Aurotek®

γ -S330M

2-Slide PCB Separator

User Manual

Version 1.1.5

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γ-S330M 2-Slide PCB Separator User Manual

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This user manual is subject to revision. The user manual will be updated when reprinted but there will be no separate notification.

γ-S330M 2-Slide PCB Separator

Model:	
S/N:	
Software Ver.:	
Spindle S/N:	
Date Manufactured:	

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Contents

Warranty

The machine has been thoroughly inspected before delivery and its warranty is guaranteed by Aurotek with the following conditions.

1. Warranty Period

Up to 12 months from time of delivery by Aurotek or 3,000 hours of service by the spindle.

2. Warranty Coverage

Any malfunctions that occur during the course of normal use will be repaired for free by Aurotek, with the following exceptions.

- Natural fading in the coating.
- Wear and tear of consumables.
- Changes in noise, heat or perceived phenomena that does not affect the machine's operation.
- Improper use or operation by the user.
- Improper maintenance.
- Use of non-Aurotek approved parts.
- Non-Aurotek approved modifications.
- Damage resulting from natural disasters.

The warranty is only valid for the machine itself and does not apply to any other problems. The user should contact Aurotek or the distributor if they have any questions about the operation of the machine.

3. Warranty Service

The price of the machine does not include the compiling of processing programs or the costs of on-site technical support. Additional charges will therefore apply even during the warranty period in the event of the following.

- Supervision of installation, assembly, calibration and test run.
- Scheduled maintenance.
- Technical instruction or training in operation or wiring.

- Technical instruction or training in the processing program and other related matters.

- Other premium services or operations specified by Aurotek.

Safety Precautions

Please read carefully through the user manual and attached documentation before installation, operation, maintenance and inspection.

The user should be thoroughly familiar with the machine, safety information and precautions before use.

SAFETY PRECAUTIONS ARE CLASSIFIED AS "DANGER" OR "CAUTION" IN THIS USER MANUAL.

⬦**DANGER**	Improper use may result in injury or death.
⚠**CAUTION**	Improper use may result in moderate injury or property damage.
🚫**PROHIBITION**	Prohibited.

Items marked for attention may also lead to serious incidents in certain circumstances. The safety instructions are very important and should be followed at all times.

1. Usage precautions

⬦**DANGER**
✪Due to electrocution hazards, please follow these instructions.
(1) Make sure that the machine is properly grounded to prevent the risk of electrocution.
(2) Please turn off the power and make sure all the status lights on the control panel have gone out before moving, re-wiring, maintaining or inspecting the machine to prevent the risk of electrocution.

⚠ **CAUTION**
(1) Do not operate in a damp environment or near corrosive gases, flammable gases or flammable objects to prevent the risk of fire.
(2) Do no touch the servo and motor mechanisms while power is on or shortly after power is turned off to prevent the risk of burns.

2. Storage and Transportation

(1.)The machinery leaves the plant when stapler by wooden box , aluminum foil of cotton bags coated inside with mechanical body.

(2.)Wooden box to car transportation, shipping, air transport can be, to avoid the to jolt car to be quite the road, loading and unloading of goods to avoid falling down. The environment during transport, please control the temperature 0 ~ 40 ℃, humidity below 85%.

(3.)Machinery to the scene to pull apart wooden nails and around the top of the chips, then more than 1 ton of mechanical lift truck, the bottom of the wooden box will be removed before it can be put down to Mechanical own casters machinery.

🚫 PROHIBITION
(1) Do not store in a location exposed to rain, water or hazardous gases/liquids.
(2) Do not leave loose parts on the machine.

3. Installation

⚠ CAUTION
(1) Avoid strong and sudden impacts as they may affect the machine's normal operation.
(2) Please ensure that the wiring is correct to prevent the risk of electrocution, injury or fire.
(3) Please check that the power supply is correct to prevent the risk of electrocution, injury or fire.
(4) Please check that the air pressure is normal to avoid leaks or damage.
(5) If the optional voltage transformer is included, please check that the power supply is correct to prevent the risk of electrocution, injury or fire.

4. Operation

⚠ CAUTION
(1) The operation of the machine in any manner other than that specified in the user manual is strictly prohibited. Please contact Aurotek or the distributor if there are any questions.
(2) The user must thoroughly understand every aspect of the machine's operation and the function of every button before installation and use.
(3) People with loose clothing and unsecured hair should not operate or maintain the machine. The power plug should be disconnected while the machine is being assembled, calibrated or maintained. **Under Maintenance** signs should be displayed prominently around the machine to prevent other people from accidentally re-connecting the power.

(4) A system of verbal safety checks should be used if there are multiple operators especially before providing power, cutting power or any motor and spindle movements to prevent accidents.

(5) To prevent any unnecessary damage, please check wiring to ensure that the power cable and signal wires are correctly connected before providing power to the machine.

(6) The safety hatch should be closed or safety goggles worn when the spindle is in operation to prevent eye damage from cuttings or cutter fragments.

(7) Do not touch the moving parts.

(8) Do not touch the cutter tip while the machine is in operation.

(9) The dust produced from PCB cutting should be removed using a powerful dust collector and vented outside for disposal in accordance with industrial waste disposal regulations.

(10) If the dust collector can not effectively reduce the volume, it is recommended that operators wear soundproof earmuffs, near the same for the operator.

(11) Machine operation, mainly in standing position, over the long standing, prone to the following symptoms:

- Lower back pain, neck pain: initial symptoms that lower back pain, neck stiffness, limb muscle Torsion bars. And even more severe upper limb numbness, sciatica, and muscle atrophy, muscle Subside

- Knee bursitis: Initial find joint swelling, pain, severe joint deformity, difficulty in walking.

- Deformed toe: toe caused by long standing valgus, joint deformation.

- Lower extremity edema: the initial feel leg cramps, ankle swelling.

- varicose veins: venous circulation, heavy legs, leg pain, lower extremity venous expansion Distorted, and even bleeding bruising, nerve.

- Dizziness: long standing head and neck caused by a sense of discomfort or dizziness.

- Proposed actions to prevent back pain as follows:

  1). The work site to provide an adjustable foot pad or seat.

  2). To avoid repeating the same posture for a long time.

  3). The work site should be designed to take the rotation of the

space station.

4). Provide for rest and warm-up time arrangements such as job rotation.

5). Belt strap reduce lower back muscle injury.

6). Musculoskeletal injury prevention health education.

7). Workplace Health Exercise.

■ Prevention of lower extremity edema, varicose veins:

Avoid prolonged standing, limiting overtime, provide personal protective equipment, such as elastic stockings

■ Prevent dizziness caused by long standing:

Timing driven workplace health exercise.

5. Maintenance and Inspection

🚫 **PROHIBITION**
(1) Unauthorized disassembly and repair is prohibited.

6. Disposal

⚠ **CAUTION**
(1) This machine should be disposed of as industrial waste.

1 Overview

The γ-S330M is a stand-alone PCB cutting machine that automatically completes the board cutting operation once the operator places the PCB on the work bench. In addition to its high precision and safety, the high-speed spindle motor and cutter keeps mechanical stress in the PCB to a minimum during cutting. The twin slides allow for alternate feeding, reducing idle time and improving productivity.

The channels in the cutter itself help with dust removal and direct dust generated during cutting to the collector in the base. This helps to keep the environment clean and avoid unnecessary pollution.

The machine is easy to operate. A supplementary CCD camera and the graphical user interface allow the user to quickly and accurately define and manage the cutting paths.

Graphical User Interface
The user interface is based on the Windows GUI operating system and is easy to use. A CCD camera is also used to display a 10X image of the PCB to improve training precision.

Spindle Motor
High-speed spindle motor to reduce mechanical stress during cutting (60,000 rpm).

Collector Funnel
Designed using fluid dynamics. Uses downward collection for high efficiency.
Safety Device
Use block-out infra-red sensors to reduce the risk of personnel inadvertently intruding on the processing area.

Axial Motor
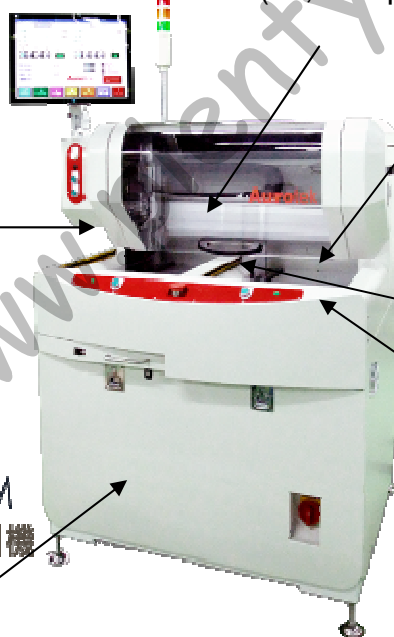Uses a high precision/response AC servo motor (Panasonic Minas) and modular actuator.

Twin Slides
The twin slides allow for alternate feeding, reducing idle time and improving productivity.

Controller
PC-based 4-axis motion controller.

2 Installation

2.1 Installation environment

(1) Please keep the cooling vents on the side and rear of the control cabinet clear during installation. (Poor ventilation will not only affect machine performance but also increase the likelihood of malfunction)

(2) Foreign contaminants should not be allowed to enter the vents. As the controller is not water-resistant or dust-proof, do not place in an environment filled with dust or oil vapor.

(3) The machine should not be exposed to large sources of radiant heat including direct sunlight or curing ovens.

(4) Please locate the machine in an environment with temperatures between 5~ 40°C, humidity between 35%~80% (no condensation), and no corrosive or flammable gases.

(5) Please do not locate the machine where it is exposed to vibration or sudden shock.

(6) Please ensure that the machine is not affected by power noise due to improper wiring or operation.

(7) Please protect the machine's internal components against damage by rats and other threats.

(8) The local placement firm ground should be flat.

2.2 Power supply

The machine must be provided with a tri-phase 4-wire AC 220V±5% 20A external power supply (minimum capacity of 3kW). An external voltage regulator should be fitted if the power quality is poor.

2.3 Machine installation

(1) Place the machine at the installation site and raise the four supports until the wheels are around 1 cm off the ground. Tighten the screws to secure the supports.

(2) The machine's power supply is inside the control cabinet on the back. Please connect the wiring as shown in "Fig. 2.1 Power Supply Wiring Diagram" and flip the control panel circuit breaker inside to the ON position.

(3) If the optional transformer is selected, please screw the input wire to the circuit breaker on the back of the machine and flip the circuit breaker to the ON position. (Optional)

(4) Please make sure that the machine is grounded using the type 3 method (standalone ground not linked in tandem with other equipment).
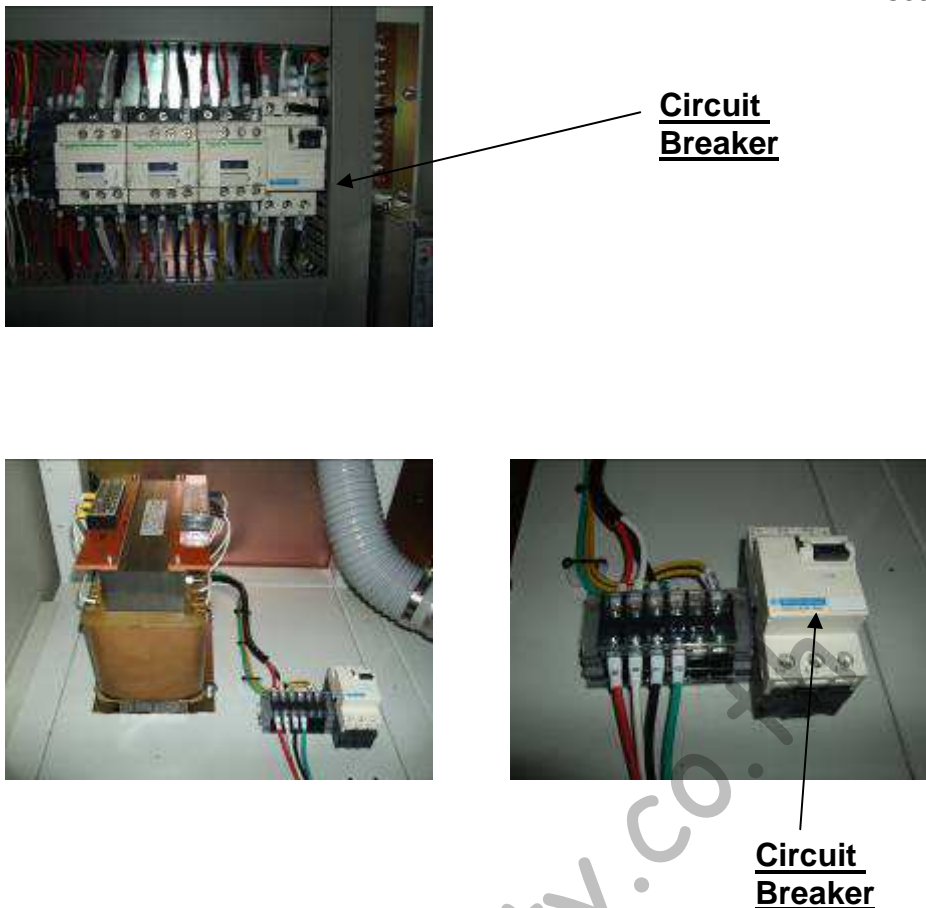
Circuit Breaker

Circuit Breaker

Figure 2.1 Power Supply Wiring Diagram

(5) Please connect the γ-S330M collector port to the suction port under the collector. The collector's exhaust should then be directed outside.

(6) Connect the collector's power supply to the separator's collector power socket and make sure that the collector motor is turning in the indicated direction. Suction will be significantly weaker if the motor is turning in the wrong direction. If this happens, switch any two of the three power supply wires to change the motor's direction.

(7) The PVC hose between the γ-S330M and the collector should be no longer than 3 m to avoid impacting on suction performance.

(8) We recommend one collector per γ-S330M for optimum dust removal performance.

(9) As static electricity can build up while cutting under certain circumstances, we recommend adding a fan-type static eraser to reduce the amount of clinging dust.

(10) Please connect the compressed air hose as shown in Fig. 2.2 and pump in compressed air (air pressure of at least 5 Kg/cm^2). Use the air pressure adjustment button to keep the machine's air pressure at around 5 Kg/cm^2.

(11) The compressed air should be dry. The air regulator filter should be checked regularly for water build-up. Any water build-up should be drained using the lower drain.

Figure 2.2 Compressed air connection and adjustment

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3 Dimensions & Specifications

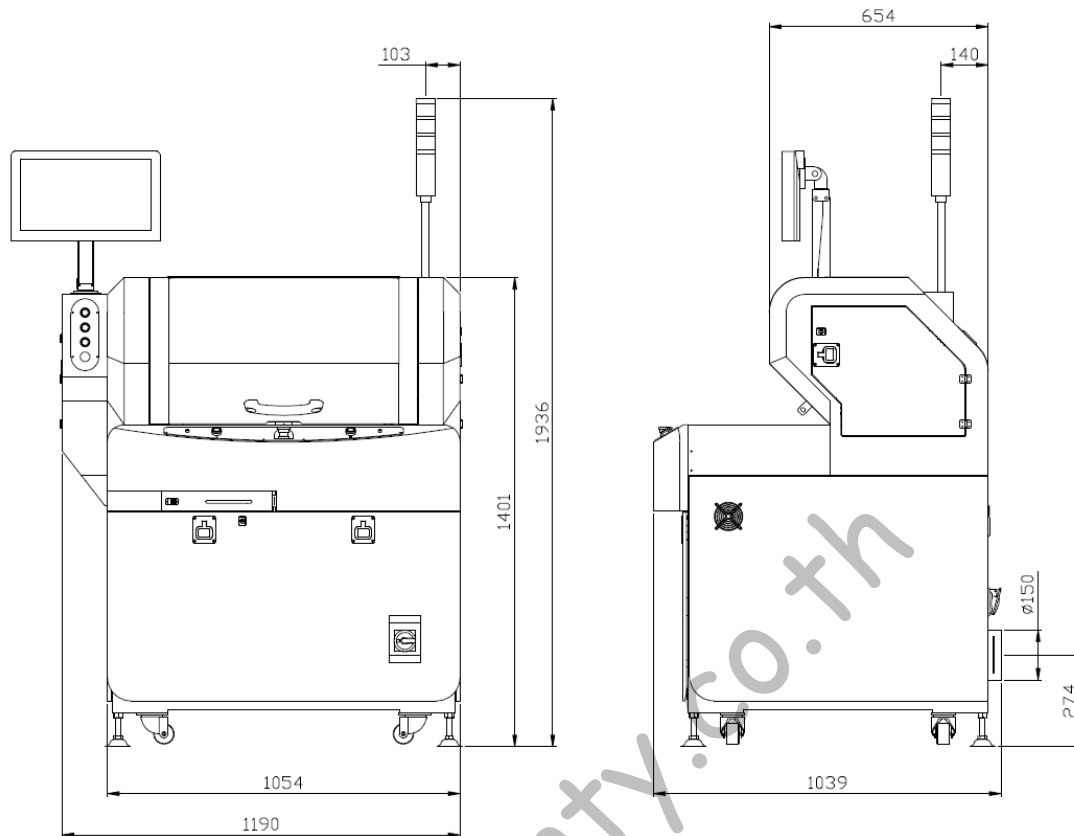## 3.1 PCB Separator external dimensions and specifications

Figure 3.1 γ-S330M external dimensions

Table 1. γ -S330M Specifications

Name	Specifications
External Dimensions	1190mm (Width) ×1039mm (Depth) × 1936 mm (Height)
Cutter Diameter	φ0.8mm ~ φ3.175mm, left-hand thread (cutting dust goes downwards)
Positioning Precision	± 0.01mm.
Number of Axes	4-axes (X, Y1, Y2, Z).
Working Area	X: 330mm, Y: 330mm, Z: 15mm
Traverse Speed (Max.)	X, Y1, Y2: 1000mm/sec, Z: 750mm/sec.
Cutting Speed (Max.)	X, Y, Z: 100mm/sec.
Spindle Motor	High speed inverter motor, 150W. Three speeds: 45,000 rpm, 40,200 rpm, 40,000 rpm.
Cutting Mode	Line, L-Cut, U-Cut, Arc, Cir.
Cutting Path Planning	Direct coordinates or JOG training mode.
Axial Motor	200W AC servo.
Power Supply	3-phase 4-wire AC220V±5% 20A 50/60Hz, 4kW (Note 1).
Weight	390 Kg.
Compressed Air Supply	Dry air over 5 Kg/cm^2.

Note 1: The power rating includes the load from the collector YSF-V553 3Hp when it is connected directly to the machine. Only 2.2 kW is necessary if it is connected to a separate power supply.

3.2 Collector dimensions and specifications

The collector is used for collecting cutting dust. It uses a 3-phase 4-wire AC220V±5% 20A power supply. Please check the air-flow direction marked on the motor vent to make sure that the motor is turning in the right direction. Correct air flow means the wiring is connected properly.

