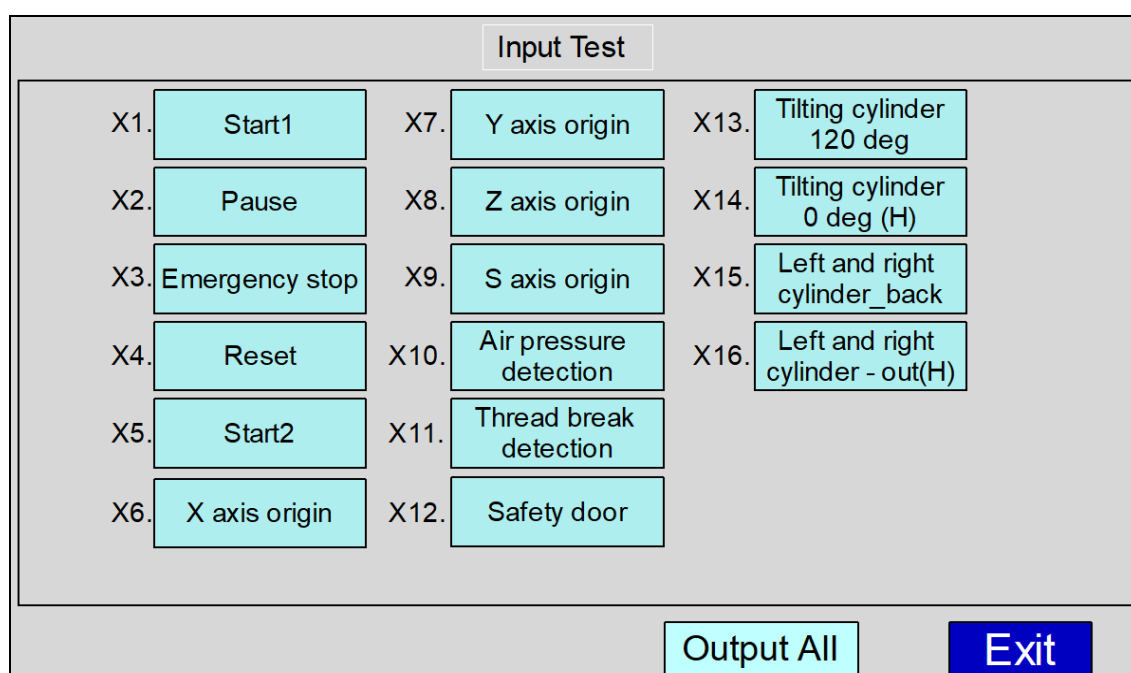


Figure 2.4.2

This interface is primarily used to test and verify the configuration of each I / O point.

【Output All】 : View the real-time status of all output ports. (This mode allows for manual control and triggering of output signals)

【Input All】 : View the real-time status of all input ports.

【Exit】 : Returns to the **Main Operating Interface**.

2.5 System Parameters

2.5.1 Speed

Speed	Axis parameters	IO settings	Limit	Workpiece Zero Point	Function Settings	
Restore default	Motor Speed rpm	Acceleration Time (s)	Deceleration Time (s)	Reset Speed mm/s	Reset retrace mm/s	IO Operation
X	####	##.##	##.##	###.#	###.#	Manual
Y	####	##.##	##.##	###.#	###.#	
Z	####	##.##	##.##	###.#	###.#	Save
S	#####	##.##	##.##	###.#	###.#	Clear alarm
Sync. Speed	###.# %	Move Delay	### ms			
Wrap Speed	###.# mm/s	Teach High Speed	###.# %			Exit
Wrap Acc. / Dec.	##.### S	Teach Mid Speed	###.# %			
S-curve	### ms	Teach Low Speed	###.# %			
					Note: Teach speed 100% refers to motor speed!	

Figure 2.5.1

This interface is used to configure speed parameters related to mechanical motion.

【 Motor Speed (rpm) 】 : Sets the maximum allowable rotation speed (RPM) for the motors.

【 Acceleration Time (s) 】 : The time required for the motor to reach its target speed from a standstill.

【 Deceleration Time (s) 】 : The time required for the motor to decelerate from its current speed to zero.

【 Reset Speed (mm/s) 】 : Sets the travel speed of the axes during the initial stage of the homing (reset) process.

【 Reset retrace (mm/s) 】 : Controls the movement speed during the secondary stage of homing when the system is searching for the precise origin signal.

【 Sync. Speed 】 : Sets the velocity for synchronized multi-axis movements, corresponding to the "Multi-Axis Interpolation "command.

【 Wrap Speed 】 : Sets the baseline operating speed for the wire wrapping command.

【 Wrap Acc. / Dec. 】 : Configures the acceleration and deceleration ramps for wrapping.

- A higher value results in a slower, smoother transition. (**Note** : Accel / Decel time refers to the duration required to transition between zero and maximum speed) .

【Teaching Speeds (High / Mid / Low) 】 : To facilitate the efficient setup of axis positions, the system provides three customizable speed presets.

- You can define the percentage values for **High, Medium, and Low** speeds (relative to the maximum reference speed) .

【I / O Operation】 : Enters the manual I / O interface to monitor input statuses or control output signals.

【Manual】 : Enters the manual servo control page for axis movement.

【Save】 : Commits all parameter changes made in this interface to the memory.

ATTENTION : Always tap [Save] before exiting to prevent data loss !

【Exit】 : Returns to the **Main Operating Interface**.

2.5.2 Axis Parameters

Speed						Axis parameters						IO settings						Limit						Workpiece Zero Point						Function Settings					
		Axis Type		Axis Accuracy (mm/pulse)		Dist / Rev		Pulse / Rev																											
X		Linear axis		#.####		###.###		#####																											
Y		Linear axis		#.####		###.###		#####																											
Z		Linear axis		#.####		###.###		#####																											
S		Linear axis		#.####		###.###		#####																											
		Motor Direction		Motor Attributes		Reset Method		Reset Direction		RST Seq.																									
X		Forward		Pulse		First homing		Reverse		1																									
Y		Forward		Pulse		First homing		Reverse		1																									
Z		Forward		Pulse		First homing		Reverse		1																									
S		Forward		Pulse		First homing		Reverse		1																									

Figure 2.5.2

This interface is used to configure the specific attributes for each motion axis, including command units, homing methods, and other core settings.

【Axis Type】 : Configures the motion axis as either a **Linear Axis** or a **Rotary Axis**, depending on the mechanical structure of the movement.

【Axis Accuracy (mm/pulse)】 : Defines the system' s pulse equivalent—the distance the terminal mechanism moves for every single command pulse.

【Dist / Rev】 :

- **For Linear Axes** : The distance the axis travels per motor revolution (e.g., Lead Screw Pitch) .
- **For Rotary Axes** : The number of degrees the terminal axis rotates per motor revolution.

【Pulse / Rev】 : The number of pulses required for one full motor revolution, as configured in the servo drive settings.

【Motor Direction】 : Sets the rotational direction of the motor. You can select between **Forward** or **Reverse**.

【Motor Attributes】 : Defines the communication method for the motor.

- There are three modes available : **Pulse**, **Bus (Communication)** , or **Unused**.

【Reset Method】 : Defines how the mechanism locates the mechanical origin.

- The system supports 5 modes : **Single-stage Homing**, **Two-stage Homing**, **Search-back Homing**, **Origin + EZ Signal**, and **EZ-only Homing**.
- Search-back Homing is the most commonly used mode.

【Reset Direction】 : Sets the direction the axis moves when searching for the mechanical origin
(**Forward** or **Reverse**) .

【RST Seq.】 : Defines the priority of each axis during the homing process.

- If axes have the same number, they will perform homing simultaneously.
- If the numbers are different, the axis with the lower number completes its homing sequence before the axis with the higher number begins.

【Save】 : Saves all parameter settings in this interface.

ATTENTION : You must tap [**Save**] before exiting to prevent any loss of configuration data !

【Exit】 : Returns to the **Main Operating Interface**.

2.5.3 I / O Settings

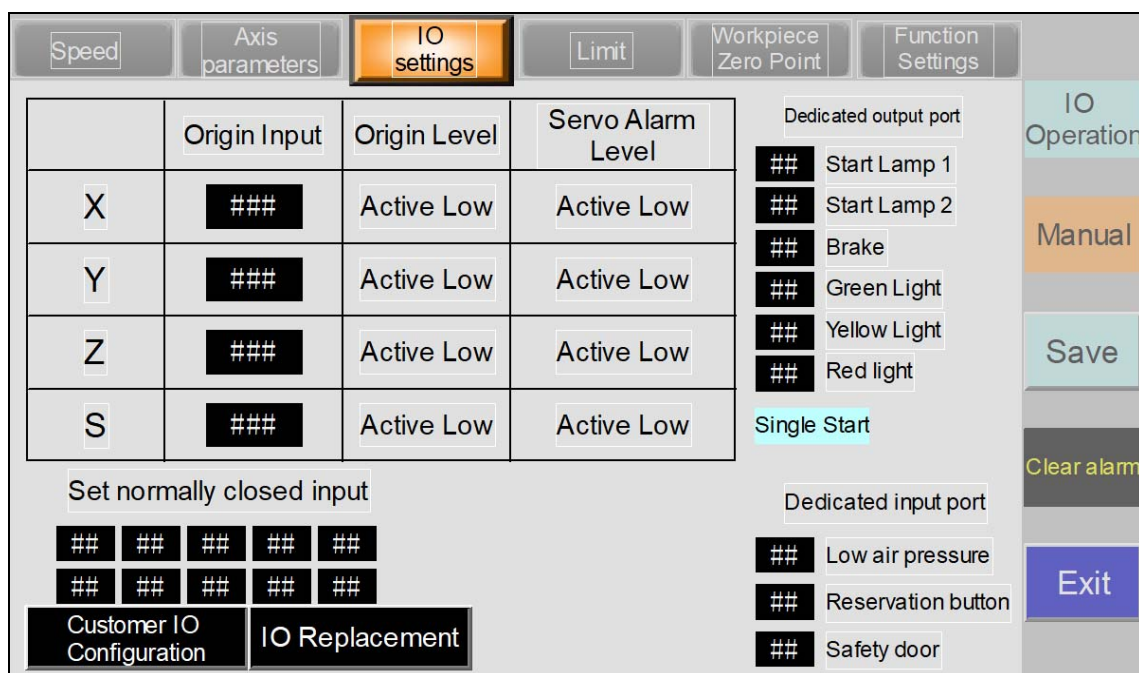


Figure 2.5.3

This interface is used to define the configuration of specialized and dedicated I / O points for the equipment.

