



深圳市艾而特自动工业化设备有限公司

AND ENGINEERING CO.,LTD

ACT, HNA Series Servo Fastening System

Manual of Operation

Ver. 2.06

Catalogue

Safety instruction.....	3
Installation and fixation.....	4
Maintenance tips.....	5
Torque calibration method.....	6
Chapter I. Overview.....	7
1.1 Function description.....	7
1.2 Technical specifications.....	7
1.3 Model description (Selection table).....	8
Chapter 2 Interface Function Introduction.....	10
2.1 Tool parameters.....	12
2.2 Task selection.....	13
2.3 Setup interface.....	14
2.3.1 Start mode.....	14
2.3.2 Number of screws.....	14
2.3.3 Re-tighten to start.....	14
2.3.4 Re-tighten to fail.....	15
2.3.5 Unscrew.....	15
2.3.6 Parameters.....	15
2.3.7 Screw sequence.....	17
2.3.8 Input interface.....	18
2.3.9 Output interface.....	19
2.3.10 System parameter setting interface.....	21
2.4 System parameter setting function (after entering the password).....	22
2.5 Graphic display interface.....	27
2.5.1, Torque time chart.....	27
2.5.2 Angle time chart.....	27
2.5.3, torque Angle diagram.....	28
2.5.3 Speed time chart.....	28
Chapter 3 External Connections.....	29
3.1 I/O definition description.....	29
3.2 I/O connection diagram.....	30
Chapter 4 Operation.....	31
4.1 Remote control.....	31
4.2 Handhold operation.....	31
4.3 Panel button operation.....	31
Chapter 5 Communication Interface.....	32
5.1 RTU mode format for each byte (10 bits) (modbus protocol).....	32
5.2 DB9 controller pin definition.....	32
5.3 Frame description.....	32
5.4 Writing and reading of general parameters.....	33
5.5 Network communication format.....	35
5.6 Parameter table.....	37

5.7 User selection parameters operation.....	42
Chapter 6 Alarm processing	43
Chapter 7 ACT Controller Built-in Tightening Positioning	44
7.1 Tightening the positioning setting premise.....	44
7.2 Fixed screwdriver.....	44
7.3 Controller interface with built-in positioning system.....	45
7.4 Function setting of built-in positioning system(set with password)	47
7.4.1 Encoder value reset.....	47
7.4.2 Confirmation of coordinate origin	47
7.4.3 "Last screw position" and "Next screw position".....	47
7.4.4 Interchange of head and tail positions	47
7.4.5 Tightening position confirmation	47
7.4.6 Insert current position.....	47
7.4.7 Current position deletion.....	48
7.4.8 Interchange of head and tail positions	48
7.4.9 Tightening position deviation	48
7.4.10 The operation steps of screw positioning.....	48

Safety instruction



Please read the product manual and precautions carefully before using the product, otherwise it may lead to accidental personal injury or damage to the equipment and parts.



Do not operate the controller or plug in the power cord in a humid environment or with water on your hands, otherwise you may be electrocuted and suffer accidental personal injury.



Ensure that the controllers power cord plug is effectively grounded. Do not remove the ground wire or use a power plug or power strip that is not effectively grounded.



Do not plug or unplug tool cables with power. If you need to replace the cable or connection screwdriver, please turn off the controller power for 10s before operating.



Please keep the environment clean and tidy for the use of screwdriver and controller to avoid the operator losing control of the screwdriver or controller due to environmental influence.



Cable lines must be correctly connected and fixed to avoid entanglement and damage to cable lines and improper fixation causing people to trip over. Please wear protective goggles when using electrical assembly tools.



Do not use the screwdriver, cable and controller for any other purposes beyond those specified in the product manual. Illegal or improper use may cause personal injury to the user, damage to the system and components, and may result in warranty issues.



Do not disassemble, repair the controller, screwdriver and any parts without authorization, otherwise it may cause accidental personal injury and may invalidate the product warranty

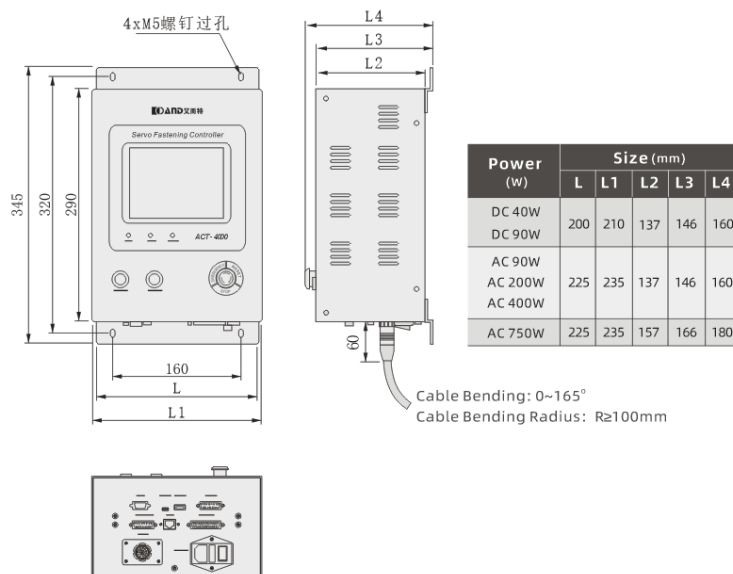
Installation and fixation

The installation and fixation of the ACT and HNA series controllers are very simple. Please refer to the following steps to fix the controller and connect the electric screwdriver to the controller through a cable.

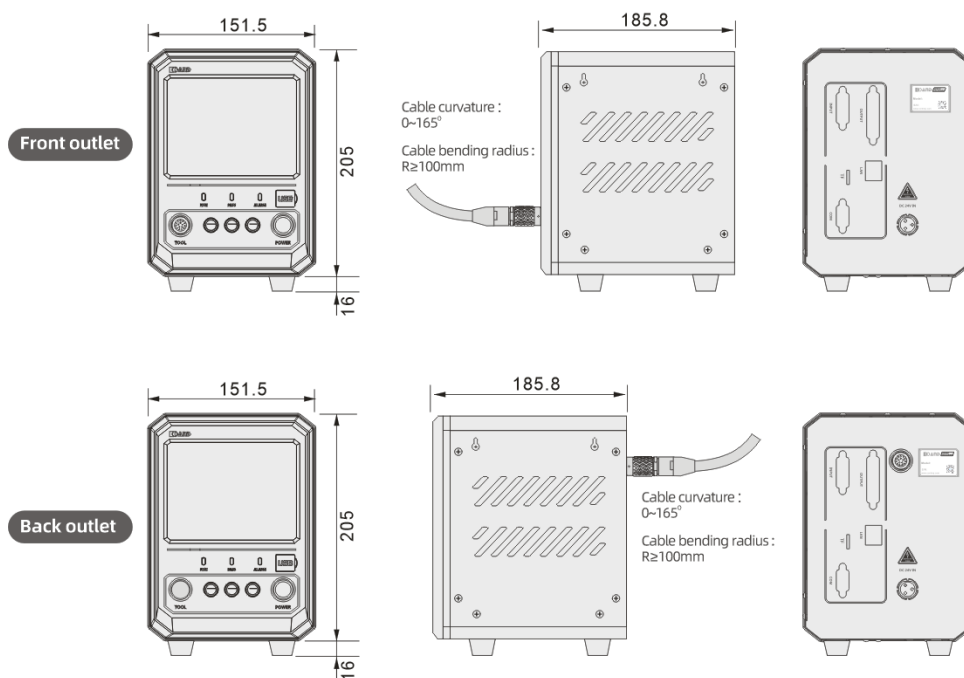
Before securing the controller, ensure that the power cable is connected to an effectively grounded power plug and the connection does not cause tripping within the work area. The controller should be fixed within the sight of the user and should be easy for relevant personnel to program or changing parameter.

Controller fixation:

1. The ACT series controller backplane provides 4×M5 screw through holes to fix the controller to walls, workbenches or tool holders.



2. For HNX series controller, fix the controller on the Workbench



Tool cable installation guide:

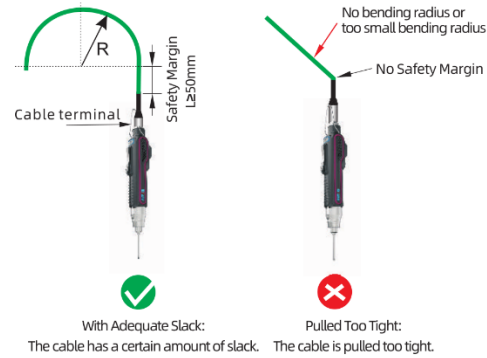
When connecting the screwdriver to the tool cable, keep a certain amount of cable space to ensure that the screwdriver won't pull the cable interface when it goes down, which will cause cable damage.

Cable space:

When bending, there must be a radius;

The allowable bending radius of the cable is 10 times of the outer diameter of the cable;

For example, if the outer diameter of the cable is 10mm, then the allowable bending radius of the cable is $10 \times 10 = 100\text{mm}$, that means when the cable bends (on the turning), it is an arc bend, and this radius should be greater than or equal to 100mm.



Maintenance tips

1. Before starting any maintenance work, turn off the power and disconnect the tool line.
2. After 500,000 times of tightening, the whole machine needs to be cleaned, check whether the noise and vibration are abnormal, and test the torsion value.
3. After 1 million times of tightening, the mechanical parts need to be maintained with lubricating oil, and calibrate the friction coefficient.
4. After 2 million times of tightening or over a year, the whole machine needs to be returned to the factory for maintenance.
5. Inspect the appearance of the screwdriver and the surface condition, and check whether the reducer is leaking oil, take photos for record.
6. According to the problems and parameters described by the customer, imitate the situation that customers using, verify the description and the deviation value, eliminate the electric control fault and parameter setting error. The machine can be disassembled for testing and photographed for record.
7. Check the position of insertion and removal batch rod and front bearing, the situation of accumulation of dust, iron filings and oil, cleaning up, and take photos for record.
8. Check whether the bearing cover is depressed and the bearing rotates smoothly. If not, replace the new parts.
9. Check whether the shaft surface of batch rod sleeve is smooth and flat, replace the new part if it's not.
10. Check whether the surface of the steel ball is smooth and flat, replace the new part if it's not.
11. Check whether guide sleeve is smooth or not, and if there are scratches and deformations, replace the new parts.
12. Check whether the internal small spring is complete and the spring force is uniform, If not, replace the new part.
13. Check whether the surface of the reducer gear sleeve is smooth and flat, replace the new part if it's not.
14. Check whether the grease inside the reducer is full, add grease if it's not.
15. Check whether the motor runs smoothly, whether there is any abnormal noise and vibration, return to the factory for maintenance with this problem.

Torque calibration method

Tools:

a. Torque tester b. Test stand(fixed frame) c. Connecting rod.

Note:

1. The specifications of torque testers vary from brand to brand, so it is recommended to use a calibrator with the maximum torque of a screwdriver accounting for about 70% of the range of the torque tester.
2. There is a large error between the handheld test and the fixed test, and the test should be fixed on the test stand as much as possible.

Operating steps:

Step 1: Power on the controller, enter the system setting interface, enter the password, and confirm that the user has successfully logged in.

Step 2: Set the target torque to the torque value to be calibrated, and set the running speed to 100rpm.

Step 3: Switch the tester to PEAK test mode

Step 4: Set two steps on the controller, the first step: tighten to the set target torque; the second step: loosen to a certain angle, the interval between the two steps is 1 second.

Step 5: Start the screwdriver, after completing the tightening action, check the display value of the tester, and then start the screwdriver repeatedly to measure several times.

When There is a Deviation in the Test Torque:

Step 1: Enter the setting interface through the main interface, and then enter the system setting. The system setting interface has two adjustable parameters, "correction coefficient" and "friction force". The default calibration factor of the system is 100 and the friction force is 0.00.

Step 2: When there is a deviation in the test torque: adjust the friction force to calibrate the torque.

(For the specific adjustment method, please refer to Chapter 2 2.4 Calibration parameters of System Parameter Setting Function)

Methods to Achieve Precise Tightening:

In order to meet the production efficiency and tightening accuracy and achieve satisfactory results at the same time, it is the best way to use step-by-step tightening. The specific methods are as follows:

The first step: in the high-speed tooth feeding stage, use a small torque (shift torque) to quickly fit the screwdriver head to the workpiece, that is, seat it;

Step 2: In the precision tightening stage, after the screw is seated, start tightening at the target torque at a low speed, generally 100rpm or less.

Note: The percentage of shift torque relative to target torque is as follows:

Hardwired: 60%

Soft connection: 80%

Chapter I. Overview

1.1 Function description

- 12 task modes can be switched freely, which is suitable for the assembly needs of various products.
- Each task can be programmed for 8 different torque parameters, to use for complex tightening process requirements.
- Meanwhile it can control torque and angular effectively, to improve the tightening qualification rate.
- It has the function of deceleration and tightening, which is conducive to the precise control of torque and Angle.
- There is programmable IO for process control and easy to connect with other equipment.
- It has the function of mistwist and missing tighten judgment, will make an alarm or re-tighten for unqualified screws.
- The screw batch supports two installation modes, handheld and fixed, which is suitable for most applications in modern industry.
- Supports the selection of Chinese and English languages.
- Supports modification of torque parameters for communication methods, and can select tasks and torque parameters.