Cutting dust will fall in the collection area shown in Fig. 3.2. The dust can be collected and disposed off as industrial waste by the user. The rocker arm is used to regularly shake (every 1 ~ 2 working days, depends on cutting quantity) the collector bag inside the dust collector. It shakes the dust loose from the bag walls to improve collection efficiency.
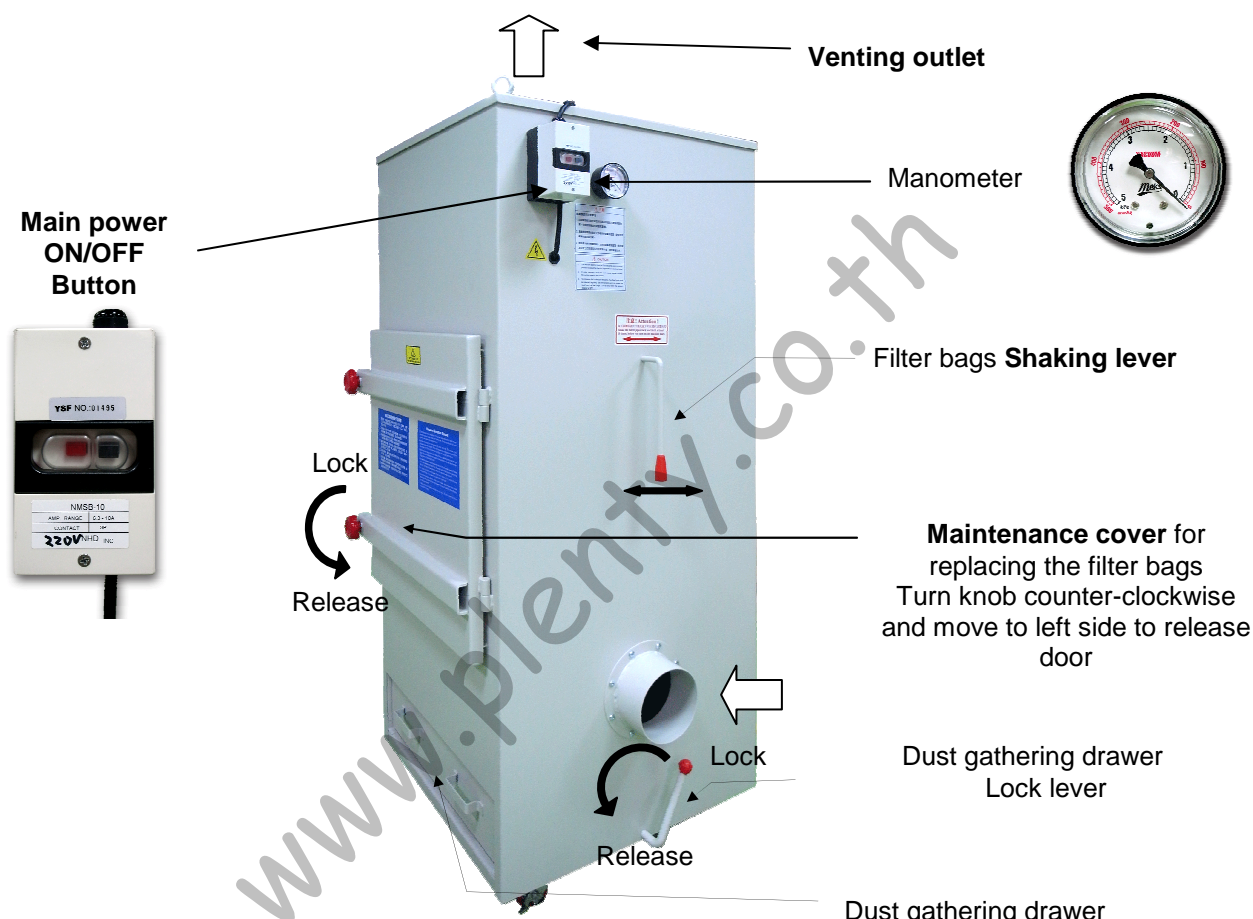

Figure 3.2 Collector components

Table 2. YSF-V553 Collector specifications

Name	Specifications
External Dimensions	665mm (Width) ×635mm (Depth) × 1,610mm (Height)
Weight	195 kg.
Motor Power Output	2.2 kW.
Power Supply	3-phase 4-wire AC220V±5% 15A 50/60Hz 3Hp.
Suction Speed	26 m/sec.
Suction Volume	28 m^3/min.
Suction Pressure	300 mm-Ag.
Noise	Under 78 dB.
Inlet Diameter	150mm.

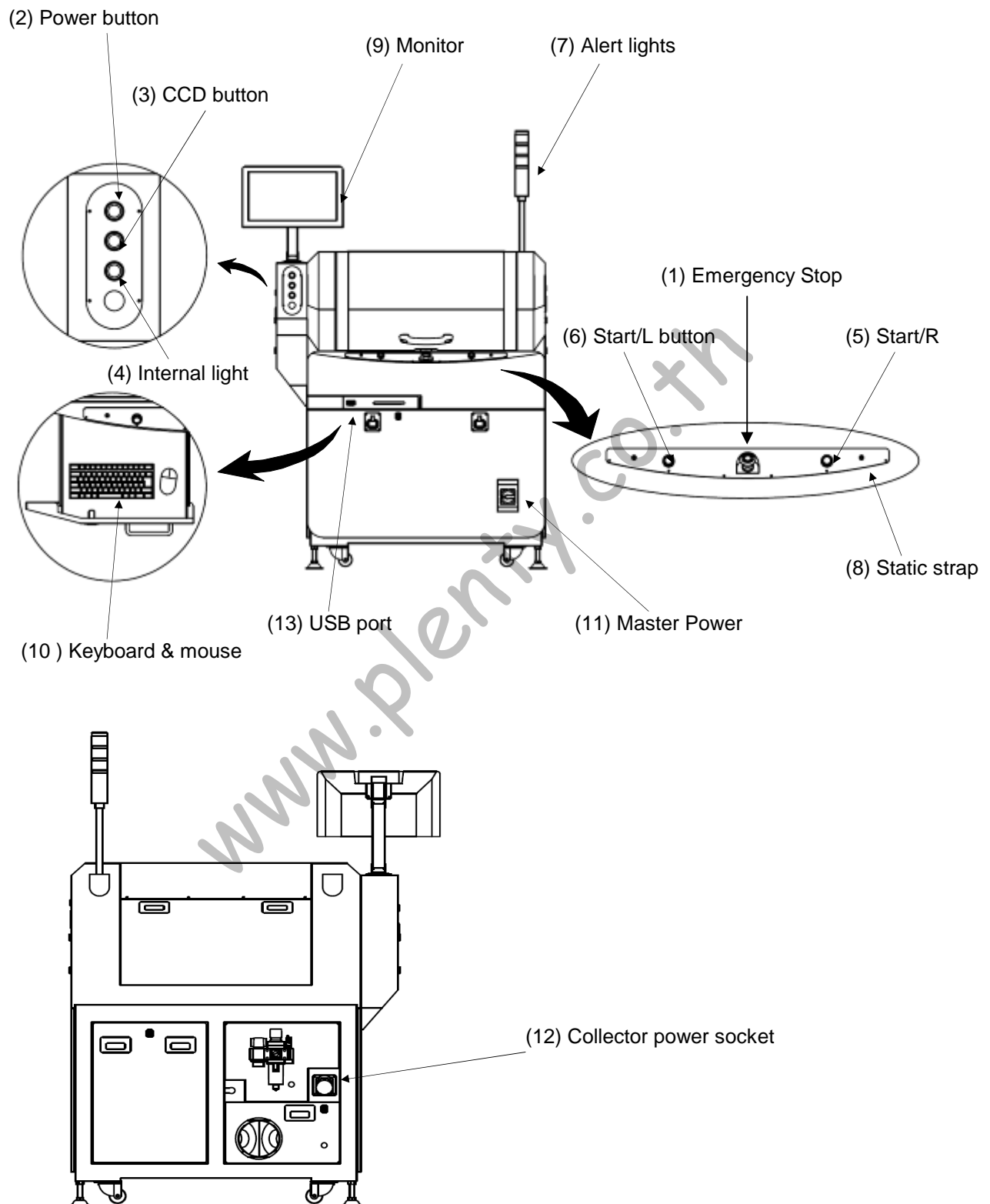| Outlet Diameter	203mm
Filter Area	5.2m^2.
Accessories	Power cable: 3M (corrugated). PVC flexible hose 6" x 3M.

4 Buttons and Functions

4.1 Control Panel

(2) Power button

(3) CCD button

(9) Monitor

(7) Alert lights

(1) Emergency Stop

(6) Start/L button

(5) Start/R

(4) Internal light

(8) Static strap

(13) USB port

(11) Master Power

(10) Keyboard & mouse

(12) Collector power socket

Figure 4.1 Control panel

(1) Emergency Stop button

Pressing this button immediately stops the machine. This is a self-locking switch. To unlock, please rotate clockwise.

(2) Power button

Pressing this button turns on power to the machine. After a 15-sec startup process the machine will enter the zero return stand-by mode. The zero return button on the monitor will start blinking.

(3) CCD button

Pressing this button turns on the CCD. Pressing this button again turns off the CCD.

(4) Light button

Pressing this button turns on the machine's internal light. Pressing this button again turns off the internal light.

(5) START/R button

In execute mode, pressing this button makes the right jig move forward to the processing position. The machine will then start cutting the PCB as programmed.

(6) START/L button

In execute mode, pressing this button makes the left jig move forward to the processing position. The machine will then start cutting the PCB as programmed.

Status	START/L	START/R
Zero reset not completed	**Blink**	**Blink**
Zero reset completed	ON	ON
In operation	ON	ON
Malfunction	OFF	OFF

(7) Alert lights

Shows the machine's current status.

Status	Green	Yellow	Red
Zero reset not completed	OFF	Blink	OFF
Zero reset completed	ON	OFF	OFF
In operation	OFF	ON	OFF
Malfunction	OFF	OFF	ON

(8) Static strap connector

For connecting the static strap.

(9) Monitor

Displays program buttons and processing information.

(10) Keyboard and mouse

Used to control the machine and input data.

(11) Master Power switch

Turns on/off power to the entire machine.

(12) Collector power socket

Provides power for the YSF-V553 or YSF-V605 collector. Power output is 3-phase 4-wire AC220V±5% 10A ~ 16A. Power to this socket will be automatically cut if the machine is idle for more than 3 minutes. It will not turn on until the machine begins processing again.

(13) USB port

Allows for programs to be backed up to or uploaded from an external USB device.

4.2 Main Interface

When the machine completes the boot-up process the screen shown in Fig. 4.2 will appear on the monitor.
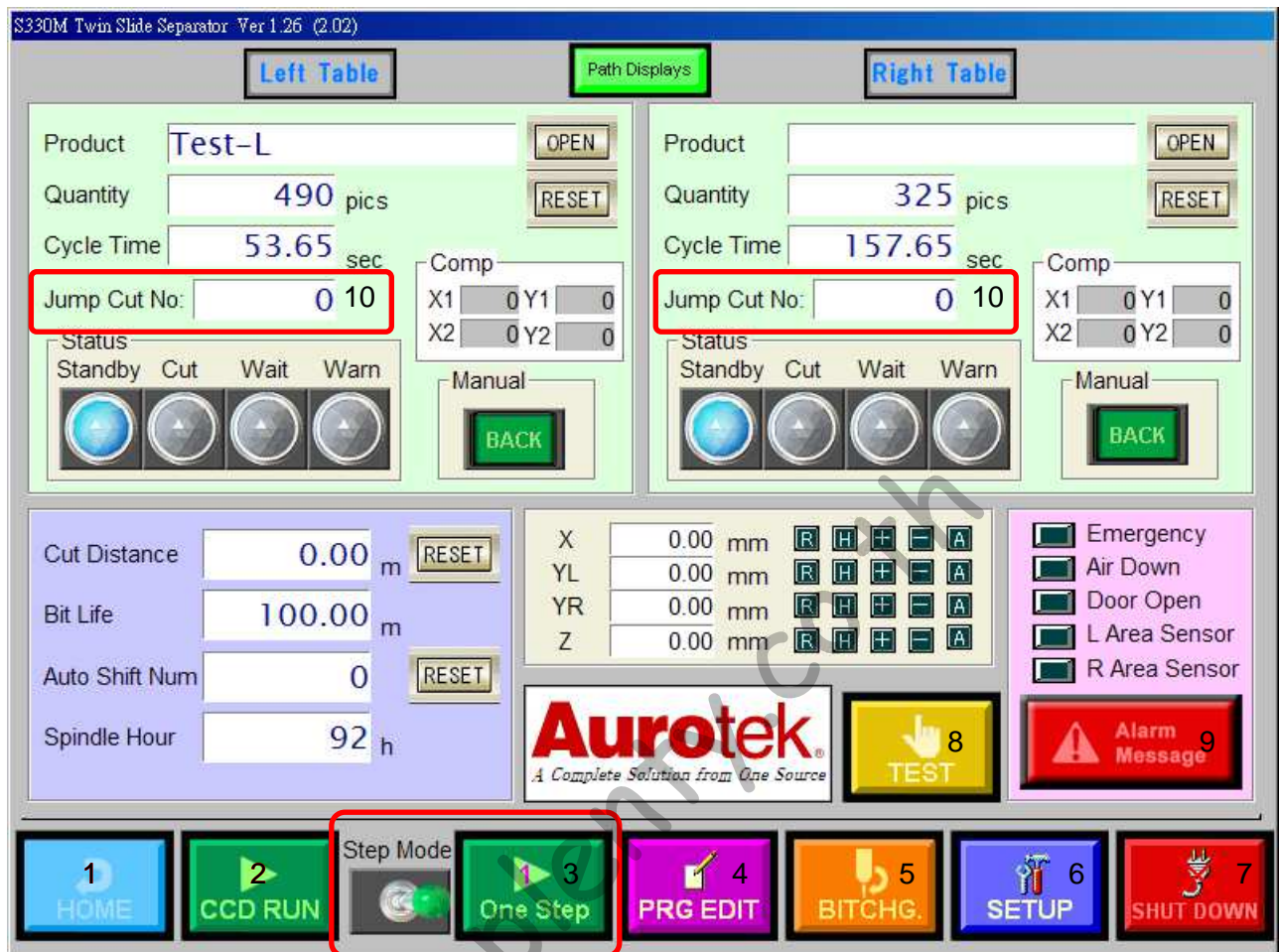
Figure 4.2 Main Interface

There are 10 main buttons in the main interface. Their functions are as follow:

(1) Zero reset:

Pressing the zero reset button causes the machine to execute the zero reset action.

PS. Zero reset must be carried out after turning on the power before processing and programming can be performed.

(2) Path simulation:

Pressing this button will cause it to light up and enter the path simulation mode. In this mode, place the PCB to be processed on the left/right jig and then press the START/L or START/R button to move the PCB to the processing station. Once in position, the machine will not actually engage the cutter. The CCD camera will instead simulate a run through the entire path. Please see Chapter 5.5 for more information.

(3) Step Mode：

Pressing this button to light on means step mode is activated ➔
. The machine performs to the "pause point" into the pause state, at the moment "single step" button start to flashing. When the single step button light on, each time press the single stop button, machine cancel the pause state and start cutting until the next pause point. If cancel the single step mode(light off), machine will cancel pause state and continue cut All the rest cutting point.

(4) Program:

Pressing this button switches to the machine's edit program mode. This mode allows the user to create, edit and copy processing programs. This feature is password-protected to prevent unauthorized alteration of parameters. Please see Chapter 6 for more information.

(5) Change Cutter:

Pressing this button will move the machine's cutting spindle to the pre-set position then turn off power to the spindle and axial motor to allow the user to change the cutter. Once the change has been made, the user must press the zero reset button and complete the zero reset operation before processing can resume.

(6) Setup:

Pressing this button switches to the machine's parameter setup mode. This feature is password-protected to prevent unauthorized alteration of parameters. Please see Chapter 8 for more information.

(7) Shutdown:

Press this button to shut down the control system.

Standard Shutdown Procedure: Please press the "Shutdown" button in the main interface first and wait until the "Turn off power now" message appears on screen. Now press the "Master Power" button below the control panel to turn off the power.

PS. Improper shutdown increases the risk of damaging the operating system or hard disk.

(8) Testing:

Pressing this button switches to the machine's testing mode. In this mode the user can monitor all of the machine's inputs, set the outputs and test each axis to make sure they are working properly. This mode can be used for machine diagnostics and troubleshooting. Please see Chapter 7 for more information.

(9) Error message:

Press this button to display the error history as shown below. Please see Chapter 9 for an explanation of error messages and troubleshooting.
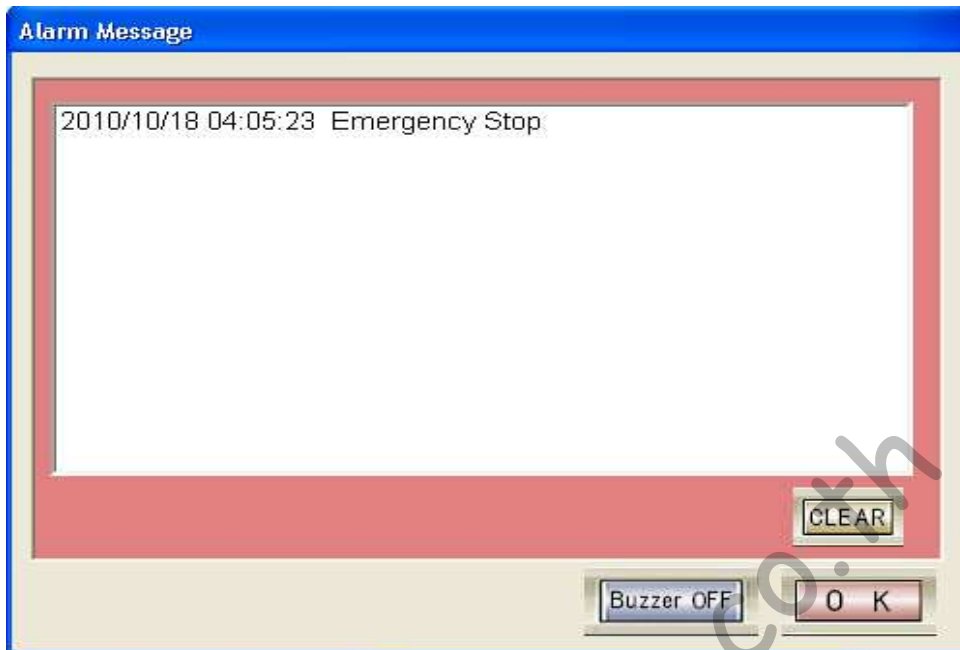
(10). Jump Cut Number:

It is available to set the number of cut point and the machine will go to the cut point number that has been set directly without start from the first cut point always. The setting range is between 0~2000, when machine finished running the program, this value will reset to 0 automatically.

5 Basic Operation

The machine is designed to be controlled through the on-screen GUI. For routine PCB cutting the operator can perform the required processing by running previously stored programs.

5.1 Turning on the power

Pressing the Power button turns on power to the machine. After a 20-sec boot up process, the machine will enter the zero reset standby mode. The green left/right buttons will start blinking at this time. Please check the following before turning on the power (or power can't be turned on).

(1) The circuit breaker (NFB1) inside the power cabinet has been switched to ON.

(2) The Master Power switch should be set to ON.

(3) The Emergency Stop button has been unlocked (or power can't be turned on).

(4) If the optional transformer is installed, please check that the input and output voltage is normal and that the circuit breaker (NFB) has been switched to ON.

※**Attention: When power is turned off, the servo inside the machine will take time to power down. Please wait at least 5~10 seconds before turning on the power again.**

5.2 Zero reset

Once the machine has booted up, the Zero Reset button and green Start L/R buttons on the main screen will start blinking to show that the machine is in zero reset standby mode. Press the Zero Reset button and the machine will begin the zero reset action.

※ **Attention: Zero reset must be carried out after turning on the power before processing and programming can be performed.**

Figure 5.1 shows a PCB separator machine with axis labels.