【Origin Input】 : Defines the input port assigned to each axis's origin sensor. **Set the value to 0 for any unused axes.**

【Origin Level / Servo Alarm Level】 : Defines whether the Origin Inputs and Servo Alarm Inputs are Active High or Active Low. (**Note** : Servo Alarm signals are typically set to Active High.)

【Dedicated Output Port】 : Assigns specific output ports to system functions such as **Brakes, Start Lamps, Pause Lamps, and Reset Lamps**. This allows for efficient resource management; if a dedicated function is not needed, setting it to **0** releases that port for use as a **General Purpose Output**.

【Dedicated Input Port】 : Assigns specific input ports to specialized system functions. Similar to outputs, setting unused functions to **0** frees the port for use as a **General Purpose Input**.

【Set Normally Closed Input】 : Specifies which input ports are set to a **Normally Closed** state. When an input is designated here, it will be considered "Active" when the physical circuit is opened.

【Save】 : Commits all I / O configuration settings to the system memory.

ATTENTION : **You must tap [Save] before exiting to ensure your configuration is not lost !**

【Exit】 : Returns to the **Main Operating Interface**.

2.5.4 Limit

	Soft limit +	Soft limit -	Positive limit input	Negative limit input	Soft limit switch	Hard limit switch
X	#####. #	#####. #	##	##	Off	Off
Y	#####. #	#####. #	##	##	Off	Off
Z	#####. #	#####. #	##	##	Off	Off
S	#####. #	#####. #	##	##	Off	Off

IO Operation
Manual
Save
Clear alarm
Exit

Figure 2.5.4

【Soft Limits (+ / -)】 : Defines the operational range of each motion axis via software constraints. These can be used in conjunction with physical hardware limits for redundant protection.

【Positive Limit Input】 : Defines the physical input ports assigned to the **Positive Hard Limits** for each axis.

【Negative Limit Input】 : Defines the physical input ports assigned to the **Negative Hard Limits** for each axis.

【Soft Limit Switch】 : Enables or disables the software limit function.

- When enabled, the system will perform real-time monitoring during teaching, editing, and execution of motion commands. If an axis exceeds the set range, an alarm notification will be triggered immediately.

【Hard Limit Switch】 : Enables or disables the hardware limit function.

- When enabled, the system will monitor the physical limit sensors during all motion-related operations (teaching, editing, or running) . If a limit sensor is triggered, the system will immediately stop and display an alarm.

【Save】 : Commits all limit parameter settings to the system.

ATTENTION : You must tap [Save] before exiting to prevent any loss of configuration data !

【Exit】 : Returns to the **Main Operating Interface**.

2.5.5 Workpiece Zero Point

Speed	Axis parameters	IO settings	Limit	Workpiece Zero Point	Function Settings	
	Manual fine adjustment	Mechanical coordinate	Workpiece Zero Point	Fixture reference		IO Operation
X	###. ###	####. ###	####. ###	####. ###		Manual
Y	###. ###	####. ###	####. ###	####. ###		Save
Z	###. ###	####. ###	####. ###	####. ###		
S	###. ###	####. ###	####. ###	####. ###		
	JOG-	JOG+	Load	Reset		
X	X Bwd-	X Fwd+	Load	X Reset		Clear alarm
Y	Y Left-	Y Right+	Load	Y Reset		
Z	Z Up-	Z Down+	Load	Z Reset	Teaching Speed	Exit
S	S Spindle (CCW-)	S Spindle (CW+)	Load	S Reset	Low	

Figure 2.5.5

This interface is used to define the coordinate system for the workpiece, allowing the machine to understand the specific starting point of the production task relative to the mechanical structure.

【Workpiece Zero Point】 :

- **Teaching Method** : Manually move the axis to the desired target position, then press and hold the [Load] button for 1 second to capture the coordinates.
- **Manual Entry** : Alternatively, you may directly input the relative position values and tap [Save] to define that point as the Workpiece Origin.

【Fixture Reference】 : This acts as an auxiliary reference for calibrating the workpiece zero point. Typically, if you are aligning directly to the zero point, this value is set to 0. However, if mechanical constraints make it difficult to reach the actual "0" position, you can use a **calibration block**.

- For example, if you want the calibration block's position to be recognized as 10, enter "10" in the Fixture Reference. After moving the axis to that block and taping [Load] , the system will register that physical location as coordinate 10.

【Reset】 : Commands the mechanical coordinates to return to the machine zero point. (**Note** : This button must be pressed and held for 1 second) .

【Save】 : Commits all workpiece origin and fixture parameters to the system memory.

ATTENTION : Always tap [Save] before exiting to avoid losing your calibration data !

【Exit】 : Returns to the Main Operating Interface.

2.5.6 Function Settings

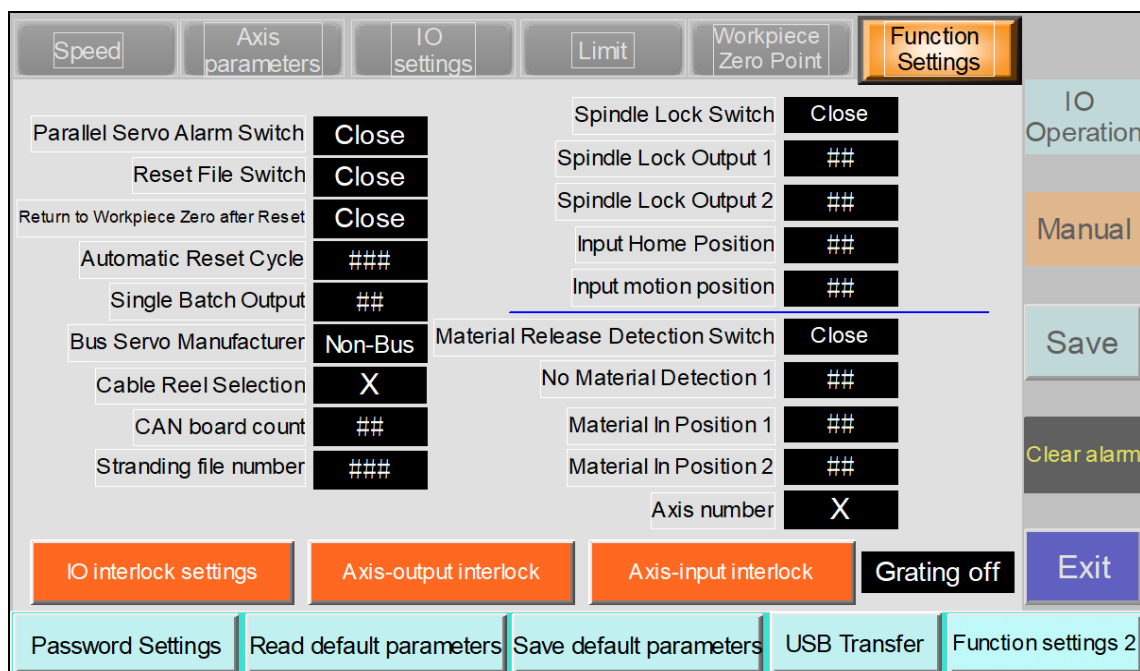


Figure 2.5.6-1

This interface allows for the configuration of system-wide logic and operational behaviors.

【 Parallel Servo Alarm Switch 】 : Enables or disables the monitoring of servo alarm signals across all axes.

【 Reset File Switch 】 :

- **ON** : When the [Reset] key is pressed, the equipment executes the custom homing sequence defined in the "Reset File."
- **OFF** : The motion axes return to the mechanical origin based on the predefined Axis Homing Sequence. Once all axes reach the origin, the pneumatic cylinders will return to their initial positions.

【 Return to Workpiece Zero after Reset 】 :

- **ON** : After the homing process is complete, the axes will automatically move to the Workpiece Zero position before entering Standby mode.
- **OFF** : The system enters Standby mode immediately after reaching the mechanical origin.

【 Automatic Reset Cycle 】 : Range: 0–999. If set to a value "X," the equipment will automatically perform a homing (reset) operation every X cycles. Setting this to 0 disables the auto-reset feature.

【 Single Batch Output 】 : Range: 1–99. Defines the actual production count incremented after each successful program execution.

【 Read default parameters 】 : Saves the current system configuration as the "Factory / Default" reference.

【 Save default parameters 】 : Restores all settings to the previously saved default values. Use this if parameters were modified incorrectly or forgotten.