1.2 Technical specifications

Technical specifications of ACT series controllers	
Enter the power supply voltage	AC220V±10% 50HZ
Outline dimension	345 (high) x210 (width) x 160 (thickness) mm
Maximum number of bolts	999 (per mission)
Torque accuracy	In the range of (30%~80%) maximum output torque, $\leq 3 \delta \pm 5\%$ and other $\leq 3 \delta \pm 8\%$
Turning accuracy	1 degree (1°)
Screen size	5.6 inches
Input	8pcs (bidirectional optical coupling isolation)
Output	7pcs (relay 3A) 1pc (solid state relay 120mA)
Weight	≈5.5Kg

Technical specifications of HNX/HMX series controllers	
Enter the power supply voltage	AC85~264V,47~63HZ
Outline dimension	205 (high) x151.5 (width) x 185.80 (thickness) mm
Maximum number of bolts	999 (per mission)
Torque accuracy	In the range of (30%~80%) maximum output torque, $\leq 3 \delta \pm 5\%$ and other $\leq 3 \delta \pm 8\%$
Turning point accuracy	1 degree (1°)
screen size	5.6 inches
Input	8pcs (bidirectional optical coupling isolation)
Output	8pcs (solid state relay 250VAC 3A)
Weight	≈3.5Kg

1.2 Model description (Selection table)

- ACT series controller selection

AC□-□□□□□ N□□□□
 ① ② ③ ④ ⑤ ⑥ ⑦

①	Product name	ACT: Precision controller ACS: Precision controller(Control with torque sensor)
②	Screwdriver type	H: 15W-180W M: 200W and above
③	Power	0:DC40W 3:AC200W 4:AC400W 5:AC750W 6:DC15W 7:DC90W 8:AC90W 9:AC180W
④	The Rotate speed of matching tools	Please refer to the "technical specification table" of Screwdriver selection guide
⑤	Interface type	1:IO+RS232 2:IO+RS485 4:IO+Ethernet 5:IO+RS232+Ethernet
⑥	Reserve items	1: No positioning device 2: Built-in positioning function (Note: it needs to be used with the force arm frame with anti-stupidity and error function)
⑦	Remarks	None: Standard software 0001~0050: Special function software 0051~9999: Non-standard, customized products

● HNX series controller selection

HN□ - □□□ 1 N□□□□
 ① ② ③ ④ ⑤ ⑥

①	Product name	HNB: LCD controller (front line) HNB-B: LCD controller (rear line) HNC: LCD controller (front line)(Control with torque sensor)
②	Motor parameters power of matching tools	1: Servo DC15W 2: Servo DC40W
③	The Rotate speed of atching tools	Please refer to the "technical specification table" of Screwdriver selection guide
④	Interface type	1 :IO+RS232 2:IO+RS485 4:IO+Ethernet 5 :IO+RS232+Ethernet
⑤	Reserve items	1: Standard
⑥	Remarks	None: Standard software 0001~0050: Special function software 0051~9999: Non-standard, customized products

●HMX series controller selection

HM□ - □□□□ N□□□□
 ① ② ③ ④ ⑤ ⑥

①	product name	HMB: LCD controller (built-in power supply) HMC: LCD controller (built-in power supply) (Control with torque sensor)
②	Accompanying tool motor parameters power	2: Servo DC40W
③	The Rotate speed of atching tools	Please refer to the "technical specification table" of Screwdriver selection guide
④	interface type	1 :IO+RS232 2:IO+RS485 4:IO+Ethernet 5 :IO+RS232+Ethernet
⑤	Reserve items	1: Standards
⑥	Remark	None: Standard software 0001~0050: Special function software 0051~9999: Non-standard, customized products

Chapter 2 Interface Function Introduction



and Qualification rate.

2-Tool: Click to view the information of the screwdriver currently connected to the controller.

3-Display controller maximum torque value

4-Complete of goal: Display the final torque or Angle value of the parameters currently being executed.

5-Sequence: Display the current screw tightening process parameter sequence. The parameter color of angular control and torque control will be different. The name of the current parameter being executed will be displayed in green with a high brightness.

6-System date and time

7-Task selection: Display the tasks selected by the current user, and you can select other tasks through this button. There are 12 tasks in total.

8-Number of bolts: shows the number of screws currently running, each task is available for 1~50 screws [Need to select the number of screws firstly]

9-Torque display: The current torque value is displayed in real time when the system starts to tighten the screw. When the screw is tightened, the background color will change. Green indicates qualified tightening, Orange indicates low current value, and Red indicates high current value.

10-Input: Display the status of 8 input signals. Green indicates valid input, and orange indicates no.

11-Angle display: the current angle value is displayed in real time when the system starts to tighten the screw. When the screw is tightened, the background color will change. Green indicates qualified tightening, orange indicates low current value, and red indicates high current value.

12-Output: Display the status of 8 output signals. Green indicates valid, and orange indicates invalid.

13-Settings: Click to enter the task parameter setting interface, including start mode, torque parameters, Screw tightening sequence, input, output, system parameters, get screws, number of bolts, etc.

14-Graph: Display the current task screws "torque time chart", "angle time chart", "torque Angle chart", "speed time chart".

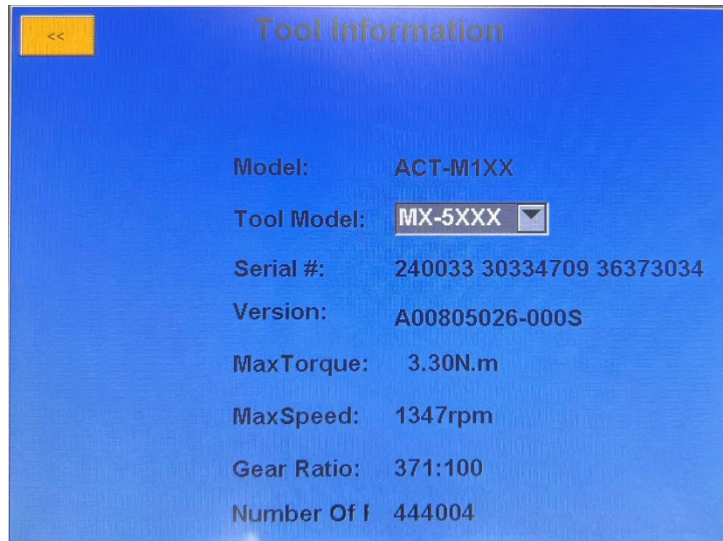
15-Data: Records the tightening results of the last 100 torque parameters. All data is stored in the internal memory of the controller and is not saved when power is lost.

16-Repeat: When this button turns green, the controller will repeat the current screw tightening sequence. Otherwise, the parameters will be automatically transferred when the screw tightening is successful.

17-Reset: Click to clear alarm, error, repeat count lock (requires user login), IO output.

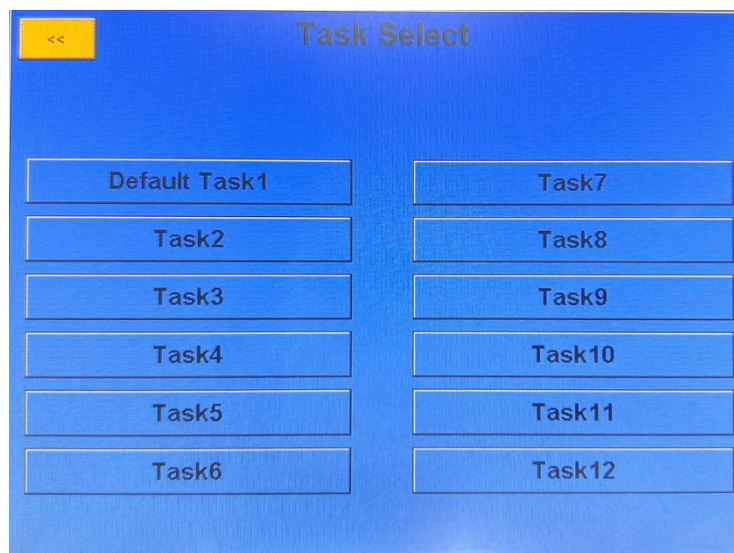
18-Barcode: Display the current barcode value

2.1 Tool parameters



- ① Model: Controller model of servo tightening system
- ② Tool model: HD series, MD series, MT/MS series screwdriver (see the selection table for details)
- ③ Sequence number: Controller ID
- ④ Version: the software version of the controller CPU running
- ⑤ Maximum torque: the maximum value to be operated by the controller
- ⑥ Maximum speed: the maximum speed value that the controller can run
- ⑦ Reduction ratio: the transmission ratio of the speed reduction device (See the selection table for details)
- ⑧ Total number of times of tightening: total times of the controller running

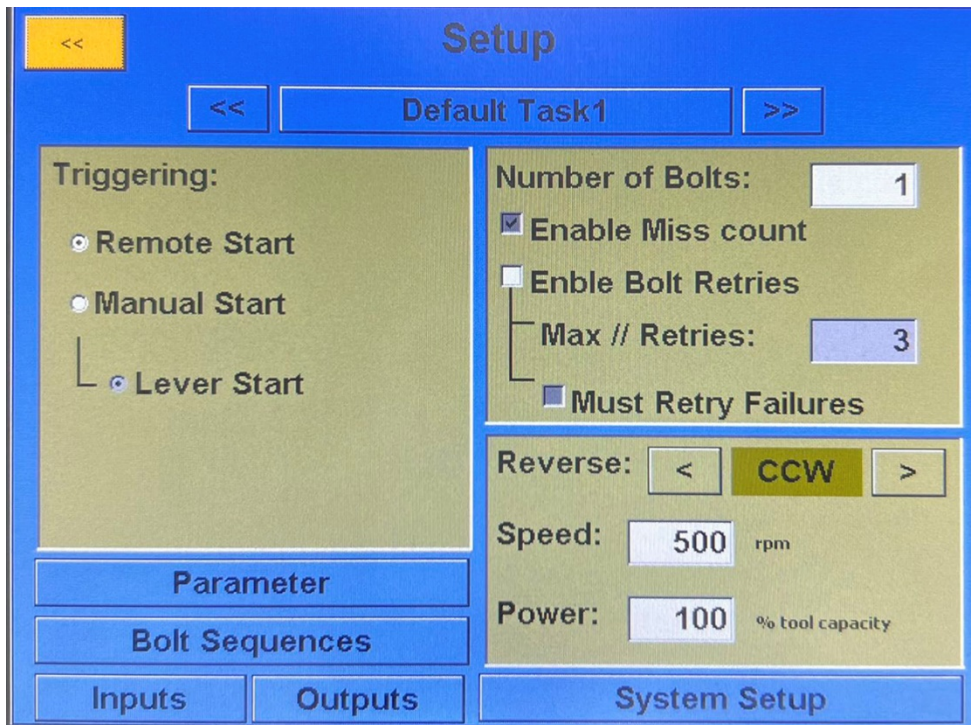
2.2 Task selection



There are total 12 tasks. Click the button to select the corresponding task and return to the running interface.

Under this interface, tasks can be copied, for example: to copy the content of "Task 2" to "Task 10". The specific operation is: Hold down the button "Task 2" and drag it to the "Task 10" button and then release it. During the dragging process, do not touch other buttons (drag from the middle), otherwise it will copy tasks from other buttons.

2.3 Settings interface



NOTE:

1. When users log in with the password and exit the setting interface, it will remind to save, otherwise it will not be saved.
2. Click on the "Task" in this interface, to customize the name of this task

2.3.1 Start mode

It can be divided into automatic start and manual start.

(Remote start-up is controlled by external input signals. See the input signal configuration for details.)

Manual start :

Press down rod to start;

2.3.2 Number of bolts

Set the number of tightening screws for the task, up to 999.

Each screw can only be run after the tightening parameter configuration completed. The number of bolts for the task will be displayed on the main screen.

(Note: When the number of bolts are more than 50, all screws share the tightening parameters of 1st Bolt)

2.3.3 Re-tighten to open

When a tightening error occurs, the screwdriver will stop. Switch to loosening and drop out screw, and then switch to tightening to repeat again. Otherwise, it will move to next bolt automatically.

Maximum number of repetitions: Set the times of re-tightening. If the tightening is not successful after reaching the set number, it will be transferred to the next parameter.

2.3.4 Re-tighten until failure

Turn on the re-tightening to failure function, if the number of repetitions exceeds, the screwdriver will be locked and it needs password to log in, it can be relieved by pressing the reset button on the main interface or pulling the stop button or remote IO reset.

If this function is not enabled, it will move to next bolt automatically if the number of repetitions exceeds.

For example: Set the "Maximum Number of Repeats" to 1, if the tightening process fails during operation, the screwdriver will automatically stop. Now you need to switch the screwdriver to reverse mode and the screen will prompt "Last Repeated", it means that you could tighten it again before the screwdriver system to be locked. Tighten it again, if it fails, you unscrew and re-tighten for third time, the screen will prompt "Locked". And now you need to click on "Reset" on the screen to reset and relieve it.

2.3.5 Unscrew

When the loosening function executes, the rotation direction can be switched by pressing the arrow button. Put the screwdriver head directly in front of the person, CCW is counterclockwise and CW is clockwise.

The speed is for loosening, measured in revolutions per minute.

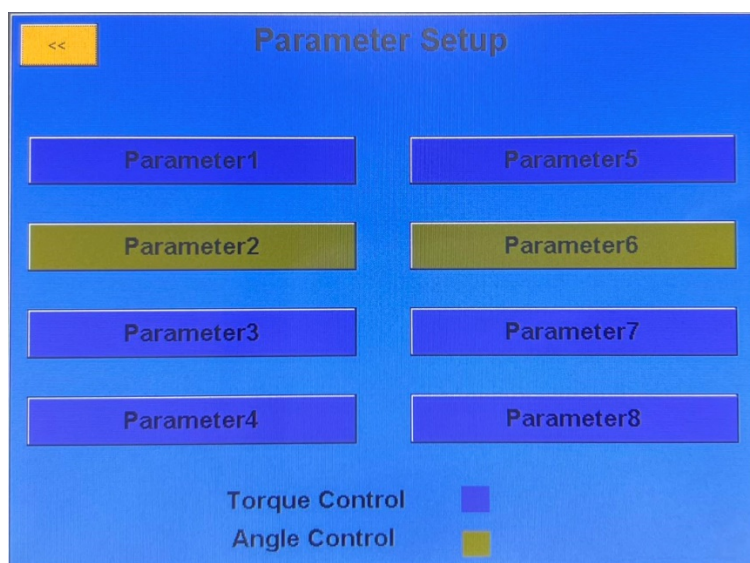
Power: The reverse torque is set in percentage of total power.

For example, if the rated torque of the screwdriver is 0.48N.m and the reverse torque is set to 50%, then the maximum output torque of loosening the screwdriver is 0.24N.m.