Z-axis

X-axis (reset direction)

YL axis

YR axis
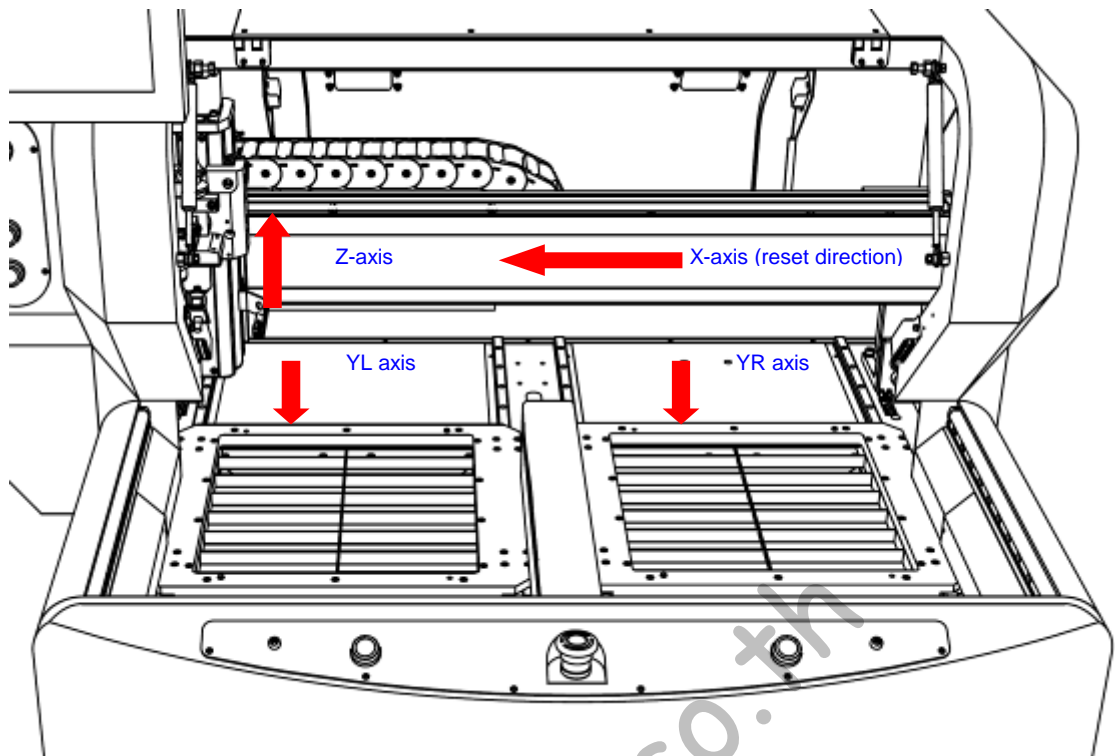
Figure 5.1 Zero reset direction

5.3 Processing

One zero reset has been carried out, the machine enters normal standby mode. Please follow the steps below to begin processing.

(1) Confirm that there are no foreign objects within the machine's processing area.

(2) Confirm that the collector power has been turned on.

(3) Confirm the name of the processing program to use.

The name of the processing program for the left/right jigs will be shown at the top of the main screen. The user can use the "Open" button to load previously stored processing programs. A summary is provided below:
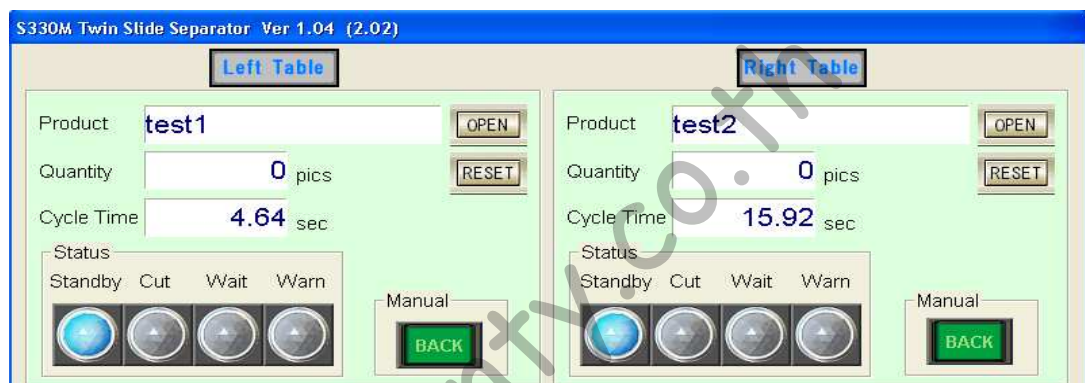
[1] Work Name:
The name of the current program (work) to process.

[2] Work Count:
The number of pieces completed so far.

[3] Open:
Open processing program. Pressing this button opens the file selection dialog box. Choose the processing program to use for that particular jig. Please note that the left and right jigs generally use different processing programs.

[4] Reset:
If the user wishes to restart the work count, pressing this button resets the work count to zero.

[5] Status:
Shows the current status for that particular jig.

[6] Manual:
Press the "Back" button to move the jig backwards（HOME）.

(4) Place the PCB to cut on the left/right jig then press the START/L or START/R button to move the PCB to the processing area. Once it is in position, the spindle will begin rotating. The machine then cuts the PCB as directed by the processing program. The user can load the other jig while the machine is in operation to improve production efficiency.

(5) Once the PCB on one side has been cut, the jig will return to the loading area. Once the operator replaces it with a new PCB the entire cycle can begin again.

5.4 Processing information

Processing information is shown on the main interface. Apart from work count and cycle time, cutter related information is also shown on the left of the screen. The details are as shown below:

(1) Cumulative Cutting Distance:
Shows the total cumulative cutting distance of the cutter.

(2) Reset:
Pressing this button resets the cutter's cumulative cutting distance to 0. This is used after a cutter change.

(3) Allowed Cutting Distance:
Shows the allowed cutting distance set for the cutter. Once the total cumulative cutting distance reaches the set distance, the cutter will automatically descent/ascend for a set distance (set by the operator) before resuming cutting to extend the cutter's service life.

(4) Control Point Count:
Shows the number of times that the cutter has ascended/descended. If the count has reached the set number and the cutter distance has reached the allowable cutting distance, the machine will issue a warning for the operator to

> change the cutter.

(5) Spindle Time:

> Shows the total service time accumulated by the spindle since delivery. The data can be used to schedule spindle motor maintenance.

5.5 Path simulation

The operator may have to check the program before actual processing in certain circumstances. A path simulation function in this feature allows the program pathing to be simulated without actual processing.

Pressing the "Simulate" button will cause the machine to light up and enter the path simulation mode. In this mode, place the PCB for processing on the left/right jig then press the START/L or START/R button to move the PCB to the processing area. Once it is in position, the display will change as shown in Fig. 5.2. Only the cutting point will be shown without actually cutting the board.
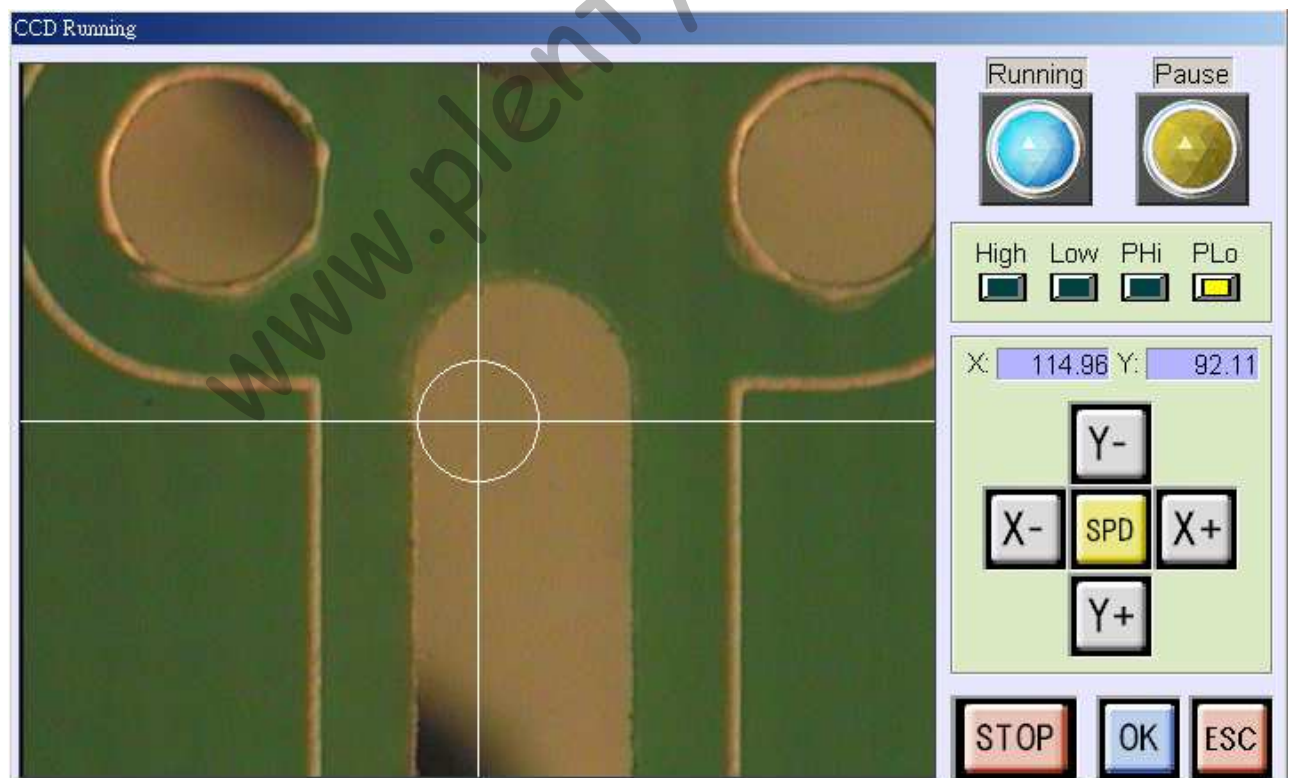
Figure 5.2 Path simulation

During the simulation the user may make minor adjustments based on the actual path. If the user detects any deviations, they can press the ESC button to pause the

simulation and then use the direction buttons and changes in speed to make minor corrections. Once the changes have been made, press OK to resume.

When the simulation is complete, the screen shown in Fig. 5.2 will revert back to the main interface. Pressing the "Simulate" button again will cause it to go dark and end the simulation mode.

Note: **To cancel the simulation while it is in progress, press the STOP button.**

Monitor	Keyboard	Function	Monitor	Keyboard	Function
X+	→ Key	Move in the + direction on the X-axis	X-	← Key	Move in the - direction on the X-axis
YL+	↑ Key	Move in the + direction on the YL-axis	YL-	↓ Key	Move in the - direction on the YL-axis
SPD	Space Bar	Cycle between the 4 training speeds	ESC	ESC key	Cancel, pause or end.
(blue light)		When light is on the machine is in processing mode.	OK	Enter key	Confirm or start.
(yellow light)		When light is on the machine is in paused mode.	STOP		Cancel simulation and return to main interface. (Button disabled in paused mode)

6 Edit Program

This mode is used to create, edit or copy processing programs. In the editor interface a 10X magnified view from the CCD camera is shown together with an auxiliary cross hair to help the operator find the right cutting location.

6.1 Edit Program Introduction

When the operator presses the "Edit Program" button at the main interface the monitor will switch to the editor interface as shown in Fig. 6.1.
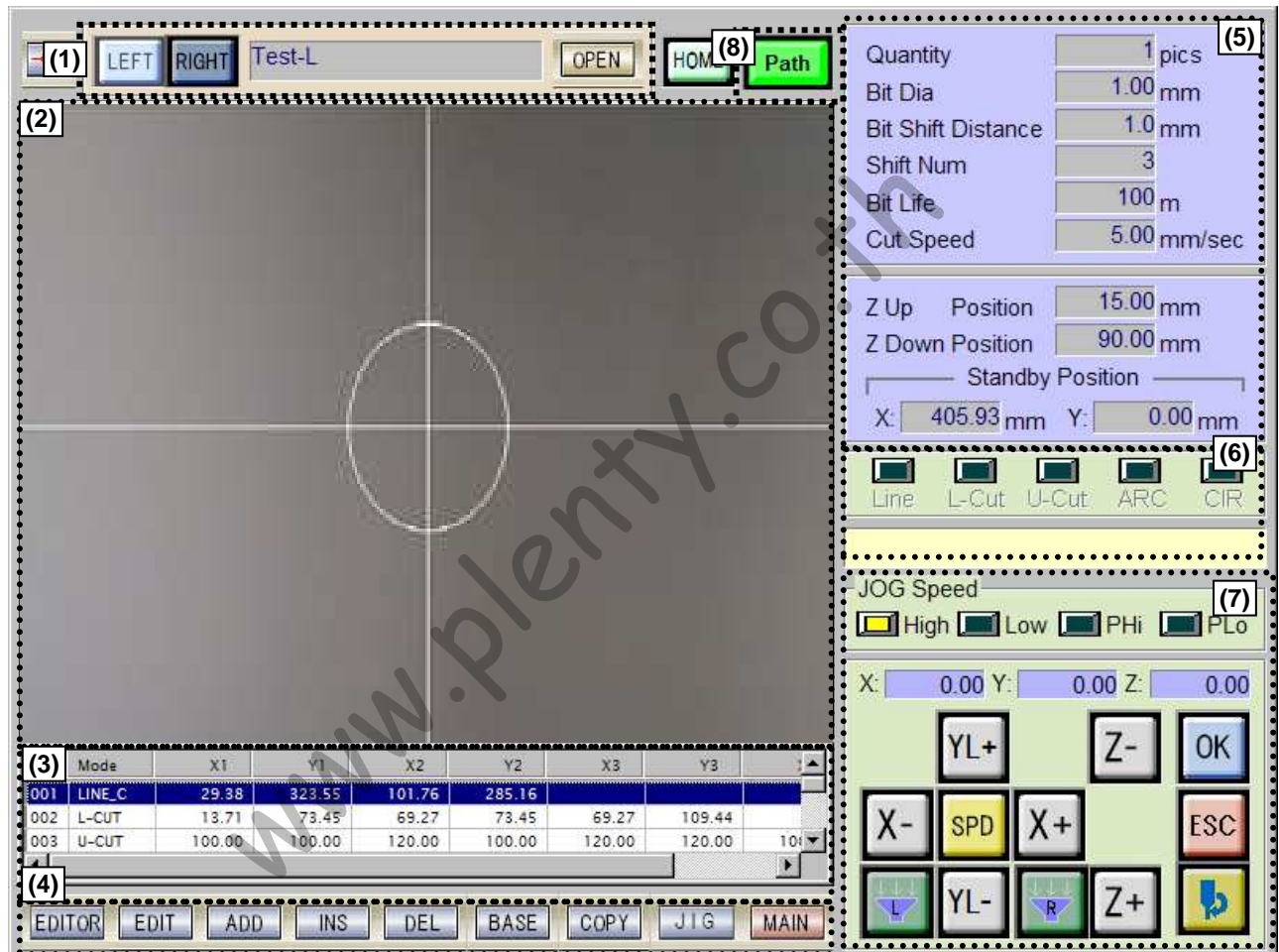

Figure 6.1 Edit Program interface

(1) Program Name:

Choose to display the jig, program name and cursor parameters for the left or right side.

(2) CCD Video:

Shows a real-time image of the PCB at 10X magnification as well as a cross-hair with the diameter of the cutter.

(3) Program Code:
Shows the code for completed training.

(4) Select Edit Mode:
Select the program editing mode.

(5) Parameters:
Displays processing-related parameters.

(6) Cutting Mode Area:
Changes between cutting modes. The five available cutting modes are: Line, L-Cut, U-Cut, curved cut (ARC) and circular cut (CIR). Please see 6.2 for more information.

(7) Training Buttons Area:

[1] Manual Training Speed:
Displays current training speed.
High: 50mm/sec, Low: 5mm/sec, Phi: 0.1mm each time, PLo: 0.01mm each time.

[2] Coordinate Display:
Displays the current coordinates (mm).

Button information:

Monitor	Keyboard	Function	Monitor	Keyboard	Function
X+	→ Key	Move in the + direction on the X-axis	X-	← Key	Move in the - direction on the X-axis
YR+	---	Move in the + direction on the YR-axis	YR-	---	Move in the - direction on the YR-axis
YL+	↑ Key	Move in the + direction on the YL-axis	YL-	↓ Key	Move in the - direction on the YL-axis
	---	Open/Close left funnel.	Z+	PgUp Key	Move in the + direction on the Z-axis
	---	Open/Close right funnel.	Z-	PgDn Key	Move in the - direction on the Z-axis

SPD	Space Bar	Cycle between the 4 training speeds	ESC	ESC key	Cancel or end training.
(spindle icon)	---	Turn spindle motor on/off.	OK	Enter key	Confirm.