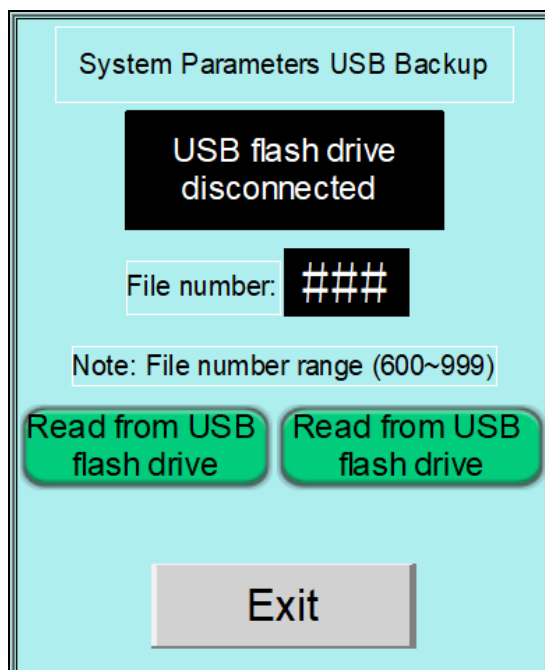


Figure 2.5.6-2

【USB Transfer】 : This function is used to back up system parameters to a USB drive for PC storage or for duplicating settings across multiple identical machines. (Refer to Figure 2.5.6-2)

- **Step 1** : Insert a USB drive (formatted to **FAT32**) into the **U-DISK** port.
- **Step 2** : Once successfully connected, the indicator / button status will turn **Red**.
- **Step 3** : Assign a **File Number** between **600 and 999**. (**Note** : The file number must be numeric; letters are not supported.)
- **Step 4**: Select [**Save to USB**] or [**Read from USB**] .
 - **Save to USB** : Creates a file named after the chosen number with a .VAR extension on the drive.
 - **Read from USB** : Uploads an existing .VAR file from the USB drive to the system's internal file list.

【Save】 : Commits all changes in this interface to the system memory.

ATTENTION : Always tap [**Save**] before exiting to avoid losing your calibration data !

【Exit】 : Returns to the **Main Operating Interface**.

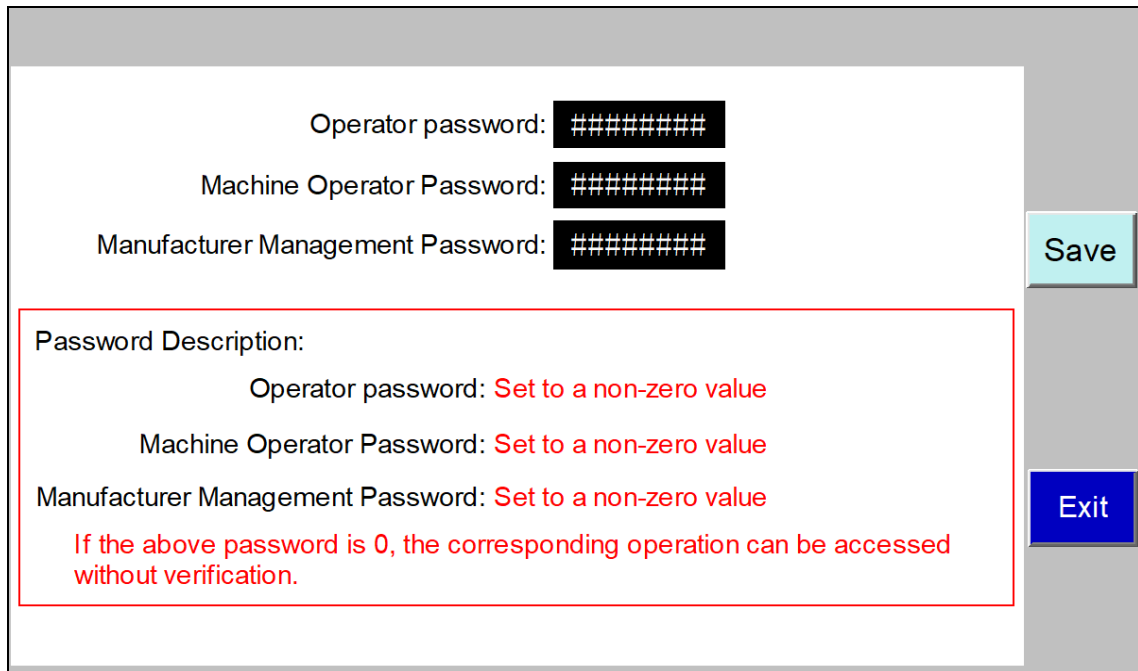


Figure 2.5.6-3

This interface is used to manage access control and secure the system configuration.

- ✧ **Password Configuration** : Upon entering this menu, you can define passwords for various access levels.
- If a password is set to 0, authorization is disabled, and the system will not require a password for any operations.
- **Recommendation** : It is highly recommended to set a password once the commissioning / debugging phase is complete to prevent unauthorized personnel from modifying critical settings.

【Save】 : Saves the password configuration to the system.

ATTENTION : Always tap [Save] before exiting to avoid losing your calibration data !

【Exit】 : Returns to the **System Settings Interface**.

3. Command Reference

3.1 Command Concepts

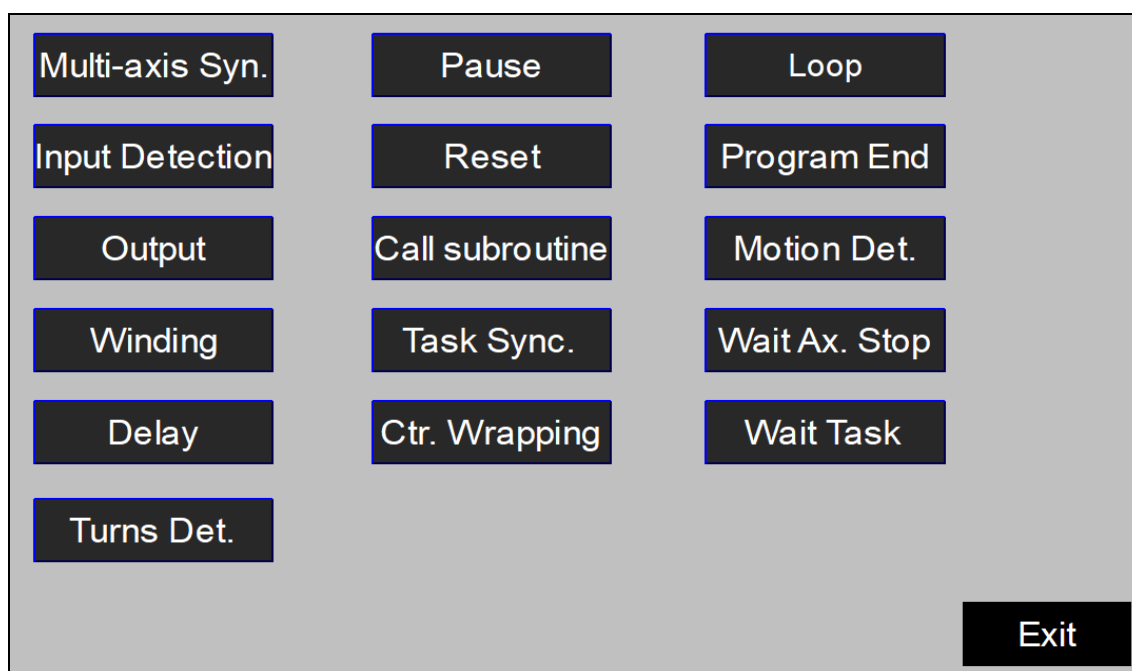


Figure 3.1.1

All commands within this system are designed to operate independently. During the programming process, each command occupies a **single line (or step)** within the program file.

The controller executes commands **sequentially (line-by-line)** . However, if a **Parallel Command** is encountered, the specified actions will be executed simultaneously.

- The system commands are categorized into the following types :
 - **Motion Commands** : Control axis movement and positioning.
 - **I / O Commands** : Manage input detection and output triggering.
 - **Logic Commands** : Handle conditional branching and program flow logic.
 - **File Operations** : Commands related to program file management.
 - **Dedicated Commands** : Specialized functions tailored for specific mechanical tasks.
 - **Call Commands** : Used for calling sub-programs or external routines.

3.2 Command Editing

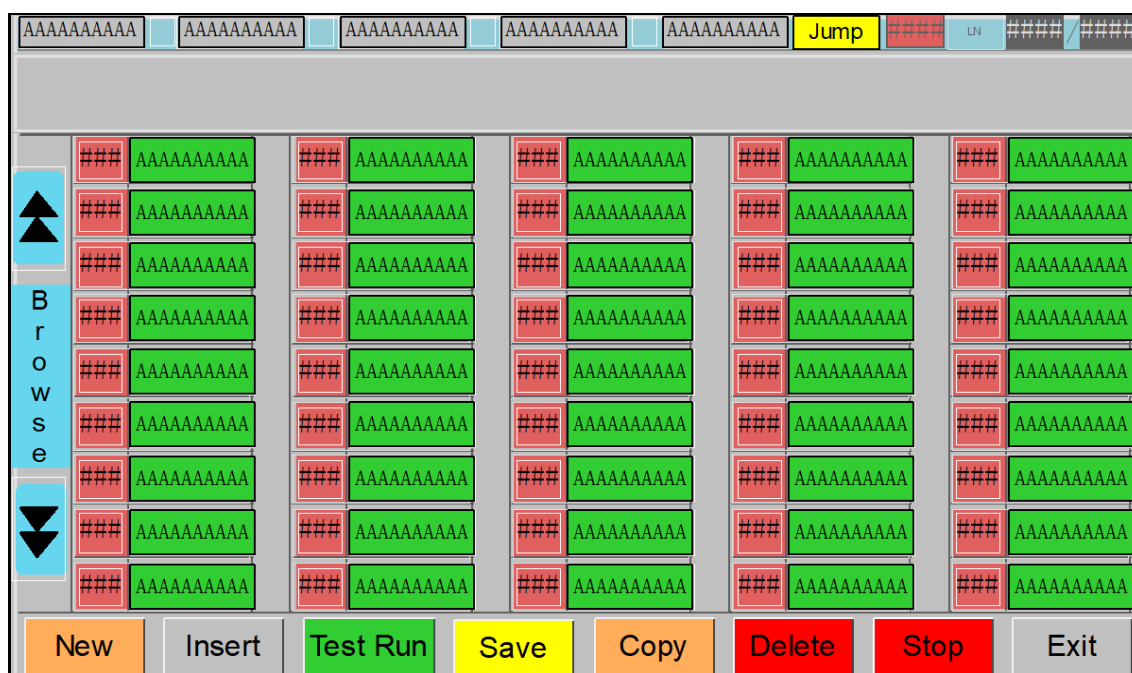


Figure 3.2.1

The **Command Editing** interface is used to program and modify instructions line-by-line. All data for each command is displayed and updated within the [**Command Area**] .

