

# S3010A Radial Insertion Machine

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## user's manual



\* Please read this manual carefully before use to ensure the correct use of the product.

# catalogue

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# Chapter 1. Brief introduction

## 1.1 overview

S3000A series radial insertion machines are high-speed, high-precision, high-performance equipment, which are independently developed by our company. It can combine different kinds of tape components (carbon film resistors, diodes, cylindrical capacitors and other components) on the clip of the chain according to the set program sequence for the plug-in head to use. This equipment fixes the plug-in head horizontally, and realizes the precise plug-in in each area of the PCB by the movement of the X and Y mechanisms. The angle of the plug-in is realized by the rotation of the turntable. This series of control software and operation software is also independently developed by our company, and all operations are controlled by a computer.

## 1.2 Advantages of this machine:

- Full computer control, full English version of the operating system, based on Windows platform, easy to operate, fast, simple and easy to learn.
- Using machine vision technology, online automatic programming, automatic deviation correction, automatic identification of MARK points, improve the degree of automation.

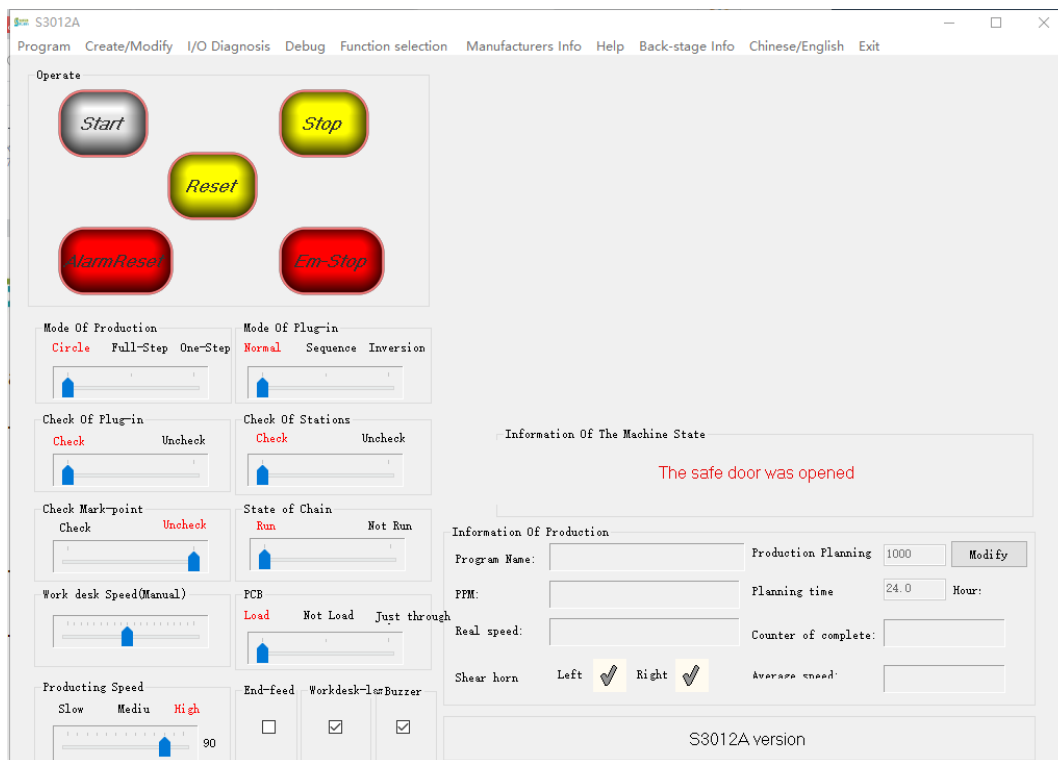
- Adopt AC servo system, optimize the line, eliminate the instability caused by line failure, and achieve the goal of stable high speed and energy saving.

### 1.3 Preparation items before use

- Check that the power supply is at the specified rated voltage 220V.
- Check that the main power is connected to the machine, that the fuses are in good condition, and that the branch circuit breakers are closed.
- Whether the equipment is properly grounded.
- Make sure that no extraneous objects are left in the electric control box and on the moving parts of the machine.
- Whether the conveyor belt and synchronous belt fall off during transportation.
- Check whether the screw, slide rail, plug-in shaft and other heavy-duty, high-speed running mechanisms are well connected.
- Push and pull the X, Y, H, W, L, J mechanisms by hand to see if they move smoothly.
- Check the limit detection and limit mechanism for dislocation.
- Check whether the emergency switch is pressed, check whether the main gas source and power switch are in the OFF state.
- Check whether the connection plugs and air pipes between the computer, electric control box, main and auxiliary machines are well connected.

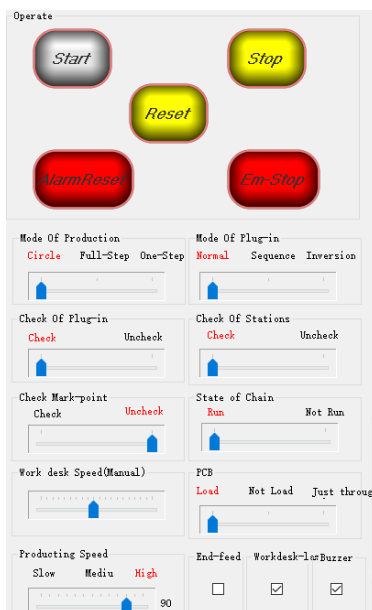
# Chapter 2.Operation interface description

## 2.1 Main interface description



Main Interface

### 2.1.1 Production operation area



S3010A Production operation area

Production operation area: This area controls the operation and production of the machine (as shown above):

- **Start** — Start the insert program, and all parts of the machine cooperate to complete the insert task.
- **Stop** — The machine stops working and enters the standby state.
- **Reset** — Return the worktable to the starting zero position. It is a necessary action before the first displacement and insert.
- **AlarmReset** — When the machine encounters a insert error during the production process, it will stop working and display the error message in the shutdown message. When the message is repaired, you can click the alarm reset and start production.
- **Em-Stop** — In the event of an emergency, make the machine stop all actions.

#### **Mode of production:**

- Circle - - - - -The action is performed continuously until the production quantity is completed.
- Full-Step - - - - -Complete a full insert cycle action.
- One-Step - - - - -The insert action is broken down into several steps to execute, and only one step is completed per startup.

#### **Mode of Plug-in:**

- Normal - - - - -Complete the plug-in according to normal plug-in actions.
- Sequence - - - - -Move the worktable empty inserts according to the program sequence, and the chain does not move.
- Inversion - - - - -Move the worktable in reverse order according to the program, and the chain will not move.

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**Check of Plug-in:**

- Check - - - - - -During the plug-in process, real-time detection of the insertion of components, if found to be bad, the machine will stop and alarm.
- Uncheck - - - - - -During the plug-in process, the insertion of components is not detected.

**Check of Station:**

- Check - - - - - -During the feeding process of the component station, it detects whether there is component on the component station. If no component is detected for three consecutive times, the machine will stop and alarm.
- Uncheck - - - - - -During the feeding process of the component station, the situation on the component station is not detected.

**Check Mark-point:**

- Check - - - - - -When there is a MARK point correction command in the plug-in sequence command, perform MARK point correction.
- Uncheck - - - - - -The MARK point correction command is not executed.

**State of Chain:**

- Run - - - - -Chain feed inserts in programmed order.
- Not Run - - - - -The chain does not feed the plug-in according to the program sequence.

**Work desk Speed(Manual):**

The speed at which the desk is moved manually.

**End-feed:**

Stop when you have finished inserting the entire set of materials on the current chain.

**Production Speed:**

Adjust the speed of each axis during the plug-in process.

**2.1.2 Plugin order list**

S3010A Plugin order list

When the plug-in data is not read, the company Log is displayed;

When there is plug-in data, display plug-in data;

When encountering MARK point correction during production, display CCD image.



### 2.1.3 Operation information area



S3010A Operation information area

#### Information of The Machine State:

Displays the reason for downtime in the production process, it may be an alarm message, or it may be a scheduled production task that has been completed.

#### Program Name:

Shows the name of the program that is about to run or has already been run. will vary with the "open" process change in sequence.

#### Production Planning:

The number of PCB boards to be plugged in in production. It will automatically stop when the number value is reached.

#### PPM:

Plug-in success rate calculation: (the number of components successfully inserted / the total number of plug-ins that have been inserted) \* 100%.

#### Planning time:

Time to plan production.

#### Real speed:

Used to display the speed of the actual plug-in of the machine. Unit: pcs/hour.

### Counter of complete:

Each time a component is inserted, a board will automatically accumulate production records.

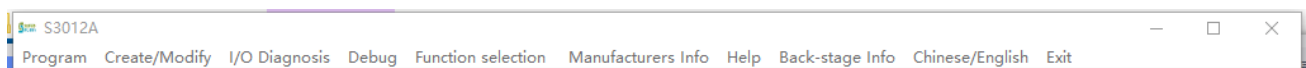
### Shear horn:

"Left" and "Right" are flashing red to indicate that the plug-in is inserted normally, and gray to indicate no insertion or insertion.