(8). Cutting Path Display:
While operator edit the cutting path, also can confirm the path route on the top-right of screen at the same moment.
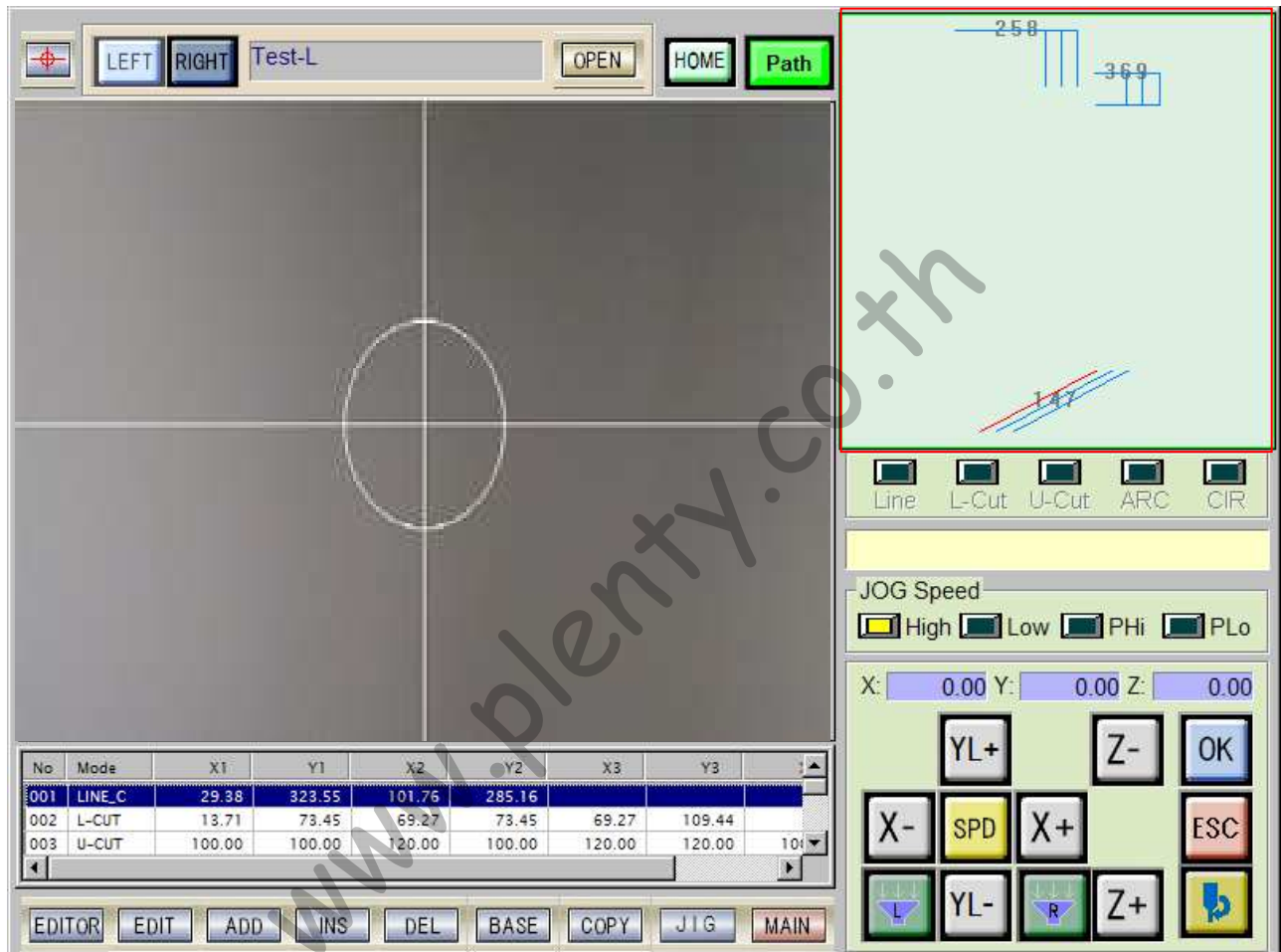
6.2 Program Introduction

Shown below is a standard PCB cutting program. The cutter starts at the Stand by Point waiting for the command to start processing. Once the start command has been received (START/L or START/R pressed and jig reaches the processing area) the cutter quickly moves to the START Cut Point with the Z-axis height being the Retract Point height. The Z-axis now descends to the Cutter Entry Point and moves through to the END Cut Point. The Z-axis then ascends back to the Retract Point height and moves to the next START Cut Point. This continues until the last cut has been made. The Z-axis then ascends back to Stand by height and the cutter returns to the Stand by Point.
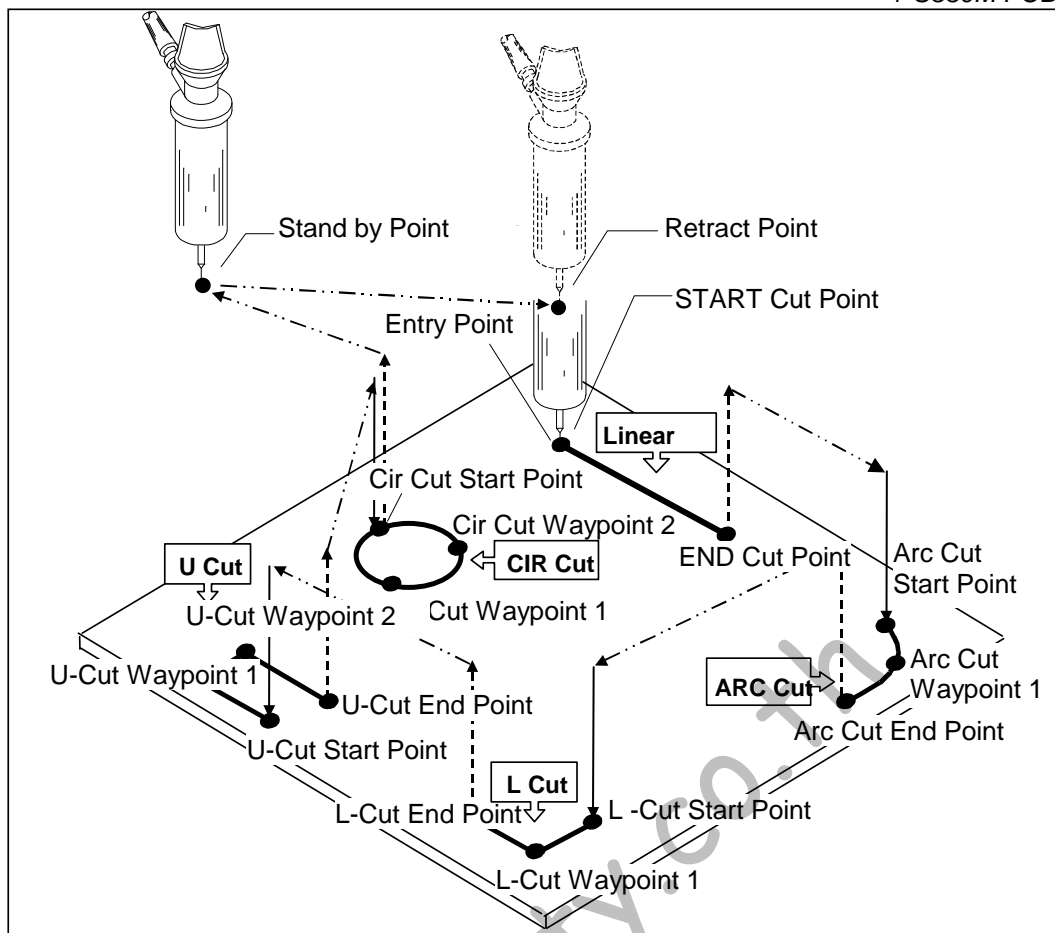
Figure 6.2 PCB Processing program diagram

Terminology

Term	Command	Description
Stand by Point		The cutter's stand by point when one piece has been completed and the next job has not yet started. This should be located between the left and right jigs if possible to reduce the amount of time the cutter spends in transit.
Retract Point		Set the Z-axis elevation. This should be higher than the tallest component on the PCB.
Entry Point		Set the cutting height for the Z-axis.
Linear Cut	Line	Cut a straight connection.
L-Cut	L-Cut	Cut a L-shaped connection. The L-cut is generally used at the corners of the PCB.
U-Cut	U-Cut	Cut a U-shaped connection. The U-cut is generally used where two PCBs are joined.
Circular Cut	CIR	Cut a circle.
Arc Cut	ARC	Cut a curved connection.
START Cut Point		The starting point of a cut. For a circular cut the starting point is also the ending point.
Waypoint 1		The waypoint that L-cut and Arc Cut must pass

		through. The 1st waypoint that U-cut and circular cut passes through.
Waypoint 2		The 2nd waypoint that U-cut and circular cut passes through.
END Cut Point		The ending point of the cut. No end point is required for a circular cut.

6.3 Create new cutting program

In this mode, the CCD camera is used to show a 10X magnified view of the PCB. The millimetric scale and cutter scope display helps the operator to quickly and efficiently create a new PCB cutting program. Shown below are the steps for editing a processing program.

Step 1:

In the program editor's program name area, press the "Left" button. This specifies that the created program is for the left jig.

Step 2:

Place the PCB on the left jig then press the ▦ button to move the jig to the processing area.

Step 3:

Press the "Open" button in the program name area at the editor. The open file dialog box will appear as shown in Fig. 6.3. Enter the name of the new file to create in the file name field then click on "Open File".
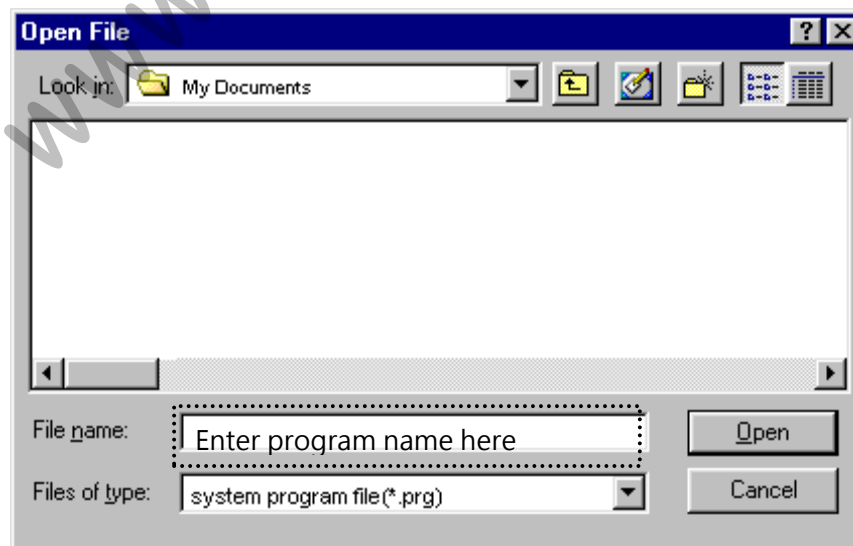
Figure 6.3 Open file dialog box

Step 4:

The machine will now ask the user to provide the processing parameters in order as shown in Fig. 6.4.

Quantity	2	pics
Bit Dia	1.50	mm
Bit Shift Distance	2.0	mm
Shift Num	2	
Bit Life	50	m
Cut Speed	6.00	mm/sec

Figure 6.4 Processing parameters

(1) Product Count:

Input the number of products that each PCB can be cut into. The range is 1 ~ 99. This value is used to track the amount of cutting done. After each processing cycle the machine automatically increments the work count by this number.

(2) Cutter Diameter:

Set the diameter of the cutter used. The unit of measurement is mm and the range is 0.01 mm ~ 3.17 mm. Once the cutter diameter has been set, a circular cursor of the same size will be displayed in the image display area to help the operator train the machine on cutting location. The machine will automatically set the spindle speed to match the cutter diameter using the following rule:

ϕ 0.01~0.99mm   Spindle speed = 45,000 rpm~45,200rpm

ϕ 1.00~2.00mm   Spindle speed = 40,000rpm~ 40,200 rpm

ϕ 2.01~3.17mm   Spindle speed =39,800rpm~ 40,000 rpm

(3) Control Point Distance:

Enter the control point distance. The unit is mm and the range is -5mm ~ 5mm. This value is used to set the control point distance when the cumulative cutting distance of the cutter reaches its set life. If set as positive, the cutter is lowered. If set as negative, the cutter blade is raised.

Note: If possible, the control point should lower the effective cutting edge to the limit and use a negative value. This avoids excessive lowering leading to non-effective cutting edge cutting the product.

(4) Control Point Count:

Enter the number of control points. The range is 0 ~ 9. When the control point count reaches the set number and the cumulative cutting distance

has reached the pre-set cutter life, the machine will display a warning message and ask the operator to replace the cutter.

Attention: Excess control point count does not reduce costs. The number of control points should depend on the cutting quality.
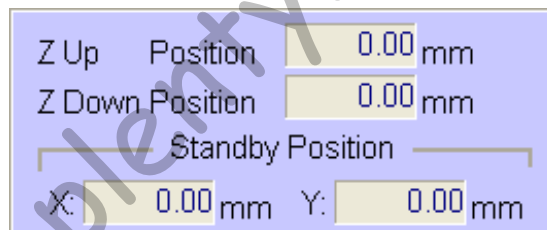
(5) Cutter Life:

Enter the allowable cutting distance for the cutter. The unit is m and scope is 1 ~ 999m. When the cumulative cutting distance reaches this value, the cutter automatically ascends or descends by the control point distance to extend the cutter life.

(6) Cutting Speed:

Enter the cutter movement speed when cutting PCB. The unit is mm/sec and the range is 0.01 ~ 50mm/sec. Please refer to Appendix 1 for actual cutting speeds.

Step 5:

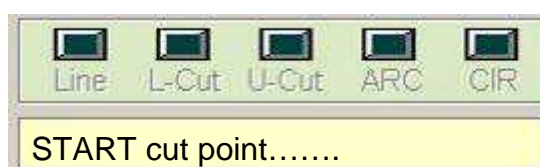Train the "Z-Axis Retract Point" and "Z-Axis Entry Point".

Figure 6.5 Retract Point and Entry Point

Use [Z+] and [Z-] to adjust the cutter height then press the [OK] button or [Enter] key to confirm.

Note: Training on the stand by point must wait until all of the cutting point training has been completed. The stand by point can be ignored by the operator at this point.
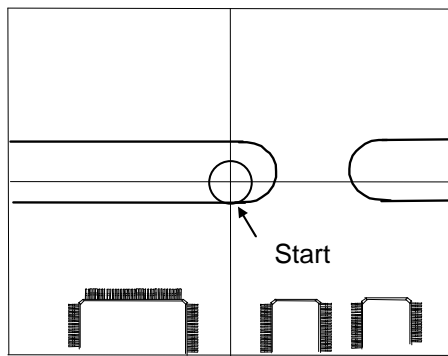
Once the cutting parameters have been entered the operator may begin training for cutting locations. The cutting mode area will become as shown in Fig. 6.6 and ask the operator to provide training on the START cut point.

START cut point.......

Figure 6.6

(1) Training on START cut point

Start

[1] Refer to the training button instructions in 6.1 and switch the training speed to Hi or Lo. Move the XY axes to place the START cut point near the center of the screen.

[2] Change the training speed to PHi or PLo and use minute adjustments to align the cutter's cutting area (circle) with the point to cut. This is then the correct location.

[3] When training the START cut point, leaving a small margin in front of the board edges will produce a smoother edge.

Step 6:

Once training for the START cut point has been completed, the operator can use the mouse to select a suitable cutting mode out of the five available in the cutting mode area for waypoint and end point training.
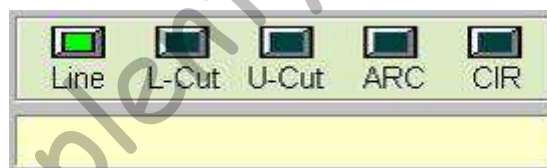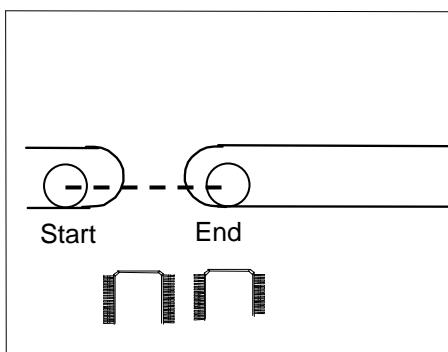

Figure 6.7

(1) Linear (2-point) cut:

Click on Line with the mouse. As a linear cut only requires two points, select Line cut then train the end point.

Start   End

[1] Refer to the training button instructions in 6.1 and switch the training speed to Hi or Lo. Move the XY axes to place the end point for the Line Cut near the center of the screen.

[2] Change the training speed to PHi or PLo and use minute adjustments to align the cutter's cutting area (circle) with the point to cut. This is then the correct location.

[3] When training the END cut point, leaving a small margin in front of the

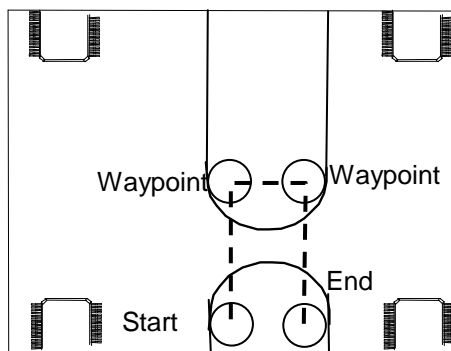board edges will produce a smoother edge.

(2) L-Cut (3-point):

Click on L-Cut with the mouse. As 3 points are needed to make an L-shaped cut, select L-Cut then train the <u>waypoint</u> and <u>end point</u>.
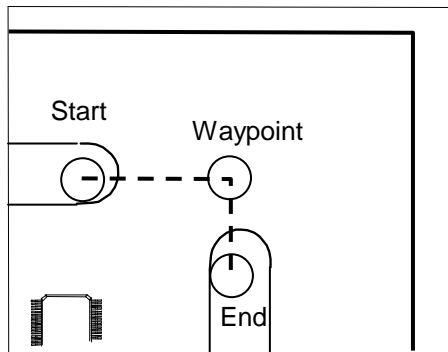
[1] Refer to the training button instructions in 6.1 and switch the training speed to Hi or Lo. Move the XY axes to place the <u>waypoint</u> for the L-Cut near the center of the screen.

[2] Change the training speed to PHi or PLo and use minute adjustments to align the cutter's cutting area (circle) with the point to cut. This is then the correct location.

[3] Repeat steps 1 and 2 to train the <u>end point</u> of the L-Cut.

[4] When training the END cut point, leaving a small margin in front of the board edges will produce a smoother edge.

(3) U-Cut (4-point):

Click on U-Cut with the mouse. As 4 points are needed to make an U-shaped cut, select U-Cut then train <u>waypoint 1</u>, <u>waypoint 2</u> and <u>end point</u>.

[1] Refer to the training button instructions in 6.1 and switch the training speed to Hi or Lo. Move the XY axes to place the <u>waypoint 1</u> for the U-Cut near the center of the screen.
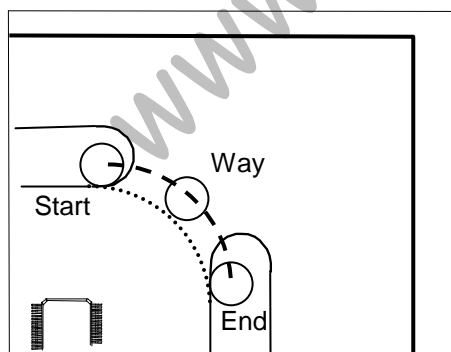
[2] Change the training speed to PHi or PLo and use minute adjustments to align the cutter's cutting area (circle) with the point to cut. This is then the correct location.

[3] Repeat steps 1 and 2 to train <u>waypoint 2</u> and <u>end point</u> of the U-Cut.

[4] When training the END cut point, leaving a small margin in front of the board edges will produce a smoother edge.

(4) Arc Cut (3-point):

Click on ARC with the mouse. As 3 points are needed to make an arc-shaped cut, select ARC then train the <u>waypoint</u> and <u>end point</u>.

[1] Refer to the training button instructions in 6.1 and switch the training speed to Hi or Lo. Move the XY axes to place the <u>waypoint</u> for the ARC Cut near the center of the screen.
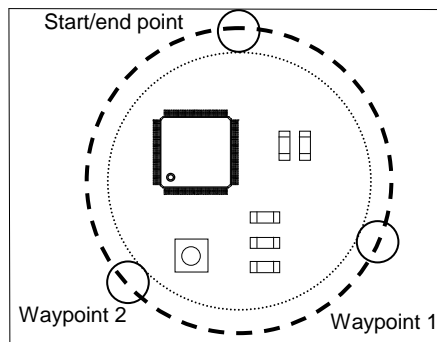
[2] Change the training speed to PHi or PLo and use minute adjustments to align the cutter's cutting area (circle) with the point to cut. This is then the correct location.

[3] Repeat steps 1 and 2 to train the <u>end point</u> of the Arc Cut.

[4] When training the END cut point, leaving a small margin in front of the board edges will produce a smoother edge.

(5) Circular Cut (3-point):

Click on CIR with the mouse. As 3 points are needed to define a circular cut. The start and end points of a circle are one and the same as well, so when CIR is selected, train <u>waypoint 1</u> and <u>waypoint 2</u>.

[1] Refer to the training button instructions in 6.1 and switch the training speed to Hi or Lo. Move the XY axes to place the <u>waypoint 1</u> for the CIR Cut near the center of the screen.

[2] Change the training speed to PHi or PLo and use minute adjustments to align the cutter's cutting area (circle) with the point to cut. This is then the correct location.

[3] Repeat steps 1 and 2 to train <u>waypoint 2</u> of the CIR Cut.

Note: When cutting a circle the starting point and the end point are one and the same. Only training for any 2 points on the arc are therefore required and none for the end point.

Note: For the CIR cut or ARC cut, the waypoints can be any point on the arc.

Note: The arc waypoint should be set at the middle of the arc if possible. When cutting a circle, proper separation should be maintained between the start point, waypoint 1 and waypoint 2 to avoid excessive cutting deviation due to training error.