- **Editing Functions Overview** : The interface features the following functions: **Browse**, **New**, **Insert**, **Test Run**, **Save**, **Copy**, **Delete**, **Stop**, and **Exit**. Once your programming is complete, tap [**Save**] and then [**Exit**] to return to the File Management interface.

【Browse】 : View the full parameters of the currently selected command.

- This allows users to modify specific parameters to meet the logic flow requirements of the site.

【New】 : Creates a new instruction and opens the command selection menu.

- Once configured, the new command is appended to the last line of the program.
- If a command is deleted, the subsequent lines will shift up automatically, but new commands will always be added at the end.

【Insert】 : Inserts a command at a specific position within the existing list.

- To insert, select the command that should follow the new one, then tap [**Insert**] .
- The new instruction will be placed directly above the selected line.

【Test Run】 : Executes the currently selected command only.

- This is useful for testing individual movements or verifying command logic.

【Save】 : Commits all modifications made to the current command list within the file.

(**Note:** Ensure you tap [**Save**] before moving to a different line or exiting.)

【Copy】 : Copies the currently selected command. Once taped, the button changes to [Paste] , which offers three options :

- **Insert Paste** : Adds the copied command above the selected line.
- **Overwrite Paste** : Replaces the selected line with the copied command.
- **Cancel Paste** : Cancels the current paste operation.

【Delete】 : Removes instructions from the list. Supports deleting the **current line** or **batch deletion** of multiple lines.

【Stop】 : Immediately halts the movement of any active motion axis in the event of an error.

【Exit】 : Returns to the [Program File] interface.

3.3 Command List

The system commands are categorized into functional groups to streamline the programming of complex motion sequences.

- **Motion Commands** : Includes Single-Axis Positioning, Multi-Axis Interpolation, and other coordinated movement instructions.
- **I/O Control Commands** : Manages hardware interaction through Input Detection and Output Triggering.
- **Logic Commands** : Controls program flow using Loops, Subroutine Calls, Synchronized Tasks (Parallel Tasks) , and Wait Conditions.
- **Program Operations** : Includes 3 fundamental operational commands : Reset, Pause, and Delay.
- **Dedicated Commands** : Specialized instructions for motor manufacturing, including 4 specific types such as Winding and Circular Terminal Wrapping.
- **Extended Commands** : The instruction set is continuously updated with expansion commands based on evolving market applications and specialized industry requirements.

3.4 Command Details

3.4.1 Multi-Axis Synchronization.

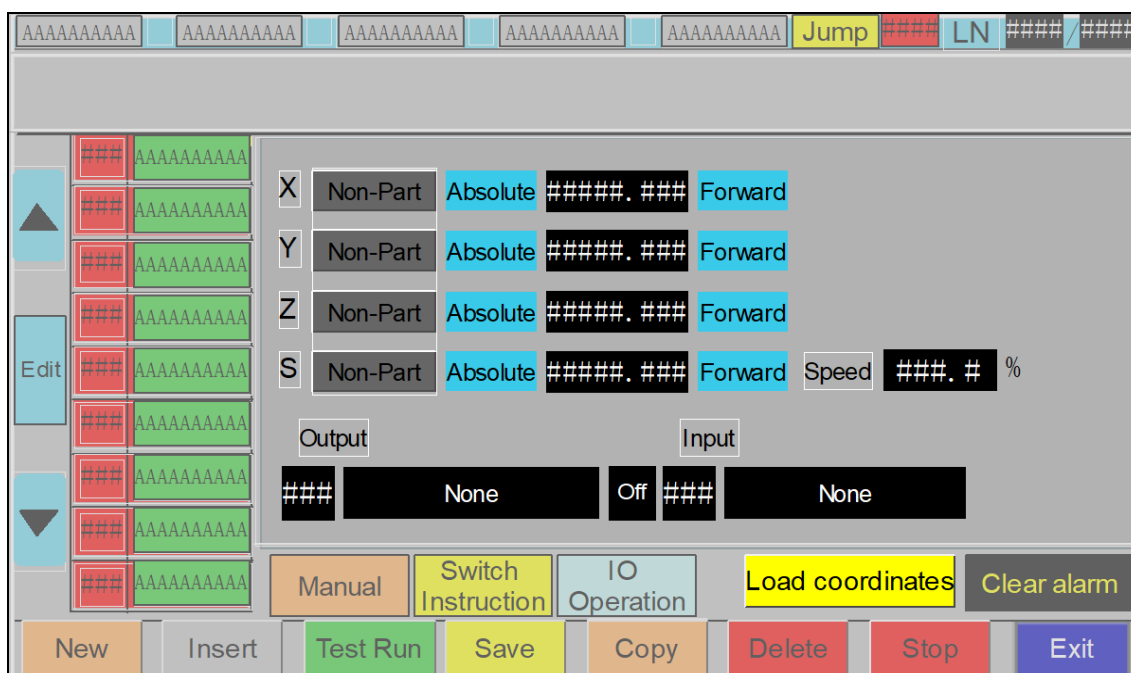


Figure 3.4.1

【Command Name】 : Multi-axis Syn. (Simultaneous multi-axis interpolation)

【Purpose】 : Executes synchronized linear interpolation for up to four axes (X, Y, Z, S) . All participating axes start simultaneously and reach their respective target positions at the exact same time. (**Note** : The displacement for this command is always calculated relative to the system origin) .

【Command Interface】 : (Figure 3.4.1)

【Participate / Non-Part】 : Select whether each specific axis selection in the current motion command.

【Absolute / Relative】 : Select whether the current axis is running in absolute or relative coordinates.

【Coordinate Value】 : The target position or distance to travel. Units are in mm (for linear axes) or degrees (rotary axes) .

【Speed】 : Range: 0.1% – 100.0%. This setting scales the "Base Interpolation Speed" defined in the [System Parameters]. Factory default : 5%.

【Teaching Speed】 : Allows for the adjustment of manual movement speed during the setup phase. You can toggle between **Low**, **Mid**, and **High** presets. °

【Axis+ / -】 : (Jogging) These manual buttons are used to drive each individual axis in either a positive or negative direction. They are essential for physical positioning, alignment, and debugging during the **Teaching Process**.

3.4.2 Input

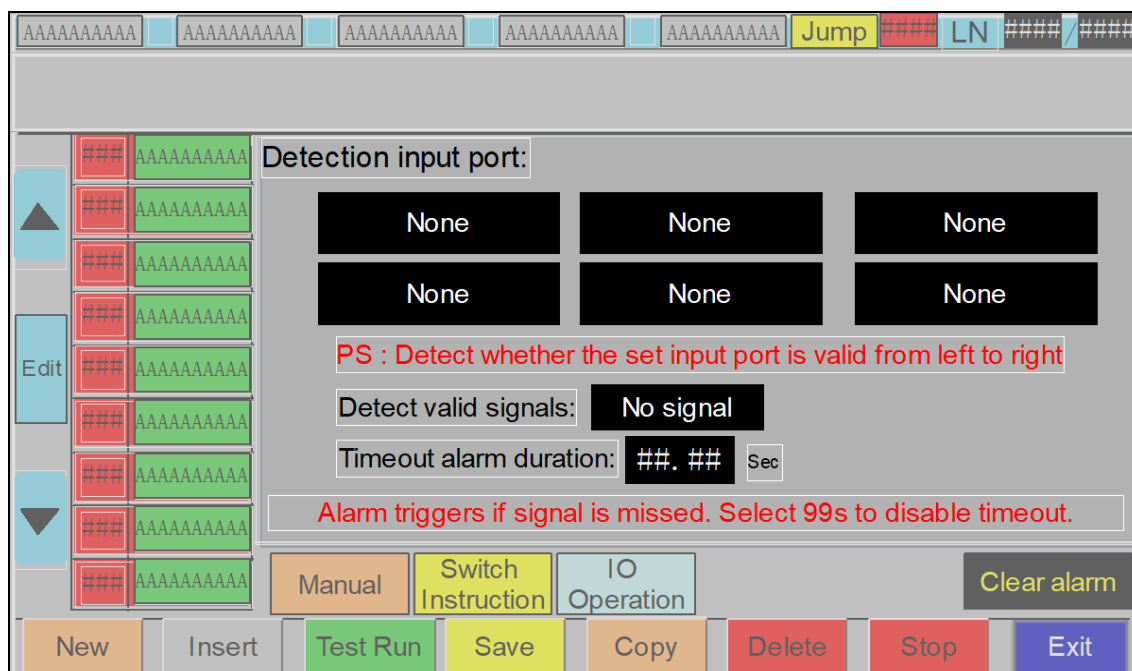


Figure 3.4.2

【Command Name】 : Input Detection (Input signal detection)

【Purpose】 : Simultaneously monitors up to **6 input points** to verify if they have reached the required state. The program will pause at this step until all specified conditions are met or the timer expires.