### Average speed:

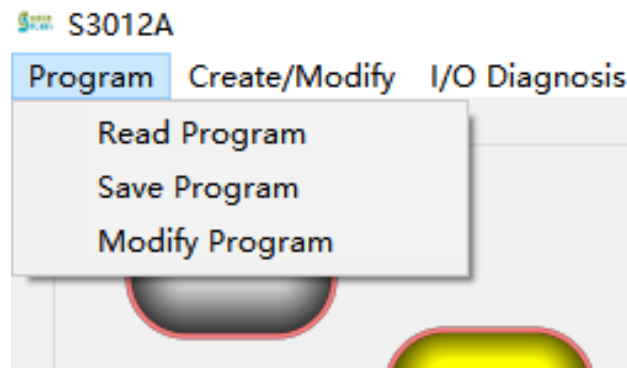
The insertion speed of the machine over a period of time.

## 2.2 Toolbar Description



Toolbar Description

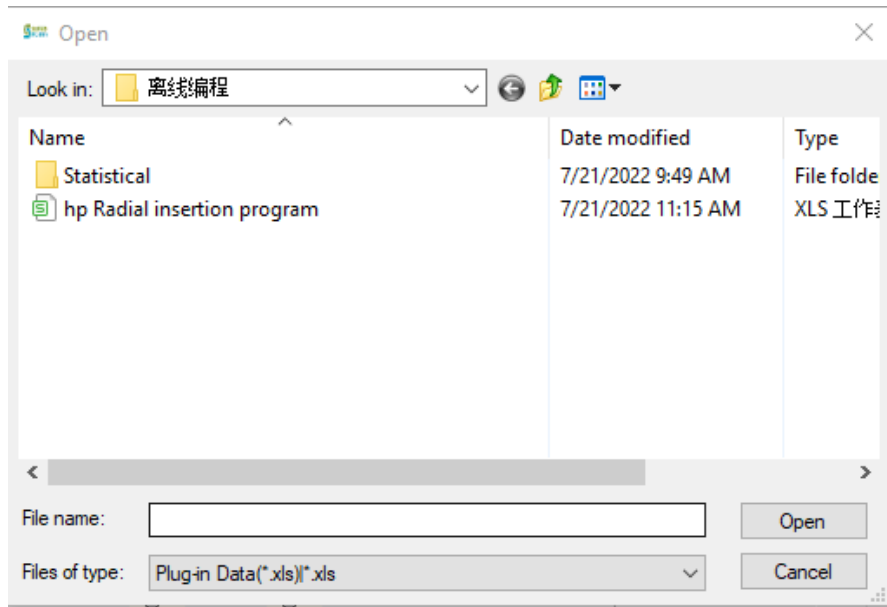
### 2.2.1 Program



Program

### Read Program:

Click File Program → Read Program, it will pop up a dialog box that can display all file names (as shown in the figure below), then click the program name you need to "open" in it, and then click "Open", the machine will accept the Executes the "task" of this program and overwrites the previous program.



Read Program

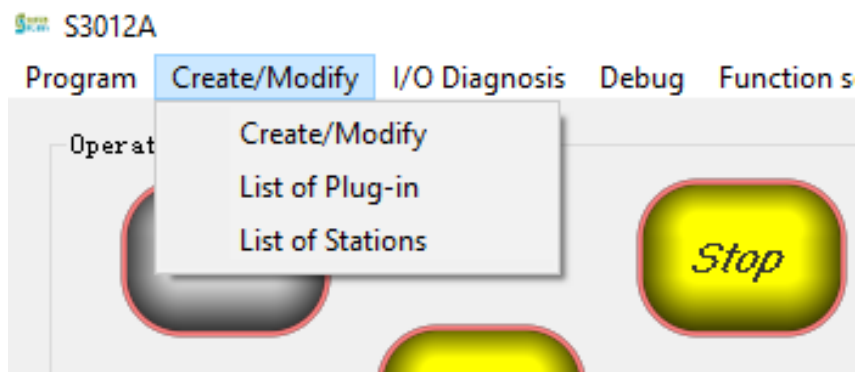
**Save Program:**

Click File Program → Save Program, it will pop up a dialog box for selecting a file name, you can also enter the file name you need in the file name field, and click "Save".

**Modify Program:**

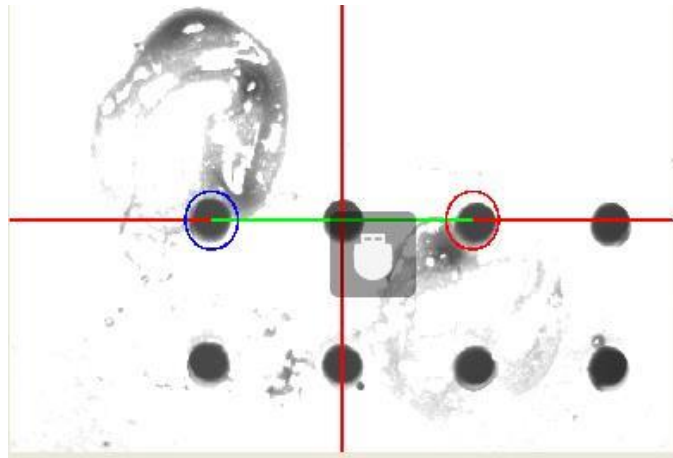
Click File Program → Modify Program File, it will pop up a dialog box for selecting a file name (as shown above). Then click the name of the program you need to "open" in it, and then click "open", it will open in .xls format in office.

**2.2.2 Create/Modify**



Create/Modify toolbar

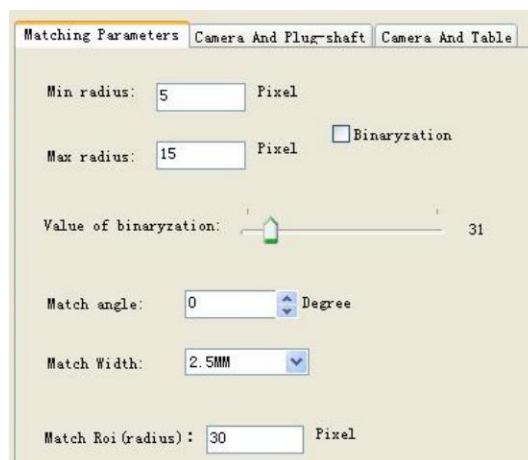




CCD image area

- Matching parameter setting area - - - - - There are three pages in this area: matching parameter setting, camera plug-in axis position calibration, camera TABLE platform calibration.

1. Matching parameter setting



Matching parameter setting

Min radius: Minimum target size radius to look for within the matching ROI area.

Max radius: Maximum target size radius to look for within the matching ROI area.

Binaryzation: Divide the image according to the threshold into a black and white two-color grayscale image.

Value of binaryzation: Adjust the size of the threshold of the segmentation map.

Match Width: According to the distance between the two leads of the component, the distance range of this machine is 2.5mm, 5.0mm, 3.5mm.

Match angle: According to the angle between the two-pin round hole of the component and the X axis, the distance range of this machine is  $-90^{\circ}$  -  $90^{\circ}$  .

Match Roi(radius): Adjust the extent of the ROI area.

## 2. Camera And Plug-shaft

CCD lens position: Move a plug-in position to the ROI area of the camera image, click CCD lens position , the program matches and records the current platform position.

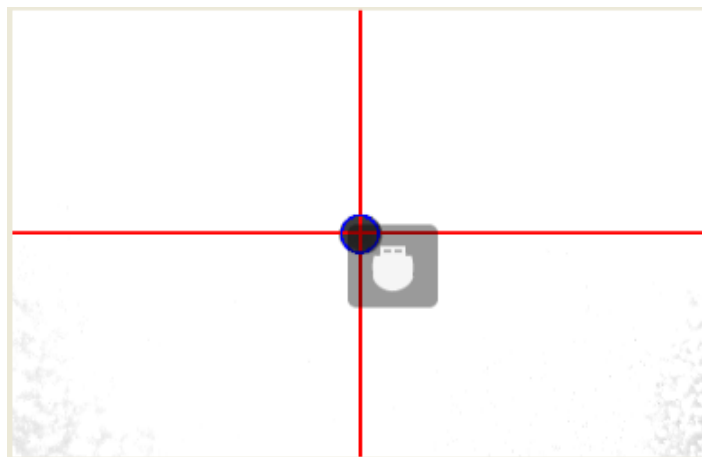
Plug-in axis position: Move the plug-in position used to calibrate the camera position to the plug-in axis, fine-tune the XY axis, and manually move H so that H can be inserted at this position, click Plug-in axis position, and the program records the current platform position.

Mark: After completing the calibration of the camera position and the calibration of the plug-in axis position and sum, click Mark, the program will calculate the relative position of the plug-in position under the camera image and the plug-in position under the plug-in axis, and fill it in the two edit boxes on the right.

Test: First move the plug-in position to the ROI area of the camera image, and click Test. The program will first correct the specific position in the ROI area, and then automatically move it below the plug-in axis. At this time, you can check whether the data is accurate.

## 3. Camera And Table

Calibrate the camera platform: Select an area with only one matching target on the matching board, as shown.