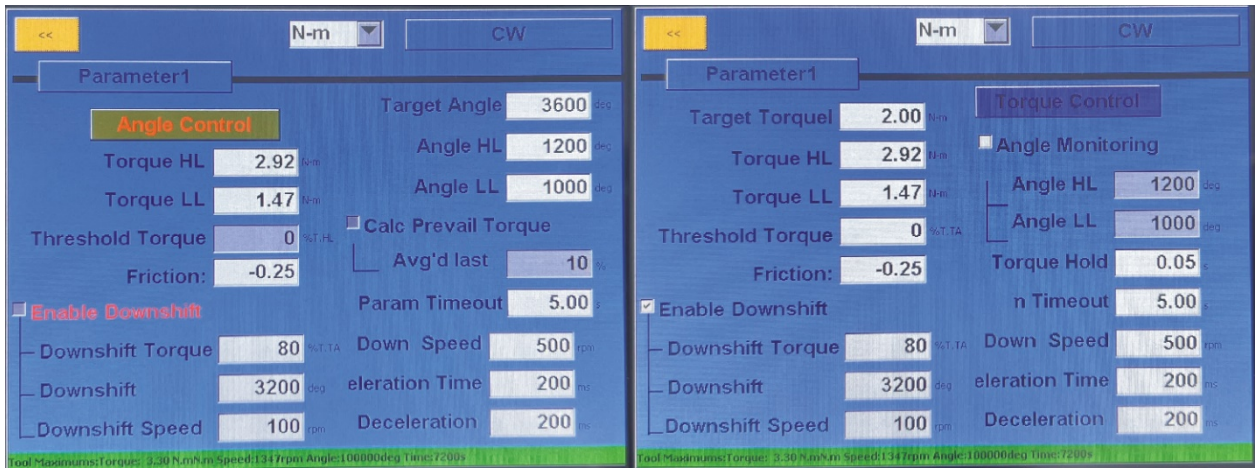
2.3.6 Parameters

Click the "Parameter" button to enter the parameter selection interface (shown as below), 8 buttons represent 8 different torque parameters of this task, the angular control and torque control are distinguished by different colors. The parameter can be copied in this interface.

For example: To copy the contents of "Parameter 1" to "Parameter 5", hold down the button "Parameter 1", drag it to the "Parameter 5" and release it. Do not touch other buttons (drag from the middle) during the dragging process, otherwise you will copy the parameters of other buttons.



Click the parameter button in above figure to enter the specific parameter setting interface (shown as above), which is divided into torque control (purple Color) and angle control (yellow-green color)



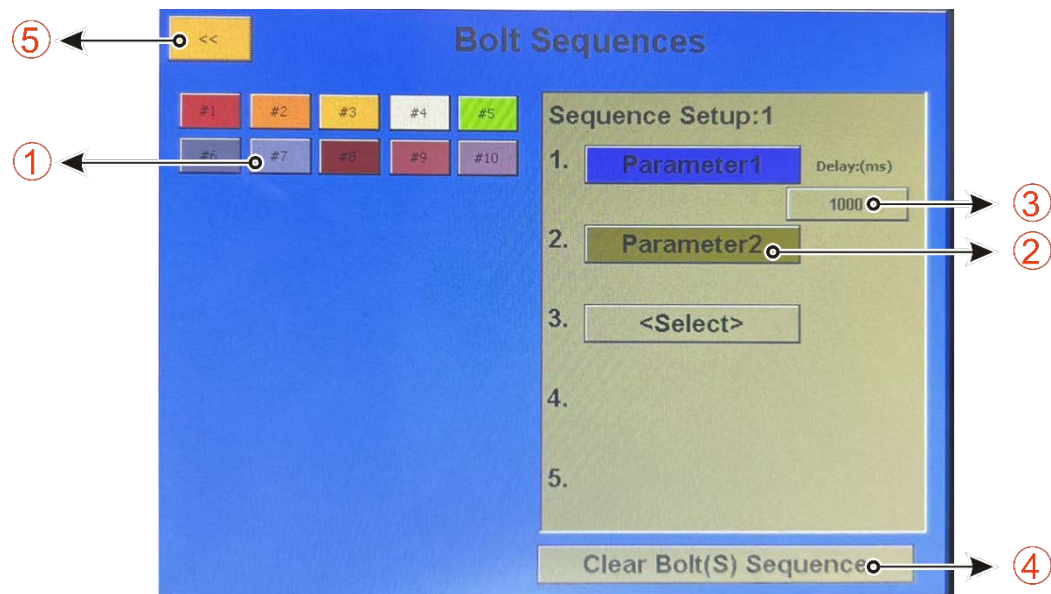
Note: Click on "Parameter" in interface to customize the name of this parameter

Target torque/angle	The final torque value and angular value when the screw is tightened
Torque upper/lower limit	Maximum allowable upper and lower torque limits for screw tightening process
Turning Angle upper/Lower Limit	During the tightening process,when the torque reaches the monitoring threshold, the maximum allowable upper and lower limits of the turning angle are reached
Turning point monitoring threshold	The number of revolutions is counted when the torque value is reached
Running speed	The speed at which the screwdriver starts, in units of revolutions per minute
Friction force	Actual torque of fine-tuned parameters
Shifting switch	Turn on or off the deceleration function (supports corner mode ONLY)
Shifting torque	Slow down when the target torque percentage is reached
Shifting angle	When the turning value is reached, the speed starts to slow down (the shift angle cannot be less than 1080, otherwise the input is invalid)
Shifting speed	The speed after deceleration
Turning Angle Monitoring Switch	Enable or disable the corner monitoring function During the tightening process, when the torque reaches the monitoring threshold, the maximum allowable upper and lower limits of the turning angle are reached
Battery life	This time is the time that the torque is maintained after reaching the target torque
Binding hours	Maximum operating time of this parameter
Feedback torque switch	Enable or disable torque feedback
Feedback torque value	The percentage of the max torque value in the turning control process is generally applied to the two-step tightening of a single screw: turning control + torque control
Operation direction	Screwdriver running direction: clockwise or counterclockwise
Accelerated speed	The acceleration of the screwdriver during operation (in units of physical objects)
Deceleration	The deceleration of the screwdriver during operation (in units of physical objects)
Torque units	N-m, N-cm, kgf-cm, oz-in, in-lb
Torque/angle control	Button switch control mode, after switching control mode, this parameter needs to be re-adjusted

2.3.7 Bolts sequence

Click the "bolts Sequence" button in the Settings interface to enter the screw sequence interface. In this interface, you can set tightening parameters of each screw under each task and program to design the tightening process through 8 parameters.

(Note: When the number of bolts are greater than 50, all bolts share the tightening parameters of No.1 bolt)



① Number of bolts:

Fill in the number of bolts in the "number of bolts" in the settings interface, and the corresponding number of screws will be displayed (Note: when the number are greater than 50, all bolts will share the tightening parameters of No.1 bolt);

Put the bolt number to set parameter sequence;

For example, input 10 to "number of screws" on setting interface, and the bolt number 1~10 will be displayed;

② Screw sequence setting:

A bolt can be set up to maximum 5 steps, each step can choose any of 8 parameters;

③ Delay Settings:

Delay time can be set between each step;

④ Screw removal sequence:

Removes all parameters in the current selected screw sequence;

⑤ Exit button: Click to exit to the main interface

2.3.8 Input interface

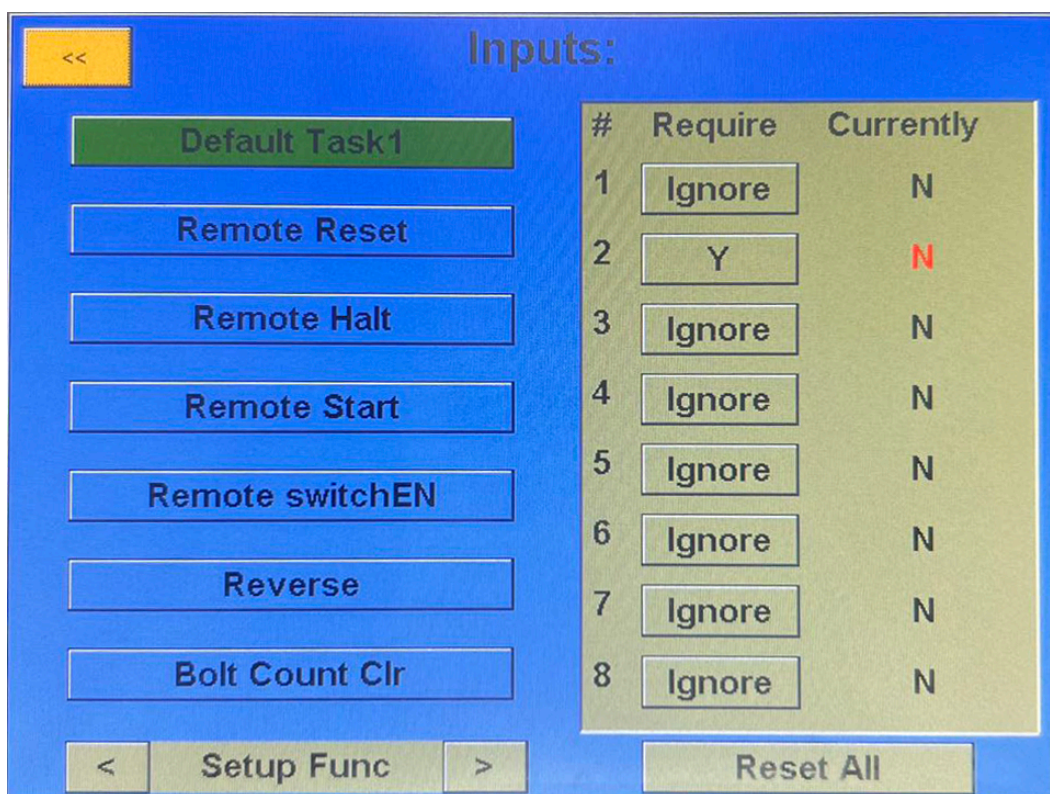
1. Function Settings:

Click the "Input" button to enter the input settings interface.

First, go to the function input settings interface where you can select one or several of the 8 input signals on the right side to achieve the functions on the left. The functions include task selection, remote reset, remote pause, remote start, remote start enable, loosening, counting reset. Switch the settings functions by pressing the corresponding buttons, with the selected functions appearing green. When using manual start mode, only the default task selection function can be set.

The "valid" in the right side of the following figure indicates a valid signal, "invalid" indicates an invalid signal, and "ignore" indicates ignoring the signal. When the required signal matches the current signal, the current signal is displayed in green; otherwise, it is displayed in red. Clicking the "Clear All" button will ignore all signals.

(For specific remote control operations, refer to Chapter 4 Operation)

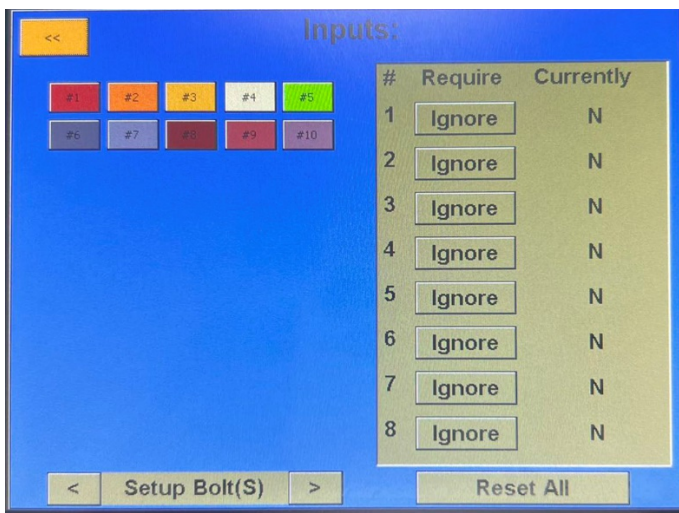


2. Matching Settings:

Click the arrow button on the left or right side of "Function settings" in the above figure to enter the bolts input matching setting interface, shown as below.

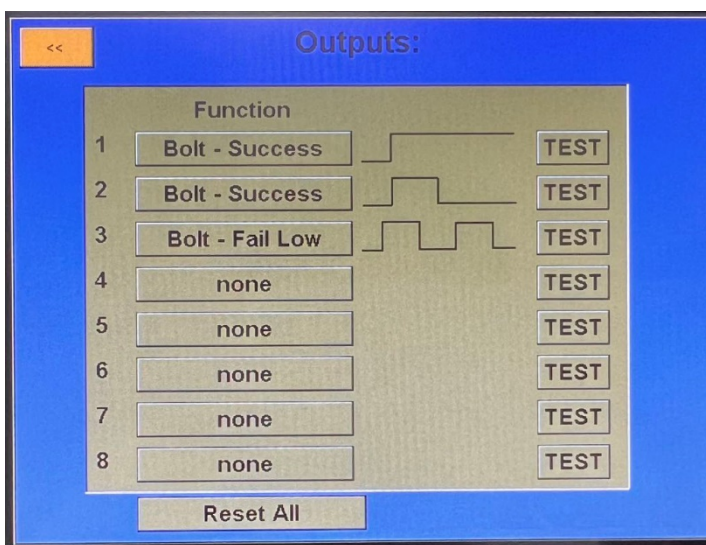
The main function of this interface is to prevent the wrong replacement of the bolt head when tightening the screw. The signal matching with each bolt can be set.

For example: (shown as below) set the signal of bolt 1 to 3 as valid and 4 as invalid, and set the others to "Ignore", which means that when the 3 input port is valid, and the 4 input port is invalid, all other signals are ignored, then you can tighten the bolt 1; otherwise, the alarm will prompt "Input mismatch". To reset the input matching of one bolt, you can press "Clear All". When there are many screws, you can use the copy function, and the specific steps for using the copy function are: select the screw to be copied → click "Copy" → select the screw to be pasted → click "Paste"



2.3.9 Output interface

Click the "Output" button to go to Settings interface

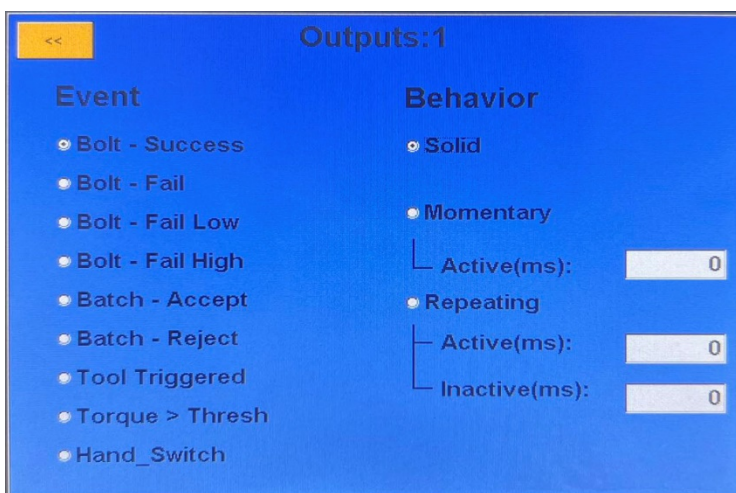


There are 8 outputs for users to program. The numbers in the above figure represent 8 different outputs respectively. Click the corresponding button to enter the specific setting interface (shown in the figure as below). After setting, the result will be displayed and measured.

And press "all clear" to reset all outputs.