【Command Interface】 : (Figure 3.4.2)

【Detection Input Port】 : Specifies the input ports to be monitored (Input1 through Input6) .
(**Note** : If a port is set to **0**, the system will skip detection for that specific slot.)

【Detect valid Signals】 : Determines the logic state required for a "Pass" condition:

- **Signal Present (Active)** : The input must be triggered (ON) .
- **No Signal (Inactive)** : The input must be untriggered (OFF) .

【Timeout Alarm duration】 : Range : **0–99 seconds**.

- This defines the maximum duration the system will wait for the inputs to reach the desired state.
- If the sensors are not "in position" within this timeframe, the system will trigger an Alarm Notification.

3.4.3 Output

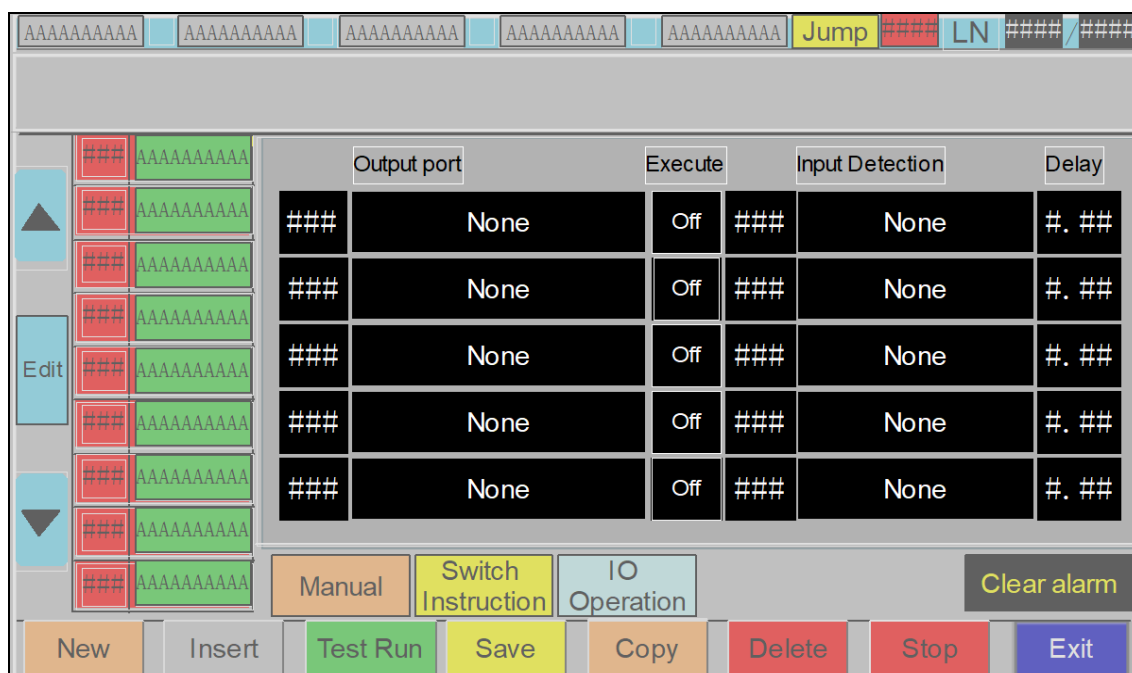


Figure 3.4.3

【Command Name】 : Output (Output control)

【Purpose】 : Executes output logic sequentially across five configurable rows.

- For each row, the system follows this operational cycle : **Set Output State** → **Verify Input (Optional)** → **Delay** → **Move to Next Row**.

【Command Interface】 : (Figure 3.4.3)

【Output Port】 : Specifies the physical output points to be controlled (output 1 through output 5) . Set to 0 if no control is required for that row.

- **Wiring Note** : All output ports utilize Common Anode (**Positive Common**) wiring.

【Execute】 : (On / Off) Sets the logic state of the specified output port.

【Input Detection】 : Opens a selection menu for common input ports.

- This is used to verify that a mechanical action (e.g., a cylinder extending) has been physically completed before the program continues. Set to 0 to skip the verification step.

【Delay】 : Defines a wait time in **seconds** after the output state is set.

- This is typically used to allow for mechanical latency or pneumatic stabilization.

【Synchronization (Sync / Non-Sync) 】 :

- **Non-Sync** : The current line must finish its delay before the next line begins.
- **Sync** : The current line and the subsequent line execute their output actions simultaneously.

3.4.4 Winding

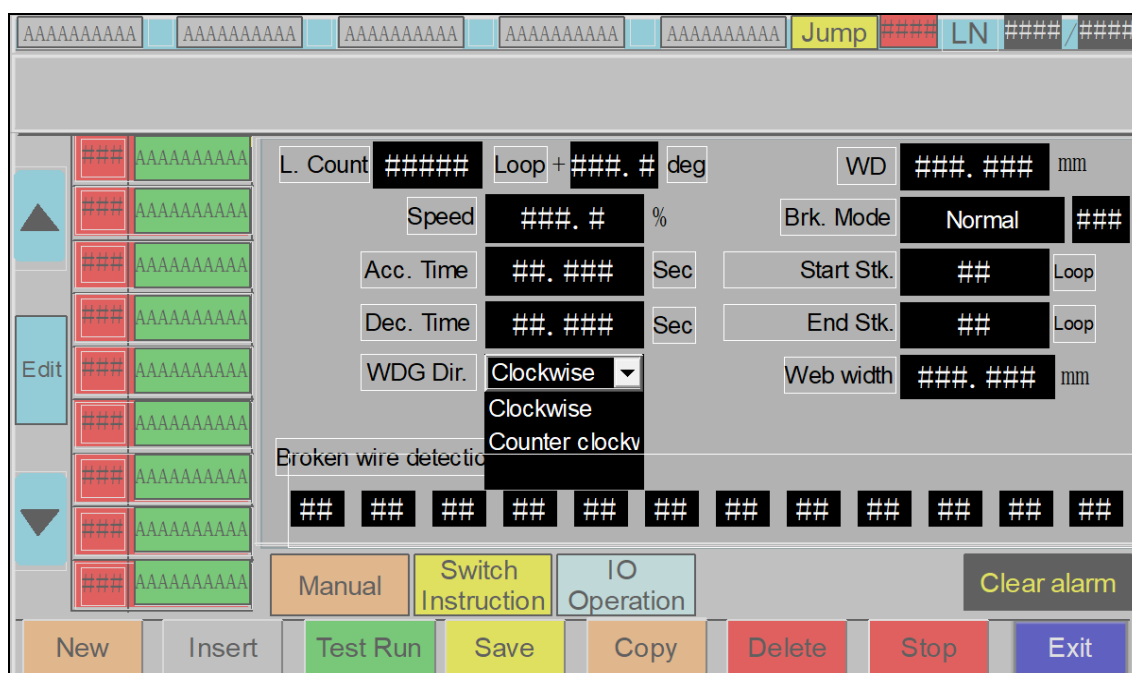


Figure 3.4.4

【Command Name】 : Winding (Wire Traversing)

【Purpose】 : A specialized command dedicated to coil winding applications, integrating spindle rotation (S-axis) with coordinated traversal (X -axis) to ensure precise wire layering.

【Command Interface】 : (Figure 3.4.4)

【L. Count】 : Range : 0–65,535 (Loop + deg) .

- Defines the total number of revolutions for the winding sequence.

【Speed】 : Range: 0.1% – 100.0%.

- Determines the rotational speed of the S-axis (Spindle) based on the "Base Speed" set in the System Parameters. Default is 5%.

【Acc. Time】 : Range: 0–99.999 (Sec) .

- Defines how quickly the spindle reaches target speed. A higher value results in a slower, smoother start.

【Dec. Time】 : Range: 0–99.999 (Sec) .

- Defines how quickly the spindle slows down. A higher value results in a more gradual stop.

【WDG Dir.】 : Select between **Clockwise (CW)** or **Counter-Clockwise (CCW)** for the spindle rotation.

【WD】 : Range: 0–999 (mm) .

- While typically representing the actual wire diameter, it is functionally defined as the Lead Pitch—the lateral distance moved by the traversal axis per one full revolution of the spindle.

【Brk. Mode】 : Normal / Start-End Stop / Tail-End Stop.

- **Normal** : The axis stops immediately at its current position once the turn count is reached.
- **Start-End Stop** : The spindle stops at the "Start" angular position, with the system managing the layer distribution.
- **Tail-End Stop** : The spindle stops at the "End" angular position, ensuring proper distribution for the final layer.

【Start Stk.】 : Range: 0–99 (Loop) .

- Defines the number of extra turns to be wound at the starting edge of the first layer (Header Stacking) .

【End Stk.】 : Range: 0–99 (Loop) .

- Defines the number of extra turns to be wound at the finishing edge of the final layer (Footer Stacking) .

【Web Width】 : (Traverse Width) Range: -999–9999 (mm) .

- Defines the total lateral width on the bobbin/product over which the copper wire will be distributed.