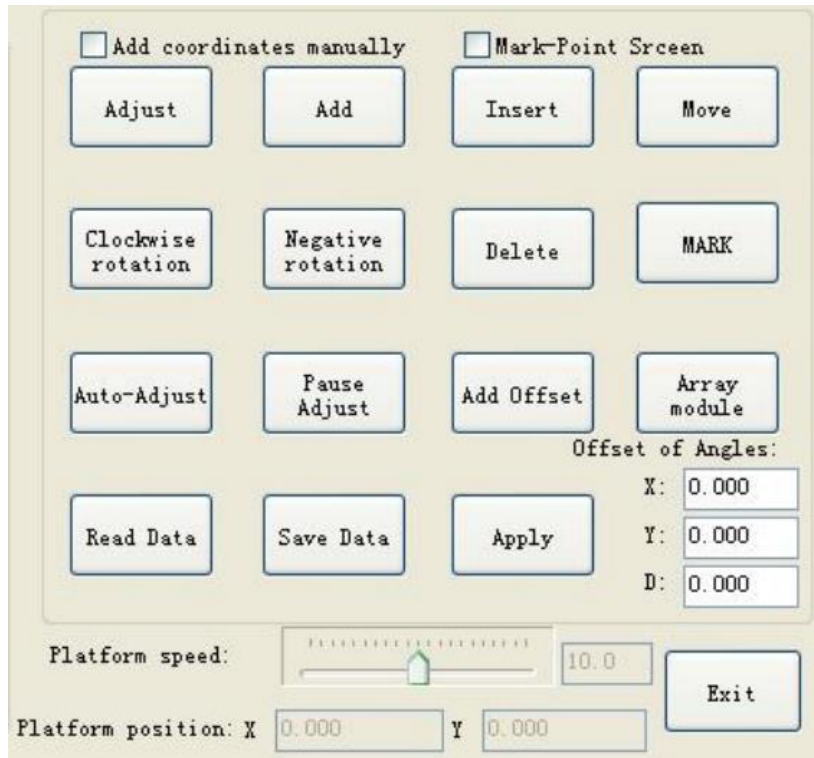


Matching target on the matching board

The program will calculate the number of pulses moved by the XY axis and the number of pixels moved by the XY axis on the image, and determine the ratio of the distance on the image to the actual distance.

Test camera platform: Move the matching target to any position in the image, if it can automatically return to the center of the camera, it proves that the calibration is successful.

#### 4. Match operation area



Match operation area

**Add coordinates manually:** Move the plug-in coordinates to the image ROI area and record the XY coordinates directly. Used to obtain the position of the plug-in when the PCB board imaging is extremely irregular and cannot be matched.

**Adjust:** Replace the data of the selected row with the plug-in data obtained in the ROI area of the current image.

**Add:** Add the plug-in data obtained in the ROI area of the current image to the end of the plug-in data list.

**Insert:** Insert the plug-in data obtained in the ROI area of the current image into the position of the currently selected row.

**Move:** If the current platform position does not reach the corresponding position of the focus line, move to the corresponding position; If the current platform position is in the corresponding position of the focus row, move to the corresponding position of the next row in the focus row.

**Clockwise rotation:** The turntable is rotated 90 degrees clockwise and recorded in the plug-in data list.

Negative rotation: The turntable is rotated 90 degrees counterclockwise and recorded in the plug-in data list.

Delete: Deletes rotated rows in the plugin data list (multiple rows are possible).

Mark: Add MARK point position correction to the program.

Auto-Adjust: Browse and correct the plug-in data of the plug-in data list starting from the focus row.

Pause Adjust: Temporarily stop browsing and correction of plug-in data.

Add offset: Select a row, and then move to the corresponding position of the focus row due to click shift, click Add offset, you can fine-tune the multi-row data before knowing the turntable rotation command or stop command after this row.

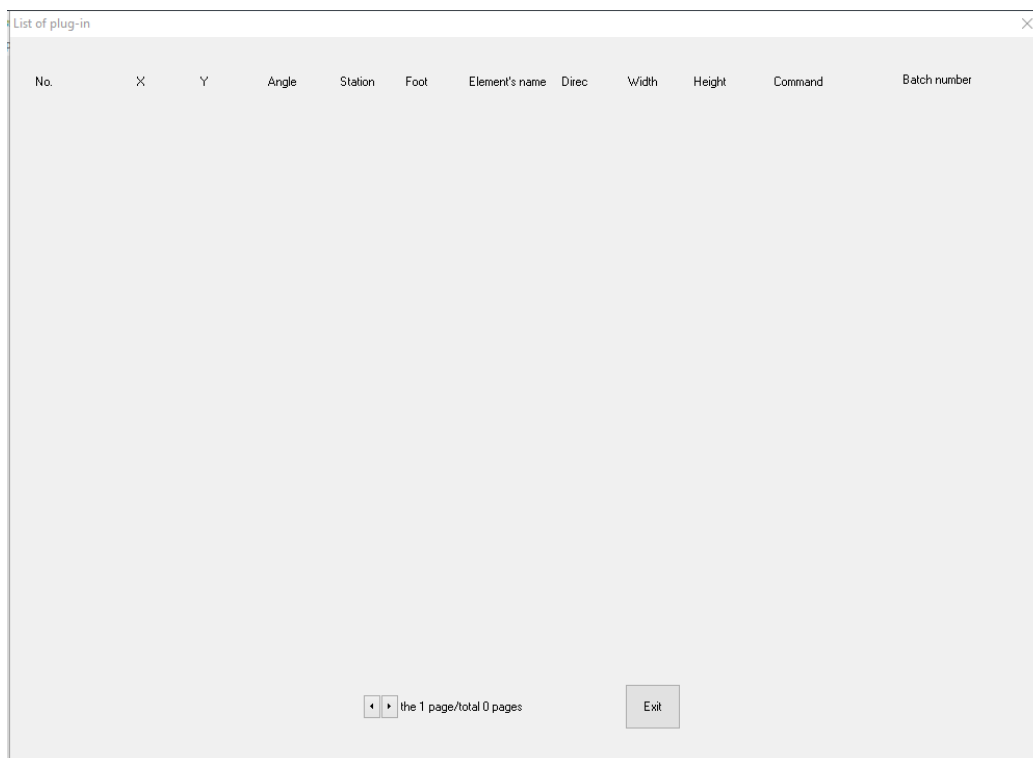
Array Module: After editing an area, you can use this command to array out several similar modules.

Read Date: Like the importer in the menu bar, read the plugin data from the file to the plugin data list.

Save Date: Like the export program in the menu bar, it saves the plug-in data in the plug-in data list to a disk file. If there is no "stop" or "continue" command at the end of the list, a "stop" command will be added automatically.

Apply: Save matching parameters to disk file so that they will be automatically loaded on next boot.

## List of Plug-in:

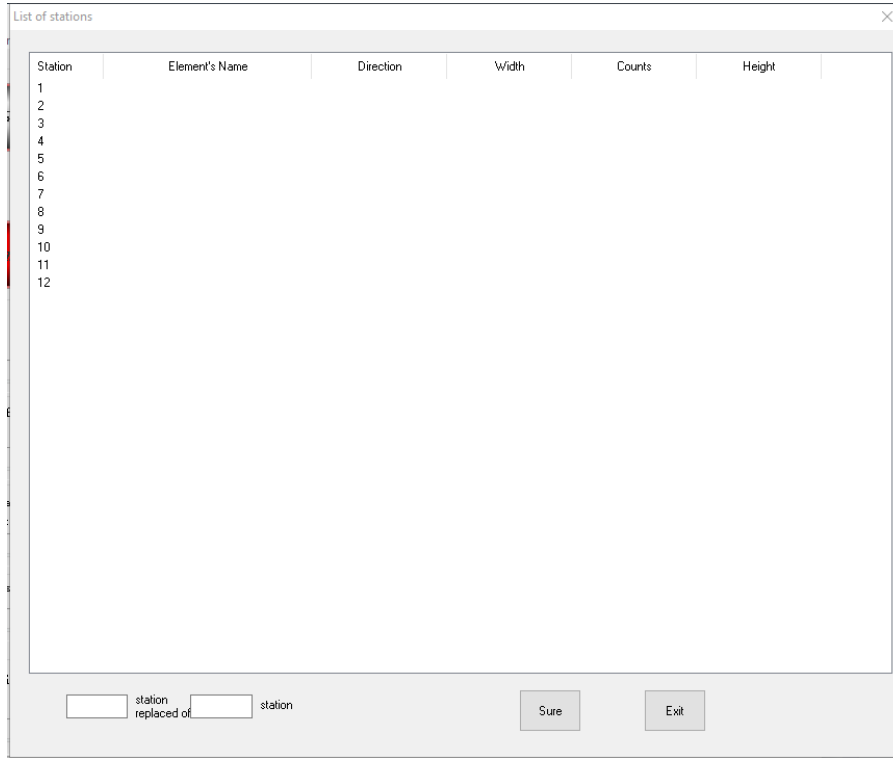


List of Plug-in



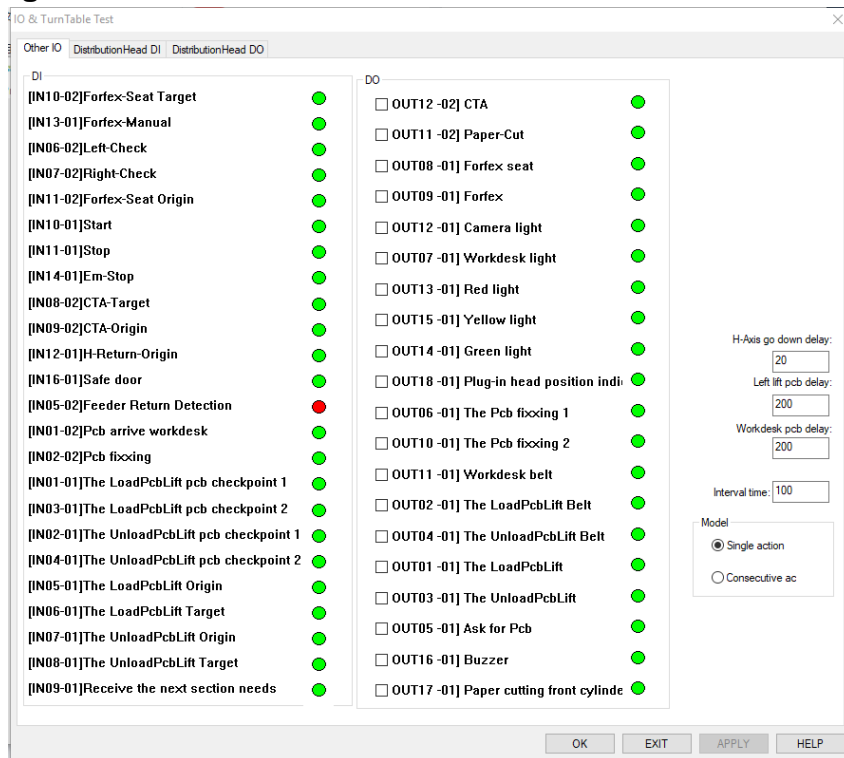
Displays the types of various plugins and the specific parameters of each type.