For example:

On above picture, No.1 outputs a fixed level signal when the screw is tightened successfully, No.2 outputs a single pulse signal when the screw is not tightened successfully, and No.3 outputs a multi-pulse signal when all screws are tightened successfully.



Output event description

Event	Description
Single-success	After the screw is tightened, the torque and angle are all within the range set by the program.
Single-failure	There was an error in the tightening of the screws.
Result-lower	During the tightening process, the torque or angle is below set minimum value.
Result-higher	During the tightening of screws, the torque or angle is higher than set maximum value.
Batch-Qualified	All screws in the current task are tightened and within the set range.
Batch-Unqualified	The tightening of screws under the current task exceeds the set range of parameters.
Tool running	The screwdriver starts running.
Single angle monitoring	When the torque reaches the angular monitoring threshold, the Angle is calculated.
Signal of hold down button	Matched with handhold screwdriver for use only

Output form description

Form	Description
Fixed	Output a fixed level signal
Mono-pulse	Output a single pulse signal
Multiple-pulse	Output multi-pulse cyclic signal

Note: 1) The maximum time is 7200ms.
2) Set the form before setting the event.

2.3.10 System parameter setting interface

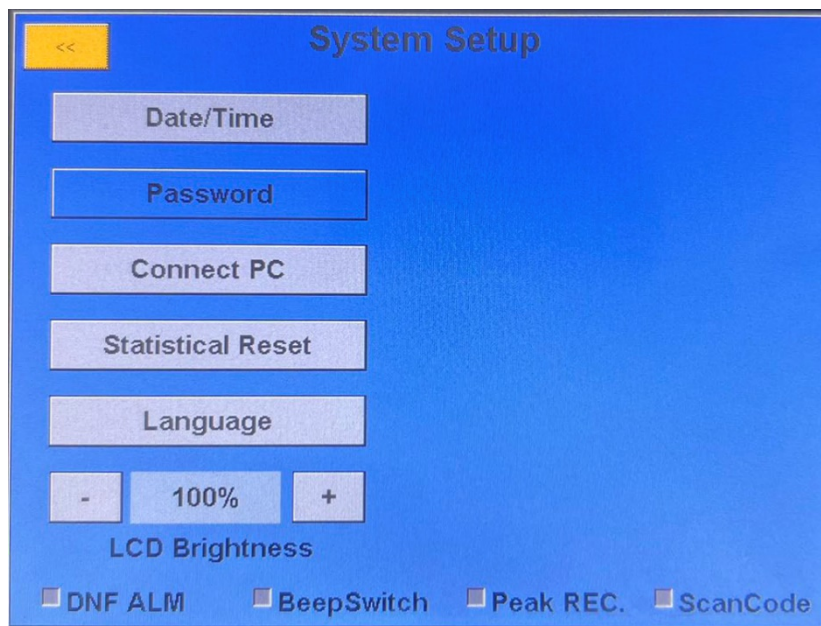
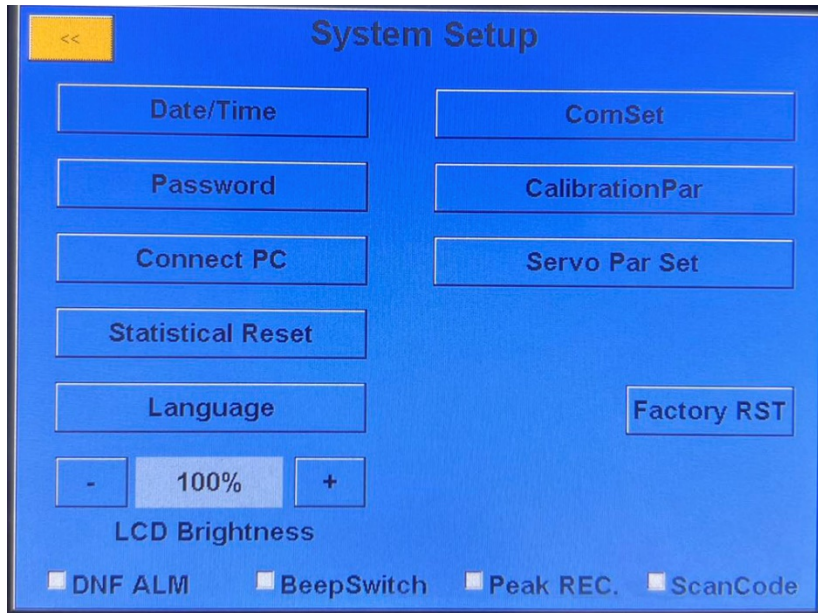
1. Users: Users are divided into two categories

① Administrator: With the function of modifying parameters, running and monitoring screwdrivers, which is suitable for managers to use.

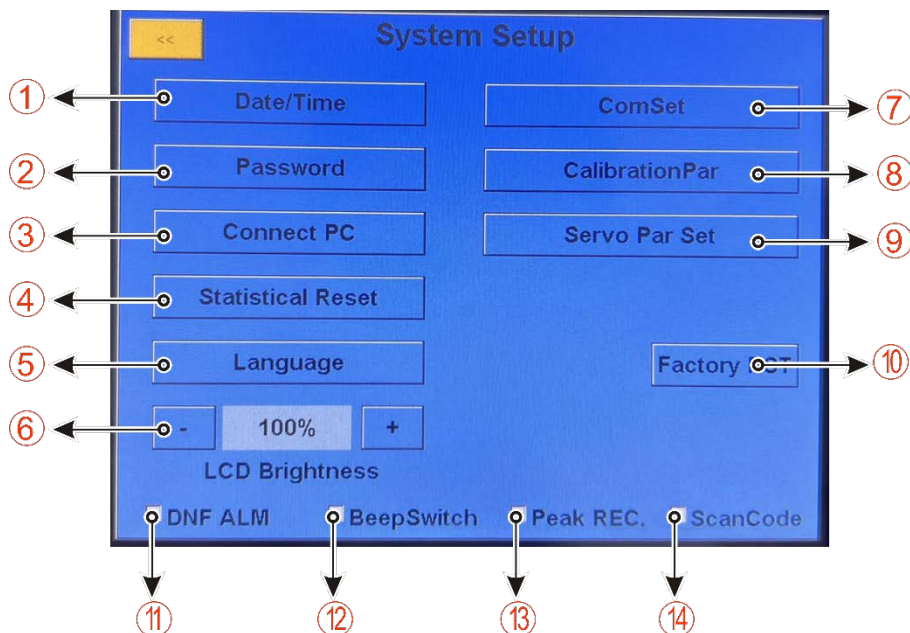
② Ordinary users: Only with function of running and monitoring screws, and the parameter setting cannot be modified. It is suitable for front-line production personnel.

2. Password: The administrator uses "Manage User Password". The initial password of the administrator is 000000. The operator does not need user name and password to log in, click enter directly.

3. Go to system parameter settings: The administrator user can set up after entering the password, and the operator can use the original setting directly without password.



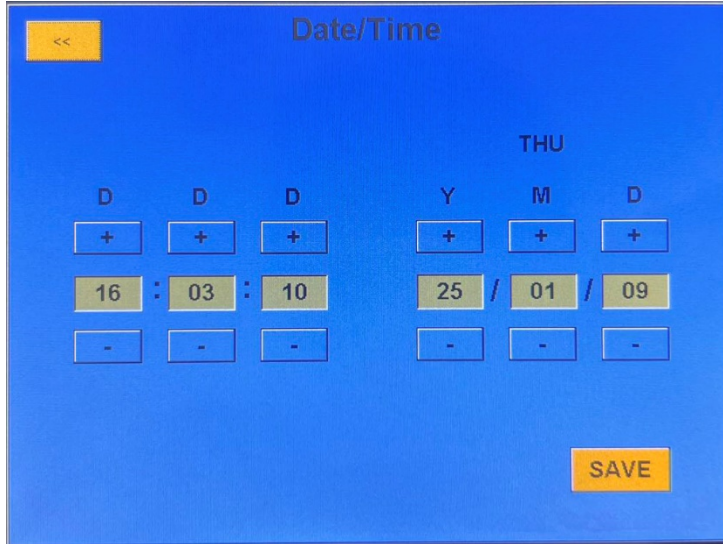
2.4 System parameter setting(interface after entering the password)



① Date and time:

Click the button "Date/time" in the system Settings interface for setting (shown as below).

From left to right are hours/minutes/seconds, year/month/day, which can be set with plus or minus signs respectively. The week day will change automatically according to the set date. Please click "Save" before exiting the interface to save the setting, otherwise the setting will be invalid.

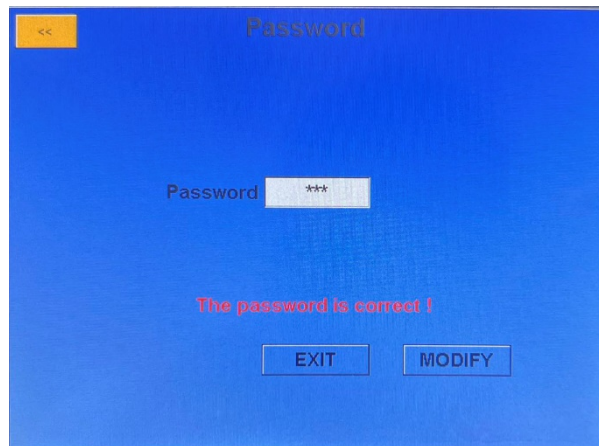
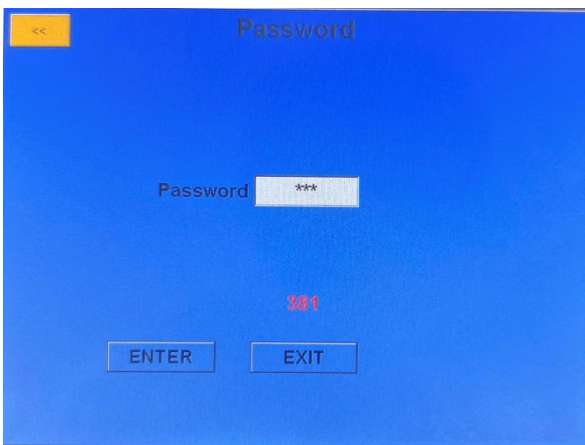


② Password:

● Click the button "password" in the system Settings interface (shown as below) and input the password, then press "Enter" to log in. It will display "password correct" if it works or display "password error" if it is not correct. Log out by pressing "exit".

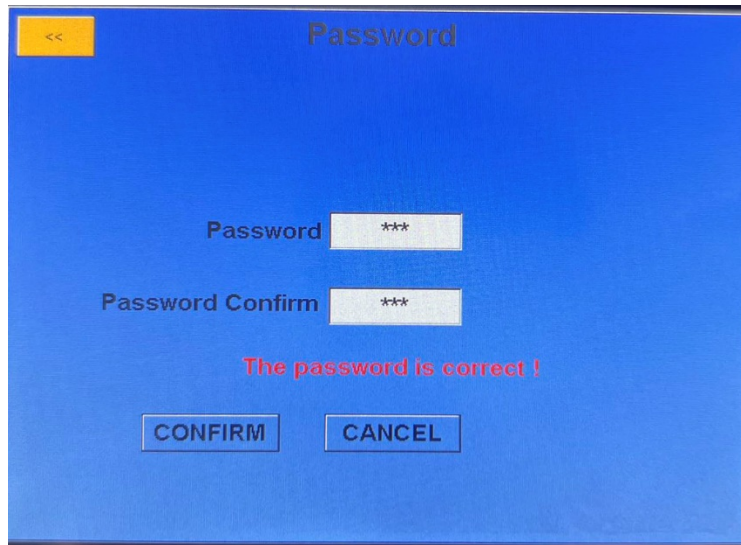
Note: 1) It will be locked after repetitions tightening, you must log in with password to unlock it.

2) Log out of the password in time after using.



● Once login in successful, the "modify" button will be displayed. Click to enter the following interface for modifying the user password.

● The user enters the same new password twice in the "Password" and "Confirm Password" fields, then presses "Confirm" for the new password. If enter two passwords differently, it will display "Inconsistent Password Entry". If the modification is successful, it will display "Modification Successful". Pressing the "Cancel" button will cancel the password modification.



Note: 1) The password can only be numbers.

2) The input range is 0~999999.

3) The user password must be set within the range, otherwise the input password is uncertain.

③ Connect to computer:

Click the button "Connect Computer" in the system settings interface to connect the controller with the computer. When the connection is successful, a new drive letter will appear on the computer, containing daily tightening records of screws. The records are stored as files daily, with a maximum storage capacity of 600 days. After 600 days, the earliest date file will be automatically overwritten.

The specific content of the record is as follows:

Content	Discription
TOOL	Tool number
Date	Record the date of preservation
Time	Record retention time
Task Number	Task numbers 1-12
Para Number	Parameter numbers 1-8
Bolts Number	Screw number in each task
Par Type(OAIT)	Parameter type: 0 means the angle type, 1 means the torque control
Direction(OCWor1CCW)	Tightening direction: 0 is CW(clockwise), 1 is CCW (counterclockwise, from the direction of the head)
Target Torque(N. cm)	It is maximum limiting torque when corner control, and it is target torque when torque control. Unit: N. cm
Target Angle(deg)	The target turning angle is used by corner control and the maximum limit turning angle is used by torque control. Unit: degree
Prevail Torque(N. cm)	Feedback on torque, unit: N. cm
Final Angle(deg)	Final turn, unit: degree
Cycle Time(ms)	Tightening time, unit: ms
Result	The tightening result corresponds to the alarm code: 0 for qualified tightening, others are error

Note:

1) The tool is not allowed to connect to the computer during operation, and the tool is not allowed to start when connecting to the computer.

2) Click the button again after the connection is successful, to disconnect.

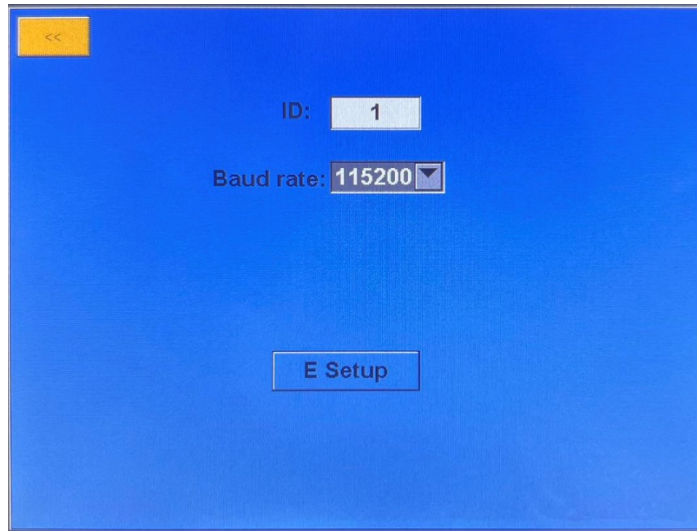
④ Statistical clearance:

It means that the data of qualified rate of screws displayed in the upper right corner of the main interface are cleared.