3.4.5 Wrapping

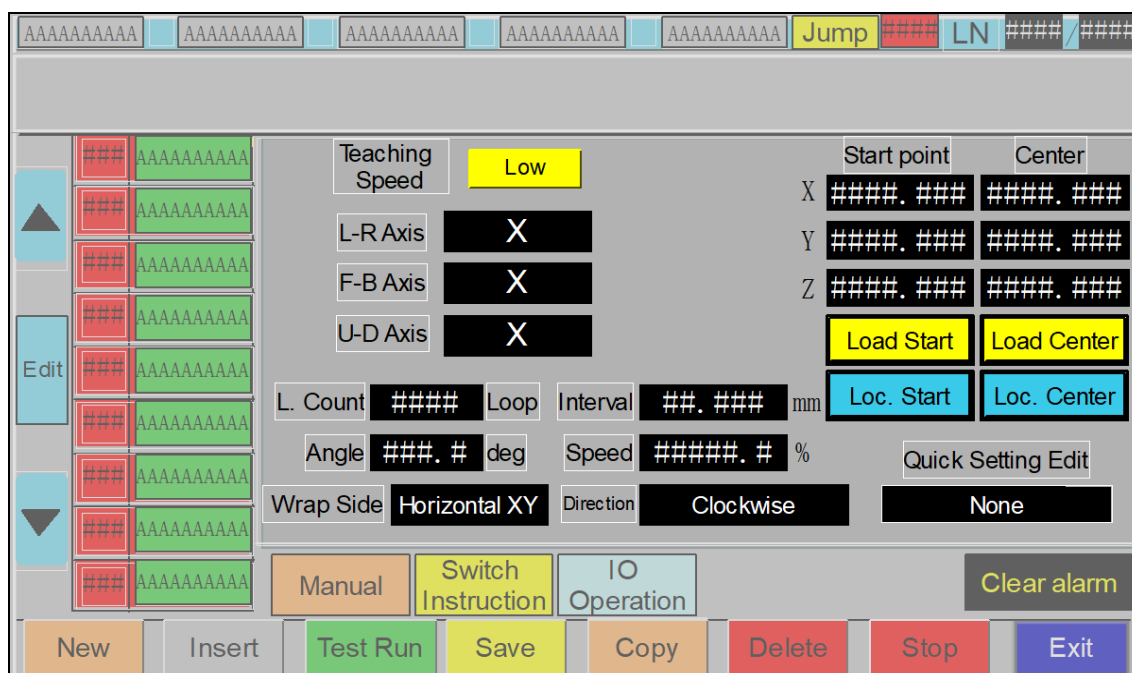


Figure 3.4.5

【Command Name】 : Ctr. Wrapping (Terminal pin wrapping)

【Purpose】 : A specialized command for the winding industry, used to create spiral or circular wraps around a pin (terminal) by interpolating two axes for the circular path and a third axis for the spiral pitch.

【Command Interface】 : (Figure 3.4.5)

【Start Point】 : (Absolute Coordinates) Range : -999.000 to 999.000.

- **Teaching** : Use the manual jog keys to reach the target, then press [Load Start] .
- **Positioning** : You can directly input values and use [Go to Start] to verify the physical location.

【Center】 : (Absolute Coordinates) Range : -999.000 to 999.000.

- Defines the center of the pin. The distance between the Start Point and the Center Point determines the Radius of the wrapping circle.

【L. Count】 : Sets the total number of full circles (360°) the axes will perform on the defined plane.

【Interval】 : <Value + / - >; Defines the travel distance of the <Spiral Axis> for each full rotation completed by <Circular 0 Axis> and <Circular 1 Axis>.

- The < + / - > sign of the value determines the vertical movement direction of the <Spiral Axis> relative to the circular plane (following the Right-Hand Rule) .

【Angle】 : (Absolute Coordinates) Range : 0° to 360°.

- Defines the absolute angular position where the wrapping motion will terminate.

【Speed】 : Range : 0.1% – 100.0%. Default is 5%.

【Wrap Side】 : Select between **Horizontal XY**, **Vertical XZ**, or **Vertical YZ** based on the orientation of the terminal pins on the product.

【Direction】 : Select **Clockwise (CW)** or **Counter-Clockwise (CCW)** for the circular interpolation.

【Teaching Speed】 : Customizable **High, Mid, and Low** speed presets for manual positioning. Supports both **Continuous Motion** and **Inching (Incremental)** movement.

【Axis+ / -】:(Jogging) These manual buttons are used to drive each individual axis in either a positive or negative direction. They are essential for physical positioning, alignment, and debugging during the **Teaching Process**.

3.4.6 Delay

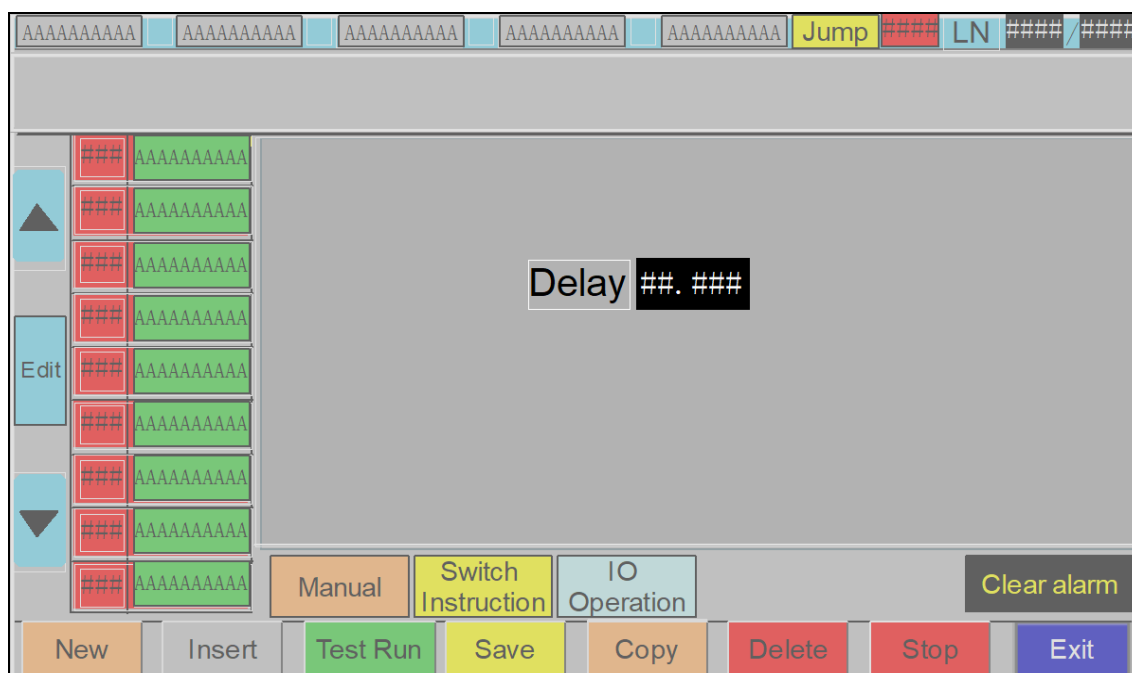


Figure 3.4.6

【Command Name】 : Delay (Dwell Time)

【Purpose】 : Commands the program to pause execution for a specified duration before automatically proceeding to the next instruction in the sequence.

【Command Interface】 : (Figure 3.4.6)

【Delay】 : Range : 0.00 – 99.00 seconds.

- Defines the exact duration the system will "dwell" at this step.
- The timer begins immediately upon reaching this command line.

3.4.7 Winding Counter

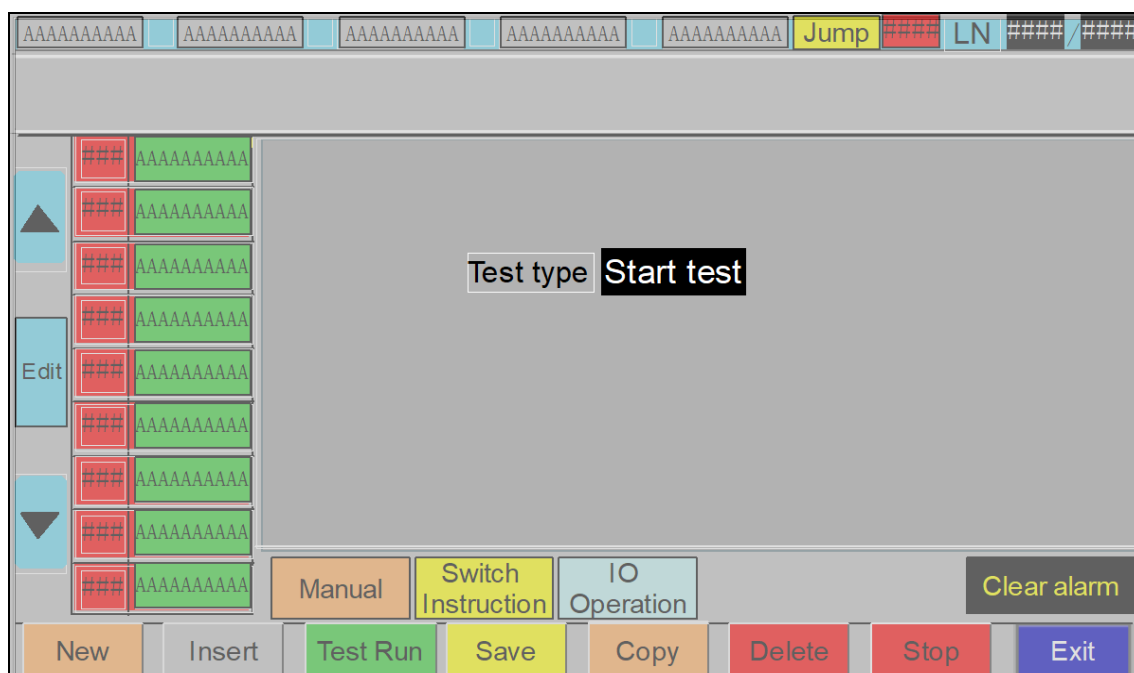


Figure 3.4.7

【Command Name】 : Turns Det. (Turn counting)

【Purpose】 : This command is used to monitor and track the total number of revolutions performed by the winding spindle during a specific part of the program. It ensures precise tracking of the total wire turns applied to the product.