## List of Station:



List of Station

Here, you can select the component type according to the pin name on the PCB that was filled in when doing the program, set the corresponding component name, and determine the feeding direction. After the component type and loading direction are determined, the first column of the list will display the schematic image of the component at 0 degrees when plugging in. Please change the schematic image of the component against the PCB to ensure the correct loading. In addition, you can also set the number of materials in one roll when loading, so that when the remaining materials at the station are less than 80, the equipment will give a prompt that the materials at a certain station are about to run out, please pay attention to the loading. It is also possible to set the running speed of the P-axis separately, so that when playing different materials, the P-axis speed can be separated for better plug-in. The height of the component can be set, so that the P-axis can decide whether to drop a part in advance. When the material is high, if the component is so high that the mechanism does not allow the chain to feed in advance, the height can be set to be greater than 42, so that a complete After the action process, the chain will send a component.Feed station for changing components.

**2.2.3 I/O Diagnosis**


Other IO

**DI Signal:**

- Forfex-Seat Target - - - - - - -Check if the Forfex-Seat is in the target position.
- Forfex-Manual - - - - - - -Detect whether there is a signal of Forfex-Manual.
- Left-Check - - - - - - -Detects the left insertion condition of the component.
- Right-Check - - - - - - -Detects the right insertion condition of the component.
- Forfex-Seat Origin - - - - - - -Check if the Forfex-seat is in a low position.
- Start - - - - - - -When the start switch on the housing is pressed, the state changes from high to low and vice versa.
- Stop - - - - - - -When the stop switch on the housing is pressed, the state changes from high to low and vice versa.
- Em-Stop - - - - - - -When the start switch on the housing is pressed, the state changes from high to low and vice versa.
- CTA-Target - - - - - - -Check if the CTA is in the target position.
- CTA-Origin - - - - - - -Check if the CTA is in a low position.

- H-Return-Origin - - - - - -Click the "H-axis" switch on the panel, the H-axis is powered off, after clicking again, the H-axis is powered on and returns to its original position.
- Safe door - - - - - -Detect if the safety door is closed.
- Feeder Return Detection - - - - - -Check if the feeder is back to its original position.
- Pcb arrive workdesk - - - - - -Detect pcb arrival at workdesk.
- Pcb fixing - - - - - -Check if the PCB is fixed.
- The LoadPcbLift pcb checkpoint 1 - - - - - -Detect whether the Pcb is at the high position of the loader.
- The LoadPcbLift pcb checkpoint 2 - - - - - -Detect whether the Pcb is at the low position of the loader.
- The UnloadPcbLift pcb checkpoint 1 - - - - - -Detect whether the Pcb is at the high position of the unloader.
- The UnloadPcbLift pcb checkpoint 2 - - - - - -Detect whether the Pcb is at the low position of the unloader.
- The LoadPcbLift Origin - - - - - -Detect whether the Pcb is at the origin position of the loader.
- The LoadPcbLift Target - - - - - -Detect whether the Pcb is at the target position of the loader.
- The UnloadPcbLift Origin - - - - - -Detect whether the Pcb is at the origin position of the unloader.
- The UnloadPcbLift Target - - - - - -Detect whether the Pcb is at the target position of the unloader.
- Receive the next section needs - - - - - -Detect whether to transport the next Pcb to the workdesk.

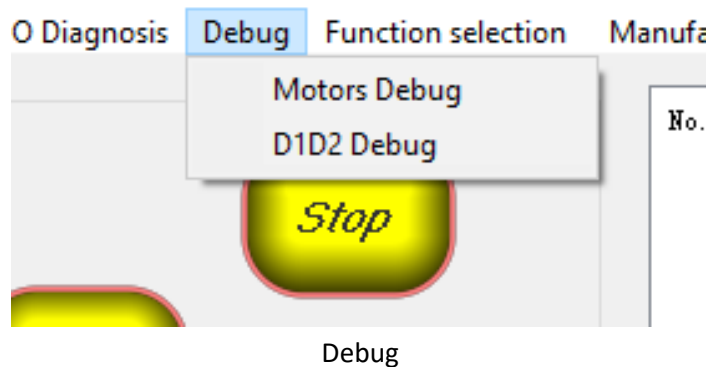
**DO Signal:**

- CTA - - - - - -The signal that drives the action of the CTA.
- Paper-Cut - - - - - -The signal that drives the action of the Paper-Cut.
- Forflex seat - - - - - -The signal that drives the action of the Forflex seat.
- Forflex - - - - - -The signal that drives the action of the Forflex.
- Camera light - - - - - -Indicator light of camera.

- Workdesk light - - - - -Indicator light of workdesk.
- Red light - - - - -Red indicator light on housing.
- Yellow light - - - - -Yellow indicator light on housing.
- Green light - - - - -Green indicator light on housing.
- Plug-in head position indicator light - - - - -Indicator light of plug-in head position.
- The Pcb fixing 1 - - - - -Signal that the Bcb is fixxed at position 1.
- The Pcb fixing 2 - - - - -Signal that the Bcb is fixxed at position 2.
- Workdesk belt - - - - -The signal that drives the action of the workdesk belt.
- The LoadPcbLift Belt - - - - -The signal that drives the action of the loadPcbLift belt.
- The UnloadPcbLift Belt - - - - -The signal that drives the action of the unloadPcbLift belt.
- The LoadPcbLift - - - - -The signal that drives the action of the loadPcbLift.
- The UnloadPcbLift - - - - -The signal that drives the action of the unloadPcbLift.
- Ask for Pcb - - - - -Indicator light of asking for Pcb.
- Buzzer - - - - -The signal that drives the action of the buzzer.
- Paper cutting front cylinder - - - - -The signal that drives the action of paper cutting front cylinder.

DO signals in a list, single and continuous action.

### 2.2.4 Debug



**Motors Debug:**



Motors Debug

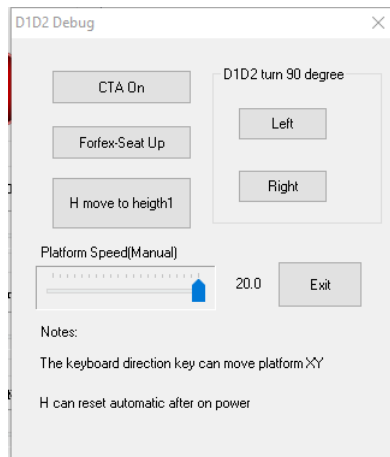
Set the movement amount and movement speed of each axis, and then move each axis according to the direction of the arrow on the button, and test whether the time movement direction of each axis is consistent with the direction indicated by the arrow; test whether the positive and negative limits are valid and reversed.

Test whether each axis can be returned to the origin and whether the position of the origin is correct.

- positive limit - - - - - - -Abbreviation for the photoelectric switch signal of the maximum limit position in the positive direction of each axis.
- negative limit - - - - - - -Abbreviation for the photoelectric switch signal of the maximum limit position in the negative direction of each axis.
- origin - - - - - - -Set "zero" detection signal.
- Stop position X - - - - - - -After the workdesk is "zeroed", the actual position of the X axis should be ahead of the zero position.
- Stop position Y - - - - - - -After the workdesk is "zeroed", the actual position of the Y axis should be ahead of the zero position.

- Turntable position X - - - - -The actual position of the X-axis before the turntable starts to turn.
- Turntable position Y - - - - -The actual position of the Y-axis before the turntable starts to turn.
- Plug-in axis height 1 - - - - -Abbreviation for the photoelectric switch signal of the maximum limit position in the negative direction of each axis.
- Plug-in axis height 1 - - - - -Abbreviation for the photoelectric switch signal of the maximum limit position in the negative direction of each axis.
- Plug-in axis height 1 - - - - -The plug-in shaft is attached to the plug-in component, and the position value of the component pins on the surface of the PCB board is a little higher than the position of the plug-in axis height 2, which is convenient to check whether the plug-in hole and the pins are aligned with each other..
- Plug-in axis height 2 - - - - -Where the plug-in shaft is fully down to the surface of the PCB.
- Restore the default values - - - - -The speed of each axis is restored to the factory guide value when leaving the factory

**D1D2 Debug:**



D1Debug

Used to set various parameters of CTA.