Repeat steps 5 and 6 to train all PCB cutting modes then click on [ESC] to end training.

Step 7

Training on stand by point. When [ESC] is pressed to end cutting point training, the machine will ask the operator for training on the cutter's <u>stand by point</u>. Refer to the training button instructions in 6.1 to move the cutter to the stand by point then press [OK].

Step 8

Training on reference point. This function is used to calibrate the machine and adjust for displacements caused by jig installation/removal. This allows existing processing programs to be used without modification or provide a reference point for program copies.

As shown in Fig. 6.8, whenever the jig is fitted/removed or moved, it may cause the PCB's position to shift. The user should therefore enter the reference points for two locations after the processing program has been completed. This will be used for automatic calibration and allow the existing processing programs to be reused.
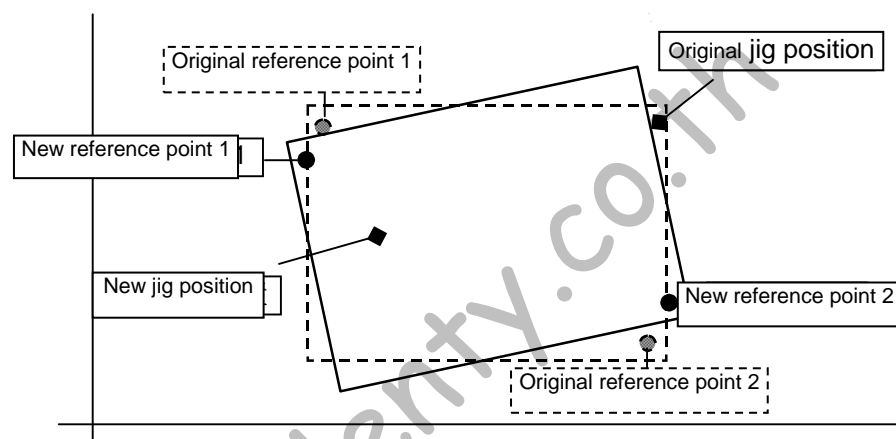

Figure 6.8

Once the processing program is complete, click on the "Reference" button to begin reference point training. Please refer to the training button instructions in 6.1 and move the crosshair cursor on the screen to some obvious point on the PCB then click on [OK]. Repeat for the second reference point then click on [OK] to complete reference point training. Attention: The two points should be as far away from each other as possible to minimize error.

When the jig has been removed or moved, please align the crosshair on the screen with these two reference points in editor mode again. The machine will correct for any errors automatically. Please see 6.7 for more information.

Step 9

Copy program. If the left and right jigs are processing identical PCBs, the operator can use the Copy mode to copy the program for the left jig over to the right jig without having to repeat the training for the right jig. Press the [Copy] button and the screen will be as shown in Fig. 6.9.

Figure 6.9 Program Copy

Please select Left Program >>> Right Program then click on [OK] to copy. A Save as New File dialog box will appear. Enter the file name of the right jig program and click on [OK] as shown in Fig. 6.10.
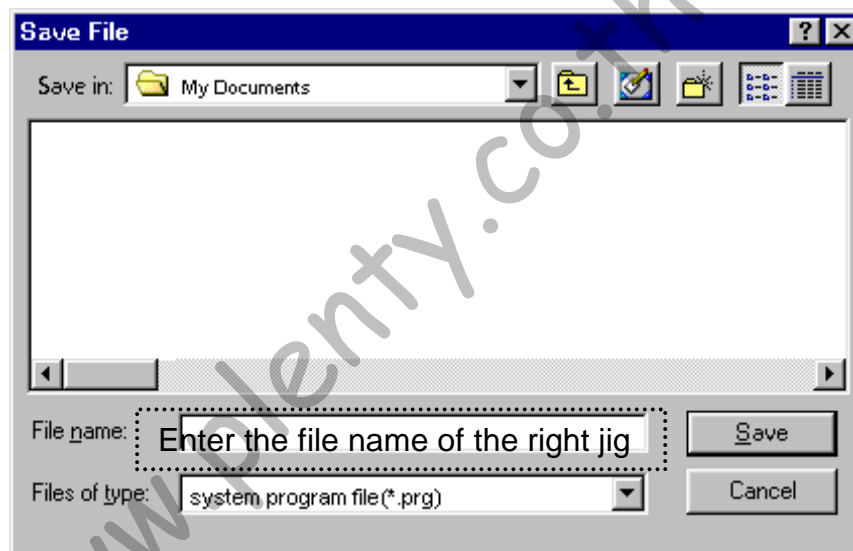

Figure 6.10 Save as New File

Once the program has been copied, the machine will ask the operator to provide reference point training for the right jig. Place the PCB on the right jig then press

YR+ to move the jig to the processing area. Follow the Step 9 instructions to train the machine on the right jig's two reference points (should mirror the two reference points for the left jig).

Note: If the PCB on the right jig and the PCB on the left jig are different, the program copy method described in Step 9 can't be used. Please follow the procedure set out in Step 1 ~ 8 to retrain the right jig program.

Completing steps 1 ~ 9 produces a set of complete left and right programs. A simulation as described in Chapter 5 or actual processing can now be carried out.

6.4 Program Modification

The editor can be used to modify the cutting points, cutting modes, stand-by point, cutting parameters and other data in previously saved programs.

Press the "EDIT" button to make it turn yellow and enter the program modification mode. The machine will also move to the first START cut point and wait for changes as shown in Fig. 6.1.1.

Figure 6.11 Modify program

(1) When the machine has moved to the start cut point, the operator can refer to the training button instructions in 6.1 to correct bad positioning. Once the change has been made, press [OK] to confirm and save.

(2) Once the START cut point has been trained, the machine will move to the cutting waypoint or end point. The operator can refer to the training button instructions in 6.1 to correct bad positioning. If the cutting mode is wrong, use the mouse to select the right cutting mode at this time and correct the cutting points. Once the change has been made, press [OK] to confirm and save.

(3) Once the start point, waypoints and end point for a cut has been completed, the machine will move to the next cut. Repeat steps 1 and 2 to make changes. Once the last line has been corrected the machine will jump back to the first line.

(4) Press [OK] to skip cutting points that do not need modification.

(5) If the operator uses the mouse to select a particular line (it will be highlighted) before pressing [Modify] the machine will move to that cut and start modifying from that line.

(6) Once the final line has been corrected, the machine will skip back to the first line. The user can press [ESC] at any time to end program modification.

6.5 Add cut

Additional cuts can be added to existing processing programs using the editor's Add mode.

Press the "Add" button and it will turn yellow. The editor enters the Add mode and the program code will also jump to the last line. The operator is then asked to add a new cut as shown in Fig. 6.1.2.

Figure 6.12 Add cut

The operator can add one or more cuts using steps 6 and 7 from 6.3. Press [ESC] to exit Add mode at any time.

6.6 Insert cut point

Additional cuts can be inserted into existing processing programs using the editor's Insert mode. The difference between Add mode and Insert mode is that in Add mode the operator can only add cuts at the end of the original program. In Insert mode, the operator can insert a cut after any line.

First, select a line in the program code area to insert the new cut after. Press the "Insert" mode so it turns yellow to enter the Insert mode as shown in Fig. 6.13.

Figure 6.13 Insert cut

The operator can insert cuts as shown in steps 6 and 7 of 6.3. Press [ESC] to exit Insert mode at any time.

6.7 Delete cutting point

Cuts can be removed from existing processing programs using the editor's Remove mode.

First, highlight a line to remove from the program code area. When [Delete] is pressed, the button turns yellow and the machine moves to the start point of the cut. A confirmation dialog box appears as shown in Fig. 6.14.

Figure 6.14 Confirm delete

Press [Delete] to confirm and delete the selected line. The machine will jump to the next line then show the delete confirmation dialog box again. Press [Cancel] in the dialog box to end Delete mode.

6.8 Change cut parameters

The operator can change cut parameters in the editor as well.

6.8.1 Change parameters

Double click to select a parameter to change. The text field will be highlighted and the keypad enabled as shown in Fig. 6.15. The operator can now input the correct parameters directly.

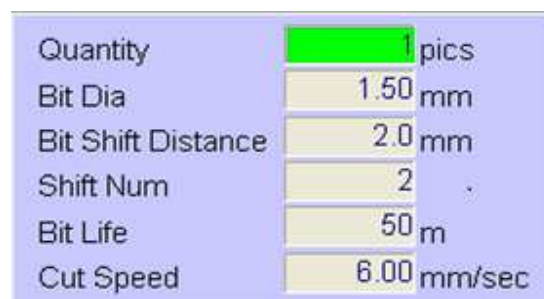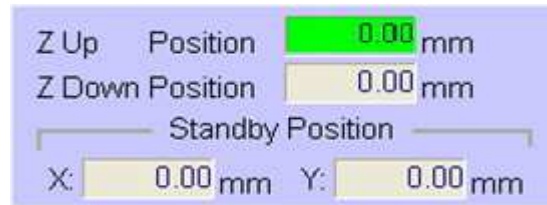|		
Quantity	1	pics
Bit Dia	1.50	mm
Bit Shift Distance	2.0	mm
Shift Num	2	.
Bit Life	50	m
Cut Speed	6.00	mm/sec

Figure 6.15 Changing the processing parameters

6.8.2 Change retract, entry and stand by points

Double click on the parameter to be changed and the text field will be highlighted as shown in Fig. 6.16. The operator can change the parameter using the following method.

6.16 Change retract, entry and stand by points

Z-axis Retract & Entry Points: Use [Z+] and [Z-] to adjust the cutter height then press the [OK] button or [Enter] key to confirm.

Stand by Point: Use [X+] and [X-] to adjust the stand by point then press the [OK] button or [Enter] key to confirm.

6.9 Calibrate cutting point

This function is used to calibrate the machine and adjust for offset caused by jig installation/removal. This allows existing processing programs to be used without modification.

As shown below, whenever the jig is fitted/removed or moved, it may cause the PCB's position to shift. The user should therefore enter the reference points for two locations after the processing program has been completed. This will be used for automatic calibration and allow the existing processing programs to be reused. Whenever a jig is removed or moved, the two reference points must be re-trained. The machine will then automatically correct for any offset.
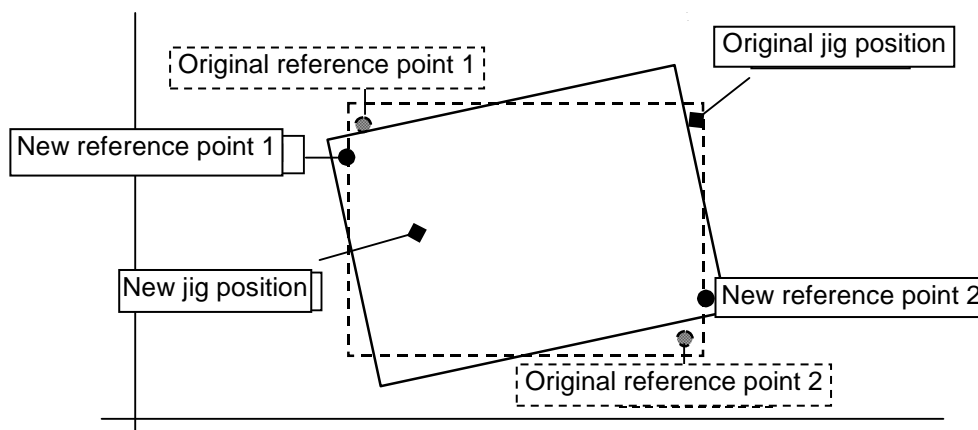
[1] Press the [Reference] button in the editor and the machine will move to the original 1st reference point and ask the operator to make the correction.

[2] Please refer to the training button instructions in 6.1 and align the crosshair cursor on the screen with the 1st reference point on the PCB, and then click on [OK]. The machine will move to the original 2nd reference point and ask the operator to make the correction.

[3] Correct the 2nd reference point using the same method, and then click on [OK] to complete the reference point correction.

6.10 Program Editor

This feature provides a text-based program editor. In this editor, the operator can input the coordinates, copy cuts and cut point offsets directly.

Pressing the [Edit] button in the editor brings up the screen shown below in Fig. 6.17.

Figure 6.17 Program Editor

(1) Program Name & Cut Parameters Area:

Displays the name of the program being edited and the cut parameters. Please note that this part cannot be changed and the [Save] button is used to save the modified program code.

(2) Program Code:

Displays the program code for editing. When the operator double clicks on a field a text input field appears. Enter the cutting mode or coordinates directly then press the [Enter] key.

(3) Function Buttons:

[1] Insert/Overwrite:

Choose whether to use insert mode or overwrite mode for editing.

[2] Offset:

When the program points do not match the actual points, this function can be used to offset the coordinates in the program by a set value. If identical PCBs are being placed on both jigs, copy, paste and offset can also be used to write the program for the second PCB.

[3] Block:

If the same PCB has multiple identical cuts (multiple panels), once the operator completes training for the first panel the Block function can be used to duplicate the program for multiple panels.

[4] Cut:

Cut selected code.

[5] Copy:

Copy selected code.

[6] Paste:

Paste cut or copied code.

[7] End:

Close the program code editor and return to the program editor. If there were changes to the program code, a dialog box will appear asking the operator to confirm and save the changes.

(4) Retract/Entry and Stand by points:

Display the retract/entry and stand by points for editing. Click on the field to edit and the text input field will appear. Enter the coordinates directly and then press the [Enter] key.

6.10.1 Edit Offset

This feature can be used to correct for deviations between the work object and the programmed locations. Offset can be used to shift only the current point, all the points in the selected area, or all the points in the program.

(1) Select the line to offset then press the [Offset] button. The offset dialog box will appear as shown.
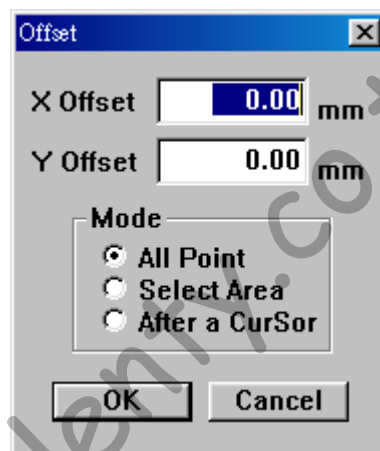
(2) Enter the X and Y offsets then select the offset mode:

[1] Shift all points in the program.

[2] Shift all points in the selected area.

[3] Shift only the points after the current cursor position (Use CTRL + left mouse button to select a line).

(3) Press [OK] to complete the offset operation. All coordinates will be changed immediately.

6.10.2 Block Copy – Copy program for multiple panels

If the same PCB has multiple identical cuts (multiple panels), once the operator completes training for the first panel the Block function can be used to duplicate

the program for multiple panels.

(1) Select the line to copy then press the [Block] button. The copy dialog box will appear as shown.
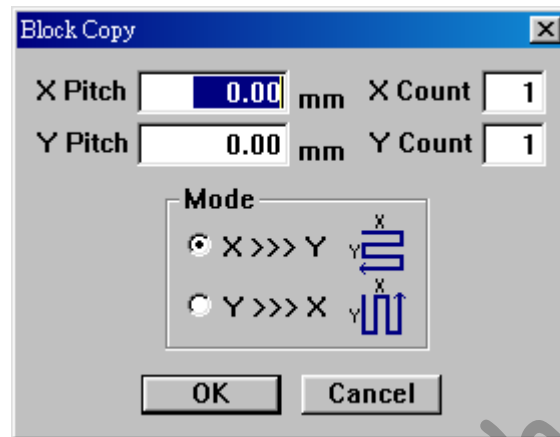
(2) Please enter the required block parameters:

[1] X Pitch:

Represents the X-axis (row) interval. The unit is mm.

[2] Y Pitch:

Represents the Y-axis (column) interval. The unit is mm.

[3] X Count:

Represents the number of repetitions on the X-axis (row).

[4] Y Count:

Represents the number of repetitions on the Y-axis (column).

[5] X→Y:

Indicates that during block copy the X-axis should be separated before the Y-axis.

[6] Y→X:

Indicates that during block copy the Y-axis should be separated before the X-axis.

(3) Press the [OK] button to add the program code generated by block copy to the end of the original code.

7 Test

This mode is used for monitoring the state of all machine inputs, testing all output functions and verifying that all axes are moving normally. It is used for machine diagnostics and preliminary troubleshooting. The user can enter the Test mode by pressing the [Test] button at the main interface. There are a total of five displays to choose from, these being: I/O Card Input Monitor, I/O Card Output Monitor, Axial Controller Card Input Monitor, Axial Controller Card Output Test and Training Test.

7.1 I/O Card Input Monitor

This is used to display the status of I/O card input signals. Pressing the [I/O Input Monitor] button brings up the screen shown in Fig 7.1. The numbers correspond to the I/O card inputs while the text field to the right of the number shows the input function. If the field is blank, then the input is unused. When the indicator light to the left of the number is lit up, it means the input signal is ON.

Figure 7.1 I/O Card Input Monitor

7.2 I/O Card Output Monitor

This is used to display the status of I/O card output signals. Pressing the [I/O Output Monitor] button brings up the screen shown in Fig 7.2. The numbers correspond to the I/O card outputs while the text field to the right of the number shows the output function. If the field is blank, then the output is unused. When the indicator light to the left of the number is pressed, the indicator lights up to show that the output signal is ON. Pressing the indicator light again makes the light go off and means that the output signal is OFF.