【Command Interface】 : (Figure 3.4.7)

【Test type】 : Defines the operational state of the counter logic :

- **Start** : Activates the winding counter to begin recording revolutions.
- **End** : Deactivates the counter and stops the accumulation for the current segment.

3.4.8 Wait for Axis Stop

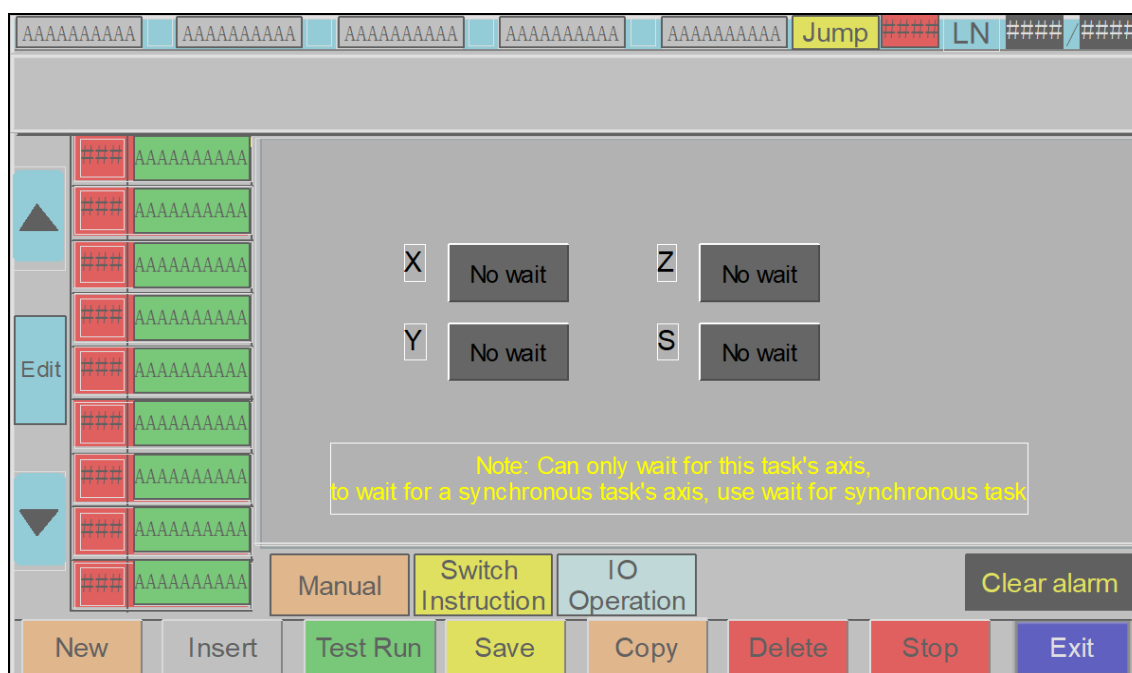


Figure 3.4.8

【Command Name】 : Wait Ax. Stop (Wait for axis stop)

【Purpose】 : Ensures that all motion axes currently in operation have come to a complete mechanical standstill before the controller proceeds to the next instruction.

【Command Interface】 : (Figure 3.4.8)

【Wait Mode】 :

- **Wait** : The program execution pauses at this line until the system confirms that all participating axes have finished their deceleration and reached zero speed.
- **No Wait** : The program will immediately move to the next command without verifying the status of the axes. (Use with caution, as this may lead to overlapping movements) .

3.4.9 Loop

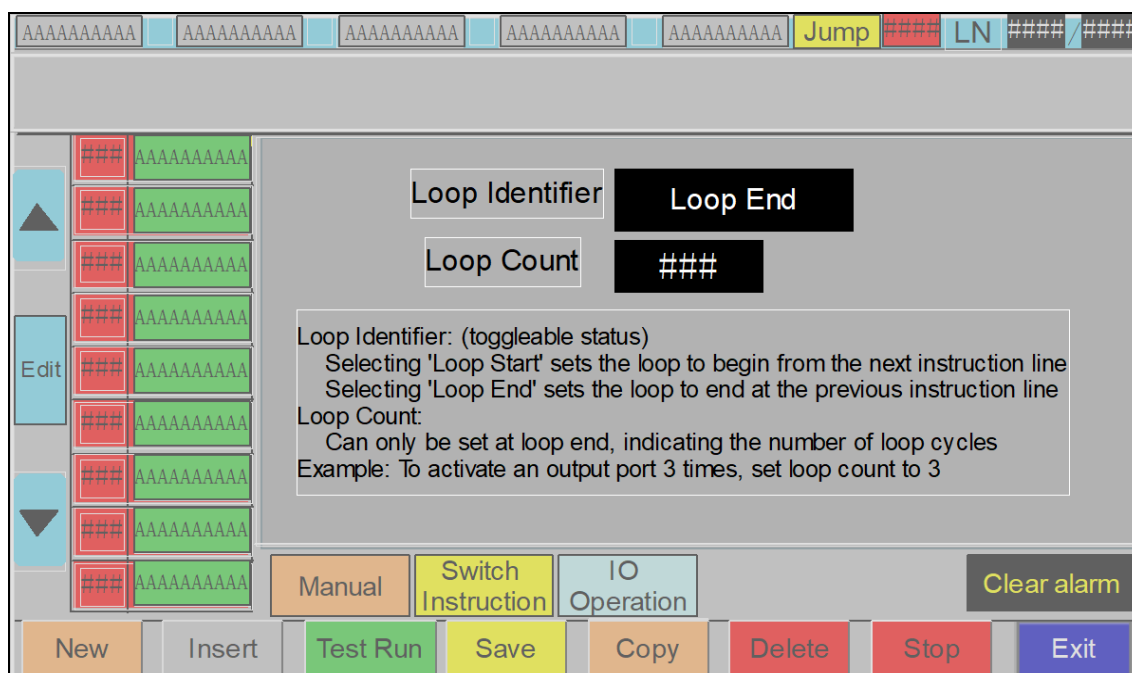


Figure 3.4.9

【Command Name】 : Loop (Cycle control)

【Purpose】 : Enables the repetitive execution of a specific segment of instructions.

- This is used to automate cyclical tasks—such as multi-layer winding or repeating a specific sequence of motions—without the need to program each step individually.

【Command Interface】 : (Figure 3.4.9)

【Loop Identifier】 : Defines the boundary of the repetitive block :

- **Loop Start** : Marks the beginning of the sequence to be repeated.
- **Loop End** : Marks the conclusion of the sequence. When the program reaches this line, it will jump back to the corresponding "Loop Start" until the count is completed.

【Loop Count】 :

- Sets the total number of times the bracketed instructions will be executed.
- **Example** : Setting this to 5 will cause the sequence to run 5 times before the program continues to the instructions below the loop.

3.4.10 Reset

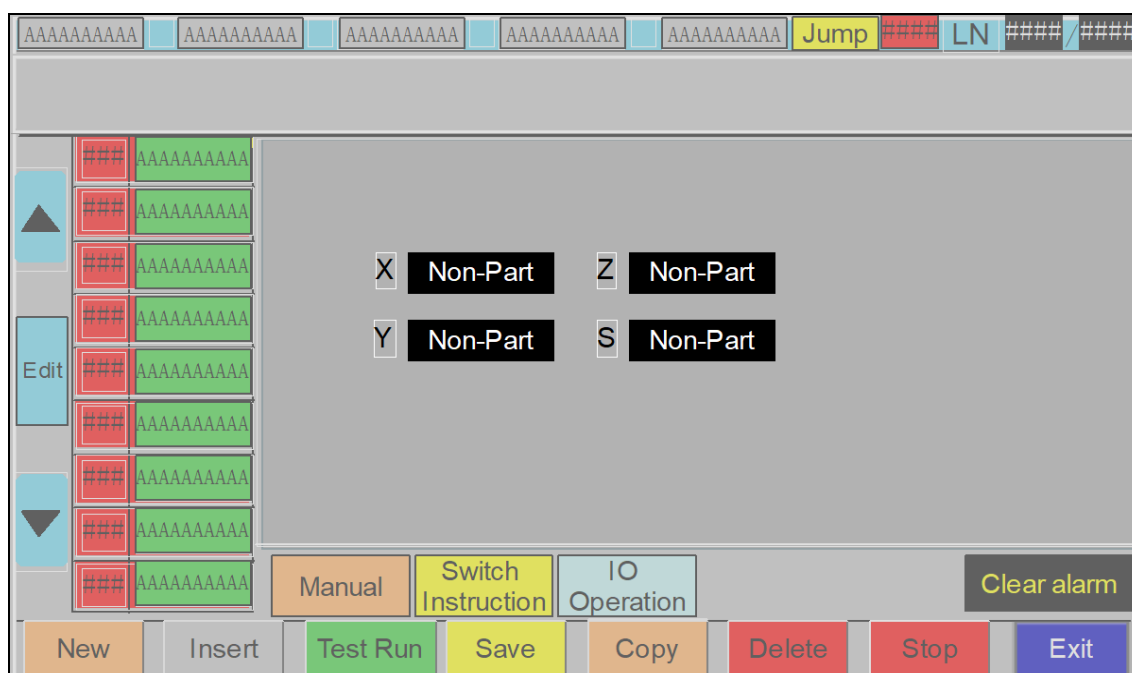


Figure 3.4.10

【Command Name】 : Reset (Homing / Reset to origin)

【Purpose】 : Initiates the homing sequence to find the **Mechanical Origin** (Zero Position) for the specified axes.

- This command ensures the system's coordinate integrity by calibrating the physical position of the machinery against its internal software coordinates.

【Command Interface】 : (Figure 3.4.10)

【Homing Axis Enable】 :

- **Participate** : The selected axis will move toward its home sensor or limit switch to establish the origin.
- **Non-part** : The selected axis will remain in its current state and will not perform a homing routine.