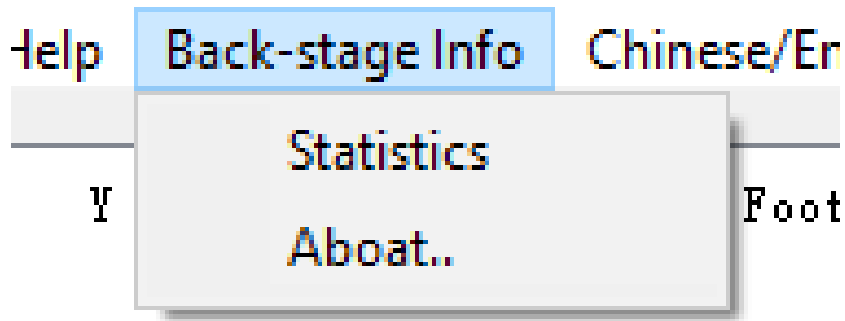
### 2.2.5 Manufactures Info

After clicking manufacturers Info, the manufacturer's information and logo will be displayed.

### 2.2.6 Help

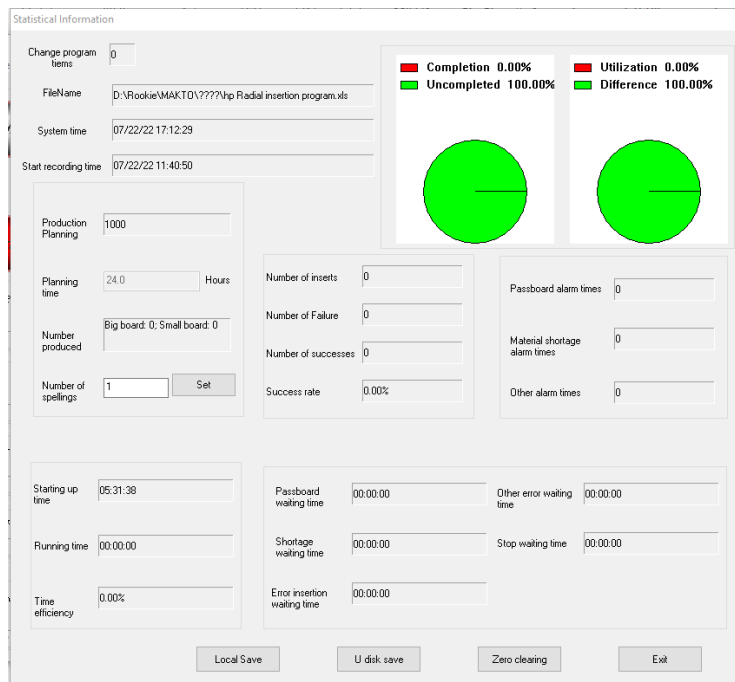
After clicking Help, the manual for the machine will open.

### 2.2.7 Back-stage Info



Back-stage Info

### Statistics:



Statistics

Displays statistics on production data and efficiency.

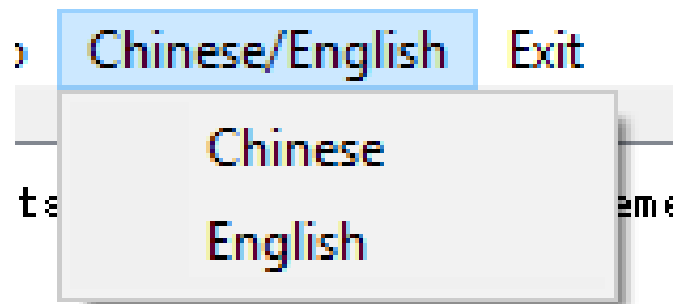
#### About S3010A:



About S3010A

Introduction to operating version and company.

#### 2.2.8 Chinese/English



Chinese/English

**Chinese:** Switch the operating language to Chinese

**English:** Switch the operating language to English

#### 2.2.9 Exit

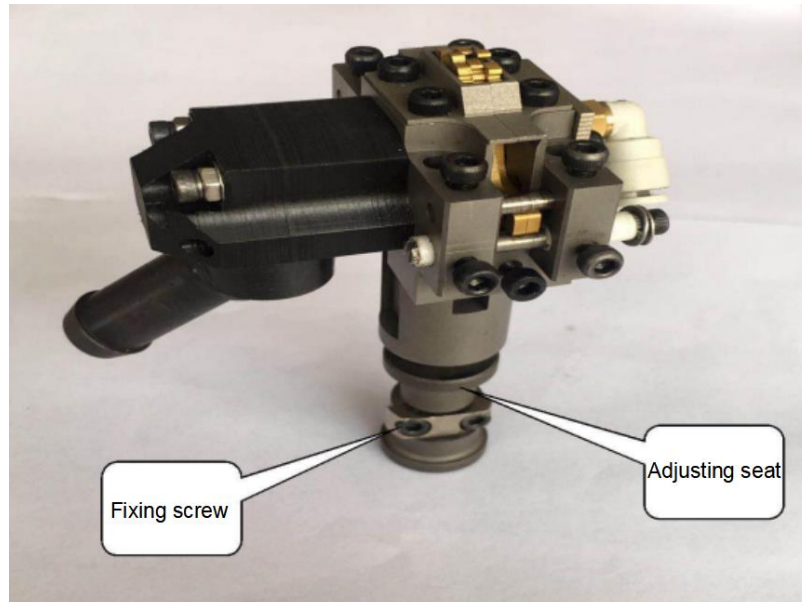
Exit the operating software



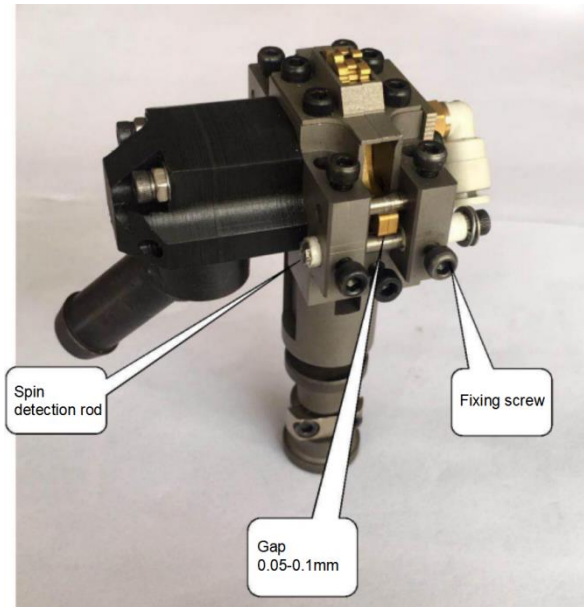
## Chapter 3. Machine Adjustment

### 3.1 Forflex Adjust

- Step 1 - - - - -Loosen the fixing screw of the adjusting seat, adjust the adjusting seat so that the upper scissors are closed 1/2-4/5, and tighten the fixing screw.

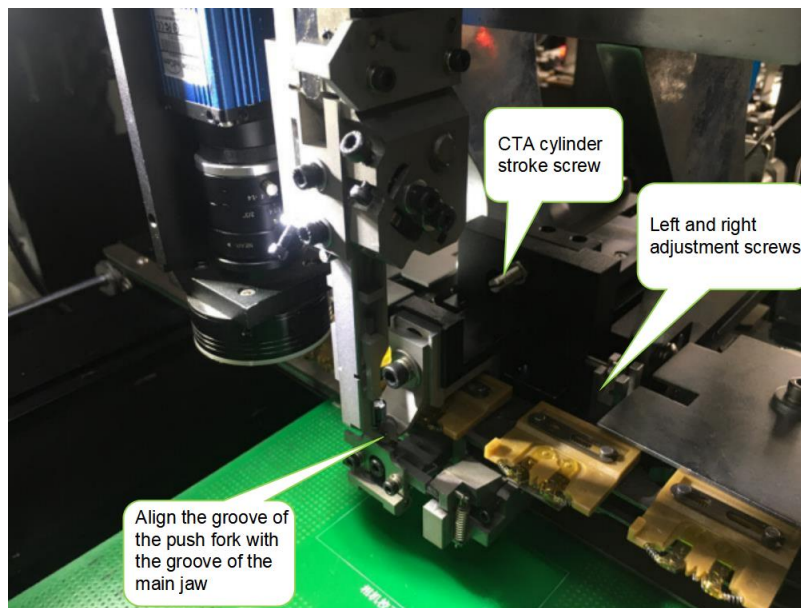


- Step 2 - - - - -To detect and adjust the forflex, loosen the fixing screw of the detection rod and adjust the eccentric pin with a flat-blade screwdriver so that the gap between the contact surface of the fixed knife and the distance of the detection rod is 0.05-0.1mm.