Attention: Pay attention to the output purpose when testing output signals manually. Keep head and hands out of the machine or it might lead to machine damage/personnel injury.
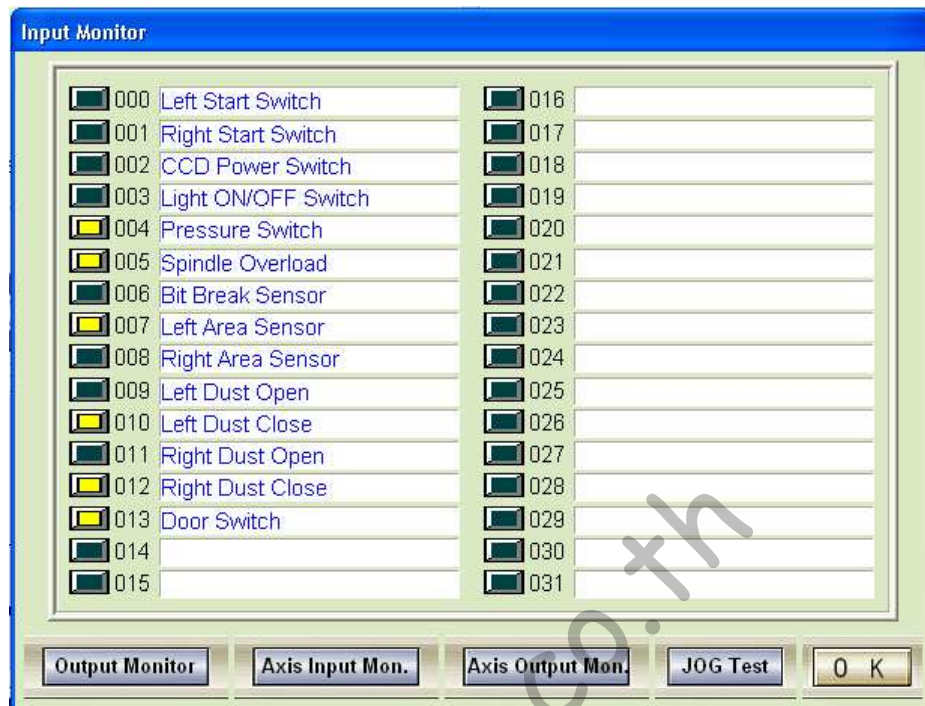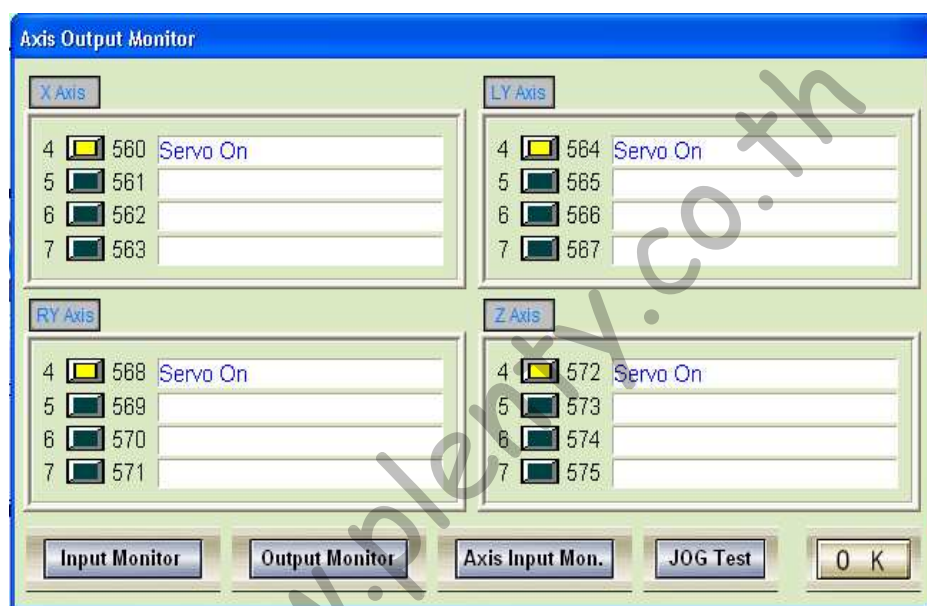
Input Monitor			

000 Left Start Switch
001 Right Start Switch
002 CCD Power Switch
003 Light ON/OFF Switch
004 Pressure Switch
005 Spindle Overload
006 Bit Break Sensor
007 Left Area Sensor
008 Right Area Sensor
009 Left Dust Open
010 Left Dust Close
011 Right Dust Open
012 Right Dust Close
013 Door Switch
014
015
016
017
018
019
020
021
022
023
024
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027
028
029
030
031

Output Monitor | **Axis Input Mon.** | **Axis Output Mon.** | **JOG Test** | **O K**

Figure 7.2 I/O Card Output Monitor

7.3 Axial Controller Card Input Monitor

This is used to display the status of axial controller card input signals. Pressing the [Axial Input Monitor] button brings up the screen shown in Fig 7.3. The numbers correspond to the inputs while the text field to the right of the number shows the input function. If the field is blank, then the input is unused. When the indicator light to the left of the number is lit up, it means the input signal is ON.

Figure 7.3 Axial Controller Card Input Monitor

7.4 Axial Controller Card Output Monitor

This is used to display and test the status of axial controller card output signals. Pressing the [Axial Output Monitor] button brings up the screen shown in Fig 7.4. The numbers correspond to the I/O card outputs while the text field to the right of the number shows the output function. If the field is blank, then the output is unused. When the indicator light to the left of the number is pressed, the indicator lights up to show that the output signal is ON. Pressing the indicator light again makes the light go off and means that the output signal is OFF.

Attention: **Pay attention to the output purpose when testing output signals manually. Keep head and hands out of the machine or it might lead to machine damage/personnel injury.**

Figure 7.4 Axial Controller Card Output Monitor

7.5 Training Test

Used to test the axes and spindle motor to make sure they are working normally. Pressing the "Training Test" button brings up the screen shown in Fig. 7.5.
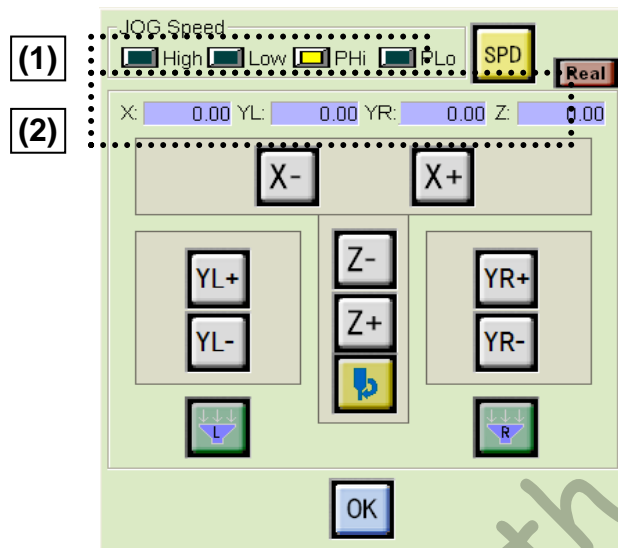
Figure 7.5 Training Test

(1) Manual Training Speed:

  Displays current training speed.

  High: 50mm/sec, Low: 5mm/sec, PHi: 0.1mm each time, PLi: 0.01mm each time.

(2) Coordinate Display:

  Displays the current coordinates (mm).

Button information:

Monitor	Keyboard	Function	Monitor	Keyboard	Function
	---	Open/Close left funnel.	X+	→ Key	Move in the + direction on the X-axis
	---	Open/Close right funnel.	X-	← Key	Move in the - direction on the X-axis
	Space Bar	Cycle between the 4 training speeds	YL+	↑ Key	Move in the + direction on the YL-axis
SPD	---	Cycle between the 4 training speeds	YL-	↓ Key	Move in the - direction on the YL-axis
	---	Turn spindle motor on/off.	YR+	---	Move in the + direction on the YR-axis

OK	Enter key	End test.	**YR-**	---	Move in the - direction on the YR-axis
實際	---	Switch from coordinate display to actual coordinates (enabled when light is on).	**Z+**	PgUp Key	Move in the + direction on the Z-axis
			Z-	PgDn Key	Move in the - direction on the Z-axis

8 Setup

This mode is used by technicians to set and adjust the machine's system parameters. Changing the parameter settings may lead to abnormal operation so this mode is password protected against unauthorized access.

Attention: General users should not use this mode. Improper settings may cause equipment malfunction.

Once the password has been authenticated the screen shown in Fig. 8.1 appears:

Figure 8.1 Setup screen

(1) Axis Parameters:

Displays the axis parameters for editing. Please note that incorrect axis parameter settings may lead to improper machine operation. Please contact the distributor before making any changes.

(2) Options:

Select other setup functions.

[1] System Update:

This button is used for system upgrades when a new function or upgrade becomes available for the machine. An open file dialog box appears when this button is pressed. Select the location of the update file and open the file (the file extension is *.prg). Once update is complete, execute Zero Reset again.

[2] System Backup:

This function saves all of the machine's system programs and parameter settings to a selected folder. A browse folder dialog box appears when this button is pressed. Select the folder to save to and click on "Confirm" to save.

[3] System Restore:

This function restores the system settings from backup files in the selected folder. A browse folder dialog box appears when this button is pressed. Select the folder to restore from and click on "Confirm" to restore.

[4] Change Password:

Used for changing the setup password. When this button is pressed, the machine will prompt the user to enter a new password as shown in Fig. 8.2.

Attention: The new password must be entered twice to confirm that it is the correct password.
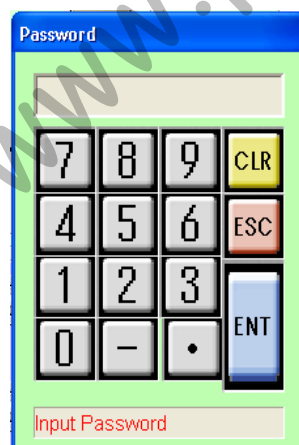
[ENT]: Confirm

[ESC]: Cancel

[Reset]: Clear input

[0~9, -]: Input data

Figure 8.2 Enter password

(3) System Setup:

Set the machine's overall operation flow.

[1] Cutter Check:

This button will light up when pressed to show that the cutter check is enabled. When enabled, the machine will move to the cutter check point after each PCB to see if the cutter is broken.

[2] Cutter Life Monitor:

This button will light up when pressed to show that the cutter life monitor is enabled. When enabled, the machine will automatically load a new cutter when the current cutter reaches the end of its service life.

[3] CCD Offset:

The CCD correction window will appear when this button is pressed. This can be used to align the CCD center with the center of the cutter.

(4) Point Setup:

Set points relative to the spindle.

[1]Cutter Change Point:

The machine is shipped with a pre-defined cutter change point. The user may use this function to modify the blade change point in certain circumstances. Switch to the training screen by pressing the training button. The user can then use the cursor keys to specify the new point and press Setup to update.
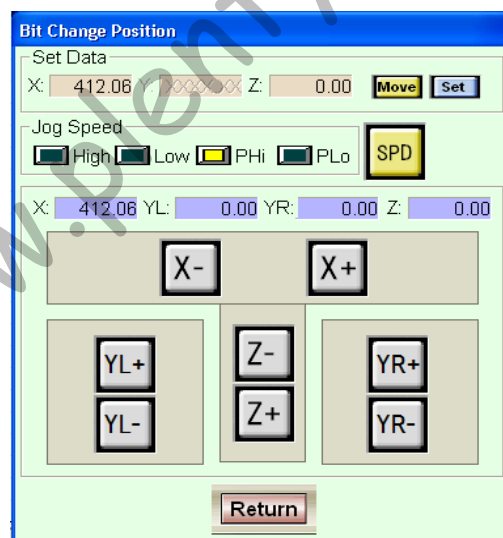

Figure 8.4 Cutter Change Point

[2] CCD Offset:

The CCD is not actually centered on the cutter blade so it must be calibrated to compensate for the upset. This function can be used to calculate the required offset and once completed, the value will be automatically written to the parameter list.
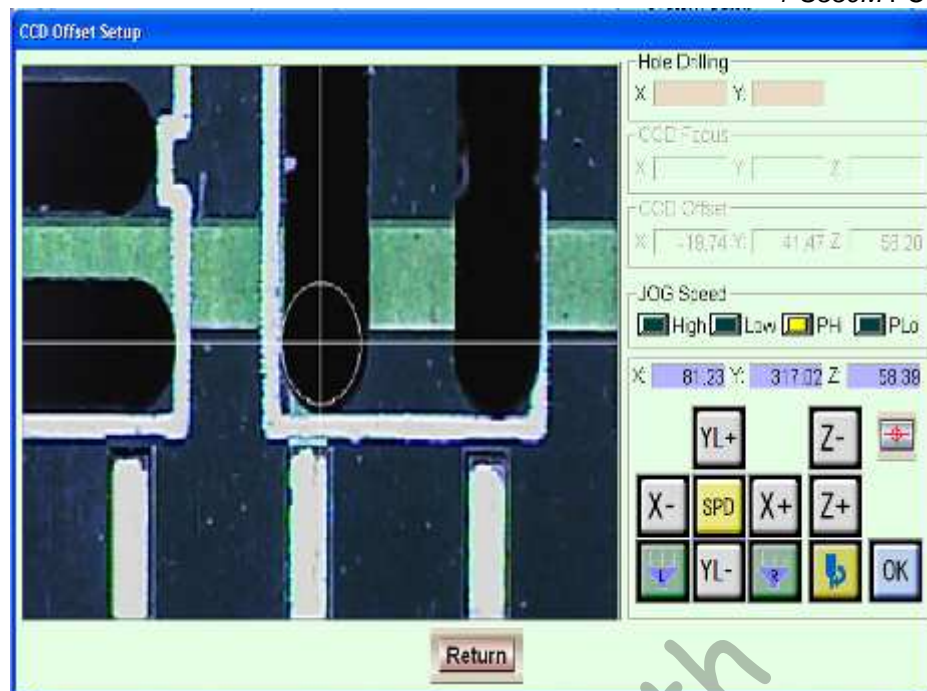
Figure 8.5 CCD Offset

(5) Check Left/Right Jig:

Check Left/Right Jig is used to prevent a left (right) program over-run interfering with the right (left) program. The indicator light 🔲 lights up when the Check button is pressed to show that the feature is enabled. If there is an overrun the separation system will display an error.

Note: For the X-axis separation coordinate, move the spindle to achieve the required separation then write the X-axis coordinates to the left/right jig interval field.

(6) CCD Auto Compensation

[1] **CCD Position Check -**If the deviation value exceeds the set range, the machine will send alarm signal.(But it won't make calibration automatically)

[2] **CCD Correcting -**During using program correct comp max times function. The compensation error value is changed set to 0~0.2mm. Which means, if the deviation value is lower the set value, the machine will not make correction. But if the deviation value is between the value that has been set in CCD position check and CCD correcting the CCD camera will recheck the position and correct the cutting route automatically.

Therefore, the program correct comp max times function is when the reference point calibration deviation value exceeds the set range, the number of times that CCD move to the center of screen then reconfirm the reference point. If the number of times that exceeds the set value then the machine still can't do the calibration, then machine will send alarm signal.

[3] **Local Fiducial Mark Check-**When the machine can't recognize the internal reference point The number of times that reconfirm the internal reference point set value.

(7) Step Run-Pause Timing

Single step mode function is using for CCD to reconfirm each cut point before actual cut start or when the machine do actual cutting, it also can reconfirm the precision of

each cut point. Also, the step run-pause timing function can be set in the setup mode by choosing 「At Start」 or 「At End」.

When you choose「At Start」, which means the spindle will move to the start cut position of each cut point first, then press the 「One Step」button in the main screen to start cutting the point.

When you choose「At End」, then after press the「One Step」button in the main screen, the spindle will cut the point that you choose first, then stop at the end position of each cut point.

(8) OK/Cancel:

[1] OK:

Confirm change.

[2] Cancel:

Cancel change and return to main interface.

9 Parameter Correction

9.1 Mark Parameter Correction

The CCD captures a magnified view of the PCB so the mark on the image might not be shown in actual size. Cursor ratio calibration is therefore needed before use.

Step 1:

Please prepare a scrap PCB (For the best precision, the test board should not be too thin or too soft. Optimum thickness is 1 mm). Install a standard diameter cutter (in this example, a cutter in the standard 1 mm thickness was used) and drill a test hole in the test board.

Step 2:

Move the CCD under the test hole as shown in Fig. 9.1.1. Align the mark with the test hole as shown below and click on [icon]. The CCD cursor calibration dialog box will appear as shown in Fig. 9.1.2. For the reference mark shape, choose a circle and set the size to 1 mm (the example uses an all new cutter in the standard 1 mm diameter).
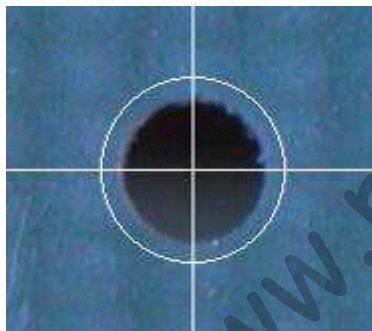
Figure 9.1.1 Test Hole
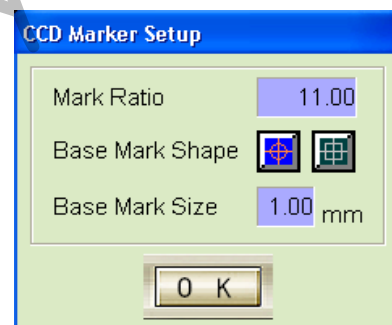
Figure 9.1.2 CCD market setup

Step 3:

Adjust the size of the mark until it matches the size of the test hole as shown in Fig. 9.1.3. Once the CCD mark has been corrected, press [OK] to finish.
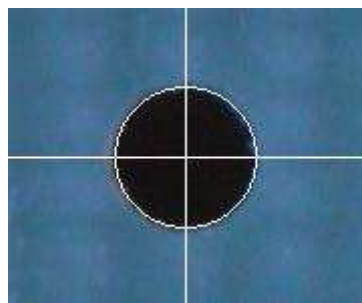
Figure 9.1.3 CCD mark correction

9.2 CCD Offset Parameter Correction

The CCD camera and the cutter are not on the same centerline. The offset must be compensated for before use.

Step 1:
Please prepare a scrap PCB (For the best precision, the test board should not be too thin or too soft. Optimum thickness is 1 mm). Install a standard diameter cutter (in this example, a cutter in the standard 1 mm thickness was used).

Step 2:
At the main interface, click on [SETUP] to open the parameter setup interface then select CCD offset setup. The CCD offset setup dialog box will appear as shown in Fig. 9.2.1.
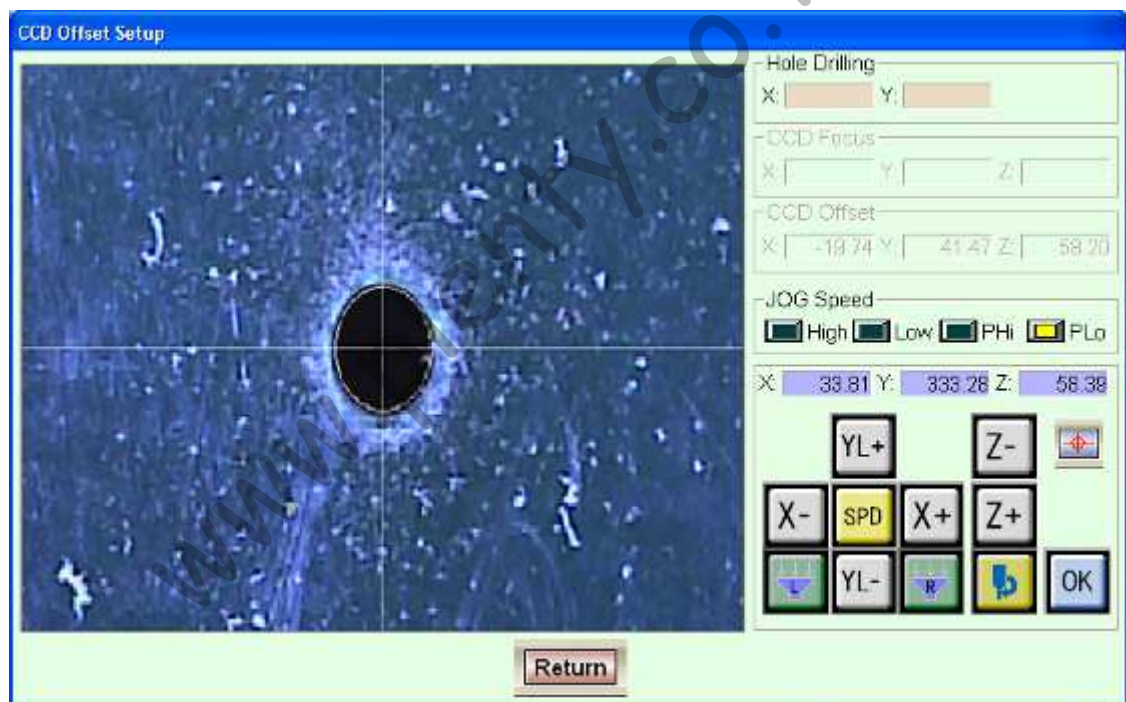
Figure 9.2.1 Cutter center setup

Step 3:
Now drill a hole in the test board by sight then press the OK button (record the coordinates of the cutter center). The coordinates of the hole will be recorded and now use the cursor keys together with the CCD to find the drilled test hole. Align the mark with the center of the hole as shown in Fig. 9.2.2.
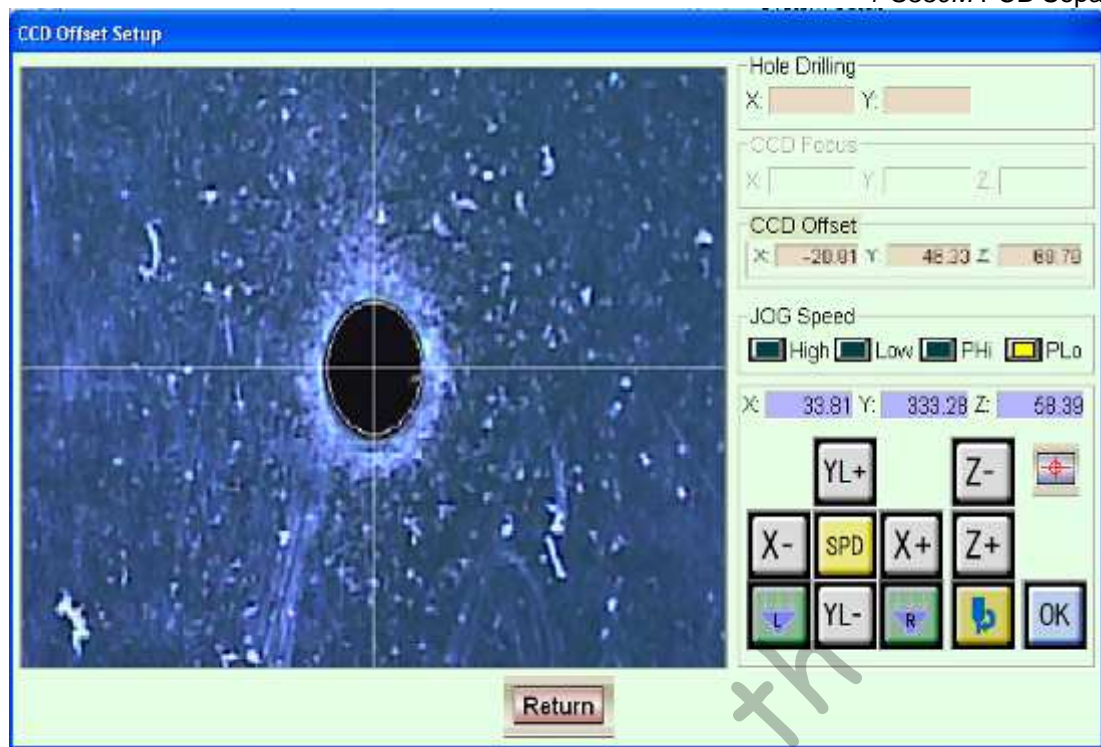
Figure 9.2.2 CCD focal length setup

Step 4:

If everything is correct, press the OK button (record the coordinates for the center of the CCD camera). The current CCD focus coordinates will now be recorded and the offset automatically calculated (offset between cutter center and CCD camera center) and written to the parameter list as shown in Fig. 9.2.3.