3.4.11 Call Subroutine

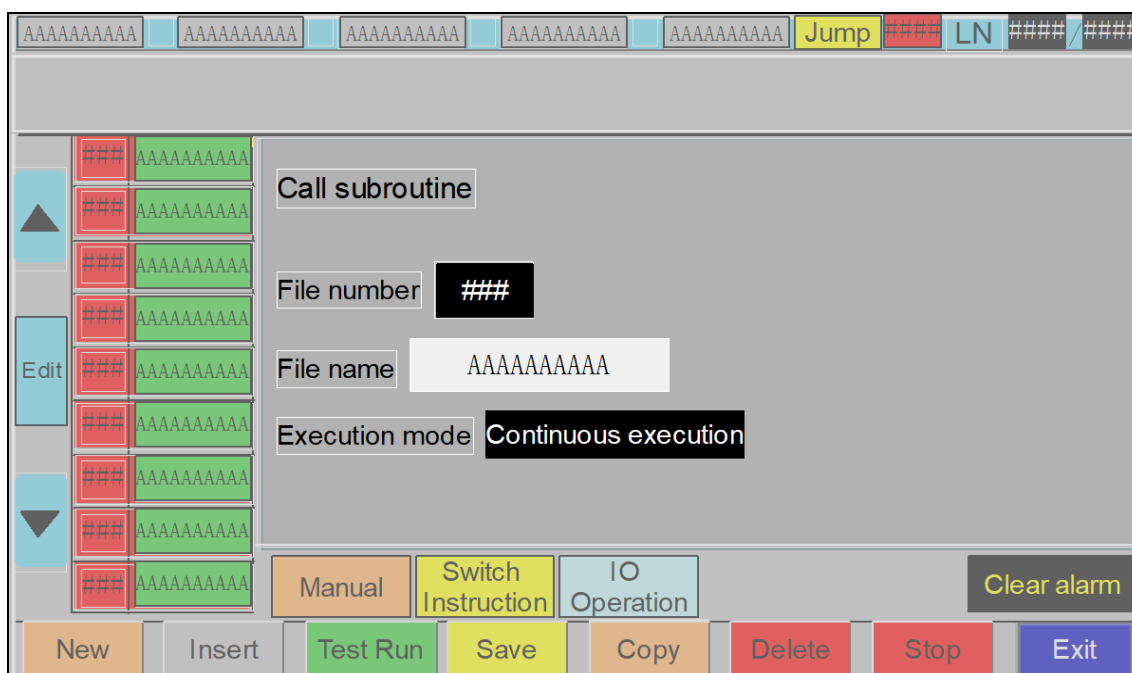


Figure 3.4.11

【Command Name】 : Call Subroutine (Subprogram call)

【Purpose】 : Integrates a pre-existing subroutine into the main program.

- This command operates via Serial Execution, meaning the system will enter the subroutine, execute all its internal steps, and then return to the main program to continue with the next instruction.

【Command Interface】 : (Figure 3.4.11)

【File Number】 : Tap to select the index number of the subroutine you wish to invoke.

【File Name】 : Displays the name of the subroutine corresponding to the selected File ID. Please verify the name to ensure the correct file is linked.

【Execution Mode】 :

- **Continuous execution** : (Always Execute) The subroutine will be called during every cycle of the main program' s execution.
- **Single execution** : (Run Once) The subroutine is called only during the first program cycle. Once completed, it will be bypassed in all subsequent cycles.

3.4.12 Synchronous Task

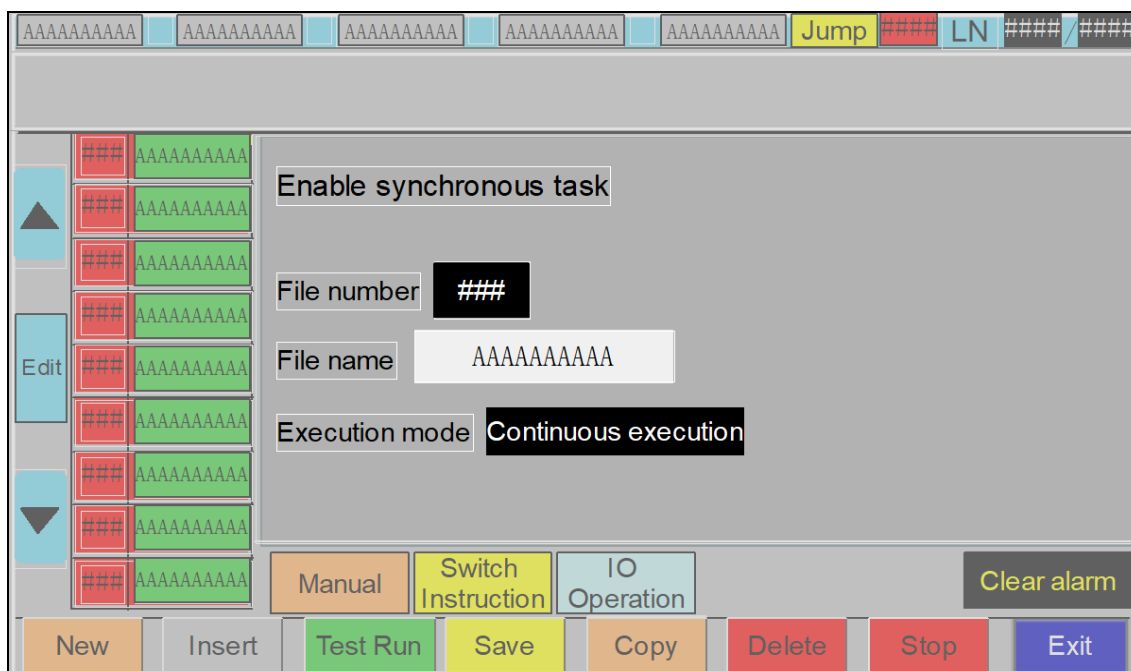


Figure 3.4.12

【Command Name】 : Task Sync. (Parallel Task)

【Purpose】 : Launches a secondary program (Sub-task) that runs **simultaneously** with the main program.

- Unlike the "Call Subroutine" command, which runs in series, this command allows the machine to perform background operations—such as sensor monitoring, data logging, or auxiliary axis control—while the main winding sequence continues without interruption.

【Command Interface】 : (Figure 3.4.12)

【File Number】 : Tap to select the index number of the parallel task (sub-program) you wish to activate.

【File Name】 : Displays the name of the program corresponding to the selected File ID.

【Execution Mode】 :

- **Continuous execution** : (Always Execute) The subroutine will be called during every cycle of the main program' s execution.
- **Single execution** : (Run Once) The subroutine is called only during the first program cycle. Once completed, it will be bypassed in all subsequent cycles.

3.4.13 Wait for Task

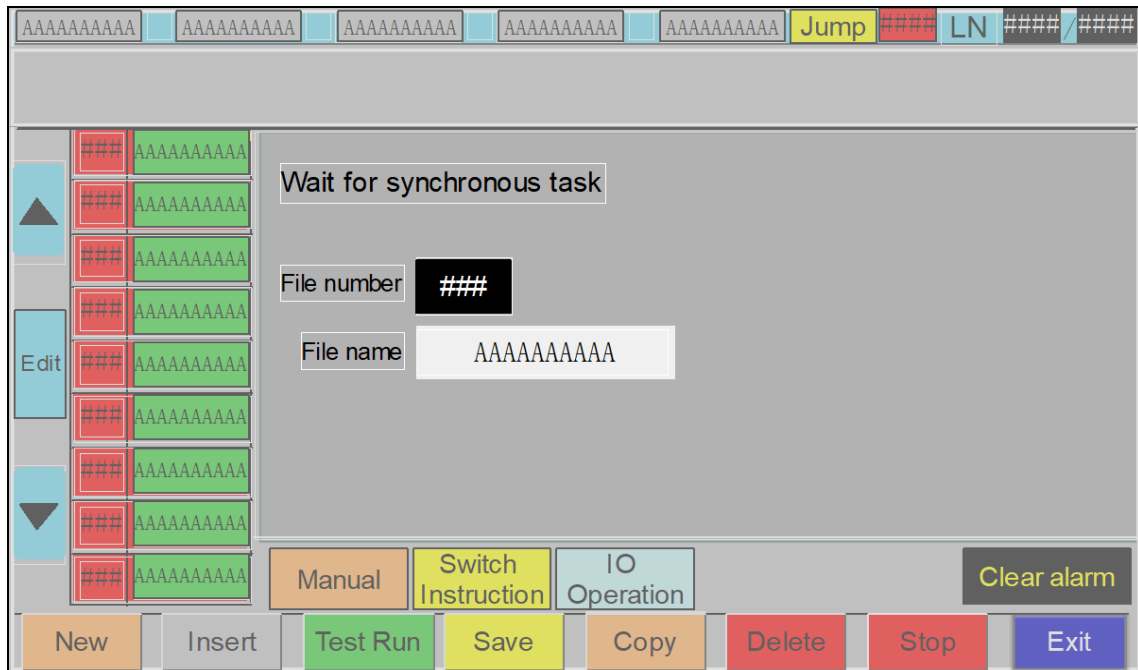


Figure 3.4.13

【Command Name】 : Wait Task (Task Synchronization)

【Purpose】 : This command acts as a "checkpoint" for parallel operations.

- It instructs the main program to pause and wait until a specific Synchronous Task (initiated by command 3.4.12) has finished its execution before proceeding to the next line.

【Command Interface】 : (Figure 3.4.13)

【File Number】 : Tap to select the index number of the specific synchronous task you are waiting for.

【File Name】 : Displays the name of the task file. The system uses this to identify which background process must reach completion.