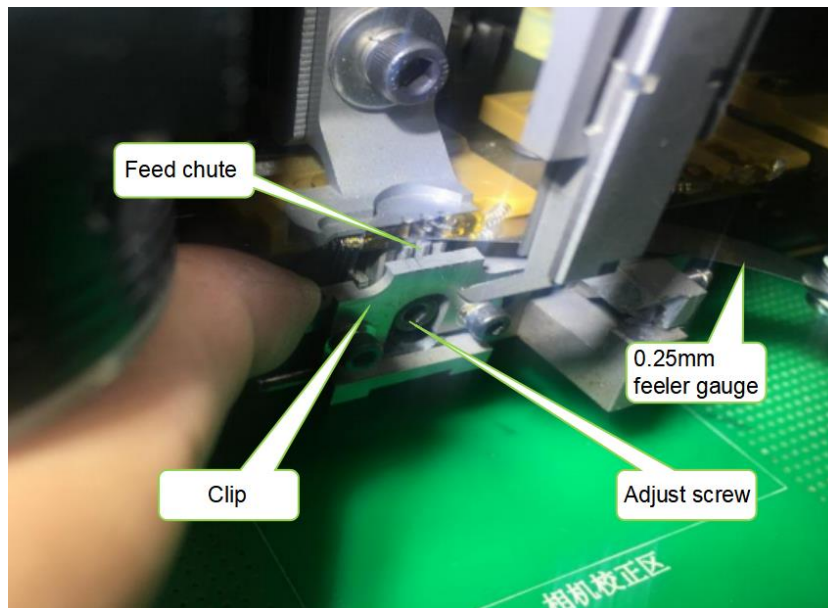
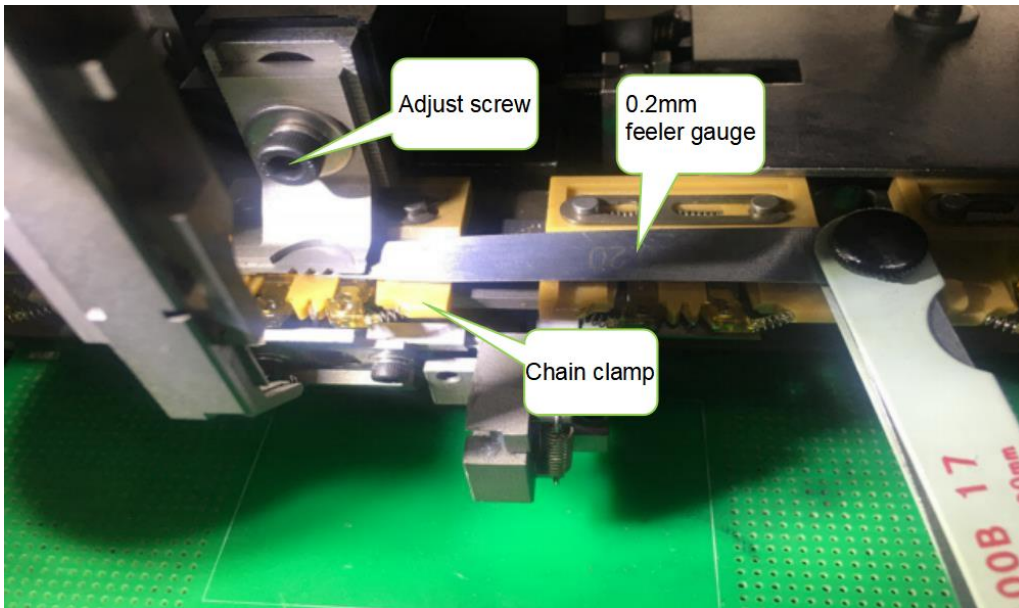


### 3.2 CTA Adjust

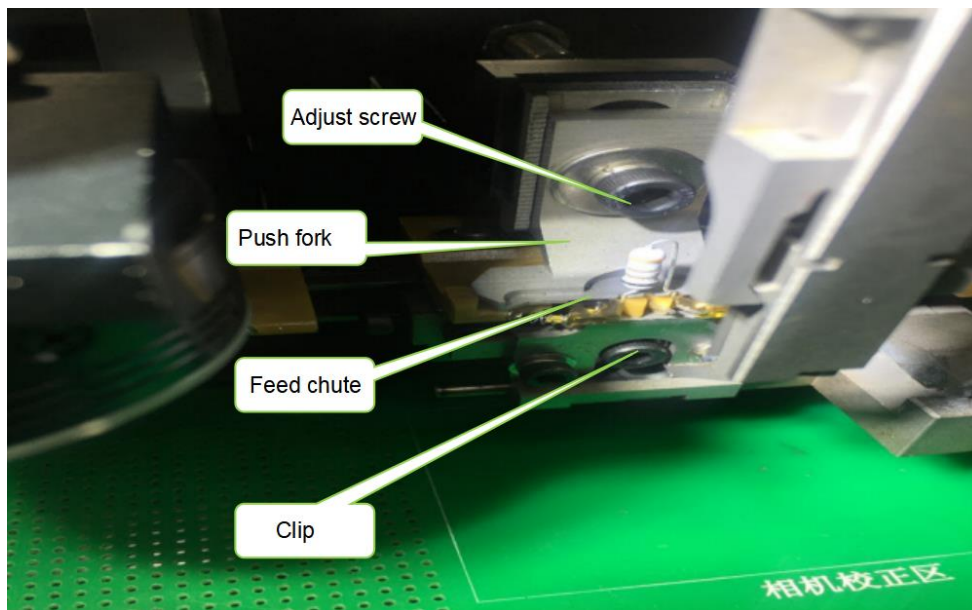
- Step 1 - - - - -CTA disassembly: Remove the L-axis chain from the CTA position, remove the CTA air pipe and photoelectric switch wire, and then remove the three M6 screws at the bottom of the CTA from the machine (the entire CTA is removed from the machine).
- Step 2 - - - - -CTA position adjustment: Slightly loosen the three M6 screws at the bottom and adjust the left and right adjustment screws to align the groove of the curved push fork with the groove of the main claw, and then adjust the CTA cylinder stroke screw to just push the main claw and the components are not deformed.



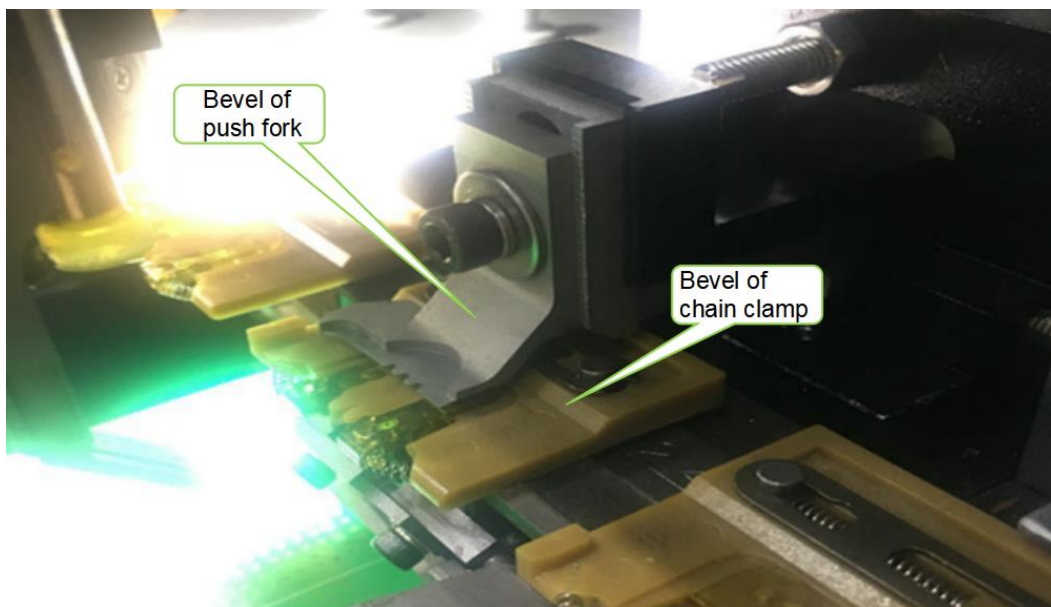
- Step 3 - - - - -Loosen the curved push fork screw to adjust the curved push fork and the surface of the chain clamp 0.2mm.



- Step 4 - - - - -Adjust the screw so that the push fork, the feeding slot, and the clamping piece can clamp the component feet at the same time when feeding.

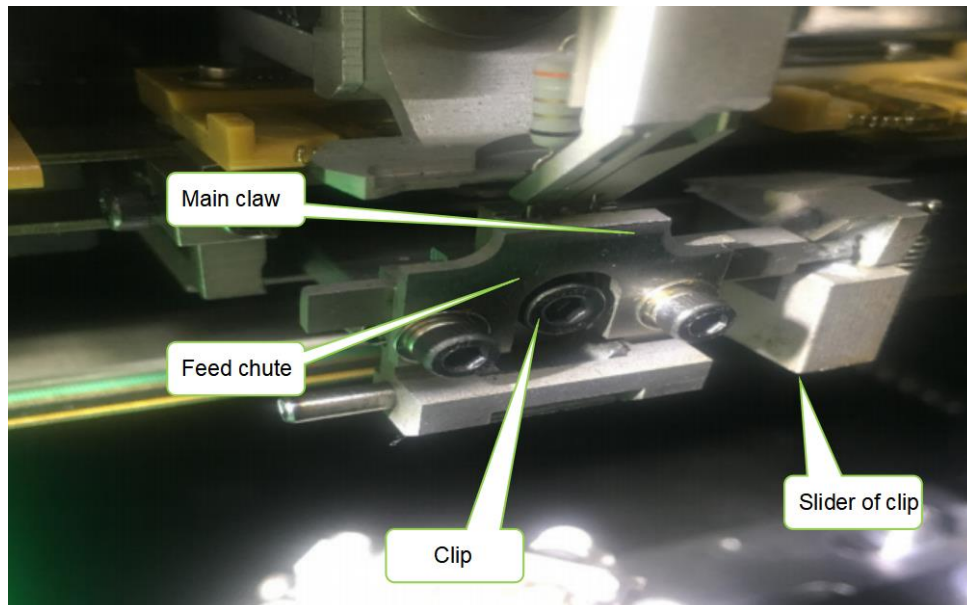


- Step 5 - - - - -Adjust the 1.5mm spacing between the pusher fork slope and the chain clip slope.