⑤ Language: Simplified Chinese and English are available.

⑥ Backlight: Adjust the brightness of controller touch screen, default is 100%.

⑦ Communications setting:



Local address: set the local address for communication;

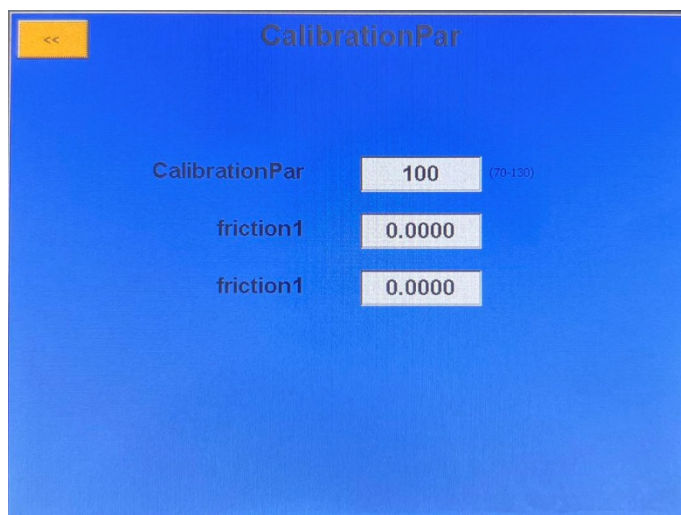
Port rate: Select the serial port communication port rate;

⑧ Calibration parameter:

The tool is calibrated by the manufacturer and the calibration coefficient is defaulted as 100.

Example 1: The parameter unit is N.m, the target torque is 1N.m, the measured torque is 1.2N.m, and the friction force is 1, input "-0.2" to adjust the output torque less.

Example 2: The parameter unit is Kgf.cm, the target torque is 10Kgf.cm, the measured torque is 12Kgf.cm, and the friction force is 1, input "-0.196" for fine adjustment (the parameter unit needs to be converted into N.m)



Friction 1:(unit N.m)

- When the actual torque is higher than the target torque: input negative friction value for fine-tuning, the output torque will decrease;
- When the actual torque is lower than the target torque: input positive friction value for fine-tuning, the output torque will increase;

Friction 2: Modify the torque value of running interface;

⑨ Servo parameters: Click the "servo parameters" button for viewing parameters, which was set by the manufacturer.

⑩ Factory Settings: All parameters will be restored to factory default values.

⑪ Uncompleted alarm: Turn on the "Uncompleted alarm" ,it will alarm when the task is interrupted (in conjunction with IO control and handheld screwdriver).

@ Buzzing switch: It will alarm when turn on the "buzzing Switch" controller.

⑬ Peak Record: Turn on "Peak Record",the controller will display the maximum torque value when the screw is tightened; Turn off "Peak Record",the controller displays the current torque value when the screw is fully tightened;

⑭ Scan code switch: It needs to be used with the code scanner.Turn on the "scan code switch",the controller need to scan the code before running; Turn off the "scan code switch",the controller will run directly;

⑮ Network Settings: Click the "Network Settings" button in the communication Settings for Ethernet settings (shown as below):

The screenshot shows a blue interface titled "Ethernet Setup". At the top left is a yellow button with "<<". The settings are as follows:

- IPType:** StaticIP
- ModuleStaticIP:** Four input boxes, each containing "0".
- Gateway:** Four input boxes, each containing "0".
- Mode:** A dropdown menu with "Server" selected.
- Remote IP:** Four input boxes, each containing "0".
- Remote Port:** One input box containing "0".
- At the bottom center is a yellow button labeled "SAVE".

IP type: default static IP.

Module static IP: The IP address of the machine.

Gateway: IP address of network communication gateway.

Mode: You can choose Server and Client.

Target IP: Server IP address (the target IP is used when the device acts as a Client, while not for using when the device acts as a server)

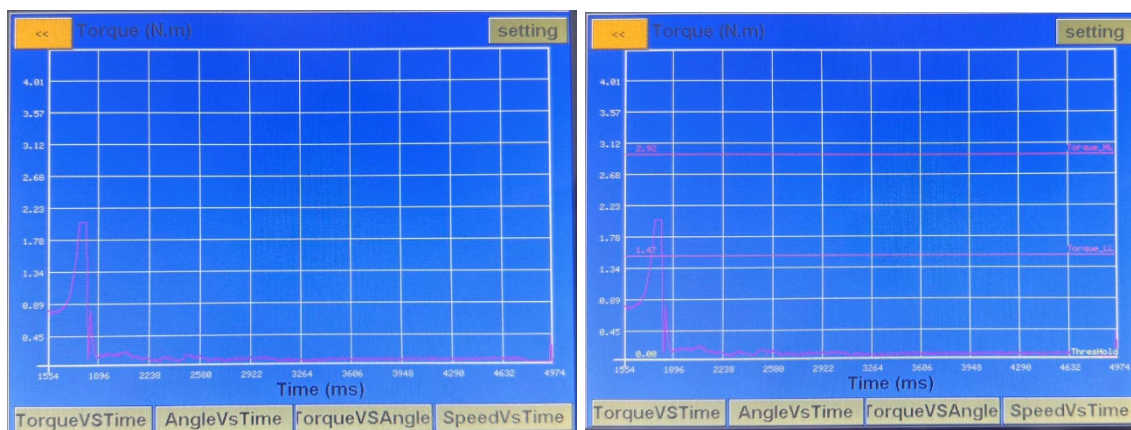
Remote port: Server network port number.

For example, when using Ethernet connection, the module static IP, gateway and default values do not need to be changed; It can be connected with Ethernet if the target IP and remote port to be consistent with the computer (PC);

2.5 Graphic display interface

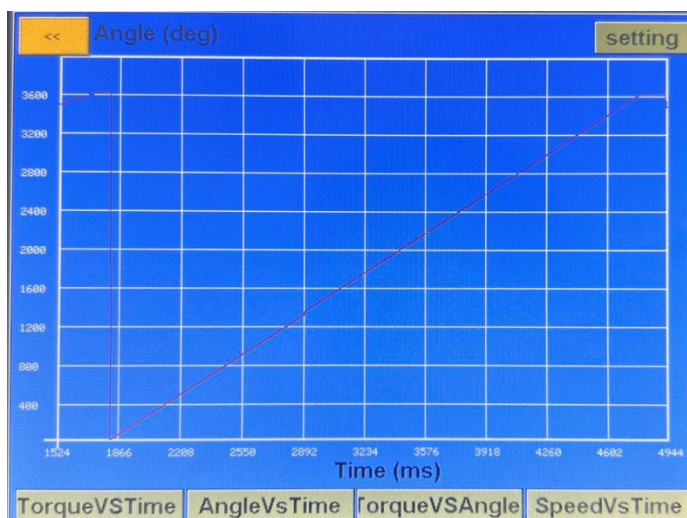
2.5.1 Torque time chart

- Click "Graph" on the main page to enter the graphic display interface. After clicking the "Torque time chart" button, the corresponding waveform chart will be displayed. Click the "Torque time chart" button again to achieve the reduction of the waveform chart;
- After clicking the "limit" button, red line will be displayed, which is the maximum torque value that the controller can run at present;



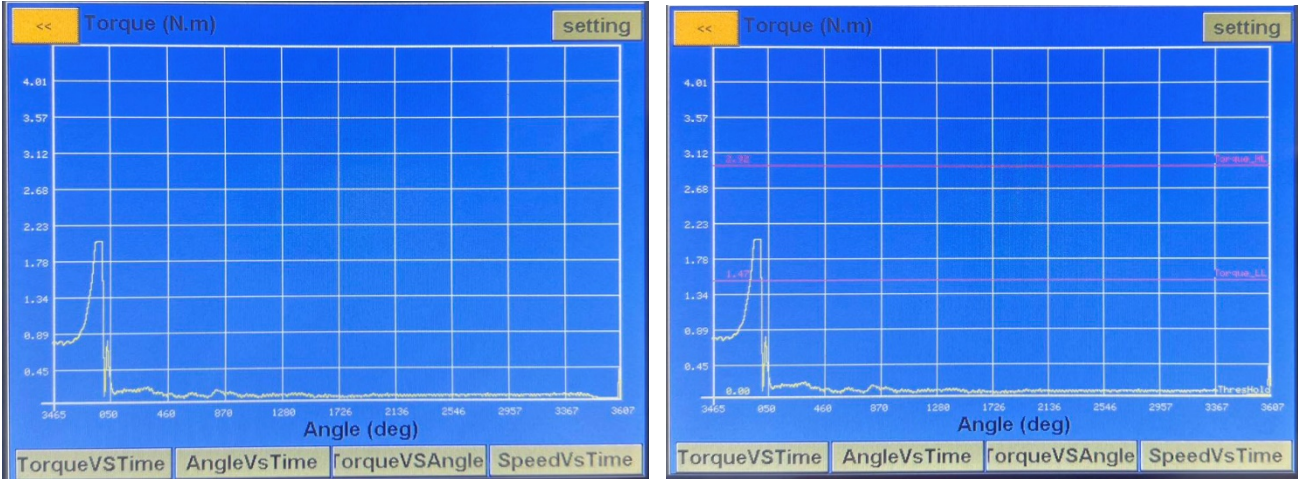
2.5.2 Angle time chart

- Click "Graph" on the main page to enter the graphical display interface, click the "Angle time chart" button to display the corresponding waveform chart;



2.5.3 Torque Angle diagram

- Click "Graph" on the main page to enter the graphic display interface, click the "Torque Angle Graph" button to display the corresponding waveform chart, and click the "Torque Angle Graph" button again to reduce the waveform chart;
- After clicking the "limit" button, a red line will be displayed, which is the maximum torque value that the controller can run at present;



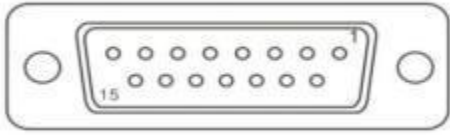
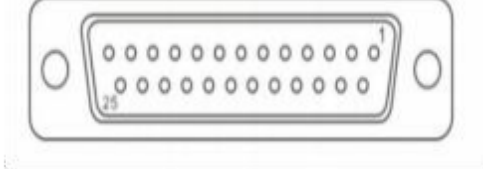
2.5.3 Speed time chart

- Click "Graph" on the main page to enter the graphical display interface, click the "Speed time chart" button to display the corresponding waveform chart.



Chapter 3 External Connections

3.1 I/O port definition description

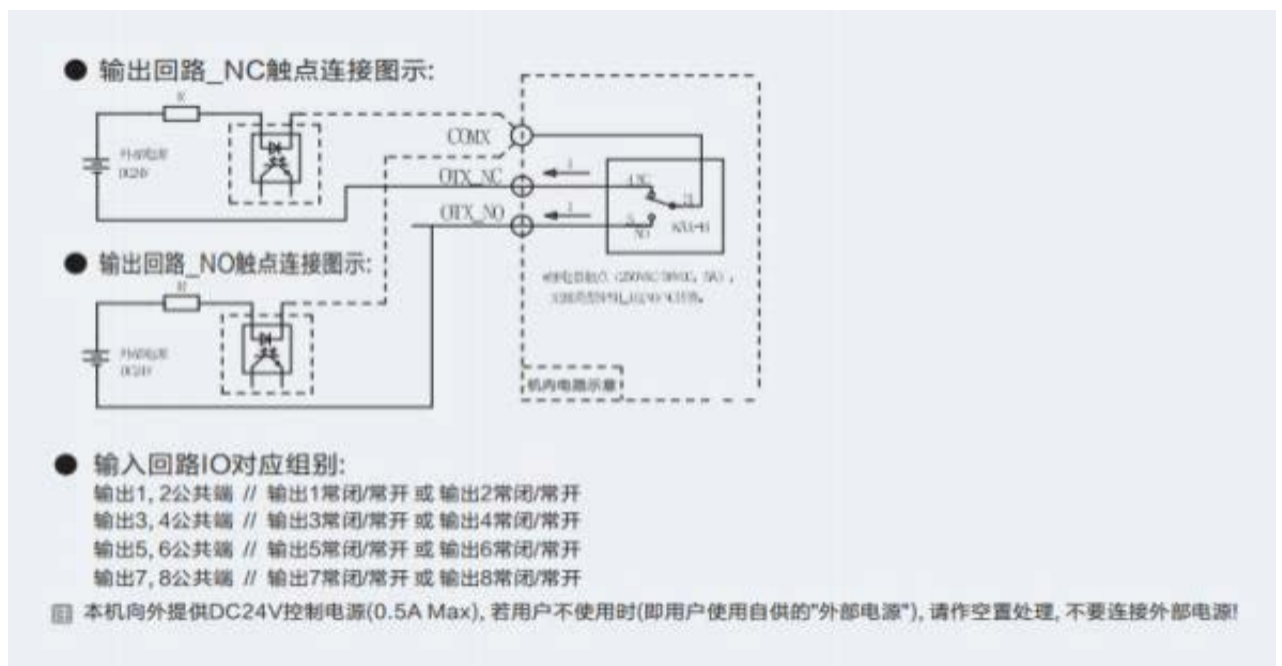
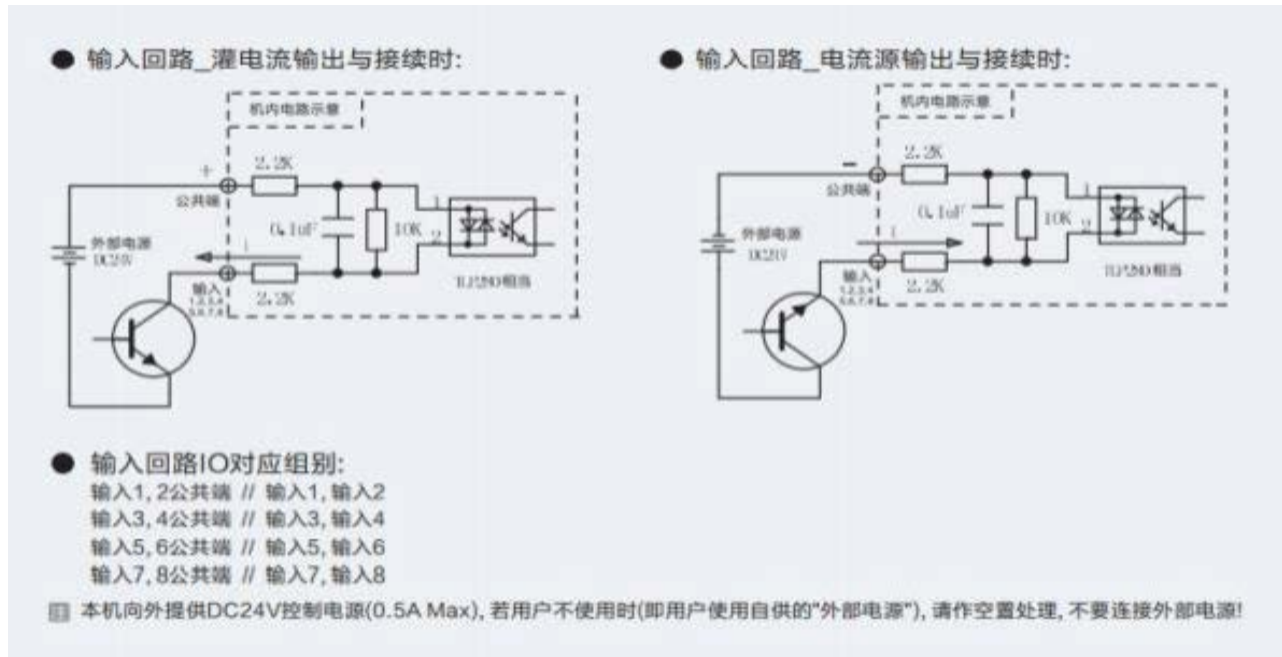
Input		Output	
			