Step 5:

Check that the parameters are correct and then click on OK to save the parameter list as shown below.
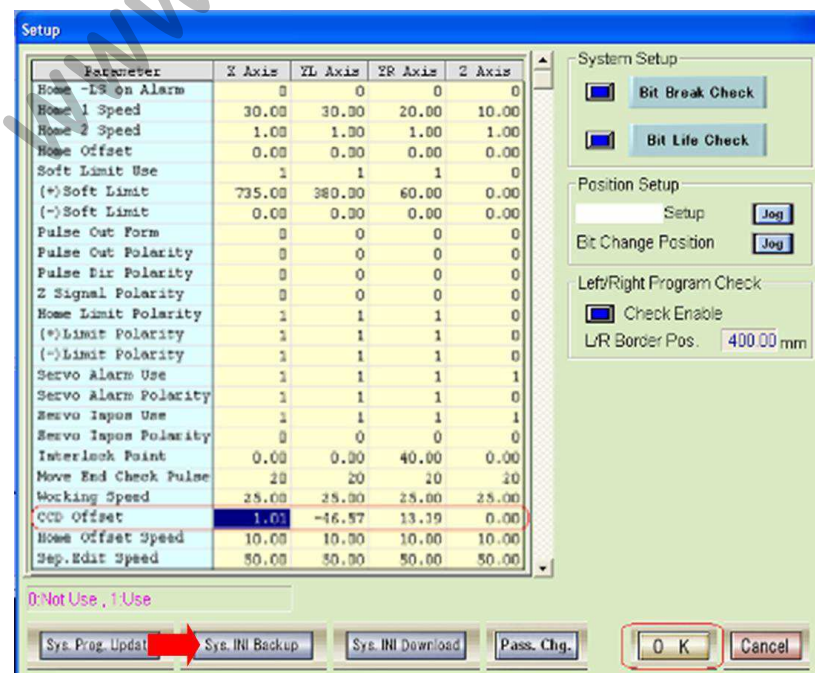
Figure 9.2.3 Parameter list
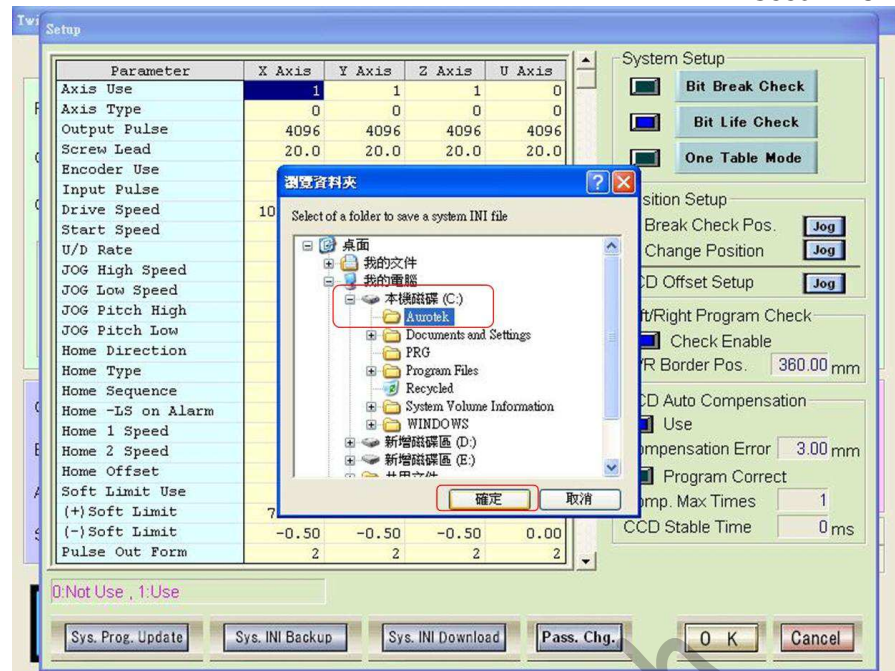
Figure 9.2.4 System INI backup

Note:

1. **Mark parameter correction must be completed before offset parameter correction can be carried out.**

2. **After finish CCD offset please also back up all the parameter by press 「Sys. INI Backup」and point the saving direction to C:\Aurotek. Otherwise once you shut down and restart the machine, parameter will disappear.**

10 Error Messages and Troubleshooting

10.1 Basic troubleshooting

1. Unable to turn on power

■ Check the power supply

■ Confirm that the power distribution cabinet's master switch (NFB1) is set to ON.

■ Confirm that the power distribution cabinet door is closed properly. Power will not turn on otherwise.

■ Confirm that the machine's emergency stop and the program trainer's emergency stop have been deactivated.

■ If the optional transformer is installed, please check that the input and output voltage is normal and that the circuit breaker (NFB) has been switched to ON.

2. Machine vibrates severely during processing

■ Confirm that the machine's four supports are properly tightened. Please see 2.3 machine installation.

3. Machine Alarm

■ Handle in accordance with the error message. Please refer to "9.2 Error message types and handling".

4. Inaccurate processing points

■ Check that the jig mounting for signs of looseness.

■ Check the XY axis interlock for signs of looseness.

5. Cutter prone to damage and separation

■ Working speed is too high. Please lower the cutting speed.

■ When the cutting speed, board material, board thickness and cutter dust extraction aren't properly matched, it becomes difficult to secure the cutter and it will tend to come loose.

■ Please refer to Appendix 1 for help with setting the cutting speed.

6. Poor dust collection

■ Please check that the collector motor is rotating in the correct direction. If rotating in the wrong direction, switch any of the two power wires to change the motor

direction. Please see 2.3 machine installation.

■ Check the PVC hose connecting the collector to see if it has become loose or damaged.

■ Use tape to seal off unnecessary holes on the jig.

■ Please manufacture custom jigs.

10.2 Error message types and handling

error code	error message	trouble shooting
[0001]	"Running Now"	Stop program before execution.
[0002]	"Emergency Stop"	(1) Confirm that the problem has been resolved. (2) Unscrew the Emergency Stop button. (3) Reboot the machine then run zero reset again.
[0003]	"AXIS:01 Servo Alarm"	(1) Check and troubleshoot the servo motor for that axis. Please refer to the servo motor user manual. (2) Please reboot the machine (turn off and wait at least 5 minutes before powering on again).
[0004]	"Homing Now"	Please wait until zero reset is complete before execution.
[0005]	"No Program"	Choose another program.
[0007]	"System Prgram Error"	Please contact with Aurotek engineer.
[0008]	"Running Task Over"	Please contact with Aurotek engineer.
[0010]	"AXIS:01 No Homing"	Please wait until zero reset is complete before execution.
[0011]	"AXIS:01 Servo Off"	(1) Check and troubleshoot the servo motor for that axis. Please refer to the servo motor user manual. (2) Reboot the machine then run zero reset again.
[0012]	"AXIS:01 +Soft Limit"	(1)Exceeds the positive software limit. (2)Reboot the machine then run zero reset again.
[0013]	"AXIS:01 -Soft Limit "	(1)Exceeds the negative software limit. (2)Reboot the machine then run zero reset again.
[0014]	"AXIS:01 +Hard Limit"	(1)Check if the positive limit sensor is normal or blocked. (2)Reboot the machine then run zero reset again.
[0015]	"AXIS:01 -Hard Limit"	(1)Check if the negative limit sensor is normal or blocked. (2)Reboot the machine then run zero reset again.

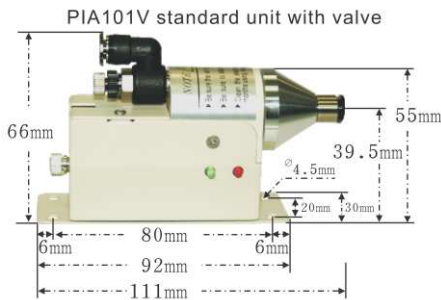| [0016]	"AXIS:01 Home Alarm"	(1)Check if Home position sensor is normal or blocked. (2)Reboot the machine then run zero reset again.
[0017]	"LMOV Point Data Error"	Correct error in program.
[0018]	"CIR Point Data Error"	Correct error in program.
[0019]	"SCON End-Line Error"	Continuous interpolation (SCON) not ended with ECON command.
[0020]	"AXIS:01 Move Error"	(1)Check if the signal transfer of the driver unit is normal. (2)Reboot the machine then run zero reset again.
[0023]	"AXIS:01 Home LS Alarm"	Please check if X axis zero sensor is damaged.
[0024]	"AXIS:01 Home LS Z Near"	Please adjust the position of X axis zero sensor.
[0025]	"AXIS:01 Encoder Z Alarm"	(1)Please check X axis decoder signal line. (2)Change the motor.
[0030]	"Program No. Error"	Input number exceeded program number limit.
[0031]	"Variable No. Error"	Input number exceeded variable number limit.
[0032]	"Position No. Error"	Input number exceeded position number limit.
[0033]	"Axis Pattern Error"	Correct error in program.
[0034]	"Axis No. Error"	Correct error in program.
[0035]	"INP No. Error"	Correct error in program.
[0036]	"OUT No. No Define"	Correct error in program.
[0037]	"JTAG No. Error"	Correct error in program.
[0038]	"JTAG No. No Define"	Correct error in program.
[0039]	"JTAG No. Duplication"	Correct error in program.
[0040]	"STAG No. Error"	Correct error in program.
[0041]	"STAG No. No Define"	Correct error in program.
[0042]	"STAG No. Duplication"	Correct error in program.
[0043]	"SUB Nesting Error"	Correct error in program.
[0044]	"SUB Error"	Correct error in program.
[0045]	"STAG Error"	Correct error in program.
[0046]	"0 Divide Error"	Correct error in program.
[0047]	"Expand Error"	Correct error in program.
[0048]	"Command Error"	No such command in system. Please input valid program command.
[0049]	"Spindle Work Over"	(1) Check spindle motor for over-heating or foreign object. (2) Remove cutter and clean spindle mount. (3) Contact distributor if problem persists.
[0050]	"Correction Alarm"	Reset the PCB position.
[0051]	"AXIS:01 Point Data Error"	Correct X axis program data.

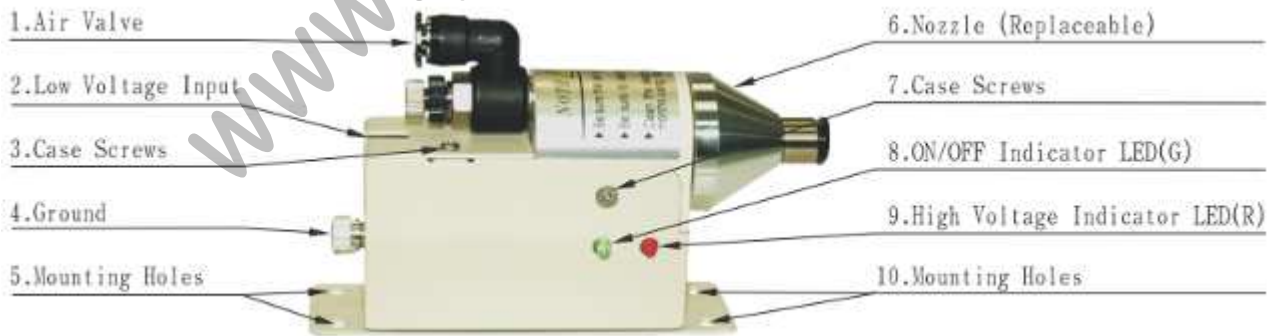| [0052]	"Z Axis Bit Shift Soft Limit Over"	Input number exceeded program number limit. Please modify Input number.
[0053]	"Left Area Sensor"	Check the Area Sensor.
[0054]	"Right Area Sensor"	Check the Area Sensor.
[0055]	"Jig is not same to the cutting prg."	Jig error
[0080]	"PRG loading failed !"	(1)Please load the program again. (2)Check the program content.
[0091]	"Emergency Stop"	(1) Confirm that the problem has been resolved. (2) Unscrew the Emergency Stop button. (3) Reboot the machine then run zero reset again.
[0092]	"Servo Alarm"	(1) Check and troubleshoot the servo motor for that axis. Please refer to the servo motor user manual. (2) Please reboot the machine (turn off and wait at least 5 minutes before powering on again).
[0093]	"Spindle Over Load"	(1) Check spindle motor for over-heating or foreign object. (2) Remove cutter and clean spindle mount. (3) Contact distributor if problem persists.
[0094]	"Air Down"	Check supplied air pressure.
[0095]	"Door Open"	(1) Check that the door is properly closed. (2) Check that the door is not jammed open. (3) Check that the door position sensor is not loose/disconnected.
[0097]	"Drill Break Alarm"	Change the drill.
[0098]	"Drill Life Alarm"	Change the drill.
[0099]	"No Homing"	Please wait until zero reset is complete before execution.
[0100]	"No Main Screen"	Please return to Main Screen before execution.

11 Options

11.1 Static eraser(SC-PIA101V)

Static electricity may build up during high-speed cutting under certain conditions. The dust will cling to the PCB and become hard to clean. The fitting of the static eraser will effectively reduce the amount of clinging dust and improve collection efficiency.

External Dimensions

PIA101V standard unit with valve

Model	SC-PIA101V
Power Supply	DC 24V/0.5A
High Voltage Power	2.5 kV
Power Consumption	3 Watts
Safety	Green LED indicates high voltage output is Normal. Red LED indicates high voltage is abnormal.
Allowed Air Pressure	0.5~7 kg/cm²
Dimensions	115mm(W) X 30mm(D) X 70mm(H)
Weight	203 g
Ion Balance	Within ±10V

External Parts:

1. Air Valve	6. Nozzle (Replaceable)
2. Low Voltage Input	7. Case Screws
3. Case Screws	8. ON/OFF Indicator LED(G)
4. Ground	9. High Voltage Indicator LED(R)
5. Mounting Holes	10. Mounting Holes

Static eraser(KIB-025)

External Dimensions

| Model	KIB-025
Power Supply	DC 24V/0.5A
High Voltage Power	2.0 kV
Safety	Green LED indicates voltage output is Normal. Red LED indicates is abnormal.
Allowed Air Pressure	0.05~0.5MPa
Dimensions	25mm(W) X 92mm(D) X 56mm(H)
Weight	164 g
Ion Balance	Within ±15V

External Parts:
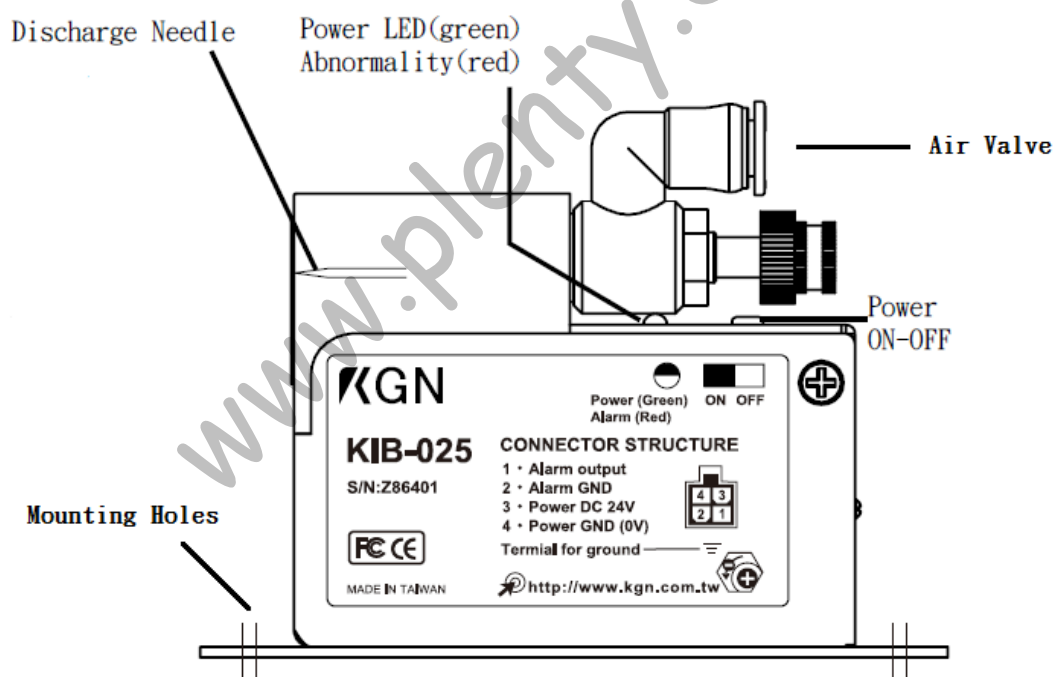
PS. One unit per machine is recommended as standard. Additional units can be fitted if necessary.