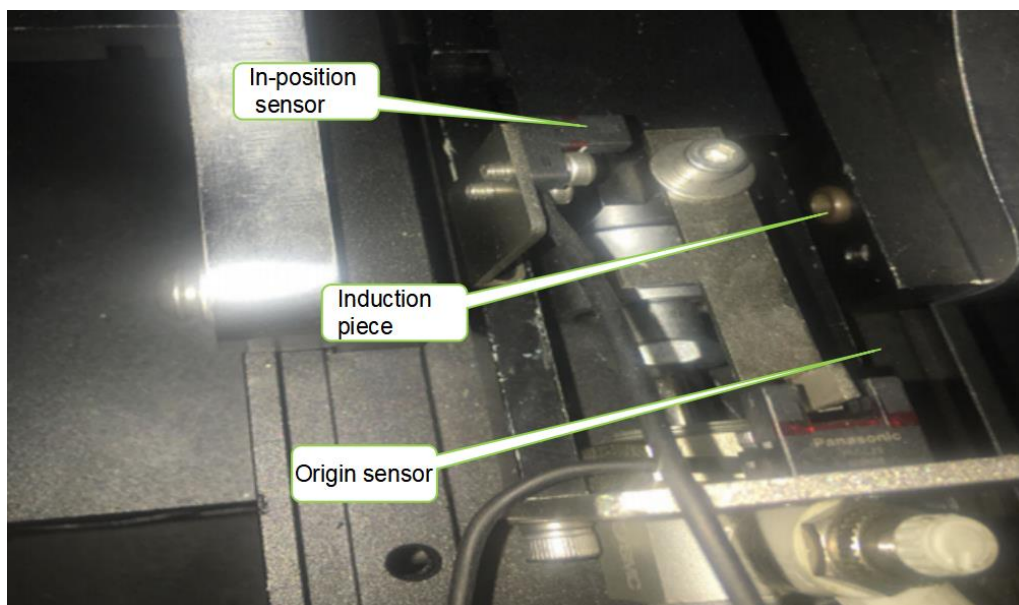




- Step 6 - - - - -Adjust the main claw and the feeding slot about 1.5mm and the push fork cannot hit the main claw, and then adjust the slider of the clip to open the clip by 2-3mm.

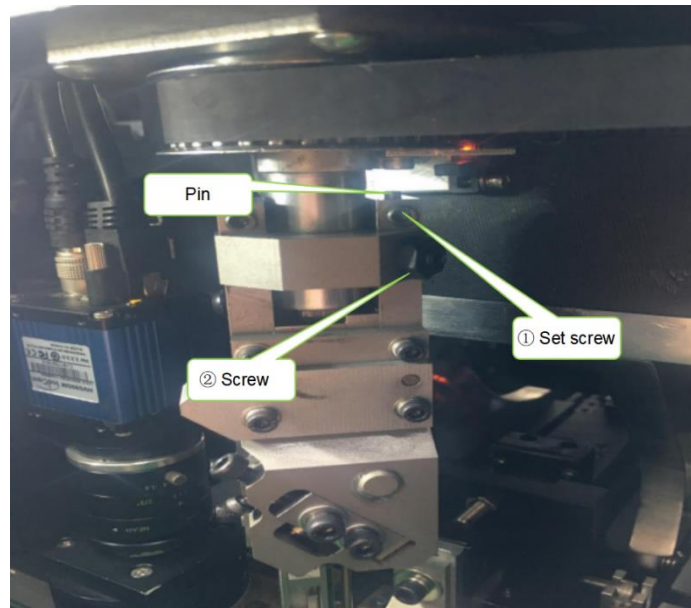


- Step 7 - - - - -Adjust the origin position so that the induction piece can just be sensed, the CTA pushes out the 1mm sensor to light up, adjust the CTA in-position sensor seat so that the induction piece just senses the in-position sensor (Note: the origin sensor and in-position sensor cannot be sensed in advance ).

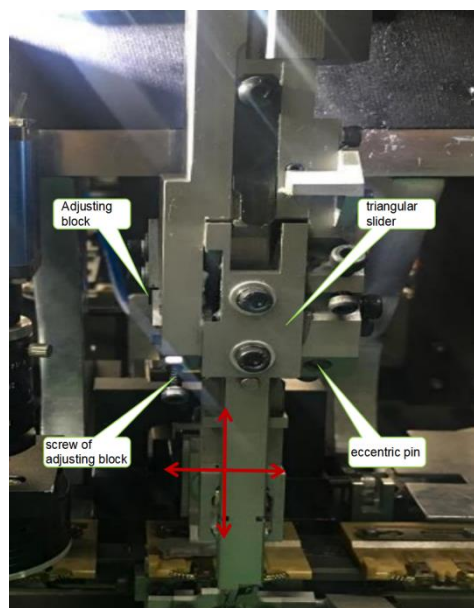


### 3.3 Plug-in Head Adjust:

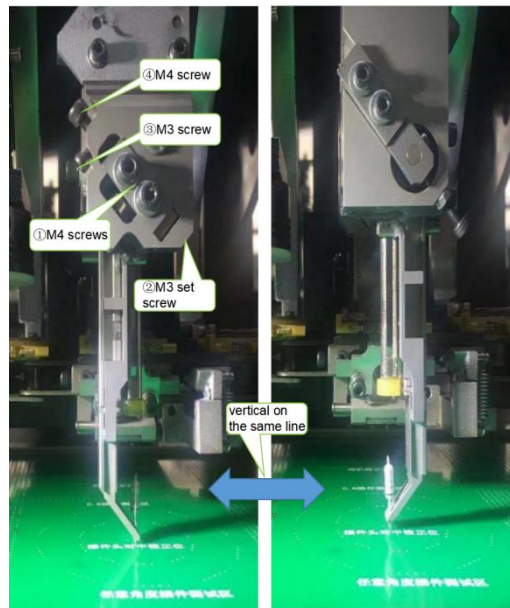
- Step 1 - - - - - - - - - - Plug-in head removal: Press the Em-stop, loosen the ① set screw of the plug-in head machine, then loosen the ② screw, and then take out the pin, you can take it off.



- Step 2 - - - - - - - - - - Plug-in head tightness adjustment: Use a flat-blade screwdriver to adjust the eccentric pin so that there is no left and right swing, and the triangular slider moves up and down smoothly. Adjust the screws of the adjusting block so that the triangular slider does not swing up and down.

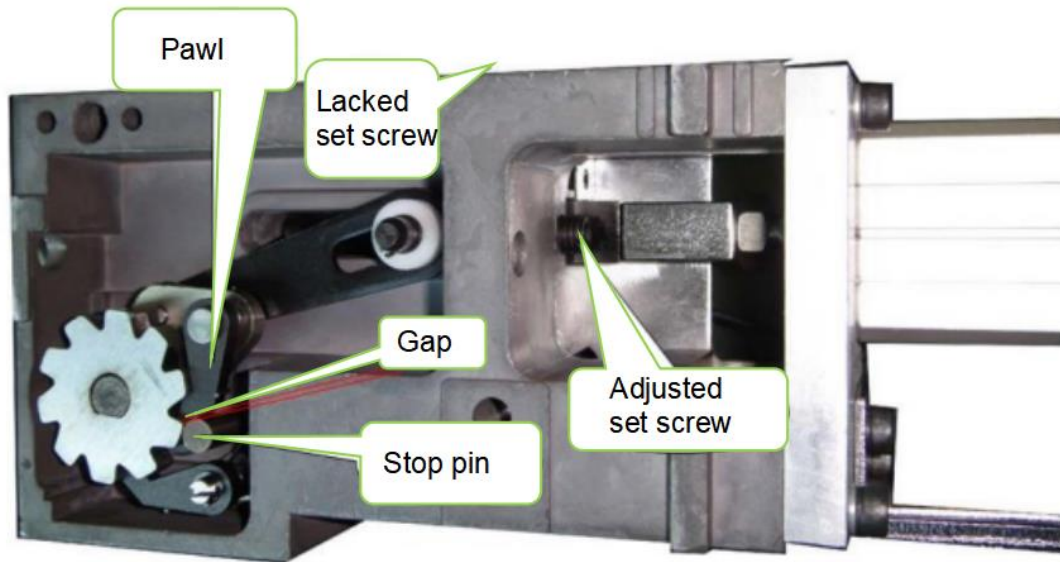


- Step 3 - - - - - -Loosen the two ①M4 screws, loosen the ②M3 set screw, loosen the ③M3 screw, and then adjust the ④M4 screw so that the triangular slider is pressed to the bottom. Load a plate CTA on the worktable and send a 5.0mm material, rotate the D-axis 90 degrees to move the worktable so that the components are just inserted into the holes, then rotate the D-axis to -90 degrees, and adjust the ②set screw and ④M4 screw to make the correct position. Minus 90 degrees are all on a straight line, and can be inserted into the hole at the same time.