Light coupling isolation		Electric relay	
1	GND	1	GND
2	Input 1	2	Reserved
3	Input the common end of 3 and 4	3	Output 1 normally closed
4	Input 4	4	Output 2 normally closed
5	Input 5	5	Output 3, 4 common points
6	Input 7 positive	6	Output 3 normally on
7	Input 8 positive	7	Output 4 normally on
8	24V DC	8	Output 5 normally closed
9	Input the common end of 1 and 2	9	Output 6 normally closed
10	Input 2	10	Output 7, 8 public points
11	Input 3	11	Output 7 normally on
12	Input the common end of 5 and 6	12	Output 8 normally on
13	Input 6	13	24V DC
14	Input 7 negative	14	GND
15	Input 8 negative	15	Output 1, 2 common points
Description: 1. The system provides 24V power supply to the outside, with a maximum driving capacity of 0.5A 2. The input signal voltage is 9-24V 3. INPUT-COM7 and INPUT-COM8 are public terminals respectively 4. Output is AC250V/DC30V 5. Output switching maximum current 3A (ACT channel 2 and channel 3 maximum 120mA) 6. The ACT output channel 2 uses a solid-state relay, and this channel is recommended for control ports with frequent switching		16	Output 1 normally on
		17	Output 2 normally on
		18	Output 3 normally closed
		19	Output 4 normally closed
		20	Output 5 and 6 public points
		21	Output 5 normally on
		22	Output 6 normally on
		23	Output 7 normally closed
		24	Output 8 normally closed
		25	Reserved

Note:

- The listed 24V DC pins are internal power supply pins, DO NOT connect external 24V to the controller as it may cause accidental damage to the controller. The listed ground pin is connected to the internal power supply input of the controller, DO NOT connect this pin to external ground as it may cause a grounding conflict.
- DO NOT switch the inductive load with the output of the controller—it may damage the relay.

3.2 I/O port connection diagram

Input circuit_Irrigation current output and connection: Input circuit_current source output and connection:



Chapter 4 Running Operation

4.1 Remote control

Through external IO ports to control and it is suitable for automatic production line. The start mode should be set to remote start. Remote control content is as follows:

1. Default task: If the function is triggered and configured as input 1 is "valid Y", other input settings to be set as "ignore" and the current task is 2, then it means that it is valid to input signal 1 and task 1 is executed, while task 2 is invalid;
2. Remote reset: If the function is triggered and configured as input 2 is "valid Y", other input settings to be set as "ignore", it means that the reset function will be executed when the input signal 2 is valid, which is the same as the reset button on the main interface.
3. Remote pause: If the function is triggered and configured as input 3 is "valid Y", other input settings to be set as "ignore", the pause function will be executed when the input 3 signal is valid.
4. Remote start: If the function is triggered and configured as input 4 is "valid Y", other input settings to be set as "ignore", then the start function is executed when input 4 signal is valid.
5. Remote start of EN: If the function is triggered and configured as input 5 is "valid Y", other input settings to be set as "ignore", it means that the start EN function is executed when input 5 signal is valid.
6. Loosen: If the function is triggered and configured as input 6 is "valid Y", other input settings to be set as "ignore", it indicates that the loosen function is executed when the input 6 signal is valid.
7. Count reset: If you need to tighten 10 different screws, but fails at the 3rd, go back to the 1st screw tighten parameters.

Note:

- 1) A function can be implemented by combining multiple input signals, which can save IO usage.
- 2) Y means the input is valid, N means invalid.

4.2 Handhold operation

Operation is performed by pressing the manual switch and direction switch on the screwdriver, which is suitable for manual production lines. The start mode should be set to "manual start". When the direction switch is downward, it indicates tightening; when upward, it indicates loosening in reverse. Reverse rotation will clear the alarm.

4.3 Panel button operation

The screwdriver can be started by pressing the front panel startup button when it is in STOP mode, and the running state is invalid when press the startup button. The PAUSE button is only effective when the front panel is started. The EMERGENCY STOP button can be used for stopping urgently during operation and to reset the alarm when it occurs, while the pull-out function starts to release the alarm and lockout functions.

Chapter 5 Communication Interface

5.1 RTU mode format for each byte(10 bits) (modbus protocol)

- Code system: 8-bit binary


Each 8-bit byte in the message contains two 4-bit hexadecimal characters (0-9, A-F)

- Each bytes bit: 1 starts at the beginning
 - 8 Data bits, firstly send the least significant bit
 - No odd-even check
 - 1 stop position
- Maximum frame length: 256 bytes;

5.2 DB9 controller pin definitions


- HNA/HMA controller:

Pin No.	Controller definition (DB9 bus)
1	RS485-A
2	RS232-RXD
3	RS232-TXD
6	RS485-B
9	GND



- ACT controller:

Pin No.	Controller definition (DB9 bus)
1	RS485-A
2	RS232-TXD
3	RS232-RXD
6	RS485-B
5/7/9	GND



Note:

1) RS232 is defined for the user side, it means 2 pins for connecting to TXD signal, 3 pins are connected to the RXD signal, and then it works for communication.

5.3 Frame description

Sub-node address	Function code	Data	CRC
1 byte	1 byte	0~252 bytes	2 bytes, CRC low CRC high

5.4 Writing and reading of General parameters

●(0x03) Read save register

Request			Respond		
Function Code	Start address	Number of registers	Function Code	Start address	Number of registers
1 byte	2 bytes	2 bytes	1 byte	2 bytes	N*2 bytes
0x03	0x0000-0xFFFF	1 to 125 (0X7D)	0x03	2xN	Value

N= Number of registers

This is a request example to read registers 6~8:

Request		Respond	
Domain name	(hexadecimal)	Domain name	(hexadecimal)
Sub-node address	01	Sub-node address	01
Function	03	Function	03
Start address HI	00	Number of bytes	06
Start address LO	05	Register value HI (6)	00
Number of registers HI	00	Register value LO (6)	D9
Number of registers LO	03	Register value HI (7)	00
CRC verification HI	15	Register value LO (7)	00
CRC verification LO	CA	Register value HI (8)	11
		Register value LO (8)	9C
		CRC verification HI	30
		CRC verification LO	9F

●(0x06) Write a single register

Request PDU			Respond PDU		
Function Code	Start address	Number of registers	Function Code	Start address	Number of registers
1 byte	2 bytes	2 bytes	1 byte	2 bytes	N*2 bytes
0x06	0x0000-0xFFFF	1 to 125 (0X7D)	0x06	0x0000-0xFFFF	Value

This is an example of a request to write the hexadecimal 0A into register 49:

Request		Respond	
Domain name	(hexadecimal)	Domain name	(hexadecimal)
Sub-node address	01	Sub-node address	01
Function	06	Function	06
Start address HI	00	Start address HI	00
Start address LO	30	Start address LO	30
Register value HI	00	Register value HI	00
Register value LO	0A	Register value LO	0A
CRC verification HI	09	CRC verification HI	09
CRC verification LO	C2	CRC verification LO	C2

●(0x10) Write multiple registers

Request PDU					Respond PDU		
Function Code	Start address	No. of registers	No. of bytes	No. of registers	Function Code	Start address	No. of registers
1 byte	2 bytes	2 bytes	1 byte	N*2 bytes	1 byte	2 bytes	2 bytes
0x10	0x0000-0xFFFF	1 to 125 (0X7D)	2 x N	Value	0x10	0x0000-0xFFFF	1 to 123 (0X7B)

N= Number of registers

This is an example of a request to write the hexadecimal numbers 0A and 02 into two registers starting with 49:

Request		Respond	
Domain name	(hexadecimal)	Domain name	(hexadecimal)
Sub-node address	01	Sub-node address	01
Function	10	Function	10
Start address HI	00	Start address HI	00
Start address LO	30	Start address LO	30
Number of Register HI	00	Register value HI	00
Number of Register LO	02	Register value LO	02
Number of Bytes	04	CRC verification HI	
Register value HI	00	CRC verification LO	
Register value LO	0A		
Register value HI	00		
Register value LO	02		
CRC verification HI			
CRC verification LO			

5.5 Network communication format

Communication protocol: Modbus /TCP

Communication mode: TCP/IP

Transmission speed: 10Mbps /100Mbps

Data format: hexadecimal

●(0x03) Read hold register

This is an example of a request to read registers 6~8:

Request		Respond	
Domain name	hexadecimal	Domain name	hexadecimal
Transaction identifier	00	Transaction identifier	00
	00		00
Protocol identifier	00	Protocol identifier	00
	00		00
Data length	00	Data length	00
	06		09
Sub-node address	01	Sub-node address	01
Function Code	03	Function Code	03
Start address HI	00	Number of bytes	06
Start address LO	05	Register value HI (6)	00
Number of registers HI	00	Register value LO (6)	00
Number of registers LO	03	Register value HI (7)	00
		Register value LO (7)	00
		Register value HI (8)	00
		Register value LO (8)	00

●(0x06) Write a single register

This is an example of a request to write the hexadecimal 0A into register 49:

Request		Respond	
Domain name	hexadecimal	Domain name	hexadecimal
Transaction identifier	00	Transaction identifier	00
	00		00
Protocol identifier	00	Protocol identifier	00
	00		00
Data length	00	Data length	00
	06		06
Sub-node address	01	Sub-node address	01
Function Code	06	Function Code	06
Start address HI	00	Start address HI	00
Start address LO	30	Start address LO	30
Register value HI	00	Register value HI	00
Register value LO	0A	Register value LO	0A

●(0x10) Write multiple registers

This is an example of a request to write the hexadecimal numbers 0A and 02 into two registers starting with 49:

Request		Respond	
Domain name	hexadecimal	Domain name	hexadecimal
Transaction Identifier	00	Transaction identifier	00
	00		00
Protocol identifier	00	Protocol identifier	00
	00		00
Data length	00	Data length	00
	0B		06
Sub-node address	01	Sub-node address	01
Function Code	10	Function Code	10
Start address HI	00	Start address HI	00
Start address LO	30	Start address LO	30
Number of registers HI	00	Register value HI	00
Number of registers LO	02	Register value LO	02
Number of bytes	04		
Register value HI (49)	00		
Register value HO (49)	0A		
Register value HI (50)	00		
Register value HO (50)	02		

5.6 Parameter table

Note: 1) Parameters 11 to 35 are screw tightening records, can be read only. It will be automatically overwritten when the next record is updated.

2) Except for the parameters marked with *, all others are 16-bit unsigned numbers.

3) The parameter address number will be reduced 1 on the parameter sequence number during communication, except for the WEILUNTONG touch screen.

System parameter						
No.	Parameter name	Parameter range	Factory value	length	Read/write	Description
1	Software version number	0~255	0	2	R	String type, is used to display the firmware version number of controller, can not change;
2	ID number	1~247	0	2	RW	The local address during communication
3	Communication baud rate (RS232/RS485)	0~4	0	2	RW	After modification, needs to power on again; 0: baud rate is 9600; 1: is 19200; 2: is 38400; 3: is 57600; 4: is 115200;
4	Operational Indicate	0~32	0	2	RW	Bit0:1 start, 0 stop ; Bit1:1 for removal screw, 0 for tightening ; Bit2 : Pause; Bit3 : Reset; Bit4 : System parameter saving; Bit5: Clear the tighten statistics to zero, qualified and unqualified numbers ;
5	Alarm code	0~25	0	2	RW	0: No alarm; 1: Screw number is not set yet; 2: Overdue tightening; 3: No tightening sequence; 4: Torque exceeds upper limit; 5: Torque exceeds lower limit; 6: Angle exceeds upper limit; 7: Angle exceeds lower limit ; 8: Input mismatch; 9: Servo alarm; 10: Communication error; 11: Internal FLASH error; 12: File loading failed; 13: File entry failed; 14: File opening failed; 15: Internal memory card writing failed; 16: Internal memory card reading failed; 22: Scan code error; 23: Missed alarm; 24: Tightening is not completed; 25: The encoder of torque arm is not connected;
6	Real-time torque (LO)	0~999999	0	4	R	Real-time value of tightening torque (torque related values are 100,000 times of the unit of use)
7	Real-time torque (HI)					
8	Real-time Angle (LO)	0~1000000	0	4	R	Tighten the real-time value of the turning angle, Unit is in degrees
9	Real-time Angle (HI)					
10	Real-time speed	-32768~ +32768	0	2	R	The real-time value of the rotational speed is tightened, Unit is revolutions per minute