11.2 Universal Jig

The universal jig is used to hold and secure the PCB to be processed. The universal jig can be adjusted to fit most types of PCB, reducing the cost and time associated with jig development.
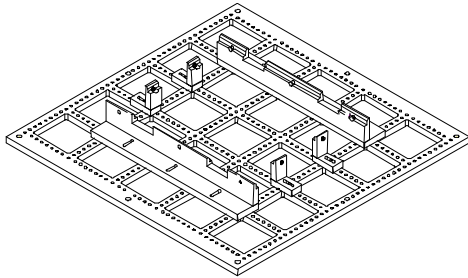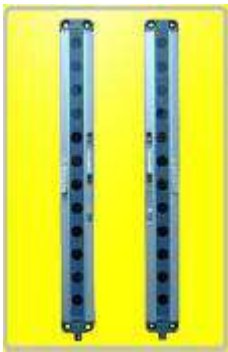
Model	330M Universal Jig
Weight	4 kg
Attachments	Support Plate (Long) 2 pcs
	Support Plate (Short) 4 pcs
	Support Rod 30 pcs
Dimensions	346mm(W) x 362mm(D)

11.3 Area sensor

The area sensor is used to prevent the operator's hands or foreign objects getting in the way when the left and right slips are moving in and out during processing.

PS.   **The MA3 Type is recommended as standard.**

Type	Twin-beam infrared area sensor: IR, 880 nm wavelength
No. of Optical Axes	5-48
Optical Axis Interval	MA1-5 = 25mm, MA1-11 = 10mm, MA2 = 20mm, MA3 = 40mm
Detection Area	100mm ~ 940mm
Range	0.2M ~ 1.5M, 0.5M ~ 3M, 0.2M ~ 1.0M (MA1-11)
Response Time	20msec (does not include relay switching time)
Status Light	TX = Yellow "Power ON"
	RX = Yellow "Power ON"
	RX – Red OSSDs "OFF"; RX – Green OSSDS "ON"
Work Frequency	Can be set to FREQ A or FREQ B
Large Work Light	Can be set to constant on or blinking
Power Supply	24VDC ±20% reg
Power Consumption	Basic module is 40mA and 8mA for each additional light axis. Maximum power consumption is 400mA.
Light Field Connector	M8 connector, direct line-out (NC type)
Safety Class	Meets CELVD requirements; no safety class (do not use near dangerous machinery such as hydraulic shears).
Output	
One output can be set to NPN (high-voltage: 24V + 20mA; low-voltage: 0V – 40mA)	

12 Maintenance

12.1 Cutter Change

Attention: The high-speed spindle is a precision product. Do not attempt to disassemble for cleaning as this will damage the product.

Please unscrew the knob by hand when replacing the cutter. Do not grip knob with pliers or other tools.
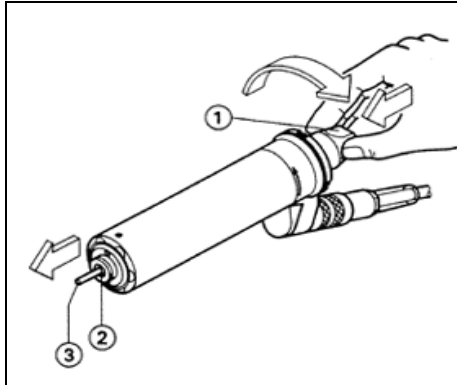
Step 1

Figure 11.1

As shown in Fig. 11.1, press the knob on top of the motor ① then rotate in the direction indicated by ⇨ until the clamp ② releases the cutter ③.

Attention: The cutter must only be replaced when the spindle motor is at a complete stop.
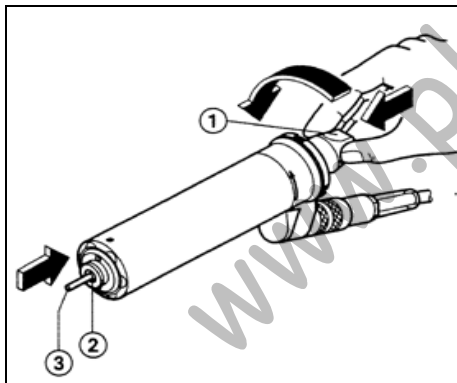
STEP 2

Figure 11.2

As shown in Fig. 11.2, insert the cutter ③ until it is up against the base of the clamp ②. Press the knob on top of the motor ① then rotate in the direction indicated by ⬅ until the clamp ② securely grips the cutter ③.
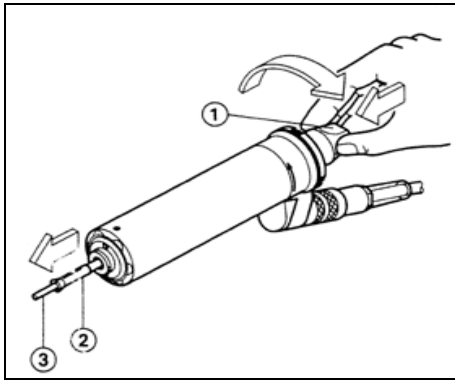
12.2 Replacing the Cutter Clamp

STEP 1

Figure 11.3

As shown in Fig. 11.3, press the knob on top of the motor ① then rotate in the direction indicated by ⇨ until the cutter clamp ② is released.
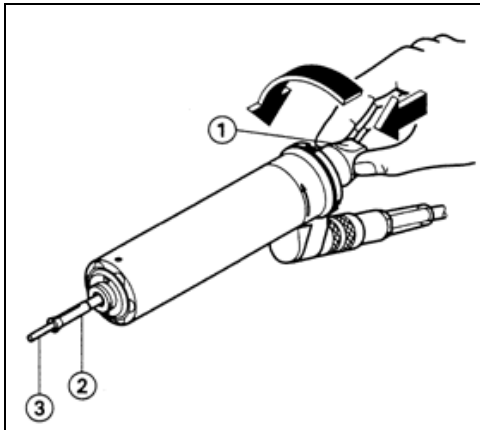
STEP 2

Figure 11.4

As shown in Fig. 11.4, press the knob on top of the motor ① and simultaneously insert the cutter clamp ② into the clamp mounting. The pin inside the clamp mount must be aligned with the channel on the cutter clamp ②. (The user may rotate the cutter clamp ② until it is in the right position).

Step 3

Press the knob on top of the motor ① then rotate in the direction indicated by ← until the cutter clamp ② is secured.

12.3 Maintenance

※Caution: <u>Never</u> clean the spindle with compressed air or ultrasonic cleaning equipment. <u>Do not allow</u> cleaning agent to penetrate the spindle during cleaning.

Clean the cutter clamp ② of the spindle regularly.

(1) As shown in Fig. 3-5, the user should clean the clamp mounting with the included brush. Apply a very thin film of oil to the clamp ② after cleaning.

(2) Re-install the cleaned clamp ②.
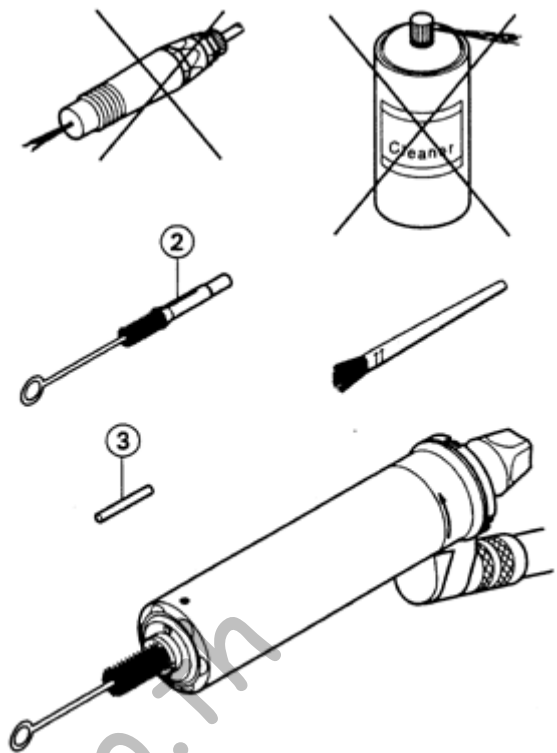
12.4 Lubrication

12.4.1 Ball screw bearing

(1) The ball screw bearing will use up its lubricant over time. The increased friction may result in higher temperatures and friction between the rails. The user must regularly inspect the ball screw bearing to check the lubricant consumption to avoid impacting on positioning accuracy. One inspection per month is recommended but this will depend on the separator's frequency of use. Lithium grease is recommended due to its water and heat resistance properties.

(2) Recommended lubricant

Shell Oil: Albanian Grease NO.2
Mobil Oil: Mobilux NO.2

12.4.2 Guide rails

(1) The lubricant level of each axis' guide rails should be inspected monthly (depending on the separator's frequency of use) to avoid excessive wear affecting positioning precision. Lithium grease is recommended due to its water and heat resistance properties.

(2) Recommended lubricant

Shell Oil: Albanian Grease NO.2
Mobil Oil: Mobilux NO.2

Appendix 1 Cutter Processing Conditions

1 Left-hand Cutter

As the machine uses a downward dust collection design it must be used with a left-hand (downward cutting) cutter to achieve the best collection efficiency. The downward design of the left-hand cutter blade pushes the dust downwards during cutting towards the collector. Replacement cutters should therefore be of the same type.
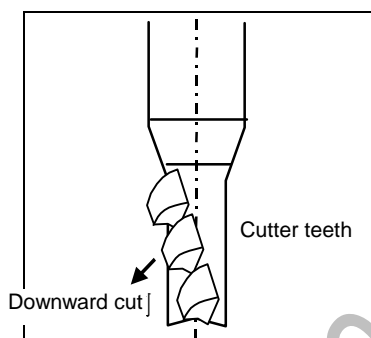
2 The recommended cutting speed for the routing bit

The cutting speed for the routing bit is related to the diameter of the routing bit and the rotational speed of the spindle. The optimal cutting speed is recommended as follows:

| Diameter (mm)	0.8	0.9	1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2
Cutting Speed (mm/s)	6.7	10	13	15	16.7	16.7	16.7	16.7	16.7	20	20	20	20
Diameter (mm)	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3	3.18		
Cutting Speed (mm/s)	20	20	20.8	20.8	21.7	21.7	21.7	21.7	21.7	21.7	21.7		

Note 1: The test result is performed by using FR4 PCB without copper laminate on it.

Note 2: The rotational speed of the spindle is automatically set after the diameter of the routing bit is entered.

Note 3: It should be noted that the cutting speed shown above is only applied to the type of routing bit coming with the separator.

3 Cutter specifications

We offer left-hand cutters with diameters between 0.8 ~ 3.18mm and blade lengths between 5 ~ 12mm for the customer to choose from.
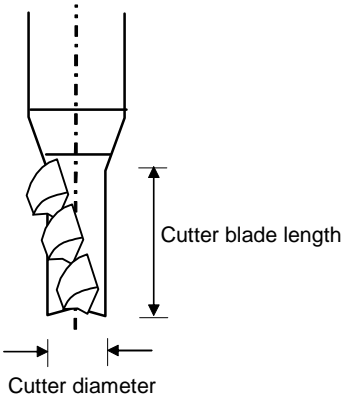
Product Name: Cutter

Specifications: **RTC 20 70**

70: Cutter blade length 7 mm

20: Cutter diameter 2 mm
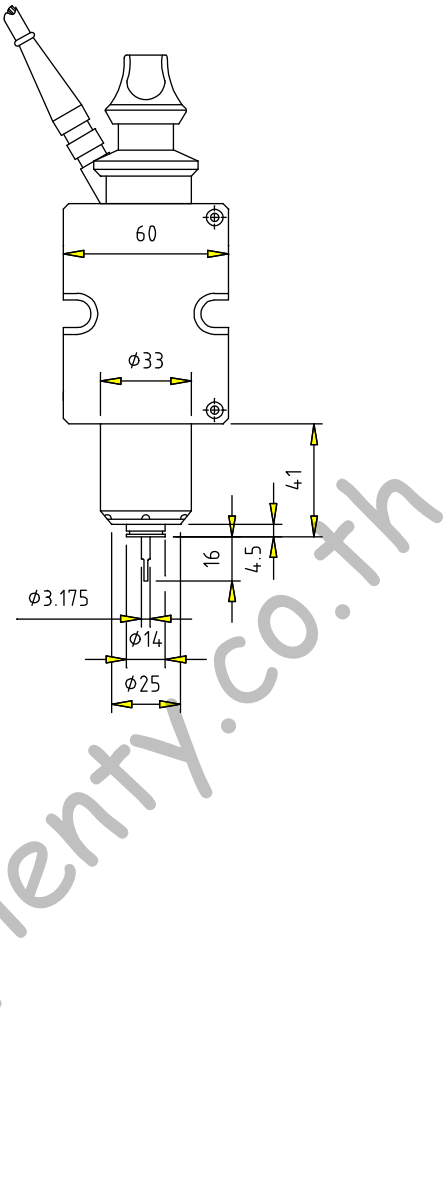
RTC: Made by TOSHIBA TUNGALOY
RHM: Made by UNION

Cutter blade length

Cutter diameter

Aurotek Corporation

Appendix 2 Related Machine Specifications

1 Spindle dimensions

Unit: mm

60

φ33

41

16

4.5

φ3.175

φ14

φ25

2 Jig dimensions

Unit: mm

Right jig platform
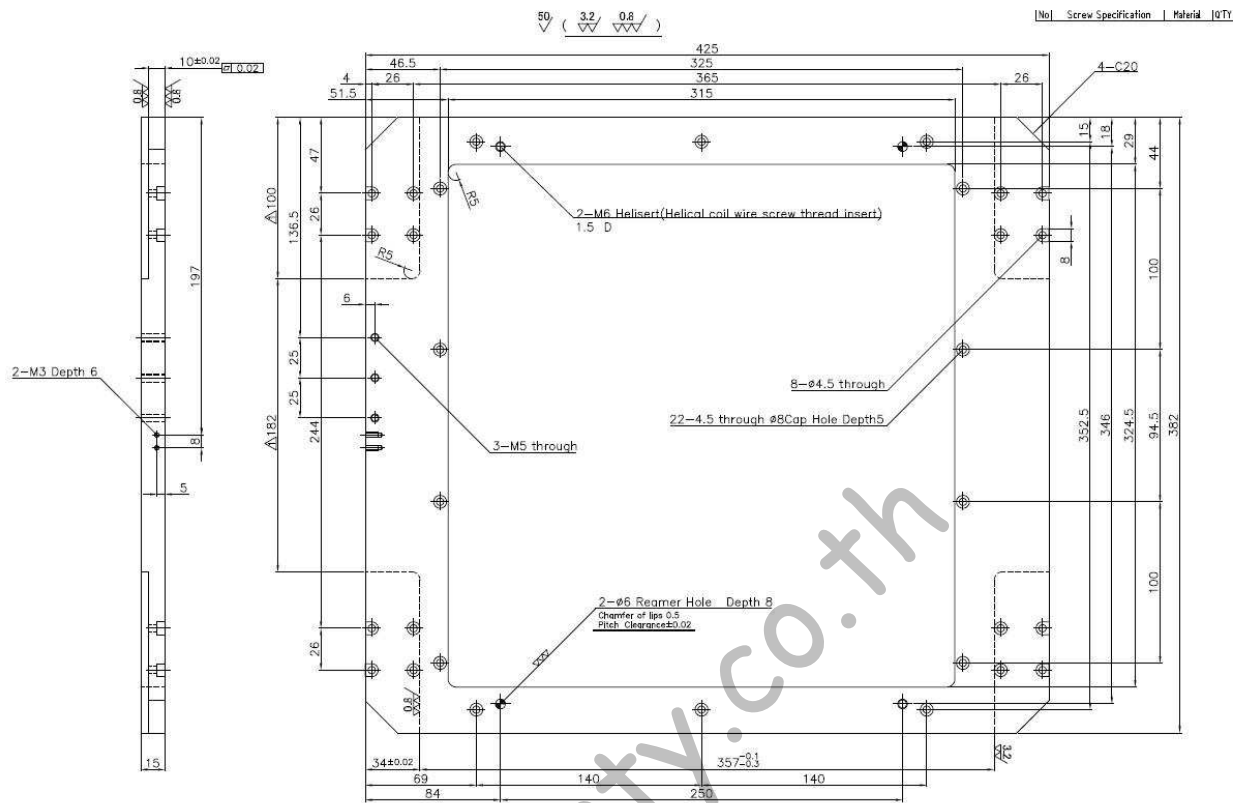
Left jig platform
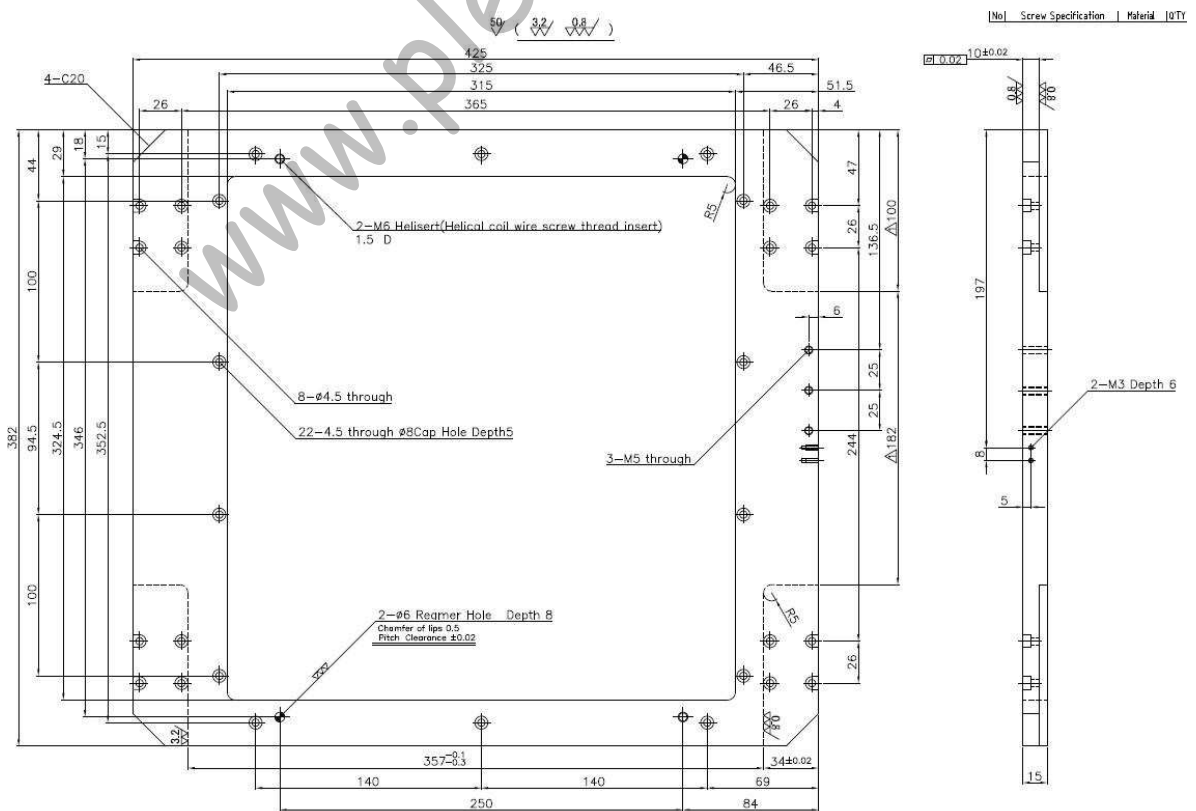
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