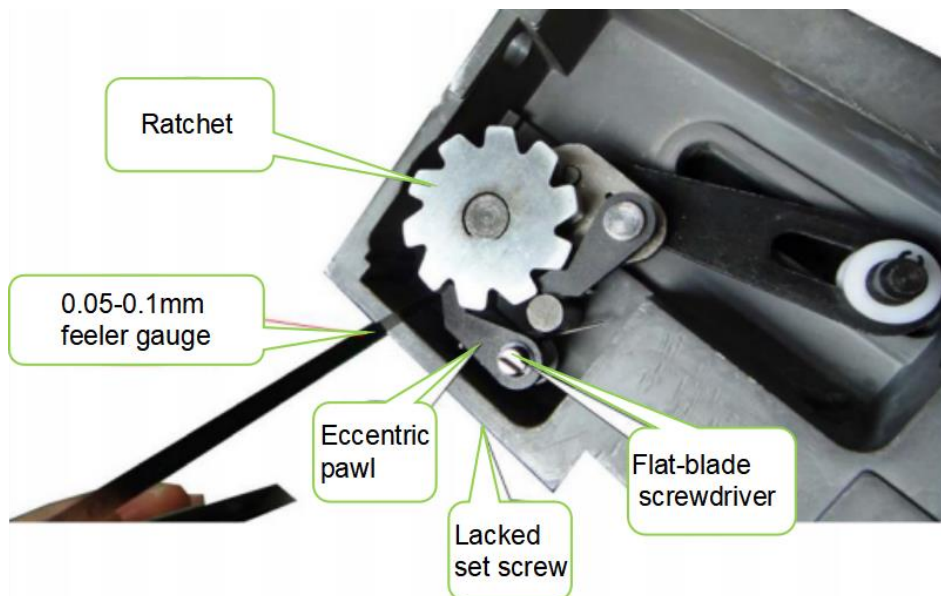


### 3.4 Feeder Adjust:

- Step 1 - - - - -The bottom of the dispensing head is upward, and when the main slider is adjusted to return (adjust the machine to 8mm), the distance between the pawl and the stop pin is 0.01-0.05mm, and the machine is locked tightly.

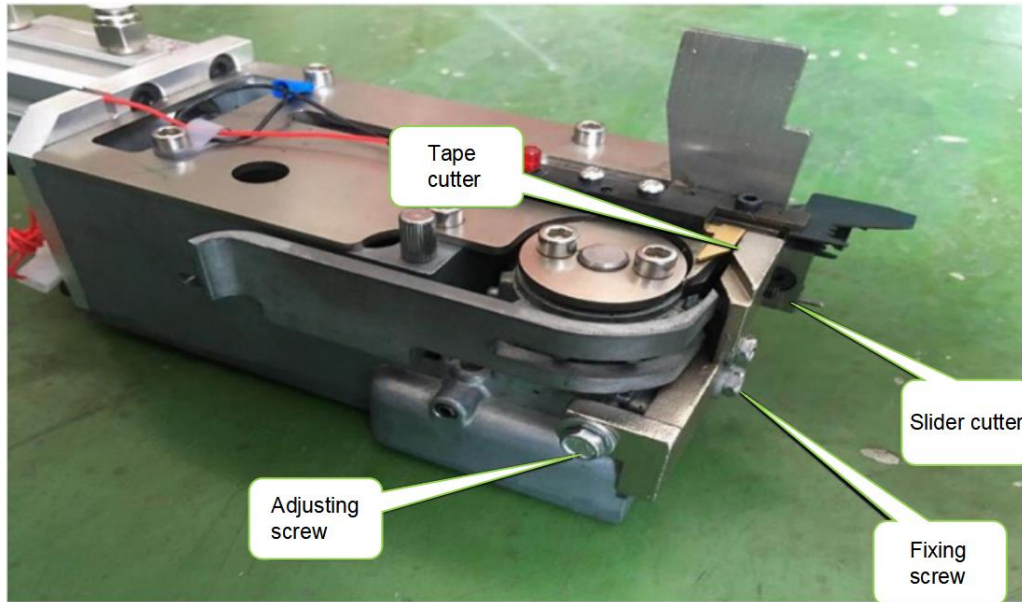


- Step 2 - - - - -Use a flat-blade screwdriver to adjust the 0.05-0.1mm gap between the eccentric pawl and the ratchet, and lock the machine.

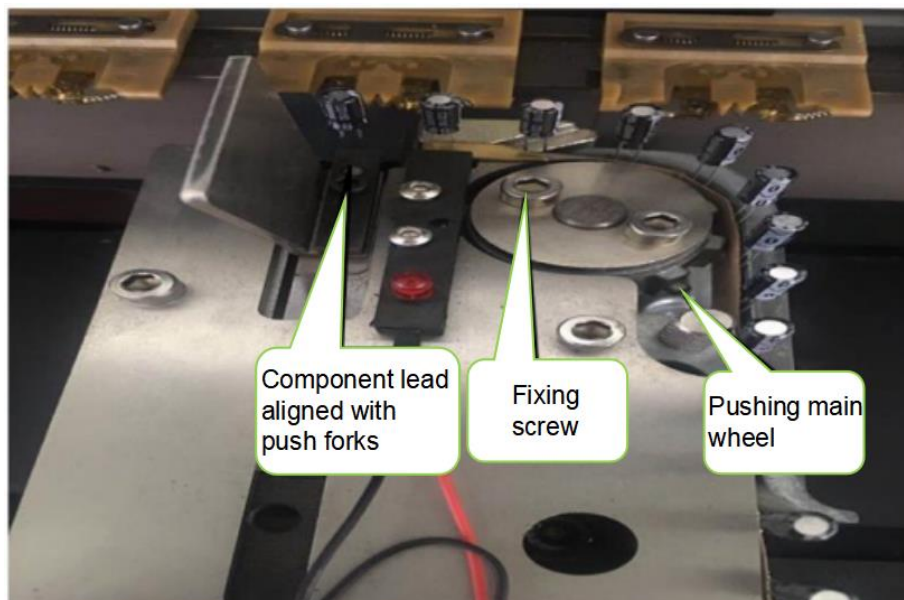




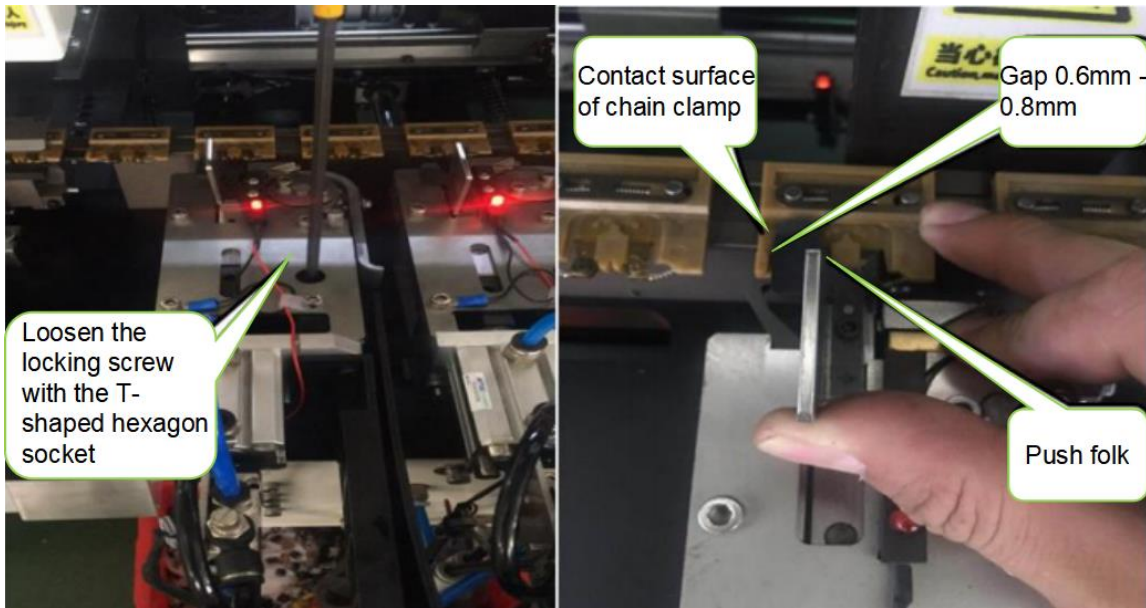
- Step 3 - - - - -Push out the main slider, adjust the adjusting screw so that the gap between the slider cutter and the tape cutter is 0.038mm, and the main slider can be pushed out smoothly before and after, and then lock the fixing screw.



- Step 4 - - - - -Loosen the two fixing screws on the main wheel of the material stopper, align the corresponding component lead with the fork type push piece of the station and lock the fixing screws (if it is 5.0mm component, the 5.0 on the left shall prevail).



- Step 5 - - - - -First, return to zero to confirm that the L-axis chain is at the origin position, loosen the feeder locking screw, make the contact surface gap between the pusher fork and the chain clamp 0.6mm-0.8mm, and adjust the locking feeder.



- Step 6 - - - - -Adjust the cylinder stroke, loosen the cylinder nut, and drive the solenoid valve manual switch, so that the feeder material is just sent to the chain clip, and the components can be moved up and down manually with a little resistance and no component foot deformation.