Tighten record

No.	Parameter name	Parameter range	Factory value	length	Read/write	Description
11	Year	2015~2999	0	2	R	Keeping time for Tighten record-year
12	Month	1~12	0	2	R	Keeping time for Tighten record-month
13	Date	1~31	0	2	R	Keeping time for Tighten record-day
14	Time	0~23	0	2	R	Keeping time for Tighten record-hours
15	Minute	0~59	0	2	R	Keeping time for Tighten record-minutes
16	Second	0~59	0	2	R	Keeping time for Tighten record-seconds
17	Task number	1~12	0	2	R	Executed Task number
18	Parameter number	1~8	0	2	R	The parameter number for execution
19	Screw number	0~999	0	2	R	The serial number of the screws in task
20	Control model	0~1	0	2	R	0: Angle control mode 1: Torque control mode
21	Target torque (LO)	0~999999	0	4	R	Turning control:torque upper limit (torque related values are 1000 times the unit of use)
22	Target torque (HI)					Torque control: torque target value (torque related values are 1000 times the unit of use)
23	Target Angle (LO)	0~1000000	0	4	R	Turning Angle Control:the target turning angle value is set with 8 bits, with the unit of degree ;
24	Target Angle (HI)					Torque control:the maximum set angle is 8 bits low,Unit in degrees ;
25	Torque feedback	0~65535	0	2	R	Percentage of feedback torque for corner control;
26	Torque completed (LO)	0~999999	0	4	R	Tighten to complete the torque(Torque related values are 1000 times the unit used)
27	Torque completed (HI)					
28	Complete Angle (LO)	0~1000000	0	4	R	Turn angle at completion of tightening
29	Complete Angle (HI)					(Unit:degree)
30	Finish time (LO)	0~7200000	0	4	R	Tightening time,only refers to the time used for a single step parameter (Unit:ms)
31	Finish time (HI)					
32	Tightening results	0~65535	0	2	R	0: success; > 0 failure; 0: no alarm; 1:number of screws not set; 2: Overdue tightening; 3: No tightening sequence; 4: Torque exceeds upper limit; 5: Torque exceeds lower limit; 6: Angle exceeds upper limit; 7: Angle exceeds lower limit; 8:Input mismatch; 9: Servo alarm; 10: Communication error; 11: Internal FLASH error; 12: File loading failed; 13: File entry failed; 14: File opening failed; 15: Internal storage card writing failed; 16: Internal storage card reading failed; 22: Scan code error; 23: missed alarm; 24: Tightening is not completed; 25: The force arm bracket encoder is not connected;

33	Sign of Tighten complete	0~65535	0	2	R	0: Tightening; 1: Tightening end ; 2: Different from the state reflected by 0 and 1, it generally corresponds to state before tightening after turning on, or state of receiving clearance alarm signal after tighten;
34	Qualified no. Of tightening	0~65535	0	2	R	The qualified number of screws tightened, be counted from the start of power-on;
35	Unqualified no. of tightening	0~65535	0	2	R	The unqualified number of screws tightened, be counted from the the start of power-on;
36	Batch tightening completed	0~1	0	2	R	1:Batch tightening is completed;
37~46	Reserved					
47	Tool preparation signal	0~1	2	2	R	0: Press the emergency stop button when the device is not ready for screwdriver running; 1: Other;
48	Tool lock	0~1	0	2	RW	0:Tool lock, the start command will not be able to start the device; 1:Tool unlocking, the start command can normally start the device;
49	Task number	1~12	1	2	RW	Users can select the tasks through this parameter
50	Parameter number	0~8	0	2	RW	1~8:User communication select parameter to run 0:Controller interface select parameter to run
51	Parameter save	0~1	0	2	RW	1:Running parameters are saved and it will be automatically cleared after saving;
52	Control method	0~1	0	2	RW	1:Torque control mode; 0:Angle control mode ;
53	Operation direction	0~1	0	2	RW	Tighten the rotation direction (In front of the batch head, 0:CW, 1:CCW)
54	Torque units	0~4	0	2	RW	0:1bf.in 1:0zf.in 2:kgf.cm 3:N.cm 4:N.m 5:lbf-ft
55	Option	0~7	0	2	RW	High 8 bits:undefined; Low 8 bits: Bit0:option 1 is valid,0 is invalid; Bit1:Angle monitoring option 1 is valid, 0 invalid; (torque control mode is valid) Bit2:Torque feedback option 1 is valid, 0 invalid; (angle control mode is valid)
56	Torque feedback value	0~200	0	2	RW	The final torque of the corner control*torque feedback value/100, the results will be added to the next step of the target torque value of step torque control (unit:%) it is used in combination with multiple steps;
57	Target torque (LO)	0~999999	0	4	RW	Torque control mode is effective when the target torque value is tightened and the angle control mode is invalid (the relevant values are 1000 times the unit of use)
58	Target torque (HI)					
59	Torque limit (LO)	0~999999	0	4	RW	The upper limit of torque for tightening screws(The relevant values are 1000 times of the unit)
60	Torque limit (HI)					
61	Torque limit (LO)	0~999999	0	4	RW	Lower torque limit for tightening screws(The relevant values are 1000 times the unit of use)
62	Torque limit (HI)					
63	Target Angle (LO)	0~999999	0	4	RW	In the corner control mode, it is invalid in the torque control mode for tightening the target angle value (unit:degree)
64	Target Angle (HI)					

65	Turning Angle limit (LO)	0~9999990		4	RW	Upper limit of rotation angle when screw is tightened (unit:degree)
66	Turning Angle limit (HI)					
67	Turning Angle Limit (LO)	0~9999990		4	RW	Lower limit of rotation angle when screw is tightened (unit :degree)
68	Turning Angle Limit (HI)					
69	Turning monitor threshold					Torque value of turning start (unit:%) The target torque percentage is used in torque control and the maximum torque limit percentage is used in angular control
70	Parameter friction	-32768~+32768	0	2	R	The current parameter number corresponds to the friction compensation (unit mN.m)
71	Running speed	0~65535	0	2	RW	Thread speed of the nut tightening (unit:rpm)
72	Shifting torque value	0~100	0	2	RW	When the screwdriver torque is greater than this parameter value, shift tighten phase;The target torque percentage is used for torque control and the maximum torque limit percentage is used for angular control;
73	Shifting angle value	0~65535	0	2	RW	When the angle of the screwdriver is greater than the value of this parameter, shift tighten phase;
74	Speed after shift	0~65535	0	2	RW	The speed value after shifting
75	Time limit (LO)	0~65535	0	4	RW	Time limit for tightening screws (unit :ms)
76	Time limit (HI)					
77	Keeping time (LO)	0~65535	0	4	RW	The time maintains after reaching the target torque, when use Torque control (unit: ms)
78	Keeping time (HI)					
79	Accelerated speed	0~5000	0	2	RW	Starting acceleration, unit:based on the physical object(the larger unit of 10rpm/s, the faster acceleration;the smaller unit of ms, the faster acceleration)
80	Deceleration speed	0~5000	0	2	RW	Stops deceleration, unit: based on the physical object(the larger unit of 10rpm/s, the faster deceleration;the smaller unit of ms, the faster deceleration)
81	Calibration coefficient	70~130	0	2	RW	Torque curve adjustment
82	Friction 1	-32768~+32768	0	2	RW	Torque calibration(unit mNm)
83	Bolts number	0~49	0	2	RW	The current running screw sequence No. is 0→1-----49 → 50
84	Step 1	0~8	0	2	RW	Step 1 parameter selection (0 means no parameter for this step)
85	Step 2	0~8	0	2	RW	Step 2 parameter selection (0 means no parameter for this step)
86	Step 3	0~8	0	2	RW	Step 3 parameter selection (0 means no parameter for this step)
87	Step 4	0~8	0	2	RW	Step 4 parameter selection (0 means no parameter for this step)
88	Step 5	0~8	0	2	RW	Step 5 parameter selection (0 means no parameter for this step)

89	Step1-intervals time	0~65535	0	2	RW	The time interval between step1 and 2(unit:ms)
90	Step2-intervals time	0~65535	0	2	RW	The time interval between step2 and 3(unit:ms)
91	Step3-intervals time	0~65535	0	2	RW	The time interval between step3 and 4(unit:ms)
92	Step4-intervals time	0~65535	0	2	RW	The time interval between step4 and 5(unit:ms)
93	Reversal direction	0~1	0	2	RW	Facing the batch head 0: CW / 1: CCW
94	Reversal speed	0~65535	0	2	RW	Rotate speed of the screw while screw reversal (unit:rpm)
95	Max torque of reverse	0~100	0	2	RW	Percentage of maximum tool torque
96	Bolt number	0~50	0	2	RW	Set the number of screws for current task
97	Multi-step&reverse parameter saving	0~1	0	2	RW	1:Parameter saving,automatic clear after saving;
98	Input port status	0~255	0	2	R	If a certain bit of 8 data bits is 0,it means the certain channel is valid; For example,0xfe present the current channel 1 is valid and channels 2-8 as invalid level;
99	Output port status	0~255	0	2	R	If a certain bit of 8 data bits is 1,it means the certain channel is valid; For example,0xfe represents the current Channel 1 is invalid and channels 2-8 are the valid level;
100-123	Scanner SN code	0~65535	0	24	RW	A single register corresponds to two characters (the low byte of the character is in front),total is 24 register addresses,and longest correspond to a 48 bit barcode(including the end character \0); For example:The barcode content is "QBC123" (corresponding to the character 0x51,0x42,0x43,0x31,0x32,0x33) Send after scan: 01 03 00 63 00 14 B5 DB Receive:01 03 28 42 51 31 43 33 32 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 01 00 01 01 F4 00 64 00 0 1 4D 8
124	System torque units	0~255	0	2	RW	0x80 :lbf.in; 0x81:0zf.in; 0x82:kgf.cm; 0x83:N.cm ; 0x84:N.m; 0x0x:Torque unit set by using parameter 54
125	Current encoder position X	-36768~36768	0	2	R	The position of current encoder X axis in ACT-P built-in positioning
126	Current encoder position Y	-36768~36768	0	2	R	The position of current encoder Y axis in ACT-P built-in positioning
127-198	Reserved					
199	Curve points	0~65535	0	2	R	The total number of points on the curve
200	Starting of curve	0~65535	0	2	R	The position of the starting point of the curve among 570 points
201-1340	Angle data		\	\	\	R Each point Angle data is 2 registers(All 16 bits of the data are in the low address corresponding register)
1341-2480	Torque data		\	\	\	R Each point torque data is 2 registers(All 16 bits of the data are in the low address corresponding register)

2481-3050	Speed data	\	\	\	R	Each point speed data is 1 register
-----------	------------	---	---	---	---	-------------------------------------

5.7 User selection parameter operation

When the user does not want to use the tightening process set by the controller, but select parameters randomly, set the number of screws in the task to "8", and assign parameters 1 to 8 to these 8 screws respectively, then set the parameter [50] through the communication method and select the parameters. The parameter [50] is defaulted as "0" after power-on, it indicates the tightening process preset by the controller, If it is greater than "0", it means the parameters selected for running.

Modify parameters	
No.	Description
1	Task selection (parameter [49] setting 1~12)
2	Parameter [50] setting 1~8
3	Modify the corresponding tightening parameters
4	Save the parameters, parameter [51] set to 1
5	Parameter [50] set to 0

Select the torque parameter to run	
No.	Description
1	Task selection(parameter [49] setting 1~12)
2	Parameter [50] setting 1~8
3	Start(parameter [4] bit0 set to 1)
4	-

Select the torque parameter to run	
No.	Description
1	Task selection(parameter [49] setting 1~12)
2	Parameter [50] setting 1~8
3	Modify the corresponding tightening parameters
4	Start(parameter [4] bit0 set to 1)

Specific examples of Modifying parameters:

06H Instruction: Modify the parameters 1 of task 2, target torque 0.5N.m, torque upper limit 0.6N.m

- ① Send task number: 49 Register → Send 2
- ② Send parameter number: 50 Register → send 1
- ③ Send modified parameter content: 57 register→send 500; 59 register→send 600
- ④ Send save instruction: No.51 send 1 for saving (zero automatically after saving)
- ⑤ Restore controller selection parameter number: No.50 send 0 to restore

Specific examples of Read parameters:

03H Instruction: Read the target torque of parameter 1 of task 2

- ① Send task number: 49 Register → Send 2
- ② Send parameter number: 50 Register → Send 1
- ③ Send the read parameter content: 57 registers
- ④ Restore controller selection parameter number: No.50 send 0 to restore

Chapter 6 Alarm processing

Alarm code	Alarm content	Solution
1	Bolt number not set yet	Set the number of screws at least for 1
2	Overdue tightening	Check if the screws are slipping or the set time is reasonable
3	No tightening sequence	Set the tightening process for each screw
4	Exceeds upper limit	Check if the screw matching is correct, or any debris or need readjust the torque upper limit
5	Exceeds lower limit	Check if the screw is slipping or need to readjust the torque limit
6	Turning angle exceeds upper limit	Check if the screw is slipping or need to readjust the upper limit of the turn
7	Turning angle exceeds lower limit	The screw is not tightened properly or the lower limit of the turning angle is readjusted
8	Matching screw input error	Set the correct screw to match the input signal
9	Motor drive alarm (servo alarm)	Reset or re-power on
10	Internal communication interruption (communication error)	Power on again or return to factory for repair
11	Internal Flash error	Return to factory for repair
12	File loading failure	Return to factory for repair
13	File entered failure	Return to factory for repair
14	File can not open	Return to factory for repair
15	Internal storage card failed to write in	Return to factory for repair
16	Internal memory card read failed	Return to factory for repair
22	Scan error	Reset the alarm and scan a new barcode
23	Alarm for missing tightening	Check if the screws are missing
24	Tightening is incomplete	Check whether the current screw is fully tightened, click reset and run again
25	Unconnected torque arm encoder	Check if the tool cable to encoder is connected

Chapter 7 ACT controller built-in tightening positioning

Tightening positioning is to preset the screw position process in advance, move the balance arm according to the screw positioning sequence, align with the predetermined position, and start the tightening of the screw by pressing the handle switch.

Note:

1. The built-in tightening positioning needs to be used in conjunction with a folding balance arm (with encoder);
2. The tightening position is limited to the handle switch only, and the start switch under the display screen of this machine is not restricted by the location.

7.1 Precondition for tightening positioning setting

Before using the built-in positioning function, the following steps should be set in advance (refer to the function setting of Chapter 2):

- 1) Select the appropriate corresponding control screwdriver model "tool model" (usually set at the factory);
- 2) Set the tightening task sequence (one of 12 options) and the total number of screws in the task (password permission required), the maximum number of screw positions to be set is 50;
- 3) In the main interface, press the [Setting] key to set the start mode as "manual" and "push rod" (it needs password permission to be effective), otherwise, the screw batch cannot be started by pressing the handle switch in the "automatic" mode;
- 4) Set screw parameters (torque, Angle, etc.), and select appropriate tightening torque or Angle parameters for each screw (8 options, password permission required);
- 4) When saving preset location information, check the SD card in advance on the system parameter interface (password permission is required);

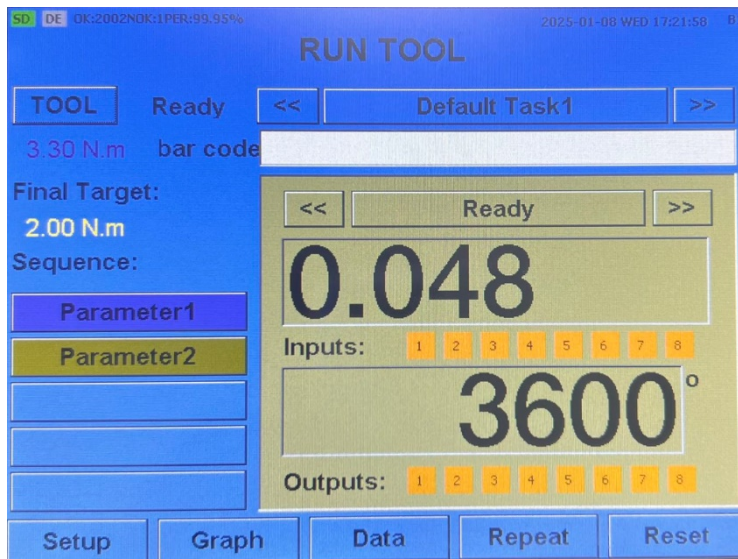
Note: Save above five settings in the controller.

7.2 Fix the screwdriver

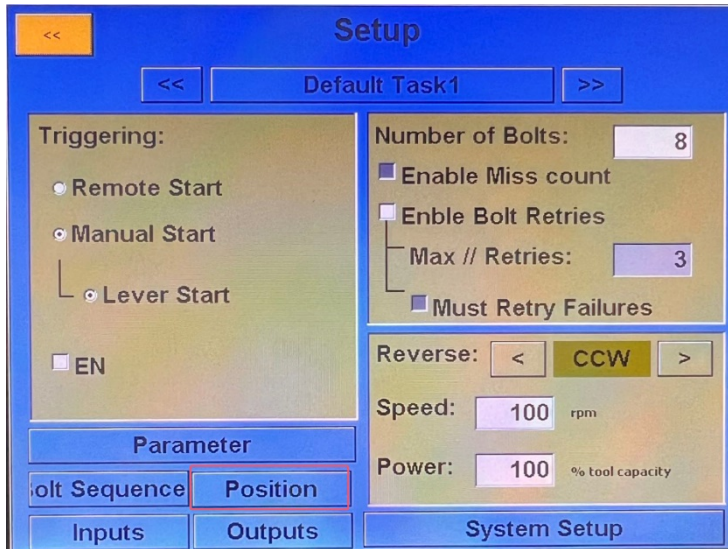
- 1) Before power on, make sure that the screwdriver body is fixed to the arm bracket, and the two encoders on the arm are OK to connect to the controller [do not plug or unplug the cable plug of the encoder with power];
- 2) Fix the workpiece to be operated and pay attention to all the screw positions on the workpiece which should be within the range of the moving arm body, so as to ensure that the screwdriver can be aligned;

7.3 Controller interface of built-in positioning system

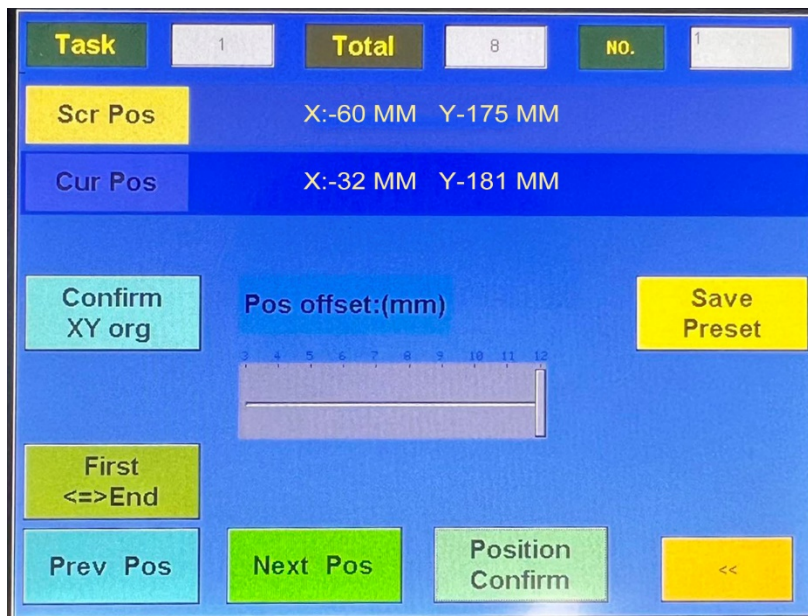
1. Operation interface:



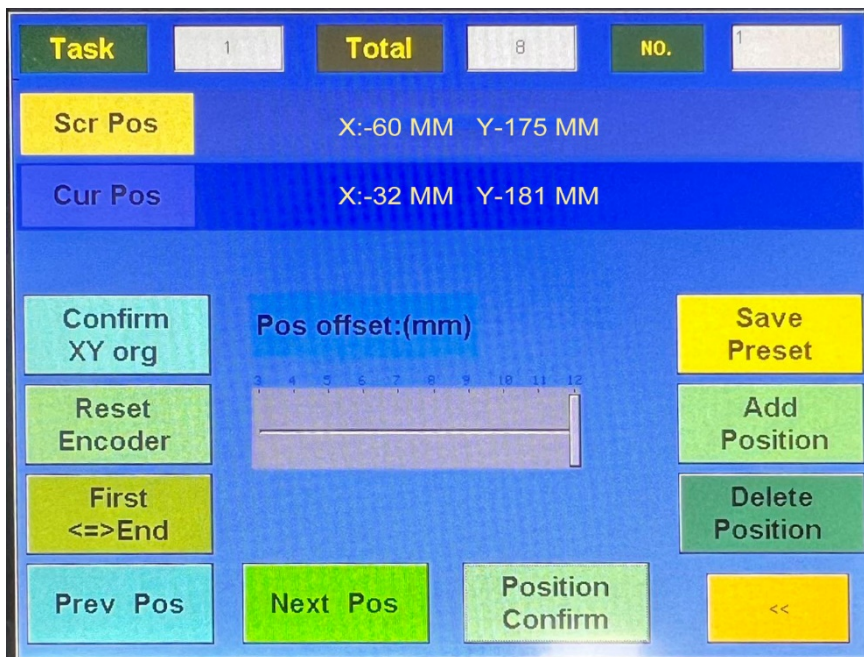
2. Set the interface and choose "position":



3. Enter the "position" interface without password:



4. Go to the "position" interface after input password:



7.4 Function setting of built-in positioning system(with password)

7.4.1 Encoder value reset

The external arm and inner arm of 0 clearing balance arm use absolute encoder angle values for positioning. It is recommended to open to maximum position of the outer and inner arms at 120 ° angle, fix the tool holder in place, press this button to reset, and display the current position value as X: 0 deg Y:0 deg.

If zero cleared in other positions, the coordinate value near the zero point will be changed suddenly, which is not conducive to accurate positioning;

This is the reference benchmark point for all screw positions. After the user fixes the balance holder, make it as "zero the encoder value". Use it for calibration only and do not make zero clearing every time when you use it;

7.4.2 Confirmation of coordinate origin

Move the boom support of arms to align the screwdriver batch with the processing coordinate origin set by the user. Press this key, if it's not showing "Coordinate origin confirmation", then the coordinate origin is the axis center of torque arms holder;

7.4.3 "Last screw position" and "Next screw position"

Select the tightening processing number sequence (displayed in [NO.] position number), the maximum is 50. After confirming the tightening position, select this key for the next screw.

7.4.4 Interchange of head and tail positions

It is convenient to quickly switch to the first screw when there are lots of screws there, or jump to the last screw.

7.4.5 Tightening position confirmation

Move the tool holder to align the screw file with the position of the screw to proceed, press [Next screw position] Or select the tightening sequence by clicking on [Position of the last screw] (shown in [NO.]) and press this button to confirm the coordinate position.

If the current screw is in the same position as the previous screw, the tightening position will be displayed as "Same as the previous position!" without asking for confirmation.

7.4.6 Insert current position

Inserting a new screw number into the current screw number, it will increase the total number of screws, which requires password permission, and the total number of screws less than 50 is valid;

If the current screw number is 2, the new insertion number will be 3, the previous 3 and all the numbers after the original 3 will add 1, so the original 3 becomes 4, the original 4 becomes 5... all move to the next position. At the same time, the total numbers will add 1 and turns red.

After inserting the number, press [next screw position] to insert the number. Meanwhile, the preset position shows "not set", then move the bracket body to the corresponding numbered screw position, and press [Confirm the tightening position] key, the data is displayed at the preset position.

7.4.7 Current position deletion

At the current screw number position, deleting the screw position where the number is located will reduce the total number of screws, which requires password permission, and the total number is greater than 1 for valid.

If the current screw number is 3, delete the original number 3 screw position, all the numbers after 3 are reduced 1 and move to the previous position in sequence; at the same time, the total number are reduced by 1 and turns red.

Insertion of [current position] and deletion of [current position] may lead to changes in the total numbers. When you press [⟨⟨] key (means EXIT) and return to the main screen, it reminds [save].

7.4.8 Interchange of head and tail positions

Press the key [first and last position swap] once to switch the first screw number to last screw number; or the last screw number to the first screw number, so as to switch quickly for numerous screw numbers;

"Task sequence" and "total points" values need password permission to click and change as well, without password permission, it's for display only;

After changing the total number of points, users should set the corresponding screw tightening parameters.

Insertion of [current position] and deletion of [current position] may lead to changes in the total numbers. When you press [⟨⟨] key (means EXIT) and return to the main screen, it reminds [save].

7.4.9 Tightening position deviation

The slider is used to adjust the deviation degree of the screw positioning point. The screwdriver moves within this range, press the manual switch and start button; if it exceeds the deviation range, the users could not execute pressing the manual switch and start button to rotate on screwdriver.

The Minimum deviation distance is 3mm and Maximum is 12mm, there are 10 shifts for adjustment;

After setting the deviation degree, you can save it to SD card by pressing [Save preset position].

If you feel that the deviation setting is not appropriate when tightening, you can re-enter the screw positioning setting interface for adjustment, and exit by pressing [Save preset position].

[Save Preset Position] is to save all preset position information and tightening position deviation as File (named lockposinf.suo) to SD card with password permission, then select the SD card option ; press this button when all screw positions are confirmed as OK.

When processing different batches of workpieces, extract this file and rename it for saving; when returning to the same batch of workpieces, retrieve the modified document and place it back on the SD card, renaming it as lockposinf.suo, thus no need to locate each screw one by one, the prerequisite is that there are no any operations between it (the encoder value is reset).

7.4.10 Screw positioning operation steps

When execute screw positioning operation, be ensure that the "zero encoder value" and "confirmation of coordinate origin" are the same coordinate origin for the same series of screws. During the process, the "zero encoder value" button could not be pressed again, otherwise all screws need to be reposition.

- The screw positioning operation steps after [encoder value reset] and [Coordinate origin confirmation] are as follows:
 - ① After securing the workpiece, turn to the corresponding screw number according to "Last Screw Position" or "Next Screw Position", enter the preset interface and it shows the first screw, this step can be skipped; if the screw position for tightening has not been confirmed yet, the preset position will show "Unset".
 - ② Move the arm bracket to make the screwdriver to align with position for tightening, press the [tightening position confirmation] button, now the preset position and current position display data are the same;
 - ③ Change to the number of the next screw according to the position of the next screw, move the bracket body to the position of the next numbered screw, and press the [tightening position confirmation] button, data displays;
 - ④ Repeat the operation of step ③ until all screw positions are confirmed.

- Check whether the location is missing setting:

Sequentially move to the first screw according to the [previous screw position], and ensure that the tightening positions display coordinates; for screws without a position setting, display "Unset"; if it display "Unset", follow up step ② for position setting; once it is completed, press key [←←] to return to the main interface, move the tool body and tighten screws in sequence according to preset screw position numbers with hand switch operation.

Note:

- 1) When the screwdriver is not in the preset position, it does not work if press the “pressure level switch” on the tool body, with red flushing light display on “current position”, it indicates that it is out of the tightening position.
- 2) When the screwdriver moves to the preset position of tightening, the red light on “current position” will change to blue color, that means it is in tightened position; press the “pressure switch” on tool, then the screwdriver works.
- 3) When a single screw is tightened and the result is OK, the background color of the torque and angle display position turns green; it turns to red with alarm and the screen above prompts the reason of alarm. Meanwhile, the preset position will jump to the numerical value of the next screws position and display the number of qualified, unqualified, and qualified rate dynamically and real-time changes on the screen above. The numerator of the screw number refers to the screw that has just been tightened, while the denominator is the total number of points.

The reason to cause alarm can also be checked by clicking [Data] on main interface:

-Go to the system parameter interface with password permission, click servo parameter and read “address 22”, get the alarm number and find out the corresponding number reason table.

-With password permission, the key of “last/next screw” and “change task” [<<] or [>>] on the main operation interface are effective, which can switch the sequence of screw tasks and numbers. It is recommended to exit the password permission state after screw positioning, then tighten the screws in the sequence by the screw number positioning to prevent omissions.

- Reference method for supply of omission screws:

After entering the password permission, press key [<<] or [>>] of the screw number on the main interface to rotate to the missing screw number position, press the hand switch or panel switch to fill in.

- Method of turning off the alarm of encoder disconnection (customer can choose to operate without tightening the positioning):

- 1) After entering the password permission, return to the main interface;
- 2) In the main interface, click key [Screw Positioning] to screw positioning interface;
- 3) In the screw positioning interface, press key [encoder value clear to Zero] to reset the encoder value and all preset position coordinates;
- 4) In the screw positioning interface, press key [Save] to the main interface and then turn off and restart;

- Method for Restore the unconnected encoder alarm (customer to set tighten the positioning operation):

- 1) After entering the password permission, return to the main interface;
- 2) In the main interface, click key [Screw Positioning] to screw positioning interface;
- 3) In the screw positioning interface, press key [Coordinate Origin confirmation] to add any preset position coordinates;
- 4) In the screw positioning interface, press key [Save] and return to main interface;